P.I.P.-AMC

PLUG-IN PANEL

OWNER'S MANUAL

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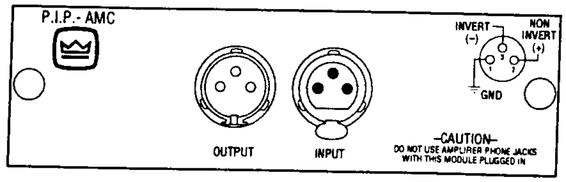


Fig. 1.1 P.I.P.-AMC

1 Welcome

Thank you for purchasing the Crown P.I.P.-AMC accessory. *P.I.P.*® modules are designed to quickly install in the rear panel of many Crown amplifiers. *P.I.P.* stands for "Plug-In Panel." Their versatile features expand the capabilities of your amplifier and enable you to customize it for your particular needs.

The P.I.P.-AMC is a versatile monophonic acoustic modelling crossover that plugs into Crown amplifiers with *P.I.P.* compatibility. It combines the functions of a crossover, equalizer and compressor.

DIP switches, plug-in SIP resistors and convenient jumper blocks make it easy to select any of its many operating modes.

Features

- ❑ Variable 24 dB/octave (4th order) Linkwitz-Riley crossover with state-variable topology.
- ❑ Variable 12 dB/octave (2nd order) low-frequency filter with Q=2 for vented-box equalization.
- ❑ Variable high-frequency shelving network with 12 dB/octave high-frequency filter for Constant-directivity horn equalization.
- ❑ Variable threshold, signal/error driven compressor with infinite compression ratio.
- ❑ Configurable output with "Daisy chain" capability.
- ❑ 3-pin balanced XLR connectors for input and output connection.

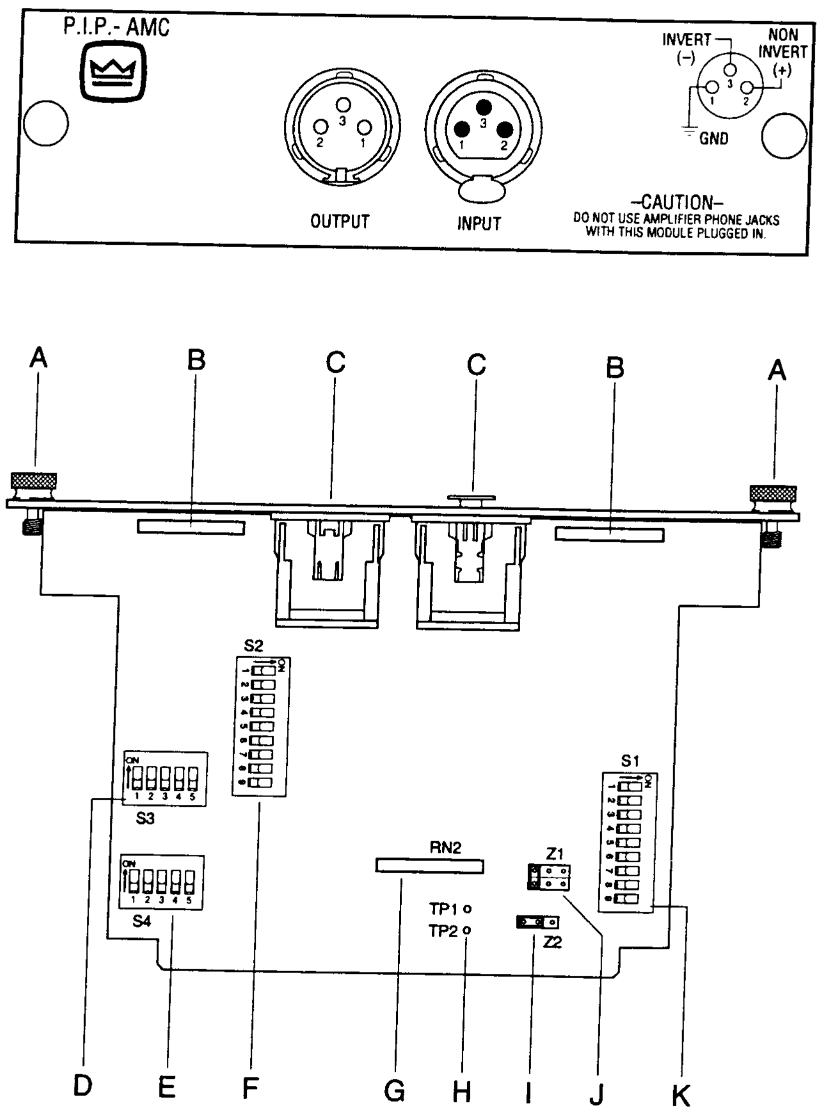


Fig. 2.1 Front & Bottom Views

2 Facilities

A. Thumb Screws

Use these two thumb screws to fasten the *P.I.P.* to the amplifier. A circlip prevents them from falling out.

B. Auxiliary SIP sockets

Two auxiliary SIP sockets are provided for spare crossover SIPs (G). Both 33 and 10 kohm SIPs are provided by the factory for 500 and 1600 Hz crossover, respectively.

C. XLR Connectors

A balanced 3-pin XLR connector is provided at both the input and output. A female connector is used for the input and a male connector is used for the output. These connectors are wired with pin 2 high.

D. Low-Frequency Compressor Threshold DIP (S3)

This five-switch DIP sets the threshold of the low-frequency compressor (Channel 1). See Figure 3.9 for the switch settings.

E. High-Frequency Compressor Threshold DIP (S4)

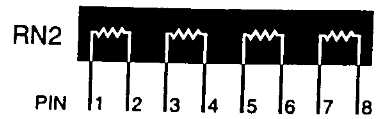
This five-switch DIP sets the threshold of the high-frequency compressor (Channel 2). See Figure 3.9 for the switch settings.

F. Constant-Directivity Horn Equalization DIP (S2)

This nine-switch DIP sets both the +3 dB shelving frequency and the –3 dB low-pass roll-off frequency for the constant-directivity horn equalization filter of Channel 2. See Figure 3.6.

G. Crossover SIP (RN2)

This SIP resistor package sets the crossover frequency. A 20 kohm SIP is installed at the factory for a crossover frequency of 800 Hz. Spare SIPs are provided (B) for crossover frequencies of 500 and 1600 Hz. See Figure 3.1.

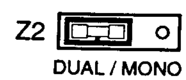


H. Compressor Tracking (TP1, TP2)

If a jumper is installed across TP1 and TP2, the compressor of each channel will track together. In this case, both compressors will be activated equally by the first error signal received.

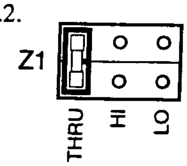
I. Dual/Mono Jumper (Z2)

This two-position jumper is used to disable the input to Channel 2 (MONO position) when the amplifier is oper-ated in mono mode. See Figure 2.2.



J. Output Jumper (Z1)

This three-position jumper is used to configure the "daisy chain" output. Three options are available: THRU passes the <u>un</u>processed input signal to the output; HI passes the <u>un</u>processed high-frequency signal from Channel 2 to the output; and LO passes the <u>un</u>processed low-frequency signal from Channel 1 to the output. See Figure 2.2.



K. Low-Frequency Equalization DIP (S1)

This nine-switch DIP sets the +6 dB boost frequency for the low-frequency vented-box equalization filter of Channel 1. See Figure 3.4.

3 Installation

Crossover Selection

The crossover is a fourth-order Linkwitz-Riley type with state-variable topology. Its frequency is set by the SIP resistor package installed in socket RN2 (see Figure 2.1).

It is set at the factory for 800 Hz. Also included with it are the necessary plug-in resistor SIPs for 500 and 1600 Hz operation. (These two additional SIPs are stored on the circuit board in two spare sockets included for that purpose. See Figure 2.1.)

The Crossover Resistor Value Table (opposite) shows the resistor value (R) required to achieve the specified crossover frequency. Standard "off-the-shelf" network values are used.

The graphs in Figures 3.2 and 3.3 show the typical frequency and phase response of the crossover when set for 800 Hz (R=20 kohm). Notice that each side of the crossover has identical phase response. This has been shown by Linkwitz[1] to yield optimum on-axis response in a multiple driver system.

CROSSOVER	
R (kohms)	Frequency (Hz)
220	72
150	106
120	133
100	159
68	234
47	339
39	408
33	483 (500)
27	590
22	723
20	796 (800)
18	884
15	1062
10	1592 (1600)
8.7	1942
6.8	2342
5.6	2843
5.1	3122
4.7	3388
3.9	4083
3.3	4825
3.0	5308
2.7	5898
2.2	7238
2.0	7962

Fig. 3.1 Crossover Resistor Value Table

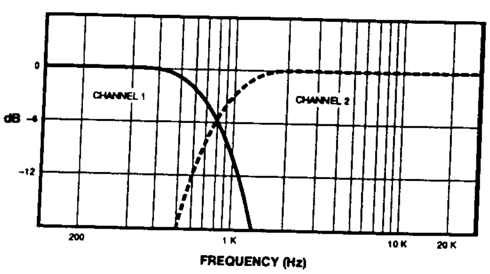


Fig. 3.2 Crossover Frequency Response (800 Hz)

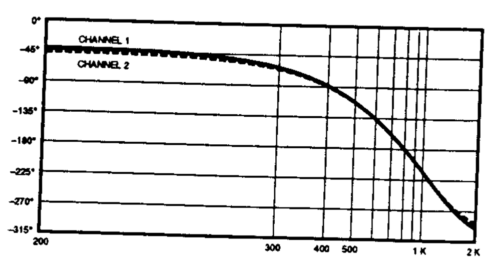


Fig. 3.3 Crossover Phase Response (800 Hz)

[1]Siegfried H. Linkwitz, "Active Crossover-Networks for Noncoincident drivers," JAES, Jan/Feb, 1976.

Low-Frequency EQ (Ch 1)

After the crossover, the low-frequency band is equalized by a second-order high-pass filter with a Q of 2. Such a filter is specified by Thiele[2] and in a more recent paper by Keele[3] where it is used to form a sixth-order Butterworth high-pass response with a vented-box low-frequency system.

The filter uses the Sallen-Key non-inverting second-order high-pass topology. Switch S1, a 9-switch DIP (Figure 2.1) sets the +6 dB boost frequency as shown in the table in Figure 3.4. There are fifteen settings (including FLAT). Figure 3.5 shows typical response curves for these settings.

LOW-FREQUENCY EQUALIZATION (CHANNEL 1)									
S1									+6 dB Frequency (Hz)
1	2	3	4	5	6	7	8	9	
ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	20
OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	24
ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	28
ON	ON	ON	ON	ON	ON	OFF	ON	ON	30
OFF	OFF	ON	ON	ON	ON	OFF	ON	ON	36
OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	38
ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	42
ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	44
OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	56
ON	ON	ON	ON	OFF	OFF	OFF	ON	ON	65
OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	68
OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON	102
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	120
ON	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	180
---	---	---	---	---	---	ON	---	---	FLAT

Fig. 3.4 Low-Frequency EQ Switch

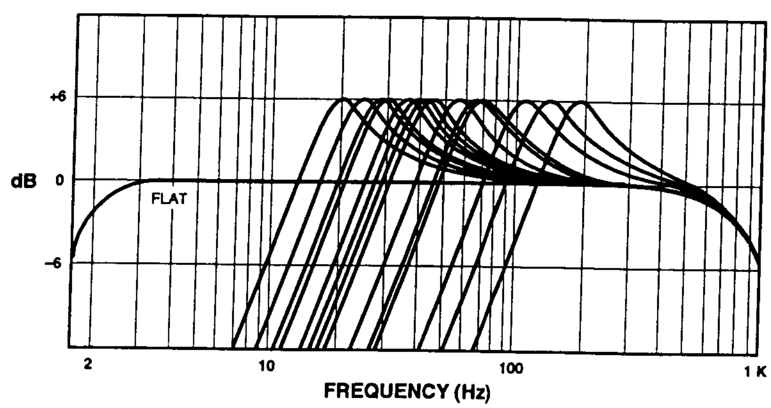


Fig. 3.5 Low-Frequency EQ Response Curves

[2] A.N. Thiele, "Loudspeakers in Vented Boxes," JAES, Vol 19 Part 1, May 1971, Part 2, June 1971.
[3] D.B. Keele Jr., "A New Set of Sixth-Order Vented-Box Loudspeaker System Alignments," JAES, June 1975.

Constant-Directivity Horn EQ (Ch 2)

After the crossover, the high-frequency band is equalized for the inherent roll-off in constant-directivity horns. Both a first-order shelving network and a second-order low-pass filter are provided for this.

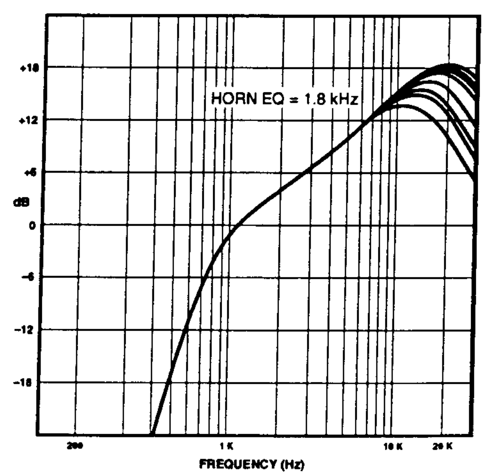
The +3 dB frequency of the shelving network is set by switches 7,8 and 9 of DIP switch S2 (Figure 2.1). Switches 1-6 set the –3 dB roll-off frequency of the low-pass filter. Notice the shelving network can be disabled (set to FLAT) but the low-pass filter is always active.

Note: When the –3 dB roll-off frequency is set to 28 kHz, the signal will be –1 dB at 20 kHz.

Figure 3.6-8 show the switch settings and their respective response curves.

CONSTANT-DIRECTIVITY HORN EQUALIZATION (CHANNEL 2)										
S2									–3 dB Roll–Off Frequency (kHz)	+3 dB Shelving Frequency (kHz)
1	2	3	4	5	6	7	8	9		
OFF	OFF	OFF	OFF	OFF	OFF				12	
ON	OFF	OFF	ON	OFF	OFF				15	
OFF	ON	OFF	OFF	ON	OFF				16	
ON	ON	OFF	ON	ON	OFF				18	
OFF	OFF	ON	OFF	OFF	ON				22	
ON	OFF	ON	ON	OFF	ON				25	
OFF	ON	ON	OFF	ON	ON				26	
ON	ON	ON	ON	ON	ON				28	
						ON	ON	ON		1.8
						OFF	ON	ON		2.2
						ON	OFF	ON		2.4
						OFF	OFF	ON		3.2
						ON	ON	OFF		4.0
						OFF	ON	OFF		6.8
						ON	OFF	OFF		10
						OFF	OFF	OFF		FLAT

Fig. 3.6 Constant-Directivity Horn EQ Switch



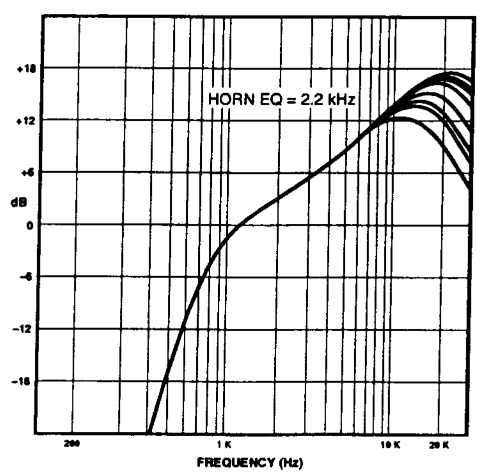


Fig. 3.7 High-Frequency EQ Response Curves (800 Hz Crossover), Part I

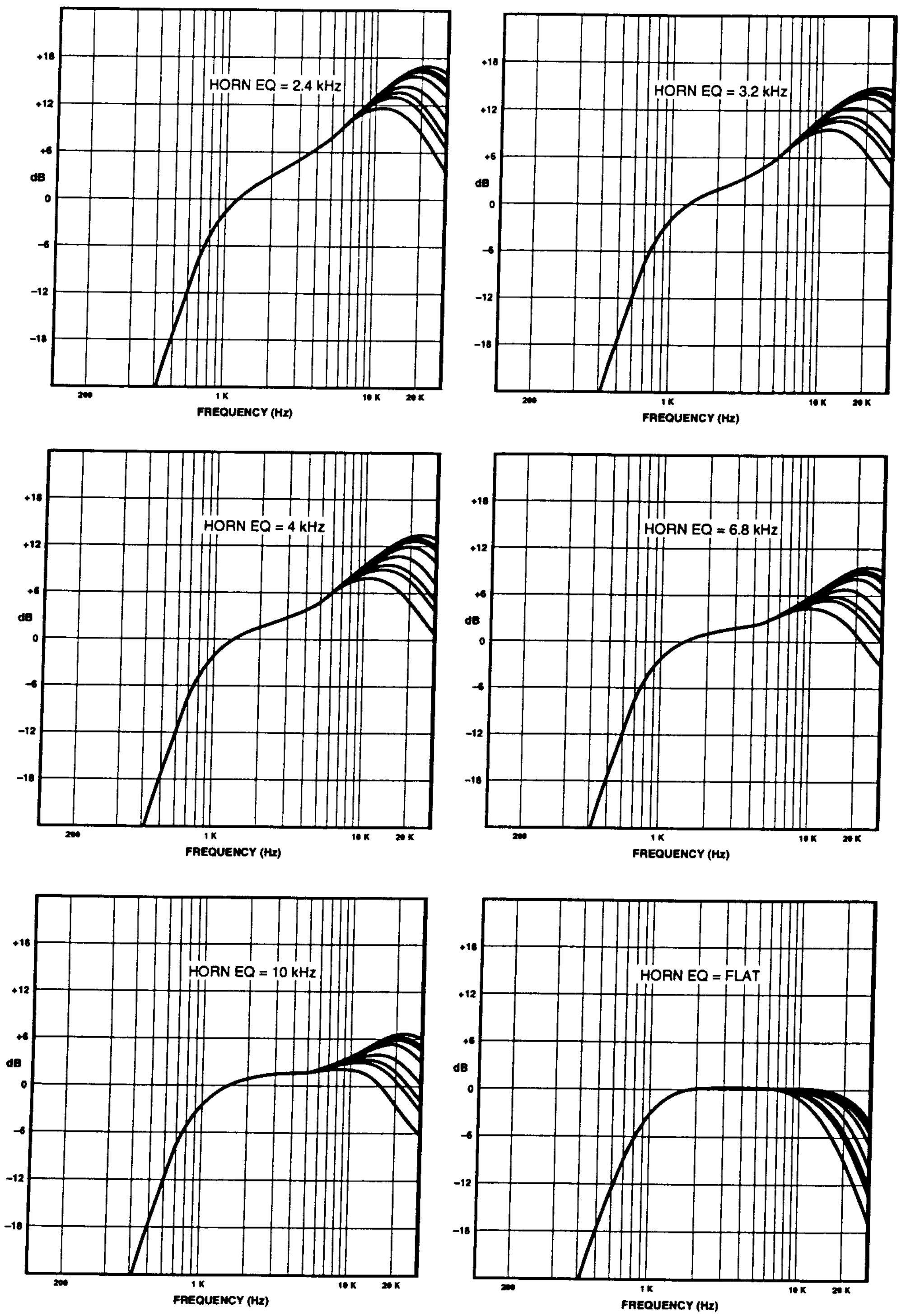


Fig. 3.8 High-Frequency EQ Response Curves (800 Hz Crossover), Part II

Compressor Threshold

After the crossover and equalizers, the signal of each channel is controlled by its own variable-threshold, signal-driven (error-driven by default) compressor.

The purpose of the compressors is to limit the signal loudness for those applications where driver and/or system protection are desired.

The compressor for Channel 1 (low-frequency signal) is set by the factory with a 10 msec attack time and a 360 msec release time. The compressor for Channel 2 (high-frequency signal) is set with a 5 msec attack time and a 180 msec release time.

Both compressors have an infinite compression ratio. This means that when the threshold is reached, an increase in input level will not result in a change in output level. The range of compression is 16 dB. If the input is driven more than 16 dB over the threshold, that portion of the signal which is more than 16 dB over will be passed linearly. At that point only the clipping of the amplifier would further limit the signal.

The threshold is selectable from approximately 8 to 84.5 VRMS in 2.5 V increments with DIP switches S3 and S4 (see Figure 2.1). The table in Figure 3.9 shows the switch settings and corresponding voltage outputs for both DUAL and PARALLEL-MONO modes of operation. Corresponding power levels are also shown for 8 and 4 ohm loads. In BRIDGE-MONO mode, the threshold voltages are double and corresponding power

COMPRESSOR THRESHOLD (CH 1 & 2)							
S3 (Ch 1) & S4 (Ch 2)					Threshold*		
1	2	3	4	5	RMS Volts	Watts-8Ω	Watts-4Ω
OFF	OFF	OFF	OFF	OFF	8	8	16
ON	OFF	OFF	OFF	OFF	10.5	14	28
OFF	ON	OFF	OFF	OFF	13	21	42
ON	ON	OFF	OFF	OFF	15.5	30	60
OFF	OFF	ON	OFF	OFF	18	41	82
ON	OFF	ON	OFF	OFF	20.5	53	106
OFF	ON	ON	OFF	OFF	23	66	132
ON	ON	ON	OFF	OFF	25.5	81	162
OFF	OFF	OFF	ON	OFF	28	98	196
ON	OFF	OFF	ON	OFF	30.5	116	232
OFF	ON	OFF	ON	OFF	33	136	272
ON	ON	OFF	ON	OFF	35.5	158	316
OFF	OFF	ON	ON	OFF	38	181	362
ON	OFF	ON	ON	OFF	40.5	205	410
OFF	ON	ON	ON	OFF	43	231	462
ON	ON	ON	ON	OFF	45.5	259	518
OFF	OFF	OFF	OFF	ON	47.5	282	564
ON	OFF	OFF	OFF	ON	49.5	306	612
OFF	ON	OFF	OFF	ON	52	338	676
ON	ON	OFF	OFF	ON	54.5	371	742
OFF	OFF	ON	OFF	ON	57	406	812
ON	OFF	ON	OFF	ON	59.5	443	886
OFF	ON	ON	OFF	ON	62	481	962
ON	ON	ON	OFF	ON	64.5	520	1040
OFF	OFF	OFF	ON	ON	67	561	1122
ON	OFF	OFF	ON	ON	69.5	604	1208
OFF	ON	OFF	ON	ON	72	648	1296
ON	ON	OFF	ON	ON	74.5	694	1388
OFF	OFF	ON	ON	ON	77	741	1482
ON	OFF	ON	ON	ON	79.5	790	1580
OFF	ON	ON	ON	ON	82	840	1680
ON	ON	ON	ON	ON	84.5	892	1784

*Note: These threshold voltages and power levels are valid only for Dual and Parallel-Mono modes of operation. The voltages shown must be doubled and the power levels recalculated for Bridge-Mono mode.
Also note: The maximum output power is strictly limited to the capability of your amplifier. Any threshold setting above the maximum output power of your amp will result in the compressor acting solely as a "clip" eliminator.

Fig. 3.9 Compressor Threshold Switches levels would need to be recalculated.

S3 sets the threshold for Channel 1 and S4 sets the threshold for Channel 2. No matter what the threshold is set to, if the amplifier output clips, the compressor will be activated because its control drive circuitry is derived from the *IOC®* error signal from the amplifier.

Note: If a clip eliminator is all that is desired, the threshold DIP switches should all be set to "ON" (84.5 V). Also, if you want both compressors to track together, install a jumper across TP1 and TP2 on the circuit board (Figure 2.1).

Input/Output Wiring

Balanced mono input is provided via a female 3-pin XLR connector where Pin 1 is ground, Pin 2 is noninverting, and Pin 3 in inverting. Figures 3.10 and 3.11 illustrates this:

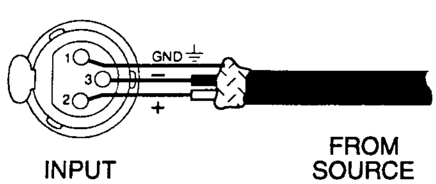


Figure 3.10 Balanced Input Wiring

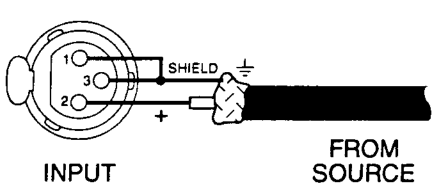


Figure 3.11 Unbalanced Input Wiring

The "daisy chain" output is also balanced and is AC coupled and can be programmed for feedthrough (THRU), high-pass (HI) or low-pass (LO) output by selecting the appropriate position for the jumper on jumper block Z1 (Figure 2.1).

The ¼-inch phone jacks on *Macro-Tech®* amplifiers should not be used for input while the P.I.P.-AMC is installed but they may be used as unbalanced "daisy chain" outputs with loads greater than 5 K ohms. If used in this way, the signal available at each jack will represent the actual signal driving the P.I.P.-AMC driven amplifier. For example, the signal will be equalized and compressed according to the status of the switch/ jumper settings of its respective channel. This can enable several amplifiers to track the one with the P.I.P.-AMC.

The dual/mono jumper block Z2 (Figure 2.1) disconnects the input signal from Channel 2 of the amplifier. This allows for the first amplifier in a "chain" to be operated in one of the mono modes.

Installation

You may need a phillips screwdriver to remove the existing *P.I.P.* module or panel from your amplifier.

Important: Before connecting this or any *P.I.P.* to your amplifier, it is important to turn its level controls down, turn it off and remove the AC power from it. Even though the amplifier is off, there could still be enough energy in the circuitry to cause electric shock.

1. Turn down the level controls (full counterclockwise), turn off the amplifier and unplug it from the AC power source.
2. Remove the existing *P.I.P.* module or panel (two screws), pulling straight out with firm pressure.
3. Align the edge connector of the P.I.P.-AMC circuit board into the *P.I.P.* card rails, as shown in Figure 3.12.
4. Firmly push the P.I.P.-AMC all the way in until it is seated against the mounting bracket.
5. Secure it with the two thumbscrews provided as shown in Figure 3.12.
6. Connect input and output wiring as described in the preceding section (Input/Output Wiring).
7. Plug in the amplifier and turn it on. Adjust its level controls to a desired setting. (The level controls can now be used to balance the low and high frequencies.)

Do not tamper with the circuitry. Circuit changes made by unauthorized personnel, or unauthorized circuit modifications are not allowed.

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

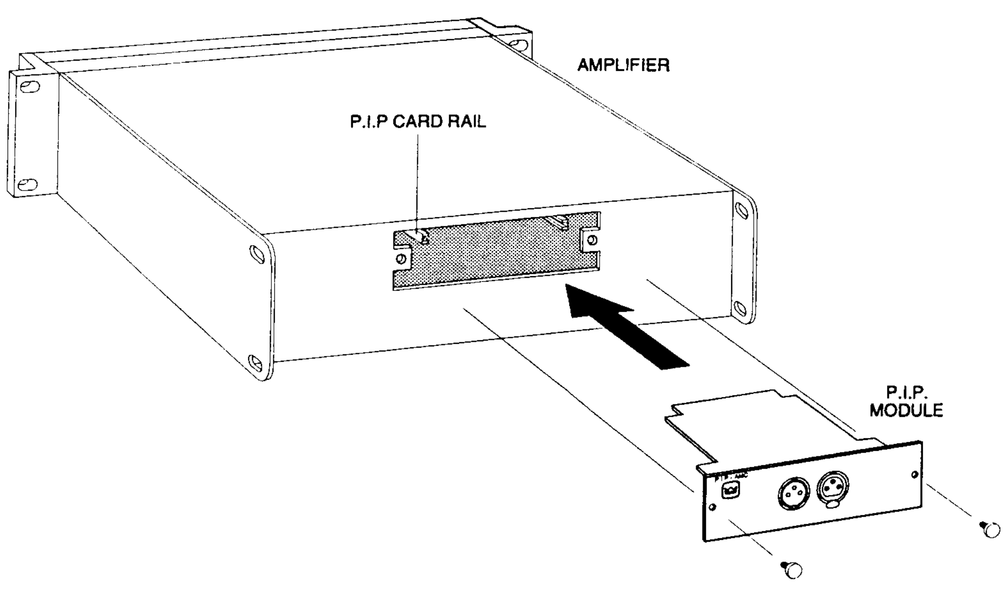


Fig. 3.12 P.I.P. Installation

4 Specifications

Signal to Noise Ratio: Greater than 85 dB (equivalent input noise) from 20 Hz to 20 kHz.

Common Mode Rejection: Greater than 68 dB at 10 kHz.

Crosstalk: Greater than 46 dB below the signal level at 20 kHz.

Harmonic Distortion: Less than 0.05% THD at 1 kHz and any setting with no compression. Less than 0.5% (either channel) at 800 Hz crossover with 6 dB of compression.

Input Impedance: Nominally 20 K ohms balanced and 10 K ohms unbalanced.

Maximum Input Level: +18 dB at 1 kHz.

Nominal Gain: Unity ±0.5 dB.

Crossover: Linkwitz-Riley, 24 dB/octave with state variable topology. Channel 1: low-pass; Channel 2: high-pass. Crossover frequency: 80 Hz to 8 kHz, selected by a plug-in SIP network. (factory set to 800 Hz with 500 and 1200 Hz SIP networks also provided.)

Low-Frequency Equalization: 2nd order high-pass filter with Q=2 for classic Thiele–Keele B_6 vented system alignment. Boost: +6 dB. Roll-off: 2nd order below boost (set by filter). Boost frequency: selectable as 20, 24, 28, 30, 36, 38, 42, 44, 56, 65, 68, 102, 120, 180 Hz or flat by 9 DIP switches.

High-Frequency Equalization: 1st order shelving network for "constant-directivity" horn equalization. Boost frequency (+3 dB): selectable as 1.8, 2.2, 2.4, 3.2, 4.0, 6.8, 10.0 kHz or flat by 3 DIP switches. The amount of boost is determined by the bandwidth. Boost roll-off: 2nd order above boost. Upper limit roll-off: selectable as 12, 15, 16, 18, 22, 25, 26, 28 kHz by 6 DIP switches.

Compressor: Driven by both the audio signal and by the *IOC*® error signal. Threshold: adjustable in 2.5 V increments from 8 to 84.5 VRMS by 5 DIP switches. Dynamic range: Greater than 16 dB. Channel 1: 10 msec attack with 360 msec decay. Channel 2: 5 msec attack with 180 msec decay. Compression ratio: ∞:1.

Connectors

Input: Balanced female 3-pin XLR.

Output: Balanced male 3-pin XLR.

Maximum Output Level: +18 dB (with a 600 ohm load).

Power Requirements: When plugged into a *Macro-Tech* or *Com-Tech* amplifier, the *P.I.P.* receives ±24 V power.

Dimensions: 6 3/8 x 1 7/8 x 3 7/8 in (16.2 x 4.8 x 9.8 cm).

Weight: 10 ounces (284 grams).

Note: All specifications referenced to a 0.775 V input signal.