

OCTOBER 1969

TAPE

RECORDING MAGAZINE

2'6

**1969 INTERNATIONAL
AUDIO & PHOTO-CINE
FAIRS
PRODUCT PREVIEW**

*Electronic
Composition in
Project Alpha*

Review—Akai 4000D

**CROSS TALK
NATURE NOTES
MUSIC REVIEWS
Etc., Etc.**

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SIZE	STANDARD	LONG	DOUBLE	TRIPLE
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2½"		200' - 5/9d.	300' 8/9d.	
3"	150' - 4/9d.	225' - 6/3d.	300' 8/9d.	450' - 13/9d.
4"		450' - 12/-	600' 18/-	900' - 27/-
5"	600' - 15/-	900' - 18/6d.	1200' 28/6d.	1800' - 45/-
5½"	900' - 18/6d.	1200' - 22/6d.	1800' 36/-	2400' - 57 6d.
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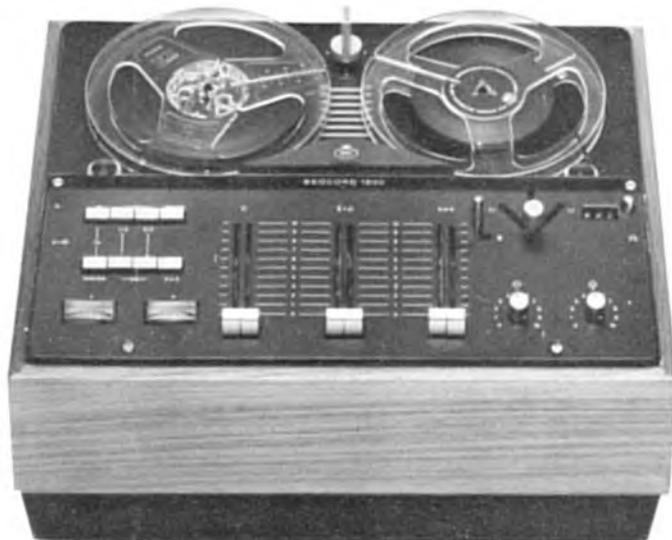
167, Finchley Road, Swiss Cottage, London, N.W.3. England. (01-624 8164/5)



A brilliant new stereo tape deck -the Beocord 1800

Made by Bang & Olufsen for those who consider design and quality before price.

Designed especially for use in conjunction with a high fidelity amplifier such as the Beomaster 1400 or Beolab, this new tape deck from B & O has an impressive specification. Available in twin or 4 track and finished in either teak or rosewood. The twin track model has an additional switched 4 track stereo head for the playback of pre-recorded 4 track tapes.



Specification (Exceeding the DIN 45.500 requirements)

FREQUENCY RESPONSE:
 $7\frac{1}{2}$ " per sec. 20-20,000 Hz
 (± 2 dB 30-18,000Hz). DIN 45.500.
 $3\frac{3}{4}$ " per sec. 20-15,000 Hz
 (± 2 dB 30-13,000 Hz) DIN 45.500.
 $1\frac{7}{8}$ " per sec. 30-7500 Hz
 (± 2 dB 40-6000 Hz). DIN 45.500.

EQUALIZATION: DIN 45.513
 1966-67 -NAB 1965.

SIGNAL TO NOISE RATIO:
 achieved without the use of special low noise tapes
 >60 dB for $\frac{1}{2}$ track version
 ($\frac{1}{4}$ track version >57 dB)
 unweighted (DIN 45.405)

CHANNEL SEPARATION:
 Mono: >60 dB at 1000 Hz
 Stereo: >55 dB at 1000 Hz

TAPE HEADS: specially developed hyperbolically ground.
 Two track machine: 2t erase, 2t record, 2t replay, 4t replay.
 Four track machine: 4t erase, 4t record, 4t replay.

WOW AND FLUTTER: (Measured according to DIN 45.506)
 $7\frac{1}{2}$ " per/sec RMS Value <0.07%.
 $3\frac{3}{4}$ " per/sec RMS Value <0.11%.
 $1\frac{7}{8}$ " per/sec RMS Value <0.18%.

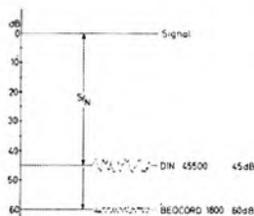
EXTERNAL CONNECTIONS: Inputs to three Channel stereo mixer for microphone, radio/gramophone and line. Outputs for headphone, line and radio.

SPECIAL FACILITIES INCLUDE:
 Fast acting thyristor controlled auto stop.

Three channel stereo mixer with split controls on each channel (6 inputs)
 Separate headphone volume controls
 Tape slack absorbers.
 Push button selection of: A-B monitoring, sound on sound, echo, synchro play, mono left, mono right, mixed mono & stereo play.



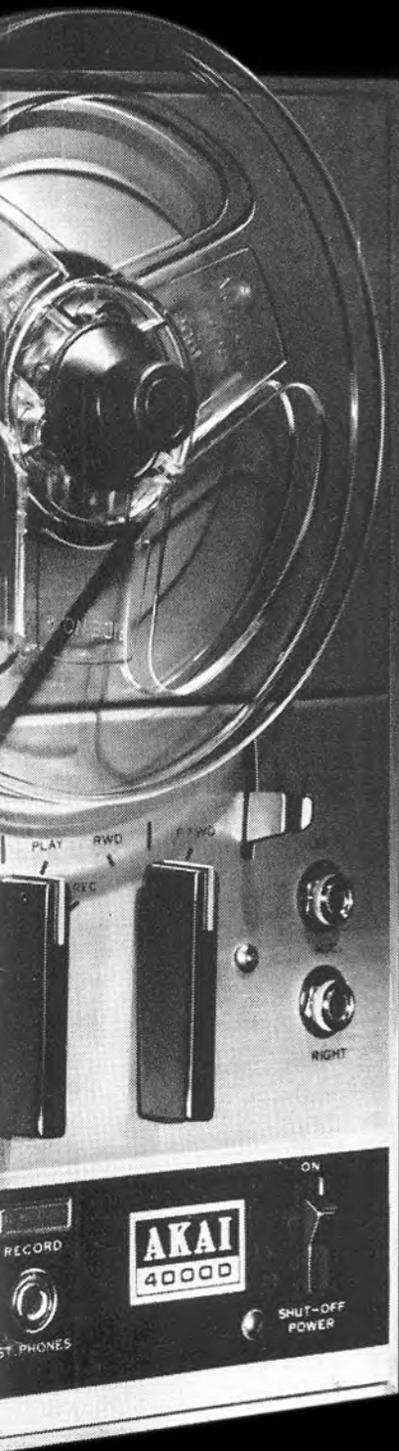
Wide Frequency Response
 $7\frac{1}{2}$ " sec: 20-20,000 Hz.



Signal to noise ratio
 60 dB on twin track version, 57 dB on 4 track. Results obtained without using special 'low noise' tapes.



Tape head bridge
 Provides gentle tape handling with minimum wear to tape and tape heads (Tape heads are hyperbolic with a smaller contact face and a higher powered magnetic field for less noise)



Introducing the Akai 4000D with new one-micron head.

Result: Another 2000Hz at 3 $\frac{3}{4}$ I.P.S.

This impressive increase in frequency response from 14000Hz at 3 $\frac{3}{4}$ i.p.s. on the previous 3000D model to 16000.Hz on the new 4000D is a direct result of the new one micron gap head.

Of the 3000D, the reviewers in the March

68 edition of Tape Recording Magazine said: 'It can claim to achieve a standard of technical performance far in excess of that indicated by its price.'

All of which makes the new Akai 4000D even better value at

£87.10.0 (recommended), and almost certainly the best tape deck in Britain for under £100. And don't forget the 4000D is just one of Akai's range—the most comprehensive range of tape recorders in Britain.

PERFORMANCE SPECIFICATIONS

TAPE SPEED	2 speeds... 3.3/4 and 7.1/2 ips
WOW AND FLUTTER	Less than 0.15% RMS at 7.1/2 ips Less than .20% RMS at 3.3/4 ips
FREQUENCY RESPONSE	30 to 22,000 Hz \pm 3db at 7.1/2 ips 30 to 16,000 Hz \pm 3db at 3.3/4 ips
SIGNAL TO NOISE RATIO	Better than 50db
LEVEL INDICATOR	2 VU meters
RECORDING SYSTEM	4 track stereo/monaural system
FORWARD/REWIND TIME	150 seconds using 1,200 foot tape at 50 cycles

SPECIAL FEATURE
3 heads for off-the-tape monitoring. Plus sound-on-sound recording.

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People who appreciate a fine sound more often than not come to Philips.

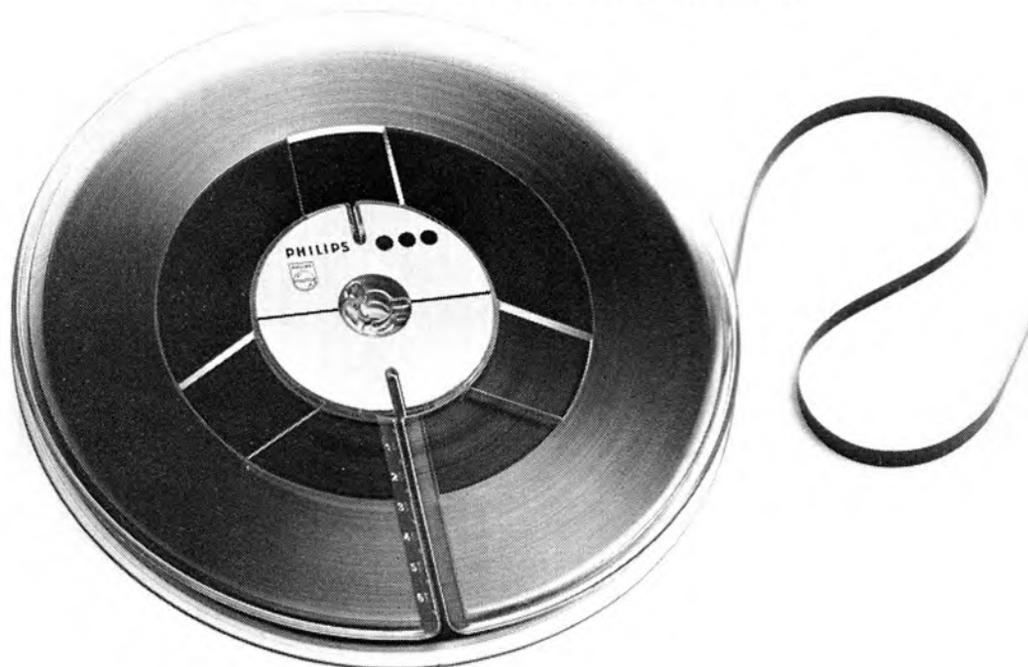
Not so bold a claim when you think about it.

Consider Philips' experience in sound reproduction.

Years and years of it. Consider the research they've done in the field. And what that research has produced in the way of new sound techniques and equipment.

So if you want the best in tapes, get Philips. Sound thinkers usually do.

And what goes for tapes, goes for recorders too.



PHILIPS ELECTRICAL LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2.

New Tandberg 1600X stereo tape deck

4 tracks. Frequency response: 40-18,000; 40-14,000; 40-8,000 cycles \pm 2dB at $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. respectively. Signal-to-noise ratio better than -55dB -53dB and -52dB at $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. respectively. Wow and flutter less than 1 R.M.S., -15 R.M.S. and, 35 R.M.S. at $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. respectively. Cross talk better than -60dB. +9v output per channel. Teak cabinet. £89.10.0

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Vortexion

This is a high fidelity amplifier (0.3% intermodulation distortion) using the circuit of our 100% reliable – 100 Watt Amplifier (no failures to date) with its elaborate protection against short and overload, etc. To this is allied our latest development of F.E.T. Mixer amplifier, again fully protected against overload and completely free from radio break-through. The mixer is arranged for 3-30/60Ω balanced line microphones, and a high impedance line or gram input followed by bass and treble controls. 100 volt balanced line output.

THE VORTEXION 50/70 WATT ALL SILICON AMPLIFIER WITH BUILT-IN 4 WAY MIXER USING F.E.T.s.



Size 14" × 11½" × 4½"
100uV on 30/60 ohm mic. input.
100mV to 100 volts on gram/auxiliary
input 100KΩ.

Weight 20lb.

100 WATT ALL SILICON AMPLIFIER. A high quality amplifier with 8 ohms-15 ohms and 100 volt line output for A.C. Mains. Protection is given for short and open circuit output over driving and over temperature. Input 0.4v on 100K ohms.

100 WATT MIXER AMPLIFIER. with specifications above is here combined with a 4-channel F.E.T. mixer, 1 gram, 1 tape and 2 mic. inputs with tone controls and mounted in a standard robust stove enamelled steel case. A stabilised voltage supply feeds the tone controls and pre amps, compensating for a mains voltage drop of over 25% and the output transistor biasing compensates for a wide range of voltage and temperature. Also available in rack panel form.

200 WATT AMPLIFIER. Can deliver its full audio power at any frequency in the range of 30 c/s-20Kc/s ± 1db. Less than 0.2% distortion at 1 Kc/s. Can be used to drive mechanical devices for which power is over 120 watt on continuous sine wave. Input 1 mW 600 ohms. Output 100-120v or 200-240v. Additional matching transformers for other impedances are available.

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Models available with 1 gram and 2 low mic. inputs. 1 gram and 3 low mic. inputs or 4 low mic. inputs.

20/30 WATT MIXER AMPLIFIER. High fidelity all silicon model with F.E.T. input stages to reduce intermodulation distortion to a fraction of normal transistor input circuits. The response is level 20 to 20,000 cps within 2 db and over 30 times damping factor. At 20 watts output there is less than 0.2% intermodulation even over the microphone stage at full gain with the treble and bass controls set level. Standard model 1-low mic. balanced input and Hi Z gram.

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<p>Other models and a full range of stands, reflectors, windshields and accessories available</p> <p>All microphones are manufactured in a special section of our works, under strictly controlled conditions with stringent test and inspection at every stage. Each and every microphone is individually tested both aurally and on Bruel & Kjoer visual and graphic recording test equipment for conformity to a prescribed performance.</p>	

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TAPE

RECORDING
MAGAZINE

Incorporating TAPE RECORDING & HI-FI MAGAZINE
and STEREO SOUND MAGAZINE

Vol. 13

No. 10

October 1969

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COVER PHOTOGRAPH: *There should be no trouble identifying the machine that our friendly cat is busy admiring. Obviously it is the brilliant Tandberg Series 11 battery portable. But who does it belong to? Answer—it could be YOU. This is the top-grade professional machine being offered as a prize in the 3M Wildlife Sound Recording Contest. Rules and entry forms are now available from W. R. Bowles, 3M Co. Ltd., 3M House, Wigmore Street, London, W1A 1ET. Apply now and take part in this great contest. Much as our cat, Brandy, loves the tape recorder, he won't really miss it too much and you could certainly put it to better use. One thing is certain—if you don't enter the contest you don't stand a chance, and to check on what you will be missing read the review of this model in our issue dated October 1968. You'll then understand why Brandy (who knows a good thing when he sees it) is being so affectionate!*

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R. DOUGLAS BROWN**

**Editor,
DENYS G. KILLICK**

Advertisement Manager, VIVIENNE GOODING

Tape trends and tape talk

By Douglas Brown

SO WE ARE TO HAVE a chain of 40 local BBC radio stations. Perhaps; if the necessary act of creation can be performed before there is a general election and a new government decides that local commercial stations would be preferable.

For my part, I favour the BBC. A couple of years ago I spent several days driving in the United States, a large part of the time with the car radio switched on. As one local radio station faded out, with my progress along the turnpikes, another came in. And all of them, in endless succession, were appalling . . . to my taste. Very rarely indeed were there as many as three minutes of unbroken music. And the commercials which broke up the programme were banal.

I don't want it here. The reply of the commercial lobby, of course, is that most people do, and that I am in a minority. And I can only retort that I often disagree with *vox populi* and will seek to persuade it to change its tune.

Certainly, recording amateurs will find the prospect of 40 local BBC stations stimulating. Experience with those already on the air has shown that the enthusiast can hope to have his work broadcast regularly, and can sometimes gain interesting studio experience as well.

Because the local stations will be operating on modest budgets, they are predisposed to use local material—if the quality is adequate. As the current F.B.T.R.C. *News and Views* comments, "In some cases, members have better portable equipment than the station itself."

One of the possibilities that excites me is that if the BBC had a genuine national network of local stations, it might be possible to persuade them to try again an amateur tape recording contest, but this time with regional heats and the best local efforts coming forward into the national final. And many of the entries, conceived and executed as genuine programme material, would be more finely focused and better disciplined than many amateur tapes have been in the past.

* * *

DETAILS ARE AVAILABLE of the Tape-Slide Competition organised by the South Devon Tape Recording Club in conjunction with the British Federation. Ten minute programmes on any subject are invited, with 35 mm transparencies in standard 2 in. x 2 in. mounts accompanied by recordings at 7½ or 3¾ or 1⅞ ips.

"The competition will be judged on the technical quality and artistic merits of the photography, the sound recording and the way in which the two have been combined," say the organisers. Full rules and entry forms from A. S. Heather, 53 Kings Ash Road, Paignton, Devon.

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Fantastic savings of up to 50 per cent off original list prices for Personal Callers only. Our stocks change daily—call today—we'll over 100 models to choose from—all guaranteed you pay no tax on secondhand machines.

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GRUNDIG TK40 (M/2)	Our price ONLY 35 gns.
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PHILIPS EL3536 (S/4)	Our price ONLY 39 gns.
REPS R10 (M/2)	Our price ONLY 29 gns.
BRELL MK5 Series III (M/2)	Our price ONLY 52 gns.
TELEFUNKEN M300 (BP/M/2)	Our price ONLY 39 gns.
WYNDSOR VANGUARD (M/4)	Our price ONLY 49 gns.
TELEFUNKEN 204E (S/4)	Our price ONLY 69 gns.
AKAI X4 (BP/S/4)	Our price ONLY 69 gns.
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(HALF DAY THURSDAY)

For the man who will only settle for perfection...

Ferguson make this 3 speed, 4 track stereo tape recorder.

This is the one. The stereo tape recorder that every real enthusiast wants to get his hands on. Ferguson know what you want from a stereo tape recorder and they've packed all your needs into the 3244.

Just imagine your ideal tape recorder and see how it checks out with the 3244.

- Stereo/Mono recording and reproduction.
- 3 speeds - $7\frac{1}{2}$, $3\frac{3}{4}$, and $1\frac{7}{8}$ i.p.s.
- $\frac{1}{4}$ track stacked stereo heads
- Transistor amplifier channels
- Clutched dual concentric controls
- Input mixing
- Calibrated record level meters
- Latching pause control
- Auto stop at tape ends
- Remote pause facility
- Monitoring while recording on built in speakers
- Track transfers on mono
- Second channel monitoring
- Interlocked controls
- Comprehensive input/output sockets
- Two dynamic microphones, 1,200 ft of tape, take-up spool, connecting lead and remote pause switch on 20ft lead.

Not only does the 3244 sound great but it looks great too in its teak veneered cabinet and neutral tinted transparent lid which is designed to match Ferguson Unit Audio equipment.

So if you take stereo tape recorders as seriously as Ferguson do, go along to your nearest dealer and ask for a demonstration. When you've heard the 3244 you'll know that it sounds like a tape recorder should.



FERGUSON tape recorders

To: British Radio Corporation Limited,
284, Southbury Road, Enfield, Middlesex.
Please send me a full colour leaflet for the
Ferguson 3244 stereo tape recorder.

NAME _____

ADDRESS _____

F19



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You can build a better radiogram than we can.

You know better than we do what you want in a home entertainment system. So we'll sell you the bits and let you build your own 'Sound System'.

You start with the Bush Amplifier Unit, plug it in to a couple of tailored speakers, then add the matched record deck. Now you've got a superb stereo system punching out a fantastic 32 watts of sound.

Next you can add the powerful radio tuner to pick up MW, LW and VHF stations and hear them in a way you've never heard before. Then when you've saved up a bit extra you can add more speakers from the Bush 'Sound System' range.

The only electronic knowledge you need is how to plug the components together. The only tools you need are your own hands.

This is the amplifier and tuner combined. If you are rich and can afford them together. They cost £71.11.10.

This is the radio tuner. Like all the Bush equipment it is finished in dark, tropical olive veneer and brushed aluminium. This unit pulls in all radio stations and plugs into the amplifier. Costs 35gns.

This is the record deck. A beautiful piece of equipment with automatic changing with cueing facilities and an ultra light record arm. Costs 28gns.

There are 3 matched pairs of stereo speakers shown here. You can choose between wall or floor mounting. The speakers plug into the amplifier. Prices are from 23/ per pair.

This is the stereo amplifier. It receives the signal from the record player or the radio tuner and blows it up with hi-fi precision. You plug the speakers into the amplifier and the sound blasts out. The amplifier costs 35gns.

Bush

For people who've forgotten just how good music can be.

Bush, a product of the Rank Organisation.

The Bush with the eye in the ear of many a li.

SONY

Model TC-630—the complete stereo sound control centre. Echo and sound-on-sound recording at the flick of a switch. Multiple inputs for stereo tuner, microphone, auxiliary speakers and optional turntable. Further refinements include three heads, three speeds, dual VU meters, retractable pinch roller, noise suppressor, and scrape filter.

Compact and superbly built, the TC-630 has a built-in stereo amplifier delivering a full 15 watts per channel rated output. Two lid-integrated speakers open up a world of stereo sound... **What more can we add?**

Model TC-630, recommended retail price £199:15:0

Specification

Recording system 4-track stereo/mono recording and playback.

Power requirements AC 100, 110, 117, 125, 220 or 240V, 50/60 Hz.

Power consumption 40 watts.

Tape speed 7½ ips (19 cm/s), 3¾ ips (9.5 cm/s) 1¾ ips (4.8 cm/s).

Reel capacity 7 in. (18 cm) or smaller.

Frequency response 30 Hz–22 kHz at 7½ ips; 30 Hz–13 kHz at 3¾ ips; 30 Hz–10kHz at 1¾ ips.

Bias frequency 160k Hz.

Wow and flutter 0.09% at 7½ ips; 0.12% at 3¾ ips; 0.16% at 1¾ ips.

Power output 15 watts per channel.

Signal-to-noise ratio 50 dB.

Harmonic distortion 1.2% at rated output (overall); 0.5% at rated output (amplifier).

Level indication Two VU meters.

Inputs Microphone: sensitivity –72 dB (0.2 mV), impedance 250 ohms.

Tuner: sensitivity –22 dB (0.06V), impedance 100k ohms.

Auxiliary: sensitivity –22 dB (0.06V), impedance 560k ohms,

Phono input (MM or MC cartridge): sensitivity –53 dB (2 mV), impedance 14k ohms.

Outputs Line: output level 0 dB (0.775V), impedance 100k ohms. Headphone: output level –28 dB (30 mV), impedance 8 ohms.

External speaker: impedance 8 ohms.

Lid speaker: impedance 8 ohms.

Rec/PB connector Input: sensitivity –40 dB (7.75 mV), impedance 10k ohms.

Output: output level 0 dB (0.775V) impedance 100k ohms.

Dimensions 17½ in. (w) x 20 in. (h) x 11⅞ in. (d).

Weight 46 lb. 3 oz.

Supplied accessories Microphone (F-45) (x2), Sony pre-recorded 5 in. tape, Sony empty reel (R-7A), connection cord (RK-74), head cleaning ribbon, reel cap (x2).

Optional accessories Speaker system (SS-3000), telephone pick-up (TP-4), stereo headset (DR-5A) (8 ohms), microphone mixer (MX-6S).



SONY

RESEARCH MAKES THE DIFFERENCE Sony (UK) Ltd Ascot Road Bedfont Feltham Middlesex

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CYRIL CLOUDS CONCLUDES HIS EXPLORATION INTO EXPERIMENTAL MUSIC

PROJECT ALPHA

MUSIC occurs in time, and the complexity attached to our experience of time is inherent in our response to music. At the centre of this complexity are questions related to the manner in which we perceive and respond to the events which surround us, that is to orders of succession in time and space. In the context of these articles, therefore, the question concerns the manner in which we perceive music which is a special order of succession, a special form of the articulation of time.

The ways in which we respond to music have changed in the same way as notions about time and space themselves have changed. The types of organisation which new music presents are a reflection of this fact. The use by many composers of multi-channel stereophony is a direct expression of the desire to experience time and space in new ways.

A foundation of all experience is the manner in which space and time are perceived as functions of each other. The following aspect of our response to music emerges from this fact: that it contains within it the ambiguities which exist between the perception of an instant and the cognition of a sequence. What we experience as a depth of response is, perhaps, partly the result of the constant operation of this ambiguity. It is, perhaps, possible to say that the feelings associated with contemplation also derive partly from this, and aspects of our experience of motion. The processes I have outlined in previous articles include a desire to articulate this factor of ambiguity in various ways. The composition of a sequence of groups of pulses which I dealt with last time is one example.

In this article I shall deal with three processes. The first will extend the system I described in the last article, the second will introduce qualities which result from the use of silence, the third will describe another system derived from the use of pulses. I think of each of these processes as expressing aspects of the ambiguity I have mentioned.

Within the sequence of groups of pulses which I dealt with in the last article the motion of each group—or section—derived from the patterns of pitch, timbre, amplitude and duration which were set up between pulses of varying rate. It should be added here that the quality of motion of a sequence would derive also from the proportions which were applied to the durations of sections. There need be no concern about choosing a complex set of proportions; a choice of, for instance, six simply related whole-number values would be sufficient.

A system of pulse groups of this kind would contain a great variety of elements within the overall uniformity of the

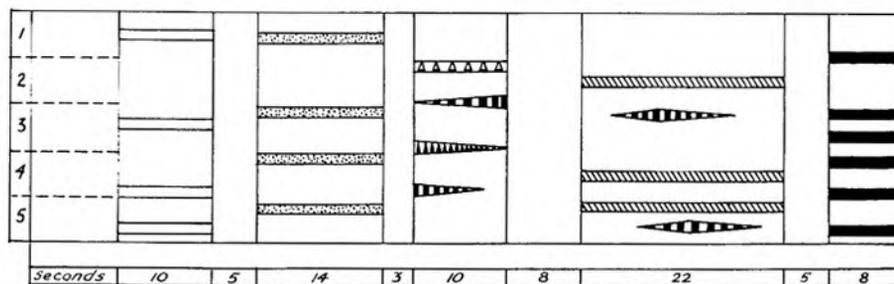


Fig. 1. Schematic rendering of composition alternating "planes of sound" with lengths of silence

pulsing motion. However, this diversity would be of a special kind as its character would be maintained throughout. The result would be what might be called an equality of detail along the full extent of the piece. A "cross section" of the sound at any point would reveal similar events. The central feature of the sound, therefore, would be the detail of its processes, that is, the entry and exit of pulses with their particular ratios of duration, pitch and timbre. This suggests that a system of this kind would be more fully realised by means of a multiple playback system in which the details of the processes would be given spatial positions within the performance area.

A multiple speaker realisation would introduce the difficulties associated with achieving synchronisation between different transport mechanisms. However, this can be obviated by a process of composition which, perhaps, realises more fully the time and space articulations of a multiple pulse system. This process would involve no sectional grouping of pulses. Instead they would be free to move, to enter the total sound as individual components at any desired point without the need to synchronise with the entry of other pulses. Each of the sound sources within the playback space could, if desired, be associated with a specific set of pulse rates, intervals, timbres and amplitudes. In the preparation of such a system the proportional values, which before were applied to section lengths, would here be applied to the duration of each individual pulse and its moment of entry. This could be done with a view to arriving at various degrees of overlap. In addition the composing scheme could include the introduction of silences of varying durations, once again related to the choice of proportional values. In one system of preparation, pulses would be recorded on to both tracks of each source

tape in the sequence desired. All tapes would be started simultaneously and not stopped until the end of a performance. Through the use of mixers the amplitudes of pulses could either be pre-set or changed during performances according to a prearranged scheme.

A second system of preparation would involve the making of the number of pulse loops (using only one track) required for a full realisation and running these on separate tape recorders at a performance. This would require an operator at each recorder who would change loops according to a programmed scheme. If sixty loops were required, each containing one pulse, and six loudspeakers associated with six recorders were involved, each operator would be responsible for the programmed sequencing of ten pulses (if the sequence called for an equal division of pulses between sound sources). The same pulses could, of course, be played several times; on each occasion their relation to other pulses would be different. The timing of loop changes would be done by stopwatch in accordance with a set of cueing instructions.

2. I have mentioned the possibility of introducing lengths of silence into a continuity of sound. When listening to music we respond to the manner in which the parts have been put together, that is to the phrase and section structure. The sequence of phrases constitutes a hierarchy governed by the statement and development of the materials; they articulate the functions of a beginning, middle and end. However, consider what can occur if a process of composition continually alternates what I shall call "planes of sound" with lengths of silence. It is possible in this way to cancel the hierarchy of parts and arrive at a process which consists of a series of "be-

ginnings." There would be no functional reference points within such a sequence of sound planes. Each sound, followed by silence, could occur as a separate entity, filling its own time without immediate reference to what preceded or succeeded it, containing its own specific harmonic properties, types of motion and timbre. Amplitude, in my view, should not be made to alter radically within this type of process. Such a process comments on the nature of diversity and change. The drama of contrast has no part in this comment.

Fig. 1 is a schematic rendering of a system of this kind, in terms of the type of motion I have dealt with in previous articles. Five sound planes of varied duration are shown, each one separated by a longer or shorter silence. Frequency bands are represented by the numbers 1 (high) to 5 (low). The sounds which occur within these bands are shown in two ways: a. as horizontal stripes and b. as shaped stripes containing a variety of symbols which depict different pulse forms. The shaping shows increases and decreases of amplitude. The horizontal stripes represent a variety of synthesised spectra. The varied markings of the stripes depict a possible variation of modulation of each set of spectra. Transformations by means of amplitude, frequency and ring modulation, filtering and transient generators, etc, can, of course, be achieved with the relevant devices. However, a number of variants can be produced using the sound generator only, as follows: open stripes—sine wave spectre; dotted—square wave spectre; hatched—sine wave spectra modulated by sub-audio signals; black—mixture of modulated square wave and unmodulated sine wave spectra.

3. I referred at the beginning to the ambiguities contained in our response to the instantaneous and successive qualities of time. A process which, I believe, clearly expresses this ambiguity involves the simultaneous beating of arrays of pulses moving at a uniformly high rate of about twelve per second. A medium paced pulsation would introduce a too deliberate motion which would not be relevant to the process I have in mind. A too excessive speed would obliterate the clear articulation of individual pulses. Within the uniformity of pulse the diversities of pitch, timbre, amplitude and attack and decay characteristics would act as the primary factors of time articulation. The process of composition would also involve the changing of the density (the number of pulses at any moment) of the array. If desired, every type of change could be governed by a system of proportional time lengths which would establish the points in time to initiate a change and the length of time over which

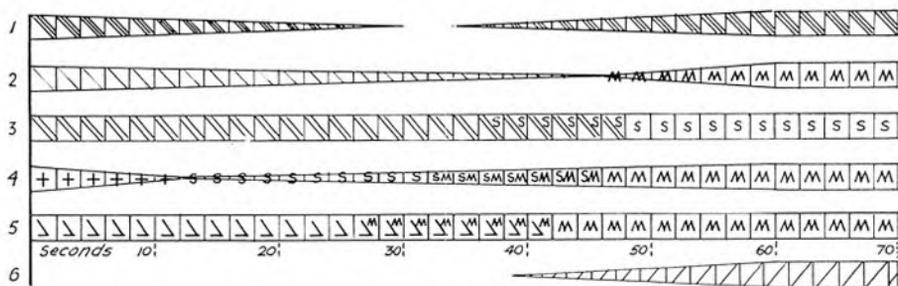


Fig. 2. The modulation of part of a pulse stream containing five components and moving at a rate of ten pulses a second

a change would be maintained. These proportions could, in turn, be derived from, or themselves, govern, the interval ratios of the primary frequency components within the work. One method of doing this would be to set out charts, one for each property (pitch, timbre, etc.) and apply the chosen set of proportions to whatever variables are chosen for each. For instance, if five degrees of amplitude were decided on and five proportionate lengths had been chosen, one length would be applied to each degree of amplitude.

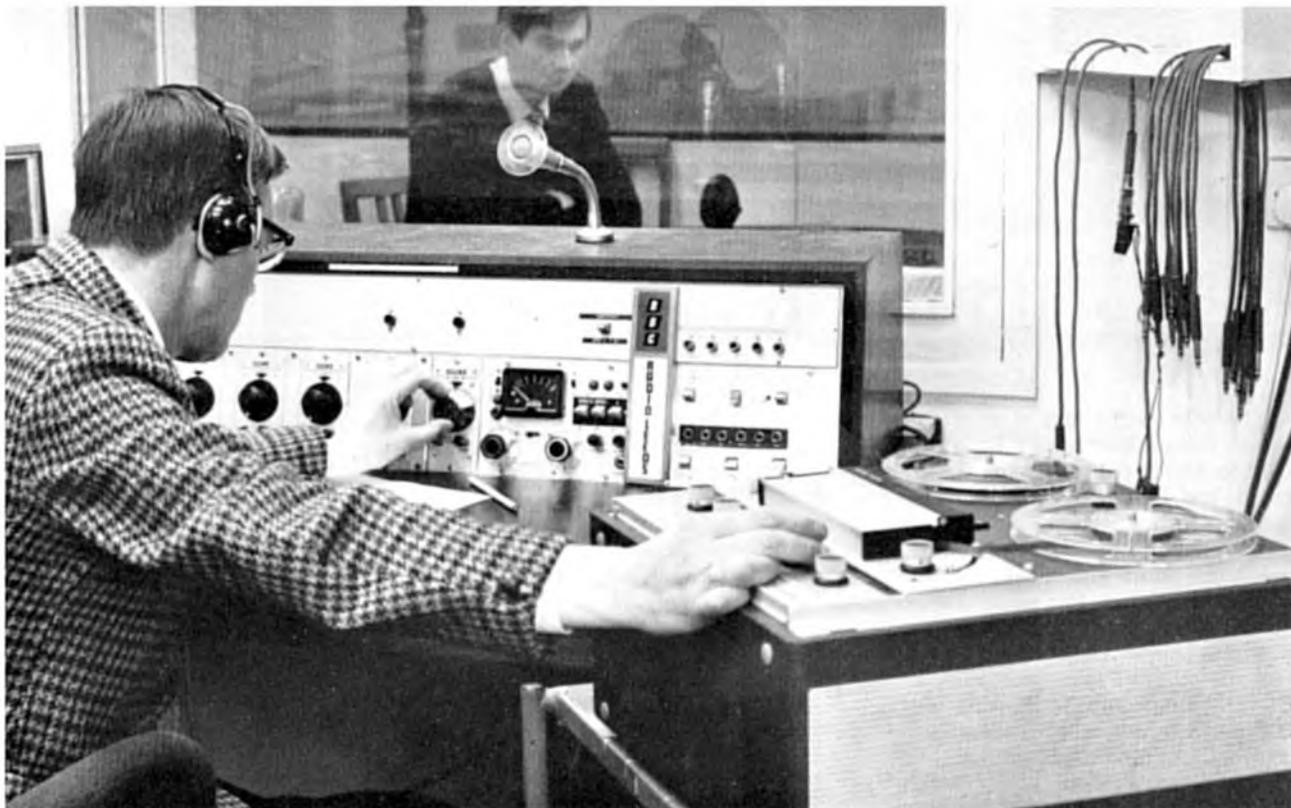
The simplest form of pulse array would consist of simple sine or square wave sounds. However, it would be preferable to apply some complexity of spectrum to each pulse in order to achieve a more pronounced quality of attack. As described in section 1, pulsed motion provides wide opportunities for varying any or all components of an array. Modulation can occur at any time and in any component. However, to achieve what I consider fundamental to the process I have in mind, the rate and extent of change would require attention.

As I have suggested, a system of this kind contains the capacity to articulate the types of ambiguity I associated with our response to time. In order to apply these ambiguities to the process of composition it would be necessary to ensure that a sense of uniformity was maintained along the full length in all dimensions. In doing this we realise one quality of ambiguity: the sense of uniformity applied to the fast rate of pulse would suggest a "stationary" quality of sound at each instant (the heart's pulsation is continuous, but the heart does not change its position in the body). In order to maintain this quality of "suspended motion" any type of modulation applied to one or more pulses in the array would have to be small, preferably articulated in terms of a scale of perceptibility, ranging from just perceptible through small increments to clearly perceptible transformation of one or more components. In addition, modulation should take place over extents of time which would allow full response to the degrees of perceptibility. In this way a model is arrived at in which slow rates of change

which require attention takes place within a high speed pulsation. Within this process the pulse stream could be made to present various degrees of modulation along its length, depending on the number of pulses and the variety of property being modulated at any instant. It should be noted that increasing or decreasing the number of pulses should be done by fading components in or out to ensure a continuously smooth flow. In addition change of pitch of any component should involve small shifts, but if any pulse were faded out it could re-emerge with a clearly different frequency.

Fig. 2 shows schematically the modulation of part of a pulse stream containing five components and moving at a rate of ten pulses per second. Each small square represents two seconds of time and, therefore, twenty pulsations. The spectrum of each component is shown by a different sign. Modulations are shown by shaping which depicts the fading out or in of a component and by the letters S (shift for frequency) and M (other forms of modulation). Number 6 represents a further possible operation. At various points within the pulse stream an additional array could be introduced moving at a different rate from the main array, that is, out of phase with it. Number 6 shows one component of a new array.

In these articles my intention has been to demonstrate some of the processes which electronic resources make possible and also the connection between the emergence of these resources and the changes which have occurred in our ways of understanding and interpreting the world. However, one thing has not changed. The basis of electronic music is that a sound is passed through and modulated by a series of circuits and produced at its destination by a loudspeaker. The composer stands between the sound and its destination. The resources suggest their specific potentialities; they do not instruct how one sound is to succeed another. This is still the composer's choice. The nature of the choice is what it has always been: the expression of a response to the world, which is what music signifies.



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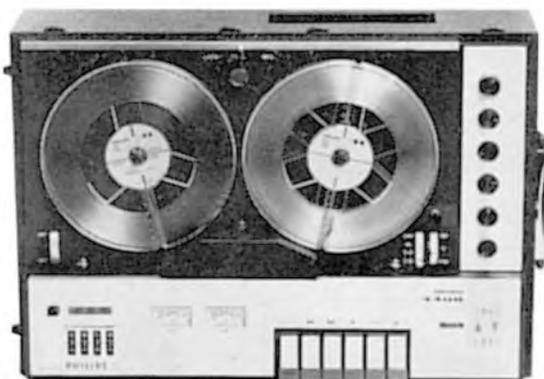
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AUDIO AND PHOTOGRAPHY REACH OUT TO JOIN HANDS AT THE 1969 AUDIO PHOTO - CINE FAIRS

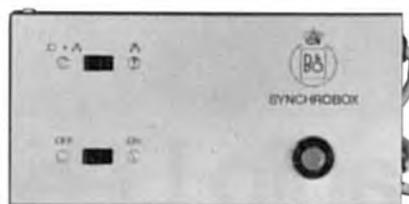


FOR many of us the idea of an Audio Fair in the autumn takes a little getting used to. In the past the words Easter, Audio Fair and Russell Hotel all signified that great annual jamboree and festival that was anticipated with trepidation, enjoyed with relish and finally looked back on with nostalgia. But times change and so has the Audio Fair. This year it forms a part—some would say a major part—of the Audio Photo-Cine Fairs to be held in Olympia during the period 16th to 22nd October excluding Sunday. For the first time also there will be a charge of 4/6d. for an admission ticket which covers the combined Fairs. We are only too sorry that we cannot follow our usual practice of sending complimentary tickets to readers on receipt of a stamped addressed envelope. Neither do we have supplies of tickets for sale.

It will be interesting to note what change of character has taken place in the Fair. We suspect very little since it was always the exhibitors themselves who, in the old days, endowed the show with its very special quality of friendliness, combining business with a very real sense of social occasion. Those same people will be showing at Olympia this year with, regrettably, a few notable exceptions whose presence will be sadly missed by all. However some new names appear in the list for the first time and they will be more than welcome.

Our own coverage of the Fair will follow the same pattern as it did in 1968. This edition, cover dated October and on sale from Wednesday 17th September, contains a full list of exhibitors together with their stand numbers. Our edition cover dated November will be on sale from Wednesday October 15th—that is the day before the Fair opens its doors for the first time. Details of interesting products about to make their debut before the public will be published in that issue. Lastly our December issue (on sale from Wednesday 19th) will carry authoritative comments on all that the T.R.M. staff saw and heard over the duration of the Fair.

One of the most important changes in this year's Fair is its coming together as a joint venture with our friends of the photographic world. Such a fusing of interests means that the event should provide a double attraction; it also underlines the fact that neither audio nor photography can continue to be regarded as isolated self-contained activities. Although utterly different in form both are media



of self-expression and each can join hands with the other to add either sound with vision or vision with sound depending on which activity one places primary importance.

In this magazine we have made frequent references to photography. It is analogous to sound recording in so many ways. There is much that we can learn from photographers, just as it is hoped they can learn something from us. We have always felt that there should be enormous scope for co-operation between specialists in the two fields. Unfortunately the high cost of both audio and photographic equipment makes it difficult for a single individual to invest adequately in both. Apart from cost each is an art requiring its own highly specialised skills and approach. Why not then take advantage of this marriage between audio and photography by making a point of contacting enthusiastic photographers with a view to undertaking joint projects in the future? We make this suggestion to the private individual visitor but it is hoped that tape recording clubs and societies will also contact their opposite numbers in the photographic world to explore the possibilities of occasionally merging interests to the benefit of both sets of members.

Please understand that these suggestions do not imply any kind of "take-over." It is highly desirable that individual enthusiasts and clubs in both fields should continue to follow their main interests in the way they have always done. All we ask is that there should be more direct co-operation which should supplement rather than supplant existing activities.

So if you as an audio enthusiast can talk to photographers and perhaps explain to them some of the things about sound reproduction that need clarification we have no doubt that they will be only too pleased to do the same for you. This is the way we visualize the 1969 International Audio and Photo-Cine Fairs progressing—as a dialogue between two great bodies of enthusiasts who each have a loyalty to their own absorbing interest but who would be only too pleased to share with and learn from the others.

Lastly don't be put off by the small charge that is being made for admission. The combined show is going to be just about the best money's worth you ever had. So make a note in your diary now; the date once again is the 16th to 22nd October (not including Sunday) and if you can manage it come along and see us on Stand No. 71 in Section C.



EXHIBITORS TO THE AUDIO SECTION



Name of Exhibitor	Trade Name	Stand No.	Section	Name of Exhibitor	Trade Name	Stand No.	Section
Acoustical Manufacturing Co. Ltd	Quad	33	B	IPC Magazines Ltd.	Practical Electronics & Practical Wireless	73	C
ADC Ltd.	ADC	42	B	KEF Electronics Ltd.	KEF	43	B
AEG (GB) Ltd.	Telefunken	26	B	H J Leak & Co. Ltd.	Leak	37	B
Agfa-Gevaert Ltd.	Agfa-Gevaert	11	A	Link House Publications Ltd.	Hi-Fi News, Audio Record Review & Tape Recorder	93	C
Aiwa Co. Ltd.	Aiwa	99	C	Lowther Manufacturing Co. Ltd.	Lowther	59	A
Akai Electric Co.	Akai	22	A	Lustraphone Ltd.	Lustraphone	64	A
Rank Organisation				Lux	Lux	5	A
Arena Hede-Neilson Fabriker	Arena	85	C	Shriro (UK) Ltd.	Luxitone	87	C
Highgate Acoustics				Highgate Acoustics Magazine		1	B
Armstrong Audio Ltd.	Armstrong	41	B	Uher		49	A
Audio Technica Corporation	Audio Technica	5	A	Brenell		98	C
Shriro (UK) Ltd.				British Radio Corporation Ltd.	HMV	66	A
B & W Electronics Ltd.	B & W	80	C	British Radio Corporation Ltd.	Ferguson	69	A
BASF (UK) Ltd.	BASF	16	A	BSR Ltd.	BSR	31	B
Bang & Olufsen (UK) Ltd.	Bang & Olufsen	97	C	Colton & Co. (Lapidaries) Ltd.	Colton	104	C
Billboard Publications Ltd.	High Fidelity Magazine			Dansette Products Ltd.	Perdio	55	A
Bosch Ltd.	Uher	49	A	Daystrom Ltd.	Heathkit	63	A
Brenell Engineering Co.	Brenell	98	C	Decca Record Co. Ltd.	Decca	35	B
British Radio Corporation Ltd.	HMV	66	A	The Diamond Stylus Co. Ltd.	Diamond Stylus	30	B
British Radio Corporation Ltd.	Ferguson	69	A	Dual Electronics Ltd.	Dual	78	C
BSR Ltd.	BSR	31	B	EMI Electronics Ltd.	EMI	56	A
Colton & Co. (Lapidaries) Ltd.	Colton	104	C	Farnell-Tandberg Ltd.	Tandberg	12	A
Dansette Products Ltd.	Perdio	55	A	Ferranti Ltd.	Ferranti	65	A
Daystrom Ltd.	Heathkit	63	A	The Ferrograph Co. Ltd.	Ferrograph	28	B
Decca Record Co. Ltd.	Decca	35	B	N & S B Field & Co.	Record Housing	53	A
The Diamond Stylus Co. Ltd.	Diamond Stylus	30	B	Garrard Engineering Ltd.	Garrard	18	A
Dual Electronics Ltd.	Dual	78	C	Goldring Manufacturing Co. Ltd.	Goldring	39	B
EMI Electronics Ltd.	EMI	56	A	Goodmans Loudspeakers Ltd.	Goodmans	15	A
Farnell-Tandberg Ltd.	Tandberg	12	A	General Gramophone Publications Ltd.	The Gramophone	94	C
Ferranti Ltd.	Ferranti	65	A	Grundig (GB) Ltd.	Grundig	6	A
The Ferrograph Co. Ltd.	Ferrograph	28	B	Hacker Radio Ltd.	Hacker	96	C
N & S B Field & Co.	Record Housing	53	A	C E Hammond & Co. Ltd.	Revox	17	A
Garrard Engineering Ltd.	Garrard	18	A	Hanimex (UK) Ltd.	Toshiba	29	B
Goldring Manufacturing Co. Ltd.	Goldring	39	B	Hansom Books Ltd.	Records & Recording	90a	C
Goodmans Loudspeakers Ltd.	Goodmans	15	A	Haymarket Press Ltd.	Hi-Fi Sound	13	A
General Gramophone Publications Ltd.	The Gramophone	94	C	P F & A R Helme Ltd.	Peerless	91a	C
Grundig (GB) Ltd.	Grundig	6	A	Highgate Optical & Industrial Ltd.	Pickering	86	C
Hacker Radio Ltd.	Hacker	96	C	Howland-West Ltd.	Howland-West	88b	C
C E Hammond & Co. Ltd.	Revox	17	A	Illiffe Ltd.	Electrical & Electronic Trader & Wireless World	101	C
Hanimex (UK) Ltd.	Toshiba	29	B				
Hansom Books Ltd.	Records & Recording	90a	C				
Haymarket Press Ltd.	Hi-Fi Sound	13	A				
P F & A R Helme Ltd.	Peerless	91a	C				
Highgate Optical & Industrial Ltd.	Pickering	86	C				
Howland-West Ltd.	Howland-West	88b	C				
Illiffe Ltd.	Electrical & Electronic Trader & Wireless World	101	C				
				Teac Corporation	Teac	52	A
				B H Morris & Co. (Radio) Ltd.			
				Teleton Electro (UK) Ltd.	Teleton	75	C
				Thorens A/S	Thorens	47	B
				Metrosound Sales Ltd.			
				Transcriptors Ltd.	Transcriptors	102	C
				Trio Corporation	Trio	50	A
				B H Morris & Co. (Radio) Ltd.			
				Whiteley Electrical & Radio Co. Ltd.	Stentorian	25	B

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ONE of the most significant announcements to appear in *TAPE Recording Magazine* recently was the reference last month to changes in the retail recommended prices of Musicassettes. Apparently this dramatic move was either not known by most magazines of the same cover date or alternatively was perhaps considered to have little reader interest.

The truth of the matter is that the Compact Cassette system, slowly but inexorably, is presenting the established gramophone record with its first real threat for some ninety years. Some might think that the rate of progress of cassettes is slow. Compared to the history of the evolution of the gramophone record itself it has been dramatically fast. Of course there is room for improvement—a great deal of improvement. This can be in better and still better reproduction standards and also in cost. Even with the latest welcome price reductions Musicassettes are only just beginning to get within shooting distance of the price tags commonly seen on gramophone records.

The fact is that production of a pre-recorded cassette is a much more involved, complex and costly process than the mere pressing of a vinyl disc. Quite apart from the cost of the recorded musical programme the actual raw materials and labour that go to make up a cassette represents a much higher basic cost than the same commodities in gramophone record production.

Fortunately a great many people have a great deal of faith in the cassette system. So far as the gramophone record is concerned the present state of the art must, to all practical purposes, be very nearly the end of the road. Such improvements as can be brought about within the foreseeable future will be marginal, of more theoretical than actual value. The cassette story is quite different. Ahead of it lies the possibility of dramatic quality improvements. It is not unreasonable to suppose that within the next decade we shall have at our disposal magnetic tapes capable of efficiently reproducing frequencies of up to 20,000 Hertz at running speeds of up to 1½ ips. At the same time speed stability of tape transport mechanisms will inevitably improve until the wow and flutter figure is brought down within the tolerances that are now regarded as acceptable for first-class gramophone transcription equipment. Lastly with increasing popularity the price must ultimately come down still further.

However hard I might gaze into my private crystal ball I cannot name a date on which these wonders will come to pass. Perhaps it will take five or ten years—who knows? But I will stake my life on the fact that this is very much the shape of things to come, and ultimately we shall look on the 12 in., 33½ L.P. gramophone

CROSS TALK

By Audios

record as being as much of an historic relic as either paper recording tape or 78 rpm discs.

So this attack on the retail prices of music in cassette form by Philips Records Limited is more than welcome. In my opinion it is but the visible tip of the much bigger iceberg below the surface. If the technicians in Holland are not working feverishly to accomplish at least some of the achievements mentioned above then I will be only too pleased to eat my hat with or without Worcester sauce. What is in doubt is not the future of the cassette system as a home entertainment but merely the time scale on which its superiority will both be asserted and generally acknowledged.

One last word. Some people have suggested that the (imagined) difficulty of finding any particular place—that is to say the beginning of a band—on a cassette is a crashing disadvantage. I wonder if any research has ever been done into the number of times the ordinary owner of gramophone records ever starts off his record other than at the first groove of a side? In purely commercial terms I suspect that the number of people who go to that trouble are so small as to be of no account whatsoever. Fortunately however even they will find that the cassette system can offer this facility with greater ease and in many cases greater accuracy than their older disc reproducers.

A MORE real problem that occurs with unfeeling regularity relates to the difficulty in exchanging tapes between owners of four-track and half-track machines. It often happens that tapes recorded on tracks 1 and 4 only, with 2 and 3 erased, produce a ghost of a previous recording when reproduced on half-track equipment.

This is not really very surprising when one considers the relative tracking arrangement. In the four-track system a small clearance (about 0.25 inches) is allowed between the parallel recorded tracks. When a half-track recording is re-recorded (and/or erased) on a quarter-track machine the quarter-track erase head will not touch the clearance space between tracks 1 and 2 or between tracks 3 and 4. This will remain as a narrow ribbon of recorded sound which will be reproduced when the tape

is placed on a half-track machine. There are only two possible cures for this trouble. Either the half-track recording must be erased on a half-track machine before it is placed on the quarter-track recorder or alternatively it should be wiped clean by a bulk eraser.

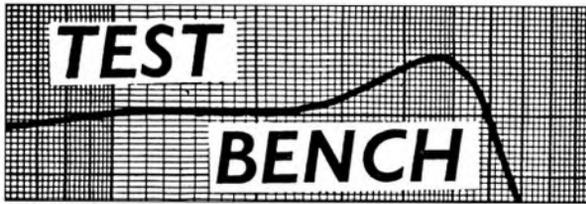
At the present time we are in the midst of the annual Trade Show. These exhibitions of manufacturers' new products are displayed for the benefit of dealers in some twenty or more hotels scattered across the breadth of London. In company with other footsore journalists yours truly has been gallantly endeavouring to cover as much of this fragmented exhibition as possible.

First impression is of the proliferation of both Compact Cassette and unit audio equipment. Some of the latter (unit audio) horrifies me. The quality of the sound is as far removed from high fidelity reproduction as it was in the days of the radiogram. Obviously there is need for caution on the part of the buying public. TAPE Recording Magazine will be dealing with this and other problems in subsequent issues. As for the cassette story, it can be summed up in a single phrase—it's booming!

It is always wonderful to see the different approach by different manufacturers. Some are real enthusiasts with beautiful products offering excellent value for money. They are the people who will talk about the subject with absorbing interest. Others are merely offering goods in exchange for money and the only sound they are really interested in is the ring of the cash register. Fortunately these are a very small minority.

A Special announcement from the Southall Tape Recording Society gives news of their next "Open Evening." This will take the form of an exhibition and demonstration of recordings made and presented by the members under the title: "Sounds Unlimited." The date to note is Monday, October 20th and the address is Cyril Grant Hall, Greenford Hall, Greenford, Middlesex. Doors open at 7.30 p.m., the show starts at 8 p.m. and admission is free. Enthusiasts living within reach of Greenford in Middlesex are assured of a most interesting evening and although they do not say as much in their official letter I have no doubt that the Society will welcome inquiries from prospective new members. The secretary's name and address is: A. Dulieu, 21, Peachey Lane, Cowley, Middlesex.

TALKING of cassettes, which we seem to be doing a great deal of, this time I have to report one development of very dubious value. It is said that certain supermarkets are secreting cassette machines behind their various stacks of groceries. As the unwary customer approaches he automatically triggers the playback mechanism and so is subjected to the subtle persuasion of a barrage of sales talk advocating the purchase of that particular product. It is not difficult to imagine a logical progression of this system from supermarkets to other fields. Surely Post Office clerks would welcome such a machine—it could automatically say: "Sorry this position is closed" as soon as a customer approached. A machine in the bank could say "You must be joking!" when impecunious customers like yours truly attempt to make withdrawals. If it ever should catch on with the ladies—heaven help us!



AKAI 4000D

INVESTIGATED BY R. HIRST AND D. KILLICK

MANUFACTURER'S SPECIFICATION AKAI 4000D

Tape speed: $3\frac{3}{4}$ and $7\frac{1}{2}$ ips.
 Wow and flutter: Less than 0.15 per cent RMS at $7\frac{1}{2}$ ips. Less than 0.20 per cent RMS at $3\frac{3}{4}$ ips.
 Frequency response: 30 to 22,000 Hz \pm 3 dB at $7\frac{1}{2}$ ips, 30 to 16,000 Hz \pm 3 dB at $3\frac{3}{4}$ ips.
 Distortion: Within 2 per cent 1,000 Hz 0 VU.
 Signal to noise ratio: Better than 50 dB.
 Input level: Microphone more than 0.5 mV. Line more than 50 mV.
 Output level: 0 VU (1.23V RMS).
 Equalisation: Correct equalisation for playback of tapes recorded to the NARTB curve.
 Recording level indicator: 2 VU meters.
 Recording system: 4-track stereo/monaural system.
 Fast forward and rewind time: 150 seconds using 1,200 ft. tape at 50 Hertz; 120 seconds at 60 Hertz.
 Motor: Induction motor.
 Transistors: 17 silicon transistors 2 diodes 2 rectifiers.
 Power supply: AC 100 to 240 V, 50/60 Hertz.
 Power consumption: 30 VA.
 Dimensions: $12\frac{3}{4}$ inches x $15\frac{7}{8}$ inches x $7\frac{1}{2}$ inches (315 x 405 x 180 mm).
 Weight: 25.3 lb. (11.5 kg).
 Price: £87 10s. including purchase tax.
 Distributors: Pullin Photographic-Rank Aldis, P.O. Box 70, Great West Road, Brentford, Middlesex.

AKAI 4000D TEST CHART

Frequency Hz	Overall Response dB	Playback Only dB	Signal/Noise Ratio dB	Crosstalk dB	Distortion
	$7\frac{1}{2}$ i.p.s.	$3\frac{3}{4}$ i.p.s.	$7\frac{1}{2}$ i.p.s.		
30	-3.6	-3.0	-3.0		
40	-2.0	-2.5	-2.5		
50	-2.0	-0.9	-2.8		
60	-1.0	-0.4	-2.0		
100	+1.5	+1.2	-1.0		
250	+1.2	+1.5	-0.8		
500	+0.8	+0.4	-0.2		
1000	0	0	0	50.4	3.8%
2000	-0.9	+0.6	+0.4		
4000	-1.4	+1.6	+1.8		
6000	-1.4	+1.8	+2.2		
8000	-2.0	+1.4	+2.5		
10000	-3.0	0	+2.3		
12000	-3.0	-2.0	+2.2		
14000	-3.0	-4.4	+1.8		
16000	-3.0	-6.8	+1.6		
18000	-3.2		+1.5		
20000	-3.2		+1.1		
22000	-3.4				
Wow and Flutter	0.12%	0.18%			

NOTES.—The Overall Response figures relate to record and playback. Playback Only relates to the reproduction of a 50 microsecond test tape at $7\frac{1}{2}$ i.p.s. (N.A.B.).

For Signal-to-Noise Ratio the tape was recorded at 0VU plus 10dB and then the input signal was removed from the record amplifier, but see text for further information. By reference to the signal level recorded and the resultant tape noise, the noise voltage was read off, with the tape still in motion. Distortion is quoted against a 1,000 Hz signal recorded at the same level and the figure is an R.M.S. value (see text).

Wow and Flutter is also R.M.S. the test frequency being 3,000 Hz. Test equipment used includes: Bruel and Kjaer Signal Generator, B & K Frequency Analyser Type 2107, B & K Level Recorder Type 2305, Marconi Distortion Factor Analyser and Gaumont-Kaylee Wow and Flutter Meter.

SOME eighteen months ago, in our edition dated March 1968, we published a review of the Akai 3000D; now we are very pleased indeed to be able to investigate its successor, the 4000D. The new machine is basically not dissimilar to the earlier one, the main differences lie in claimed performance improvements and additional facilities, together with small styling changes that have to be looked for to be noticed. It is therefore suggested that this review should be read in conjunction with the earlier notes on the 3000D, but for the sake of those for whom this is not possible we will dis-

cuss the new machine fully here, although this naturally involves unavoidable duplication of information.

Basically, then, the 4000D is a three-head, two speed ($7\frac{1}{2}$ and $3\frac{3}{4}$ ips) four-track mains stereo deck and pre-amp; that is, it is a complete record/playback unit, lacking only the final audio output stages. It is intended for use in conjunction with an external amplifier and speaker system and is within the same family as the many other "tape units" that we have reviewed in recent months. The popularity of equipment in this form is hardly surprising. By dispensing with

main amplifiers and built-in speakers, neither of which can ever come up to the quality standards of external equipment, the price can be cut right back so that even with the addition of purchase tax it still represents good value for money. There is no reason why the man who already owns hi-fi equipment and intends to use his recorder mainly at home should be forced to buy facilities he is rarely likely to use. For such a man the deck and pre-amp is the perfect answer. The only question we now have to consider is: how does the Akai 4000D shape up and would it provide the high

standard of recording and reproduction that the owner of such auxiliary equipment is likely to demand?

Let us first turn to the technical investigation, the results of which are published in the usual tabular form. It would be convenient if these figures could be read in conjunction with those given for the 3000D in March last year. Since the newer machine claims improvements on the older model and since we were quite enthusiastic over that machine, comparisons are bound to be made. Response measurements from a 50 microsecond calibration tape show that at $7\frac{1}{2}$ ips the machine is within specification of plus or minus 3 dB. At the lowest end of the scale, 30 Hz, we are just 3 dB down, whereas the 3000D was -4.5 dB at that point. The older machine exhibited a curve that was commendably flat but which ran about 2 dB *below* the straight line. Our present curve does the reverse; it shows a gentle incline above straight to a maximum of 2.5 dB at 8,000 Hz. Thereafter it falls to plus 1.1 dB at 20,000 Hz. In the lower register we find we are about a couple of dB down, so the tonal correction required is a *little* bass boost plus a *little* top cut to change the incline into flat. But let us be quite fair. The amount of adjustment required is very small indeed. The curve has no nasty humps or bumps, in fact it could almost be drawn with a ruler.

Overall response at $7\frac{1}{2}$ ips demonstrates a most interesting phenomenon. As will be seen the curve is *below* the datum line from 1,000 Hz onwards, but is dead flat within half a dB from 10,000 to 22,000 Hz. The fact that our curve is pitched low is almost certainly a comment on the relationship between the head and the tape used for the investigation. In fact this was Scotch 150. A tape of slightly higher coercivity would almost certainly have pulled the curve up to give a remarkably flat result. Our interpretation of these figures means that far from being outside the manufacturer's specification the machine is actually operating well within the claimed response, and is doing so in the best possible way by once again providing a line that is as near to a knife-edge as makes no difference. Remember that 1 dB is the smallest *perceptible* difference in sound levels—fractions of a dB are quoted only as a matter of interest and would be quite inaudible.

When considering figures of this kind one must always relate the findings to the cost of the equipment. A three-head machine with full A/B monitoring facilities at the price of the Akai is really in the bargain category; when coupled with response figures of this kind it is truly remarkable—as was its predecessor of

course. One of the claimed improvements in the new machine is the extension of this response at the slower tape speed. A glance at the $3\frac{3}{4}$ ips figures shows that although we quote a reading at 16,000 Hz this is down to minus 6.8 dB. However, if we allow for the effect of the tape used (Scotch 150) we can again easily imagine a less serious fall-off when using other tape of slightly higher coercivity. To be honest, we do not attach great importance to this extra couple of thousand Hertz. In our opinion it is a good sales story that has little practical consequence. However, commercialism was always thus! The actual situation is that the equipment is operating so well in terms of frequency response that the tiny extra on top doesn't really matter.

Before leaving this very complex matter of response tables and what they mean we must point out that all figures so far quoted have referred to operation with the machine in the stereo mode. A duplication of the overall tests in the mono mode revealed a difference of a couple of dB. Where we show -3 dB, for instance, in mono the reading would be -5 dB. This is something the distributors might care to take up with the manufacturer, although if one allows for correction on the assumption that tape of the correct coercivity will be used the tables then pull back to the plus or minus 3 dB of the specification. A very small point which Tokyo might well think too insignificant to worry about, but we mention it in the interests of strict impartiality.

For signal-to-noise and distortion readings we applied a signal 10 dB above 0 VU. This gave us a reading of 50.4 dB for the former and 3.8 per cent for the latter. The reason we have adopted this method is because the manufacturer quotes no reference for his signal-to-noise reading, although he does quote distortion against a 0 VU signal. This latter figure, under 2 per cent, could be regarded as conservative in relation to our own 3.8 per cent at plus 10 dB. The confusion in methods and standards here is caused by the operation of the VU type meters, which, as is usual in domestic machines, do not follow accepted professional specifications. Crosstalk at 1,000 Hz was shown to be 52 dB and wow and flutter 0.12 per cent RMS at $7\frac{1}{2}$ ips and 0.18 per cent RMS at $3\frac{3}{4}$ ips.

Summarising the technical findings we can say that the Akai 4000D has shown itself to perform well up to the very high standard set by the 3000D; in certain respects the figures show improvements, although as might be expected these are small. In practical terms our measurements hold the promise of excellent

sound quality, so we continued with user tests hopefully anticipating many hours of thoroughly pleasant listening. And we were not disappointed.

First however, a brief resumé of the physical appearance and controls. These follow very closely the styling and layout of the 3000D and were dealt with in great detail in that review. The most obvious difference is the change in styling from brown trim on the deck to black. A definite improvement. The overall concept of the machine itself is still to provide an essentially uncomplex piece of equipment with the very minimum of expensive design features. As a result speed change, for instance, involves slipping a sleeve over the capstan and manually changing the setting of a rocker-type equalisation switch. Not the most convenient of arrangements, but certainly the most economical. And the money saved in such ways is reflected in the price to the customer, so who is complaining? Whilst on the subject of the equalisation switch we must mention the need for the user to be careful to set it correctly; we fell right into that trap and wondered why on earth some of our figures did not make sense—until it was realised that we were running at $7\frac{1}{2}$ ips with the switch in the $3\frac{3}{4}$ ips position. The result of that mistake, by the way, is to mysteriously add some 12 dB to the upper end of the response table!

One of the most important features of both the 3000D and the 4000D is the lack of pressure pads. It is most unusual to find that a budget machine (which is what these equipments are) has been designed with a tape transport system so good that pressure against the rear of the tape can be dispensed with. The advantage in reduced head wear is obvious, but one could be forgiven for wondering if such an arrangement would not encourage the appearance of drop-outs. We will refer back to this question later in this review, but this is an appropriate place to mention that the new model has an improved tape guide system of retracting pins which serve to hold the tape well clear of the heads during fastwind.

The transport itself is controlled by a pair of substantial rotary levers, the right-hand one giving fast wind in either direction with Stop in the centre, the one on the left also having three positions, Stop, Play and Record. To engage the latter function a safety button must be depressed and a large red warning light is illuminated. Record Level Controls are a pair of knobs, now black and very slightly larger than on the older model, but still lacking any kind of reference scale against which to turn

them. The meters are small but brilliantly lit and so quite easy to read. Monitoring from source or tape is merely a matter of operating a simple rocker switch, similar switches provide mains on/off and equalisation change. The very massive pinch-wheel is fully exposed to give access to the capstan for changing sleeves, a pair of sockets for microphone connection are provided on the main deck plate which also carries what we consider to be the weakest feature of otherwise excellent design and lay-out, the brief pause. We did make some pretty caustic comments about this control when discussing the other machine; it turns up again unchanged in the 4000D. We treated it with contempt by ignoring it. Another jack socket on the deck is provided for stereo 'phones.

Connections are in a recessed panel at the side of the machine, and they comprise a pair of phono sockets for line out and a similar pair for line in; in the centre of these four connecting points is a five-pin DIN socket providing the usual record/playback facility via a single connecting lead. The mains cable exits from the underside of the machine. Operation can be either horizontal or vertical, and rubber spool retaining caps are provided for the latter operating position, as well as hard rubber skids to protect furniture. The shape is severe and box-like with a fraction more silver trim than before. In our opinion the general impression is most pleasing despite the no-compromise squareness.

We must just mention the instruction manual which, though not very detailed is exceptionally clearly written. Once again Akai devote a whole page to emphasising the need for regular head cleaning. To force the point home they show pen charts of response curves from two heads, one clean and the other dirty—and they do not exaggerate one little bit. We will repeat the headline over that page just as we did before—in bold type. It cannot be said too often. **"Tape oxide/dust deposits cause 90 per cent of your tape recording failures."** Akai say you should clean the heads every time the machine is used. We are not going to argue with that.

When we came to use the machine we discovered it had been supplied complete with a five-pin DIN plug and lead with the other end fitted with phono plugs suitably colour coded. Now that pleased us greatly because it so happens that the amplifier to which connection had to be made is not fitted with that very useful DIN socket. Alas, our jubilation was premature; the shanks of the phono plugs are slightly thicker than standard and as the sockets were very close together two plugs could just not

be inserted side-by-side. Pity, that; it was such a pleasant surprise to find that lead provided—but perhaps the fault lay in the socket arrangement on the amplifier.

After wiring up with separate phono-to-phono leads, which is simplicity itself thanks to the side connection panel in the 4000D, we switched on and settled down to enjoy ourselves. The machine worked like a dream. One is first impressed with its extreme quietness. When the motor turns, as it does as soon as power is applied, it literally whispers. After several hours running it was still quite inaudible from more than an inch or two away.

Now a 3000D has been in regular use in our music review department for the last eighteen months where it has been given what might be described as "a good bashing," so we thought it would be interesting to place these two machines side by side to see if age and use had had any obvious ill-effect on the older model. We were delighted to find that the older machine was just as quiet as the brand new sample. That speaks volumes for the quality of engineering that goes into this Japanese equipment—there's no test like continuous use to show up mechanical defects, but it's a test we cannot usually apply due to the obvious time limitation. It might perhaps be of some interest if in the near future we were to carry out a complete investigation on this well-worn 3000D and report on its present technical performance. Our guess is that apart from the usual slight deterioration in speed stability (which can be brought back to standard by simple servicing) the machine is probably still performing up to the specification we published last year!

We have a standard drill for user tests, and this includes copying from 15 ips master tapes, playing back pre-recorded tapes of known quality and dubbing "off the air" from VHF mono and stereo radio transmissions. All these exercises were repeated twice with the Akai, once at 7½ ips and again at 3¾ ips. In each case comparative listening tests were made by means of the very simple source/tape monitor switch on the machine. Just for fun we invited a listening panel to join in the game by telling us which was the source signal and which was the playback of the tape.

The result of this interesting experiment was that all were agreed that at 7½ ips it was quite impossible to differentiate accurately between the two. At the slower tape speed there were a few more inspired guesses (or very sharp ears!) and following discussion it was

decided that a small increase in hiss can be detected when working at 3¾ ips. This is, of course, the effect of the equalisation network coming into play and can be compensated for by slight tonal correction at the main amplifier.

We took some trouble over these subjective tests because with the extension of frequency response at slow speeds there is an obvious inclination on the part of owners to save tape by dropping down from 7½ ips. Whilst we would certainly confirm that at 3¾ ips the 4000D will give outstandingly good quality there is a marginal advantage to be obtained by running at 7½ ips and so we would still use that speed when ultimate quality standards are required. When one comes to edit, 7½ ips is essential.

And what a joy editing is on the 4000D! With no fittings in the way the rear of the tape is instantly available for marking with the Chinagraph pencil. We would have liked to see some of that spare space on the deck plate used to accommodate a decent splicing block, but unfortunately the manufacturer apparently did not think of it.

Although our existing 3000D has never required any service attention we are only too well aware of the importance of good service facilities to new owners, so we discussed the terms of the guarantee with the distributors. It seems that in common with all other Akai equipment the machine is doubly covered by two quite separate guarantees. First the manufacturer promises to replace free of charge any defective part—including labour charges—for a period of six months after purchase. This is extended by the Rank Organisation's own guarantee which again covers parts and labour, but for a period of twelve months after the original purchase date. That seems to us to be very fair indeed—much better than the guarantee that one would get with, say, a new motor car. We like to think of the purchase of new recording equipment as an investment rather than an expense, so these very generous guarantee terms do help to inspire confidence.

Turning back from such thoughts to practical use once again we found ourselves admiring this delightful tape recorder more and more. The almost complete absence of mechanical noise with a lack of background mush or hum together emphasise the extreme clarity of the reproduced sound. In spite of the too-small level control knobs we had no difficulty in setting accurate recording levels, thanks to the operation of the meters. These, by the way, also read the playback signal when the monitor switch is in that position. But what about the

drop-out danger? Surely the lack of pressure pads would increase this?

Our investigation into this produced a result which still rather puzzles us. We took a recorded tape with some of the most atrocious drop-out we have heard for a long time. It is really "unlistenable," it's so bad. We played it on a machine with pressure pads to confirm. It sounded ghastly. Then we put it on the 4000D. The drop-outs almost disappeared! This apparent absurdity can only be accounted for by assuming that the very highly polished surfaces of the heads on the 4000D are able to maintain better tape/head contact than is achieved by some other machines using rear pressure applied by means of felt and springs. Interesting, isn't it?

Unlike the 3000D the new machine has facilities for both sound-on-sound and sound-with-sound, so it can be used for building up multi-track recordings or for creating composite sounds recorded

separately on different tracks. In addition the usual echo effects can be obtained by feeding the output of the playback head back into the record circuit. All very useful for creative work. And we were pleased to find that the 4000D is supplied complete with a simulated leather cover for the deck. Although not very elegant it does serve the essential purpose of keeping the dust out; with the older machine it was charged for as an extra.

And talking of price we have some very late news just as this review is being completed. The price of the 3000D in March 1968 was quoted by us as £86. That was in the palmy days before purchase tax reared its ugly head. Price of the 4000D was £99 15s. inclusive, but has now been reduced to £87 10s. including purchase tax. So this means that in terms of cost we are right back to where we were eighteen months ago, but the same price is now attached to a slightly better and more modern machine. This is quite

an achievement which is no doubt due to the great power of the Rank Organisation and we do feel that the fact that they at once pass on their advantage to the consumer should not go without acknowledgment from us. Congratulations and thanks to you!

Our review can best be concluded by quoting again the words with which we summarised our faithful 3000D. In March 1968 we said of this machine: "It cannot claim to be a Rolls-Royce amongst tape recorders; it can, however, claim to achieve a standard of technical performance far in excess of that indicated by its cost." Those words are even more true when applied to the 4000D today. It is a machine that can be bought in the sure knowledge that it is not only very fine value for money but it will provide its owner with an enviable standard of audio quality that is likely to be maintained over the years. And the owner's wife will be proud to see it in the living-room too.



NATURE NOTES

FOR OCTOBER

BY RICHARD MARGOSCHIS

THE British Institute of Recorded Sound in London is recognised as the National collection of sound recordings. It was established some years ago and from its premises, at 29, Exhibition Road, S.W.7, it aims to do for recorded sound what the National Film Archive does for films.

I had the pleasure of being present, on July 2, when a new department of the Institute was declared open by the well-known broadcaster and naturalist David Attenborough. This new department is known as the British Library of Wildlife Sounds, or B.L.O.W.S., and its establishment is the culmination of much groundwork by Jeffrey Boswell and Patrick Sellar who both recognised the need for a national repository for natural history recordings which should be made available for scientific and cultural purposes.

The library is now wanting to build up its stock of recordings and is only too willing to accept material from beginners and experts alike. A good technical quality is preferred, of course, but this does not rule out recordings made on inexpensive equipment; many recordings of doubtful technical quality can be of considerable scientific value. Contributors are invited to submit any of their recordings which they consider to be of interest. No payment is made but there is the great satisfaction that copies of your recordings are held safe in a national collection and that they are available to other people for scientific study; much better than being filed away in your own collection only.

You need have no fear about copyright, it remains with you and very stringent rules protect it. Users of the library have to

sign an agreement not to infringe your copyright in any way and that the recording is to be used for scientific purposes; due acknowledgment must also be given in any scientific paper to which the use of the recording contributed. Full details of the workings of the B.L.O.W.S. and how to become a "Friend of the Institute" can be obtained from the Director at the address already given.

As the collection of recordings grows the library will start its second main purpose, that is to become the co-ordinating and advisory service for all interested in wildlife sound in Britain. To do this it must, and I am sure it will, maintain close contact with other interested organisations such as the Wildlife Sound Recording Society. If it is successful in this it will then be able, for example, to say to a Society, whose main purpose is to obtain recordings, that another organisation requires recordings of a certain species for scientific study. It will also attempt to supplement the recorded sounds with a collection of printed literature on the subject of wildlife sound recording.

It is vital that documentation of any recordings sent to the library—in fact of any worthwhile recordings—should be as complete as possible. I hope to devote some space to this very important matter in the future.

The autumn migration will soon be complete and with it comes the annual change in our bird population which has the effect of considerably reducing the number of species present. This, together with the fact that trees will soon be bare of leaves to make their inhabitants more visible, makes the next few months a good time to become familiar with our native species, but you must remember that the plumage, generally, will not be so brilliant in its colours as during the breeding season.

If during October you hear a sort of "si-si-si" call you can be fairly certain that there is a member of the tit family in the vicinity, for this is characteristic of their calls but it does vary somewhat with the species. There are about eight species of tit to be found in the British Isles though at least two are confined to relatively small areas; for instance the bearded tit is found in the reed beds of East Anglia and the crested tit in the Cairngorms of Scotland. The high pitched, and very strong, song of the great tit—"teacher-teacher"—is probably the best known but, like others in the family, it has a very wide vocabulary and experience is the only sure way of learning to recognise the species from their song.

I think the long-tailed tit is my favourite. It would be one of our smallest birds if it were not for its very long tail which, together with the upper parts, is black and contrasts with the pinkish white under parts; the body appears quite round. Like all members of the family the bird is an accomplished acrobat. During the autumn particularly, they are gregarious. To stand in a wood on a cold day and listen to a party going through a foraging expedition is, to me, one of the joys of winter expeditions.

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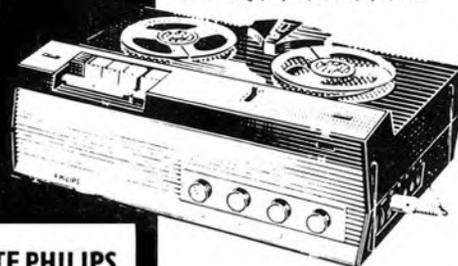
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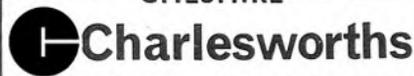
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REVIEWS

BACH. Concerto in D Minor for oboe and
violin BWV 1060, Concerto in D Minor
for two violins BWV 1043 and Concerto
in A Minor for flute, violin and clavier
BWV 1044. I Musici. Philips CPC 0064
49s. 11d. including purchase tax.

Only the other day a highly musical friend
of mine asked plaintively when we arrogant
English are going to stop referring to the
plural of "concerto" as "concertos" in-
stead of, as she would have it, "concerti."
The person concerned is, of course, of non-
English extraction (and therefore beyond
either redemption or the pale!) but surely
the answer is that the word has now become
so anglicised as to warrant an English
plural? The question came to mind when
faced with this delightful Musiccassette of no
fewer than three Bach concertos(!).

Whether spelt with an "s" or an "i"
makes not the slightest difference to the
value of this truly great collection. By con-
trasting these three works with their differ-
ing solo instrumentation we have an album
of the greatest interest to both music lover
and musicologist alike. The only snag is with
the very occasional fractional drop-out.
What a pity they should be there to mar an
otherwise perfect recording. We shall care-
fully watch for the claimed improvement to
the quality of classical Musiccassettes when
they are dubbed on the new copying equip-
ment in Holland. Mind you, even up to now
much of the technical quality has been quite
exemplary, but there's always room for
improvement. I shall be pleased to report on
developments as soon as I can get my hands
on an imported sample.

But small imperfections are not sufficient
to spoil the pleasure of listening to music
such as this. Or to the performance of I
Musici. As usual they excel themselves.

The first two concertos come from Bach's
Anhalt-Köthen period when he was orches-
tral conductor to the Court of Prince
Leopold. Origins of the third work in A
Minor for flute, violin and clavier are more
obscure, probably being derived from much
earlier pieces. Of the three concertos this is,
I think, the one which gives me most plea-
sure; especially the second movement where
the three soloists freely interchange richly
figured melodies.

Why waste words talking about the in-
comparable Bach? He wrote his music for
listening, not for discussion, so I shall sit
back and enjoy hearing these three con-
certos yet again. I hope that at least some of
my readers will be able to do the same.

**THE AYNSLEY DUNBAR RETALIA-
TION.** Liberty CO917E. 47s. 6d.
including purchase tax.

Every now and again one comes across an
album that exercises a strange fascination
for little or no obvious reason. So far as I
am concerned that was precisely the effect
of this collection on me. A compelling desire
to hear more. There's no doubt at all about
it—this group really has something and
makes the most of what its got.

A few peculiar things happen on this
cassette. The voice quality, for instance.
It's very "boxy" and artificial. Yet that
distortion must be deliberate; the rendering

of the instrumental parts is excellent. No, this is a tape one likes in spite of, rather than because of. There's some "oh-so-blue" blues singing and some virtuoso displays on the drums. And plenty of tongue-in-cheek humour with numbers like *My whisky head woman*. She, by the way, "stinks like a whisky bell—ugh! nasty!!" All charmingly down to earth and all that.

Repertoire includes: *Watchin' chain, My whisky head woman, Trouble no more, Double lovin', Sage of Sydney Street, See see baby, Roamin' an' ramblin', Memory of pain and Mutiny*.

The sleeve notes quote detailed biographies of the members of the group, whose purpose is said to be "to explore an unlimited landscape in which we can paint whatever we want." That's fair enough, and certainly there's bags of originality in this batch of numbers. And fine performance, too. So for something a little different in the blues idiom try Aynsley Dunbar. You might like it.

BACCHANAL. Gabor Szabo. Fontana CFP4040. 47s. 6d. including purchase tax.

Gabor Szabo is described as "a true mystic" who does not clothe himself in exotic robes or adorn himself with beads or charms. That makes a change. His mysticism is claimed to manifest itself only through his music. That's even better. But the word "mystic" has been so overworked lately as to have fallen into disrepute. There are so many gurus around one wonders if the supply of disciples is not running short.

But the music of Gabor Szabo is no joke. This is a serious exploration into the world of sound. He doesn't so much play his guitar as think aloud with it. And it's wonderful how effective that can be. Apparently when

on stage he stands in front of his group as he improvises around his thoughts and a theme with silence all around him. As the mood takes the boys they come in with variations, counter-tunes and new points of view. The total effect is quite extraordinary.

There are only four numbers on each side because every one is a lengthy excursion into the Szabo mind and style. They are: *Three king fishers, The look of love, Theme from "Valley of the Dolls," Bacchanal, Sunshine superman, Some velvet morning, Love is blue and Divided city*. The latter, written by Szabo, is an obvious reference to Budapest from which city he escaped at the time of the Revolution. As did bassist Louis Kabok.

Recording is good with interesting stereo effects. If you want to invest in a little respectable mysticism then this is for you.

3 $\frac{3}{4}$ ips STEREO

ORGAN FAVOURITES FROM BLENHEIM PALACE. Nicholas Danby. Columbia TD-TWO 208. 3 $\frac{3}{4}$ ips four-track Stereo. 41s. including purchase tax.

In my humble opinion there are few more magnificent sounds to be heard than that of a great pipe organ. Here in this album we have a great width of tonal quality produced on the instrument in Blenheim Palace by Nicholas Danby. What a pity the publishers tell us nothing about the organ itself. Every organ has a story to tell and this instrument can be no exception.

From the sound I would say that it is rather more modest than some of the truly mighty cathedral instruments—some of

which I have been privileged to record myself.

Performance of Nicholas Danby is superb. It's the only word for it. And as such it will delight the hearts of all organ aficionados. The repertoire comprises: *Toccata and Fugue in D Minor* (Bach), *Trumpet Voluntary* (Clarke arranged Ratcliffe) *Suite Gothique Opus 25* (Boëllmann), *Toccata from Symphony No. 5 Opus 42* (Widor) *Nimrod from Engina Variations Opus 36* (Elgar arranged Harris), *Scherzo from Dix Pieces* (Gigout) and *Choral No. 3 in A Minor* (Franck).

The last time I heard the Bach *Toccata and Fugue in D Minor* was at a "hi-fi" demonstration. As the very first note seared across the auditorium it was quite obvious that we were fated to endure a manufacturer's idea of what a church organ should sound like rather than the reality of the instrument itself. It is a fact that harsh speaker units will quickly transmute the lovely rounded tones of the pipes into something approaching an electronic screech. So good listening equipment is needed to do justice to this album, particularly as there are plenty of low register notes to cope with. And don't be put off by the "clonks" now and again. These are the mechanical noises of the organ itself and without them the record would be incomplete.

A very good buy for all lovers of the instrument amongst which I am proud to number myself.

Equipment used for review tapes: Amplifiers—Quad valved and Ferrograph F307 Loudspeakers—Celestion and Jordan-Watts. Tape Recorders—Akai 3000D and Tandberg 64X.

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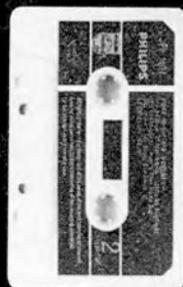
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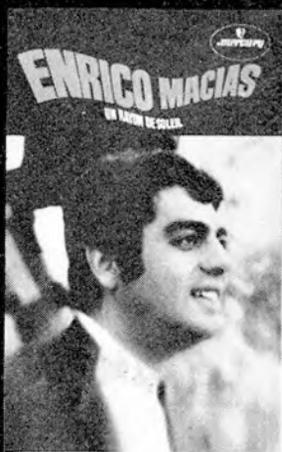
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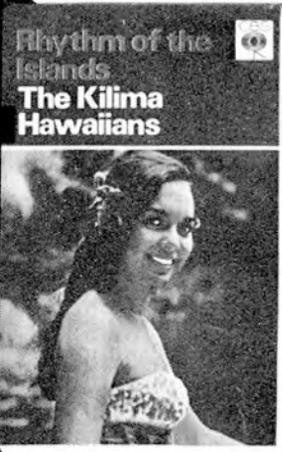
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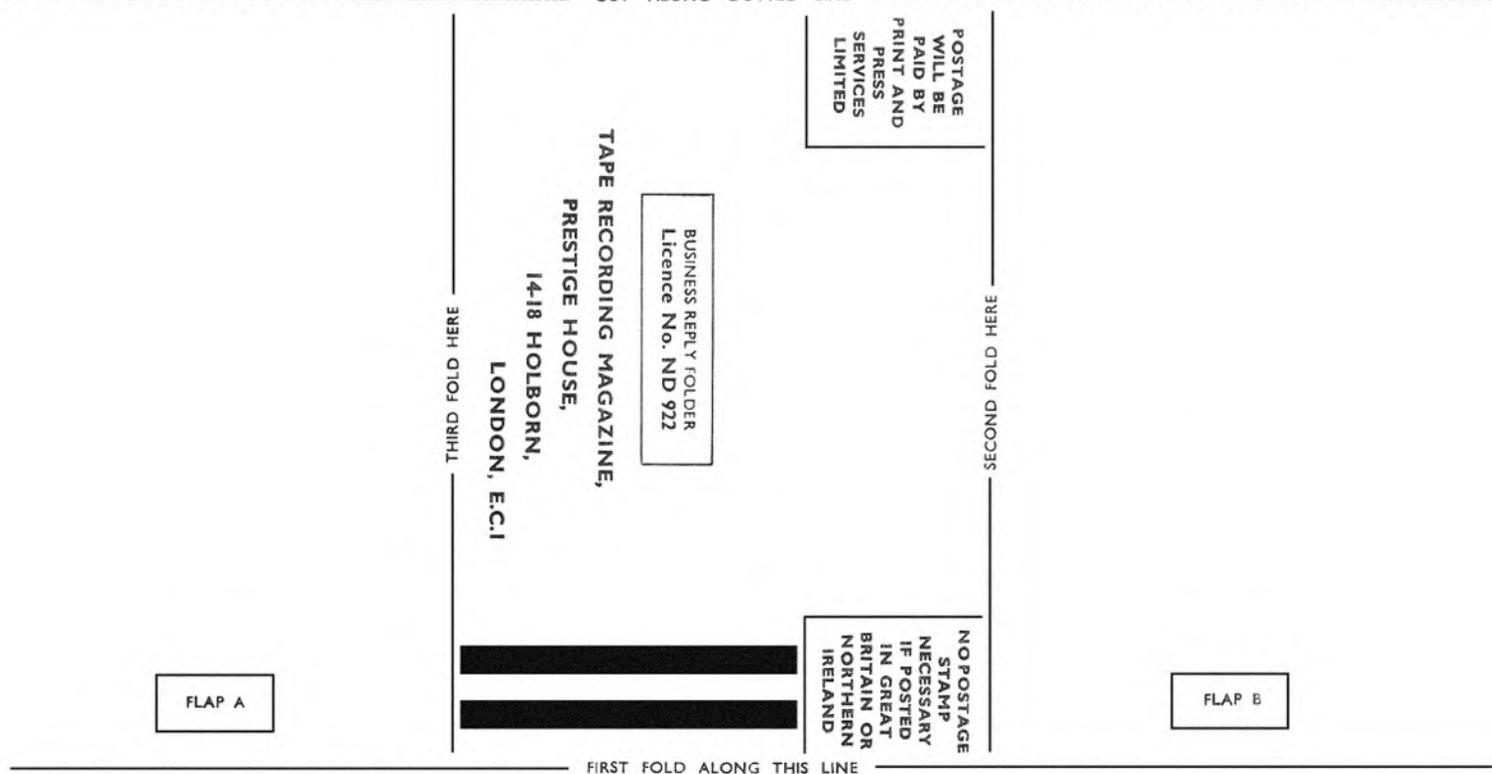
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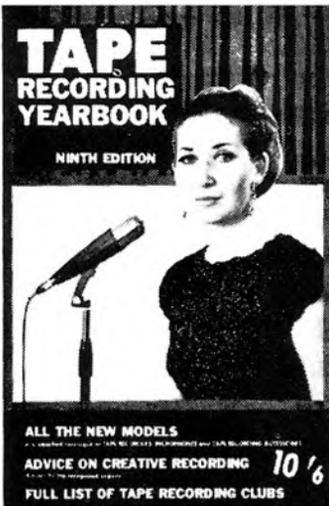
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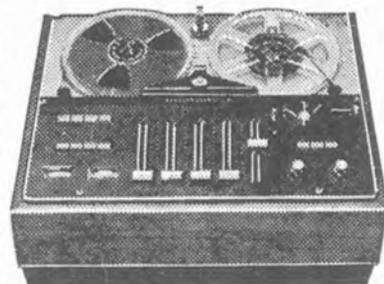
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Recording System: AC bias
Erasing System: AC erase
Reel Size: 7" dia.
Speeds:
 $7\frac{1}{2}$ in/sec (19 cm/sec),
 $3\frac{3}{4}$ in/sec (9.5 cm/sec)
Playing Time:
 stereo
 30 min. x 2 at $7\frac{1}{2}$ in/sec
 with 7" (18 cm),
 1,200 ft. (360m) tape

1 hour x 2 at $3\frac{3}{4}$ in/sec
 with 7" (18 cm),
 1,200 ft. (360 m) tape
 monaural
 30 min. x 4 at $7\frac{1}{2}$ in/sec
 with 7" (18 cm),
 1,200 ft. (360 m) tape
 1 hour x 4 at $3\frac{3}{4}$ in/sec
 with 7" (18 cm),
 1,200 ft. (360 m) tape
Rewind Time: 3 min. with 7" (18 cm)
Frequency Response:
 20-19,000 c/s at $7\frac{1}{2}$ in/sec
 (19 cm/sec)
 (30-15,000 c/s \pm 3db)
 30-12,000 c/s at $3\frac{3}{4}$ in/sec
 (9.5 cm/sec.)
Recording Level Indicator:
 VU meter
Power Output:
 Maximum 4W (each channel)
 Music 6.5 W (each channel)
Speakers:
 Two 4" free-edge permanent
 speaker boxes.

Voice coil impedance 10K ohms.
Line Outputs:
 1K ohms
Power Source:
 AC 100V, 117V, 125V, 220V, 240V
Dimensions:
 $14\frac{1}{4}$ " wide x $12\frac{3}{4}$ " deep x 11" high
 (350mm x 330mm x 280mm)
Weight:
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