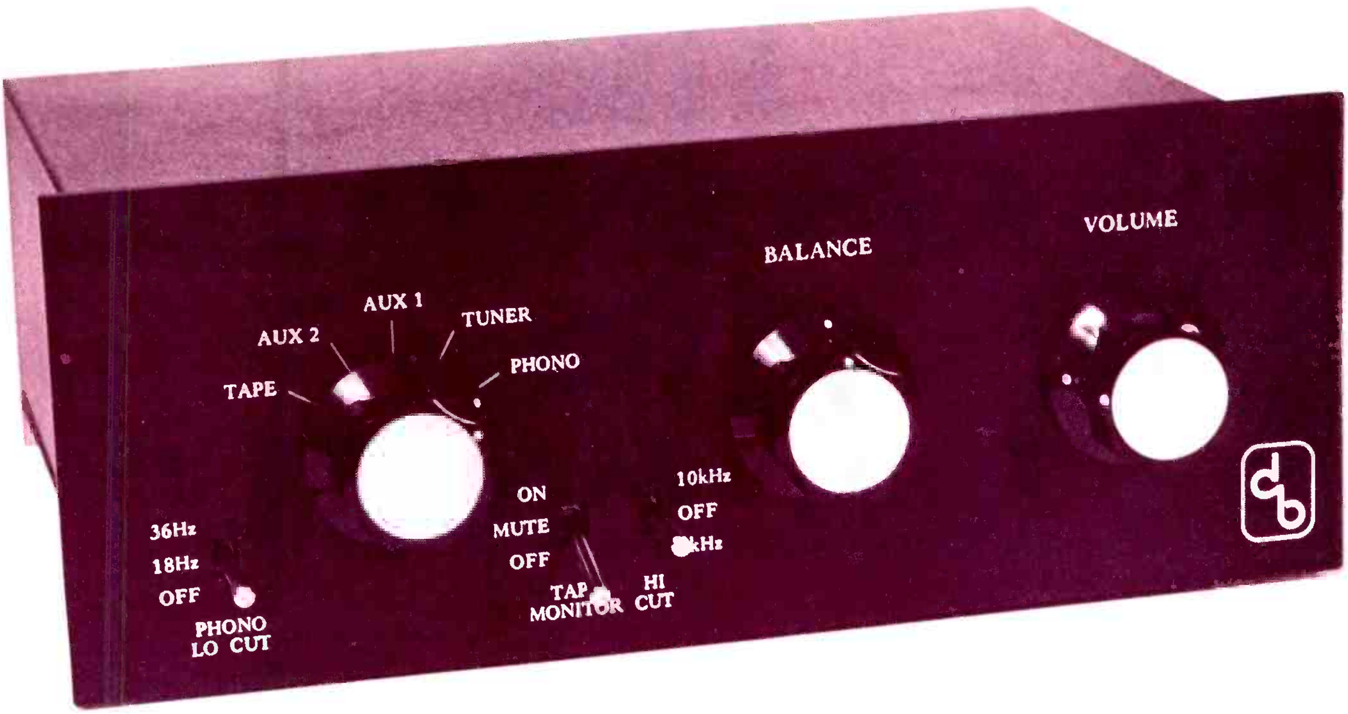
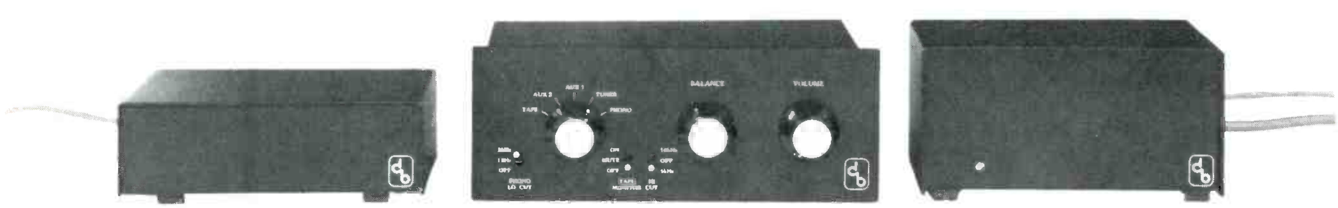
DB Systems DB-1 Preamplifier & DB-4 Moving Coil Cartridge Pre-Preamplifier



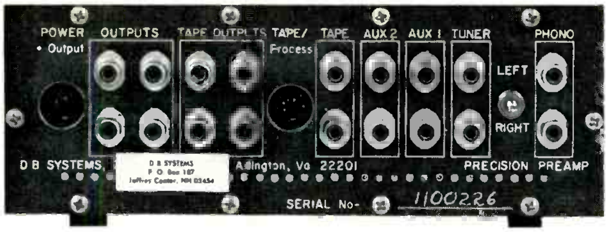
MANUFACTURER'S SPECIFICATIONS
DB-1 Preamplifier
THD: Less than 0.0008 per cent, 20 Hz to 20 kHz, excluding hum and noise.
Noise: Phono, −89 dB, A weighted with 10 mV input; high level, −90 dB, A weighted with 1 volt input.
Frequency Response: Phono, ±0.25 dB 5 Hz to 20 kHz RIAA extrapolated; high level, +0 −1 dB, 2 Hz to 50 kHz, +0 −0.25, 10 Hz to 20 kHz.
Filters & Positions: Low cut, flat, 18 Hz, 36 Hz, 6 dB/octave (phono only); High cut, flat, 5 kHz, 10 kHz, 6 dB/octave.
Output Impedance: 1000 ohms.
Maximum Output Voltage: 6 volts into 10 kilohms.
Maximum Load for Rated Distortion: 10 kilohms and 3000 pF.
Input Sensitivity (For 1 Volt Output): Phono, 2.0 mV into 50 kilohms and 100 pF; High Level, 120 mV into 50 kilohms.
Phono Overload: 150 mV @ 1 kHz, 1.5 V @ 20 kHz, 16 mV @ 20 Hz.
Dimensions: 8.5 in. (21.6 cm) x 3.2 in. (8.1 cm) x 7 in. (17.8 cm).
Weight: 2.6 lbs. (1.2 kg).
Price: DB-1 preamp, $397.00; DB-2 power supply, $78.00; wood cabinet, $34.95.

DB-4 Moving Coil Cartridge Pre-Preamplifier
THD: Less than 0.0008 per cent 20 Hz to 20 kHz, 1 V output, Medium gain setting.
Noise: —83 dB ref. 1 mV, shorted input, RIAA, A weighted.
Frequency Response: +0, —0.1 dB, 10 Hz to 100 kHz.
Input Impedance: 9 kilohms and 2000 pF.
Output Impedance: 220 ohms.
Maximum Load for Rated Distortion: 10 kilohms and 3000 pF.
Gain/Overload: High gain, 30 dB gain, 73 mV input overload; Medium gain, 24 dB gain, 122 mV input overload; Low gain, 18 dB gain, 130 mV input overload.
Channel Balance: Within 0.2 dB.
Dimensions: 6.2 in. (15.7 cm) x 4.5 in. (11.4 cm) x 2.2 in. (5.6 cm).
Price: $150.00; power supply, $78.00. Supply not needed when used with DB-1 preamp.



The DB-1 preamp and its companion DB-2 power supply is a fairly new, no frills, basic preamplifier of high quality currently selling for $475.00. Used in conjunction with the DB-4 pre-preamp, $150.00, it is capable of processing low level (moving coil) cartridge inputs in addition to the standard moving magnet cartridges.

The pre-preamplifier, if used, preamplifier, and power supply are separate units. The power supply has a 5-prong DIN connector through which its regulated 33 volts is delivered to the preamp's rear panel power socket. Another 5-prong DIN socket is provided on the rear of the preamp which allows the DB-4 pre-preamp to share power from the same power supply. Since this socket also has high level audio connections, the accessory DB-3 crossover (not tested)

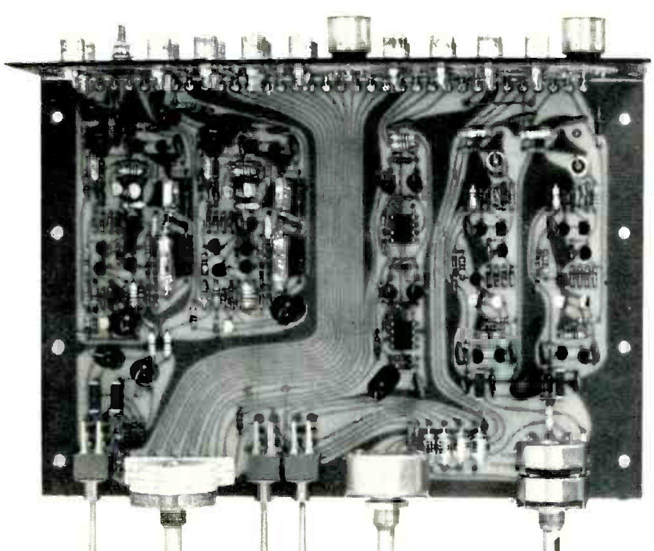


will have the power and audio connections made simultaneously, eliminating the need for an extra pair of audio cables.

Construction of the DB-2 power supply and DB-4 pre-preamp each consists of a simple two-piece metal box into which the respective circuit boards are mounted and connected. The DB-1 preamplifier is a more complicated structure which is composed of one PC board for all electronics, another for the rear panel to which the various sockets are soldered, a bottom cover, a black anodized aluminum front panel, and, finally, the one-piece top and sides cover. The rear panel P.C. board and the bottom cover are securely fastened with several sheet metal screws. The front panel is bolted to the three rotary controls and attached to the case with a bead of black RTV compound. Although there is quite a bit of electronic hardware in each package, the circuit board layouts are sufficiently well planned to allow dense component placement and compact packaging, as the dimensions indicate.

There can be no doubt that the simple packaging and lack of frills on these DB Systems units have helped make it possible to price them modestly. There are other components in this price range that, to this reviewer, have more attractive exterior designs and also sport more features, such as tone controls, multiple outlets, and headphone drivers, however, the electronics of the other units are all too often of low grade and cheaply mass produced. Definitely not so in the DB units we tested.

Looking inside the DB-1 preamp, one finds a clear, solder-plated, epoxy-glass PC board filled with components of unusually high quality. For example, all the electrolytic capacitors in the audio chain are the superior tantalum type. All feedback components are 1 per cent types, the resistors being high stability metal film types, the capacitors propylene.



It is apparent to those engaged in high level audio design that great attention was devoted to the choice of *passive* components and their effect on the sonic and electronic performance of the system.

For those who can enjoy the fine points of electronic design, the schematic diagrams (Fig. 1) of the circuits used in DB's products are gold-mines of original thinking and solid engineering. A look at the schematic for the phono preamp shows DB's low level amplifier design. Although component and feedback values are different, both the DB-1 and the DB-4 utilize similar circuits. The input stage is bipolar-FET cascode (Q_1 & Q_2), which offers good low noise possibilities and very good output-to-input rejection—an important point often overlooked when driving phono inputs from high impedance type cartridges. Following is a Darlington common-emitter amplifier (Q_3 & Q_4), set up to achieve a stable operating point and to provide very high load impedance to the first stage for high gain. This second stage drives the common base amplifier Q_5, which is loaded with the current source Q_7 and emitter follower Q_8. Q_{10} is used as an integrater in the bias network and is not in the signal path. These two or three stages of voltage amplification provide a low frequency, open loop gain between 10 and 20 million, or 140 to 146 dB! This means that before compensation, there is 105 dB or more negative feedback available at mid-band frequencies and approximately 85 at low frequencies with RIAA equalization.

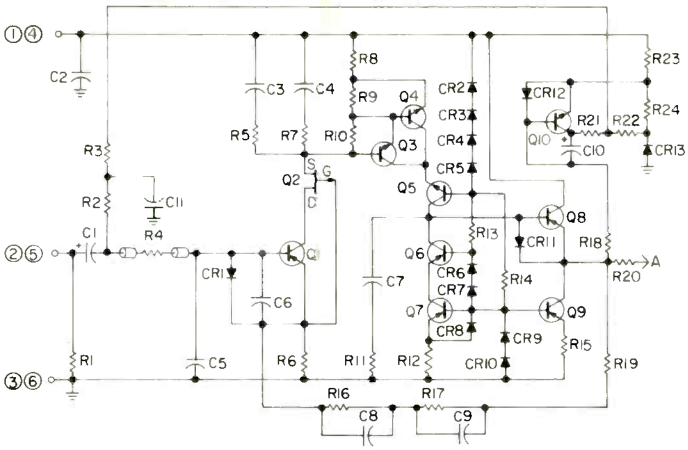
Table 1

Volume Control Tracking		Output Noise, 10K Source	
ATTENUATION	ERROR	20-20kHz	400-20kHz
0 dB	0		
-5	-0.3	13.5 at 0 dB	12.9 at 0 dB
-10	-0.5	24.5	24.0
-15	-1.2		
-20	-1.2	16.8	16.3
-25	-0.8		
-30	-0.8	11.5	10.8
-35	-1.0		
-40	-1.1	9.25	8.69
-45	-1.7		
-50	-1.3	8.69	7.77
-55	+0.8		
-60	-5.0	8.32	7.58

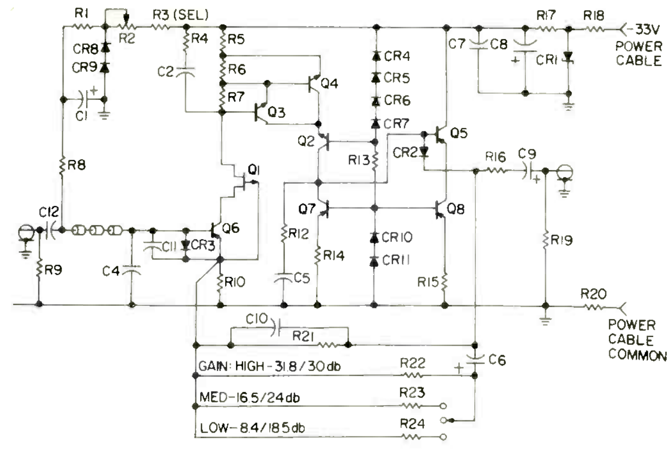
Table 1—Volume control tracking and output noise vs. volume control attenuation.

A discussion with Walt Morrey, partner at DB Systems, revealed that the compensation applied, in the form of three RC stops, tends to follow the RIAA equalization somewhat, thereby giving a fairly constant distortion reading over the audible range.

Although DB's five-year warranty, like others, does not cover electrical abuse, the circuit is definitely well protected from any likely accidental misuse. All inputs have diode clamps to protect against input transistor base-emitter avalanche, which can quickly and often subtly degrade a transistor's current gain and noise characteristics. All outputs also appear to be protected from abnormally low impedance loads by resistive padding. Another benefit of this resistive padding is that external loads are sufficiently isolated

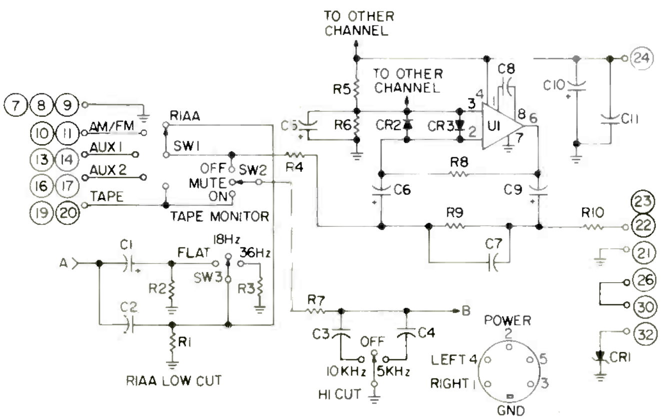


RIAA EQUALIZED AMPLIFIER

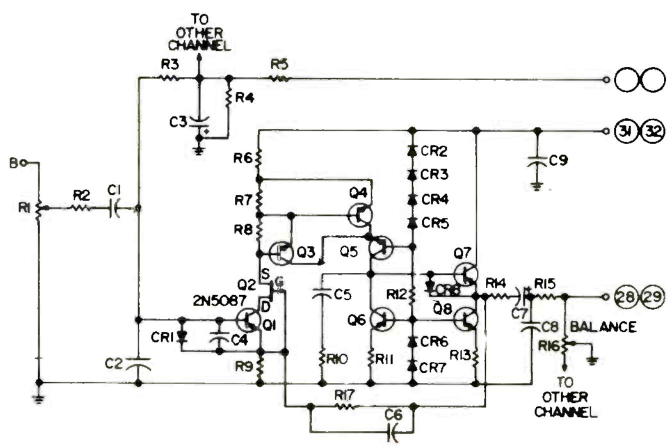


VARIABLE GAIN AMP

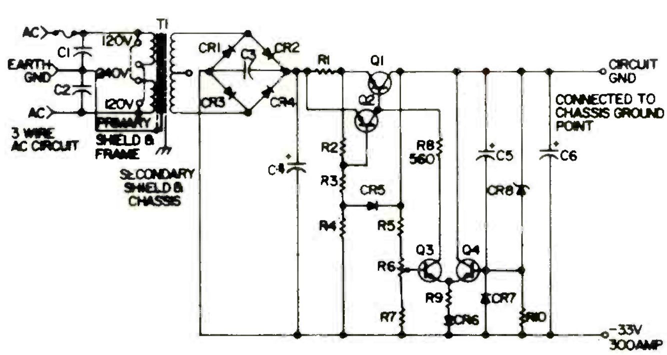
Fig. 1—Schematic diagrams of DB Systems phono section, filter and buffer, amplifier stage, power supply, and variable gain amp.



FILTER & BUFFER



X10 AMPLIFIER STAGE



POWER SUPPLY

from the preamp's electronics to insure that the preamp's distortion will not noticeably rise with non-linear loads.

A not uncommon problem with many preamplifiers arises when operating in the *Phono* mode, with a tape machine connected to the *tape output* jacks. Low impedance tape inputs, or complicated nonlinear loads on this output caused by a tape machine's electronics being turned off, can seriously degrade the performance of the phono preamp stage. DB has chosen to eliminate this problem with an inverting buffer using a high slew rate operational amplifier fed back to unity gain.

Unique to the DB-1 and DB-4 is the amount of r.f. suppresssion provided on low level inputs. Both are extensively filtered with ferrite beads and disc ceramic bypass capacitors. DB Systems claims some 50-dB rejection at citizen band frequencies (27 mHz) in the DB-4 pre-preamp. Those living near large r.f. fields may find these products ease or eliminate their r.f. interference problems.

Measurements

As one would expect from a preamplification system design of this sort, the distortion products in the DB-4 and the DB-1 are vanishingly low at any output voltage below clipping. They are so low, in fact, that normal distortion measurements are impossible and the residuals were found to be below those generated in the finest commercially available test oscillators. DB Systems has specially constructed single frequency oscillators and filter sets, which in conjunction with a finely tuned spectrum analyzer, are used to measure distortion at three frequencies in every single unit produced.

It is this reviewer's opinion that such small quantities of THD and IM are not directly related to the sonic performance of either pre-preamplifiers, preamplifiers, or power amplifiers, and therefore no attempt was made to verify DB's claims. Let it be said, however, that both THD or IM distortion under normal conditions is below, and perhaps considerably below, 0.001 per cent for both the DB-1 and the DB-4. The manufacturer's specifications do show distortion figures, provided by DB Systems, to satisfy the reader's curiosity.

Frequency responses are shown in Fig. 2. The upper curve here shows the RIAA equalization error of the phono section of the DB-1 as measured with a non-inductive 50-ohm signal source. From 20 Hz to 10 kHz, it can be seen that the error is less than 0.1 dB — very good equalization here. Above 10 kHz, the output shows a slowly rising response because of the 50-kHz break in the equalization caused by R19. The oscilloscope photograph in Fig. 3 shows a pre-equalized 20-kHz square wave test of the preamp. Overshoot on the output is also due to the 50 kHz break in preamp equalization network due to R19 (see Fig. 1). The bottom trace in Fig. 3 is the unequalized generator output waveform, and the top trace is the same waveform with inverse RIAA equalization, as applied to the preamp input. Notice the high amplitudes applied to and processed by the phono stage. Figure 4 shows perfect reproduction of tone-bursts of triangle waves near 20 kHz, a feat which requires large high frequen-

TABLE 2

DB-1	GAIN	20-20K	400-20K
L, High Level	8.71, 18.8 dB	See Table 3	
R, High Level	8.71, 18.8 dB		
L, Phono	59.2, 35.44 dB	487 nV*-86.4 dB	223 nV*-93 dB
R, Phono	60.3, 35.61 dB	487 nV*-86.4 dB	225 nV*-93 dB

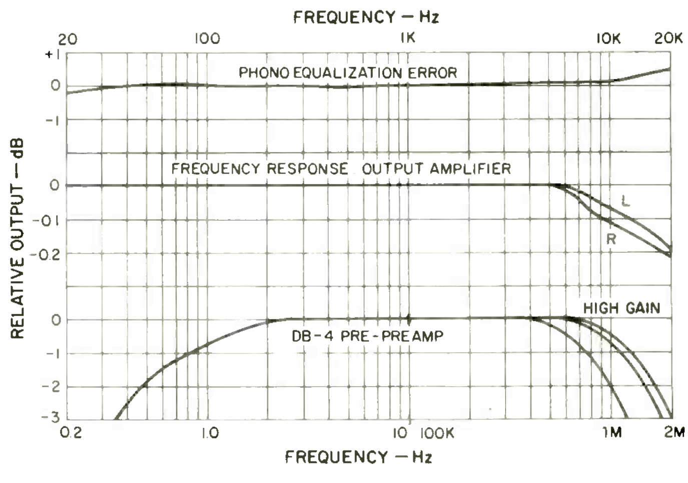
*Shorted Inputs, referred to 10mV for decibels.

DB-4			
L Low	8.38, 18.47 dB		
Med	16.62, 24.21	127 nV,-77.9 dB*	125 nV-78.1 dB
High	31.87, 30.07		
R Low	8.45, 18.53 dB		
Med	16.53, 24.37	135 nV-77.4*	129 nV-77.8*
High	31.68, 30.00		

*Shorted inputs, referred to 1mV for decibels

Table 2—Gain vs. phono preamp noise and pre-preamp noise.

Fig. 2—RIAA equalization error, frequency response of the output amplifier, and response of the DB-4 pre-preamp. (Note break in scale at 10 Hz/100 kHz for the bottom curve.)



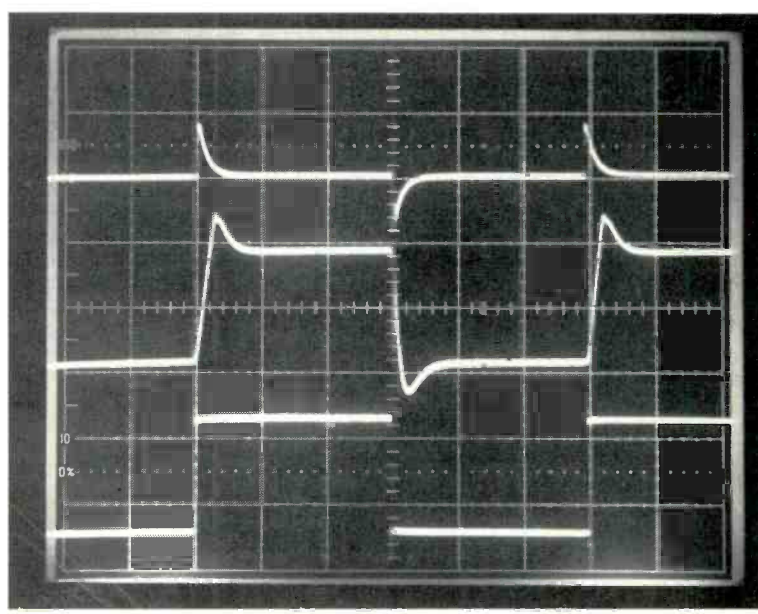
cy level acceptance and very accurate RIAA equalization in the mid and high frequency range.

Figure 5 shows square wave response in the moving coil cartridge pre-preamplifier at 20 Hz and 20 kHz, medium gain setting. The bottom curve in Fig. 2 shows, on a greatly expanded frequency scale, the measured response for the DB-4 at the three gain settings.

The high level/output amplifier has similarly wide bandwidth, being down 1 dB around 2 Hz and 50 kHz as DB claims. The middle curve in Fig. 2 shows the 20 Hz to 20 kHz response on a 0.1 dB per division scale.

One possible minor problem with the DB system is the relatively low gain in the DB-1 (see Table 2). Moderate to low output moving magnet cartridges, when used with the DB's 35 + dB gain, may not provide a sufficiently high level on the tape outputs to drive some tape decks to 0 dB, so possible users of the DB-1 should make sure that their systems have enough gain to record properly. Gain in the output amplifier (near 19 dB) is a good choice, as were the settings available in the DB-4. Gains were quite well matched from channel to channel in each stage due to the type of circuitry employed and the precision feedback components.

Fig. 3—Response of the DB-1 to pre-equalized square waves. Top trace is input (1 V/div.), and lower trace is preamp output (5 V/div.) Time scale is 10 μS/div.



The noise in the DB-1 phono preamp was sufficiently low to provide good signal-to-noise ratios even with low output cartridges, as shown in Table 2. Noise performance of the output amplifier was also quite low—with the volume control off the stops, it is fairly well dominated by thermal noise in the 10k resistive source used and the 100k volume pot.

The DB-4 did not do as well in the noise department. Equivalent input noise voltage for a shorted input was over 120 nanovolts in the 400 Hz to 20 kHz region. Those using very low output moving coil cartridges, such as the Ortophon SL-15E MK II, may find it objectionable on recordings with a wide dynamic range. Although more difficult to achieve, 75 nV would be a better number here.

TABLE 3

	IN	OUT
20 Hz	17.7 mV	10V
100	37.9	10.4V
1k	172	10.4V
5k	438	10.5V
10k	842	10.4V
20k	1.56V	10.3V

Table 3—Phono preamp overload levels.

Listening Results

The DB-1 was first driven with a standard pre-preamp which made preamp A-B comparisons fairly easy to implement. Then, a number of high quality preamps, of both tube and transistor design, were alternately compared to the DB with several experienced listeners. Overall sound quality was reported to be rather good, though the DB-1 does have a sonic thumbprint as does every other piece of electronics yet encountered by this reviewer.

Some initial criticism centered on the preamp's bass response, which appeared to be weak in comparison with some other units. In subsequent tests using a network which permitted straight wire vs. pre-equalized phono preamp comparisons, the DB seemed to reproduce low frequency material quite accurately, yielding both solid and deep reproduction upon demand! So, the other preamps were compared on the same basis with special attention to their bass response. We then realized that two of the reference preamps appeared to slightly reinforce bass, perhaps with low order harmonic distortion! It should be noted here that RIAA equalization was quite accurate in each unit, so the sonic differences were felt to be circuit qualities rather than frequency response differences.)

Midrange and high frequency material seemed to be reproduced in the DB-1 with some, but comparatively little edge and grit, being at least as good as the other excellent transistor circuits. However, the DB-1 was not judged to have quite the spaciousness and "freedom" of our best reference preamps, and the most complicated passages lost some of the nuances so important to accurate three-dimensional reproduction.

The DB-4, not surprisingly, had a sonic character much like the DB-1. Bass response solid and well defined, midrange and high end fairly smooth and extended, but accompanied by a slight loss of definition and space.

Readers should be reminded that criticism of high level audio electronics often revolves around very fine points of difference, and the DB Systems units have, in turn, their advantages over their competition, not the least of which is that these products offer long term stability and consistency from unit to unit thanks to the design techniques employed. Further, the DB-1 and DB-4 sound good in comparison with units at any price, but at $475.00 and $150.00, they probably offer the best performance per dollar. *George Pontis*

Fig. 4—Response of the DB-1 to tone-bursts of triangle waves near 20 kHz. Lower trace is input, and top trace is output at *Tape* (2 V/div.). Time scale for both is 50 μS/div.

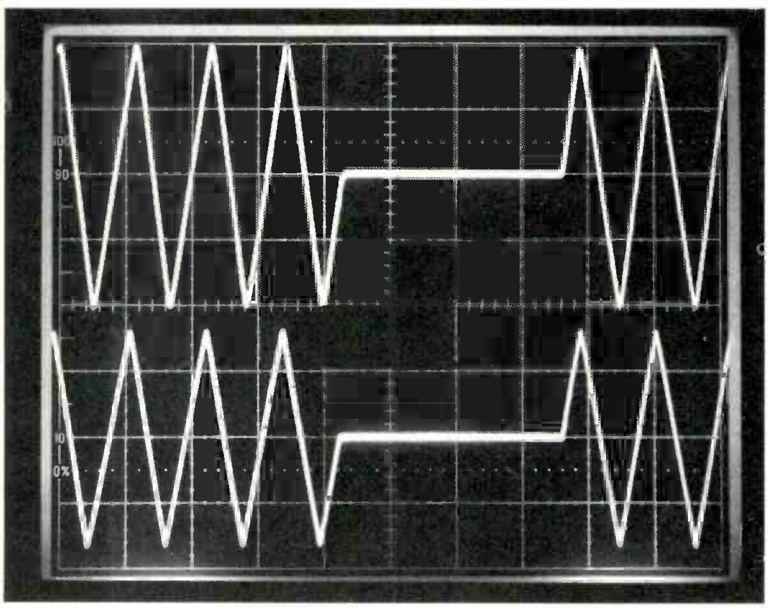


Fig. 5—Response of DB-4 pre-preamp to 20-Hz and 20-kHz square waves, medium gain setting, 50 ohm source. Inputs (5 mV/div.) are superimposed over outputs (50 mV/div.). Time scales: top traces, 10 μS/div.; bottom traces, 10 mS/div.