



# **INSTRUCTION MANUAL**

## **POWER LINE THREE STEREO AMPLIFIER**

**CROWN INTERNATIONAL, INC. 1718 W. MISHAWAKA RD. ELKHART, INDIANA 46517**

## **FULL THREE-YEAR WARRANTY**

### **SUMMARY OF WARRANTY**

We, CROWN INTERNATIONAL, INC., 1718 West Mishawaka Road, Elkhart, Indiana 46517 (Warrantor) warrant 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 (warranty period) that the product is free of defects in materials or workmanship and will meet or exceed all advertised specifications for such a product.

### **ITEMS EXCLUDED FROM WARRANTY**

We are not responsible for product failure caused by misuse, accident or neglect. This warranty does not extend to any product on which the serial number has been defaced, altered, or removed. It does not cover damage to speakers or any other products resulting from Crown product failure. It does not cover defects or damage caused by your use of unauthorized modifications, parts, or service. It also excludes batteries and damage caused by leaky or defective batteries.

### **WHAT WE WILL DO**

We will remedy any defect in materials or workmanship 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 component available to Crown 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 Crown factory. We will remedy the defect and ship the product from the service center or Crown factory within a reasonable time after receipt of the defective product at the authorized service center or the Crown factory. All expenses in remedying the defect, including shipping costs in the United States, will be borne by Crown. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other custom's fee 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. We will give you written notice of the dealer service centers to whom you may deliver the product, or we will give you an authorization to return it for factory service. All components must be shipped in a factory pack, which, if needed, may be obtained from Crown 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 service center. If the repairs made by Crown or the authorized service center are not satisfactory, notify Crown or the authorized service center immediately.

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

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN OUR PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. **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 WARRANTY. THE WARRANTY IS NOT EXTENDED BY THE LENGTH OF TIME WHICH YOU ARE DEPRIVED OF THE USE OF THE PRODUCT. REPAIRS AND REPLACEMENT PARTS PROVIDED UNDER THE TERMS OF THIS WARRANTY SHALL CARRY ONLY THE UNEXPIRED PORTION OF THIS WARRANTY.

### **DESIGN CHANGES**

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

### **LEGAL REMEDIES OF PURCHASER**

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

CROWN INTERNATIONAL, INC.  
1718 West Mishawaka Road, Elkhart, Indiana 46517

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

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. It does not cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise, or further information be desired, please contact the Crown International Customer Services Department.

Crown International  
1718 W. Mishawaka Rd.  
Elkhart, Indiana 46517  
Ph: (219) 294-8000

## **WARNING**

**TO PREVENT SHOCK OR FIRE HAZARD DO NOT EXPOSE TO  
RAIN OR MOISTURE!**

## **CAUTION**

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

## **ATTENTION**

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

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## SECTION 1

# GENERAL INFORMATION

### 1.1 Introduction/Purpose of Equipment

The Crown® Power Line Three is a single or dual channel, high output power amplifier. Because of its attractive design and reliable construction, it is an ideal selection for the sincere audio enthusiast. To familiarize yourself with its many features, we recommend studying this manual thoroughly. We also suggest at this time that you pay special attention to the Crown warranty which will help to assure your total satisfaction with the Power Line Three power amplifier (Fig. 1.1).



*Fig. 1.1 Power Line Three Power Amplifier*

### 1.2 Features

The Power Line Three power amplifier has an output capability of 90 watts per channel minimum into an 8 ohm load over a bandwidth of 20Hz-20KHz. This same amplifier when bridged and operating as a single (mono) channel unit, will produce 180 watts minimum into a 16 ohm load. Extremely low harmonic and intermodulation distortion and low noise, add to its high quality characteristics.

An amber "on/off" lamp illuminates when the Power pushbutton is depressed, allowing visual observation of the unit's power status even at long distances.

Other front panel LED's are the Crown IOC™(Input/Output Comparator) and Frequency Analyzing Display. The red, IOC™ lamps not only indicate the operating condition of the unit (clipping, overload, etc.) but also glow when the unit is in the Stand-by mode. Three colored lamps, make up the Frequency

Analyzing Display which attests to the fact that output signal does exist and also shows what frequencies (low, mid or high) make up that signal. This feature is particularly helpful for monitoring the amplifier output during system troubleshooting.

Input Level controls for both channels are detented for exact "resettability" and more accurate control. The detents also provide less chance of accidental movement should they be bumped or jarred.

To help eliminate annoying thumps or pops which can occur upon turn-on, a four second mute/delay circuit is incorporated. As additional aid, protection against accidental DC being fed through the amplifier (and possibly destroying speakers) is provided in the Low Frequency Interrupt circuit.

A thermal circuit automatically places the unit in the Stand-by mode should overheating occur due to insufficient ventilation.

The output transistor circuitry operates in the Crown designed, Multi-Mode™ configuration where at low listening levels, it functions as a Class A circuit, at medium power levels Class A plus B and at high levels, a Class AB+B. At each level, the Crown Multi-Mode™ circuit offers optimum performance and extremely low distortion (see Section 4.2 for further detail). Protection against shorted and low impedance loads is provided with dependable V-I current limiting as well as protection against overloaded power supplies, input overload and high frequency overload blowups.

A front panel output monitor jack is provided not only for headphone use, but also as an additional output source should access be necessary from the front.

Conventional unbalanced pin jacks provide an input signal path to the unit.

The output signal uses standard MDP banana jacks, mounted in a manner to allow simple connection especially for mono signals.

An external Mono /Stereo slide switch provides quick and easy conversion for determining the Power Line

Three's operating configuration as a single or dual channel amplifier.

### 1.3 Service Policies

Due to the sophisticated circuitry of your unit, only qualified, fully trained technicians should be allowed to service it. Please observe the following label on the unit:

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

For service, return the unit to the factory in the original packing or in replacement packing obtainable from the Crown factory. For warranty service, the unit must be returned to the factory or an approved service station (Amcron customers consult your local representative). In either case, fill out and enclose the Service Information form located at the rear of this manual. This will help to ensure a speedy and effective response.

Crown will pay shipping costs (in the U.S.) for warranty service upon receiving copies of all shipping receipts.

Before returning your unit to the factory for service, authorization should be obtained from the Crown Technical Service Department. All shipments should be sent UPS or truck freight (insured). The factory will then return your serviced unit by one of the above methods.

Upon receipt of the warranty registration card from your dealer, Crown will register your unit on our computer warranty file.

Retain your copy of the bill of sale from your Crown dealer. This is your proof of purchase.

When you need service for your unit from an authorized Crown Service Station, simply present your bill of sale. With it, the service station can promptly initiate any needed paperwork. It will save you time and effort.

The bill of sale is also your proof of ownership should you need it for insurance or legal reasons.



## SECTION 2

# SPECIFICATIONS AND PERFORMANCE

### 2.1 General Specifications

**Hum and Noise (20Hz-20KHz):** 112dB below rated output.

**Phase Response:** +0, -15 degrees 10-20KHz at 1 watt.

**Input Impedance:** 30K ohm,  $\pm 20\%$ .

**Amplifier Output Protection:** Short, mismatch, and open circuit proof. Limiting is instantaneous with no flyback pulses, thumps, cutout, etc. No premature limiting transients.

**Overall Protection:** AC line fused. Thermal switch in control logic protects against overheating caused by insufficient ventilation. Controlled slewing rate voltage amplifiers protect overall amplifier against RF burnouts. Input overload protection is furnished by internal resistance at inputs of amp.

**Low Frequency Interrupt:** Interrupts output drive (standby mode) with automatic sampling every four seconds. Activates at DC outputs greater than 10V or low frequency outputs greater than 10V at 2Hz.

**Turn-on:** Four second delay with minimum thumps and no dangerous transients.

**DC Output Offset (shorted input):** 10 millivolts or less, internally adjustable to zero.

**Power Supply:** Massive computer-grade filter capacitors store over 20 joules of energy. Two regulated supplies for complete isolation and stability.

**Power Requirements:** Requires 50-400Hz AC with selectable taps for 100, 120, 200, 220 and 240V  $\pm 10\%$  operation. Draws 30 watts or less on idle, 300 watts at 180 watts total output.

**Heat Sinking:** The entire amplifier is used as a heat sink along with integral fins.

**Chassis:** All aluminum construction for maximum heat conduction and minimum weight.

**Controls:** Pushbutton on/off power switch. Independent Input Level controls. Rear panel Stereo/Mono slide switch.

**Display:** Three pair of LED's form a Frequency Analyzing Display. A pair of red LED's indicate the action of the IOC™ circuitry. An amber LED is used as a Power indicator.

**Connectors:** AC Line - two wire male connector. Input - standard pin jacks, unbalanced. Output - color coded dual binding posts on 3/4 inch centers. Output Monitor - 1/4" stereo phone jack.

**Dimensions:** 19 inch (48.3cm) standard rack mount, 5.25 inches (13.3cm) high, 10.125 inches (25.7cm) deep from mounting surface of front panel.

**Weight:** Approximately 25 pounds (11.34kg) net weight.

**Finish:** Two finishes are available: black polyester vinyl coated aluminum front panel (shown in this manual) or a brushed and satinized aluminum front panel.

### 2.2 Stereo Specifications

**Output Power:** 90 watts per channel minimum RMS (both channels operating) into an 8 ohm load over a bandwidth of 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.05% of the fundamental output voltage. 140 watts per channel minimum RMS (both channels operating) into a 4 ohm load over a bandwidth of 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage.

**Frequency Response:**  $\pm 0.1$ dB 10-20KHz at 1 watt into 8 ohms; +0dB, -1.5dB 10Hz-100KHz.

**1KHz Power:** 90 watts RMS into 8 ohms, per channel, both channels operating, 0.1% total harmonic distortion.

**Harmonic Distortion:** Less than 0.001% from 20Hz-800Hz, and increasing linearly to .025% at 20KHz at 90 watts RMS per channel into 8 ohms.

**I.M. Distortion (60Hz-7KHz 4:1):** Less than 0.05% from 0.01 watts to 0.25 watts and less than 0.01% from 0.25 watts to 90 watts into 8 ohms, per channel.

**Slewing Rate:** 12 volts per microsecond (slewing rate is the maximum value of the first derivative of the output signal, or the maximum slope of the output signal).

**Damping Factor:** Greater than 400, DC-400Hz into 8 ohms.

**Output Impedance:** Less than 15 milliohms in series with less than 3 microhenries.

**Load Impedance:** Rated for 4 and 8 ohm usage; safely drives any load including completely reactive loads.

**Voltage Gain:** 20.6  $\pm 2\%$  or 26.3  $\pm 2$ dB at maximum gain.

**Input Sensitivity:** 1.30 volts  $\pm 2\%$  for 90 watts into 8 ohms.

**Output Signal:** Unbalanced, dual channel

## 2.3 Monaural Specifications

**Output Power:** 180 watts minimum RMS into a 16 ohm load over a bandwidth of 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.05% of the fundamental output voltage. 280 watts minimum RMS into an 8 ohm load over a bandwidth of 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage.

**Frequency Response:**  $\pm 0.15$ dB, 10-20KHz at 1 watt into 16 ohms; +0dB, 01dB 10-60KHz

**1KHz Power:** 180 watts RMS into 16 ohms; 0.1% total harmonic distortion.

**Harmonic Distortion:** Less than 0.001% from 20Hz-800Hz and increasing linearly to .025% at 20KHz at 180 watts into 16 ohms.

**I.M. Distortion (60Hz-7KHz 4:1):** Less than 0.05% from 0.01 watts to 0.25 watts and less than 0.01% from 0.25 watts to 180 watts into 16 ohms, per channel.

**Slewing Rate:** 24 volts per microsecond.

**Damping Factor:** Greater than 400, DC-400Hz into 16 ohms.

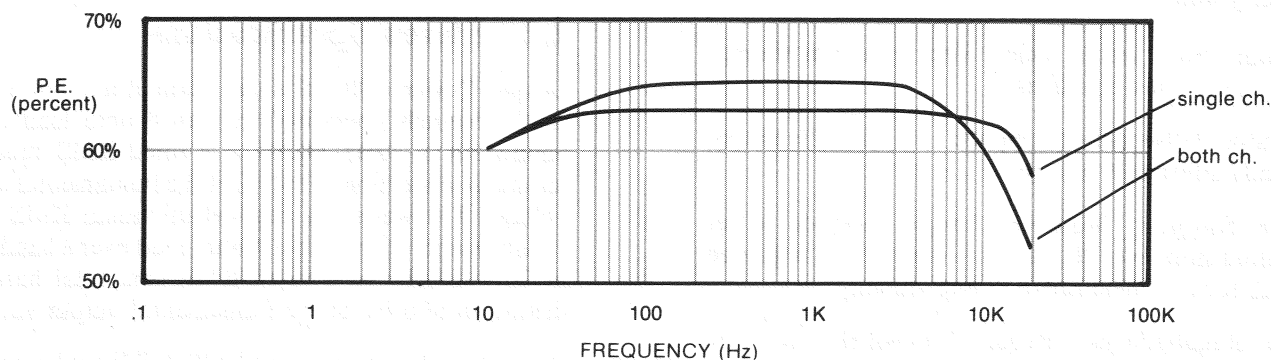
**Output Impedance:** Less than 30 milliohms in series with less than 6 microhenries.

**Load Impedance:** Rated for 8 and 16 ohm usage; safely drives any load including completely reactive loads.

**Voltage Gain:** 41.2  $\pm 2\%$  or 32.3  $\pm 0.2$ dB at maximum gain.

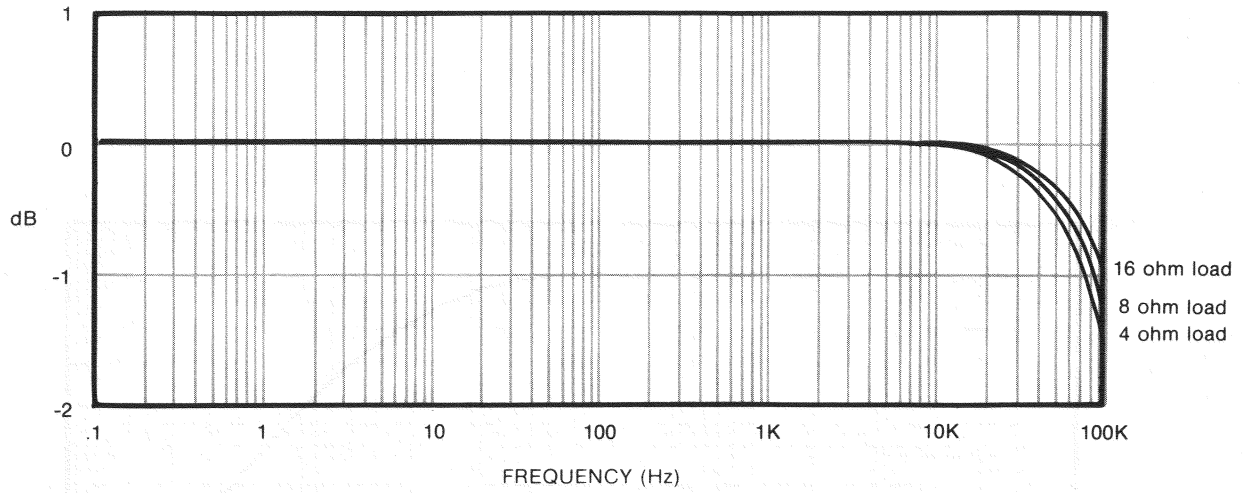
**Input Sensitivity:** 1.30 volts for 180 watts into 16 ohms.

**Output Signal:** Balanced, single channel.

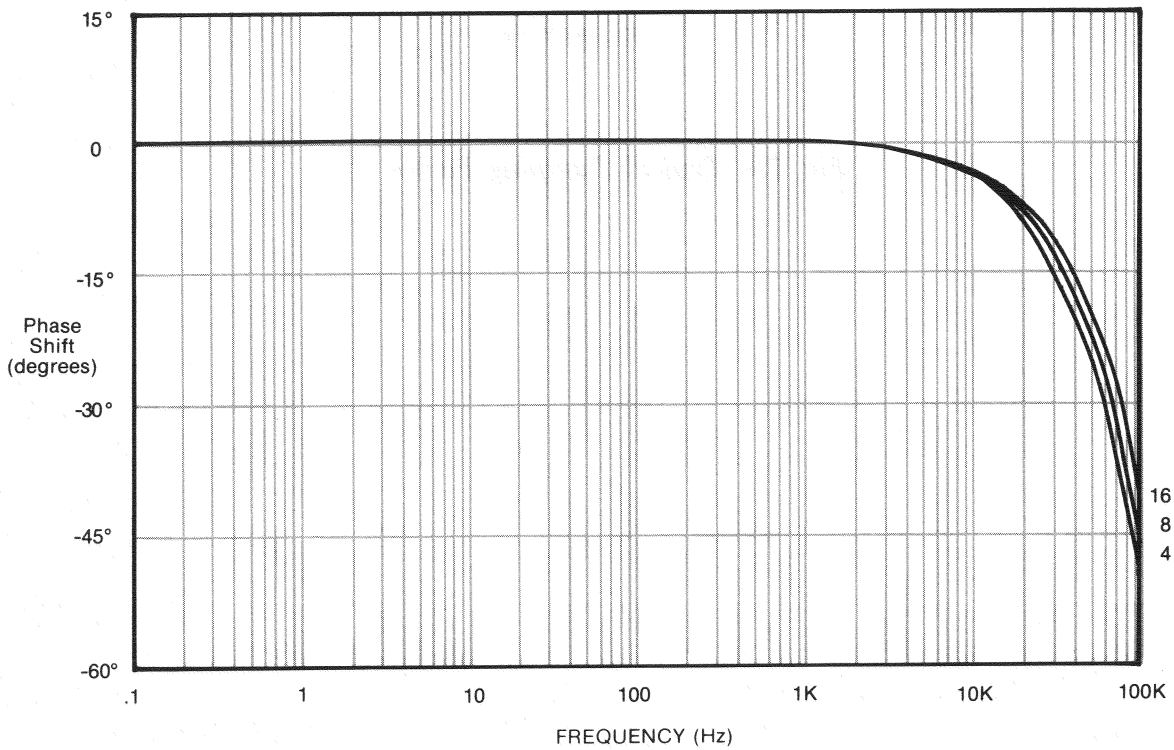


**BOTH CHANNELS DRIVEN TO MAXIMUM UNDISTORTED LEVEL**  
**120 VAC LINE IN**  
**8 OHM LOAD**

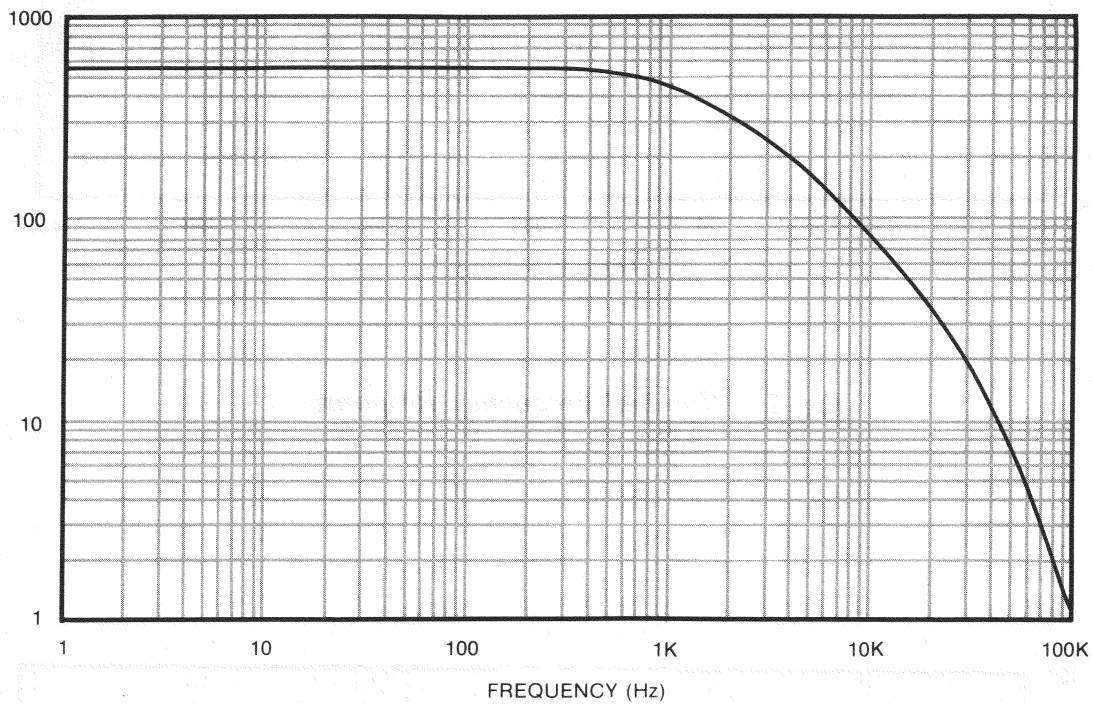
*Fig. 2.1 Nominal Power Efficiency*



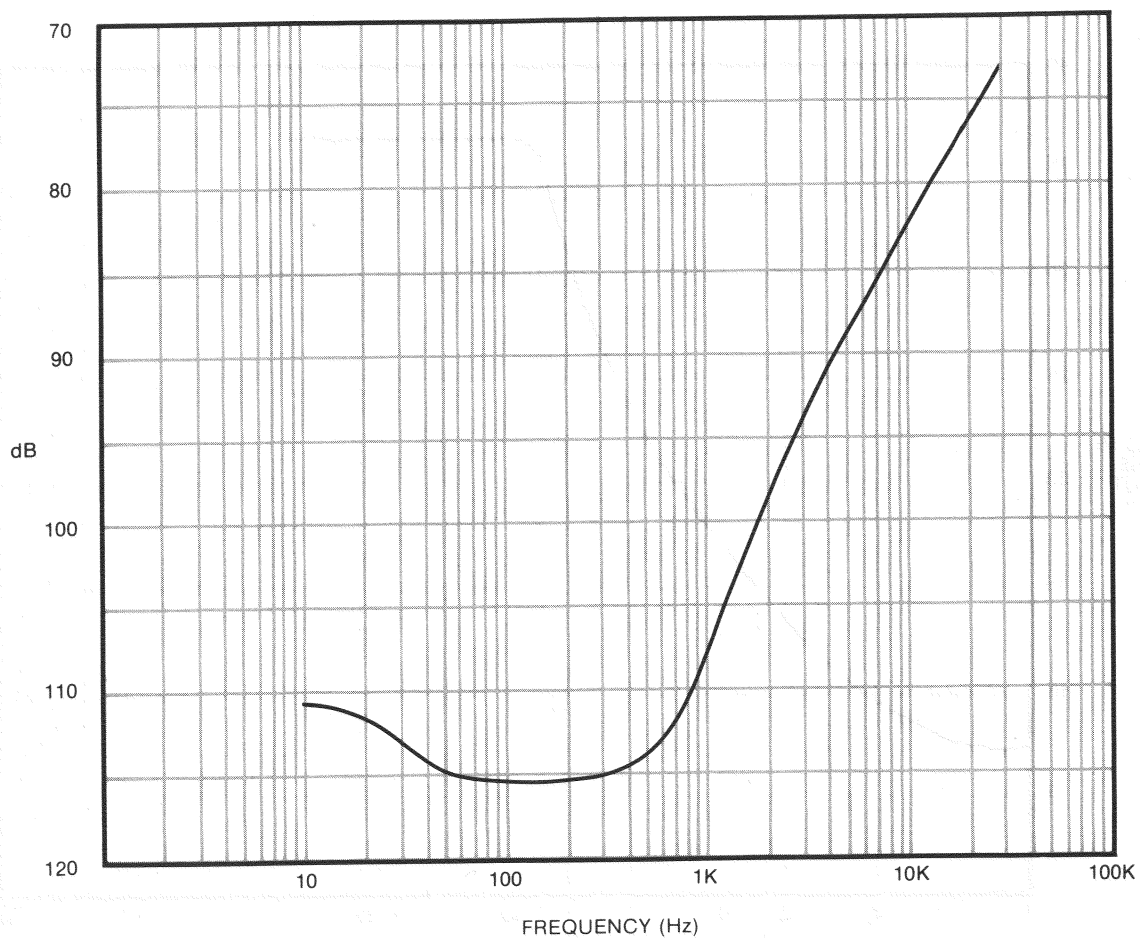
*Fig. 2.2 Nominal Frequency Response*



*Fig. 2.3 Nominal Phase Response*



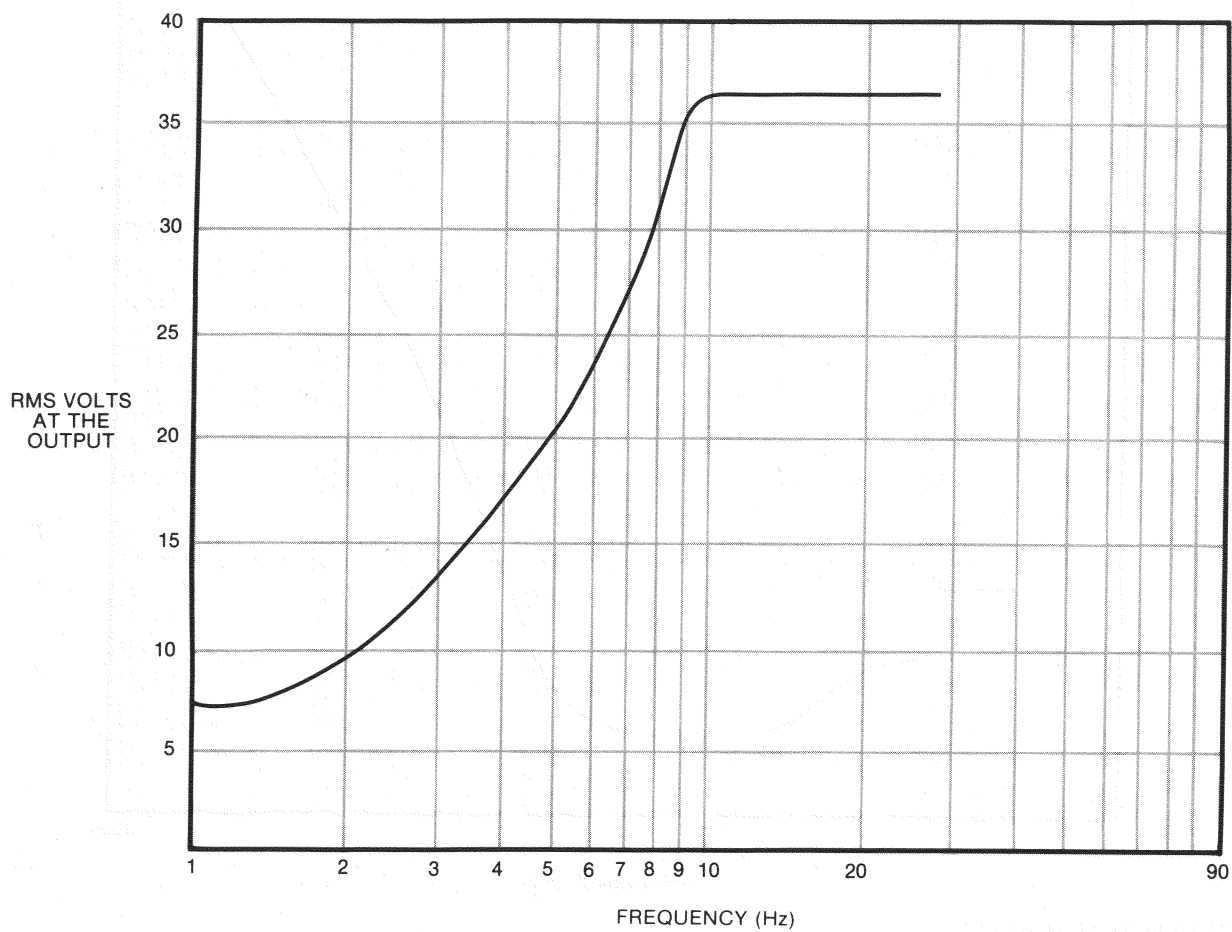
***Fig. 2.4 Typical Damping Factor***



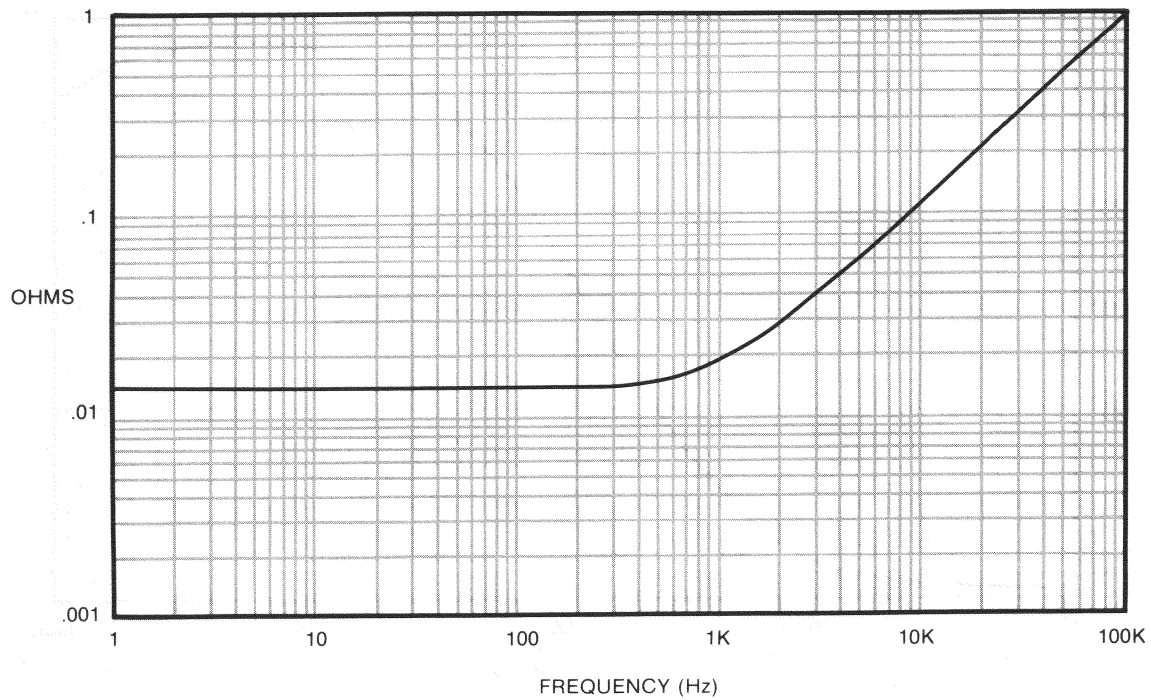
**ONE CHANNEL DRIVEN AT 90 WATTS**

**1K OHM TERMINATOR USED ON NON-DRIVEN INPUT**

*Fig. 2.5 Typical Crosstalk*

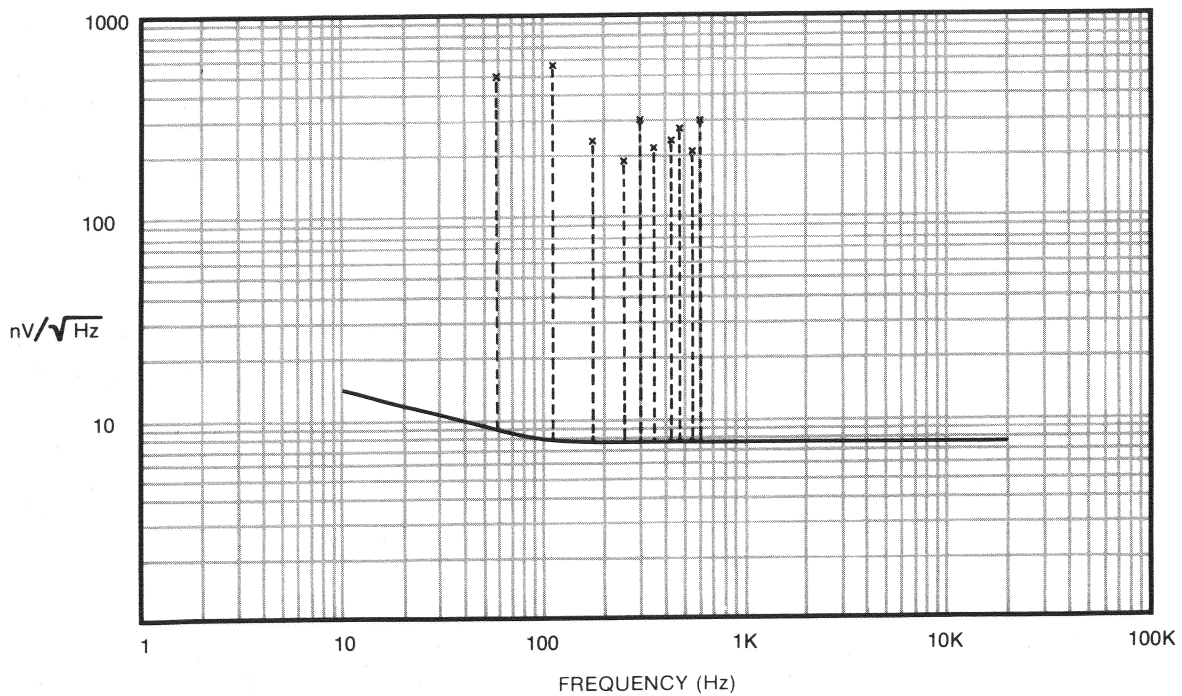


*Fig. 2.6 Low Frequency Interrupt Action*



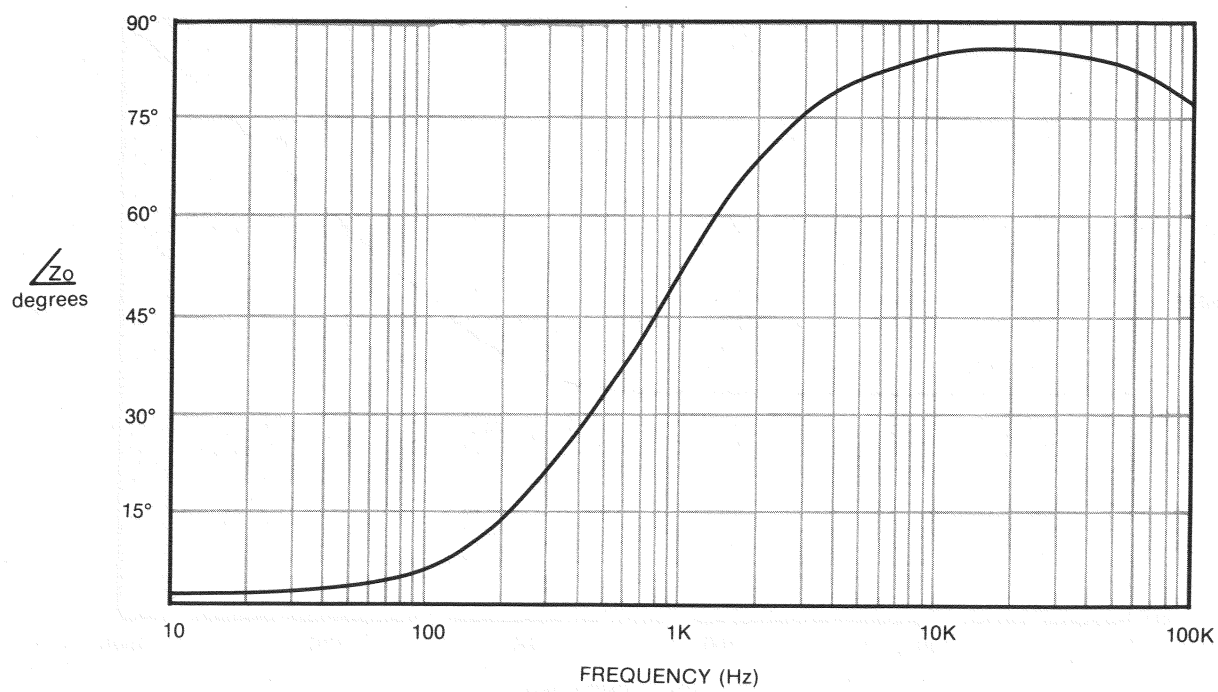
#12 WIRES INSTALLED FROM OUTPUT BOARD TO BINDING TERMINALS  
MEASUREMENTS TAKEN AT OUTSIDE OF BINDING POSTS

*Fig. 2.7 Typical Output Impedance*



LINE FREQUENCY HARMONICS PLOTTED TO THE TENTH  
OUTPUT IS INDICATED BY (X) ON EXTENDED DOTTED LINES

*Fig. 2.8 Nominal Noise Spectrum*



**Fig. 2.9 Nominal Output Phase Angle**



## SECTION 3

# INSTALLATION AND OPERATION

### 3.1 Unpacking

As soon as the unit is received, please inspect for any damage incurred in transit. Since the unit was carefully inspected and tested at the factory, it left unmarred. If damage is found, notify the transportation company immediately. Only the consignee may institute a claim with the carrier for damage during shipment. However, Crown will cooperate fully in such an event. Be sure to save the carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, as most do, it is advantageous to save the packing materials. They will prove valuable in preventing damage should there ever be occasion to transport or ship the unit. Note the carton and internal pack - each is designed for protection during transit. **DO NOT SHIP THE UNIT WITHOUT THIS FACTORY PACK!**

Be sure to return the warranty registration yourself or through your dealer within ten days to receive your Care Card.

### 3.2 Accessories Supplied

The Power Line Three comes complete with an Instruction Manual and:

- 4 mounting screws
- 4 nylon washers
- 2 fuses
- 2 fuse holders
- 2 banana plugs
- 2 wire nuts
- 2 6' pin-pin cables

### 3.3 Mounting

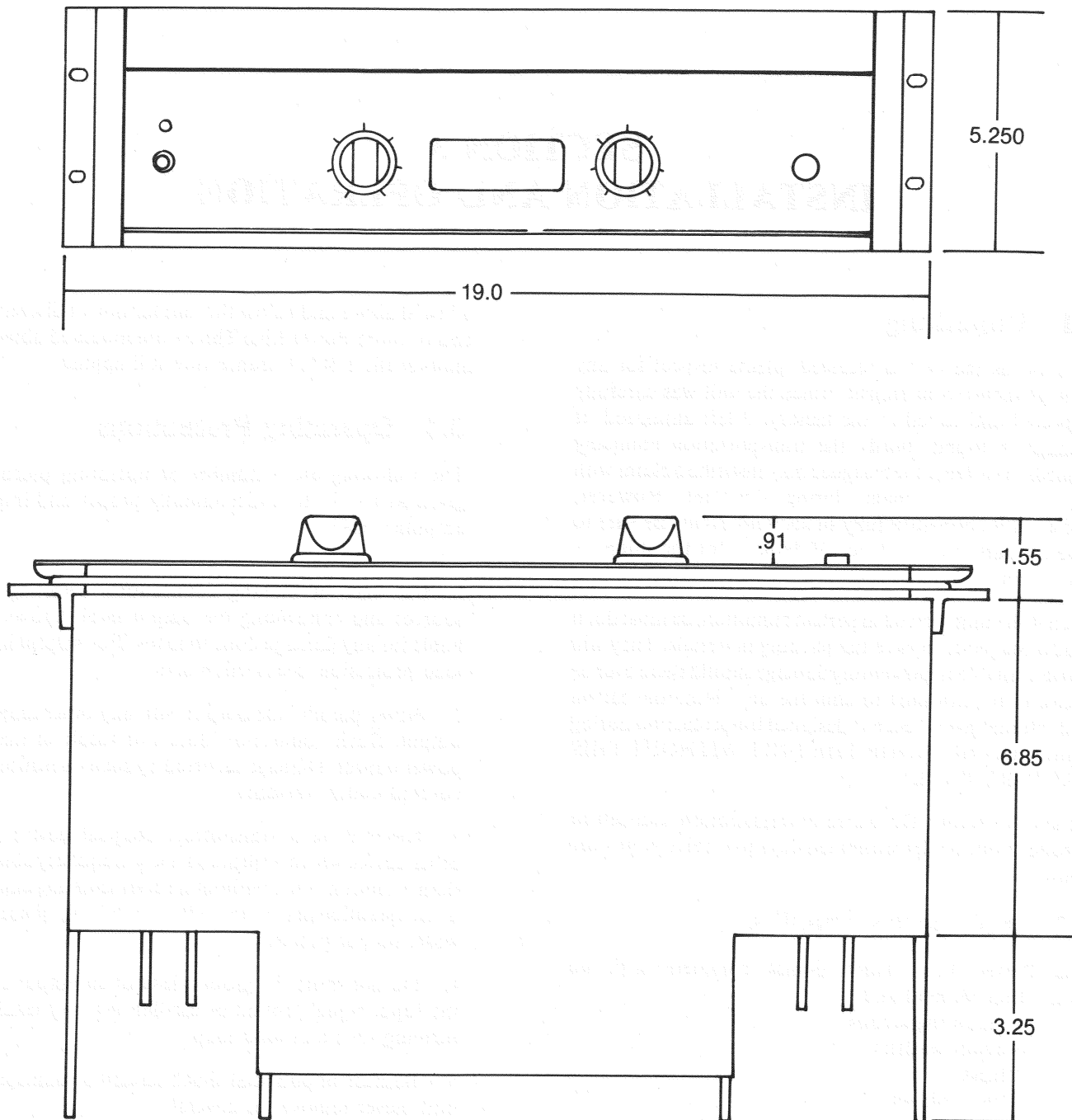
The Power Line Three may be mounted in either a Crown walnut cabinet (other hardwoods available upon request) or a customized cabinet of your own design. In each case, standard 19" width spacing should be utilized as shown in Fig. 3.1. Sufficient ventilation should be provided for the unit in order to avoid premature activation of the Stand-by mode. Ideally, a rack clearance of 1 3/4" should be

allowed above and below the unit for hot air discharge. If two or more Power Line Three's are mounted above one another the 1 3/4" clearance rule still applies.

### 3.4 Operating Precautions

The following are a number of operating precautions given as an aid to understanding proper and improper amplifier usage.

1. Use care in making connections, selecting signal sources and controlling the output level. Crown is not liable for any damage done to loads. For helpful hints on load protection, see Section 3.10.
2. Never parallel the output with any other amplifier's output. Such connection does not result in increased power output. Damage incurred by such operation is not covered under warranty.
3. Never drive a transformer coupled device or any other device which appears as a low frequency short (less than 3 ohms at DC) without a series isolating capacitor. Such operation may damage the device and/or needlessly waste output power.
4. Do not short the ground lead of an output cable to the input signal ground as oscillations may result from forming such a ground loop.
5. Because of potential shock hazard or damage to the unit, never remove the covers!
6. Operate the amplifier from AC mains of not more than 10% above or below the selected line voltage and only 50-400Hz. Failing to comply with these frequency limits will also invalidate the warranty.
7. Never connect the output to a power supply output, battery, or power mains. Damage caused by such hook-up is not covered by the warranty.
8. Tampering in the circuitry by unqualified personnel or the making of unauthorized circuit modifications, invalidates the warranty.



**Fig. 3.1 Power Line Three Mounting Dimensions**

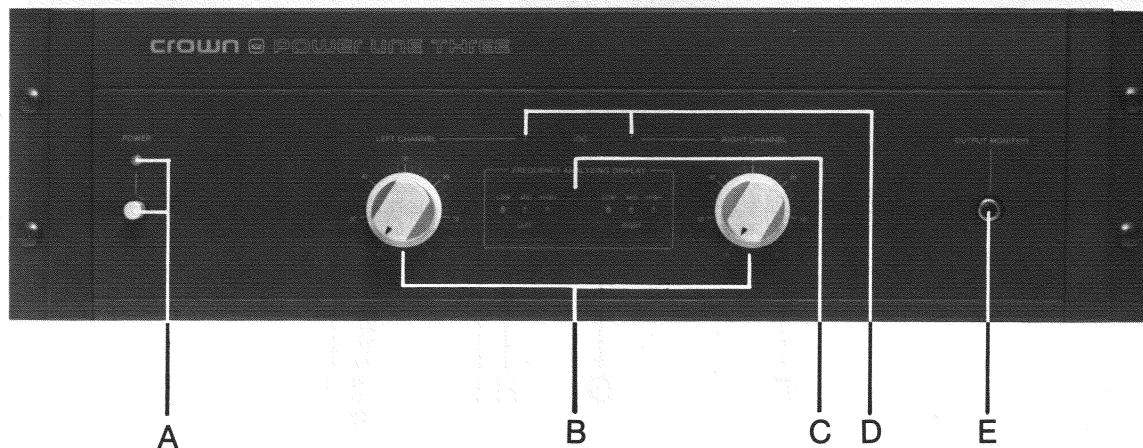


Fig. 3.2 Power Line Three Front Panel

### 3.5 Controls and Adjustments

The following paragraphs refer to the front and rear panel diagrams (Fig. 3.2 and Fig. 3.3).

#### A. Power Switch/Indicator

This pushbutton when depressed, will activate the Power Line Three and also cause the amber indicator to glow if all proper power requirements are being met. Also, upon turn-on the IOC™ indicators will illuminate for approximately four seconds while the unit is in the Stand-by mode (turn-on mute delay).

#### B. Input Level Controls

Both Input Level Controls are detented with thirty-one positions. This provides more accurate control of the input signal as well as the ability to adjust the input level to a previously desired setting with identical results. The detents are also helpful in preventing movement of the controls should they be accidentally bumped or jarred.

#### C. Frequency Analyzing Display

Three LED's (yellow, green and orange) make up the Frequency Analyzing Display of the Power Line Three. Besides general monitoring of the output signal, it provides a convenient method of observing whether or not a signal has been interrupted somewhere from the system's input to output. In addition, it can be used to check the over-all spectral balance of the system, music, amplifier, speakers or room. Each of the three lights represent a frequency range; orange = high, green = mid and yellow = low. During normal audio passages, all

three indicators should be lit or flash occasionally with respect to the frequency range of the musical information. In other words, if a flute is being amplified, one would expect the orange light to flash as compared to a bass guitar which would illuminate the yellow indicator.

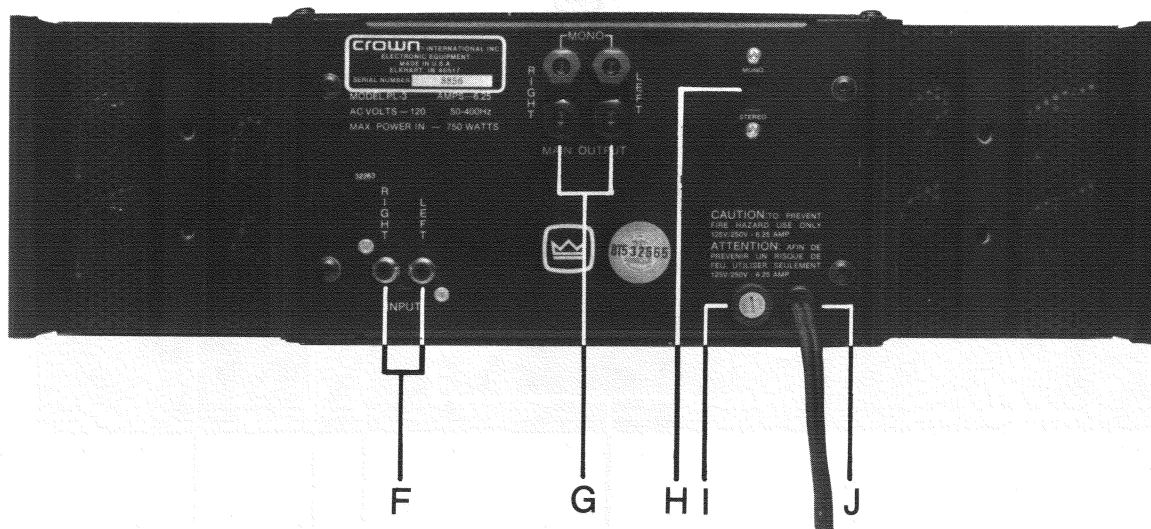
#### D. IOC Indicators

IOC™ (Input Output Comparator) indicators are red in color and stand alone above the Signal Presence Indicators. IOC™ is a Crown designed and developed circuit which helps the user identify any problems the unit may be experiencing such as excessive input signal, improper load impedance or even an amplifier based problem. Occasional flashing with music programs peaks is normal however, continuous illumination indicates a problem and should be investigated. **Note:** IOC™ indicators also double as Stand-by indicators and will glow at any time this feature is active (turn-on delay, Low Frequency Interrupt and temperature overload.).

#### E. Output Monitor

This jack provides access to the stereo output signal with a front panel, standard 1/4" phone jack. As with the main output, its level is controlled by the Input Level Controls.

**Caution:** When inserting a headphone set into this jack, always first rotate the Input Level controls fully counterclockwise. This helps eliminate the possibility of large volume levels damaging the headset or harming delicate ear tissues.



*Fig. 3.3 Power Line Three Rear Panel*

Also note that the monitor output jack signal and the main output are connected in parallel and can produce a high power signal simultaneously. If monitor output is desired without main output, it will be necessary to disconnect the main speaker outputs. Impedance mismatches should also be watched closely in order not to go below the recommended 4 ohm stereo load impedance rating by "ganging" several speakers/headphones together in parallel. Headphones with an 8 ohm or higher impedance rating are recommended (see Section 3.7 for hook-up details).

#### **F. Input Phone Jacks**

Conventional input signal hook-up is supplied with unbalanced, pin jacks.

#### **G. Main Output Jacks**

The Power Line Three main output jacks are of the standard MDP banana type. These jacks are mounted in such a manner to allow easy mono connection with only one MDP dual banana plug rather than two (see Section 3.8).

#### **H. Mono/Stereo Switch**

This rear panel slide switch determines whether the unit is to perform as a single (mono) or dual (stereo) channel amplifier. Section 3.9 shows all necessary connections that must be made for mono use.

#### **I. Fuse**

Fuse replacement should not normally be necessary unless AC mains conversion is needed (see Section 3.11) or the fuse has blown due to excessive voltage applied to the unit.

#### **J. AC Line Cord**

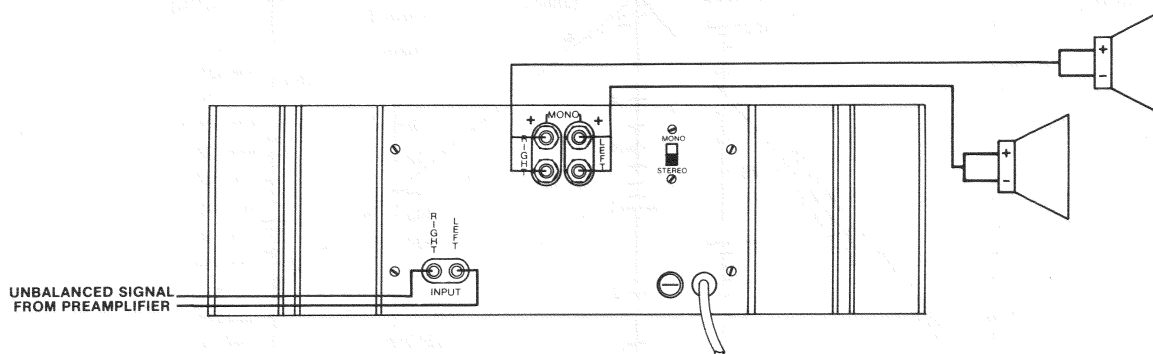
The Power Line Three is furnished with a two-wire, heavy duty plug as standard equipment. Instructions for connecting power are located in the following section.

### **3.6 Connecting Power**

The Power Line Three is furnished with a standard two-wire AC plug. The reason for this is that sound systems tend to function audibly better when the individual components are tied together only through their input and output cable ground rather than with both the AC ground and signal cable ground. This method reduces the chances for multiple ground paths or loops.

**Note:** Crown assumes no liability whatsoever for operation of ungrounded auxiliary equipment, nor for the violation of UL or electrical codes.

The Power Line Three may be connected for any of five AC operating voltages: 100, 120, 200, 220 and 240 VAC. Converting from one to another is a fairly complex operation and should be attempted by a competent technician only. See your Crown dealer should alteration become necessary.



*Fig. 3.4 Typical Stereo Hookup*

### 3.7 Connecting Input/Output Lines

All input and output connections (except monitor) are made from the rear panel of the Power Line Three. Figure 3.4 is a hook-up diagram that may be followed for most conventional stereo systems.

It is always wise to remove power from the unit and turn the Input Level Controls fully counterclockwise while making connections, especially if the load is a speaker. This will eliminate any chance of loud blasts. **Crown is not liable for damage incurred to any transducer due to its being overpowered!**

When connecting input lines, use the standard pin jacks.

Connecting the inputs will require observance of three basic precautions: undesirable signals to the inputs, ground loops, and feedback from the output(s) to input(s).

For loudspeaker-driving applications, the input should be free of large sub-sonic or undesired low frequencies, as they could cause unnecessary activation of the Low Frequency Interrupt circuitry. A simple visual test for DC on the inputs is to slowly turn up the Input Level control with the amp turned on, and then watch for displacement of the loudspeaker cone. If very much movement is observed or if the unit's Low Frequency Interrupt circuitry activates and causes the unit to go into the stand-by mode (IOC lit), the DC content may be excessive and may require the use of an input blocking

capacitor. Only a low leakage type paper, mylar or tantalum capacitor should be used for this purpose.

A second precaution is "ground-loops" - electronic jargon for undesirable circulating circuits flowing in a grounding system. A common form of loop (possibly resulting in hum at the output) is a pair of input cables whose area is subjected to a magnetic field. In practice, both cables should be tied together along their length, and away from power cords. Tying the input and output grounds together may also form a ground loop.

A third precaution is feedback oscillation from AC power lines. Proper grounding and isolation of inputs of common AC line devices is a good practice.

Output connectors should be of such a type to reliably handle the unit's output signal. One type of output connector is available for use on the Power Line Three: MDP banana type jacks. Since banana plugs are used, care should be taken so that the connector is kept "snug fitting" as frequent plugging and unplugging will loosen the connector.

The gauge and length of speaker cable is directly proportional to the resistance; as the wire diameter decreases (higher gauge number) and/or the length increases, the resistance rises. Because an increase in cable resistance effectively increases the source impedance of the amplifier (as seen by the speaker), the cable affects the damping factor (see Glossary of Terms). Figure 3.5 is a nomograph which illustrates the relationship between load impedance, damping factor, wire gauge and length.

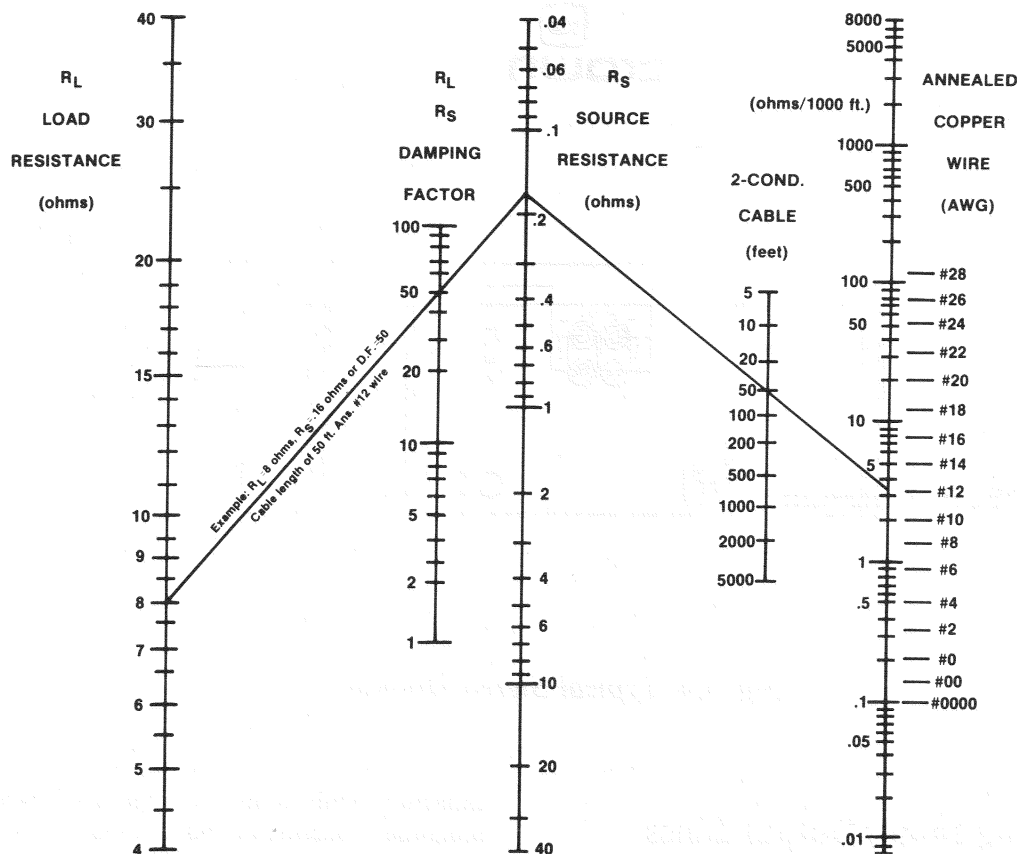


Fig. 3.5 Source Resistance and Damping Factor vs. Length and Size of Output Leads

As can be seen from the example in Fig. 3.5, a 50 ft. length of #12 AWG annealed copper wire (two conductor) yields a combined amplifier/cable source impedance of 0.16 ohms. Given a typical 8 ohm load impedance, this results in an effective damping factor of 50 (not the rated 400, DC-400Hz that would be obtained were there zero ohms cable resistance). From this example it can be seen that larger diameter (lower wire gauge number) wire, should be used for longer cables.

For dynamic moving-coil loudspeakers (as most are), the value of  $R_L$  should be preferably that measured by an ohmmeter across the voice coil (speaker terminals) rather than the manufacturers rating. For electrostatic speakers and such, the manufacturers rated impedance should be used for  $R_L$ .

Output cables should always be carefully laced together so that large magnetic fields are not formed, resulting from current carrying loops. Such fields often will couple with the input signal path and result in undesired feedback and oscillations. Of course the output cables should never be routed with the input cables for the same reason.

Amplifier input and output grounds should never be joined externally to the unit. Such a connection is almost always a form of regenerative feedback and results in system oscillations. High frequency coupling between output signals and input grounds and signals is frequently difficult to eliminate. A common cause of this problem is capacitive coupling through the AC mains where the output and input signals are attached to AC powered devices. In some situations the only solution may be to low pass filter the input to the amplifier.

Under normal stereo conditions, a load impedance of no lower than four ohms total across each channel of the Power Line Three, should be used. This means it will be necessary to exercise caution when connecting more than one transducer to an output terminal. Remember, two 8 ohm speakers in parallel produce a total impedance of 4 ohms and two 4 ohm speakers in parallel produce a total of 2 ohms. On the other hand, two 8 ohm speakers in series, produce a total impedance of 16 ohms and so forth. Headphones, when connected to the front panel jack contribute to the over-all load impedance as well.

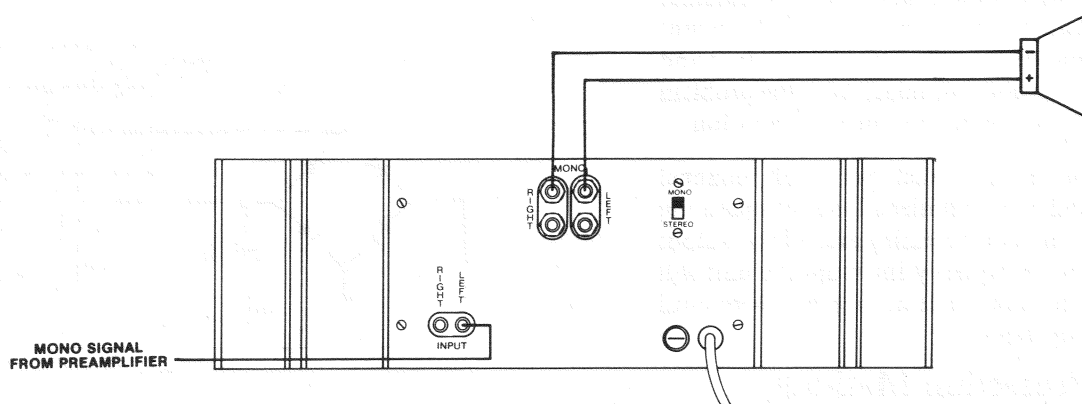


Fig. 3.6 Typical Mono Hookup

### 3.8 Mono Operation

To change the Power Line Three from stereo to mono mode, simply move the rear panel slide switch to the Mono position. No internal modifications are necessary, however a special wiring scheme (see Fig. 3.6) should be followed.

The input circuitry of the Power Line Three is altered in the mono mode so that the two amplifiers are added for mono output. This means that only the left channel Input and Level control, should be used.

**Note:** The right channel input jacks and Level control are not defeated in the Mono mode. However, the right channel input should not be used in this mode. If a right channel input is added to the left channel input, distortion may result. If right channel is used alone, a very low power output will occur. For best results, unplug the input to right channel when operating in the mono and turn its front panel Input Level control fully CCW.

The output signal from the Power Line Three in Mono is balanced and is isolated from the chassis and from the input grounds. MDP banana jacks are to be used as the output connector, but with only one dual-pin banana output connected to the red (+) or "hot" terminals.

- **Caution:** Be certain that all equipment (meters, switches, etc.) connected to the mono output lines is balanced. Both sides of the line must be totally isolated from the input grounds to the Power Line Three. If this is not observed, severe oscillation may result.

Total speaker impedance should not be lower than 8 ohms in the mono mode. Should the load impedance go below 8 ohms (possibly by paralleling several speakers together), it is possible to unnecessarily activate the thermal protection circuitry to the point of needless activation of the Stand-by circuitry.

### 3.9 Protection Mechanisms

Crown power amplifiers are widely known for their quality construction, high reliability and extensive internal protection circuitry. The Power Line Three is no exception. It provides protection against all forms of load mis-matching, overloaded or Low Frequency Interrupt signal information being fed to the input, excessive temperature and overloaded power supplies.

Should a speaker connected to the output of the unit ever become open, shorted or mismatched (too low impedance rating), protection will be provided by a fast-acting limiter circuit which instantaneously limits the output power to a maximum safe stress value. The

audible effects of this circuit resembles that of crossover notch distortion (muffled snapping sound). Speaker systems which are truly four ohms or greater (stereo mode) will not activate this protection circuit.

DC applied to the input should never cause accidental speaker damage because of the Low Frequency Interrupt circuit which automatically senses DC at the output and places the unit into the stand-by mode. After the problem is removed, the unit will return to normal operation.

Thermal protection is provided for each channel independently should the amplifier's internal operating temperature exceed the safe operating area of the output devices. Like the Low Frequency Interrupt the unit will go into the Stand-by mode, but will remain there until excess heat has dissipated.

### 3.10 Load Protection Methods

The most common of all load protection methods is a fuse in series with the load. The fuse may be single, fusing the overall system, or (in the case of multi-element speaker systems), may be multiple with one fuse for each speaker. Fuses help prevent damage due to prolonged overload, but provide essentially no protection against damage that may be done by large transients. To minimize the problem, high speed instrumentation fuses such as Little fuse 36100 series are recommended. For a nomograph showing fuse size vs. loudspeaker ratings, refer to Fig. 3.7.

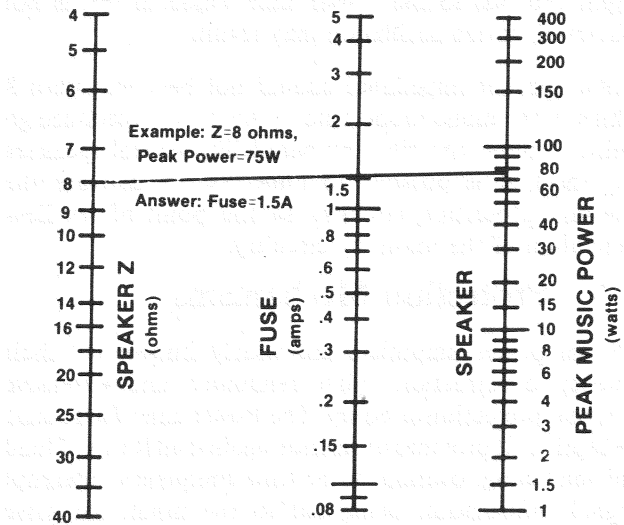


Fig. 3.7 Fuse Selector Nomograph for Loudspeaker Protection

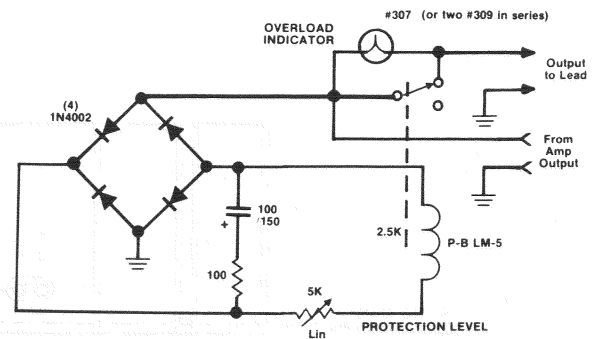


Fig. 3.8 Relay Controlled Protector with Overload Indicator

Another form of load protection is shown schematically in Fig. 3.8. This circuit may be assembled with parts available from your local electronics shop. Whenever the load is overdriven a relay switches a lamp in series with the load, smoothly relieving the overload. The lamp then doubles as an overdrive indicator as it glows. If overdrive is unreasonably severe, the lamp will serve as a fuse. By adjusting the relay tension and the protection level control, this system is useful from 25 to 200 watts for a typical 8 ohm load.



## SECTION 4

# TECHNICAL INFORMATION

### 4.1 General Information

This section provides moderately technical information for those interested in the electrical operation of the Power Line Three. It is **not** service information and should therefore not be used as such. Always refer servicing to the Crown factory or a qualified Crown Service Center.

### 4.2 Block Diagram Explanation

Refer to the block diagram, Fig. 4.1. The diagram does not show all circuit connections or feedback loops due to circuit complexity, but there is sufficient data to grasp the function of each circuit. Note also that only the left channel is shown for simplicity.

An input signal is fed to the initial Main Amplifier stage via standard unbalanced pin jacks. At this stage, the maximum gain of the amplifier is established. However, it is possible to vary the input signal level with the variable potentiometer, preceeding the Main Amplifier. The main operational amplifier used in this circuit provides ultra-low noise specifications, particularly for audio use. The input bias compensation stage, directly related to the Main stage, helps control a DC drift that may occur with a unique temperature-controlled circuit.

At the output of the Main Amplifier, is the IOC™ circuitry which works in conjunction with the error correcting signal of the main op amp. Any time a small "non-linearity" exists in the amplifier, an error signal appears at the output of the main op amp (via the feedback loop of the unit). This produces an abnormally high value, exceeding the "window" of the IOC™ and illuminating the LED. Since transient overload can happen rapidly, a pulse stretching circuit is added so the eye can detect the LED lighting.

A pair of gated switches follow next in line and provide a method of controlling the signal path through the unit. When a signal is obtained from the Control stage, these switches allow the signal to pass through the unit uninterrupted. However should the Delay, Thermal or

Low Frequency Interrupt circuits become activated, the control stage will cause the switches to open, blocking the signal to the output stages.

The Signal Translator stage combined with the push-pull Last Voltage Amplifier, form a voltage amplifier stage of the Power Line Three. Virtually no voltage amplification is performed beyond these stages.

Current amplification circuitry (otherwise known as the Crown \*Multi-Mode™ circuit) consists of basically three stages: the Predriver, the Driver and the Output transistor stage. With low level signals, the Multi-Mode™ circuit has been designed to function as a Class A circuit, with the drivers always biased on. This provides the optimum low distortion for which the Class A circuit is famous, but reserves its use only for the low-level situations for which it is optimum. When the signal asks the output to move into middle power ranges, the Multi-Mode circuit immediately changes state to a "Class A plus B" mode in which the drivers continue to operate in Class A and are always on; but the output devices move smoothly into a Class B operation to provide the additional power needed to boost the output signal to the desired level.

Finally, at highest levels, the first and second stage drivers go into an AB mode, with divided responsibilities for positive and negative portions of the signal, with the third-stage output devices operating in Class B to develop the desired power.

At each level, the Crown Multi-Mode™ circuit thus offers optimum performance in terms of extremely low distortion (whether measured in music-type signals or with more traditional test signals) and in terms of circuit efficiency.

Connected next is the protection circuitry which is activated when a predetermined amount of voltage and/or current is drawn across the output stage sense resistors. This protection signal is then in turn fed back to the limiting circuit which limits any increase in the bias servo voltage to the power devices. Feedback paths are indicated as such.

\*For additional information on the Multi-Mode™ circuit request "A Crown White Paper, Theory and Operation of the Crown Multi-Mode™"

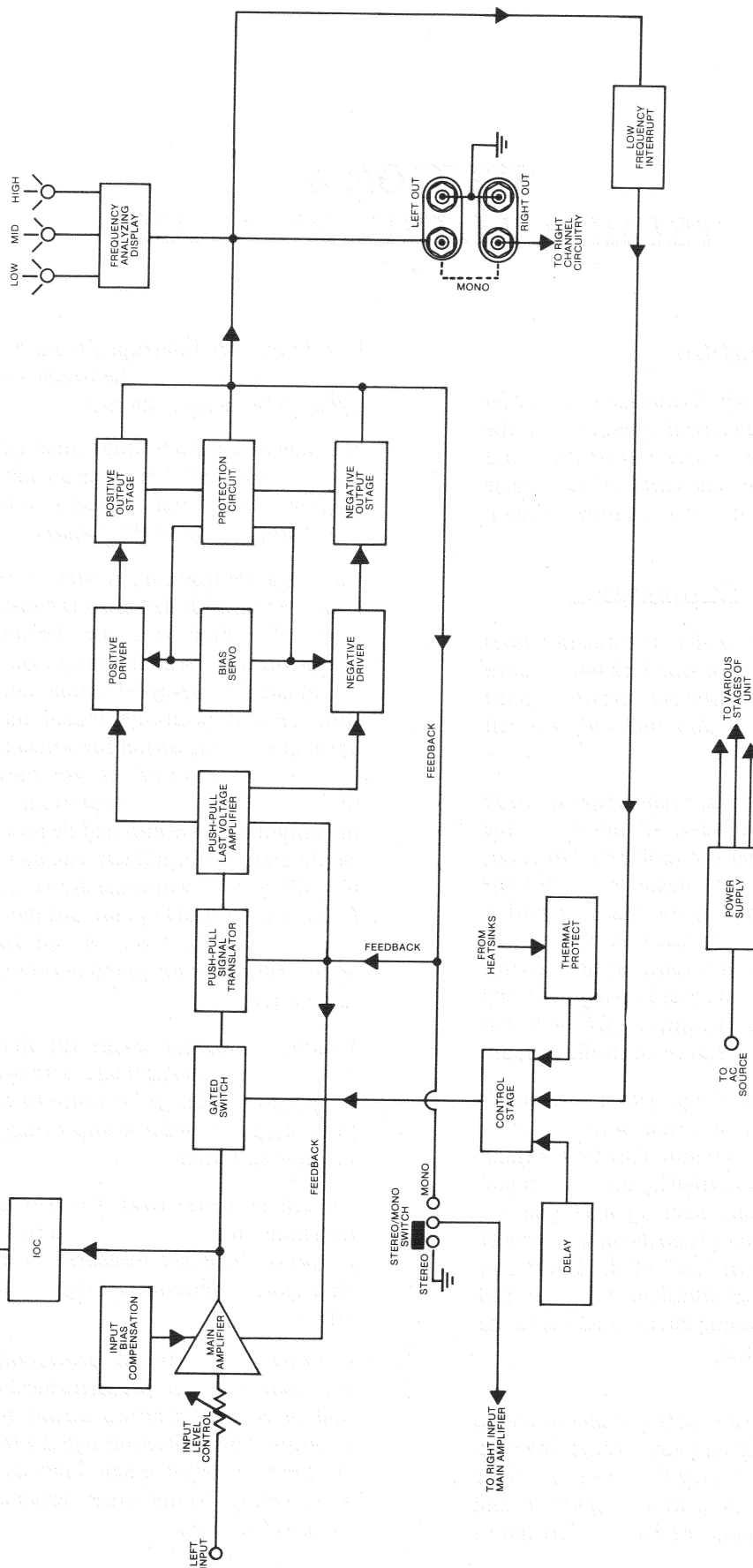


Fig. 4.1 Power Line Three Block Diagram



Before the signal reaches its final output destination, it confronts the Frequency Analyzing Display circuitry. At any time an output signal of .25V RMS volt or more is monitored at this point, all or several (depending on the frequency range of the output signal information) of the LED's will light. Also at this point, a portion of the channel 1 output is sent to the Stereo/Mono switch where it will feed the input of the channel 2 Main amplifier when in the Mono mode.

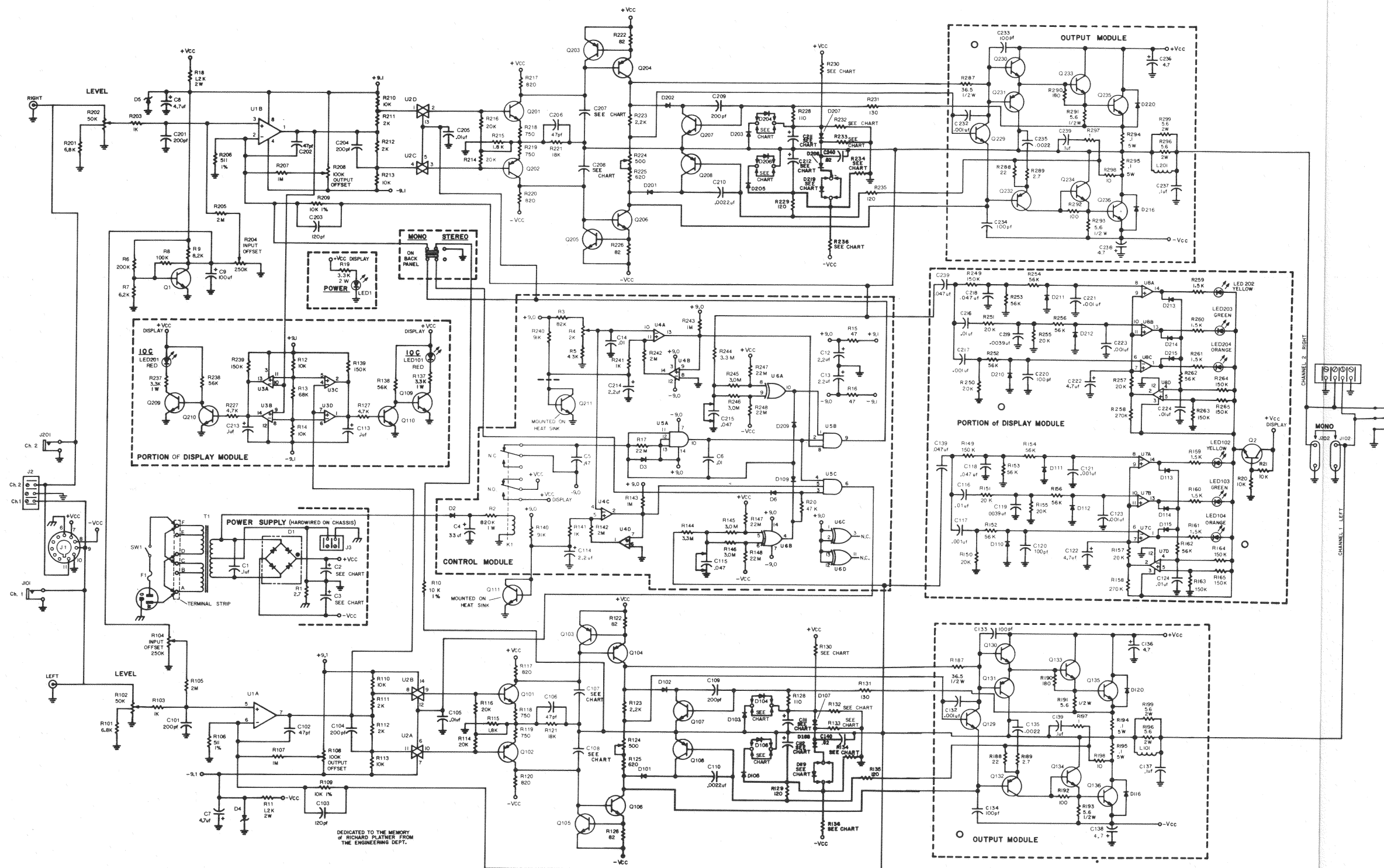
Output jack configuration on the rear panel of the Power Line Three are MDP or banana jacks. Only the positive terminals are used when the amplifier is in the bridged or Mono mode.

The power supply is a continuous-duty type. The main DC supplies are full-wave capacitor input type with heavy duty chassis heatsinked diodes. The main amplifiers, thermal protect and other supplementary circuitry, are powered by zener regulated power supplies. The temperature compensated bias current source, along with the biasing of the push-pull Signal Translator Stage, is from well regulated zener supplies. The results: no distortion or noise due to mis-biasing from line voltage variations.









#### PL THREE SCHEMATIC NOTES

- CIRCUIT SHOWN APPLIES TO UNITS WITH SN7034 AND ABOVE.
- ALL RESISTORS ARE IN OHMS, ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE DESIGNATED.
- ALL RESISTORS ARE .25 WATT, 5% TOLERANCE UNLESS OTHERWISE DESIGNATED.
- COMPONENTS COMMON TO BOTH CHANNELS ARE NUMBERED FROM 1 TO 99.

- LEFT CHANNEL COMPONENTS ARE NUMBERED FROM 100 TO 199.
- RIGHT CHANNEL COMPONENTS ARE NUMBERED FROM 200 TO 299.
- MONO/STEREO SWITCH SHOWN IN THE MONO POSITION.
- +VCC IS 46 VOLTS.

#### Component Value Chart

|            | PS-200/PL-3        | PS-400/PL-4    |
|------------|--------------------|----------------|
| C107, C207 | 62pF               | 27pF           |
| C108, C208 | 62pF               | 27pF           |
| C110, C210 | .002mF             | .01mF          |
| C111, C211 | 10mF               | 22mF; 50V      |
| C112, C212 | 10mF               | 22mF; 50V      |
| C114, C214 | .02mF; 50V         | Open           |
| R11, R18   | 1.2K ohm; 2W; 10%  | 2K ohm; 2W; 5% |
| R128, R228 | 110 ohm; .5W       | 120 ohm; .5W   |
| R130, R230 | 24K ohm            | Open           |
| R131, R231 | 130 ohm; .5W       | 120 ohm; .5W   |
| R132, R232 | Open               | 17.4K ohm; 1%  |
| R133, R233 | 5.1K ohm; 1W       | 4.7K ohm; 1W   |
| R134, R234 | Open               | 17.4K ohm; 1%  |
| R136, R236 | 22.1K ohm; .5W; 1% | Open           |
| D101, D201 | D2961              | IN270          |
| D104, D204 | Jumper             | IN4148         |
| D106, D206 | Jumper             | IN4148         |
| D119, D219 | IN4148             | Jumper         |
| Q104, Q204 | A93                | 2923           |
| Q106, Q206 | A43                | D40P3          |