CP-10 Complementary Phase Parametric Equalizer

Operating Instructions

The Meyer Sound CP-10 is a dual-channel parametric equalizer featuring five bands of fully parametric equalization per channel with an additional high and low shelving cut filter for each channel. Any frequency between 60 Hz and 6 kHz can be controlled by two equalization circuits per channel. Frequencies below 60 Hz and above 6 kHz are controlled by one equalization circuit and one shelving cut filter per channel.

The front panel occupies 3½ inches of rack space and the clearly marked controls include individual In/Out switches for each band of equalization. There are separate, calibrated Center Frequency, Bandwidth and Boost/Cut controls. The complementary phase circuitry assures controlled phase distortion, even at extreme settings and the dynamic range of the instrument is better than 110 dB in operation.

The front panel can be removed without affecting any equalization settings, and each of the fourteen equalization circuits is mounted on its own gold-socketed removable printed circuit board, guaranteeing ease of service. LEDs indicate power status and clip levels. Signal processing is initiated by a relay that closes only when the power supplies have stabilized. In the event of AC failure, the unit automatically switches to hardwire bypass.

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Connections

Rear panel connectors are XLR-type and both inputs and outputs are balanced. An associated rear-panel switch labeled **Balanced/Unbalanced Gain Adjust** controls the unit's gain to accommodate either unbalanced or balanced output connections.

In the **Unbalanced** position, unity gain is obtained using single-ended output cables, and 6db of voltage gain is added if balanced lines are used. Prior versions of the CP-10 without this switch operate in this mode by default, and cascading equalizer sections should be connected with the CP-10 cascading jumper. In the **Unbalanced** position, the channel gain is at unity when CP-10 is driving a single-ended device input.

In the **Balanced** position, the unit will operate at unity gain using standard balanced XLR cables (P3 -> P3, P2 -> P2, P1 -> P1= shield), so that multiple CP-10 units can be cascaded using mic cables, and the unit can be inserted in an all-balanced system without affecting system gain.

Note that the labeling terminology for this switch refers to the type of output connection cable required for unity-gain performance; the switch affects only the gain of the unit. In either position, the CP-10 input remains actively balanced and its output remains push-pull.

In summary, if using unbalanced output cables, or if compatibility with preceding versions of the CP-10 is desired, set the switch in the **Unbalanced** position. If using balanced output cables, put the switch in the **Balanced** position.

A field installation retrofit is available to upgrade prior versions of the CP-10.

AC Power Inlet and Voltage Selector Switch

The rear-panel AC input connector is an IEC/CEE Standard Receptacle. The signal path relay closes only when power supplies are stable and once the relay is closed the unit is inserted into the signal path. In the event of loss of AC power or unstable line voltage the CP-10 will automatically remove itself from the signal path into a hardwire bypass mode. If the unit remains connected to the AC supply it will automatically reinsert itself in the signal path as soon as the power supplies stabilizes.

The rear-panel AC inlet is equipped with an integral voltage selector and a fuse holder, both concealed in a compartment above the AC inlet. The selected voltage is displayed in a small window and reads 115Vac or 230Vac. In order to change the voltage, **first disconnect the AC cord**. Open the door of the voltage-selector compartment using a small screwdriver or pen-knife and remove the voltage selector cam. Rotate the cam and replace it so that the desired voltage is visible through the window of the voltage selector compartment door. When the door to the voltage selector compartment is closed and the AC cord is reconnected, the unit is ready for use.

AC Fuse

The rear-panel voltage selector compartment contains a 1/4 Amp SIo Blo 250 V fuse. In order to replace the fuse, **first disconnect the AC cord**. Open the voltage selector compartment (see the previous section) and remove the sliding tray which contains the fuse. When replacing the fuse tray, take care to insert it in the slot to the right, aligning the printed arrow with those on the inside door of the voltage selector compartment. Close the compartment and reconnect the AC cord. The unit is now ready for use.

The fuse holder assembly can accommodate both U.S.- and European-size fuses in their respective trays. When the unit is shipped with the AC voltage set at 115, the U.S. size fuse tray and fuse are included (Meyer Sound Part Numbers 422.006 and 420.002, respectively). Otherwise the European size fuse tray and fuse are supplied (Meyer Sound Part Numbers 422.005 and 420.003, respectively), and the voltage-selector cam is set at 230Vac.

Indicators

The front panel of the CP-10 includes six LEDs. The two Green LEDs indicate the power status at all times, the LED marked **Power** indicating the presence of AC power and the LED marked **Ready** indicating that the signal path relay has engaged and that the selected equalization is in circuit. The four Red LEDs indicate signal levels in excess of 16dBv at the input and output stages of the unit. If the **Input Clip** LED for either channel is lit, reduce the level of the input signal. If the **Output Clip** LED for either channel is lit, reduce the amount of gain through the equalizer by reducing the Boost setting in those equalizer sections that are in use, or reduce the drive signal level.

Ground Lift Switch

A ground lift switch on the rear panel lifts pin 1 from the chassis, which is grounded through the AC "U" ground. This switch may be used to eliminate hum due to ground loops. Pin 1 on the XLR connectors is tied to signal common at all times.

Front Panel Controls

Each of the ten tunable filter circuits has its own Center Frequency, Bandwidth and Boost/Cut controls, and each of these filters can be inserted or removed from the signal path with an individual In/Out switch.

In/Out Switch

The individual In/Out switches are provided so that individual filters may be switched in and out without changing any settings. The efficacy of particular equalization settings may thus be easily verified, both by measurement and subjective evaluation. In the Out position the signal is not affected in any measurable way by any of the filter settings. (For lowest system noise it is recommended that filters not in use be bypassed using the In/Out switch.)

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Examples of Complementary Phase Equalization

Effective equalization of loudspeaker/room resonances requires exact and opposite matching with anti-resonance circuitry. An example is shown here of the correction of a response curve aberration caused by reflection from a single surface adjacent to a loudspeaker under test (half-space loading). All measurements have been made with Meyer Sound's SIM® System II.

Figure 1

The test loudspeaker is first measured in near-free space conditions (on a stand approximately six feet off the ground, away from all other reflecting surfaces). The upper window displays the amplitude response, and the lower the phase response. Frequency resolution is third-octave. The loudspeaker exhibits very flat response in both amplitude and phase.

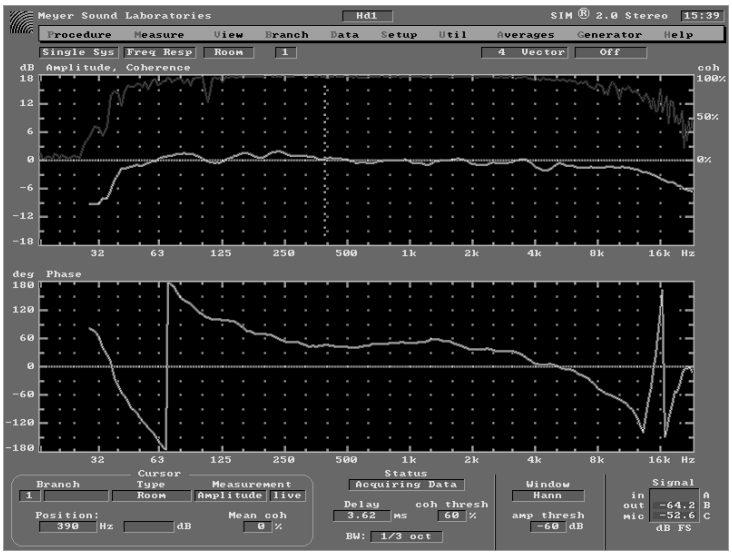

Figure 2

This display shows the impulse response (amplitude vs time) of the test loudspeaker under the same near-free field conditions. The upper window is a ±560 msec span, and the lower window shows the same data zoomed to a ±56 msec span. The loudspeaker exhibits a very controlled and coherent impulse response.

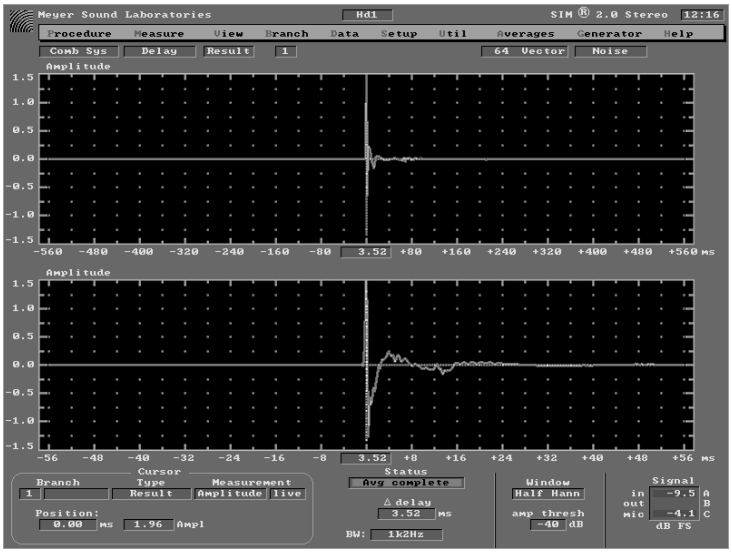

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Figure 3

The loudspeaker is now placed with its back against a wall, again at approximately six feet off the ground. This frequency response measurement illustrates the low-frequency (below 500 Hz) aberrations that half-space loading typically causes. Disruptions appear in both the amplitude and the phase trace.

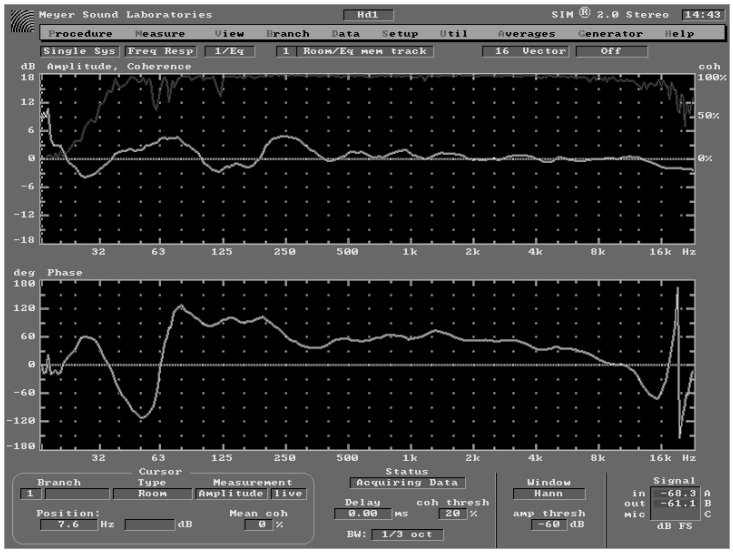

Figure 4

This impulse response measurement of the loudspeaker in half-space shows that the frequency-response aberrations of Figure 3 also appear in the time domain as echoes at approximately 4 and 8 msec (note peaks). These are reflections from adjacent surfaces.

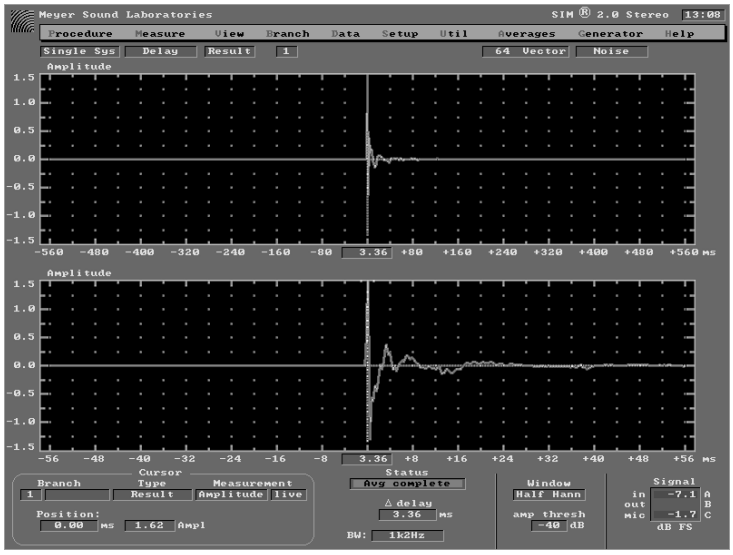

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Figure 5

Complementary Phase Equalization is now applied to remove the response aberrations shown in Figure 3. The lower window shows the unequalized loudspeaker response (bright trace) with the inverse of the equalizer response overlaid (grey trace). The equalized loudspeaker measurement (upper window) shows restoration of the amplitude response.

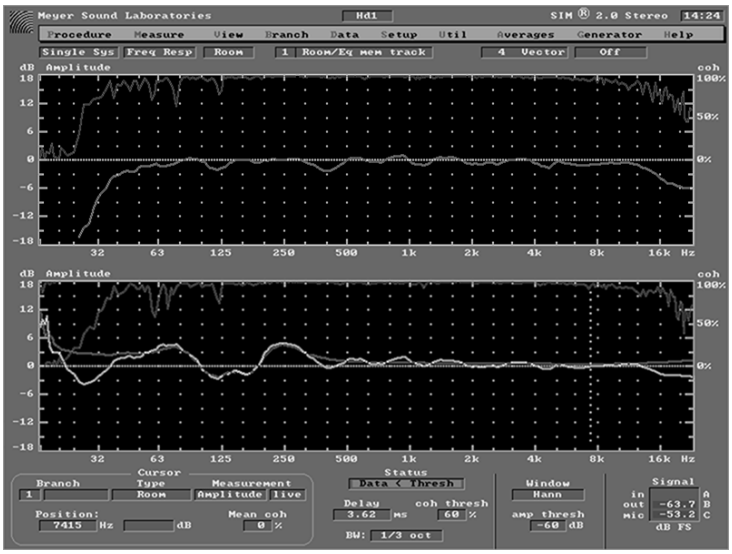
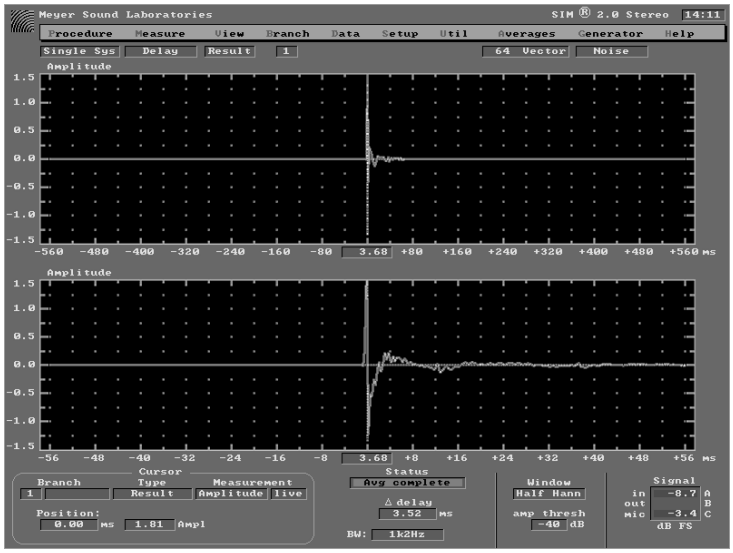


Figure 6

This is the impulse response of the corrected test loudspeaker in half space. The echoes shown in Figure 4 have been suppressed, and the impulse response restored. This is proper deconvolution, as can only be performed with Complementary Phase equalization applied under high-resolution measurement.



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Center Frequency Control

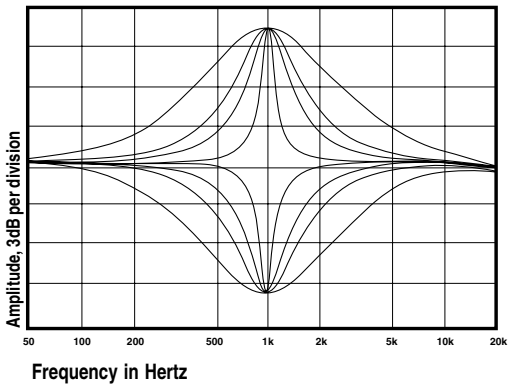
Each of the ten tunable filters in the CP-10 have a 10:1 frequency range and the Center Frequency Control callibration is accurate to within 10%. Any frequency between 20 Hz and 20 kHz may be selected for equalization and the overlap between filters is such that any frequency between 60 Hz and 6 kHz can be selected in two filters per channel. This degree of versatility and precision is most useful when equalizing resonances that are both narrow in bandwidth and closely spaced in frequency.

When two filters in the same channel are tuned to the same frequency, the combined effect is dependent on the amount of boost of cut selected in each filter and the bandwidths chosen. When the same center frequency and bandwidth are chosen, the net effect of the two filters will be approximately two-thirds of the sum of the boost or cut of the filters when inserted separately. If a filter is set to 0 dB of boost or cut, then it should be removed from the signal path using the In/Out switch. This will prevent any interaction with adjacent filters tuned to the same frequency.

Bandwidth Control

Each of the tunable filters can be adjusted from a minimum bandwidth setting of 0.1 octave to a maximum of 1.1 octaves. The Bandwidth Control is continuously variable between these extremes and is accurately calibrated. In combination with the Center Frequency and Boost/Cut Controls, the Bandwidth Control makes it possible to complement exactly a resonance or response peak in order to remove the resonance and flatten system response.

The figure to the right shows a set of equalization curves displaying symmetry at 10 dB boost and cut (minimum and full bandwidth settings included).



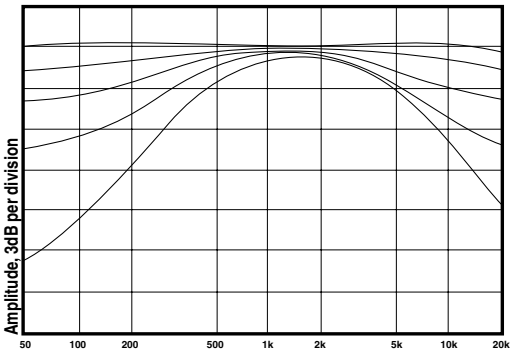
Boost/Cut Control

The Boost/Cut Control for each of the tunable filters in the CP-10 is continuously adjustable from 15 dB of boost to 15 dB of cut. In the center, or 0 position, the Boost/Cut Control will have no appreciable effect on the signal unless another filter in the same channel is tuned to the same frequency. In this case the amount of boost or cut available in the active filter is reduced. It is recommended that filters not in use be bypassed using the In/Out switch.

High and Low Shelving Cut Filters

In addition to the tunable filters described above, there are two shelving cut filters per channel, each with its own control. The high and low shelving cut filters are so described because as each is turned from flat response to maximum cut, the turnover frequency shifts and the slope steepens. This provides the user with a flexible tool for house-curve tailoring or bandwidth limiting. Using the shelving cut filters at maximum attenuation reduces the bandwidth of the equalizer to approximately 3 octaves between 5 kHz and 500 Hz, with a filter slope of 6 dB per octave above and below those frequencies.

The figure to the right shows equalization curves displaying the resulting response of the high and low shelving cut filters, from flat to maximum attenuation.



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Replacing Filter Modules

The CP-10 front panel is secured to the chassis with four 6-32 x 5/16" black flat-head machine screws which can be removed using a No. 2 Philips screwdriver. Once the screws are removed, the front panel can be slipped over the filter control knobs without removing them or disturbing any of the settings. This feature makes it possible to replace individual filter circuits without removing the unit from its installed position, though it is recommended that AC power be disconnected before removing any filters. The CP-10 will operate with any or all of the tunable filter cards removed, so the unit may be relied on to operate usefully with a minimum of filter cards. Replacement filter cards are available; contact Meyer Sound for pricing and other information.

Rack Mounting End Plates and Security Window

The CP-10 is supplied with rack-mounting end plates which are designed to hold the unit in a standard 19" rack. These end plates are fastened to the chassis of the CP-10 with four 6-32 x 5/16" black flat-head machine screws, and can be mounted in two positions. In the standard position, the unit's control knobs stand proud of the front of the rack ears by 7 7/16", making for ease of adjustment. In the alternative position, the unit is recessed from the rack mount, and the filter control knobs are effectively protected against accidental adjustment. For additional protection, a smoked acrylic **Security Window Kit** is available (Meyer Sound Part Number 66.101017.01) which is secured to the unit using the supplied brackets and fasteners.

Specifications

Frequency Response[1]	20 Hz to 20 kHz ±0.5 dB
Input Type	Active balanced 20K ohms
Output Type	Active balanced, will drive 600 ohms
Maximum Input Level	+20 dBv
Maximum Output Level[2]	+20 dBv
THD[2,3]	Less than 0.01%
Hum and Noise	-90 dBv ("A" weighted)
Dynamic Range	110 dB normal operating conditions, all filters in circuit
Indicators	
Power	Green LED
Ready	Green LED
Clip (Input and Output)	Red LEDs
Controls	
Front Panel	EQ In/Out switch Center Frequency Control Bandwidth control Cut or Boost Control Lo and Hi Shelving/Cut control
Rear Panel	Ground Lift switch
Connectors	
Input/Output	XLR-type
Power	115/230 VAC (rear panel switchable)
Physical Dimensions	19" x 3½" x 8½"
Weight	10 lbs (4.6 kg)

1 All EQ Ciruits out

2 All EQ circuits engaged, unity gain

3 +4 dBv drive @ 1 kHz

Meyer Sound Part Number 05.101.029.03 Revision C

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