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MACRO REFERENCE

STUDIO REFERENCE AMPLIFIER

OWNER'S MANUAL

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P.O. Box 1000, Elkhart, IN 46515
Telephone: 219-294-8000



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WORLDWIDE THREE YEAR FULL WARRANTY

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 Crown¹ 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.

¹ Note: If your unit bears the name "Amcron," please substitute it for the name "Crown" 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. 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. All expenses in remedying the defect, including surface shipping costs to the nearest authorized service center, will be borne by us. (You must bear the expense of all taxes, duties and other customs fees when transporting the product.)

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

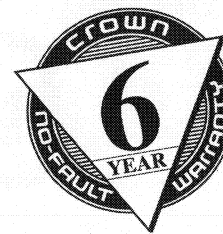
No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

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 AMERICAN SIX YEAR FULL WARRANTY



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 six (6) 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 your unit bears the name "Amcron," please substitute it for the name "Crown" in this manual. If you need special assistance beyond the scope of this manual, please contact our Technical Support Group.

Crown Audio Division Technical Support Group

57620 C.R. 105, Elkhart, Indiana 46517 U.S.A.

Phone: **800-342-6939** (U.S.A.) or 219-294-8200 Fax: 219-294-8301

IMPORTANT

**THE MACRO REFERENCE REQUIRES
CLASS 1 OUTPUT WIRING.**

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 COUVERTURES. RIEN DES PARTIES UTILES À L'INTÉRIEUR. 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.

WATCH FOR THESE SYMBOLS:



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.

CONTENTS

1 Welcome	7
1.1 Unpacking	7
1.2 Features	7
2 Facilities	8
3 Installation	10
3.1 Mounting	10
3.2 Cooling	10
3.3 Wiring	11
3.3.1 Stereo (Two-Channel) Operation	11
3.3.2 Bridge-Mono Operation	12
3.3.3 Parallel-Mono Operation	13
3.3.4 Input Connection	14
3.3.5 Output Connection	16
3.3.6 Additional Load Protection	18
3.3.7 AC Mains Power Requirements	18
4 Operation	19
4.1 Precautions	19
4.2 Indicators	19
4.3 Protection Systems	21
4.3.1 <i>ODEP</i>	21
4.3.2 Standby Mode	21
4.3.3 Transformer Thermal Protection	21
4.3.4 Circuit Breaker	22
4.4 Controls	22
4.5 Filter Cleaning	23
5 Service	24
5.1 Worldwide Service	24
5.2 North American Service	24
5.2.1 Service at a N.American Service Center	24
5.2.2 Factory Service	24
6 Technical Information	25
6.1 Overview	25
6.2 Circuit Theory	25
6.2.1 Stereo Operation	25
6.2.2 Bridge-Mono Operation	27
6.2.3 Parallel-Mono Operation	27
7 Specifications	28
8 AC Power Draw & Thermal Dissipation	30
9 Accessories	31
9.1 <i>P.I.P.</i> Modules	31

ILLUSTRATIONS

1.1	Macro Reference Amplifier with Engraved Electroluminescent Front Panel	6
1.2	Macro Reference Amplifier with Steel Front Panel	6
2.1	Front Facilities	8
2.2	Rear Facilities	9
3.1	Mounting Dimensions	10
3.2	Top View of a Rack-Mounted Unit	10
3.3	Proper Air Flow in a Rack Cabinet	10
3.4	Stereo Wiring	11
3.5	Bridge-Mono Wiring	12
3.6	Parallel-Mono Wiring	13
3.7	Unbalanced Input Wiring	14
3.8	Balanced Input Wiring	14
3.9	Balanced and Unbalanced Phone Plugs	14
3.10	Subsonic Filter Capacitors	15
3.11	Unbalanced RFI Filters	15
3.12	Balanced RFI Filters	15
3.13	AWG from Ohms/1000 ft	16
3.14	Inductive Load (Transformer) Network	17
3.15	Loudspeaker Fuse Selector Nomograph	18
4.1	Indicators	19
4.2	ODEP, IOC and Signal Presence Indicator Status	20
4.3	Meter Mode Switch	22
4.4	Input Sensitivity and Ground Lift Switches	23
4.5	Macro Reference Front Panels	23
6.1	Circuit Block Diagram	26
8.1	Power Draw, Current Draw and Thermal Dissipation at Full Rated Power for the Listed Duty Cycles	30
9.1	P.I.P. Modules	31

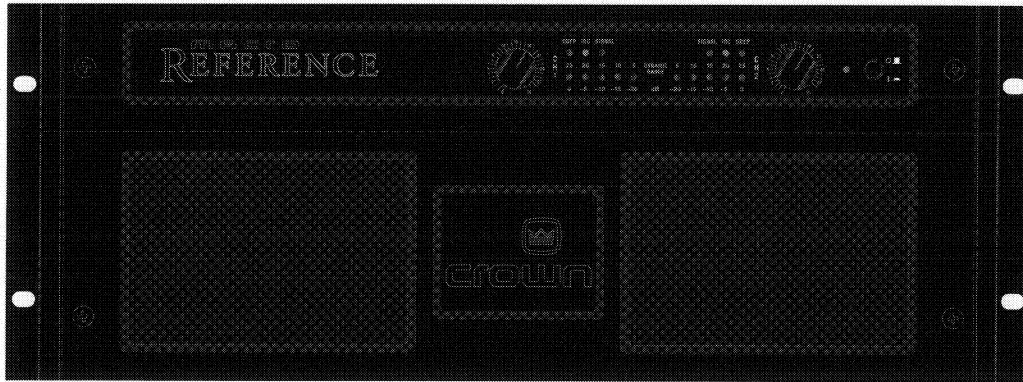


Fig. 1.1 Macro Reference Amplifier with Engraved Electroluminescent Front Panel



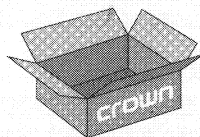
Fig. 1.2 Macro Reference Amplifier with Steel Front Panel

1 Welcome

The stunning realism of the *Macro Reference*[™] attests to its technical excellence. It has a dynamic range in excess of 120 dB!—more than enough dynamic range to faithfully reproduce a 20-bit digitally recorded audio signal.

At the heart of the *Macro Reference* is a tightly damped, high-excursion circuit design so advanced it can adapt to match the instantaneous demands of any audio signal. It has the highest dynamic transfer function available, making it the closest thing to a “straight wire with gain” ever created. Superior motion control of loudspeakers is achieved with the ultra-high damping control of its outputs, producing deeper, tighter bass. Low-frequency transient response must be heard to be fully appreciated. Great care has been taken with the routing of each wire, the layout of each circuit board, and the selection of each component. As a result, its sonic integrity is without peer.

This manual will help you successfully install and use your new amplifier. Please read all the instructions, warnings and cautions contained within—especially Sections 3.3.2 and 3.3.3 if you plan to use one of the two mono modes. For your protection, please send in your warranty registration card today and save your bill of sale since it is your **official proof of purchase**.



1.1 Unpacking

Please unpack and inspect the 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 as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Important: Please save all packing materials in case you need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

1.2 Features

This amplifier uses advanced technology to provide the most accurate reference amplifier available. Its patented *grounded bridge*[™] circuitry offers many advantages over conventional designs. In Stereo mode each channel can be treated as a separate amplifier because of its separate high voltage power supply and ultra-low crosstalk specifications. Features:

- ❑ Crown's patented *grounded bridge* circuitry generates incredible voltage swings while avoiding the stressful output configurations common to conventional amplifiers. The result: 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 performance*.
- ❑ *P.I.P.* (Programmable Input Processor) connector accepts accessories that tailor your amplifier to suit individual applications.
- ❑ Super low harmonic and intermodulation distortion give best *dynamic transfer function* in the industry.
- ❑ Extremely wide dynamic range capable of reproducing the dynamic range of a 20-bit digitally recorded audio signal.
- ❑ Ultra-high damping factor provides superior low-frequency motion control of loudspeakers for accurate, tight bass response.
- ❑ High voltage and high current headroom provide high energy reserves to easily drive even low impedance or highly reactive loads to full power.
- ❑ Two mono modes (Bridge-Mono and Parallel-Mono) for driving a wide range of load impedances.
- ❑ Full protection against shorted outputs, open circuits, mismatched loads, general overheating, and high frequency overloads; loudspeaker protection against low frequency and DC output; full fault protection and overvoltage protection.
- ❑ Two front panels are available: A deluxe engraved front panel with electroluminescent backlighting (Figure 1.1) or a standard steel front panel (Figure 1.2) for rugged applications. Both include an *ODEP*, *IOC* and Signal Presence indicator and a Dynamic Range/Level meter for each channel as well as an Enable Indicator.
- ❑ Efficient heat sinks and a self-contained, on-demand, infinitely-variable forced air cooling system prevents overheating and prolongs component life.
- ❑ Balanced inputs with internal 3-position sensitivity switch and adjustable front-panel level controls.
- ❑ Ground lift switch to isolate chassis and audio grounds.
- ❑ Two pair of 5-way binding posts for each channel provide versatile output connection.
- ❑ Custom designed, tape-wound, low-noise toroidal supply with extremely high power density.
- ❑ Rack mountable in a standard 19 inch (48.3 cm) equipment rack (the rear must be supported). Multiple units can be stacked on top of each other.

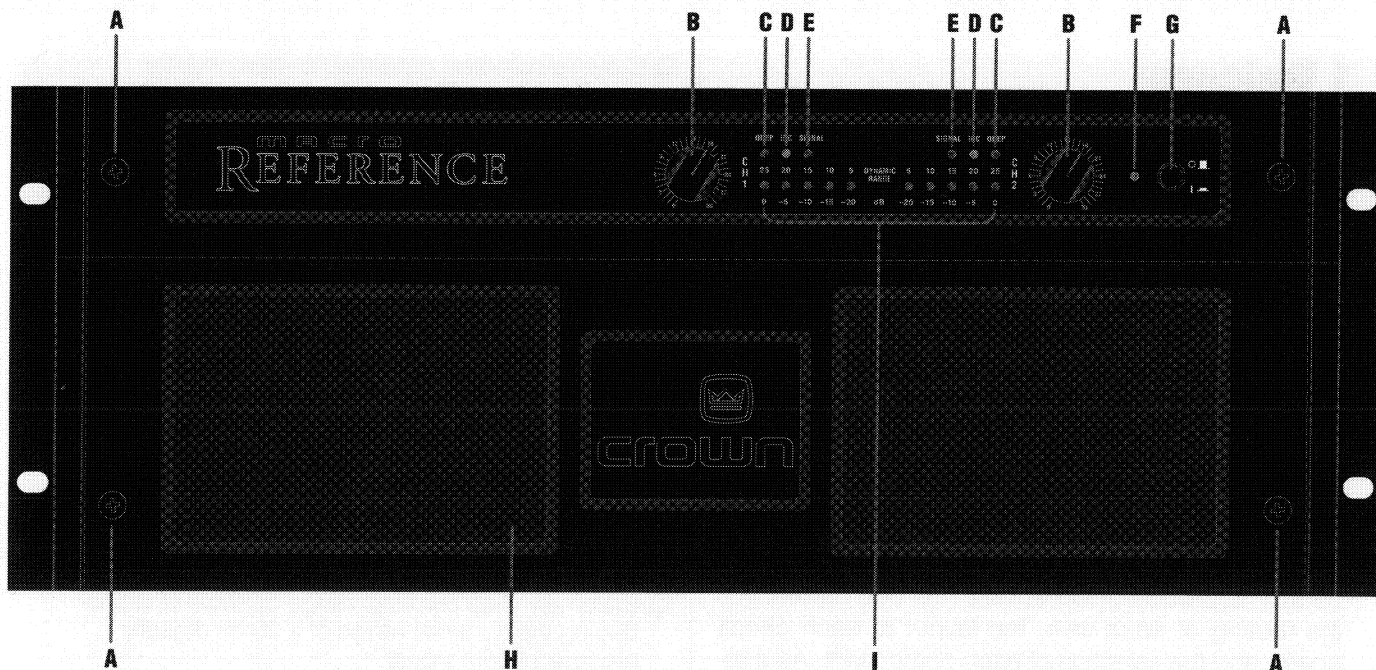


Fig. 2.1 Front Facilities

2 Facilities

A. Front Panel Access Screws

Remove these four screws to remove the front panel to clean the dust filter(s) or adjust the meter mode switch. See Sections 4.4 and 4.5.

B. Level Controls

The level of each channel is set with these convenient level controls. Each one has 31 detents for precise adjustment. See Section 4.4.

C. ODEP Indicators

The ODEP indicators glow brightly to confirm the normal operation of the Output Device Emulation Protection circuitry and the presence of reserve thermal-dynamic energy. They proportionally dim as the energy reserve decreases. In the rare event there is no reserve, the indicators will turn off and ODEP will proportionally limit the drive level of the output stages so the amplifier can continue to operate safely even when the operating conditions are severe. The indicators also turn off if the high voltage power supplies are in "standby" mode. See Section 4.2.

D. IOC Indicators

The total distortion level of each channel is monitored by the Input/Output Comparators. They compare the waveform of the input signal to that of the output and they flash brightly with a 0.1 second hold delay if there is a difference of 0.05% or more. This function is provided as proof of performance. Another IOC function is to indicate input overload. If the input signal is too large the indicators will flash brightly with a 0.5 second hold

delay to indicate input clipping distortion. *Note: The Channel 2 IOC indicator stays on in Parallel-Mono mode. See Section 4.2.*

E. Signal Presence Indicators

The presence of an audio signal is confirmed by these indicators which flash synchronously with it. *Note: They may not flash if the level is low. See Section 4.2.*

F. Enable Indicator

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

G. Enable Switch

Depress this push-button to turn the amplifier on or 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 the Crown Technical Support Group for details.)

H. Dust Filter

The air drawn inside the amplifier is filtered by the dust filter(s) mounted behind the front panel. Because the fan rarely needs to run, they seldom become dirty. They can be cleaned with mild detergent if they do.

I. Dynamic Range / Level Meter

A five-segment output meter is provided for each channel. It is set as a dynamic range meter at the factory and shows the dynamic range in dB. (It computes dynamic range as the ratio of the peak to average power level.) The meter can also be switched to an output level meter. As a level meter it displays the output power rela-

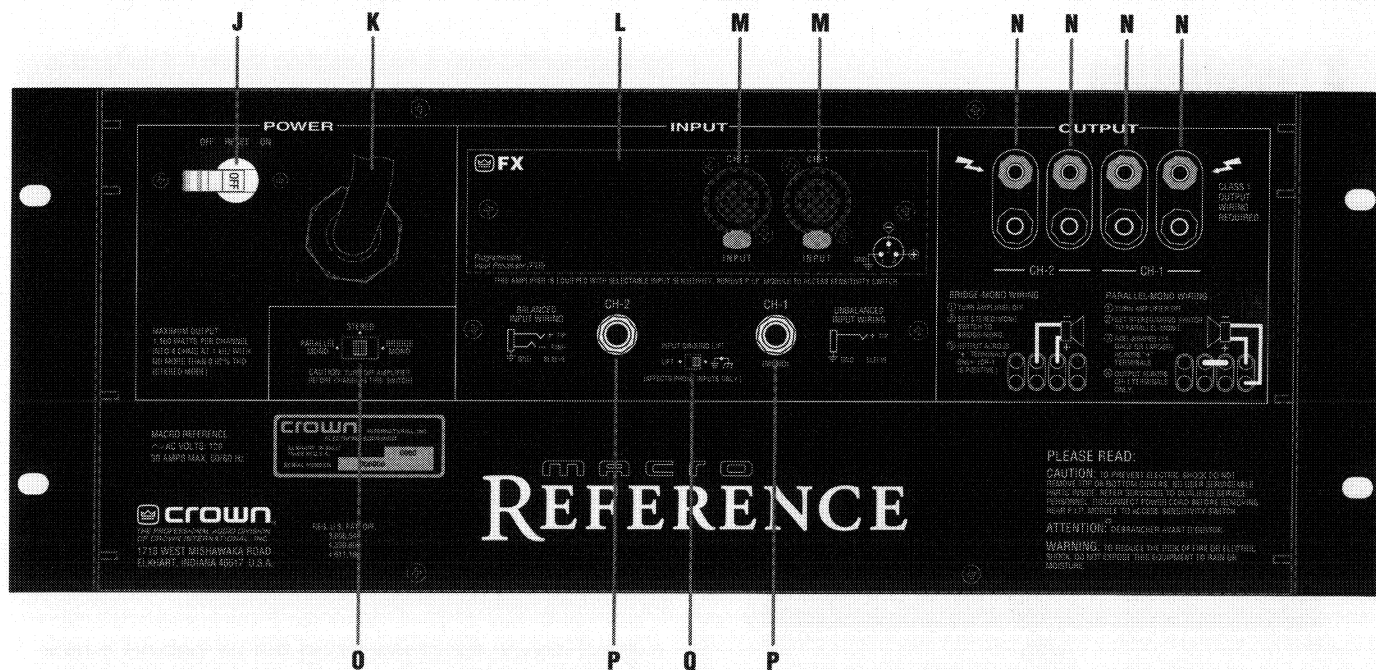


Fig. 2.2 Rear Facilities

tive to full power. For example, at 0 dB the output power would be 760 watts per channel while driving 8 ohm loads. See Section 4.2.

J. Reset Switch

A circuit breaker, located on the rear panel, serves as a reset switch to protect the power supplies.

K. Power Cord

An appropriate power cord and grounded AC plug are provided for the AC system for which your unit is rated.

L. P.I.P. Module

A variety of versatile Programmable Input Processor modules are available for your amplifier. They add features that can customize the amplifier for different applications. A standard P.I.P.-FX is included to provide balanced XLR inputs. P.I.P. input connectors are connected in parallel with the input phone jacks (P). Because the P.I.P.-FX has no circuitry, its XLR connectors can be used along with the phone jacks to “daisy chain” a single source. See Section 9.

M. Balanced XLR Inputs

A balanced 3-pin female XLR connector is provided at the input of each channel of the P.I.P.-FX which comes as a standard feature of your amplifier. The P.I.P.-FX places the XLR inputs in parallel with the phone jacks.

Do NOT use the Ch. 2 inputs in either mono mode.


N. Output Jacks

Two pair of versatile 5-way binding posts are provided

for each channel for easy connection of multiple loudspeakers to each output. They accept banana plugs (the preferred connector), bare wire or spade lugs.

O. Stereo-Mono Switch

The three operating modes of this amplifier are controlled by this switch. Stereo mode is used for normal two-channel operation. Bridge-Mono mode is used to drive a mono load with an impedance of 4 ohms or more. Parallel-Mono mode is used to drive a mono load with an impedance less than 4 ohms.

Important: Do NOT change this switch unless the amplifier is first turned off. See Section 3.3. 

P. Balanced Phone Jack Inputs

A balanced 1/4-inch phone jack is provided at the input of each channel. They may be used with balanced (tip, ring and sleeve) or unbalanced (tip and sleeve) input wiring. Because they are parallel to the P.I.P. connector, they should not be used as inputs when certain P.I.P. modules are installed. See Section 3.3.

Do NOT use the Ch. 2 inputs in either mono mode. 

Q. Ground Lift Switch

The input signal ground may be isolated from the AC ground with this switch to help prevent the hum created by unwanted ground loops. It affects only the phone input jacks (P). It has no effect upon the P.I.P. module's XLR input connectors. Activating the switch inserts an impedance between the sleeve of each phone input jack and the circuit ground.

3 Installation

3.1 Mounting

The *Macro Reference* is designed for standard 19 inch (48.3 cm) rack mounting and "stack" mounting without a cabinet. In a rack cabinet it is best to mount them one on top of the other. This provides efficient air flow and enables each unit to support the one above.

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

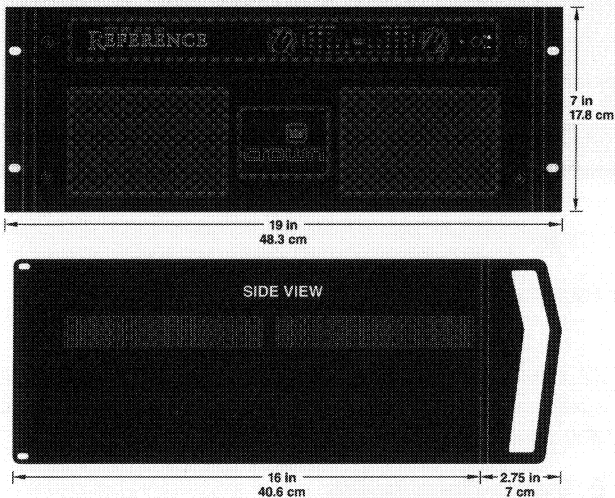


Fig. 3.1 Mounting Dimensions

3.2 Cooling

NEVER block the amplifier's side vents and front air intake. Allow at least 45 cubic feet (1.3 cubic meters) per minute of air flow. All empty spaces in the rack cabinet should be covered with blank panels to prevent improper air flow. The amplifier's air flow should

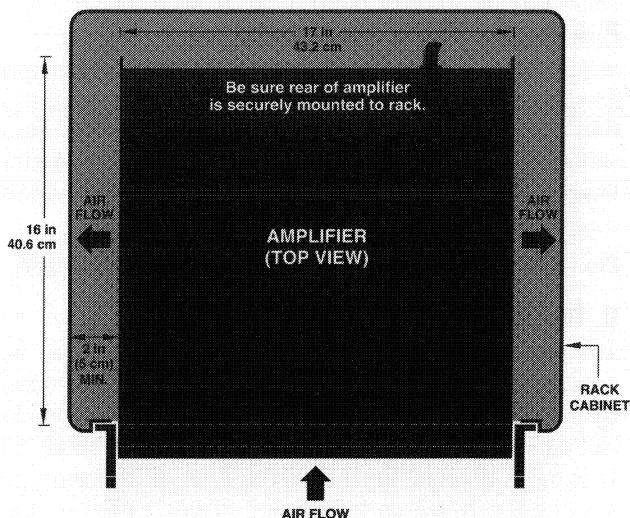


Fig. 3.2 Top View of a Rack-Mounted Unit

be augmented with a rack cooling system if its load is less than 4 ohms and it must operate at consistently high output levels (see Section 8).

When mounting the unit in a rack cabinet, the rack side walls must 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 either with a grille in the door or by pressurizing the air behind the door. Wire grilles are recommended as opposed to 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 is drawn out the back (Option 2 below).

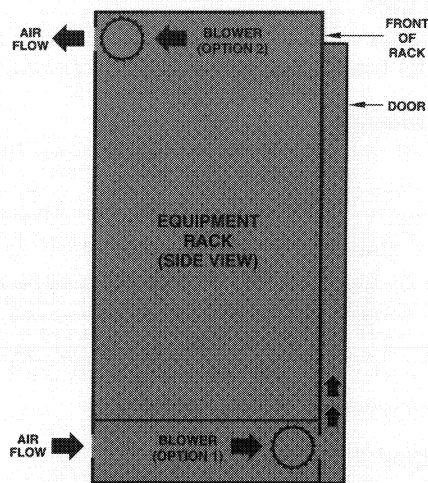


Fig. 3.3 Proper Air Flow in a Rack Cabinet

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 ways to install your amplifier into a sound system. The input and output terminals are located on the rear panel. Please use care in 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: Always 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.

The *Macro Reference* may be operated in one of three modes (Stereo, Bridge-Mono, and Parallel-Mono) by switching the Stereo-Mono switch on the rear panel. There are VERY IMPORTANT wiring differences between these three modes which are discussed next.

3.3.1 Stereo (Two-Channel) Operation

The installation is very intuitive in Stereo mode. The input of Channel 1 feeds the output of the same channel as does the input of Channel 2. To put the amplifier into Stereo mode, first turn the amplifier off, then slide the Stereo-Mono switch to the center position, and properly connect the output wiring as shown in Figure 3.4. Two sets of binding posts are provided for each channel to facilitate easy connection of multiple loudspeaker wires to each channel. Observe correct loudspeaker polarity and be very careful not to short the outputs of one channel to that of the other channel while in Stereo mode.

CAUTION: In Stereo mode never parallel the two outputs by directly tying them together or parallel them with the output of any other amplifier. Such connection does not result in increased power output and can cause premature activation of the protection circuitry to prevent overheating.

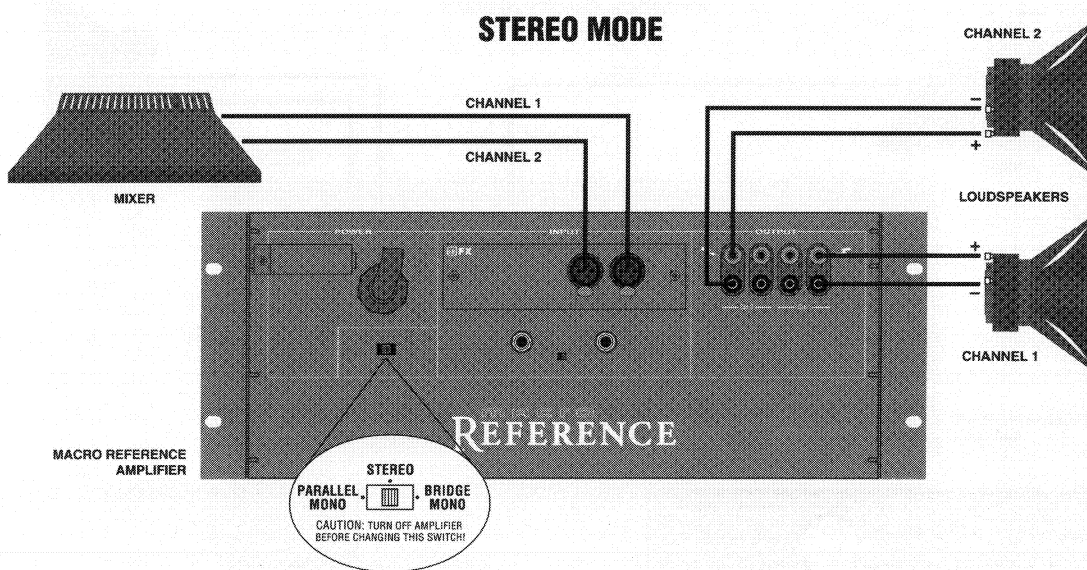


Fig. 3.4 Stereo Wiring

3.3.2 Bridge-Mono Operation


Bridge-Mono mode is intended for driving loads with a net impedance of 4 ohms or greater. (See Parallel-Mono if the load is less than 4 ohms.) Installing the amplifier in Bridge-Mono mode is very different from the other modes and requires special attention.

To put the amplifier in Bridge-Mono mode, turn the amplifier off and slide the Stereo-Mono switch toward the right (as you face the back panel). Both outputs receive the signal from Channel 1 with the output of Channel 2 inverted so it can be bridged with the Channel 1 output. DO NOT USE THE CHANNEL 2 INPUT or the signal level and quality may be greatly degraded. Keep the Level control of Channel 2 turned completely down (counterclockwise).

Note: The input jack and level control of Channel 2 are

not defeated in Bridge-Mono mode. Any signal fed into Channel 2 will work against and add to or distort the signal in Channel 1.

Connect the load across the Channel 1 and 2 red binding posts with the positive lead from the load attaching to a red post of Channel 1 and the negative lead of the load attaching to a red post of Channel 2 as shown in Figure 3.5. THE BLACK BINDING POSTS ARE NOT USED AND SHOULD NOT BE SHORTED. The load must be balanced (neither side shorted to ground).

CAUTION: Be certain all equipment (meters, switches, etc.) connected to the mono output is balanced. To prevent oscillations, both sides of the line must be isolated from the input grounds. 

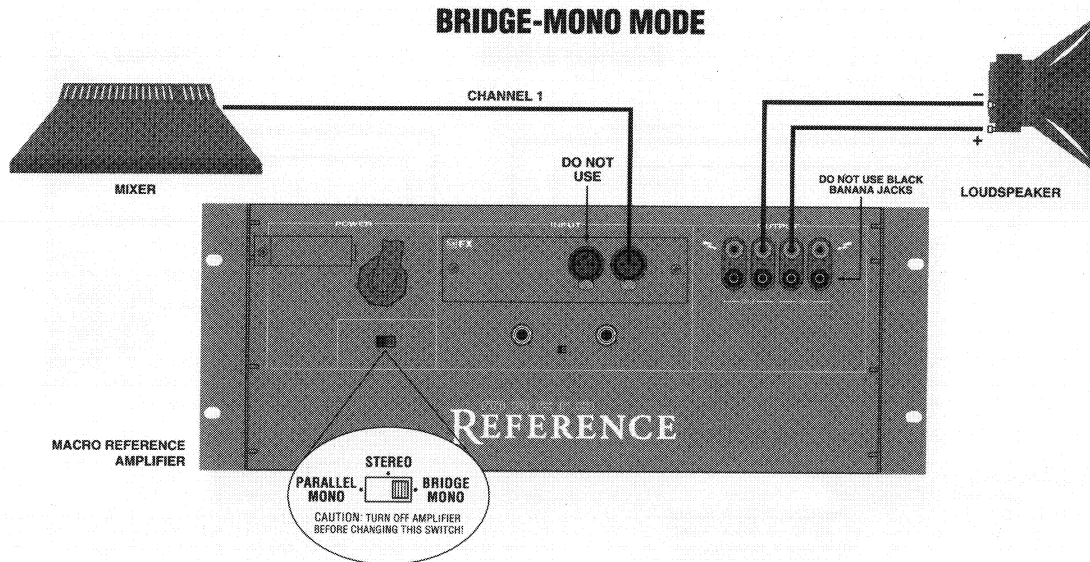


Fig. 3.5 Bridge-Mono Wiring

3.3.3 Parallel-Mono Operation

Parallel-Mono mode is intended for driving loads with a net impedance less than 4 ohms. (See Bridge-Mono if the load is 4 ohms or greater.) Installing the amplifier in Parallel-Mono mode is very different from the other modes and requires special attention.

CAUTION: Do not attempt to operate in Stereo or Bridge-Mono mode until the Parallel-Mono jumper is first removed. Failure to do so will definitely cause inefficient operation, high distortion and excessive heating.

To put the amplifier in Parallel-Mono mode, first turn it off, then slide the Stereo-Mono switch to the left (as you face the back). Connect the input signal to Channel 1 only. DO NOT USE THE CHANNEL 2 INPUT or the signal level and quality may degrade greatly. Keep the level control of Channel 2 turned completely down (full counterclockwise).

Note: It is normal for the IOC indicator of Channel 2 to stay on in Parallel-Mono mode.

The input jack and Level control of Channel 2 are not defeated in Parallel-Mono mode. Any signal fed into Channel 2 will work against and add to or distort the signal in Channel 1.

Install a jumper wire between a red binding post of both Channel 1 and 2 that is at least 14 gauge in size. Then, connect the load to the output of Channel 1 as shown in Figure 3.6. The positive lead from the load connects to a red binding post of Channel 1 and the negative lead from the load connects to a black binding post of Channel 1.

CAUTION: Remove the jumper wire before changing to any mode except Parallel-Mono.

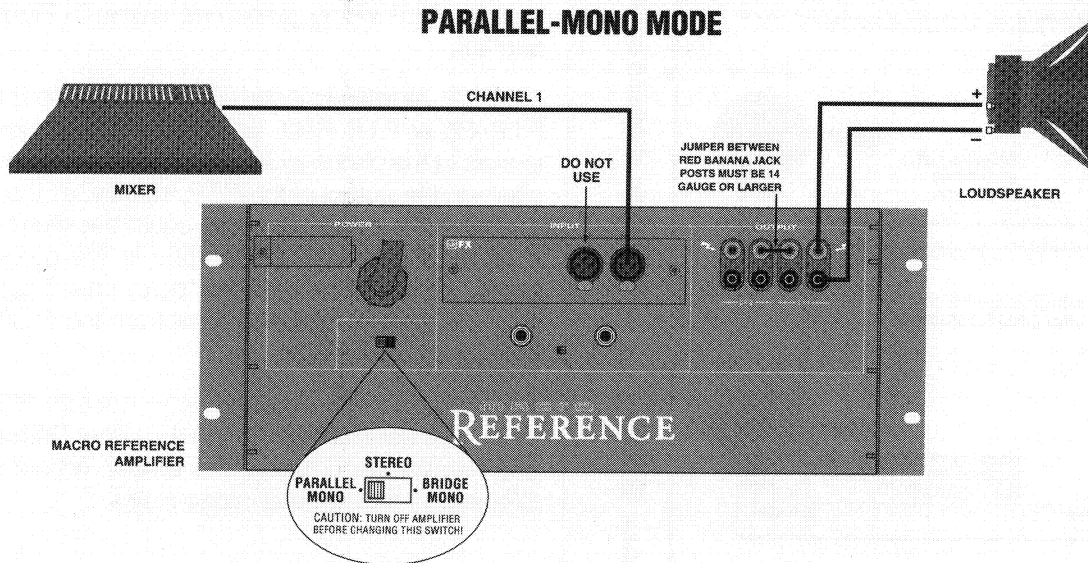


Fig. 3.6 Parallel-Mono Wiring

3.3.4 Input Connection

Both the balanced XLR and phone jack inputs have a nominal impedance of 10 K ohms (5 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 P.I.P. modules are described in Section 9). 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 1/4 inch input phone connectors can be wired similarly for balanced or unbalanced, floating or ground-referenced sources. They have a standard tip-ring-sleeve (TRS) configuration: the tip is

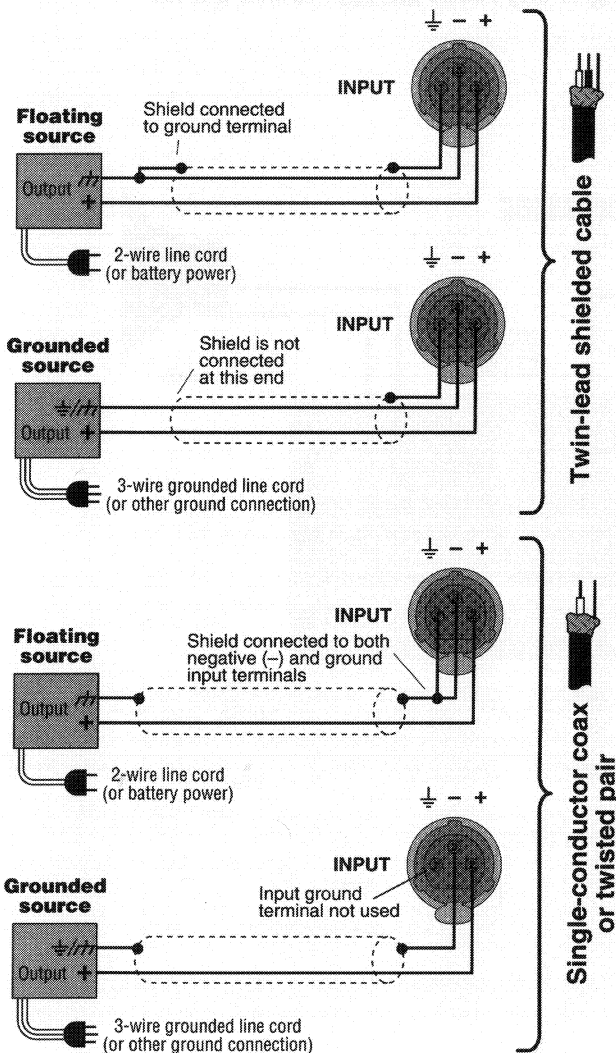


Fig. 3.7 Unbalanced Input Wiring

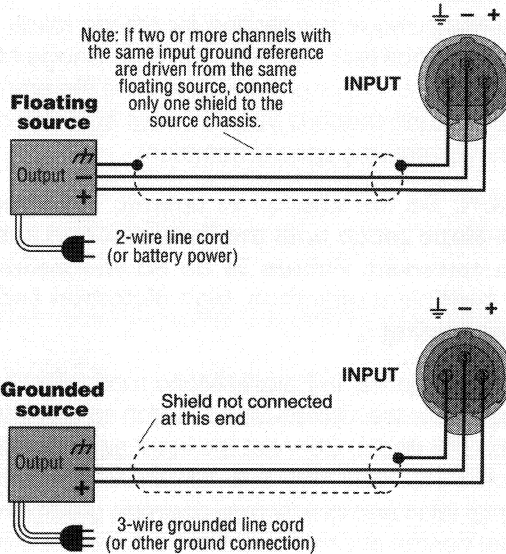


Fig. 3.8 Balanced Input Wiring

positive (+), the ring is negative (-) and the sleeve is ground (see Figure 3.9). Wiring for various sources follows the XLR wiring guidelines shown in Figures 3.7 and 3.8.

If a P.I.P. module is installed other than the P.I.P.-FX, P.I.P.-BB or P.I.P.-FMX, you should not connect input signals to the phone jacks. The phone jacks are in parallel with the output of the P.I.P. module, so the source connected to the phone jacks could backfeed into the P.I.P. and generate a distortion in the output. The phone jacks can be used as "daisy chain" outputs to feed the post-processed signal from the P.I.P. to the input of other amplifiers.

Please follow the instructions in Section 3.3.2 and 3.3.3 if the amplifier will be used in either Bridge-Mono and Parallel-Mono mode. Remember, do not use the Channel 2 input in either mono mode.

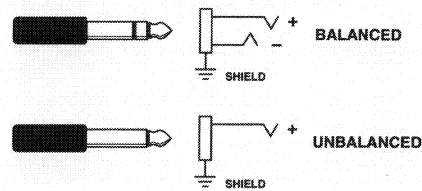


Fig. 3.9 Balanced and Unbalanced Phone Plugs

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 3.10 shows some possible capacitor values and how they affect the frequency response. Use only low-leakage paper, mylar or tantalum capacitors.

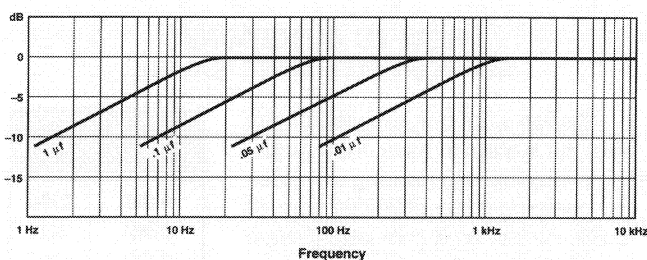
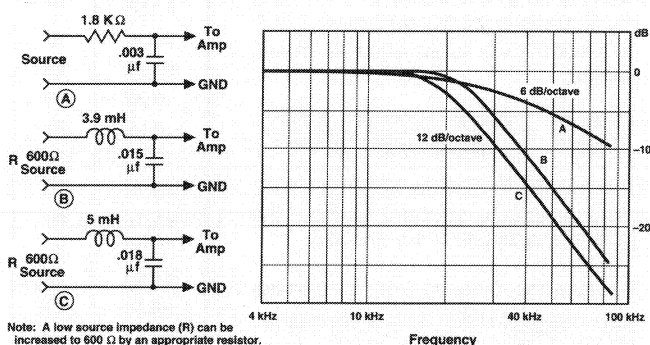


Fig. 3.10 Subsonic Filter Capacitors

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 which 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 are shown below for unbalanced wiring:



Note: A low source impedance (R) can be increased to 600 Ω by an appropriate resistor.

Fig. 3.11 Unbalanced RFI Filters

For balanced input wiring use one of the examples in Figure 3.12. Filters A, B and C correspond to the unbalanced filters above. Filter D also incorporates the subsonic filter described previously.

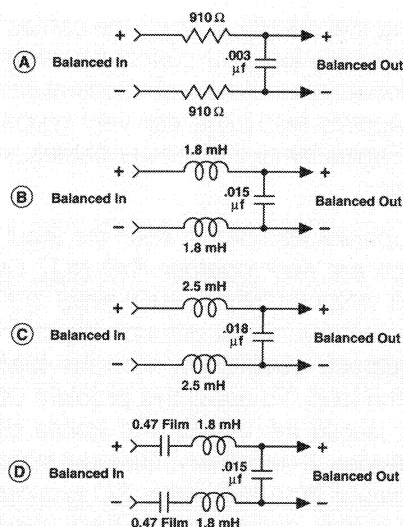


Fig. 3.12 Balanced RFI Filters

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

A third problem to avoid is **ground loops**. These are undesired currents which flow in a grounded system and which usually cause hum in the output. A common source of ground loops is the placement of input cables parallel to power cables or near power transformers. The ground loop occurs when the magnetic field generated by the 60/50 Hz alternating current in the power cables or transformers is induced into the input cables. To prevent this you can lace the input

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 greatly lessens the chance of hum or noise being induced into the input cables.)
4. Turn the entire system off before changing any connections and turn the Level controls all the way down before powering the system back up. Crown is not liable for damage incurred when any transducer or component is overdriven.

cables along their length. (Lacing the cables helps reduce magnetically-induced current by minimizing the cross-sectional area between conductors which could bisect a magnetic field.) It is also very important to locate input cables away from power cables and power transformers.

Ground loops will also occur when the input and output grounds are tied together. **DO NOT CONNECT THE INPUT AND OUTPUT GROUNDS TOGETHER.** Tying the input and output grounds together can also cause **feedback oscillation** from the load current flowing in the loop. To avoid this problem use proper grounding, isolate the inputs, and isolate other common AC devices. If necessary, the input signal ground can be isolated from the mains AC ground with the ground lift switch located on the back panel of your amplifier (see Figure 2.2 and Section 4.4).

3.3.5 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 its being overpowered. The use of loudspeaker protection fuses is highly recommended (see Section 3.3.6). Please also pay close attention to the Operating Precautions in Section 4.1.

Use Good Connectors

1. Male connectors on loudspeaker cables should not be exposed to prevent possible short circuits.
2. Connectors which might accidentally cause the two channels to be tied together when making and breaking connections should not be used. (A common example is the standard 3-wire stereo phone plug.)
3. Connectors which can be plugged into AC power receptacles should never be used.
4. Connectors having low current-carrying capacity should not be used.
5. Connectors having any tendency to short should never be used.

Use loudspeaker cables of sufficient gauge (thickness) for the length 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 speaker cable resistance increases. This is very important because the amplifier's excellent damping factor can be easily negated by using insufficient loudspeaker cables.

Use the following procedure to find the recommended wire gauge (AWG or American Wire Gauge) for your system.

HOW TO DETERMINE APPROPRIATE WIRE GAUGE

1. Decide what damping factor you want the system to have. Your amplifier is capable of providing an excellent damping factor of 20,000 from 10 to 200 Hz into an 8 ohm load (Stereo mode). Typical damping factors are 50 or lower. Higher damping factors yield greater motion control of loudspeakers.
2. Calculate the required source impedance. This is done by dividing the impedance of the loudspeaker by the desired damping factor as shown below:
3. Determine the loudspeaker cable length. **Important:** Keep the length as short as possible.
4. Calculate the maximum allowable wire resistance per 1,000 feet (305 meters) for the cable by dividing the source impedance times 1,000 by twice the cable distance as shown below:

$$\text{Source Impedance} = \frac{\text{Loudspeaker Impedance}}{\text{Damping Factor}}$$

$$\text{Ohms per 1000 ft} = \frac{\text{Source Impedance} \times 1000}{\text{Cable Length (ft)} \times 2}$$

The reason the cable length is multiplied by 2 is to account for both the conductors feeding the speaker.

5. Use the table at right to find the wire gauge (AWG) with a resistance equal or less than the maximum allowable wire resistance calculated above. *Note: The smaller the AWG, the bigger the wire.*

Ohms per 1000 ft	AWG No.
0.059	0000
0.064	000
0.081	00
0.102	0
0.126	1
0.159	2
0.200	3
0.254	4
0.319	5
0.403	6
0.508	7
0.605	8
0.808	9
1.018	10
1.284	11
1.619	12
2.042	13
2.575	14
3.247	15
4.094	16
5.163	17
6.510	18
8.210	19
10.35	20
13.05	21
16.46	22
20.76	23
26.17	24
33.00	25
41.62	26
52.48	27
66.17	28

Fig. 3.13 AWG from Ohms/1000 ft.

Example: Drive an 8 ohm loudspeaker with a damping factor of 1,000. First, calculate the required source impedance as 8 ohms ÷ 1,000 = 0.008 ohms. Since the loudspeaker cable must be 10 feet (3 m) long the