dynaco

TEST REPORTS FROM LEADING HIGH FIDELITY PUBLICATIONS

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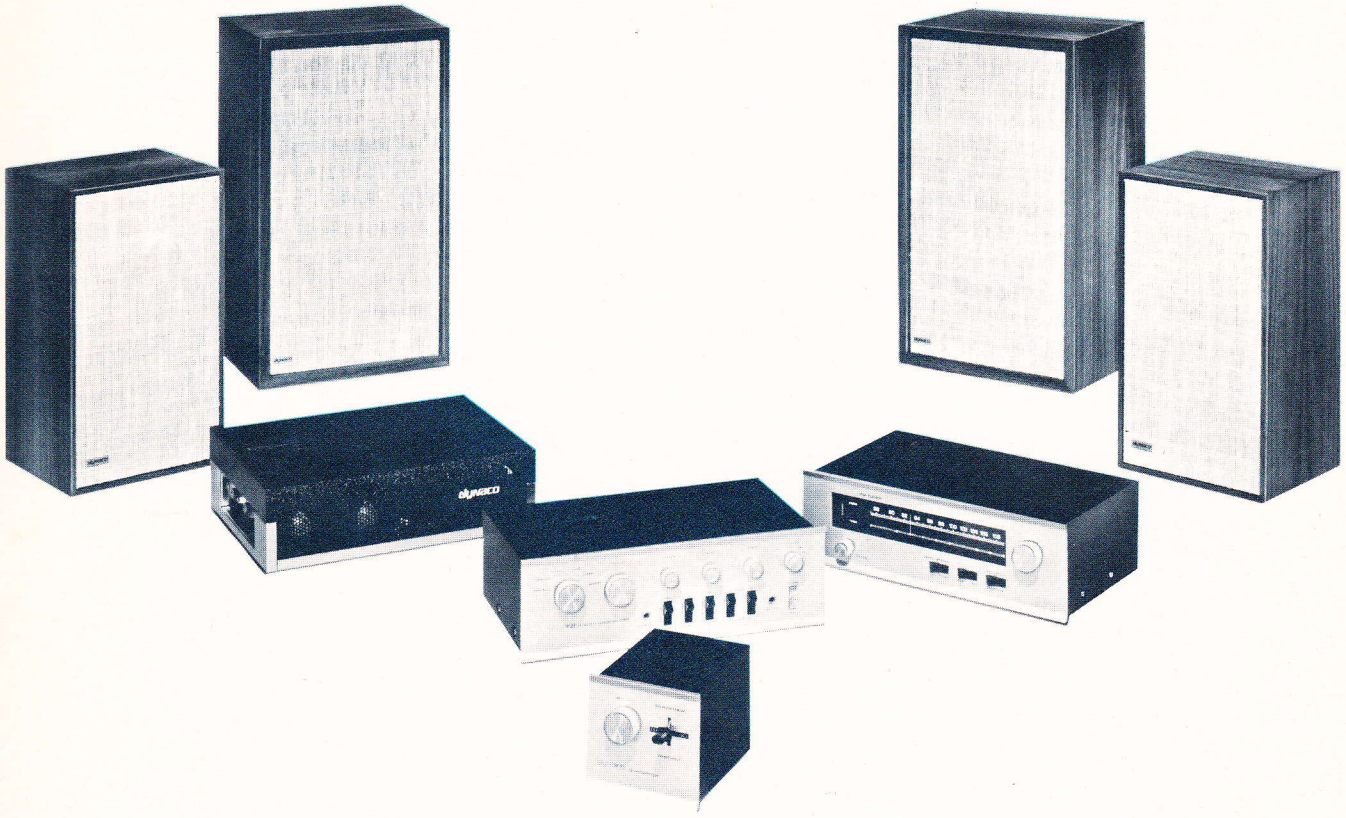


Since its inception, Dynaco has introduced products only when they clearly demonstrated extraordinary value. Painstaking engineering, refined by exhaustive distillation of each circuit to the simplest reliably effective design, is a Dynaco hallmark. The results have consistently met with enthusiastic critical acclaim from high fidelity reviewers and audiophiles.

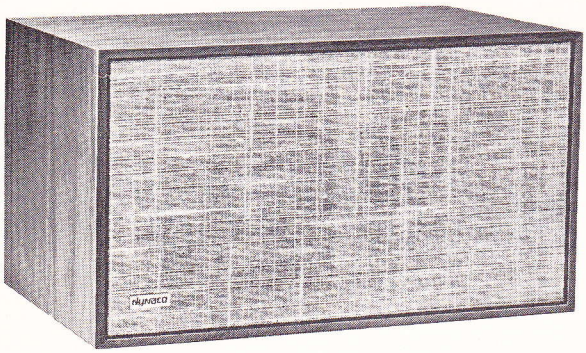
These objective test reports remain current for many years because Dynaco products rarely change. We urge you to read these reports carefully. Thus we do not excerpt or underline. Note particularly the frequent references to Dynaco's inordinate value. These are not just "best for the money", but reasonably priced components which are singularly "state of the art".

CONTENTS

Big Sound from Dynaco's Small Speaker

The Equipment: Dynaco A-10, a compact full-range speaker system in enclosure. Dimensions: 8½ by 7⅞ by 15 inches. Price, sold only as a pair, $104. Manufacturer: Dynaco Div., Tyco, 3060 Jefferson St., Philadelphia, Pa. 19121.

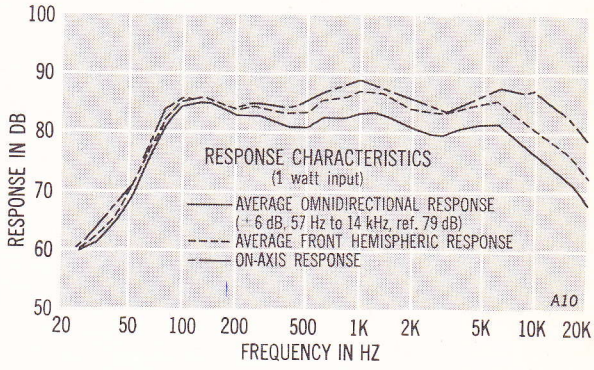
Comment: Dynaco has entered the "$50-speaker market" with a worthy competitor for this burgeoning product area. A two-way direct-radiating system, the A-10 consists of a 6½-inch extended-range woofer crossed over at 2,500 Hz to a soft-dome tweeter. Both drivers are



mounted on the front baffle (behind the decorative grille) where there also is a vent that helps load the system to the listening room at low frequencies. The cabinet is a neatly styled walnut enclosure that may be positioned vertically or horizontally and also is lightweight enough to hang on a wall (brackets for this purpose are fastened to the rear). Input is via color-coded screw terminals that will accept large or small spade lugs or bare wires. No level controls are provided.

In contrast to bass-reflex design, which relies on cabinet resonance for bass enhancement, the A-10 employs what Dynaco calls an "aperiodic" or nonresonant design in which the vent opening is treated with special material to add acoustic resistance to smooth the woofer's response and aid in the transfer of low-frequency energy from the speaker to the room.

Our tests confirm that the design works. The A-10, to our ears, furnishes a level and quality of sound at all frequencies that are hard to believe for the size and cost of the unit. The lab measurements show response within plus or minus 6 dB from 57 Hz to 14 kHz. On test tones of audible response we found the bass holding up cleanly to just below 50 Hz, with a gradual rolloff below this frequency, but with a surprising freedom from doubling. The middles and highs sounded well rounded and balanced, with very good dispersion, to beyond audibility. Rated for 8 ohms, the A-10's lowest impedance was measured as 6.5 ohms at the usual bass dip above bass resonance. From this area it rises rapidly and never falls below 8 ohms out to its response limits. Efficiency is moderate; the A-10 needed 6.3 watts to produce the standard test output of 94 dB at 1 meter on axis. It could take up to 72 watts of steady-state power (producing an output of 100 dB) before distorting significantly. Its maximum capability for handling power pulses was 69 watts average or 138 watts peak. These figures indicate ample dynamic range but within obvious design limits. That is to say, the A-10 should not be driven with any of the recent super-powerhouse amplifiers but it will do nicely when coupled with a unit that can deliver up to and even a bit more than 50 watts average sine-wave (or "rms" power) per channel. By the same token, don't look to the A-10s to cover a ballroom-size area with sound—but you can expect it to furnish a surprising and pleasant impression of "big sound" in a room of normal size or slightly larger. In such a room, its sound is quite natural on both voice and instruments, and a pair projects a good, firm stereo image.



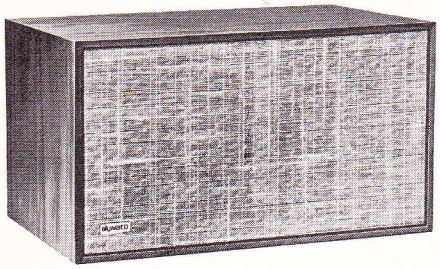
Dynaco A-10 Speaker Harmonic Distortion*

Output Level (dB)	Frequency 80 Hz % 2nd	80 Hz % 3rd	300 Hz % 2nd	300 Hz % 3rd
70	0.55	0.55	0.22	0.28
75	0.85	0.60	0.20	0.35
80	1.6	0.75	0.22	0.40
85	2.5	1.0	0.28	0.33
90	4.0	1.4	0.35	0.33
95			0.42	0.28
100			0.45	1.1

*Distortion data are taken on all tested speakers until distortion exceeds the 10 per cent level or the speaker produces the spurious output known as buzzing, whichever occurs first.

Stereo Review

Dynaco A-10 Speaker System



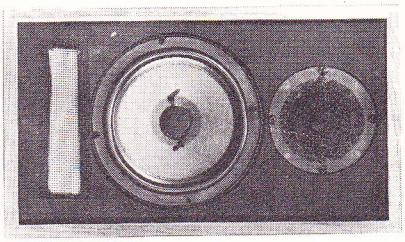
● A NEW member has been added to the Dynaco speaker family. The Model A-10, a very compact two-way system, closely matches the acoustic characteristics of the larger Dynaco A-25 and A-50 speakers. The A-10 uses the same soft-dome tweeter as the A-25, and its 6-inch woofer has the same magnet structure used on the 10-inch woofers of the A-25 and A-50. The 6-dB-per-octave crossover is at 1,500 Hz. Unlike the larger systems, the A-10 has no tweeter-output level adjustment.

Since the A-10's efficiency and general response match those of the A-25 and A-50, it is a good choice for use in the rear of a four-speaker quadrasonic array with the larger Dynaco models in front. When A-10's are used as a stereo pair, amplifiers of at least 15 watts per channel are recommended, and peaks of up to 50 watts can be handled safely.

The Dynaco A-10 is 8½ inches wide, 15 inches high, and 7⅞ inches deep; it weighs 11¼ pounds. The walnut cabinet and the grille cloth match the appearance of the other Dynaco speakers. Three recessed brackets in the rear of the A-10 permit wall mounting, either horizontally or vertically. The Dynaco A-10 is sold only in pairs, for $104.00 the pair.

● ***Laboratory Measurements.*** Recalling the great similarity in response and sound character between the A-25 and A-50 systems, we were not too surprised to find the A-10 almost identical to them. The averaged frequency response was ±4 dB from 50 to 15,000 Hz, with the maximum low-frequency output at 80 Hz and a broad high-frequency maximum at 10,000 Hz. The overall response was smooth. The lowest frequencies were not reproduced as strongly, or with as low distortion, as with the larger Dynaco speakers. Nevertheless, the bass performance of the tiny A-10 was most impressive, with the distortion (at a 1-watt level) under 5 per cent down to 65 Hz and reaching about 10 per cent at 50 Hz. We would judge the useful lower limit of the A-10's response to be between 50 and 60 Hz, which is not at all bad for a 6-inch woofer.

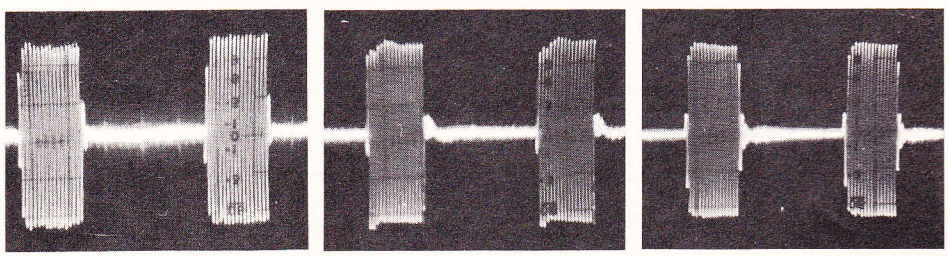
The pedigree of the A-10 was further emphasized by its performance in the simulated "live-*vs.*-recorded" listening test, and by its tone-burst response. We would give it a B+ rating in the former, since a loss of extreme highs (above 10,000 Hz) could be heard, and at times there was a slight mid-range coloration whose exact cause we could not identify. The tone bursts, at all frequencies, were as close to perfect as we have seen. Comparing our tone-burst photos with those we made on the A-25 and A-50, we found them as nearly alike as the proverbial "peas in a pod," and completely free of ringing or any other distortion. The impedance of the Dynaco A-10 reached its minimum of 5 ohms at 150 Hz, and had two peaks of 20 and 30 ohms at 70 and 1,300 Hz. The average impedance was between 8 and 10 ohms.



Like the larger A-25 system, the Dynaco A-10 enclosure has a heavily damped port. The tweeter is similar to those in the larger models.

● ***Comment.*** We used the Dynaco A-10's in the rear of a four-speaker "Dynaquad" setup, with A-25's in the front. The results were excellent, with a good front-to-rear balance when the rear-speaker level control was at maximum. We then placed them in the front of the room and compared them with some of the best speakers at our disposal. With some types of program material the sound of the A-10's was frequently almost indistinguishable from that of speakers costing many times their price. Of course, there *were* differences. The high-frequency output and dispersion of the A-10, while better than average, were no match for those of more elaborate systems using multi-unit dome-tweeter arrays. The *subjective* bass output of the A-10 woofer was hard to believe, but switching to the larger speakers while reproducing the pipe organ or bass drum always supplied another octave of the kind of bass that can be *felt*. Without this comparison, it would have been easy to convince someone that the A-10 was reproducing the lowest bass octave. It is very good, especially when compared with most speakers of its size or price, but of course it cannot work miracles.

To summarize, the Dynaco A-10 does exactly what is claimed for it. It is a nearly exact match, electrically and acoustically, for the larger A-25 and A-50 Dynaco speakers. This, plus its size and cost, makes it ideal for the rear speakers of a quadrasonic setup with the larger speakers in front. In addition, it sounds good enough to earn a place in the front of many listening rooms. Although it cannot deliver the volume of sound of a larger speaker, it can play loud enough for almost any reasonable purpose. Its wide dispersion and tonal balance are such that it *sounds* big, and a blindfolded listener would never suspect that he is listening to a speaker system of subcompact size and price.



The A-10 exhibited nearly perfect tone-burst response. The oscilloscope photos show frequencies of (left to right) 100, 1,000, and 10,000 Hz.

the stereophile

Box 49, Elwyn, Pa. 19063

Vol. 2, No. 9

Dynaco A-25 Speaker System

MFR'S SPECS-- Type: Two-way dynamic bookshelf loudspeaker system. Impedance: 8 ohms. Power ratings: minimum amplifier 15 watts contin. sine watts/ch; maximum signal 70 watts program. Dimensions: 19-3/4 inch W by 11½ H by 10 D. Price: $89.00 MFR: Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121

Everyone knows that a lot of serious music listeners -- that is, those who listen to music instead of using it as a conversational background -- have neither the space nor the money for a pair of typical floor-standing speakers, and must make do with bookshelf-type systems that are actually small enough to put in a bookshelf. But while the typical audio perfectionist will freely admit that there is a place in the audio sun for these dinky little speakers, he cannot really take them seriously, particularly when they're priced significantly under $100 each. At least, that has been our feeling about the cute little boxes we've tested, and as a result, we have always tended to marvel at any pretensions to quality in them, rather than compare them directly with the "full-sized" systems that we have come to expect something from.

Dynaco warned us in advance that the A-25's were "something special," but since we have heard exactly the same kind of ballyhoo about every other new product we've ever tested, we could be forgiven for being just a little skeptical. Of course, Dyna's stuff had been pretty good in the past, but how much could anyone really do with a speaker just a little bit bigger than a large bread box. Nice highs, maybe, but perfectionist-type bass? Not a chance!

According to the laws of physics, small dimensions are just not conducive to deep-bass reproduction. Small cones tend to be lighter than large cones, and thus resonate at a higher frequency. And a woofer's output normally falls off progressively below its resonance point. Enclosing the woofer tends to raise its resonant frequency even further, and the smaller the enclosure, the more the resonance is raised, and the more pronounced it becomes. And as if that weren't enough, a small cone can't get a big enough "bite" on the air to produce long-wavelength pressure changes. Hence, the speaker's efficiency diminishes as the frequency goes down. These are the hard facts of audio life, but while there is no known way of repealing the physical laws involved, there are ways of circumventing them.

For example, it was learned many years ago that the dwindling low-end efficiency of a cone could be offset to a large extent by letting the enclosure resonate at a lower frequency than the cone, and cutting a hole in the front of cabinet to let its internal pressure augment that from the front of the cone. The hole also relieved some of the internal pressure buildup (making the enclosure behave as though it were somewhat larger), and it was found subsequently that if the passage of air back and forth through the hole were limited to some extent by the addition of acoustic resistance (via a couple of layers of burlap, for instance), the sharpness of the two resonant peaks could be reduced to the point where the whole low end was acceptably smooth. This "bass reflex" system (generally attributed to Jensen Loudspeakers, Inc.) was the accepted way of producing "small" (that is, smaller than large horn-type) speaker systems until Ed Villchur spawned the acoustic-suspension system.

By the end of the 1940's, some designers had found that stuffing an enclosure full of fiber glass had the effect of making it behave like a larger enclosure, and also helped to smooth out resonances. If the enclosure were totally sealed, only one resonance would develop, and if the proper design parameters were chosen, the resulting system could give smoother bass and just as good low-end range as a bass-reflex system of comparable size.

Because of the lack of augmentation from internal pressures, the whole bass range was slightly less efficient than from a bass-reflex system, but since higher-powered amplifiers were becoming increasingly common, it was no great disadvantage to have to reduce the system's upper-range efficiency slightly in order to match the low end.

Villchur's acoustic suspension system just carried the stuffed "infinite baffle" principle (used in Bozak speakers at that time) a step further. The suspension of the woofer cone was made exceedingly flexible (to reduce its free-air resonance to an extremely low frequency), and the air pressure in a small enclosure was used as the main source of "restoring force" (the force needed to return the cone to its "at-rest" position between vibrations). The combination of a heavy cone, a small sealed box and just the right amount of internal stuffing yielded a broad low-end resonance that could maintain a fairly flat low end down to around 30 Hz, and although the efficiency was now even lower in the bass range than that of the larger completely-enclosed systems, 50-watt amplifiers made it practical to reduce the entire upper-range efficiency even further, to match the low end.

The first AR system (the AR-1) and its successor, the AR-3, were the ideal size for no-holds-barred low-end response, and the slightly smaller AR-2 carried the principle down to its practical limit of miniaturization. Smaller systems ran into the same inflexible laws of physics as before (before the fiber-glass stuffing, that is), and in order to cover up the resulting lack of deep bass from them, designers found it necessary to underdamp their mid-bass resonance to give "fullness" to their sound. So while these ultra-compact systems sounded balanced, they also had a characteristic boominess and a conspicuous absence of output below their boom range. Clearly, the acoustic suspension system was no longer enough.

In view of the history of the small loudspeaker, it is surprising that nobody thought of Dynaco's "aperiodic" system a long time ago. The bass-reflex system allowed for a significant reduction in cabinet size without undue sacrifice in low-end range, without any stuffing in the cabinet. Eventually, it must have occurred to someone to add a reflex port to a stuffed enclosure.

We don't really know whether or not the A-25 qualifies as a genuine bass-reflex system, but its construction and behavior suggest that that is exactly what it is, although this particular variety works the way earlier versions should have but never quite did.

As before, the hole in the A-25 enclosure relieves some of the internal pressure buildup and feeds some out through the front to augment the woofer's front radiation, and a "plug" of acoustically resistant material in the hole reduces the amplitude of the system resonances and spreads them out to the point where they become virtually a smooth low-end rise through the range where the woofer would normally fall off. The result is not quite an "aperiodic" system, but is at least "essentially nonresonant," to quote from Dyna's poop sheet.

The A-25 differs from other acoustic-suspension-type systems in another respect, too. Most of these use rather heavy cones, to keep the system resonance as low as possible, concomitant with the other design parameters. The A-25's cone is considerably lighter, and this plus a lower-than-usual crossover frequency (1500 Hz as opposed to about 2 kHz) should, at least in theory, assure better transient response than is typical of such systems.

The tweeter is described as a non-rigid hemispheric (dome) type, whatever that may be, and tweeter/woofer balance is adjustable by a five-position switch at the rear of the enclosure. The switch knob, by the way, is quite small and relatively difficult to turn. It won't challenge the average adult, but it will frustrate any child who's too young to have learned to keep his mitts off things.

We compared the A-25's with two systems of comparable price -- the Acoustic Research AR-4x ($63) and the KLH Model Seventeen ($75) -- and some top-rated higher-priced systems -- Janszen Z-600's, Acoustic Res-

earch AR-3a's, and a single pair of KLH Model Nine panels. Readers of previous Stereophile reports will recall that we have faulted many an otherwise-excellent loudspeaker system for coloring the critical musical range, because we feel that if a speaker distorts instrumental timbres, no amount of dispersion or bass or treble range can make it any more accurate a reproducer of music. The speakers we put up against the A-25's were all outstandingly good in this respect, so we were most curious to see which, if any, the A-25's could match. Would you believe, the A-25's beat out all of them!

This is one of the very few speaker systems we have ever neard that seemed to have virtually no sound of its own. Brasses, strings, woodwinds and most percussion instruments were reproduced equally naturally and with nary a trace of hollowness or nasality or steeliness, and it was just not possible to characterize the sound as Row-A or Row-G or Row-M. In these respects, it was slightly better than the best of the other systems we compared it with.

Dynaco has the center position of the balance switch indicated as the Flat position, so we started our tests with the balance set accordingly. We found no reason to change this, in the three rather acoustically different rooms we listened in, so the following comments apply to the systems with that balance setting.

Treble dispersion was excellent: estimated at about 100 degrees, and without any significant interference effects between drivers. As a result, stereo imaging was excellent, and good stereo spread was obtained even when sitting to the left of the left-hand speaker (and vice versa). Efficiency was typically low for a compact system -- around 1% -- but power-handling ability was considerable. These speakers were able to put out rather more clean sound than some slightly-higher-efficiency systems, including the Janszen Z-600's, which tended to get a bit muddy at equivalent levels. Dynaco's literature makes a strong point about the smoothness of the A-25's impedance curve, explaining that solid-state amplifiers are less tolerant of load impedance variations than were tubed amplifiers. This is true, but we did not think the problem was quite as acute as the A-25 proved it to be. By actual comparisons, the AR-3a is only slightly less efficient than the A-25. But we were able to get almost 4 db more clean signal from the A-25's than from the AR's, which do have rather more variable impedance.

At the high end, the A-25's were good but not really outstanding. Generally, the impression was one of considerable smoothness but with a very subtle roughness up around 10 kHz and a mildly soft quality which we found much more agreeable than the hardness which passes for hi-fi in a lot of other small systems. We judged the A-25's about equal to the AR-4x's at the top and somewhat smoother than the KLH Seventeens. At the low end, though, it was a different story.

Unlike most small systems, which need all the low-end augmentation they can get, the A-25's tend to put out too much bottom in most rooms when placed on the floor or in the room corners. Best results were obtained in most instances with the speakers a couple of feet above floor level, which is convenient in view of the fact that these are, after all, supposed to be bookshelf systems.

Both the AR-4x and the Seventeen have a noticeable amount of the mid-bass heaviness that seems almost to be an innate characteristic of ultra-compact systems, so whatever output they may have in the extreme low-bass range is rather effectively masked by the upper-range weight. By contrast, the A-25's seemed at first to be deficient through the entire low end, at least until some really deep stuff came along. When it did, what came out of the A-25's simply defied belief, for they went deeper even than two of our "standard" systems, the Z-600's and the KLH Nines.

We knew that a single pair of Nines, with the panels separated, start to roll off below about 50 Hz, and that the Z-600's in most rooms start to dwindle below 40 Hz. But we were certainly not prepared to find these piddling little Dyna systems going flat down to 35 Hz and rattling windows at a hair below 30 Hz! And this with a degree of detail and tightness that rivalled the Nine's and ran circles around the Z-600's.

The AR-3a, of course, is practically in a class by itself when it comes to low-end range. With virtually flat bottom down to around 25 Hz, nothing short of some monster systems can equal it in this respect. Certainly, the A-25's couldn't. But in the matter of transient response, particularly through the woofer's range, the AR-3a has left something to be desired, and it is here where the A-25's offer the AR-3a's some real competition.

In test after test, the A-25's revealed more bass detail than the AR-3a's and, in most cases, produced a more natural bass/treble balance than the larger AR's. Some listeners have complained about a certain "heavy" or "thick" quality about the AR-3a's sound. The A-25's had virtually none of this, and neither did they have any of the mildly distressing "crinkling-paper" sound that is so common in small acoustic-suspension-type systems. In other words, as ridiculous as this may sound in view of the price difference, we would opt for a pair of the A-25's over a pair of AR-3a's.

As we mentioned, the AR-3a's real point of superiority is in low-end range. But since both systems more than span the low-end range on commercial recordings, the AR-3a's superiority down there strikes us as being somewhat academic.

Only in one respect did we find the A-25's to be clearly inferior to two of the systems we compared them with: transparency. By comparison with the liquid clarity of the electrostatic systems, the A-25's had a dry, almost grainy quality and a somewhat dead sound. There was however practically no sense of restricted high end, so we attribute the difference mainly to the simple fact that nobody has yet managed to design a dynamic loudspeaker driver whose transient response can challenge that of an electrostatic.

Actually, we have heard some dynamic systems (like the Altec A-7-500 and some of the Hartley units) that had more apparent transparency than the A-25's, but these were much higher-priced and had a few minor shortcomings of their own. Actually, although we were not able to make direct comparisons, the A-25's reminded us more of the KLH Model Twelves than anything else we've heard, although our recollection was that the Twelves had a shade more impact and detail at the bottom, a somewhat better-detailed high end, and a subtly drier sound than the A-25's.

Summing up, then, we feel that these A-25's are better than anything else we've ever encountered for less than $200 each, and are worth consideration in any but the highest price category. We will even go so far as to say that they are quite probably the best buy in high fidelity today.

If you're looking for some small loudspeakers for a second, remote listening location, these would seem to be the logical choice. For a main, price-no-object speaker setup, you can buy better transients and more efficiency and, perhaps, deeper bass with equivalent or better detail, but you'll have a hard time buying more musical naturalness at any price. Just one other suggestion, though: don't tell your status-conscious friends how much they cost. They don't sound quite as good when you know.

MFR'S COMMENT: The aperiodic design is not a bass-reflex approach, since there is no acoustic output through the port. The characteristics of the "plug" in the port are quite critical, necessitating individual adjustment of each system. This added acoustical impedance damps the woofer, improving its response to transient signals.

Examination of the woofer cone motion shows that, with this aperiodic design (on which patents are pending), the cone follows the input signal all the way down to DC with far greater precision than is the case with either bass-reflex or acoustic-suspension designs.

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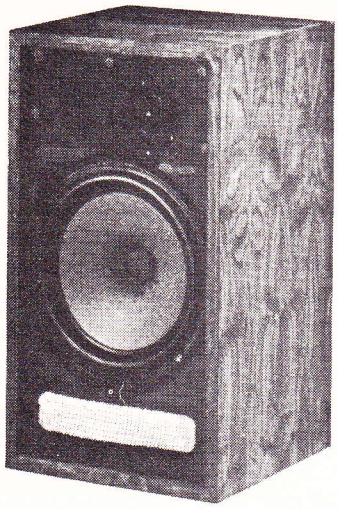
DYNACO APERIODIC LOUDSPEAKER SYSTEM A-25



In many products one finds a close relationship between price and performance; in the case of loudspeakers this is patently not so. Consequently, with a bit of patience and exploration one can come up with speakers which offer better than usual performance per investment dollar: occasionally one stumbles on an unassuming system having a performance which truly belies its price and/or size.

The name Dynaco has long been associated with reasonably priced components possessing near state-of-the-art performance. I am pleased to report that this fine tradition has been continued with the A-25.

The A-25 is a two-way system. It has a single 10 inch "extended excursion" woofer crossing over at 1500 Hz to a small soft-dome direct-radiator tweeter. The enclosure has a single heavily-damped port. A switched high-frequency level adjustment is accessible at the back. It is recessed along with the (8 ohm) connecting posts so that the system can be hung on the wall (hangers are provided). The 19½" high x 11½" wide x 10" deep box is smoothly finished in oiled walnut. (Teak or Rosewood finishes are available).

In the laboratory anechoic chamber the A-25 passed its tests with a good degree of 'scholarship'. The frequency response curves shown in Fig. 1 tell an important tale. *(See box for comment on curves — Ed).* Space does not permit a complete analysis of this characteristic but a few important points can be made.

Firstly, the on-axis response is good. The low-frequency performance is comparable with the best of the bookshelf class of loudspeakers. The smooth rolloff above 10 kHz is not ideal but is commonplace in loudspeakers. The aberration between 1 and 4 kHz bears further consideration.

Going off-axis 30° to the left reduces the aberration, and one sees the expected rolloff of the high frequencies. Moving 30° to the right reveals a nearly 10 dB chasm between 1.5 and 2.7 kHz. At 30° above and below the normal axis, things have returned to respectability.

At 60° off-axis the effects shown in the 30° curves are generally even more exaggerated: the high-frequency rolloff now begins at about 5 kHz and the irregularities in the 1 -4 kHz region are larger.

Albeit imperfect, this is a reasonable performance on an absolute scale of quality and it is excellent by today's prevailing standards. One would anticipate a depression in radiated power between 1 and 3 kHz since, in the family of curves, one frequently finds dips in this region but few peaks. The importance of this to a listener in a normal room would depend on the acoustical characteristics of the room itself. In a normal room the bass holds up well down to about 40 Hz, and although there is a measurable rolloff of the high-frequencies, subjectively this is not a serious deficiency. So much for frequency response.

Transient response is another important characteristic of a transducer. One normally looks for (and finds) sluggishness in responding to the onset of a transient (pulse or tone burst) and ringing or hangover after the signal has stopped.

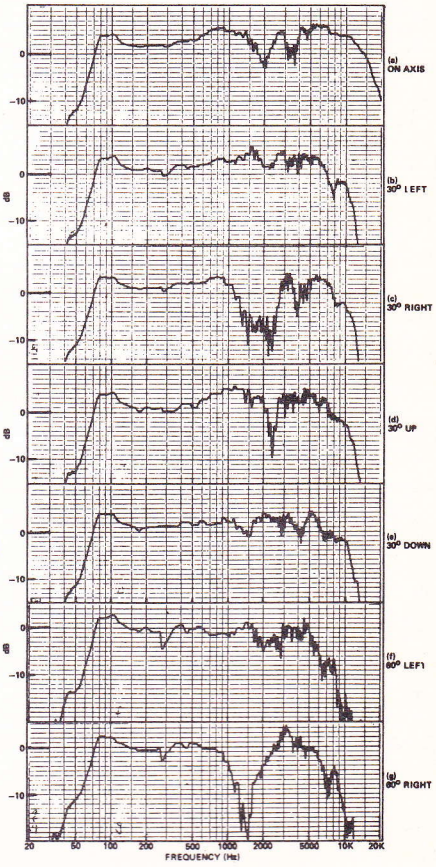


Figure 1 — Frequency response curves measured at 6' distance in an anechoic chamber. The high-frequency level control was set at maximum.

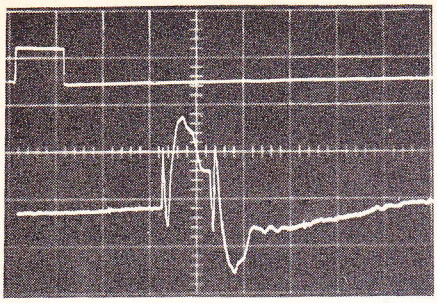


Figure 2 — Pulse Response. Upper trace: 1 msec pulse from power amplifier. Lower trace: acoustical pulse from loudspeaker.

In response to a 1 msec (or any other) duration rectangular pulse, the output is free from serious ringing. (Fig. 2). The narrow spikes are the tweeter responses. The woofer responds slightly later, as is common in such 2-way systems. Incidentally, this is an excellent test of speaker phasing.

Tone bursts of most frequencies came through unscathed. Fig. 3 (a) and (b) show clean responses at frequencies two decades apart. Fig. 3 (c) and (d) show the worst responses that showed up in this range — notice the gradual rise in amplitude and the decay at the end of the burst.

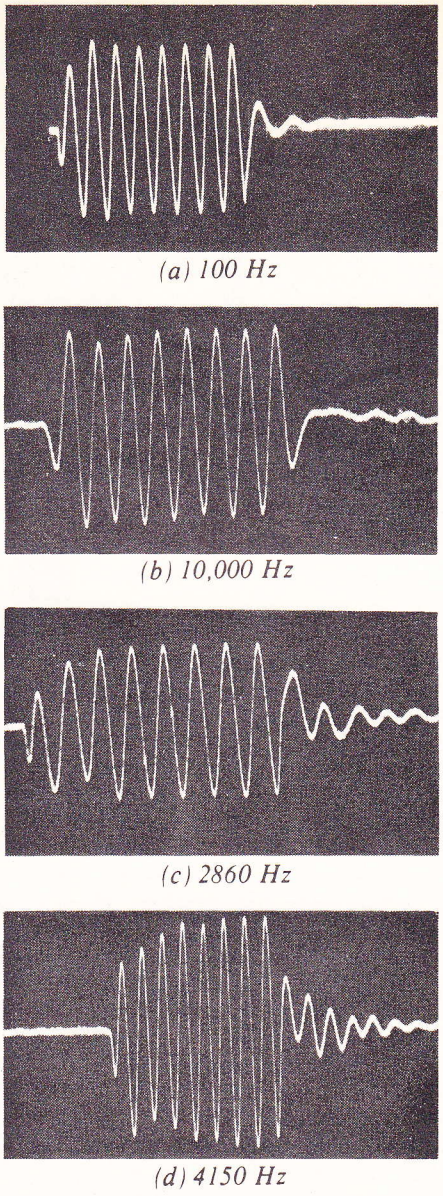


Figure 3 — Tone Burst Response

Total harmonic distortion measured less than 1% over most of the frequency range. It approached this value at frequencies around 3000 Hz, and between 200 and 500 Hz. Going further down, distortion rose from 0.3% at 100 Hz to 1% at 70 Hz and 3% at 50 Hz and 10% at 30 Hz. All these measurements used an input of 10 watts at which power our laboratory measured a sound pressure level of 90 dB at 400 Hz at a distance of 6 feet on-axis in the anechoic room. The latter information is a measure of sensitivity which readers may use to compare different speakers appearing in these tests. In a normal listening room it would be advisable to use an amplifier capable of producing at least 15 to 20 watts (RMS) per channel.

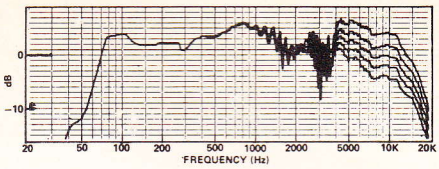


Figure 4 — Frequency response measurements on a second A-25. The family of curves represents on-axis performance with the high-frequency control at various settings. The middle curve is for the control set at "normal".

A second sample of the A-25 was spot tested and it proved to be a close duplicate of the original — a credit to the quality control department. Fig. 4 displays a family of on-axis responses for the second sample showing (top curve) the similarity with the original speaker shown in Fig. 2(a) and the effect of the switchable high-frequency control (lower curves).

The A-25 is a true high-fidelity loudspeaker. In the listening room this is reflected in a pleasant neutrality to the sound. It was blissfully free from the consumer-oriented 'presence' built into many systems. Such colouration as was audible was certainly not obtrusive in normal listening. The bass was solid and free from annoying boom. The all-important middle frequencies were competently reproduced — complex orchestrations came through clearly, voices were distinct, and instrumental sounds were credible. High frequency performance was clean, without serious directionality problems.

Overall, it is a speaker which bears comparison with any of today's systems. Speakers this good are rare enough if price and size were no object. In this economical package it should have 'bargain' written all over it.

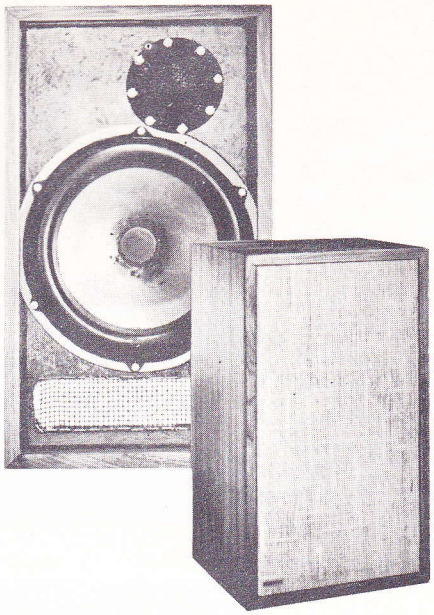
The A-25 lists at $100.00 in walnut and $110.00 in teak or Rosewood. (in Canada)

This audiolab report was prepared by audio writer Edward Osman.

A NOTE ON LOUDSPEAKER MEASUREMENTS

To the uninitiated the adjoining loudspeaker response curves may look impossibly bad, but as we publish more of these reviews it will become clear that these are very much par for the course. Measurements are made in an anechoic (echo-free) quiet room using precisely calibrated equipment. The on-axis response is related to the character of the important "direct" sound which reaches the listener in the stereo seat. The off-axis responses (only a few of which are shown) collectively may be taken as an indication of the total sound power which reaches the listener by the numerous reflected or "indirect" paths. Both of these characteristics are important in evaluating the quality of sound heard by a listener in a normal room.

• The low-frequency performance (below about 200 Hz) measured in an anechoic room will be different from that obtained in a normal room with its sound reflecting surfaces (in a normal room the output will be higher and the response less regular than the curves suggest). However, these curves can be used to compare one speaker with another measured in the same situation. *(E.W.)*



Dynaco A-25 Loudspeaker System.

Dynaco Model A-25 Speaker System

MANUFACTURER'S SPECIFICATIONS:
Two-way System—10-in. woofer, friction loaded; 1½-in. dome tweeter. Frequency Response: 47-20,000 Hz ±5 dB; Power Handling Capacity: 35 watts; Crossover Frequency: 1500 Hz; Impedance: 8 ohms. Grille Material: linen beige; Weight: 20 lbs. Price: $89.00 in oiled walnut; $99.00 in teak or rosewood.

The A-25 marks Dynaco's entry into the speaker field. Until now, Dyna Company has manufactured amplifiers, preamplifiers, tuners and has marketed a tape recorder made in Denmark. All of their products have had one thing in common: high-quality of performance, at moderate cost. The A-25, also made in Denmark, turns out to be an addition to Dyna's successes, being an outstanding performer for under $90.00

A 10-in. acoustic suspension woofer, operating in a damped, ducted-port enclosure, provides bass frequencies right up to 1500 Hz, at which time a soft dome tweeter takes over and goes on up to the top of the audible range. The port at the bottom of the cabinet is stuffed with fiberglas, which offers some resistance and causes more of an infinite-baffle-type acoustic suspension than a ducted port, as we know it. The crossover network is a two-section filter with a stepped attenuator control, recessed in the rear of the speaker cabinet, which provides five steps of treble operation. Each step is just under 3 dB at 10 kHz, so that the ±2 steps around the "normal" setting offer just under ±6 dB of high-frequency change. This should be enough to adapt the speaker to most listening environments, which is the manufacturer's intent. Its nominal impedance is 8 ohms.

The speaker system is legitimate bookshelf size: 20-in. wide by 11½-in. high, by 10-in. deep. Or it can be used in an upright position just as well. A nice mounting convenience feature is the built-in mounting brackets which allow for either horizontal or vertical wall mounting of the unit on either the #6 screws (supplied) or small hooks. This beats drilling in order to mount eyes in the speaker cabinet. The speaker elements are mounted from the front and covered by a tightly woven, beige grille cloth on a wooden frame (glued to the baffle). The cabinet is finished in a dark oiled walnut on all four sides.

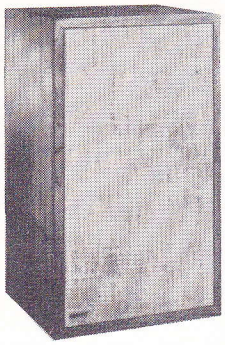
While the A-25 exhibited an excellent frequency response of 60 to 15,000 ±6 dB in our averaged room tests, it was its outstanding transient response which really impressed us. Tone bursts throughout the meaningful frequency range showed up its excellence. In truth, the A-25 produced the finest tone-burst response of any speaker tested in this manner, regardless of price. A clue to the smooth response was found when we examined its impedance through the audible range and found it to be nearly constant. It never went below four ohms. Among other things, this means that several units can be paralleled and successfully driven by a power amplifier that likes to look at loads greater than two ohms in order for it to produce significant power, safely. For example, three A-25's per channel, operating in three rooms, lets say, could work well off a 60-watt (rms) power amplifier. Thus, series/parallel switching arrangements are not necessary for a multiple-room speaker setup.

We found the system to be at the efficient end of low-efficiency systems. We recommend an amplifier of 25 watts continuous power per channel (rms) as a good match for average conditions. Many applications could be found, however, which could make this figure go either way by two (halving or doubling). The A-25 can handle hefty amounts of power and certainly doesn't sound like a small box.

The high frequencies are widely dispersed, which also significantly contributes to its overall smoothness, despite a small peak at 9 kHz. The bass rolls off sharply below 60 Hz, while the harmonic distortion is very low all the way down to 50 Hz, increasing gradually below that frequency. In extended listening tests, the smooth measured response and excellent transient response showed up as a relatively uncolored, neutral sound. With one click up on the high-frequency attenuator, the speaker sounded a little more open or brighter of sound, especially on clean source material. On not-so-clean material, a slight harshness of sound developed. Except for the deficiency in the lowest audible octave, it is difficult to fault the moderately priced Dynaco A-25 speaker system.

Stereo Review

DYNACO A-25 SPEAKER SYSTEM



● DYNACO has long been noted for its development of inexpensive components capable of the highest-quality performance. Their designs are not changed annually (in fact, some of their decade-old vacuum-tube amplifiers are still sold, in addition to their more recent solid-state models). When a new product carries the Dynaco name, we expect it to be a worthwhile addition to the high-fidelity scene. Dynaco's new A-25 speaker system, we are happy to note, lived up to our expectations.

The A-25 is a true bookshelf speaker system, in that it measures 20 inches by 11½ inches by 10 inches deep, and weighs about 18½ pounds. Its oiled-walnut cabinet has a slightly recessed back with reinforced key-hole slots to facilitate installation on a wall. Its 10-inch, long-throw woofer operates up to 1,500 Hz, at which frequency there is a crossover to a small dome-type direct-radiator tweeter. A five-position switch in the rear permits the high-frequency response of the system to be adjusted to room acoustics. It has a range of about 5 to 7 decibels around the "normal" response. The enclosure is ported, but the port is small and heavily damped, giving the system an acoustic characteristic closer to that of an acoustic-suspension than of a bass-reflex system. The Dynaco A-25 has an 8-ohm impedance, and its moderate efficiency makes it suitable for use with practically any modern amplifier.

In our listening tests, the Dynaco had a remarkably neutral quality. Many speakers have response irregularities that color reproduction of male voices, for example, and leave no doubt in the listener's mind that he is listening to a speaker. The A-25 had less of this coloration than most speakers we have heard, regardless of price. The highs were crisp, extended, and well dispersed. At times, we felt that the bass might be a trifle thin, but when the music contained low bass (under about 70 or 80 Hz), the Dynaco left no doubt of its capabilities. This led us to conclude that the "thinness" was really a smoothness in the 100- to 300-Hz mid-bass range.

Having established by listening that this was a very fine speaker system, we were quite curious to see the results of our live-room measurements. They contained few surprises. Except for a small peak at 10,000 Hz, the response was within ±4.5 dB from 60 to 15,000 Hz. There were no obvious regions of depressed or elevated response, and the overall response curve was as flat and smooth as can be when measured in a "live" environment. Below 60 Hz, the output fell off at 12 dB per octave.

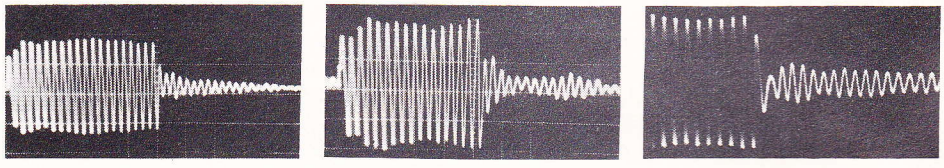
The tone-burst measurements also confirmed our listening tests. From 100 to 10,000 Hz, we did not find a single aberration in the transient response of the A-25. In the hundreds of tone-burst measurements we have made, we have found a few instances where a speaker was slightly better than this one at specific frequencies, but nothing we have tested had a better overall transient response.

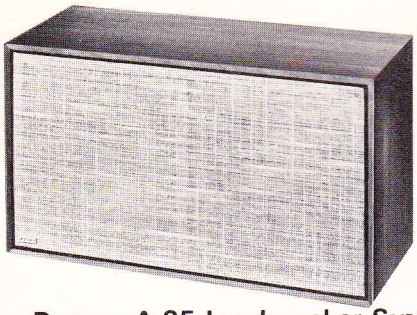
The low-frequency harmonic distortion was under 3 per cent down to 50 Hz at a 1-watt drive level. It rose gradually to 10 per cent at 20 Hz. This, too, is excellent performance, and is topped only by a few speakers among those we have tested.

The Dynaco A-25 has slightly more mid-range output than a number of top-rated bookshelf models, but its most obvious quality is its lack of flashy or characteristic coloration. It *is* neutral, in the best sense of the word. The A-25 is a new addition to that select group of speakers that are easy to listen to, that do not offend the ears with harsh or unnatural sound, and that produce outstanding definition and low-bass solidity.

Not the least of the A-25's attractions is its low price of $89.00. We have compared the A-25 with a number of speaker systems costing two and three times as much, and we must say it stands up exceptionally well in the comparisons. All in all, we judge the A-25 to be another feather in Dynaco's cap and a continuation of Dyna's policy of very high quality at moderate cost.

The excellent overall transient response of the Dynaco A-25 speaker system is shown by the tone-burst-response photos at (left to right) 600, 2,000, and 10,000 Hz.





The Dynaco A-35 Loudspeaker System

MANUFACTURER'S SPECIFICATIONS:

Bass Speaker: 10 inch. **Treble:** 1½ inch dome. **Crossover:** 1800 Hz. **Cabinet:** Oiled walnut finish. **Dimensions:** 12½ by 22 by 10 inches deep. **Price:** $120.

The Dyna 35 uses very similar speakers to the popular A-25 but the cabinet is somewhat larger. High frequencies of the 25 tended to roll off slightly from about 2,500 and the overall sound was smooth but a trifle distant; this was especially noticeable at low volume levels. The 35 has a more linear response and the sound quality is more "forward" but just as smooth. The larger cabinet has enabled the bass to be extended almost another octave. System resonance is about 55 Hz and the enclosure is sealed. The smaller air volume of the 25 made it necessary to use a resistance-loaded port to get a reasonable bass response.

The 35 actually uses two compartments, one venting to the other. Dynaco calls this "dual spectrum damping" claiming that it provides critical damping at resonance plus the low distortion benefits of the sealed enclosure at the very low frequencies.

A 5-position high frequency control is provided at the rear and there is provision for wall mounting. Cabinet finish is walnut and the beige linen grille cloth is replaceable.

Measurements

Figure 1 shows the frequency response taken with one-third octave pink noise. B is taken with the high frequency control in the normal position and A and C at maximum and minimum respectively. Dispersion at 30 and 60 degrees is shown in the lower curve. Apart from the tiny dip at 1800 Hz, the response is sensibly flat. The impedance characteristics are shown in Figure 2 and it will be seen that the lowest point is 8 ohms. This falls to 7 ohms with the treble control at maximum. Tone burst responses at 100 Hz, 500 Hz and 5 kHz are given in Figure 3. Figure 4 shows low frequency distortion and SPL measurements for inputs of 5 and 15 watts. The system would handle a continuous power of 62.5 watts at 40 Hz without distress and 120 watts at 70 and 100 Hz. White noise tests showed a very low coloration.

Listening Tests

If we had to describe the performance of the A-35 in one word, that word would be "unobtrusive". A loudspeaker is not a musical instrument, it should reproduce what is applied to it without adding or taking away. Some designers opt for a "warm sound" by having a broad peak in the 80 to 200 Hz region; others prefer the "West Coast Sound" which involves a peak or series of peaks in the 2 to 6 kHz range to give "presence". In a dealer's showroom, they can make very impressive sounds with the appropriate program material, but the buyer will invariably be disappointed when he gets them home. In contrast, what is called the "New England" sound is neutral with a minimum of coloration. Now, the Dynaco speakers are made in Denmark—a long way from Boston, Mass., but they could certainly fall into this neutral sound category—in fact, many European speakers do.

Sensitivity of the A-35 is about average and we found a power of 20 watts per channel adequate for our listening room. We used a Pioneer 8000A 4-Channel receiver for some of the tests with two A-10's at the rear. This combination worked beautifully—although it would be even better with two 25's or 35's at the rear. Summing up: the A-35 joins the top six bookshelf systems in this price range. *T.A., G.W.T.*

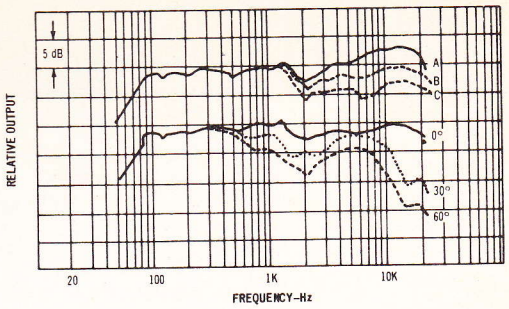


Fig. 1—Response measured with one-third octave pink noise. B was taken with the high frequency control in the normal position; A and C at maximum and minimum respectively.

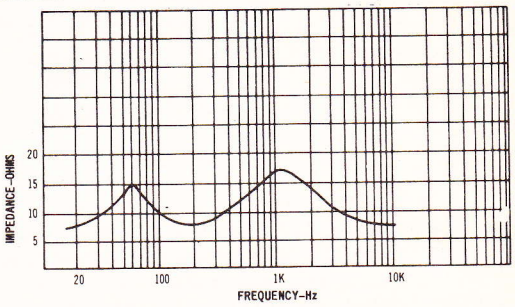


Fig. 2—Impedance characteristics.

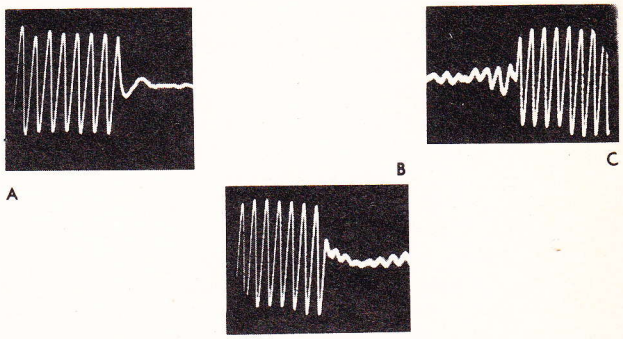


Fig. 3—Tone-burst responses. A is 100 Hz; B is 500 Hz; C is 5 KHz.

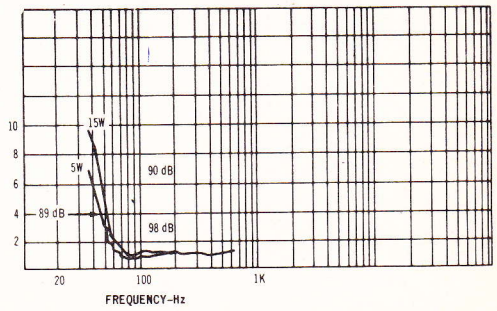


Fig. 4—Low frequency distortion and some SPL measurements.

TOP PERFORMING LOUDSPEAKER FROM DYNACO

THE EQUIPMENT: Dynaco A-50, full-range speaker system in enclosure. Dimensions: 28 by 21½ by 10 inches. Price: $189.00. Manufacturer: Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121.

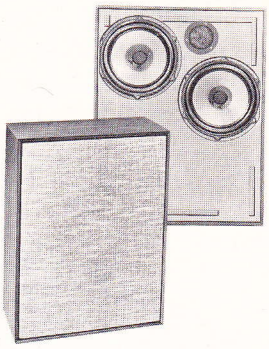
COMMENT: If Dynaco's first speaker system (the Model A-25; see HF test report, July 1969) could be characterized as an excellent reproducer for its size and cost, the company's new A-50 system must be called an excellent speaker period. You soon forget "size" and "price" when listening to it. The A-50 impresses one initially—and the impression is reinforced after repeated sessions with all types of music—as a top-quality speaker system without qualification. Its response is wide-range, smooth, uncolored, well-dispersed, and blessed with that "natural" musicality that many of the best speakers have—that is, they don't "sound like speakers" to us but more like the orchestra or singers or whatever they are reproducing.

A two-way system, the A-50 is housed in a completely sealed walnut enclosure. It employs twin 10-inch woofers mounted in one chamber that vents internally (via an acoustic impedance system) into a second chamber. A small dome tweeter fitted with an acoustic lens handles the middles and highs. The design of the dividing network and drivers makes for a gradual, rather than an abrupt, frequency crossover at nominally 1,000 Hz. Rated impedance is 8 ohms. Connections are made via binding posts at the rear that accept ordinary stripped leads, or—if you prefer—leads fitted with banana plugs. A five-position control adjusts the relative level of the upper frequencies. Our tests show that the A-50 is not critical of its driving amplifier power: it will produce a level of 94 dB (at 1 meter on axis) when powered by as few as 3.5 watts, yet it is robust enough to take continuous input power of up to 100 watts without distorting or buzzing. In fact, the A-50 can handle an instantaneous pulse of 250 watts average power (500 watts peak) without distorting.

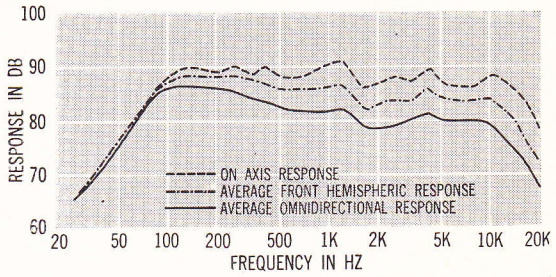
The A-50's impedance curve is one of the smoothest and most consistent yet measured, averaging its rated 8-ohm value across the audio band and never dipping to less than 7.2 ohms. This data, which attests to Dynaco's design claim for the unit, means that two A-50 systems can be safely connected in parallel to the output of each channel of a solid-state amplifier or receiver, since their net average impedance will not fall below 4 ohms. The smooth impedance curve also means that the A-50 loads very linearly to its driving amplifier, especially in the critical bass region which probably accounts, at least in part, for its full and well-defined low-frequency response.

Over-all measured response was clocked as plus or minus 6.5 dB from 41 Hz to 15 kHz. On audible test tones, the A-50 responded from 20 Hz to beyond audibility, and only the least amount of doubling could be discerned at high volumes in the 35-Hz region. Some directive effects are discernible beginning in the midrange but they do not become any more pronounced above 10 kHz than they are at 1 kHz. The rear level control can be used to raise or lower the response above 2,000 Hz in two steps (up or down) of about 2 dB each. The action of this control is well-nigh perfect; no spurious crossover effect was observed, and the response plot of each control setting duplicates the other in shape. White noise response sounded exceptionally smooth and uncolored.

As we've experienced in the past with other really top-grade loudspeakers, we soon found ourselves—when auditioning the A-50s—listening to the program material rather than to the equipment. These systems have impressed all of our listeners here as possessing a balanced, eminently musical, transparent quality that makes for long listening with no fatigue. They reach down into the bass (try a pair of A-50s as they pump out the low pedal notes of the opening of Strauss's *Zarathustra*); their middles are free and clear; the highs have ample air and "bite." We've listened to them in both a very large and average-small room;



they seemed perfectly at home in either setting. From an installation/decor standpoint, the A-50 presents a simple and neat appearance. A walnut box with a neutral-tint grille cloth, it can be placed just about anywhere: on the floor, on a bench, on a deep shelf, or—by means of brackets supplied on its rear panel—even mounted on the wall. All told, we'd say that the A-50 becomes a very serious contender for the serious listener's attention. Like Dynaco's electronic products, it takes its place among the choice audio gear now available.



Dynaco A-50 *Harmonic Distortion**

Output Level (dB)	Frequency			
	80 Hz		300 Hz	
	% 2nd	% 3rd	% 2nd	% 3rd
70	0.7	0.5	0.4	0.3
75	0.85	0.55	0.5	0.25
80	1.0	0.75	0.55	0.25
85	1.1	1.5	0.55	0.3
90	1.2	1.0	0.5	0.25
95	1.3	1.75	0.55	0.3
100	1.5	1.9	0.6	0.3
105			0.65	0.3
110			0.8	0.35

*Distortion data is taken on all tested speakers until a level of 100 dB is reached, or distortion exceeds the 10-per-cent level, or the speaker produces the spurious output known as buzzing, whichever occurs first.

DYNACO SCA-80 STEREO AMPLIFIER KIT

● DYNACO's new integrated amplifier is essentially a combination of their PAT-4 preamplifier (reviewed in January 1968) and the Stereo 80 power amplifier (April 1970) in a single component only slightly larger than the preamplifier alone. In the interest of economy, some of the exceptional control flexibility of the PAT-4 has been omitted from the SCA-80. For example, the PAT-4's three-position high-cut filter with steep cut-off slopes has been replaced by a single filter with a gradual rolloff effective above 6,000 Hz. The low-cut filter, operating below 150 Hz, has been retained. A single three-position rocker switch bypasses both filters, connects the low filter alone, or selects both filters simultaneously. Another obvious departure from the PAT-4's control layout is the SCA-80's use of bass and treble controls that are ganged for both channels, instead of separate concentric controls. The tone-control circuits and characteristics have not been changed.

The SCA-80 has three high-level inputs, one of which is normally intended to accept the outputs of tape-recorder playback preamplifiers. There is also a separate tape-monitor switch that replaces the signal to be recorded with the playback signal. The amplifier has two low-level inputs: PHONO and SPECIAL. The latter is normally wired as a second phono input, with RIAA equalization. Optionally it can be wired as a flat microphone input, or to provide tape-head playback equalization.

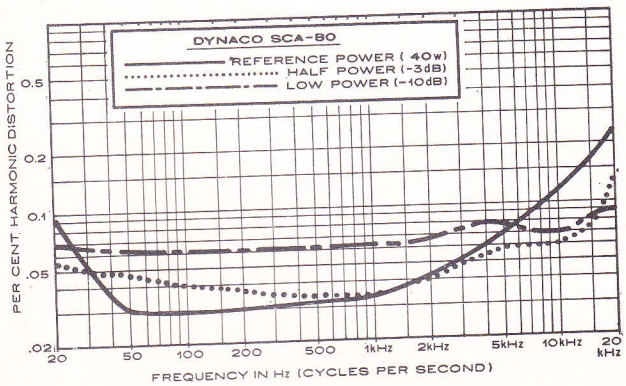
The Dynaco SCA-80 has separate volume and balance controls and switchable loudness compensation that affects only the low frequencies. The MODE selector is a three-position rocker switch, with STEREO and MONO positions plus a BLEND position in the middle. The BLEND diminishes stereo separation to 6 dB, which is useful when a center-fill speaker or four-channel stereo system is employed (instructions for these applications are obtainable from Dynaco), or for headphone listening. The headphone jack on the SCA-80 is suitable for use with phones of 8-ohm or higher impedances. There are outputs for two pairs of speakers, either of which can be selected from the front panel. The plastic-insulated terminals for speaker connections require no screwdriver and are very easy to use. Also in the rear are two a.c. outlets, one of which is switched by the SCA-80 power switch, which has a built-in neon-lamp pilot light.

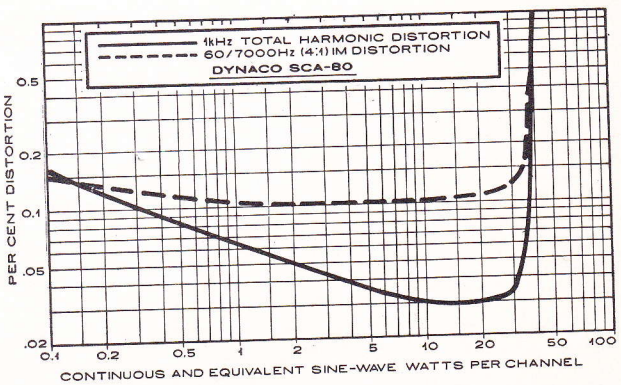
Our laboratory measurements verified Dynaco's fine specifications, and conformed closely to the data we obtained when testing the separate PAT-4 preamplifier and Stereo 80 power amplifier. The SCA-80, with both channels operating at 1,000 Hz into 8-ohm loads, had less than 0.1 per cent harmonic distortion from 0.35 watt to above 37 watts per channel, clipping at 46 watts. The IM distortion was 0.17 per cent or less up to 37 watts, and typically a low 0.1 per cent.

At the rated 40-watt output, harmonic distortion was under 0.1 per cent from 20 to 9,000 Hz, rising to 0.25 per cent at 20,000 Hz. At half power or less, the distortion was quite low—under 0.1 per cent over practically the full 20 to 20,000-Hz range—and was typically about 0.05 per cent. The SCA-80 delivered about 50 per cent more power into 4 ohms, and 40 per cent less into 16-ohm loads. The protective circuits, identical to those in the Stereo 80, worked well, preventing damage to the amplifier under overdrive conditions or when the speaker outputs were shorted. Hum and noise were extremely low—about 76 dB below 10 watts on high-level inputs and 68 dB below 10 watts on the phono input. Only 1.4 millivolts was needed at the phono input for 10 watts output, yet the input could handle 70 millivolts before overloading.

The tone-control characteristics are somewhat unusual. Over most of its range, the treble control produced a slightly shelved response, uniform from a few hundred hertz to 20,000 Hz. Only near its limits did it have the sloped response typical of most tone controls. The bass tone control, on the other hand, had conventional slopes, but had most of its effect in the first third of its rotation from center. With both controls centered, the response was flat within ±0.5 dB from 20 to 20,000 Hz. The RIAA equalization was accurate to within ±1 dB from 30 to 15,000 Hz. The high- and low-cut filters were effective, although their gradual slopes made them most useful with program material of limited frequency range.

It is clearly evident that Dynaco has retained the high quality of their separate preamplifier and power amplifier while combining them into a single component selling at an appreciably lower price than the separates. Like other Dyna electronic products, the SCA-80 is offered in kit form or factory wired. Our kit builder reports that the kit went together easily, with no tight corners, and only one assembly operation (the winding of a 20-turn coil around each output capacitor) that might tax a novice's digital facility. The instruction book was typical of Dynaco—detailed, logical, and unambiguous. Four evenings of work at a relaxed pace sufficed to complete the amplifier. The Dynaco SCA-80 sells for $179.00 as a kit, or $269.00 factory wired.





DAY'S WORK PRODUCES TOP AMPLIFIER AT MIDDLE COST

THE EQUIPMENT: Dynaco SCA-80, an integrated stereo amplifier available in kit form. Dimensions: front panel, 13½ by 4⅛ inches; chassis depth, 11¼ inches. Price: kit, $179.00; factory-assembled, $269.00. Manufacturer: Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121.

COMMENT: In this pushbutton "let George do it" world, it is satisfying to be able to report that a man still can build his own amplifier and come up with a unit that rivals factory-built counterparts costing considerably more. Dynaco's SCA-80 combines a very clean, low-distortion, versatile front-end or preamp-control section with an equally clean, low-distortion basic amp, the latter using essentially the same circuit found in the Stereo 80 (see HF test report, August 1970).

The unit tested for this report was built from the kit, following instructions furnished. No snags were encountered, and the SCA-80 performed admirably on completion, confirming all the manufacturer's specifications. With both channels driven simultaneously, the unit provided 40 clean watts per channel at less than its rated distortion of 0.5 per cent. Distortion generally hovered not much above the zero line; we had to expand the vertical scale of the IM graph to show any values at all. No appreciable increase was noted at very low output levels down to 400 milliwatts; total harmonic distortion there remained well below the 0.5 per cent mark. Power bandwidth and frequency response more than spanned the audible range by a healthy margin at low and high ends. Sensitivity and signal-to-noise figures were uniformly excellent on all inputs; damping factor was comfortably high; tone controls, filters, loudness contour, and disc equalization were all very satisfactory. Square-wave response was similar to that measured on the Stereo 80, showing good, clean bass and excellent transient response for a well-aired effect in middles and highs.

Controls include five knobs for: a five-position input selector (special, phono, tuner, tape, spare); volume; channel balance; bass; treble. The "special" position on the selector refers to a second phono input that normally accepts an additional magnetic pickup. This input also may be wired for direct tape-head playback, or as a microphone input. These and other possible uses are explained in the owner's manual. Treble and bass controls regulate both channels simultaneously.

Besides the knobs, the front panel contains several rocker switches for: power off/on (this one lights up when power is turned on); tape monitor; loudness contour; filter; mode; speakers main and remote. Each of the last three switches has three positions. The filter offers "narrow band" (the highs and lows are rolled off), "rumble" (only the lows are rolled off), and "flat" (no filter action at all). The mode switch has a "mono" position. It also has a "blend" position (6 dB of channel separation recommended by Dynaco for use with its proposed three- or four-speaker hookup, or simply to reduce any two-channel separation that you may find excessive—for instance, a normal pair of stereo speakers spaced too far apart for certain program material, or possibly when listening over headphones). For full channel separation, just place this switch on "stereo." The speaker switch lets you choose either or neither of two pairs of stereo speaker systems connected at the rear and nominally designated as main and remote. A standard headphone jack on the front panel remains live at all times.

The rear panel contains the inputs corresponding to the front panel selector, plus a pair of jacks for feeding signals to a tape recorder. Screw terminals permit connecting the main and remote speaker systems. There's also one unswitched and one switched AC convenience outlet, the set's fuse holder, power cord, and a system grounding screw. The amplifier is protected, in addition to the fuse, by special current-reducing circuits. Although the speaker selector chooses only one pair of speakers at a time, you can drive both main and remote speakers at once by connecting a jumper-wire between the hot lugs of each channel on the rear panel; the selector switch then serves only to choose or silence both pairs. You also can make an internal wiring change to run the SCA-80 on power lines that supply 100, 220, or 240 volts AC.

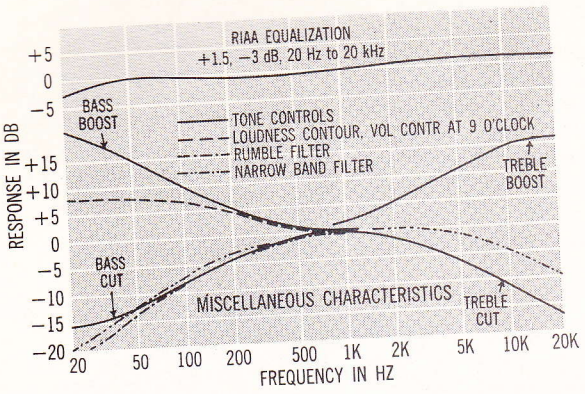
Aside from its normal use in powering and controlling a first-rate home stereo system, we had some extra fun using the SCA-80 to try Dynaco's multi-speaker hookups which involve the use of that 6-dB blend control to help create a sense of quadriphonic ambience and front-to-rear (in addition to left-to-right) directionality. Four speakers, naturally, provided this effect more dramatically, but we found that adding a third speaker behind the listening area also enhanced the presentation and did lend a new note of realism to familiar stereo recordings.

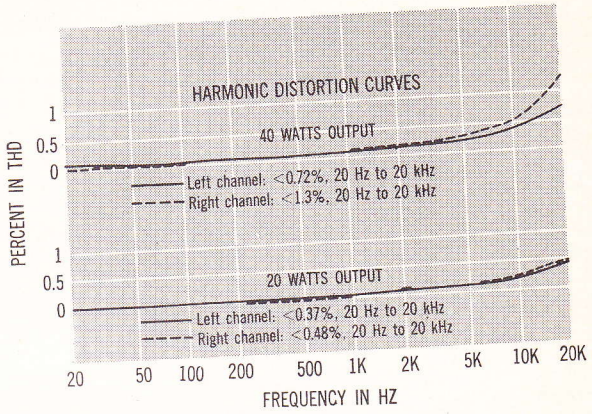
As with the Stereo 80, we found the most difficult and fascinating chore, when building the amplifier, to be the winding of the huge coils of wire that get wrapped around the enormous coupling capacitors. Since the SCA-80 includes a rather sophisticated preamp-control section, over-all wiring and assembly were more complex and time-consuming than when building the basic amplifier. As we said, we hit no snags but there were a few places where we had to use a little common sense: e.g., in step 4 of the front-panel wiring we decided to put sleeving over the resistor leads just to play safe. Another place we chose to use "spaghetti" was on the resistor nearest to the ground lugs on PC-19 (page 26 of the manual). Total work time was 9½ hours, of which ½ hour was spent unpacking and sorting the parts. A day well spent, we'd say.

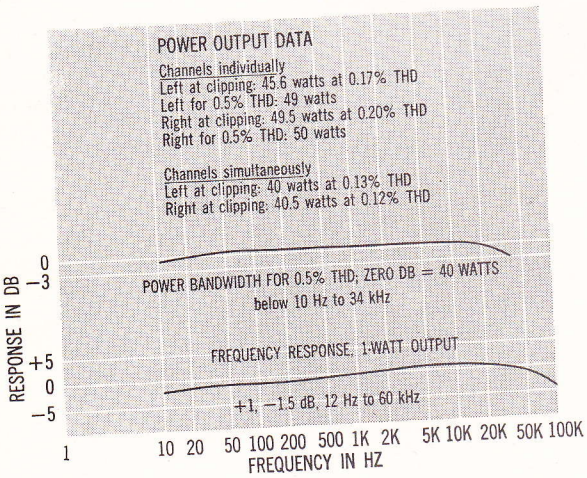
Dynaco SCA-80 Additional Data →

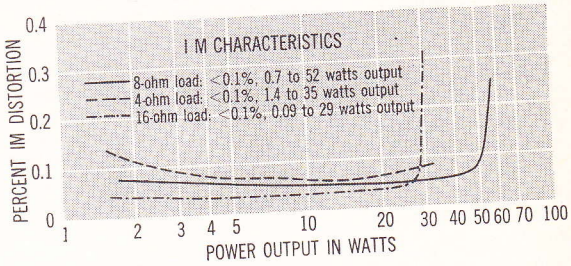
Input characteristics (for 40 watts output)	Sensitivity	S/N ratio
phono	2.9 mV	63 dB
special	2.9 mV	63 dB
tuner	130 mV	82 dB
tape	130 mV	82 dB
spare	130 mV	82 dB

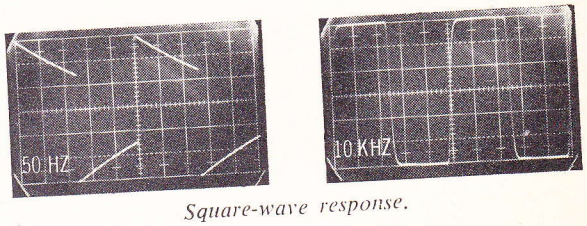
DYNACO SCA-80 (continued)











Square-wave response.

DYNACO PAT-4 STEREO PREAMPLIFIER KIT

● HAVING achieved an extremely high level of performance with vacuum-tube circuits, Dynaco engineers were understandably cautious about leaping into the solid-state arena. As we see it, they felt that any new solid-state component must offer a tangible advantage over its vacuum-tube counterpart. We have seen this philosophy embodied successfully in their Stereo 120 power amplifier (HIFI/STEREO REVIEW, June 1967). Now, the popular PAS-3X preamplifier has a potential successor in the new PAT-4 transistorized stereo preamplifier.

The PAT-4, which presently coexists with the PAS-3X, has many features in common with it, plus some interesting refinements. Like the PAS-3X, it is simple. Only four transistors are used in each channel, corresponding in function to the two dual-triode tubes of the PAS-3X. One pair serves as a feedback-equalized low-level preamplifier for magnetic phono cartridge, tape head, or microphone. The first two functions are equalized for the RIAA and NAB (7½-ips) playback curves, respectively, and the last is normally flat (but can easily be converted to another magnetic-phono or other high-gain equalized input).

The second pair of transistors provides some gain, plus tone control and frequency-filter functions. The feedback-type tone controls are similar to those in the PAS-3X, with a definite "flat" response at their center settings. In addition, the tone controls, when centered, are removed completely from the circuit, without the necessity for added switching.

Each channel has its own bass and treble tone control mounted concentrically with the corresponding control fo

the other channel. The four-position high-frequency filter is one of the best we have seen, with 18-db-per-octave slopes and nominal cut-off frequencies of 7,000, 10,000, and 15,000 Hz, plus an OFF or flat setting. This is one filter that really works, cleaning up distortion and hiss with minimum effect on the program content.

Aside from the six-position input selector, volume, balance, and tone controls, and high-filter switch, the Dynaco PAT-4 has six rocker-type switches. One controls a.c. power (there are two switched and two unswitched a.c. convenience outlets in the rear of the unit) and is illuminated when turned on. Another rocker switches in a low-frequency filter, and a third adds loudness compensation at low volume-control settings. A pair of switches is used for mono/stereo mode selection. With both down, normal stereo operation is obtained. Pressing the top of either the A or the B switch connects the signal from that channel through both outputs. Pressing both switches up (MONO) provides a partially blended (quasi-mono) signal with about 6-db separation between the outputs. (This setup is suggested for use with Dyna's derived center-channel setup, for reducing the excessive separation of stereo earphones, and for all other times when a mono signal is desired.) The last switch is for tape monitoring. Unlike any other preamplifier we have seen, the PAT-4 has a spring-return switch for this function. The assumption is that one will only wish to monitor from the tape as a brief check on recording conditions. (A standard switch available from Dyna may be substituted if desired.) For normal tape playback, the TAPE position of the input selector is used.

A front-panel input jack (for a regular three-contact stereo phone plug) overrides the input selector and disconnects all other signal sources when a signal source is plugged into it. This is a high-level input, but we found that a high-impedance dynamic microphone or electric guitar worked well through it.

The front-panel output jack is intended for stereo headphones of 600-ohm or higher impedance. It is in parallel with one pair of the two pairs of output jacks in the rear of the PAT-4. The second pair of outputs is switched off when phones are plugged into the front-panel jack. Another obvious use of the front-panel input and output jacks is to connect to an external tape recorder when the rear of the PAT-4 is inaccessible.

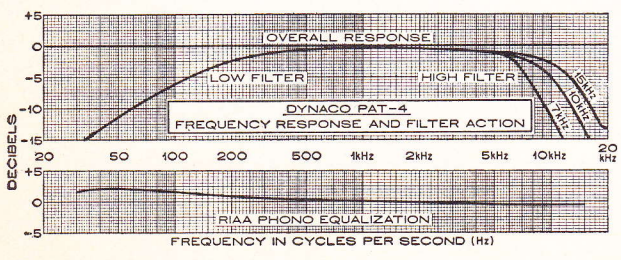
In addition to the normal inputs and outputs in the rear, the Dynaco PAT-4 has three sets of phono inputs. The LO magnetic-cartridge inputs can handle up to about 80 millivolts before overloading. The HI inputs are designed to accommodate cartridges with unusually high outputs—up to 700 millivolts—if and when they become available. (A simple modification of the circuit boards will be necessary for use of the HI inputs.) The CER inputs are for ceramic cartridges, converting their outputs to a velocity basis and reducing the level to that of a magnetic cartridge. The construction manual for the kit is up to Dyna's usual high standard and construction time runs about 7 or 8 hours.

In our laboratory tests, we loaded the PAT-4 outputs with about 100,000 ohms, simulating the input impedance of many transistor power amplifiers. Harmonic distortion was less than the residual distortion of our test instruments (0.06 per cent) up to 3 volts output. It rose to 0.1 per cent at 7 volts and 0.25 per cent at 10 volts. Clipping occurred at about 11 volts. Since no power amplifier requires more than a couple of volts to develop its full output, one may reasonably describe the Dynaco PAT-4 as essentially distortionless.

The PAT-4 has a truly flat frequency response with its tone controls centered. Our General Radio response-curve plotter drew a straight line, ±0.25 db, from 20 to 20,000 Hz when measuring the PAT-4. We commented earlier on the excellent high-frequency filter characteristics of the PAT-4; the low-frequency filter had a more gradual slope of 6 db per octave beginning at about 150 Hz. The loudness compensation affects only the frequencies below about 1,000 Hz and is sufficiently moderate that it does not impart any "boom" or tubby quality to the program.

The LO-input phono equalization was within +2, —0.5 db from 30 to 15,000 Hz and the NAB tape equalization was +2.5, —1 db over its range. The tone controls rotate through about 180 degrees, instead of the usual 300 degrees, and are designed so that the treble control has little effect until near its full rotation, while the bass control has almost all its effect in the first half of its rotation. The LO phono input requires 2.2 millivolts for 1-volt output at maximum volume-control setting, and the HI input requires 13.2 millivolts for the same output. The high-level inputs require a 0.12-volt input signal for 1-volt output. The signal-to-noise ratio is 66 db on LO phono, 53 db on TAPE HEAD, and better than 80 db on the high-level inputs.

Like a good power amplifier, the PAT-4 has no sonic character of its own—when the tone controls are centered and the filters switched out. We have seen some of the better power amplifiers described as a "piece of wire with gain" as a tribute to their insignificant distortion. The Dynaco PAT-4 most definitely is in the same category. The "piece of wire" can be twisted very effectively with the controls of the PAT-4. The loudness compensation is truly usable, the filters work as filters should, there are no clicks or thumps when any of the switches or controls are operated, there's no hum or hiss (except with the volume set for full gain on a low-level input, a most unlikely operating condition), and it is free of microphonics and internal heating. Add to this an extraordinary degree of operating flexibility achieved with a total semiconductor complement of eight silicon transistors and two power-supply rectifier diodes, and you have an excellent example of what can be achieved by competent engineering and design integrity. In sonic quality, we would unhesitatingly say that the Dynaco PAT-4 is unsurpassed by any preamplifier we have seen. It is a remarkable unit and unmatched at anywhere near its low price of $104.00 in kit form or $169.00 factory-wired.



AUDIO

Dynaco PAT-4 Solid-State Stereo Preamplifier

MANUFACTURER'S SPECIFICATIONS—

Frequency Response: High-level input, 10 Hz to 100 kHz ±0.5 dB; low-level, 20 Hz to 20 kHz ±1 dB. Distortion (at rated 2V output): THD—under 0.05%, 20 Hz to 20 kHz; IM, under 0.05% with any frequency combination. Hum and Noise: Magnetic Phono—70 dB below 10 mV; High Level—85 dB below 0.5V. Tone Control Range: ±16 dB at 50 Hz; ±12 dB at 10 kHz. Inputs: low-level and high-level RIAA magnetic phono, and ceramic phono; NAB tape head; tape amplifier; tuner; spare high level; front-panel high level; special (normally microphone). Outputs: tape out ahead of controls; 2 audio outputs (one switched) front-panel output. Controls: switches, selector, volume, balance, 2 bass, 2 treble, high filter at 15 kHz, 10 kHz, 7 kHz; loudness; tape monitor; low filter; paired stereo-mono for A or B channels or A + B channels with blend for 3rd channel. Dimensions: 13½-in. wide × 4¼-in. high × 9-in. deep. Weight: 10 lbs.

The long-awaited PAT-4 has finally arrived, and it turns out to be all that any avid audio buff could expect in the way of performance. This is the first Dynaco solid-state preamp, and follows the Stereo 120 as the company's second venture into the world of transistors. The PAT-4 is a unit for which we have received many requests to Profile over the past several months.

Actually, the preamplifier is by way of becoming a near-extinct component, it appears. In the days of tubes, the power amplifier was usually heavy, generated a lot of heat, and was best relegated to the bottom of the cabinet, with only the tuner and preamplifier up in the control area. With the advent of solid-state equipment, the receiver has practically usurped the field.

In the August Product Preview section, for example, only thirteen preamps were listed this year, although there were twenty-two in 1964. Dynaco has kept the preamplifier alive ever since its first one, both in kit form and as a factory-wired product.

This is not to indicate that separate preamplifiers have been rendered obsolete. Decidedly, they have not. With a separate preamplifier, a more selective choice of a high-quality power amplifier can be made. In addition, separate preamplifiers are generally more sophisticated units than are integrated preamplifiers, both in operating flexibility and performance characteristics. Too, some separate preamps, like the Dynaco unit examined here, are small and light weight in comparison to integrated amplifiers or receivers, making it possible to locate it in a convenient area that is normally barred to larger, monolithic units.

The input and output jacks are similarly double-purposed. Inserting a plug in the input jack cuts out the selector switch, and feeds the signal from the plug to the input of the second amplifier section, just as with any other high-level input. If the plug is inserted only part way, so as to contact the right-channel jack spring only, a mono signal may be fed into the right channel only, leaving the normal signal feeding the left channel. Thus a guitar amplifier, for example, could be plugged in and reproduced on the right channel, while a record could be playing through the left channel at the same time. This jack also permits the introduction of the signal from a tape recorder without disturbing the rear panel connections.

The output jack provides a normal 600-ohm output in parallel with rear-panel OUTPUT-1 jacks, and mutes OUTPUT-2 jacks on the rear panel. Thus plugging in a pair of 600-ohm (or higher) phones could serve to disconnect the speakers by feeding the power amplifier from OUTPUT-2 jacks. The OUTPUT-1 jacks are not muted, but plugging in a 600-ohm load will lower their level by 6 dB.

All normal connections are made by phono jacks on the rear panel. Eleven jacks are provided for each channel—plate wired to the three phono jacks of each channel. The high-level inputs are labeled TUNER, TAPE, and SPARE.

The filter switch has four positions which are marked FLAT, 15, 10, and 7, with the output down approximately 6 dB at 15, 10, and 7 kHz respectively in the numbered positions, and flat to over 100 kHz in the FLAT position.

The tone controls in this unit, as well as in the earlier PAS-3X and PAS-2X, are of a patented Dynaco design which effectively removes them from the circuit when in the center of their rotation. This is accomplished by a double-armed pot on the bass control to provide a short on the unused portion of the rotation for each half, and by an open in the center of the treble control. This has the added advantage of a truly flat position for some 10 to 15 deg. of rotation at the center, so that the setting does not have to be exact to ensure flat response.

The power transformer has a split primary, so the unit can be wired to operate on either 120 or 240 volts, as required by the available supply. The power switch is fitted with a clear plastic rocker, and a small neon bulb is mounted on the switch, along with a current-limiting resistor. This combination serves as the pilot light. Two "hot" power receptacles are provided on the rear panel, as well as two switched ones and the line fuse.

The design of the PAT-4 offers a number of interesting features, some of which are hold-overs from earlier Dynaco preamps and some of which are new items. The holdovers include provision for extra inputs which give considerable flexibility for the user who may have special requirements or who may wish a second phono input or a second tape head input, for example.

The panel accommodates, from left to right, the input selector switch, dual volume control, balance control, dual-concentric bass and treble tone controls and a filter switch, all of which are rotary controls. Along the bottom are an input jack, a momentary spring-action tape monitor switch, a loudness switch, lo filter switch, two mono/stereo switches, an output jack, and the power switch. All switches are of the popular rocker type, and the input and output jacks are three-circuit units which break the normal connections when a plug is inserted. The tape monitor switch is spring loaded, so it returns to the normal position when not held in the monitor mode. This may be defeated in the construction by substitution of a normal detent-action switch, which can be supplied if the builder does not plan on using the monitor function extensively. Instructions are provided for ordering the switch if required.

The two stereo/mono switches require some explanation. These switches are both normally left in the stereo position, with the bottom of each switch depressed. Three choices of operation are available: with the top of the "A" switch depressed alone, the left-channel input is switched through both outputs; with the top of the "B" switch depressed alone, the right-channel inputs are switched to both outputs; with the tops of both switches depressed, a partially blended signal is obtained at both outputs. This provides 6 dB of separation, and is desirable for reducing the apparent separation between stereo speakers, as well as providing the proper spatial effect when using headphones, and is the normal position to use when playing mono records with stereo cartridges. Instructions are given for a minor wiring change which will give a fully blended signal.

While this switching system seems complicated, it does permit connecting mono sources to either the "special" (high-gain) or "spare" (low-gain) inputs with full control from the preamp panel.

Circuit

Two pairs of npn silicon transistors are used in each channel—one providing the low-level amplification required for phono, tape-head, and microphone inputs, and the other providing sufficient gain to permit the use of tone control and filter sections. Each pair has both a.c. and d.c. feedback paths, and both sections are of the same configuration, although their values and the transistors themselves are different. The selector switch controls the source and the equalization, and the filter switch, which follows the output of the second pair, uses an inductance in combination with a number of capacitors to achieve the relatively sharp cutoff. The power supply employs full-wave silicon diode rectification with RC filtering, using a total of 2200 μF of capacitors.

Construction

At first glance it might appear that the instructions for assembly are hardly adequate, since only one pictorial diagram is provided. However, this one diagram, together with two small ones for assembling the filter switch, are all that are necessary. There are 64 separate operations in assembling and wiring the front panel, which is integral with the chassis bottom. The filter switch requires 30 operations, and the separate rear panel requires 32 more. Then the rear panel is wired to the main chassis unit in a flat position before it is finally mounted on the chassis. Then there are 99 more operations to complete the assembly, which should be done in slightly over nine hours total. We took 9 hours and 20 minutes, but were especially careful to follow the instructions as closely as possible. The printed-circuit boards are completely assembled at the factory, and require only the connections to the remainder of the unit. After completion, the PAT-4 worked perfectly from the first moment it was turned on, indicating that care in assembly is certainly worthwhile.

Performance

The PAT-4 is one unit which comes up to its specifications without any fudging whatever. Its frequency response is flat within ±0.5 dB from 10 Hz to 100 kHz at the high-level inputs, and within ±1 dB at the low-level inputs, all of which are equalized except the SPECIAL, which is flat for microphone inputs. Most interesting is the fact that both channels are so nearly identical, with equalization tracking within ±1 dB throughout the range. This also applies to the filters and to the volume control, which exceeded the 1-dB mark only at over 40 dB attenuation (it actually reached 2 dB at that point). Response curves are shown in Figs. 5, 6, 7, and 8. The unit's performance in face of square waves and tone bursts was excellent, as can be seen in scope traces pictured in Figs. 2 and 3. Figure 1 shows front panel and interior views.

Total harmonic distortion at the rated 2-volt output measured less than 0.05% at 20, 100, 1000, 10,000, and 20,000 Hz, and IM distortion measured less than 0.05% with 60 and 7000 Hz mixed 4:1 at 2 volts out. The unit went into a symmetrical flattening of a sine wave at 11.2 volts out, which is more than sufficient to drive any power amplifier to total distortion. See Fig. 4. Hum and noise measured 87 dB below a 0.5-volt input signal on the high-level inputs. This was measured by feeding in a 0.5-volt signal, adjusting the volume control to a 2-volt output, then removing the signal, shorting the input, and measuring the output. Similarly, the hum and noise measured 73 dB below a 10-mV signal on the phono input.

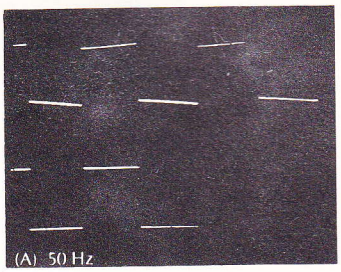
The LO PHONO input required a signal of 4 mV to produce a 2-volt output, and the overload signal was 80 mV. The HI PHONO input required 23 mV for the 2-volt output, and it overloaded at 480 mV. The tape-head input required 7.6 mV and its overload figure was 39 mV. The ceramic phono input required 160 mV, and overloaded at 2.9 V.

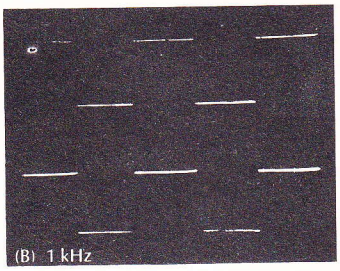
The high-level inputs required 2 volts in for a 2-volt output, and channel separation was 41 dB at 1000 Hz, 23 at 10 kHz. Phono separation was 39 dB at 1000 Hz, 22 at 10 kHz. Just for the fun of it, we measured IM at 5 volts output, and the figure was 0.26%, which is remarkable.

Conclusion

We cannot help but compliment Dynaco for the performance of the PAT-4. There are possibly one or two preamps with a shade better performance figures, and a handful with more switches and controls, but they can't be bought for $169.00 factory wired, or only $104.00 and nine hours of work. The unit is neat and attractive (pale gold finished panel and knobs, brown finished case), compact (13½" wide, 4¼" high, and 9" deep), lightweight (10 lbs.), and an excellent performer.

Driving a high-quality power amplifier with the PAT-4, sound reproduction was as transparent and crisp with all sound sources as one could wish. And a lot of money is saved by giving up some control frills featured by higher-priced units. Considering all this, the PAT-4 can only be called superb.





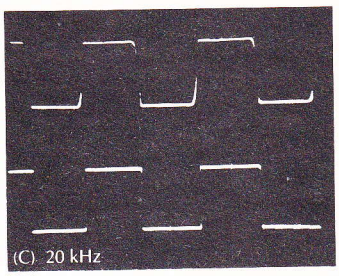
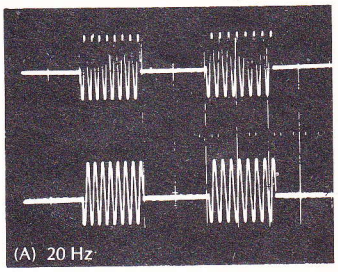


Fig. 2—Oscilloscope traces of PAT-4 square-wave response.



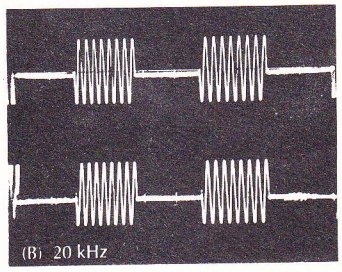


Fig. 3—Tone-burst pattern of PAT-4.

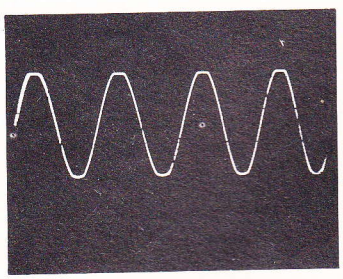
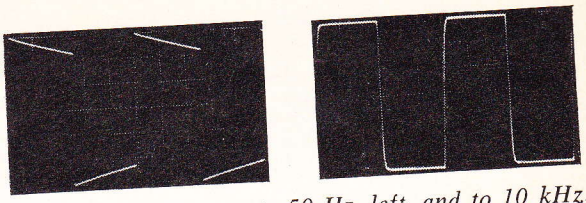
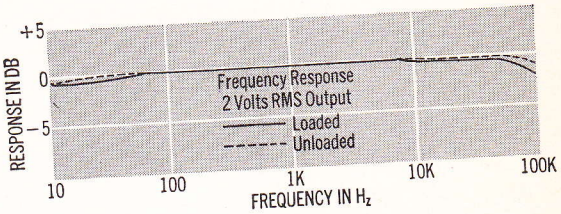


Fig. 4—The new solid-state Dynaco preamp goes into symmetrical clipping here at 11.2 V output with a 1 kHz signal.

DYNACO PAT-4 PREAMP-CONTROL



Square-wave response to 50 Hz, left, and to 10 kHz.



THE EQUIPMENT: Dynaco PAT-4, a preamplifier-control unit. Dimensions: 13½ by 9 by 4¼ inches. Price: kit, $104.00 assembled, $169.00. Manufacturer: Dynaco, Inc., 3060 Jefferson Street, Philadelphia, Pa. 19121.

COMMENT: Essentially a solid-state counterpart of Dynaco's PAS-3X tube preamp, the new PAT-4 is a preamplifier-control unit for use, ahead of a stereo basic amplifier, as the nerve center of a fairly elaborate system, and a few new features give it a measure of versatility not found in the PAS-3X.

The PAT-4 will accept signals from: magnetic pickups of various signal levels, ceramic pickups, tape head, tape playback amplifiers, microphones, radio tuners, and other high-level sources. You can convert the mike input, marked "special," to another low-level magnetic phono input by making a minor wiring change in the chasis.

Signal input jacks, and the output jacks for feeding two external stereo amplifiers plus a stereo tape recorder, are at the rear. In addition, there are input and output phone jacks on the front panel. The front input jack overrides all rear inputs when you insert a phone plug; it may be used as a convenient tape playback connection in amplifing a musical instrument, such as an electronic guitar. The front output jack is a 600-ohm connection in parallel with one of the sets or rear amplifier outputs. It can be used for special bridging applications or for medium-impedance headphones. For low-impedance headphones, you'll need a matching transformer as recommended by the headphone manufacturer.

Controls include knobs for a six-position program selector, volume, channel balance, bass, treble, and high-frequency filter. The bass and treble controls operate independently on each channel, but you can rotate them to handle both channels simultaneously if you desire. The tone control circuits, by the way, are out of the amplifier circuit when the controls are centered. The filter has three positions of high-frequency attenuation: at 15 kHz, at 10 kHz, and at 7 kHz.

In addition there are rocker switches for tape monitor, loudness contour, low-frequency filter, stereo/mono mode, and power off/on. Stereo/mono selection actually is made on a pair of switches that provide a unique versatility: with both switches in stereo position, the preamp plays normal stereo; with only the left channel or A switch in stereo position, left channel signals appear at both stereo outputs; with only the B switch in stereo, right channel signals are available at both outputs; with both switches in mono position, a partially blended mono (A plus B) signal appears at the outputs. The actual amount of separation remaining between the two channels is 6 dB which Dynaco feels is desirable for playing mono discs with a stereo cartridge, or for reducing any apparent exaggerated separation between stereo speakers, or for "establishing the proper spatial effect for more natural sound in stereo headphones." These switches also can be used when operating a derived center-mix channel, explained in the owner's manual, and they permit you to connect different mono signal sources to left and right channel inputs. Incidentally, another minor wiring change—described in the manual—will get the switches to provide full A plus B blending, if desired, instead of the 6 dB separation blend.

CBS Lab tests, run on the PAT-4, simply confirm the manufacturer's specifications and performance claims for the unit. Detailed in the accompanying graphs and chart, the numbers on this preamp add up to sheer excellence, and at a very attractive price on today's market. The unusually wide, linear response and the superior square-wave behavior of the PAT-4, combined with its very low distortion and noise, mark it as one of the best audio "front ends" now available.

Dynaco PAT-4 Preamp

Lab Test Data

Performance characteristic	Measurement
Output (clipping at 1 kHz)	
l ch	10.5 volts RMS at 0.90% THD
r ch	9.5 volts RMS at 0.38% THD
Harmonic distortion at 2 volts (rated output)	
l ch	less than 0.036%, 20 Hz to 20 kHz
r ch	less than 0.056%, 20 Hz to 20 kHz
IM distortion, 2 volts	less than 0.05%
Frequency response	+0, −2 dB, 10 Hz to 100 kHz
RIAA equalization	+0.75, −3.5 dB, 20 Hz to 20 kHz
NAB equalization	+1.5, −3 dB, 35 Hz to 20 kHz

Input characteristics (re 2 volts output)	Sensitivity	S/N ratio
phono, low	3.8 mV	62 dB
phono, ceramic	150.0 mV	53 dB
tape head	1.28 mV	52 dB
special	5.2 mV	69 dB
tuner	189.0 mV	79 dB
spare	189.0 mV	79 dB

Note: phono, low input, re 10 mV signal, S/N = 70 dB.
tuner, spare inputs, re 0.5 V signal, S/N = 87 dB.

DYNACO STEREO 120 POWER AMPLIFIER

THE EQUIPMENT: Dynaco Stereo 120, a solid-state basic or power amplifier. Dimensions: 13 by 10½ by 4 inches. Price: in kit form, $159.95; factory-assembled, $219.00. Manufacturer: Dynaco, Inc., 3060 Jefferson Street, Philadelphia, Pa. 19121.

COMMENT: Dynaco's entry into solid-state electronics is an auspicious one, marked by the Stereo 120 amplifier which is a splendid, top-performing unit. It furnishes high, very clean power at all output impedance ratings, and its distortion for the most part is literally nonmeasurable. A basic or power amplifier, the Stereo 120 is designed for use with a separate preamp-control. Its circuitry is built around 15 transistors and 13 diodes. The only transformer used is in the power supply. Styling is reminiscent of former Dynaco basics but somewhat streamlined. The input jacks and the speaker binding posts, as well as a fuse-holder, an off/on switch, and the AC line cord all are grouped together on one recessed panel at one end of the chassis.

The fuse, incidentally, is for the AC line input; the circuit itself employs, for protection against overload, a current-limiting biasing arrangement (on which patents are pending). Under conditions of an abnormally heavy load the amplifier simply shuts itself off. Sound comes back instantaneously when the offending load is removed. The amplifier requires no adjustments.

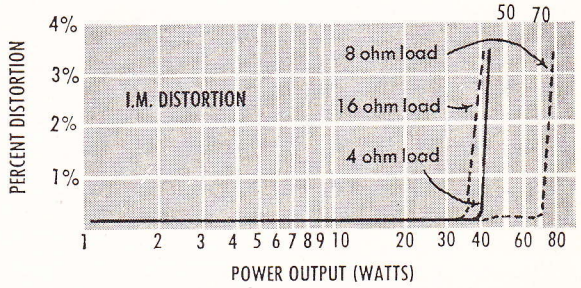
Tests run at CBS Laboratories indicate that the Stereo 120 easily meets or exceeds its published specifications. With both channels driven simultaneously, the Stereo 120 produced better than 60 watts per channel, and at a lower distortion level than claimed by the manufacturer. The similarity of these power figures to those for single-channel operation indicate very good regulation in the power supply section. The 120's power bandwidth, for its rated distortion of 0.5 per cent, clearly extends below and above the normal 20-Hz to 20-kHz band. Harmonic distortion, at 60 watts output, could not be measured across most of the normal band; it either was the same as, or lower than, the residual distortion of the test instruments. At half-power output, or 30 watts, the picture was even more impressive. The 1-watt frequency response of the Stereo 120 was virtually a straight line from 10 Hz to 100 kHz.

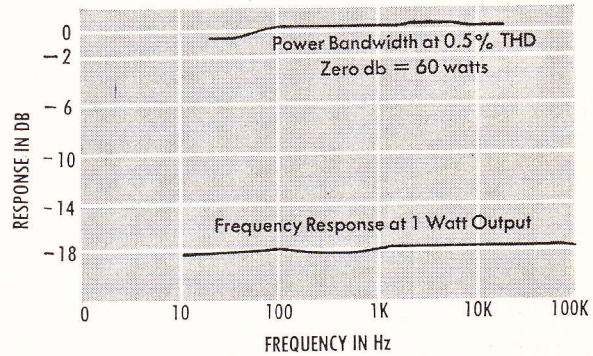
Equally remarkable was the amplifier's IM characteristic. As the accompanying graphs show, IM distortion remained nonmeasurable up to fairly high output levels at all three impedance ratings. It also was extremely linear, and showed nothing of the "bump and dip" effect so often seen in solid-state equipment. Signal-to-noise ratio was superb and exceeded 95 dB. Damping was extremely high at 110. Square-wave response was excellent to both the low and high frequency test signals, indicating full, solid, clean bass and superb transient response in the midrange and highs.

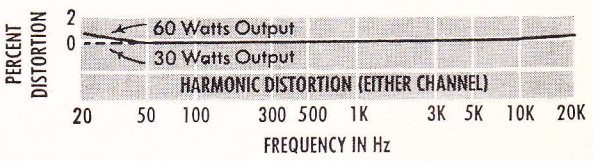
The Stereo 120 shapes up as one of the best power amplifiers offered for home high fidelity use. Its response, as far as we can determine, is utterly uncolored and neutral; its stability very high; its recovery from overload amply proven in our tests; its ability to drive any speaker system self-evident. Truly, another "amplifier great" and at a very reasonable price on today's market.

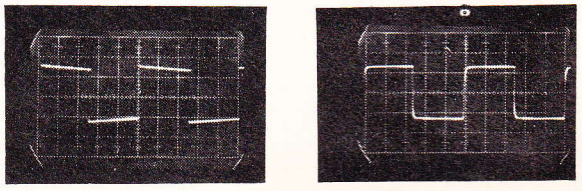
Lab Test Data

Performance characteristic	Measurement
Power output (at 1 kHz into 8-ohm load)	
l ch at clipping	65.8 watts at 0.14% THD
l ch for 0.5% THD	66.1 watts
r ch at clipping	64 watts at 0.1% THD
r ch for 0.5% THD	67 watts
both chs simultaneously	
l ch at clipping	65.3 watts at 0.19% THD
r ch at clipping	62.1 watts at 0.13% THD
Power bandwidth for constant 0.5% THD	below 20 Hz to well beyond 20 kHz
Harmonic distortion	
60 watts output	nonmeasurable, 100 Hz to 10 kHz; below 0.25%, 70 Hz to 20 kHz; 1% at 20 Hz
30 watts output	nonmeasurable, 100 Hz to 10 kHz; below 0.15%, 20 Hz to 20 kHz
IM distortion	
4-ohm load	nonmeasurable up to 40 watts
8-ohm load	nonmeasurable up to 42 watts; below 0.2% up to 70 watts
16-ohm load	nonmeasurable up to 33 watts
Frequency response, 1-watt level	+0, –0.5 dB, 10 Hz to 100 kHz
Damping factor	110
Input characteristics	Sensitivity, 1.61 volts; S/N ratio, better than 95 dB









Square-wave response to 50 Hz, left, and to 10 kHz.

DYNACO STEREO 120 POWER AMPLIFIER

● OVER the past decade, Dyna amplifiers have achieved an enviable reputation for uncompromised quality at bargain prices. Either in the form of easy-to-build kits or as factory-wired models, the Dyna units have consistently matched or surpassed the performance of competitive models costing far more.

As we see it, the "secret" of Dynaco's success has been in their refusal to incorporate gadgets or passing fads into their products. Sound engineering practice, combined with deceptively simple yet highly effective circuit design, has characterized every Dyna product we have tested over the years.

It has been obvious for some time now that transistors have gone beyond the fad stage. Dyna was understandably reluctant to release a transistorized amplifier until they were sure it could at least match the performance of their vacuum-tube models. They have unquestionably achieved that goal in the new Stereo 120 power amplifier. The Stereo 120 is rated at 60 watts per channel continuous output (both channels driven) with less than 0.25 per cent distortion between 20 and 20,000 Hz. These specifications are slightly better than those of a *pair* of the very popular vacuum-tube Mark III Dyna amplifiers, except that the Stereo 120 is considerably smaller, lighter, and cooler than *one* Mark III.

Practically all of the weaknesses of early transistor designs have been eliminated from the Stereo 120. It has practically unmeasurable distortion at almost any power below maximum output. It is completely stable under any conceivable load or drive condition. The transistors are nearly immune to damage from overdriving or short-circuited output leads. The Stereo 120 has no controls or adjustments, internal or external, except its power switch. An electronic delay prevents the turn-on "thump" experienced with some solid-state amplifiers.

The input impedance of the Dyna Stereo 120 is 100,000 ohms, which is high enough for it to be driven by most preamplifiers, including current models of the Dyna PAS-2X, PAS-3X, and the soon-to-be-released solid-state PAS-4. A simple modification of older Dyna preamplifiers will permit them to operate with the Stereo 120.

Although the Stereo 120 is rated for 8-ohm loads, it will drive 4-ohm loads with no diminution of power, and will deliver nearly 40 watts to 16-ohm loads. Large amounts of a.c. and d.c. feedback are used to reduce distortion and (more important) to make the amplifier meet its specifications without the use of specially selected transistors. A patented protective circuit limits the maximum current that can be drawn by the output transistors (under short-circuit conditions) to a safe value. A similar circuit protects the power supply against short circuits. The power supply is regulated to insure full output-power capabilities with line voltages from 100 to 130 volts. (Most amplifiers lose an appreciable portion of their available power if the line voltage falls below 120 volts.) Another advantage of the Stereo 120's very effective power-supply regulation is that it provides essentially the same power rating by continuous-power measurement or by the so-called "music-power" rating method.

HIFI/STEREO REVIEW's kit builder, who built the unit for this test, reports that the construction manual for the Stereo 120 is in the Dyna tradition of clear, straightforward, step-by-step procedures. The three circuit boards that comprise the right- and left-channel driver stages and the power-supply circuits are prewired (and pretested), which makes possible a total assembly time of about five hours for the kit. The protective circuit in the power supply practically eliminates any possibility of damage resulting from wiring errors.

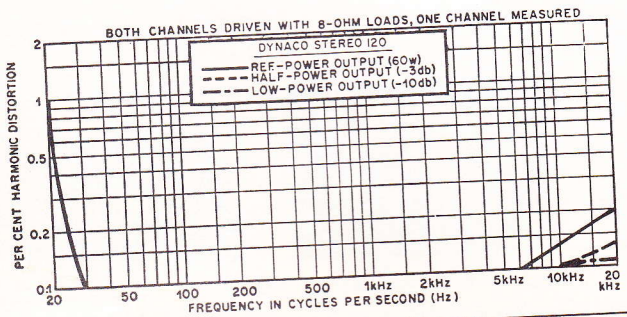
In our laboratory tests, we found the distortion of the Dyna Stereo 120 to be literally unmeasurable with our instruments under most conditions below full-power operation. This is no reflection on the test instruments, which have a residual distortion of about 0.06 per cent, but is rather to the credit of the Stereo 120. At a full 60 watts per channel, the distortion was under 0.1 per cent from 30 to 7,000 Hz, rising to 1 per cent at 20 Hz and to 0.2 per cent at 20,000 Hz. At lower powers it was under 0.1 per cent from 20 to 10,000 Hz, reaching 0.13 per cent at 20,000 Hz with 30 watts output.

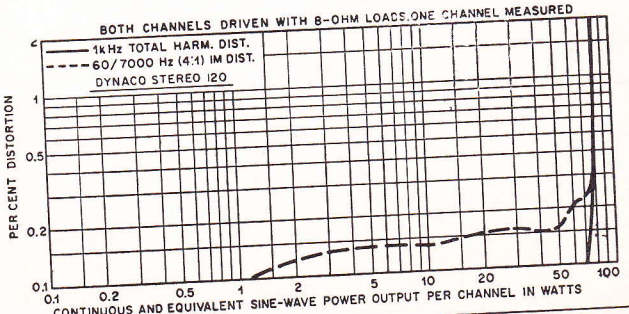
At 1,000 Hz, harmonic distortion was under 0.1 per cent from 0.1 watt to 70 watts. Intermodulation distortion was under 0.1 per cent below 1 watt and reached 0.2 per cent at 60 watts. The frequency response was perfectly flat, as indicated by our meters, from 20 to 20,000 Hz. Hum and noise with an open input were 80 db below 10 watts, or 88 db below 60 watts. An input signal of 0.7 volt will drive the Stereo 120 to 10 watts per channel, more than enough for any normal listening situation.

We checked the maximum power, at the point where the waveform became clipped, into different load resistances. At 4 ohms, the output was a staggering 90 watts, although this could not be maintained for long and actually corresponds to the often-used "music-power" output rating. At 8 ohms, the clipping level was 66 watts, and at 16 ohms it was 37.5 watts.

As a test of the protective circuits, we drove the amplifier to full power and short-circuited the speaker-output terminals. One sample of the Stereo 120 withstood such brutal treatment indefinitely; another, after several such shorts, blew out one channel. This sort of test is, of course, not really representative of the conditions encountered in use. At less than full power output, both samples of the Stereo 120 were unaffected by short circuits of any duration.

We agree with Dyna's own appraisal of the Stereo 120. Its sound quality is easily equal to, though not better than, a pair of Mark III amplifiers. Considering that the Mark III is widely accepted as being one of the finest power amplifiers ever produced for home use, this is a noteworthy achievement. Comparing the sonic quality of the Stereo 120 with that of any other premium transistor amplifier would be a difficult and probably fruitless endeavor. However, we can state that we have never heard an amplifier that sounded better. The Dyna Stereo 120 kit costs $159.95. It is also available factory-wired for $219.00.





DYNACO STEREO 80 POWER AMPLIFIER

● DYNACO's Stereo 80 power amplifier is a lower-power and lower-cost version of their Stereo 120, which we reported on in June of 1967. The Stereo 80 is a compact unit, measuring 14 x 4 x 8 inches and weighing 13 pounds. The chassis is bright nickel plated, with a black perforated cover. Power-line adaptability is provided by the universal power transformer, tapped for use with either 110 to 130-volt or 220 to 260-volt power sources, either 50 or 60 Hz. This makes it entirely compatible for overseas use.

The Stereo 80's amplifier circuits are essentially identical to those of the Stereo 120. The chief difference between the two is in the power supplies—the Stereo 120 has a special electronically regulated supply, while the Stereo 80 has a conventional unregulated power supply.

We have often commented that the degree of difference between the continuous and music-power (dynamic) ratings of an amplifier is essentially a matter of power-supply regulation. This fact is beautifully illustrated by these two Dynaco power amplifiers. Prefering a rigorous approach to the rating question, Dynaco uses a continuous-power rating for all their amplifiers. Therefore, the Stereo 80 is rated at 40 watts per channel continuous into 8 ohms, with both channels driven. If Dynaco used music power, the Stereo 80 would have exactly the same power rating as the Stereo 120 (60 watts per channel or 120 watts total). However, the regulated power-supply voltage of the Stereo 120 gives it the same power-output capability for both continuous and transient (music) signals.

For most listeners, 40 watts per channel is probably adequate, and there are a number of amplifiers that can deliver that much power. There are very few, however, that can provide that much power with the extremely low distortion and wide power bandwidth of the Stereo 80. And all of them are considerably more expensive.

Dynaco's specifications are precise and unambiguous, stating that the output is 40 watts per channel into 8 ohms with less than 0.5 per cent harmonic distortion or 0.1 per cent IM distortion, and that the distortion decreases when power output is reduced. The frequency response at 1 watt is rated ±0.5 dB from 15 to 50,000 Hz. The Dynaco protection circuit prevents damage to the output transistors under conditions of overdrive or shorted outputs and restores normal operation as soon as the fault is corrected.

At the time of our Stereo 120 test, our test equipment could not measure distortion below a residual level of about 0.06 per cent. With the aid of our new Radford low-distortion measuring equipment however, we were able to measure with assurance the actual distortion of the Stereo 80. The results were impressive, to say the least.

The 1,000-Hz harmonic distortion was 0.08 per cent at 0.1 watt, dropping to about 0.025 per cent in the 8 to 20-watt range, and reaching 0.038 per cent at the rated 40-watt output. Clipping occurred at 44 watts with 8-ohm loads, 45 watts with 4 ohms, and 28.5 watts with 16 ohms. IM distortion was slightly higher: 0.17 per cent at 0.1 watt, falling to 0.065 per cent between 1 watt and 10 watts. It was 0.14 per cent at the rated 40 watts.

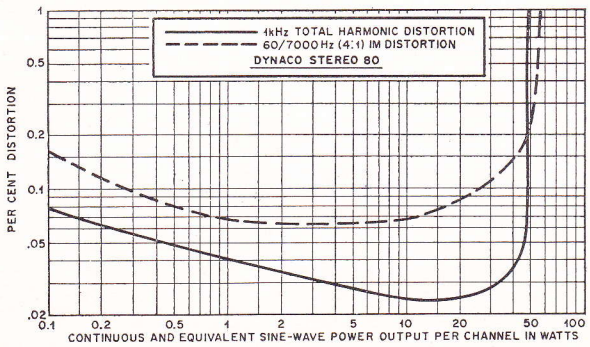
At full output, harmonic distortion was 0.36 per cent at 20 Hz, dropping to 0.05 per cent or less between 30 and 2,000 Hz. It increased gradually at higher frequencies, to 0.1 per cent at 7,000 Hz and 0.25 per cent at 20,000 Hz. At half power or less, the distortion curve followed a similar pattern, remaining between 0.028 and 0.1 per cent over most of the audio-frequency range.

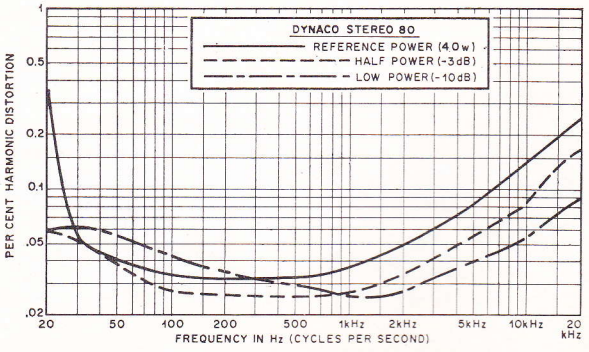
When attempting to drive the amplifier to the clipping point with 4-ohm loads, we were able to observe the action of the protection circuit, which suddenly reduced the output to safe levels when excessive current was drawn from the output transistors. At higher load impedances this did not occur, since clipping limited the output to a safe value. Shorting the outputs at full power caused no damage.

A test signal of 0.58 volt into the amplifier's 100,000-ohm input impedance developed our 10-watt reference power output. Hum and noise were 85 dB below 10 watts, which is a completely inaudible level. The frequency response was as flat as that of our instruments from 10 to 50,000 Hz, and was down 1 dB at 5 and 100,000 Hz.

Our kit builder reports that the amplifier was completed with no difficulty in two short evenings—and possibly could have been built in one long one. The mechanical design of the Stereo 80 is simple to the point of being ingenious. Each pair of output transistors is mounted on a finned black anodized-aluminum heat sink. The two heat sinks serve as guides and mounting supports for the two identical prewired amplifier-circuit boards. A third small board contains the power-supply rectifiers and filter resistors. The only other electrical components are the power transformer and four large electrolytic capacitors, which are installed directly on the metal chassis pan. The rocker-type power switch (the only control or adjustment on the amplifier) is illuminated. The speaker terminals have color-coded plastic-tip screws designed to be hand-tightened.

When we listened to the Dynaco Stereo 80, we received no surprises. It was totally neutral in character, and clean and unstrained at any power level that our ears or speakers could stand. As we stated earlier, there are some other basic power amplifiers that offer comparable performance and even more power. They are certainly no "better," from a listener's standpoint, than this one when used within its limits, and they are far more expensive. The Dynaco tradition of providing an outstanding value for the money seems to have been retained without compromise in this new power amplifier. The Dynaco Stereo 80 can be bought factory-wired for $169.00 In kit form it is $129.00.





A FIRST-RATE BASIC AMPLIFIER FROM DYNACO

THE EQUIPMENT: Dynakit Stereo 80, a stereo basic or power amplifier available in kit form. Dimensions: 14 by 4 by 8 inches. Price: kit, $129.00; factory-wired, $169.00. Manufacturer: Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121.

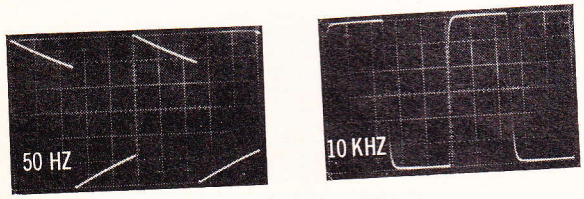
COMMENT: Continuing its tradition of offering high-performing, conservatively rated, and reasonably priced separates, Dynaco has come out with a medium-high-powered basic amplifier for use with a separate preamp/control unit. The amplifier is generously designed, with obvious attention to chassis layout and evidence of high-grade parts. The unit's input jacks and speaker terminals are located at one end of the chassis; the power cord, fuse-holder, and off/on switch are at the other end. No level controls are furnished; listening volume must be controlled by whatever preamp one uses before the Stereo 80. A multiple-type power transformer enables the amplifier to be used on line voltages found anywhere in the world. Its transistors are protected by special circuitry rather than by circuit breakers or fuses.

Performance tests run at CBS Labs on a kit-built version indicate that the Stereo 80 performs exactly as advertised. The test results, detailed in the accompanying graphs and table, add up to a high-performing, reliable basic amplifier that offers clean power reserves and high stability. Distortion is extremely low; note that we had to expand the vertical scales of our graphs to show the actual amounts measured. Input sensitivity for rated output is 1.28 volts, which is just about average for typical preamp outputs. Signal-to-noise ratio, at 97 dB, marks the Stereo 80 as one of the quietest amplifiers yet tested. Frequency response is literally a ruler-flat line from 30 Hz to 25 kHz, being down by only 1 dB at 10 Hz at the low end and at 70,000 Hz at the high end.

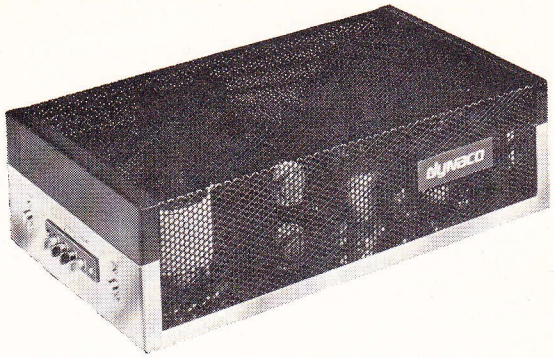
Building the Stereo 80 from a kit is an easy, straightforward job that shouldn't take more than five or six hours. The hardest and most fascinating part of the work was the winding of heavy-gauge wire into coils that get wrapped around the enormous coupling capacitors. The amplifier worked satisfactorily upon completion with no need for any adjustments.

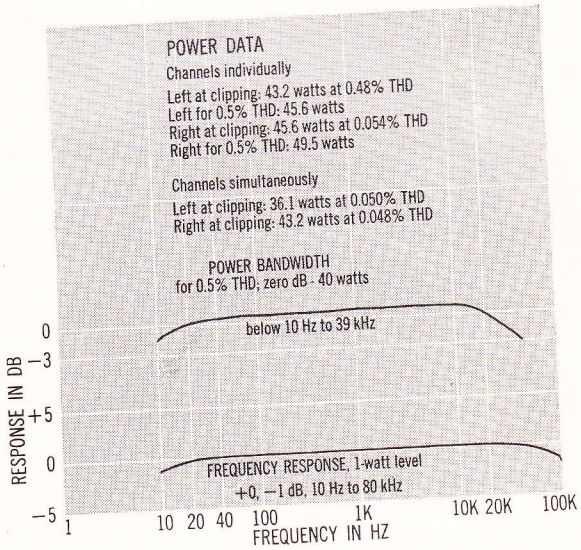
Dynakit Stereo 80 *Additional Data*

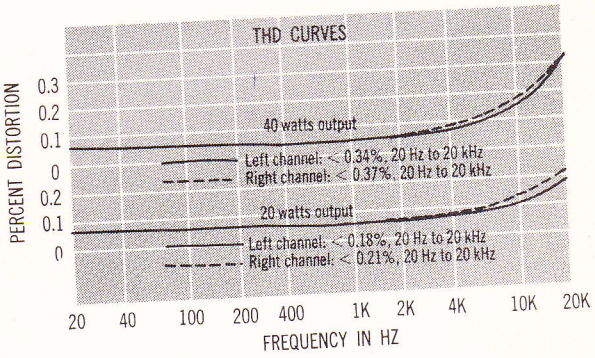
Performance characteristic	Measurement
Damping factor	80
Input sensitivity 1.28 V	S/N ratio 97 dB

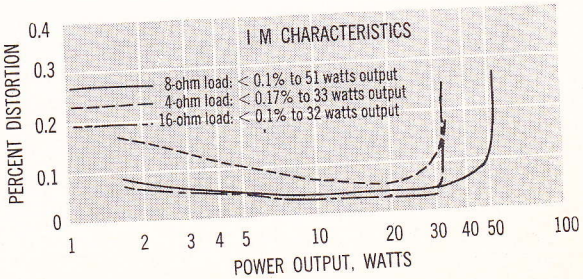


Square-wave response









Popular Electronics

DYNACO FM-5 STEREO FM TUNER
(A Hirsch-Houck Labs Report)

THE NEW Dynaco Model FM-5 stereo FM tuner, which measures 13½″ wide by 4″ high by 9″ deep, matches the company's Model SCA-80 integrated amplifier in style and size. Its satin-finished, gold-colored front panel is dominated by a large rectangular dial window. Only two control knobs appear on this panel—a large tuning knob and a smaller volume control/power switch.

Three rocker switches located below the dial window betray a hint of some of the FM-5's unusual features. One is a MONO/STEREO switch with a center position that provides blending of the high frequencies in the two channels for stereo noise reduction, a common feature in FM tuners. Next is the AUX/FM switch which permits the user to connect the tuner's audio outputs and volume control to the two AUX inputs located on the rear of the tuner. This means that the FM-5 can be connected directly to a basic stereo power amplifier to form a usable stereo system, minus the tone controls and integrated amplifiers. Dyna also plans to offer as an accessory a magnetic phono preamplifier module (Model PPM-5) that can be installed in the FM-5 tuner. Connected to the AUX inputs, this will effectively convert the FM-5 into a simple high-quality preamplifier/FM tuner combo at minimum cost.

The third switch on the front panel controls the muting and DYNATUNE systems, both of which are disabled in the OFF position. DYNATUNE is a novel form of highly amplified afc in which an IC amplifier is used to insure that the tuner is locked onto the exact center, or minimum distortion point, of an FM channel over a 500-kHz tuning range.

Normally, such a strong afc system would invalidate the dial calibration and make it impossible to tune in stations with the 400-kHz alternate channel spacing. However, the DYNATUNE system can acquire a signal only when the tuning is within 50 kHz of the channel center, after which it holds onto the signal for an additional 250 kHz or so. The muting circuit, which works in conjunction with DYNATUNE, senses off-center tuning of more than 50 kHz or excessive ultrasonic noise over 150 kHz in the detector output; either condition would be sufficient to mute the receiver.

The FM-5 has a FET front end and an i-f amplifier that contains four IC's and seven ceramic filters. An IC handles most of the multiplex decoding functions, while another is used only for the DYNATUNE system. In addition to the variable audio outputs, there are fixed-level outputs for driving a tape recorder.

The construction of the tuner kit is greatly simplified by the fact that both of its circuit board assemblies and the front end are factory-assembled and aligned. Building the kit is essentially a matter of mechanical assembly and interconnection of the electronic modules. We assembled our kit in less than four hours. So, even a novice kit builder should not require more than five or six hours of assembly time.

Once the kit is assembled, there is absolutely no electrical alignment required (or possible without the use of instruments not available to the average kit builder). Positioning the dial pointer is the only assembly step that affects the final calibration or performance of the tuner in any way. A note of caution is in order, however. Some of the potentiometers on the circuit boards are quite critical in their settings and can easily be disturbed if the modules are carelessly handled. When assembling the kit and connecting wires to the modules, care must be exercised to avoid changing any control settings.

Laboratory Measurements. In spite of the ease with which the kit went together, the FM-5 tuner proved to be one of the most outstanding tuners we have put to the test. Its measured IHF usable sensitivity was 1.4 μV, which is close to the theoretical maximum and is in a range where measurement errors can become significant. In any event, it easily surpassed its rated 1.75-μV sensitivity. The limiting curve was steep, with a 50-dB (S + N)/N ratio occurring at 2 μV and an ultimate (S + N)/N ratio of almost 75 dB—among the best figures we have yet measured on an FM tuner. The measured distortion at 100 percent modulation was 0.75 percent, which includes the 0.5 percent residual distortion of our signal generator.

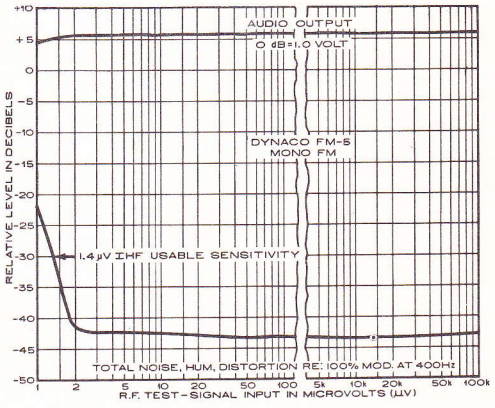
The capture ratio of 1 dB also surpassed the published specification of 1.5 dB. The AM rejection was 52 dB, and image rejection was 65 dB. Alternate channel selectivity was difficult to measure accurately because Dyna specifies it at 65 dB, while our measurement was nearer 90 dB! Doubtful as the latter figure may be, the tuner again surpassed its ratings in this important characteristic. The muting (and stereo switching) threshold was 4.5 μV. Maximum audio output from a 100 percent modulated signal was about 2 volts.

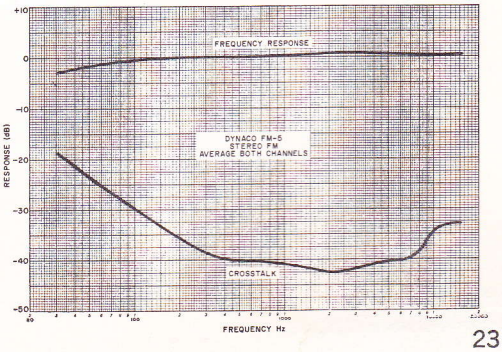
The stereo FM performance of the FM-5 was also quite extraordinary. Its frequency response dropped off slightly at the lower frequencies to −3 dB at 30 Hz. But is was flat within ±0.5 dB from 90 Hz to 15,000 Hz. Channel separation exceeded 40 dB from 450 Hz to 7000 Hz and exceeded 33 dB from 140 Hz to 15,000 Hz. At low frequencies, the separation fell to 18.5 dB at 30 Hz. Overall, the stereo separation of this tuner was among the greatest we have yet measured.

Use Tests. In use, the Dynaco FM-5 stereo FM tuner was delightfully smooth and easy to tune. The flywheel mechanism had a "feel" not usually associated with kit-built tuners (or even a great many factory-wired units). The muting action was perfect, with absolutely no extraneous sounds such as thumps and noise bursts. We found that with DYNATUNE, any receivable station could be tuned simply by spinning the dial to the indicated frequency and stopping. In a fraction of a second, the TUNED light came on.

Although the dial calibrations are located at only 1-MHz intervals, they are so accurate that the pointer setting can easily be interpolated to 200 kHz or better.

A tuner with the performance of the Dynaco FM-5 would be a good value at almost any price. At its factory-wired price of $250, it is not exactly a steal, but it is worth every cent. Considering the ease of building the tuner, the kit price of only $160 is an unqualified bargain.





Dynaco FM-5 Stereo FM Tuner

MANUFACTURER'S SPECIFICATIONS
IHF Sensitivity: 1.75 μV. **S/N:** 65 dB (S/N at 5 μV: 50 dB). **THD** (Mono): Better than 0.5%; Stereo, better than 0.9%. **Capture Ratio:** 1.5 dB. **Selectivity:** 65 dB. **AM Suppression:** 58 dB. **38 kHz Carrier Suppression:** At least 55 dB. **Drift:** Less than 0.02%. **Muting and Stereo Threshold:** 4 μV. **Stereo FM Separation:** 40 dB @ 1 kHz (30 dB @ 50 Hz and 10 kHz). **Frequency Response:** 30 Hz to 15 kHz (de-emphasized) ±1 dB, Mono and Stereo. **Dimensions:** 13½ in. W, 4¼ in. H, 9 in. D. **Retail Price:** $159.95 kit, $249.95 wired.

Dynaco kits have long been noted for a basic, simple look on the outside and state-of-the art performance on the inside. The FM-5 is no exception. Its business-like extruded aluminum front panel and black metal enclosure house some sophisticated r.f. engineering and layout that is ideally suited to the kit-builder of limited experience but will serve the FM enthusiast who elects to buy the unit fully wired equally well. The front panel controls include an on/off volume control and a large tuning knob, coupled to a flywheel that easily propels the dial pointer from one end of the dial to the other with one twist of the knob. In addition, there are three three-position rocker switches. The first of these selects MONO or STEREO operation, with a center FILTER position available for improving signal-to-noise ratios when weak stereo signals are received with some sacrifice in high frequency stereo separation. The next rocker switch is labelled AUX-FM and enables the user to select another signal source, such as tape-recorder outputs, which can be connected at the rear panel. The built-in volume control is active for this auxiliary source as well as for FM. The last rocker switch has to do with the interstation muting circuitry designed for the FM-5 and has positions for OFF, MUTE and DYNATUNE®, about which we'll have more to say later.

The large dial scale area includes a logging scale with 100 divisions in addition to the usual frequency scale. A signal strength meter is located at the left of the dial scale area and adjacent to it are two indicator lights—one of which is labelled TUNED, the other STEREO. The STEREO light, of course, becomes illuminated in the presence of a stereo broadcast. The TUNED light is the end result of a carefully engineered sensing or logic circuit in combination with a closed-loop AFC tracking circuit which insures center-of-channel tuning and which will be described shortly, when overall circuitry is analyzed.

The rear panel of the FM-5 tuner is shown in Fig. 1. Antenna connections are provided for 300 ohm or 75 ohm transmission lines and there is a convenience a.c. outlet as well as a line fuse for circuit protection. A fixed pair of outputs labelled TAPE OUT provide approximately 2 volts of audio (under conditions of 100% FM modulation) regardless of volume control settings, and these outputs are intended for connection to a tape recorder input pair which can be controlled at the recorder itself. The AUDIO OUT jacks are for connection to your amplifier or amp-preamp components while the AUX jacks, as previously mentioned, will accommodate a stereo high level signal source. In the event that you want to make the FM-5 your "operations center" and have only a basic stereo power amplifier, Dynaco will make available a separate phono preamp (Model PPM-5) which will accommodate a magnetic phono cartridge. The outputs of this accessory could then be connected to the AUX inputs on the FM-5.

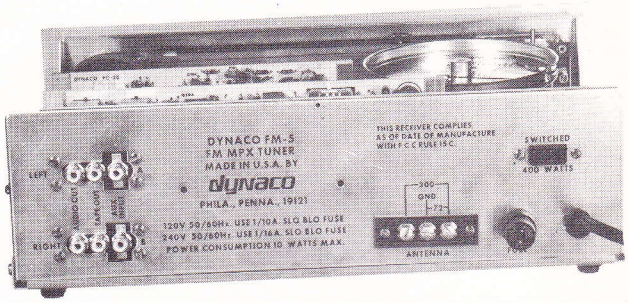


Fig. 1—Rear panel layout of the Dynaco FM-5

In Fig. 2, the assembled and wired FM-5 is shown with the top cover removed and back panel swung down. There are three major assemblies, all of which come fully wired, aligned and tested. The kit builder is concerned only with the mechanical assembly of the modules to the chassis and their interwiring. With so much of the Dynaco FM-5 pre-wired and pre-aligned, the kit building phase of the project is quite minimal and well worth the effort for the difference in price between the wired and kit price of this tuner. There are 22 initial assembly steps (mechanical), 87 steps concerned with the actual wiring (mostly cutting lengths of wire and hooking them up from here to there and 12 final assembly steps. In general, we have found that Dynaco's step-by-step instructions are a bit on the brief side and could benefit from a few more illustrations. A novice kit-builder may not be able to readily identify the less familiar parts which are merely referred to by name. The kit was built by a fairly well experienced kit builder in a little over five hours, but a novice might well take a little longer.

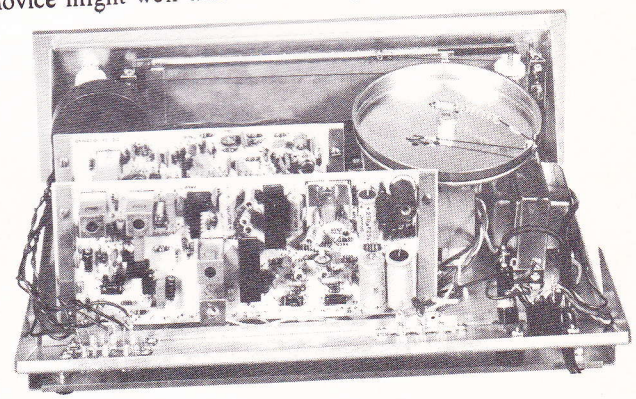


Fig. 2—Internal view showing major p.c. modules.

The front-end (obscured in the photo by the large dial string drum) includes a tuned r.f. input to a Field Effect Transistor amplifier, followed by interstage double-tuning to a FET mixer. A bi-polar transistor is used for the local oscillator. The output of the first i.f. stage is tuned by a section of the four-section variable capacitor.

The basic i.f. section of the FM-5 consists of two IC amplifiers followed by a high gain limiter IC. There are four cascaded ceramic filter sections between the first and second stages and three additional filter sections between the second and third stages. Another high-gain amplifier (also an IC) drives a ratio-detector which feeds an emitter follower for audio output. There follows a 67 kHz filter for SCA rejection and an FET which feeds the muting and multiplex circuits. An IC multiplex circuit includes a cross-coupled multiplier-demodulator for additional SCA rejection. Also included are additional 19 kHz and 38 kHz rejection filter circuits and a two transistor audio amplifier which provides low output impedance and incorporates the necessary de-emphasis circuits.

The muting circuit is controlled by a logic circuit which is fed by the detector's emitter follower audio output. Sensing the detector's d.c. level, audio is switched off when the variation from "zero center" exceeds 80 kHz. This circuit is also activated by a second signal (the output of a 150 kHz high pass filter) which consists of interstation noise. If such noise is present, audio is also switched off.

The Dynatune Circuit

This automatic circuit consists of an amplified closed-loop tracking circuit with a narrow "window." The amplified d.c. output of the detector is fed back to the front-end through a limiter. This signal controls the frequency of the local oscillator and "tracks" for zero d.c. at the detector output. Since the "looking action" is so strong that it might track a single signal over wide ranges of frequency, the circuit is so arranged that when the d.c. level reaches a predetermined value (as the tuning dial is moved), the muting logic switches off before audible noise or distortion is heard.

Electrical Measurements

Figure 3 is a graphic plot of major FM performance characteristics. IHF sensitivity was reached at a near-theoretical limit of 1.7 μV but, even more important, notice the excellence of the quieting slope. At 5 microvolts input, we observed over 55 dB of quieting (fully 5 dB better than Dynaco's published specification) and ultimate S/N for any signal level beyond 50 μV was 68 dB (as compared with 65 dB claimed by the manufacturer). Harmonic distortion in mono was a mere 0.3%, while in stereo we measured 0.55% at mid-band frequencies. As can be noticed in the graph, stereo threshold (the point at which the circuits "open up"

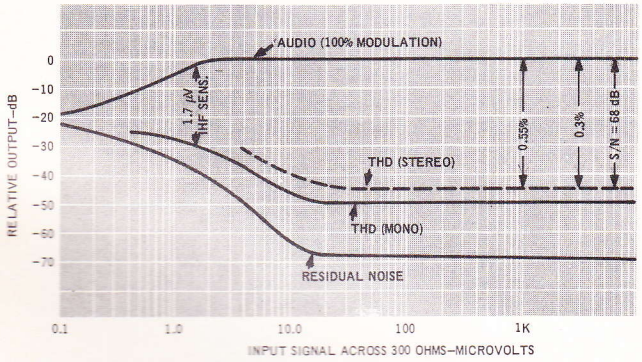


Fig. 3—FM characteristics.

the stereo circuitry) was 4 μV and that corresponded to the muting threshold as well. This last figure is particularly significant. Less sophisticated muting circuits invariably restrict the listener to signals of greater than 7 to 10 μV—which means that if you want the benefit of interstation silence and have the muting circuits turned on, you're liable to "block out" otherwise listenable stations. In the case of the Dynaco FM-5, with a threshold of 4 μV in its muting circuits, just about any station you'd deem worth listening to (in terms of signal-to-noise ratio) defeats this muting circuit positively—with no "half-way" distortion points so common to other forms of this circuit. Stereo separation actually exceeded published specs, measuring 42 dB at mid-band and maintaining 30 dB from 50 Hz to 10 kHz.

Listening Tests

Tuning the dial of the FM-5 offers immediate proof of the superiority of Dynaco's Dynatune circuit. While the signal strength meter gives some indication of the fact that you are approaching a station, with the switch set in the Dynatune position it really is not needed. That TUNED light comes on and clear distortion-free audio is heard. There is none of the "side skirt" noise often associated with lesser "muting and tuning" circuits. No pops, no clicks—just audio when-

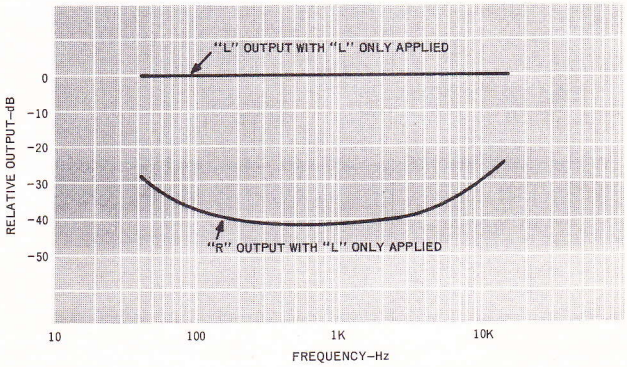


Fig. 4—Stereo FM separation characteristics.

ever that light lights. We found the so-called "window" to be quite narrow and critical, but that is one of the penalties you have to pay if you're going to get absolute accuracy in center-of-channel tuning. With the switch set to the MUTE position, stations came on over a somewhat broader range of movement of the dial, but of course center-of-channel precision was then left up to the user and there is some margin for the introduction of distortion as one nears the edge of the mute defeat range for each station. Dynaco suggests tuning for stations in the MUTE position and introducing the Dynatune feature only after the station has been tuned in (for final center-of-channel accuracy) and this may be the best way to work it, although the *tune* light must be illuminated before you can switch to this latter position for the "tracking" circuits to take over.

In our location, we were able to pick up exactly the same number of listenable stations with or without the mute circuit on—a total of 51 with our outdoor Yagi antenna facing New York City, of which 28 were broadcasting in acceptable noise-free stereo—which further attests to the desirability of Dynaco's low threshold in this new muting circuit. There was no evidence of drift at any time and, most surprisingly, calibration was excellent—never off by more than 100 kHz at any point on the dial. That's quite an accomplishment for a tuner whose front-end was aligned in Philadelphia and whose dial string and dial pointer were assembled months later at a remote kit-builder's home! In all, you're not afraid to mount some parts, cut some wires, and do a bit of easy soldering, the Dynaco FM-5 offers you expensive sounding stereo FM at a budget price. *Leonard Feldman*

Dynaco's Long-Awaited FM Tuner Kit

The Equipment: Dynaco FM-5 tuner. Dimensions: 13½ by 4⅛ by 7⅞ inches. Price: $159.95 in kit form; $249.95 wired. Manufacturer: Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121.

Comment: Dynaco has been whetting our appetite for some time with preproduction samples of a new FM tuner to replace the FM-3 which, while an excellent performer and an extremely attractive value, lacked a number of features we have come to expect in the years since it first appeared. Repeated delays have prevented delivery of the FM-5, however, and readers have been writing in to ask whether it was worth waiting for.

It was worth waiting for, without question. Dyna has done it again—given us a component that will bear comparison with other companies' top models, but at moderate price. The value it represents is most striking in the kit version; many readers will think the $90 saving a windfall in view of the unit's simple assembly.

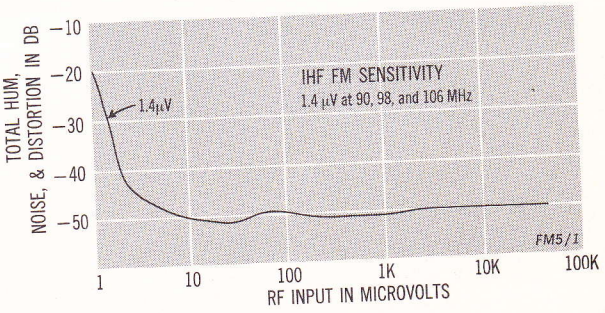
After about an hour and a half of mechanical assembly (mounting switches and other chassis parts) on the front panel, you wire this section in conventional style, soldering leads to lugs and other connecting points. Next you fasten the prewired front end to the main-chassis bottom plate; wiring to the front end itself is via a series of eyelets not unlike those found on printed-circuit boards. The latter (two are supplied) come fitted with all parts in place, and so the work from here on is mostly mounting the boards onto the chassis and then soldering the leads to and from them. Final assembly consists of installing the tuning dial and its control, stringing the dial cord, and fitting the cover to the set. No alignment at all is required. The instruction steps are clear, and line drawings and photos of the kit help in the work. An experienced kit builder should be able to finish the job in about 6¼ hours; a novice probably will need somewhat more time. Only one chore is tricky: wiring the antenna matching coil, whose leads are very delicate and whose insulation could be damaged by heat from the soldering iron.

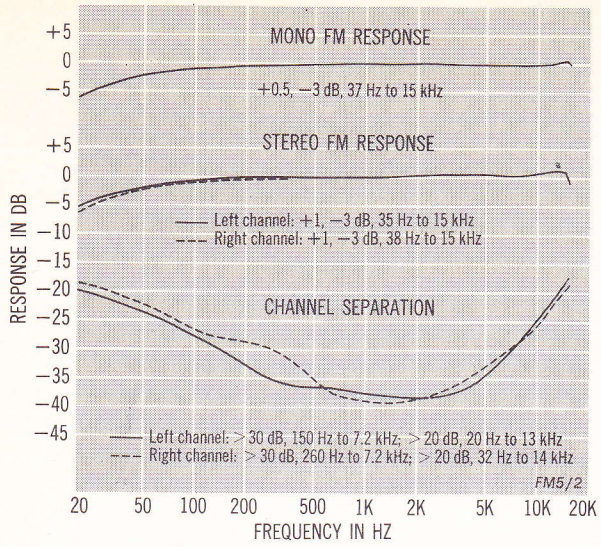
The front panel is simplicity itself. Set into the dial area are a signal-strength meter and two indicator lights: one for center tuning, one for stereo reception. The tuning knob is at the right. Across the bottom are a volume control knob with an off position, a mode switch, an aux/FM switch, and a three-position Dynatune switch. The off position on the volume control will not be used if the tuner is plugged into a switched accessory outlet on the preamp. The mode switch has three positions: mono only, automatic mono/stereo switching with channel blend introduced at high audio frequencies to cancel excessive transmission noise in weak stereo broadcasts, and automatic switching without the high blend. The aux position of the next switch turns off the FM audio and chooses the signals arriving via aux connections provided on the back panel for that purpose. The Dynatune switch has three positions: muting off, muting on, and Dynatune itself—Dyna's version of automatic frequency control, using what Dyna describes as a logic circuit to tune for minimum distortion.

On the back panel are phono-jack inputs for the aux connections and output pairs for tape recorder and "audio"—the main feed to your stereo system. It is this output that is controlled by the front-panel volume control, allowing you to match FM levels to those of other system inputs ad lib. Recording levels are, of course, controlled at the recorder. Also on the back panel are the antenna connections for either 75-ohm coaxial or 300-ohm antenna leads, a switched accessory AC outlet, and the fuseholder.

The first performance measurement most readers seem to look at is IHF sensitivity. (This was one respect in which the FM-3 looked unimpressive, though the raw sensitivity figure is far less important in our opinion than the behavior of the unit above that barely minimal input level.) The FM-5 comes in at 1.4 microvolts—a spectacular figure, particularly considering that it is maintained all across the FM dial. From the 30-dB point (where IHF sensitivity is measured) quieting descends rapidly to 45 dB for only 2.5 microvolts—the 30-dB point for many budget tuners. From below 10 microvolts to the limit of the CBS Labs test procedure quieting remains at or near 50 dB, an excellent mark for any tuner regardless of cost.

The remaining lab data all confirm the FM-5's superior performance. The only point on which we might cavil is the frequency response in the extreme bass. The roll-off (which may contribute to the unit's extremely low distortion and noise measurements) reaches -3 dB at about 40 Hz in each curve. But since most speakers roll off sharply at a higher frequency, it would require a program signal with exceptional bass information and extremely wide-range speakers to hear the difference between the FM-5 and a tuner with flatter bass response. In listening to actual programs we can only say that we were delighted. Moreover the operating controls—notably the tuning knob with its elegantly smooth flywheel action—are a joy to work with. The FM-5 looks like a real winner.



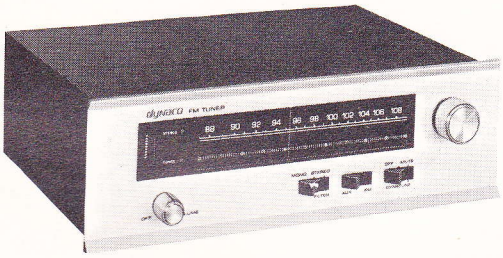


Dyna FM-5 FM Tuner Additional Data

Capture ratio		1.7 dB	
Alternate-channel selectivity		75 dB	
S/N ratio		67 dB	
THD	Mono	L ch	R ch
80 Hz	0.17%	0.23%	0.29%
1 kHz	0.12%	0.15%	0.14%
10 kHz	0.22%	1.1%	0.90%
19-kHz pilot		−63 dB	
38-kHz subcarrier		−67 dB	

Stereo Review

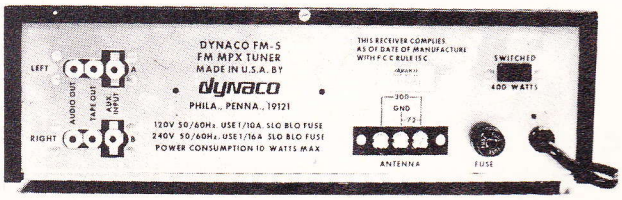
Dynaco FM-5 Stereo FM Tuner



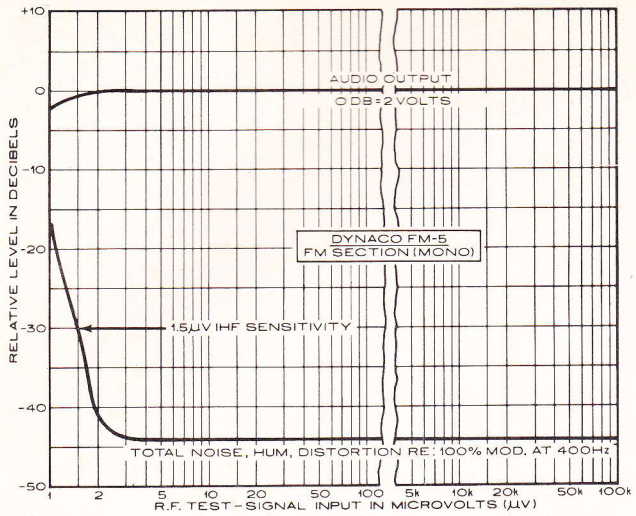
● WITH the introduction of the FM-5 stereo FM tuner, the Dynaco product line has completed its transition from vacuum tubes to solid-state design. Unlike the FM-3, its vacuum-tube ancestor, the new tuner (when built from a kit) requires little assembly and *no* alignment to achieve rated performance. It is almost entirely constructed on two printed-circuit boards that are supplied with all parts mounted and factory aligned. The builder mounts the boards and the pre-aligned "front end" in the U-shaped chassis, installs the front-panel controls, tuning-dial components, and power transformer, and makes the necessary interconnections. (Our kit builder reports that the unit went together easily and might even be completed by an experienced kit builder in one long evening.) The only "alignment" after completion consists of positioning the dial pointer over a reference mark at the end of the dial.

The FM-5 resembles other Dynaco components in size and styling. Its satin-finish gold panel is 13½ inches by 4¼ inches, and the depth of the unit is 9 inches. A metal dust cover is supplied. The large rectangular dial cutout reveals an FM scale (not quite linear in its calibration spacings) with 1-MHz calibration intervals and a separate logging scale. At the left is a signal-strength meter and two blue indicator lights marked TUNED and STEREO. The large tuning knob at the right of the dial operates a silky-smooth flywheel mechanism.

Below the dial are the combined volume-control/power switch and three rocker switches. One selects mono or automatic stereo/mono operating modes, with a center position that blends the high frequencies of the two channels to reduce noise on weak stereo signals. Another three-position rocker switch controls the interstation muting and the DYNATUNE automatic fine-tuning feature. A sophisticated interstation-noise muting circuit responds to both the d.c. voltage and the high-frequency noise (over 150 kHz) in the detector output. The circuit is completely thump-free and silent in operation, with a



The FM-5 tuner has outputs for the amplifier and a tape recorder, and inputs for a high-level auxiliary source. An optional module converts these inputs for a magnetic-phono cartridge.



slight time delay that keeps the receiver completely muted while the FM band is being scanned rapidly.

The Dynatune system is actually a highly amplified automatic frequency-control (AFC) system which operates only when the tuner is within 50 kHz of the received signal. This is also the point where the TUNED light comes on, whether or not the Dynatune is in use. The FM-5, once "locked on" to a signal, holds it for an additional 250 kHz of dial movement. Dynatune is not intended as a drift-correcting system, since the FM-5 has negligible drift, but rather as a very accurate automatic fine-tuning system. If the tuning knob is released as soon as the TUNED light comes on, the FM-5 is tuned for minimum distortion with greater accuracy than is possible with most zero-center tuning meters, to say nothing of relative signal-strength indicators. The meter of the FM-5 is driven by a special amplifier, and is designed to give useful readings over an extremely wide range of input levels, from a few microvolts to tens of thousands of microvolts. The meter is intended to be a guide to correct antenna orientation rather than a tuning indicator.

The third rocker switch is the AUX/FM selector, which connects the audio-output jacks either to the internal FM circuits or to a high-level source connected to its rear AUX connectors. The AUX input is controlled by the tuner's volume control (but, like the FM signal, it appears at the tape-recording outputs at constant level). The FM-5 therefore can be used to drive a stereo power amplifier directly, while providing the ability to play programs from another source such as a tape recorder. Dynaco plans to produce a magnetic-phono preamplifier module that can be installed within and powered by the FM-5 so that the AUX input can be used with a record player.

Despite its apparent external simplicity, the circuits of the Dynaco FM-5 are highly sophisticated. The front end has an FET r.f. amplifier and an FET mixer. The i.f. section has four IC's and seven stages of ceramic filters. Audio amplification, muting, Dynatune, and multiplex decoding functions all employ IC's. In all, the FM-5 has fourteen transistors and seven IC's, plus numerous diodes. The price of the Dynaco FM-5, in kit form, is $159.95. It is also available factory-wired for $249.95.

● ***Laboratory Measurements.*** We tested two Dynaco FM-5 tuners, one factory-wired and one assembled from a kit. The two had very similar performance characteristics, and both surpassed the manufacturer's specifications in all important respects. Some of the key measured performance parameters of the two tuners are listed in the table (left), together with the published specifications.

Our measurements confirm that the Dynaco FM-5 is indeed one of the finest FM tuners available at any price. Not many tuners can match more than a few of its specifications, and most of them cost considerably more than the wired FM-5. In view of the simple construction process and lack of alignment requirements, the kit version of the FM-5 is an outstanding value.

● ***Comment.*** Specifications alone do not adequately describe a product such as this. The FM-5 is a delightfully easy tuner to use and the Dynatune system is definitely not a gimmick. A spin of the tuning knob carries the pointer across the dial, and not a sound is heard until the TUNED light comes on and the program emerges. As for overall performance and sound quality, the first is the equal of any tuner we have used, and the second is entirely a function of the FM program quality. The FM-5 offers even a novice kit-builder the opportunity to obtain a tuner for $159.95 that could not be significantly surpassed in any important specification at any price.

Dynaco's Specification	*Tested Units*	
	Wired	*Kit*
IHF sensitivity: 1.75 μv (microvolts)	1.50 μv	1.65 μv
Input for 50 dB S/N ratio: 5 μv	2.1 μv	2.3 μv
Stereo frequency response, 50 to 15,000 Hz: ±1 dB	±2.1 dB	±2 dB
THD (mono): 0.5 %	0.62 %*	0.65 %*
Capture ratio: 1.5 dB	1 dB	1 dB
Capture ratio (@ 10 μv): no spec.	3 dB	3 dB
Muting threshold: 4 μv	3.4 μv	3.5 μv
Output @ 100 % modulation: 1.8 volts	2 volts	2 volts
Ultimate S/N ratio: 65 dB	66 dB	71.5 dB
Alternate-channel selectivity: 65 dB	80 dB	70 dB
AM suppression: 58 dB	51.5 dB	53 dB
Image rejection: no spec.	67 dB	70 dB
Stereo separation: 1,000 Hz, 40 dB	37.7 dB	36.9 dB
50 Hz, 30 dB	24.1 dB	25.5 dB
10 kHz, 30 dB	27.8 dB	32.7 dB

*Includes approximately 0.5 per cent residual distortion in our signal generator.