

Technics Offers a Uniquely Interesting Cassette Deck

The Equipment: Technics Model RS-676US, a stereo cassette deck with Dolby B noise reduction, in metal case. Dimensions: 16 1/8 by 5 1/16 inches (front panel); 11 3/4 inches deep plus allowance for controls and connections. Price: \$459.95. Warranty: one year parts and labor. Manufacturer: Matsushita Electric Corp., Japan; U.S. distributor: Matsushita Electric Corp. of America (Panasonic), 200 Park Ave., New York, N.Y. 10017.

Comment: First, let's say it again: Front loading, in our opinion, is a feature that hardly justifies all the fuss that's being made over it. If you want a cassette deck that will be convenient for eye-level use, you want front loading; but there is a price to be paid. In the RS-676US, that price consists primarily of reduced accessibility to the heads for cleaning, a small loss in convenience in inserting or removing cassettes, and somewhat reduced visibility of the cassette while it is in use. And that said, we can get to the real point: The RS-676US is above all a fine unit whose operating "feel" and control scheme—for metering, mixing, and "Dolby FM" in particular—are among the most attractive we've encountered.

To insert a cassette you press the eject button next to the transport compartment door, which opens a crack but must be manually swung down the rest of the way, like a see-through oven door. An angled mirror at the back (plus a small light in the "ceiling") allows you to see a cassette in play/record position at the bottom of the compartment. The transport mechanism that holds the cassette is similar to that of typical top-loading decks, with the heads at the near side of the cassette, just inside and below the bottom edge of the door.

The controls to the right of the door are the solenoid type that—presumably because they reproduce much of the "feel" of expensive open-reel equipment—contribute materially to the sense of luxury in using the RS-676. There are large bars for play and stop, smaller ones for the two fast-wind modes, the recording interlock, and pause. Pilot lights are built into the faces of the play, record, and pause bars; you must examine the counter to make sure which fast-wind mode is in use.

When you press the recording button the meters immediately read the source signal, but the heads are not brought into contact with the tape. When levels have been set and you want to begin recording, a press on



the play button starts tape motion. The lack of an interlock requiring you to press the recording button simultaneously at first seemed to threaten accidental tape erasure, though in practical terms we found it difficult to dream up situations in which accidental erasure would logically take place. There is interlock to prevent going directly from play to record without pressing stop, and one between the fast-wind modes and normal transport speed so that you can't go from the former to the latter without first stopping the transport.

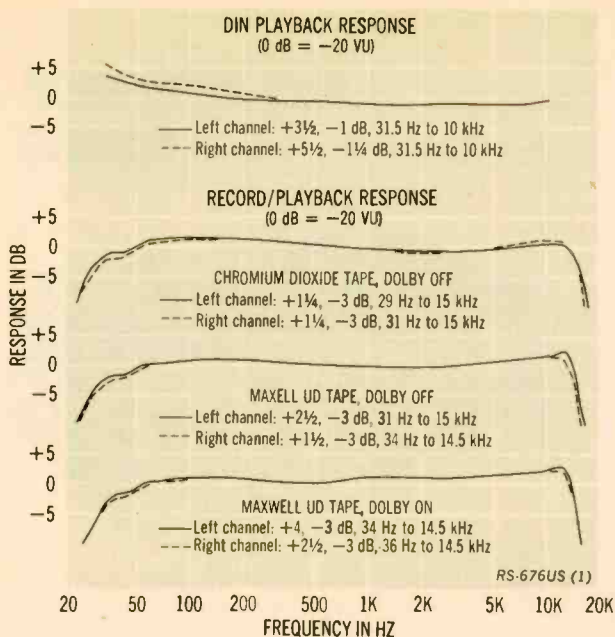
There are a tape counter and "memory rewind" switch just above the solenoid controls. Though they look familiar, their operation is unconventional. Set the counter to 000, turn on the memory switch, and the tape will return to the 000 point when you rewind; but instead of merely stopping, it automatically goes into the play mode. You can easily study a given passage on the tape by playing it over and over, or you can achieve instant playback of what you've just recorded by simply pressing rewind. If you want to stop the tape at 000 in the usual way, you can switch to pause during the rewind cycle and then press the stop button before releasing the pause.

To the right of the solenoid controls are three lever switches. The bottom one chooses either ferric ("normal") bias and equalization or that for chrome tapes. The lab tested the chrome position with TDK (though brand is not particularly critical) and, on Technics' recommendation, used Maxell UD with the ferric setting. UD is not among the tapes listed in the manual, however (BASF LH, Scotch High Density, TDK SD, and Sony HF are shown), and we judged TDK SD to be possibly a slightly better match on the basis of both listening and lab tests. When chrome cassettes with the extra key well for automatic chrome sensing are used, the RS-676 will override the front-panel switch, adjusting itself for chrome even if the switch is in the ferric position.

The other two lever switches, next to the counter, are for Dolby functions. One has positions for off, Dolby with FM-pilot filter, and Dolby without the filter; the other is an on/off switch for the "Dolby FM" mode. In this mode

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the input signal is fed directly (without decoding) to the recording head and through the Dolby circuit (for decoding) to the output jacks. The mode thus can be used to make Dolby-encoded cassettes from either Dolby broadcasts or other Dolby tapes while listening to the decoded output, or it can be used simply as a decoder for listening to Dolby-encoded signals derived from other, non-Dolby equipment. A pair of screwdriver adjustments for aligning Dolby-FM reference levels in each channel are on the front panel just below the large recording-level knob. Other wrinkles in this unusually comprehensive system will be described in due course.

The recording-level knob is, in effect, a master gain control that works in conjunction with several other controls. To its right is a smaller knob for channel balance. Thus balance can be preset and level adjustments or fades made with a single control—an easier route to good results, in our opinion, than the conventional paired sliders or dual-element knobs. Still farther to the right is a similar knob for input mode selection: mike only, line/mike mixing, and "tuner"/mike mixing. The mike level control is above the master level control and has a separate knob element for each channel.

The mike inputs are phone jacks below the balance control. A stereo headphone jack next to them is intended for low-impedance headsets. Nearby is the main power on/off switch.

The meters are calibrated with two scales. At the top is a conventional VU scale running up to +6 VU; the lower one has calibrations at 50% (-6 VU), 100% (0 VU), and Dolby reference level (+3 VU). The latter is used—with test signals broadcast by a Dolby-FM station or with a Dolby reference cassette in dubbing—to align the Dolby-FM screwdriver controls. The lab data show the calibration to be less than ideally exact. The meters' 0 VU measures approximately 3 dB below DIN reference 0 VU. Since Dolby reference level is about 2 dB below DIN 0 VU, it should be at about +1 (rather than +3) on the meters according to these measurements. The difference, though surprising, is not enough to cause serious audible mistracking of the Dolby circuit.

Below the meters is a peak/normal switch. In the nor-

Technics RS-676US Additional Data

Speed accuracy	0.1% fast at 105 VAC exact at 120 VAC 0.1% slow at 127 VAC
Wow and flutter	playback: 0.04% record/play: 0.06%
Rewind time (C-60 cassette)	66 sec.
Fast-forward time (same cassette)	66 sec.
S/N ratio (re 0 VU, Dolby off)	
playback	L ch: 55 dB R ch: 53 dB
record/play	L ch: 52 dB R ch: 51 dB
Erase (333 Hz at normal level)	67 dB
Crosstalk (at 333 Hz)	
record left, play right	39 dB
record right, play left	37 dB
Sensitivity (re DIN 0 VU)	
tuner input	L ch: 118 mV R ch: 103 mV
line input	L ch: 95 mV R ch: 85 mV
mike input	L ch: 0.4 mV R ch: 0.4 mV
Meter action (re DIN 0 VU)	
	L ch: 3/4 dB high R ch: 2 1/2 dB high
Total harmonic distortion (at -10 VU)	
L ch	<1.3%, 50 Hz to 10 kHz
R ch	<1.4%, 50 Hz to 10 kHz
IM distortion (record/play, -10 VU)	
L ch	6.0%
R ch	5.5%
Maximum output (re DIN 0 VU)	
L ch	0.90 V
R ch	0.82 V

mal position the meters have the characteristics of "true" VU meters, reading average signal values; the peak position will read all but the briefest of transients with a quick-rise, slow-decay characteristic in the needle ballistics. Technics recommends that with preprocessed material (broadcasts and most disc recordings) the normal mode be used and the highest readings held to the 0-VU indication; with live recordings or others that may contain the kind of spiky transients usually removed in audio processing, the peak-reading mode is recommended, holding highest values to the +6 VU indication. This strikes us as an interesting, flexible, and eminently useful approach that, in our experience so far, is unique to the RS-676 among consumer units.

The back panel has three pairs of pin jacks. One is for the line outputs and has screwdriver level controls that can be set to match tape levels to other sources in your stereo system. The other two are marked "tuner" and "line" inputs. When the deck is switched to the Dolby FM mode, however, the tuner input automatically is selected no matter what position the front-panel selector switch is set to. For this reason, the tuner input (not line) is the normal one, and line is the equivalent of an aux for subsidiary use (perhaps non-Dolby tape dubbing, for example).

Next to the tuner input jacks is a 25/75-microsecond FM de-emphasis switch. This switch operates only in

the Dolby-FM mode and should be set to the time-constant supplied by your tuner. A conventional tuner would require the 75-microsecond setting, which would then compensate at the recorder for the difference between the Dolby broadcast's 25-microsecond pre-emphasis and the tuner's 75-microsecond de-emphasis. Since the 25-microsecond position is for tuners that already provide the correct time constant, it makes no change in the incoming signal and therefore must be used in copying Dolby cassettes via the Dolby-FM mode (that is without decoding and re-encoding). These points are badly covered in the manual, which is hardly up to the quality standards of the unit itself.

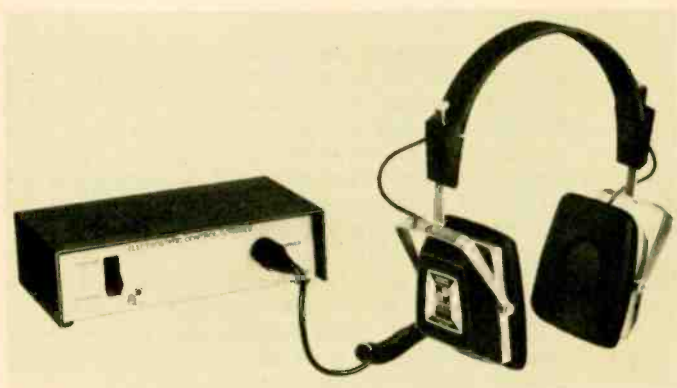
The back panel also has a multipin jack for a remote-control unit (Model RP-9275, \$34.95, which is not included with the unit and which we did not test) with a 17-foot cord and buttons for recording, play, and pause. In addition, there is a grounding connection that accepts bared wires or spade lugs. There are no user-accessible Dolby alignment controls other than those for

Dolby FM on the front panel.

The lab measurements suggest what in-use tests confirm: The RS-676 is an excellent unit that need make apologies to no competing model. Speed accuracy is exceptional; wow and flutter are extremely low. Distortion and noise are about average for a really fine deck, as are the response figures. The response curves do suggest that Dolby alignment is slightly off for the UD tape with which they were made; but, with a rise of less than 2 dB by comparison to the non-Dolby curves, the "shelving" attributable to the misalignment certainly is not serious.

The fine performance, the unusual and highly functional treatment of the recording controls, and the unusually comprehensive working-out of the Dolby FM mode make this an unusually interesting deck. If you want front loading and are ready for the \$460 price bracket, we know of no more exciting model you could consider.

CIRCLE 144 ON READER-SERVICE CARD



Superex Adds a Superb Electrostatic Headset

The Equipment: Superex Model PEP-79E, an electrostatic stereo headphone system consisting of PEP-74 headset and CC-79 control/energizer box. Dimensions of box: 7 by 2½ inches (front), 4 inches deep. Price: \$90. Warranty: one year parts and labor. Manufacturer: Superex Electronics Corp., 151 Ludlow St., Yonkers, N.Y. 10705.

Comment: Although it is by now commonplace to find headphones that sound as good as—or perhaps even better than—many speaker systems, it still is something of a discovery to unpack a new model, hook it up, put on some favorite tapes or records, and hear stereo sound that can be described only in superlatives. So it is with the new Superex PEP-79E, an electrostatic stereo headset that is sold together with a small junction-and-control box.

The box must be connected to the speaker terminals of the power amplifier in your stereo system. Ordinary zip cord (the kind used for AC extensions) is appropriate. The lines to the speakers then are reconnected to appropriate terminals on the box. The headset is plugged into the box via a special connector on its coiled cord. A switch on the box lets you select either headphones or speakers.

Note that this particular headset—like most other electrostatics—cannot be connected into the familiar front-panel headphone jack found on receivers and tape decks. It must be driven from a power-amp output stage capable of supplying at least 5 watts. The control

box has no AC power cord. A portion of the audio signal, stepped up by circuitry inside the box, is used as the energizing voltage needed by the electrostatic elements.

All of the "electronics" is in the control box; the headset itself, which has extremely lightweight metallized Mylar diaphragms, weighs just under 10 ounces (less cord). This light weight, combined with the cushioned adjustable headband and soft surround earpieces, makes for a very comfortable headset. The cord itself may be uncoiled to a length of over 14 feet without strain. Since the length of the lines from amplifier to control box is not critical, the distance you care to put between yourself and your components while wearing the headphones can be considerably greater than with conventional models.

The control box, finished in wood-grain vinyl over metal, is neat and unobtrusive. The back contains the terminal strips for leads from the amplifier and to the speakers (screw connectors that accept stripped leads or spade lugs); the front has only the headset-cord socket and speaker/phones selector switch. Control of volume, tone, and so on are made at the stereo system, as they would be for speaker listening.

The headphones themselves are a modified rectangle in shape with rounded corners. They are, in a manner of speaking, rather stylish. They do not provide complete acoustic isolation, yet with a signal present at normal listening level they block out all but the shrillest of environmental sounds. More important, in our view,

the lack of a conventionally tight seal has no deleterious effect on bass response, which is full, clean, and very solid.

Indeed the response of this headphone system strikes us as excellent from top to bottom of the audible range. We checked the PEP-79E with discrete frequency test tones and with sweep tones and found it to be remarkably smooth and linear from below 30 Hz to beyond 15 kHz. There were no significant peaks or dips and very few insignificant ones. We could not get the phones to rasp, buzz, or commit other forms of sonic mayhem even when driving them at ridiculously loud levels. The treble range has a wonderfully smooth and open quality; the low end holds up firmly with no audible doubling effects. White noise response is smooth and

uncolored, transient response superbly crisp and well defined.

The headset's dynamic range covers at least a 60-dB span, which is about the limit found on modern recordings, and everything is reproduced so cleanly that there is no loss of musical information from thundering crescendos to whispered pianissimos. Stereo imaging is excellent; voices sound utterly natural; ensemble balance and internal detailing are unimpeachable. The headset also is quite efficient by contrast to speakers, producing what psychoacoustically could be termed "room-filling sound" with only modest amplifier gain.

We cannot remember testing any headphones that sounded better.

CIRCLE 143 ON READER-SERVICE CARD

Top-of-the-Line Manual from Pioneer



The Equipment: Pioneer PL-71, a two-speed (33 and 45 rpm) turntable with integral arm, supplied on wooden base with hinged cover. Dimensions: 18 $\frac{1}{2}$ by 16 $\frac{1}{2}$ inches; 7 $\frac{1}{4}$ inches high with cover closed, about 17 $\frac{1}{2}$ inches fully open. Price: \$299.95. Warranty: one year parts and labor. Manufacturer: Pioneer Electronic Corp., Japan; U.S. distributor: U.S. Pioneer Electronics Corp. (Pioneer High Fidelity), 75 Oxford Dr., Moonachie, N.J. 07074.

Comment: The PL-71, Pioneer's top-of-the-line turntable, ranks among the very best of any HF has yet tested. A two-speed (33 and 45 rpm) single-play manual, it is a direct-drive type with an electronically controlled DC servo motor. Virtues claimed—and verified in lab tests—for this system include low wow and flutter, low rumble, and excellent speed accuracy and stability (independent, actually, of changes in supply voltage). The turntable is fitted with an integral tone arm and has a handsome walnut base and a sturdy hinged dust cover. The low-capacitance signal cables could be used satisfactorily for CD-4 pickups if desired.

The impression one gets from just looking at the PL-71, and then handling its adjustments and controls, is one of all-out, no-compromise professionalism in design and workmanship. CBS Labs' test data and our use

of the unit reinforce this impression. Speed accuracy is absolute, with no variations measured at either speed setting regardless of changes in line voltage. Once the fine-speed adjustment has been set, it stays set. There is a separate adjustment for each speed to be used in conjunction with the strobe markings along the turntable's rim, which are illuminated by a built-in lamp at the front left corner of the base. The lab reported the actual range of variation as +4.2 to -3.2% at 45 rpm, +3.7 to -3.0% at 33 rpm. Weighted (ANSI/IEEE) peak flutter readings at 33 rpm were 0.06% average and 0.10% maximum. Total audible rumble (ARLL) was -63.5 dB. These are of course excellent figures—among the best measured on any turntable.

The platter itself, covered with a ridged rubber mat, weighs a little over 3 lbs. and has very fast startup time. To start rotation you press the 33 or the 45 button, either of which will turn on the AC power; to stop it you press the "power off" button.

The manual cueing is aided by an ample-size finger lift and a built-in cueing system, which works smoothly and with no side-drift.

The S-shape tubular arm carries a removable lightweight head. Adjustments are provided for stylus overhang, arm height, longitudinal balance, lateral balance (via an ingenious outrigger device) VTF, and, of course, antiskating—via a convenient knob whose scale is coordinated with the VTF scale. The latter proves extremely accurate, showing on-the-nose values when checked against a laboratory gauge for settings of 0.5, 1.0, 1.5, and 2.0 grams. It measured a minute 0.1 gram low for the 2.5-gram setting. Tested with our standard Shure V-15 (Type II Improved) pickup, the arm showed a 4-dB rise at 7.5 Hz, a very low resonance indeed. Arm friction, laterally and vertically, was too low to be measured.

The silence and precision with which the PL-71 handles records are due not only to its sophisticated motor and drive system and its beautifully designed and crafted tone arm, but also in part to the shock absorbers built into the four sturdy feet under the base. Another plus is the fact that the PL-71 will operate on either 50- or 60-Hz supply line frequencies. All told, this is a turntable for use in the finest of playback systems—stereo or four-channel—and by the fussiest of record collectors.

CIRCLE 142 ON READER-SERVICE CARD

A Super-Preamp from Accuphase



The Equipment: Accuphase Model C-200, a stereo control preamp in metal case. Dimensions: 17½ by 6 inches (front panel); 14 inches deep plus allowance for controls and connections. Price: \$600; accessory walnut case, Model AWC-1, \$45. Warranty: five years parts and service, shipping paid one way. Manufacturer: Kensonic Laboratory, Inc., Japan; U.S. distributor: Teac Corp. of America, 7733 Telegraph Rd., Montebello, Calif. 90640.

Comment: Last month we reviewed the P-300 basic amplifier, the companion-piece to the C-200. (There also is a matching FM/AM tuner, the Model T-100, \$650.) We said then that in reviewing the preamp we would comment in more detail on Teac's claim that the two units are so good that each can be heard at its best only in conjunction with the other.

This is a difficult contention to prove—or to disprove. If you move in audiophile circles, you've no doubt heard its like before. To the novice, struggling to determine unequivocally why one speaker is considered better than another, the claim is meaningless since the quantitative difference between one fine piece of electronics and another is minute by comparison to that between competing loudspeakers. So to say that you *can* hear the difference between the C-200 and other fine preamps would, in our opinion, be misleading to the majority of our readers—though we have no doubt that some *will* hear it.

The C-200's sound is utterly open and clean. We could find no sonic grounds on which to fault the unit; it is, in a word, superb. It also is expensive and complex. If these factors leave you undaunted and you're after great sound, we don't see how you could do better than this preamp—either singly or in combination with the P-300.

Let's begin our description with the back panel, which must be understood before the front-panel controls will make much sense. Each pin-jack pair for the two phono inputs has a grounding post and a pair (left and right channels) of sensitivity controls. High-level inputs include pin-jack pairs for tuner, aux 1, and aux 2; and there are input and output pairs for tape 1 and tape 2. Outputs—also pin jacks—are provided for left, right, and mono, the last appropriate for a center-fill speaker, if you want one, or for a remote mono system (with its own amplifier) in, say, the kitchen.

There are seven convenience AC outlets, one unswitched. Another, intended for the power amplifier, has its own front-panel switch but also is switched by the C-200's own AC button; that is, the amp will turn off when you switch off the C-200 but can also be turned off independently from the preamp's front panel. The remaining five receptacles, switched only by the C-200's main AC control, are marked for turntables 1 and 2, tape

decks 1 and 2, and tuner. Some users may prefer non-switched outlets for turntables and even, unless they are solenoid-operated, tape decks; but there's no reason you *must* use these outlets as marked of course.

There also is a special "speaker control" jack on the back panel. It is designed to accept a relay system (available on special order) that can be wired into the speaker leads from the power amp and that will interrupt the power feed on command from the C-200's front panel.

At the bottom of the front panel is a black trim strip that hinges down to give access to the more esoteric features. As in the P-300 power amp, the main AC switch protrudes through an opening so that it is accessible whether the strip is open or shut. Next to it is the switch for the back-panel power-amp AC outlet. There is a stereo headphone jack, followed by pin jacks for an accessory output (which parallel the left- and right-channel outputs on the back panel), tape input and output (which are, in effect, a tape-3 set of connections since they don't parallel the two sets on the back panel), and an aux input (again, in effect, aux 3). To the right of these inputs are a disc-1 impedance switch and a "low-enhance" switch for discs. The impedances offered are 30,000 ohms (appropriate for matching transformers used with some moving-coil cartridges), 47,000 ohms (standard for stereo magnetic cartridges), and 100,000 ohms (for CD-4 cartridges). The "enhance" switch gives a very subtle lift to the bass response with either disc input; measured values are close to the ratings (at 100 Hz) of 1 dB and ½ dB for the two boost positions, while the "0" position yields a very flat RIAA curve indeed. At the extreme right of the hidden panel are phone jacks for left and right mike inputs.

At the left of the main (upper) portion of the front panel are four tone-control knobs: separate bass and treble for each channel. Among the switches at the lower-center portion of this panel is one for tone defeat, one to switch bass turnover between 200 and 400 Hz, and one to switch treble turnover between 5 and 2.5 kHz. As measured at CBS Labs these frequencies represent (for maximum tone-control rotation) the ±3-dB points in the bass and the +2, -3-dB points in the treble. There are three filter buttons as well—subsonic, low, and high—and one for loudness compensation.

The volume and balance knobs are above the push-button array. The volume control becomes a loudness control when the compensation switch is pushed, of course, and the actual degree of compensation bears a fixed relationship to volume-control rotation (as it does in almost all receivers). When the preamp is used with the P-300 amp, however, the level controls on the amp can be set to give somewhat more level than you ever will want with full preamp gain, and the loudness action will then be tailored to the actual operation of your sys-

tem. If you're using only a portion of the available power (say, with fairly efficient speakers) this way of adjusting the system will prevent the common anomaly of conventional loudness controls: excessive "compensation" at high volume settings.

Also in the pushbutton array are two for use with the speaker relay box mentioned earlier; one controls the main speakers, the other the remote units.

The remaining four knobs control inputs and modes. The main mode switch has positions for stereo, reverse stereo, and three mono modes (L, R, and L + R) each feeding both output channels identically from the selected input(s). The main selector knob has five positions for back-panel inputs (disc 1 and 2, tuner, aux 1 and 2) and two for front-panel inputs (mike and the extra aux). The tape monitor switch has positions for source, tape 1, tape 2, and the front-panel tape input. And the tape-copy knob will select tape 1 to tape 2, tape 2 to tape 1, and off.

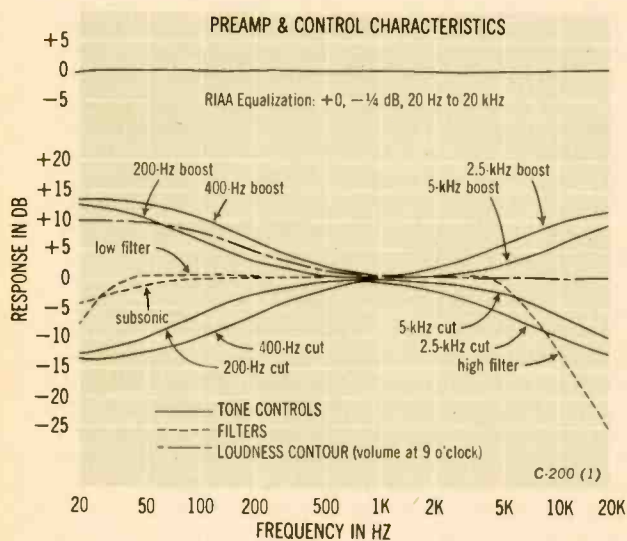
Actually, however, the inputs and outputs of up to four tape units can be used with the C-200, and the capabilities of each will depend on the connections used. In addition to the back-panel jacks there are the front-panel tape jacks plus the front-panel output and aux input. The decks connected at the back panel will be able to record from any input and will permit dubbing from one to the other (even while you are listening to a different program via the "source" selector) and will permit simultaneous playback monitoring from either deck (as long as it has the feature) in any of these uses. The front-panel tape jacks will allow dubbing from any of the other three, with simultaneous monitoring, but not dubbing to the others from the front-connected deck. Using the output/aux connections you can record from any

source or dub to or from any of the other decks, using the tone controls and filters, if you wish, to equalize the signal you are recording—though of course none of this can be done while you are listening to another source and you cannot monitor from the tape as you record it. (This is not the only use for the front-panel output connections. The owner's manual suggests their use to A/B power amplifiers, but we consider the tape-recording-with-equalization option to have broader practical application.)

The preamp, in short, offers an extremely broad range of possibilities. It also performs superbly, as CBS Labs' test data show. The clipping point is above 12 volts—far more than any normal signal source will ever feed to the unit—and the distortion is at or below 0.02% in every measurement that the lab made. Note that the *least* impressive noise measurements (about 65 dB for the disc inputs or the mike) are measured for a sensitivity of 2 millivolts (for 2 volts' output); with heftier input signals even these good S/N measurements will be improved in practice, because the signal is increased while the noise is not. While there are a few units with better S/N measurements, those of the C-200 exceed the dynamic range to be expected in any input signal. And of course linearity is excellent; the RIAA response varies from flat by only about 1/4 dB, while over-all response shows a departure of only about 1/8 dB between 20 Hz and 20 kHz.

In sum, the C-200 is an altogether fitting companion for the P-300 and is, in fact, a top-notch preamp for any stereo system. And when its performance and control flexibility are added to the five-year warranty and Teac's guaranteed specifications, the total picture is seductive indeed.

CIRCLE 146 ON READER-SERVICE CARD



Square-wave response

Accuphase C-200 Preamp Additional Data

Output at clipping, channels individually
 L ch 12.2 volts for 0.014% THD
 R ch 12.9 volts for 0.020% THD

Output at clipping, channels simultaneously
 L ch 12.2 volts for 0.014% THD
 R ch 12.9 volts for 0.020% THD

Input characteristics (for 2 volts' output)		
	Sensitivity	S/N ratio
disc 1, 2	2.0 to 6.5 mV*	65 to 72 dB*
mike	2.08 mV	64 1/2 dB
tuner	200 mV	86 dB
aux 1, 2	200 mV	86 dB
aux, front	200 mV	86 dB
tape 1, 2	203 mV	85 1/2 dB
tape, front	203 mV	85 1/2 dB

Harmonic distortion (2 V output)
 L ch <0.019%, 20 Hz to 20 kHz
 R ch <0.020%, 20 Hz to 20 kHz

IM distortion (2 V output) 0.002%

Frequency response
 +0, -1/4 dB, 20 Hz to 20 kHz
 +0, -1/2 dB, 10 Hz to 40 kHz
 +0, -3 dB, below 10 Hz to above 100 kHz

RIAA equalization accuracy
 +0, -1/4 dB, 20 Hz to 20 kHz

*First figure measured with input-level control at maximum, second with control at minimum.



A "Budget" Tandberg—With Dolby

The Equipment: Tandberg Model 3641XD, a three-speed (7½, 3¼, and 1½ ips) stereo open-reel deck with Dolby B noise reduction, in metal case with wood ends. Dimensions: 15¾ by 16¾ inches (front), 5¾ inches deep plus allowance for feet, connecting cables, and controls; can be used vertically or horizontally. Price: \$599.50. Warranty: two years parts and labor. Manufacturer: Tandbergs Radiofabrikk, Norway; U.S. distributor: Tandberg of America, Inc., Labriola Ct., Armonk, N.Y. 10504.

Comment: The "Tandberg 3600XD" specifies a series of recorders, all of which have crossfield bias head (X) and Dolby (D). There are several models; we chose the quarter-track stereo-deck version (Model 3641XD) as the one of overriding interest to American readers—who doubtless will refer to it as we generally do, by the series number, just as they have on past Tandbergs.

It is a "budget" model in the sense that, in Tandberg's words, it "is the only stereo tape deck in its price range to combine [the] Cross-Field recording technique [with] Dolby B." It also includes a number of other important features from Tandberg's more expensive decks: the peak-reading metering system about which we have waxed enthusiastic in the past, the automatic mixing of left and right inputs for mono recording (a big flexibility plus, assuming you *do* mono recording), and the excellent performance—even at the "low-fi" speed (for open-reel decks, though not in cassette equipment) of 1½ ips. Thus \$600, while by no means cheap, is a modest price for all that the model offers.

The transport system is not the solenoid type, like that in the Model 9000X (HF test reports, October 1973), but is completely mechanical and built around the joystick control that has been used by Tandberg for a generation. The center position is "off"; it applies the reel brakes and releases the capstan drive. The up position ("free"), with the deck sitting vertically, releases the reel brakes as well for easy threading. The left and right positions are, respectively, for rewind and fast forward. The down position engages the tape with the heads and capstan for playback or recording. In addition there is a start/stop lever switch protruding from the lower head cover. It is used in recording or playback as a pause

control; its "stop" position retracts the pinch roller slightly from the capstan without otherwise altering head switching or tape alignment.

With both head covers removed the relatively complex tape path can be studied. After passing the left-hand guide and a photoelectric tape sensor it goes through what looks like a pressure-pad assembly—actually a tape-backing cleaning pad to prevent debris on the tape from fouling the crossfield bias head. Then it passes the erase head and a second guide before coming to the recording-head assembly, consisting of the recording head proper (which carries only the signal to be recorded) above the tape and the crossfield head (which carries AC bias only) below it. Following another guide and an idler is the playback head, with a hum shield opposite it, below the tape; then another guide and the capstan/pinch-roller assembly and a final guide.

The photoelectric system (whose lamp, incidentally, doubles as the on/off pilot) will stop the motor whenever light reaches the sensor—because of a mis-threaded tape, because the tape has broken or run through, or because clear leader has been used—but it will not disengage the drive system. The hum shield near the playback head complicates but does not prevent marking the tape for physical editing; the pause control allows "rocking" the tape to find a precise cue. Physical editing thus is possible on the 3600, though it isn't as easy as the owner's manual implies.

The reel spindles have twist-to-lock finials that hold the reels in place even in the vertical operation. Between the reels is a speed-selector lever; to their right is a four-digit counter. The remaining controls are similar to those on the 9000X series: paired sliders for input and output levels, separate push-push recording-interlock and tape/source buttons in each channel, and a three-position switch for sound-on-sound or (mono) tape-echo operation. The input sliders control *both* mike and line signals; if you want only one source, you must make sure that the other is disconnected or, at least, that it carries no signal. The mike inputs are front-panel phone jacks. There is a stereo headphone jack on the front panel and a choice of pin or DIN line connections on the back.

The Dolby control on the front panel has positions for off, normal, filter, and Dolby FM. The latter position turns off the Dolby circuit in the recording amp while retaining that in the playback side and allows you to listen to the decoded broadcast while (if you wish) recording it without decoding. For this purpose the station's Dolby alignment tone is set to the 50% modulation mark (-6 VU) on the 3600's meters. The normal and filter positions both switch in the Dolby circuitry of recording and playback (encoding and decoding) modes, the filter being, of course, a 19-kHz pilot suppressor for use in taping (non-Dolby) broadcasts from FM. All positions but "off" light a pilot near the switch. There are no user-accessible Dolby alignment controls on the deck.

Since Tandberg uses its peak-reading meters in the 3600, their calibration is totally different from that of conventional metering systems. The "meter action" figures (see Additional Data) of 14½ and 12 dB low therefore represent the way in which Tandberg uses the tape's available headroom. "Standard" (NAB) 0 VU is well below overload, leaving a "pad" to absorb transients too brief to register on the meters; Tandberg's 0 VU calibration is near the overload point, since even very brief transients are displayed by the meters and can be "positioned" (via the recording level controls) at

or below this point, making maximum use of the tape's total dynamic range.

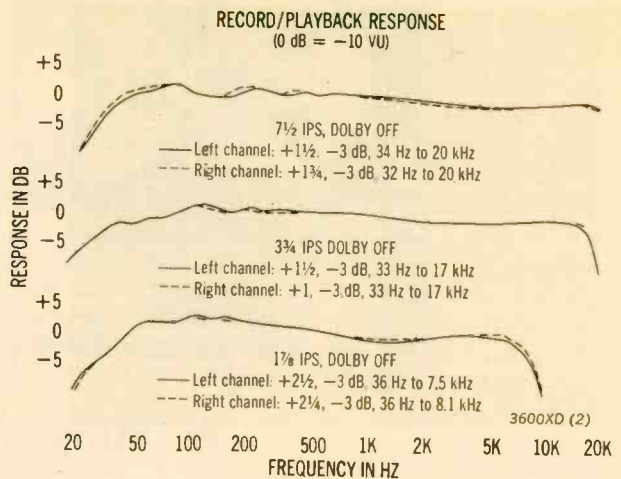
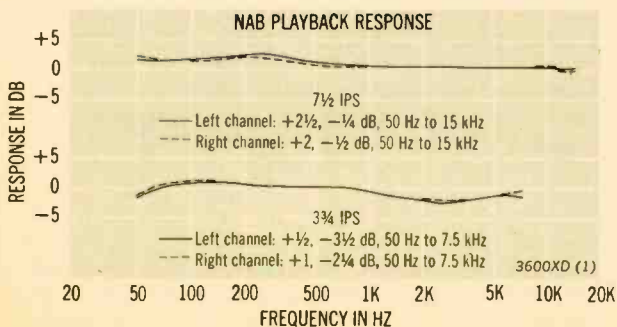
Unlike the meters in the 9000, these do not read playback values; they light up and display signal values only for source signals and only when the transport is in the recording mode (achieved by pressing a red recording button at the left of the head cover and putting the transport control at the right into the record/play position). If the recording selector buttons for either or both channels are then switched off, the meter for the appropriate channel(s) will stop functioning, though recording can be reactivated in either or both by pressing these buttons once again, as long as the transport has not been turned off in the meantime. Thus to preset levels you must press the appropriate channel selector(s), put the pause lever to "stop," and engage the drive in the recording mode. To begin recording, you release the pause lever.

The lab data and the listening tests were all made with Maxell UD tape, though Tandberg says Scotch Classic and TDK Audua will give similar results. However, the manual warns that, if you should use other low-noise high-output tapes, it is best to keep peak levels about 2½ dB below the meters' 0 VU indication because these tapes may not provide as much headroom as the three already mentioned. For a fuller explanation of the meters and their influence on both S/N ratios (which can, in practice, be better than those shown—with respect to NAB 0 VU—under Additional Data) and harmonic distortion (which are influenced by noise to some extent at -10 VU), see the October 1973 report on the 9000X.

Both on the bench and in the listening room we found the performance to be very fine indeed. Even at 1½ ips we were able to record from a reasonably good FM signal (using the Dolby circuitry) with no audible increase in noise and only the barest loss in "bloom" at the high end. It took better signals than we could find on FM to demonstrate the superiority of 7½ ips over 3¾ as captured and reproduced by the Tandberg. The excellence of the lab's response and distortion data at these speeds readily demonstrates why this was so.

We did miss the "feel" and mechanical adroitness of the Model 9000X (which, even without Dolby, is a more expensive deck), but for home purposes we could find nothing in the 3600's technical performance to complain of. This is not to be wondered at since its audio electronics (as opposed to the 9000's transport-logic electronics) seem to be based on the earlier model. So if you can live without remote controls, automatic recording (with a timer), and the like, the 3600XD will give you much of the 9000's quality at a considerable saving.

CIRCLE 145 ON READER-SERVICE CARD



Tandberg 3600XD Additional Data

Speed accuracy		
7½ ips	1.8% slow at 105 VAC	
	0.9% slow at 120 VAC	
	0.7% slow at 127 VAC	
3¾ ips	0.9% slow at 105 VAC	
	0.3% slow at 120 VAC	
	0.07% slow at 127 VAC	
1½ ips	0.9% slow at 105 VAC	
	0.5% slow at 120 VAC	
	0.3% slow at 127 VAC	
Wow and flutter (ANSI weighted)		
7½ ips	playback: 0.03%	
	record/play: 0.04%	
3¾ ips	playback: 0.05%	
	record/play: 0.06%	
1½ ips	record/play: 0.10%	
Rewind time, 7-in., 1,800-ft. reel		109 sec.
Fast-forward time, same reel		112 sec.
S/N ratio (re NAB 0 VU; Dolby off)		
playback	L ch: 57½ dB	R ch: 57½ dB
record/play	L ch: 54½ dB	R ch: 55 dB
Erasure (400 Hz at normal level)		73 dB
Crosstalk (at 400 Hz)		
record left, play right		48 dB
record right, play left		58 dB
Sensitivity (re NAB 0 VU)		
line input	L ch: 29 mV	R ch: 37 mV
mike input	L ch: 0.12 mV	R ch: 0.13 mV
Meter action (re NAB 0 VU)		
	L ch: 14½ dB low	R ch: 12 dB low
Total harmonic distortion (at -10 VU)		
7½ ips	<1.6%, 50 Hz to 10 kHz	
3¾ ips	<1.8%, 50 Hz to 10 kHz	
1½ ips	<2.4%, 50 Hz to 5 kHz	
IM distortion (record/play, -10 VU)		
7½ ips	L ch: 1.6%	R ch: 2.2%
3¾ ips	L ch: 2.4%	R ch: 3.5%
1½ ips	L ch: 3.8%	R ch: 5.5%
Maximum output (line, 0 VU)		
	L ch: 580 mV	R ch: 620 mV