

# The Electronic Crossover/Equalizer Unit

The active Crossover/Equalizer control unit, which is part of the Reference Standard 4.5 system and optional with the RS 2.5, makes it possible for the user to compensate for room acoustics and speaker placement.

The unit is connected into the signal path between the preamplifier(s) and power amplifier(s). In the case of a receiver without an externally accessible link between its pre-amp output and its power amp input, the connections are made through the tape monitor circuit for equalizer use only.

When active bi-amplification of an RS 4.5 or RS 2.5 speaker system is desired, the Crossover/Equalizer must be used.

## Brief Theory of Operation

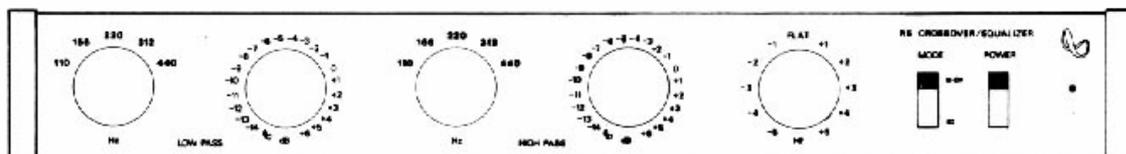
Each signal channel of the unit consists of a 6-dB-per-octave low- and high-pass filter. Each of these filters has its own variable cutoff frequency (3 dB down point) and output level controls. The high-pass portion of the circuit has a high-frequency contour control giving 5 dB of boost or cut at 15 kHz. With the **MODE** switch in the EQ position, the output of the high and low filters is summed electrically. By varying **LOW PASS GAIN**, **LOW PASS** and/or **HIGH PASS** frequency controls, it is possible to generate a wide variety of frequency response contours in the 20Hz- 1 kHz range. Use of the high-frequency contour control (HF) affects the response in the 2-20 kHz region. The EQ position of the MODE switch permits frequency response variations in modes 2 and 4 that are essentially like those possible in mode 5. (See RS 4.5 and 2.5 speaker instruction manuals.)

With the **MODE** switch in Bi-Channel (BI-CH), the low- and high-pass filter outputs appear at their respective output jacks and will feed separate low- and high-range power amps as outlined in mode 5. The effect of the controls is similar to the EQ position, except the "summing" is taking place acoustically.

### ***Description of Front Panel Controls***

A summary of the controls and their functions on the Crossover/Equalizer from left to right on the front panel listed below:

Figure A. (EQ unit, front)



1. **LOW PASS Frequency:** Sets the - 3dB point of the low-pass filters from 110 to 440 Hz in 1/2-octave steps.

2. **LOW PASS Gain:** Adjusts the output level of the low-pass filters. Low-pass output appears at low-pass output jacks regardless of the position of the MODE switch. With the **MODE** switch in EQ, **LOW PASS GAIN** sets the amount of low-frequency signal in wide-band

sum appearing at high-pass outputs. Absolute gain from input to low-pass outputs is unity (x 1 or 0 dB) with **LOW PASS GAIN** control at 0 mark.

3. **HIGH PASS Frequency:** Sets the - 3dB point of the high pass filters from 110 to 440 Hz in 1/2-octave intervals.

4. **HIGH PASS Gain:** With the **MODE** switch in Bi-Channel setting (**BI-CH**), the **HIGH PASS GAIN** adjusts the output in the high-pass frequency range independent of the **LOW PASS GAIN** settings. When the **MODE** switch is set to **EQ**, the **HIGH PASS GAIN** controls the output level of the wideband output at the high-pass jacks on the rear panel. In this mode, bass is adjusted relative to mid and high frequencies with the **LOW PASS GAIN**. Absolute gain from input to **High Pass** outputs is unity in either mode when the **HIGH PASS GAIN** is set to the 0 mark. This control should be set to unity (0) for most installations. The Crossover/Equalizer has 6 dB of excess gain with the **HIGH PASS GAIN** rotated fully clockwise. This can be put to advantage if the overall system gain is low because of the use of some lower-gain preamps or power amps (such as the Infinity Hybrid Class A Power Amp).

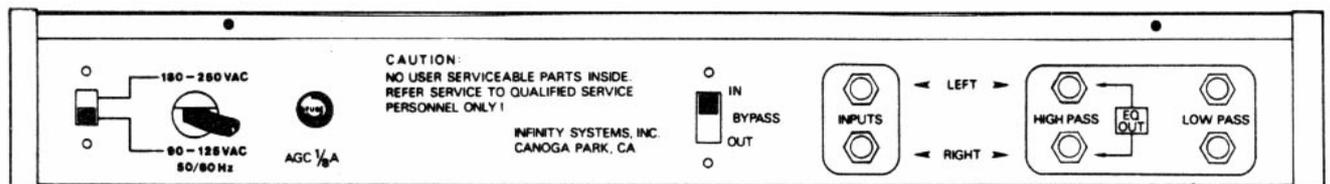
It is not recommended that the **HIGH PASS GAIN** be used as an overall system volume control in the **EQ** mode and further should not be set at less than unity (0).

5. **HF (High Frequency Contour):** Adjusts high-frequency response of system in a boost/cut fashion with a range of  $\pm 5$  dB @ 15 kHz.

6. **MODE** sets the unit for functioning as a low-level active electronic crossover in the BiChannel (**BI-CH**) position or as an active equalizer in the **EQ** position.

7. **POWER** turns unit power on and off. Power on is indicated by a red LED indicator to the right of the **POWER** switch. Power can be switched on or off with system preamp power, switched independently, or left on continuously.

Figure B (EQ unit back)



## BACK PANEL FUNCTIONS

Viewed from rear of panel from left to right:

**AC Voltage Selector.** Allows the unit to be externally set to operate in different countries. Insert pointed object, such as a small screwdriver, into depression of switch and set position of switch so that white line lines up with correct voltage range.

**AC line cord:** Connect to suitable source of power (50/60 Hz frequency 105-125 V AC).

**Fuse:** Replace with AGC 1/8A fuse only. *If fuse blows, most likely cause is voltage selector switch set in wrong position.*

### **BYPASS Switch:**

Permits the unit to be signal-bypassed in the **EQ** mode. Normal operation as described herein is with the **BYPASS** switch placed at **IN**. With the **BYPASS** switch placed at **OUT**, the input signal will appear at the **High Pass/EQ** outputs.

### **Inputs:**

Connect the signal source from the preamp, or preamp outputs of receiver or integrated amplifier, to these jacks.

### **HIGH PASS / EQ:**

Connect these jacks to system power amplifier inputs in operational modes 2 and 4. Connect them to system midhigh power amplifier inputs in mode 5. The signals at these jacks are phase inverted in respect to the inputs with the bypass switch in.

#### **LOWPASS:**

Connect these output jacks to system low-frequency power amplifier in mode 5 only. Do not connect anything to these jacks for any other mode of operations. The signals at these jacks are phase inverted in respect to the inputs.

## Operation of the Crossover/Equalizer

Operation will first be described with the **MODE** switch in the **EQ** position, which is relevant to system operation modes 2 and 4. Connect the Crossover/Equalizer inputs to an appropriate signal source (pre-amplifier, tape recorder, tuner output) and the outputs to the power amplifier(s).

The low-pass frequency is controlled by the left-hand control. Start by setting the **LOW PASS** frequency at **220**. The **LOW PASS GAIN** control (second from left) should be set at unity gain (0).

The **HIGH PASS** frequency control (third from left) should be set at **220**. **HIGH PASS GAIN** (fourth from left) should be set at unity gain (0).

The **HF** contour control (fifth from left) should be set at **FLAT**, which is straight up, or twelve o'clock. The **MODE** switch should be set at **EQ**. Under these conditions, the gain of the Crossover/Equalizer is unity and the signal out will be flat. This can be checked by operating the **BYPASS** switch on the rear panel, which puts the unit in and out of the circuit.

The easiest way to understand how to use the controls is to think of the **LOW PASS GAIN** as a bass control, similar to a tone control on a pre-amp, and the High-frequency contour control (HF) as similar to a treble control on a pre-amp.

*If the flat setting does not satisfy you, try these adjustments.*

Play music of various sorts and listen to the effect of these controls. If more bass is desired, rotate the **LOW PASS GAIN** clockwise, or if less bass is desired rotate it counter-clockwise. The high frequency contour control (HF) works the same way; clockwise for more highs, counter-clockwise for less highs.

As long as the two frequency controls are set to the same frequency and the **LOW PASS GAIN** control is set to unity gain (0), the low frequency response of the unit will be flat. There are five frequency sets **110, 156, 220, 312 and 440** -- that will give a flat frequency response.

When the frequency controls are set to different frequencies, the result is equalization.

For example: If both controls are set at 220 Hz, and the **LOW PASS** is then moved to a lower frequency such as 156 Hz, and the **HIGH PASS** is moved to a higher frequency such as 312 Hz, the result is a dip in response between 156 and 312 Hz. As the low pass is moved lower and the high pass is moved higher, the dip in the response becomes deeper.

If a peak in response is needed, the frequency controls should be overlapped. For example: If more output is desired at 220 Hz, the **LOW PASS** frequency can be raised to 312 Hz and the **HIGH PASS** frequency lowered to 156 Hz. The more the settings are over-lapped, the higher the peak.

In summary, when you rotate the two frequency knobs toward each other, there is an increase in output in the range between the two settings. When you rotate the knobs away from each other, there is a decrease in output in the range between the two settings.

These EQ characteristics are illustrated by Figures C and D. As these figures suggest, a large variety of curve shapes can be obtained. Further action can be obtained by adjusting the **LOW PASS GAIN** control. When the unit is placed in the Bi-Channel (**BI-CH**) mode and appropriate connections to amplifiers and speakers have been made, the effect of the controls is the same as in the **EQ** mode, with one difference.

In the **EQ** mode the **HIGH PASS GAIN** control affects the overall system output, and does not alter the frequency balance. In the Bi-Channel (BI-CH) mode, the **LOW** and **HIGH PASS GAINS** are independently adjustable. The recommended nominal starting settings for the RS 2.5 or RS 4.5 in bi-channel operation are:

	4.5	2.5
<b>Low pass frequency</b>	220	312
<b>Low pass gain</b>	0	0
<b>High pass frequency</b>	220	312
<b>High pass gain</b>	0	0
<b>HF contour</b>	0	0
<b>Mode</b>	Bi-Ch (Necessary)	

Since the **RS** crossover/equalizer inverts phase at its outputs, both in the equalizer and bi-channel modes, it is recommended that each amplifier to speaker cable be phase reversed at *one end* only so that red or "hot" at the amp end goes to black at the speaker input terminals. This is done to preserve overall system absolute phase.

Figure C

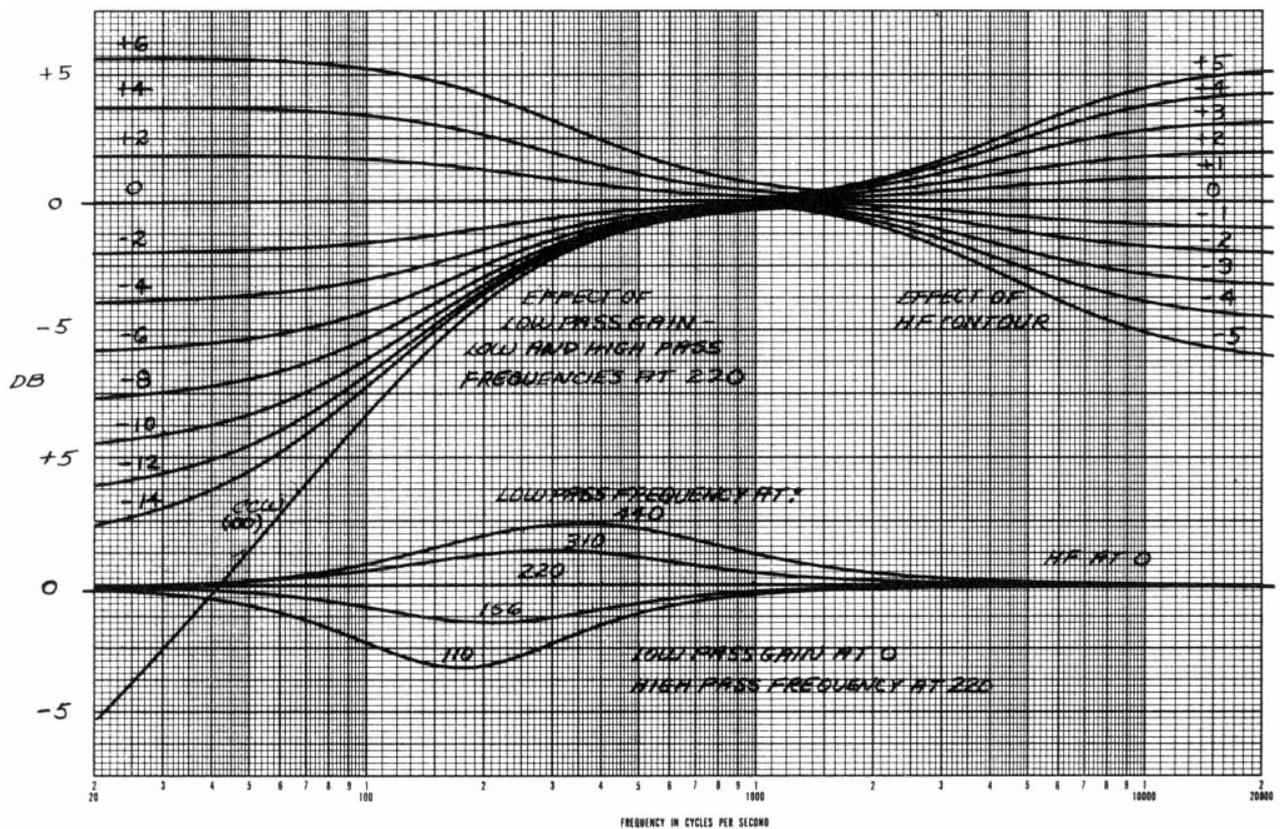
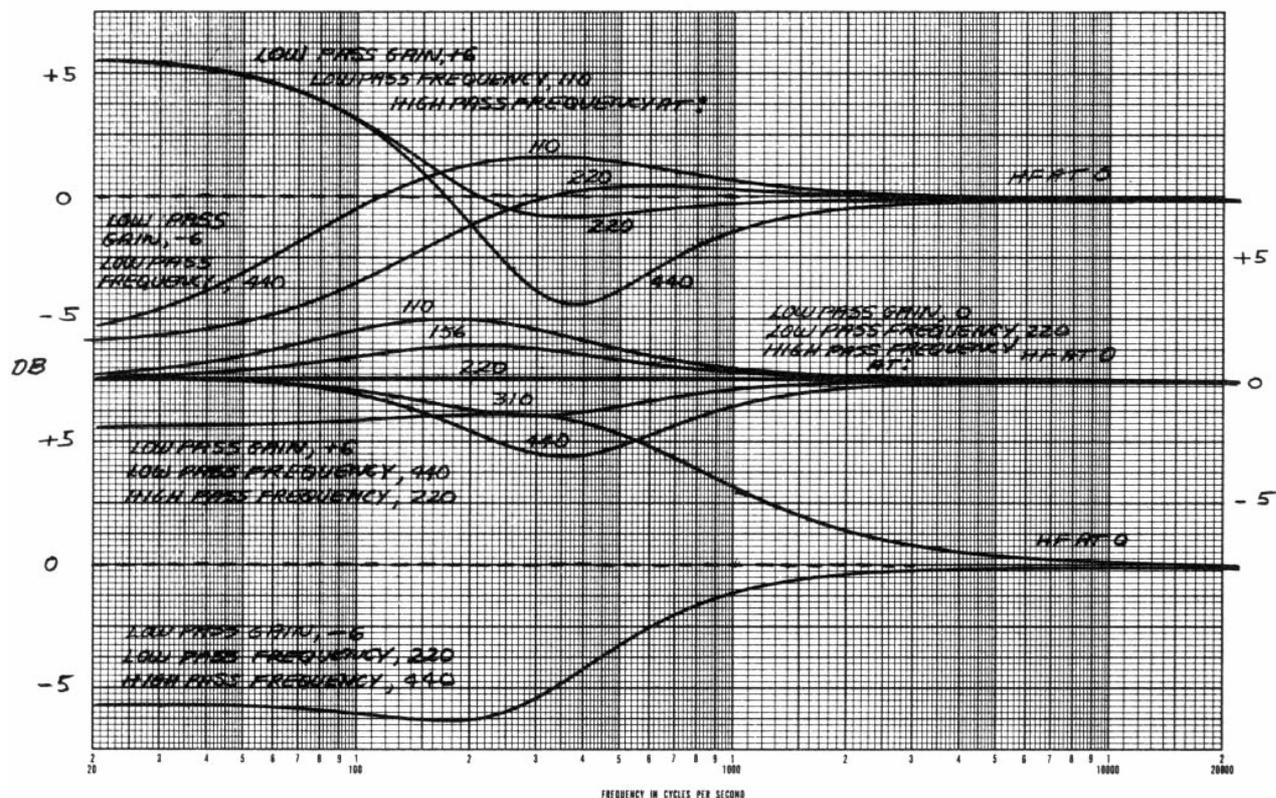


Figure D



## In Case of Trouble

**DO NOT ATTEMPT ANY REPAIRS.** Check the fuse and, if necessary, replace it only with a fuse of the same type. But do not open the Crossover/Equalizer unit; doing so voids the warranty. The unit is delicate and difficult to service; it is also light and easy to ship. So if the unit seems not to be functioning properly, ask the dealer from whom you purchased it for instructions.

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