PRODUCT *ANALYSIS*

Electronic Laboratories looks at the McIntosh C 28 Preamplifier

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THE McINTOSH C 28 STEREO PREAMPLIFIER

Fig. 1 — Front view

MANUFACTURER'S PUBLISHED PERFORMANCE LIMITS (SPECIFICATIONS):

Frequency Response: 20 Hz to 20,000 Hz, +0, -0.5 dB. **THD:** 0.1% at rated output, 20 Hz to 20 kHz. **Inputs Sensitivity:** Phono: 2.0 mV (adjustable); Microphone: 2.5 mV; High Level Inputs: 250 mV. Tape Head: 2.0 mV. **Signal-to-Noise Ratios:** Phono 1 & 2: 78 dB below 10 mV input; High Level Inputs: 90 dB below rated output. **Output Levels:** Main: 2.5 volts; Tape: 0.25 volts; Headphone/Line: 0.75 V into 8 ohms, or 2.5 volts into 600 ohm line. Center Channel: 1.25 volts. **Tone Control Range:** Bass: ± 20 dB at 20 Hz; Treble: ± 18 dB at 20,000 Hz. **High Filter:** 12 dB/octave slope above 7 kHz. **Low Filter:** 12 dB/octave slope below 50 Hz.

GENERAL SPECIFICATIONS:

Power Requirements: 120 volts, 50/60 Hz, 45 watts. **Dimensions:** 16" wide by 5-7/16" high by 13" deep (behind panel). Knobs project 1-1/2" in front of panel. **Weight:** 25 pounds (net). **Suggested Price:** $649.00.

Those of us who have examined and tested a great many preamplifiers find it a bit odd that this well known unit from McIntosh Laboratory Inc. should weigh in at 25 pounds (not counting the shipping cartons and packing material which adds another 12 pounds or so to shipping weight). Owners of other McIntosh equipment will probably find nothing odd about this at all, since ruggedness of construction is one of the things in which that company takes great pride. Some of the extra weight is, to be sure, accounted for by McIntosh's unique PANLOC mounting arrangement which eliminates the need for any shelf or bracket to support the C 28, should it be mounted behind a custom cabinet panel. Detailed instructions and hardware for that purpose are supplied along with the unit itself. The hardware and brackets supplied completely support the unit in such mounting arrangements. The front panel of the C 28, pictured in Fig. 1, extends beyond the largest width and height dimensions of the chassis, so that panel cutouts need not be made with great precision. Controls are symmetrically positioned on the face of the black heavy glass front panel, with separate bass and treble control knobs for left and right channels along the bottom left and right extremes of the panel and master volume (including power on/off switch), mode selector (seven positions of mono and stereo reproduction capabilities including reverse stereo and combinations of mono that permit feeding one channel to both speakers, two channel signals to a single speaker or a mono L & R mix to both speakers), six position program selector and a dual concentric balance and compensation switch control arrangement which selects flat response, loudness compensation, or "presence" mid-frequency emphasis. One input facility on the C 28 which we have not encountered in some time is a TAPE HEAD input which not only permits direct connection of tape playback heads to the preamp, but provides equalization as well. While we know of no tape transport systems currently sold for consumer use that are not equipped with their own preamplifier electronics (such tape playback devices were sold some years ago), this extra input facility does not impose significant penalties on the end price of the C 28, since the low-level preamplifier circuits used for phono double as a tape preamplifier (with a switched change of equalization curves). Selector and mode switches are coupled to tiny red illuminated dots, visible from behind the panel, which denote switch positions chosen. Eight rectangular push-buttons, surmounted by rectangular colored illuminated areas above each, take care of two tape monitor circuits, tape-to-tape copying (from deck 1 to deck 2 or vice versa), low and high frequency cut-off filters and main and remote speaker system turn-on (providing an accessory McIntosh SCR control unit is used in an installation). Below the push-button row are a tape input and output jack which parallel the rear panel TAPE 2 connections (and disconnect them, if front panel jacks are used) and a headphone jack for connection of stereo phones powered by the built-in headphone/line amplifier of the C 28.

Fig. 2 — View of rear panel

The rear panel of the C 28 is pictured in Fig. 2. No less than seven AC convenience receptacles are supplied, two of which are specifically intended for power amp line cord connections, with one of the remaining five an unswitched receptacle for turntable system connection. Two pairs of main and center channel output jacks are positioned above a four-contact receptacle labelled "speaker remote control" which accepts a plug from an aforementioned speaker switching accessory. Line outputs, tape outputs and high level inputs come next, with all low level input jacks positioned at the extreme right of the rear panel, far removed from AC line receptacles, line cord and line fuse at the left. A ground terminal completes the rear panel layout.

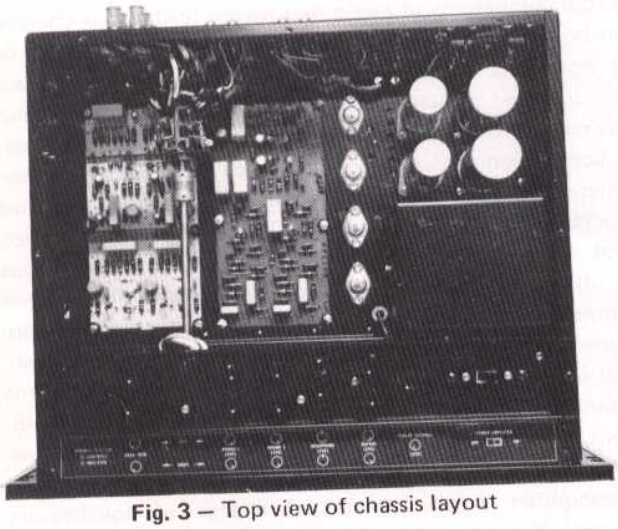

Fig. 3 — Top view of chassis layout

Additional controls are positioned atop the chassis, as can be seen in the overall chassis view of Fig. 3. These secondary controls include low-frequency trim controls, phono 1 and 2 input level controls, output level controls, headphone level controls and a power switch which controls the rear AC receptacles specifically designated for connection of associated power amplifiers. By means of this switch, power amps could be turned off during headphone listening, for example. As we soon learned, these extra controls provide a refinement of control that is rarely found in preamplifier/control units these days and their designation as "secondary" controls fails to reflect their importance in helping to match up all elements of a good high fidelity component system.

Circuit Features and Considerations

Each channel of the C 28 consists of four main sections: low level preamplifier, high level amplifier, active filters and headphone amplifier. A block diagram of the circuit is reproduced in Fig. 4.

A four-transistor differential amplifier input circuit is used in the low-level preamp section. Equalization is applied by a negative feedback loop. Phono input sensitivity controls are also included in the negative feedback loop (rather than as simple input potentiometers) which permits gain reduction (if required, because of higher than average outputs from phono cartridge selected) without degrading signal-to-noise ratios.

The high-level amplifier section has a gain of 20 dB and consists of a 3-transistor circuit per channel with tone control action introduced via a negative feedback loop. Bass trim controls, presence and loudness compensation circuits are positioned at the input of this amplifier section.

The filter amplifier sections utilize two transistors per channel in a compound emitter follower configuration. In addition to the low and high cut 12 dB/octave filter components in this section, the filter amplifier also forms a 20,000 Hz active low-pass filter. McIntosh subscribes to the philosophy that response beyond audible limits is neither needed nor desirable and this filter design reduces noise outside the useful audio spectrum while maintaining flat response out to 20,000 Hz.

The headphone amplifier section delivers 0.75 volts of signal into 8 ohm headphone loads (approximately 70 milliwatts) or up to 2.5 volts into impedances above 50 ohms. Internal impedance is low enough (0.2 ohms) so that relatively long shielded cables can be used without rolling off high end response.

The power supply of the C 28 consists of a 75 volt supply and a separate 14 volt supply for the headphone amplifier circuits. Actual output from the 75 volt supply, following series regulation, Zener diode regulation, filters and voltage dividing networks is 18 volts, used to power the low level circuits.

Laboratory Measurements

Response, in high level input positions, measured within 1.0 dB from 18 Hz to 26 kHz, with the -3 dB points observed at frequencies of 11 Hz and 40 kHz. Since we were a bit concerned (from an academic rather than from an audible standpoint) over the fact that response was down 0.75 dB at 20 Hz, as compared with the 0.5 dB claimed by McIntosh, we attempted to "flatten" the low end response by means of the bass trim secondary controls referred to earlier. It was only then that we discovered that this trim control action is dependent upon the setting of the master volume control. In other words, with volume control at maximum, the bass trim control, like the loudness compensation circuits, has no effect. Since most listening will, we presume, be done at lower settings of the master volume control, this circuit configuration does not practically reduce the effectiveness of this trim control, but we wondered why McIntosh chose to make it dependent upon that control. The "presence" setting of the compensation switch is also effective only at lower than maximum settings of the master volume control. It would seem to us that *if* presence control action is desired (and that is a big "if" depending upon what kind of music you like to listen to) it should be possible to achieve that slight mid-range boost at any setting of the master volume control.

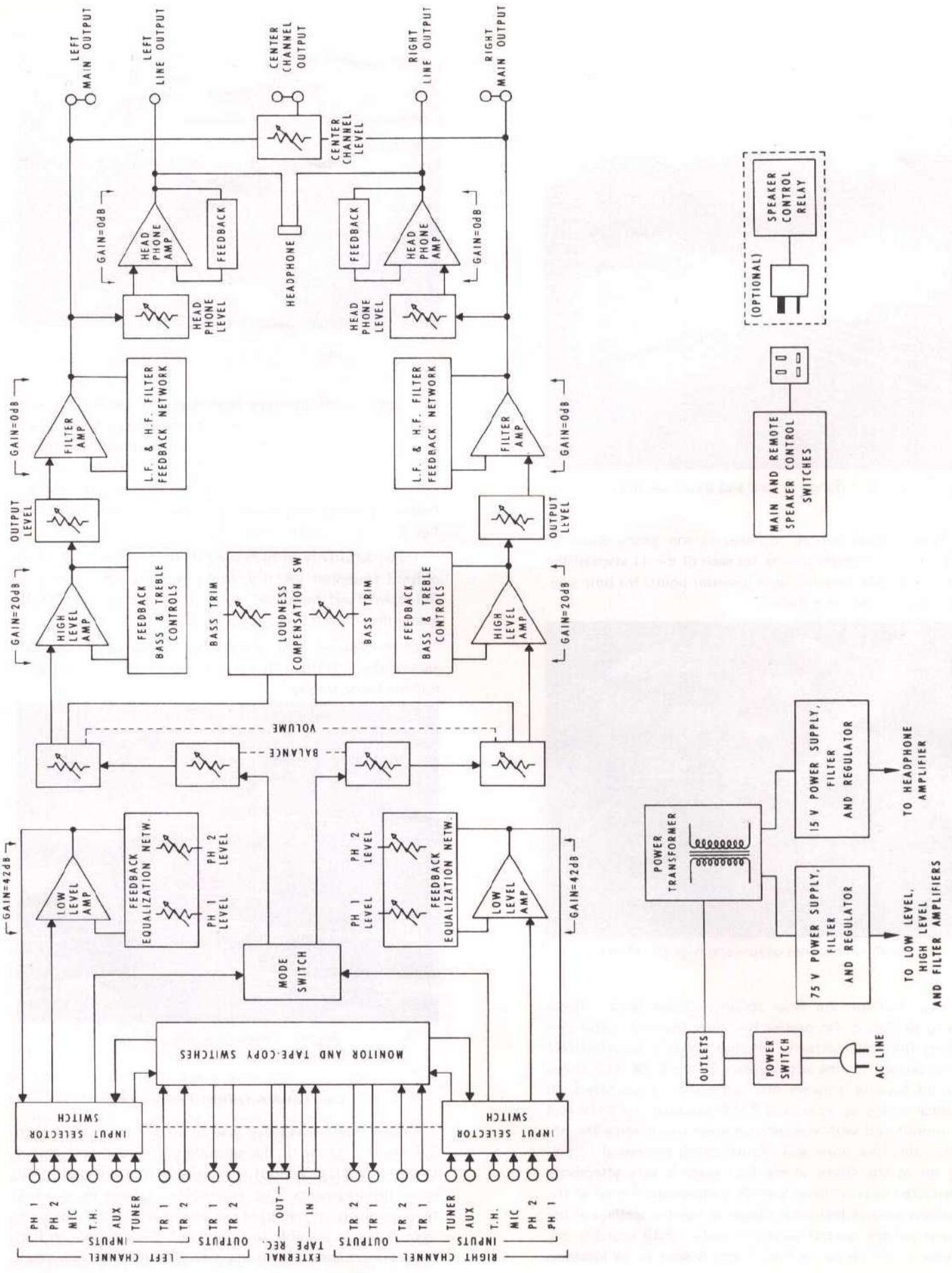

Fig. 4 – C 28 block diagram

As for harmonic distortion, it measured 0.05% at any audio frequency from 20 Hz to 20,000 Hz for 2.5 volt (rated) output signals. Rated THD of 0.1% was not reached until the preamplifier was delivering 14.0 volts to the main output terminals.

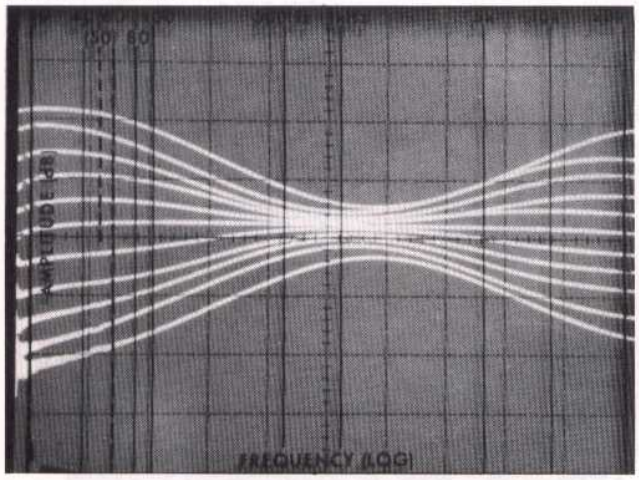

Fig. 5 — Range of bass and treble controls

Tone control action, depicted in the 'scope photo of Fig. 5, was extremely precise for each of the 11 steps of the bass and treble controls, with turnover points for both controls at approximately 1 kHz.

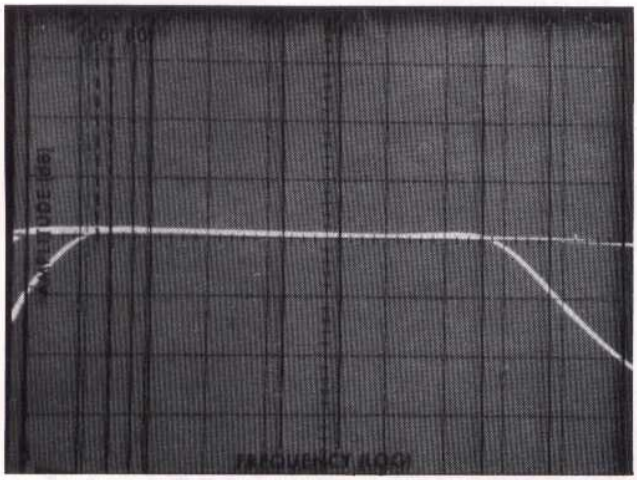

Fig. 6 — Response of low and high cut filters

High and low cut filter action is shown in the 'scope photo of Fig. 6. No passive R-C filter network could ever deliver the sharp-cornered filtering which is so effectively accomplished by the active filters of the C 28. This is important because it means that, when using these filters, all musical energy up to around 7 kHz and down to 50 Hz will be reproduced with virtually no attenuation while the objectionable hiss, noise and rumble which prompted switching on of the filters in the first place is very effectively attenuated beyond those cut-off frequencies. Action of the loudness control feature is shown at various settings of the master volume control (approximately 10 dB apart) in the storage scope photo of Fig. 7 and is seen to be loudness

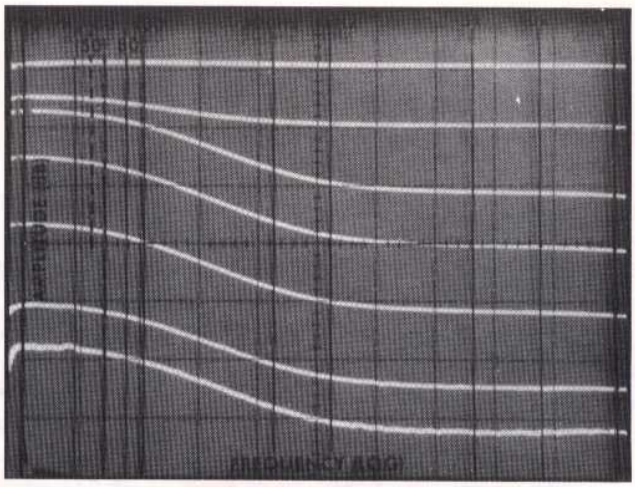

Fig. 7 — Loudness compensation

compensation of the type that does not include any high frequency boosting (in better agreement with more recent hearing tests than with those originally conducted by Mssrs. Fletcher and Munson back in 1933). The presence control setting was found to provide approximately 5 dB of mid-frequency boost at mid-settings of the volume control. (See Fig. 8.)

Input sensitivity at high level inputs (for rated, 2.5 volt output) measured 180 mV, with secondary output controls full open, and hum and noise measured exactly 90 dB below that output level, as claimed.

Master volume control tracking maintained channel balance within 1.0 dB all the way down to -65 dB relative to full clockwise setting.

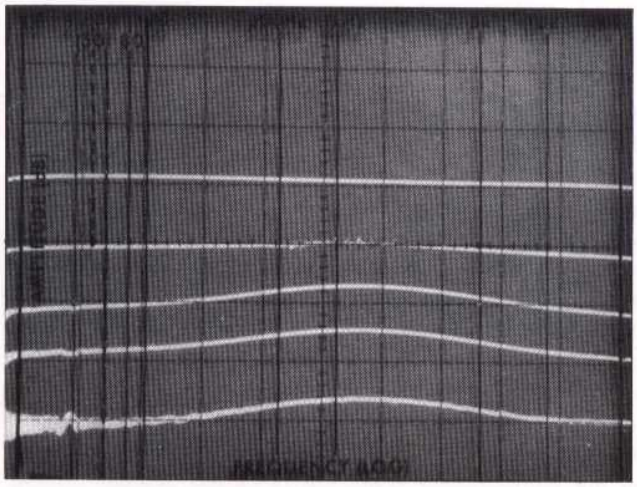

Fig. 8 — Presence compensation

Low Level Amplifier Performance

Phono input sensitivity was adjustable from 1.3 mV to 5.0 mV by means of the secondary controls, and we set them for a 2.0 mV input sensitivity as a reference for our other measurements. The availability of these input sensitivity controls, as well as of the output level secondary controls, makes it possible to "calibrate" one's system so that the loudness control circuitry has some validity. Too many

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