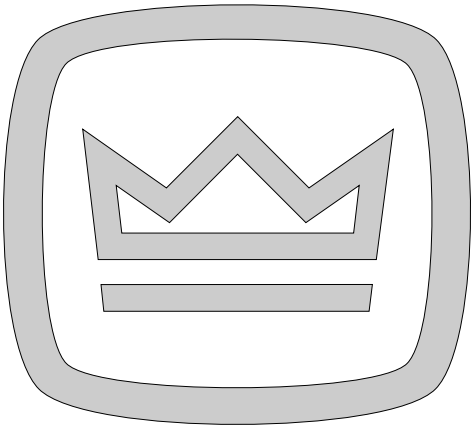

P.I.P.-XOV

Programmable Input Processor

REFERENCE MANUAL

Obtaining Other Language Versions: To obtain information in another language about the use of this product, please contact your local Crown Distributor. If you need assistance locating your local distributor, please contact Crown at 574-294-8000.

This manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance.

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred. To obtain the latest version of this manual, please visit the Crown website at www.crownaudio.com.

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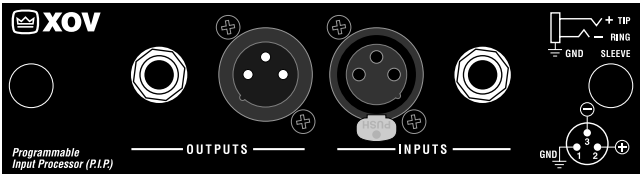


Fig. 1.1 P.I.P.-XOV

1 Welcome

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

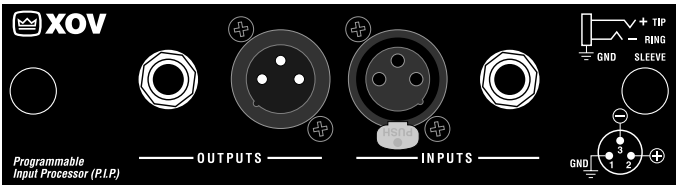
The P.I.P. -XOV is a versatile and economical mono crossover filter that plugs into Crown amplifiers with PIP compatibility. It provides high-pass and low-pass filters with 18 dB/octave (3rd order) slopes for bi-amp and tri-amp systems.

Five two-position sliding switches make it easy for the user to select one of twenty-four modes of operation.

Plug-in resistor and capacitors make it easy to change the crossover frequencies.

Features

- ❏ 18 dB/octave high-pass and low-pass filters.
- ❏ User-selectable Butterworth, Bessel, or Chebyshev response.
- ❏ Fully protected from output shorts.
- ❏ Unity gain.
- ❏ Very economical.
- ❏ Twenty-four modes of operation.
- ❏ Both 3-pin XLR connectors and 1/4-inch phone jacks are provided for input and output connection.



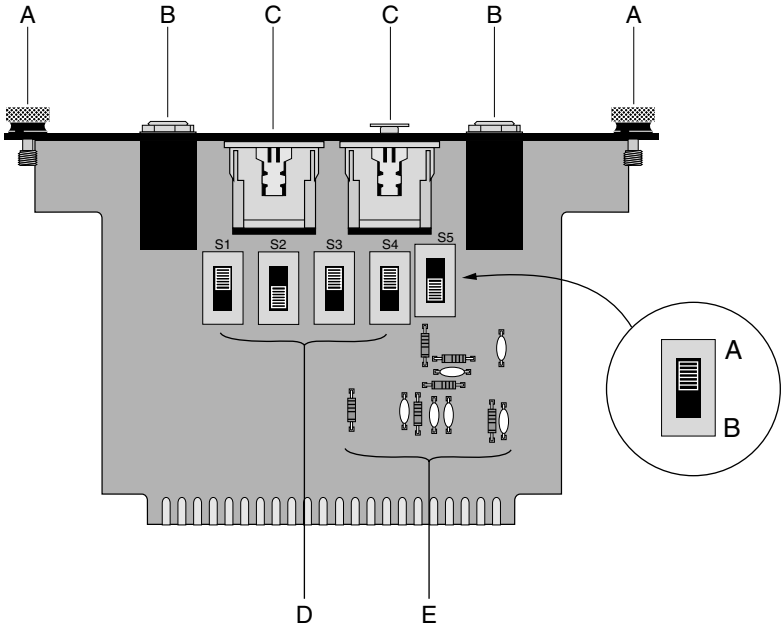


Fig. 2.1 Front & Bottom Views

2 Facilities

A. Thumb Screws

Use these two thumb screws to fasten the PIP to the amplifier. An E-ring prevents them from falling out.

B. Balanced Phone Jacks

A balanced 1/4-inch phone jack is provided at both the input and output of the P.I.P.-XOV. Each phone jack is parallel to its XLR connector counterpart.

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 and are parallel to their phone jack counterparts.

D. Mode Switches

Five slide switches (S1–S5) are used to configure the P.I.P.-XOV in any of its 24 different modes of operation. Each switch has two positions: A (up) and B (down). See the table in Figure 3.1 for a description of each mode and their respective switch settings.

E. User-Replaceable Components

Six resistors (R1–R6) and six capacitors (C1–C6) can be easily unplugged and replaced with components of different values to change both the crossover frequency and the response curve (Bessel, Butterworth, or Chebyshev).

3 Installation

Mode of Operation

Use switches S1 through S5 to configure the P.I.P.-XOV in the desired operating mode. The following five modes are just a sample of the twenty-four different modes which are available:

- Mode 3: High-pass to Ch. 1, low-pass to Ch. 2, unprocessed signal to the output connectors for daisy-chaining.
- Mode 5: Low-pass to Ch. 1, high-pass to Ch. 2, unprocessed signal to the output connectors for daisy-chaining.
- Mode 16: Band-pass to Ch. 1 for mono operation, with unprocessed signal to the output connectors for daisy-chaining.
- Mode 20: High-pass to Ch. 1 for mono operation, with low-pass signal routed to the output connectors.
- Mode 22: Low-pass to Ch. 1 for mono operation, with high-pass signal routed to the output connectors.

Figure 3.1 shows the switch settings and explanation of each mode. The

MODE	SWITCH SETTINGS					FUNCTION		
	S1	S2	S3	S4	S5	CH. 1	CH. 2	OUTPUT CONNECTOR
1	A	A	A	A	X	LP	LP	FLAT
2	A	A	A	B	A	BP	LP	FLAT
3	A	A	A	B	B	HP	LP	FLAT
4	A	A	B	A	A	LP	BP	FLAT
5	A	A	B	A	B	LP	HP	FLAT
6	A	A	B	B	A	BP	BP	FLAT
7	A	A	B	B	B	HP	HP	FLAT
8	A	B	A	A	X	LP	LP	
9	A	B	A	B	A	BP	LP	
10	A	B	A	B	B	HP	LP	
11	A	B	B	A	A	LP	BP	
12	A	B	B	A	B	LP	HP	
13	A	B	B	B	A	BP	BP	
14	A	B	B	B	B	HP	HP	
15	B	A	X	A	X	LP	MONO	FLAT
16	B	A	X	B	A	BP	MONO	FLAT
17	B	A	X	B	B	HP	MONO	FLAT
18	B	B	A	A	X	LP	MONO	LP
19	B	B	A	B	A	BP	MONO	LP
20	B	B	A	B	B	HP	MONO	LP
21	B	B	B	A	A	LP	MONO	BP
22	B	B	B	A	B	LP	MONO	HP
23	B	B	B	B	A	BP	MONO	BP
24	B	B	B	B	B	HP	MONO	HP

X = A or B
LP = Low-pass
HP = High-pass
BP = Band-pass

Fig. 3.1 Twenty-Four Operating Modes

output connector is provided as a convenient means for "daisy chaining" the signal from amplifier to amplifier. However, please note that modes 8–14 do not provide any output signal to the output connector.

Also note that modes 15–24 are to be used only with the amplifier configured in one of its two mono modes (BRIDGE-MONO or PARALLEL-MONO). When the P.I.P.-XOV is placed in one of these modes, no signal will be fed to the input of Channel 2.

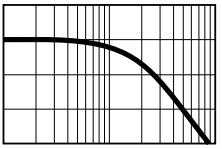
Diagrams illustrating the connection of each mode are included in Appendix A to assist your selection.

Crossover Selection

The P.I.P.-XOV is factory-set for a crossover frequency of 800 Hz with a Butterworth response. Included with the PIP are additional resistors to change the crossover frequency to 100 or 500 Hz, and capacitors to change it to 1, 5 or 8 kHz.

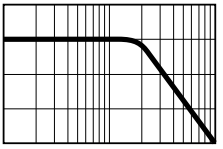
Changing the filter type or its crossover frequency is simply a matter of plugging in resistors and capacitors of the desired values. Six resistors and six capacitors are socketed for this purpose (Figure 2.1).

Three filter types are available: Bessel, Butterworth, and Chebyshev. Each differs in its ability to provide ideal frequency response, a constant signal delay, and large stopband attenuation. A brief description of each type follows:



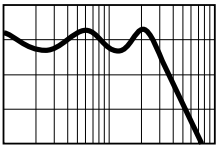
Bessel

A Bessel filter provides minimum phase distortion throughout its passband (i.e. the most constant signal delay), which is desirable for pulse-type waveforms, but has the poorest stopband attenuation of the three filter types.



Butterworth

A Butterworth filter provides the flattest response in the passband with a moderate amount of stopband attenuation. This filter is most commonly used in crossover applications.



Chebyshev

A Chebyshev filter has more attenuation in the stopband at the expense of ripple in the passband. For example, a 0.5 dB Chebyshev filter has attenuation varying from 0 dB to 0.5 dB in the passband, but has attenuation in the stopband greater than that of the other two filter types.

The formulas shown below calculate the correct component values for the low-pass and high-pass filters. The value of constants K1, K2 and K3 determine the filter type.

Notice that the value of resistors R1, R2 and R3 will always be equal. The same is true of capacitors C4, C5 and C6. Resistors R1–R5 should always be greater than 2 K ohms and less than 330 K ohms. Resistor R6 should always be less than 1 M ohm. The value of capacitors C4, C5 and C6 can be any arbitrary value so long as it allows R1–R6 to meet the above criteria.

All resistors should have a 1% tolerance and should be rated for 0.25 watt. All capacitors should have a 10% tolerance and be of the film type.

LOW-PASS FILTER

$$C1 = \frac{K1}{2\pi F_L R} \qquad C2 = \frac{K2}{2\pi F_L R} \qquad C3 = \frac{K3}{2\pi F_L R}$$

HIGH-PASS FILTER

$$R4 = \frac{1/K1}{2\pi F_H C} \qquad R5 = \frac{1/K2}{2\pi F_H C} \qquad R6 = \frac{1/K3}{2\pi F_H C}$$

Where:

- π = 3.14159
- F_L = Low-pass crossover frequency (Hz)
- F_H = High-pass crossover frequency (Hz)
- R = R1 = R2 = R3 (ohms)
- C = C4 = C5 = C6 (farads)

Note: R1–R5 must all be > 2 K ohms and < 330 K ohms and R6 must be < 1 M ohm. All resistors are 0.25 watt, 1% and all capacitors are 10% film.

Filter Type	K1	K2	K3
Bessel	0.988	1.423	0.2538
Butterworth	1.392	3.546	0.2024
0.1 dB Chebyshev	1.825	6.653	0.1345
0.25 dB Chebyshev	2.018	8.551	0.1109
0.5 dB Chebyshev	2.250	11.23	0.0895
1 dB Chebyshev	2.567	16.18	0.06428
2 dB Chebyshev	3.113	27.82	0.03113
3 dB Chebyshev	3.629	43.42	0.02533

Fig. 3.2 Resistor / Capacitor Selection Values

Example

Suppose that you need a 0.25 Chebyshev high-pass filter with a 400 Hz cutoff. The preceding chart shows the correct values for K1–K3: K1=2.018, K2=8.551, and K3= 0.1109. Next choose an arbitrary value for C (C4, C5, C6) which yields R4 and R5 values approximately within the range of 2 K to 330 K ohms and a value for R6 less than 1 M ohm. For this example, let C=0.01 mF.

Then:R4 = (1 / 2.018) / (2 x 3.14159 x 400 x 0.01 x 10E–6) = 19,717 ohms.

R5 = (1 / 8.551) / (2 x 3.14159 x 400 x 0.01 x 10E–6) = 4,563 ohms.

R6 = (1 / 0.1109) / (2 x 3.14159 x 400 x 0.01 x 10E–6) = 358,800 ohms.

The 1% precision resistors with the closest values are: R4=19.6 K ohms, R5=4,640 ohms, and R6=357 K ohms.

Figure 3.3 lists the resistor and capacitor values for a Butterworth filter using K1=1.392, K2=3.546, and K3=0.2024:

CROSSOVER FREQUENCY (Hz)	**LOW-PASS** C1=3300 pF_1 C2=8200 pF_1 C3=470 pF_1	**HIGH-PASS** C4=C5=C6=0.0022μF_1		
	R1,R2,R3	R4	R5	R6
10000	6810	5230	2050	35700
9000	7500	5760	2260	40200
8000	8450_2	6490_2	2550_2	44200_2
7000	9760	7500	2940	51100
6000	11300_3	8660_3	3400_3	59000_3
5000	13700	10500	4120	71500
4000	16900	13000	5110	88700
3000	22600	17400	6810	119000
2000	34000	26100	10200	178000
1500	45300	34800	13700	237000
1000	68100_4	52300_4	20500_4	357000_4
	C1=0.033μF_2 C2=0.082μF_2 C3=0.0047μF_2	C4=C5=C6=0.022μF		
	R1,R2,R3	R4	R5	R6
1000	6810	5230	2050	35700
900	7500	5760	2260	40200
800	8450_2	6490_2	2550_2	44200_2
700	9760	7500	2940	51100
600	11300	8660	3400	59000
500	13700_3	10500_3	4120_3	71500_3
400	16900	13000	5110	88700
300	22600	17400	6810	119000
200	34000	26100	10200	178000
100	68100_4	52300_4	20500_4	357000_4

Notes:
1. Parts in the >1000 HZ kit
2. Factory installed parts
3. Parts in the 500 Hz kit
4. Parts in the 100 Hz kit

Fig. 3.3 Butterworth Filters

A guide to reading resistor color codes is included in Appendix B for your convenience.

Installation Procedures

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

CAUTION: Before connecting this or any PIP to your amplifier, it is important to turn its level controls down, turn it off and remove the AC power. Don't touch the circuitry while the amp is plugged in. Even though the amplifier is off, there could still be enough energy remaining 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 PIP module or panel (two screws). For *PIP2™* amplifiers, this may involve disconnecting the PIP from a PIP2 input adapter (see Figures 3.5 and 3.6). If a PIP2 input adapter is already present, do not remove the ribbon cables from the adapter. Otherwise you will have to reconnect them in the next step.
3. *Standard PIP Amplifiers*: Align the edges of the P.I.P.–XOV in the PIP card rails and firmly push the unit in until it is seated against the mounting bracket (see Figure 3.4).

   PIP2 Amplifiers: (Requires a PIP2 input adapter. Crown part number Q43528-1.) Connect the PIP2 input adapter to the two input cables of the amplifier (see Figure 3.5). Notice that the PIP2 input adapter should be positioned with the PIP edge connector on top and facing away from the amplifier. The 20-pin cable (A) is connected first then the 18-pin cable (B) is connected. Both ribbon cables should extend below the PIP2 input adapter.

   Next, insert the edge connector of the P.I.P.–XOV into the PIP2 input adapter (see Figure 3.6) and insert the assembly into the PIP opening in the back of the amplifier.
4. Secure the P.I.P.–XOV with the two screws and lock washers provided. (The lock washers are important because they bond the PIP to the chassis ground of the amplifier.)
5. Connect input and output wiring.
6. Plug in the amplifier and turn it on. Adjust its level controls to a desired setting.

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.

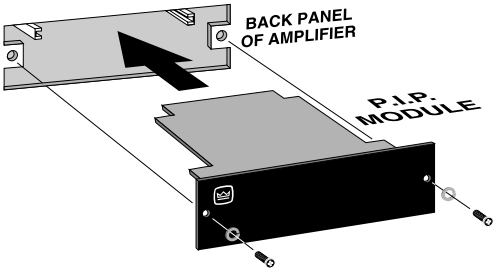


Fig. 3.4 Installation into a Standard PIP Amplifier

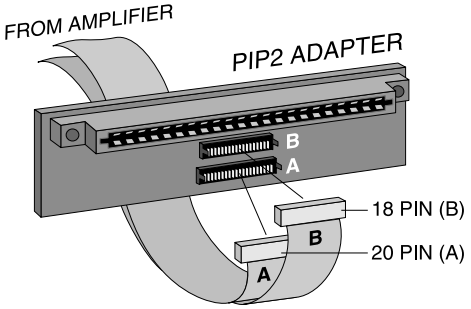


Fig.3.5 PIP2 Input Adapter Connection

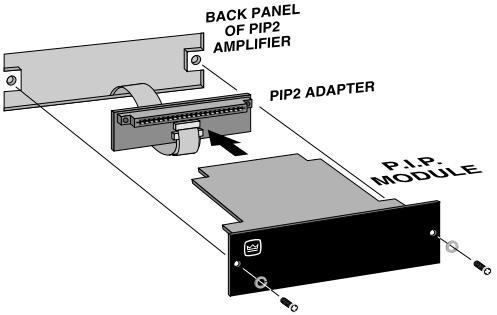


Fig. 3.6 Installation into a PIP2 Amplifier

4 Specifications

Signal to Noise: Better than –85 dB with 800 Hz low-pass or high-pass (equivalent input noise, 20 Hz to 20 kHz).

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

Output: 10 VRMS balanced maximum.

Nominal Gain: 1.

Frequency Response: +/– 0.75 dB, dropping to –3 dB at the selected crossover frequency (Butterworth response). See Figures 4.1 to 4.4.

Filters: One low-pass and one high-pass with user-selectable filter type. Factory-set for 3-pole Butterworth at 18 dB/octave with 800 Hz crossover frequency. Bessel or Chebyshev filters are also available.

Connectors

Input: Balanced female 3-pin XLR and balanced 1/4-inch phone jack.

Output: Balanced male 3-pin XLR and balanced 1/4-inch phone jack.

(The input signal can be switched to the output connector for external "daisy chaining.")

Power Requirements: When plugged into a *Macro-Tech®* or *Com-Tech®* amplifier, the PIP 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: 8.5 ounces (241 grams).

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

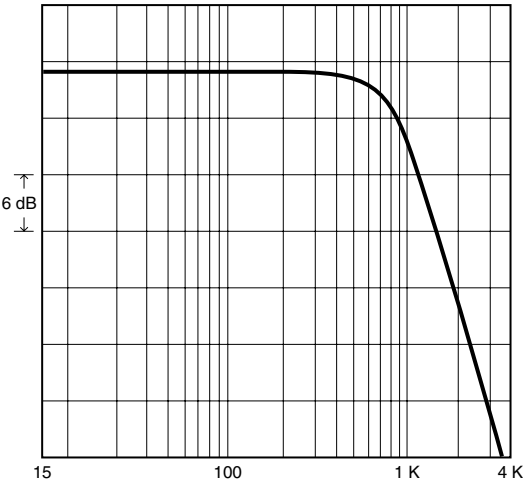


Fig. 4.1 Low-Pass Frequency Response
800 Hz Crossover Frequency

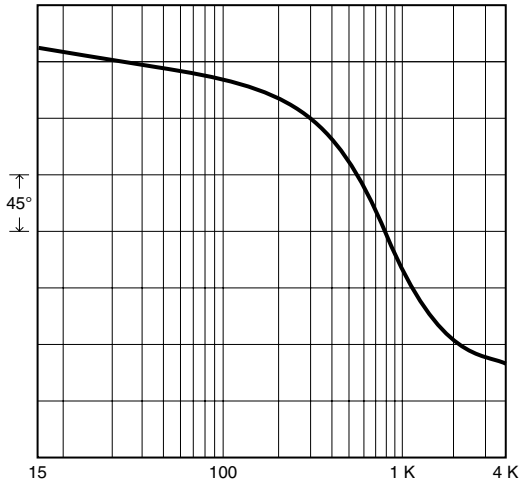


Fig. 4.2 Low-Pass Phase Response
800 Hz Crossover Frequency

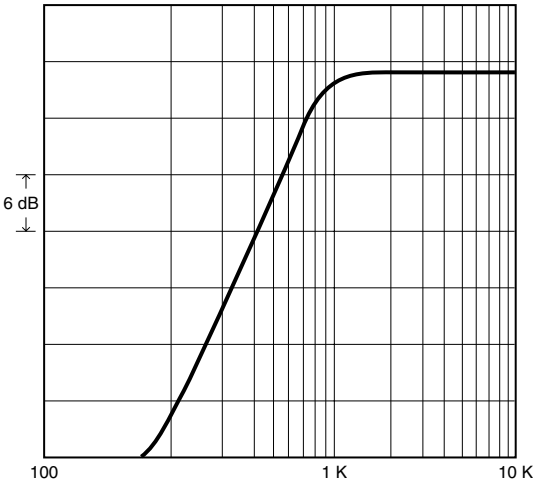


Fig. 4.3 High-Pass Frequency Response
800 Hz Crossover Frequency

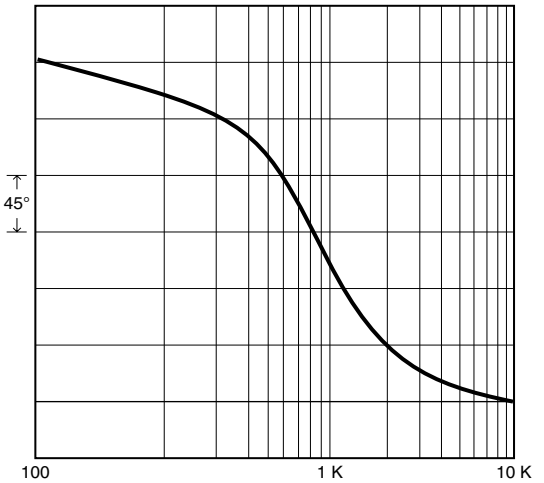
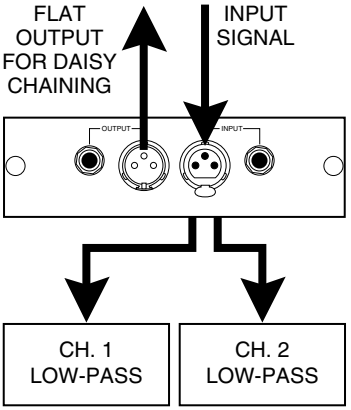
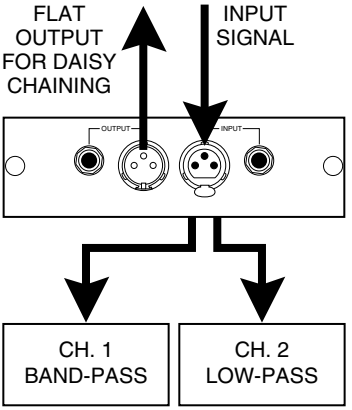


Fig. 4.4 High-Pass Phase Response
800 Hz Crossover Frequency

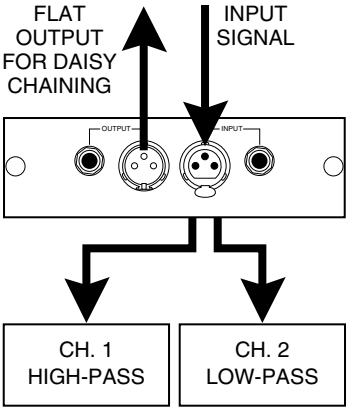
Appendix A: Operating Modes



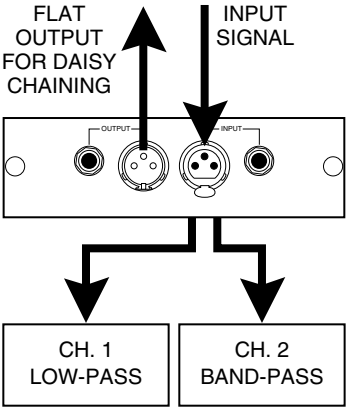
MODE 1



MODE 2



MODE 3



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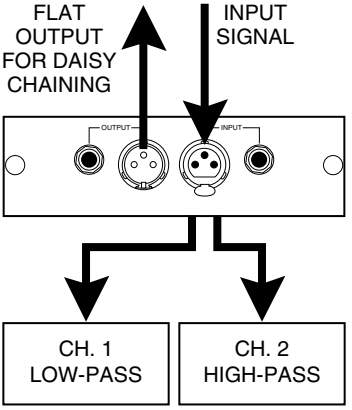
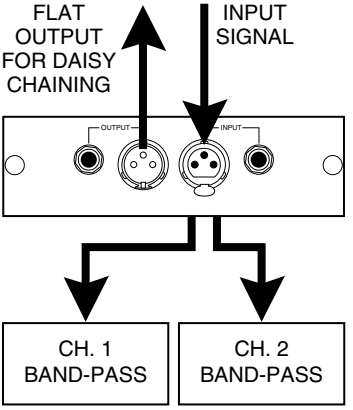


MODE 5



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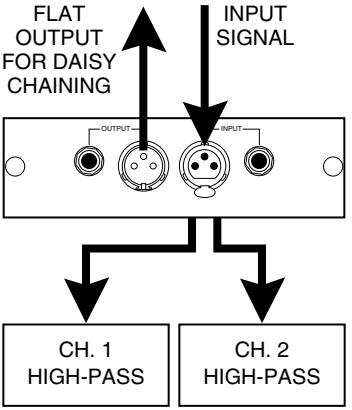

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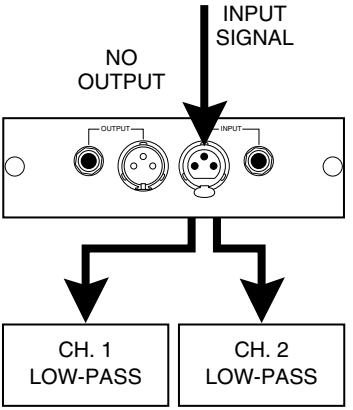
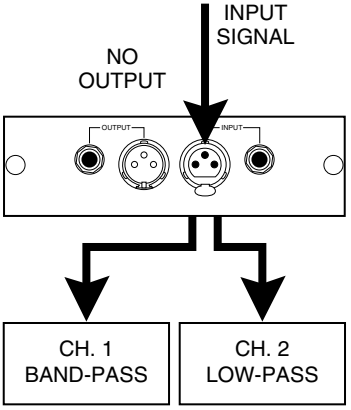


MODE 8



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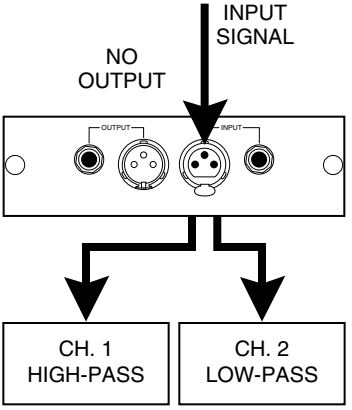

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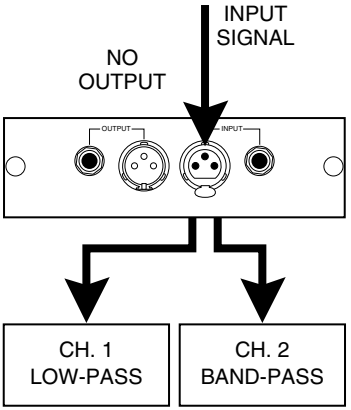

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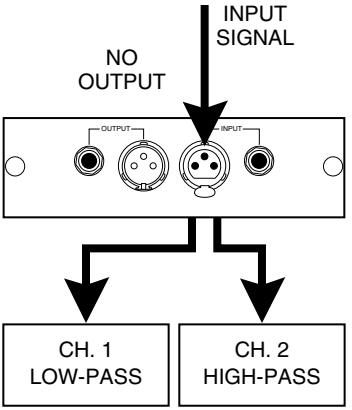
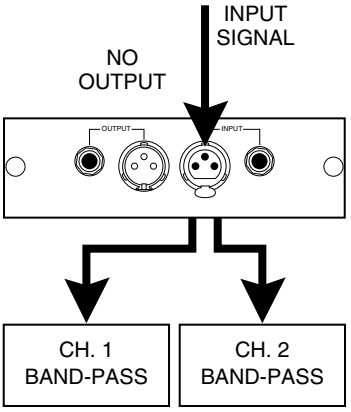
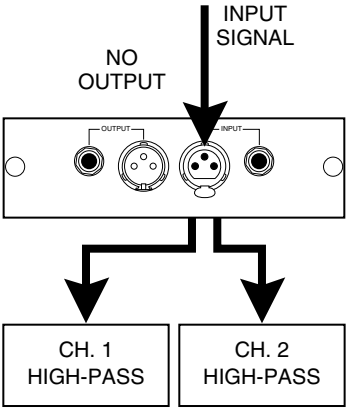


MODE 12



MODE 13



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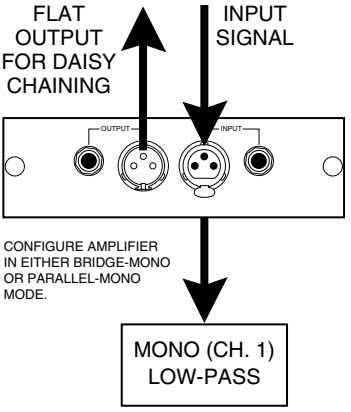

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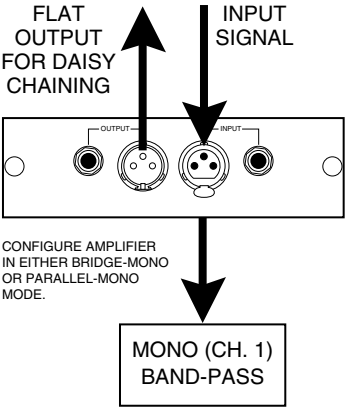

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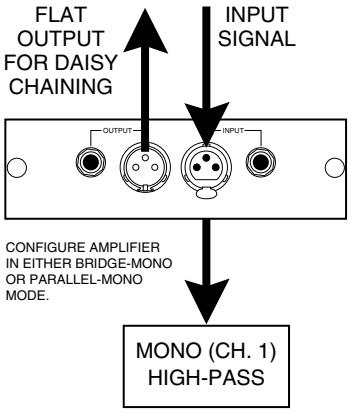

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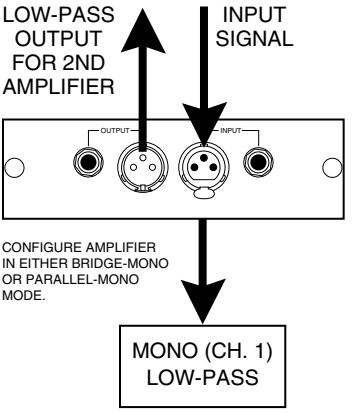

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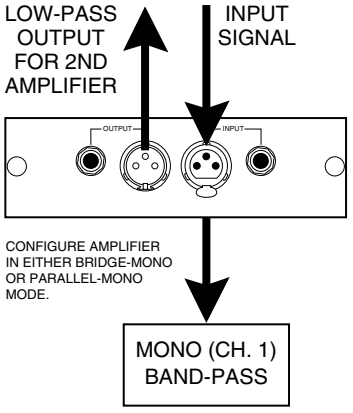

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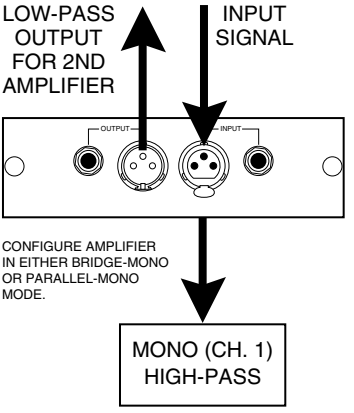

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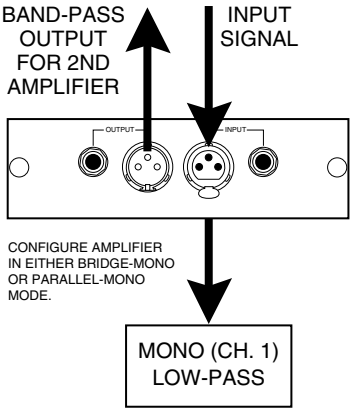

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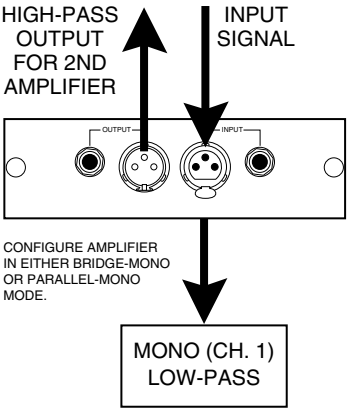

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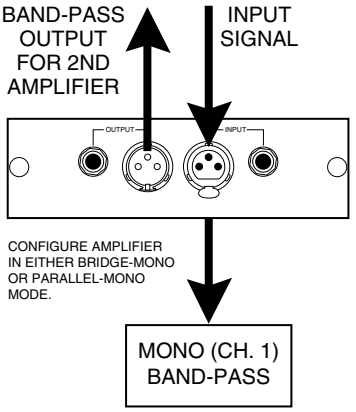

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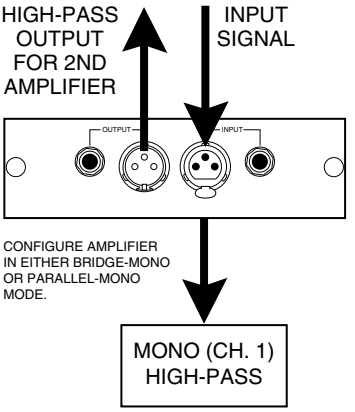

MODE 24

Appendix B: Reading Component Values

Capacitors

Capacitors' values are usually stamped on the capacitor. However, not all capacitors are labeled the same way. For example, a 0.022 microfarad (µF) capacitor may be marked as .022 K, 22n, .022 µF, or 223 K. The last example could be read 22 x 10^3 picofarads (pF), where 1 pF=10^6 µF.

Resistors

Figure B.1 shows how to read the value of a resistor:

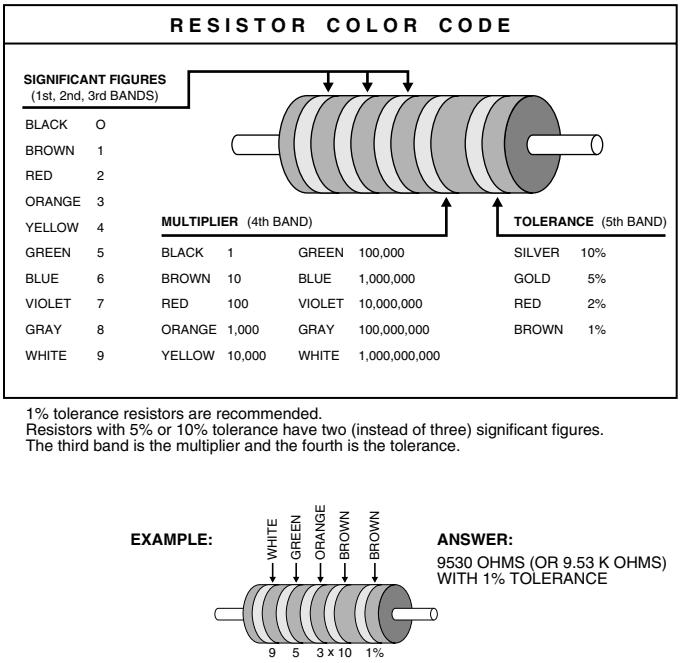

Fig. B.1 Reading Resistor Color Codes

Due to quality considerations, this graphic was omitted from the online version of this document.

Notes:

1. All resistors are in ohms, 0.25W, 5%, unless otherwise specified.

Due to quality considerations, this graphic was omitted from the online version of this document.

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2. All Capacitors are in microfarads unless otherwise specified.