

# Film-Tech

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**BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP  
PLEASE READ THE SECTION ON UNPACKING AND INSPECTION**



**UREI  
ELECTRONIC  
PRODUCTS**

**model 5235  
ELECTRONIC FREQUENCY  
DIVIDING NETWORK**

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## Table of Contents

Section 1	Introduction.....	1
1.1	Preface.....	1
1.2	Unpacking and Inspection.....	1
Section 2	Installation.....	2
2.1	Installation of Standard Crossover Frequency Modules.....	2
2.2	Programming the Internal High-Pass Filters.....	3
2.3	Signal Connections.....	5
2.3.1	Barrier Strip.....	5
2.3.2	XL Connectors.....	5
2.3.3	Input Connections.....	5
2.3.4	Output Connections.....	6
2.3.5	Using Floating or Balanced Cables for Longer Runs.....	6
2.3.6	Impedance and Termination for 600 Ohm Lines.....	8
2.4	AC Power Connection & Line Voltage Conversion.....	8
2.5	Grounding.....	9
2.6	Mounting.....	10
2.7	Security Cover.....	10
Section 3	Setup & Operation.....	11
3.1	General Applications.....	11
3.2	Typical Systems Employing the 5235.....	11
3.3	Protection of Compression Drivers.....	12
3.4	A Safety Procedure for Initial Powering Up of the System.....	14
3.5	Level Control Adjustment.....	15
3.5.1	Subjective Adjustment of Bi-amplified Systems.....	16
3.5.2	Subjective Adjustment of Tri-amplified Systems.....	16
3.6	System Phasing & Signal Polarity.....	17
3.6.1	Objective Method of Polarity Determination.....	17
3.6.2	Subjective Method of Polarity Determination.....	18
3.7	Selecting the Low Frequency High-Pass Filter Options.....	19
3.7.1	Suggestions for JBL Professional Series Products.....	20
3.8	Blank Crossover Card Assembly.....	20
Section Four	Maintenance.....	25
4.1	General.....	25
4.2	Repairs and Warranty.....	25
Section 5	Specifications.....	26

**Section 1 INTRODUCTION**

**1.1 Preface**

Thank you for purchasing this JBL/UREI product. We have prepared this instruction manual to enable you to achieve optimum utility and performance from your new Frequency Dividing Network. We encourage you to read and to make use of the material contained in this manual. We welcome your suggestions and comments on our products and on this manual.

This manual is dedicated to all the people who are interested in learning about the capabilities and limitations of our products in order to best use them. Learn, Enjoy and Share.

**1.2 Unpacking and Inspection**

Your new JBL/UREI Frequency Dividing Network was carefully packed at the factory, and the container was designed to protect the unit during shipment. Nevertheless, we recommend careful examination of the shipping carton and its contents for any sign of physical damage which may have occurred in transit.

If damage is evident, do not destroy any of the packing material or the carton, and immediately notify the carrier of a possible claim for damage. Damage claims must be made by you.

The shipping carton should contain:

The JBL/UREI Model 5235 Frequency Dividing Network

This Instruction Manual

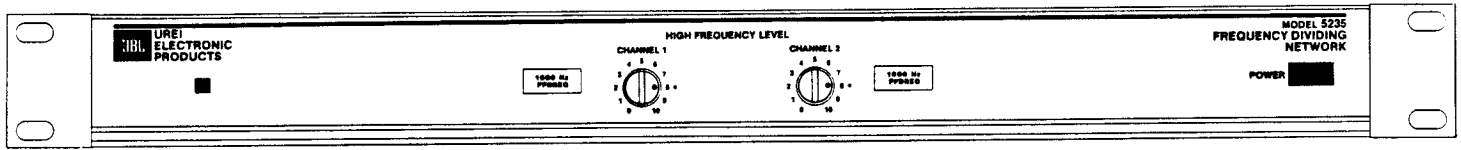
An envelope containing Rack Mounting Hardware

In a separate package you will receive ( if ordered ) one or more plug-in crossover cards.

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Note: In this manual, unless otherwise specified, 0 dBu is equivalent to 0.775 volts and 0 dBm is one milliwatt in a circuit with a load impedance of 600 ohms.

Section 2 INSTALLATION



HIGH FREQUENCY LEVEL CONTROLS SHOWN AT UNITY GAIN SETTING.

Figure 1 - The Front Panel

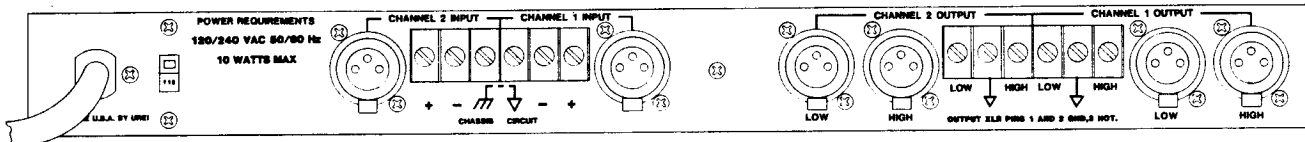


Figure 2 - The Rear Panel

**WARNING:** In many cases, installation of the 5235 Electronic Frequency Dividing Network involves opening the cover to gain access to internal circuit modules and programming switches. Since dangerous AC voltages may exist inside the unit, caution must be exercised. These instructions are intended for use by qualified personnel only.

2.1 Installation of Standard Crossover Frequency Modules

The dividing network requires the installation of a pair of crossover modules (cards) before operating. Before opening the inside of the 5235 make sure it is NOT plugged into the AC power mains.

1. Place the 5235 upside down on a soft surface, remove four slotted hex head screws, and lift the bottom cover from the chassis.
2. Align the three holes in each crossover card with the corresponding mounting pins on the main printed circuit board (refer to Figure 3). The components on the card should face toward the chassis, with the frequency designation label toward the front panel.
3. As each card is gently pressed against the mounting pin stops (roughly 6 mm, 1/4 in), electrical connection will be made between the card connector and the pins on the printed circuit board.
4. Unless LF filter shape and frequency programming are to be reset (refer to next topic in this manual), replace the bottom cover, observing the proper orientation. The cover will not seat properly in the chassis if rotated 180°. Secure the cover with the four screws. The unit is now ready for mounting and connection of the various inputs and outputs.

Note: Powered cards connect to all nine pins. All others use the first six pins only.

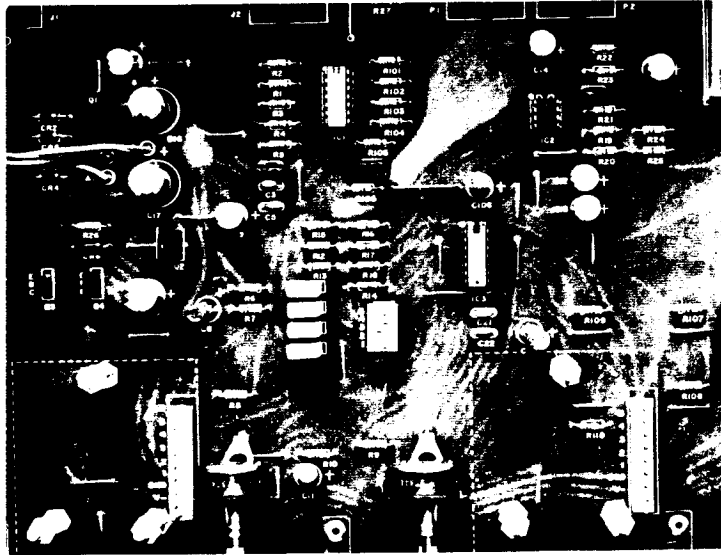


Figure 3 - Crossover Card Location

## 2.2 Programming the Internal High-Pass Filters

Inside the 5235, each channel is equipped with a miniature bank of five On-Off slide switches. Each bank of sliders is housed in a small rectangular package resembling an integrated circuit, and since the multi-switch housing has two rows of pins which secure it to the circuit board, it is known as a dual in-line pin switch (hence "DIP"). Each of the two DIP switches performs the identical functions, one for Channel 1 and the other for Channel 2.

Of the five sliders on each DIP switch, #1 through #4 determine the high-pass filter characteristics of the channel, while #5 is reserved for creating a monaural low frequency output for the two channels.

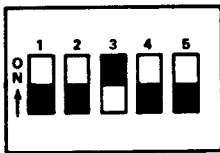
The 5235 is shipped with the switches set for flat low frequency response and discrete low frequency outputs. In the Setup and Operation section of this manual, considerations in selecting the various low frequency cutoff characteristics are discussed. If a characteristic other than the factory preset is desired, it can be established as follows:

**Caution:** The 5235 AC power cord should not be connected to the power receptacle. Also, any power amplifiers to which the Frequency Dividing Network may be connected should be turned Off during this procedure.

1. Place the 5235 upside down on a soft surface and remove the bottom cover.
2. Locate the DIP switch(es) for the channel(s) to be programmed.

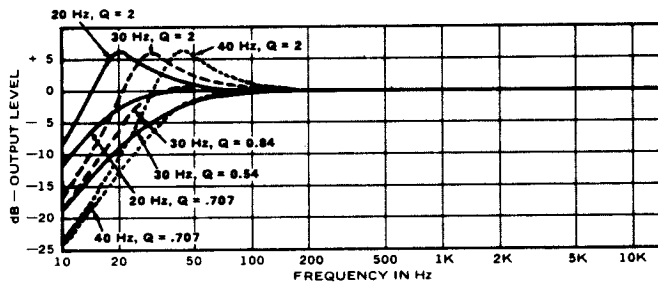
Note: In a triamplified system, use high-pass filtering only on the channel used for the low-mid/high transition; the mid/high channel should be set for flat response. In a biamplified system with a mono subwoofer, both channels' DIP switch "mono" sliders must be engaged.

3. Each of the switches consists of five small switches which may be turned on or off. In this section we will refer to the switch settings according to a binary code. Figure 4 shows the factory preset position, binary code 00100. In this code "0" indicates that the switch is in the off position and "1" indicates that the switch is in the on position.



Black square indicates switch position

**Figure 4**  
DIP Switches



**Figure 5**  
Low Frequency Cutoff Characteristics

The functions of the switches are as follows:

- Switch positions 1 and 2 select the low frequency cutoff.
- Switch position 3, when on, gives flat response.
- Switch position 4, when on, lowers the Q of the low frequency filter allowing a sharp or less sharp "knee".
- Switch position 5, when on on both channels, combines the LF outputs for a mono summed signal.

The following table applies to Figures 4 and 5.

Table 1

Switch Positions	Low Frequency Cutoff	Switch Positions	Low Frequency Cutoff
11010	20 Hz Q = .707 (-3dB @ 20 Hz)	01000	30 Hz Q = 2 (+6dB @ 30 Hz)
11000	20 Hz Q = 2 (+6dB @ 20 Hz)	00010	40 Hz Q = .707 (-3dB @ 40 Hz)
10010	30 Hz Q = .54 (-5.5dB @ 30 Hz)	00000	40 Hz Q = 2 (+6dB @ 40 Hz)
01010	30 Hz Q = .84 (-1.5dB @ 30 Hz)		

4. Replace the bottom cover, observing the proper orientation. The cover will not seat properly in the chassis if rotated 180°. Secure the cover with the four screws. The unit is now ready for mounting and connection of the various inputs and outputs.

### **2.3 Signal Connections**

The JBL/UREI Model 5235 Frequency Dividing Network provides both XL and barrier strip type connectors for input or output signal connection. A brief discussion of the reasons for using one connector type over another follows. In all cases good wiring practice must be followed using good quality two-conductor shielded cable. This will ensure maximum reliability and low noise operation.

Since both connectors are wired in parallel, only one should be used at a given time (unless it is specifically desired to loop a signal through the input).

#### **2.3.1 Barrier Strip**

The barrier strip is the preferred connector for all fixed installations. It is a highly reliable connector which requires only wire strippers and a screwdriver to use. Wires may optionally be terminated in #6 spade or ring lugs or a 6 position fanning strip. When using stranded wire take care that no individual strands work loose to short to adjacent connectors or to the chassis. Because of the high pressure exerted on the wire or lug by the screw terminal, the barrier strip connector is less subject to oxidation or corrosion than many other types.

#### **2.3.2 XL Connectors**

This popular connector style allows quick connect and disconnect of cables to and from the 5235 which is an advantage in temporary or portable sound systems. Additional advantages include a locking connection using standard connectors and the ability to plug the two cable end connectors together to bypass a failed unit.

Disadvantages include the cost of the mating connectors and the time to wire them. Also because the connectors are not "gas-tight" there may be a tendency for the contacts to oxidize over time in some environments, so we recommend plugging and unplugging the connectors at least once a year. This will remove any oxide build-up.

Connections to and from other system components are simple and straightforward. Pin three of the XL-type connector is "hot" or in phase with the (+) terminal of the barrier strip, and pin two is in phase with the (-) terminal of the barrier strip.

#### **2.3.3 Input Connections**

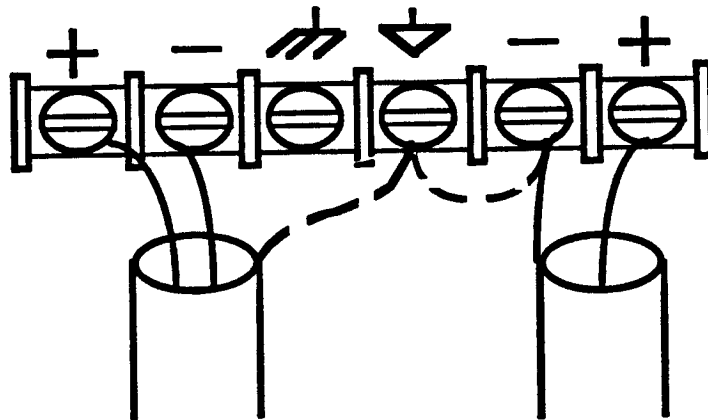
The 5235 will not unbalance floating or balanced output sources since the input circuits consist of balanced differential amplifiers. Balanced wiring is the preferred style, especially when running long lines, due to the ability of a balanced input to reject signals (such as hum fields) which are induced equally into both of the signal carrying conductors. Even if the previous piece of equipment has an unbalanced output it may be



advantageous to wire it to the input of the 5235 as though it were balanced. This takes advantage of the ability of the input to reject common-mode noise.

To use an unbalanced source, wire the signal carrying conductor of the cable from that source to the (+) terminal of the barrier strip (XL-type pin 3), and wire the shield to the (-) terminal of the barrier strip (XL-type pin 2). The unused connector terminal, pin 1 (sleeve), may also be connected to shield ground if that is compatible with your system grounding. (See the section on Grounding and Figure 6, for illustration of barrier strip connections. Figure 7 shows XL Connector wiring.)

We recommend that two-conductor shielded cable be used even in an installation using unbalanced wiring. Do not depend on the shield wire itself to complete the signal connection. Stranded shield wires are more subject to breakage, especially in portable installations, than the more protected internal insulated wires. Using this wiring system the worst that would happen with a broken shield would be a rise in noise or hum due to the lack of shielding. If the ground connection were completely lost this would result either in loss of audio or a terrible loud hum.



**Figure - 6**  
**Balanced and Unbalanced**  
**Barrier Strip Connections**  
 {Ground Connections depend on your Installation}

**2.3.4 Output Connections**

The 5235 outputs are unbalanced, delivering up to 6.2 V rms into a 600 ohm or higher impedance load (+18 dBu). Each channel has a HIGH frequency and LOW frequency output, and each of these outputs is available at two points on the rear panel by way of a barrier strip or a parallel-wired XL connector.

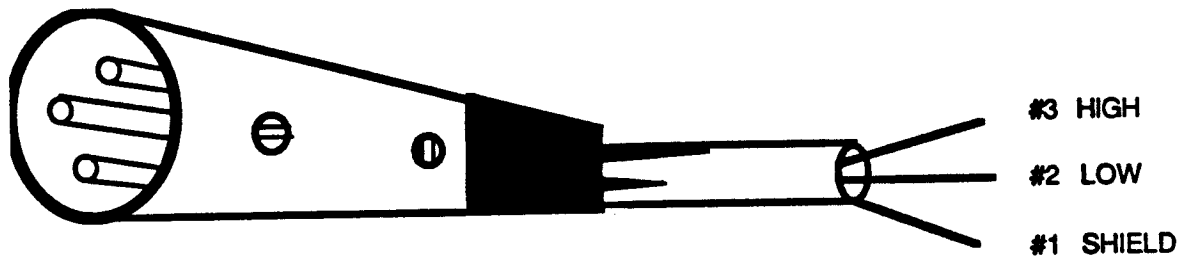
**2.3.5 Using Floating or Balanced Cables for Longer Runs**

Shielded cables are required for all input and output signals. If the output cable lengths are greater than 4.5 to 6 m (15 to 20 ft), consider installing isolation transformers (600 ohm:600 ohm) at each end of the cable. This allows dual-conductor shielded cable to be used in a floating mode, greatly reducing the possibility of radio frequency interference

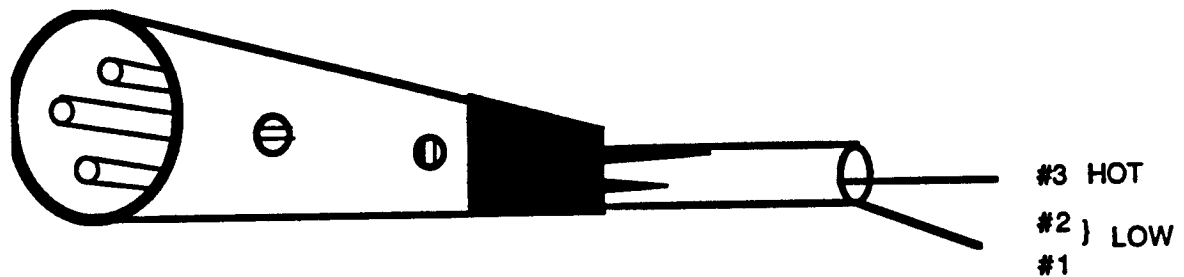
(RFI) or hum. If the amplifier to which the 5235 output is connected has a balanced or floating input, only one transformer need be installed - at the end of the cable connected to the 5235 output.

Similarly, longer input cables should be balanced or floating to reduce susceptibility to RFI and hum. If the output of the device feeding the 5235 is balanced or floating, no transformer is required at all; simply use a dual-conductor shielded cable. If the input source is unbalanced, an isolation transformer should be used at the source device's output.

With shorter cables, particularly where interconnected equipment is mounted in a single rack or is powered by the same AC receptacle, there is less need for balanced or floating input and output cables.



**BALANCED XL CONNECTION**



**UNBALANCED XL CONNECTION**

Figure - 7

### **2.3.6 Impedance and Termination for 600 Ohm Lines**

In the USA the early history of the audio industry is very closely tied to the history and technology of the telephone industry. Much of the early equipment used for public address systems, recording, broadcast and reproduction of sound was either designed by or heavily influenced by the scientists and engineers at Bell Telephone Laboratories. The technology that they and others developed has had a lasting influence on the design and specification of all types of audio products. Among their contributions was the 600 ohm transmission line.

The 600 ohm line was developed because of a need for a standardized impedance for long distance transmission lines. Transmission and reception equipment using vacuum tubes, transformers, and passive equalization and mixing networks require known source and load impedances to achieve predictable results. Because much of the early professional audio equipment was designed by telephone company people or used similar types of equipment, it is not surprising that the 600 ohm line became a standard in the professional audio industry.

Correct use of the 600 ohm transmission line requires a signal source with an exact 600 ohm source impedance, and a receiving device which also has a 600 ohm input impedance. If a device does not have the correct impedance, it must be modified until it does. In the case of a device with a lower than required source impedance this would require addition of a series buildout resistor (or two in the case of a balanced line). In the case of a higher impedance input a resistor across the input will suffice. Other variations require either a resistive network or transformer to match impedances.

Therefore, if the 5235 is to be used in a 600 ohm system attach a 620 ohm resistor across the input terminals of the equalizer to terminate the source and build out the output impedance with a 560 ohm resistor in series with the output (or one 270 ohm resistor in each leg of a balanced system).

However, most modern audio systems do not require the use of 600 ohm transmission line practices. This is for two reasons. First most audio systems are relatively small (especially as compared to a telephone network) and the cabling between parts of the system is under more careful control, and second, modern audio electronic products are no longer designed to require the use of 600 ohm line. Matching of input and output impedances is no longer necessary because the output impedance of a device may be made very low and the input impedance very high. Multiple inputs may thus be connected in parallel to the same source with ease and no loss of signal level.

### **2.4 AC Power Connection & Line Voltage Conversion**

The 5235 can be powered from either 100 to 120 VAC or 200 to 240 VAC 50 or 60 Hz mains. The SUPPLY VOLTAGE SELECT SWITCH on the rear panel converts the unit from one operating range to the other.

As shipped, the unit is set for 100 to 120 VAC operation, and the line cord provided is suitable for use in the U.S., Canada or Japan. To convert the unit for operation with other mains voltages or outlet types, use the following procedure.

1. Be sure the 5235 is not connected to any power source.
2. Slide the SUPPLY VOLTAGE switch to the appropriate range.
3. Install a suitable plug or adaptor to mate the existing line cord with the power receptacle. The 5235 line cord uses IEC Standard color code in which Blue is Line, Brown is Neutral, and Green/Yellow is Mechanical Ground.

**Note:** Any line cord or adapter used for 200-240 V operation in the U.S. or Canada must be U.L. Listed or C.S.A. Certified. For 240 V AC, 50/60 Hz operation in other countries, select a line cord or adaptor based on governing local regulations.

**Caution:** This unit may be damaged if operated with the supply voltage select switch set incorrectly for the line voltage applied. Also, verify the mains are AC since, in some countries as well as certain areas within the U.S., DC mains exist.

## 2.5 Grounding

For safe operation the 5235 must be connected to a good mechanical ground. This provides a current path for any voltage which might appear on the chassis due to a severe electrical fault in the network. Without this path the unit might be a shock hazard. In addition, a good quality ground on the chassis provides shielding from external fields and minimizes radiation of internal fields to the outside world. To comply with safety regulations in many localities, and to protect our customers, we provide this product with a ground connection through a three-wire power cord.

In many situations this will present no problem. But there are instances where a hum or buzz will be introduced due to a phenomenon known as a ground loop. This results when there is a significant potential between the audio ground of the previous piece of equipment and the mechanical ground to which the 5235 has been connected.

If this is the case, the first attempt at a solution should be to remove the strap on the rear panel barrier strip which connects audio ground and chassis. Removal of this strap may have a significant effect on reducing the hum. Audio ground will then be referenced from the signal source and the chassis ground will be separate but still connected to mechanical ground for shock protection.

In some instances the voltage difference between the grounds will be so great that a direct connection to mechanical ground is not possible without hum in the equalizer output. Use of an isolation transformer in the input signal line may allow the signal to be connected while maintaining ground isolation. Check for this using a 3 prong to 2 prong AC adaptor between the power cord and the power outlet, temporarily ungrounding the unit. Try the 5235 both with and without the ground strap on the barrier strip. Determine which connection works best. Remember however, that for safety you must still have a connection to chassis ground. This is normally made through a properly grounded third pin connection.

## **2.6 Mounting**

Rack mount your Frequency Dividing Network with the enclosed rack mounting hardware. The 5235 is equipped with rack ears which may be moved forward to allow the controls to be recessed and/or the optional security cover mounted flush with the front of the rack ears.

The Model 5235 will operate satisfactorily over a range of ambient temperatures from 0° C to +50° C ( +32° F to +122° F ), and up to 80% non-condensing relative humidity.

If the unit is installed in an equipment rack, console or other area along with high heat producing equipment (such as power amplifiers), adequate ventilation should be provided to assure longest component life. Also, while internal circuitry susceptible to hum pickup is sufficiently shielded from moderate electromagnetic fields, avoid mounting the unit immediately adjacent to large power transformers, motors etc.

## **2.7 Security Cover**

In some installations it may be necessary to safeguard the 5235 gain settings from deliberate or accidental mis-adjustment. In some environments the controls may benefit from additional protection against entry of dirt and dust.

The Model SC6 Security Cover offers protection for all operating controls of 1-3/4 in (44 mm) panel height JBL-UREI Electronic Products. The Security Cover is a five-sided box of smoked-gray plexiglass. It attaches to the front panel of the unit with two 6-32 x 2 in. Phillips head machine screws. Control positions and display status may be viewed through the cover after installation.

As noted earlier, the 5235 may be rack mounted in two different ways: flush mounted with the panel and rack ears in the same plane, or recess mounted with the rack ears extending forward so that the controls do not extend beyond the front panel of the rack ears. With the unit flush mounted the Security Cover will extend approximately 1-1/4 in. (32 mm) in front of the front surface of the rack ears. With the unit recess mounted the Security Cover is flush with the rack ears.

Installation of the Security Cover is simply a matter of placing it against the front panel of the unit, pushing the screws through the holes in the cover and screwing them into the two holes provided on the front panel. Note that the screws in the Security Cover match up with the holes in the front panel in only one orientation. Take care not to scratch the front panel of the unit with the screws. The Security Cover may be cleaned with any mild, non-abrasive cleaner and a clean cloth.

**Section 3 Setup & Operation****3.1 General Applications**

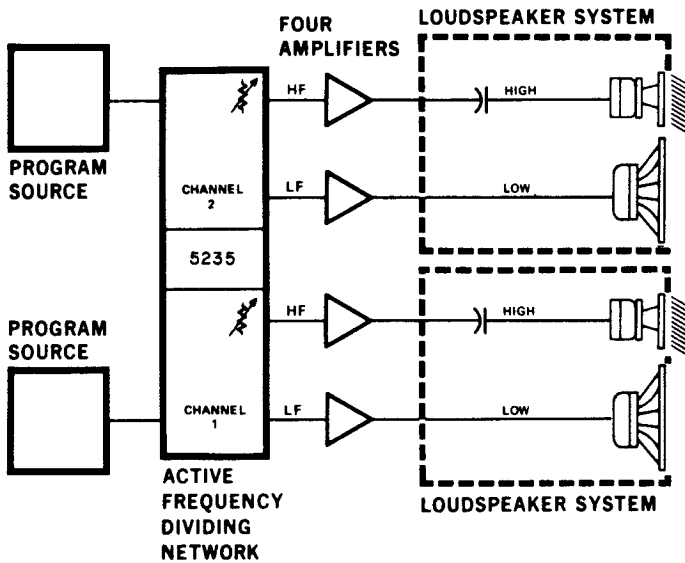
When used for two-channel bi-amplification, each channel INPUT of the 5235 receives the full-range program signal from a line level source such as a preamplifier, mixing console or graphic equalizer. Identical frequency selection modules are installed in both channels, and the dividing network separates each of the two channel's signals into high and low frequency bands. Each channel's LOW and HIGH outputs then feed individual power amplifiers (or discrete amplifier channels), which in turn drive their respective loudspeaker components.

The 5235 also may be used as a dividing network for a single channel of triamplification. In this application, Channel 1 of the 5235 receives the full-range program signal, and separates it into two bands, one consisting of low and mid frequencies, the other of high frequencies only. The Channel 1 HIGH output then feeds the amplifier which drives the high frequency driver, while the Channel 1 LOW output (carrying low and mid frequencies) is connected to the 5235's Channel 2 INPUT. The Channel 2 crossover point is chosen to fall in the region where the low frequency loudspeaker's operating range ends and the midrange driver's operating range begins. Therefore, Channel 2's LOW output is suitable for feeding the amplifier which drives the low frequency loudspeaker, while its HIGH output is suitable for feeding the amplifier which drives the midrange driver. In this way, the CHANNEL 2 HIGH FREQUENCY LEVEL control becomes a midrange driver level control and is independent of the CHANNEL 1 HIGH FREQUENCY LEVEL control, which affects only the high frequency driver.

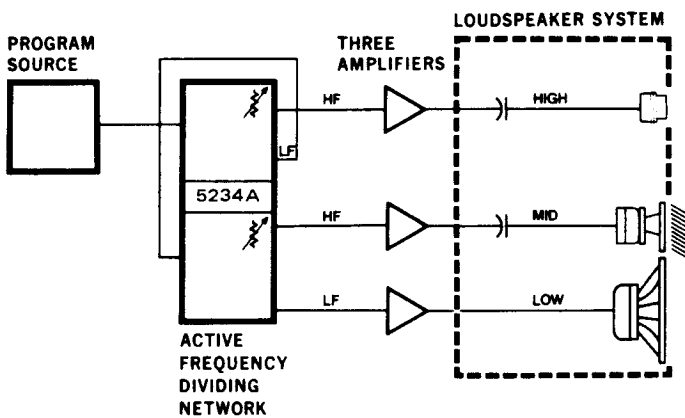
As an option, the 5235 can be fitted with "blank" frequency dividing modules that have jumper resistors installed in such a way that the input signal is split and fed to each channel's HIGH and LOW outputs. As such, the 5235 operates as a fully buffered dual distribution amplifier. While this is not the primary purpose of the unit, the capability can be useful when it is necessary to split a signal and drive separate lines and prevent any short or noise source on one line from causing problems on the other.

**3.2 Typical Systems Employing the 5235**

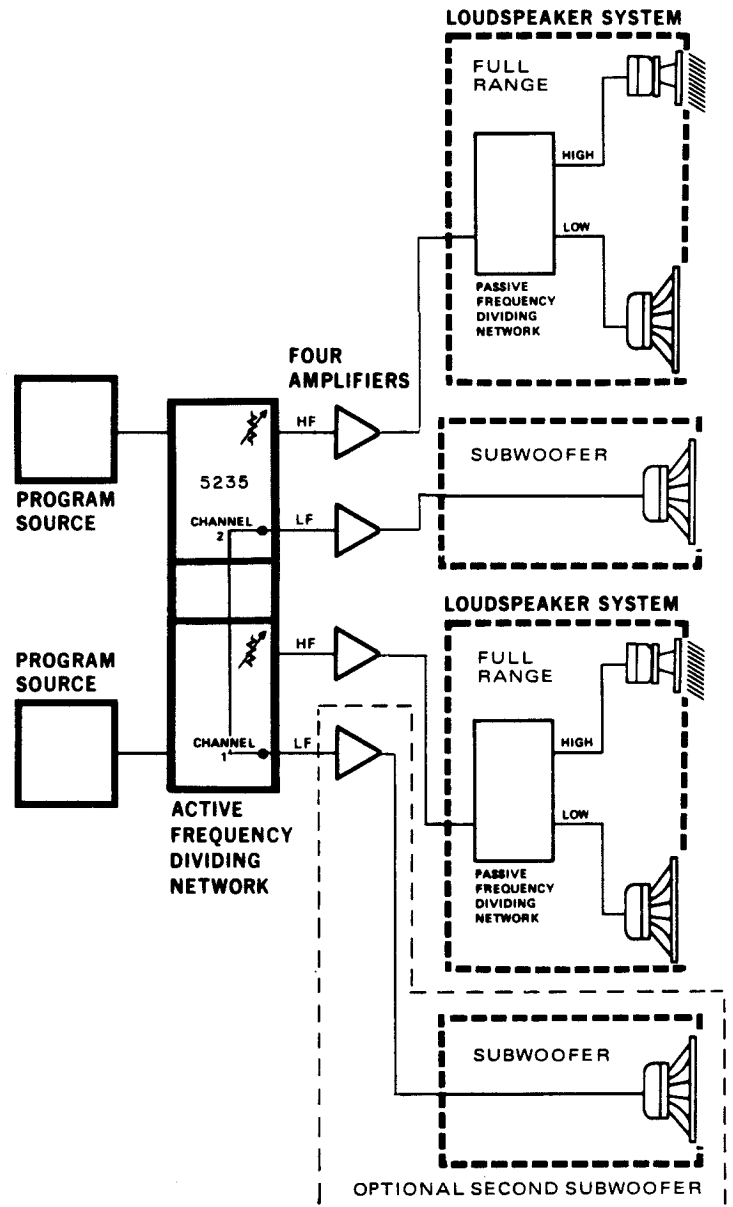
Figures 8,9 and 10 illustrate various biamplified and triamplified systems; these show typical examples of 5235 applications, although by no means are they all-inclusive.



**FIGURE 8 DUAL CHANNEL TWO-WAY BIAMPED**



**FIGURE 9 SINGLE CHANNEL THREE-WAY TRIAMPED**



**FIGURE 10 DUAL SYSTEM WITH MONAURAL SUBWOOFERS**

**3.3 Protection of Compression Drivers**

Whenever a midrange or high frequency compression driver is connected directly to a power amplifier, it is recommended that a capacitor be wired in series with the driver in order to attenuate unwanted low frequency and switching transient signals, and to block DC components, any of which can damage the driver. This applies to most biampified and triampified systems employing compression drivers. (In conventional systems with passive, high-level dividing networks, the network comes between the power amplifier and the driver(s) so the protection is already built-in).

**Notes:**

1. In all JBL monitors which are designed for bi-amplification, the dividing networks already incorporate the required attenuation capacitors between the input(s) and the compression driver(s).
2. Series capacitors are not required for low frequency and midrange cone or dome type transducers.

**Caution:** It is imperative that each output of the 5235 electronic frequency dividing network be properly connected. Inadvertent exchange of low and high frequency output connections (at the 5235, the power amplifiers, or the transducers) may result in severe damage to midrange or high frequency loudspeaker system components. If in doubt, always test the low frequency loudspeaker(s) first, since the presence of high frequencies there will be less apt to cause damage than the converse.

The low frequency series protection capacitors should be non-polarized electrolytics, mylar, metallized polyester or polyester type with working voltages of at least 50 V. **DO NOT USE POLARIZED ELECTROLYTIC CAPACITORS.** Maximum capacitance depends not only on the crossover frequency used for the driver, but also on the driver's impedance, as listed in Table 2.

**TABLE 2**

<u>Crossover Frequency</u>	<u>Capacitor Values (Driver Impedance)</u>		
	<u>16Ω</u>	<u>8Ω</u>	<u>4Ω</u>
250 Hz to 500 Hz	40μF	80μF	150μF
500 Hz to 5000 Hz	20μF	40μF	80μF
Above 5000 Hz	2μF	5μF	8μF

Suitable 10% tolerance capacitors for many frequency/impedance combinations are available directly from JBL professional products dealers, JBL or UREI directly; the recommended values for specific cutoff frequencies are listed in Table 3.



**TABLE 3**

<u>Capacitor Value</u>	<u>Optimum Crossover Frequencies for Driver Impedance of</u>		
	<u>16Ω</u>	<u>8Ω</u>	<u>4Ω</u>
72μF	275 Hz	550 Hz	1100 Hz
36μF	550 Hz	1100 Hz	2200 Hz
24μF	800 Hz	1650 Hz	3300 Hz
16.5μF	1200 Hz	2500 Hz	5000 Hz
13.5μF	1500 Hz	3000 Hz	6000 Hz
12μF	1700 Hz	3500 Hz	7000 Hz
8μF	2500 Hz	5000 Hz	10 kHz
5μF	4000 Hz	8000 Hz	16 kHz
4μF	5000 Hz	10 kHz	--
3μF	7000 Hz	13 kHz	--

**Notes:**

1. The optimum value cited in Table 3 assumes that the capacitor is active at approximately one octave below the listed crossover frequency, assuring minimum acoustical interference with crossover region performance while maintaining a good degree of protection.
2. Somewhat smaller capacitor values may be required for additional protection in high-power sound reinforcement systems.
3. To shunt the reactive component of the compression driver's impedance below horn cutoff, a 50 W resistor having a value of two to three times the rated impedance of the compression driver should be connected across the driver's terminals.

**Caution:** Below the cutoff frequency of the capacitor, the power amplifier will be unterminated. If the power amplifier has an output transformer (typical of vacuum tube amps and some solid state amps designed to drive constant voltage lines), a 20 W resistor equal to ten times the compression driver impedance should be installed across the amplifier output terminals.

**3.4 A Safety Procedure for Initial Powering Up of the System**

Prior to full operation of the dividing network/amplifier/ loudspeaker system, it is important to verify that the various frequency bands are connected to the correct amplifiers and loudspeakers. The following procedure should be followed for each program channel prior to operation:

1. With all POWER off (amplifiers included), set the 5235 HIGH FREQUENCY LEVEL control at #2, and adjust the program source output to minimum level. (The source may be wideband pink noise or music.)
2. If the power amplifiers are equipped with level controls, adjust them to approximately one quarter of the maximum.
3. Turn on the program source, the 5235, and the power amplifier(s) for the channel under test.
4. Gradually increase the program source level until it just becomes audible.

Caution: If the sound comes mainly from the midrange or high frequency driver(s), shut off all power immediately and check all wiring. Since the HIGH FREQUENCY LEVEL control is turned down, the low frequency transducer should become audible first; if this is not the case, and low frequency sounds are emerging from higher frequency drivers, the output wiring is reversed somewhere between the 5235 and the loudspeaker system. Continued operation could easily damage compression drivers.

5. With the low frequency transducers producing bass, gradually increase the 5235 HIGH FREQUENCY LEVEL control. (In a triamplified system, do this first on the channel which feeds the high frequency driver, Channel 1.) Correct system wiring will be verified if the treble component of the program material increases in level and is emerging from the high frequency driver. (In a triamplified system, repeat this procedure for the channel feeding the midrange driver, and verify the HF LEVEL control increases midrange output.)

### 3.5 Level Control Adjustment

There are several points in the sound system where levels can be set. Naturally, it is important that the gain structure be established correctly so that no input is overdriven, and so that the best signal-to-noise ratio possible is maintained. Beyond that, however, it becomes necessary to obtain the correct level balance between the various frequency bands so that overall frequency response conforms to the desired characteristic.

In many instances, manufacturers of multi-amplified loudspeaker systems provide instructions for balancing levels of the individual drivers in the system. In the absence of formal instructions, or in the case of custom loudspeaker systems, balance can be established by adjusting levels to achieve the flattest response as measured with a real-time analyzer and a pink noise source (much like the technique described in the System Phasing and Signal Polarity Section of this manual). Alternately, subjective evaluation of familiar program material can provide a good means to balance levels. In fact, perfectly flat electro-acoustic response is seldom desirable for the listener, so subjective evaluation may be the preferable technique.

Note: Each program channel should be adjusted individually. Subjective evaluation should be made while seated in the normal listening location. If subjective analysis is to be used and the power amplifiers are equipped with level controls, initially adjust those controls to one half their rotation and then regulate as necessary.

**3.5.1 Subjective Adjustment of Bi-amplified Systems**

**Note:** The following procedure applies to each channel of a 5235 used in a dual channel bi-amplified system.

- 1. With the HIGH FREQUENCY LEVEL control at #0, adjust the program source output for a comfortable listening level.**
- 2. Rotate the HIGH FREQUENCY LEVEL control clockwise until a satisfactory high frequency balance has been obtained in the program material. If necessary, trim the source and/or amplifier levels.**
- 3. Turn off the first channel's signal source and/or amplifiers, and adjust the other channel per steps 1 and 2 above.**

**Note:** Once the HIGH FREQUENCY LEVEL and amplifier level controls have been adjusted in this manner, readjustment is not generally needed. Some method of locking the power amplifier level controls (or at least marking the desired settings) is recommended.

**3.5.2 Subjective Adjustment of Tri-amplified Systems**

**Note:** When both channels of the 5235 are used for a tri-amplified loudspeaker system, the recommended installation is such that the CHANNEL 1 HIGH FREQUENCY LEVEL CONTROL regulates the output of the midrange driver, and the CHANNEL 2 HIGH FREQUENCY LEVEL CONTROL governs the high frequency driver.

- 1. With both HIGH FREQUENCY LEVEL controls at #0, adjust the program source output for a comfortable listening level.**
- 2. Rotate the CHANNEL 1 HIGH FREQUENCY LEVEL control clockwise until a satisfactory midrange level has been obtained.**
- 3. Rotate the CHANNEL 2 HIGH FREQUENCY LEVEL control clockwise until a satisfactory high frequency balance has been obtained. If necessary, trim the source and/or amplifier levels.**
- 4. It may be necessary to readjust the midrange, source and amplifier levels to achieve the most desirable overall balance of the loudspeaker system.**
- 5. In a two-channel system, turn off the first channel's signal source and/or amplifiers, and adjust the other channel per steps 1 through 4 above.**

**Note:** After the HIGH FREQUENCY LEVEL controls and amplifier level controls have been adjusted in this manner, readjustment is not generally needed. Some method of locking the power amplifier level controls (or at least marking the desired settings) is recommended.

### **3.6 System Phasing & Signal Polarity**

A major factor in the natural sound character of a multi-way loudspeaker system is the relative polarity and phase relationship between the various transducers. Physical driver positioning and relative electrical polarity will affect the frequency response in the crossover region, and improper phase or polarity relationships between channels can cause a loss of bass response and/or degradation of the stereo image.

Note: Where this discussion involves the exchange of signal-carrying conductors, POLARITY is the topic, not phase. Polarity reversal is not a 180° PHASE SHIFT, although some people loosely describe it as such. Polarity is the term used to describe the direction of electrical/mechanical output of a device with respect to its input signal. In an electrical device, given a positive-going signal on the input, a positive-going signal on the output is referred to as being "in polarity", while a negative-going signal on the output would be referred to as being "out of polarity". A loudspeaker is "in polarity" if, for a positive-going input signal, it produces a positive pressure wave ( compression as opposed to rarefaction ).

Physical driver positioning affects the relative phase of signals, but, for the purposes of this discussion, it is assumed that the loudspeaker system is already constructed and therefore nothing can be done to alter the phase relationship between transducers. It is true that in a multi-way system with separately packaged mid and high frequency horns and bass bins, it is advisable to experiment with relative phasing by moving drivers to align the acoustic plane of all the transducer diaphragms. These techniques are beyond the scope of this manual, however. We have limited this discussion to the method of establishing the correct signal polarity for the components in any one channel multi-way system, as well as the correct polarity relationship between channels.

Two suitable methods for establishing polarity of components in a two-way system are described in the following paragraphs. Either one may be used, depending on the availability of test equipment. A three-way or four-way system would be treated in a similar manner by first establishing the proper polarity for the transducers of the low frequency transducers, and then progressing to the midrange and high or ultra-high frequency transducers, as applicable.

#### **3.6.1 Objective Method of Polarity Determination**

The following test equipment is necessary:

- a. A real-time 1/3 octave or continuous spectrum frequency response analyzer.
- b. A microphone of known, calibrated frequency response.
- c. A pink noise source.

Note: To optimize the results obtained with this procedure, the loudspeaker systems should be placed in their normal operating locations.

**Note:** If different loudspeaker systems are used, or in a stereo system, first establish common polarity among the low frequency drivers as follows:

1. Connect the pink noise source to two channels, set the two channels for the same comfortable level, and observe low frequency response on the real-time analyzer (RTA).
2. Now intentionally reverse the polarity of one low frequency transducer and see whether the low frequency response diminishes or increases. If it diminishes, the system has been correctly wired initially; return the transducer wiring to the original polarity. If low frequency response increases, the two channels' low frequency transducers were reversed in polarity relative to one another; leave the wiring in the "improved" configuration.

**Note:** In stereo or multi-channel systems, follow steps 3 and 4 below for one channel at a time.

3. Using pink noise as program material, adjust the system volume to a comfortable listening level. Then set the level of individual transducers to display the flattest overall frequency response on the real-time analyzer.
4. Reverse the polarity of the high frequency driver and observe the effect on the frequency response through the crossover region. Proper transducer polarity is indicated by the flattest frequency response through the crossover region (as shown by the RTA).
5. Once proper polarity among the transducers of a loudspeaker system has been determined, other loudspeaker systems in the installation (assuming they are the same model) may be connected accordingly and double-checked with the RTA.

### 3.6.2 Subjective Method of Polarity Determination

The following method is recommended to establish proper polarity of the loudspeaker system when no test equipment is available. To optimize the results obtained with this procedure, the loudspeaker systems should be placed in their normal operating locations.

**Note:** If different loudspeaker systems are used, or in a stereo system, first establish common polarity among the low frequency drivers as follows:

1. Connect a program source known to contain substantial bass to two channels, set the two channels for the same comfortable level, and listen to the intensity of the low frequencies.
2. Now intentionally reverse the polarity of one low frequency transducer to see whether the low frequency response diminishes or increases. If it diminishes, the system has been correctly wired initially; return the transducer wiring to the original polarity. If low frequency response improves, the two low channels' low frequency transducers were reversed in polarity relative to one another; leave the wiring in the "improved" configuration.

**Note:** In stereo or multi-channel systems, follow steps 3 through 5 for one channel at a time.

3. Adjust the volume for a comfortable listening level and set the approximate system balance using the noise heard between stations of an un-muted FM tuner.
4. Listen to a recording of a male voice long enough to be accustomed to the performance of the loudspeaker system.
5. Reverse the polarity of the high frequency loudspeaker, which will produce a change in voice character. When the transducers are in correct polarity, a recorded male voice should sound natural and exhibit presence (an "up front" quality), in contrast to the undesirable "hollow" sound heard when the transducers are out of phase.

**Note:** If the crossover point lies above 2 kHz, reversing the polarity of the high frequency driver will create little (if any) perceptible difference in system performance. The "correct" polarity in such a case will be that which yields the most natural quality with a variety of program material.

6. Once proper polarity among the transducers of a loudspeaker system has been determined, other loudspeaker systems in the installation (assuming they are the same model) may be connected accordingly.

### 3.7 Selecting the Low Frequency High-Pass Filter Options

As described in the Installation Section of this manual, the 5235 provides for low frequency high-pass contouring by use of binary DIP switches. While the method of setting these switches was discussed, it remains to treat the reasons for choosing various settings.

In the most basic terms, one can select flat response (no rolloff) or a 12 dB per octave rolloff below 20 Hz, 30 Hz, or 40 Hz. While the specific filter characteristics can be further modified, in general the major purpose of high-pass filtering is to remove subsonic signal energy below the lowest useable loudspeaker frequency. Without high-pass filtering, subsonic signal content can waste amplifier power (lowering the available headroom), and induce distortion in audible regions by modulating the higher bass and midrange frequencies. In severe cases transducer damage can occur due to extreme cone excursion.

One of the special features of the 5235 is the 6 dB boost at 20 Hz, 30 Hz or 40 Hz selectable with the DIP switches (the Q=2 setting). This moderate boost equalization, coupled with the high-pass filtering, can often improve the acoustical response of a sound system.

The use of the 6 dB boost/high-pass filter option maximizes the useful low frequency acoustic output while minimizing cone excursions both in and out of the system operating range. The use of this option requires certain precautions, and care should be taken not to exceed the power ratings of the system. Bear in mind that the 6 dB boost results in a

four-times increase in power from the amplifier to the loudspeaker system. However, this boost is restricted to the octave just above the system's lower cutoff.

The boost/high-pass filter function should normally be applied to vented box systems, set to the box tuning frequency. The boost/high-pass filter can be used with closed-box (sealed) loudspeaker systems, but because of the high cone excursions of these systems near cutoff, caution must be taken so that the cones do not "bottom out" during high level passages. In general, for sealed box systems it is better to use one of the high-pass filter settings that produce a rolloff without a peak (e.g., with a Q of 0.707). If it is desirable that the loudspeaker system have a slight peak near an acoustic cutoff of 30 Hz, the 5235's slightly underdamped rolloff (Q=0.84) may be selected.

**3.7.1 Suggestions for JBL Professional Series Products**

1. Generally, JBL studio monitors should have high-pass filtering at 30 Hz.
2. Sound reinforcement systems tuned to 40 Hz should use 40 Hz high-pass filtering. This includes most 4500 series enclosures and 4600 systems.
3. For very low crossover frequency points in subwoofer applications, monaural summing of the low frequency outputs will tend to cancel extraneously generated, oppositely polarized low frequency signals such as turntable rumble, disc warp and acoustic feedback. Therefore, setting the DIP switches for a monaural LOW output can increase the maximum usable acoustic output level.
4. The 6 dB boost/high-pass filter option may be used with any JBL Professional Series system when required to flatten and extend the low-frequency response, provided that the filter frequency is appropriately chosen.

**3.8 Blank Crossover Card Assembly**

In addition to the standard crossover cards, circuits for other crossover frequencies may be assembled on blank crossover cards using standard components. Filter slopes (12 dB or 18 dB per octave) are identical to those of the standard crossover cards. The crossover frequency can be written on the card bracket and will appear through the front panel window of the network. Tables 4 and 5 list component values which may be used with the blank cards.

**Table 4: 12 dB/Octave Crossover Card Component Values**

Resistors are all 1/4 W, ± 5% tolerance. Capacitors are all ±5% tolerance, metallized polyester, unless otherwise noted.

<u>Crossover Frequency</u>	<u>Capacitors (C1-C5)</u>	<u>Resistors (R1-R5)</u>
50 Hz	.22 μF	10 k ohm
70 Hz	.22 μF	7.5 k ohm
100 Hz	.22 μF	4.7 k ohm

200 Hz	.12 $\mu$ F	4.7 k ohm
250 Hz (JBL Part No. 52-5121)	.018 $\mu$ F	24 k ohm
300 Hz	.082 $\mu$ F	4.7 k ohm
400 Hz	.056 $\mu$ F	5.1 k ohm
500 Hz (JBL Part No. 52-5122)	.015 $\mu$ F	15 k ohm
600 Hz	.039 $\mu$ F	4.7 k ohm
700 Hz	.032 $\mu$ F	5.1 k ohm
800 Hz (JBL Part No. 52-5123)	.022 $\mu$ F	6.2 k ohm
900 Hz	.027 $\mu$ F	4.7 k ohm
1.1 kHz	.022 $\mu$ F	4.7 k ohm
1.2 kHz (JBL Part No. 52-5124)	.0082 $\mu$ F	11 k ohm
1.5 kHz	.012 $\mu$ F	6.2 k ohm
2 kHz	.012 $\mu$ F	4.7 k ohm
2.5 kHz	.0082 $\mu$ F	5.6 k ohm
3 kHz	.0068 $\mu$ F	5.6 k ohm
3.5 kHz	.0068 $\mu$ F	4.7 k ohm
4 kHz	.0056 $\mu$ F	5.1 k ohm
4.5 kHz	.0039 $\mu$ F	6.2 k ohm
5 kHz (JBL Part No. 52-5125)	.0015 $\mu$ F	15 k ohm
5.5 kHz	.0033 $\mu$ F	6.2 k ohm
6 kHz	.0033 $\mu$ F	5.6 k ohm
7 kHz (JBL Part No. 52-5127)	.0015 $\mu$ F	11 k ohm
7.5 kHz	.0027 $\mu$ F	5.6 k ohm
8 kHz	.0027 $\mu$ F	5.1 k ohm
8.5 kHz	.0012 $\mu$ F	11 k ohm
9 kHz	.0022 $\mu$ F	5.6 k ohm
9.5 kHz	.0012 $\mu$ F	10 k ohm
10 kHz	.0022 $\mu$ F	5.1 k ohm
JBL Part No. 52-5140	.018 $\mu$ F	R1 27 k ohm
Designed for the 4343	.018 $\mu$ F	R2 27 k ohm
and 4350 Studio Monitors	.018 $\mu$ F	R3 22 k ohm
	.018 $\mu$ F	R4 22 k ohm
	.018 $\mu$ F	R5 22 k ohm
JBL Part No. 52-5130	C1 0.039 $\mu$ F	R1 11 k ohm
Designed for the 4435	C2 0.082 $\mu$ F	R2 11 k ohm
and 4430 Studio Monitors	C3 0.0013 $\mu$ F	R3 11 k ohm
	C4 0.01 $\mu$ F	R4 13 k ohm
	C5 jumper	R5 N/A
	C6 jumper	R6 N/A

Note: The values for the crossover frequencies can be calculated by using the formula  

$$RC = \frac{0.1125}{F}$$
 where R is the resistance in kohm,

C is the capacitance in  $\mu$ F, and F is the frequency in Hz. The recommended value for R is 4.7 k ohm.



**Table 5: 18 dB/Octave Crossover Card Component Values**

Resistors are all 1/4 W, ± 1% tolerance. Capacitors are all ±5% tolerance, metallized polyester, unless otherwise noted.

<u>Crossover Frequency</u>	<u>Capacitors</u>	<u>Resistors</u>
80 Hz (JBL Part No. 51-5138)	C1 .047 μF C2 .12 μF C3 .0068μF C4 .1 μF C5 .1 μF C6 .1 μF	R1 56 k ohm R2 56 k ohm R3 56 k ohm R4 14 k ohm R5 5.6 k ohm R6 100 k ohm
100 Hz	C1 .39 μF C2 1.0 μF C3 .056 μF C4 .15 μF C5 .15 μF C6 .15 μF	R1 6.8 k ohm R2 6.8 k ohm R3 6.8 k ohm R4 9.1 k ohm R5 3.6 k ohm R6 62 k ohm
160 Hz	C1 .33 μF C2 .82 μF C3 .047 μF C4 .056 μF C5 .056 μF C6 .056 μF	R1 4.3 k ohm R2 4.3 k ohm R3 4.3 k ohm R4 13 k ohm R5 5.1 k ohm R6 91 k ohm
200 Hz	C1 .22 μF C2 .56 μF C3 .033 μF C4 .039 μF C5 .039 μF C6 .039 μF	R1 5.1 k ohm R2 5.1 k ohm R3 5.1 k ohm R4 15 k ohm R5 5.6 k ohm R6 100 k ohm
250 Hz	C1 .015 μF C2 .39 μF C3 .022 μF C4 .039 μF C5 .039 μF C6 .039 μF	R1 5.6 k ohm R2 5.6 k ohm R3 5.6 k ohm R4 12 k ohm R5 4.7 k ohm R6 82 k ohm
290 Hz (JBL Part No. 51-5145 Designed for the 4345 and 4355 Studio Monitors)	C1 .12 μF C2 .33 μF C3 .018 μF C4 .033 μF C5 .033 μF C6 .033 μF	R1 5.2 k ohm R2 6.2 k ohm R3 6.2 k ohm R4 12 k ohm R5 4.7 k ohm R6 82 k ohm

300 Hz

C1	.12 $\mu$ F	R1	5.1 k ohm
C2	.22 $\mu$ F	R2	5.1 k ohm
C3	.012 $\mu$ F	R3	5.1 k ohm
C4	.033 $\mu$ F	R4	6.8 k ohm
C5	.033 $\mu$ F	R5	2.7 k ohm
C6	.033 $\mu$ F	R6	47 k ohm

500 Hz

(JBL Part No. 51-5132)

C1	.082 $\mu$ F	R1	5.1 k ohm
C2	.22 $\mu$ F	R2	5.1 k ohm
C3	.012 $\mu$ F	R3	5.1 k ohm
C4	.033 $\mu$ F	R4	6.8 k ohm
C5	.033 $\mu$ F	R5	2.7 k ohm
C6	.033 $\mu$ F	R6	47 k ohm

800 Hz

(JBL Part No. 51-5133)

C1	.056 $\mu$ F	R1	4.7 k ohm
C2	.15 $\mu$ F	R2	4.7 k ohm
C3	.0082 $\mu$ F	R3	4.7 k ohm
C4	.012 $\mu$ F	R4	12 k ohm
C5	.012 $\mu$ F	R5	4.7 k ohm
C6	.012 $\mu$ F	R6	82 k ohm

1 kHz

C1	.039 $\mu$ F	R1	5.6 k ohm
C2	.1 $\mu$ F	R2	5.6 k ohm
C3	.0056 $\mu$ F	R3	5.6 k ohm
C4	.015 $\mu$ F	R4	7.5 k ohm
C5	.015 $\mu$ F	R5	3 k ohm
C6	.015 $\mu$ F	R6	51 k ohm

1.2 kHz

C1	.039 $\mu$ F	R1	4.7 k ohm
C2	.1 $\mu$ F	R2	4.7 k ohm
C3	.0056 $\mu$ F	R3	4.7 k ohm
C4	.0082 $\mu$ F	R4	12 k ohm
C5	.0082 $\mu$ F	R5	4 k ohm
C6	.0082 $\mu$ F	R6	82 k ohm

1.6 kHz

C1	.033 $\mu$ F	R1	4.3 k ohm
C2	.082 $\mu$ F	R2	4.3 k ohm
C3	.0047 $\mu$ F	R3	4.3 k ohm
C4	.0056 $\mu$ F	R4	13 k ohm
C5	.0056 $\mu$ F	R5	5.1 k ohm
C6	.0056 $\mu$ F	R6	91 k ohm

2 kHz

C1	0.22 $\mu$ F	R1	5.1 k ohm
C2	0.56 $\mu$ F	R2	5.1 k ohm
C3	.0033 $\mu$ F	R3	5.1 k ohm
C4	.0039 $\mu$ F	R4	15 k ohm
C5	.0039 $\mu$ F	R5	5.6 k ohm
C6	.0039 $\mu$ F	R6	100 k ohm

**5 kHz**

C1	.0082 $\mu$ F	R1	5.1 k ohm
C2	.022 $\mu$ F	R2	5.1 k ohm
C3	.0012 $\mu$ F	R3	5.1 k ohm
C4	.0015 $\mu$ F	R4	15 k ohm
C5	.0015 $\mu$ F	R5	5.6 k ohm
C6	.0015 $\mu$ F	R6	100 k ohm

**5.5 kHz**

C1	.0068 $\mu$ F	R1	5.6 k ohm
C2	.018 $\mu$ F	R2	5.6 k ohm
C3	.001 $\mu$ F	R3	5.6 k ohm
C4	.0018 $\mu$ F	R4	12 k ohm
C5	.0018 $\mu$ F	R5	4.7 k ohm
C6	.0018 $\mu$ F	R6	82 k ohm

**8 kHz**

C1	.0056 $\mu$ F	R1	4.7 k ohm
C2	.015 $\mu$ F	R2	4.7 k ohm
C3	.00082 $\mu$ F	R3	4.7 k ohm
(use Silver Mica only)			
C4	.0012 $\mu$ F	R4	12 k ohm
C5	.0012 $\mu$ F	R5	4.7 k ohm
C6	.0012 $\mu$ F	R6	82 k ohm

**10 kHz**

C1	.0039 $\mu$ F	R1	5.6 k ohm
C2	.01 $\mu$ F	R2	5.6 k ohm
C3	.00056 $\mu$ F	R3	5.6 k ohm
(use Silver Mica only)			
C4	.0015 $\mu$ F	R4	7.5 k ohm
C5	.0015 $\mu$ F	R5	3 k ohm
C6	.0015 $\mu$ F	R6	51 k ohm

**Section Four Maintenance****4.1 General**

The Model 5235 is all solid state, ruggedly constructed and uses the finest components. As such it will provide years of trouble free use with normal care. All parts are conservatively rated for their application. **NO SPECIAL PREVENTIVE MAINTENANCE IS REQUIRED. THERE ARE NO USER SERVICEABLE PARTS INSIDE.**

The metal and plastic surfaces of the Diving Network may be cleaned with a damp cloth. In case of heavy dirt, a non-abrasive household cleaner such as Formula 409 or Fantastik® may be used. **DO NOT SPRAY THE CLEANER DIRECTLY ONTO THE FRONT OF THE UNIT AS IT MAY DESTROY THE LUBRICANTS USED IN THE SWITCHES AND CONTROLS!** Spray onto a cloth and then use the cloth to clean the unit.

**4.2 Repairs and Warranty**

This product is warranted by the manufacturer to the original purchaser against defects in material and workmanship for a period of two years from the date of purchase. We suggest that you retain a copy of your dated sales receipt for proof of warranty status should that be necessary.

If you wish to return the unit for service, please call or write to the Customer Service Department at the Service Address listed on the title page of this manual for a Return Authorization Number. All products returned to the factory must be accompanied by a Return Authorization Number, and must be shipped prepaid. COD shipments will not be accepted. If it can be determined that the defect is associated with one of the plug in crossover modules by substitution or otherwise, it is only necessary to return the module.

For prompt service, ship the unit to the factory with the RA number marked on the shipping label. Be sure that it is well packed in a sturdy carton, with shock absorbing material such as styrofoam pellets or "bubble-pack" surrounding the unit. Pay particular attention to protecting the controls and switches and make sure that the unit cannot drift around in the shipping box. Shipping damage caused by inadequate packing is not covered by the JBL/UREI warranty. Tape a note to the top of the unit describing the problem, include your name and a phone number where we may contact you if necessary, and give us instructions for returning the product. We will pay return shipping costs on any repair covered under the terms of this warranty.

Field repairs are not normally authorized during the warranty period, and repair attempts by unqualified personnel may invalidate the warranty.

Customers outside the USA should contact their local JBL/UREI Professional Products dealer for warranty assistance. Do not return products to the factory unless you have been given specific instructions to do so.

**Section 5 Specifications**

<b>Gain:</b>	Unity, $\pm 1$ dB low-pass output Variable, + 6 dB Max. high-pass output		
<b>Rated Output:</b>	Maximum 6.2 V rms (+ 18 dBu)		
<b>Distortion:</b>	0.01% THD, 20 Hz-20kHz @ +18 dBu into 600 ohm load or greater		
<b>Frequency Response:</b>	$\pm 0.5$ dB, 20 Hz-20 kHz		
<b>Crossover Frequency:</b>	Selectable by plug-in module. - 3 dB crossover point $\pm 10\%$		
<b>Filter Slope:</b>	12 dB/octave or 18 dB/octave		
<b>High Pass Filtering:</b>	<b>Filter</b>	<b>Level at Filter</b>	<b>Filter Q</b>
		<u>Frequency</u>	
		20 Hz	- 3 dB 0.707
		20 Hz	+ 6 dB 2
		30 Hz	- 5.5 dB 0.54
		30 Hz	- 1.5 dB 0.84
		30 Hz	+ 6 dB 2
		40 Hz	- 3 dB 0.707
		40 Hz	+ 6 dB 2
<b>Input Impedance:</b>	40 k ohm balanced 20 k ohm unbalanced		
<b>Load Impedance:</b>	600 ohms or greater		
<b>Output Impedance:</b>	50 ohms, unbalanced		
<b>Channel Isolation:</b>	> 70 dB. 20 Hz-20 kHz		
<b>Signal/Noise Ratio:</b>	> 90 dB. 20 kHz equivalent bandwidth		
<b>Controls:</b>	High frequency level. Power. Supply voltage select (rear panel)		
<b>Connections:</b>	Inputs and outputs on rear panel barrier strips and XL connectors. Power through 3-wire power cord.		
<b>Power Requirements:</b>	10W Max. 100-120/200-240 VAC 50/60 Hz		
<b>Operating Temperature:</b>	5° C (+41° F) to 55° C (+132° F)		

**Dimensions:** 483 mm x 44 mm x 194 mm deep  
(19 in x 1-1/4 in x 7-5/8 in deep)

**Net Weight:** 1.8 kg (4 lb)

**Shipping Weight:** 3 kg (6-1/2 lb)

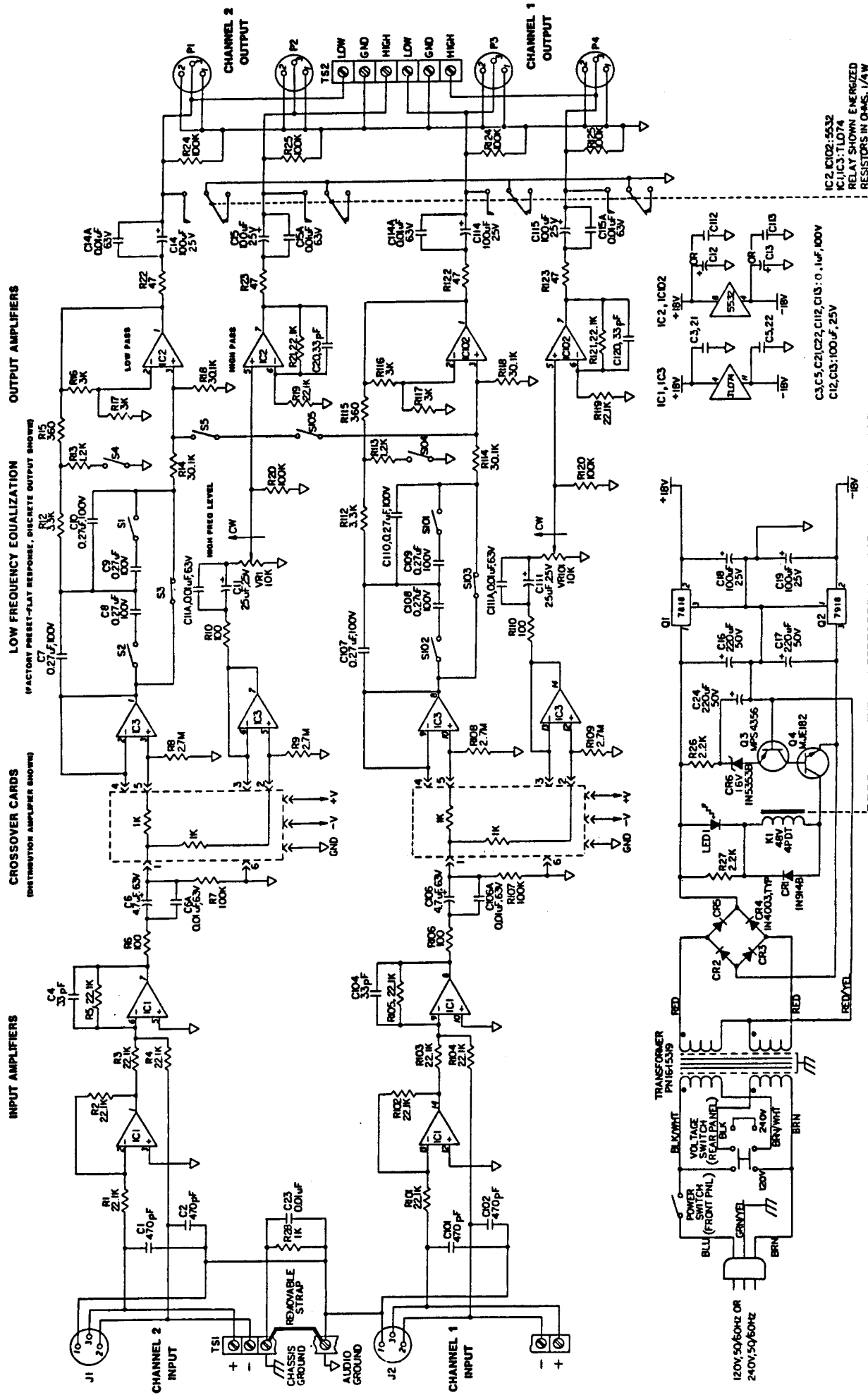
**Crossover Cards (one required per channel):**

**18 dB/octave:**

- 51-5130-Blank Card, unloaded 18 dB/Octave
- 51-5232-500 Hz, 18 dB/Octave
- 51-5133-800 Hz, 18 dB/Octave
- 51-5138-80 Hz, 18 dB/Octave
- 51-5232-500 Hz, 18 dB/Octave, with Power Response Correction for 2360-Series  
Constant-Coverage Bi-Radial™ Horns
- 51-5233-800 Hz, 18 dB/Octave, with Power Response Correction for 2360-Series  
Constant-Coverage Bi-Radial™ Horns
- 51-5332-500 Hz, 18 dB/Octave, with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns
- 51-5333-800 Hz, 18 dB/Octave, with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns
- 51-5334-1200 Hz, 18 dB/Octave, with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns
- 51-5336-1600 Hz, 18 dB/Octave, with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns

**12 dB/octave:**

- 52-5120-Blank Card, Unloaded 12 dB/Octave
- 52-5121-250 Hz, 12 dB/Octave
- 52-5122-500 Hz, 12 dB/Octave
- 52-5123-800 Hz, 12 dB/Octave
- 52-5124-1200 Hz, 12 dB/Octave
- 52-5125-5000 Hz, 12 dB/Octave
- 52-5127-7000 Hz, 12 dB/Octave
- 52-5130-For 4430 and 4435 Studio Monitor
- 52-5222-500 Hz, 12 dB/Octave with Power Response Correction for 2360-Series  
Constant-Coverage Bi-Radial™ Horns
- 52-5223-800 Hz, 12 dB/Octave with Power Response Correction for 2360-Series  
Constant-Coverage Bi-Radial™ Horns
- 52-5322-500 Hz, 12 dB/Octave with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns
- 52-5323-800 Hz, 12 dB/Octave with Power Response Correction for 2380-Series  
Flat-Front Bi-Radial™ Horns



IC2, IC102: 5532  
 IC1, IC3: TL074  
 RELAY SHOWN ENERGIZED  
 RESISTORS IN OHMS, 1/4W

IC1, IC3 +18V  
 IC2, IC102 +18V  
 C3, C5, C2, C12, C112, C13: 0.1uF, 100V  
 C12, C13: 100uF, 25V

SCHEMATIC DIAGRAM, 5235 FREQUENCY DIVIDING NETWORK