TECHRON®

7560/70 Series

Power Supply Amplifier

Technical Manual

K80630-5

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AE TECHRON®

Limited One-Year Warranty

SUMMARY OF WARRANTY

AE TECHRON, of Elkhart, Indiana (Warrantor) warrants to you, the ORIGINAL COMMERCIAL PURCHASER ONLY of each NEW ***AE TECHRON*** product, for a period of one (1) year from the date of purchase, by the original purchaser (warranty period) that the product is free of defects in materials or workmanship and will meet or exceed all advertised specifications for such a product. This warranty does not extend to any subsequent purchaser or user, and automatically terminates upon your sale or other disposition of our product.

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We are not responsible for product failure caused by misuse, accident or neglect. This warranty does not extend to any product on which the serial number has been defaced, altered, or removed. It does not cover damage to loads or any other products or accessories resulting from ***AETECHRON*** product failure. It does not cover defects or damage caused by the use of unauthorized modifications, accessories, parts, or service.

WHAT WE WILL DO

We will remedy, at our sole discretion, any defect in materials or workmanship by repair, replacement, or refund. If a refund is elected, you must make the defective or malfunctioning component available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at our factory. Expenses in remedying the defect will be borne by ***AE TECHRON***, including one-way surface freight shipping costs within the United States. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

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DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

You are not entitled to recover from us any consequential or incidental damages resulting from any defect in our product. This includes any damage to another product or products resulting from such a defect.

WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this warranty. The warranty is not extended by the length of time for which you are deprived of the use of this product. Repairs and replacement parts provided under the terms of this warranty shall carry only the unexpired portion of this warranty.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

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There is no warranty which extends beyond the terms hereof. This written warranty is given in lieu of any oral or implied warranties not contained herein. We disclaim all implied warranties, including, without limitation, any warranties of merchantability or fitness for a particular purpose. No action to enforce this Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

AE TECHRON Customer Service Department
2507 Warren St. Elkhart IN 46516-0000 U.S.A.
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Model 7560/70 Series Introduction

The basic models in the 7560/70 series of amplifiers are the 7560, 7570, and the 7571. Any customization of these basic models results in a model with a name that includes letters, e.g. G7570 or GMB7560S. Any model other than the basic models will have a supplemental manual included with this manual.

The Techron 7560/70 series of amplifiers comes from one of Crown's highest powered amplifiers—the M600. Its design and construction has withstood the test of time. Its reputation was one of pushing the upper limits of power to the extreme! It has a tradition of rugged reliability and performance—providing years of dependable and faithful amplification for its owners. A 7560/70 amplifier with its industrial look and Techron name is the same distinguished amplifier. Some of the outstanding features that make this Techron amp a winner are:

- ❑ Its high power (1000 watts continuous average output power into a 4 ohm load) has very low harmonic (<0.07%) and intermodulation (<0.01%) distortion and low noise (100 dB below rated output).
- ❑ Dependable V-I current limiting along with input, RF, power supply, and thermal overload protection make the amplifier practically indestructible.
- ❑ Strong physical construction of thick aluminum stock dissipates heat and withstands unusual abuse!
- ❑ Front panel Input Plug-in Modules allow flexibility and customization.
- ❑ Interlock master/slave system allows multiple amplifiers to combine to act as one powerful amplifier.

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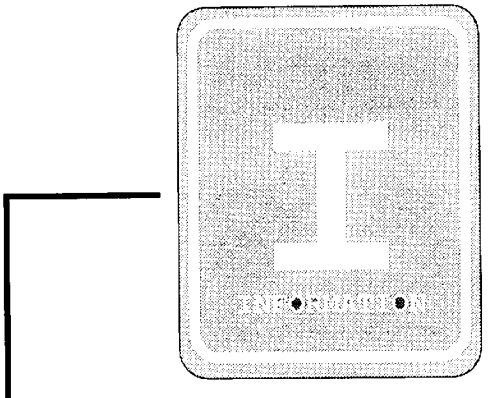
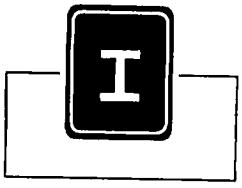


Section 1—Preinstallation

This section describes safety conventions used within this document and provides essential information about a Model 7560/70 series amplifier. Review this material before installing or operating the amplifier.



1.1 Safety Conventions

The 7560/70 amplifier is a highly sophisticated instrument. Accordingly, this document provides full information on the amplifier including service procedures. Safety should be your primary concern as you use this product and follow these procedures.

Special hazard alert instructions appear throughout this manual. Note the following examples:

⚠ DANGER

DANGER represents the most severe hazard alert. Extreme bodily harm or death **will** occur if these guidelines are not followed. Note the explanation of the hazard and instructions for avoiding it.

⚠ WARNING

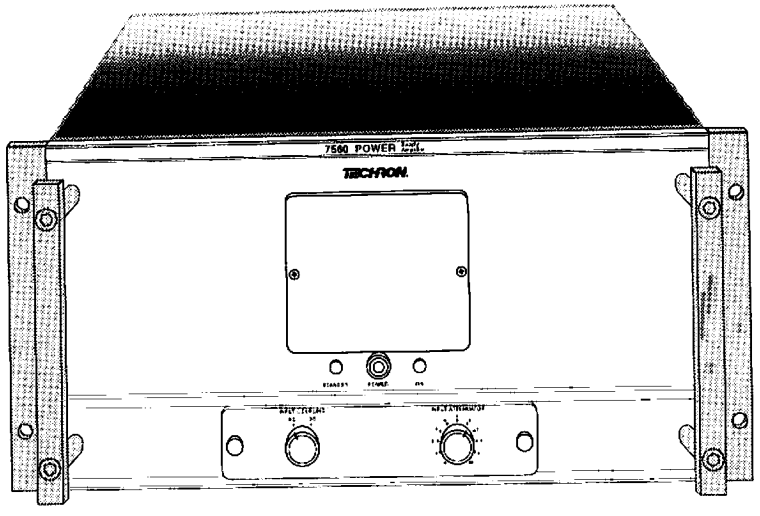
WARNING alerts you to hazards which **could** result in severe injury or death. Not the explanation of the hazard and the instructions for avoiding it.

⚠ CAUTION

CAUTION indicates hazards which could result in potential personal injury or equipment or property damage. Once again, note the explanation of the hazard and the instructions for avoiding it.

Note: A Note represents information which needs special emphasis but does not represent a hazard.

1.2 Product Description



1.2.1 General Description

The basic models in the 7560/70 family of amplifiers are the 7560, 7570, and the 7571. The 7560 has a single-ended input and operates in the constant voltage mode only. The 7570 and 7571 have an input plug-in module that provides a differential input and a capability to operate in either the constant voltage or the constant current mode. The 7571 has a built in peak-reading current meter. Otherwise, the three basic models are the same.

Model 7560/70 is a powerful amplifier for precision amplification of frequencies from DC to 45kHz, with extremely low harmonic and inter-modulation distortion and very low noise. In systems requiring higher power levels, two or more Model 7560/70 amplifiers may be teamed together with an interlock allowing them to function together. This interlock also allows the use of external controllers. With two amplifiers joined through the interlock and a heavy output ground-strap, output power can reach over 120V rms (sinusoidal) at over 2Kw.

To enhance the amplifier's overall reliability, each of the 32 rugged 150 Watt output transistors is individually tested before being installed in the 7560/70. In the patented bridge circuit, one end of the load is common to ground. This circuit effectively doubles the available output voltage without subjecting output transistors to unnecessarily high voltage. Reliability remains high, even at high power levels, since neither fragile high-voltage transistors nor series output circuitry are needed.

The visually-indicating power switch activates a red ON lamp as well as the cooling system and low voltage power supply. This provides power to control circuitry, which in turn activates the high voltage power supply by means of a high current, solid-state relay.

A dual-fan, forced air cooling system meets cooling needs under heavy power demand. Cooling capacity is 1900 watts at an ambient temperature of 25°C. Internal heat sinking eliminates handling problems when the unit is hot and provides a short and efficient path for air flow.

The high voltage power supply contains two 1000 watt transformers for driving the output stages, along with computer grade filter capacitors giving 100 joules of energy storage. The low voltage power supply furnishes ±15Vdc outputs from current-limited IC regulators which are also protected with automatic thermal shutdown. Shutdown of low voltage power supply simultaneously disables the high power supply.

The output transistors operate in the CROWN® patented AB+B mode of operation where all quiescent current is carried by the driver transistors. Electronic overload protection is provided in the form of the proprietary Signal Programmed Automatic Current Executor (SPACE controller) which acts as a signal-variable current limiter at most frequencies and as a VI limiter at very low frequencies and DC.

Slide switches, located at the rear of the unit, engage a four second turn-on delay and a low frequency load protector if desired. These systems, when activated, place the unit in standby mode.

The chassis design incorporates provisions for standard 19inch rack mounting. Front panel handles allow easy mobility. The four heavy-duty rubber feet on the bottom of the unit permit stacking of several amplifiers.

1.2.2 General Specifications

General Protection: High line voltage or over temperature results in shutdown of the high voltage power supplies. Controlled-slewing-rate voltage amplifiers protect the amplifier against RF burnouts. Input overload protection is furnished by a resistor and back-to-back diodes at the input of the amplifier to limit input current and voltage.

High Voltage Power Supply: Two 1kW transformers with computer grade capacitors storing 100 joules are powered through a 30 ampere, solid state relay.

Low Voltage Power Supply: ±15Vdc supplies are provided by current limited shortproof regulators which have automatic thermal shutdown. Supplies are accessible at the input plug-in and interlock connector. Shutdown of high voltage power supplies leaves low voltage supplies on, resulting in fan operation and STANDBY status.

Power Requirements: 50-60Hz AC with adjustable taps for 100, 120, 200, 220 and 240 V ±10% operation. Draws 80 watts or less on idle. 1KW at 600 watts output into 8 ohms.

Displays: A red neon lamp indicates power on. A green mechanical indicator in the power switch indicates power switch engaged. An amber neon indicator indicates the standby mode (high voltage power supply deactivated). The 7560 and 7570 can have an optional VU meter.

The 7571 has a peak reading current meter that provides output current monitoring to 30 A. This full-wave peak catch-and-hold circuit displays the highest output current reached before resetting itself every 0.6 seconds.

Controls: Push-Push power switch. The Low Frequency Protection and Delay switches are located on the rear panel. See Input Plug-ins for a description of the controls on the various plug-ins.

Interlock: Multiple units may be commonly interlocked such that if any one is requesting the standby mode, all units will be in standby. The standby mode may be initiated by closing an external common to ground contact of 15V 3ma rating, i.e., an open collector high voltage TTL output or an opto-isolator output. The ±15Vdc supplies are available through the interlock connector for supplying interlock peripherals.

Input Plug-ins: The standard plug-in for a **7560** contains an AC-DC input coupling capacitor and switch, an input attenuator, and a universal PC layout which may be adapted for input peripherals such as: differential inputs, filters, oscillators, servo amplifiers, remote DC gain controls, compressors, digital controllers, etc. Regulated ±15 Vdc supplies are provided with the maximum total available current of the supplies limited to 50 ma (25ma with optional meter display module). The delay mode of amplifier operation may be programmed from the plug-in.

The standard plug-in for the **7570** and **7571** contains an active differential input, an input attenuator, a current monitor output jack, a toggle switch to select constant current or constant voltage operation, and enough room on the PC board to construct additional circuitry.

Connectors:

Input: BNC (main input for 7560)
3–terminal barrier strip (main input for 7570 and 7571)
Output: 2–terminal barrier strip (for permanent connections)
Dual banana color coded binding posts (3/4" centers)
AC line: Three wire 20 ampere, 120 volt male plug with 5 foot cable.
Interlock: 11 pin "octal-type" socket.
Current Monitor: 1/4 in, 3–conductor phone jack (7570's only).

Construction: Aluminum chassis with 1/4" thick front panel reinforced with steel to retain the power transformers, 1/8" aluminum side panels. Heavy duty handles on front for easy transport. Plug in circuit boards.

Dimensions: 19" (48.26cm) standard rack mount, 8 3/4" (22.22cm) height, 16 1/2" (41.91cm) behind mounting surface, handles extend 2" in front of mounting surface. Center of gravity is nearly centered at 5" behind the mounting surface.

Weight: 92 pounds (41.7kg) net weight.

Finish: Two tone front panel coated with durable textured polyurethane. The front panel is tan; handles and end bars dark brown. Black painted aluminum chassis and covers.

1.2.3 Performance Specifications

Power Response: DC-45kHz at 600 watts continuous average output power into 8 ohm with no more than .05% THD (Total Harmonic Distortion). DC-40kHz at 1KW continuous average output power into 4 ohms with no more than .07% THD (Total Harmonic Distortion).

Power at Clip Point (less than .01% THD at 1kHz): Typically 750 watts into 8 ohms, 1350 watts into 4 ohms. (See graphs)

DC Output: Typically 20A maximum (supply fuse limited) at 100 V or 2KVA. (See V-I Plot).

Frequency Response: ±0.1dB DC-20kHz at 1 watt into 8 ohms (see graphs.); ±1dB DC-100kHz at 1 watt into 8 ohms; ±1dB 10Hz-100kHz at 1 watt in AC coupled input mode of standard input plug in.

Slew Rate: 32V/μsec. (slew rate is the maximum value of the first derivative of the output signal, or the maximum slope of the output signal.)

I.M. Distortion (60Hz-7kHz 4:1): Less than .05% from .01 watt to 600 watts (peak equivalent to a single sinusoid, rms.) into 8 ohms. Less than .01% at 600 watts into 8 ohms or 1200 watts into 4 ohms.

Harmonic Distortion (True RMS Measure): Less than .05% from DC-45KHz at 600 watts into 8 ohms. Less than .001% from 20Hz-400Hz and increasing linearly to .05% at 600 watts into 8 ohms.

Output Impedance: 5 Milliohms in series with 1.25μH which are together shunted by 2.7 ohms in parallel with 0.1 μF.

Load Impedance: Primarily used at 4 ohms or greater; maximum continuous sinusoidal output power at 2.5 ohms, lower impedance affects only maximum power; will drive a completely reactive load with no harm to amplifier. (Oscillations may occur with highly inductive loads. These loads will require external compensation.) See V-I Graph.

Input Gain: 20 +/-1% (26dB) at standard input with input attenuator fully CW (-1, ±1% at interlock connector input.)

Standard Input Sensitivity: 3.45V rms (±1%) for 600 Watts output into 8 ohm load. For 7570's: 0.1 volts/ampere.

Input Impedance: 25 kΩ (±30%) with standard input. 44.76 kΩ (±.5%) at interlock connector input. For 7570's: 20 kΩ, differential.

Common Mode Rejection (7570's): Ratio: > 70 dB; Range: +11 volts.

Current Monitor (7570's): Impedance: Differential, 600 Ω; Single ended, 300 Ω; Scale: 0.2 volts/ampere, differential.

Hum and Noise (20Hz-20kHz): 100dB below 600 watts into 8 ohms. Typically 107dB.

DC Drift at Output: Typically less than 100uV/°C with all inputs grounded.

Heatsinking: Forced air with 8 high efficiency coolers which can dissipate 1900 watts with 25° C intake air at 1 atmosphere. (Dissipation derates to zero at 75° C) Dual fans with intake filters (washable) force air through the coolers. Coolers are non-condensing at humidity of 90% or less, 0 - 25° C.

Turn-On: May be switch selected for instantaneous or 4-5 seconds of delay after applying power.

Low Frequency Load Protection: May be switch selected to produce shutdown of the high voltage power supply for DC outputs greater than 6 volts or low frequency outputs greater than 600 watts at 20Hz and 8 ohms.

Output Transistor Protection: Short, mismatch, and open-circuit proof; electronic protection operates without thumps or shutdown.

Maximum AC Current Draw: 20 Amps.

1.2.4 Multiamp Specifications (Push-Pull)

These specifications are for two 7560/70 amplifiers joined into a Push-Pull configuration by cable option 75D01 (other combinations of multiple 7560/70 amplifiers can be constructed). Consult the factory for design assistance.

Power Response: +1, -0dB DC -40kHz at 2KW continuous average output power into 8 ohms with no more than .1% THD; +1, -0dB DC=45kHz at 1.2KW continuous average power into 16 ohms with no more than .07% THD.

Power at Clip Point (Less than .01% THD at 1kHz): Typically 2.7KW into 8 ohms, 1.5KW into 16 ohms.

DC Output: Typically 20A max. (supply fuse limited) at 200V or 4KVA.

Frequency Response: ±.2dB DC-20kHz at 1W into 8 ohms; ±1dB DC-50kHz at 1W into 8 ohms.

Slew Rate: 64V/usec.

I.M. Distortion (60-7kHz 4:1): Less than .1% from 10mW to 2KW (peak equivalent to a single sinusoid, rms into 8 ohms).

Harmonic Distortion (True RMS Measure): Less than .05% from DC-10kHz at 2KW into 8 ohms.

Output Impedance: 20 mohms in series with 4uH.

Load Impedance (Balanced Output): Primarily used at 8 ohms or greater; maximum continuous sinusoidal output power at 5 ohms, lower impedance affects only maximum power. (Multiply V by 2 on V-I graph)

Input Gain: 40 (±1%, 32dB, at standard input with attenuator fully CW).

Standard Input Sensitivity: 3.6V rms (±1%) for 2KW rms into 8 ohms.

Hum and Noise: 96dB below 2KW into 8 ohms. Typically 104dB.

DC Drift at Output: Typically < 200uV/deg C with inputs grounded.

1.2.5 Performance Graphs

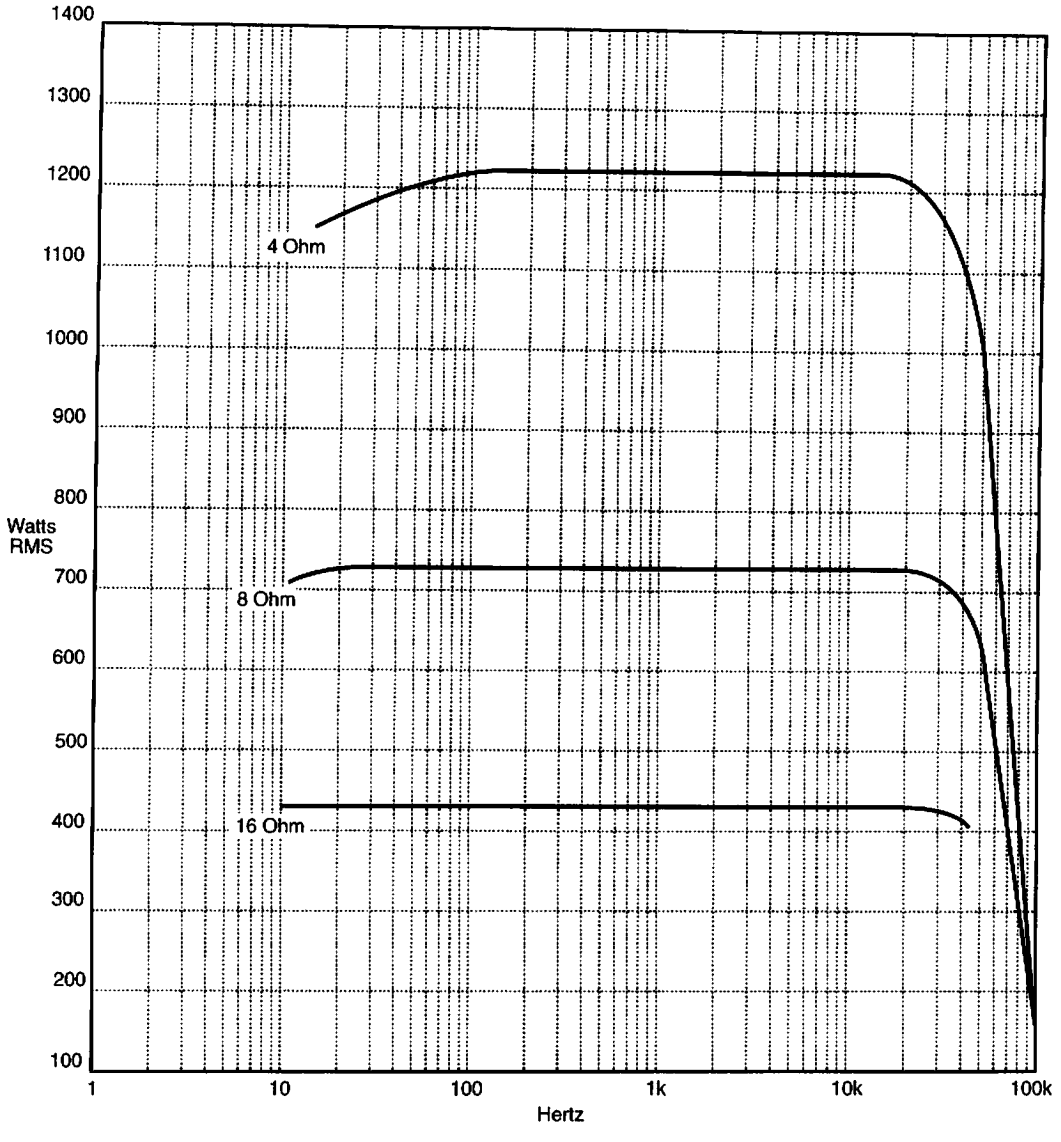


Illustration 2-1 Typical Output Power

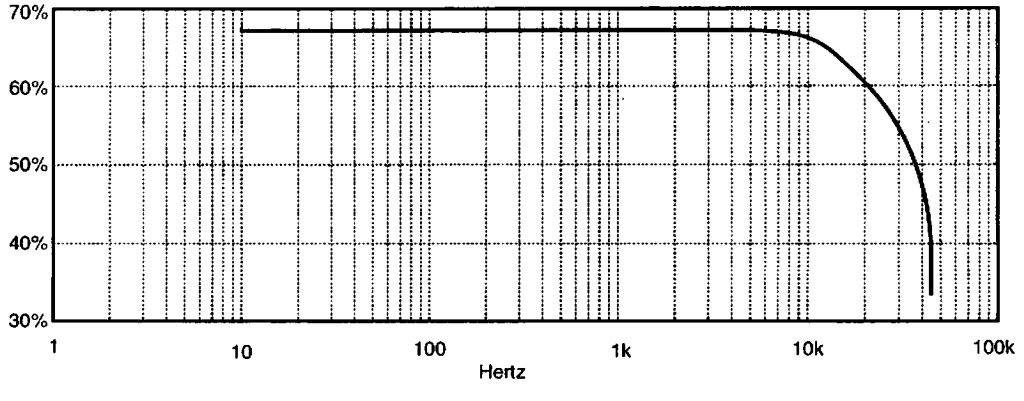


Illustration 2-2 Typical Power Efficiency

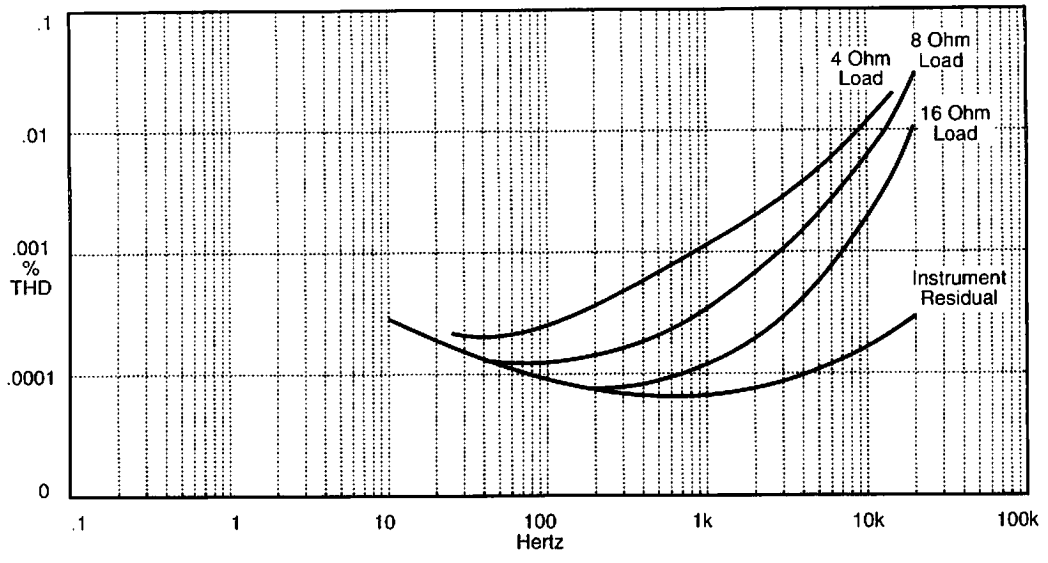


Illustration 2-3 Total Harmonic Distortion

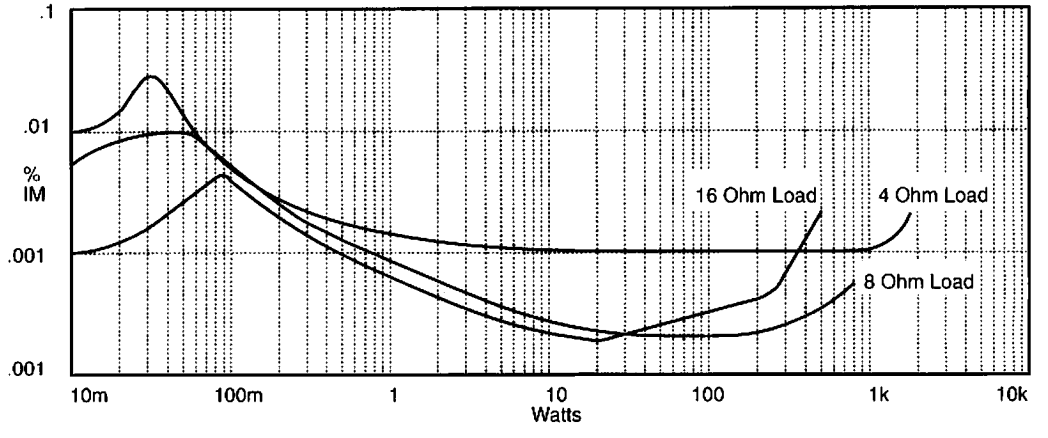
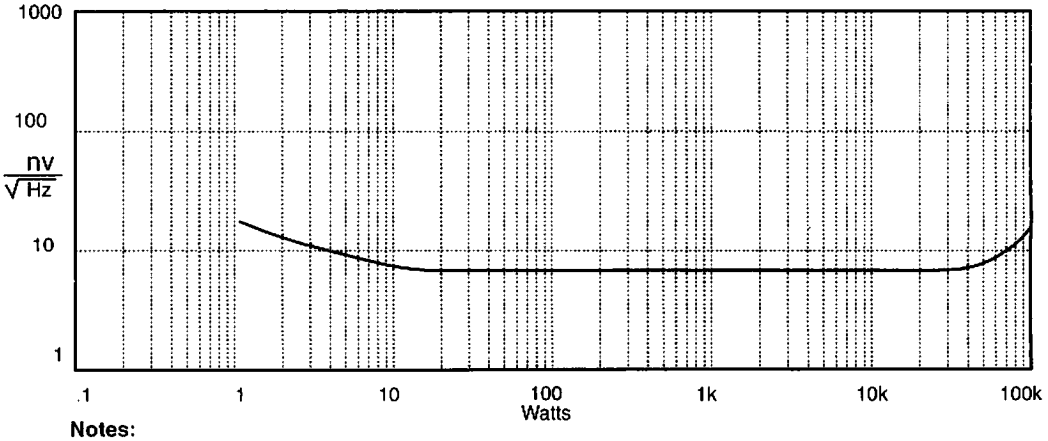


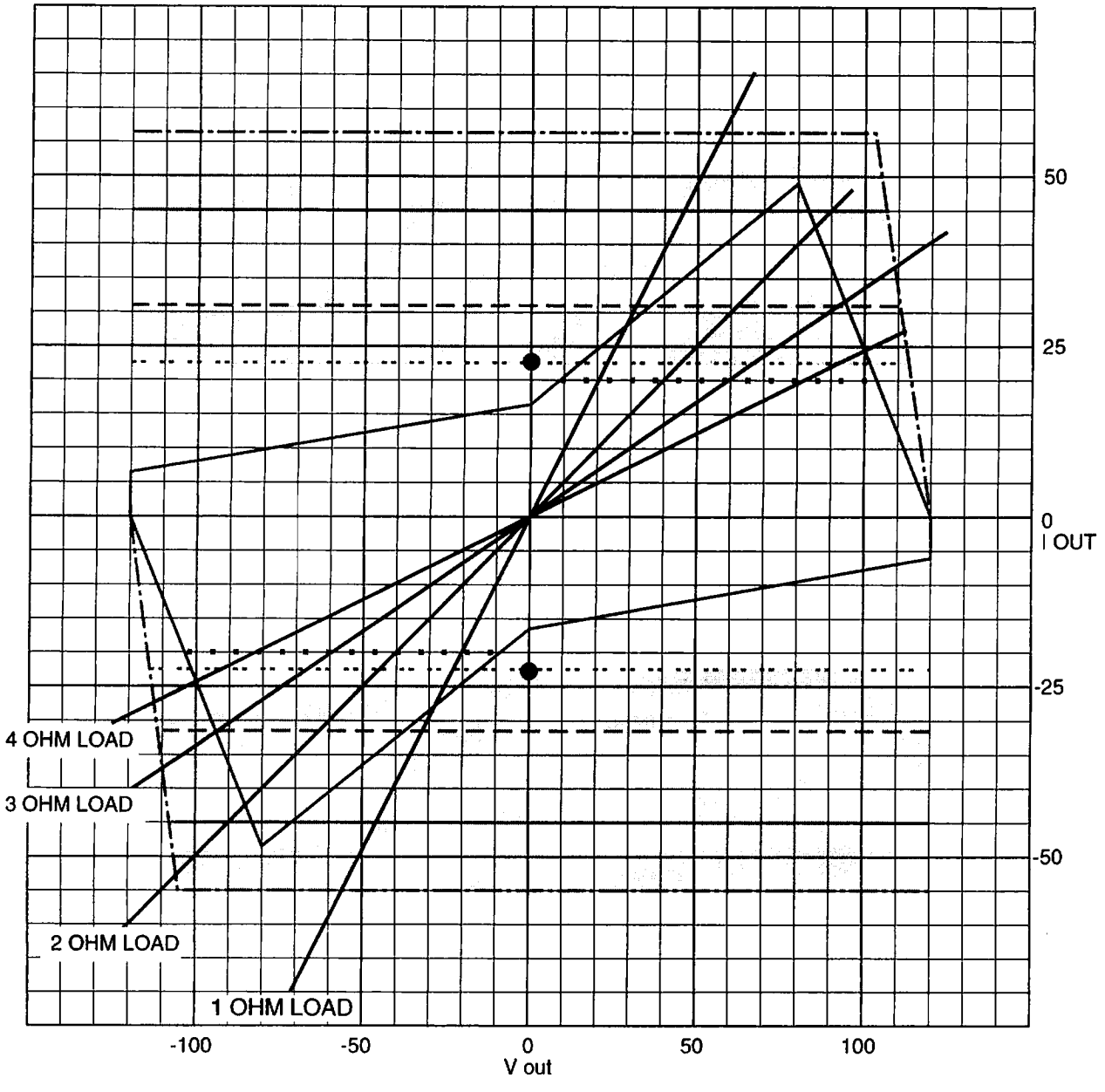
Illustration 2-4 IM Distortion



Notes:

1. Spectrum total is equivalent to 1.7μV input.
2. Noise measured over 20Hz to 20kHz bandwidth.

Illustration 2-5 Noise Spectrum



AC LINE FUSE BLOWS

MID-FREQ.BURST LIMIT
5 CYCLES AT 1KHZ
1 SEC REPEAT

SHORT CIRCUIT
CONTINUOUS LIMIT

AREA OVER WHICH LIMITER (AC)
VARIES (SIGNAL DEPENDENT)

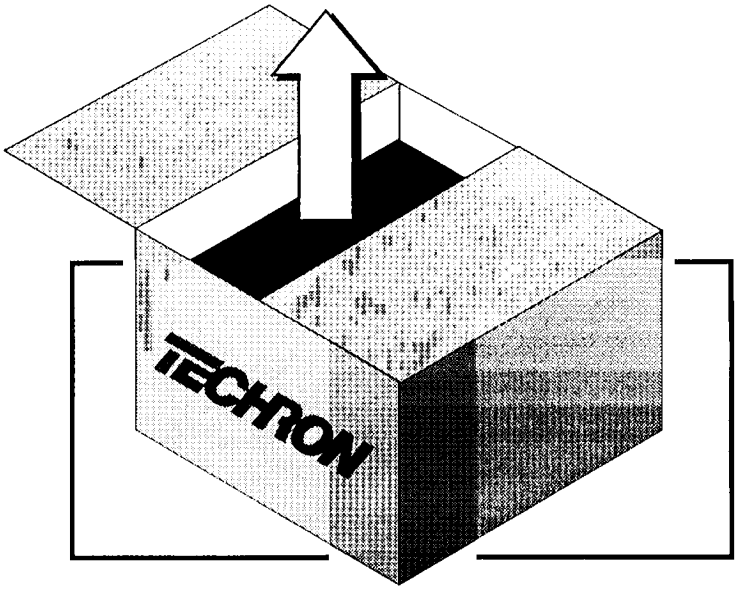
MAX. AC LIMIT (Z_L, V OUT
(SINE) AT MAX.)

MAX. CONT. AC POWER
(Z_A=2.75 OHMS)

MIN. AC LIMIT (Z_A AT MAX.)

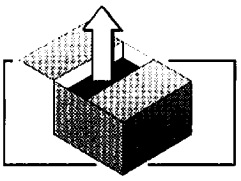
DC LIMIT

Illustration 2-6 V-I Plot



Section 2—Installation

This section provides general guidelines for installing a Model 7560/70 series amplifier with special emphasis on system installations.



2.1 Unpacking

Every TECHRON Model 7560/70 is carefully inspected and tested prior to leaving the factory. Carefully unpack and inspect the unit for damage in shipment. If damage is found notify the transportation company immediately. Save the shipping carton and packing materials as evidence of damage for the shipper's inspection. TECHRON will cooperate fully in the case of any shipping damage investigation.

In any event, save the packing materials for later use in transporting or shipping the unit. Replacement packing materials are available from TECHRON. Never ship this unit without proper packing.

2.2 Mounting

Model 7560/70 is equipped with four large rubber feet. The amplifier may also be mounted in a standard 19 inch rack as follows:

1. Rack mounting requires additional internal support underneath the amplifier.
2. If chassis slides are used, take care to avoid tipping of the rack when slides are extended.

Note: The balance point of the amplifier is approximately 5.4 inches behind the front panel.

3. If several units are racked on electrically common rails, maintain signal to noise ratio by one of the following methods:

- Use a differential input on each of the amplifiers.
- Use multiple signal sources, one per amplifier.
- Separate the chassis grounds of the units by insulating the units from the mounting rails.

4. Allow a rack clearance of 1-3/4 inches above and below each unit for hot air discharge.

Note: Rubber feet on the bottom of the unit provide proper clearance for air circulation and will not need to be removed; however, these may be removed if desired. Front feet are attached with sheet metal screws. Rear feet are attached with bolts, nuts, and lock washers. To remove rear feet, remove bottom cover and be sure not to leave any loose hardware inside the amplifier. For bottom cover removal, see Section 5. Do not discard removed bolts or feet in case they are needed in the future.

⚠ CAUTION

Do not install 7560/70 in a small sealed chamber of any kind. Improper operation and overheating will result.

5. Provide a source of cool air for the fan intake on the side of the amplifier. If the rack is crowded or rack ventilation is poor, use a vent tube to the outside of the rack.

6. When operating Model 7560/70 in a dusty environment, use commercial furnace filters or equivalent to prevent rapid clogging of the unit's own filters.

Note: Clean air filters on 7560/70 with mild soap and water. Replacement is not necessary unless filters are physically damaged.

⚠ WARNING

To reduce the risk of *ELECTRIC SHOCK* or FIRE HAZARD, do NOT expose the 7560/70 amplifier to rain or moisture.

2.3 Operating Precautions

1. Use care in making connections, selecting signal sources, and controlling output level. Model 7560/70 protects itself thoroughly, but is capable of causing serious damage to improper loads or through improper connections. See Section 2.9 for information on Load Protection.
2. Do not DIRECTLY parallel the output of Model 7560/70 with any other amplifier's output. This connection may cause serious damage to the amplifier and/or load and will not result in increased power output. If higher output current is needed, see Section 3, "Applications". Select Parallel, Push-Pull, or combined Push-Pull Parallel operation to meet increased power demands.
3. Do not short the ground lead of an output cable to the input signal ground. Oscillations may result.
4. Operate Model 7560/70 from proper AC power. AC mains frequency must be 50 to 60Hz and voltage no more than 10% above or below the selected AC mains voltage. Failure to comply with these frequency and voltage limits will result in improper operation and possible permanent damage to the amplifier.
5. Do not DIRECTLY connect the amplifier's output to a power supply output, battery, or AC mains. These connections will cause serious permanent damage to the amplifier.
6. Do not permit unqualified personnel to tamper with circuitry. Circuit modifications not covered in this manual may invalidate the warranty.
7. Follow instructions carefully for proper amplifier operation.

⚠ WARNING

An *ELECTRIC SHOCK* HAZARD exists when cover panels are removed. Refer to Section 5 if service is necessary.

2.4 7560/7570/7571 Functions

This section describes the different functions of the three basic models in the 7560/70 series of amplifiers.

2.4.1 7560 Front Panel Functions

Power Switch: Pushbutton on/off, with green ON mechanically indicated.

On Indicator: When AC Power Switch is ON, a red power indicator light should be on unless power is disconnected or an internal problem is present.

Standby Indicator: An amber indicator operates during turn-on delay (if selected), during operation of Low Frequency Protect Circuit (if selected), and during periods of shutdown due to overheating or other protection circuitry. Normal operation resumes automatically when appropriate.

Input Attenuator: Use to attenuate the input signal.

Input coupling Switch: Switch between AC and DC coupling at the input.

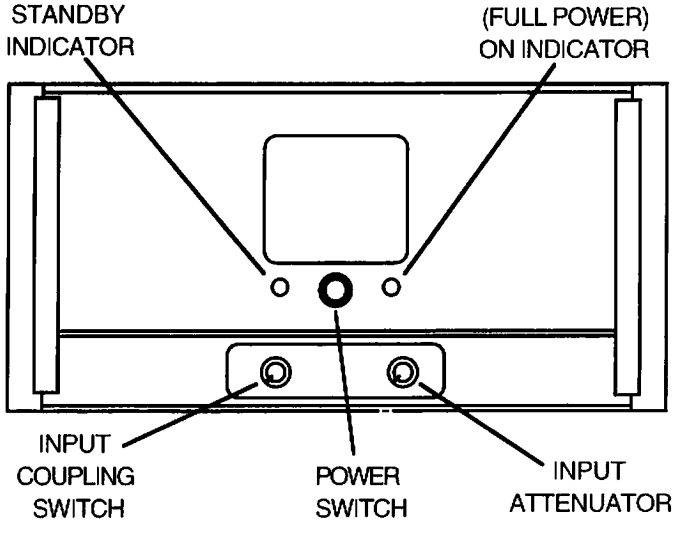


Illustration 2-1 **7560** Front Panel Functions

2.4.2 7570 Front Panel Functions

Power Switch: Pushbutton on/off, with green ON mechanically indicated.

On Indicator: When AC Power Switch is ON, a red power indicator light should be on unless power is disconnected or an internal problem is present.

Standby Indicator: An amber indicator operates during turn-on delay (if selected), during operation of Low Frequency Protect Circuit (if selected), and during periods of shutdown due to overheating or other protection circuitry. Normal operation resumes automatically when appropriate.

Input Attenuator: Use to attenuate the input signal.

Mode Switch: Use to select Constant Current or Constant Voltage mode.

Monitor Jack: Use to monitor output current. Tip-to-shell connection measures 0.1 V/A. Tip-to-ring connection measures 0.2 V/A.

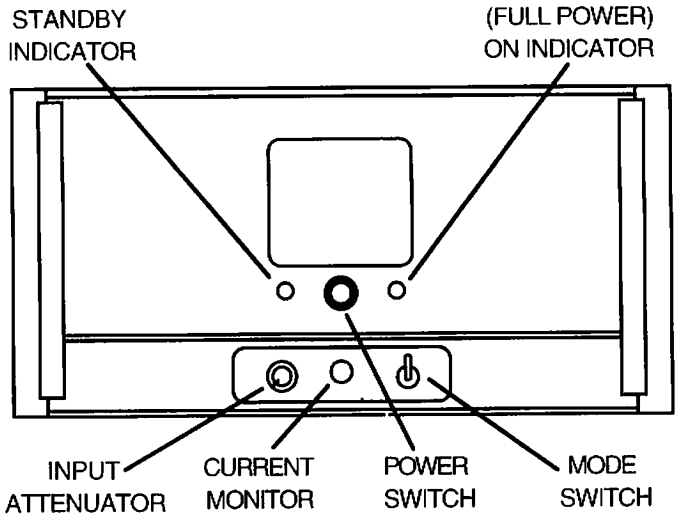


Illustration 2-2 **7570** Front Panel Functions

2.4.3 7571 Front Panel Functions

Power Switch: Pushbutton on/off, with green ON mechanically indicated.

On Indicator: When AC Power Switch is ON, a red power indicator light should be on unless power is disconnected or an internal problem is present.

Standby Indicator: An amber indicator operates during turn-on delay (if selected), during operation of Low Frequency Protect Circuit (if selected), and during periods of shutdown due to overheating or other protection circuitry. Normal operation resumes automatically when appropriate.

Input Attenuator: Use to attenuate the input signal.

Mode Switch: Use to select Constant Current or Constant Voltage mode.

Monitor Jack: Use to monitor output current. Tip-to-shell connection measures 0.1 V/A. Tip-to-ring connection measures 0.2 V/A.

Current Meter: Use this peak reading meter to read 0 to 30 A output.

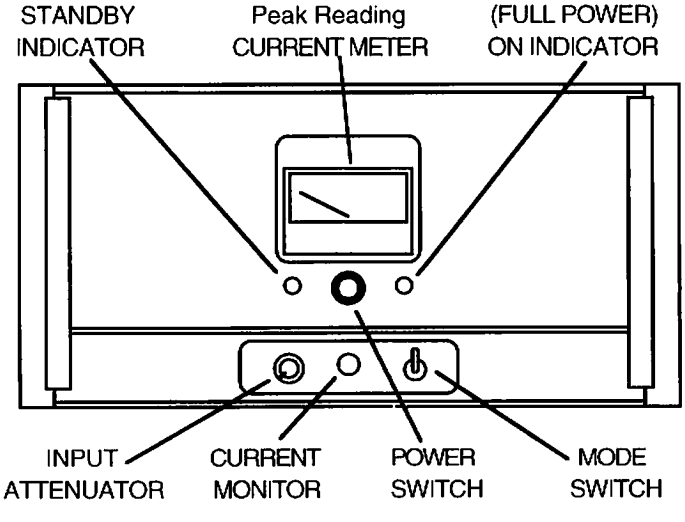


Illustration 2-3 **7571** Front Panel Functions

2.4.4 Back Panel Functions

Delay Switch: Invokes a four second time delay after turning power on. (STANDBY light indicates operation of this feature).

Low Frequency Protect Switch: Initiates Standby mode when low frequency (DC to 10Hz, 10 volts or more) appears at output. Engaging this switch automatically engages the delay feature.

Low Voltage Fuse, F1: Protects the ±15 volt supplies and fans.

High Voltage Fuse, F2: Protects the high voltage, high current supply for the output stage.

Interlock, J3: Signals and control for multiple amplifier systems.

Output, J5: Amplifier output. Five way binding posts for quick or temporary connections.

Output, J6: Amplifier output. Heavy duty barrier block for permanent connections.

J1: Normally used as an input on 7560's, or as a slave "signal output" on parallel systems. May be rewired for other uses.

Barrier Block Input, J2: Normally used as a differential input, or for slave inputs and outputs in multiamp systems. May be rewired for other uses.

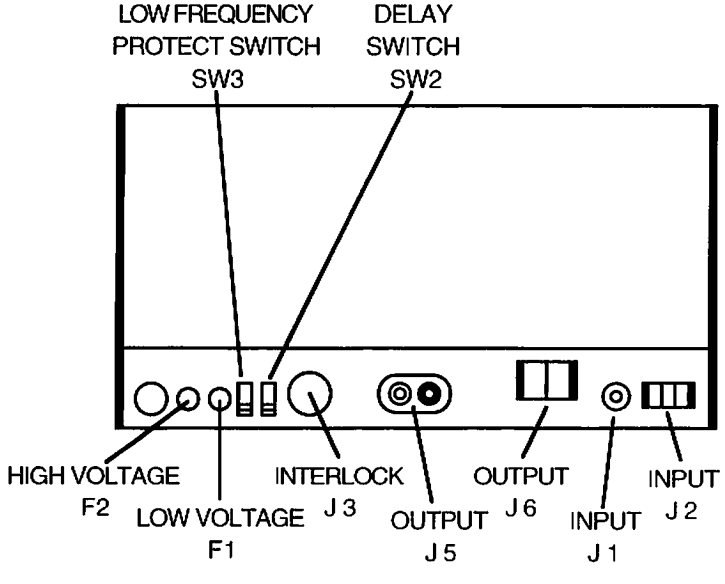


Illustration 2-4 Back Panel Functions

2.5 Load Connection

⚠ WARNING

Output potentials can be hazardous.
Make connections only with AC power OFF and input signals disconnected.

Connect your load to the terminal block. Use the five-way binding post only for temporary connections or testing.follow these steps:

1. Turn unit power off.
2. Adjust the input attenuator control fully counter-clockwise.

⚠ CAUTION

TECHRON is not liable for damage to any transducer due to overpowering.

3. Use proper output connectors. The barrier block is preferred for output signal connections. Use "banana" plugs only in test procedures, as these tend to loosen with wear.
4. Use proper output wire gauge and length. Use #12 wire, rated for 150 volts when the 7560/70 is operated at full power.
5. Carefully lace output cables together to prevent spurious oscillations and undesired feedback. For the same reasons, never route output cables with input cables.
6. Do not join amplifier input and output grounds externally to the unit.

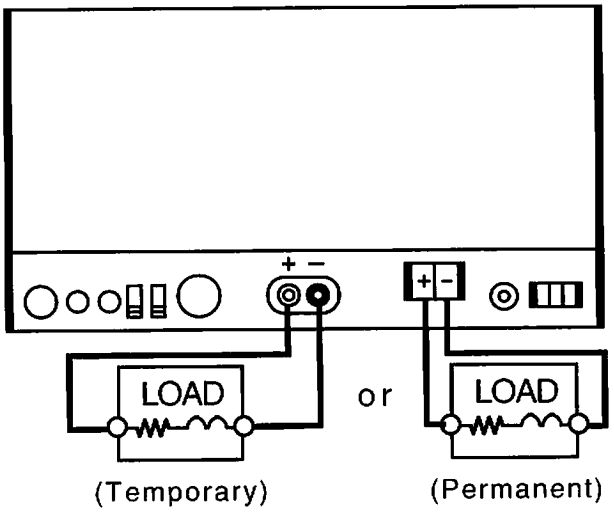


Illustration 2-5 Load Connection To Binding Posts or Barrier Block

2.6 Connecting Input Lines

Model 7560/70 offers a wide range of input possibilities. With the 7560 standard input plug-in, connect input signal via BNC input jack (J1) on the back panel as shown in Illustration 2-6. With a 7570 or 7571, connect the differential input signal to the 3–terminal barrier block (J2) on the back panel as shown in Illustration 2-7. If a single ended input is desired on a 7560/70, connect as shown in Illustration 2-8. The resistor value in Illustration 2-8 equals the output impedance of the signal source.

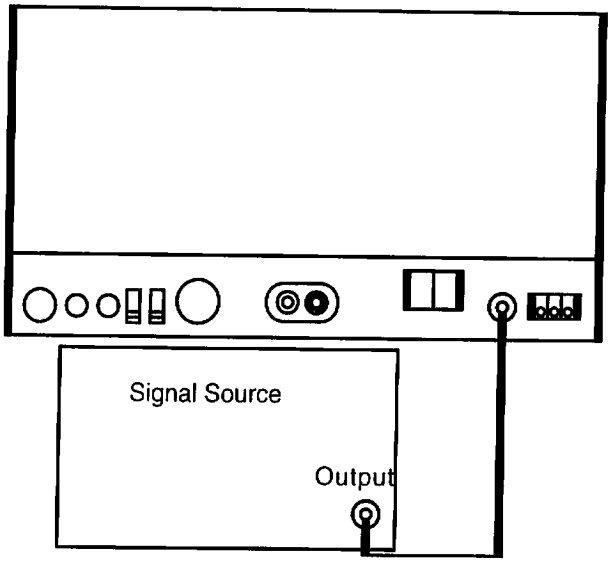


Illustration 2-6 **7560** Standard Input Connection at J1

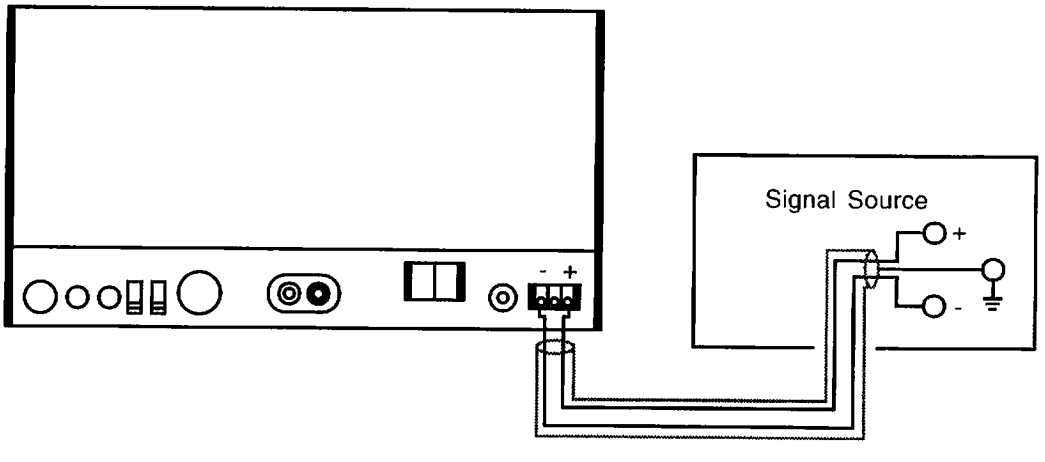


Illustration 2-7 **7570** and **7571** Standard Differential Input Connection at J2

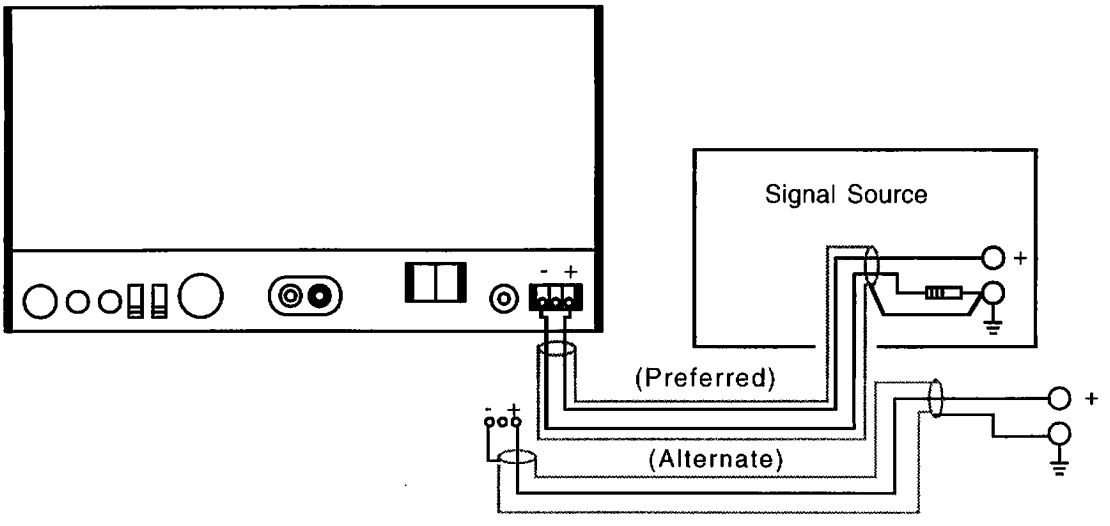


Illustration 2-8 Single Ended Input Connections

2.7 Current Monitor

Model 7570 has a built-in current monitor, eliminating the need for external shunts or transformers to perform this function. Monitor the output current at the front panel 1/4" inch jack.

To monitor the 7570s output current with a ground referenced signal, connect a meter or other equipment from the tip of a 1/4" phone plug to the shell. Scale factor is 0.1 volt/ampere. Illustration 2-9 shows proper connections for unbalanced monitoring.

For balanced current monitoring, connect a meter or scope from the tip of a 1/4" phone plug to the ring. Scale factor is 0.2 volts/ampere. Illustration 2-10 shows proper connections for balanced current monitoring.

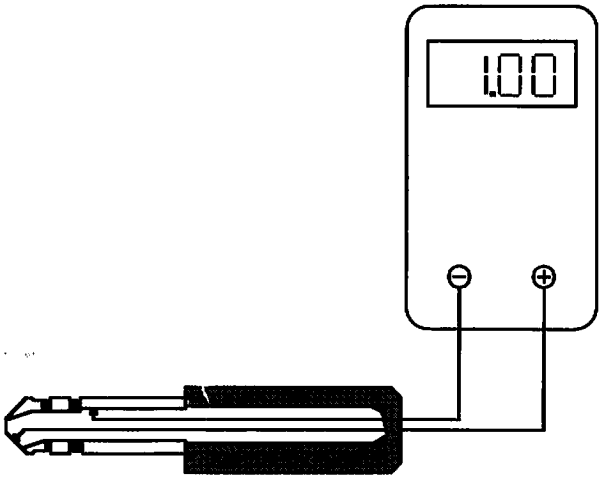


Illustration 2-9
Unbalanced Current Monitor

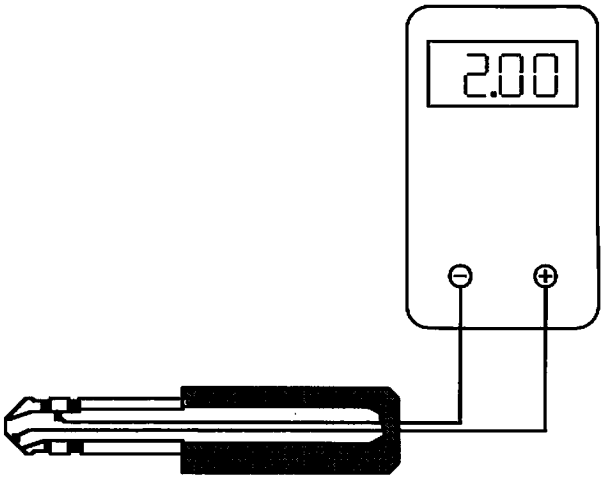
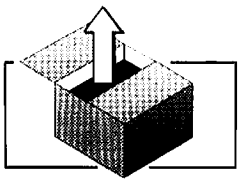


Illustration 2-10
Balanced Current Monitor



2.8 Connecting Power

Model 7560/70 includes a three-wire 20 ampere, 120 volt AC plug as standard equipment. To use another type of AC connector, remove the standard plug and install a new one. Include an integral cable strain relief with the new connector.

Use third wire ground with caution, as this may introduce a ground loop in a system. Review Section 3 for advice on removing ground loops.

⚠ CAUTION

Operate 7560/70 on 50-60 Hz AC power only. Fans will not operate on 400 Hz.

2.9 Turn-On

Before turning on a 7570 or 7571, place the front panel switch in the CONSTANT VOLTAGE mode position and turn the input attenuator completely CCW. This will prevent any turn-on thumps. After applying power , set the CC/CV switch to either position and set attenuator where desired.

2.10 Protection Mechanisms

2.10.1 Circuitry Protection

Model 7560/70 is protected against all hazards common to high power amplifiers, including shorted, open, or mis-matched loads, overloaded power supplies, excessive temperature, chain destruction phenomena, input overload damage, and high frequency overload damage.

The patented Signal Programmed Automatic Current Executor (SPACE control) protects the unit against shorted and low impedance loads. At very low frequencies, the SPACE control functions as a V-I limiter and protects circuitry endangered by excessively high-level low frequency signals.

2.10.2 Fuses

The following fuses protect power supplies against overload:

120VAC: High V (F2): 20A 125V Time Delay, Buss type FNW-20
Low V and cooling fan (F1): 1/2A Type AGC

200/220/240VAC: High V (F2): 10A 250V Time Delay, Buss type FNM-10
Low V and cooling fan (F1): 1/2A Type AGC

⚠ WARNING

Always turn power OFF when changing fuses. Using other fuse sizes may be hazardous to you or the amplifier.

2.10.3 Heat Protection

Four of the heat sinks include semiconductor heat sensors which place the amplifier in the Standby mode at 75° C. The fans continue to operate in this mode, and normal operation will resume automatically when temperatures drop below 75°.

2.10.4 Other Protection Features

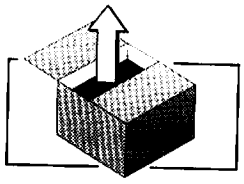
All voltage-amplifier circuitry is inherently current-limited. This protects the amplifier from general damage, should any output device fail.

A series limiting resistor protects the input stage from excessive input signal current, while two diodes provide protection from excessive input voltages.

The amplifier's controlled slewing rate, along with the SPACE controller, protects the amplifier from damage when large RF input signals are present.

2.11 Load Protection Methods

The most common method of load protection is a fuse in series with the load. A single fuse may be used, or multiple fuses may be used in the case of multiple phase loads. Ordinary fuses will help prevent damage due to a prolonged overload. To protect against large transients, use high-speed instrument fuses such as Littlefuse 361000 in series. If the load is susceptible to damage by overheating, use a fuse or circuit breaker having the same slow thermal response as the load, for example, a slow-blow fuse.



If large, low frequency (DC to 10Hz) signals threaten sensitive loads, engage the low frequency protection switch (rear of unit). Engaging this switch automatically engages the four-second turn-on delay, causing any excessive low frequency to place the amplifier in Standby and then cycle on again after excessive low frequency output has subsided. In operation, this feature will cause a sampling action every four seconds until excessive low frequency level is gone. Approximately 26 volts of DC output are required to trigger this detector.

Note: Whenever an overload condition is known to be present, take the following steps as applicable to protect amplifier and load:

1. Reduce or limit input level.
2. Disconnect load from amplifier.
3. Place amplifier in Standby mode.

2.12 Cleaning Air Intake Filters

Model 7560/70 includes dust filters on the cooling air intakes. Check these filters periodically and clean as needed. To remove filters:

1. Loosen screws at corners of filter cover.
2. Rotate cover slightly and remove.
3. Remove filter from amplifier.
4. Clean filter with mild dishwashing detergent and warm water.
5. Rinse thoroughly and allow to air dry before reinstalling.
6. Install filter and plastic cover by reversing steps 1 and 2.

In particularly dusty environments, cleaning of the heat sinks may be required occasionally. To clean heat sinks:

1. Turn power off.

⚠ WARNING

An *ELECTRIC SHOCK* HAZARD exists when cover panels are removed. Refer to Section 5 before service.

2. Remove top and bottom covers. See Section 5 for instructions.
3. Discharge capacitors as described in Section 5.
4. Aim compressed air directly into heat sinks.

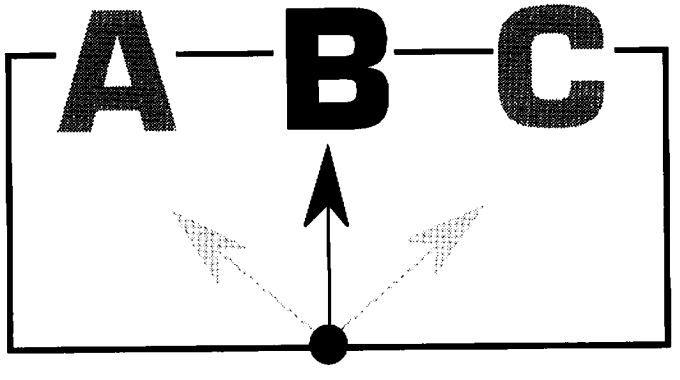
CAUTION

Air stream may damage cooling fins. Use care.

5. After cleaning, reinstall panels and turn power on.

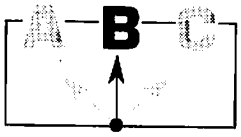
Note: In very dusty areas, use commercial furnace filters for additional filtering of cooling air.

While periodic cleaning should be sufficient, order replacement filters from TECHRON when desired.



Section 3—Applications

This section describes the uses of the Techron Model 7560/70 series amplifier, its capabilities, and various associated system configurations. Review this material before attempting to change the amplifier.



3.1 Amplifier Capability

Typically, Model 7560/70 Amplifiers are manufactured and shipped in specific configurations to fill a particular user requirement. This section is included for customers who may need to change Model 7560/70 series amplifiers for a new application. For these users, this section provides general theory and guidance regarding the amplifier's capabilities and flexibility.

This section assumes significant competence on the part of the reader in terms of amplifier systems, electronic components, and generally sound electronic working practices. Readers are urged to contact TECHRON Engineering for assistance with any of this information.

⚠ WARNING

Except as recommended in this manual, do not attempt to change the circuitry of the amplifier. This could invalidate the warranty, damage the equipment, or harm the operator.

Hum and noise problems caused by ground loops are one of the most common problems that plague power amplifier systems. Theoretically, ground loops will never occur if one and only one ground path is allowed between the 7560/70, the signal source and the load. The input and output grounds of the amplifier should not be externally joined since this external ground path will form a loop with the internal ground path. The output ground is connected to the chassis on the rear connector panel, allowing the chassis mounting to be a possible source of ground loops. If other devices attached to the amplifier inputs and outputs are mounted in an electrically common rack and are likewise internally chassis-ground joined, ground loops may be formed. When this occurs, isolate the most appropriate units from the rack so a loop is not formed.

Another source of ground loop trouble is the third wire of the AC mains connector. Only one piece of equipment in a system should connect this terminal to the system's signal ground.

Unintentional feedback of output signals into input signal lines can result in system oscillations, or gain errors. Input signals should never be supplied to the amplifier via the current carrying output common lead except when driving the unity gain inverting inputas in a Push-Pull interconnection. In this case, the ground to ground strap should be kept short and heavy. Under normal circumstances, supply input signal to the amplifier via its own independent ground lead which is not connected to the output signal ground.

AC mains frequently form a high frequency feedback path between input and output devices which are powered by the mains. The amplifier itself couples the mains because of its floating supply-lead grounded bridge circuit which

couples some output signal back to the AC mains through approximately 200pF. TECHRON recommends the protective earth ground of the amplifier be connected rather than any other system-to-earth ground. Whenever possible, minimize AC mains coupling in devices connected to the output signals. If oscillations are present, the typical results are excess heating in the amplifier and load.

3.2 Input Modifications

If it is not feasible to eliminate the feedback path, reduce the high frequency system gain by using a lowpass filter at the amplifier's input. Build such a filter on the standard input plug-in board or purchase a 75A12 filter input plug-in.

3.2.1 Low Pass Filters

Filters built on the input plug-in may be either of the passive or active type. Illustration 3-1 shows three designs for passive Butterworth filters (maximally flat frequency response). The component values in Illustration 4-1 are for a 3dB cutoff frequency of 15kHz. Use the formulas in the illustration to compute component values for other frequencies.

Inductors used to construct these filters should have a cutoff frequency Q of 10 or greater and be of low external magnetic field pickup type. Torroidal construction works best.

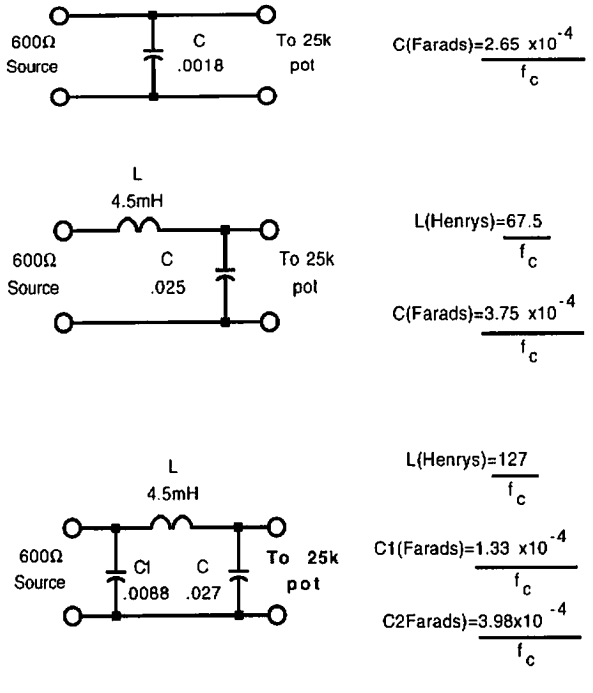
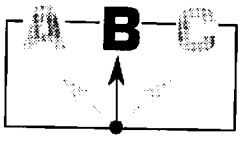
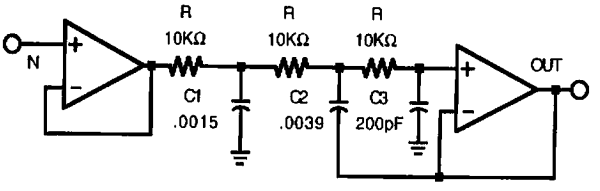


Illustration 3–1 Passive Low Pass Filters



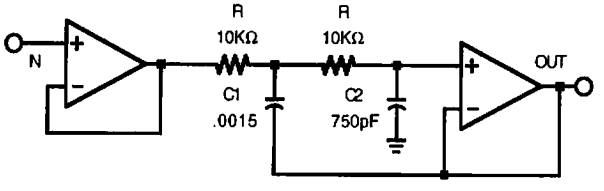
Active low pass filters may be constructed on the standard input plug-in card. Illustration 3-2 shows the most popular form for 2 and 3 pole Butterworth types. As in Illustration 3-1, 15kHz component values and equations are provided.

Low pass filters are useful for much more than preventing system oscillations. Should very high frequency or RF input signals which could either damage a load or slew rate jam the amplifier be present, they may be subdued with a low pass filter.



$$C1(Farads) = \frac{.2251}{f_c \times R} \qquad C2(Farads) = \frac{.112}{f_c \times R}$$

Two Pole - 12dB/Octave



$$C1(Farads) = \frac{.2251}{f_c \times R} \quad C2(Farads) = \frac{.5644}{f_c \times R} \quad C3(Farads) = \frac{.032}{f_c \times R}$$

Three Pole - 18dB/Octave

Illustration 3-2 Active Low Pass Filters

3.2.2 High Pass Filters

High pass filters are useful if a low frequency signal is over driving the load. The simplest high pass filter is a capacitor in series with the input.

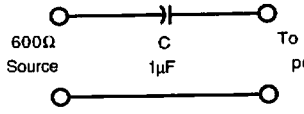
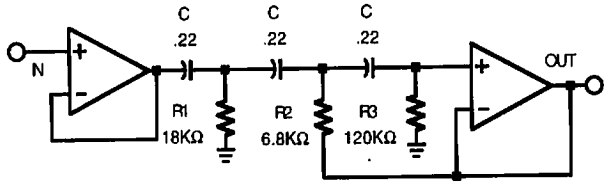


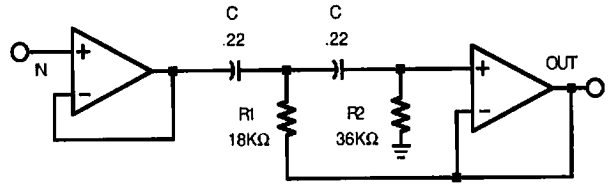
Illustration 3-3 Passive High Pass Filter

Use active filters for good sharp cutoff characteristics. Illustration 3-4 shows the discussed filters and their responses. Formulas are given and typical component values for a cutoff frequency of 30 Hz.



$R1 = \frac{.1125}{f_c \times C}$ $R2 = \frac{.2251}{f_c \times C}$

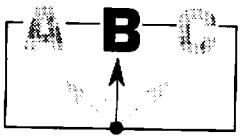
Three Pole -18dB/Octave



$R1 = \frac{.1143}{f_c \times C}$ $R2 = \frac{.04488}{f_c \times C}$ $R3 = \frac{.7864}{f_c \times C}$

Two Pole -12dB/Octave

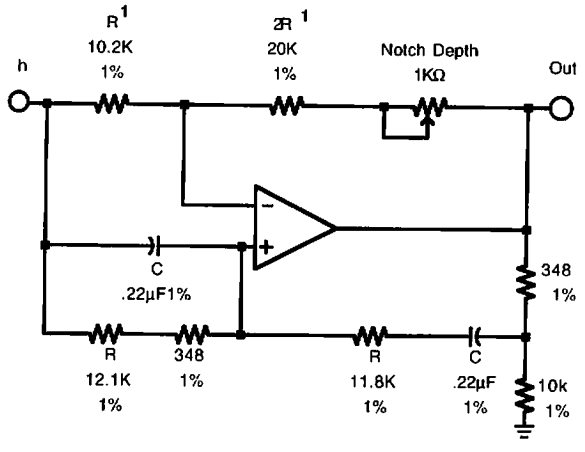
Illustration 3-4 Active High Pass Filters



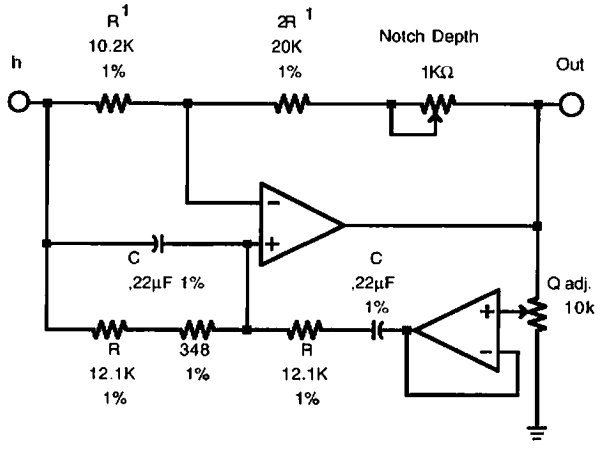
3.2.3 Notch Filters

If discrete frequencies such as AC mains hum are found to contaminate the input signal, a band reject or notch filter may improve the signal-to-noise ratio without limiting the overall bandwidth. Illustration 3-5 shows two adjustable Q Wein bridge circuits. The component values shown are for a notch frequency of 60Hz and Q of 10. Qs as high as 100 and 1000 have been realized at 1KHz and 60Hz respectively. Such high Qs are not recommended since the stability of notch depth is greatly degraded.

Cascaded notch filters are frequently needed to reject signals such as AC mains hum since substantial harmonics of the fundamental frequency are usually present.



$$f_n = \text{notchfreq.} = \frac{.1592}{(R+348)C}$$



$$f_n = \text{notchfreq.} + = \frac{.1592}{RxC} \qquad Q = \frac{1}{3\ (1\text{-pot ratio})}$$

Illustration 3-5 Wein Bridge Notch Filters

3.2.4 Differential Input

If system instability results from high frequency signals being produced along the common (ground) of the input cabling between the signal source (unbalanced) and amplifier, use a differential input amplifier to solve the problem. To get a differential input for 7560's, order the 75A11 Input Plug-in Module.

Note: The 75A11 has a 10 turn pot that adjusts the top 3% of gain.

Appropriate cabling is shown in Illustration 3-6. R1 should equal the source impedance of the signal generator. If the difference in potential across R2 is 5 VDC or less, leave it open. If the difference is greater, use a 1 Ω to 10 Ω resistor at R2. It will be necessary to use J2 as the input connector. Looking at J2 on the back panel: pin 1 (left) is minus, pin 2 (middle) is ground, and pin 3 (right) is plus. Any potential differences between the signal source and amplifier grounds will appear as a common mode signal at the differential input and will not produce an input to the power amplifier.

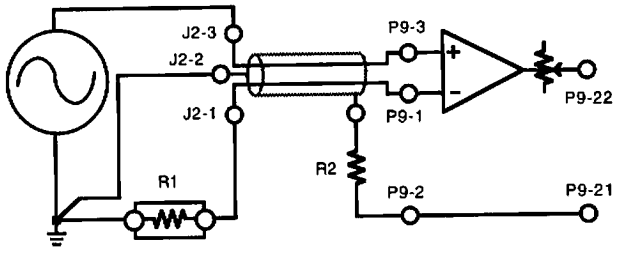


Illustration 3-6 Differential Input

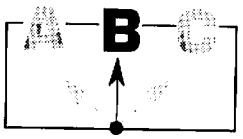
3.3 Interlock System

The interlock system permits two or more amplifiers to work together in special configurations. The interlock system assures that all amplifiers in a given system will start and stop precisely together, preventing damage to amplifiers and/or loads. The interlock system can provide remote start/stop functions, digital control interface, voltage comparator standby control, and output crowbarring.

The 11-pin socket, J3, on the rear panel provides all necessary connections for the interlock system. Illustration 3-7 shows the socket in detail.

Whenever the interlock terminal (pin 1) is allowed to rise above the 10 volt threshold, the main AC power relay will engage. An internal resistor pulls pin 1 up to the +15 volt supply, while an internal FET pulls pin 1 to ground potential to hold the amplifier in standby. When several amplifiers must work together as one system, wire all interlock terminals (pin 1) in parallel and all the amplifier grounds connected to the system ground connected with heavy wire. In this configuration, when any amplifier in the system goes into standby, all amplifiers in the system will follow simultaneously.

External grounding of pin 1 will also put the amplifier (or the entire system) into standby.



External devices can be powered from the 15 volt supplies at J3. Total current available from the ±15Vdc supplies is 50ma without optional meter module and 25ma with meter module installed. The current drawn at pin 1 will be the number of amplifiers in the system multiplied by 150 microamps.

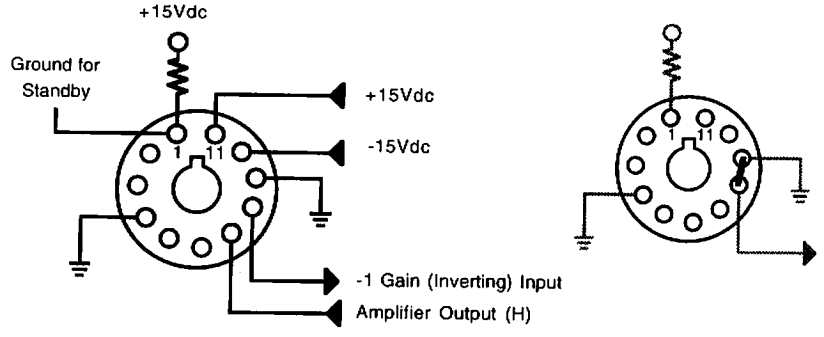


Illustration 3-7 Interlock Socket

3.4 Remote Standby

The 7560/70 amplifier can also be enabled and disabled from a remote point by a computer or other type of industrial controller. The following sections describe several methods of grounding pin 1 for remote standby.

3.4.1 Relay Control

A relay is the simplest form of remote standby. Use the appropriate set of contacts to cause the amplifier to go into standby when the relay is energized.

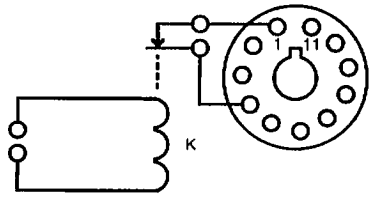


Illustration 3-8 Relay Control

3.4.2 AC with Optical Isolation

If large common mode signals are present between the controller and the amplifier, an optical coupler may be used to close the interlock circuit. Illustration 3-9 shows an AC powered remote start controller.

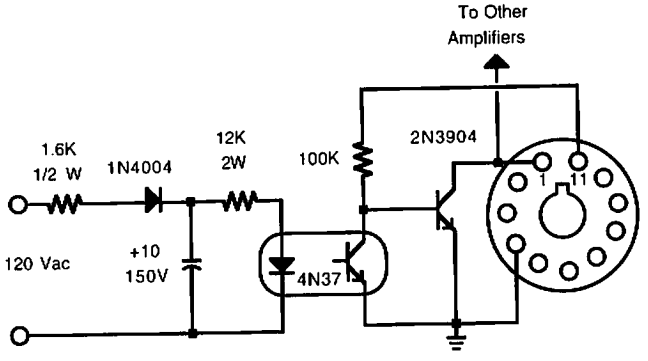


Illustration 3-9 AC Powered Remote Standby Control

3.4.3 High Common Mode Operation

When lines controlling enabling of the 7560/70 are susceptible to noise or high common mode range, a comparator may be used to negate these effects. Illustration 3-10 shows an LM339 being used to control a 7560/70. Any one or all of the comparators in the LM339 package could be used in a "wire or" application.

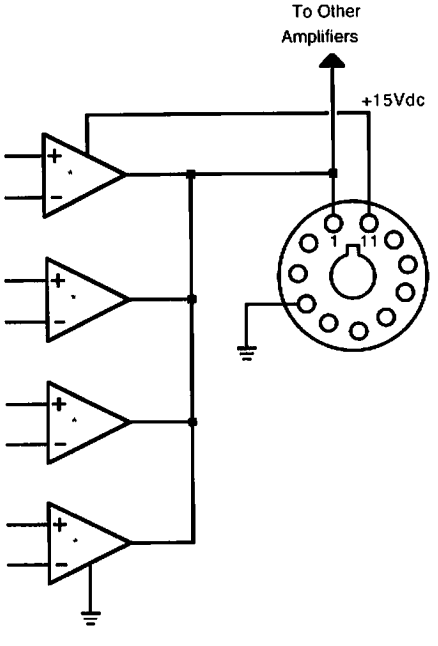
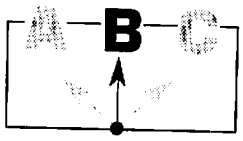


Illustration 3-10 Voltage Comparator Controller



3.4.4 TTL Open Collector

For computer controlled remote ENABLE, an open collector TTL device may be used. Direct interface from the 5 volt logic level may be made by choosing the correct 7400-family IC. A 7406 buffer can be used in this application. The pull-up for the open collector in the 7406 is built into the 7560/70. See Illustration 3-11 for a suitable system.

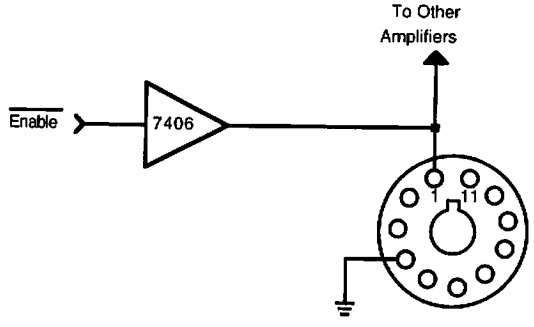


Illustration 3-11 Logic Control

3.4.5 Crowbar Load Protection

For maximum load protection, crowbarring of the output may be necessary when initiating the standby mode. Illustration 3-12 shows a method for including this feature.

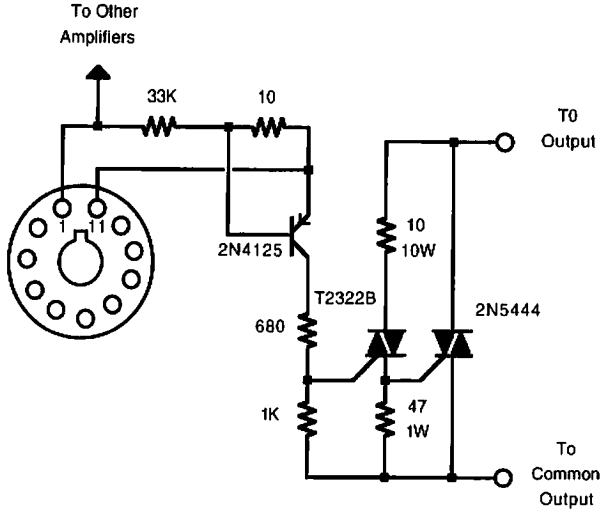


Illustration 3-12
Crowbar Load Protection

3.5 Alternative Supply Voltage

Model 7560/70 is factory wired for a specific AC mains voltage. The serial plate indicates factory voltage wiring. For new applications, users can make limited modifications to allow operation under different voltages.

Illustrations 3-13 and 3-14 shows transformer wiring for five AC mains configurations. Conversion requires changing the wiring connections to match the wiring diagrams in the illustrations. The following steps will be helpful in interpreting the diagrams:

⚠ WARNING

Only a competent technician should attempt to convert from one voltage to another. Follow instructions thouroughly.

1. Disconnect the amplifier from the AC mains.
2. Remove top, bottom and back cover.
3. Determine the desired AC mains voltage.
4. Locate the two high voltage transformers and their terminal strips or terminal boards.
5. Move the jumpers and wires to the positions shown in Illustration 3-13.

Note: Both high voltage terminal strips are wired identically but are positioned to mirror each other.

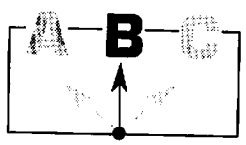
6. Locate the control voltage transformer terminal board.
7. Move the jumpers and wires to the positions shown in Illustration 3-14.
8. Change the fuses F1 and F2 to values shown in Table 3-1.
9. Replace covers.

Note: Amplifier may go into standby after conversion. If this happens, adjust R421 CW to allow amplifier to just leave standby and start normal operation. Refer to Section 6 for complete adjustment procedure of R421.

Note: All fuses measure 0.3438 in (8.731mm) X 1.5 in (3.81 cm).

AC Mains	F2 (high voltage fuse)	CPN	F1 (low voltage fuse)	CPN
100 V	20 Amp Type 3AB	A10285-29	1/2 Amp Type 3AB	A10285-8
120 V	20 Amp Type 3AB	A10285-29	1/2 Amp Type 3AB	A10285-8
200 V	10 Amp Type FNM	A10285-25	1/2 Amp Type 3AB	A10285-8
220 V	10 Amp Type FNM	A10285-25	1/2 Amp Type 3AB	A10285-8
240 V	10 Amp Type FNM	A10285-25	1/2 Amp Type 3AB	A10285-8

Table 3-1 Fuse Chart



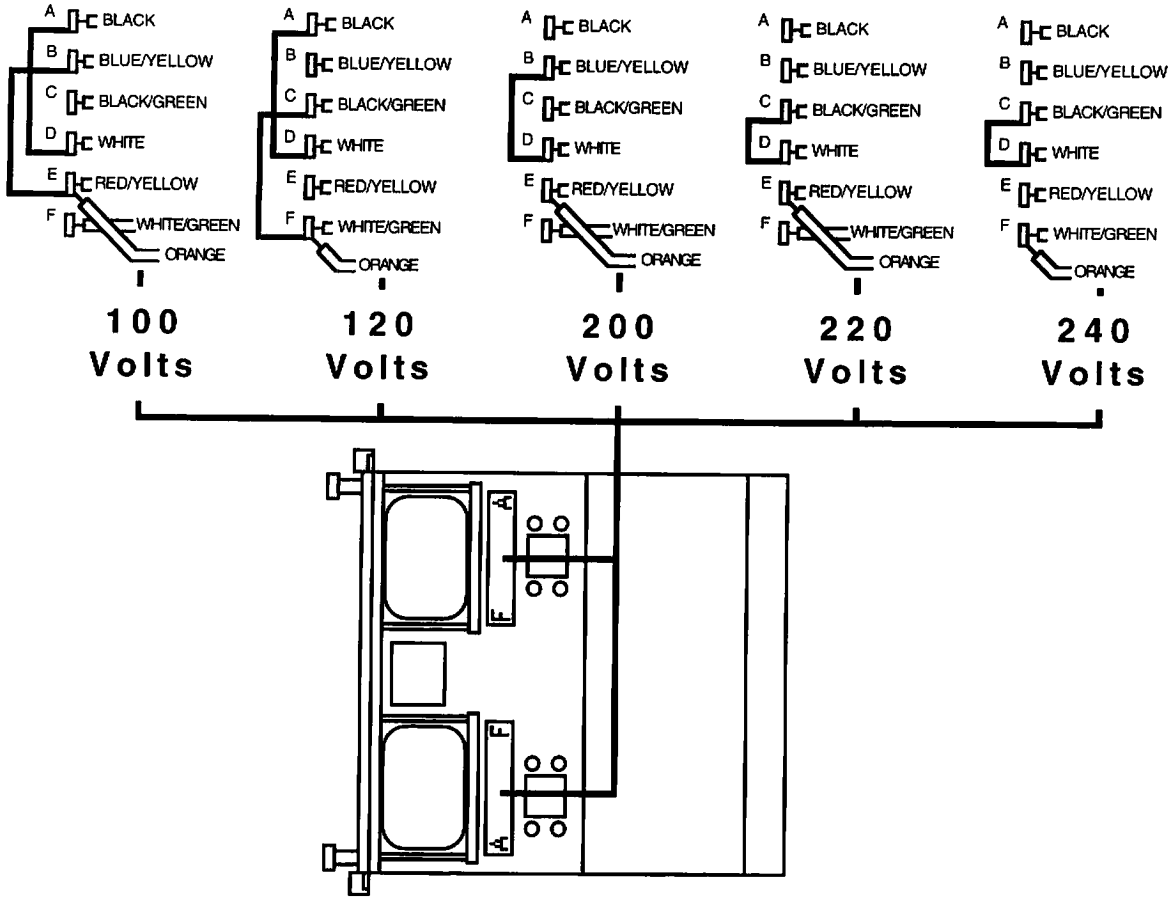


Illustration 3-13 Power Transformer Alternate Primary Voltage Connections

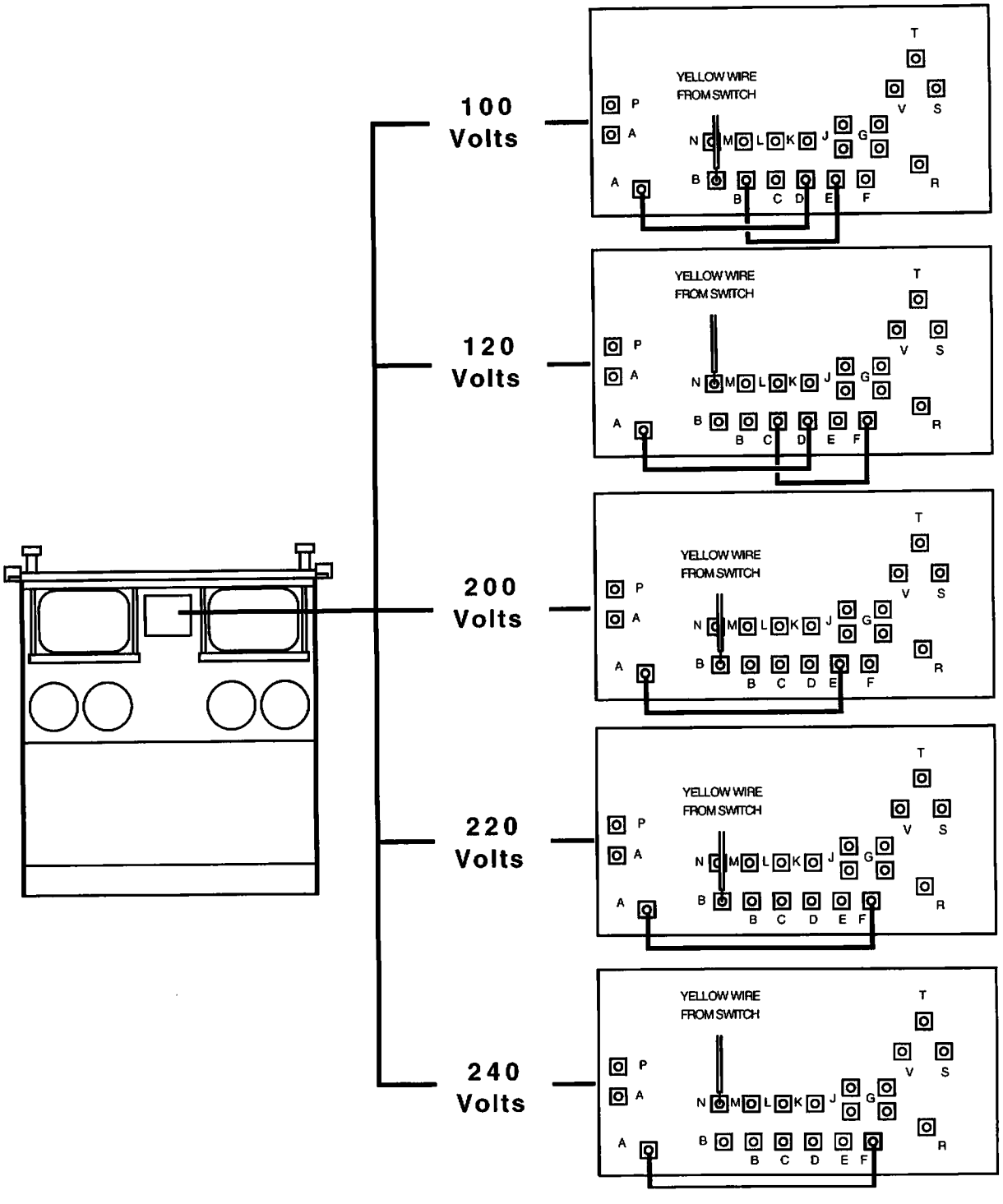
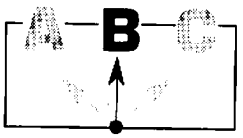


Illustration 3-14 Control Transformer Alternate Primary Voltage Connections



3.6 Combining Amplifiers

3.6.1 General Overview

A TECHRON 7560/70 amplifier may be used with other 7560/70 amplifiers to increase available current or voltage. This section explains the objectives of such amplifier systems and provides general guidelines for their construction.

Construct multiple amplifier systems according to the following principles:

Use Model 7560/70 Only to construct multiple amplifier systems. Do not attempt to insert any units other than additional TECHRON Model 7560/70s. Such an improper connection could damage all amplifiers.

Never Directly Connect Output Terminals of any two amplifiers. The resulting circulating currents will waste power and may damage the amplifiers.

High Voltage is present within Model 7560/70 amplifier. In systems assembled for increased voltage, some points could carry lethal voltage levels.

Wire Specifications Are Important. Section 3.6.2 details the minimum wiring specifications of multi-amplifier systems. Make sure the guidelines outlined in this section are followed carefully.

3.6.2 Wiring Principles

This section outlines the minimum wiring requirements in terms of size, length, and rating for connecting multi-amplifier systems.

Wire size or gauge should be selected to match the expected current it will carry. Table 3-2 shows the minimum matching requirements of wire gauge and continuous duty amperage limits.

Control the length of wire connecting each amplifier with care. Particularly in parallel applications, the length of branches to each amplifier should match within a tolerance of 1/4". Similarly, in any Y-branching application, both legs should be of the same length with a tolerance of ± 1/4".

Wires connecting the amplifier grounds together should be as short as possible.

Wire rating refers to the allowable voltage handled by the wire. In configuring multi-amplifier systems for increased voltage, make sure that the wire insulation is appropriate for the intended voltage.

WIRE SIZE (AWG)	DIAMETER (millimeters)	DIAMETER (inches)	CURRENT CAPACITY (continuous duty) *
8	3.264	.1285	46 A
10	2.588	.1019	33 A
12	2.053	.0808	23 A
14	1.628	.0641	17 A
16	1.291	.0508	13 A
18	1.024	.0403	10 A

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

Table 3-2 Wire Current Carrying Capacity

3.6.3 Push-Pull Operation

You can put Model 7560/70 amplifiers in push-pull configurations to double available voltage to a load. To take advantage of this configuration, purchase the optional interlock cable kit, 75D01. In this configuration, both amplifiers are at ground potential and the system output is balanced above ground.

Push-Pull operation is done in pairs. Current remains the same as with one amplifier. Voltage is doubled in each push-pull pair. Load Impedance as seen by each amplifier is 1/2 the normal load impedance.

Follow this procedure to set up one pair of amplifiers:

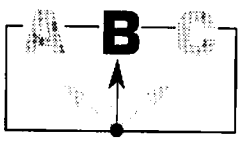
1. Connect (+) output of the Master 7560/70 amplifier to load (+) terminal.
2. Connect (+) output of the Slave 7560/70 amplifier to load (-) terminal.
3. Connect the ground (–) of the MASTER amplifier to SLAVE (-) ground.

⚠ CAUTION

Electrically isolate the load and all test instruments used in a push-pull system from ground.

4. Connect interlock cable between amplifiers (at J3) using kit 75D01.

NOTE: You may wire this configuration without the kit as described in Illustration 3-15. Note, however, that you must shield pin 1 from pins 7 and 8 to avoid potential oscillations.



5. Connect the input signal to the MASTER via the BNC connector.
6. Adjust system amplitude using the gain control on the MASTER amplifier.
7. Note changes in value for V, I, and Z:
   I (Current) remains the same as with one amplifier
   V (Voltage) is doubled in each push-pull pair
   Z (Impedance) as seen by each amplifier is the normal load impedance divided in half.

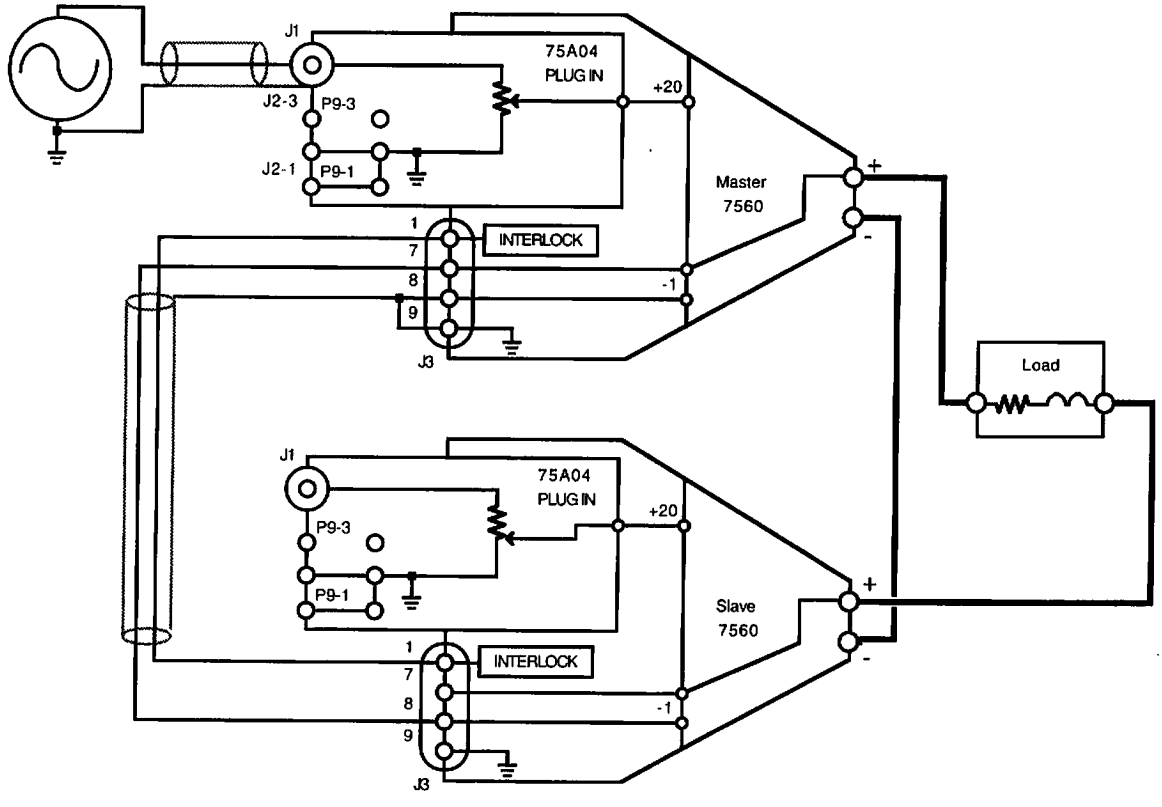


Illustration 3-15 Push-Pull System

3.6.4 Parallel Operation

Model 7560/70 amplifiers can be paralleled to increase available current. Illustration 3-16 shows basic parallel wiring. The downward arrows represent further connections for additional units in the parallel system.

Note: Depending on frequency used, system stability may require a 0.1 Ω to 1.0 Ω ballast resistor.

In assembling the parallel system, note the following conditions:

1. Connect a .1Ω–.25Ω, 50W, 1% resistor to the (+) output of each amplifier.
2. Connect (+) outputs, after resistors, together to Load (+) terminal.
3. Connect (-) outputs together, then to Load (-) terminal.
4. Connect interlock cable to all amplifiers operating in parallel.
5. Connect input to Master amplifier via J1 connector. Any special input card installed in the Master need not be duplicated in the Slave amp(s).
6. Add a 47 ohm, 1/4 watt resistor to the input plug in board of the Master amplifier. Connect the resistor from P9-22 to P9-3.
7. If not already present, install gain trimming input plug-in (75A11) on each Slave amplifier.
8. Adjust gain trimmer for equal output on each amplifier, using Master Output as the reference point.
9. Note changes in value for V, I, and Z:
   V (Voltage) remains the same
   I (Current) is multiplied by the number of amplifiers in parallel
   Z (Impedance) equals number of amplifiers times the R value of the load itself, plus the numerical value of the added resistor.

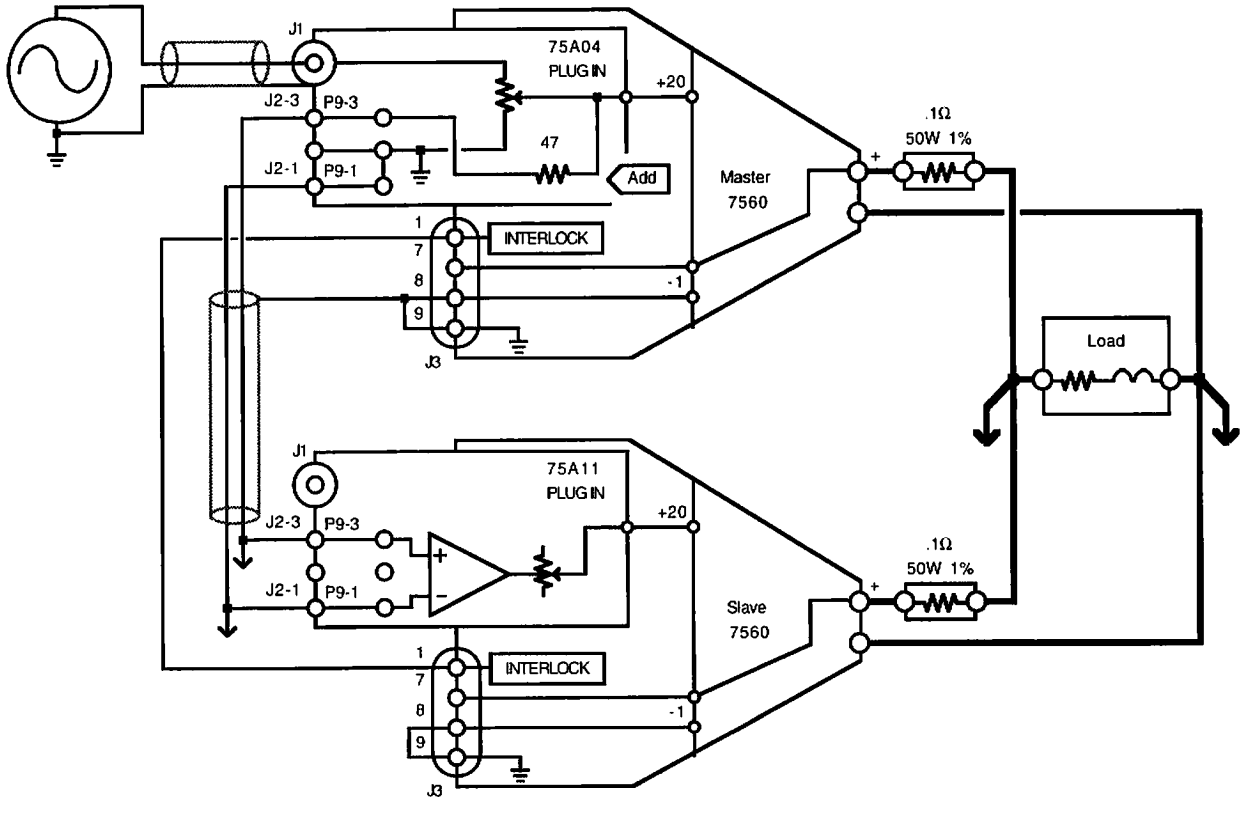
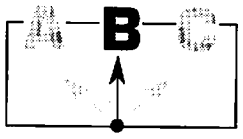


Illustration 3-16 Parallel System



3.6.5 Parallel Push-Pull Operation

A push-pull parallel system is another possible configuration. Illustration 3-17 shows the wiring connections for a 7560/70 and three 7560/70s in such a system.

To begin, set up these systems according to Parallel instructions in Section 3.6.4 and Push-Pull instructions in Section 3.6.3. Following set up, integrate the system in the following manner:

1. Treat each push-pull pair as one amplifier.
2. Treat each parallel team (two or more) as one amplifier.
3. ALL amplifiers MUST be connected to interlock cable.
4. See Illustration 3-17 for connection examples. Note changes in values for V, I, and Z.

3.7 Cooling Needs

In operation, amplifiers must dissipate the heat produced by the circuitry. Models 7560/70 are dual-fan-cooled. In closed rack installations, in areas of high ambient temperature, and in installations of high continuous output, additional cooling may be required. External fan cooling of the rack itself may be desirable. Use commercial furnace filters to avoid excessive dust-loading of amplifier filters.

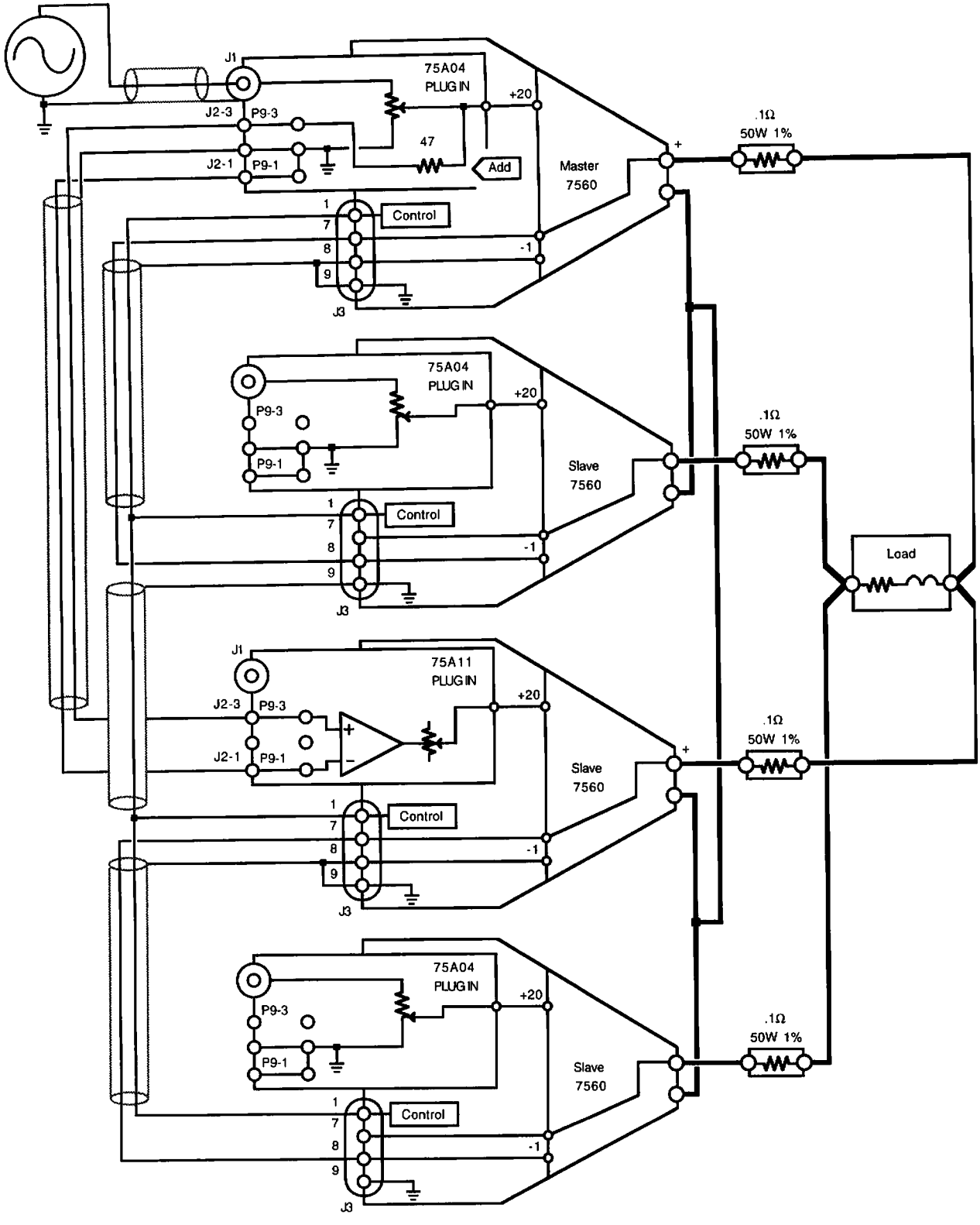
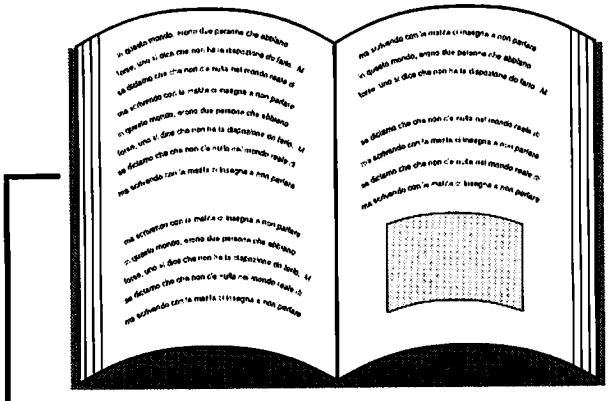


Illustration 3-17 Parallel Push-Pull System



Section 4—Principles of Operation

This section descusses the principles upon which a Techron Model 7560/70 series amplifier functions.

4.1 General Information

TECHRON's Model 7560/70 amplifiers are high power, direct coupled, controlled current (7570's only), versatile amplifiers with protection circuitry for the power output transistors. The 7560/70 is basically a bridge of four power amplifier elements powered by a floating power supply.

4.2 Principles of Bridge Amplifiers

4.2.1 Output Stage Topology

Illustrations 4-1 and 4-2 are block diagrams of the topologies commonly used for direct-coupled amplifiers. The totem-pole is the most common and makes available a peak voltage to the load of 1/2 of the total supply voltage (Vcc) while exposing the output stage devices to stress from the total supply voltage (2 Vcc). Only one half of the supply is used at a time, reducing the supply operating efficiency as well. The full bridge output stage as shown makes full use of the available supply voltage as the peak output to the load is 2 Vcc.

The peak-to-peak output voltage of the full bridge amplifier is actually twice the available supply voltage (4 Vcc). The maximum voltage stress to the output stage devices is the same as in the totem-pole topology (2 Vcc). The supply utilization is now total.

4.2.2 Output Stage Synchrony

Operation of the full bridge to produce a positive output current requires that the output stages one and three be increased in conductance in synchrony and output stages two and four be decreased in synchrony, decreasing as one and three are increasing.

In class AB operation, the conductance of two and four would diminish to zero and stages one and three would increase to the level required to carry the desired positive peak output current. For a negative output current the roles of the pairs one and three and two and four are interchanged with two and four ultimately carrying the negative peak output current.

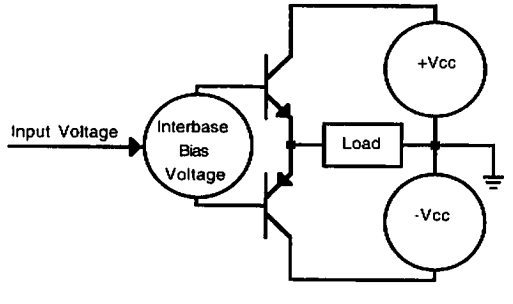


Illustration 4-1 Totem-Pole Topology

4.2.3 Output Stage Terminology

The names one, two, three and four are not preferred for describing the output stages. Since the output stages are constructed with bipolar transistor devices, the preferred and more descriptive terminology is to name an output stage in terms of whether the stage acts as a giant NPN or PNP stage and whether it is on the high (output) side of the load or low (ground) side of the load. Thus stage one is generally referred to as the high side NPN stage and stage three is referred to as the low side PNP stage.

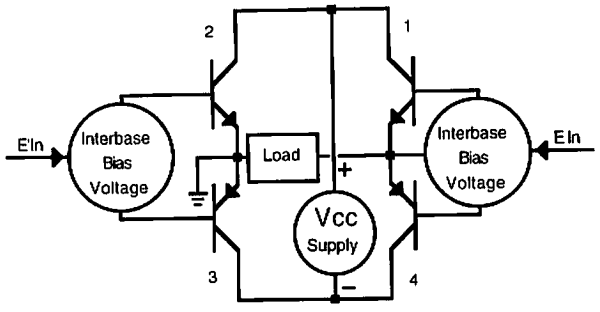


Illustration 4-2 Full Bridge Topology

4.2.4 Transistor Topologies

There are four basic composite transistor topologies (Illustration 4-3) which may be used in any configuration which can be derived by recursive application of the forms. Other three terminal devices such as FETs could be substituted for the bipolar transistors without loss of generality. In the application of the 7560/70 all of the devices of the output stages are bipolar. The principle output devices are NPN transistors paralleled eight times. They are driven from NPN driver transistors (Darlington form). NPN stages use an NPN predriver (Darlington form) driving the drivers. PNP stages use a PNP predriver (Complementary form) driving the drivers.

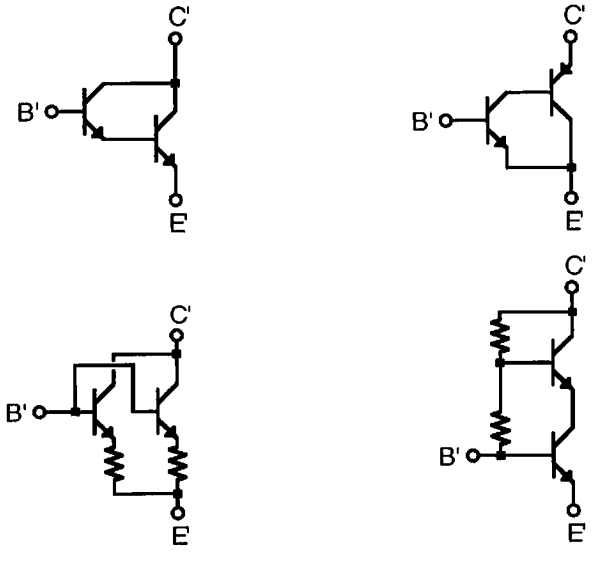
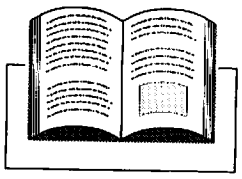


Illustration 4-3 Composite Transistor Topologies



4.2.5 Bias Current and Protection Circuitry

The main quiescent bias current is carried by the driver transistors. The power transistors sense when the drivers are carrying a significant current then boost their own current, taking the current load away from the drivers.

The Signal Programmed Automatic Current Executor (SPACE) provides protection for the bridge by acting as an automatic current limiter at most frequencies, and as a VI limiter at very low frequencies. The SPACE circuit remembers the history of the output signal and adjusts the threshold of current limiting. The no-signal threshold of current limiting is high enough to allow full-power signal bursts at loads of 4 ohms or greater.

4.3 Block Diagram Circuit Theory

Illustration 4-4 shows a block diagram of the amplifier's circuitry. Due to circuit complexity, not every connection or feedback loop is shown, but the diagram will aid in understanding each circuit.

The 7560 amplifier's input signal, with conditioning from the input bias compensator, goes directly to the input amplifier section. With 7570 amplifiers, the input signal is first fed to the current control amplifier. Feedback from the output current is compared to the input signal to produce an error signal to drive the input amplifier section.

The input amplifier section op-amp amplifies the signal and sends it to the signal translator which divides the signal into two complementary signals. From there, the two signals are sent to the last voltage amplifiers which are of conventional design. The signal then feeds into the positive and negative predriver and driver sections which drive the high side power sections. The main bias servo corrects the bias on the driver stage according to the temperature sensed from a positive power section heat sink.

The signal next enters the load from the power sections and is referenced to ground. The feedback signal is taken from the signal terminal of the load and returns to the input amp, signal translator, and last voltage amp. The feedback signal is also the input to the Bridge Balance Amp. The amplifier also uses the common point between the positive and negative power supplies (Vcc common) as its feedback signal and feeds the BBA buffers which in turn drive the low side power sections.

In the 7570 amplifiers, output current is sampled by a .033 Ohm, 50 watt resistor to return output current information to the current control stage.

The protection circuit measures the current in the power transistors and stores voltage and current information from the output signal, signals from the last voltage amplifiers, and the bridge balance amp buffers. The protection circuit uses all this information to provide power transistor protection. The Power Control senses high line voltage, high temperature, low frequency output, and time delay (last two are switch-selected), and controls the main supply voltage through a relay. Operation is indicated by red and amber lights on the front panel.

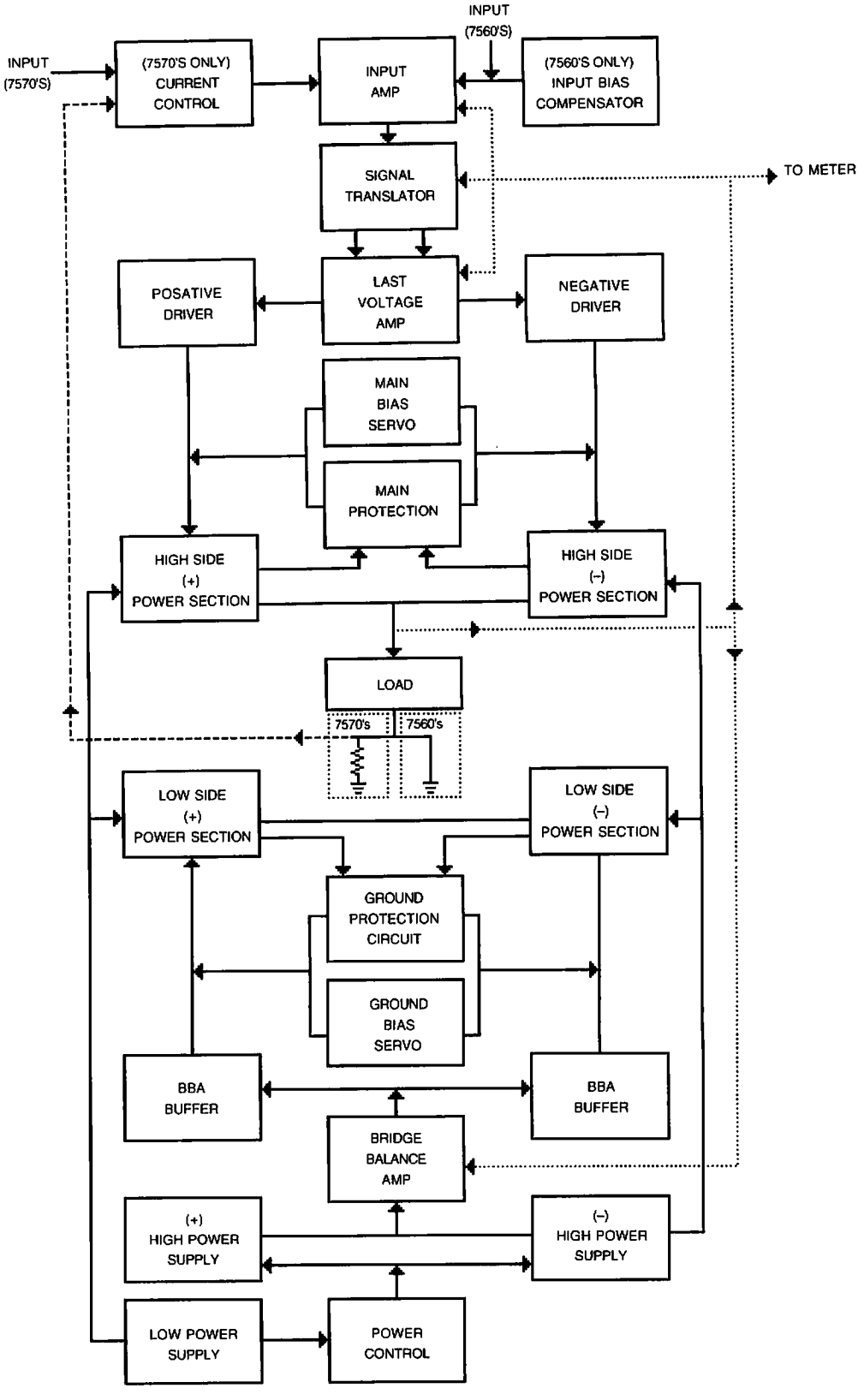
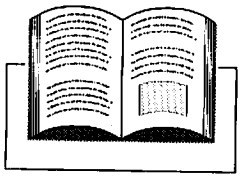


Illustration 4-4 7560/70 Block Diagram



4.4 Detailed Circuit Description

Refer to schematics in the back of the manual for the discussion of circuitry.

4.4.1 7560's Standard Input Plug-In

An input signal is applied to either J1, the standard input, or J2, the special input. The signal is then fed to the plug-in assembly or module.

The signal enters the input plug-in through P9-19 for the standard input. The special input is not connected on the board, but enters through P9-1 to P9-3. The signal from P9-19 connects to SW500 and C500. Switch SW500 switches the DC blocking capacitor C500 in or out of the input circuit. The signal proceeds to R500 which is the input attenuator. The signal now goes to P9-22 and is routed to P1-4.

4.4.2 7570's Standard Input Plug-In

An active differential input is formed by U1C and resistor pack RN1. The common mode rejection of the amplifier is tuned for optimum rejection at low frequencies by adjusting R4. The high frequency common mode rejection ratio is adjusted by tuning TC1 which is tuned to set TC1 plus C2 to equal C1. U1C is offset zeroed by R7 via R6.

R40 provides the operator with a gain control. The controlled current mode works by U1D comparing the current output of the amplifier with the desired current waveform at the output of U1C.

Output current of the power amplifier section is sensed by R307 (found on Schematic J0117B8) and amplified by U1B for use in the current control loop.

U1B forms a differential amplifier with an adjustable gain control, R21. The time constants of R20*C7 along with R25*C8 compensate the sense resistor for its series inductance(i.e. L/R). The output of U1B is calibrated for .1 volt per ampere of output. The zero offset of U1B is eliminated by adjustment of R26 via R24.

The current control amplifier, U1D, is offset zeroed by R8 via R9. R10 and C3 provide the proper source impedance to U1D for minimum offset drift.

The current monitor output is made available at the front panel 1/4" jack. U1A is a unity gain inverter to provide a balanced output. The output is isolated from capacitive loads by R27 and R30 The monitor output amplifier, U1A, is offset zeroed by R31 via R32. R33 and C10 provide the proper source impedance to U1A for minimum offset drift.

C5, C6 and R16 comprise the principle compensation network which serves to control the open loop gain of the closed loop current controlled system. In the controlled voltage mode of operation these compensation parts are not used. U1D becomes a unity gain stage when SW1 switches in R14 to operate the 7570 in the constant voltage mode. Q1 and Q2 allow U1D to recover quickly from any overloads that might occur. C17 and C18 bypass the ± 15 V lines.

The output of U1D is also routed to the back panel to drive slave amplifiers. R15 provides an isolation from capacitive loads when driving slave amplifiers.

U21A and U2B and associated parts are used to form optional high pass and low pass filters. The signal now goes to P9-22 and is routed to P1-4.

4.4.3 Amplifier Input

From the input plug-in at P1-4, the signal enters U100, through input protection resistor R105. D100 and D101 form a differential voltage limiting circuit to protect the IC. C105 attenuates RF inputs and controls the apparent input impedance.

Feedback from the power section to the input is accomplished through a voltage divider formed by R112 and R113.

4.4.4 Last Voltage Amplifiers

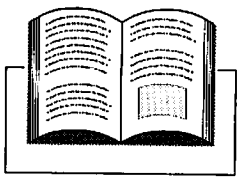
The signal now appears at the bases of Q104 and Q105, through R110 and R111. Q104 and Q105 translate the signal to the last voltage amplifiers which require complementary signal components to drive the positive and negative power quadrants of the high side of the output bridge.

4.4.5 Beginning of Bridge Circuitry Description

Output transistors and other components mounted on heat sinks are designated by a two part number. The first part is the position on the heat sink and the second part designates the heat sink within the amplifier. For example "R1A1" refers to resistor R1 on heat sink A1.

Following the signal through the positive side, Q104's collector direct-couples to Q103, the last voltage amplifier. Q102 limits the collector current of Q103. C135 applies a feedback signal to the base of Q103. C127, C130, and C134 provide slew rate limiting. Q114 and temperature sensing Q1A3 (mounted on a positive quadrant [high side] heat sink) control the bias for positive and negative predrivers, Q115 and Q117. Q116 is a speed-up device and discharges the base of the positive driver, Q2A3. As the current through Q2A3 increases, the voltage across R4A3 increases and turns on Q3A3 through Q6A4. These transistors then carry the heavy current until the voltage on R4A3 drops and turns them off. This action allows the drivers to carry the main bias current which reduces the bias circuit complexity normally found in high power amps.

The negative side of the amplifier works in the same way as the positive side.



4.4.6 Bridge Balance Amp

U101 forms the bridge balance amp. It is basically a comparator using the point between the two high voltage power supplies (Vcc common) as its feedback signal. A reference voltage is applied to U101 through R120 and R124 and is compared with the half voltage across the bridge from R127 and R125. R117 and R119 form the static balancing circuit and R122 adjusts the dynamic balance of the bridge through the voltage dividers using R124, R125 and R121, R123.

The output of U101 is fed to Q109 and Q110 which buffer and translate the signal to the positive and negative quadrants of the low side predrivers. From this point the operation is the same as described previously.

4.4.7 Protection of the Amplifier

The amplifier is protected from inductively induced transients by flyback diodes D1A3, D1A6, D1A2, and D1A7. C300 and R305 provide high frequency loading for the output.

The protection circuitry controls the drive on the bases of Q115 and Q117 which drive the output modules. The output voltage is applied to the emitters of Q108 and Q113 to C124 and C125. These components form the main output transistor protection circuit. C124 and C125 store a voltage related to the history of collector-to-emitter current (Ic) and output voltage. A history of Ic discharges the capacitors so as to reduce the limiting thresholds. D105 through D108 are overcharge limiters. Q113 is the positive limiter and gets its Ic information from current sensing resistor R5A3. Q108 is the negative limiter and obtains its control from R9A6.

At low frequencies or DC, the limiters perform in a foldback manner, i.e. allow increasing output voltage (when the product of output voltage and current is positive). Such a limiter fits a set of straight line approximations to the transistor power dissipation (V vs I) hyperbolas and is generally known as a V-I limiter. When the output voltage polarity is opposite the current polarity, the limiters voltage sensitivity is a function of R143 and R141. In quadrants 1 and 3 the network of R140 and R142 is also conducting through D108 or D107 which give increased slope to the limiting line and additional output power without exceeding the output transistor dissipation ratings.

At audio frequencies, C124 and C125 filter all voltage information to Q113 and Q108 such that the instantaneous response is that of a current limiter, R159, C126 and R137, C114 provide positive and negative limiter stabilization respectively. Q111, Q112 and their associated circuitry duplicate the protection circuits previously described, but are referenced to ground and protect the low side of the bridge should it require additional protection.

4.4.8 Power Supply and Power Control

The power supply is conventional, except the high voltage is not referenced to ground. The low voltage supply is a fixed ±15 volts regulated, ±24 volts unregulated and +23 volts unregulated. IC400 and IC401 are the voltage regulators, protected from reverse polarity output shorts by D405 and D406.

The power control circuit controls the high voltage relay K1. Q402 drives the relay coil and D409 protects Q402 from flyback transients when the coil de-energizes. Q401 is a phase inverter to control the base of Q402. Q401 is controlled by the voltage comparator IC402A which is driven by the interlock line. The interlock line goes out to pin 1 of the interlock plug so that multiple amplifiers can be connected together. All interconnected amplifiers will be in standby or will be in operation at the same time.

Pin 7 of IC402A is held at about a 10 volt potential by the voltage divider, R401 and R402. R403 provides feedback to pin 7 to provide hysteresis of the switching point. The interlock control line is pulled high by R400, but it can be shorted to ground by FET Q400 with the diode D410 in series. The FET Q400 is in conduction whenever any condition of the amplifier is calling for standby. With the amplifier in operation, pin 2 of IC402B is held to -15 volts. Then R408, R409 and R410 form a voltage divider setting pin 5 of IC402 to -1 volt. When pin 4 is driven more negative than -1 volt, pin 2 will no longer be held at -15 by the IC and the amplifier will go into standby.

4.4.9 Standby Conditions

There are four different conditions that will put the amplifier into standby.

1. **At turn on,** C406 holds IC402 pin 4 at -15 volts. C406 is charged through R411 making the voltage at pin 4 more positive. The rear panel DELAY switch (SW2) connects C407 increasing the delay approximately 5 seconds.

2. **10% high AC mains** standby point is set by a voltage divider R413, R421 and R414 connected between +15 V and -24 V supplies. R421 is adjusted to switch the amplifier into standby if the line voltage is more than 10% high by making pin 9 of IC402C more negative than the reference voltage set at pin 8.

3. **Low frequency protect** is controlled by IC402D. When the rear panel low frequency protect switch (SW3) is up, it connects Vcc common (which is 1/2 of the output voltage of the amplifier) to P6-4 bringing the signal onto the power supply module. R417, R418, C409, C410 form a low pass filter to the inputs of IC402D. In normal operation, pin 10 is biased at about +0.7 volts and pin 11 is biased at about +1.2 volts. If the junction of D411 and D412 is driven negative by the output signal, pin 11 becomes more negative than pin 10, which causes the output (pin 13) of IC402D to go to -15 volts. If the signal drives the junction of the diodes positive, then pin 10 becomes more positive than pin 11 and also drives the output of IC402D to -15 volts.

4. **Heat sink temperature exceeding 75°C** will also cause the amplifier to go into standby. The temperature sensors are R1A4, R1A5, R1A1 and R1A8. These solid state sensors go to a low resistance at a temperature of 75°C. In normal operation, the voltage at the junction of D413 and D420 is limited to +1.2 volts by D413 and D414. If any heat sink temperatures exceeds 75°C, the sensors conduct, lowering that voltage. If the voltage at the junction of D413 and D420 is lowered below +0.7 volts, the output of IC402D goes to -15 volts.

4.4.10 7571 Peak Meter Principles

Refer to the block diagram (Illustration 4-5) and the schematic in Section 7, page 7-40, for the discussion of Model 7571 peak meter circuit theory.

The output signal enters the 7571 meter at IC202B. Forming a precision full-wave rectifier, IC202B, D203, and D204 supply a negative input current to IC202A. IC202A compares the input signal with the meter output through R218. If the output signal is greater than the input signal, D205 conducts. If the opposite is true, Q200 will conduct. Q200 charges C201, which is buffered by IC201A, a voltage follower. IC201A drives R218 and the 200 microampere meter movement. The result is that C201 will store the largest peak value of the input signal. The catch-and-hold timing circuit consists of Q202, Q203, and IC201.

Hold time is determined by C202 and R229. When Q200 charges C201, its collector current triggers Q202 and Q203 to fully charge C202. During the intervals when D205 is conducting, C202 discharges through R229. When the charge on C202 falls below 0 volts, IC201B turns on Q201, which discharges C201, resetting the hold cycle. D206 prevents the leakage in Q201 from discharging C201.

During the intervals when D205 is conducting, C202 discharges through R229. When the charge on C202 falls below 0 volts, IC201B turns on Q201, which discharges C201, resetting the hold cycle. D206 prevents the leakage in Q201 from discharging C201.

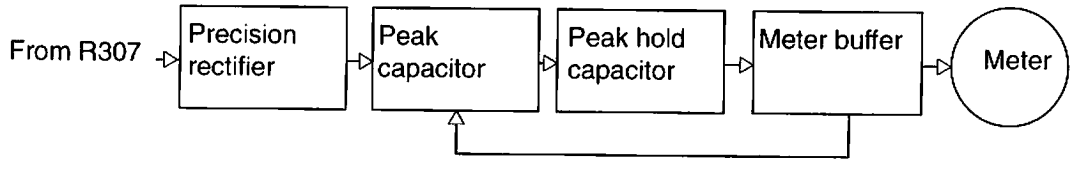
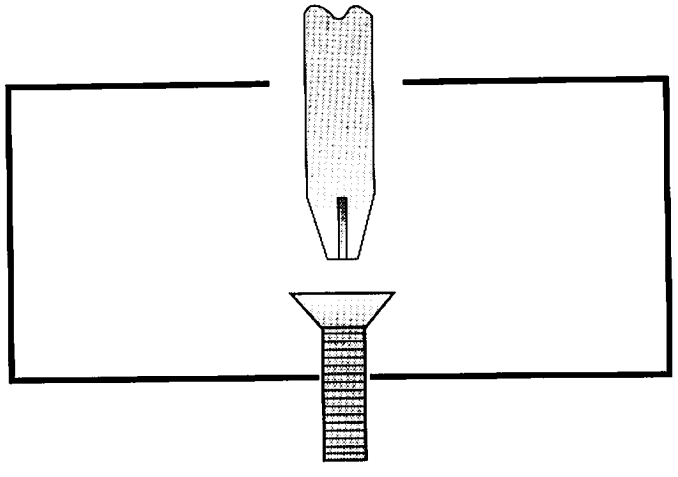


Illustration 4-5 7571 Meter Block Diagram



Section 5—Component Removals/Replacements

Failed components may need to be removed, seviced, and reinstalled or replaced. Use this information for removing and reinstalling such components.

5.1 Introduction

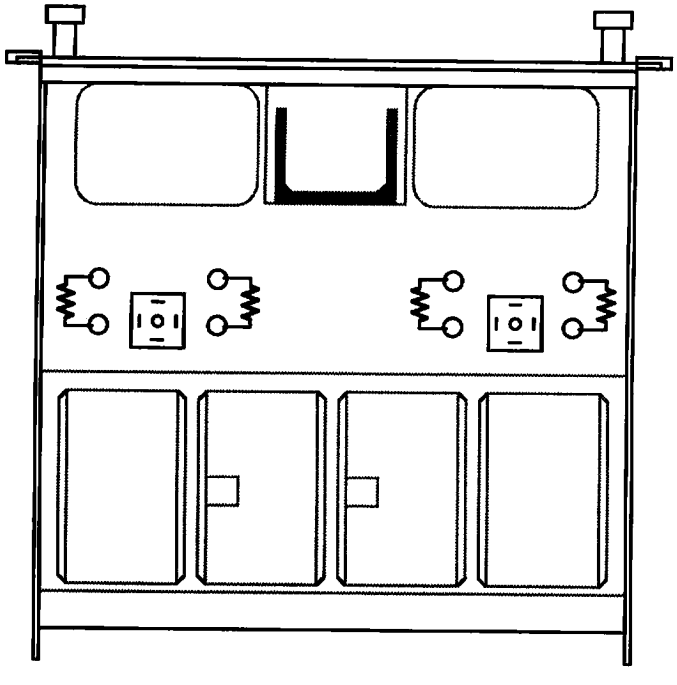
This section contains technical information which will guide the technician through effective repair of Model 7560/70. It includes dissassembly and reassembly procedures and helpful repair notes. Use this section with section 8 (schematic/board layout diagrams, parts lists, and exploded view drawings).

5.2 Important Safety Information

⚠ DANGER

A 6560/70 amplifier carries potentially lethal voltages even after the main power supply has been disconnected. If covers are removed, disconnect AC power and discharge the power supply capacitors.

To discharge capacitors, place a 10 ohm 10 watt resistor across positive and negative terminals of each of the four capacitors for at least 5 seconds each. Do not touch leads of resistor or capacitor terminals.



All resistors 10Ω, 10 watt.

Illustration 5-1 Capacitor Discharge Points

5.3 Visual Inspection

Visually inspect Model 7560/70 regularly during normal operation, and at the beginning of any troubleshooting procedure. For a complete yet efficient visual inspection, follow these instructions:

1. Check all external screws. Be sure these are tight and that none are missing.
2. Check all fuses and circuit breakers.
3. Check switches, knobs, jacks and other connections. Be sure these operate smoothly and properly, and that none are loose.
4. Inspect line cord for possible damage to cap, jacket and conductors.
5. Remove top and bottom covers as outlined in Sections 5.5. and 5.6.
6. Check that all attaching parts for internal circuits are tight and that none are missing.
7. Inspect wiring and internal components for evidence of charring or discoloration. These may indicate previous overheating.
8. Check all electrical connections, including wire terminals, screw and stud type terminals, and all soldered connections.
9. Check for obvious destruction of internal structural parts.

Note: The interior of Model 7560/70 normally looks neat and orderly. Physical distortion or disorder of wiring or other components may indicate damage from severe shock, from being dropped, or from previous improper repair procedures.

5.4 Back Cover Service

Back Cover Removal:

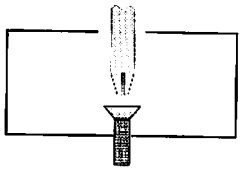
1. Remove four hex head sheet metal screws (2 each side) from the side panels nearest the back cover.
2. Remove three hex head sheet metal screws along upper edge of back cover.

> **⚠ CAUTION**
>
> Pull straight out on the back cover to remove it from the amplifier. Failure to pull straight out may damage parts on the main board.

3. Carefully remove back cover.

To reinstall back cover place all screws through the cover into their original holes but do not tighten until everything is aligned.

Note: Do not install back cover if top cover is off unit. Back cover must be off in order to install top cover. Screws along top are longer than those along sides.



5.5 Top Cover Service

Top Cover Removal:

1. Remove back cover as described in Section 5.4.
2. Remove 6 hex head screws (3 each side) along top edge of side panels.
3. Slide top cover towards the rear of unit about 1/4", then lift and remove.

Note: Back cover must be off unit in order to reinstall top cover.

Top Cover Installation:

4. Carefully engage front edge of top cover in channel along top edge of front panel.
5. Slide top cover forward into channel, aligning side screw mounting holes.
6. Start 6 hex head screws (3 each side) along top edge of side panels, but do not tighten.
7. When all screws have been started, tighten securely.
8. Reinstall back cover as described in Section 5.4.

5.6 Bottom Cover Service

The bottom cover may be removed without removing any other panels or covers. Set unit on side or upside down. If unit is slide-mounted in rack, rotate for best access to bottom.

⚠ WARNING

Turn power off, disconnect the AC supply and discharge capacitors as described in section 5.2 before proceeding with service.

Bottom Cover Removal:

1. Remove 4 hex head sheet metal screws (2 each side) along bottom edge of each side panel.
2. Remove front feet by loosening screw in center of each foot.
3. Remove screw from center front edge, bottom cover.
4. Remove 3 short screws from rear edge, bottom cover.
5. Taking care not to touch any interior components, pull back edge of bottom cover outward slightly, then slide front edge out of slot in back side of front panel.
6. When cover is free, remove.

Bottom cover installation:

7. Turn amplifier on its side, insert front edge of bottom cover into slot in lower front extrusion.
8. Align bottom cover for installation of mounting screws.
9. Start, but do not tighten, hex head sheet metal screws in center front edge of bottom panel and front rubber feet with mounting screws.
10. Start, but do not tighten, four hex head sheet metal screws (2 each side) along bottom edge of side panels.
11. Start, but do not tighten, 3 short screws in rear edge, bottom panel.
12. When all screws have been started, tighten securely.

5.7 Cooling Fan Service

Cooling Fan Removal:

1. Remove back panel, top cover, and bottom cover as described in Sections 5.4, 5.5, and 5.6.
2. Discharge Capacitors as instructed in Section 5.2.
3. Remove 10 hex head sheet metal screws which attach top output panel mounting plate to front and back cooling duct panels.
4. Taking care not to disturb wiring at back edge of this panel, lift front edge and set 180° towards rear with wiring acting as hinge points. Support panel so as not to damage wiring.
5. Disconnect fan wiring at Faston connectors nearest fan being serviced.
6. Loosen four screws at corners of fan shroud/bracket.
7. Remove fan and shroud/bracket assembly through opening in the top of cooling duct.

Cooling Fan Assembly Installation:

8. Set fan/shroud/bracket assembly in place, aligning screw holes.
9. Install four fan mounting screws and tighten.
10. Connect fan wires via Faston connectors to terminals nearest the fan.
11. Install filter and filter cover over four mounting screws and tighten.
12. Carefully align output panel to mounting screw holes.
13. Install ten hex head mounting screws, tightening screws only after all have been started.

Note: Two of these hex head mounting screws attach wires as well as holding output panel in place. Be sure to include wire attachments where needed. Wire length and location are exact, and proper location will be easy to see.

14. Install top, bottom, and back covers as described in 5.4, 5.5, and 5.6.

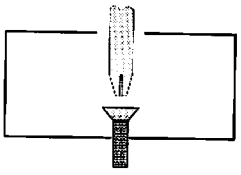
5.8 Servicing Output Components and Output Transistors

1. Remove covers as described in Sections 5.4, 5.5, and 5.6.
2. Discharge Capacitors as instructed in Section 5.2.
3. Remove 10 hex head sheet metal screws which attach top output panel mounting plate to front and back cooling duct panels.
4. Taking care not to disturb wiring at back edge of this panel, lift front edge and set 180° towards rear with wiring acting as hinge points. Support panel so as not to damage wiring.
5. Service output components from inside or outside of cooling duct, and from top or bottom of amplifier, as needed.

Note: To reach certain output transistors, remove aluminum baffle to gain access to screws.

Installing Output Components and Output Transistors:

6. Set output panel in place, lining up mounting screw holes.
7. Install mounting screws.
8. Be sure wire connectors to certain mounting screws are in place. Wire length and position make correct location very clear. Tighten all mounting screws. Do not over tighten.



5.9 Output Transistor Service

Output Transistor Removal:

1. Remove top output panel as described in Section 5.8.
2. Unsolder leads of transistor being replaced.
3. Remove transistor mounting bolts.

Output Transistor Installation:

4. Apply heat sink compound lightly and completely to mounting surface of new transistor.
5. **Bolt new transistor in place and tighten before soldering leads.**
6. Solder leads.
7. Replace top output panel.
8. Install chassis covers as described in Sections 5.4, 5.5, and 5.6.

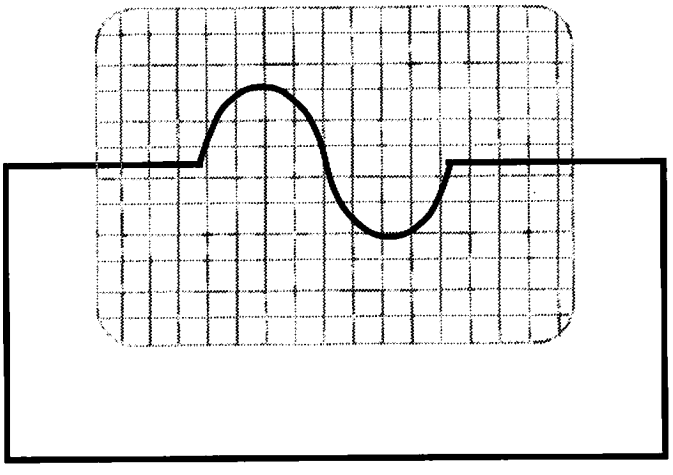
5.10 Power Transformer Service

Transformer Removal: (refer to exploded view in section 8)

1. Remove power and covers as described in Sections 5.2, 5.4, 5.5, and 5.6.
2. Remove input plug-in assembly from the front panel.
3. Remove the meter module assembly, if there is one, from the front panel.
4. Remove the handels from the front panel.
5. Loosen four screws and remove end bars from ends of the front panel.
6. Reach in and withdraw the bulbs from red and amber lens caps.
9. Unscrew retaining ring from power on/off switch.
10. Remove the upper and lower extrutions from the front panel.
11. Remove long machine screw and clamp bar from top of transformer.
12. Remove four hex nuts and star washers from lower end of mounting bolts passing through bottom transformer mounting surface.
13. Unbolt terminal strip nearest transformer being removed.
14. Disconnect red wires from rectifier block of transformer being removed.
15. Unsolder yellow wire (an unshielded wire with yellow tubing over it) from two points: one terminal on each of two filter capacitors. Solder points for this wire are clear upon visual inspection.
16. Remove transformer and terminal strip together.
17. To reassemble, reverse the proceedure.

⚠ CAUTION

After replacement of any electronic component in Model 7560/70, insure proper amplifier operation by performing check-out procedures as described in Section 6.



Section 6—Adjustments and Tests

This section describes the tests and adjustments you may need to perform following other service activities such as parts replacements.

6.1 Introduction

The procedures outlined in this section must be performed following service to the Model 7560/7570 Amplifier. Procedures in this section are NOT REQUIRED following replacement of fans.

6.1.1 Determining Correct AC Mains

Model 7560/7570 may be wired for a number of different AC mains voltages. The factory-wired voltage is stamped on the serial plate. However, because voltage may be changed after the unit leaves the factory, check wiring of the unit to be serviced. Compare with Illustrations 3-13 and 3-14 in section 3 showing various wiring configurations. For ALL tests, use the voltage for which the unit is wired. Check AC mains voltage with an RMS AC voltmeter.

⚠ WARNING

Turn power off, disconnect the AC supply and discharge capacitors as described below before proceeding with service.

6.1.2 Discharge Before Testing

Discharge capacitors C6, C7, C8, C9 on transformer mounting panel by connecting a 10 ohm, 10 watt resistor across the terminals of EACH capacitor for five seconds, each capacitor. See Illustration 6-1 for discharge points. Use care in handling resistor.

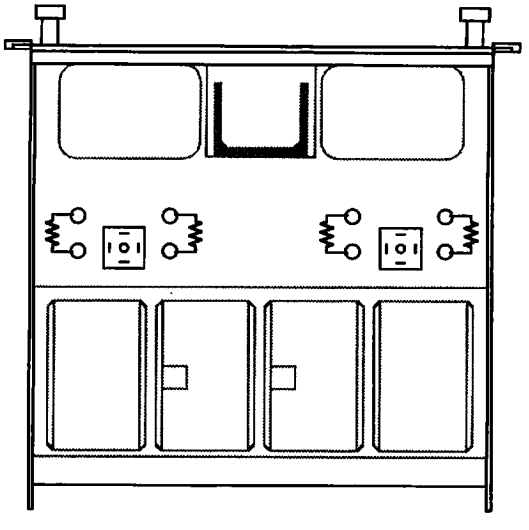


Illustration 6-1 Power Supply Discharge Points

6.1.3 Equipment Requirements

In addition to standard hand tools and electronic test equipment, the following specialized equipment is required to perform the tests in this section. Using the equipment listed in Table 6-1 will help you test and adjust the 7560/70 to factory specifications. Any compromises in equipment could result in unsatisfactory performance or calibration.

Equipment Needed	Recommendation
1. Oscilloscope Dual Channel Vert. Sensitivity - 2mV/div Vert. Frequency DC-15 MHz	Tektronix 2215A Hewlett-Packard 1740A Phillips PM3207
2. Audio Signal Generator Sine/Square Output-3 Volts RMS into 600 ohm load, 1%THD	Wavetek 193 Khrohn-Hite 1000, 1200
3. AC Voltmeter 20Hz-4Mhz Sensitivity-100μV FS ±1% Accuracy 20-20kHz	Hewlett-Packard 400F Amber 3501 Sound Technology 170B/1710A
4. Digital Voltmeter AC/DC Volts-1mV-100v AC/DC Amps-10mAmps-10 Amps Ohms-.1 ohm-10Mohms	Data Precision 248/1350,1351 Fluke 8020B Fluke 8060 series
5. Intermodulation Distortion Analyzer IM capable of .003% 60Hz/7kHz THD capable of .01% 20Hz-20kHz	Amber 3501 Technology 17701A, 1700 series Hewlett-Packard 339A
6. Variac or Autotransformer 0-140 volts 20 Amp capacity 0-260 volts 10 Amp capacity	Various Gen Rad. Models, Superior Electric Models or equivalent.
7. Peak Equivalent Line Voltage Monitor	See schematic in Illustration 7-2 for construction details.
8. Bandpass Filter 20-20kHz, 18dB/Octave rolloff	Sound Technology 170 or equivalent.
9. Resistive Loads 8 ohms-1kW 4 ohms-2kW 2 ohms-500 W	Construct from Dale NH-250 series, 1% resistors.
10. Non metallic screwdriver	GC 8276 or 8277
11. Plug-In Extender Board	Crown Part M41471-0
12. Precision Current Shunt	1% resistor

Table 6-1 Required Test Equipment

6.1.4 Test Equipment Grounding

Avoid ground loops in test equipment caused by connecting input ground to output ground. In service procedures, be sure shield is NOT connected to amplifier output ground.

6.1.5 Loads for Testing

Use resistive loads, having less than 10% reactive component at any frequency up to five times the highest test frequency (10kHz) specified in these tests. Dale resistor NH-250, a 250 watt, 8 ohm, 1% resistor is acceptable as a load at 8 ohms.

6.1.6 Measuring Amplifier Output

Take all output measurements at the binding post terminals of the amplifier. Do not measure output anywhere else along the output cables, or at the load.

6.2 Test and Adjustment Procedures

Performing the following instructions for all tests and adjustments in sequence will return the 7560/70 to optimum performance.

6.2.1 Inspection and Pretest

The purpose of this procedure is to determine whether the amplifier will accept input power without an input signal and under a no load condition without drawing excessive current. Do not operate the amplifier with a signal or load applied until it is capable of performing properly without signal and load. If there is a serious problem within the amplifier, application of signal and load will intensify the problem by blowing fuses and damaging other circuit components.

Inspection:

1. Turn amplifier power switch OFF.
2. Discharge the power supply capacitors.
3. Unplug 75M01 Meter, if present.
4. Remove main circuit board and power control circuit board.
5. Remove the input plug-in from the front of the amplifier.
6. Inspect circuit board components for the following defects:
   - Components incorrectly oriented or damaged
   - Solder or copper bridges on board or at input and output pins.
7. Reinstall the circuit boards after inspecting them.

Pretest:

1. Turn power OFF.
2. Connect the AC mains and test equipment as shown in Illustration 6-3.
3. Insert interlock plug (Illustration 6-2) with pins 8 & 9 shorted into J3F.

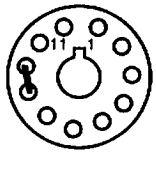


Illustration 6-2 Interlock Plug

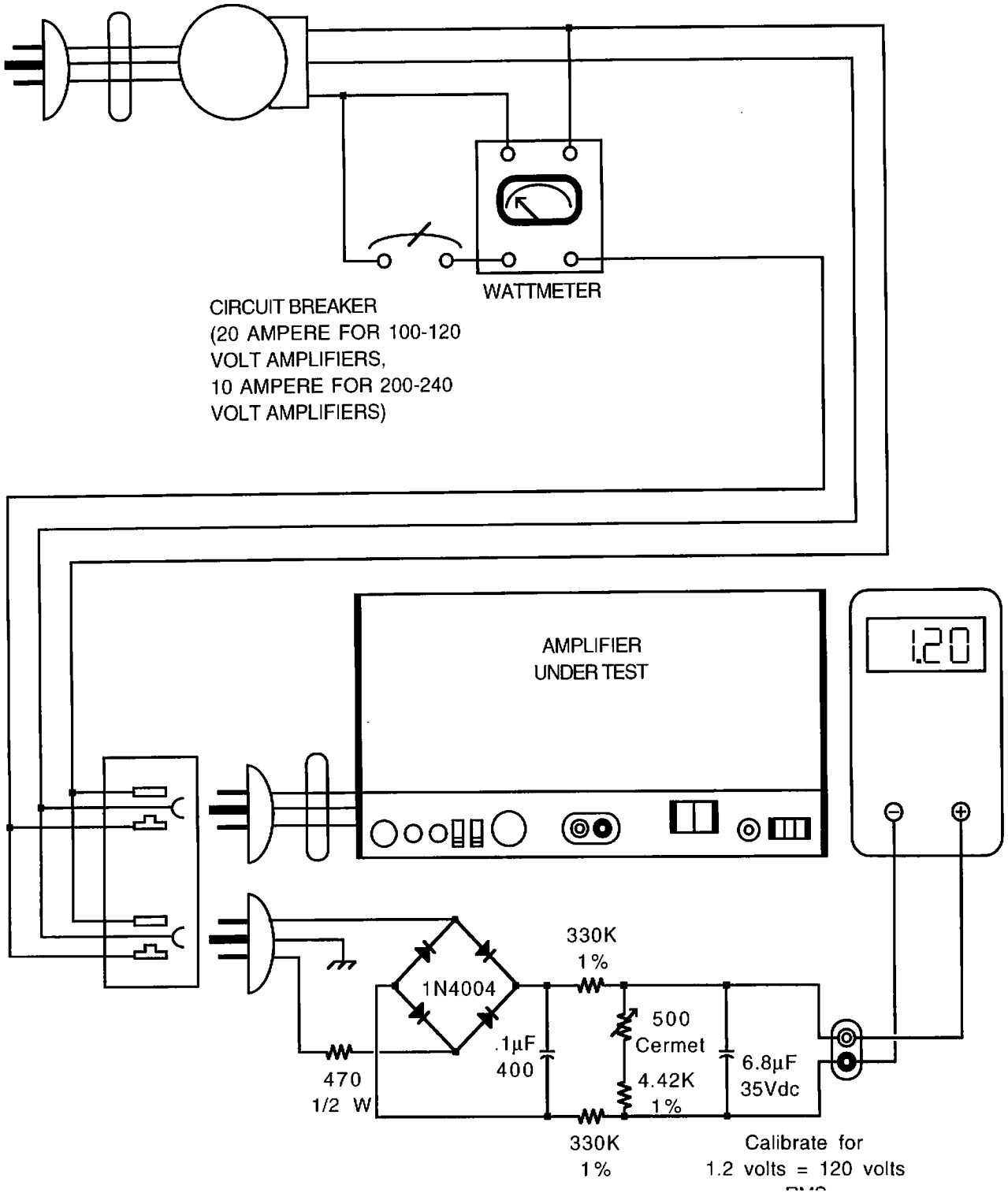


Illustration 6-3 AC Mains and Test Equipment

4. Adjust variable transformer to obtain reading on AC digital voltmeter which corresponds to AC mains voltage of the amplifier.
5. Set mode switch (7570's only) to Constant Voltage (down).
6. Set DELAY and LOW FREQ PROTECT switches down (off position).
7. Turn amplifier power switch ON.
8. Recheck variable transformer adjustment to be sure AC reading is still correct. Adjust if needed.
9. As signs of proper operation, check all of the following:
   - Red POWER indicator is ON—if not, check fuse.
   - Fans are running—if not, check fuse.
   - Amber STANDBY indicator is OFF.
   - Amplifier does not blow its fuses or circuit breakers.
   - Maximum power consumption does not exceed 80 watts.
10. Test at points shown in Illustration 6-4 for voltages listed in Table 6-2.
11. Turn amplifier off.

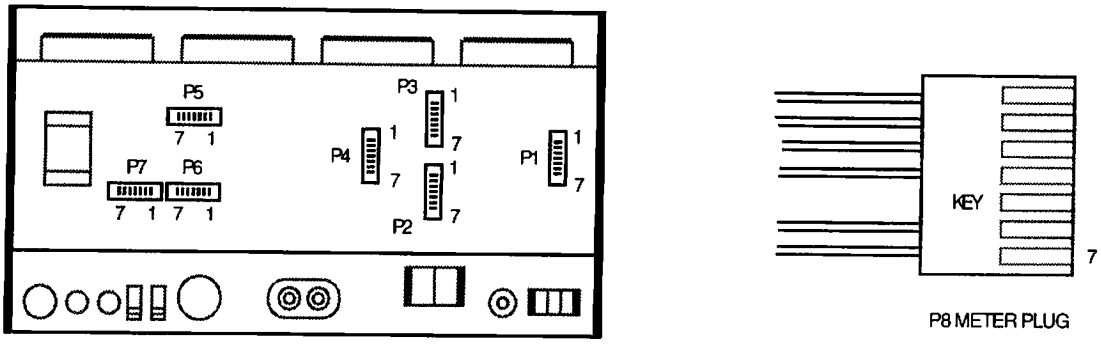


Illustration 6-4 Test Points Behind Back Panel and at Meter Plug

All voltages referenced to ground at P6-1.

Terminal	Voltage	Terminal	Voltage
P1-5	+15Vdc	P8-3	-15Vdc
P6-7	+15Vdc	P5-6	+12Vdc
P8-4	+15Vdc	P7-4	-24Vdc
P1-6	-15Vdc	P7-3	+23Vdc
P7-1	-15Vdc	P8-1	+23Vdc

Table 6-2 Proper Pre-Test Voltages

6.2.2 Power Control Board Test and Adjustment

This procedure verifies operation of the power control circuit board and associated circuits and to adjust the sensitivity of the amp to high AC mains.

Perform the pre-test in Section 6.2.1 and the tests in this section if any part has been replaced on the power control circuit board.

Checkout and adjustment of power control circuit board:

1. Set DELAY and LOW FREQ PROTECT switches on back panel to OFF.
2. Turn amplifier on.
3. Adjust variable transformer for proper supply voltage.
4. IF and ONLY IF amplifier remains in standby when power is turned on, adjust R421 on power control circuit board CW to just past the point at which the amplifier leaves standby and begins operating. Further adjustment of this control will be made later in the testing procedure.
5. Using a voltmeter, check these points on main circuit board:
   - From pin P1-6 (negative) to P1-2 (ground), read +15 Vdc (±0.5).
   - From pin P1-5 (positive) to P1-2 (ground), read -15 Vdc (±0.5).
6. Switch amplifier power ON and OFF several times in succession and check that amplifier comes into operation immediately (and does not remain in standby) each time the power switch is turned ON.
7. Turn amplifier off.
8. Set DELAY switch to ON.
9. Turn amplifier power switch ON and see that amplifier comes into operation after a 4 to 5 second delay. Observe STANDBY indicator on front panel to verify this.

6.2.2.1 Verify Overtemperature Protection

1. Set DELAY switch to OFF.
2. Short leads of thermal sensor Q1 on output circuit board A1. See that amplifier goes into standby immediately.

Note: The leads of Q1 are connected to black and white wires. Short only these wires.

3. Remove short and see that amplifier leaves standby mode immediately.
4. Repeat steps 2 and 3, above, for thermal sensor Q1 on positive output circuit board A4. If amplifier fails any of these tests, replace power control circuit board.

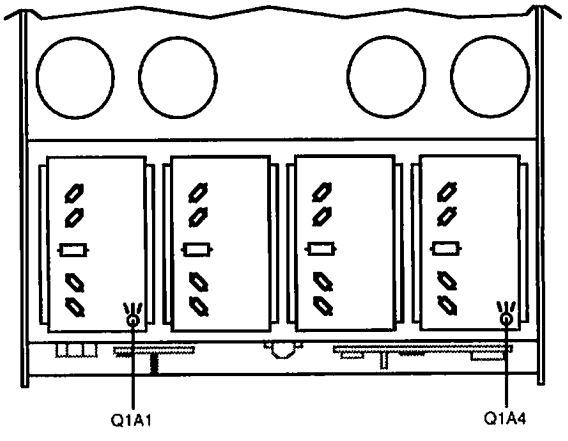


Illustration 6-5 Overtemperature Protection Test

6.2.2.2 Adjust Hi Mains Protection

1. Adjust variable transformer to increase AC mains voltage by 10%.
2. Slowly adjust R421 CCW until amplifier enters STANDBY mode.

Note: Amplifier may go into standby when voltage is increased. If this happens, adjust R421 CW to go from standby to normal operation again. Then readjust R421 CCW until standby mode just begins.

3. Return AC mains voltage to the original value.
4. Amplifier should go from standby mode to normal operation, and stay there, before the original AC mains voltage value is reached.

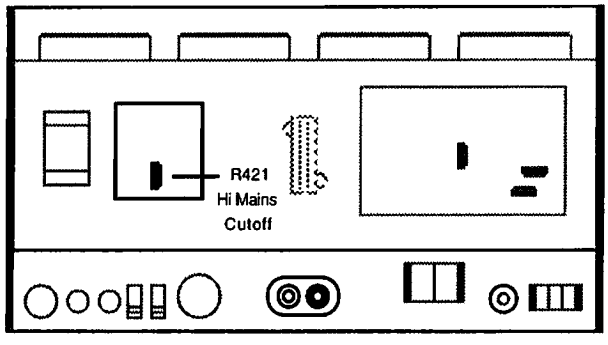


Illustration 6-6 Hi Mains Adjusment

6.2.2.3 Verify Low Frequency Protection

1. Set LOW FREQ PROTECT switch to ON (up).
2. Connect a scope probe to P4-6 and to ground. See Illustration 6-7.
3. Apply a 1Hz sine wave to the input. Adjust the input for 8 to 12 volts peak on the scope. STANDBY should occur on peaks of either polarity.
4. Turn amplifier power switch OFF.

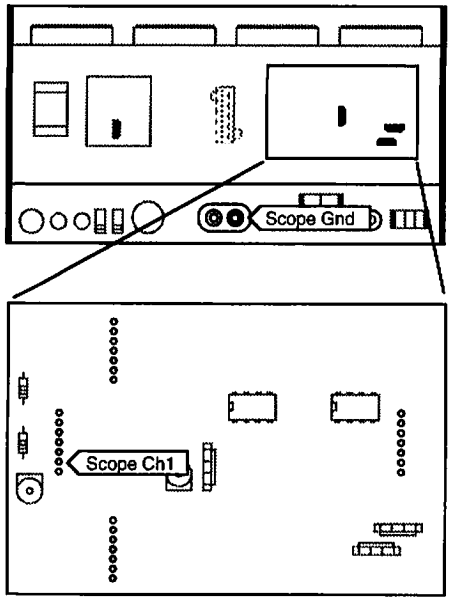


Illustration 6-7 Low Frequency Protection Test Points

6.2.3 Main Amplifier Testing Adjustment

Use this section to confirm operation of the main circuit board, input plug-in and associated circuits, and to adjust the output and input offset potentiometers, static balance and dynamic potentiometers, and output stage bias.

6.2.3.1 Set-up for Main Board and Plug-In Board Testing

1. Turn power OFF and observe the **warnings** described in section 6.1.1.
2. Perform the pretests in Section 6.2.1.
3. Remove input plug-in from the front of the amplifier and install an extender board.
4. Set LOW FREQ PROTECT and DELAY switches on rear panel to OFF.
5. Connect AC mains and test equipment as shown in Illustration 6-2.
6. Turn power switch ON.
7. Adjust variable transformer for correct supply voltage as often as needed throughout testing and adjustment.

6.2.3.2 Adjust Amplifier Output Offset

1. Place a short between P9-22 and P9-21. (P9 is the edge connector for the plug-in).

NOTE: If the input plug-in is still in place, remove it before proceeding.

2. Connect a DC voltmeter to the output terminals of the amplifier.
3. Turn amplifier on.
4. Adjust output offset potentiometer R115 for 0Vdc (±.001Vdc) at output.
5. Turn amplifier off.
6. Remove the short.

Testing can proceed to Section 6.2.3.6 if changes have not been made to the input plug-in.

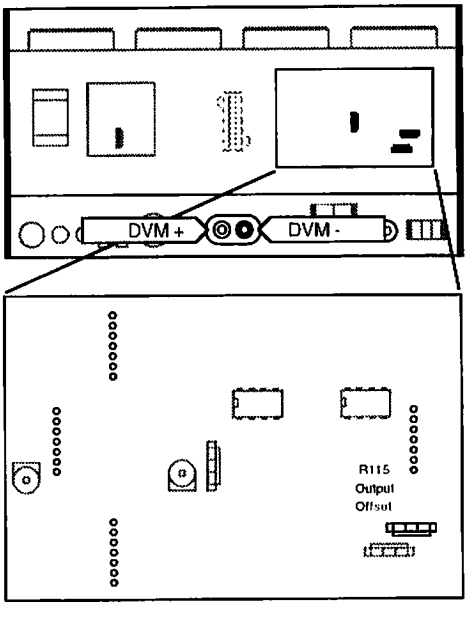


Illustration 6-8 Output Offset Adjustment

6.2.3.3 Common Mode Rejection Adjustment

If the differential input (J2) is not used, proceed to Section 6.2.3.4.

1. Set mode switch to Constant Voltage.
2. Apply signal 100Hz sine wave to both outside screw terminals (J2-1 and J2-3) and signal ground to input ground (J2-2). See Illustration 6-9. Adjust for 5 volts AC, peak-to peak at J2.
3. Set scope for maximum sensitivity.
4. Connect a X1 probe to pin 8 of U1.
5. Adjust R4 for minimum voltage reading.
6. Change the signal generator to 20kHz.
7. Adjusting TC1 for minimum output voltage.

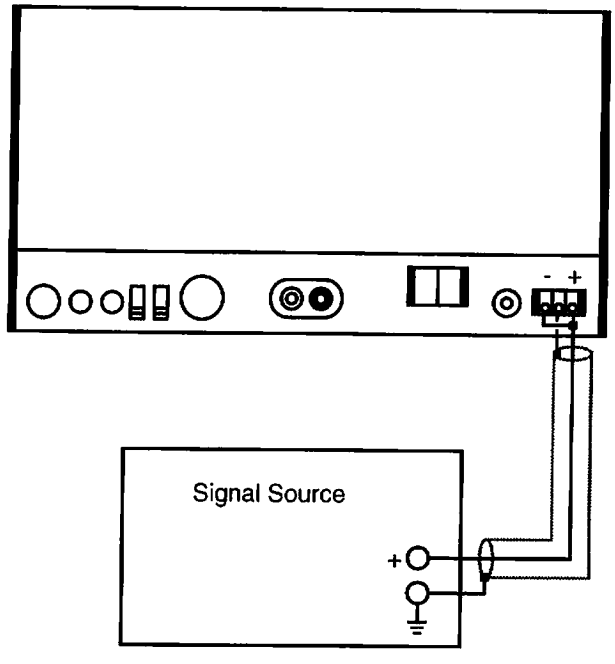


Illustration 6-9 CMR Input

6.2.3.4 Adjust Input Plug-In Offsets.

If the standard plug-in is used (7560's typically), proceed to Section 6.2.3.5.

1. Set the mode switch to Constant Voltage.
2. Set the Input Attenuator CW
3. Remove the input signal and place a short across the input.
4. Connect a DC voltmeter from ground to pin 8 of U1.
5. Adjust R7 for zero volts at pin 8 of U1.
6. Adjust R8 for zero volts at pin 14.
7. Recheck output voltage at amplifier output. This should be near zero. If it's not, refer to Section 6.2.3.2. for output offset adjustment procedure.
8. Adjust R26 for zero volts at pin 7.
9. Adjust R31 for zero volts at pin 1.

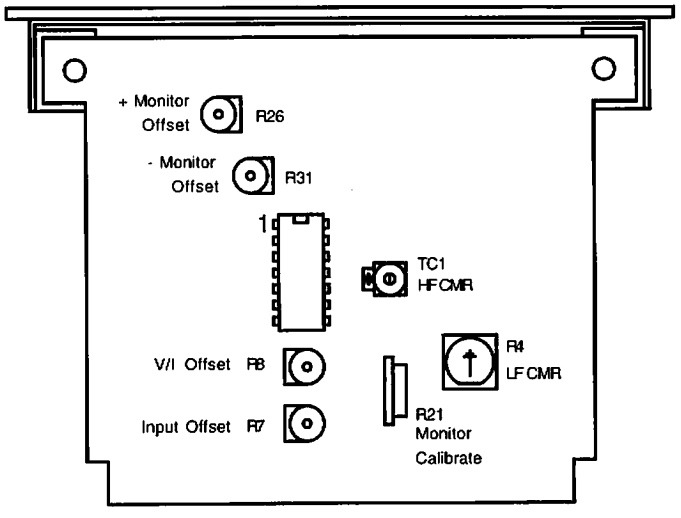


Illustration 6-10 Input Plug-In Adjustments

6.2.3.5 Adjust Static Balance

Illustration 6-11 shows locations of test points and adjustments.

1. Connect positive voltmeter lead to Vcc common on main circuit board(pin P3-6).
2. Connect negative voltmeter lead on black output binding post.
3. Adjust static balance potentiometer R117 on main circuit board to obtain a null reading on voltmeter between Vcc common and output.

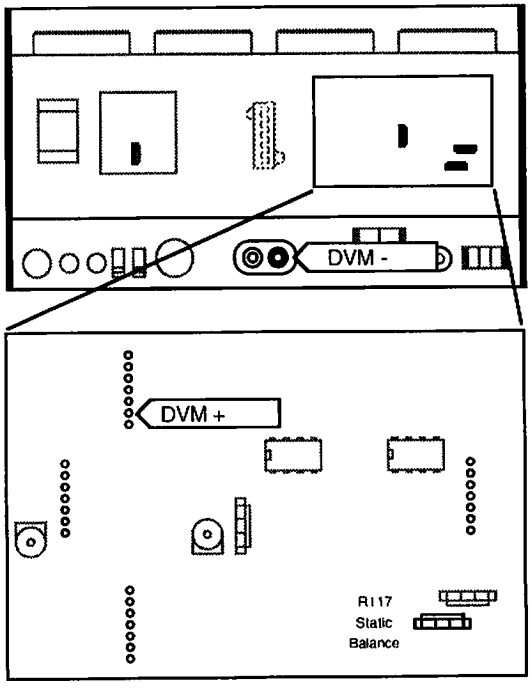


Illustration 6-11 Static Balance Adjust

6.2.3.6 Adjust Bias

Note: Perform the following tests ONLY with amplifier thoroughly warmed up at quiescent conditions. Allow at least 15 minutes for warm up. This applies equally to initial checkout and to verifying proper operation.

1. Connect a DC voltmeter across resistor R4 on positive output board A3 (See Illustration 6-12 for location).
2. Adjust R164 for a reading of 0.31 to 0.37 Vdc.
3. Connect a DC voltmeter across resistor R4 on positive output board A2
4. Adjust R169 for a reading of 0.31 to 0.37 Vdc.

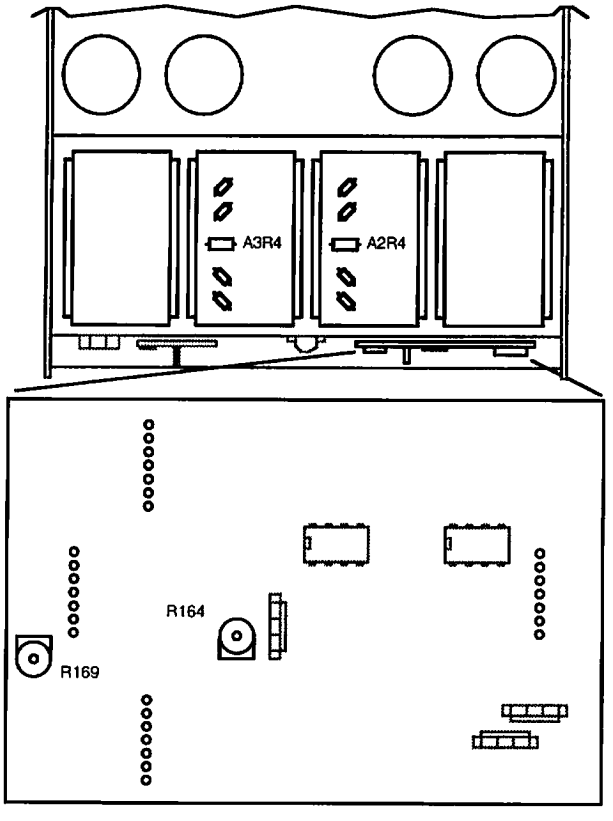


Illustration 6-12 Bias Adjustment

6.2.3.7 Verify Bridge Balance

1. Turn amplifier on.
2. Connect channel 1 of a dual trace oscilloscope to red output binding post.
3. Connect channel 2 to Vcc common (Pin P3-6)
4. Connect ground lead of oscilloscope to black output binding post.
5. Connect amplifier output binding posts to an 8 ohm load.
6. Apply a 1kHz sine wave to input.
7. Set input coupling switch on plug-in module to AC position (7560's only).

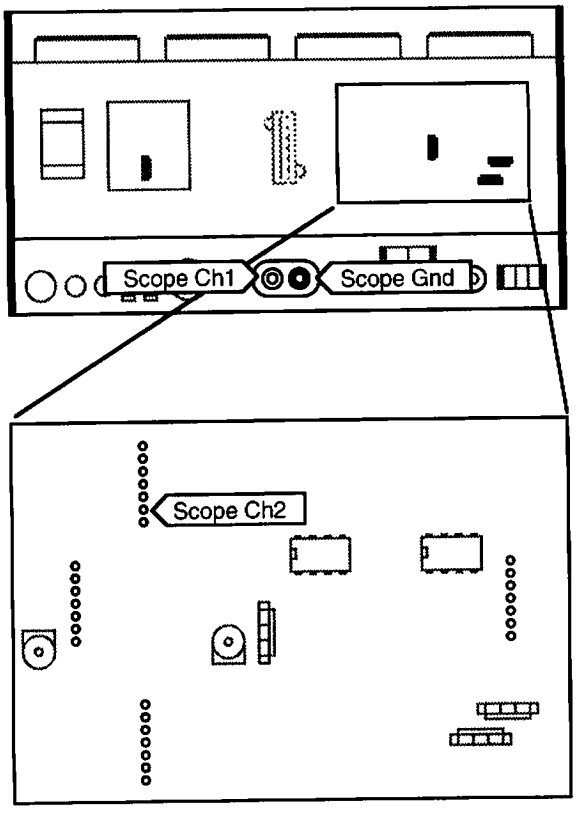


Illustration 6-13 Bridge Balance Test Points

8. See that oscilloscope traces as shown in Illustration 6-14 can be obtained by rotating INPUT ATTENUATOR control on front panel. See that as control is rotated, the larger waveform (output) is always twice the amplitude of the smaller waveform (Vcc common). This should be true at any attenuator setting from zero to clipping point. See that no distortion occurs at the onset of clipping, and that clipping is sharp with no ringing or other oscillation.
9. Turn amplifier off.

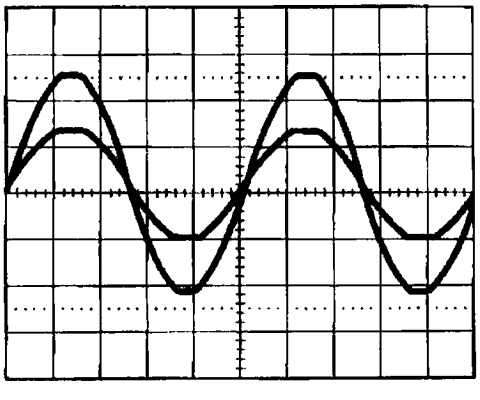


Illustration 6-14 Bridge Balance Waveforms

6.2.3.8 Adjust Dynamic Balance

Illustration 6-15 shows locations of test points and adjustments.

1. Connect channel 1 of a dual trace oscilloscope to red output binding post.
2. Connect ground lead of oscilloscope to black output binding post.
3. Connect channel 2 of a dual trace oscilloscope to junction of resistors R151 and R152 on main circuit board. This is the output of bridge balance operational amplifier U101.

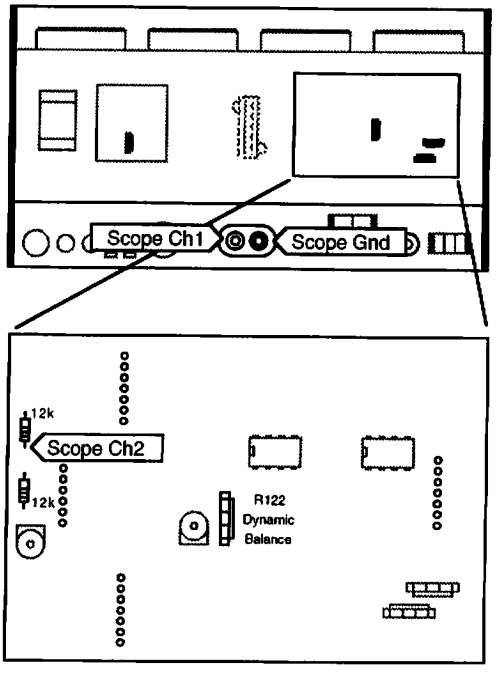


Illustration 6-15 Dynamic Balance Test Points

4. Turn amplifier on.
5. Set INPUT ATTENUATOR control on front panel clockwise to the point where clipping of the output starts to occur.
6. Adjust R122 on main circuit board to obtain oscilloscope trace as shown in Illustration 6-16. Note that when proper adjustment is reached, the negative spike of U101 output is saturated, but the positive spike is not.

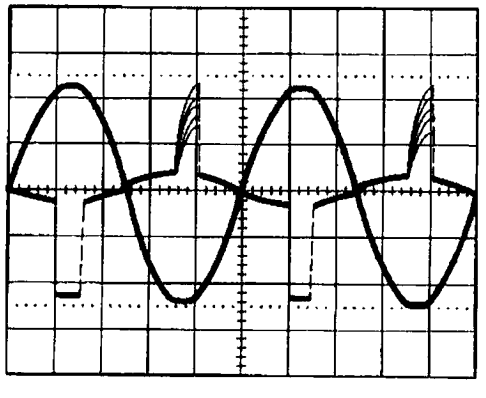


Illustration 6-16 Proper Dynamic Balance Adjustment

6.2.3.9 Power Test

1. Connect 8 ohm load.
2. Input 1kHz sine wave.
3. Connect an AC voltmeter to binding posts.
4. Connect a scope to binding posts.
5. Increase input signal while observing the scope.
6. Amplifier output should be 70 volts or more without visible distortion, which is equivalent to 600 watts.
7. Change input to 20kHz sine wave, into same 8 ohm load.
8. Amplifier output should be 70 volts or more, equivalent to 600 watts.

6.2.3.10 Checking Slew Rate

1. Input a 10 kHz square wave signal into the amplifier input jack.
2. Connect oscilloscope to amplifier output.
3. Set INPUT ATTENUATOR to get an output of approximately 40 watts (18V) RMS. See that output trace is as shown in Illustration 6-17. See that traces are stable and slew rates are 16 volts per microsecond or higher.

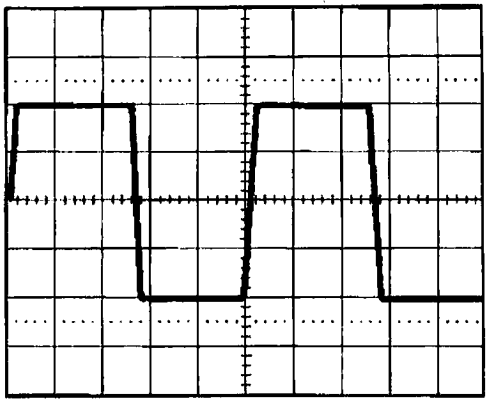


Illustration 6-17 Slew Rate Waveforms

6.2.3.11 Reliability Test

1. Turn amplifier power OFF.
2. Connect a shorting jumper made of #12 wire between the amplifier output binding posts.
3. Turn amplifier power ON.

⚠ CAUTION

Be prepared to turn amplifier off immediately if it should fail this test and the output circuit boards begin to overheat.

4. Apply a 0.5 Hz sine wave input to the amplifier.
5. Adjust INPUT ATTENUATOR control full clockwise.
6. Block airflow by covering both air filters with cardboard.

7. Observe that output heat sinks heat up rapidly. Within 15 to 30 seconds after blocking airflow, the amplifier should go into STANDBY mode.
8. Varify that the amplifier cycles between ON and STANDBY.
9. Remove cardboard from air filter.
10. Turn the amplifier OFF.
11. Remove jumper from output binding posts.

6.2.3.12 Protection Test

1. Connect a 4 ohm load.
2. Clipping of the output signal should remain clean and the bridge remain balanced. Positive and negative peaks should be equal, without ringing.
3. Connect a 2 ohm load. Limiting of output signal should be observed as flattening of positive and negative peaks of sine wave. With the 2 ohm load, verify proper and steady supply voltage. If voltage is correct and steady, limiting should appear clean and sharp. A ragged trace at clipping indicates a defective protection circuit.

Note: When driving a 2 ohm load, the output power at 60 volts is 1800 watts. This could cause power supply sag which appears as clipping at the output. To distinguish power supply sag from limiting circuitry operation, slow oscilloscope trace and look for sharpness at the clip point. Limiting circuitry operation results in a clean, sharp trace. Power supply sag causes an uneven or ragged (120Hz) appearance at the clip point.

6.2.3.13 Intermodulation Distortion Checkout

For this test, the equipment shown in Illustration 6-18 is required. Test equipment is described in Table 6-1.

Note: For accurate results in these tests, be sure to know the residual distortion and noise levels of all test equipment.

1. Connect input power and test equipment to the amplifier.
2. Connect an 8 ohm load and an intermodulation analyzer to the amplifier input and output as shown in Illustration 6-18.
3. Turn analyzer ON and set AC mains voltage to correspond with voltage for which amplifier is wired. Set analyzer for an output of 55.4 volts from amplifier (low frequency only). Adjust the high frequency for 25% of the low frequency amplitude. (Input to amplifier should have a grounded shield. Output from amplifier to analyzer should have a shield connection broken at amplifier).
4. Measure the distortion at levels shown in Table 6-3 and see that results are at or below values in the table.

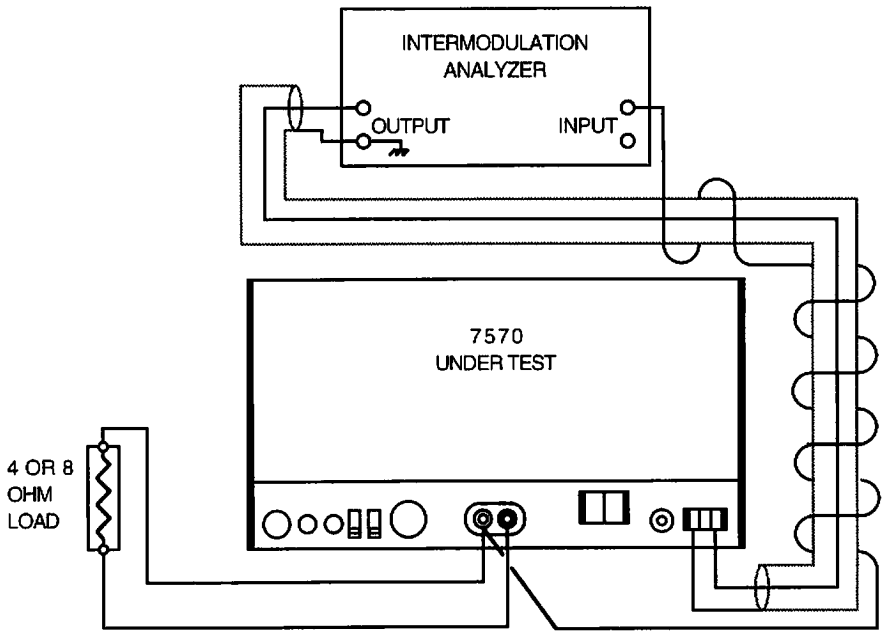


Illustration 6-18 Intermodulation Test Set Up

Note: The 60 Hz LF output is 55.4V RMS at 600 and 1200 watts.

8 Ohm Load		**4 Ohm Load**	
Watts:	**Distortion:**	**Watts:**	**Distortion:**
600	0.01%	1200	0.01%
190	0.01%	379	0.01%
60	0.01%	120	0.01%
19	0.01%	37.9	0.01%
6	0.01%	12	0.01%
1.9	0.01%	3.79	0.01%
0.6	0.01%	1.	0.05%
0.19	0.05%	0.379	0.05%
0.06	0.05%	0.12	0.05%
0.019	0.05%	0.0379	0.05%

Table 6-3 IM distortion

6.2.3.14 Noise Level Checkout

Note: This test requires the test equipment shown in Illustration 6-19. Test equipment is described in Table 6-1.

1. Disconnect all test equipment from amplifier, except voltmeter and output filters.
2. Connect AC power and test equipment to the amplifier as shown in Illustration 6-3.
2. Connect 8 ohm load to output binding posts.
3. Connect test equipment to the amplifier output binding posts as shown in Illustration 6-19.
4. Short the amplifiers input.
5. Turn amplifier ON.
6. Adjust AC mains voltage for amplifier's wired voltage.
7. Set INPUT ATTENUATOR on front of amplifier to full clockwise.
8. Measure the noise level relative to 600 watts. Noise level must be at least 100dB below 600 watts or 692 microvolts.

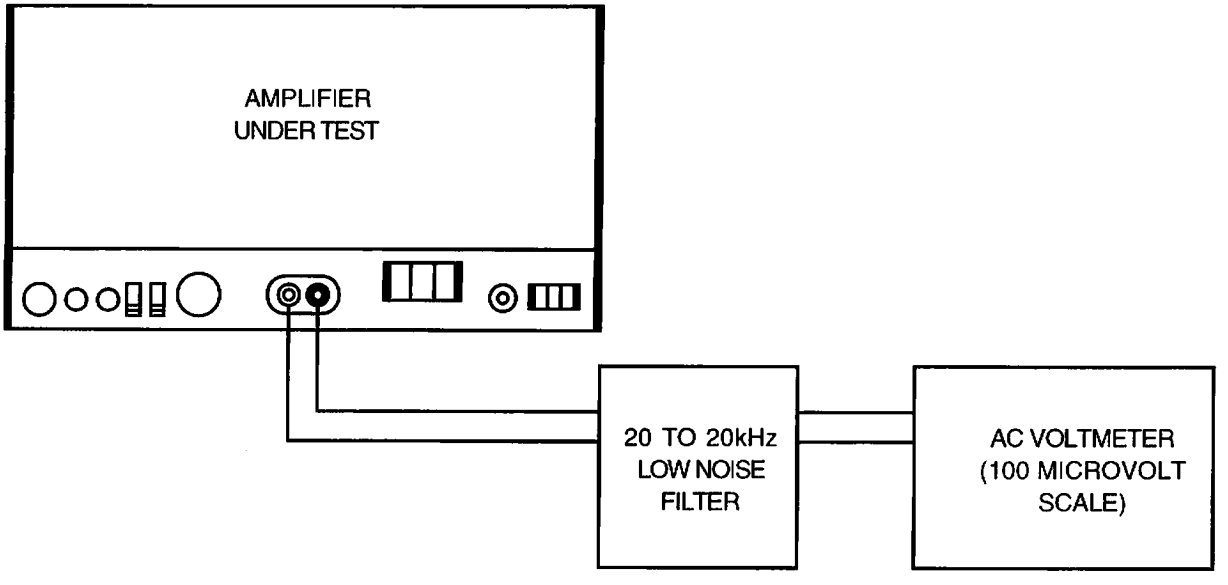


Illustration 6-19 Noise Test

6.2.3.15 Current Calibration (7570's only)

Place a current shunt in series with the load. Place the 7570 in the Constant Current (CC) mode.

1. Set signal generator for a low frequency sine wave within limits of bandwidth set by compensation RC network. (Typically 100 Hz)
2. Set 7570 to Constant Current mode.
3. Apply signal to amplifier input and check for oscillations at the output.
4. Connect ACVM to pin 7 of U1.
5. Adjust Input Attenuator for 0.3000 volts AC at pin 7 of U1.
7. Adjust R21 for 3.000 amperes of load current.

6.2.4 Current Meter Test (7571's only)

Note: While performing this test, constantly monitor the ac line voltage and adjust the variable transformer to keep the ac mains at the required level.

1. Turn amplifier OFF.
2. Connect an ac voltmeter to the amplifier output terminals.
3. Connect a signal generator to the amplifier input.
4. Turn amplifier ON and use variable transformer to adjust input line voltage to correct level as required by amplifier wiring.
5. Check that the meter illuminating lamps are on.

6.2.4.1 Adjust Drift Potentiometer

This procedure adjusts the drift potentiometer to stabilize the catch-and-hold feature of the meter. See Illustration 2-4 for the location of this adjustment.

1. Adjust R227 on the meter printed circuit board fully clockwise as viewed from the top.
2. Connect an oscilloscope to test point and ground.
3. Adjust R227 slowly counterclockwise until wave stops jumping.

6.2.4.2 Calibration

Note: This procedure calibrates the 7571 meter to a known value. The accuracy of this adjustment is proportional to the accuracy of the ac voltmeter measuring the output current of the amplifier.

1. Connect a 4Ω, 1% load to the output of the amplifier.
2. Connect a DVM across the 4Ω load.
3. Apply a 1 kHz input signal.
4. Turn amplifier ON.
5. Adjust the amplifier INPUT ATTENUATOR control to obtain 56.57 volts rms across the load.
6. Adjust R219 so that the meter pointer is at 20.

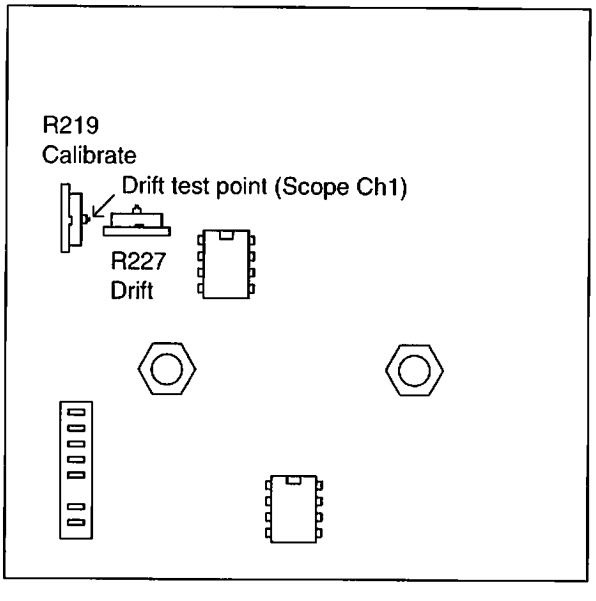


Illustration 6-20 7571 Meter Adjustment points

6.2.4.3 Schematic Changes

Please note the change to the 7560/70 main amplifier schematic found in the back of this manual (Section 7.30, page 7-41). Illustration 6-21 shows the modified wiring for the 7571 meter.

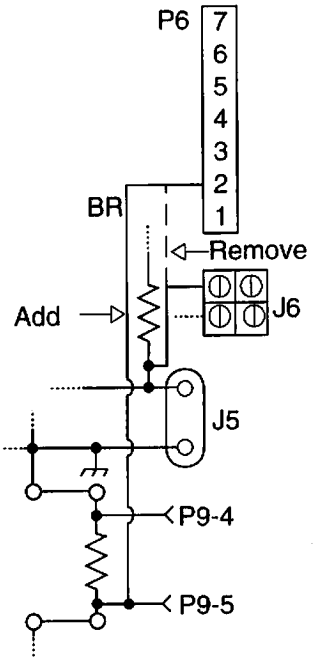
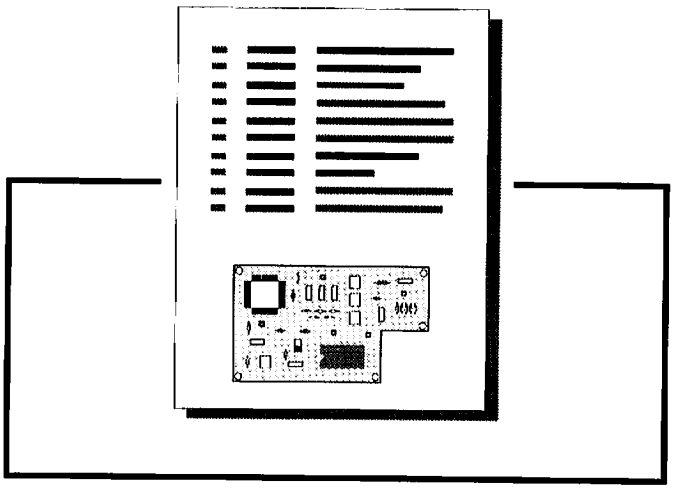


Illustration 6-21 7571 Schematic Modifications

6.3 Final Procedure

1. Use standard latex paint to seal all adjustment points. This will protect adjustments against vibration or accidental movement.
2. Remove extender board and replace input plug-in.
3. Replace all covers.



Section 7—Parts and Schematics

This section provides a complete graphic summary of parts used in a 6560/70 series amplifier including board layouts and exploded views to aid in service procedures.

7.1 General Parts Information

This section includes illustrations, schematics, and parts lists for the Model 7560/70 Power Supply Amplifiers. This information should be used with the service, repair and adjustment procedures in Sections 5 and 6.

Mechanical and structural parts are illustrated and indexed on exploded view drawings. Electrical and electronic parts are listed and indexed in both the exploded view drawings and the schematic parts lists.

7.2 Standard and Special Parts

Many electrical and electronic parts used in Model 7560/70 are standard items stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard are actually special. Order parts from TECHRON to be sure of a workable replacement. Structural items, covers and panels are available only from TECHRON.

7.3 Ordering Parts

TECHRON, a division of Crown International, supplies parts through the Crown International Parts Department. Replacement parts are obtained from the following address:

Crown International
Parts Department
P.O. Box 1000
Elkhart, Indiana 46515

Phone: (219) 294-8210
FAX: (219) 294-8301

When ordering parts, be sure to give the model and serial number and include the part description and Crown Part Number (CPN) from the parts list. Price quotes are available upon request.

7.4 Shipment

Shipment will be made by UPS or best method unless a preferred method is specified. Shipments are made F.O.B. Elkhart, Indiana, only.

Shipments to Techron should be made as described below:

Techron
Customer Service Department
57620 C.R. 105
Elkhart, Indiana 46517

7.5 Terms

Normal terms are C.O.D., Master Card, or Visa, unless the order is prepaid. If prepaying, please add an amount for the freight charge. Established accounts will have large orders shipped freight prepaid and billed net 30 days. All others, shipped freight collect.

Parts prices are subject to change without notice. New parts returned for credit are subject to a 10% restocking charge.

You must receive authorization from the Crown Parts Department before returning parts for credit. Please state reason for returning.

7.6 7560's Standard Input Plug-In

ITEM #	PART #	QTY.	DESCRIPTION
1	D 4075J3	1	Techron Tan Knob
2	C 1288-7	2	3/8" Bright Nut
3	C 2189-6	1	3/8" Bright Washer
4	C 4822-0	2	.507 x 391 Internal Star Washer
5	D 3492-2	1	SPST Rotary Switch
6	D 2942A5	1	25KΩ Variable Resistor
7	C 3957-5	2	Screw, #8-18x.375 Phillips
8	P 7931-2	1	Plug-in board, standard
9	C 3008-7	1	1.0MF, 100V Film
10	F 9530J0	1	7560 Plug-in bracket
11	F10232J0	1	7560 Access Door

7572 INPUT CARD ONLY
A11634-1

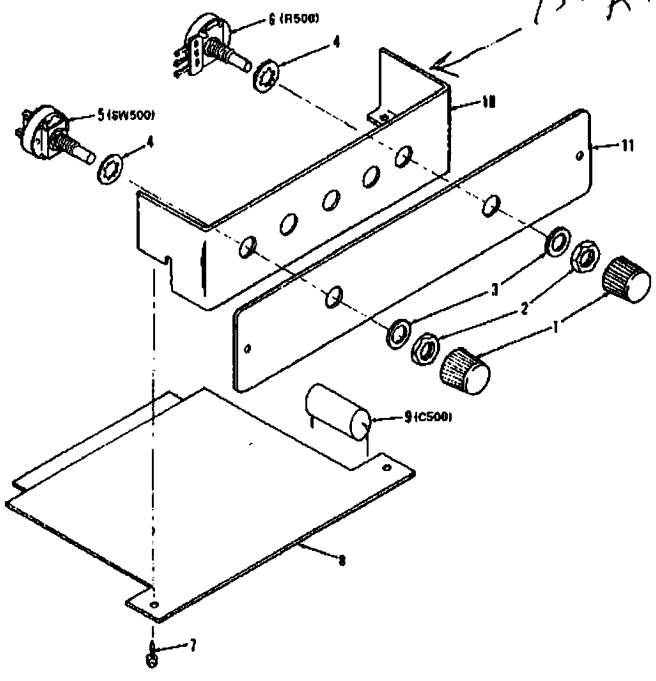


Illustration 7-1 7560's Standard Plug-In Exploded View

7.7 7570's Standard Input Plug-In

ITEM #	PART #	QTY.	DESCRIPTION
1	——		7560/70 Plug-In Module
2	C 3958-3	2	Screw, #8-18x.375 Phillips
3	C 3507-8	1	Three conductor jack
4	D 6067-9	1	5 K ohm Linear Pot
5	F 9530B7	1	7560/70 Plug-in bracket
6	C 4359-3	1	DPDT Toggle switch
7	C 2189-8	1	3/8" Bright Washer
8	C 1288-7	2	3/8" Bright Nut
9	D 4075J3	1	Techron Tan Knob
10	F10384J9	1	7560/70 Access Cover

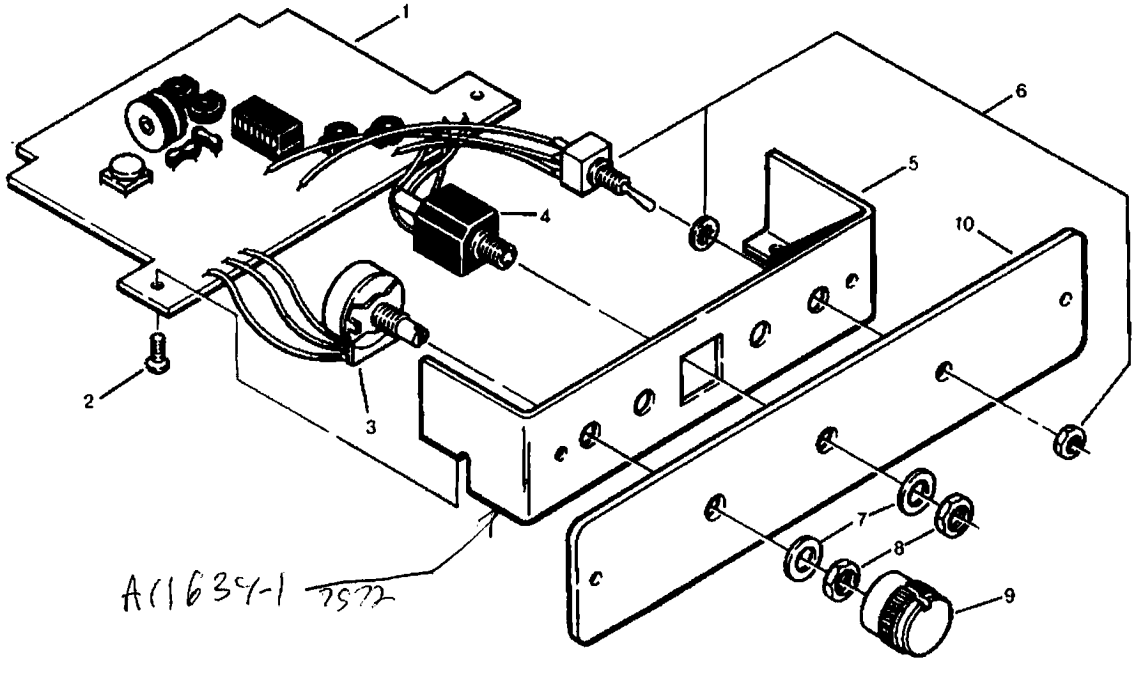


Illustration 7-2 7570's Standard Plug-In Exploded View

7.8 Fan Panel Assembly

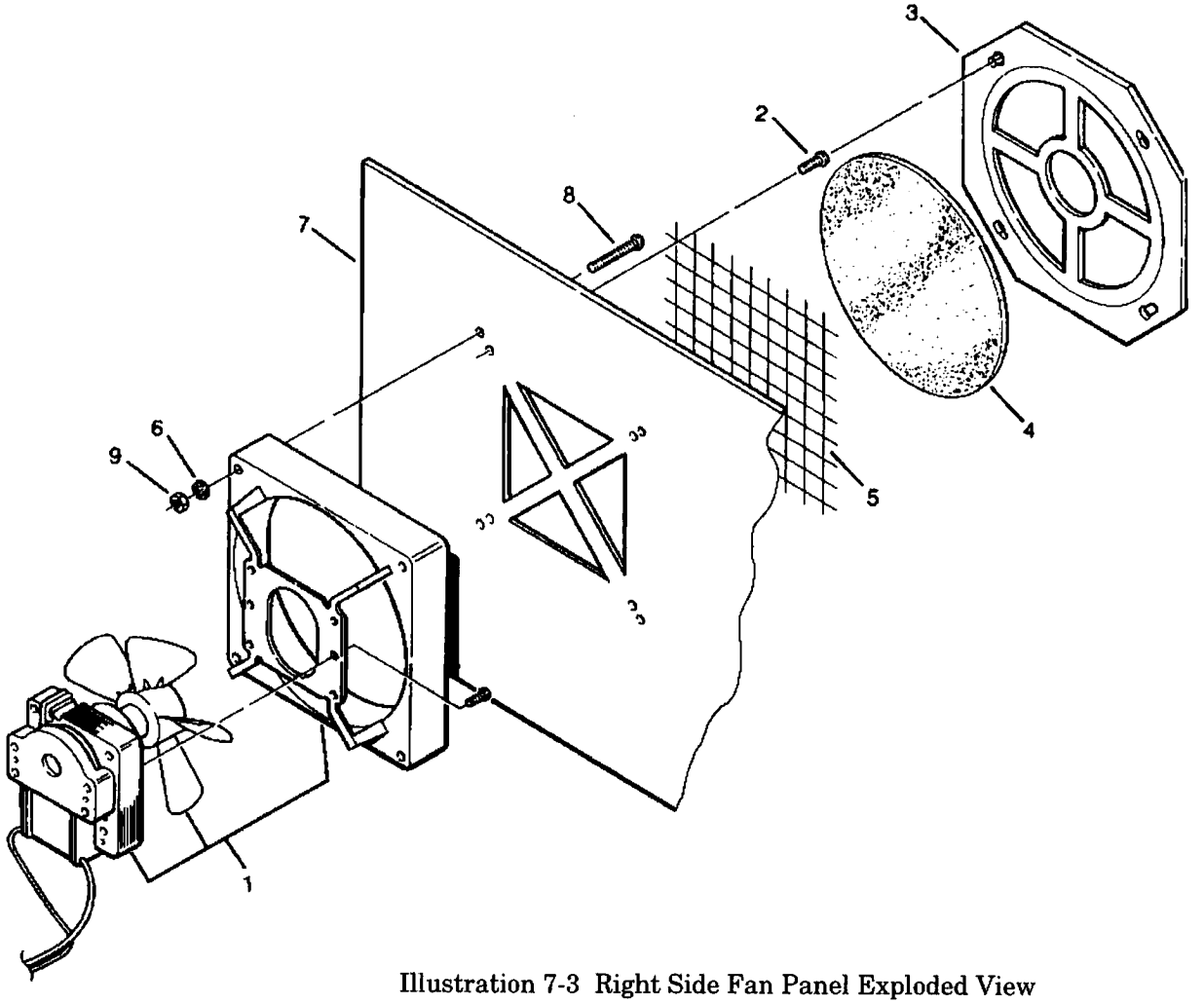


Illustration 7-3 Right Side Fan Panel Exploded View
(Left side is mirror image)

ITEM #	PART #	QTY.	DESCRIPTION
1	M20141-4	1	Fan and motor, with Connectors
2	C 4329-6	4	Screw, Self-Tapping Phillips, #6 x 3/8"
3	D 5458-1	1	Fan Filter Housing
4	D 5459A7	1	Fan Filter Foam
5	D 6243-6	1	Filter Backing Mesh
6	C 5594-4	2	#6 Internal Star Lock Washer
7	F 10004L8	1	Fan Panel, Right
	F10005L5	1	Fan Panel, Left (not shown)
8	C 2138-3	2	Screw, Binding Head, #6-32 x 1"
9	C 1889-2	4	#6-32 Hex Nut

7.9 Covers and Front Duct Panel

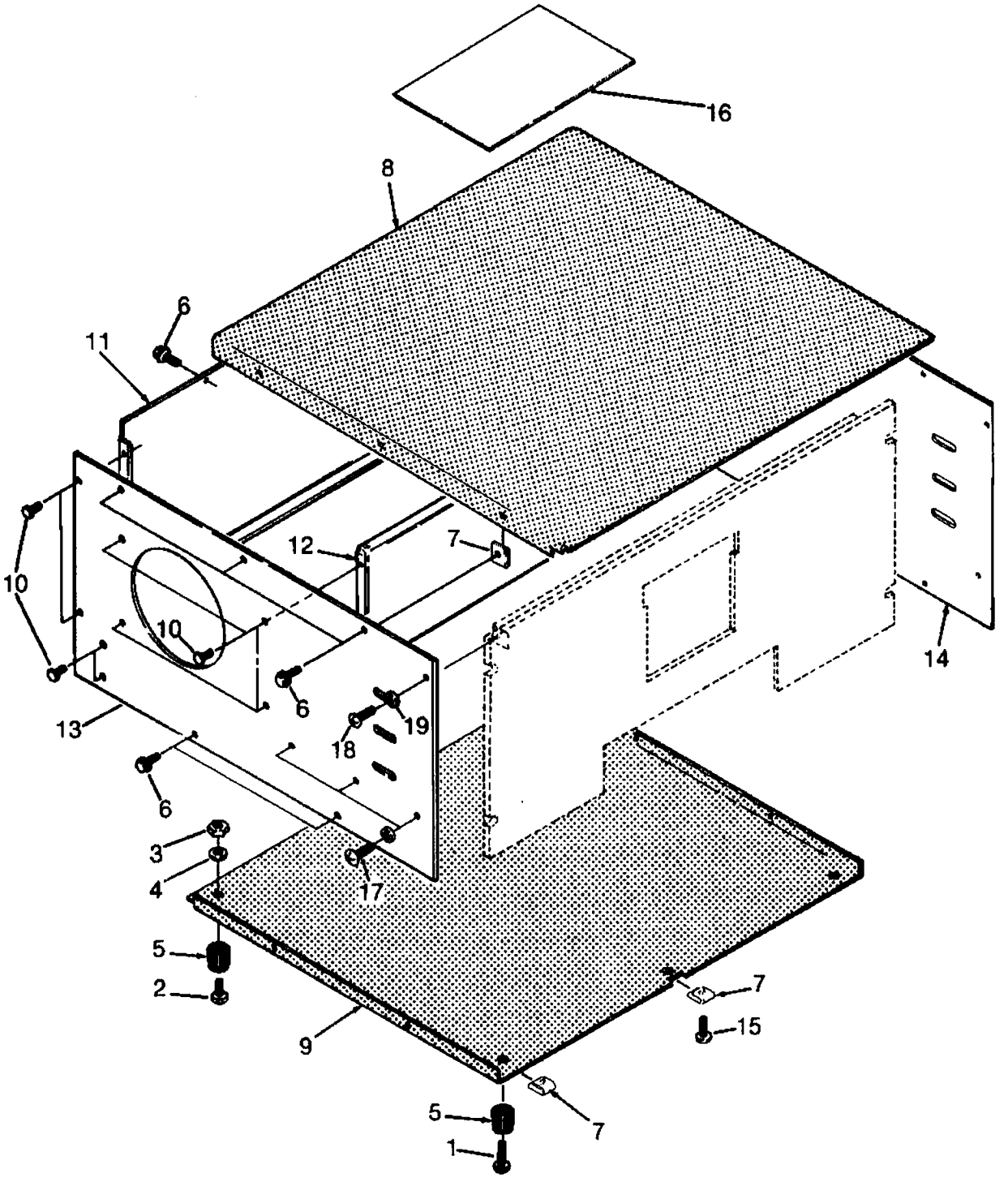


Illustration 7-4 Covers and Front Duct Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 2088-0	2	Sheet Metal Screw, #8 x 1"
2	C 4252-0	2	Screw, Truss Head Phillips, #8-32 x 1"
3	C 1986-6	2	#8-32 Hex Nut
4	C 1951-0	2	#8 Internal Star Lock Washer
5	C 2945-1	4	Rubber Feet, 3/4"
6	C 2757-0	13	Screw, WH Sheet Metal, #8 x 5/8"
7	C 3859-3	15	Speed Nut C10163-8A44
8	F 9548K9	1	Top Cover, Perforated
9	F 9547K1	1	Bottom Cover, Perforated
10	C 3957-5	16	Screw, Hex Sheet Metal, #8-18 x 3/8"
11	F 9546K3	1	Back Cover, 7560/70
12	F 9523A4	1	Front Duct Panel
13	F10005L5	1	Fan Panel, Left
14	F10004L8	1	Fan Panel, Right
15	C 6836-8	1	#8 x .625 Phillips selftap screw
16	D 5491-2	1	Perf Top Caution Label
17	C 2049-2	6	Screw, Truss Phillips, #10-32 x 1/2"
18	C 4013-6	2	Screw, Truss Phillips, #10-32 x 3/8"
19	C 2279-5	8	#10 Internal Star Lock Washer

7.10 Transformer and Front Panel

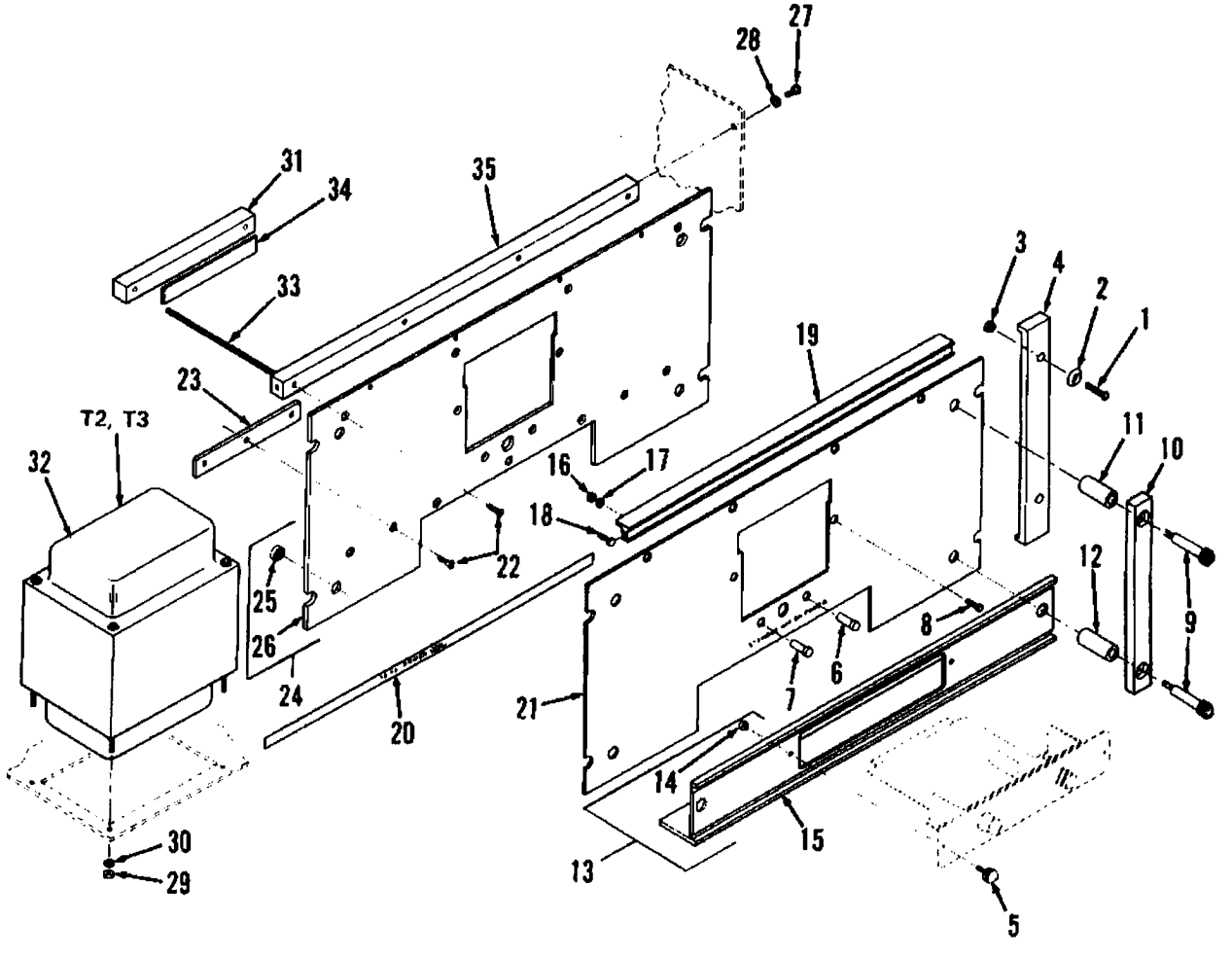


Illustration 7-5 Transformer and Front Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 5290-9	4	Screw, Machine, 10x32 x 3/4", Black
2	D 4137-2	4	Nylon Thumbscrew Washer
3	C 2170-6	4	#10-32 Hex Nut
4	F10259K0	2	Bar, End, 7560/70
5	D 5896A0	2	Retainer, Access Door, 7560/70
6	C 2359A3	1	Cap, Lens, Red
7	C 2468A2	1	Cap, Lens, Amber
8	C 6078J6	1	Screw, Binding Hd, #6-32x3/8", Brn
9	C 6106-6	4	Screw, Cap Socket Head, 5/16-18 x 1"
10	F10253J6	2	Handles, 7560/70
11	F10262K4	2	Spacer, Handle, Long
12	F10263K2	2	Spacer, Handle, Short
13	M20237J9	1	Extrusion Assembly, Lower, 7560/70
14	N/A		
15	N/A		
16	C 1889-2	4	#6-32 Hex Nut
17	C 5594-4	4	#6 Internal Star Lock Washer
18	C 3917-9	4	Screw, Hex Hd, Machine, #6-32 x 1/2"
19	D 5876J3	1	Extrusion, Upper, 7560/70
20	F10251-1	1	Logo Strip, 7560/70
21	F10231K9	1	Overlay, 7560/70 Front Panel
22	C 5305-5	1	Screw, Flt Hd, Machine, #10-32 x 1/2"
23	F 9528J4	2	Plate, Retainer
24	M20214B5	1	Panel Assembly, Front, 7560/70
25	N/A		
26	N/A		
27	C 4013-6	2	Screw, Machine, Tr Hd, #10-32 x 3/8"
28	C 2279-5	2	#10 Internal Star Lock Washer
29	C 2829-7	8	#10-32 Hex Nut
30	C 2279-5	8	Black #10 Internal Star Lock Washer
31	F10435-0	2	Bar, transformer clamp
32	D 5781-6	2	Transformer, 7560/70 Power
33	C 6368-2	4	Screw, Flat Hd, M, #10-32 x 4 3/4"
34	S 2859-7	—	Tape, Foam
35	F10408J6	1	Bracket, Transformer Mounting

7.11 Power Supply Assembly

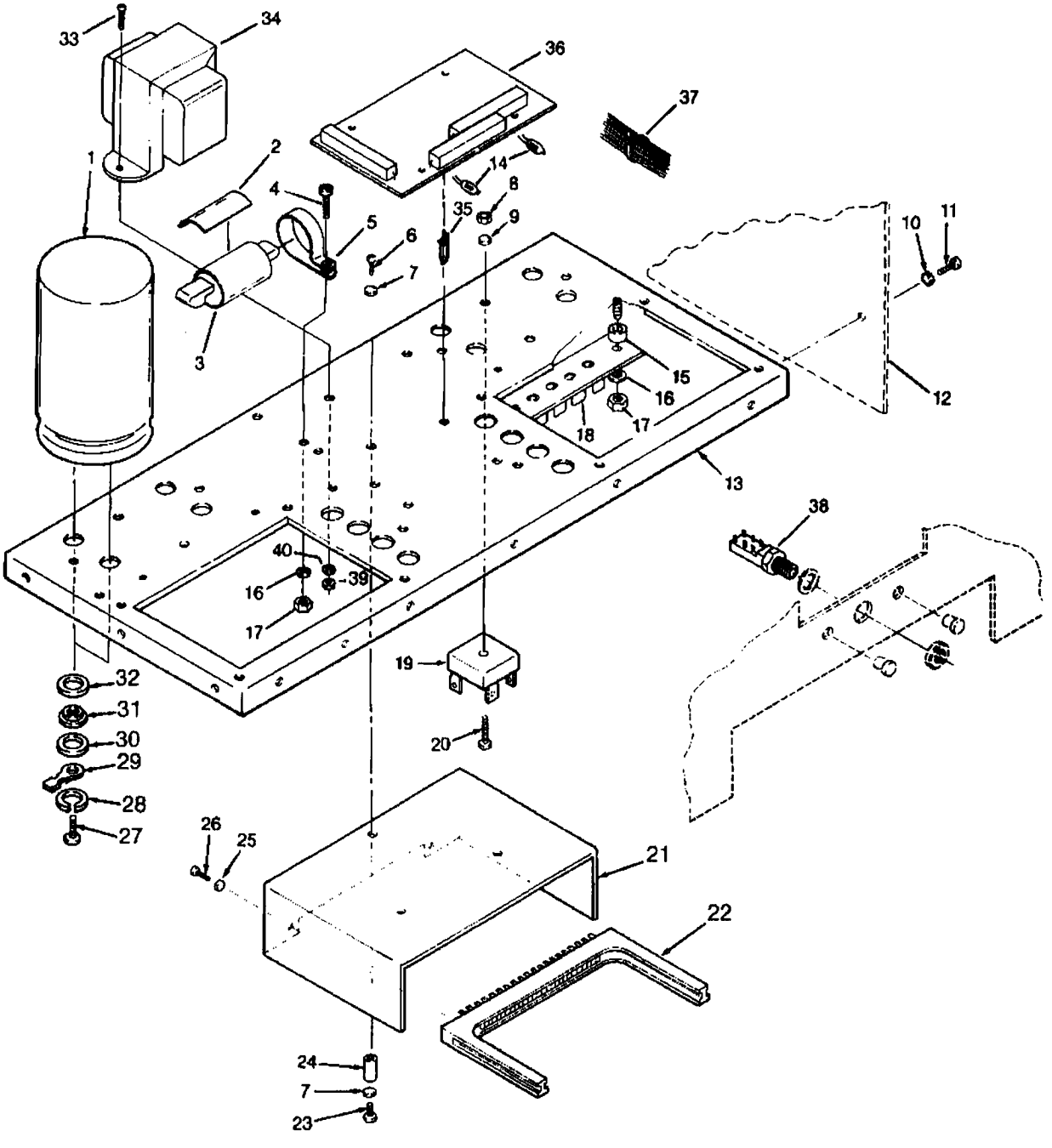


Illustration 7-6 Power Supply Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 3436-0	4	13,500 µF, 70 Volt
2	S 2859-7	—	Tape, Foam
3	C 7595-9	2	8.0µF, 250 V 10% Polypropylene
4	C 2228-2	2	Screw, Rd Hd Machine, #8-32 x 5/8"
5	C 5056-4	2	Bracket, Capacitor Mounting
6	C 1954-4	3	Screw, Round Hd Phillips, #6-32 x 1/4"
7	C 5594-4	6	#6 Internal Star Lock Washer
8	C 1889-2	2	#6-32 Hex Nut
9	C 5594-4	2	#6 Internal Star Lock Washer
10	C 2279-5	6	#10 Internal Star Lock Washer
11	C 2049-2	6	Screw, Trs Hd Phillips, #10-32 x 1/2"
13	M20214B5	1	Mounting Panel, Transformer
14	C 2500-4	2	Lamp, Neon, NE2H
15	C 2762A8	4	Nylon Spacer
16	C 1951-0	5	#8 Internal Star Lock Washer
17	C 1986-6	5	#8-32 Hex Nut
18	D 4925-0	2	Terminal Strip
19	C 4305-6	2	35 Amp Bridge Rectifier
20	C 2135-9	2	Screw, Bind Hd Phillips, #6-32 x 3/4"
21	F 9541-8	1	Shield, Plug-In Module
22	C 3823-9	1	Socket, 22 Pin Printed Circuit, Elco
23	C 1954-4	3	Screw, Bind Hd Phillips, #6-32 x 1/4"
24	D 1896-6	3	Switch Mount Spacer
25	C 1824-9	2	#4 Internal Star Lock Washer
26	C 1844-7	2	Screw, Round Hd Slotted, #4-40 x 3/8"
27	C5263-6	8	Screw, 10-32 x .62 Truss Head Phillips
28	C 6518-2	8	.25 Split Ring Lock Washer, zinc
29	C2934-4	8	389 Solder lug, .218" Hole
30	C 5917-7	8	.281 ID x .625 OD Steel Washer
31	C1306-7	8	.375 Fiber Shoulder Washer
32	D7001-7	8	.525 x .730 x ,125 Nylon Washer (FR)
33	C2155-7	1	Screw, Truss Hd Phillips, #8-32 x 3/8"
34	H42401-2	1	7560/70 Low Voltgage Transformer with Connectors
35	C 6974-7	4	1/2" Nylon PCB Standoff
36	——	1	Low Voltgage Wiring Board
37	C 1811-6	4	Cable Tie
38	C 3823-1	1	Switch, DPDT Pushbutton, Power
39	C 1986-6	1	#8-32 Hex Nut
40	C1951-0	1	#8 Internal Star Lock Washer

7.12 Control Panel Assembly

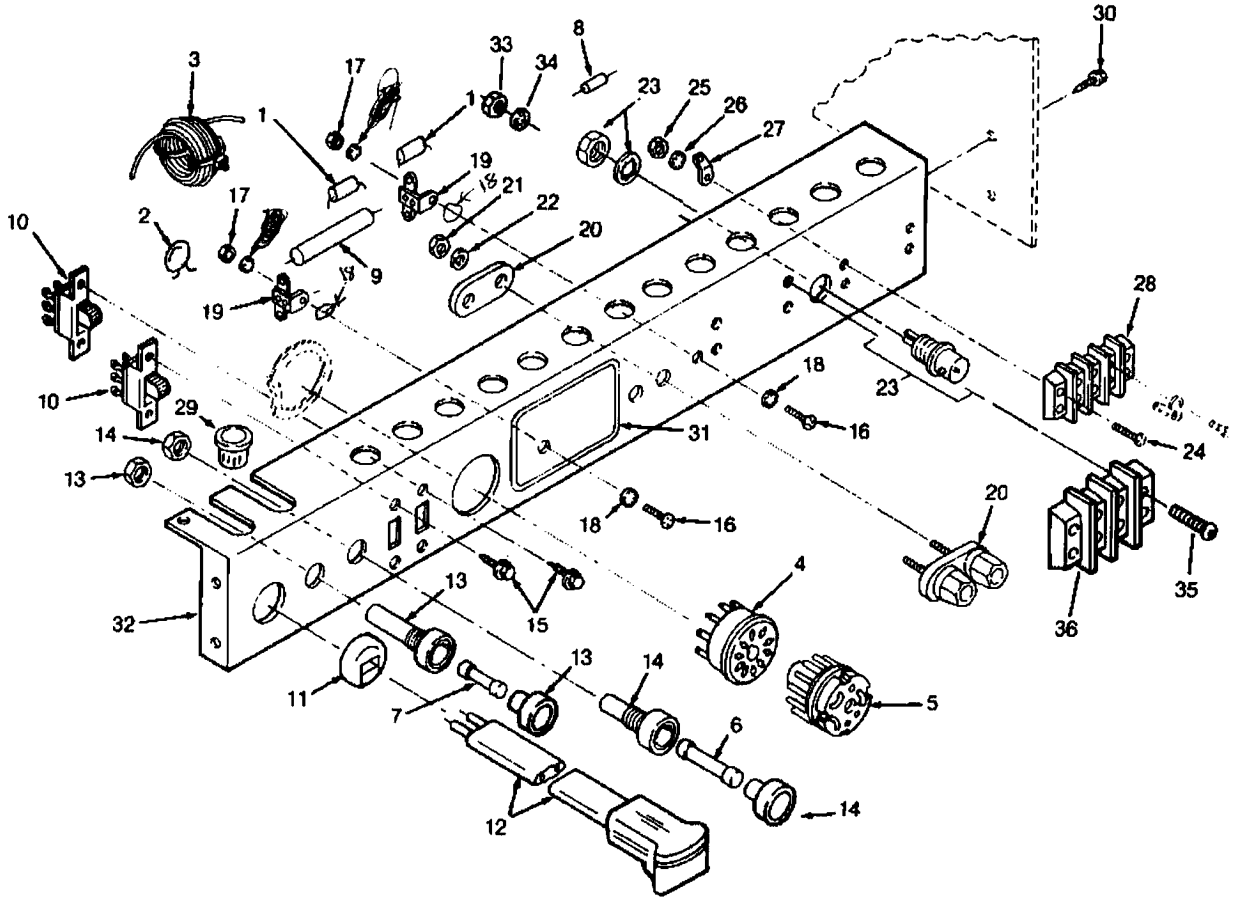


Illustration 7-7 Control Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 8426-6	2	.1μF 200 Volt, Filmatic
2	C 1751-4	2	.01μF Ceramic Disc
3	F10531J5	1	Coil, 2.5 μH
4	C 3910-4	1	Interlock Socket
5	C 3911-2	1	Interlock Plug
6	A10285-8	1	Fuse, AGC 1/2 Amp
7	A10285-28	1	20 Amp Type 3AB (100,120 Vac)
	A10285-26	1	10 Amp Type 3AB (200, 220, 240 Vac)
8	A10266-2R72	1	2.7 ohm .5W 5% Resistor
9	C 7045-7	1	2.7 ohm, 9W 5% Resistor
10	C 2668-9	2	Switch, Slide, DPDT
11	C 3815-5	1	Strain Relief SR34-2
12	H42734-6	1	Power Cord SPT-3 (3–cond. 12 Gauge)
13	C 7956-3	1	Fuseholder, Screwdriver Slot
14	C 5597A5	1	Fuseholder, Screwdriver Slot
15	C 1954-4	2	Screw, Bind Hd Phillips, #6-32 x 1/4"
16	C 1954-4	2	Screw, Bind Hd Phillips, #6-32 x 1/4"
17	C 1889-2	2	#6-32 Hex Nut
18	C 5594-4	4	#6 Internal Star Lock Washer
19	D 3827-9	2	Terminal Strip 2 ULD
20	C 2823-0	1	Binding Post, Dual
23	C 6011-8	1	Panel Mount BNC .39" Diameter
24	C 2176-3	4	Screw, Bind Hd Phillips, #6-32 x 1/2"
25	C 1889-2	4	#6-32 Hex Nut
26	C 5594-4	3	#6 Internal Star Lock Washer
27	C 3163-0	1	Solder lug 505 #6 Hole
28	C 3842-9	1	Barrier Block, 3-140-Y
29	C 4014-4	4	Snap Bushing
30	C 3957-5	4	Screw, Slotted Sheet Metal #8-18x3/8"
31	N/A		
32	F111235J2	1	Control Panel
34	C 1951-0	4	#8 Internal Star Lock Washer
35	C 2228-8	4	Screw, Round Hd Phillips, #8-32 x 5/8"
36	C 1986-6	4	#8-32 Hex Nut
36	C 6347-6	1	Barrier Block, 2-142
—	C 1811-6	—	Cable Tie

7.13 Bottom Output Panel Assembly

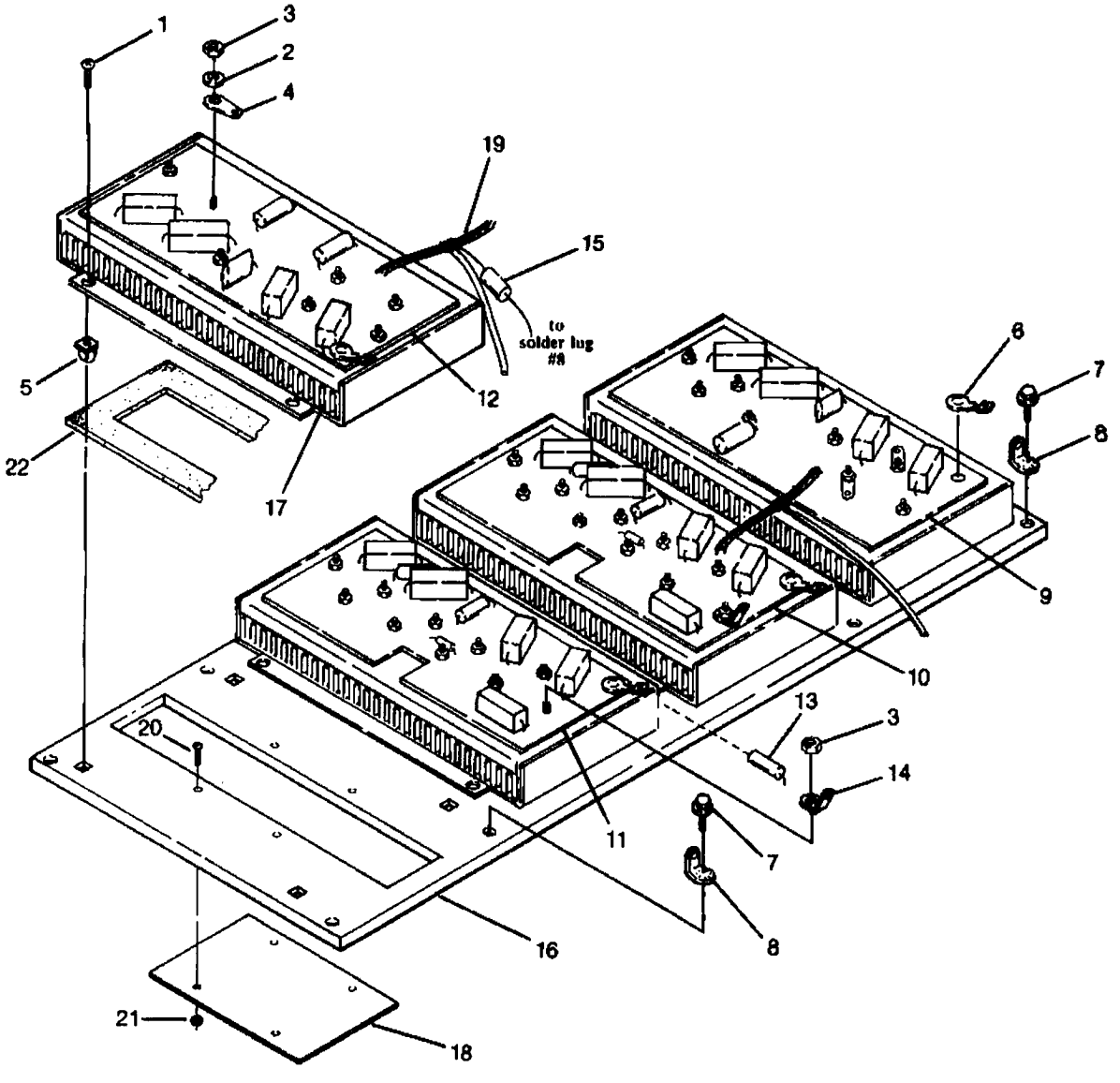


Illustration 7-8 Bottom Output Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 3958-3	16	Screw, #8-18x.375 Phillips
2	C 6897-0	36	#6 Safety Washer, Zinc Plated
3	C 1889-2	36	#6-32 Hex Nut
4	D 2934-4	4	Solder Lug, 389, .218 Hole
5	C 2543-4	16	#8 x .03 Expansion Nut
6	D 2935-1	4	Solder lug 505, #8 Hole
7	C 2757-0	10	Screw, Wshr Hd Sheet Metal, #8 x 5/8"
8	C 3163-0	2	Solder lug, 505 #6 hole
9	—	1	Negative #4 A8
10	—	1	Negative #3 A7
11	—	1	Negative #2 A6
12	—	1	Negative #1 A5
13	A10266-5R62	1	5.6 ohm 1W 10%
14	C 3163-0	2	Solder Lug, 505 #6 hole
15	C 4253-8	1	4.7µF 63Volt
16	M20087A7	1	Heat sink Mounting Plate
17	M20142A0	4	7560/70 Heat sink
18	F 9779-4	2	Air Deflector
19	B 4785-0	2	15 Gauge Wire Braid
20	NA		
21	C 1889-2	36	#6-32 Hex Nut
22	D 5656-0	1	Heat sink Gasket

7.14 Top Output Panel Assembly

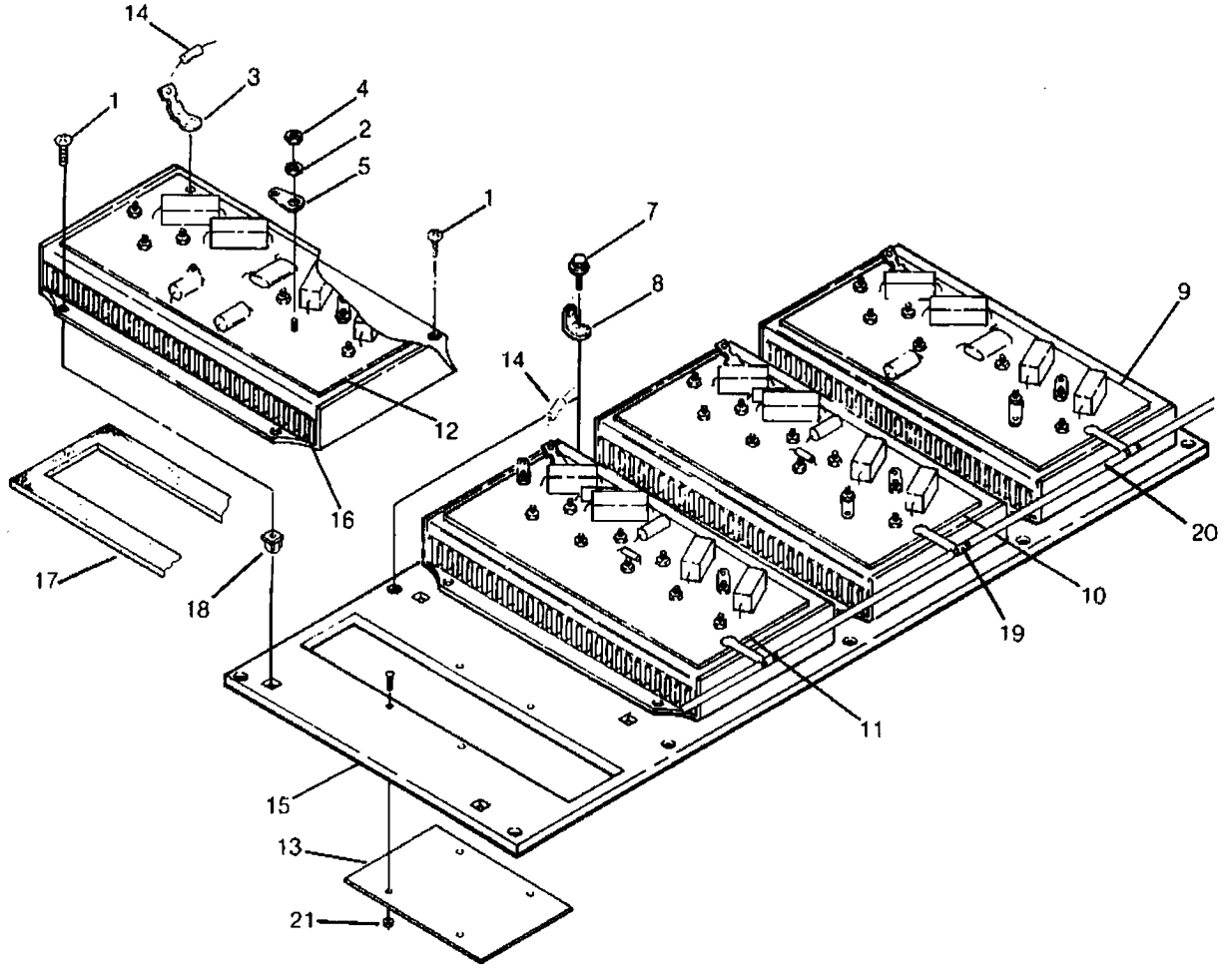


Illustration 7-9 Top Output Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION
1	C 3958-3	16	Screw, #8-18x.375 Phillips
2	C 6897-0	36	#6 Safety Washer, Zinc Plated
3	D 2934-4	4	Solder Lug, 389, .218 Hole
4	C 1889-2	36	#6-32 Hex Nut
5	D 2935-1	8	Solder Lug, 505, #8 Hole
6	C 3163-0	12	Solder Lug, 505, #6 Hole
7	C 1889-2	10	Screw, Wshr Hd Sheet Metal #8x5/8
8	D 1220-9	2	Solder lug, 11B, .144 Hole
9	——	1	Positive #4 A4
10	——	1	Positive #3 A3
11	——	1	Positive #2 A2
12	——	1	Positive #1 A1
13	F 9779-4	1	Air Deflector
14	C 4253-8	2	4.7µF 63V VERT
15	M20087-9	1	Heat sink Mounting Plate
16	M20142A0	4	7560/70 Heat sink
17	D 5656-0	1	Heat sink Gasket
18	C 2543-4	16	#8 x .03 Expansion Nut
19	B 1384-5	—	#12 Solid Buss Wire
20	C 6133-0	4	Jumper Solder Lug
21	C 1889-2	36	#6-32 Hex Nut

7.15 Back Duct Panel Assembly

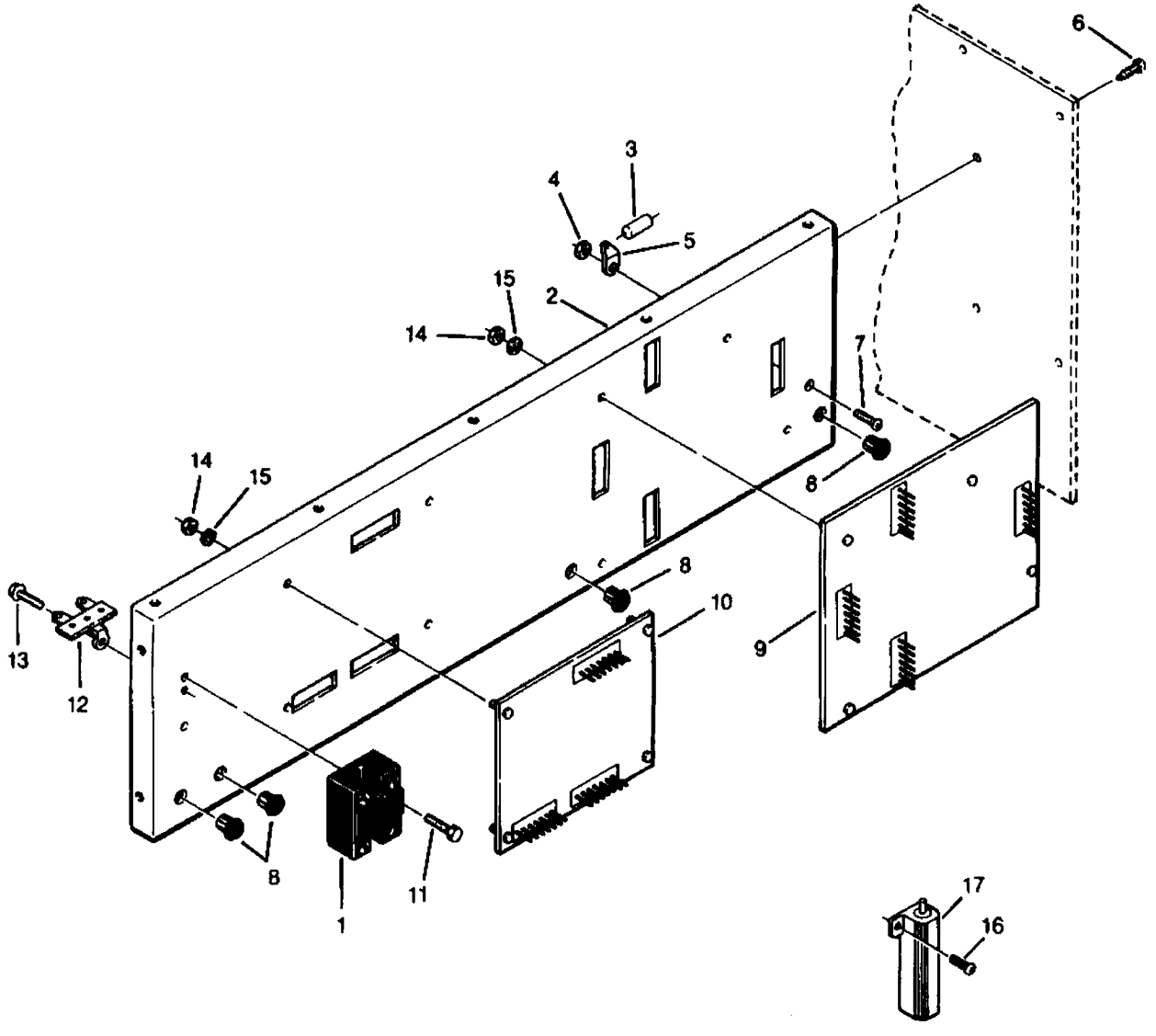


Illustration 7-10 Back Duct Panel Exploded View

ITEM #	PART #	QTY.	DESCRIPTION	
1	C 7308-7	1	Relay, 30A, 240V Solid State	
2	F10369A9	1	Back Duct Panel	
3	A10266-2R72	1	2.7 ohm .5W 10% Resistor	
4	C 1889-2	1	#6-32 Hex Nut	
5	C 3163-0	1	Solder lug, 505, #6 Hole	
6	C 3957-5	6	Screw, Slot Hex Sh Mtl, #8-18 x 3/8"	
7	C 4758-6	1	Screw, Binder Hd Phillips #6-32 x 1/4"	
8	C 3816-3	5	Bushing, Snap-In, .500"	
9	Q42512-6	1	7560/70 Main Board Mount	
10	Q42511-8	1	7560/70 Power Control Board Mount	
11	C 3957-5	6	Screw, Slot Hex Sheet Mtl, #8-18 x 3/8	
12	D 6109-9	1	Terminal Strip, 3AUA, #6 hole	
13	C 3957-5	6	Screw, Slot Hex Sheet Mtl, #8-18 x 3/8	
14	C 1889-2	8	#6-32 Hex Nut	
15	C 5594-4	8	#6 Internal Star Lock Washer	
16	C 5961-5	2	Screw, Taptite, #4-40 x .375	(7570's)
17	C 5352-7	1	.033 Ohm %50W 1%	(7570's)

7.16 7571 Current Meter

ITEM #	PART #	DESCRIPTION
1	_____	75M01 Circuit Board
2	F11699J9	7571 Display Plate
3	D 3812A9	Meter, Dixson VU, 330T
4	C 6063-9	LAMP 6.3V .5A WIRE LEAD
5	C 1889-2	6 X 32 Hex Nut
6	C5594-4	#6 Internal Star Washer
7	C 2279-5	#10 Internal Star Washer
8	C 6331-0	10 X 32 Brass Hex Nut

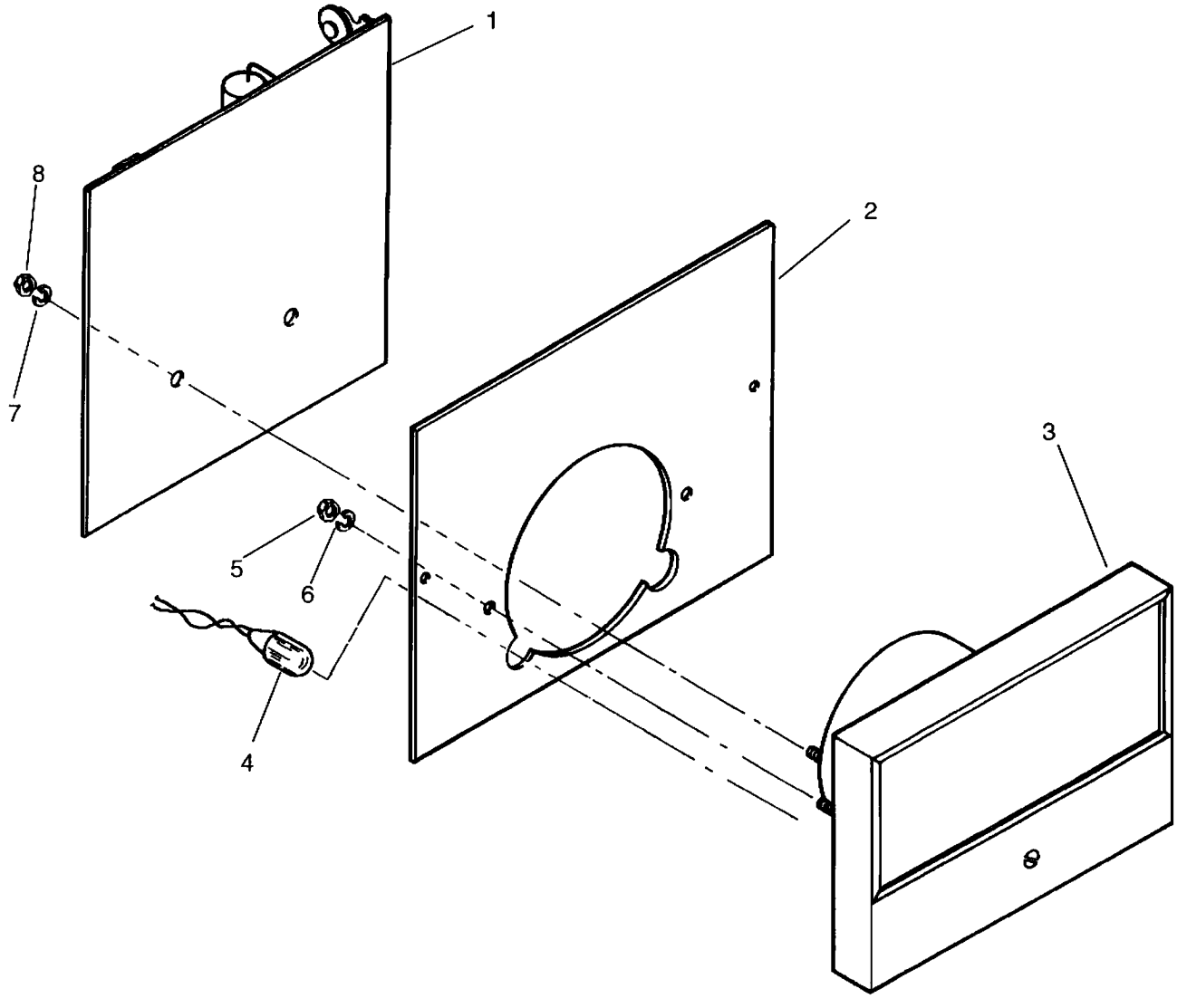


Illustration 7-11 7571 Meter Exploded View

7.17 7571 Current Meter Parts List

LOCATION #	PART #	DESCRIPTION
C201	C 3995-5	0.47MF100V 10%(K) POLYESTER C
C202	C 3190-3	0.068MF200V 10%FILM
C203	C 1751-4	0.01MF500V .3 IN LEADS DISC
C204	C 5362-6	2.2MF 50V VERT ELECTROLYTIC
C205	C 5362-6	2.2MF 50V VERT ELECTROLYTIC
D203	C 3181-2	DIODE, 1N4148
D204	C 3181-2	DIODE, 1N4148
D205	C 3181-2	DIODE, 1N4148
D206	C 3181-2	DIODE, 1N4148
I202	C 6063-9	LAMP 6.3V .5A WIRE LEAD
I203	C 6063-9	LAMP 6.3V .5A WIRE LEAD
IC201	C 3919-5	RC4558 DUAL NB IC
IC202	C 3919-5	RC4558 DUAL NB IC
M200	D 3812A9	METER, DIXSON VU 330T
P8	C 3847-8	7-PIN CONNECTOR
Q200	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q201	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q202	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q203	C 3625-8	2N4125 PNP
R217	C 4505-1	2.0 KOHM .25W 1% MF
R218	C 2343-9	10. KOHM .5W 1% MF
R219	C 1681-3	5K BLU TRIMPOT
R220	A10266-4721	4.7 KOHM .25W 5% CF
R221	A10266-3011	300. OHM .25W 5 CF
R222	C 4850-1	1.0 KOHM .25W 1 MF
R223	C 2343-9	10. KOHM .5W 1% MF
R224	C 2343-9	10. KOHM .5W 1% MF
R225	A10266-1501	15.0 OHM .25W 5% CF
R226	C 3536-7	56. MOHM .25W 10 COMP
R227	C 3028-5	250K 1 VERT WHT POT
R228	A10266-2751	2.7 MOHM .25W 5% CF
R229	C 3052-5	22. MOHM .5W 10 COMP
R230	A10266-1841	180.KOHM .25W 5% CF
R231	A10266-3321	3.3 KOHM .25W 5 CF

7.18 7570 Input Plug-In Parts List

LOCATION #	PART #	DESCRIPTION	
C1	C 3290-1	120pf	
C2	C 3410-5	100pf	
C3	C 5639-7	.1μF	
C4	N.A.		
C5		Selected to load	
C6		Selected to load	
C7	D 4463-2	544pf 63V	
C8	D 4463-2	544pf 63V	
C9	C 3410-5	100pf	
C10	C 5639-7	.1μF	
C11	C 4510-1	.22μF	
C12	C 4510-1	.22μF	
C13	C 4510-1	.22μF	
C14	C 3089-7	.00l5μF	
C15	C 4151-4	.0039	
C16	C 5978-9	220pf	
C17	C 5639-7	1μF	
C18	C 5639-7	.1μF	
Q1	D 2961-7	sel 2N3859A	
Q2	D 2961-7	sel 2N3859A	
R1		10kΩ .25W 1%	Part of RN1
R2		10kΩ .25W 1%	Part of RN1
R3		9.9K 1%	Part of RN1
R4		200	Part of RN1
R5		9.9K	Part of RN1
R6	C 4661-2	15M ohm .25W 5%	
R7	C 5062-2	100K ohm lin trim pot	
R8	C 5012-2	100K ohm lin trim pot	
R9	A10266-7551	7.5M ohm .25W 5%	
R10	A10266-2421	2.4K ohm .25W 5%	
R11		Selected	
R12	C 3686-0	4.99K ohm .25W 1%	
R13		Selected	
R14	C 3686-0	4.99K ohm .25W 1%	
R15	A10266-4701	47 ohm .25W 5%	

R16		Selected
R17	C 3686-0	4.99K ohm .25W 1%
R18	A10266-3311	330 ohm .25W 5%
R19	C 6371-6	499 ohm .25W 1%
R20	C 3929-4	1.74K ohm .5W 1%
R21	C 1681-3	5K blue vert. pot
R22	A10266-3301	33 ohm .25W 5%
R23	C 6371-6	499 ohm .25W 1%
R24	A10266-1051	1M ohm .25W 5%
R25	C 3929-4	1.74K ohm .5W1%
R26	C 5062-2	100K ohm Linear Trim Pot
R27	A10266-3011	300 ohm .25W 5%
R28	C 4859-2	10K .25W 1%
R29	C 4859-2	10K .25W 1%
R30	A10266-3011	300 ohm .25W 5%
R31	C 5062-2	100K ohm lin trim pot
R32	C 4661-2	15M ohm .25W 5%
R33	A10266-5121	5.1K ohm .25W 5%
R34		68K * selected
R35		18K * selected
R36		
R37	A10266-1031	10K ohm .25W 5%
R38	A10266-1031	10K ohm .25W 5%
R39	A10266-1031	10K ohm .25W 5%
R40	D 6067-9	5K Linear Pot
R41	A10266-3301	33 ohm .25W 5%
RN1	C 4669-4	Bal Input Resistor Trimmer
TC1	C 5058-0	30pf PC mount trimmer
U1	D 5466-4	HA474l sel quad op amp
U2	C 5070-5	TL072CP op amp
	C 3450-1	14 pin DIL IC socket
	C 5868-2	0 ohm .25W jumper
	C 3451-9	8 pin DIL IC socket

7.19 Main Amplifier Parts List

LOCATION #	PART #	DESCRIPTION
A2S1	C3814-8	140°F NC Thermal Switch
A6S1	C3814-8	140°F NC Thermal Switch
C100	C 5198-4	0.1MF100V 10%POLY CAP
C104	C 3409-7	47PF DIPPED SILVER MICA
C105	C 3410-5	100PF DIPPED SILVER MICA
C106	C 2342-1	27PF DIPPED SILVER MICA CAPC
C108	C 3409-7	47PF DIPPED SILVER MICA
C111	C 2511-1	470PF MICA (D195F471J0)-LARGE
C112		10 PF
C113	C 2511-1	470PF MICA (D195F471J0)-LARGE
C114	C 1751-4	0.01MF500V DISC
C115	C 3409-7	47PF DIPPED SILVER MICA
C116	C 3409-7	47PF DIPPED SILVER MICA
C118	C 1751-4	0.01MF500V DISC
C119	C 5311-3	22MF 50V NP 20%
C120	C 5311-3	22MF 50V NP 20%
C121	C 2288-6	0.001MF CERAMIC DISC CAPC
C122	C 8549-5	.0047MF200V 5%FILM
C123	C 8550-3	.0082MF100V 10% POLYESTER
C124	C 5311-3	22MF 50V NP 20%
C125	C 5311-3	22MF 50V NP 20%
C126	C 1751-4	0.01MF500V DISC
C127	C 3411-3	200PF DIPPED SILVER MICA
C128	C 8268-2	220MF 16V VERT
C129	C 8547-9	.0027MF200V FILM
C130	C 3411-3	200PF DIPPED SILVER MICA
C131	C 3411-3	200PF DIPPED SILVER MICA
C132	C 8268-2	220MF 16V VERT
C133	C 3411-3	200PF DIPPED SILVER MICA
C134	C 3409-7	47PF DIPPED SILVER MICA
C135	C 6227-0	20PF MICA #D155E200JO
C137	C 8553-7	.033MF200V 5%FILM Labeled R183
C138	C 8547-9	.0027MF200V FILM
C139	C 6087-8	62PF SILVER DIPPED MICA
C140	C 8220-3	0.015MF100V 10%FILM
C141	C 2288-6	0.001MF CERAMIC DISC CAPC
C142	C 5198-4	0.1MF100V 10%POLY CAP
C143	C 2342-1	27PF DIPPED SILVER MICA CAPC
C144	C 8220-3	0.015 µF 100V 10% FILM
C300	C 8426-6	.1MF 200V FILM
C301	C 1751-4	01µF CERAMIC DISK
C302	C 4253-8	4.7µF 63V VERT

C303	C 4253-8	4.7µF 63V VERT
C304	C 4253-8	4.7µF 63V VERT
C500	C 3008-7	1.0µ 100V Film
D100	C 3181-2	DIODE, 1N4148
D101	C 3181-2	DIODE, 1N4148
D103	C 3181-2	DIODE, 1N4148
D104	C 3181-2	DIODE, 1N4148
D105	C 3181-2	DIODE, 1N4148
D106	C 3181-2	DIODE, 1N4148
D107	C 3181-2	DIODE, 1N4148
D108	C 3181-2	DIODE, 1N4148
D109	C 3181-2	DIODE, 1N4148
D110	C 2851-1	RECTIFIER, 1N4004 SILICON
D111	C 3181-2	DIODE, 1N4148
D112	C 3181-2	DIODE, 1N4148
D113	D 6212-1	DIODE, 3447
D114	C 3181-2	DIODE, 1N4148
D115	C 2851-1	RECTIFIER, 1N4004 SILICON
D116	C 3181-2	DIODE, 1N4148
D117	C 3181-2	DIODE, 1N4148
J1	C 6011-8	Panel mount BNC .39 diameter
J2	C 3842-9	Barrier Block, 3-140-Y
J5	C 2823-0	Binding Post, Dual
J6	C 3842-9	Barrier Block, 3-140-Y
L100	C 3510-2	CHOKE, .5 MH AXIAL 470 UH
L101	C 3510-2	CHOKE, .5 MH AXIAL 470 UH
L102	C 3510-2	CHOKE, .5 MH AXIAL 470 UH
L300	F 9537J5	Coil, 1.2 microhenrys
Q102	C 3625-8	2N4125 PNP
Q103	D 2923-7	SEL 2N4929 SS7304PNP
Q104	C 6776-6	MPSA43 NPN TEXTET
Q105	C 3578-9	MPSA93 PNP
Q106	C 4061-5	NPNSDS151 NPN
Q107	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q108	C 3625-8	2N4125 PNP
Q109	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q110	C 3625-8	2N4125 PNP
Q111	C 3625-8	2N4125 PNP
Q112	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q113	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q114	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q115	C 7339-2	MJE344 NPN TRANSISTOR
Q116	C 3625-8	2N4125 PNP
Q117	D 2923-7	SEL 2N4929 SS7304PNP
Q118	C 7339-2	MJE344 NPN TRANSISTOR

Q119	C 3625-8	2N4125 PNP
Q120	D 2923-7	SEL 2N4929 SS7304PNP
R105	A10266-1021	1.0 KOHM .25W 5% CF
R108	A10266-1531	15. KOHM .25W 5% CF
R110	A10266-1321	1.3 KOHM .25W 5 CF
R111	A10266-1321	1.3 KOHM .25W 5 CF
R112	C 7110-7	2.49KOHM .5 W 5% MF
R113	C 3854-4	44.7KOHM .5 W.5% MF
R114	A10266-2751	2.7 MOHM .25W 5% CF
R115	C 1713-4	100KOHM VERT WHITE POT
R116	A10266-1531	15. KOHM .25W 5% CF
R117	C 1713-4	100KOHM VERT WHT POT
R119	A10266-1041	100.KOHM .25W 5% CF25
R120	C 3128-3	44.2KOHM .5 W 1% MF
R121	A10266-1021	1.0 KOHM .25W 5% CF
R122	C 1681-3	5K BLUE VVERTICAL POT
R123	A10266-1021	1.0 KOHM .25W 5% CF
R124	A10266-1011	100. OHM .25W 5% CF
R125	A10266-1011	100. OHM .25W 5% CF
R127	C 3855-1	22.1KOHM .5 W 1% MF
R128	A10266-5611	560. OHM .25W 5% CF25
R129	A10266-4701	47.0 OHM .25W 5 CF
R130	A10266-7511	750. OHM .25W 5 CF
R132	A10266-1021	1.0 KOHM .25W 5% CF
R133	A10266-3332	33. KOHM .5 W 5% CF
R134	A10266-7511	750. OHM .25W 5 CF
R135	A10266-5611	560. OHM .25W 5% CF25
R136	A10266-4701	47.0 OHM .25W 5 CF
R137	A10266-4711	470. OHM .25W 5% CF
R138	A10266-1011	100. OHM .25W 5% CF
R139	A10266-1211	120. OHM .25W 5 CF
R140	A10266-8211	820. OHM .25W 5% CF
R141	A10266-1532	15. KOHM .5 W 5% CF
R142	C 3617-5	3.3 KOHM 1.W 5% CF RSF1-A
R143	A10266-1532	15. KOHM .5 W 5% CF
R144	A10266-1532	15. KOHM .5 W 5% CF
R145	C 3618-3	3.9 KOHM 1.W 10 CF
R146	A10266-1532	15. KOHM .5 W 5% CF
R147	A10266-5611	560. OHM .25W 5% CF25
R149	A10266-9111	910. OHM .25W 5 CF
R150	A10266-2231	22. KOHM .25W 5% CF
R151	A10266-1231	12.0KOHM .25W 5% CF25 RCD
R152	A10266-1231	12.0KOHM .25W 5% CF25 RCD
R153	A10266-2231	22. KOHM .25W 5% CF
R154	A10266-1021	1.0 KOHM .25W 5% CF

R155	A10266-1311	130. OHM .25W 5 CF
R156	A10266-5611	560. OHM .25W 5% CF25
R157	A10266-1311	130. OHM .25W 5 CF
R158	A10266-1111	110. OHM .25W 5 CF
R159	A10266-4711	470. OHM .25W 5% CF
R160	A10266-1211	120. OHM .25W 5 CF
R161	A10266-1031	10. KOHM .25W 5% CF
R162	A10266-1031	10. KOHM .25W 5% CF
R163	A10266-3321	3.3 KOHM .25W 5 CF
R164	C 6548-9	1KOHM HORZ TRIMPOT, DRVR ADJ
R165	A10266-2R72	2.7 OHM .5W 5% CF50
R166	A10266-1011	100. OHM .25W 5% CF
R167	A10266-2221	2.2 KOHM .25W 5% CF
R168	A10266-8211	820. OHM .25W 5% CF
R169	C 6048-0	500 OHM PIHER TRIM
R170	A10266-5R62	5.6 OHM .5 W 5 CF
R171	C 3854-4	44.7KOHM .5 W.5% MF
R173	A10266-1211	120. OHM .25W 5 CF
R174	A10266-1111	110. OHM .25W 5 CF
R176	A10266-4711	470. OHM .25W 5% CF
R177	A10266-4701	47.0 OHM .25W 5 CF
R178	A10266-4701	47.0 OHM .25W 5 CF
R179	A10266-1211	150. OHM .25W 5 CF
R180	A10266-4701	47.0 OHM .25W 5 CF
R181	C 5702-3	75. KOHM .25W 1 MF
R183	C 5868-2	0.0 OHM .25W O WIRE
R186	A10266-2051	2.0 MOHM .25W 5 CF
R187	A10266-2221	2.2 KOHM .25W 5% CF
R301	A10266-2R72	2.7 ohm .5W 5% resistor
R305	C 7045-7	2.7 ohm, 9W 5% Resistor
R306	A10266-5R62	5.6 ohm .5W
R307	C 5352-7	.033 Ohm %50W 1%
R500	D2942A5	25 kΩ Variable Resistor
S500	D3492-2	SPST Rotary Switch
U100	C 7621-3	LF357 OP AMP
U101	C 7621-3	LF357 OP AMP
Misc:	C 1250-7	TO5 MTG PAD
	C 1824-9	#4 INT.STAR LOCKWASHER
	C 1844-7	R 4-40 X .37 A S MSCR
	C 1938-7	4 X40 HEX NUT
	C 3175-4	2225B TO5 COOLER
	C 3451-9	IC SOCKET, 8PIN DIP
	C 3846-0	AMPMOD 1 PC RCPT #87316-3
	C 5213A9	PB1-36T HEAT SINK XSISTOR
	C 5214-9	TO-5 HEAT SINK
	S 1152-8	TAPE,DOUBL SIDE FOAM
	S 5700-0	732 SILASTIC RUBBER

7.20 Output Module A1

LOCATION #	PART #	DESCRIPTION
C3	C 8511-5	.047mF 200V 5% Film
J1	D 2934-4	389 Solder Lug, .218 Hole
Q1	C 3785-0	TS3.75 Thermal Sensor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R1	A10266-1204	12 Ohm 2W 10% comp
R2	A10266-1204	12 Ohm 2W 10% comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
	P10051A	Output Board Without Notch

7.21 Output Module A2

LOCATION #	PART #	DESCRIPTION
C1	C 1751-4	.01mF 500V disc
D1	C 2941-0	1N5402 Power Diode
J1	D 2934-4	389 Solder Lug, .218 Hole
Q1	D2961-7	SEL 2N3859A
8271-9 Q2	~~C 8213-4~~	Power NPN Transistor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R3	A10266-1011	100 Ohm .25W 5%CF
R4	A10266-5R63	5.6 Ohm 1W 5 comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
	P10051A	Output Board Without Notch

7.22 Output Module A3

LOCATION #	PART #	DESCRIPTION
C1	C 1751-4	.01mF 500V disc
C2	C 1751-4	.01mF 500V disc
D1	C 2941-0	1N5402 Power Diode
J1	D 2934-4	389 Solder Lug, .218 Hole
Q1	C 3625-8	2N4125 PNP
Q2	~~C 3810-4~~	Power NPN Transistor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R3	A10266-1011	100 Ohm .25W 5%CF
R4	A10266-5R63	5.6 Ohm 1W 5 comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
	P10051A	Output Board Without Notch

7.23 Output Module A4

LOCATION #	PART #	DESCRIPTION
C3	C 8512-3	.022mF 200V 5% Film
J1	D 2934-4	389 Solder Lug, .218 Hole
Q1	C 3785-0	TS3.75 Thermal Sensor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R1	A10266-1204	12 Ohm 2W 10% comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
	P10051A	Output Board Without Notch

7.24 Output Module A5

LOCATION #	PART #	DESCRIPTION
C3	C 8512-3	.022mF 200V 5% Film
J2	D 2934-4	389 Solder Lug, .218 Hole
R1	A10266-1204	12 Ohm 2W 10% comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
	P10051A2	Output Board Without Notch

7.25 Output Module A6

LOCATION #	PART #	DESCRIPTION
D1	C 2941-0	1N5402 Power Diode
Q1	C 3785-0	TS3.75 Thermal Sensor
Q2	C 8210-4	Power NPN Transistor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R3	A10266-1011	100 Ohm .25W 5%CF
R4	A10266-5R63	5.6 Ohm 1W 5 comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
R9	C 3583-9	.33 Ohm 5W 5% Wire
J2	D 2934-4	389 Solder Lug, .218 Hole
	P 7997A1	Output Board With Notch
	D 5083-7	1.0 x .4 x .02 Fishpaper

7.26 Output Module A7

LOCATION #	PART #	DESCRIPTION
D1	C 2941-0	1N5402 Power Diode
Q1	C 3785-0	TS3.75 Thermal Sensor
Q2	C 8210-4	Power NPN Transistor
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R3	A10266-1011	100 Ohm .25W 5%CF
R4	A10266-5R63	5.6 Ohm 1W 5 comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
R9	C 3583-9	.33 Ohm 5W 5% Wire
J2	D 2934-4	389 Solder Lug, .218 Hole
	P 7997A1	Output Board With Notch

7.27 Output Module A8

LOCATION #	PART #	DESCRIPTION
C3	C 8511-5	.047mF 200V 5% Film
Q3	C 7423-4	Graded NPN Power Transistor
Q4	C 7423-4	Graded NPN Power Transistor
Q5	C 7423-4	Graded NPN Power Transistor
Q6	C 7423-4	Graded NPN Power Transistor
R1	A10266-1204	12 Ohm 2W 10% comp
R2	A10266-1204	12 Ohm 2W 10% comp
R5	C 3583-9	.33 Ohm 5W 5% Wire
R6	C 3583-9	.33 Ohm 5W 5% Wire
R7	C 3583-9	.33 Ohm 5W 5% Wire
R8	C 3583-9	.33 Ohm 5W 5% Wire
J1	D 2934-4	389 Lug, .218 Hole
	P10051A	Output Board Without Notch

7.28 Power Supply Parts List

LOCATION #	PART #	DESCRIPTION
A1Q1	C 3785-0	TS3.75 thermal sensor
A4Q1	C 3785-0	TS3.75 thermal sensor
A6Q1	C 3785-0	TS3.75 thermal sensor
A7Q1	C 3785-0	TS3.75 thermal sensor
B1	M20141-4	Fan and motor, with Connectors
B2	M20141-4	Fan and motor, with Connectors
C6	C 3436-0	13,500 µF, 70V
C7	C 3436-0	13,500 µF, 70V
C8	C 3436-0	13,500 µF, 70V
C9	C 3436-0	13,500 µF, 70V
C10	C 4991-3	7.5µF 220 Volt AC
C11	C 1751-4	0.01µF500 Volt DISC
C14	C 4991-3	7.5µF 220 Volt AC
C400	C 4147-2	220µF 50V AXIAL
C401	C 4477-3	470 µF 35V VERT
C402	C 4477-3	470 µF 35V VERT
C403	C 4253-8	4.7µF 63V VERT
C404	C 4253-8	4.7µF 63V VERT
C405	C 1751-4	0.01µF500V DISC
C406	C 6096-9	3.3µF 50V LOW LEAK
C407	C 5311-3	22µF 50V NP 20%
C408	C 5198-4	0.1µF100V 10%POLY CAP
C409	C 5198-4	0.1µF100V 10%POLY CAP
C410	C 5198-4	0.1µF100V 10%POLY CAP
C411	C 3728-0	10µF 50V VERT
C412	C 1751-4	0.01µF500V DISC
C413	C 1751-4	0.01µF500V DISC
D400	C 2851-1	RECTIFIER, 1N4004 SILICON
D401	C 2851-1	RECTIFIER, 1N4004 SILICON
D402	C 2851-1	RECTIFIER, 1N4004 SILICON
D403	C 2851-1	RECTIFIER, 1N4004 SILICON
D404	C 2851-1	RECTIFIER, 1N4004 SILICON
D405	C 2851-1	RECTIFIER, 1N4004 SILICON
D406	C 2851-1	RECTIFIER, 1N4004 SILICON
D407	C 3181-2	DIODE, 1N4148
D408	C 3181-2	DIODE, 1N4148
D409	C 3181-2	DIODE, 1N4148
D410	C 3181-2	DIODE, 1N4148
D411	C 3181-2	DIODE, 1N4148
D412	C 3181-2	DIODE, 1N4148
D413	C 3181-2	DIODE, 1N4148

D414	C 3181-2	DIODE, 1N4148
D415	C 3549-0	DIODE, 1N961B 10V ZENER
DM1	C 4305-6	35 Amp Bridge Rectifier
DM2	C 4305-6	35 Amp Bridge Rectifier
F1	A10285-8	Fuse, AGC .5 amp
F1	C 5597A5	Fuseholder, Screwdriver Slot
F2	A10285-28	20 Amp Type 3AB (100,120 VAC Mains)
	A10285-26	10 Amp Type 3AB (200,220,240 VAC)
F2	C 5597A5	Fuseholder, Screwdriver Slot
I1	C 2500-4	Lamp, Neon, NE2H
I2	C 2500-4	Lamp, Neon, NE2H
IC400	C 5095-2	MC7815CT +15V.REGLTR
IC401	C 5096-0	MC7915CT -15V.REGLTR
IC402	C 4345-2	LM339N VOLTCOMPARATR
J3F	C 3910-4	Interlock Socket
J3M	C 3911-2	Interlock Plug
K1	C 7308-7	Relay, 30A, 240V Solid State
Q400	C 6049-8	J-310 JFET
Q401	D 2961-7	SEL 2N3859A, SPS8010 NPN
Q402	C 3528-4	MPSA06 NPN
R6	A10266-2732	27KΩ .5 W 10% resistor
R7	C 3809-8	100K ohm 1W 10% resistor
R8	C 3902A9	600 ohm 12W 5% wire wound resistor
R9	C 6066-2	33 Ohm 10 W 10%
R10	C 6066-2	33 Ohm 10 W 10%
R400	A10266-1041	100.KΩ .25W 5% CF25
R401	A10266-1041	100.kΩ .25W 5% CF25
R402	A10266-2041	200.kΩ .25W 5 CF
R403	A10266-1851	1.8 MΩ .25W 5% CF
R404	A10266-3031	30. kΩ .25W 5 CF
R405	A10266-6821	6.8 kΩ .25W 5 CF
R406	A10266-1031	10. kΩ .25W 5% CF
R407	A10266-2241	220.kΩ .25W 5% CF
R408	A10266-1531	15. kΩ .25W 5% CF
R409	A10266-1021	1.0 kΩ .25W 5% CF
R410	A10266-1011	100. Ω .25W 5% CF
R411	A10266-2441	240.kΩ .25W 5% CF
R412	A10266-4711	470. Ω .25W 5% CF
R413	A10266-3331	33. kΩ .25W 5% CF
R414	A10266-5131	51. kΩ .25W 5 CF25
R415	A10266-1041	100.kΩ .25W 5% CF25
R416	A10266-2051	2.0 MΩ .25W 5 CF
R417	A10266-8241	820.kΩ .25W 5% CF

R418	A10266-4741	470.kΩ .25W 5% CF
R419	A10266-9131	91. kΩ .25W 5 CF
R420	A10266-3921	3.9 kΩ .25W 5% CF
R421	C 5947-4	10kΩ VERT LINEAR POT
R422	A10266-2722	2.7K Ohm .5W 10%
SW1	C 3822-1	Power, DPDT Pushbutton, NE15
SW2	C 2668-9	Switch, Slide, DPDT
SW3	C 2668-9	Switch, Slide, DPDT
SW300	C3814-8	140°F NC Thermal Switch
SW301	C3814-8	140°F NC Thermal Switch
T1	H42401-2	Low Voltgage Transformer & Connectors
T2	D 5781-6	Transformer, 7560/70 Power
T3	D 5781-6	Transformer, 7560/70 Power
Misc:	C 3846-0	AMPMOD 1 PC RCPT #87316-3
	C 3450-1	IC SOCKET, 14PIN DIP

7.29 Circuuit Board Layouts

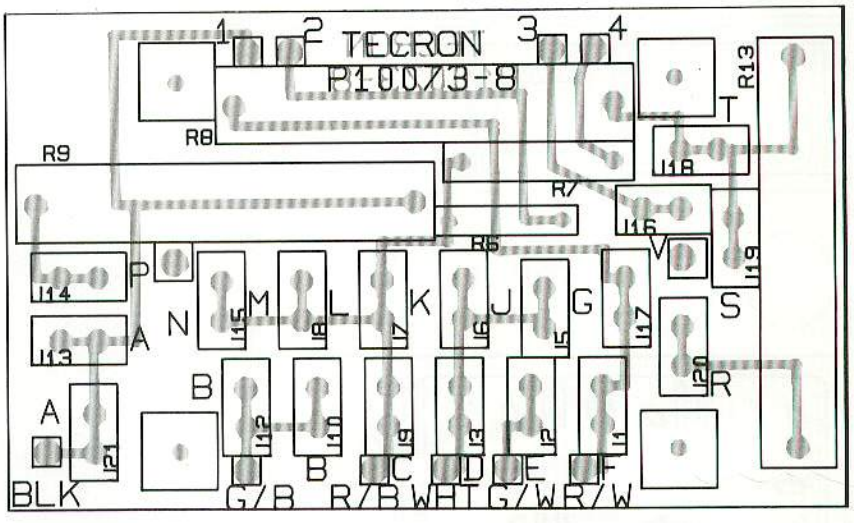


Illustration 7-12 Low Voltage Wiring Circuit Board

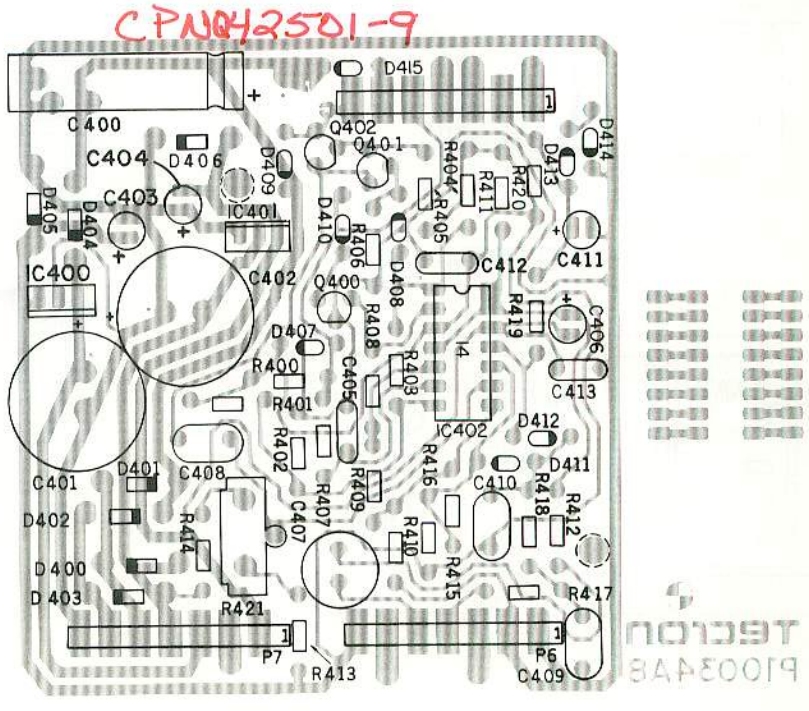


Illustration 7-13 Power Control Circuit Board

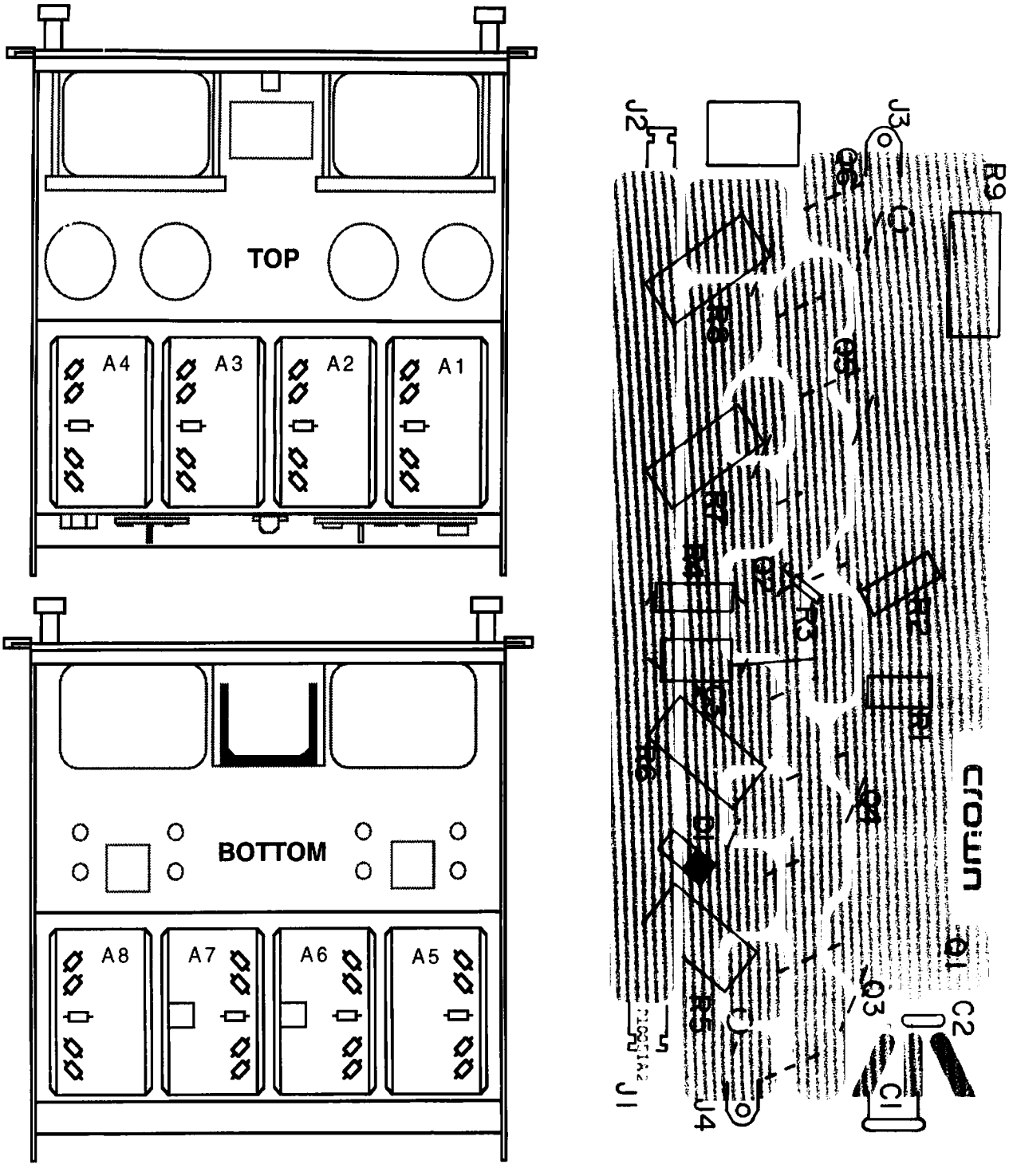


Illustration 7-14 Output Transistor Circuit Board and Locations

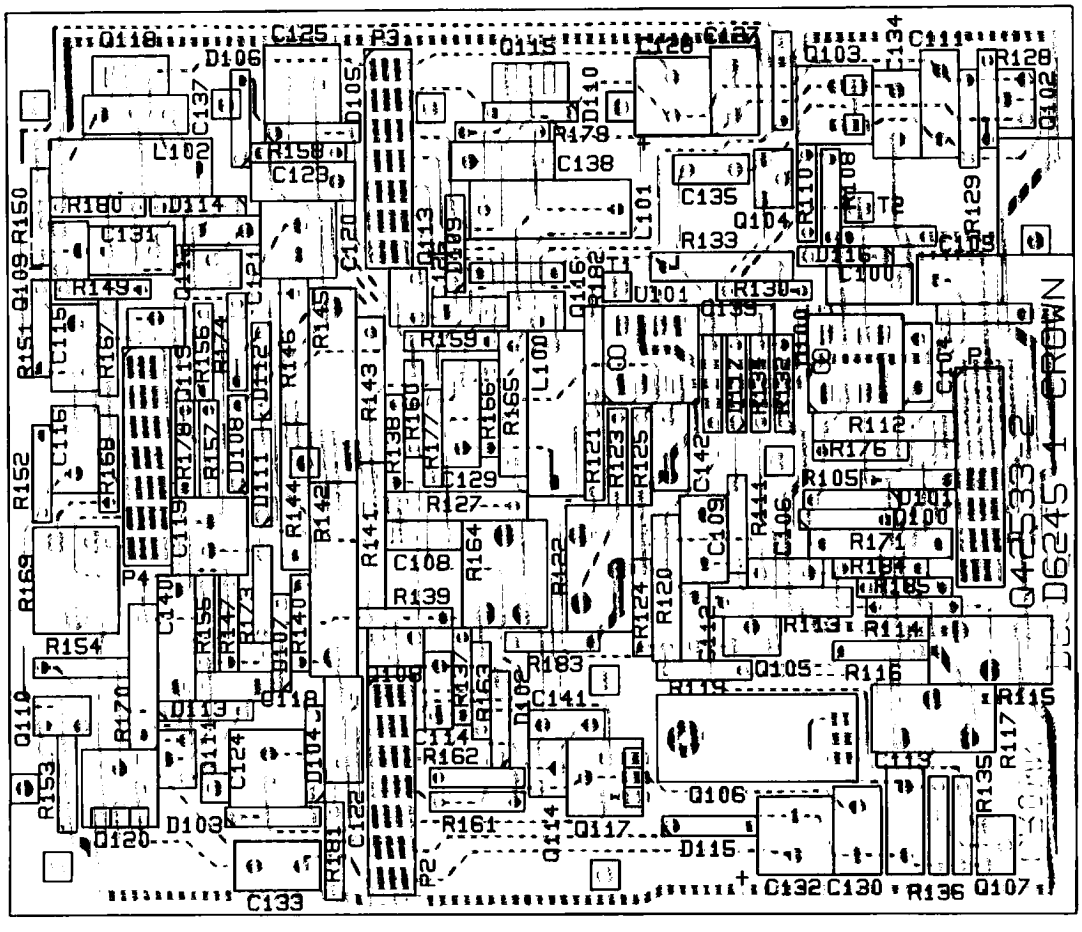


Illustration 7-15 Main Amplifier Circuit Board

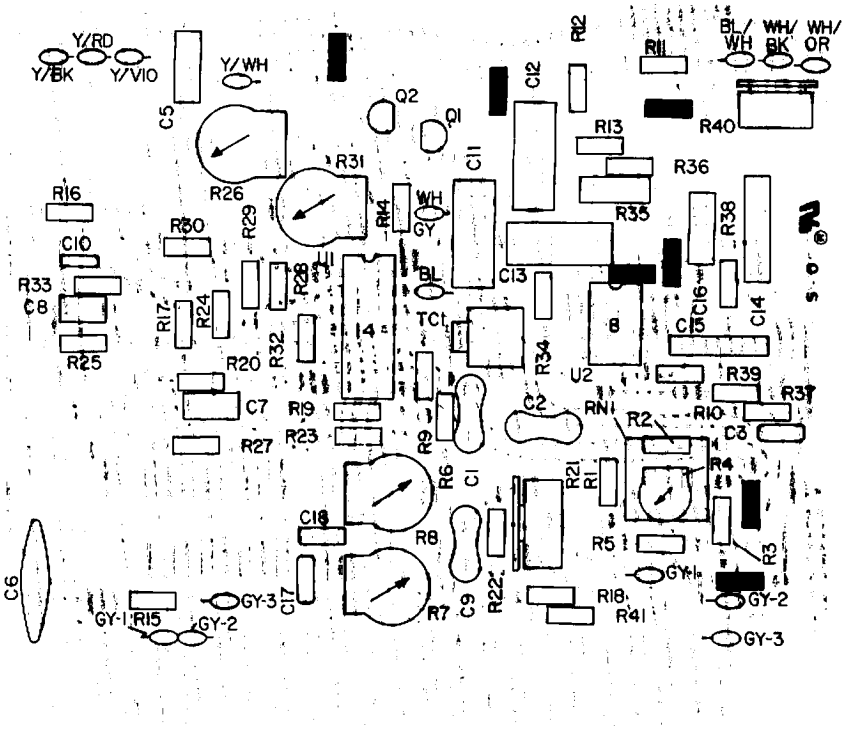


Illustration 7-16 7570 Input Plug-In Circuit Board

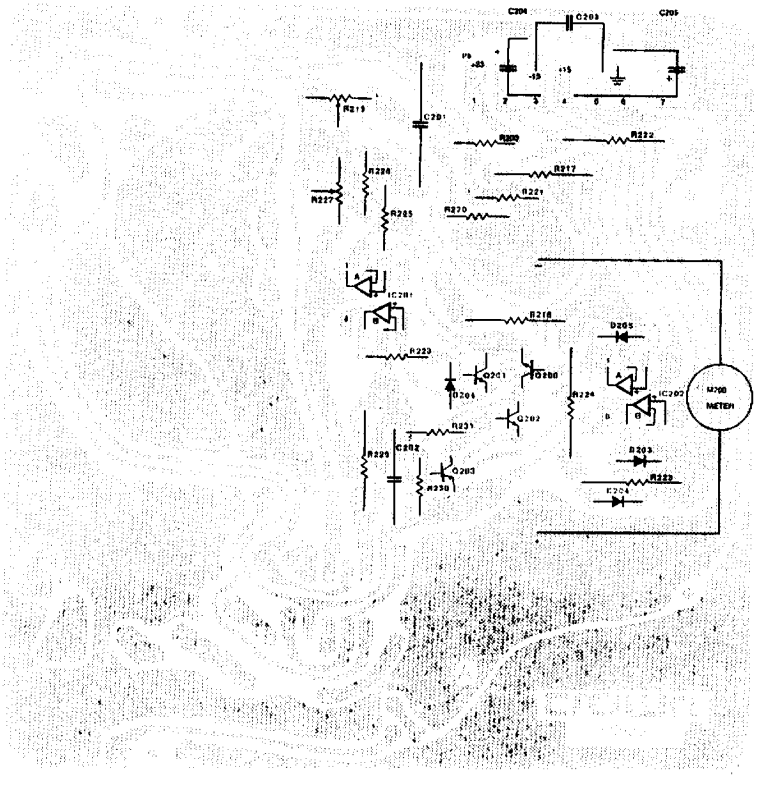
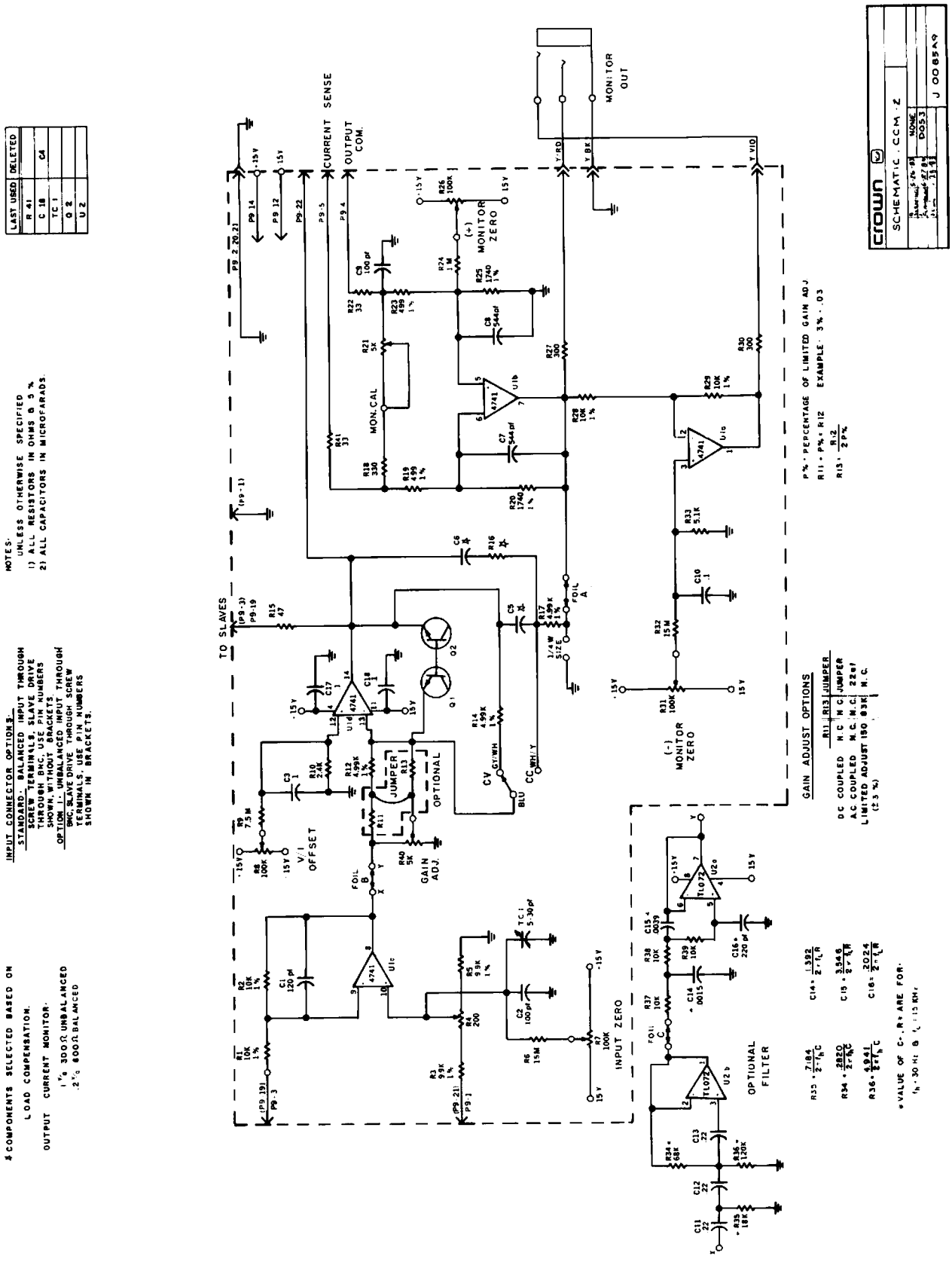
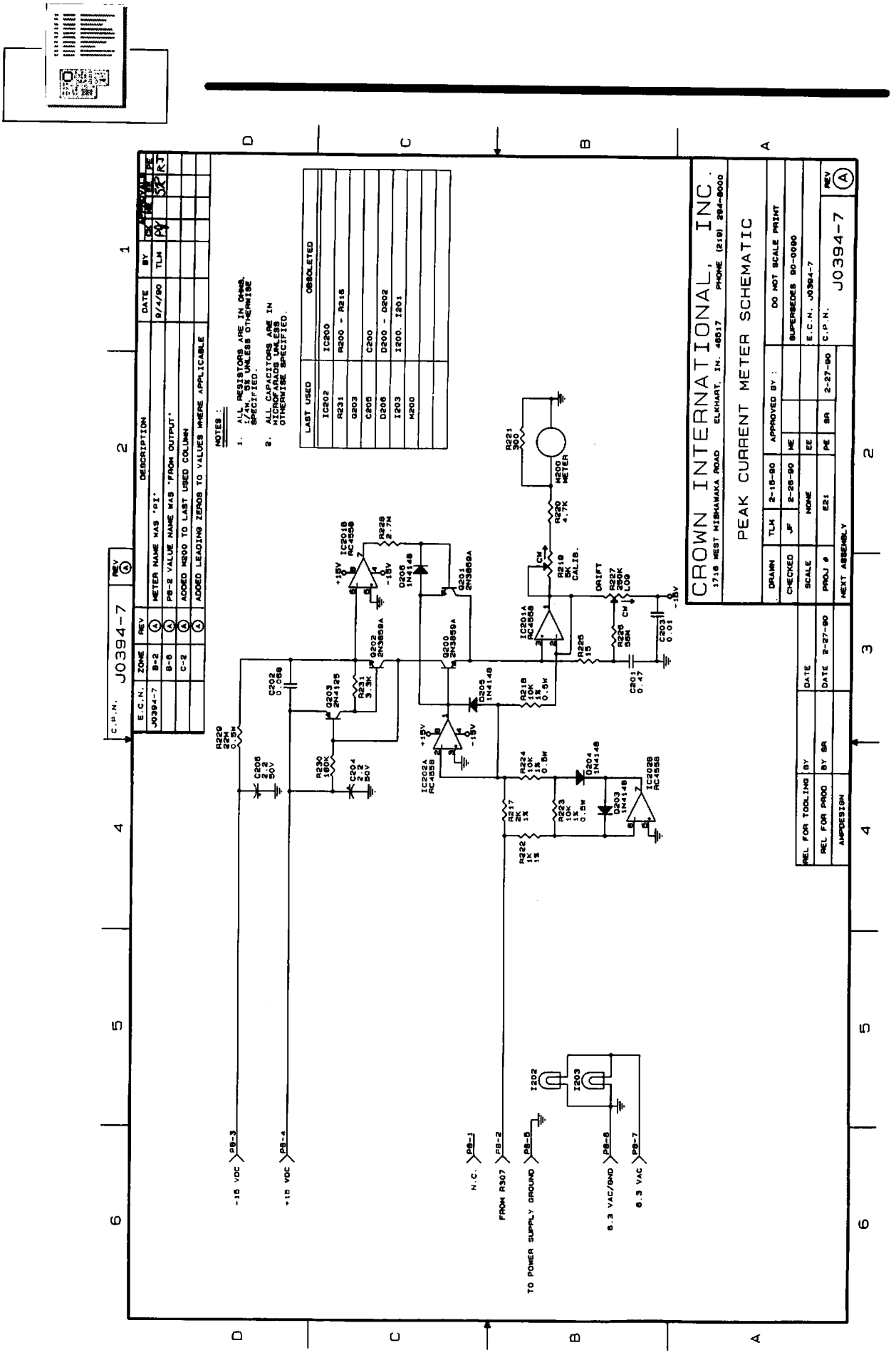


Illustration 7-17 7571 Peak Current Meter Circuit Board

7.30 Schematics



Schematic, 7570 Input Plug-In



Schematic, 7571 Peak Current Meter