MACRO-TECH®

REFERENCE MANUAL

Models: Macro-Tech® 24x6 & 36x12

Some models may be exported under the name *Amcron*.®

125782-3
3/00

THREE YEAR FULL WARRANTY

WORLDWIDE

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship, and we further warrant the new Crown product regardless of the reason for failure, except as excluded in this Crown Warranty.

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product 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. We will remedy the defect and ship the product from the service center within a reasonable time after receipt of the defective product at our authorized service center.

HOW TO OBTAIN WARRANTY SERVICE

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

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

WARRANTY ALTERATIONS

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

LEGAL REMEDIES OF PURCHASER

No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

9/90

Telephone: 219-294-8200. Facsimile: 219-294-8301

NORTH AMERICA

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship. We further warrant the new Crown product regardless of the reason for failure, except as excluded in this Warranty.

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product 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 the factory. We will remedy the defect and ship the product from the service center or our factory within a reasonable time after receipt of the defective product at our authorized service center or our factory. All expenses in remedying the defect, including surface shipping costs in the United States, will be borne by us. (You 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.)

HOW TO OBTAIN WARRANTY SERVICE

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

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

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

WARRANTY ALTERATIONS

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

LEGAL REMEDIES OF PURCHASER

THIS CROWN WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

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

Crown Audio Division Technical Support Group

Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

Phone: **800-342-6939** (North America, Puerto Rico and Virgin Islands) or 219-294-8200

Fax: 219-294-8301 Fax Back (North America only): 800-294-4094 or 219-293-9200

Fax Back (International): 219-294-8100 Internet: http://www.crownaudio.com

CAUTION

RISK OF ELECTRIC SHOCK DO NOT OPEN

TO PREVENT ELECTRIC SHOCK DO NOT REMOVE TOP OR BOTTOM COVERS. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. DISCONNECT POWER CORD BEFORE REMOVING REAR INPUT MODULE TO ACCESS GAIN SWITCH.

AVIS

RISQUE DE CHOC ÉLECTRIQUE N'OUVREZ PAS

À PRÉVENIR LE CHOC ÉLECTRIQUE N'ENLEVEZ PAS LES COUVERCLES. IL N'Y A PAS DES PARTIES SERVICEABLE À L'INTÉRIEUR. TOUS REPARATIONS DOIT ETRE FAIRE PAR PERSONNEL QUALIFIÉ SEULMENT. DÉBRANCHER LA BORNE AVANT D'OUVRIR LA MODULE EN ARRIÈRE.

WARNING

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

Magnetic Field

CAUTION! Do not locate sensitive high-gain equipment such as preamplifiers or tape decks directly above or below the unit. Because this amplifier has a high power density, it has a strong magnetic field which can induce hum into unshielded devices that are located nearby. The field is strongest just above and below the unit.

If an equipment rack is used, we recommend locating the amplifier(s) in the bottom of the rack and the preamplifier or other sensitive equipment at the top.

The lightning bolt triangle is used to alert the user to the risk of electric shock.

The exclamation point triangle is used to alert the user to important operating or maintenance instructions.

Printed on recycled paper.

Important Safety Instructions

1) Read these instructions.

2) Keep these instructions

.

3) Heed all warnings.

4) Follow all instructions.

5) Do not use this apparatus near water.

6) Clean only with a dry cloth.

7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.

9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

10) Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

11) Only use attachments/accessories specified by the manufacturer.

12) Use only with a cart, stand, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.

13) Unplug this apparatus during lightning storms or when unused for long periods of time.

14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

CONTENTS

ILLUSTRATIONS

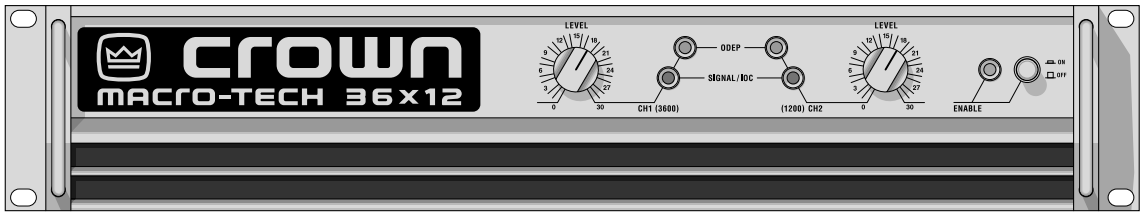


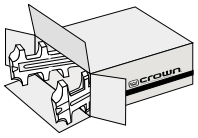
Fig. 1.1 Macro-Tech 36x12 Amplifier

1 Welcome

Congratulations on your purchase of a *Macro-Tech®* dual level professional power amplifier. Your amplifier has a separate high-power and medium-power channel, making it ideal for biamplified systems. The Macro-Tech 24x6 combines one channel of a Macro-Tech 2400 with one channel of a Macro-Tech 600. The Macro-Tech 36x12 combines one channel of a Macro-Tech 3600VZ with one channel of a Macro-Tech 1200. And because each model has a separate power supply for each channel, each channel can be treated as a separate power amplifier.

As a member of the Macro-Tech family, your amplifier offers the added benefit of *ODEP®* protection which keeps the show going long after other amps would thermal off and Programmable Input Processor (PIP™) compatibility to accept custom input modules (see Section 8 for available input modules).

This manual will help you successfully install and use your new amplifier. We strongly recommend you read all instructions, warnings and cautions contained within. Also for your protection, please send in your warranty registration card today and save your bill of sale because it is your official proof of purchase.



1.1 Unpacking

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

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

1.2 Features

Here are some of the impressive features:

- ❏ Crown's *Grounded Bridge*™ design delivers incredible voltage swings without using stressful output transistor configurations like conventional amplifiers. The results are lower distortion and superior reliability.
- ❏ Patented ODEP (Output Device Emulation Protection) circuitry compensates for overheating and overload to keep the amplifier working long after others would fail.
- ❏ *IOC®* (Input/Output Comparator) circuitry immediately alerts of any distortion exceeding 0.05%, providing dynamic *proof of distortion-free performance*.
- ❏ PIP connector accepts accessories that tailor the amplifier to suit specific applications.
- ❏ Very low harmonic and intermodulation distortion give the best *dynamic transfer function* in the industry.
- ❏ High damping factor provides superior control over low frequency drivers for a clean, accurate low end.
- ❏ Full protection against shorted outputs, open circuits, DC, mismatched loads, general overheating, high frequency overloads and internal faults.
- ❏ Extra rugged, extruded aluminum front panel with ODEP and Signal Presence/IOC indicators for each channel, as well as an Enable indicator.
- ❏ Macro-Tech 36x12: Articulated VZ power supply for Channel 1 (3600) provides the best power matching to your load.
- ❏ Efficient heat sinks and forced air cooling prevent overheating and prolong component life.
- ❏ Balanced inputs with three-position sensitivity switch and adjustable front panel level controls.
- ❏ 5-way binding post outputs provide versatile connection.
- ❏ Mounts in a standard 19-inch (48.3-cm) equipment rack (units can also be stacked).
- ❏ Three Year "No-Fault" Full Warranty completely protects your investment and guarantees its specifications.

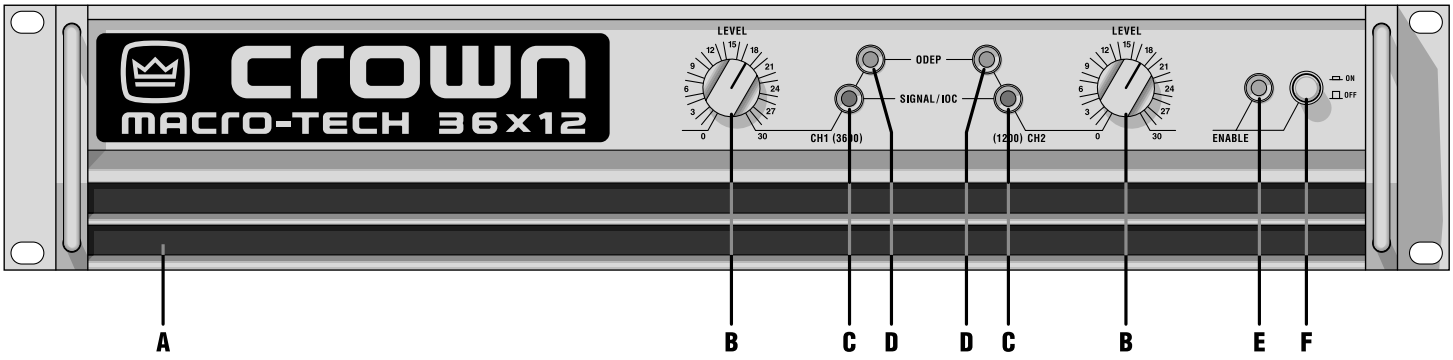


Fig. 2.1 Front Facilities

2 Facilities

A. Dust Filter

The dust filters remove large particles from the air at the air intake. Check the filters regularly to be sure they don't become clogged. The filter elements can be easily removed for cleaning by gently pulling them away from the front panel. See Section 3.2 and 4.5.

B. Level Controls

The level for each channel is set with these convenient controls mounted on the front panel. Each level control has 31 detents for precise adjustment (see Section 4.4). A security option is available to prevent tampering (see Section 8.2).

C. Signal / IOC Indicators

These green multifunction indicators show signal presence and distortion for each channel. As signal presence indicators, they flash synchronously with the output audio signals to show their presence. As IOC (Input/Output Comparator) indicators, they flash brightly with a 0.1 second hold delay if there is a difference of 0.05% or more between the input and output signal waveforms. This provides *proof of distortion-free performance*. Another IOC function is to indicate input overload. If an input signal is too large, the indicator for the affected channel flashes brightly with a 0.5 second hold delay to show clipping distortion.

D. ODEP Indicators

During normal operation of the ODEP (Output Device Emulation Protection) circuitry, these amber indicators glow brightly to show the presence of reserve thermal-dynamic energy. They dim proportionally as energy reserves decrease. In the rare event that energy reserves are depleted, the indicators turn off and ODEP proportionally limits output drive so the amplifier can safely continue operating even under severe conditions. These indicators can also help identify more unusual operating conditions (see Section 4.2).

E. Enable Indicator

This indicator lights when the amplifier has been "enabled" or turned on and AC power is present (see Section 4.2).

F. Enable Switch

This push button is used to turn the amplifier on and off. When turned on, the output is muted for approximately four seconds to protect your system from start-up transients. (This delay can be changed. Contact Crown's Technical Support Group for details.)

G. Power Cord

An appropriate power cord is provided. 120 VAC, 60 Hz units have a 20-amp (12 AWG) line cord with a grounded NEMA 5-15P plug. See Section 7 for AC power usage.

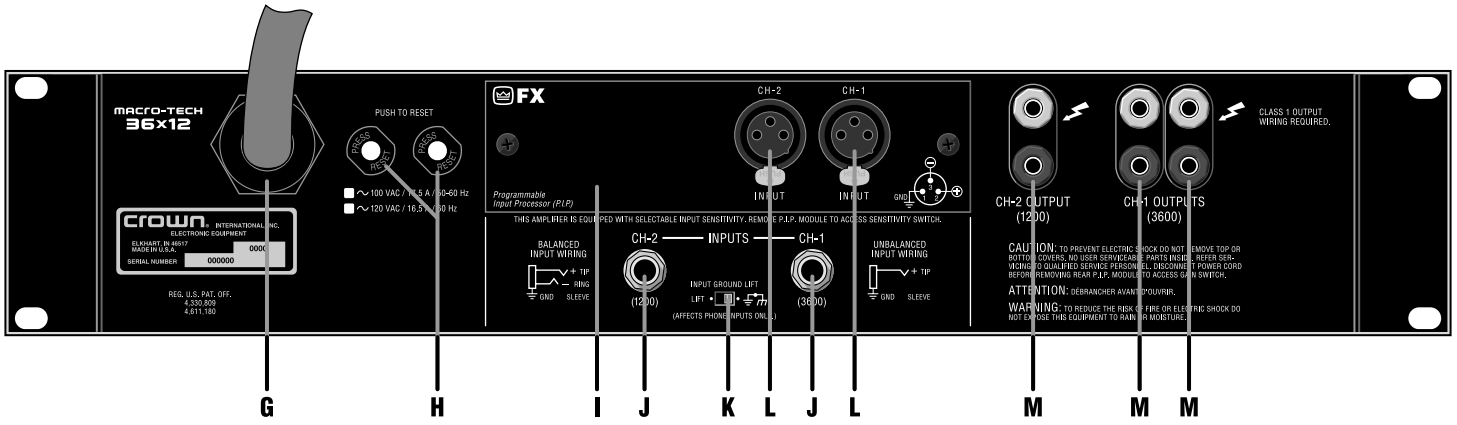


Fig. 2.2 Rear Facilities

H. Reset Switches

The reset switches are used to reset the breakers that safeguard each power supply from overload.

I. PIP Module

The standard P.I.P.-FX is included with your amplifier. It provides female XLR input connectors. A variety of other PIP modules can be used in place of the P.I.P.-FX. They add additional features that customize the amplifier for different applications (see Section 8.1 for information on available PIP modules).

❑ Input Sensitivity Switch

The three-position input sensitivity switch located inside the amplifier is accessed by removing the PIP module (I). It is factory-set to 0.775 volts for rated 8 ohm output. It can also be set to 1.4 volts for rated output, or a voltage gain of 26 dB (see Section 4.4).

J. Balanced Phone Jack Inputs

Balanced ¼-inch phone jack input connectors are provided on the back panel of your amplifier. The phone jacks can be wired for either balanced (tip, ring and sleeve) or unbalanced (tip and sleeve) input signals. Because they are electrically in parallel with the PIP input connectors, input signals should not be connected to the phone jacks when certain PIP modules are installed (see Section 3.3.1). The phone jacks can also be used as "daisy chain" outputs to simplify connecting input signals to multiple amplifiers.

K. Ground Lift Switch

This switch isolates or "lifts" the phone jack signal grounds from the AC power ground. Activating the switch inserts an impedance between the sleeve of each phone jack and the unit's AC ground to help prevent the hum that can result from a ground loop.

L. Balanced XLR Inputs

The factory-installed P.I.P.-FX provides a three-pin female XLR connector for balanced input to each channel. The XLR inputs are connected in parallel with the amplifier's phone jack inputs. Because the P.I.P.-FX does not have any active circuitry, its XLR connectors can also be used as "daisy chain" outputs to connect signals from phone jack inputs to multiple amplifiers (see Section 3.3.1).

M. Output Jacks

A pair of versatile 5-way binding posts is provided for the output of each channel. The 5-way binding posts accept banana plugs, spade lugs or bare wire. *Note: Because of its higher output power, the Macro-Tech 36x12 has an additional set of binding posts.*

3 Installation

3.1 Mounting

Macro-Tech amplifiers are designed for standard 19 inch (48.3 cm) rack mounting as well as "stack" mounting without a cabinet. In a rack cabinet, it is best to mount them directly on top of each other. This provides efficient air flow and the best support.

Important: Due to the weight of the unit, it should be securely fastened at the back of the cabinet.

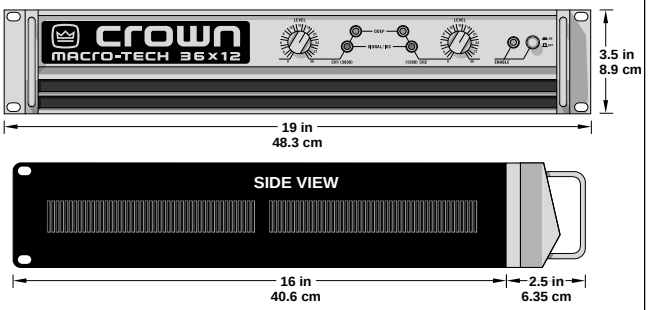


Fig. 3.1 Mounting Dimensions

3.2 Cooling

NEVER block the amplifier's side vents or front air intake. Allow at least 45 cubic feet (1.3 cubic meters) of air flow per minute. All empty spaces in the rack cabinet should be covered with blank panels to prevent improper air flow. The amplifier's air flow should be augmented with a rack cooling system if its load is less than 4 ohms and the amplifier must operate at high output levels. See Section 7 for additional information on thermal dissipation.

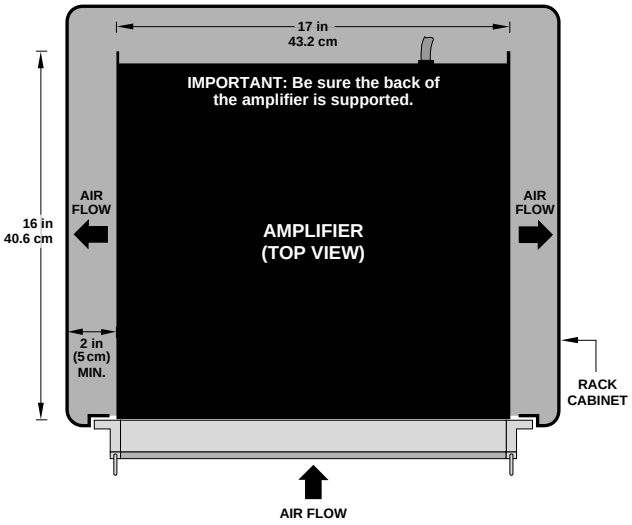


Fig. 3.2 Top View of a Rack-Mounted Unit

When mounting the amplifier in a rack cabinet, the side walls of the rack should be at least 2 inches (5 cm) away from the chassis as shown in Figure 3.2.

Tip: An easy way to verify adequate cooling is to observe the ODEP indicators while the amplifier is operating under worst-case conditions. If the indicators dim, additional cooling is recommended.

If your rack cabinet has a front door that could block air flow to the amplifier's air intakes, you must provide adequate air flow with either a grill in the door or by pressurizing the air behind the door. Wire grilles are recommended over perforated panels because they tend to create less turbulence.

A good choice for pressurizing the air behind a rack cabinet door is to mount a "squirrel cage" blower inside the rack (option 1 below). At the bottom of the rack, mount the blower so it blows outside air into the space between the door and the front of the amplifiers, pressurizing the "chimney" behind the door. This blower should not blow air into or take air out of the space behind the amplifiers. For racks without a door, you can evacuate the rack by mounting the blower at the top of the rack, so that air inside the cabinet blows out the back (option 2 below).

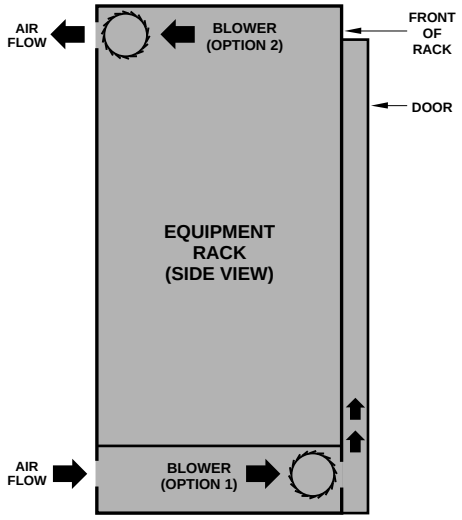


Fig. 3.3 Proper Air Flow in a Rack Cabinet

If the air supply is unusually dusty, it may be necessary to pre-filter it using commercial furnace filters, etc., to prevent rapid loading of the unit's own air filter. When needed, the unit's filter can be cleaned with mild dish detergent and water (see Section 4.5).

3.3 Wiring

This section describes the most common way to install the Macro-Tech 24x6 and 36x12. Each model is designed for biamplified systems and includes both a high-power and a medium-power channel. The input and output terminals are located on the back panel. Please use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own! Crown assumes no liability for damaged loads resulting from careless amplifier use and/or deliberate overpowering.

CAUTION: It is always wise to remove power from the unit and turn the input level controls off while making or changing connections—especially if the load is a loudspeaker system. This will eliminate any chance of loud blasts or damage to the loudspeakers.

Because each channel produces a different power level, the Macro-Tech 24x6 and 36x12 are dedicated to two-channel operation. They do NOT offer mono operation.

WARNING: Never strap the outputs together for Parallel-Mono operation! Never bridge the outputs for Bridge-Mono operation!

Installation of the Macro-Tech 24x6 and 36x12 is very intuitive. The Channel 1 input feeds the Channel 1 output and the Channel 2 input feeds the Channel 2 output. Be sure to connect the output wiring as shown in Figure 3.4. Five-way binding posts are provided to facilitate easy connection of loudspeakers to each channel. *Note: Because of its higher output power, Channel 1 of a Macro-Tech 36x12 has an additional set of binding posts.* Observe correct loudspeaker polarity and be very careful not to short the outputs of one channel to the outputs of the other channel.

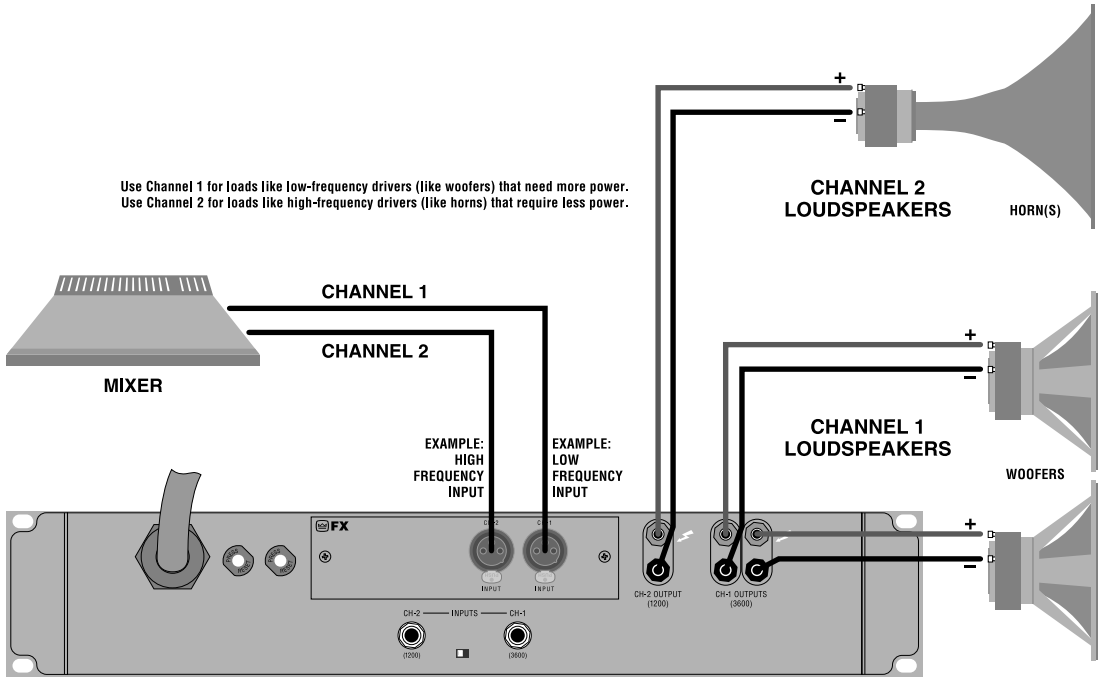


Fig. 3.4 Wiring (a Macro-Tech 36x12 is shown)

3.3.1 Input Connection

Both the balanced XLR and phone jack inputs have a nominal impedance of 20 k ohms (10 k ohms with unbalanced wiring) and will accept the line-level output of most devices. Female XLR input connectors are provided on the standard P.I.P.-FX input module (other PIP modules are described in Section 8.1). Correct input wiring will depend on two factors: (1) whether the input signals are balanced or unbalanced, and (2) whether the signal source floats or has a ground reference. Figures 3.7 and 3.8 show the recommended connection techniques for each type of signal source.

The amplifier's built-in ¼ inch input phone connectors can be wired similarly for balanced or unbalanced, floating or ground-referenced sources. The connectors have a standard tip-ring-sleeve (TRS) configuration: the tip is positive (+), the ring is negative (–) and the sleeve is ground (see Figure 3.7). Wiring for various sources follows the XLR wiring guidelines shown in Figures 3.5 and 3.6.

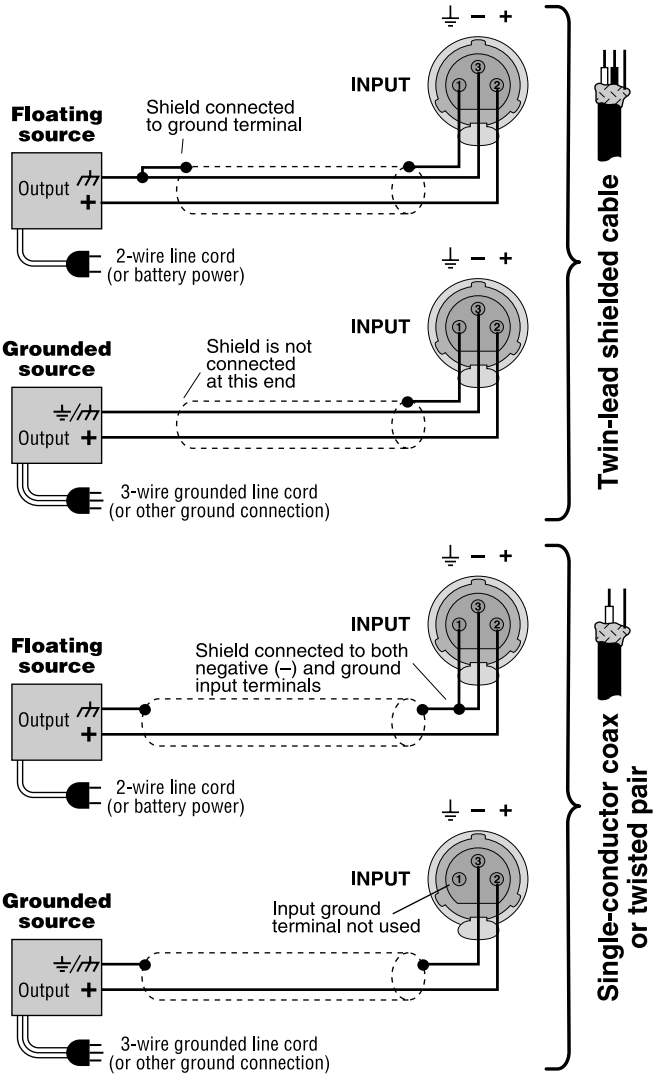


Fig. 3.5 Unbalanced Input Wiring

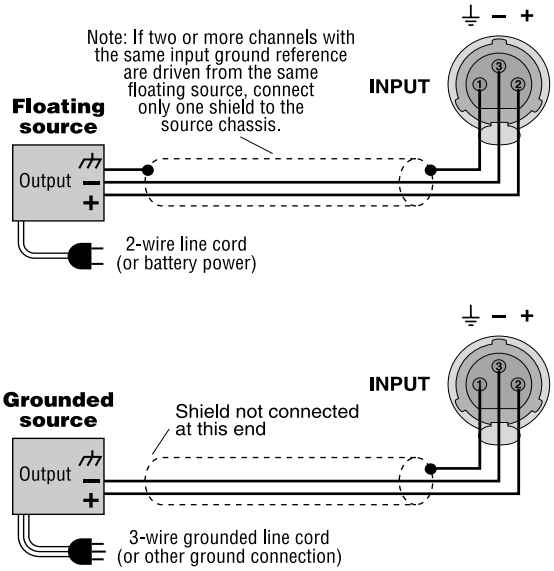


Fig. 3.6 Balanced Input Wiring

The phone jacks should not be used as inputs when a PIP module with active circuitry is installed. The phone jacks are in parallel with the output of the PIP module, so an input signal connected to the phone jacks can feed backwards into the active circuitry of the PIP and cause undesirable distortion. You can use the phone jacks for signal input with any of the following PIP modules installed: P.I.P.-FX, P.I.P.-BB, P.I.P.-FMX, P.I.P.-FXQ and P.I.P.-FPX. All other PIP modules have active circuitry and should not be installed if you plan to connect input signals to the phone jacks. The phone jacks can always be used as "daisy chain" outputs to feed post-processed signals from the PIP to the inputs of other amplifiers.

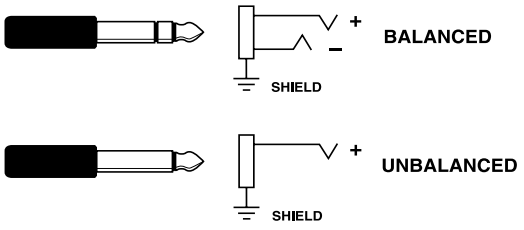


Fig. 3.7 Balanced and Unbalanced Phone Plug Wiring

SOLVING INPUT PROBLEMS

Sometimes large **subsonic** (subaudible) **frequencies** are present in the input signal. These can damage loudspeakers by overloading or overheating them. To attenuate such frequencies, place a capacitor in series with the input signal line. The graph in Figure 3.8 shows some capacitor values and how they affect the frequency response. Use only low-leakage paper, mylar or tantalum capacitors.

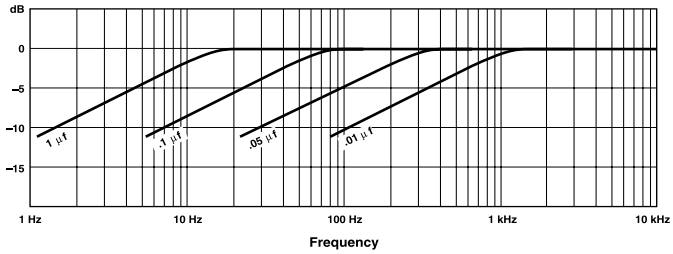


Fig. 3.8 Subsonic Filter Capacitors

Another problem to avoid is the presence of large levels of **radio frequencies** or RF in the input signal. Although high RF levels may not pose a threat to the amplifier, they can burn out tweeters or other loads that are sensitive to high frequencies. Extremely high RF levels can also cause your amplifier to prematurely activate its protection circuitry, resulting in inefficient operation. RF can be introduced into the signal by local radio stations and from the bias signal of many tape recorders. To prevent this from happening, place an appropriate low-pass filter on the input(s). Some examples of unbalanced wiring are shown below:

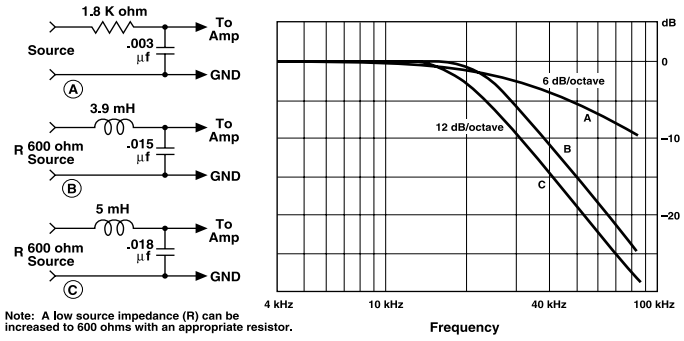


Fig. 3.9 Unbalanced RFI Filters

For balanced input wiring use one of the examples in Figure 3.10. Filters A, B and C correspond to the unbalanced filters above. Filter D also incorporates the subsonic filter described in Figure 3.8.

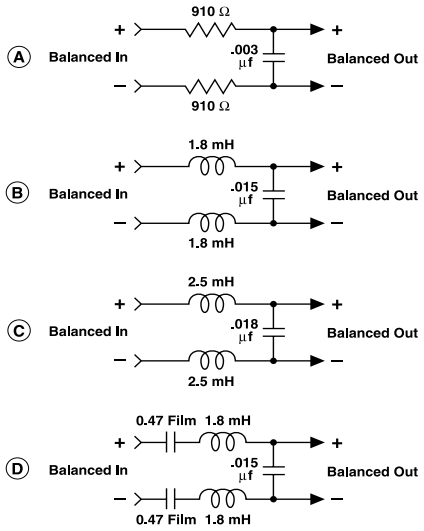


Fig. 3.10 Balanced RFI Filters

Tip: The P.I.P.-FX that came with your amplifier has plenty of room on its circuit board for input filters.

A third problem to avoid is **hum**. The two most common sources of hum in an audio system are **inductive coupling** and **ground loops**.

Inductive coupling can occur when input cables are subjected to a magnetic field from a power cord or power transformer. One way to prevent inductive coupling is to lace the input cables together along their length and route them as far away as possible from power transformers and power cords. The use of

Input Wiring Tips

1. Use only shielded cable. The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.

2. When using unbalanced lines, keep the cables as short as possible. Avoid cable lengths greater than 10 feet (3 meters).

3. Do not run signal cables together with high-level wiring such as loudspeaker wires or AC cords. (This lessens the chance of hum or noise being induced into the input cables.)

4. **The amplifier should be off for at least 10 seconds** before changing any connections. Remember, the amplifier can produce lethal output energy and can drive loudspeakers to levels which can cause permanent hearing damage. Crown is not liable for personal injury or damage incurred when a transducer or component is overdriven.

shielded pair cable is another effective way to reduce or eliminate hum resulting from inductive coupling.

Ground loops often result when two or more devices are improperly grounded. This causes undesirable stray currents that may produce hum in the output. The best way to avoid ground loops is to ensure that all system devices are plugged into the same power strip. In addition, make sure that all cable shields are grounded at one end only.

Input and output grounds are sometimes tied together for testing or metering. This can cause **feedback oscillation** from load current in the test loop. In some systems, even the AC power line may provide this feedback path. Proper grounding, input isolation and isolation of common AC devices in the system is good practice.

3.3.2 Output Connection

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

Use Good Connectors

1. To prevent possible short circuits, do not expose the loudspeaker cable connectors.
2. Do not use connectors that might accidentally tie two channels together when making or breaking connections (for example, a standard three-wire stereo phone plug).
3. Connectors that can be plugged into AC power receptacles should never be used.
4. Connectors having low current-carrying capacity should not be used.
5. Connectors with any tendency to short should never be used.

HOW TO DETERMINE APPROPRIATE WIRE GAUGE

It is important to use loudspeaker cables with sufficient gauge (thickness) for the length being used. The resistance introduced by inadequate loudspeaker cables will reduce both the output power and the motion control of the loudspeakers. The latter problem occurs because the damping factor decreases as the cable resistance increases. This is very important because the amplifier's excellent damping factor can easily be negated by insufficient loudspeaker cables.

Use the nomograph in Figure 3.11 and the procedure that follows to find the recommended wire gauge (AWG or American Wire Gauge) for your system.

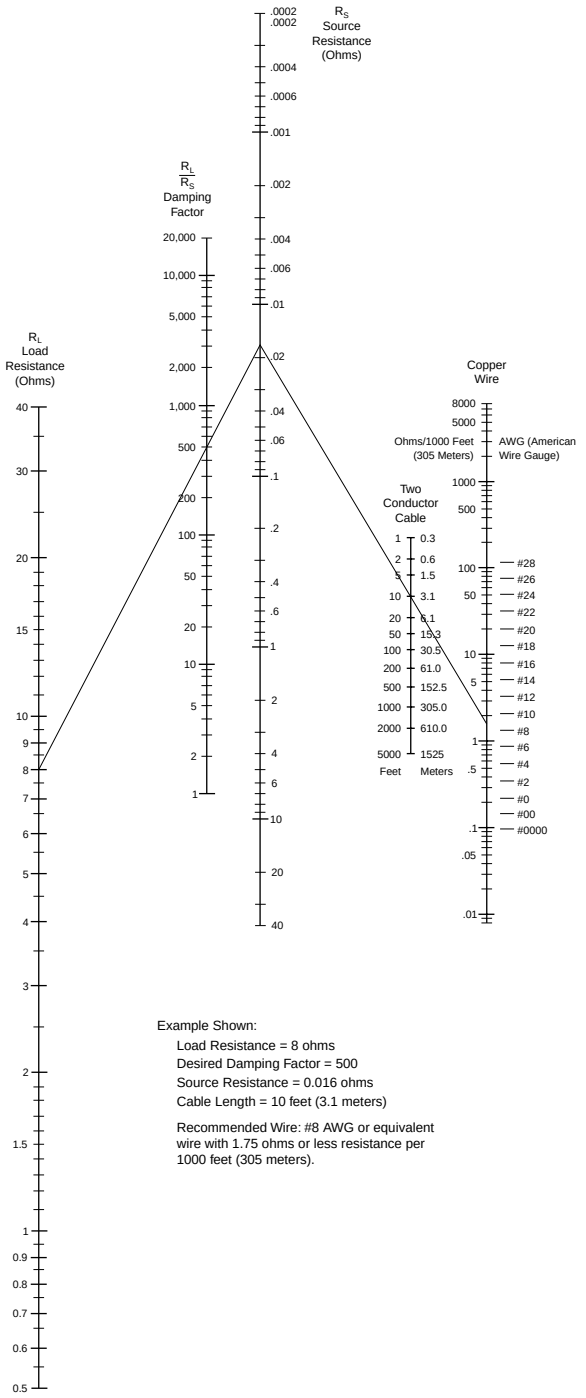


Fig. 3.11 Wire Size Nomograph

1. Note the load resistance of the loudspeakers connected to each channel of the amplifier. Mark this value on the **Load Resistance** line of the nomograph.
2. Select an acceptable damping factor and mark it on the **Damping Factor** line. Your amplifier can provide an excellent damping factor of 1,000 from 10 to 400 Hz in Stereo mode with an 8-ohm load. In contrast, typical damping factors are 50 or lower. Higher damping factors yield lower distortion and greater motion control over the loudspeakers. A common damping factor for commercial applications is between 50 and 100. Higher damping factors may be desirable for live sound, but long cable lengths often limit the highest damping factor that can be achieved practically. (Under these circumstances, Crown's *IQ System*® is often used so amplifiers can be monitored and controlled when they are located very near the loudspeakers.) In recording studios and home hi-fi, a damping factor of 500 or more is very desirable.
3. Draw a line through the two points with a pencil, and continue until it intersects the **Source Resistance** line.
4. On the **2-Cond. Cable** line, mark the length of the cable run.
5. Draw a pencil line from the mark on the **Source Resistance** line through the mark on the **2-Cond. Cable** line, and on to intersect the **Annealed Copper Wire** line.
6. The required wire gauge for the selected wire length and damping factor is the value on the **Annealed Copper Wire** line. *Note: Wire size increases as the AWG value becomes smaller*.
7. If the size of the cable exceeds what you want to use, (1) find a way to use shorter cables, like using the *IQ System*, (2) settle for a lower damping factor, or (3) use more than one cable for each line. Options 1 and 2 will require the substitution of new values for cable length or damping factor in the nomograph. For option 3, estimate the effective wire gauge by subtracting 3 from the apparent wire gauge every time the number of conductors of equal gauge is doubled. So, if #10 wire is too large, two #13 wires can be substituted, or four #16 wires can be used for the same effect.

SOLVING OUTPUT PROBLEMS

Sometimes **high frequency oscillations** occur that can cause your amplifier to prematurely activate its protection circuitry which can result in inefficient operation. The effects of this problem are similar to the effects of the RF interference described in Section 3.3.1. To prevent high frequency oscillations from occurring:

1. Lace the loudspeaker conductors together. (Do NOT lace cables together from different amplifiers.) This minimizes the chance of them acting like an antenna to transmit or receive high frequencies that can cause oscillation.
2. Avoid using shielded loudspeaker cable.
3. Avoid long cable runs where the loudspeaker cables from different amplifiers share a common cable tray or jacket.
4. Never connect the amplifier's input and output grounds together.
5. Never tie the outputs of multiple amplifiers together.
6. Keep loudspeaker cables separated from input cables.
7. Install a low-pass filter on each input line (similar to the RF filters described in Section 3.3.1).
8. Install the input wiring according to the instructions in Section 3.3.1.

Another problem to avoid is the presence of large **subsonic currents** when primarily inductive loads are used. Examples of inductive loads are 70-volt step-up transformers and electrostatic loudspeakers.

Inductive loads can appear as a "short" at low frequencies, causing the amplifier to produce large low frequency currents and unnecessarily activate its protection circuitry. Always take the precaution of installing a high-pass filter at the amplifier inputs when a predominantly inductive load is used. A three-pole (18 dB per octave) filter with a –3 dB frequency of 50 Hz is recommended. (Depending on your application, it might be desirable to use a filter with more than a –3 dB frequency.) Such a filter should eliminate the subsonic frequency problems mentioned in Section 3.3.1.

Another way to prevent the amplifier from activating its protection systems early and also protect the inductive load from large low-frequency currents is to connect a 590 to 708 µF nonpolarized capacitor and a 4 ohm, 20 watt resistor at the output of the amplifier and in series with the positive (+) lead of the transformer. This is depicted in Figure 3.12 on the next page.

Note: The components shown in Figure 3.12 are commonly available from most electronic supply stores.

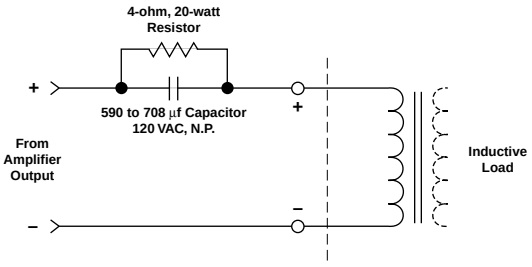


Fig. 3.12 Inductive Load (Transformer) Network

3.3.3 Additional Load Protection

Because the amplifier generates enormous power, it may be desirable to protect loudspeakers (or other sensitive loads) from damage due to excessive power. A common way to do this is to put a fuse in series with the load. This may be accomplished by using a single fuse to protect all drivers connected to an output, or each driver may be fused individually. The nomograph in Figure 3.13 shows fuse size versus loudspeaker peak power rating. It can be used to determine what size fuse to use.

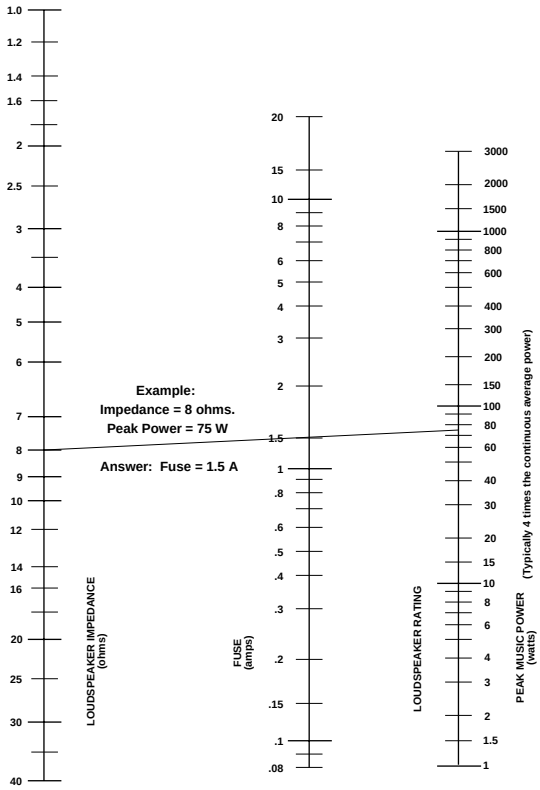


Fig. 3.13 Loudspeaker Fuse Selector Nomograph

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

3.4 AC Power Requirements

All Macro-Tech amplifiers are shipped with an appropriate line cord. When possible, use a power receptacle on a dedicated circuit and always make sure that it can supply the correct voltage and current. We do not recommend operating your amplifier on voltages greater than 10% above or below the unit's rated voltage. For example, if your amplifier is rated for 120 VAC, the line voltage should not exceed 132 VAC. See Section 7 for power requirements under a variety of conditions.

All specifications in this manual were measured using 120 VAC, 60 Hz power, unless otherwise noted. Specifications were derived using a voltage that is accurate to within 0.5% with THD less than 1.0% under all testing conditions. Performance variations can occur at other AC voltages and frequencies. In addition, line regulation problems directly affect the output power from the amplifier.

4 Operation

4.1 Precautions

Macro-Tech amplifiers are protected from internal and external faults, but you should take the following precautions for optimum performance and safety:

1. **WARNING: Never strap the outputs together for Parallel-Mono operation! Never bridge the outputs for Bridge-Mono operation!** The Macro-Tech 24x6 and 36x12 cannot be used in any mono mode.
2. **Turn off the amplifier and unplug it from the AC mains** before removing a PIP card.
3. Use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own.
4. Do not short the ground lead of an output cable to the input signal ground. This may form a ground loop and cause oscillations.
5. Operate the amplifier from AC mains of not more than 10% variation above or below the selected line voltage and only the specified line frequency.
6. **Never connect the output to a power supply output, battery or power main.** Such connections may result in electrical shock.
7. Tampering with the circuitry by unqualified personnel or unauthorized circuit changes invalidates the warranty.

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

4.2 Indicators

The front panel has several helpful indicator LEDs.

The amber **Enable indicator** is provided to show the amplifier has been turned on (or enabled) and that its low voltage power supply and forced-air cooling system are working. It does not indicate the status of the high voltage supplies. For example, the Enable indicator will remain lit during unusual conditions that would cause the amplifier's protection systems to put a high-voltage supply in "standby" mode (see Section 4.3).

The amber **ODEP indicators** confirm the normal operation of Crown's patented Output Device Emulation Protection circuitry. During normal operation, they glow brightly to show the presence of reserve thermal-dynamic energy. They dim proportionally as the energy reserve decreases. In the rare event that there is no reserve, the indicators turn off and ODEP proportionally

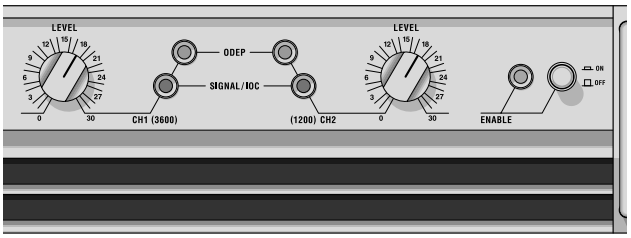


Fig. 4.1 Indicators

limits the drive level of the output stages so the amplifier can continue safe operation even when conditions are severe. (For a more detailed description of ODEP, see Section 4.3.1.)

The ODEP indicator for the affected channel will turn off if a high-voltage power supply is put in "standby" mode, a high-voltage power supply fuse (or breaker) blows, or a transformer activates its thermal protection circuitry (see Section 4.3.2). Both ODEP indicators turn off if the amplifier loses AC power, the power switch is turned off or the low-voltage power supply fuse blows.

The green **Signal/IOC indicators** show signal presence, distortion and input overload. As signal presence indicators, they flash with normal intensity in sync with the output audio signals. As IOC (Input/Output Comparator) indicators, they flash brightly if there is any difference between the input and output signal waveforms greater than 0.05%. Because transient distortion happens quickly, a 0.1 second "hold delay" keeps the indicators on long enough to be easily noticed. The IOC function provides *proof of distortion-free performance*. As input overload indicators, they flash brightly with a 0.5 second hold delay to show that an input signal is too large and must be clipped at the input.

Under conditions where one of the amplifier's high-voltage power supplies is temporarily put in standby mode, the Signal/IOC indicators will stay on with full brightness. They will resume normal operation when the amplifier is no longer in standby mode.

The table in Figure 4.2 shows the possible states for the ODEP and Signal/IOC indicators. It also describes the conditions that may be associated with the different indicator states. The Enable indicator will be off with the first indicator state, "There is no power to the amplifier." All other conditions in the table will occur with the Enable indicator turned on. It is important to note the possible states of the indicators in the rare event that you experience a problem. This can greatly aid in determining the source of problems. Please contact your local Crown representative or our Technical Support Group for further assistance.

Indicator Status	Amplifier Condition
ODEP — OFF SIGNAL/IOC — OFF	**There is no power to the amplifier and all indicators are off, including the Enable light.** Possible reasons: (1) The amplifier's Enable switch is off. (2) The amplifier is not plugged into the power receptacle. (3) The AC circuit breaker has been tripped. (4) The amplifier's low-voltage power supply fuse has blown.
ODEP — ON SIGNAL/IOC — OFF	**Normal operation for a channel with NO audio output.** Possible reasons: (1) There is no input signal. (2) The input signal level is very low. (3) The channel's level control is turned down.
ODEP — ON SIGNAL/IOC — Normal	**Normal operation for a channel with audio output.** The ODEP indicator will remain at full intensity to show that there is reserve thermodynamic energy, and the Signal/IOC indicator will flash with normal intensity to show that the channel has audio output.
ODEP — ON SIGNAL/IOC — Bright	**The channel's output is exceeding 0.05% distortion.** The input signal level is too high and IOC is reporting either an input overload or output clipping. OR **Channel 2 only: The amplifier is in Parallel-Mono mode.** The channel 2 Signal/IOC indicator always turns on to full brightness whenever the amplifier's stereo/mono switch is set to Parallel-Mono mode.
ODEP — OFF SIGNAL/IOC — Bright	**The amplifier channel is in standby mode.** Possible reasons: (1) A PIP module like an *IQ–P.I.P.–SMT* has turned off the channel's high-voltage power supply. (2) The amplifier has just been turned on and is still in the four second turn-on delay. (3) The DC / low-frequency protection circuitry has been activated. (4) The fault protection circuitry has been activated. (5) The transformer thermal protection circuitry has been activated. OR **A channel's circuit breaker has tripped.** Transformer overload can cause a channel's circuit breaker to trip. OR **ODEP limiting has been activated.** Possible reasons: (1) The amplifier's air filters are blocked and need to be cleaned. (2) There is insufficient cooling because of inadequate air flow or air that is too hot. (3) The load impedance for the channel is too low because the output is shorted or the amplifier is driving too many loudspeakers for the selected stereo/mono mode. (4) The amplifier channel is continuously being driven to very high output levels.
ODEP — OFF SIGNAL/IOC — Normal	**ODEP limiting is about to begin.** Possible reasons: (1) The amplifier's air filters are blocked and need to be cleaned. (2) There is insufficient cooling because of inadequate air flow or air that is too hot. (3) The load impedance for the channel is too low because the output is shorted or the amplifier is driving too many loudspeakers for the selected stereo/mono mode. (4) The amplifier channel is continuously being driven to very high output levels.

Fig. 4.2 ODEP and Signal/IOC Indicator States

4.3 Protection Systems

Macro-Tech amplifiers provide extensive protection and diagnostics capabilities. Protection systems include ODEP, "standby" mode, fuses (or breakers), and special thermal protection for the unit's transformers.

4.3.1 ODEP

Crown invented ODEP to solve two long-standing problems in amplifier design: to prevent amplifier shutdown during demanding operation and to increase the efficiency of the output circuitry.

To do this, Crown established a rigorous program to measure the *safe operating area* (SOA) of each output transistor before installing it in an amplifier. Next, Crown designed intelligent circuitry to simulate the instantaneous operating conditions of those output transistors. Its name describes what it does: Output Device Emulation Protection or ODEP. In addition to simulating the operating conditions of the output transistors, it also compares their operation to their known SOA. If it sees that more power is about to be asked of them than they are capable of delivering under the present conditions, ODEP immediately limits the drive level until it falls within the SOA. Limiting is proportional and kept to an absolute minimum—only what is required to prevent output transistor damage.

This level of protection enables Crown to increase output efficiency to never-before-achieved levels while greatly increasing amplifier reliability.

The on-board intelligence is monitored in two ways. First, the front panel ODEP indicators show whether the amplifier is functioning correctly or if ODEP is limiting

the drive level. Second, ODEP data is fed to the back panel PIP connector so advanced PIP modules like the IQ–P.I.P.–SMT can use it to monitor and control the amplifier.

With ODEP, the show keeps going because you get the maximum power with the maximum protection.

4.3.2 Standby Mode

At the heart of the protection systems is the standby mode which removes power from the high-voltage supplies to protect the amplifier and connected loads. The standby mode can be identified using the indicator table in Figure 4.2.

Standby mode can be activated in several situations. First, if dangerous subsonic frequencies or direct current (DC) is detected in the amplifier's output, the unit will activate its **DC/low-frequency protection** circuitry and put the affected channels in standby. This protects the loads and prevent oscillations. The unit resumes normal operation as soon as the amplifier no longer detects dangerous low frequency or DC output. Although it is extremely unlikely that you will ever activate the amplifier's DC/low-frequency protection system, improper source materials such as subsonic square waves or input overloads that result in excessively clipped input signals can activate this system.

The amplifier's **fault protection** system will put an amplifier channel in standby mode in rare situations where heavy common-mode current is detected in the channel's output. The amplifier should never output heavy common-mode current unless its circuitry is damaged in some way, and putting a channel in standby mode helps to prevent further damage.

The amplifier's **transformer thermal protection** circuitry is activated in very unusual circumstances where the unit's transformer temperature rises to unsafe levels. Under these abnormal conditions, the amplifier will put the channel of the affected transformer in standby mode. The amplifier will return to normal operation after the transformer cools to a safe temperature. (For more information on transformer thermal protection, refer to the following section.)

4.3.3 Transformer Thermal Protection

All Macro-Tech amplifiers have transformer thermal protection. It protects the power supplies from damage under the rare conditions of transformer temperatures rising too high. A thermal switch embedded in each transformer removes power to the channel if there is excessive heat. The switch automatically resets when the transformer cools to a safe temperature.

It is very unlikely that you will ever see a Macro-Tech amplifier activate transformer thermal protection as long as it is operated within rated conditions (see Section 6, *Specifications*). One reason is that ODEP keeps the amplifier working under very severe conditions. Even so, higher than rated output levels, excessively low impedance loads and unreasonably high input signals can generate more heat in the transformer than in the output devices. These conditions can overheat the transformer and activate its protection system.

Macro-Tech amplifiers are designed to keep working under conditions where other amplifiers would fail. But even when its limits are exceeded, it will still protect itself—and your investment—from damage.

4.3.4 Circuit Breakers

The power supplies are protected by circuit breakers. With rated loads and output levels, the circuit breakers should only shut down the amplifier in the rare instance of a catastrophic failure. Other protection systems like ODEP keep the amplifier operational under most other severe conditions. The circuit breakers can also shut down the amplifier in cases where extremely low-impedance loads and high output levels result in current draw that exceeds their rating. Again, this should only be possible when operating *outside rated conditions*, like when the amplifier is used to drive a 1-ohm load in Stereo mode, or when a signal overloads the input and is clipped severely.

Macro-Tech amplifiers do not trip their breakers unless something is wrong. If a breaker trips, try to identify and correct the problem before resetting the breakers with the back panel **Reset switches**. If the problem persists, refer the unit to a qualified technician.

4.4 Controls

The **Enable switch** is located on the front panel so you can easily turn the amplifier on or off. If you ever need to make any wiring or installation changes don't forget to disconnect the power cord. The six steps listed next should be followed whenever you turn on the amplifier:

1. Turn down the level of your audio source. For example, set your master mixer's volume to –∞.
2. Turn down the level controls of the amplifier (if they are not already down).
3. Turn on the Enable switch. The Enable indicator beside the switch should glow. During the four second mute delay which immediately follows, the Signal/IOC indicators will flash unpredictably and the ODEP LEDs will stay off. After the mute delay, the ODEP indicators should come on with full brilliance and the Signal/IOC indicators should

function normally (remain off if no signal is present; flash if a signal is present).

4. After the mute delay, turn up the level of your audio source to the maximum desired level.
5. Turn up the level controls of the amplifier until the maximum desired sound level is achieved.
6. Turn down the level of your audio source to its normal range.

For ease of use, the **Level controls** are also located on the front panel. Each control has 31 detents for accurate repeatability. To prevent tampering with these controls, the Level Control Security Kit is available (see Section 8.2).

The **Input Sensitivity switch** is located inside the PIP compartment at the back of the amplifier. It is factory-set to 0.775 V for rated output into 8 ohms.* If desired, it can be switched to 1.4 V for rated output into 8 ohms, or to a fixed voltage gain of 26 dB. At 26 dB voltage gain, the equivalent input sensitivity is: Macro-Tech 24x6: 3.1 and 2.2 V for Channel 1 and 2, respectively. Macro-Tech 36x12: 4.8 and 2.6 V for Channel 1 and 2, respectively.

To change the input sensitivity:

1. Turn off the amplifier and disconnect its power cord from the AC mains power receptacle.
2. Remove the PIP module (two screws).
3. Locate the sensitivity switch access hole inside the chassis opening as shown in Figure 4.3. It is located just above the phone jack inputs.
4. Set the switch to the desired position noted on the access hole label. (Move the switch toward the front panel to set the input sensitivity to 1.4 V for rated output power, move it to the middle position for a voltage gain of 26 dB, or move it toward the back panel to set the input sensitivity to 0.775 V.)
5. Replace the PIP module and connect the power.

The **Ground Lift switch** is located on the back panel and can provide isolation between the input signal grounds and the AC (chassis) ground. It affects only the phone jack inputs and has no affect on the PIP module input connectors. Sliding the switch to the left isolates or “lifts” the grounds by placing an impedance between the sleeve of each input phone jack and the AC power ground.

The noninverted and inverted signal lines for the PIP module are connected in parallel with the corresponding lines of the phone jack inputs. The input signal grounds are not paralleled. Specifically, XLR pins 2 and 3 are connected in parallel with the tip and ring of the corresponding phone jack. However, pin 1 of the XLR is not connected in parallel with the sleeve of the phone jack. This makes it possible for a PIP module to handle its own signal grounds independently.

* Factory setting for international models is 1.4 V.

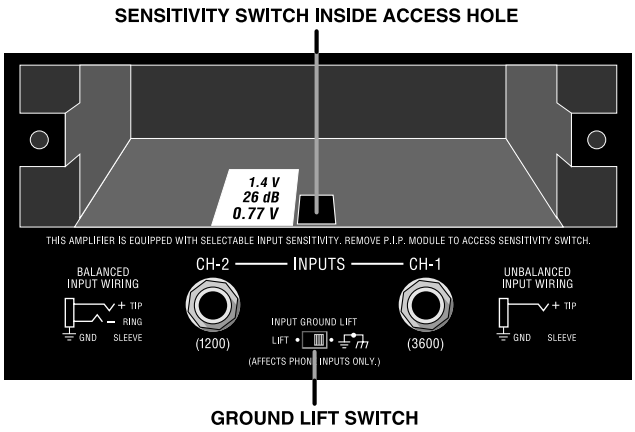


Fig. 4.3 Input Sensitivity and Ground Lift Switches

The **Reset switches** for the power supply circuit breakers are located on the back panel. The circuit breakers protect the power supplies against damage in cases where excessive current is being drawn from the AC mains. If a breaker trips, the IOC indicator for the affected channel(s) will turn on and the Enable indicator will remain on. To reset a breaker:

1. Turn off the Enable switch.
2. Press the breaker’s reset switch.
3. Turn the amplifier back on.

Contact an authorized service center or Crown’s Technical Support Group if the problem persists.

4.5 Filter Cleaning

Dust filters are provided on the air intakes to the cooling system (Figure 2.1). If this filter becomes clogged, the unit may not cool as efficiently as it should which might produce lower-than-normal output levels due to high heat diffuser temperature.

To clean, remove each of the filter elements by gently pulling them away from the front panel. Clean with mild dishwashing detergent and warm water. Replacement filters may be ordered from the factory.

Dust filters are not 100% efficient—depending on the local environment, the internal heat sinks of the ampliifer will benefit from periodic cleaning by a qualified technician. Internal cleaning information is available from our Technical Support Group.

5 Technical Information

5.1 Overview

Your amplifier incorporates several new technological advancements including low stress output stages, real-time computer simulation of output transistor stress, an advanced heat diffuser embodiment and a modular system for signal input and processing. In addition, Macro-Tech 36x12 models also have an articulated VZ power supply in Channel 1.

Custom protection circuitry limits temperature and current to safe levels while making the amplifier highly reliable and tolerant of faults. Unlike many lesser amplifiers, it can operate at its voltage and current limits without self-destructing.

Real-time computer simulation is used to create an analogue of the junction temperature of the output transistors (hereafter referred to as the "output devices"). Current is limited only when the device temperature becomes excessive—and just by the minimum amount necessary. This patented approach is called ODEP or Output Device Emulation Protection. It maximizes the available output power and eliminates overheating, the major cause of output device failure.

The amplifier is protected from all common hazards that plague high-power amplifiers, including shorted, open or mismatched loads; overloaded power supplies, excessive temperature, chain-destruction phenomena, input overload damage and high frequency blowups. The unit protects loudspeakers from DC in the input signal, turn-on and turn-off transients, and it detects and prevents unwanted DC in the output. The amplifier is also protected from internal faults.

The patented four-quadrant topology used in the grounded output stages is called the grounded bridge. The grounded bridge topology takes full advantage of the power supplies delivering peak-to-peak voltages to the load that are twice the voltage seen by the output devices and twice the voltage generated by the power supplies.

The grounded bridge topology is ground-referenced. Because the required current exceeds the limits of presently available components, composite output devices are constructed to function as gigantic NPN and PNP devices. Each output stage has two composite NPN devices and two composite PNP devices.

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

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

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

Our thermal diffusers are fabricated from custom convoluted fin stock that provides an extremely high ratio of area to volume, or area to weight. All power devices are mounted directly to massive heat spreaders that are electrically alive. Electrifying the heat spreaders improves thermal performance by eliminating the insulating interface underneath the power devices. The chassis itself is used as part of the thermal circuit, and this maximizes utilization of the available resources.

5.2 VZ Power (Macro-Tech 36x12 only)

VZ means Variable Impedance and is the name of Crown's patented articulated power supply technology. This technology is what makes it possible to pack such tremendous power into Crown's *Macro-Tech 3600VZ* and *Macro-Tech 5002VZ* amplifiers. The high-power channel of the Macro-Tech 36x12 uses this articulated power supply technology.

5.2.1 Background

A power supply must be large enough to handle the maximum voltage and current needed by the amplifier to drive its maximum rated power into a specified load. To fulfill this requirement, conventional power supply designs produce lots of heat, are heavy, and take up precious real estate. And it's no secret that heat is one of a power amplifiers worst enemies. Consider the circuit that follows in Figure 5.1.

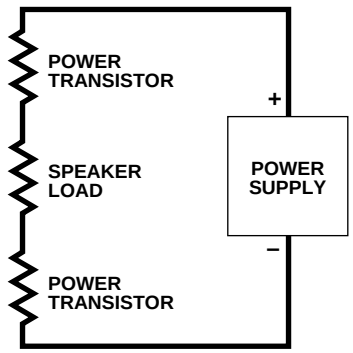


Fig. 5.1 A Typical Power Supply

According to Ohm's Law, as your power

supply becomes larger, the power transistors must dissipate more heat. Also, the lower the resistance of the power transistors, the more voltage you can deliver to the load. But when you lower the resistance of the transistors, you increase the current passing through them, and again increase the amount of heat they must dissipate.

5.2.2 The VZ Supply

An articulated power supply like VZ avoids much of this problem by reducing the voltage applied to the transistors when less voltage is needed. Reducing the voltage reduces the heat, so the amplifier runs cooler and more power can be packed in safely.

The VZ supply is divided into segments to better match the voltage and current requirements of the power transistors. Remember that audio signals like music are complex waveforms.

Fig. 5.2 Complex Musical Waveforms

For music the average level is always much less than the peak level. This means a power supply does not need to produce full voltage all of the time.

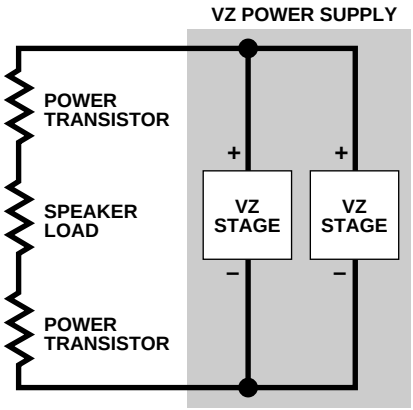


Fig. 5.3 VZ Supply in Parallel Mode

The VZ supply is divided into two parts. When the voltage requirements are not high, it operates in a *parallel mode* to produce less voltage and more current.

The power transistors stay cooler and are not forced to needlessly dissipate heat. This is the normal operating mode of the *VZ* power supply.

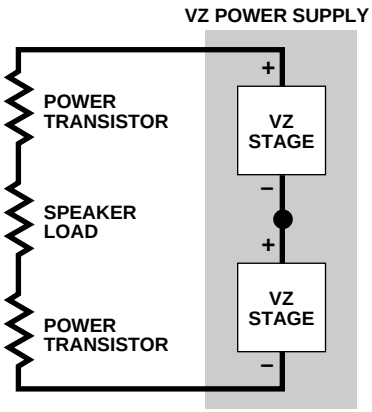


Fig. 5.4 VZ Supply in Series Mode

When the voltage requirements are high, VZ supplies switch to a *series mode* which produces higher voltage and less current. The amplified output signal never misses a beat and gets full voltage when it needs it—not when it doesn't need it.

Sensing circuitry watches the voltage of the signal to determine when to switch VZ modes. The switching circuitry is designed to prevent audible switching distortion and yield the highest possible dynamic transfer function—you hear only the music and not the amplifier. You get not only the maximum power with the maximum safety, but you also get the best power matching to your load.

5.3 Circuit Theory

Each channel is powered by its own power transformer, T100 or T200. Both channels share TF-1, a low voltage transformer. The secondary outputs of each transformer are full-wave rectified by heavy duty bridge rectifiers and are filtered by large computer grade capacitors. A thermal switch embedded in each transformer protects them from overheating.

The low voltage transformer TF-1 uses a separate fan motor winding. The TF-1 output is rectified by diodes D1-4, generates an unregulated 24 volts. Monolithic regulators U1-2 provide a regulated ±15 volts.

For simplicity, the following discussion of the circuitry and operation will refer to one channel only. Please refer to the block diagram in Figure 5.5 and the schematics provided at the back of this manual.

The input signal at the phone jack passes directly into the balanced gain stage (U104-C,D). Use of a PIP module for input signal causes the input signal to pass through the PIP and then to the balanced gain stage.

The balanced gain stage (U104-C,D) causes balanced to single-ended conversion to take place using a difference amplifier. From there, gain can be controlled with a potentiometer. The error amp (U104-A) amplifies the difference between the output signal and the input sig-

nal from the gain pot, and drives the voltage translator stage.

The voltage translator stage channels the signal to the Last Voltage Amplifiers (LVAs), depending on the signal polarity, from the error amp U104-A. The +LVA (Q105,Q125) and the –LVA (Q110,Q126), with their push-pull effect through the bias servo Q318, drive the fully complementary output stage.

The bias servo Q318 is thermally coupled to the heat sink, and sets the quiescent bias current in the output stage to lower the distortion in the crossover region of the output signal. D301, D302, D303, and D304 are used to remove the charge on the unused portion of the output stage, depending on the polarity of the output signal.

With the voltage swing provided by the LVAs, the signal then gains current amplification through the Darlington emitter-follower output stage.

The bridge-balanced circuit (U104-B) receives a signal from the output of the amplifier, and differences it with the signal at the Vcc supply. The bridge-balanced circuit then develops a voltage to drive the bridge-balanced output stage. This results in the Vcc supply having exactly one half of the output voltage added to their quiescent voltage. D309, D310, D311 and a trimmer resistor set the quiescent current point for the bridge-balanced output stage.

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

Q107 and Q108 act as a conventional current limiter, sensing current in the output stage. The allowable current level is also adjusted as a function of voltage. When current at any one instant exceeds the design criteria, the limiters remove the drive from the LVAs, thus limiting current in the output stage to a safe level.

To further protect the output stages, a specially developed ODEP (Output Device Emulation Protection) circuit is used. It produces an analog output proportional to the always changing safe operating area of the output transistors. This output controls the translator stage by removing any drive that exceeds the safe operating area of the output devices. Thermal sensor S100 gives the ODEP circuits vital information on the operating temperature of the heatsink on which the output devices are mounted.

Should the amplifier fail in such a way that would cause DC across the output lead, the DC protection circuit senses this on the negative feedback loop and shuts down the power supply until the DC is removed.

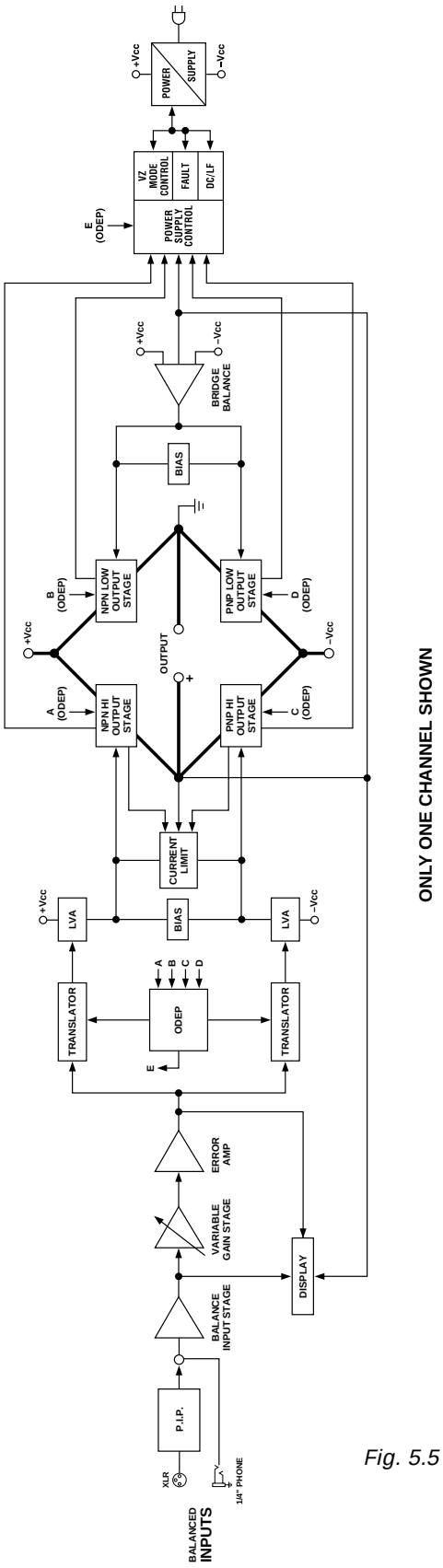


Fig. 5.5 Circuit Block Diagram (Channel 1)

6 Specifications

The following specifications apply to 120 VAC, 60 Hz units in stereo mode with 8 ohm loads and an input sensitivity of 26 dB unless otherwise specified.

120 VAC, 60 Hz Units: These units have a dedicated transformer for 120 VAC, 60 Hz power mains.

International Units: These units have dedicated transformers for various AC mains voltages and line frequencies.

Performance

Frequency Response: ±0.1 dB from 20 Hz to 20 kHz at 1 watt (see Figure 6.1).

Phase Response: ±10° from 10 Hz to 20 kHz at 1 watt (see Figure 6.4).

Signal-to-Noise Ratio: (A-weighted) Greater than 105 dB below rated continuous average output from 20 Hz to 20 kHz. (No weighting) 100 dB below rated continuous average output from 20 Hz to 20 kHz.

Harmonic Distortion (THD): Less than 0.05% at rated output from 20 Hz to 1 kHz, increasing linearly to less than 0.1% at 20 kHz.

IM Distortion (IMD): Less than 0.05% from 10 milliwatts to full rated output.

Damping Factor: Greater than 1,000 from 10 Hz to 400 Hz (see Figure 6.2).

Slew Rate: Channel 1, greater than 30 volts per microsecond; Channel 2, greater than 13 volts per microsecond.

Voltage Gain: 20:1 ±3% or 26 dB ±0.25 at +26 dB input sensitivity and the maximum level setting. The sensitivity varies by model and channel when the input sensitivity is set to 0.775 V as listed below:

Macro-Tech 24x6 Channel 1 (2400): 83:1 ±12% or 38 dB ±0.5 dB.

Macro-Tech 24x6 Channel 2 (600): 54:1 ±12% or 35 dB ±0.5 dB.

Macro-Tech 36x12 Channel 1 (3600): 124.6:1 ±12% or 41.9 dB ±1.0 dB.

Macro-Tech 36x12 Channel 2 (1200): 64:1 ±12% or 36 dB ±0.5 dB.

Power

Output Power: *The following are guaranteed minimums for standard 1 kHz power at 1 kHz and 0.1% or less THD.*

120 VAC, 60 Hz Models

Macro-Tech 24x6

Channel 1 (2400):
- 1050 watts into 2 ohms.
- 800 watts into 4 ohms.
- 520 watts into 8 ohms.

Channel 2 (600):
- 400 watts into 2 ohms.
- 325 watts into 4 ohms.
- 225 watts into 8 ohms.

Macro-Tech 36x12

Channel 1 (3600):
- 1800 watts into 2 ohms.
- 1565 watts into 4 ohms.
- 1120 watts into 8 ohms.

Channel 2 (1200):
- 675 watts into 2 ohms.
- 480 watts into 4 ohms.
- 310 watts into 8 ohms.

International Models

Macro-Tech 24x6

Channel 1 (2400):
- 875 watts into 2 ohms.
- 745 watts into 4 ohms.
- 510 watts into 8 ohms.

Channel 2 (600):
- 375 watts into 2 ohms.
- 335 watts into 4 ohms.
- 230 watts into 8 ohms.

Macro-Tech 36x12

Channel 1 (3600):
- 1460 watts into 2 ohms.
- 1300 watts into 4 ohms.
- 965 watts into 8 ohms.

Channel 2 (1200):
- 515 watts into 2 ohms.
- 420 watts into 4 ohms.
- 285 watts into 8 ohms.

It is extremely important to have adequate AC power available. Power amplifiers cannot create energy—they must have the required voltage and current to deliver the undistorted rated wattages you expect.

Load Impedance: Rated for 16, 8, 4, and 2 ohm use only. Safe with all types of loads, even reactive ones.

Required AC Mains: All units require 90 watts or less at idle. See Section 7 for detailed information on AC power draw, current draw and thermal dissipation.

In-Rush Current*: 73.20 amperes.

* Per EN 55103-1: 1996 Annex B and Annex F. Highest reading from a sample of 10 random readings. Reading measured using MA-3600VZ amplifier. Results for these amps deemed ≤MA-3000VZ results.

Controls

Enable: A front panel pushbutton used to turn the amplifier on and off.

Level: A 31-position detented rotary potentiometer for each channel located on the front panel used to control the output level.

Sensitivity: A three-position switch located inside the PIP compartment used to select one of three input sensitivities for both channels: a sensitivity of 1.4 volts for full rated output, a fixed voltage gain of 26 dB or a sensitivity of 0.775 volts for full rated output (see Section 4.4).

Ground Lift: A two-position back panel switch used to isolate the signal ground of the phone jacks from the chassis (AC) ground.

Reset: A back panel switch for each channel used to reset the circuit breaker which protects each channel's power supply.

Indicators

Enable: This amber indicator lights when the amplifier's Enable switch is turned on and the low voltage power supply is operating. See Section 4.2.

Signal/IOC: Each channel has a green front panel indicator that flashes to show amplifier output. If a channel's output waveform differs from its input by 0.05% or more, the indicator flashes brightly to show distortion. This function provides *proof of distortion-free performance*.

ODEP: Each channel has an amber front panel indicator that shows thermal-dynamic energy reserve. Normally, each ODEP indicator is lit to show available reserve energy. In the rare event that a channel has no reserve, its indicator will dim in proportion to ODEP limiting. An ODEP indicator may also turn off under other conditions (see Sections 4.2 and 4.3.1).

Input/Output

Input Connector: Two balanced ¼-inch phone jacks on the back panel and two balanced 3-pin female XLR connectors on the factory-installed P.I.P.-FX (see Section 8 for information on optional PIP modules).

Input Impedance: Nominally 20 k ohms, balanced. Nominally 10 k ohms, unbalanced.

Input Sensitivity: Settings include 0.775 V and 1.4 V for rated output, or a fixed voltage gain of 26 dB (see Section 4.4).

Output Signal: Unbalanced, two-channel.

Output Connector: A pair of color-coded 5-way binding posts (for banana plugs, spade lugs or bare wire) for each channel. *Note: Channel 1 (3600) of Macro-Tech 36x12 models has two pair of binding posts.*

Output Impedance: Less than 10 milliohms in series with less than 2 microhenries (see Figure 6.3).

DC Output Offset: (Shorted input) ±10 millivolts.

Protection

Macro-Tech amplifiers are protected against shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain destruction phenomena, input overload damage and high-frequency blowups. They also protect loudspeakers from input/output DC and turn-on/turn-off transients.

If unreasonable operating conditions occur, the patented ODEP circuitry will proportionally limit the drive level to protect the output transistor stages, particularly in the case of elevated temperature. Transformer overheating will result in a temporary shutdown of the affected channel; when it has cooled to a safe temperature, the transformer will automatically reset itself. Controlled slew-rate voltage amplifiers prevent RF burnouts. And input overload protection is provided by current-limiting resistance at the input. Refer to Section 4.3.

Turn On: Four second turn-on delay with no dangerous transients. Contact Crown's Technical Support Group to change the turn-on delay time.

Construction

Black coated steel chassis and aluminum front panel with Lexan overlay. Chassis utilizes specially designed flow-through ventilation from front to side panels.

Cooling: Internal heat diffusers with forced air cooling for rapid, uniform heat dissipation.

Dimensions: 19 inch (48.3 cm) standard rack mount (EIA Std. RS-310-B), 3.5 inch (8.9 cm) height, 16 inch (40.6 cm) depth behind mounting surface, 2.5 inch (6.35 cm) in front of mounting surface.

Approximate Weight: Center of gravity is approximately 6 inches (15 cm) behind the front mounting surface.

Macro-Tech 24x6: 45 lbs, 4 oz. (20.5 kg). Shipping weight is 54 lbs, 11 oz. (24.8 kg).

Macro-Tech 36x12: 50 lbs (22.7 kg). Shipping weight is 59 lbs. (26.8 kg).

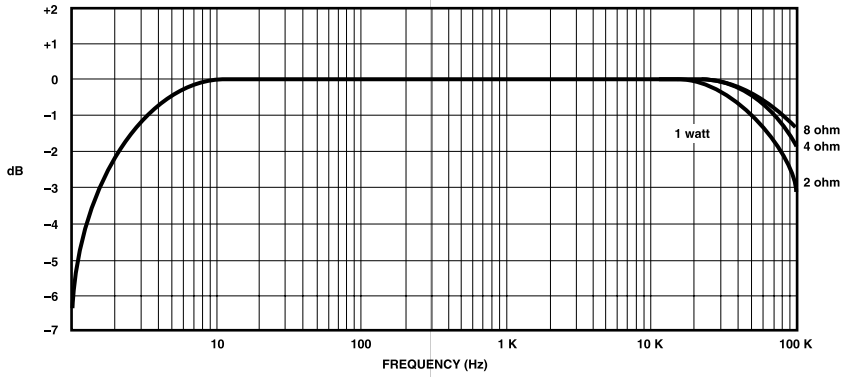


Fig. 6.1 Typical Frequency Response

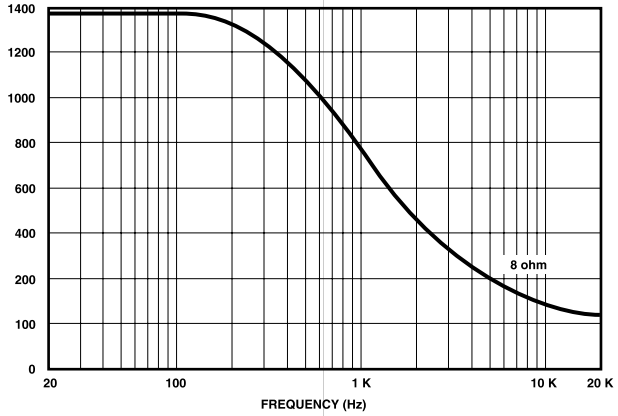


Fig. 6.2 Typical Damping Factor

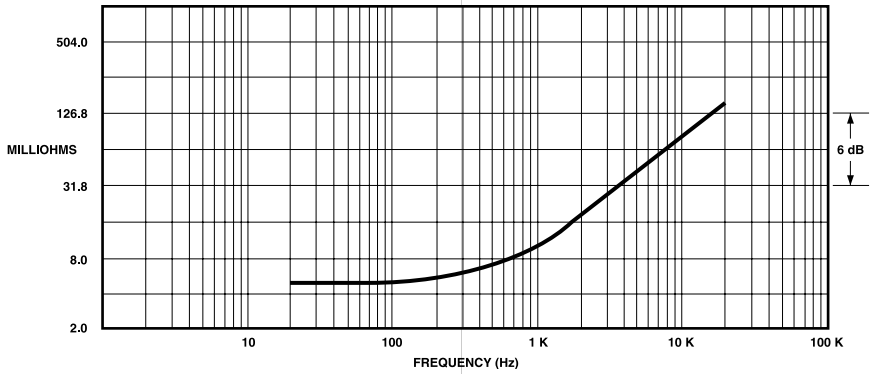


Fig. 6.3 Typical Output Impedance

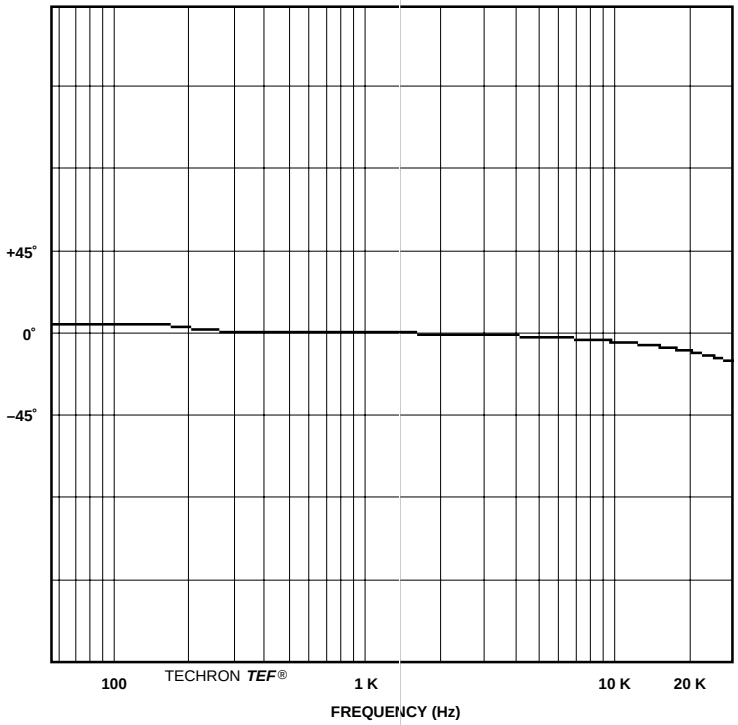


Fig. 6.4 Typical Phase Response

Macro-Tech 24x6

Duty Cycle	LOAD														
	8 Ohm					4 Ohm					2 Ohm				
	AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation	
		100-120 V	230 V	btu/hr	kcal/hr		100-120 V	230 V	btu/hr	kcal/hr		100-120 V	230 V	btu/hr	kcal/hr
50%	663	6.7	3.5	992	250	955	9.6	5.0	1342	338	1205	12.1	6.3	1641	414
40%	548	5.5	2.9	855	215	782	7.9	4.1	1135	286	982	9.7	5.1	1374	346
30%	434	4.4	2.3	718	181	609	6.1	3.2	928	234	759	7.6	4.0	1107	279
20%	319	3.2	1.7	581	146	436	4.4	2.3	721	182	536	5.4	2.8	841	212
10%	205	2.1	1.1	444	112	263	2.6	1.4	514	130	313	3.1	1.6	574	145

Fig. 7.1 Macro-Tech 24x6 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

7 AC Power Draw and Thermal Dissipation

This section provides detailed information about the amount of power and current drawn from the AC mains by the Macro-Tech 24x6 and 36x12 amplifiers and the amount of heat produced under various conditions. The calculations presented here are intended to provide a realistic and reliable depiction of the amplifiers. The following assumptions or approximations were made:

- The amplifier's available channels are loaded and full power is being delivered.
- The amplifier efficiency at standard 1 kHz power is estimated to be 65%.
- Quiescent power draw is 90 watts (an almost negligible amount for full-power calculations).
- Quiescent thermal dissipation equals 105 btu/hr at 90 watts.
- The estimated duty cycles take into account the typical crest factor for each type of source material.
- Duty cycle of pink noise is 50%.
- Duty cycle of highly compressed rock 'n' roll midrange is 40%.
- Duty cycle of rock 'n' roll is 30%.
- Duty cycle of background music is 20%.
- Duty cycle of continuous speech is 10%.
- Duty cycle of infrequent, short duration paging is 1%.

Here are the equations used to calculate the data presented in Figures 7.1 and 7.2:

$$\text{AC Mains Power Draw (watts)} = \frac{\text{Total output power will all channels driven (watts)} \times \text{Duty Cycle}}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)}$$

The quiescent power draw of 90 watts is a maximum value and includes power drawn by the fan. The following equation converts power draw in watts to current draw in amperes:

$$\text{Current Draw (amperes)} = \frac{\text{AC Mains Power Draw (watts)}}{\text{AC Mains Voltage} \times \text{Power Factor (.83)}}$$

The power factor of 0.83 is needed to compensate for the difference in phase between the AC mains voltage and current. The following equation is used to calculate thermal dissipation:

$$\text{Thermal Dissipation (btu/hr)} = \left(\frac{\text{Total output power with all channels driven (watts)} \times \text{Duty Cycle} \times .35}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)} \right) \times 3.415$$

The constant 0.35 is inefficiency (1.00–0.65) and the factor 3.415 converts watts to btu/hr. Thermal dissipation in btu is divided by the constant 3.968 to get kcal. If you plan to measure output power under real-world conditions, the following equation may also be helpful:

$$\text{Thermal Dissipation (btu/hr)} = \left(\frac{\text{Total measured output power from all channels (watts)} \times .35}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)} \right) \times 3.415$$

Macro-Tech 36x12

	LOAD														
	8 Ohm					4 Ohm					2 Ohm				
Duty Cycle	AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw (Amps)		Thermal Dissipation	
		100-120 V	230 V	btu/hr	kcal/hr		100-120 V	230 V	btu/hr	kcal/hr		100-120 V	230 V	btu/hr	kcal/hr
50%	1190	12.0	6.2	1622	409	1663	16.7	8.7	2188	551	1994	20.0	10.4	2583	651
40%	970	9.7	5.1	1359	342	1348	13.5	7.1	1812	457	1613	16.2	8.5	2128	536
30%	750	7.5	3.9	1096	276	1034	10.4	5.4	1436	362	1232	12.4	6.5	1673	422
20%	530	5.3	2.8	833	210	719	7.2	3.4	1059	267	852	8.6	4.5	1218	307
10%	310	3.1	1.6	570	144	405	4.1	2.1	683	172	471	4.7	2.5	762	192

Fig. 7.2 Macro-Tech 36x12 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

8 Accessories

8.1 PIP Modules

One advantage of Macro-Tech amplifiers is the ability to customize them using PIP (Programmable Input Processor) and PIP2 modules. Macro-Tech amplifiers are equipped with an edge card connector inside the back panel PIP compartment. The modules install easily:

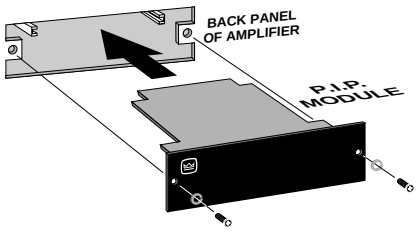
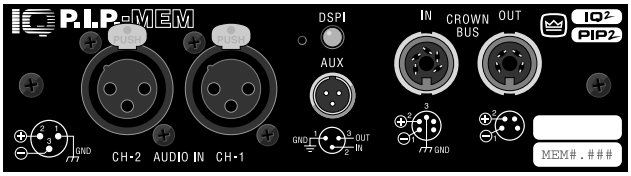


Fig. 8.1 Installing a PIP Module

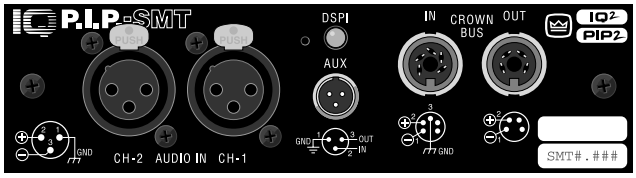
WARNING: Disconnect power to the amplifier when installing or removing a PIP module.

PIPs carrying the PIP2 logo are configured to use one or more of the PIP2 enhanced features. These features are only available in a PIP2-compatible amplifier. Of course, the exact features used will depend upon the function of the PIP2 module. Here are some of the available PIP and PIP2 modules:

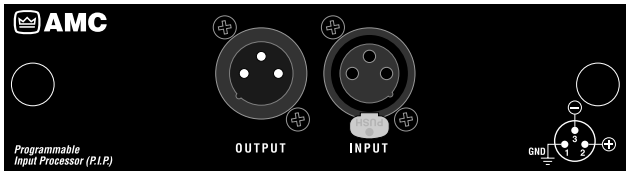
IQ-P.I.P.-DSP is an IQ System Programmable Input Processor with DSP (Digital Signal Processing) for PIP-compatible amplifiers. As a component of the IQ System, it connects the amplifier to the Crown Bus so the amplifier can be controlled and monitored. Its DSP capabilities enable it to be programmed with a variety of functions, such as filters and crossovers, signal delay, input compressor and output limiter, and a variety of other useful features similar to those included with the IQ-P.I.P-SMT. Requires an IQ2 interface and a computer for initial setup.



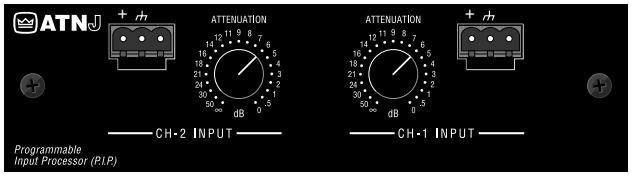
IQ-P.I.P.-MEM Integrates Com-Tech, Macro-Tech and Studio Reference amplifiers into Crown's IQ System. Each channel of each amplifier can be monitored and individually controlled from an inexpensive PC. A total of 15 functions can be either monitored or controlled. Memory backup is also incorporated in case of power failure. Requires an IQ2 interface and a computer for initial setup.



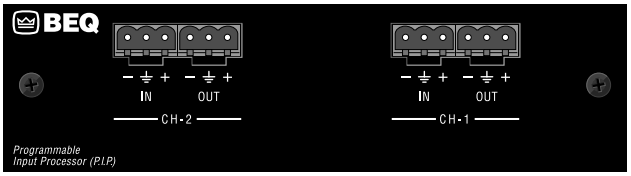
□□□□□□□□□□ "Smart Amp" offers impressive new features unavailable elsewhere. The processing speed is substantially enhanced over other designs. A programmable power-supply gate conserves energy by shutting off the amplifier's high-power supplies until an audio signal is present. The user may define error-reporting conditions of the amplifier. There is much greater flexibility and thermal operational protection available, as well as a built-in smooth output limiter to discretely control maximum amplifier output. Requires an IQ2 interface and a computer for initial setup.



P.I.P.-AMCb combines many of the features found in the P.I.P.-XOV and P.I.P.-CLP to provide both a variable 4th-order Linkwitz-Riley crossover and an IOC-driven or variable-threshold signal-driven compressor. In addition, variable equalization networks provide for "constant-directivity" horn equalization and filter-assisted B6 vented bass box equalization. Bi-amping and tri-amping capabilities are provided via XLR connectors.

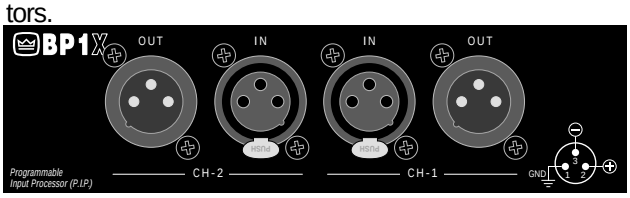


P.I.P.-ATNJ includes the features of the P.I.P.-FXT (balanced Jensen® 1:1 isolation transformers) and adds to each channel a 12-dB/octave RFI filter, a variable 18-dB/octave high-pass filter (to reduce bass/subsonic frequencies), and a 6-dB/octave 3-kHz shelving network for "constant-directivity" horn equalization. Special quick-connect barrier blocks are provided for inputs to each channel. Also adds a Jensen® 32-step precision attenuator to each channel.



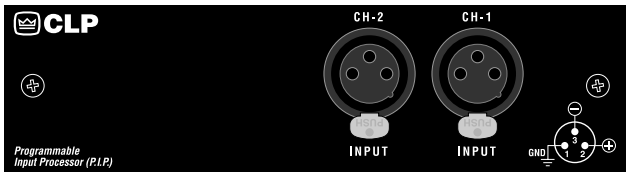
P.I.P.-BEQC adds many features of the Bose® Controllers to the input of your amplifier. Each channel includes a custom equalization network for Bose loudspeakers. Also included is a bass-cut (high-pass) filter for each channel. The equalization and bass-cut filters can be bypassed, if desired. Balanced inputs and "daisy-chain" outputs use removable barrier block connectors for quick, solderless connections.

P.I.P.-BEQX Same as P.I.P.-BEQC but with XLR connectors.

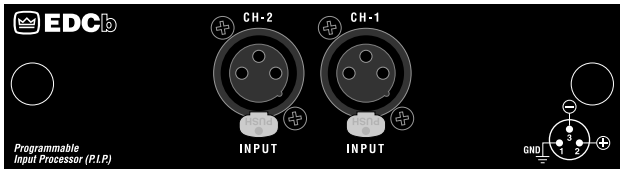


P.I.P.-BP1C The P.I.P.-BP1C is a versatile, stereo band-pass processor that plugs into any PIP-capable Crown amplifier. Each channel of the P.I.P.-BP1C is completely independent from the other and combines the functions of a low-pass filter, a high-pass filter, vented loudspeaker box equalization, horn equalization and compression. DIP switches and convenient jumper blocks make it easy to configure any of its powerful operating features. Uses removable barrier block, quick-disconnect connectors.

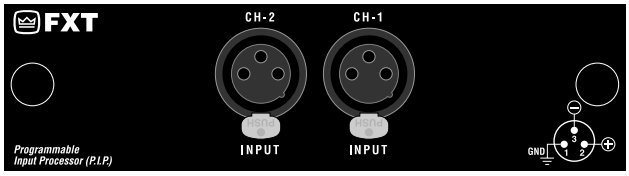
P.I.P.-BP1X Same as the P.I.P.-BP1C but with XLR connectors.



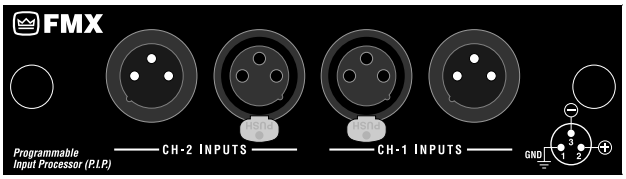
P.I.P.-CLP is designed to detect and prevent overload. The same error detecting circuit that is used to signal the IOC indicator is used to activate this error-driven compressor. It is not a typical signal-driven compressor, but a circuit to prevent any overload. It can yield up to 13 dB or additional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



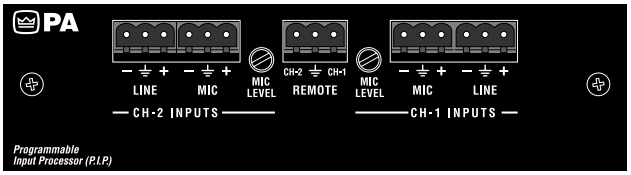
P.I.P.-EDCb State-of-the-art programmable error-driven and signal-driven compressor plus a variable high-pass filter for each channel. Fast or slow attach and release times can be set independently for each channel.



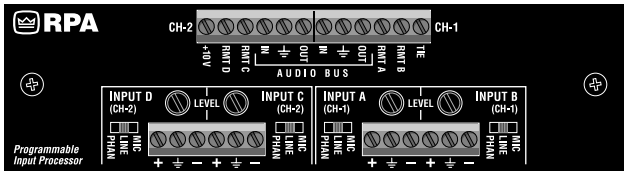
P.I.P.-FXT uses balanced 1:1 transformers to isolate the source from the inputs. It comes with balanced female 3-pin XLR connectors.



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

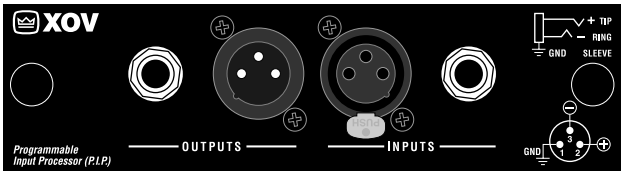


P.I.P.-PA permits the unique capability of adding one mic/line input directly to each channel of an amplifier. With phantom power for microphones, this mic/line input may be remotely switched from mic to line priorities.



P.I.P.-RPA A phantom-power mixer that has four balanced mic or line inputs with voiceover capability and adjustable "duck" level, 84 dB of attenuation. A 10-volt DC source for remote control capability is provided. The P.I.P.-EXT (Part M44731-4), available from service, allows the P.I.P.-RPA and other PIP cards to be "extended" outside the amplifier for easy set up.

P.I.P.-RPAT has the same features as the P.I.P.-RPA but includes four input transformers.



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

For more information on these or other PIPs under development, contact your local dealer or Crown's Technical Support Group.

8.2 Level Control Shaft Lock

A security accessory, the shaft lock, can be used to secure your amplifier's level controls in situations where the front panel controls are subject to tampering. One is needed for each channel. They can be ordered through the Crown Service/Parts Department. For more information, contact the Crown Service Department.

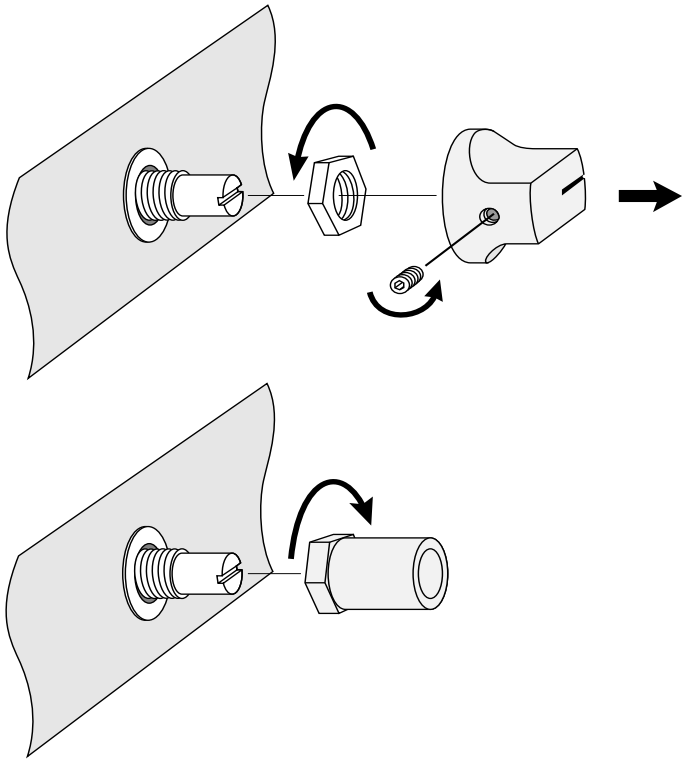


Fig. 8.2 Installing a Level Control Shaft Lock

9 Service

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

CAUTION: To prevent electric shock, do not remove covers. No user serviceable parts inside. Refer servicing to a qualified technician.

9.1 Worldwide Service

Service may be obtained from an authorized service center. (Contact your local Crown representative or our office for a list of authorized service centers.) To obtain service, simply present the bill of sale as proof of purchase along with the defective unit to an authorized service center. They will handle the necessary paperwork and repair.

Remember to transport your unit in the original factory pack.

9.2 North American Service

Service may be obtained in one of two ways: from an authorized service center or from the factory. You may choose either. It is important that you have your copy of the bill of sale as your proof of purchase.

9.2.1 Service at a North American Service Center

This method usually saves the most time and effort. Simply present your bill of sale along with the defective unit to an authorized service center to obtain service. They will handle the necessary paperwork and repair. Remember to transport the unit in the original factory pack. A list of authorized service centers in your area can be obtained from our Technical Support Group.

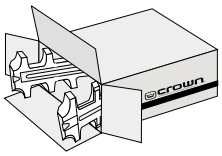
9.2.2 Factory Service

To obtain factory service, fill out the **service information page** that follows and send it along with your proof of purchase and the defective unit to the Crown factory.

For warranty service, we will pay for ground shipping both ways in the United States. Contact Crown Factory Service or Technical Support to obtain prepaid shipping labels prior to sending the unit. Or, if you prefer, you may prepay the cost of shipping, and Crown will reimburse you. Send copies of the shipping receipts to Crown to receive reimbursement.

Your repaired unit will be returned via UPS ground. Please contact us if other arrangements are required.

Always use the original factory pack to transport the unit.



Factory Service Shipping Instructions:

1. When sending a Crown product to the factory for service, be sure to fill out the service information form that follows and enclose it inside your unit's shipping pack. Do not send the service information form separately.
2. To ensure the safe transportation of your unit to the factory, ship it in an original factory packing container. If you don't have one, call or write Crown's Parts Department. With the exception of polyurethane or wooden crates, any other packing material will not be sufficient to withstand the stress of shipping. **Do not use loose, small size packing materials.**
3. Do not ship the unit in any kind of cabinet (wood or metal). Ignoring this warning may result in extensive damage to the unit and the cabinet. Accessories are not needed—do not send the instruction manual, cables and other hardware.

If you have any questions, please call or write the Crown Technical Support Group.

Crown Audio Division
Technical Support / Factory Service
Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

Telephone:	219-294-8200 800-342-6939 (North America, Puerto Rico, and Virgin Islands only)
Facsimile:	219-294-8301 (Technical Support) 219-294-8124 (Factory Service)
Fax Back:	219-293-9200 (North America only) 800-294-4094 (North America only) 219-294-8100 (International)
Internet:	http://www.crownaudio.com

Crown Factory Service Information

Shipping Address: Crown International, Inc., Factory Service, Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, IN 46517
Phone: 1-800-342-6939 or 1-219-294-8200 Fax: 1-219-294-8124

Owner's Name: _____

Shipping Address: _____

Phone Number: _____ **Fax Number:** _____

Model: _____ **Serial Number:** _____ **Purchase Date:** _____

NATURE OF PROBLEM

(Be sure to describe the conditions that existed when the problem occurred and what attempts were made to correct it.)

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Other equipment in your system: _____

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If warranty has expired, payment will be: ❑ **Cash/Check** ❑ **VISA** ❑ **MasterCard** ❑ **C.O.D.**

Card Number: _____ **Exp. Date:** _____ **Signature:** _____

ENCLOSE THIS PORTION WITH THE UNIT. DO NOT MAIL SEPARATELY.

Detach and send with unit.