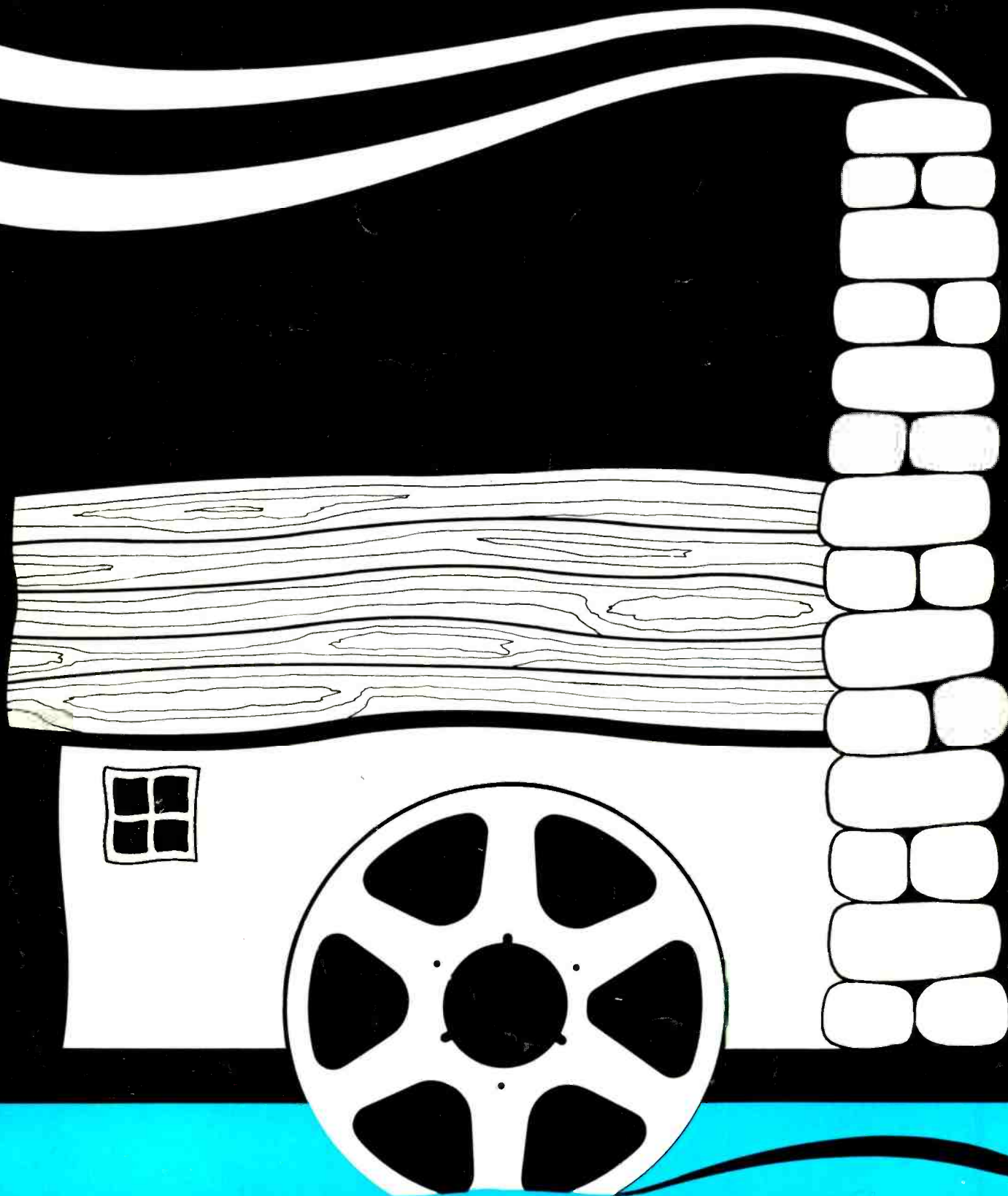


# studio sound

October 1976 35p

AND BROADCAST ENGINEERING



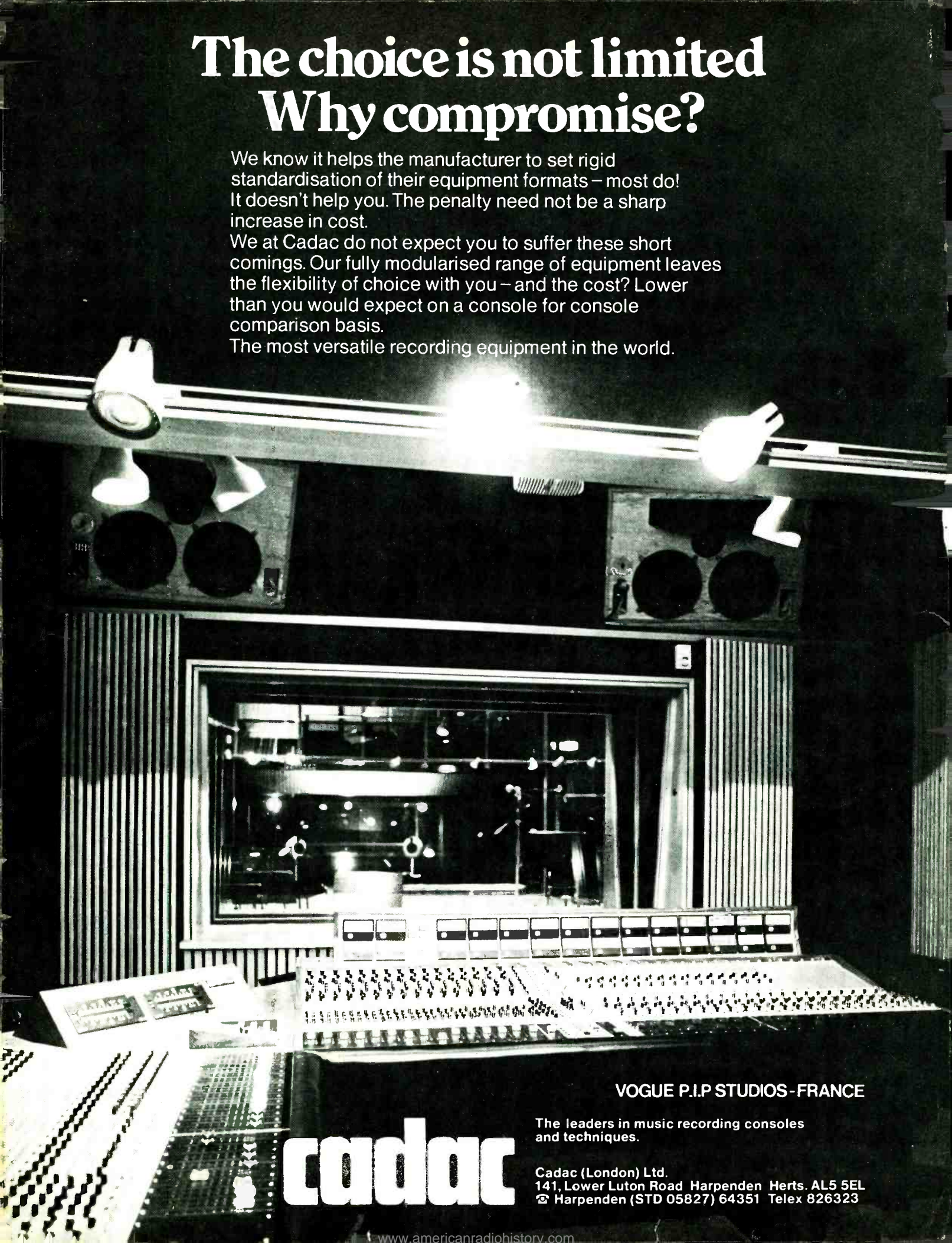
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At the height of the recording boom which, needless to say, everyone remembers with affection, one top rock group booked a London studio for a solid 24 hours a day, five days a week for a total of five months. This ran up a total of 3500 hours putting the cost at around £140 000, ignoring the inevitable cash discount which might have made it a little bit less. The bill, in spite of this, came to quite a lot.

Even apart from the musicians' time, the expense didn't end there. Feeling unhappy about the drum booth sound, the group went out and bought several hundred pounds worth of plywood and bathroom tiles with which they built their very own drum booth on the studio floor. Also, because the record company had originally promised them time in a studio deep in the country, the group felt cheated recording in the heart of the Metropolis. Their answer was to fill the studio with potted plants and bring in a herd of life-size plastic cows complete with heads specially designed to nod in time with the music. Naturally, the resulting album sold Jolly Well.

From the foregoing (an absolutely true story) it suggests that most studio clients are artistically sensitive petals who wilt in a workmanlike environment. It hasn't always been the case though; once upon a time, it was all done on a two track tape recorder borrowed from a friend of a friend, originally purchased at a second-hand shop somewhere in SE11. Plenty of beer in the fridge was far more important than headroom on the tape, although not even the destination cared about the blemishes, provided the resulting tape had feeling.

Then everything changed. Artistically adept tapes made a lot of money which naturally concentrated attention on its source: the musician. This resulted in a turnaround situation; whereas before the Spartan working conditions led to a kind of freebooting spontaneity in the people who had to make the system work, the economic muscle power of the bright lights made the system work for its superstars.

Naturally the supply met the demand in a manner that only capitalism can cater for. People initially wove the myth—which the music industry readily propagated—that the perfect ideal for the recording environment was a Houston launch special, manned by dudes in dark shades peering through a gloom of red spotlamps (mood lighting). It is no wonder that clean-living superstars wanted to go up the country and seek the working solitude of log cabins/great danes.

Sure, they had to be there long enough to make a 1000-mile round trip worth the effort; country studios aren't the right place for a three-hour overdub. Similarly, not everyone is brave enough to stand the rigours of poison ivy/lack of Macdonald's Gristle Burgers which means the status quo won't crumble overnight. However, the demand for rural recording is a cry to better the working environment. Similarly, it is worth noting that sandwiches and showers on tap can do more for the resulting tape than equalisation and headroom, especially at four in the morning.

Plastic cows are merely symptomatic of a need.

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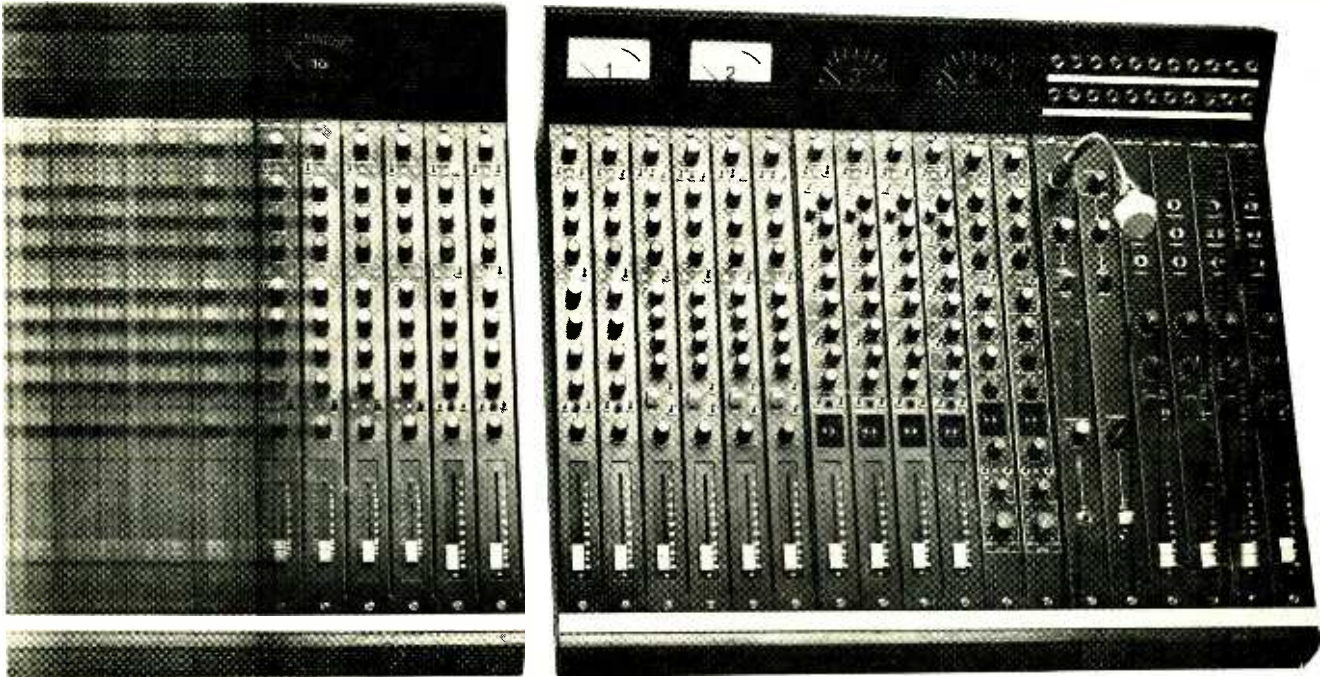
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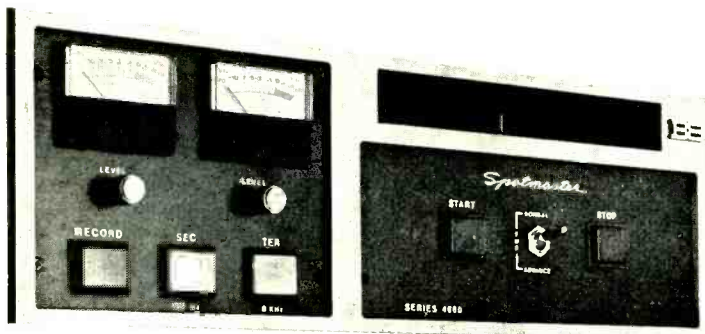
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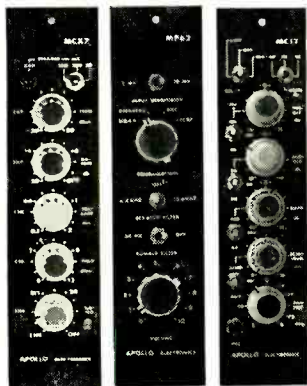
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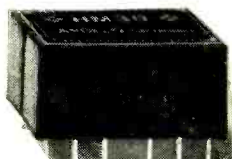
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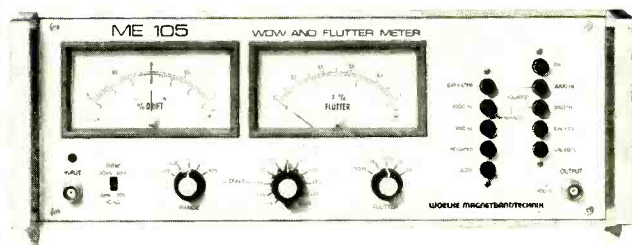
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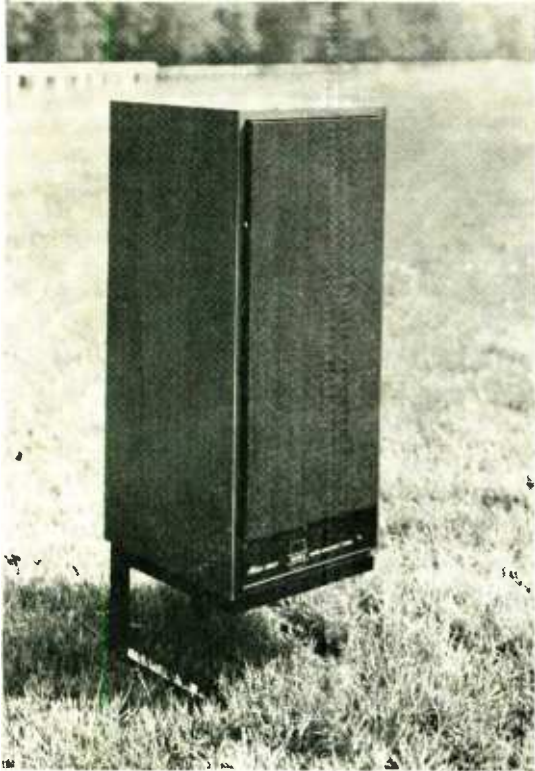
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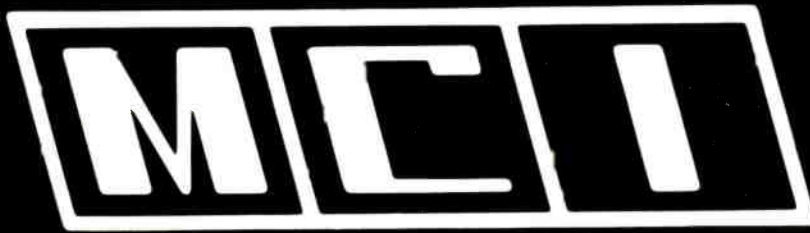
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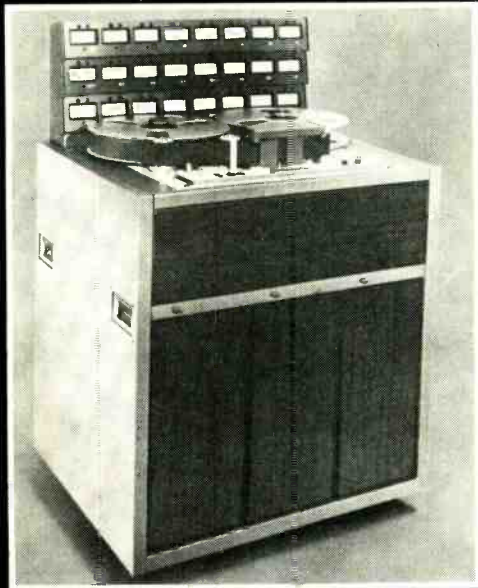
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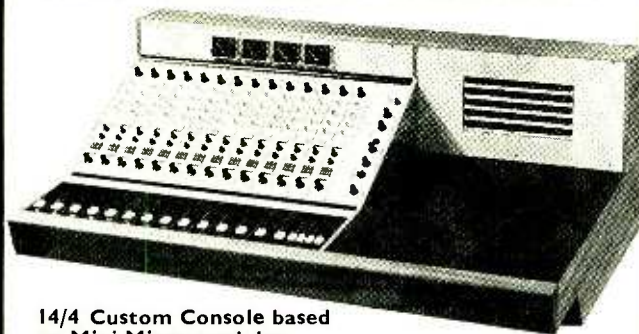
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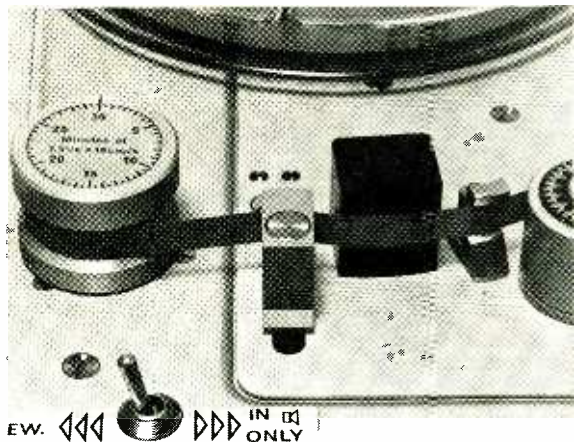
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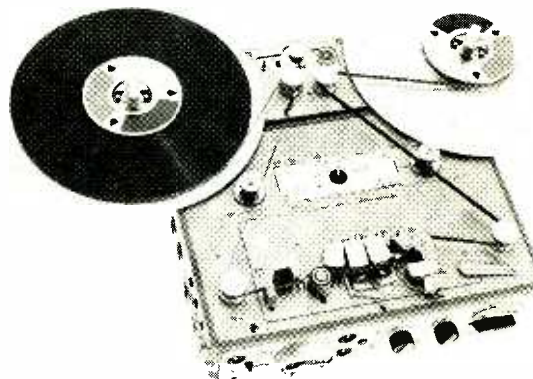
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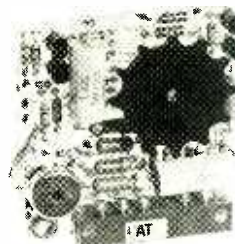
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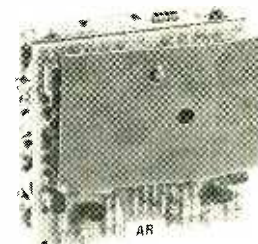


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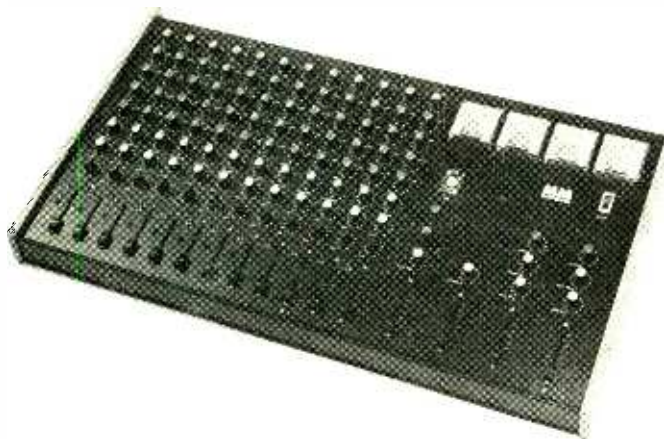
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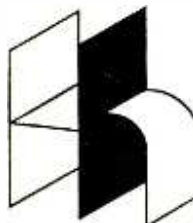
# Eagle



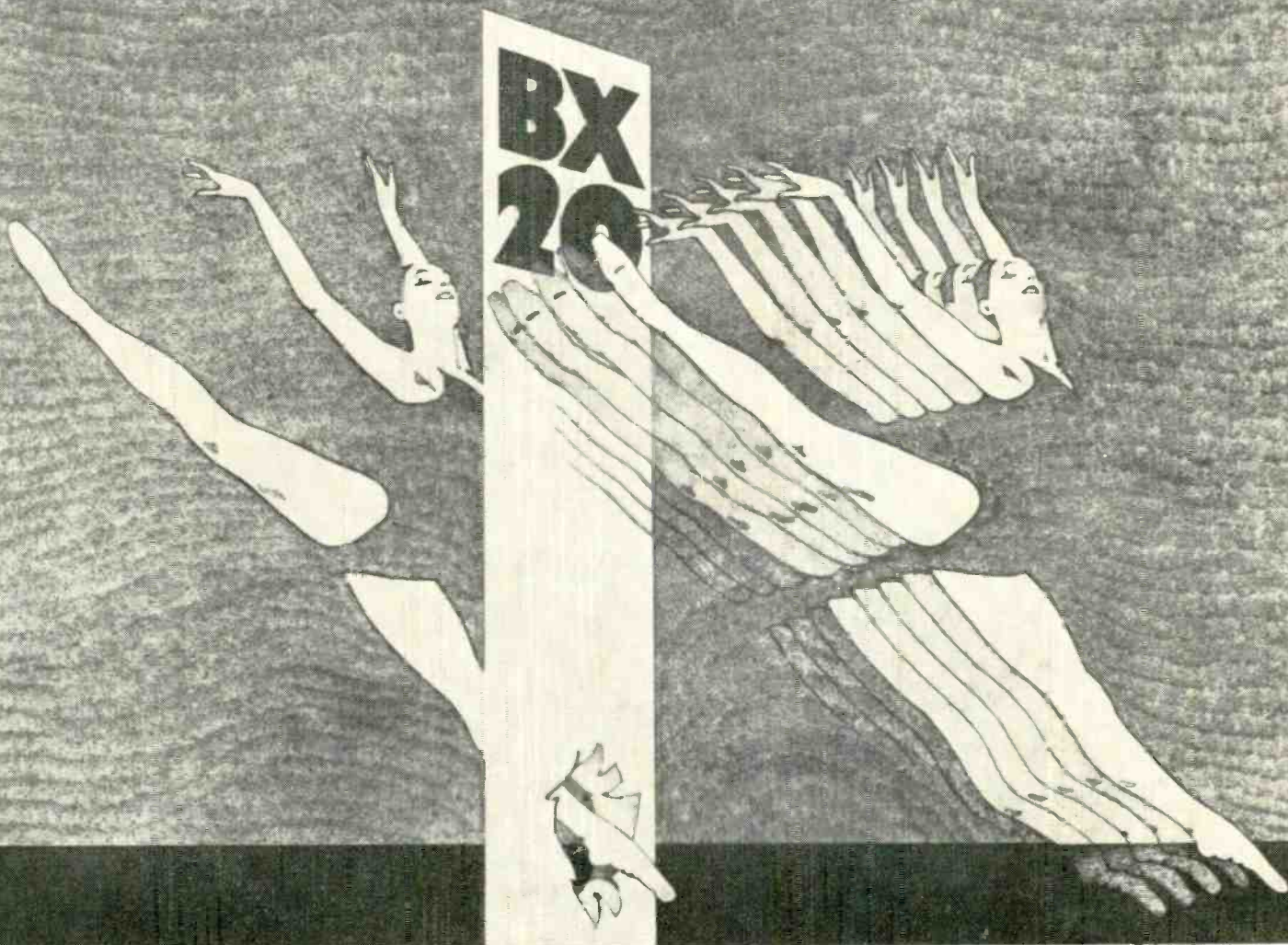
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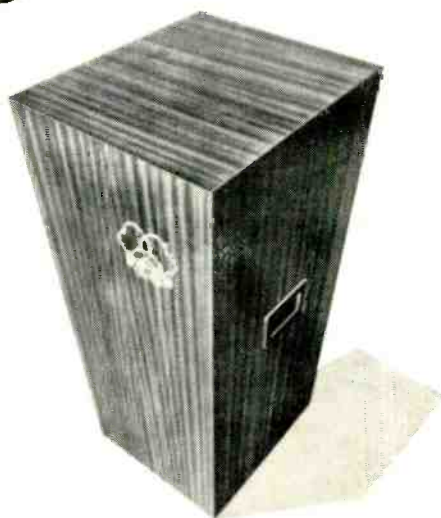
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Have a Laugh:- What's the difference between Nicholas Hi Fi and Neil Gwynne?  
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and Nick always keeps abreast — of the times.



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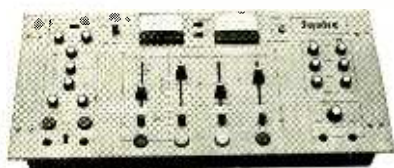


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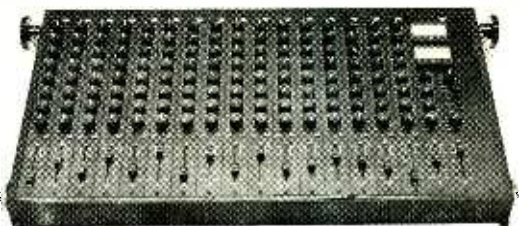


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## Hear Hear **CHILTONS** New Mixer 8 TRACK MONITORING & STEREO MIXDOWN

Series **QM1**

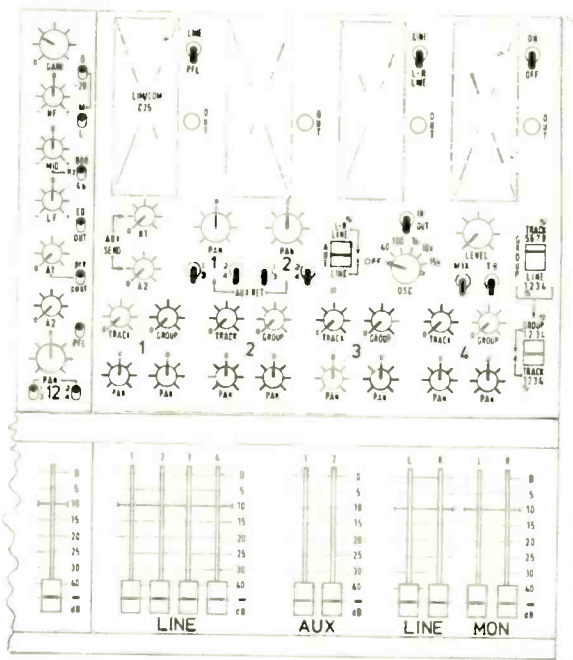
Here is the mixer that is equally at home in the 4 or 8 track studio or in the PA rig. It provides 4 output groups, 3 band equalisation, balanced Mic. pad, Mic/Line switch, stereo monitor mix and a stereo master too. We install two auxiliaries talkback and ppms as standard and package it all in a compact case 9 inches high, 18 inches deep and 32 inches wide following our earlier classic outline.

We do a variation on the QM1 series which is tailor made for the hard pressed radio DJ who also has to use his mixer when recording live events.

The price starts at £1210 for a 12/4 as above.

**MAGNETIC TAPES Ltd.,**

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## MELLOTRON 400 FX EFFECTS CONSOLE

Mellotronics have introduced a new model of their Keyboard effects console—the simplest and quickest means of dropping in spot effects.

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For further details ring:

Peter Granet 01 637 0692  
Mellotronics Limited,  
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London,  
WIN 3AG

Midlands and North, Bradmatic Limited 021 353  
contact: 338 Aldridge Road, 3171  
Streetly,  
Sutton Coldfield,  
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## a remarkably easy compressor



Illuminated meter shows peak operating level, output level or gain reduction.  
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Noise level below -70dBm.  
Max. output +18dBm.  
Frequency response 30Hz - 20KHz ±1dB.  
Separate switched 20 : 1 limiter side chain with LED indicator.  
Bypass comparison switch.

Because we've done the work for you, bringing up the compression on a CM4 doesn't alter the output level at all. In fact, our twelve IC's track compression, threshold and make up gain all on one control, so adding compression doesn't upset your mix.

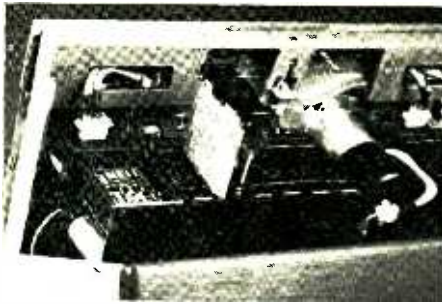
One wire links CM4's for stereo or quad and we guarantee the match to within 1dB.

For less than £100 per channel the Quail CM4 is also remarkably easy on your budget.

**Quail audio**

115 Hatfield Road St. Albans Herts.  
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A subsidiary of Zero 88 Lighting Ltd.



## Quartz precision. What it's done for watches, it does for the F400



In timekeeping, quartz accuracy is measured in millionths of a second. That's precision.

Now, with the F400 from Schlumberger, quartz precision comes to professional tape recording. Because the F400's DC drive motor is crystal-slaved and phase-locked, setting new standards of stability in tape transport speeds. Better, in fact, than 0.02%. With stability like this, the necessity for a speed control is eliminated.

The slave facilities make the F400 ideal for integration into computer-controlled systems. The DC drive makes possible a wider range of speeds; forward and reverse tape transport; and easily

controllable acceleration and deceleration.

Other features include modular construction of both mechanical and electrical components for easy maintenance, and hard-tipped long-life magnetic heads.

So when it comes to the latest technology in professional tape recording, think quartz. Think precision. Think F400.

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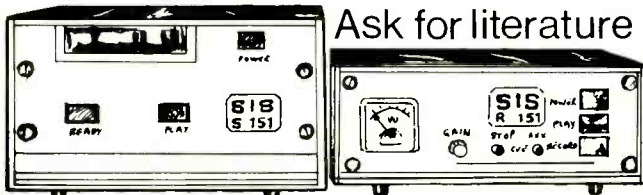
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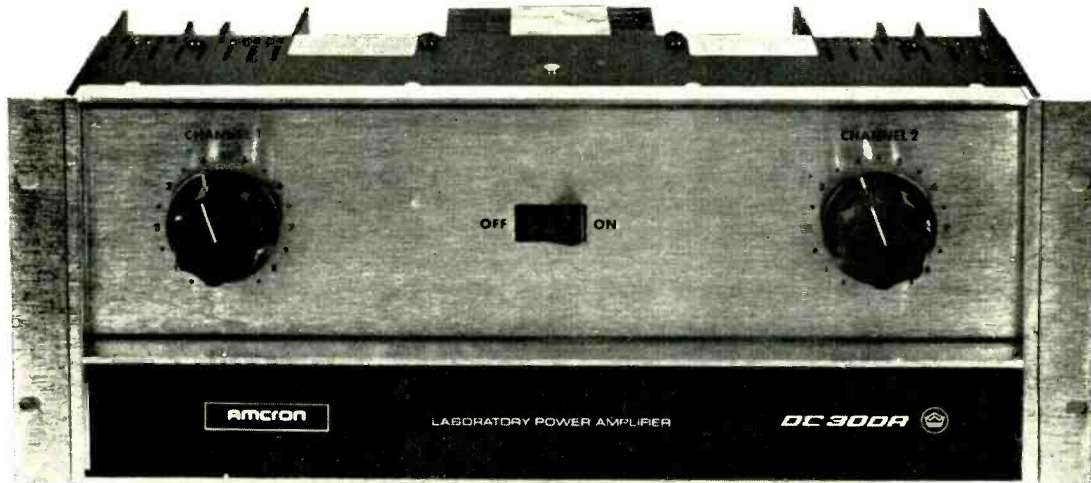
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## IT HAS TO BE AMCRON!

Amcron power amplifiers come in three sizes, D60, D150 and DC300A, and all offer superb quality sound reproduction combined with a well-earned reputation for reliability. Introduced back in 1967, they are found in all possible applications involving amplification of Audio Frequency signals. Little wonder that they are chosen by leading studios such as Advision, De Lane Lea, Island, The Manor, Central Sound, and Kingsway Recorders to name but a few.



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## Electret Condenser Microphone Family

The new Sennheiser System comprises of a common powering module with a choice of DIN or cannon connector and three microphone heads. The microphone modules screw directly onto the powering module and give a choice of omni, super-cardioid or super directional 'gun' patterns.

The advantage of this system is its versatility and the individual modules can be purchased separately.



Illustrated are the pre-amplifier and three different capsules.

FOR FURTHER INFORMATION SEND THE CUT-OUT COUPON TO:

### Hayden Laboratories Ltd

**HAYDEN**

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Please send a free copy of the Sennheiser Catalogue —  
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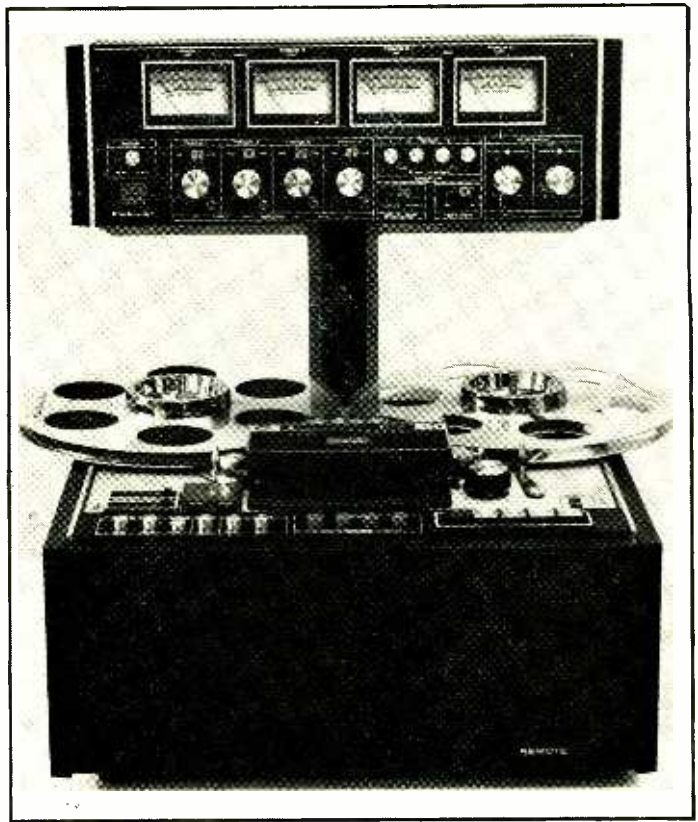
Code SS/ECM/10

# news

**MCI (UK) handles L J Scully**  
Dag Felner announces that his company, MCI (UK) Ltd now handles the British agency for the L J Scully Manufacturing Corporation residing at 138 Hurd Ave, Bridgeport, Conn 06604, USA. Phone: (203) 368 2332. This company should not be confused with the Scully/Metrotech Division

of Dictaphone.

L J Scully products include *The Lathe* and a complementary tape machine with advanced head, the *Pre-view Master*. The latest models include half speed cutting for carrier quadraphony. MCI (Professional Studio Equipment) Ltd, 21 Claremont Square, London N1 9IX. Phone: 01-278 8190.



Left: L J Scully lathe

Above: Dokorder 1140

## New studio

Sound Developments Ltd, Spencer Court, 7 Chalcot Road, London NW1, recently opened their new 16-track studio with the kind of party so beloved by freeloaders the world over. Despite the inevitable crush, it was evident that the whole Spencer Court complex (music studio, production studio and pre-production studio, along with audio-visual workshop) is sensibly and tastefully laid out without any skimming on equipment.

SD are planning to charge £27 per hour for the new 16-track studio. The 24/16 desk has an especially interesting history. Eighteen months ago SD purchased the API console from Command Studios (remember them?) with the intention of modifying it. In the event, the modifications became so extensive that virtually nothing of the original desk remains, which is why it is listed as a Sound Developments/API console and the exercise has taken 18 months. Amongst the

modifications are monitoring and fader control on each of 24 channels/tracks; two separate stereo foldback systems with individual equalisation and echo return; and the facility to record the monitor mix at the flick of a switch.

**Adrian Hope**

## New console from Audix

The company has added a new product to its range of broadcast consoles. The *B102* is a 16 input, four group, two main output desk designed to meet the requirements for radio and tv broadcast networks. Due to the modular construction, the *B102* can be expanded to accommodate up to 36 input modules; the addition of a monitoring section to the basic desk enables the unit to function in multitrack recording applications.

On August 1, John Freeman was appointed to the board of Audix in the capacity of director. Formerly,

he was the company's chief engineer.

Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4L9. Phone 0799-40888.

## Cheap tracks

Dokorder offers four tracks on 6.25 mm for the sum of £675; the *1140* also features full simul-sync and provision for adjusting bias over a  $\pm 50\%$  range. Individual channel leds indicate line levels in excess of +8 dB and operate in conjunction with four eye level vu meters installed within the overhead electronics rack. Two speeds offer 19 or 38 cm/s. Extract from manufacturer's specification:

**Frequency response:**  $\pm 3$  dB from 30 to 20 kHz at 19 cm/s at unspecified recording level.

**Signal-to-noise:** better than 60 dB (weighted rms) 56 dB (unweighted rms).

**Crosstalk:** better than 50dB at 1 kHz.

**Wow and flutter:**  $\cdot 07\%$  rms at 38 cm/s  $\cdot 1\%$  at 19 cm/s.

REW, 146 Charing Cross Road, London WC2. Phone: 01-240 3065.

## Distant drums

Keith Monks Audio Ltd announces an extension to their range of cable drums (sic). It's called the *CD3* and will hold approximately 400m of microphone cable or 120m of 2 cm multicore. This represents a

twofold increase on the *CD2* and a fourfold increase on the *CD1*.

All units are designed for stacking and spare drums are available complete with clips and hooks for securing cable terminations.

Keith Monks (Audio) Ltd, 26/28 Reading Road South, Fleet, Nr Aldershot, Hants. Phone 02514-7316.

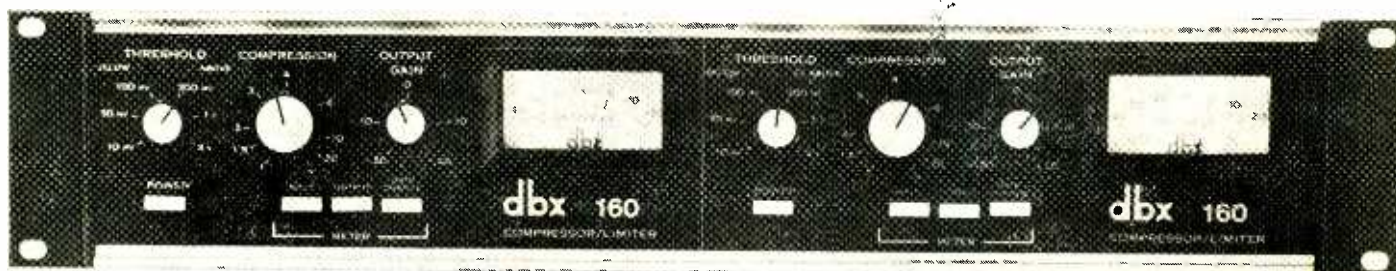
## Complex

Compteurs Schlumberger, Sodeteg and Thomson CSF are nearing the completion of a large contract to supply a complex to 'La Voix du Zaire', the Kinshasa-based broadcast network for the Republic of Zaire.

Commissioned by the Department de L'Orientation Nationale, the complex is built on a vast area of ground dominated by a 25-storey tower housing the administration, itself surrounded by technical buildings for radio, television and film. Schlumberger provided 18 studios of varying size and usage, four large television facilities, as well as post-sync and dubbing rooms etc. Opening date for the complex is envisaged as November 24, 1976.

To complement the activities at the centre, Schlumberger will also supply five outside broadcast vehicles equipped with broadcast con-

# The Compressor that's seen but not heard. DBX 160.



DBX Inc. Waltham, Mass, USA

The dbx 160 compressor/limiter is the first in a new series of devices from the manufacturers of the dbx noise reduction system for the control *without degradation* of audio signals.

Unlike most conventional compressor/limiters which use peak detection and fast response characteristics, the dbx 160 employs true RMS level detection circuitry signal sensing coupled to a highly sophisticated voltage controlled amplifier gain control element.

As the human ear responds not to peak but to RMS signal values (defined as the sum of all frequencies/energies present), the dbx 160 produces listenable results *even at extreme levels of operation*.

Overall distortion on the dbx 160 is markedly low owing

to the use of feed-forward control circuitry. This gives superior results to the level sensing feedback loop used in conventional compressor/limiters. Feedback circuitry results in increased distortion when progressively higher compression ratios are used—the feed-forward circuitry used in the dbx 160 eliminates noticeable distortion even at high compression ratios.

The dbx is a reasonably priced professional studio product with balanced high impedance differential input stage and balanced low impedance output. Ground loop compensation is built in to electronically sense any ground loop at the output and attenuate it at least 40 dB. Transient protection circuitry prevents turn-on turn-off thumps appearing at the output.

#### DBX 160 Features :

- True RMS level detection
- Low distortion at high compression ratios
- 1 :1 to infinity variable compression ratio
- 10 mV to 3V variable threshold point
- LED indication of input signal above or below threshold
- 60 db range meter switchable to input, output or gain change
- Ground loop compensated and transient protected
- Available free-standing or in 19" rack mounting pairs

For full information on the model 160 contact :

**Scenic Sounds Equipment 27-31 Bryanston St. London W1H 7AB Telephone: 01-935 0141**

In France : 3M France SA 134 Blvd. Serurier, Paris 19E Telephone : 202 8080

In France : 3M France SA 134 Blvd. Serurier, Paris 19E Telephone : 202 8080

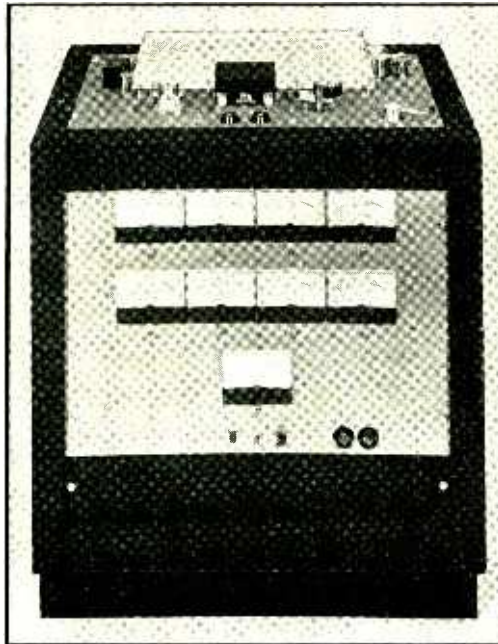
In Sweden : Ing-Firma Jan Setterberg Kungsgatan S. 5411-19 Gothenberg Telephone : 031-130 216

## NEWS

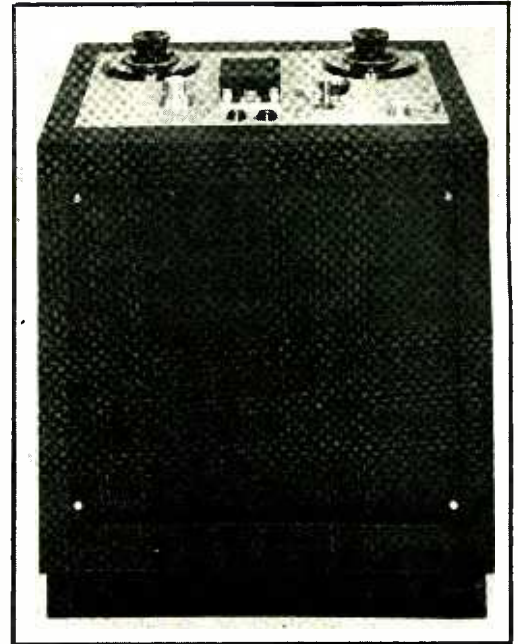
soles, tape machines and record decks manufactured by the same company. They will also carry public address equipment for use at village gatherings where the vehicles can be used to de-seminate education for the improvement of agricultural knowledge at a local level.

### Eight track duplication

The recently introduced Recordex Pro 60 8-track duplicating equipment from the US Singer Products Company is now said to be available for export markets. With average production from a basic package exceeding 3000 programmes in an eight hour shift, the system uses a 16:1 dupe rate; both the master and slaves run at 153 cm/s. The manufacturer claims a transport cost reduction by use of a standard format eight-track master contained within a top mounted bin. Up to six further slaves may be added effectively doubling the production rate. The overall system uses full logic control—one button starts the production. Singer Products Company Inc, One World Trade Center, New York, NY 10048, USA.



Recordex Master



Recordex Pro 60

Dolby 'B' decode circuitry will increase the level of noise reduction obtained to approximately 9 dB when receiving the Dolby encoded transmissions. Both systems have some effect on received sound quality. To determine the exact effect, the JBA proposes a series of announced tests to be operated by Capital Radio, London and BRMB, Birmingham throughout October. The timetable is as follows:

#### Capital Radio

Midday October 1 to midday October 14, Dolby 334.

Midday October 19 to midday November 1, Variable Pre-emphasis System.

#### BRMB

Midday October 1 to midday October 14, Variable Pre-emphasis System.

Midday October 19 to midday November 1, Dolby 334.

Anyone with observations about the tests should address them to: Reception Tests, Engineering Information Service, Independent Broadcasting Authority, Crawley Court, Winchester, Hants SO21 2QA. Phone 0962-822444.

The background to the Dolby system needs little explanation; the Audio and Design Prototype Variable Pre-emphasis System requires more detail. Basically, it operates by lowering the slope of the pre-emphasis curve if the high frequency programme content would exceed peak modulation when using the standard 50  $\mu$ s value. Programme content below peak modulation remains unaffected. According to the system designers, it offers less audible intrusion than a sharp, variable roll-off filter.

The Creators didn't supply much in the way of information on the Why, Where and How much but it appears to use a phonetic code input which is analysed by a mini-computer and subsequently split into nine data channels. These control a specialised synthesiser which produces the nine basic characteristics of speech from the corresponding data channels.

Please don't send suggestions to the magazine's office. Computalker Consultants, 821 Pacific Street, Santa Monica, Ca 90405, USA.

### UK broadcast experiments

In conjunction with two of the 19 independent radio companies, the Independent Broadcasting Authority intends to carry out on-air tests with two signal processing systems, the object being to evaluate the subjective effect of each.

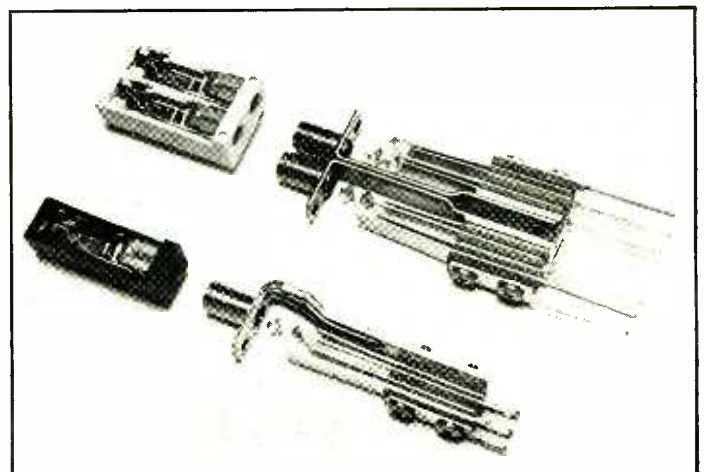
This experiment involves the use of the Dolby 334 'B' type broadcast system and a prototype variable pre-emphasis system developed by Audio and Design Ltd. Each offers about 2 dB increase in effective signal-to-noise ratio using a conventional receiver equipped with 50  $\mu$ s; additionally, receivers incorporating 25  $\mu$ s pre-emphasis with

Below: the small pcb jacks (picture depicts size comparison) are said to be less than half the size of bantam jacks. They are intended for direct mounting pcb use wherever access points are required.

Manufactured by Communication Accessories and Equipment Ltd of Tring, Herts, UK, the units can be supplied in both single and dual format.

### Genuine zombie

Or at least, almost. The Baron Frankensteins who created this particular piece of real time shock horror invite potential users of their speech synthesiser to write in describing their ideas for application of the Computalker.



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# There is a Dolby noise reduction unit for every professional application

## Professional Recording and Transmission Applications



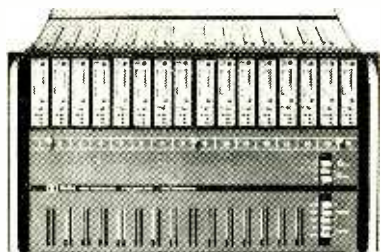
### 360

The Dolby 360 is a basic single-channel A-type noise reduction unit for encoding or decoding. This unit is normally used in a fixed mode such as in disc cutting or landline sending or receiving; the operating mode is manually selected.



### 361

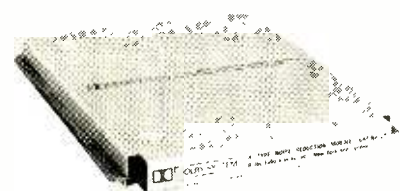
The Dolby 361 is similar to the 360, providing a single channel of A-type noise reduction, but with relay switching of operating mode and tape recorder connections. The changeover can be controlled automatically by the recorder.



### M-Series

The Dolby M16H A-type unit is designed specifically for professional multi-track recording, and incorporates 16 channels of noise reduction in a compact chassis only 10½ inches high. The similar M8H is an 8-track version, and the M8XH allows simple extension of the M16H for 24-track use.

## Noise Reduction Module



### Cat. No. 22

The Dolby noise reduction module, Cat. No. 22 is the basic functional unit employed in all A-type equipment. The Cat. No. 22 is available as a spare or in quantity to OEM users for factory installation. A half-speed version of the module (Cat. No. 40) is also available.

## Motion Picture Industry



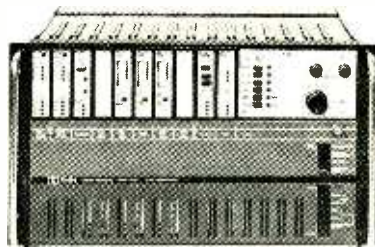
### 364

The Dolby 364 Cinema Noise Reduction Unit is intended primarily for use with Dolby A-type encoded optical sound-tracks. The 364 also includes a standard 'Academy' filter for conventional tracks, and provision for playback of magnetic sound-tracks with or without Dolby system encoding.



### E2

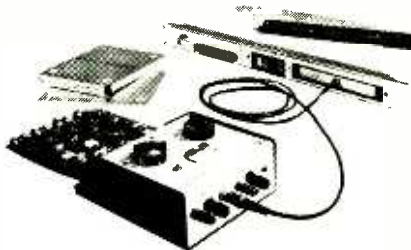
The Dolby E2 Cinema Equalizer is a companion unit to the 364, and has been specifically designed to solve the response equalization problems of cinemas. Used with the 364 and Dolbyized optical sound-tracks, the E2 enables most cinemas to achieve modern sound reproduction standards without replacement of existing equipment.



### CP100

The Dolby CP100 Cinema Processor is designed for the reproduction of all current and presently foreseeable film sound-track formats including conventional optical and magnetic tracks, Dolby encoded monaural optical tracks, Dolby encoded magnetic sound-tracks and the new stereo optical release prints. Up to three noise reduction modules can be incorporated. Typically, three channels of theatre equalization, as in the E2, will be incorporated, but facilities exist for five channels of equalization and the connection of an external quadraphonic decoder.

## Test Set (A-type)



### Cat. No. 35

The Dolby NRM Test Set, Cat. No. 35, permits rapid verification of performance of Cat. No. 22 Noise Reduction Modules without their removal or the need for additional test equipment.

## Professional Encoders for Consumer Media



### 330

The Dolby 330 Tape Duplication Unit is a professional quality unit with B-type (consumer) noise reduction characteristics. The unit is used for encoding duplicating master tapes in the high-speed duplication of Dolbyized cassettes, cartridges, and open-reel tapes. The 330 is a two-channel unit.



### 334

The 334 FM Broadcast Unit allows broadcast stations to encode stereo FM broadcasts with the Dolby B-type characteristic. The unit also provides for a reduction of high frequency pre-emphasis to 25 microseconds; this reduces the need for high frequency limiting, thus allowing a significant additional improvement in reception quality.

## Noise Weighting Filter



### Cat. No. 98

Noise weighting filter to CCIR/ARM characteristic (recommended by Dolby Laboratories). Filter is used with average responding meter (ordinary millivoltmeter) allowing noise measurements to be made on tape recorders, tapes, FM tuners, etc., with results which correlate closely with the subjective effect of the noise. Filter can be used for the testing of professional and consumer equipment.



## Dolby Laboratories Inc

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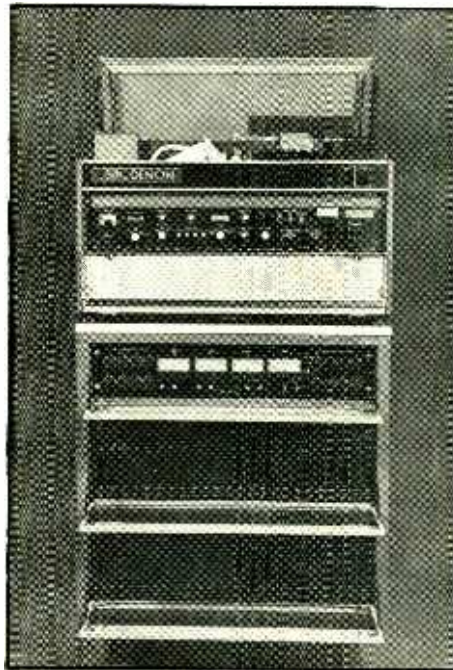
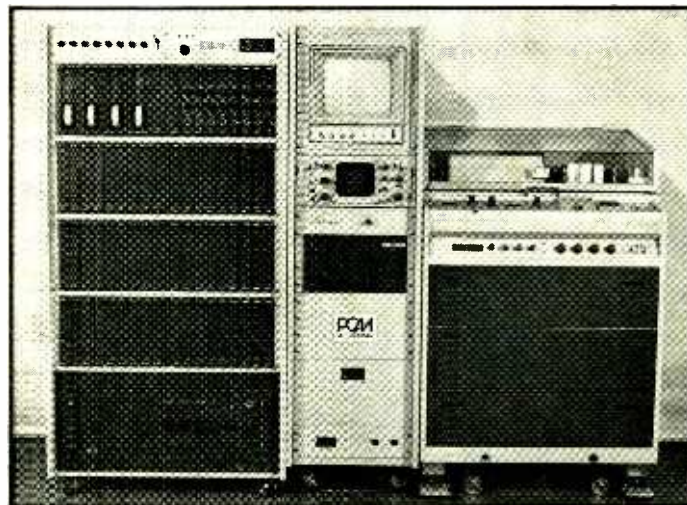
346 Clapham Road  
London SW9  
Telephone 01-720 1111  
Telex 919109  
Cable Dolbylabs London

# PCM recording~the future?

TAKEAKI TAKASU\*

*In the recording studio, the ideal recording process should exhibit no difference between source and result. Conventional systems using proportional magnetisation are far from the ideal. The author describes a digital recording system which exceeds the performance specification of all existing analogue techniques—at a price.*

\*NIPPON COLUMBIA RECORDING DEPARTMENT



Above:  
Fig. 1,  
PCM  
recording  
system  
No. 1

Left:  
Fig. 2,  
PCM  
recording  
system  
No. 2

THE deficiencies of the established recording process are well known leading to attempts to improve the characteristics of tapes and tape machines. Although such attempts have improved the tonal quality of recordings, the problems have not been solved perfectly and it is becoming increasingly difficult to achieve further improvements. Fortunately there is an entirely different method for solving such problems at one sweep. It is the Pulse Code Modulation (pcm) method, which is actively being adopted for space communications, telephone systems, etc, because it can transmit a great deal of information accurately under restrictive conditions.

Under the pcm method, music waveforms are not directly recorded on tapes as in the case of ordinary tape recorders, but are converted into a pulse code. This is then recorded on a magnetic tape or other memory devices. For reproduction, the code is reconverted into the original music waveforms by synchronising the recordings to a reference signal so that the playback time domain will be the same as for the original recording. If there is an error in the code, it is detected and corrected. Since the tape is recorded with nothing but a train of pulses there is no distortion or noise attributable to the tape. The wow of the tape recorder transport is also eliminated because the recordings are synchronised to a reference signal. However, the pcm method needs such a wide range of frequencies that video tape recorders or other wide range recorders are necessary for recording purposes. This means that the whole recording system must be a large one which incorporates the latest in electronic engineering.

The first pcm recording system (no. 1, fig. 1) for studio use, and a portable pcm recording system (no. 2, fig. 2) were developed by Nippon Columbia Co in 1972 and 1974 respectively.

Not only excellent characteristics but also improvements of sound quality could be achieved by introducing both pcm recording systems generally into the record manufacturing process.

## Composition of pcm recording system

Pcm recording system no. 1 was developed for the studio recording and disc cutting, and no. 2 for portable applications. Both are compatible with each other and both systems have almost the same performance except the latter does not have half-speed reproduction and advance head for cutting cue.

## Composition of system 1

Pcm converter.

Magnetic tape recorder (four-head low-band vtr).  
Audio and video waveform monitors.

## Specification

Modulation: pcm.

Coding: 13-bit sign and magnitude binary code.

Transmission clock frequency: 7.1825 MHz.

Audio sampling frequency: 47.25 kHz.

Transmission waveform: standard tv signal (except vertical sync signal).

Number of audio channels: eight/four/two, selectable.

Advance signal recording method: analogue recording.

Number of advance signal channels: two.



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And the trouble is that people take you at your word. And make you work. And work hard.

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BASF LPR 35LH and SPR 50LH. On 5", 7", 8 1/2" and 10" brushed aluminium NAB spools.  
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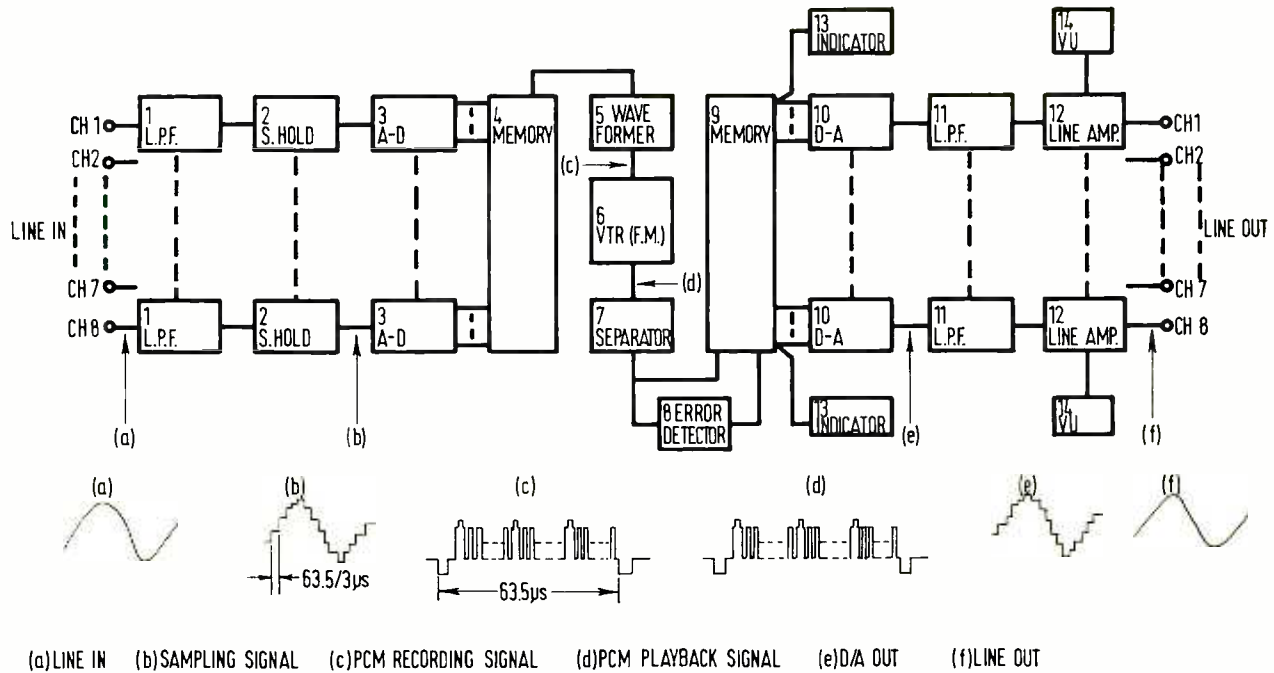


I am interested in knowing more about your professional recording tapes.

Name \_\_\_\_\_ Address \_\_\_\_\_



FIG. 3 RECORDING SYSTEM BLOCK DIAGRAM



**PCM RECORDING—THE FUTURE ?**

Tape speed: 38 cm/s at recording, 38 cm/s or 19 cm/s at reproducing.  
Tape: 50 mm video tape.

As shown in fig. 3, the system digitises eight channel audio signals and records pcm waveform recorded as fm on the tape by the vtr. When reproducing, the recorded pcm signal is demodulated first, and then data errors are detected and corrected.

After correction, the data is converted into the recorded audio signals.

**Sampling and coding**

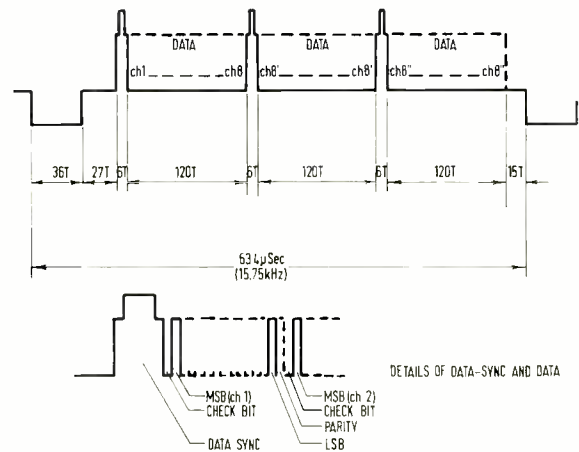
In these processes, each of the eight channels comprises an independent input filter, sample and hold circuit and a/d converter for maintenance of a/d conversion speed. The sampling frequency is three times the frequency of the tv horizontal sync signal, that is,  $15.75 \times 3 = 47.25$  kHz (approx 21  $\mu$ s). The input filter is flat from dc to 20 kHz and has an attenuation of more than 72 dB/octave above 23.625 kHz which is half the sampling frequency.

The audio signal is linearly converted into a 13-bit natural binary code by the a/d converter: its lsb becomes 122 ppm. The system does not use compansion of the signal on tape because level distribution of programme sources should be known for an optimum compression-expansion characteristic. It is difficult to decide the optimum level and in any event, the system is apt to create distortion.

**Transmission waveform**

Signals from each channel, coded to a binary 13-bit signal, are transformed into a sign and magnitude binary code and stored temporarily in a shift register, and then serialised into pcm signals. A parity check bit to detect dropout during replay, a check bit for detection of phase error, and data-sync signal area added to the encoded audio. The whole is formed into tv signal format (fig. 3). As shown in fig. 4, three samplings of data are placed in a horizontal scanning section, and a horizontal sync. Front and back porch signals are added.

FIG. 4 TRANSMISSION WAVEFORM



A horizontal interval is equivalent to 456 bits, so the clock frequency becomes 7.1825 MHz. As the signal is nRZ (non return to zero) type, the maximum data frequency becomes 3.59 MHz, one-half the clock frequency. This makes an ordinary vtr suitable for the pcm system. Recorded waveform is similar to a tv signal (pcm lacks vertical sync signal). It is possible, therefore, to apply broadcast vtr techniques for editing and duplicating.

**Audio track format**

Standard audio format gives eight channel recording, paralleled up where the full number are not used; the remaining channels are employed to minimise record/replay errors.

In four-channel recording, the coded signals for channels one to four are each staggered by one sample and fed to channels five

FIG. 5 FREQUENCY RESPONSE AND NOISE PERFORMANCE

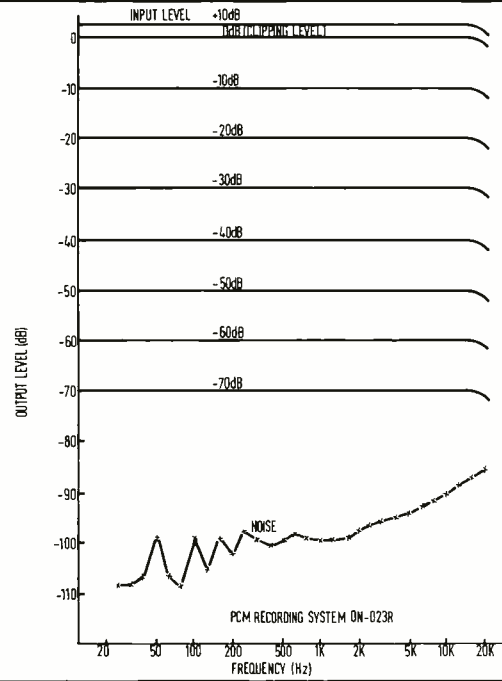
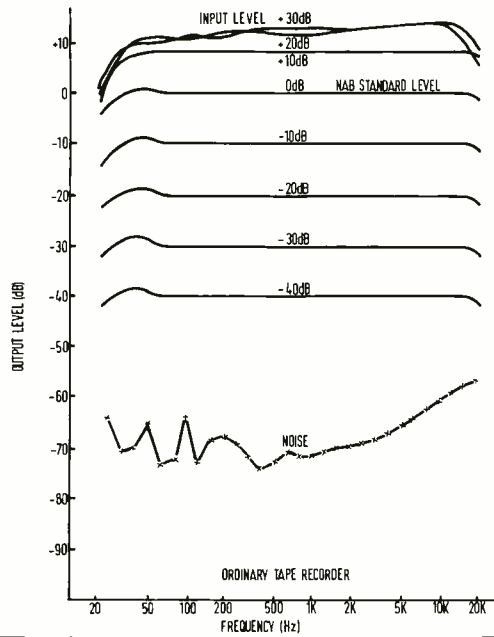
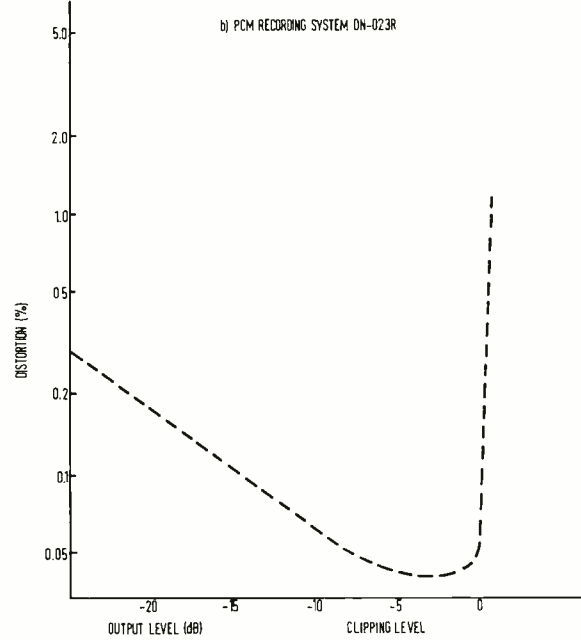
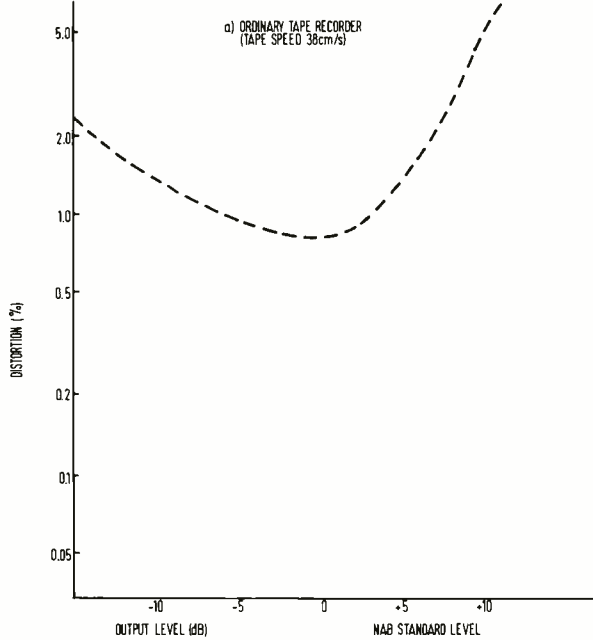


FIG. 6 DISTORTION CHARACTERISTICS AT 1kHz



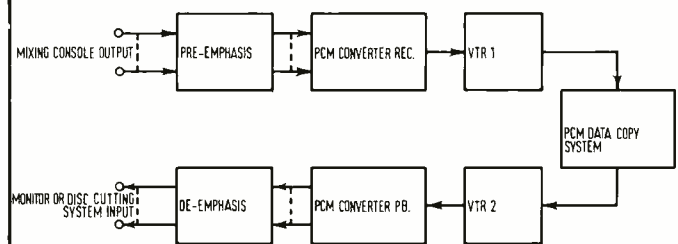
to eight, so that on replay, the bits of the same signal in different positions can be compared to see if they agree or not. Putting signals in different sample positions improves data sync performance and also prevents simultaneous omission due to a large dropout.

In two-channel recording, the same signal is sent to four audio channels so improving even further the system performance.

**Magnetic tape recorder**

An ordinary four head lowband vtr is employed although this is modified to enable half speed playback for carrier cutting. The audio track is divided into two channels with a replay head arranged at a place of cue appropriate for the advance signal reproduction.

FIG. 7 TOTAL PCM RECORDING SYSTEM



## PCM RECORDING—THE FUTURE ?

Important parameters in a vtr for pcm recording systems are jitter, frequency characteristic, signal-to-noise, waveform distortion (including phase distortion), and so on.

Jitter should be less than 139 ns (1 bit) in interval in an eight channel serial data 120 bits cycle, because data is extracted by a clock signal locked to the replay data sync signal. It is necessary to reproduce the 3.59 MHz clock signal without distortion in the waveform or phase characteristic. Naturally, tape with minimum dropouts should be selected.

### Data extraction, error detection and compensation

Data is extracted by the clock signal locked to the data-sync signal and stored in a shift register. The data is checked by the parity and check bits and further examined for dropouts by the level detector. In the case of two or four-channel transmission, all the data from the same sample is compared to correct errors. The interpolation following error detection consists of adding the average of the preceding and following signals for each omission of one sample. When more than one sample is omitted, the signal is maintained at previous level. In two-channel transmission the right data can be chosen because of the number of options. These processes minimise data error noise in the analogue output signal. The data after extraction and compensation is converted into natural binary code and is sent out as eight channel parallel data.

### Decoding

After these parallel input data streams are converted from digital signal into analogue signal, the analogue signals pass through low pass filters which have 20 kHz cut-off frequency (10 kHz at half speed reproducing) and feed the line amplifiers.

### Characteristics of pcm recording

The measured results of the frequency response and signal-to-noise characteristic in this system are shown in figs. 5 and 6.

### Results are as follows:

Frequency response: dc—20 kHz  $\pm 0.5$  dB (38 cm/s reproducing).  
dc—10 kHz  $\pm 0.5$  dB (19 cm/s reproducing).

Dynamic range: more than 75 dB.

Distortion: less than 0.1% (at operating level).

When Scotch 400 is used as recording tape and the rm carrier is low band, the error rate per one bit is  $0.9 \times 10^{-7}$  and that is  $1.3 \times 10^{-6}$  per one sample of one channel. This value means that the error occurs one time every 15s. But in the case of high band, the error rate per bit is  $3.5 \times 10^{-7}$  on the same tape. Thus it is shown that low band is better than high band. The detection error becomes about  $10^{-2}$  in the case of eight channel reproducing.

### Application

In the practical recording process, the setup as shown in fig. 7 has been adopted. Input and output of the recording system are connected to mixing console, monitor system, disc cutting system and so on. An emphasis circuit is introduced to improve the dynamic range of the system. The emphasis curve employed is shown in fig. 8. In this case the overall system has more than 83 dB of dynamic range in practical use. To get the highest quality reduction master, another vtr is employed.

### Duplication

As fig. 9 shows, three duplication methods are considered: audio signal copy, transmission wave copy and data copy. In the case of audio signal copy, quantising noise grows larger and in the case of transmission wave copy, signal-to-noise transmission wave and jitter become worse. So, the best way is to copy only the data, using the pcm data copy adapter.

### Conclusion

Excellent results can be obtained from a simple a-b test. And from there, the overall system has been used on various recording sessions in studios, halls, churches and so on, to manufacture more than 100 disc titles by Nippon Columbia Co.

FIG. 8 EMPHASIS CURVES

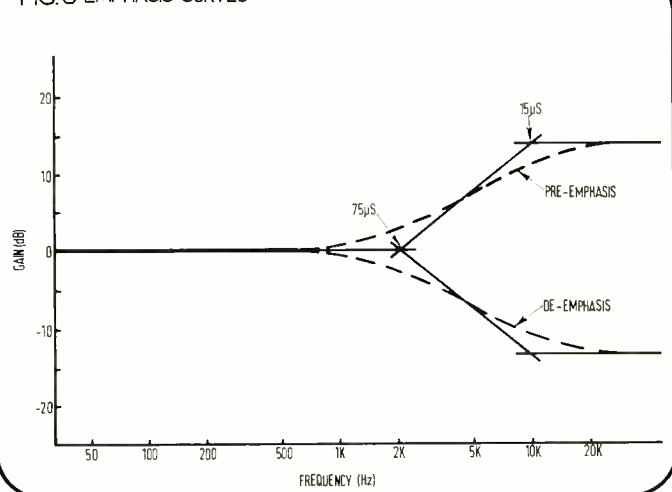
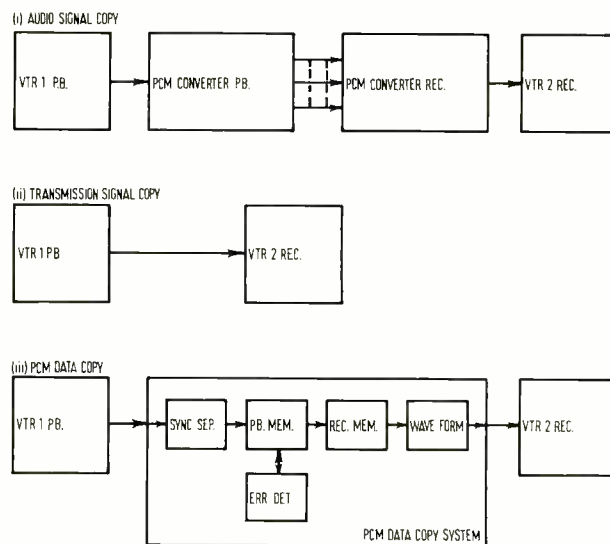


FIG. 9 COPY



All these are of better quality than expected. Particularly, faithful tape master duplication is realised by employing the data copy adapter. And vtr techniques can be applied in broadcasting studios.

There are slight drawbacks; the price of system hardware and vtr tape is high, and the operation and editing are somewhat difficult to handle.

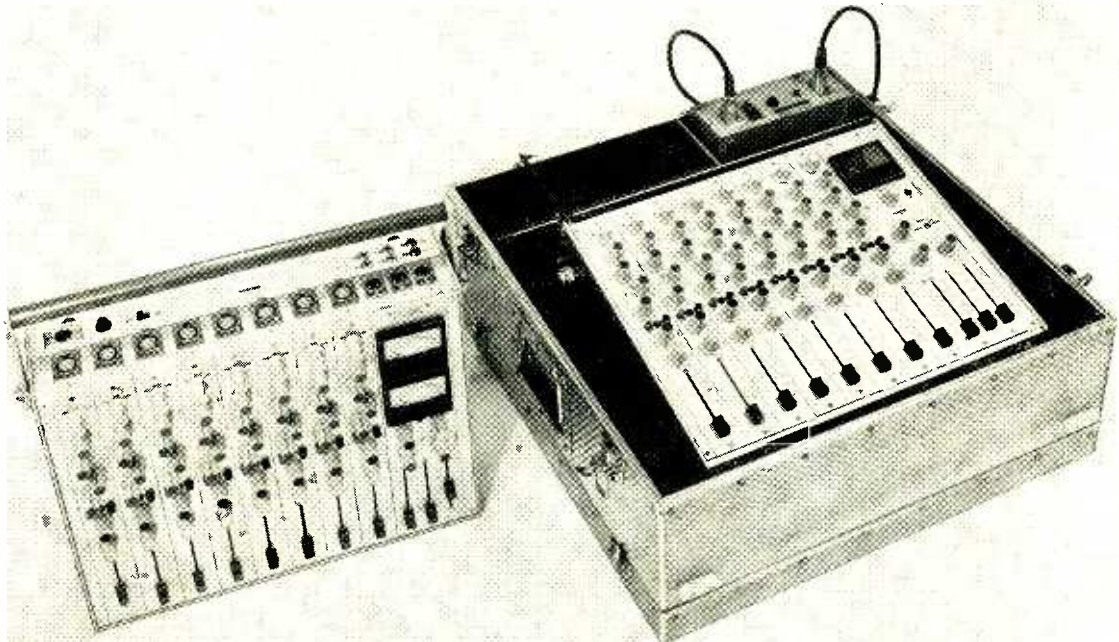
Finally authors express their deep gratitude to the members of NHK Technical Research Laboratories for their technical support.

# agony

'Sensazionale,' said the national press when La Scala Milan came to Covent Garden as part of a 'remarkable exchange deal'. The Italians certainly did the trip in style, bringing with them not only twice the cash subsistence granted to the British company in Milan but their own chef and lavatory attendanta as well. But for the good Italian lady entrusted with the all important task of attending the gents loo at the Garden it was all very puzzling—at least until someone could be found to translate for her the sad news that she had brought brush and pan all the way from Milan for nothing, the Gents being irrevocably out of order.



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# IBC '76 preview

*Held biennially, the International Broadcasting Convention provides an opportunity for television and radio broadcasters to meet, inspect the latest technical equipment and attend the various conference sessions.*

Taking place between September 20 and 24, the exhibition opens at 11.00 on the first day and 9.00 for the rest of the week—closing time 18.00 except Friday which is 16.00. Fee for the whole week is £36.72 (inc VAT) which includes a copy of the Convention Publication, a ticket to the Champagne Reception (Tuesday evening at the Guildhall) and morning and afternoon refreshments. A limited number of places are available to research students whose applications are endorsed by their professor or head of department, at a cost of £18.36, but this does not include the Champagne Reception. One-day passes are available at £9.72 each. Enquiries to: The IBC Secretariat, phone: 01-240 1871, Ext 261.

Location of the exhibition and conference is the Grosvenor House Hotel, but due to a lack of exhibition space various other locations are also in use. Ampex have taken the US Trade Centre in Langham Place (next to the Beeb), while Mercury Electronics and Mercury

Mobiles are located at the Europa Hotel and a display of Electronic News Gathering equipment is being held at the Hilton.

The afternoon conference session on September 22 is concerned with Sound Systems and includes the following provisional sessions: Automation in broadcasting (UK).

Cartridge machines: standards and problems in use (UK).

The application of memory techniques to sound mixing consoles for programme production. UK Variable emphasis limiter for sound programming signals (UK).

Requirements for a new generation audio recorder (UK).

Automatic test tape maker (UK).

Fade reduction techniques for radio microphones (UK).

A proposal for a traffic information service (UK).

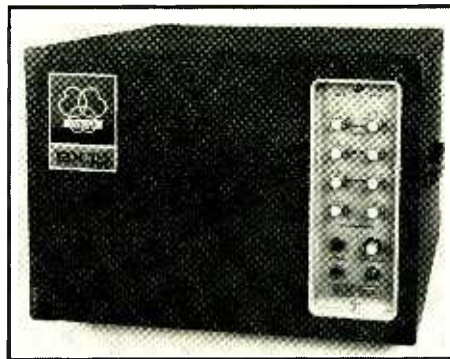
BBC's radio taxis and their operational role (UK).

THE exhibitors in the following preview are principally audio related—a complementary preview, including the video exhibitors and full conference programme, appears in our sister publication, *Video and Audio Visual Review*, September.

As usual at IBC, the AKG stand will be a complete little mini studio to demonstrate AKG microphones live. The studio was born from an idea by Peter Eardley, md of AKG, some years ago as he found it rather boring just to display microphones. The new portable two channel reverberation unit *BX15*—ideal for mobile use—will be demonstrated together with the complete range of AKG capacitor microphones, including the new *C414EB* variable pattern type.

Exhibiting at Grosvenor House, the Hilton and US trade Centre, Ampex is showing television cameras and vtrs previously seen at NAB Chicago. The professional recorders *MM-1200* and the newly-introduced (at the Los Angeles AES in May) *ATR-100* will be seen in the basement of the US Trade Centre together with the *406* series and *456 Grandmaster* audio tapes.

The new *MXT-1000* mixer which enables a custom-built system at a highly competitive price is being introduced by Audix. Available with either two or four groups, modular construction is used with two basic versions available: one for general mixing applications such as outside broadcasts and small recording studios, the other for on-air broadcasting. The



AKG BX15

*B102* audio mixing console also to be shown is a 16 input four group type with two main outputs which are basically designed for television use.

**FWO Bauch** are exhibiting a wide range of audio equipment including: Studer 6.25 mm and multitrack tape machines, *Tape Lock System 2000* which synchronises an *A80* with a vtr, the *Unisette* tape deck for automatic broadcast systems, the portable mixing unit Studer *169* and stereo power amplifier *A68*; Neumann capacitor microphones; EMT electronic reverberation system, electronic time display, transcription turntables, four track logging recorder and small wow and flutter meter; Urei response plotting system, acoustic analyser, limiters, compressors, graphic equalisers and filter units; Albrecht magnetic film recorders and holoscope projector; MRL test tapes; Lexicon digital delay system; Klein &

Hummel parametric equaliser and monitor loudspeakers; Switchcraft QC audio connectors; Danner and Seydel faders; Sontec parametric equalisers; Transco disc recording blanks; Allison Research *KepeX* and *Gain Brain* modules.

The **Future Films Developments** division of **Allotrope Ltd** will display a complete range of audio cabling, connection and associated components including: Sescom transformers, audio modules, splitting and combining boxes; Trimm jacks (both 6.25 mm and miniature); broadcast pattern jackfields, cords, plugs and accessories; connectors by Cannon, Switchcraft, Amphenol Tuchel, Preh, Rendar etc; Hellermann distribution range of wiring aids, a variety of microphone cables in rubber or pvc with ten jacket colours and multiple pair individually foil screened cables with up to 27 pairs. Also on the stand will be the *DNR* series portable stereo Dolby-A unit operating with the *Nagra IV-S* recorder, the *HES Electronics TSV* automatic telephone balancing unit and *Inovonics* tape electronics and frequency selective compressor/limiter units.

**Hayden Laboratories** will be exhibiting products from no less than seven principals: the full range of *Nagra* professional portable tape recorders complete with the latest accessories; the Sennheiser range of professional microphones featuring the new 48V phantom powered capacitor studio microphone and the new electret series, models *MKE202*, *MKE402* and *MKE802*—also the new closed ear type headphones model *HD224*; the new *Telefunken M15A* studio tape recorder; *Sondor* sprocketed



magnetic recorder and reproducer model *M2/OMA3* and also the portable *Libra MO3* recorder; a range of Isophon loudspeaker drive units; a range of Flexwell semi-flexible air dielectric coaxial cable, waveguides, *Cellflex* and *Comflex* foam and solid dielectric coaxial cable and various radiating and CATV cables; and finally Spinner coaxial cable and waveguide components together with rotary joints for coaxial cable and waveguide.

**Imhof-Bedco** is exhibiting typical examples from its extensive range of cases, racks, control consoles and related accessories, all specifically designed for housing electronic and similar equipment. Among the recent additions to the range is a low noise level fan unit and a cable carrier that facilitates chassis being withdrawn from a cabinet without disconnecting the cables.

**Leavers-Rich** will be exhibiting their range of professional recording equipment including the *Proline 1000* series first seen at APRS. Standard features include plug-in head block, servo or direct drive, electronic tape tension control, specially designed air damping for excellent tape handling and spooling, motion sensing logic to eliminate tape damage, and separate preset controls for starting and servo operation on small or large spools. An improved version of the *E200* professional recorder which is now equipped with electronic tape tension, improved bias and erase head, will also be seen.

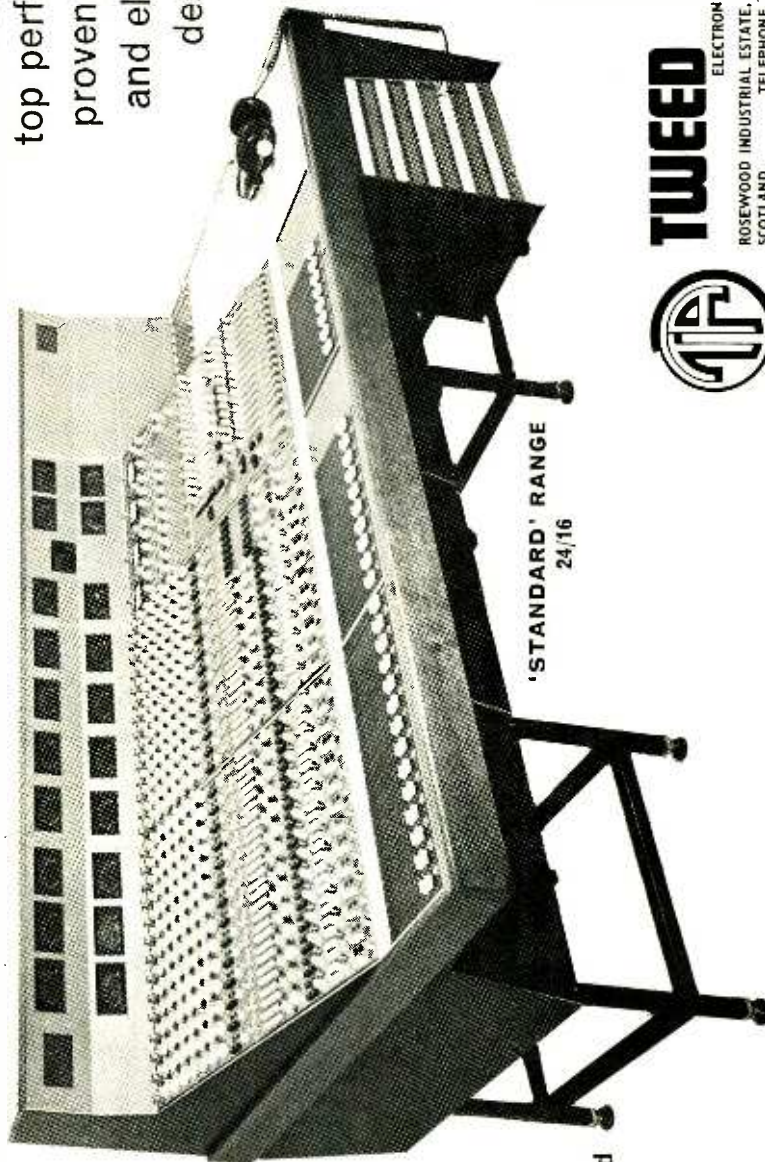
The professional equipment division of **Mellotronics Ltd** will be exhibiting a working model Schafer Automation System for radio stations. Cuemaster cartridge machines, the Multitrack Parametric Equaliser and Multitrack Analogue Delay Line will also be seen.

**Rupert Neve & Company** is once again sharing a major stand with **Link Electronics** and **Autocue**. The new *5305* television sound control console system will be seen and a new range of consoles specially built for local radio stations introduced. The *CRC* range have facilities for self-operation by presenter and also for small scale production use. A 16-track sound recording vehicle built jointly by Link Electronics, Neve and Dell Coachbuilders for the Australian Broadcasting Commission will be on show in Upper Grosvenor Street.

**NTP** of Denmark will be displaying a new mixing desk system, type *363*. A modular system specifically designed for outside broadcast use, desks can be built from four in/four out up to 40 in/eight out. Designed in close co-operation with the Danish Broadcasting Authorities, features include sub-grouping, separate outputs from each input channel, extensive metering facilities including compatibility meter with leds, and limiters on the stereo output channels. NTP's range of television display bar peak programme meters will also be on display.

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# Country life

*Recording in the back of beyond has proved itself to be a more attractive way of working for a growing number of musicians.*

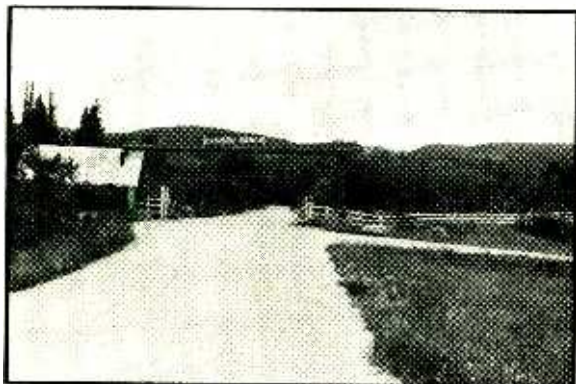
*Al Lawrence, Mike Oldfield and Obie Clayton each give their reasons for going up the country . . .*

## Caribou

*Of the Rocky Mountain studio, Gus Dudgeon said: 'Caribou is what every Englishman dreams America should be'. Attorney at Law and record producer **Al Lawrence** finds a large fragment of the American Dream.*

COLORADO is a place where legends are born. The name itself glides across the tongue and conjures mystical images in the mind of the listener. To the Wild West buff it means Denver, Durango and Cheyenne Wells, the Rocky Mountains, the Continental Divide, Buffalo Bill's grave, and fabulous gold mining towns like Central City. For the ski enthusiast it means Aspen, Vail and Steamboat Springs; the best skiing mountains in America. To those of us in the recording business a new Colorado legend is Caribou Ranch of which many have heard but few have visited.

Caribou Ranch is more than a recording studio; it is a total



experience which begins the moment one reaches Denver, the 'Mile High City'. Looking directly east at the American Great Plains the traveller may be unaware that the land has risen, ever so gradually, for more than 1600 kilometres. But put the dull, unending

flatness of the plains to your back and in the west a giant wall of rock rises about 1.5 kilometres high, north and south as far as the eye can see. It is as though America had been cut in half and lifted to the heavens. So begin the fabled Rocky Mountains.

When we arrived in Denver we chose to rent a car, but Caribou does have several four-wheel drive Chevy station wagons as well as two plush GMC mobile campers to pick up new arrivals. Elton John chose a more spectacular conveyance, journeying by helicopter for a better look at the mountains.

Leaving Denver we drove north parallel to the mountains for 30 minutes until we reached Boulder, then turned west and climbed through a mountain pass, surrounded by sheer cliffs, to the town of Nederland at 2600 metres above sea level. Heading north from Nederland past horse corrals and abandoned mines, we nearly missed the entrance to the ranch. A hundred metres off the main road was a gate with a small sign; but there were no buildings to be seen, only higher and more splendid mountains in the distance. It was another couple of kilometres along the dirt road to the ranch buildings.

For those who don't know, Caribou Ranch is owned by James William Guercio, the highly successful producer of America's top recording group Chicago. In 1970 while looking for an unusual spot from which to run his growing recording enterprises he rescued a 12 square-kilometre parcel of land from developers bent on constructing a condominium style community in the mountains above Boulder. The property with its lush meadows, rolling hills and forested mountainsides had once been a dude ranch. The remains consisted of a handful of dilapidated log cabins and a site



of unlimited potential. Guercio, whose business acumen matches his musical talents, immediately began a major overhaul of the existing facilities plus the construction of a studio for Chicago's recordings and other projects Jimmy contemplated. He decided to make the ranch his main residence as well as a hideaway for the relaxation of the group. Since Chicago spends about 30 to 40 days a year in the studio it was obvious from the start that other bookings would be necessary to pay the bills. The studio opened operation in early 1973 and has been a smashing success ever since.

Located as it is in the heart of one of America's great natural vacation lands Caribou's success rests largely in its unique setting and the style and taste with which it has been reconstructed. Great care (and expense) was taken to preserve the natural appearance of the ranch. The first building is a beautiful two storey log cabin set beside two mirror-like ponds. A stream flowing from the ponds in front of the cabin must be crossed via a small footbridge to reach the large rustic barn that houses the studio. Close by the studio is another two storey cabin, the office, and another small two bedroom log cabin. A few paces behind that cabin is the mess hall and to its left a large 100 year old lodge.

Beyond that, in a wooded area, are three more cabins including a new one that houses Jimmy Guercio. In all, the various buildings can accommodate 30 to 40 guests in the truly picture-book setting.

To accomplish the transition from rundown to modern the original log cabins were disassembled, the logs sandblasted and replaced, and the interiors completely renovated. Some buildings, like Jimmy's cabin, are new but constructed of the same native stone and logs or rough hewn fir siding. No two are identical, yet all convey the proper appearance and atmosphere, close but secluded. Inside, nearly every bed I saw was brass and many rooms have beautiful roll-top desks and period furniture. Each unit has a small kitchen area and Sony colour televisions abound; all linked to a 3-channel video cassette system, as well as the local channels.

Another factor that ensured the early success of Caribou was the presence of Guercio and Chicago. They are known as thorough professionals and their reputations were enough to attract other important artists. Steven Stills, who lives in nearby Gold Hill, began using the studio. Bill Szymczyk, one of the country's top



producers, lived in Denver and brought many of his groups there as well. Soon Caribou was entertaining Earth, Wind and Fire, Michael Murphy, Rod Stewart and producer Tom Dowd, Dan Fogelberg and more recently America with George Martin producing. Aside from Chicago, Elton John has probably logged the most time there, often booking five weeks at a time.

It should be understood that Caribou caters mainly to self-contained groups. The reason is partly geographical, since the Denver area simply does not offer the number of studio musicians that the big cities have in residence. Though there are many fine musicians like Steven Stills, Joe Lalla (the percussionist) and keyboard man Paul Harris living in the area, they spend much of their time touring. Nonetheless, members of the Denver Symphony have occasionally provided orchestral work on recordings.

As far as engineers go many groups bring their own. For those who don't Wayne Tarnowsky, the original resident engineer, still lives close to the ranch. Wayne records Chicago, as he has since their fifth album, but works independently as well. Jim Guercio's brother, Jeff, has taken over as the resident engineer and has among his credits the engineering of Elton John's *Captain Fantastic* album and two Michael Murphy albums. Yet another brother, Mark, is presently gaining credits for his own engineering.

The studio occupies the second floor of the large, attractive three-storey barn. One end of the first floor has a kitchen and lounge area while the other end houses the maintenance and equipment rooms and the tape vault. A recreation room, with pool table, foosball (table soccer) game and other diversions occupies half of the third floor, and functions as a sort of impromptu clubhouse between sessions.

The studio itself is an early Hidley design which appears to have set the pattern for subsequent Westlake installations. In New York and Los Angeles, rustic wood and stone decor provide a peaceful if somewhat surreal refuge from the humdrum and bustle of everyday city life. At Caribou those same materials are wholly in keeping with the overall style of the ranch.

The control room is large and comfortable, measuring approximately 5.5 by 7.3 metres. The action centres around a basic 24-in 8-out Neve console which has been placed well forward in the room. Though it requires some additional patching for tricky



effects the Neve is extremely quiet and offers ease of operation for visiting engineers. The back wall features a massive stone fireplace, the entire floor is heavily carpeted and there is ample seating on soft English leather couches and chairs for those in attendance. Four Hidley speaker systems are placed two front and two back for use in quadraphonic mixing—most of Chicago's albums have been mixed for quad. Additional pairs of speakers are available for a choice of monitoring, including Tannoy Lockwoods requested by Gus Dudgeon.

Two Ampex (*MM 1100*) 24-track machines provide the present record capabilities though they are soon to be replaced by two new Ampex (*MM 1200*) 24-trackers. Two and four track machines are 3M. There are 52 Dolby channels as well as two Cooper Time Cubes, an Eventide Digital Delay Unit, Kepexes, Pultecs and various phasers etc. For additional inputs there is an outboard mixer capable of 12-in and 2-out.

The studio is approximately 10.5 by 5.5m with a ceiling height of 6 metres. The near end of the room has a wooden floor that has been left uncovered to capture some of the live sound of strings, horns or voices. The back part is carpeted, with alcoves for piano and guitar and a semi-enclosed drum house. There is plenty of equipment including a Hammond *B3*, two Leslie speakers, pianos, Mini Moog, Arps (*Odyssey 2600* and String Ensemble), Clavinet and RMI electric piano. Along with the numerous Shure, ElectroVoice and Sony mikes are some *U87s*, Beyer *500s*, several Sennheisers including a triaxial, an EKG *C24* Stereo and an *M 249* Neumann.

Part of the third floor houses a projection room and complete film editing equipment. The 24-track machines can be interlocked for film scoring and, when in use, the studio doubles as a screening room.

It should be noted that there are certain peculiarities to recording in the thin, extremely dry mountain air. Singers and horn players are particularly susceptible to fatigue so oxygen tanks are kept on hand in the studio. Some people report that singers can hit higher notes while losing a bit of their bottom range, and others claim the studio produces an unusually clearer sound than elsewhere. It also seems to take a bit more power to drive speakers at that altitude. The studio itself is humidified but I met one young classical guitarist who was having fits with the tuning and tone of his gut stringed instrument.

At \$1250 per day, recording at Caribou is not cheap, but it still comes in under the average charges of the most popular studios in New York and Los Angeles. Tape is the only additional cost. Price however is not the object for artists who choose to work at the ranch, regardless of their personal wealth. Bookings are handled on a first come, first served basis and though some schedule months in advance the doors are open to the aspiring as well as the established stars.

Since Caribou provides complete accommodation and meals 36 ►

## COUNTRY LIFE—CARIBOU

there is an additional charge of \$45 per day per person. If that seems like a steep, added cost you must remember that most of the guests bring guests of their own including wives, children, friends and managers; most parties include about a dozen people.

I found it possible to eat about \$45 worth of food per day. The meals are fantastic and the hours are set to accommodate the artists, while every attempt is made to fulfil their particular gastronomic or dietary requirements. (I could spend several pages describing the food alone, but will refrain from doing so.) Eventually one staggers or is dragged away from the table and back to work only to discover, later at night, that the studio kitchen contains a heaping platter of cold cuts, cheese, rolls and butter, etc, etc. Tea, coffee and other snacks are in the cabin kitchens and if that's not enough you can store your own private stash of tasty treats in the cabin refrigerators.

It is when one leaves the studio that the real experience of Caribou begins. Satisfied by the session, comforted by the accommodations and fortified by the food, the guests are ready to begin a serious exploration of the ranch, and there are horses available at any time for the experienced rider. If you are like me you can, on occasion, ride in a group, or if horses don't appeal to you at all there is usually someone willing to drive you around in a Jeep. I was lucky enough to borrow Jimmy's motorcycle and ride the roads and trails with Chicago's Lee Loughnane. For the groups, the staff frequently puts together a hayride and cookout.

The ranch has streams and ponds stocked with brook and rainbow trout and fishing is encouraged. If you're the get-rich-quick type, or just have an unusual amount of patience, you can try panning the stream pools for gold; but a must activity is a trip to the ghost town at the site of a long-abandoned silver mine. A small settlement once flourished there and while only a few actual buildings remain, there are traces of other buildings, some old trails, and even the roadbed of a narrow gauge train that once served the area. Much of the now rusting mine equipment remains including tracks, ore cars and a rock crusher. Another spot that should be seen is a spectacular waterfall on a remote corner of the ranch which can be reached by car or horse. Just a few kilometres away from the ranch, near a beautiful mountain lake, are the foundations of a once famous lodge; a favourite watering spot for Denverites near the turn of the century.

There are dozens of other side trips to interesting and scenic attractions in the area. Central City will take you back to the gold mining days when the town was so prosperous nearly every square metre sported a mine shaft. Occasionally, the ground collapses under a tourist, revealing yet another abandoned mine. At Estes Park, an hour to the north, tourists can take a harrowing drive up Trail Ridge Road to view the mountains of the Continental Divide from above the tree line. If you go there remember you have climbed to about 3700 metres where the air is thinner and colder.

Train buffs will enjoy the railroad museum in the Denver suburb of Golden, a town also renowned as the home of Coors Beer, another Colorado legend. Buffalo Bill's grave is located on a mountain overlooking Denver and there are any number of other ghost towns to explore. Many visitors come to the area to hike and if you keep your eyes open you'll notice mountain climbers dangling from every peak. Sometimes just driving on dirt roads, through small mountain settlements, on the edge of sheer cliffs can be a trip in itself.

For more domestic pursuits, the city of Boulder is only about 24 kilometres down the mountain and offers craft stores, Western gear and movie theatres. There are a number of good restaurants and cozy bars in the area for a further change of pace. Those guests who arrive in winter can ski at nearby Eldora mountain and Caribou has a fleet of snowmobiles to satisfy ardent thrill seekers.

Despite the many diversions, or perhaps because of them, recording seems to go more easily and be more pleasurable than it is in the city. It's only a few steps from bed to breakfast to the studio, thus valuable time is saved in the process. The list of important artists who have recorded there bears adequate testimony to the quality of the studio and its popularity.

Except for the Guercios, ranch manager John Carsello and maintenance engineer Al Burnham, the staff are all women. Daily

maid service is provided and there is a laundry on the premises. They even boast a snow plough and road grader; in fact the only things missing are a swimming pool and tennis court, both of which have been contemplated. However, there is the genuine fear that visitors, unaccustomed to the altitude, could easily over-exert themselves.

With so many things to offer, it's no wonder that Caribou is America's favourite 'country' studio, and producers Gus Dudgeon, Joe Wissert and Tom Dowd all told me the same things: that they



loved the natural, casual and friendly atmosphere. More importantly they all stressed the fact that Jimmy and the entire staff made every effort to accommodate their requests. Because of their personal work habits some artists only record there and mix elsewhere, while others prefer to reverse the procedure. Most, however, definitely prefer to return again and again. Perhaps Gus summed it up best when he told me that Caribou is what every Englishman dreams America should be. Having spent five weeks there myself I wasn't about to argue with him. ■



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# Mike Oldfield

*'Actually, I'm a rather jovial fellow . . .'* Oldfield talks about his music and its relationship to the environment in which he works. Interview with **Frank Ogden** and **Ray Carter**.

WELL, I had a Bang and Olufsen with a sound on sound facility . . . you know, a bit like track jumping. Anyway, I did a bit in mono which meant that I ended up with half the instruments on one side of the tape. Then it had this strange button which said 'overdub' which, when you pressed it, allowed you to put one instrument on the other side. I blocked off the erase head with a piece of cardboard and then superimposed on that side until I ended up with both sides full and nothing in the middle. The only instruments I had were an electric organ borrowed from the band I was in and electric lead and bass guitars.

'I took the resulting tapes round to the man from EMI who said he was going to do something with them. After six months, he told me that they had too many people on their label—I went to EMI first because that was the label that Kevin Ayers was on at the time. Next I gave copies to Virgin, who were just in the process of building up the Manor, as well as giving tapes to a few others. Virgin had them for about a year before they eventually did anything with them.'

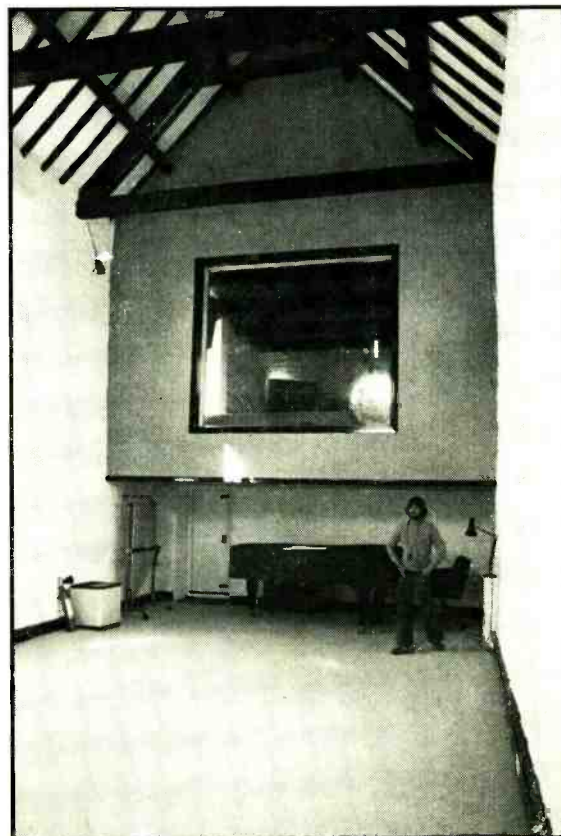
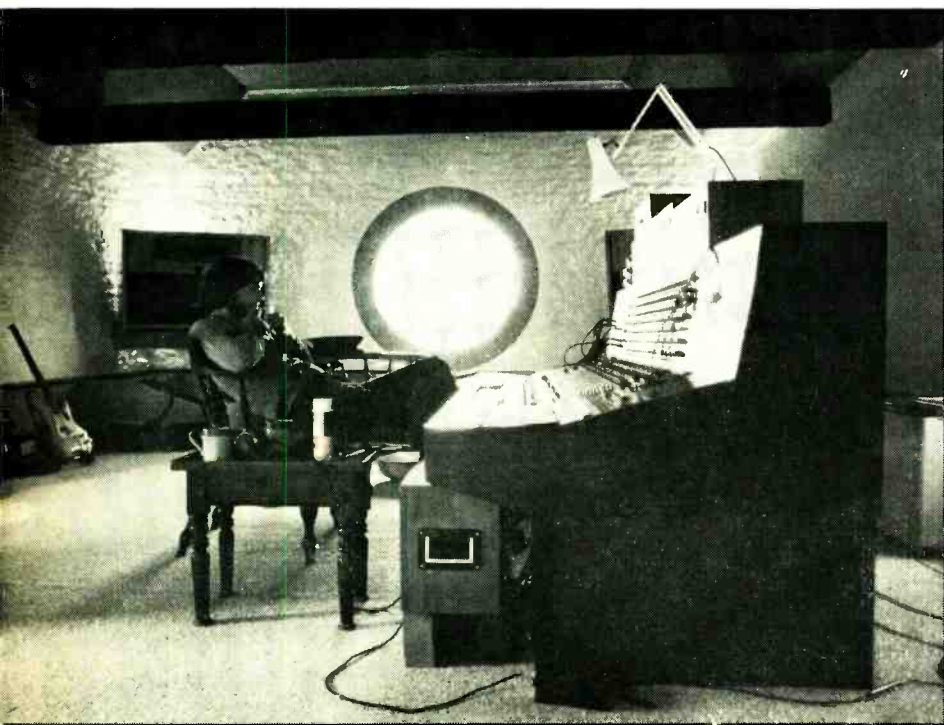
The rest is history. *Tubular Bells*, *Hergest Ridge* and *Ommadawn* followed soon after, all doing for the guitar what Phil Spector did for the piano. Naturally, multitrack studio technique helps quite a lot. After all, juggling with a piece of card in front of the erase head is a hassle which can't do much for creativity. But Oldfield's ascetic approach to recording seems unchanged since the original demo tapes. For him, it's the feeling in the sound that matters; he regards the recording process as merely a vehicle, albeit necessary, which enables him to string his 'little tunes' together. The way he does this is relatively straightforward: 'Well, getting started is the worst thing . . . you just have to bung anything on—I usually start with a tick track—and follow up with an idea that I might have had in mind. This may be a little tune or a simple sequence of chords which fit nicely together. This is how *Ommadawn* was started; just two chords and two tunes.'

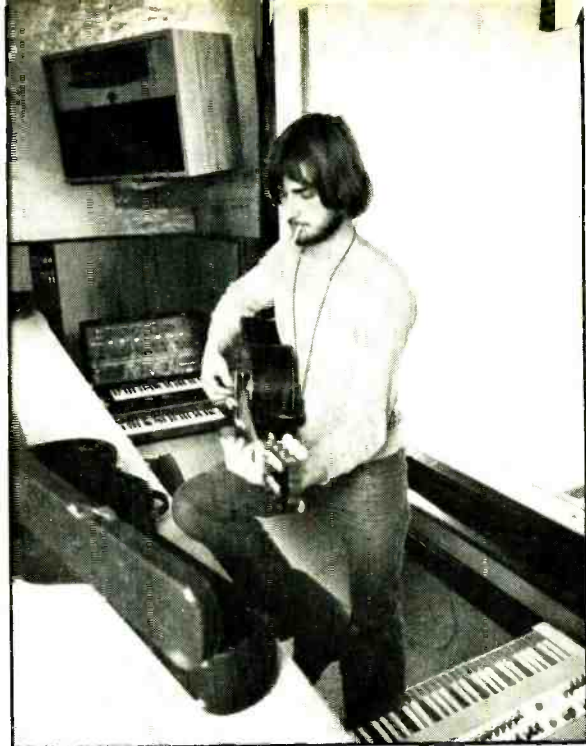
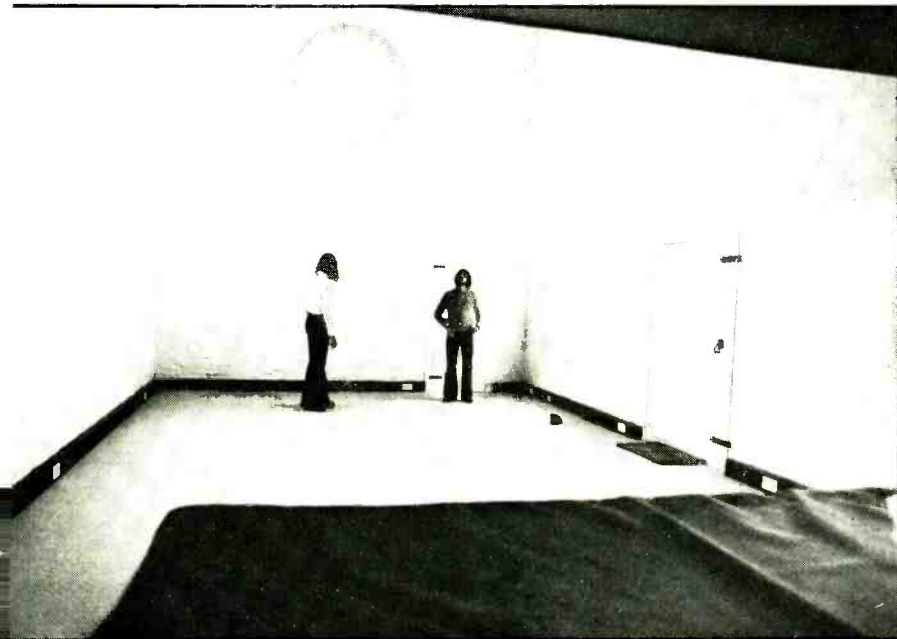
The music isn't formally scored depending rather more on keeping 'little tunes in my head that I might use one day'. At the last count, Mike said that he had about ten potential melodies stored up top.

He brings them out for dusting by playing the piano and guitar every day whether he is recording or not. The nearest that things get to being written are the routing and submix details contained within the track diagrams. However, these are no more than the usual 'guitars (3.48 to 5.36)'. Naturally, in the first instance, he puts down something that he can play along with. Having done this, he decides what sort of 'texture' he wants.

Mike Oldfield talks more about 'textures' than the individual instruments which make them up: 'It's very much a knack really. If I want a smooth, steady texture, I'll probably use that Farfisa organ over there . . . it's got a lovely deep, flutey sound. I might put a couple of them on or, if I wanted something harder, I might use electric guitars. I very much like doing about six played in harmony to build up chords, rather like an organ chord. For a huge texture, I will use from 20 to 30 guitars, including basses, played in unison and then submix to a single track. Of course, there's a whole range of percussive textures. One instrument isn't usually sufficient; I have to use several to create a texture. That's not all because I will usually place several textures on top of each other in the mix to create a main theme. Of course, there's always the problem of finding the right instrument to play the actual tune that goes along with it all. The whole thing is finished when it sounds really good. Occasionally, I let things go when I've just worked too hard and I can't seem to think of anything else to do with them . . . they may end up as link pieces from one section to another.'

The overall sound of Oldfield's music would seem to suggest the use of exotic effects units. This just isn't the case; in fact, he normally restricts sound bending to compressor limiting, reverberation and double speeding of individual instruments: 'If you want, say, a texture with a rhythm in it, then I might do three acoustic guitars and squash them flat. It's got to be done because you can't play them all at the same degree of smoothness . . . it results in a rhythmical, mushy thing rather than three acoustic guitars.' To illustrate the possibilities of compression on an individual instrument, Oldfield played a glockenspiel track from *Hergest Ridge*: 'It doesn't sound like a glockenspiel. All the attack has been taken out while prolonging the decay. I often use the same technique with acoustic guitar to get a nice sort of *thummmm*





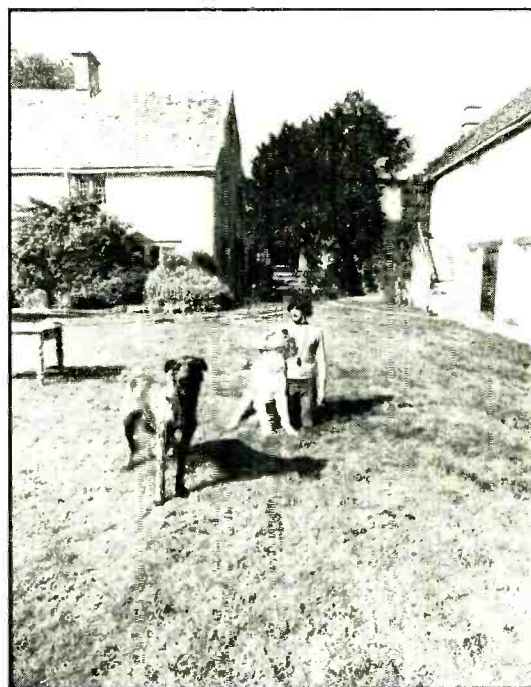
sound. When you do recorders, some sort of gain ride is a must because they go up and down like hell . . . Much of the typical sound results from double speed instrumental playback once again built up from many successive layers of individual instruments. In spite of this, Oldfield seldom uses double tracking because, simply, he doesn't like the sound.

Naturally, he attaches importance to mic technique, but that job is made much easier when using quality instruments: 'With acoustic things, as long as you've got a really good instrument, mic placement is not quite so fussy. It's only when the instrument isn't so good that you've got to fiddle about. I'm lucky enough to be able to afford good guitars which means I only have to plonk a mic a metre in front and play them. They always sound beautiful . . . it's the instrument that counts. I use Neumann U67s mostly; the choice of microphone does bear some relationship to the sound that comes out. Getting that glockenspiel sound was very difficult . . . as you move around it while it is playing, you can hear different harmonics. I eventually ended up with the instrument sitting in the middle of the floor with the mic about two metres above it pointing straight down. It also depends on how you play it. Occasionally, I limit very heavily and just touch the keys. That's why there is so much hiss there . . .'

*Tubular Bells* posed a considerable problem at the mixdown stage because it was post eq-ed: 'Things were really difficult because we recorded everything flat making it almost impossible to mix it (due to the detailed submixes). It took Tom Newman and I months . . . but with *Hergest Ridge* and *Ommadawn*, we hardly post eq-ed anything: we simply did it all as it was being recorded. Not doing that meant I might have to do a whole overdub again simply because the eq wasn't right . . . I think we mixed *Ommadawn* in a week and it was so much more complex than anything else technically. And I did loads of submixes.'

The Ferrari, sitting a trifle uncomfortably in the rustic garage, suggests that Mike Oldfield likes and enjoys more than the simple pleasures of Irish Wolfhounds, St Bernards and model airplanes (as well as a parrot and a macaw named Screech and Squawk respectively). Similarly, he feels that his music benefits from recording technology: 'There's a lot more equipment that I would like . . . for instance, a computer mix would be lovely.' This would represent an addition to the recording facility already constructed at his Gloucestershire home—more on this later. Automation would seem especially applicable to his sort of music: 'On my mixes, I do a lot of fiddling little bits—bringing things up and down here and there and all over the place. Being able to do it, like, once and having it immediately repeated to you . . . useful. Then there are the things you want to fade out while putting other things back up. It's easy to pull down a fader that you shouldn't or leave something up with hiss on it.'

Mike Oldfield's studio reflects the way he works. It's not



extravagantly equipped by current standards although it offers 24-track operation through a 30/24 custom-built desk. Apart from four channel Westlake monitors in line with the quad desk channel panning and the exclusive use of dbx noise reduction, it boasts little other than an *EMT 240* echo foil, good quality compressor limiters, digital harmoniser, and wide range eq facilities. Little touches are provided in respect of the one man operational aspect like facilities for foot operated drop ins. 'When I worked on *Ommadawn*, there was that remote box sitting on the tape recorder which I used. I had to hold the record button down with one toe and press the play with the other at the right point. I rather enjoyed it actually . . .' Guitars don't pose any problems when lining up because Oldfield plays them all in the control room, a bright, airy place with a large circular window looking out on green fields. To enhance this effect, the walls are painted white. Other instruments, such as keyboards *et al*, are played in the recording studio below; lining up is done either by a matchstick jammed in the keys of the organ or by plonking carried out by ex-Rockfield engineer, Paul Lindsay. Once again, the studio is large and full of 40 ▶

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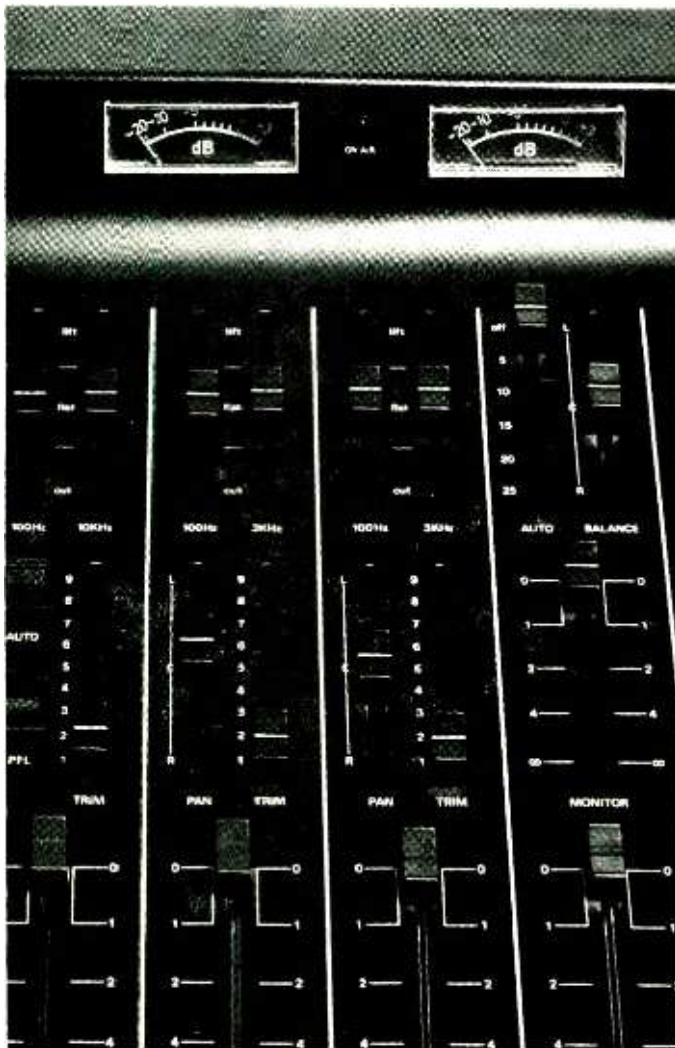
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## COUNTRY LIFE—MIKE OLDFIELD

light from many windows. It has been designed to an ecclesiastical theme, even down to the pent, dark timbered roof. The sunlight streams in through a high circular window similar to that in the control room, itself overlooking the studio floor through a large, double glazed, plate glass window.

Such an amount of daylight is unusual in a recording studio but, then again, so is its owner: 'There seems to be an image of recording studios as dark places illuminated by dingy red lights, populated by people wearing dark glasses . . . they are usually horrific places. Here, I have sought to create an environment which, apart from anything else, is a nice room to sit in. I'm glad you said it looks like a chapel 'cause that was really what it was meant to be. In fact, I've got a very nice pipe organ due to go in about Christmas time.'

During his time with Kevin Ayers, Mike Oldfield worked in many studios but generally found it a disenchanting experience. For a start, he found them 'sealed in' and acoustically dead—now he works in a very live environment; laying one instrument at a time makes leakage problems non-existent. Also his nearest neighbour is over a quarter of a mile away. Other studios could be detrimentally awe-inspiring: 'There is a bit of studio fright when you know that you are recording—especially when you've got a producer upstairs and a little red light glaring at you. It makes you slightly nervous. You get frightened that you're going to make a 'nana of yourself—I probably did and still do.' However, there were other developing factors to his style that stem directly from working in a band: 'It used to be frustrating working with a producer and the rest of the band; I was only the bass player in the group and my opinion wasn't worth anything although I knew what was needed. This had everything to do with going it alone . . . seeing the wasted potential of things that could have been really nice, ending up as gash tape on the editing room floor.'

Owning a personalised studio makes economic sense because the recording process is inevitably longer if everything has to be put down one at a time. Working in a band makes for a quicker recording job with the added impetus for a quick turnaround since time means money; something which record companies are very conscious of. For *Ommadawn*, Oldfield worked from January to September last year fairly solidly: 'I'd take a week off now and then although this was unintentional; this happened when I just couldn't get any further. For instance, I got half way through and couldn't think of what to do next—everything I tried didn't sound right so I left it for a few days. I used to work from nine in the morning to one at night . . . when I am actually working, I work all the time. However, mostly I fiddle with model airplanes although I play something everyday . . . The first take is never good enough. With an acoustic guitar, it usually requires about three or four. Keyboards are the worst because I'm not a very good keyboard player. It takes ages and ages when one has to keep dropping in—especially with piano.' Although, by his own confession, he isn't another Liberace, he perseveres and does it all himself because the 'one man band' aspect is part of Oldfield's image. In spite of this, he does make some concessions to instruments such as the uilleann pipes (small bagpipes).

He has some feeling for the public who has to suffer the effect of lousy record pressings, especially when he goes out of his way to ensure that his masters are of merchantable quality: 'What can I do? All I can do is to shout at somebody from the record company . . . I have no control over the situation. Ideally, I wish I could press my own records.' He went to the cutting room for the first two records and trusted Phil Newell with the third. The situation of poor quality pressings is made harder to understand by the fact that the test pressings were of good quality. Phil Newell, of Virgin, handles the SQ quad mixdowns in which Oldfield has little interest. In the latter's opinion, it is impossible to place instruments solidly enough around the listening rectangle to make the benefits worthwhile; the best that can be achieved is a small increase in depth away from the basic stereo plane. Ask Oldfield about quad and the answer comes back something like: 'I've only heard SQ discs . . . not very impressive. What's the other system? . . . something like C, um, C4. Ah yes, CD-4 . . . No, I've never heard QS . . .' Mike feels that quad can only be a practical proposition if and when discrete tapes become available. ■



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Surveillance  
Video Publishing  
Viewdata  
Teletext  
Video art

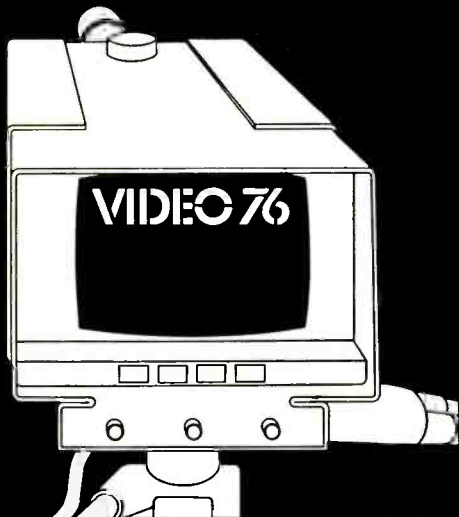
Thursday 11th  
REPRODUCTION  
Timebase correction  
Video image processing  
Video links  
Video duplication  
Video displays and monitors

Sessions start at 2.30pm each day. Admission by ticket only. Price £5.00 for the three sessions or £2.00 per session.

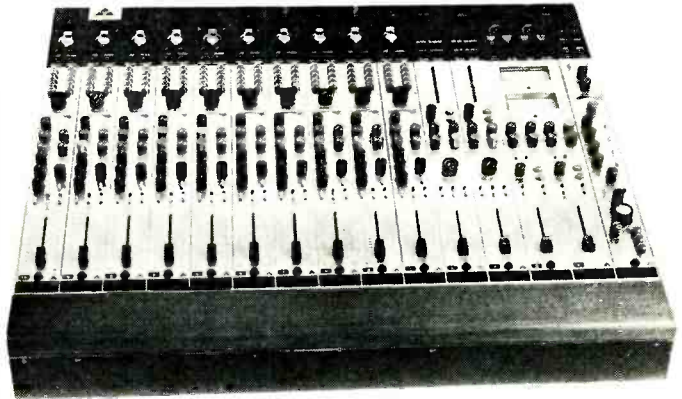
To get your VIDEO 76 CONFERENCE ticket application form circle ref. 559

# VIDEO 76

AT THE HEATHROW HOTEL LONDON AIRPORT



# The mixer which carries on



# When others are carried out . . . .

The Trident Fleximix System isn't just another portable mixer which has to be discarded as your requirements grow. Fleximix is a carefully thought out *expandable* mixer which will meet your needs now and in the future. Any time you decide you need more channels you simply slot-in additional modules; if you run out of slots, just add another mainframe. Modules may be placed in any sequence you like. No factory rework is required and no rewiring necessary.

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Factory Address:  
Shepperton Studios,  
Squiresbridge Road,  
Shepperton, Middx.  
Tel. Chertsey (09328) 60241



**Obie Clayton**, *talented musician, session man and writer, describes the advantages of going up country rather than Oxford Street, London.*

**T**HE drop-in was tricky: a one-beat gap in an otherwise complete track-sheet into which the producer had decided that a live shotgun report was to be slotted. This naturally called for a cool hand on the record button—not to mention a hefty pair of shoulders to handle the kickback. But the team was practised and experienced. Marksman Jerry Boys, who also doubles as chief engineer at Sawmills Studio, Cornwall (scene of the incident), needed only one run through. He aimed the shotgun past the Neumann standing on the quay, and out across the shimmering green waters of Bodmin Pill. Take two finally did it. The packet of 25 shells had hardly been used.

The episode was typical of the adaptability of a studio set in splendid isolation. You can do that sort of thing when the only complaints come from a pair of swans, a cormorant, and the anxious gaze of a distant holiday fisherman.

Some weeks before, in the same pioneering spirit, experiments had been carried out with the natural echo facilities of the hills which cradle the studio. My H/H combo was aimed out of the studio door and a microphone placed on the control room roof to capture the eerie natural delay as the bottleneck guitar riff that I was playing bounced back across the creek. Try that in Oxford Street.

It took me nearly four years of aimless wandering in and out of the music business to find a place with the eccentricity of Sawmills Studio: a studio with the ability to accommodate almost any musical delinquency you care to dream up and handle it with care and an exacting level of professional competence.

The great initial difference that I discovered between this studio and those I had worked in during my time in London was the lack of a time-based system: the clock did not rule. For people on a

limited recording budget the necessity of having to work under the three hour session system can be frustrating and often unsatisfactory; there are enough pressures in this business without building them in. If you are working under the pre-packed system, with super-slick session men reading pre-arranged dots, then it is easy to pack everything into the available time. But this is not the only way to work and some would say that its results are less than perfect in terms of vitality, energy, and that mystical quality 'feel'.

Yet it is inconceivable for most bands or solo artists not in the superstar league to use the studio as an instrument, to use what it has to offer creatively and not mechanically. At £40 an hour it is impossible for most people to take detours, to develop ad libs or experiment on the spot, let alone go into the studio with the very basics of a song and use the time and the resources to build the finished product bit by bit, in a spontaneous and informal way.

I always favoured this open-minded approach to recording, even when I was making records with a producer who believed in pre-scoring everything. He liked the security that writing everything down beforehand gives; and I underwent hours of 'scheduling', during which we would discuss where we were going to have a tambourine or a tubular bell chime, or when my voice would be dry or in full bathroom reverberation. The theory was that this saved time (and, of course, money) in the studio; but it actually wasted much more than it saved, for the time could have been used creatively—with more benefit to the record. You can talk about things as much as you like; but it's not the same as doing them. And this is particularly true of the studio, which generates its own creative stimuli. Once you are there your imagination invariably begins to work harder, if it is allowed to. If things are

worked out minutely beforehand, no one feels like wasting all those preconceptions. Besides, there is usually no time to waste.

Under normal circumstances the decision to pre-pack a session or not is probably the producer's; but as often as not this is an economic decision. The studios have their price, and the producer has his budget. The artist is caught between the two, and the result is often compromise. An incompetent producer, however, only makes things worse: on this score, I have often wondered whether a studio is only as good as the producers that use it; or can it deliver the goods on its own account and override ineptitude?

In my case, I was as dissatisfied with my producer as I was with the studio environments that I was working in. There is nothing worse than someone who fancies that he is a 'producer' just because he has scored some money to make a record, though his technical knowledge extends no farther than the fact that he knows that a fader pushed upwards makes things louder, and his musical experience is confined to singing in the bath.

There is, of course, no absolute need for a producer to be a boffin; but I have come to think that he needs to have a certain minimum of inside information regarding the anatomy and functions of the studio. For one thing, it helps the relationship between him and the engineer if they don't know each other; if the producer can talk to the engineer in the language of the desk, and not as a complete civilian, then so much the better.

A rudimentary grasp of musical theory, and a little practice too, are handy things for a producer to have. They stop him telling the bass player to play a root F sharp when the rest of the band are in F, as has happened to me. An ear that is alive to basic harmonic structure, for example, can be invaluable during overdubbing when vocal parts or multitracked guitars are either experiencing a difficult birth or else threaten to get out of hand. A wider awareness of the studio's possibilities and a surer touch overall generally goes with a degree of musical and technical know-how, since the producer is in control of his medium, and not at the mercy of it.

These personal attitudes to the three-way relationship between the musician, producer and engineer help to clarify the way I operate. Much of my work owes far more to intuitive progression from a basic idea rather than the stylised approach to a fixed format. Obviously, the inherent improvisation within my working style demands much in the way of adaptability from those around me—this is what I get from Sawmills Studio.

I think that it's the unmistakable sense of freedom about the place—freedom from every preconception there might possibly be about a fully equipped 16-track (soon to be 24) studio. Non-conformity is of the very essence. The recording process is open-ended; you go on until you have had enough. I can spend my time writing and making demos; or I can work out vocal parts; record a number of alternative guitar solos; even take a few hours to search out just the sound I want from the ARP synthesiser. This is not wanton self-indulgence: it's using the studio as a creative source, and not just as a dictation machine.

For me, it is a logical extension of the way I write, which I do rather less by actually sitting at the piano than by working with my Revox. I make up to half a dozen demos of any one song, changing and developing as I listen to and compare each recording. Things that I could not have foreseen as being part of the song's structure at the piano become apparent when I start dubbing on a bass, guitar fills, or drum patterns. It also gives me some idea of how it will work when I hand over the song to the band.



This sort of flexibility, allowing a song to develop organically, as it were, is just what Sawmills offers. This and its perfect setting, make you completely unaware of time. Consequently you feel less restricted by economic limitations. You feel less harassed by your budget since the basic unit of time at Sawmills is the day or, more often, the week. And it's a real day: all 24 hours of it if you want.

My own band is also the house rhythm section: Alan Eden, drums; John Atkinson, bass; and Ian Wilson, guitar. Tony Cox, the studio owner, produces me, and Jerry Boys (intrepid and ever-patient) drives the desk. The team is a sympathetic and capable foil to any tendency I might have toward needless self-indulgence, while, at the same time, they allow me to work out my ideas as I would in the privacy of my own Revox.

Sawmills Studio is, perhaps, the only genuine 'country' studio: it is not the West End transplanted snugly amidst fields and cows. It makes no concessions: you have to make an effort to get there in the first place—a brisk walk up the railway line, or a bracing trip by boat, if the tide's in your favour. There's an absence of surface luxury: not a Swedish armchair to be seen. But the studio is white and cool; the control room commands a view of tumbling trees and rocks. Well, the view has its disadvantages: I have been known to miss an important cue during mixing because I was watching the squirrels frolic among the hazel trees on the other side of the creek.

This might sound rather like a commercial but Sawmills is so radically different to any London studio and, importantly, to any of the other 'country' studios, that I have become violently partisan about it after nearly two years spent working there. The limitations imposed on making a record by the London-based commercial studios are, I believe, genuinely crippling to many people. I don't mean just the avant-garde, or the 'progressives' who make a living from being experimental. Even those, like myself, who are involved in the mainstream of pop can only benefit from studios, like Sawmills, which can afford to make themselves musician-based and flexible while maintaining high standards of professional excellence.

Of course it would not do for every London studio to move to the extremities of the kingdom and 'go Sawmills'. But a studio like this fills a genuine need. A few weeks ago, in the *Melody Maker*, Richard Williams wrote of an attempt by Robert Wyatt, Phil Manzanera and Brian Eno to build their own studio. Of this he commented:

'Amidst the conformity of the rock world, which places so many unwanted restrictions upon its brighter practitioners, it seemed to me that here was an opportunity to break, in a small but significant way, with accepted patterns, and make the mould fit the contents, rather than the habitual reverse.'

This is exactly the principle behind Sawmills Studio. It is a musician's studio, not a business man's.

The band and I are each given our head from time to time, on the theory that anything is worth trying: the number of sounds that have been coaxied out of the studio's 1905 Bechstein is an object lesson in taking time out to make the most of available resources. And then there was the wah-wah tom-toms; the eight part vocal chorus, all done with high-speed voices. Oh, and once we used a live shot gun . . .

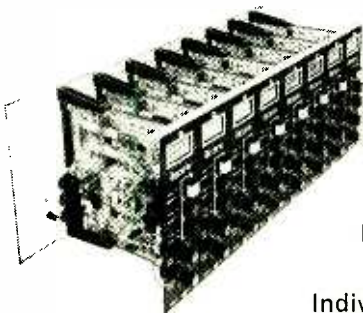
Of course you may not like fresh air, utter seclusion, squirrels, real ale, boat rides, and a chance to be yourself for once in a studio. Please yourself.



# A revolution in the recording industry



## The Itam 805 8-track master recorder. £1790



Fully modular electronics using plug-in PCB's throughout. Separate sync and replay amps give identical levels. Switchable VU's with slow decay.

Individual oscillator for each channel. Dolby A switching facility.

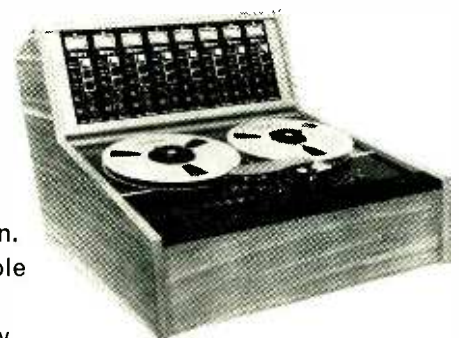
Comprehensive facilities include sync on all

channels, servo controlled capstan, modular electronics, variable speed (optional), relay-solenoid operation.

Compact console presentation for easy portability.

£1790 + VAT. Full console optional extra.

**Compatible 8-output Mixer available £1260 + VAT.**



# itam

Industrial Tape Applications, 5 Pratt Street, London NW1 0AE. Tel: 01-485 6162/7833. Telex: 21879.  
STUDIO SOUND, OCTOBER 1976

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Queen  
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David Essex  
London Palladium  
Sarm  
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Virgin Records  
YES music  
Olympic  
AIR  
United Artists  
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Screen Gems Columbia  
Orange  
Trident  
Rolling Stones  
Tin Pan Alley  
Alvin Stardust  
Island  
Morgan  
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Gooseberry  
Molenaire  
Warner

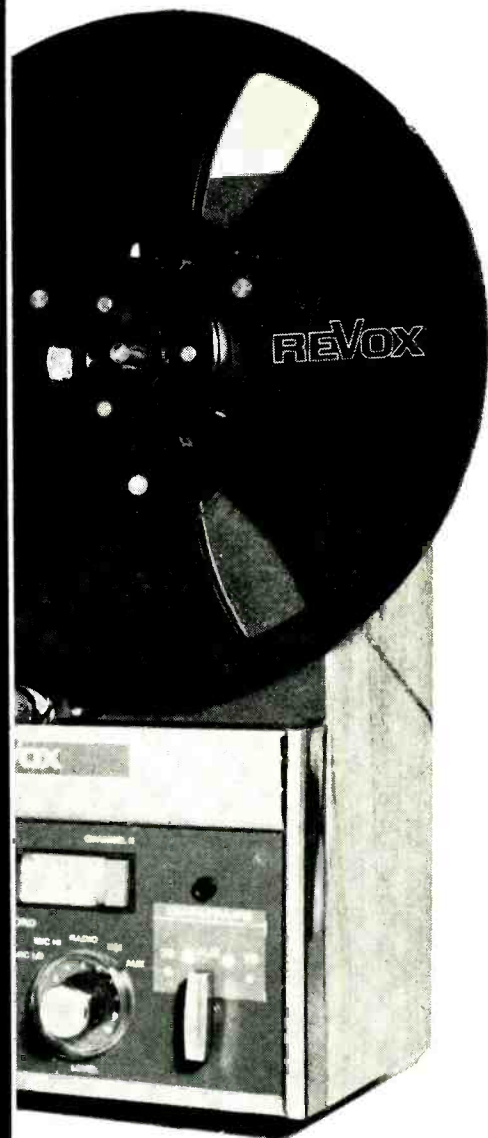
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# Survey: studio mastering machines

*Future surveys will comprise Equalisers (November), Broadcast and Sound Re-inforcement Mixers (December) and Multitrack Recording Consoles (January). Manufacturers and agents are invited to submit product details for publication to reach the magazine office (address p3) at least six weeks before publication date.*

Suffolk IP17 2NL.  
Phone: 0728 2262/2615.

## 800 series

**Construction:** modular; built to specification by purchaser.  
**Tape width:** 6.25 mm.  
**Track format:** mono, stereo and four track.  
**Transport:** logic controlled, fully interlocked.  
**Equalisation:** NAB/CCIR.  
**Speed:** 9.5, 19/38 cm/s switchable.  
**Head block:** fixed.  
**Signal interface:** unbalanced. Mic amps available.  
**Wow and flutter:** 0.05% weighted at 38 cm/s to rms measurement.  
**Spooling time:** 60s for 740m.  
**Reel type:** to 26.7 cm.  
**Optional extras:** remote control.  
**Special features:** can be built to virtually any specification. Also, cheaper transport available.  
**Price:** for example, 2 channel stereo machines costs £1395.



*Brenell Mini 8*

to DIN 45507.  
**Tape timer:** mechanical counter reading minutes and 1/100 minute in all modes. Electronic digital display available.  
**Tape tension:** electronic servo back tension system.  
**Spooling time:** 120s for 730m.  
**Capstan drive:** synchronous hysteresis motor.  
**Weight:** 33 kg.

## Type 19

**Construction:** tape transport only.  
**Tape width:** usually 6.25 to 25 mm.  
**Tracks:** one, two, four, eight.  
**Track width:** full or half track.  
**Transport control:** full interlock.  
**Spool type and size:** NAB, cine and European to 29 cm.  
**Tape position indicator:** mechanical counter.  
**Head type:** Bogen 6.25 mm. Branch & Appleby 12.5/5.25 mm.  
**Tape speed and wow and flutter:** 38 cm/s 0.05%, 19 cm/s 0.08%, 9.5 cm/s 0.12%, 4.75 cm/s 0.2%. All values rms.  
**Spooling time:** 100s for 730m.  
**Other features:** pause/play control.  
**Optional extras:** Non standard speeds—two or four options.  
**Dimensions (whd):** 48.3 x 35.6 x 16 cm. 16 kg.

## Mini 8

The machine offers eight tracks on 25 mm tape. Constructed to a portable format. No specific price is quoted by the manufacturers, Brenell and Allen & Heath, claim that a package comprising a 16/8 desk and a *mini 8* tape machine will cost around £4000.

## Mk 7S

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** stereo, two track or stereo quarter track.  
**Equalisation:** NAB/DIN switchable.  
**Speed:** 19/38 cm/s switchable.

## ABE

ABE Apparatebau und Elektronik, Becker GmbH & Co, Kommanditgesellschaft, D-7750 Konstanz, Otto-Raggenbassstrasse 5, Switzerland.  
Phone: 075-31-21536.

## 8/16 track

**Construction:** console.  
**Tape width:** 25/50 mm.  
**Tracks:** 8/16 half track.  
**Transport control:** logic interlock.  
**Equalisation:** NAB or CCIR switchable.  
**Spool type and size:** up to 26.7 cm.  
**Tape position indicator:** digital timer  
**Noise:** ref 510 nWb/m unweighted better than 54 dB at 38 cm/s, and 52 dB at 19 cm/s to DIN 45405.  
**Tape speed and wow and flutter:** to DIN 45 507 38 cm/s 0.05%, 19 cm/s 0.08%.  
**Input level at impedance:** } 0 dBm at 600Ω  
**Output level at impedance:** } nominal.  
**Spooling time:** 120s for 750m.

## 24 track

**Construction:** console.  
**Tape width:** 50 mm.  
**Tracks:** 24.  
**Transport control:** logic interlock.  
**Equalisation:** NAB/CCIR switchable.  
**Spool type and size:** NAB.  
**Tape position indicator:** digital timer.  
**Noise:** ref 510 nWb/m unweighted better than 52 dB at 38 cm/s, and 50 dB at 19 cm/s to DIN 45405.  
**Tape speed and wow and flutter:** as for 8/16 track.  
**Input level at impedance:** } 0 dBm at 600Ω  
**Output level at impedance:** } nominal.  
**Spooling time:** 120s for 750m.

## AMCRON

Amcron International, 1718 West Mishawaka Road, Elkhart, Indiana 46514, USA.  
Phone: (219) 294 5571.  
UK: Macinnes Laboratories Ltd, Macinnes House, Carlton Park Industrial Estate, Saxmundham,

## AMPEX

Ampex Corporation, Audio-Video Systems Division, 401 Broadway, Redwood City, Ca 94063, USA.  
Phone: (213) 240 5000.  
UK: Ampex (GB) Ltd, 72 Berkeley Avenue, Reading RG1 6HZ.  
Phone: 0734-55341.

## MM1200

**Construction:** console mounting.  
**Tape width:** 25 and 50 mm.  
**Track format:** 8/16 and 24 track.  
**Transport:** logic controlled, full interlock.  
**Speed:** 19/38/76 cm/s.  
**Head block:** detachable with fixed alignment.  
**Noise:** 8/16 track 64 dB, 24 track 59 dB using 456 tape 30 to 18k Hz referenced to 520 nWb/m at any speed.  
**Signal interface:** balanced 0 dBm variable.  
**Wow and flutter:** 0.08% peak weighted at any speed to DIN 45507.  
**Tape position indicator:** digital mins and sec.  
**Spooling time:** 120s for 740m.  
**Reel type:** any to 35.6 cm.  
**Optional extras:** PURC, video playback head, search to cue device, vari-speed, synchronising apparatus for video interlock.  
**Distortion:** less than 1% at 370 nWb/m using 456 tape.  
**Dimensions (whd):** 74 x 115 x 69 cm. 240 kg.

## ATR 100

(see review p58)

## BRENNELL

Brenell Engineering Co Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8.  
Phone: 01-340 3291.

## 600 series

**Construction:** tape transport only.  
**Tape width:** 50 mm.  
**Speed:** 38 cm/s. Other speeds to order.  
**Reel type:** any to 35.6 cm.  
**Wow and flutter:** better than 0.06% peak weighted

# Introducing the TEAC Tascam Series

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## 3 NEW MIXERS

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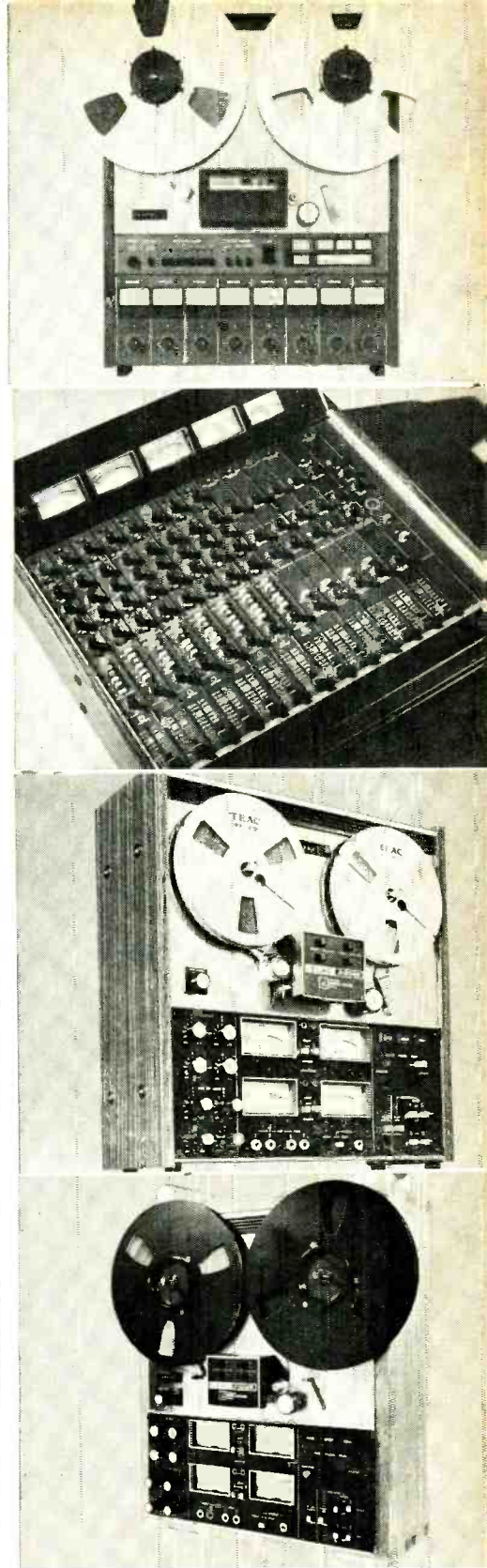
### A-3340S Industrial (The quiet one)

This version of the 3340S is by far the most popular and is supplied as standard issue to practically all budget and medium sized studios.

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New high speed version of the established 2340. Identical to the ubiquitous A-3340 but with 7 inch reel capacity. 3 3/4 and 7 1/2 version also available.

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- Model 2
- Model 3
- Model 5
- A-3340S
- A-2340H

Name .....

Address .....

## SURVEY: STUDIO MASTERING MACHINES

**Head block:** fixed.

**Noise:** 60 dB ref 0 vu at 38 cm/s stereo track.

**Signal interface:** unbalanced multipurpose.

**Wow and flutter:** 0.05% weighted at 38 cm/s to rms.

**Tape position indicator:** mechanical position.

**Spooling time:** 100s for 740m.

**Reel type:** all types to 26.7 cm.

**Dimensions (whd):** 46 x 44 x 23 cm. 18 kg.

### FERROGRAPH

**Ferrograph Co Ltd, Durban Road, Bognor Regis, West Sussex PO22 9RL.**

**Phone: 02433 25811/86120.**

#### Studio 8

**Construction:** console, rack, trolley and transportable mounted.

**Tape width:** 6.25 mm.

**Track format:** two track and stereo.

**Transport:** logic controlled, servo controlled capstan.

**Equalisation:** NAB/CCIR by plug in cards.

**Speed:** 19/38 cm/s switchable.

**Head block:** interchangeable between two track and stereo.

**Noise:** 62 dB ref 514 nWb/m at 38 cm/s stereo track using CCIR eq.

**Signal interface:** balanced 0 dBm variable.

**Wow and flutter:** 0.06% weighted at 38 cm/s to DIN 45507.

**Tape position indicator:** digital mins and sec.

**Spooling time:** 120s for 740m.

**Reel type:** all types to 26.7 cm.

**Special features:** auto stop at time counter zero. Internal amplifiers for loudspeaker output.

### ITAM

**ITAM, 5 Pratt Street, London NW1 0AE.**

**Phone: 01-485 6162/7833.**

#### 805

**Construction:** portable or console.

**Tape width:** 12.5 mm.

**Track format:** 8 tracks.

**Transport:** controlled by solenoid relay logic.

**Tape speed:** 38 cm/s.

**Noise:** 65 dB ref 900 nWb/m using *Grandmaster* tape.

**Distortion:** less than 1% at Dolby level.

**Signal interface:** 0 dBm nominal.

**Wow and flutter:** 0.06%.

**Spooling time:** 100s for 740m.

### KLARK-TEKNIK

**Klark-Teknik Research Ltd, MOS Industrial Site, Summerfield, Kidderminster DY11 7RE.**

**Phone: 0562-64027.**

#### SM2

**Construction:** console mounting.

**Tape width:** 6.25 mm.

**Track format:** mono, stereo two track.

**Transport:** digitally controlled, phase locked capstan.

**Equalisation:** NAB/DIN switchable.

**Speed:** 19/38/76 cm/s switchable between choice of two.

**Head block:** interchangeable.

**Noise:** 60 dB ref 320 nWb/m at 38cm/s stereo track between 20 to 20k Hz.

**Signal interface:** unbalanced 0 dBm variable.

**Wow and flutter:** 0.05% weighted at all speeds to DIN 45507.

**Tape position indicator:** digital mins and sec.

**Spooling time:** 90s for 740m.

**Reel type:** all types to 29.5 cm/s.

**Price:** mono £2150, stereo £2250, two track £2350.

### LEEVEES-RICH/BIAS

**Leevers-Rich Equipment Ltd (incorporating Bias Electronics), 319 Trinity Road, London SW18 3SL.**

**Phone: 01-874 9054.**

#### E200

**Construction:** console and rack mounting.

**Tape width:** 6.25 mm.

**Track format:** mono, stereo and two track.

**Equalisation:** NAB/CCIR.

**Speed:** 19/38 cm/s switchable.

**Head block:** detachable.

**Noise:** 60 dB ref 320 nWb/m at 38 cm/s stereo track.

**Signal interface:** balanced 0 dBm variable.

**Wow and flutter:** 0.06%.

**Tape position indicator:** mechanical mins and sec.

**Spooling time:** 90s for 740m.

**Reel type:** all types to 29 cm.

**Optional extras:** remote unit, internal power amplifiers.

**Dimensions (whd):** 48.3 x 36 x 28 cm.

**Weight:** 120 kg.

**Price:** available on request.

#### Proline 1000

**Construction:** console.

**Tape width:** 6.25 mm.

**Track format:** mono, stereo and two track.

**Equalisation:** NAB/CCIR.

**Speed:** 19/38 cm/s switchable.

**Noise:** -58 dB ref 320 nWb/m at 38 cm/s stereo track. 20 to 20k Hz unweighted.

**Distortion:** 1% thd ref 320 nWb/m at 38 cm/s.

**Signal interface:** balanced 0 dBm variable.

**Wow and flutter:** 0.05% weighted at 38 cm/s to DIN 45507.

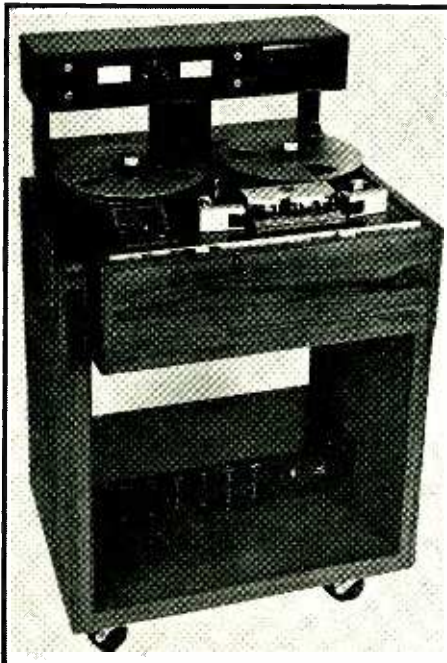
**Tape position indicator:** mechanical mins and sec.

**Spooling time:** 100s for 740m.

**Reel type:** all sizes to 29 cm.

**Price:** available on request.

*Klark-Teknik SM2*



### MCI

**MCI, 4007 N E 6th Avenue, Fort Lauderdale, Florida 33334, USA.**

**Phone: (305) 566 2853.**

**UK:** MCI (Professional Studio Equipment) Ltd, MCI House, 54-56 Stanhope Street, London NW1. Phone: 01-388 7867.

#### JH110 series

**Construction:** console mounting.

**Tape width:** 6.25/12.5 mm.

**Track format:** mono, 2 and 4 track.

**Transport:** full logic control.

**Equalisation:** NAB/CCIR.

**Speed:** 19/38/76 cm/s switchable.

**Head block:** removable.

**Noise:** 64 dB ref 250 nWb/m at 38 cm/s 2 track

66 dB ref 250 nWb/m at 76 cm/s 2 track

63 dB ref 250 nWb/m at 19 cm/s 2 track

**Distortion:** 1.5% thd ref 500 nWb/m at 38 cm/s using 3M 206 tape.

**Signal interface:** balanced to +24 dBm variable.

**Wow and flutter:** 0.02% weighted at 76 cm/s. 0.04% weighted at 38 cm/s.

**Tape position indicator:** digital mins and sec.

**Reel type:** NAB.

**Optional extras:** auto-locator, remote control, tape velocity indicator.

**Special features:** touch toggle tape nudge for editing. The 110 series is available for tape to disc mastering when fitted with a tape delay loop and pre-view head.

**Dimensions (whd):** 64.2 x 88.9 x 66.1 cm. 86.4 kg.

**Price:** \$4293.

#### JH-114—24 track

**Construction:** console mounting.

**Tape width:** 25 and 50 mm.

**Track format:** 8/16/24 track.

**Transport:** full logic control.

**Equalisation:** NAB.

**Distortion:** 1.5% thd ref 350 nWb/m at 38 cm/s using 206 tape.

**Signal interface:** balanced 0 dBm variable.

**Wow and flutter:** 0.05% weighted at 38 cm/s to DIN 45507.

**Tape position indicator:** digital mins and sec.

**Spooling time:** 85s for 740m.

**Reel type:** NAB and cine spools to 35.6 cm.

**Optional extras:** as for JH-110 series.

**Special features:** touch and nudge toggle for editing.

**Remote control:** included.

**Dimensions (whd):** 95.8 x 127 x 68.6 cm. 260 kg.

**Price:** \$29000.

### 3M

**3M Mincom Division, 3M Centre, Saint Paul, Minnesota 55101, USA.**

**UK:** 3M Mincom Products, Witley Works, Witley Gardens, Southall, Middlesex.

**Phone: 01-574 5929/6045.**

#### M79 series

**Construction:** console.

**Tape width:** 6.25/12.5/25/50 mm.

**Track format:** mono, 2, 4, 8, 16 and 24 track.

**Transport:** logic controlled, differential loop capstan.

**Equalisation:** NAB/CCIR.

**Speed:** 19/38/76 cm/s switchable between two speeds.

**Head block:** detachable for interchange between 25 and 50 mm formats.

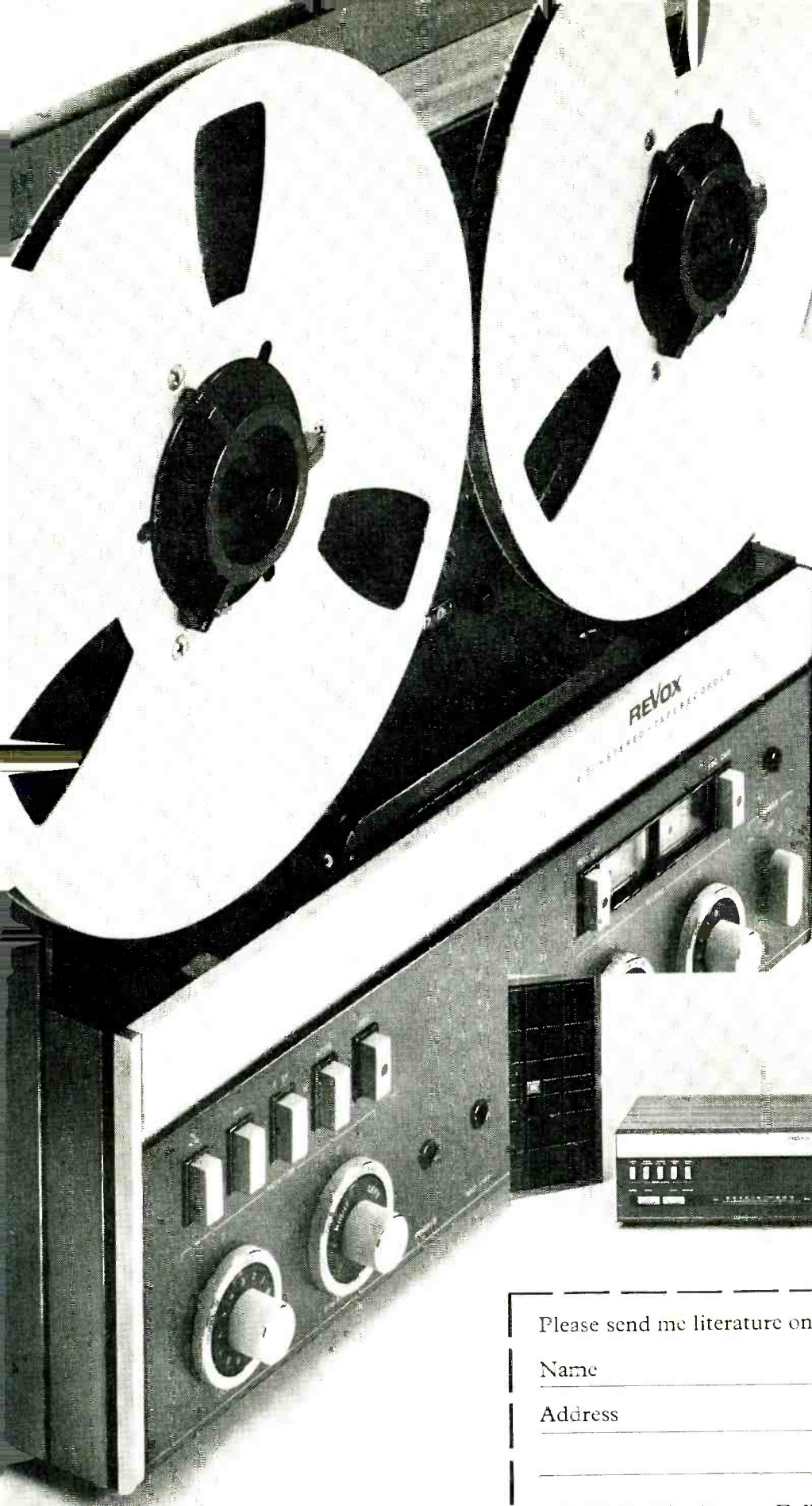
**Noise:** 64 dB ref mol at 38 cm/s

2/4/8/16 track

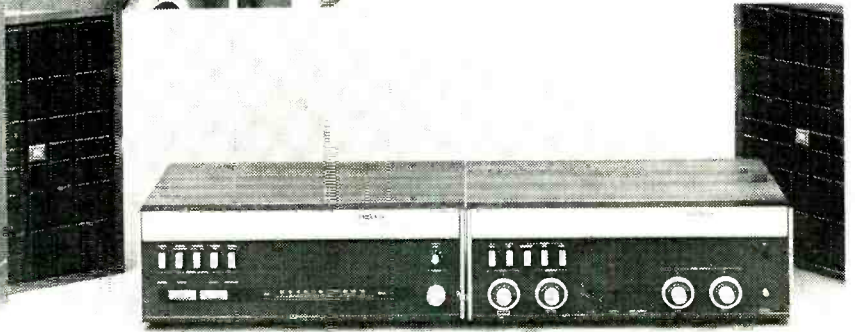
60 dB ref mol at 38 cm/s, 24 track

**Signal interface:** balanced 0 dBm variable.





# The timeless Revox A77



Please send me literature on the Revox range of Hi-Fi products.

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_

Sole U.K. Distributor: F. W. O. Bauch Limited,  
49 Theobald Street, Boreham Wood, Herts. WD6 4RZ.

# STUDER REVOX

## SURVEY: STUDIO MASTERING MACHINES

**Wow and flutter:** 0.04% weighted at 38/76 cm/s to DIN 45507.

**Tape position indicator:** digital mins and sec.

**Spooling time:** 90s for 770m.

**Reel type:** NAB and cine to 26.7 cm. Extension kit to 35.6 cm available.

**Optional extras:** Sonaplan XT14 autolocator, tape timer, remote control.

**Dimensions (whd):** 75.6 x 154 x 65 cm. 137 kg.

**Price:** on application.

### NAGRA

**Kudelski SA, CA 1033 Cheseaux, Lausanne Switzerland.**

**UK:** Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Buckinghamshire SL9 9EW.

Phone: 01-49 (Gerrards Cross) 88447.

### IV-S and IV-SL

**Construction:** portable.

**Tape width:** 6.25 mm.

**Tracks:** two or two + pilot (IV-SL).

**Track width:** half-track.

**Equalisation:** NAB/IEC/Nagramaster (38 cm/s only).

**Spool type and size:** to 12.7 cm.

**Noise:** with 206 tape, better than 69 dB with IEC eq to ASA 'A' weighting.

**Tape speed and wow and flutter:** 38 cm/s 0.05%, 19 cm/s 0.07%, 9.5 cm/s 0.15%, 4.75 cm/s 0.25%. Measured to DIN 45507.

**Input level at impedance:** most dynamic and phantom condenser mics.

**Output level at impedance:** standard 0 dBm level.

**Other features:** Dolby connection, modulation meter 10 ms.

**Optional extras:** 26.7 cm spool adaptors, pilot (IV-SL).

**Dimensions (whd):** 33 x 24 x 11.5 cm. 5.3 kg.

### 4.2L, 4.2LSP, IV-SJ and IV-SJS

THESE MACHINES include the same transport as the models IV-S and IV-SL and thus offer a similar standard of mechanical performance.

The first two machines are intended for use as mono report machines, the 4.2L being a pilotone version which provides a sync signal for sound on vision cameras. Both models feature a wide range of input filters; a suitable combination can improve the intelligibility of the human voice in noisy surroundings. Switchable automatic level control is standard.

The IV-SJ and IV-SJS are intended for noise and vibration recording for analysis at a later date. Both conform to the appropriate IEC recommendations for sound level meters through use of the integral modulation meter when used with an instrumentation condenser mic. Both versions are two track the SJ machine features an fm (cue) track of bandwidth 3.5 kHz for dc and low frequency vibration measurements or a voice track. In addition, the SJ model is fitted with switchable input filters appropriate to the relevant ASA weighting networks.

### SN series

**Construction:** miniature portable.

**Tape width:** 3.81 mm.

**Tracks:** one.

**Track width:** SNVZ full track, SNS2 half track.

**Equalisation:** 50 + 3180  $\mu$ s.

**Spool type and size:** 68 mm special.

**Noise:** better than 60 dB to 'A' weighting.

**Tape speed and wow and flutter:** 0.1% peak weighted to DIN 45507.

**Input level at impedance:** 3  $\mu$ A input from 200 $\Omega$ .

**Input overload point:** 100  $\mu$ A.

**Spooling time:** hand crank.

**Other features:** automatic level control.

### OTARI

**Otari Electric Co Ltd, 4-29-18 Minami Ogikubo, Suginami-ku, Tokyo 167, Japan.**

**Phone: (03) 333-9631.**

**USA:** Otari Corporation, 981 Industrial Road, San Carlos, Ca 94070.

Phone: (415) 593 1648.

**UK:** C. E. Hammond & Co Ltd, 105/109 Oyster Lane, Byfleet, Surrey KT14 7LA.

Phone: 41131.

### MX7308

**Construction:** rack mounted or console.

**Tape width:** 25 mm.

**Track format:** 8 track.

**Transport:** motion sensing, constant tension.

**Equalisation:** NAB/CCIR/IEC/AES (76 cm/s only).

**Speed:** 19/38/76 switchable between any two.

**Head block:** three head.

**Noise:** 65 dB below peak record measured to 'A' weighting.

**Distortion:** less than 1% at NAB reference level.

**Signal interface:** balanced 0 dBm variable.

**Wow and flutter:** 0.06% weighted at 38 cm/s to ANSI S 4.3.

**Spooling time:** 90s for 760m.

**Reel type:** to 26.7 cm NAB.

**Optional extras:** remote control unit, portable case.

**Dimensions (whd):** 67 x 162 x 68 cm. 136 kg.

**Price:** \$8150.

### MX-5050 Mini-Pro

**Construction:** portable.

**Tape width:** 6.25 mm.

**Track format:** half and quarter track.

**Transport:** digital transport control.

**Equalisation:** NAB standard.

dbx eliminates tape noise when connected to any reel-to-reel recorder. You can make original recordings with no audible hiss or background noise, which even the most expensive studio recorders cannot achieve using conventional noise reduction systems.

dbx 157 is a two-channel simultaneous tape noise elimination system which permits monitoring off tape while recording. It is fully compatible with all dbx professional studio systems and costs \$414 from professional audio dealers. Switchable (record or play) 150 series noise elimination systems start as low as \$130 per channel.

For complete product information contact: **Scenic Sounds Equipment, 27-31 Bryanston Street, London, England W1H 7AB, 01-935-0141.**



**dbx inc.**



Otari MX-7398

**Speed:** 19/38 cm/s switchable.

**Head block:** available with four head arrays.

**Noise:** 65 dB ref 200 nWb/m at 38 cm/s two track using 456 tape.

**Distortion:** 1% thd ref 200 nWb/m at 38 cm/s using 456 tape.

**Signal interface:** unbalanced 0 dBm variable.

**Wow and flutter:** 0.05% weighted at 38 cm/s to NAB.

**Tape position indicator:** mechanical position.

**Reel type:** to 26.7 cm NAB.

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# Our tradition of excellence your decision for today M15A

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Chalfont St. Peter, Bucks. SL9 9EW

Gotham Audio Corporation  
741 Washington St.  
New York, N.Y. 10 014

AEG-TELEFUNKEN  
A532  
P.O.Box 2154  
D-7750 Konstanz



professional tape recorders  
by AEG-TELEFUNKEN

## SURVEY: STUDIO MASTERING MACHINES

### MX-5050-8

**Construction:** portable, rack or console mounting.  
**Tape width:** 12.5 mm.  
**Track format:** 8 track.  
**Equalisation:** NAB/CCIR.  
**Speed:** 19/38 cm/s switchable.  
**Head block:** three head.  
**Noise:** 58 dB ref mol at 38 cm/s 8 track NAB weighted.  
**Distortion:** 1% thd ref 200 nWb/m at 38 cm/s using 3M 206 tape.  
**Signal interface:** unbalanced 0 dBm variable.  
**Wow and flutter:** 0.06% weighted at 38 cm/s to NAB.  
**Tape position indicator:** mechanical position.  
**Reel type:** to 26.7 cm NAB.  
**Optional extras:** balanced input and output lines.  
**Price:** \$4000 for basic machine in wooden cabinet.

### REVOX

**Willi Studer, CH-8105 Regensdorf, Zurich, Switzerland.**  
**US:** Revox Corporation, 155 Michael Drive, Syosset, NY 11791.  
**UK:** FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts.  
**Phone:** 01-953 0091.

### A700

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** 2 track.  
**Transport:** digitally controlled, full interlock.  
**Equalisation:** NAB. CCIR on request.  
**Speed:** 9.5/19/38 cm/s switchable.  
**Head block:** detachable, hard permalloy.  
**Noise:** —65 dB ref 514 nWb/m at 38 cm/s, 2 track  
 —66 dB ref 514 nWb/m at 19 cm/s 2 track.  
 —63 dB ref 514 nWb/m at 9.5 cm/s 2 track  
 } NAB eq.  
**Signal interface:** unbalanced 0 dBm variable.  
**Wow and flutter:** 0.06% weighted at 38 cm/s to DIN 45507.  
**Tape position indicator:** digital mins and sec.  
**Reel type:** to 26.6 cm NAB and cine.  
**Dimensions (whd):** 48.3 x 46.3 x 17.5 cm. 24 kg.  
**Price:** £904.

### A77 HS

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** 2 track.  
**Transport:** mechanical interlock.  
**Equalisation:** NAB recording. Playback NAB, DIN switchable.

**Speed:** 19/38 cm/s switchable.  
**Head block:** fixed heads, hard permalloy.  
**Noise:** —66 dB ref 514 nWb/m at 19 cm/s 2 track.  
**Signal interface:** unbalanced —75 dBm variable to +13 dBm.  
**Wow and flutter:** 0.08% weighted at 19 cm/s to DIN 45507.  
**Tape position indicator:** mechanical position.  
**Reel type:** NAB cine to 26.6 cm.  
**Optional extras:** remote control.  
**Dimensions (whd):** 41.5 x 35.6 x 18 cm. 15 kg.  
**Price:** from £450.

### SCHLUMBERGER

**Compteurs Schlumberger, Departement Audio-Professionnel, 296 Avenue Napoleon Bonaparte, 92503 Rueil-Malmaison, France.**  
**Phone:** 977 9223.  
**Construction:** console.  
**Tape width:** 6.25 mm.  
**Tape format:** mono, two track and stereo.  
**Tape speed:** 9.5/19/38 cm/s with vari-speed.  
**Spooling time:** 150s for 1000m.  
**Signal interface:** balanced 0 dBm variable.  
**Equalisation:** all the usual standards.  
**Noise:** 61 dB ref 510 nWb/m at 38 cm/s using CCIR eq.  
**Wow and flutter:** 0.04% to DIN 45507 at 38 cm/s.  
**Distortion:** 0.5% using Agfa PER525 tape at 38 cm/s ref 320 nWb/m.  
**Tape timer:** min and sec in digital format.  
**Dimensions (whd):** 65 x 61 x 106 cm. 91 kg.

### SCULLY/METROTECH

**Scully/Metrotech, 475 Ellis Street, Mountain View, California 94040, USA.**  
**Phone:** 415-968 8389  
**UK:** Lee Engineering Ltd, Napier House, Bridge Street, Walton on Thames, Surrey.  
**Phone:** 01-98 (Walton on Thames) 43124.

### 270

**Construction:** rack mount reproducer only.  
**Tape width:** 6.25 mm.  
**Tracks:** mono or stereo.  
**Track width:** full, half, quarter or stereo.  
**Equalisation:** front panel switch.  
**Spool type and size:** all hubs to 35 cm.  
**Tape position indicator:** accuracy to 99.7% over 30 mins.  
**Noise:** (no baseline) stereo half track at 38/19 cm/s 60 dB.  
**Tape speed and wow and flutter:** 38 cm/s 0.08%, 19 cm/s 0.1%, 9.5 cm/s 0.2%. All rms.  
**Input level at impedance:**  
**Output level at impedance:** + 13 dBm.  
**Spooling time:** 105s for 1464 m.  
**Dimensions (whd):** 43 x 63 x 23 cm. 45.5 kg.



Schlumberger F412

### 100 series

**Construction:** console.  
**Tape width:** 25/50 mm.  
**Tracks:** 8/12 on 25 mm, 16 on 50 mm.  
**Transport control:** full digital control.  
**Equalisation:** NAB/CCIR.  
**Spool type and size:** NAB to 28.25 cm.  
**Tape position indicator:** accuracy to 99.9%.  
**Noise:** ref + 10 dBm 206 tape 16 track 63 dB unweighted.  
**Wow and flutter:** unweighted to ASA Z57.1 0.06% 0.5 to 200 Hz.  
**Input level at impedance:** } 0 dBm operating  
**Output level at impedance:** } level.  
**Spooling time:** 75s for 732m.  
**Other features:** single speed 38 cm/s (76 on request).

### 280-B

**Construction:** console.  
**Tape width:** 6.25/12.5/25 mm.  
**Tracks:** 1/2/4/8.  
**Track width:** full, half or stereo.  
**Transport control:** full control interlock motion sensing.  
**Equalisation:** plug in NAB/IEC.  
**Spool type and size:** to 29.2 cm.  
**Tape position indicator:** 0.2% accuracy.  
**Head type:** interchangeable head block assembly.  
**Noise:** ref 500 nW/m NAB eq 206 tape NAB weighted—half track 38 cm/s 68 dB, 19 cm/s 68 dB.  
**Tape speed and wow and flutter:** ANSI 4.3 1972 38 cm/s 0.08%, 19 cm/s 0.1%, 9.5 cm/s 0.2%.  
**Input level at impedance:** } 0 dBm operating  
**Output level at impedance:** } level.  
**Spooling time:** 60s for 732m.  
**Optional extras:** remote control.  
**Dimensions (whd):** 128 x 64 x 73 cm. 64 kg.

### 500 series

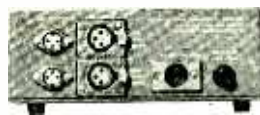
**Construction:** console or panel mount.  
**Tape width:** 6.25 mm.  
**Tracks:** mono or stereo.  
**Track width:** full, half and quarter.  
**Transport control:** logic interlock.  
**Equalisation:** NAB/CCIR plug in.  
**Spool type and size:** NAB to 26.7 cm.  
**Tape position indicator:** counter optional extra.  
**Noise:** ref 500 nW/m 38 cm/s 206 tape NAB eq half track 60 dB.  
**Tape speed and wow and flutter:** to ANSI 54.3 1972 38 cm/s 0.09%, 19 cm/s 0.12%, 9.5 cm/s 0.2%, 4.75 cm/s 0.3%.  
**Input level at impedance:** 140 mV into 100Ω (min).  
**Output level at impedance:** to + 24 dBm 600Ω.  
**Spooling time:** 90s for 732m.  
**Optional extras:** mic preamps, remote control.  
**Dimensions (whd):** 49 x 40 x 23 cm. 17.2 kg.

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Reviewed Studio Sound  
 March 1976

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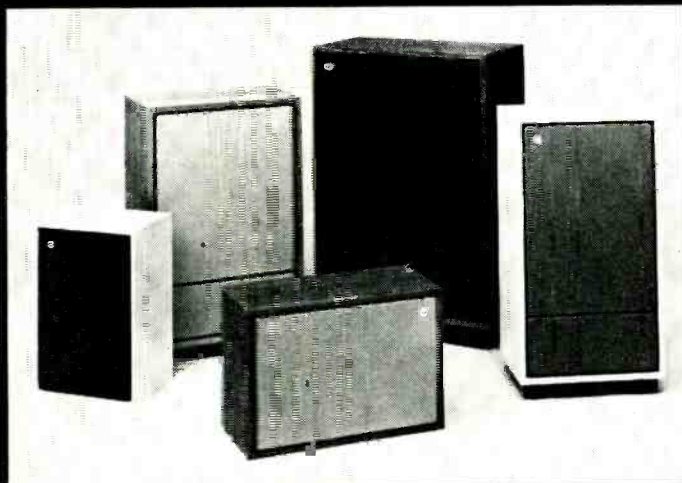
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# TANNOY

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## SURVEY: STUDIO MASTERING MACHINES

### STELLAVOX

**Stellavox, Georges Quellet, Engineer EPZ, 2968 Hauterive/Ne, Switzerland.**  
**UK:** AV Distributors (London) Ltd, 26 Park Road, Baker Street, London NW1 4SH.  
Phone: 01-935 8161.

#### SP 7

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Tracks:** mono or stereo.  
**Track width:** full or half track.  
**Transport Control:** interlocked to capstan.  
**Equalisation:** 35 µs DIN.  
**Spool type and size:** 12.7 cm.  
**Head type:** interchangeable inc pilottone.  
**Noise:** ref 500 nWb/m 'A' weighted mono 70 dB, stereo 65 dB.  
**Tape speed and wow and flutter:** 38 cm/s 0.1%, 19 cm/s 0.12%, 9.5 cm/s 0.25%.  
**Input level at impedance:** mics 0.2 to 75 mV mixer 1.55V at 820k.  
**Output level at impedance:** various, nominal 0 dBm.  
**Spooling speed:** 406 cm/s.  
**Other features:** film sync (pilottone) facility.  
**Optional extras:** many inc large spool adaptors.

#### Stellamaster

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Tracks:** stereo.  
**Track width:** 2.6 mm.  
**Equalisation:** 35 µs DIN.  
**Spool type and size:** to 12.7 cm.  
**Head type:** Bogen.  
**Noise:** ref 800 nWb/m 'A' weighted 70 dB.  
**Tape speed and wow and flutter:** 38 cm/s 0.05%.  
**Other features:** 25 Hz—23 kHz ± 2 dB.  
**Optional extras:** as for SP7.

### STUDER

**Studer Franz AG, CH-5430 Wettingen, Switzerland.**  
**USA:** Willi Studer America Inc, Buffalo, 3916 Broadway, NY 14227.  
Phone: 716-681 5450.  
**UK:** F. W. O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ.  
Phone: 01-953 0091.

#### A67

**Construction:** portable and console.  
**Tape width:** 6.25 mm.  
**Track format:** mono, stereo and two track.  
**Transport:** digitally controlled, full interlock.  
**Equalisation:** NAB/CCIR.  
**Speed:** 9.5/19/38 cm/s switchable.  
**Head block:** detachable.  
**Noise:** 62 dB ref 370 nWb/m at 38 cm/s stereo track using NAB eq.  
**Distortion:** 1% thd ref 185 nWb/m at 38 cm/s using 3M 207 tape. NAB eq.  
**Signal interface:** balanced 0 dBm variable.  
**Wow and flutter:** 0.06% weighted at 38 cm/s to DIN 45507.  
**Tape position indicator:** mechanical mins and sec for 19 cm/s.  
**Spooling time:** 120s for 700m.  
**Reel type:** all types up to 26.7 cm.  
**Optional extras:** different mounting arrangements, vu complement and sync.  
**Special features:** transport developed from Revox A700.  
**Price:** from about £1400, \$2500.

#### B62

**Construction:** portable, free standing.

**Tape width:** 6.25 mm.  
**Tracks:** full track mono, half track stereo.  
**Track width:** 2 and 0.75 mm guard band available.  
**Transport control:** full interlock.  
**Equalisation:** NAB or CCIR.  
**Spool type and size:** to 26.7 cm NAB.  
**Tape position indicator:** digital, 0.5% accuracy.  
**Noise:** ref 510 nWb/m unweighted. 38 cm/s stereo 61 dB, half track 56 dB.  
**Tape speed and wow and flutter:** 38 cm/s 0.05%, 19 cm/s 0.08%.  
**Input level at impedance:** } nominal 0 dBm  
**Output level at impedance:** } at 600Ω.  
**Input overload point:** +22 dBm.  
**Spooling time:** 120s for 730m.  
**Optional extras:** vus, pilottone, mounting options.  
**Dimensions (whd):** 48.2 x 35.6 x 22 cm. 28 kg.

#### A80/R

**Construction:** console.  
**Tape width:** 6.25 mm.  
**Tracks:** full, half and stereo.  
**Track width:** 2 and 2.75 mm.  
**Transport control:** logic interlock.  
**Equalisation:** plug in CCIR or NAB.  
**Spool type and size:** up to 26.7 cm NAB.  
**Tape position indicator:** digital, 0.2% accuracy.  
**Noise:** ref 320 nWb/m stereo 38/cm s CCIR 61 dB two track 56 dB.  
**Tape speed and wow and flutter:** 38 cm/s 0.04% 19 cm/s 0.06%.  
**Input level at impedance:** } 0 dBm at 600Ω  
**Output level at impedance:** } nominal.  
**Input overload point:** +22 dBm.  
**Spooling time:** 120s for 1000m.  
**Optional extras:** chassis and vu available.

#### A80/VU 24 track

**Construction:** console.  
**Tape width:** 50 mm.  
**Tracks:** 24.  
**Transport control:** logic interlock.  
**Equalisation:** CCIR or NAB  
**Spool type and size:** up to 26.7 cm NAB.  
**Tape position indicator:** 0.2% accuracy.  
**Noise:** ref +6 dB above 200 nWb/m NAB at 38 and 19 cm/s.  
**Tape speed and wow and flutter:** 38 cm/s 0.04%, 19 cm/s 0.06%.  
**Input level at impedance:** }  
**Output level at impedance:** } as for A80/R.  
**Input overload point:** }  
**Spooling time:** }

### TEAC

**Teac Corporation of America, 7733 Telegraph Road, Montebello, Calif. 90640, USA.**  
**Phone:** (213) 726 0303.  
**UK:** Acoustic Research International, High Street, Houghton Regis, Dunstable, Bedfordshire LU5 5QJ.  
Phone: 0582 603151.

#### 80-8

**Construction:** portable.  
**Tape width:** 12.5 mm.  
**Track format:** 8 track.  
**Transport:** logic interlock.  
**Equalisation:** NAB.  
**Speed:** 38 cm/s.  
**Head block:** fixed.  
**Noise:** 60 dB ref mol at 38 cm/s unweighted.  
**Distortion:** 1% thd ref 0 vu.  
**Signal interface:** unbalanced —10 dBm.  
**Wow and flutter:** 0.04% weighted at 38 cm/s to NAB rms.  
**Tape position indicator:** mechanical position.  
**Reel type:** NAB to 26.6 cm.  
**Special features:** performance figures referenced to Ampex 456.  
**Dimensions (whd):** 44.5 x 53.4 x 30.5 cm. 34.6 kg.  
**Price:** £1960.

#### A3340

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** 4 track.  
**Equalisation:** NAB.  
**Speed:** 19/38 cm/s switchable.  
**Head block:** heads fixed, hyperbolic ground.  
**Noise:** 64 dB at 38 cm/s weighted to ASA curve.  
**Signal interface:** unbalanced —70 dBm variable to 0 dBm.  
**Wow and flutter:** 0.04% at 38 cm/s rms.  
**Tape position indicator:** mechanical position.  
**Reel type:** NAB 26.6 cm. Other sizes can be used.  
**Optional extras:** remote control.  
**Special features:** full sync.  
**Dimensions (whd):** 58.5 x 46 x 23 cm. 27.5 kg.  
**Price:** £646.

#### 90-16

**Construction:** console mounting.  
**Tape width:** 25 mm.  
**Track format:** 16 track.  
**Transport:** logic controlled.  
**Equalisation:** NAB.  
**Speed:** 38 cm/s.  
**Head block:** fixed three head.  
**Noise:** 60 dB ref mol at 38 cm/s quarter track using Ampex 456.  
**Signal interface:** unbalanced —10 dBm variable.  
**Wow and flutter:** 0.03% weighted at 38 cm/s to NAB.  
**Tape position indicator:** mechanical mins and sec.  
**Spooling time:** 120s for 738m.  
**Reel type:** NAB type to 26.7 cm  
**Optional extras:** dbx noise reduction interface.  
**Special features:** combined record/playback head; third head serves simply as monitor.  
**Dimensions (whd):** 63.2 x 120 x 72 cm.

#### A-7300 2T

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** stereo or mono.  
**Transport:** full logic transport control.  
**Equalisation:** NAB.  
**Speed:** 19/38 cm/s switchable.  
**Head block:** fixed.  
**Noise:** 60 dB ref mol at 38 cm/s stereo track.  
**Signal interface:** unbalanced —20 dBm variable.  
**Wow and flutter:** 0.04% weighted at 38 cm/s to NAB.  
**Tape position indicator:** mechanical position.  
**Spooling time:** 150s for 550m.  
**Reel type:** NAB to 26.7 cm.  
**Optional extras:** remote unit.  
**Special features:** vari-speed.  
**Dimensions (whd):** 54.8 x 44 x 25 cm. 28 kg.  
**Price:** £785.

### TELEFUNKEN

**AEG-Telefunken, 775 Konstanz, Buchlestrasse 1-5, West Germany.**  
**Phone:** 07531-86 1.  
**UK:** Hayden Laboratories, Hayden House, Churchfield Road, Chalfont St Peter, Bucks.  
Phone: 02813-88447.  
Telex: 849 469.

#### M15A

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** 2 track or stereo.  
**Transport:** full logic control.  
**Equalisation:** NAB/CCIR.  
**Speed:** 19/38 cm/s switchable.  
**Head block:** fixed, ferrite.  
**Noise:** —64 dB ref 400 nWb/m at 38 cm/s 2 track A weighted.  
—64 dB ref 400 nWb/m at 19 cm/s 2 track A weighted.

# INTRODUCING A NEW TAPE DECK FROM A COMPANY THAT NEEDS NO INTRODUCTION.



Besides the standard 1 inch 8 track you see here, there's a  $\frac{1}{2}$  inch 8 track and a 2 inch 16 and a 24 track.

Their features include full solenoid transport functions. Full sync facilities. Full modular electronics. Silent drop-ins. Instant start cue. N.A.B. and C.C.I.R. equalisation.

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Where you can also take the opportunity to look over the Allen & Heath Mod II mixer. It's offered with the tape deck in a uniquely priced package deal.

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**brenell**

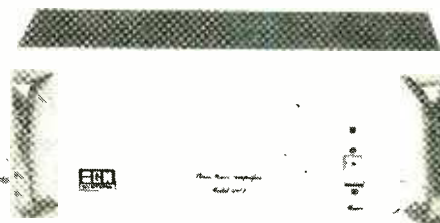
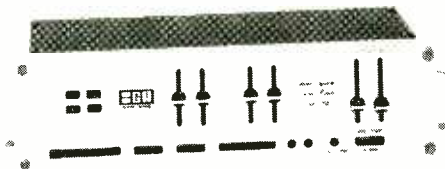
# PROBLEM SOLVERS

The new BGW range offers standards of performance, reliability and safety without precedence. Whether used in the most critical studio work, the highest powered PA system, or simply driving domestic stereo, it guarantees the cleanest and most accurate sounds attainable. BGW's state-of-the-art professional line of audio amplifiers is the result of fundamental rethinking of the traditional design parameters, solving the inherent problems of conventional models.

**Instability Problem** — BGWs safely drive continuously into loads as low as 2 ohms. Highly reactive loads, such as electrostatic loudspeakers are no longer a factor. **Distortion Problem** — voltage and current limiting circuits often causing annoying distortion in conventional designs have been eliminated. **Safety Problem** — to protect the amplifier and loudspeakers a 'fail-safe' SCR crowbar circuit is incorporated, which discharges all energy stored in the massive power supplies and turns the unit off via magnetic circuit breakers, without relying on fuses or relays. **Thermal Problem** — exceptional thermal stability is ensured by mounting all signal carrying transistors on to massive totally enclosed heat sinks. Additionally, except for the 250B, all models have a forced air cooling system employing a thermostatically controlled dual speed fan. **Service Problem** — each channel's circuitry is on a separate 'plug-in' module enabling quick replacement. **Reliability Problem** — only industrial grade precision components are used, for example, all resistors are low-noise types, all harness wiring is Teflon insulated, all circuit boards are flame retardant epoxy glass and all signal transistors are in hermetically sealed metal cases.

**Durability Problem** — All units feature welded steel chassis for maximum strength and rigidity. Other features include 19" rack-notched heavy gauge front panels. A rear panel switch converts the two channel amplifier to a higher power bridge connected single channel amplifier.

Also from BGW is the model 202 preamplifier. Outstanding features include: \* An advanced phono preamplifier design using two discrete component operational amplifiers per channel. The high and low frequency signals are separately equalised to the RIAA playback curve, achieving exceptional accuracy in the phono stage (within  $\pm 0.25$  dB from the RIAA curve). \* A new active tone control system with ultra low distortion and precision calibrated step switches. \* Active high and low pass filter systems with 18 dB per octave slope. \* Special line amplifier output stage capable of driving 50 ohm lines. \* High/low gain switch for optimal signal to noise ratio. \* Fully stabilised dual rail power supplies. \* Plug-in moving coil pre-preamplifier. \* Independently switched pre and power amp power supplies. \* Tape monitor and tape dubbing facilities. \* Matrix input selection.



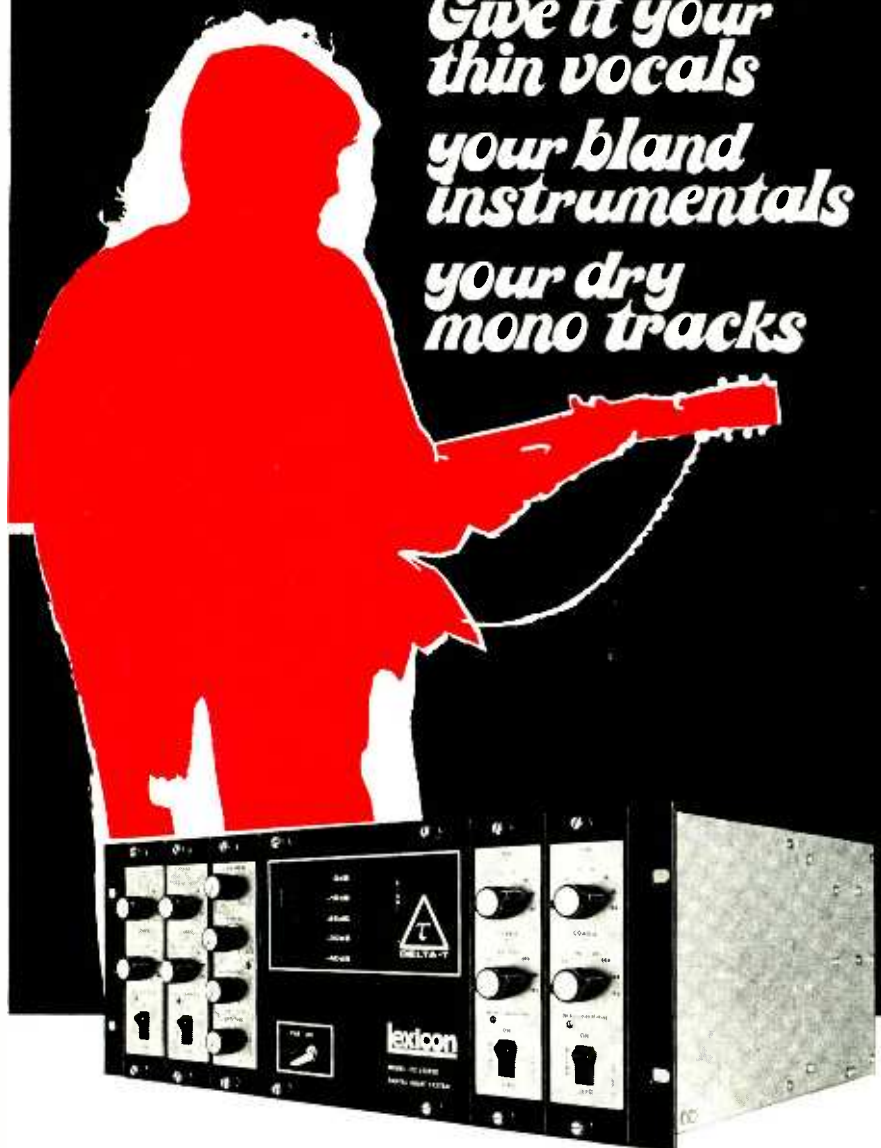
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# New Stereo Delta-T

Give it your  
thin vocals  
your bland  
instrumentals  
your dry  
mono tracks



Now relax, playfully invite your muse, and transform these tracks, adding body, stereo perspective, flanging, and a host of other time-base effects. Since Lexicon introduced digital delay over six years ago, most studios have come to depend on it at least for doubling and slap. Now, the stereo 102-S with the new VCO module\* produces many other effects, including more natural double tracking, flanging, vibrato, time delay panning, extreme pitch modulation, and signal transformation for special effects. Of course, you can also use the two channels for completely independent processing.

The Lexicon Delta-T has earned an enviable reputation for its 90 dB dynamic range, impeccable audio quality, high reliability, and functional modularity. All this is retained in the new 102-S, while two channel operation, finer delay steps (3 ms), and the VCO have been added. And the 102-S is economical. Its totally modular construction allows you to start with a bare bones mono system and expand later as needs and budget grow. We'll help you define the configuration you need to get started. Call or write Lexicon for further information.

Write on your letterhead for AN-3, *Studio Applications of Time Delay*.  
F.W.O. Bauch, Ltd. 49 Theobald St., Boreham Wood/Herts  
WD6 4R2, Telephone 01-953 0091.

\*The new VCO module also fits any 102-B or C mainframe to enhance its time-base signal processing capability.

**Lexicon**  
Waltham  
Massachusetts 02154 USA

## SURVEY: STUDIO MASTERING MACHINES

**Distortion:** 1% thd ref 400 nWb/m.  
**Signal interface:** balanced 0 dBm variable.  
**Wow and flutter:** 0.04% weighted at 38 cm/s to DIN 45507.  
**Tape position indicator:** digital, mins and sec.  
**Spooling time:** 150s for 1000m.  
**Reel type:** NAB cine to 26.6 cm.  
**Optional extras:** autolocator, varispeed, remote control.  
**Dimensions (whd):** 80 x 72 x 59.5 cm. 28 kg.

## TELEX COMMUNICATIONS

Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420, USA.  
Phone: 612-884 4061.  
UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12.

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Track format:** 2 and 4 track.  
**Transport:** logic interlock.  
**Equalisation:** NAB.  
**Speed:** 9.5 cm/s switchable.  
**Head block:** fixed, hyperbolic heads.  
**Noise:** -60 dB at 38 cm/s 2 track NAB weighted.  
**Signal interface:** balanced 0 dBm variable. Also mic level input.  
**Wow and flutter:** 0.17% weighted at 38 cm/s to DIN 45507.  
**Spooling time:** 80s for 365m.  
**Reel type:** cine to 20 cm EIA.  
**Optional extras:** remote control.  
**Special features:** available without electronics.  
**Price:** on application.

## UHER

Uher Werke Munchen, 8 Munchen 71, Postfach 71 10 20, West Germany  
UK: Uher (GB) Ltd, 24 Market Place, Falloden Way, London NW11  
Phone: 01-455 1771

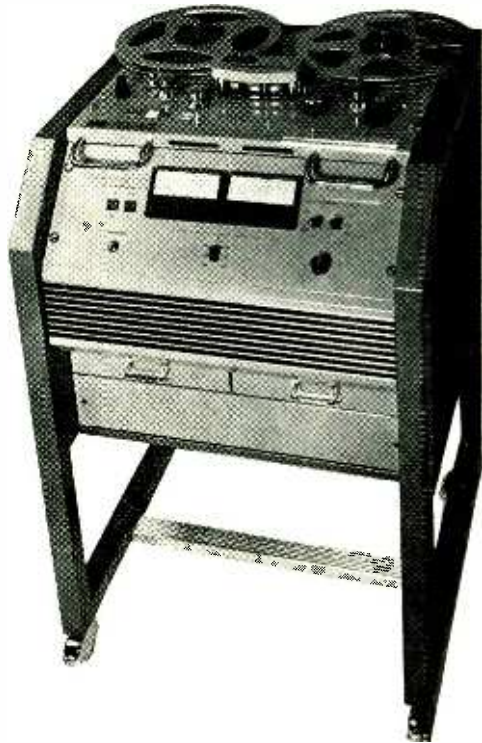
## 4000 series

**Construction:** portable.  
**Tape width:** 6.25 mm.  
**Tracks:** mono (4000), stereo (4200 and 4400).  
**Track width:** half track (4000, 4200) quarter track (4400).  
**Transport control:** piano key.  
**Spool type and size:** cine to 13 cm.  
**Tape position indicator:** mechanical counter.  
**Noise:** weighted to 'A' curve two track 19 cm/s 64 dB, 9.5 cm/s 63 dB, 4.75 cm/s 61 dB. Quarter track about 2 dB lower.  
**Tape speed and wow and flutter:** 19 cm/s 0.15%, 9.5 cm/s 0.18%, 4.75 cm/s 0.25%. All rms.  
**Input level at impedance:** 0.12 mV, 200Ω source.  
**Output level at impedance:** 1V at 15 kΩ.  
**Input overload point:** 40 mV.  
**Other features:** remote control, internal loudspeakers, automatic level control.  
**Optional extras:** mics, Ni-Cd packs, chargers etc.  
**Dimensions (whd):** 28.5 x 9.5 x 22.7 cm. 3.8 kg.

## 1200 Report Synchro

This machine offers a similar performance to the 4000 series but with the addition of a pilot track and relevant electronics. The 1200 is intended for use with the W352 Synchroniser which provides a suitable interface for film sound sync. Both units are powered by their own internal rechargeable batteries.





The new Proline Professional 1000 is the product of many years development and experience in the production of professional recording equipment from the United Kingdom's leading manufacturer. Excellent performance, ruggedly reliable, economically priced and backed by an efficient spares and after sales service.

For a demonstration or further information contact:

## LEEVERS RICH EQUIPMENT LTD.

incorporating Bias Electronics  
319 TRINITY ROAD,  
LONDON SW18 3SL

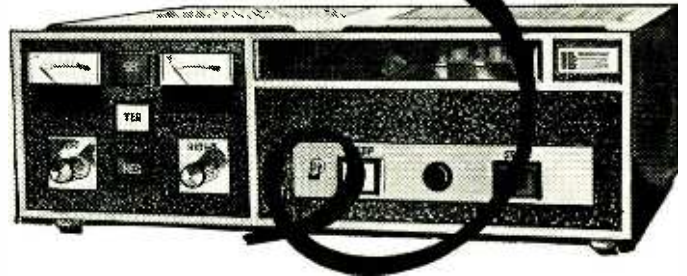
Tel: 01-874 9054

Cable: LEEMAG London SW18

Telex: 423455

## PROBLEM: STEREO PHASING IN CARTRIDGE!

### ANSWER:



## ITC RP0006 CARTRIDGE MACHINE

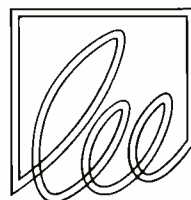
The biggest single problem facing broadcasters today is undoubtedly mono-stereo phase compatibility.

The answer is the new RP0006 cartridge machine from ITC. It offers the same reliability and simplicity of operation associated with all ITC cartridge machines, plus the most significant operational advance for years – a motor-driven azimuth adjust – operated by a two-way 'up-down' switch.

In this way every individual cartridge can be easily recorded to its optimum alignment. You simply adjust the two-way switch until the 8Khz cue signal, indicated on the front panel of the machine, is at maximum for each cartridge. It's as simple as that and you get performance comparable to the best reel to reel tape machine.

Prove to yourself what other broadcasters already know. If you use cartridge machines or other studio or broadcasting equipment, talk to us first. Most others did, that is why the B.B.C., 17 of the 19 commercial stations and most of the major studios already use our equipment.

The RP0006 is also available with +18dBm output. For further information on these and other equipment and exchange details for +18dBm P.C.Bs contact :-



C. Welsh,

### LEE ENGINEERING

Napier House, Bridge Street,  
Walton-on-Thames, Surrey KT12 1AP  
Tel: Walton-on-Thames 43124  
Telex: 928475 Cables: LEETECH

# reviews

## Ampex ATR-100 professional audio recorder

Hugh Ford

### MANUFACTURER'S SPECIFICATION

**Tape widths:** 6.3 mm for full track and 2-track 2 channel systems, 1.9 mm track width. 12.6 mm for 4-track systems, 1.8 mm track width.

**Tape speeds:** 9.5 cm/s, 19.05 cm/s, 38.1 cm/s, 76.2 cm/s (any two may be selected).

**Reel size:** 50 mm to 355 mm diameter.

**Reel type:** NAB or EIA (cine).

**Inputs** (with input/output system—bridging input standard): balanced floating.

**Input impedance:** 50 000 ohms  $\pm 5\%$ , 5 Hz to 20 000 Hz.

**Input level:** variable; minimum  $-5$  dBm to produce 1000 nWb/m recorded flux level, maximum  $+40$  dBm. Input clip level, including record amplifier at mid-freq, 26 dB above system operating level. Input level; preset;  $-1$  dBm to  $+20$  dBm to produce 1000 nWb/m recorded flux level.

**Outputs** (with input/output system): balanced floating.

**Output impedance:** less than 50 ohms, 5 Hz to 20 kHz.

**Maximum output level:** with 600 ohm load  $+28$  dBm, with 200 ohm load  $+25$  dBm. Preset output level: line output level is adjustable over a range  $+12$  dBm to  $-2$  dBm.

**Metering:** meters are switchable vu or peak. Vu ballistics conform to ASA standards. Peak ballistics conform to EBU standards. Zero meter reading is continuously adjustable over a range of  $+12$  dBm to  $-2$  dBm line level.

**Inputs** (without input/output system): unbalanced. Input impedance 10 000 ohm minimum, 5 Hz to 20 kHz. Input level  $-5$  dBm nominal, for system operating level.  $-5$  dBm input provides 26 dB clip level margin at mid-freq.

**Outputs** (without input/output system): unbalanced. Output impedance 40 ohm, 5 Hz to 20 kHz. Minimum load impedance 5000 ohm. Output level  $-5$  dBm nominal, for system operating level.  $-5$  dBm output level provides 26 dB clip level margin at mid-freq.

### Overall frequency response:

speed	reference frequency	within $\pm 0.75$ dB	within $\pm 2$ dB	level*
76 cm/s	1 kHz	200 Hz to 20 kHz	35 Hz to 28 kHz	0
38 cm/s	1 kHz	100 Hz to 15 kHz	20 Hz to 20 kHz	0
19 cm/s	500 Hz	100 Hz to 10 kHz	30 Hz to 15 kHz	$-10$ dB
9.5 cm/s	500 Hz	—	30 Hz to 10 kHz	$-20$ dB

\*Reference Level (0 is operating level). Operating level is 370 nWb/m at 700 Hz for Ampex 456 tape and 260 nWb/m at 700 Hz for Ampex 406/407 tape.

tape speed and equalisation	track format	30 Hz - 18 kHz unweighted	ANSI 'A' weighted	CCIR rec 468 weighted
76 cm/s AES	full track	77 dB	81 dB	73 dB
	2 track and 4 track	72 dB	76 dB	67 dB
38 cm/s IEC/CCIR	full track	74 dB	78 dB	70 dB
	2 track and 4 track	70 dB	74 dB	65 dB
38 cm/s NAB	full track	73 dB	77 dB	69 dB
	2 track and 4 track	69 dB	73 dB	63 dB
19 cm/s NAB	full track	75 dB	78 dB	70 dB
	2 track and 4 track	71 dB	74 dB	63 dB
19 cm/s IEC/CCIR	full track	71 dB	76 dB	67 dB
	2 track and 4 track	68 dB	71 dB	62 dB
**9.5 cm/s IEC/NAB	full track	68 dB	72 dB	64 dB
	2 track and 4 track	64 dB	66 dB	57 dB

\*\*At 9.5 cm/s overall s/n ratio is measured with respect to a record level of 740 nWb/m (6 dB above operating level of 370 nWb/m). At 740 nWb/m mid-freq. 3rd harmonic distortion is less than 3%.

equivalent at any wavelength shorter than 190  $\mu$ m (200 Hz at 38 cm/s) recorded 6 dB above system operating level. 85 dB min.

**Erase frequency:** 144 kHz.

**Bias frequency:** 432 kHz (both bias and erase frequencies are derived from master crystal oscillator).

**Speed accuracy:** using 25  $\mu$ m - 37  $\mu$ m base film thickness tape, absolute accuracy  $\pm 0.03\%$ . Speed variation from beginning to end of reel  $\pm 0.02\%$  max.

**Stop time:** 5.0s from fast wind modes. 2.0s from spooling mode. 0.7s max from play mode (76 cm/s).

**Rewind time:** normal fast wind modes - 60s for 730m reel. Spooling modes (for 730m reel) 457 cm/s - 2.7 min, 152 cm/s - 8 min.

**Wow and flutter:**

speed	ANSI 54.3/ DIN 45507	ANSI/DIN peak unweighted	NAB rms unweighted
	peak weighted		
9.5 cm/s	$\pm 0.1\%$	$\pm 0.15\%$	0.1%
19 cm/s	$\pm 0.05\%$	$\pm 0.12\%$	0.06%
38 cm/s	$\pm 0.03\%$	$\pm 0.08\%$	0.04%
76 cm/s	$\pm 0.03\%$	$\pm 0.08\%$	0.03%

Start time:	speed	time to attain flutter spec
	9.5 cm/s	100 milliseconds
	19 cm/s	200 "
	38 cm/s	250 "
	76 cm/s	500 "

**Electronic tape timer:** tape driven, reads in hours, minutes and seconds (option minutes, seconds and tenths of seconds). Absolute accuracy  $\pm 0.05\%$  (1s in 730m reel at 33 cm/s).

**Heads:** ferrite, precision mounted. Full track 6.35 mm. 2-track 6.35 mm. 4-track 12.7 mm.

**Size (WHD):** basic machine (including transport, power supply and audio and servo electronics) 483 mm x 305 mm x 405 mm. Cabinet (1 or 2 channel) 533 mm x 483 mm x 813 mm. Cabinet (4 channel) 533 mm x 584 mm x 863 mm. Input/Output system (1 or 2 channel) 483 mm x 89 mm x 254 mm. Complete system (including basic machine, 4 channel cabinet, I/O system and roll-around pedestal) 660 mm x 1180 mm x 813 mm.

**Weight:** basic machine 56 kg. Cabinet 7 kg. I/O System 7 kg. Pedestal 23 kg.

**Power line requirements:** 90-115, 110-135, 180-230, 220-270V ac 50/60 Hz.

**Power consumption:** 0.6 kVA max. (with all accessories).

**Environmental operating specifications:** temperature: 10-50°C. Humidity: 20-95% non-condensing.

**Price as reviewed:** \$6750 (£4490).

**Manufacturer:** Ampex Corporation, Audio-Video Systems Division, 401 Broadway, Redwood City, California 94063, USA.

**UK:** Ampex (Great Britain) Ltd, Acre Road, Reading, Berkshire.

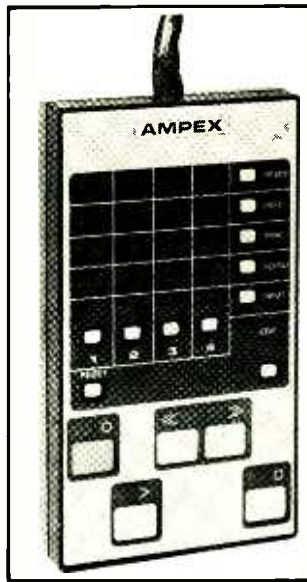
THE Ampex ATR-100 series of recorders are professional units which have been designed to compete with the world's highest quality reel to reel machines in the 6.3 mm and 12.6 mm tape widths. Thus the machine has been made very quickly convertible from one tape width to the other, and also it has a rapidly removable headblock with a variety of track formats available.

Essentially the complete machine comprises five separate parts: 1) Tape transport and heads. 2) Signal and servo electronics frame. 3) Power supplies. 4) Motion and function control unit. 5) Input/output module. A number of physical layouts of these five parts are available, including rack mounting or fitting on a mobile trolley as in the case of the review machine.

While all basic machines are ready wired for four channel operation and have space for the



Left: Pedestal-mounted ATR-100



Right: Operator control unit

signal electronics for four tracks, the input/output modules are an optional extra as an add-on feature. The function of the input/output modules is to feed to and from the signal electronics section and to provide interfacing for normal line levels and to provide metering, but for some applications this may not be required.

The tape transport is of completely novel design as it does not use any form of pinch roller in normal operation and also has movable reel motors so that it can be adapted to use either 267 mm diameter or 356 mm diameter NAB spools in addition to the capability of using cine type spools.

A heavy duty alloy casting forms the basis of the tape transport, with the casting flanges facing upwards and the lower face of the casting precision machined to form a reference face for the various sub-assemblies and dowels, which are fixed in the upper face to form a reference face for the headblock. The casting also forms a heatsink for the servo power transistors: I am not sure that this is a particularly good idea, as the whole purpose of using a really solid casting is to prevent movement of the tape path. Adding heat would seem to be contrary to the intention of stability.

The reel motors, which bolt on to the main casting, may each be mounted in either of two positions giving the 267 or 356 mm spool option. Both spool turntables are adjustable in height and bolt on to the motor shafts. There did not appear to be any temperature rise problems with this arrangement which, with some machines, leads to tape damage. The turntables, together with the spool hold-downs, are novel: the centre spindle is extended and fits cine spools while the turntable has a 'clover leaf' to fit the slots. However, it was found to be necessary to use the NAB spool clamping device with loose fitting cine spools which could otherwise drive the servo system crazy. This clamping device is quite unconventional as NAB spools are just laid on a flat turntable with the clamping device used to centre the spools as well as to hold them down by means of a spring-loaded cup which fits the centre hole in the spool.

From each spool, the tape passes over a

roller guide which is fitted with fixed ceramic edge guides and is mounted on a 'live' tension sensing arm. Single (captive) screw mounting is used so that it is very quick to change the guides to an alternative tape width. The sensing arms are, in normal operation, electronically driven to arrive at a fixed position for a given tape tension. Any positional error is detected by a photoresistor arrangement and is used to correct the position by driving the appropriate reel servo motor. This tension servo had an almost unbelievable control of the tape tension at either reel motor without affecting the other reel at all.

Adjacent to each 'servo arm', the tape passes over a 6 cm diameter knurled roller and then to the headblock. The left-hand knurled roller is used to drive the tape timer via an optical pickup, while the right-hand roller is the capstan and is equipped with a thumbscrew on its top for manual movement of the tape. The tension balance between the reel servos is such that they automatically follow any tape movement which would, of course, result in a tension shift at the tension arms. Thus, very little force is needed to move the tape and the friction of the tape on the capstan is quite adequate to drive the tape without the use of any form of pinch roller. Therefore, tape movement is always controlled by the capstan; even in the fast wind modes! The capstan speed is referred to a reference oscillator by means of a tachometer disc on the capstan shaft which is phase locked to the reference oscillator in the four normal tape speeds of 76, 38, 19 and 9.5 cm/s.

All that remains of the tape path is the plug-in headblock which contains three ceramic edge guides, two at the bottom edge and one at the upper edge of the tape, such that the tape is very slightly bowed to give positive lateral location. In addition, there is a flutter roller which is inserted between the record and replay heads which are fixed in all directions except azimuth. This is adjusted by means of a tapered disc which can be rotated underneath the heads. All three are Ampex ferrite heads, and there is space for a fourth head which is normally occupied by a dummy head in the form of a large diameter rod. The headblock

is of substantial construction and is mounted on to three steel reference faces in the main casting by means of a spring-loaded pin. This draws the headblock on to the reference faces by means of a cam. Removal of the headblock requires only a 90° turn of a hexagonal socket and a good pull, whereupon the headblock releases complete with its printed circuit edge connector.

A tape lifter is fitted to remove the tape from the heads in the fast wind modes; it is solenoid-operated and completely silent in operation. Normally, a pull-off cover hides the heads and some other parts of the transport, and a head shield is arranged to meet this cover in order to give good head screening. The headshield is a press to release and press to withdraw type of device which is simple in operation, but it has two snags. Firstly, it is possible to thread the tape over the shield in lieu of the headblock, and secondly the access to the head for editing is very awkward unless the top cover is also removed.

Tape loading was found to be very quick and simple and, except in the very fast wind mode, the tape handling was found to be superb with a number of different tape types. There are, in fact, two fast wind modes. The first winds with the capstan theoretically locked at 457 cm/s in either direction—in the review machine, the phase lock was intermittent. The other mode goes 'flat out' in either direction at immense speed, which I consider to be far too fast, leading to a poor, leafy wind on Ampex 156 tape. It was rather better with 3M 250 or better still with BASF *SPR50LH*, but still not happy!

The control of tape motion is by means of a small control unit plug-connected to the transport. This may be inserted on either the left or right side of the transport. A remote unit is also available which has most functions repeated but which does not include a remote dump edit. Other than power on/off and tape speed selection which are on the transport, all controls are on the control unit. Tape motion is controlled by four press-buttons which have full electronic interlock so that it was completely impossible to damage the tape. Furthermore, Ampex claims that the tape tension never exceeds the working tension by more than 50%—certainly the tension control is excellent and I quite believe the claim. A number of protective features are inbuilt, such that accidental stoppage of the tape reverts the machine to standby, or loss of capstan phase lock in record reverts the machine to the replay mode. However, I do feel that the latter is a little dangerous as the machine continues to run in the replay mode—perhaps it would be safer if the machine stopped.

Normal editing cannot be done by the conventional method of rocking the reels with the spool motors tensioning the tape, but this is replaced by turning the knurled knob on the capstan in either direction—a much simpler and more accurate procedure. In addition, the control unit includes a dump edit button which disengages the take-up motor and uses the right-hand tension roller as a capstan to dump the tape—a very clever idea.

The other functions all relate to the record/replay selection for each track. There are five mode selection buttons for 'input', 'reproduce',

STATE-OF-THE-ART  
DUNLAP CLARKE  
**Dreadnaught  
1000 and 500**  
audio power amplifiers



**Model 1000 specifications**

continuous power output per channel with both channels driven into 8 ohms across 20 to 20,000 Hz at less than 0.25% T.H.D.	250 watts
continuous power output per channel with both channels driven into 4 ohms across 20 to 20,000 Hz at less than 0.25% T.H.D.	500 watts
continuous power across 2 ohms	800-1000 watts
T.H.D. from 0.1 watt to 250 watts per channel with both channels driven into 8 ohms across 20 to 20,000 Hz	0.25% maximum 0.025% typical
intermodulation distortion at 60 and 7,000 Hz mixed 4:1 at any power from 0.01 watt to 250 watts into 8 ohms	0.1% maximum 0.025% typical
frequency response at 250 watts per channel	20 to 20,000 Hz, ±0.5 dB, -0.0 dB
frequency response at 1 watt per channel	20 to 20,000 Hz, ±0.05 dB
slew rate	greater than 25 V/μs
signal to noise ratio	100 dB minimum
load impedance	2 ohms or greater
input impedance	100 k ohms
input sensitivity	1.75 volts RMS for full output
power line requirements	120 V AC, 60 Hz +240 V AC 50 Hz
temperature rise at full power fan on low (silent) speed	less than 40°C
dimensions, amplifier only	19" W x 7" H x 12" D
net weight, amplifier only	85 pounds

**Model 500 specifications (identical to Model 1000 except for the following):**

continuous power output per channel into 8 ohms	150 watts
continuous power output per channel into 4 ohms	300 watts
input sensitivity	1.2 volts RMS for full output
temperature rise at full power	60°C maximum
net weight, amplifier only	60 pounds

**front panel features**

- power on/off switch, lighted push-button
- professional quality meters with true VU characteristics
- five position meter switch indicates following power levels at 100% or 0 VU
  - 0 full power
  - 3 half power
  - 10 one-tenth power
  - 20 one-hundredth power
  - Off meter out of circuit
- individual channel level controls to balance unequal drive from preamp and prevent amplifier overload

**exposures electronics**

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Richardson Road, Hove, Sussex

**AMPEX ATR-100**

'sync', 'safe' and 'ready' in vertical array. These operate with a selector button for each track in horizontal array with indicator lights at the intersections of the function and track arrays. Thus, it is very easy to see what function is being performed by each track. In addition to these basic lights, the 'ready' position also has a red indicator to indicate the record condition which is selected by entering the ready state and then simultaneously pressing the play and the record buttons. The whole system is electronically interlocked and completely foolproof with the exception that it is possible to accidentally enter the dump edit mode when in record—there is no way of recovering without stopping the tape. Unfortunately the 'edit' button is symmetrically arranged about the tape timer display with the tape timer reset button, so the record dump edit provides potential for an easy clanger!

The tape timer is a five-digit display which normally indicates hours, minutes and seconds; it can be arranged to indicate minutes, seconds and tenths of seconds by means of links in the electronics. The display is, of course, corrected for the current tape speed setting.

In the trolley-mounted review machine both the power supplies and the electronics were mounted underneath the tape transport as separate plug-in units bolted to the main casting. Like the power transistors mounted on this casting, the practice of mounting heavy unnecessary weights on the casting is open to dispute as there is clearly unwanted strain which could cause it to distort slightly.

The electronics department includes a novel feature: all the components are mounted on double-sided high-quality printed boards which plug into a mother board by means of keyed connectors. This makes it impossible to insert a board in an incorrect socket. All components are of high quality and are properly identified by screen printing on the boards. Furthermore, all the important pre-set adjustments are by means of multi-turn potentiometers—these are vibration proof and easy to adjust. In addition to one board for each fitted channel, there are four control boards and an extender board supplied for servicing. The capstan servo occupies one board which has only two adjustments which are simple settings for a given voltage at identified test points on the board. Likewise, the reel servo board has only two adjustments—one for tape tension and the other for balance between pay-off and take-up tensions. The third control board, the transport control, is without any adjustments and with the fourth control board, the audio control, the ingenuity of the audio system starts!

The audio control board contains the crystal oscillator to which all audio and transport servo functions are referenced, such that bias, erase, reel servo control etc are locked to sub divisions of the crystal so that no beating problems can occur. This board has five internal plug-in links, four of which are used to select the two speeds which may be chosen out of the four available for automatic equalisation and bias changes when the tape transport speed control is switched. The selected speeds can be any two out of the four available, and if a prohibited speed is selected on the transport control a 'lockout' lamp is illuminated adjacent

to the speed control switch and the tape transport is inhibited. Link five on the audio control board is used to inhibit the record function, or to permit recording.

One internal potentiometer control is fitted which controls the erase bussbar level, while four front panel potentiometers and a toggle switch are associated with bias setting. Briefly, the individual audio channel boards each have a bias control for individual tracks and tape speeds: these controls are set to match all the available tracks for a given tape. Overall bias changes can be made by operating a single bias control for each tape speed on the audio control board, while ignoring the individual track controls.

The front panel of the board has ten multi-turn preset adjustments which are conventional adjustments effecting replay, sync and record gain: high and low speed record equalisation and replay equalisation at high and low frequencies and also individual channel bias. Internally there are three plug-in links, two of which select the tape speeds in use, and the third of which selects 'PURC'. What is Pick Up and Record Capability? In most recorders, when one enters the record mode, there is an almighty click left on the tape resulting from the physical gap between the erase and record heads which leaves an unrecorded gap on the tape. With PURC this problem is overcome by delaying the activation of the erase head by an appropriate time in relation to the tape speed and performing other tricks which eliminate the almighty clicks—so you have the option of precise silent drop-ins or hitting the ceiling when the record button is pressed.

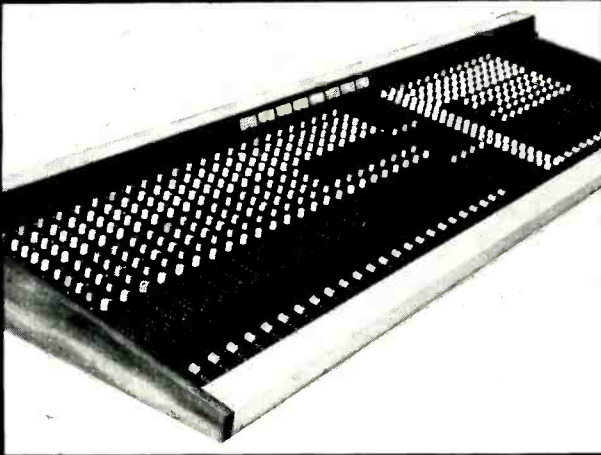
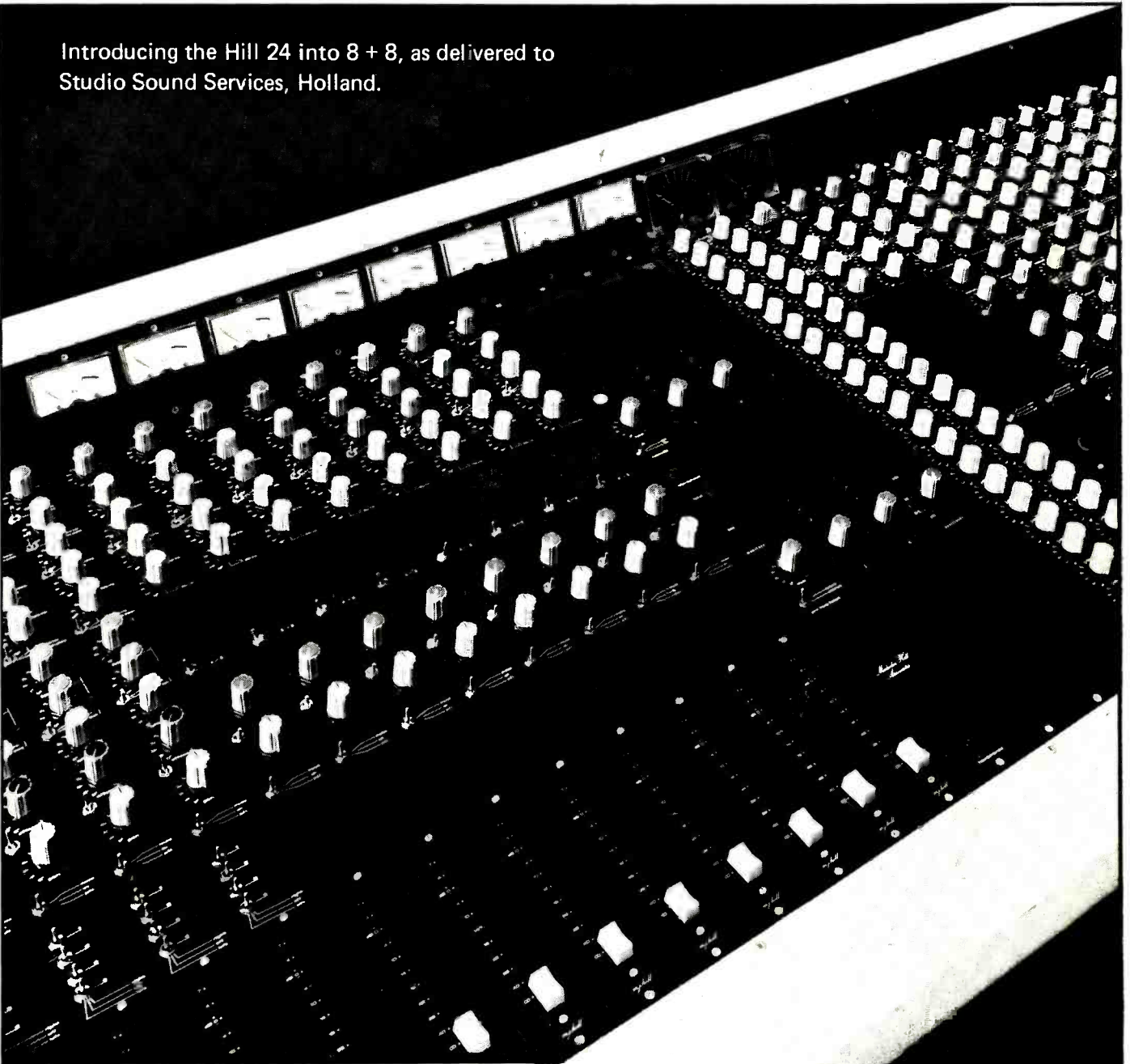
The final part of the ATR-100 to be described is the input/output unit for each channel. As has already been said, this unit converts the input and output levels and impedances of the basic recorder to normal line levels as well as providing metering. In the latter respect, the unit is unusual as the meter can be internally switched between the vu characteristic and the EBU peak characteristic but retains the vu scaling. Input and output levels can either be manually varied over a large range, or can be switched to be at pre-determined levels. In addition, there is a headphones jack (which is not in the most convenient of positions, as the leads trail over the tape transport) and XLR type input and output connectors with an optional switch-selected 600 ohm output impedance.

This is an unusually lengthy description of a tape machine, but clearly the ATR-100 is unusual and justifies what constitutes a brief outline of its facilities. Unfortunately, the manufacturer's publicity material is full of 'specmanship' and literally requires a pocket calculator to make comparisons with other manufacturers' products, for, among other things, it quotes reference levels of 1040, 1000, 740, 370, 260 and 185 nWb/m—has Ampex forgotten that the decibel exists?

**Replay performance**

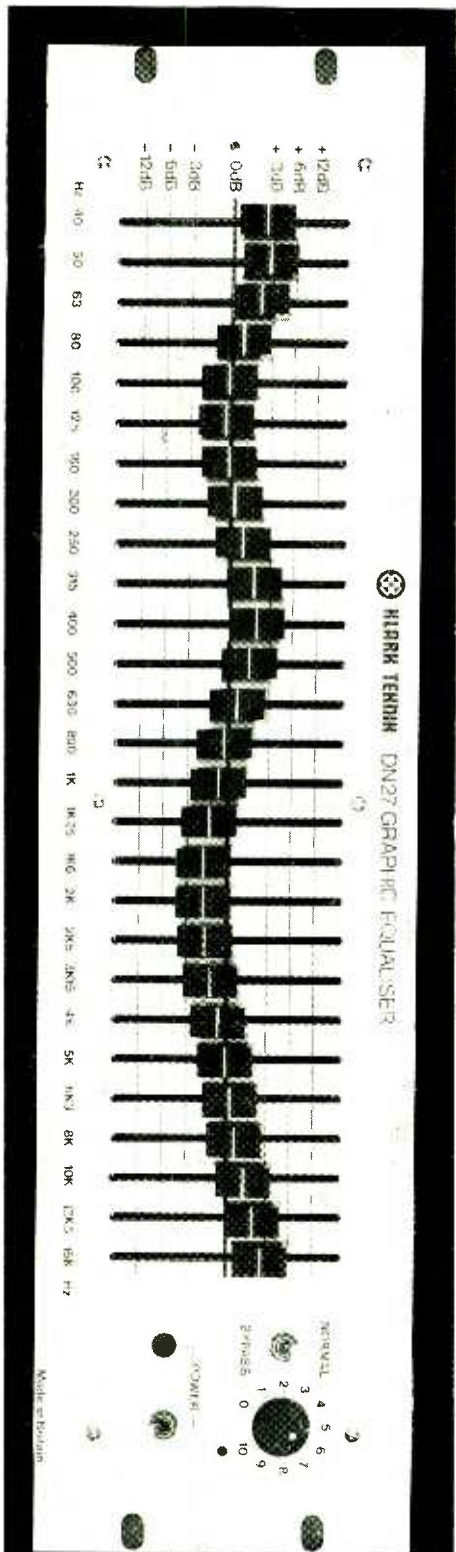
The frequency response in the replay mode was checked by using both calibration tapes and by means of a flux loop at tape speeds of 76 cm/s and 38 cm/s. The resulting figures indicated such a flat response that the errors found can only be considered as being approximate. For instance, the replay response at

Introducing the Hill 24 into 8 + 8, as delivered to  
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## Malcolm Hill Associates

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### AMPEX ATR-100

76 cm/s was flat to within  $\pm 0.6$  dB from 200 Hz to 20 kHz with a maximum error of  $-1.4$  dB at 80 Hz. Similarly at 38 cm/s the replay response was flat to within  $\pm 0.8$  dB from 63 Hz to 20 kHz with errors of only about  $-1$  dB at 31.5 Hz and 40 Hz.

As is only to be expected, the replay response in the sync mode is degraded, particularly at 38 cm/s, but even then the 38 cm/s response was within  $\pm 1$  dB from 125 Hz to 10 kHz and the 76 cm/s response within  $\pm 1$  dB from 125 Hz to 20 kHz. This excellent sync performance must partially result from the use of a separate replay winding on the record head.

Modern tapes such as the Ampex *A56* are capable of recording at such high flux levels that they cannot be replayed on some recorders without overloading the replay amplifiers. The signal handling capabilities of the replay chain are therefore important with a view to even higher output tapes. Using a flux loop to drive the head at 1 kHz it was found that the *ATR-100* replay chain could handle a level 26 dB above 320 nWb/m in either the replay or the sync modes—this certainly gives plenty of margin for new tape types.

Initial attempts to measure the replay chain noise in relation to a reference level of 320 nWb/m were confused by inconsistent results, and these were eventually traced to a number of high frequency tones in the machine output which are above the audible spectrum. Fig. 1 shows the frequency and amplitude of these tones, the predominant one of which is at 28.8 kHz and which was found to have an amplitude 60.6 dB below reference level on one channel and 55.3 dB below reference level on the other channel. The above data relates to 38 cm/s NAB equalisation, and, as it transpired that the tones originate from reel servo break-

through into the replay head, the output level is appropriately related to the replay equalisation.

It is likely that these high frequency outputs will not be of any significance in almost all applications, but there are conceivable conditions in which practical troubles could occur. Furthermore, the level of the 28.8 kHz is such that, at 38 cm/s with NAB equalisation, the tone reflects an apparent 3 dB deterioration in the 'A' weighted machine noise due to the characteristics of the weighting filter not providing a rapid roll off above 20 kHz. I had considerable co-operation from Ampex in this country and in California in assessing the significance of the defect, and it would appear that the review machine was below production standards on one channel; the  $-60.6$  dB level is said to be typical of production machines. The designer of the electronics system stated that he would prefer to see the level lowered and that this was likely to be the subject of future development work.

The following figures relate the machine noise (without breakthrough) to the replayed output of a full track recording at 320 nWb/m and demonstrate that the machine is an outstandingly good performer so far as audible replay noise is concerned (see below).

A comparison with the bias noise from a few samples of popular tape types demonstrates the enormous margin which the machine has on tape noise (see below).

#### Record/replay performance

The overall frequency response is effected by a number of design points within the record and replay amplifiers. To start with there is 'secondary gap' correction which aims to correct for the effects of the head pole piece resonance at very low frequencies—often these effects do not show when replaying calibration

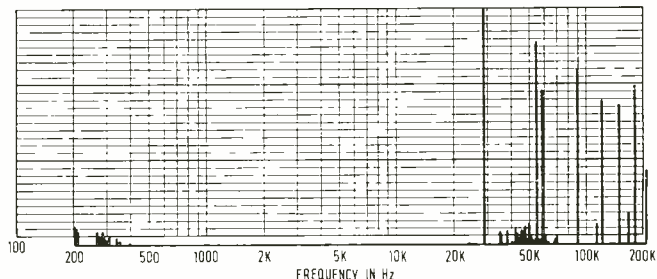
64 ▶

condition	reference level to noise ratio			
	38 cm/s NAB		76 cm/s AES	
	channel 1	channel 2	channel 1	channel 2
<b>REPRODUCE</b>				
Unweighted 20 Hz to 20 kHz	-69.5 dB	-69.3 dB	-69.8 dB	-69.4 dB
'A' weighted rms	-76.5 dB(A)	-77.0 dB(A)	-81.0 dB(A)	-80.8 dB(A)
CCIR weighted rms	-71.2 dB	-71.2 dB	-77.3 dB	-77.0 dB
CCIR weighted quasi-peak	-67.8 dB	-67.8 dB	-72.3 dB	-72.0 dB
<b>SYNC</b>				
Unweighted 20 Hz to 20 kHz	-61.3 dB	-64.0 dB	-62.0 dB	-63.8 dB
'A' weighted rms	-71.7 dB(A)	-72.2 dB(A)	-75.3 dB(A)	-76.5 dB(A)
CCIR weighted rms	-67.6 dB	-67.8 dB	-74.5 dB	-74.0 dB
CCIR weighted quasi-peak	-63.8 dB	-63.0 dB	-68.5 dB	-68.1 dB

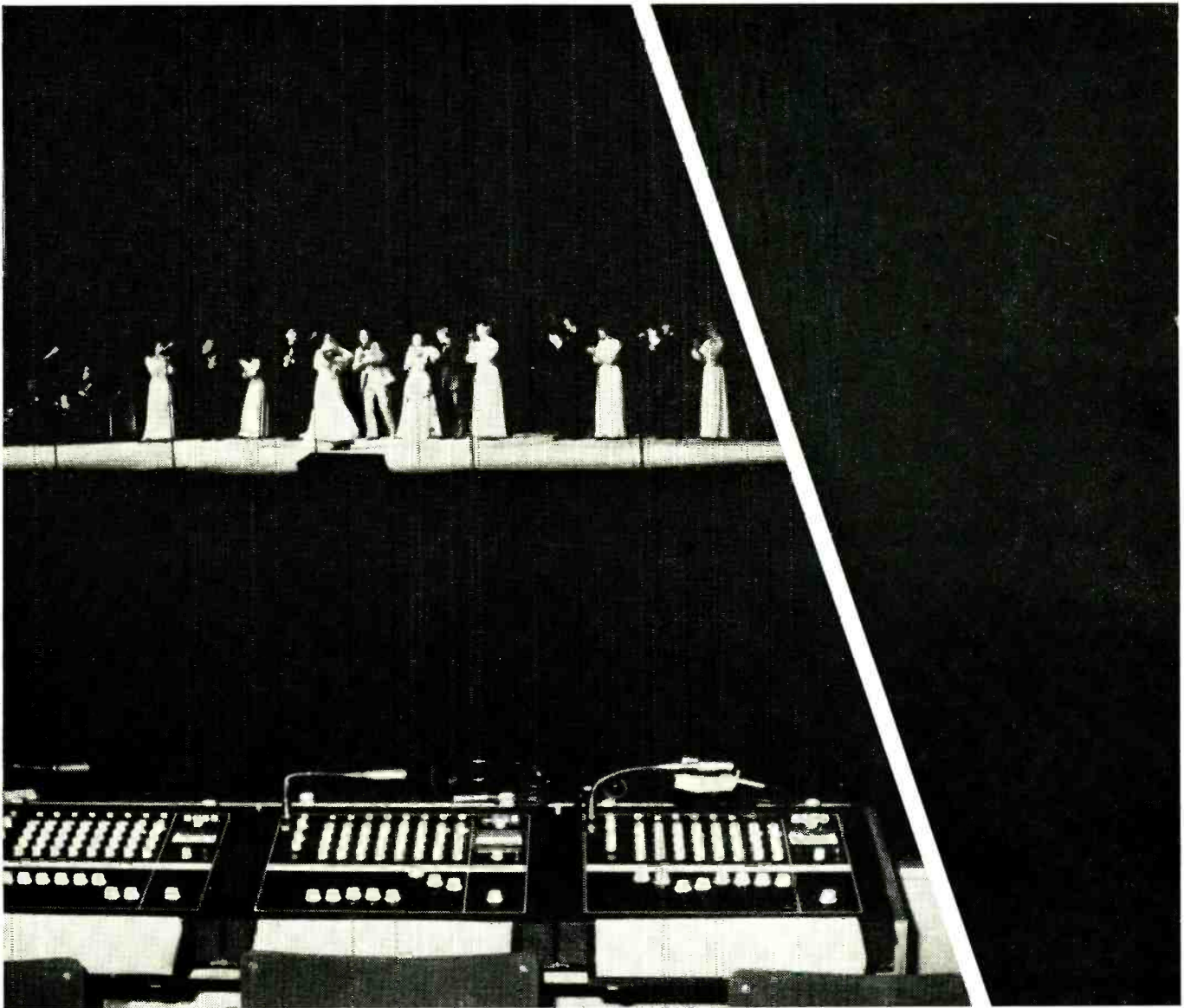
38 cm/s	machine	Ampex 456	BASF SPR50LH	3M 250
Unweighted 20 Hz to 20 kHz	69 dB	60 dB	55 dB	55 dB
'A' weighted rms	76 dB(A)	63 dB(A)	60 dB(A)	61 dB(A)
CCIR weighted rms	71 dB	58 dB	55 dB	57 dB
CCIR weighted quasi-peak	68 dB	53 dB	50 dB	53 dB

FIG. 1  
ATR-100  
HIGH FREQUENCY NOISE  
IN REPLAY NOISE

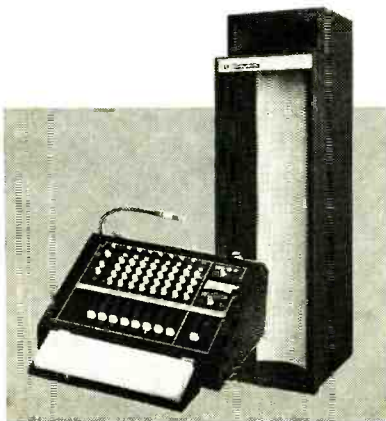
320 nWb/m  
ZERO LEVEL -90dB



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## AMPEX ATR-100

tapes which have recordings of discrete frequencies, but they become apparent, particularly at high speeds, in the overall frequency response. Examination of **fig. 2**, which shows the overall response at 76 cm/s, demonstrates that the low frequency performance is not only exceptionally smooth, but also that, for 76 cm/s operation, the lower frequency limit is unusually good.

The three high frequency plots in **fig. 2** show the effect of inbuilt switched shelving facilities in the record amplifier, the centre plot being the 'normal' position for 456 tape. The other positions are suitable for old type tapes or new super tapes—this is of course in addition to a high frequency equalisation potentiometer which has a very wide range; furthermore, the 3180  $\mu$ s bass boost can be switched in or out of circuit! The same comments apply at 38 cm/s, but only a straightforward frequency plot is included as in **fig. 3**.

Regarding harmonic distortion, **fig. 4** shows the second and third harmonic content when recording at 320 nWb/m at 38 cm/s. The second harmonic distortion is seen to be extremely low, and certainly the third harmonic is also at a low level, but it is just above the manufacturer's specification. The maximum output level for 3% third harmonic distortion at 1 kHz at both 76 cm/s and 38 cm/s was found to be 10 dB above 320 nWb/m, which is in line with the specification for 456 tape, but the record amplifier could manage a further 17 decibels of drive at 1 kHz. This is a truly amazing headroom—27 dB above 320 nWb/m.

SMPTE intermodulation distortion using 50 Hz and 7 kHz tones in the amplitude ratio 4:1 at an rms level of 320 nWb/m gave sidebands predominantly 100 Hz from the 7 kHz at a level -42 dB at either 76 or 38 cm/s, which is clearly a very high performance standard. Furthermore, a swept difference tone intermodulation test produced **fig. 5** (which was made with the new B & K 1902 distortion control unit at 76 cm/s tape speed) and also shows a high performance standard.

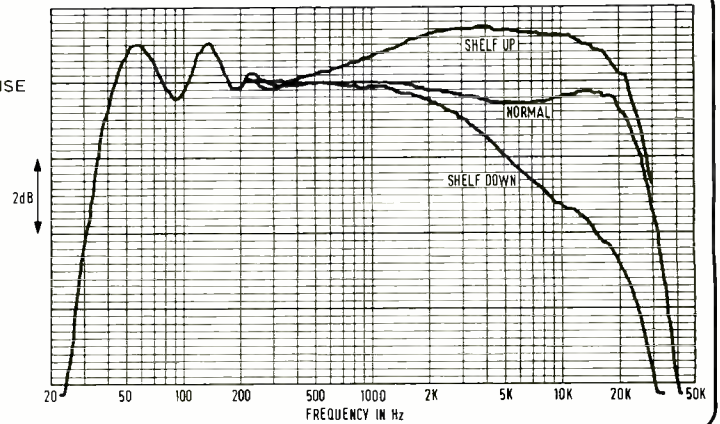
The crosstalk between the two channels obtained when recording both channels but only applying the signal to one is shown in **fig. 6**, which shows the expected rise in crosstalk at very low frequencies but with crosstalk less than 50 dB above about 200 Hz to 20 kHz—no complaints here. Similarly, the depth of erasure was very good, with a 200 Hz signal at 38 cm/s being erased in excess of 88 dB with 456 tape.

Testing with squarewaves plays havoc with some recorders if they use inductors in the equalisation, so this was tried with the results shown in **fig. 7**, which shows a complete absence of ringing.

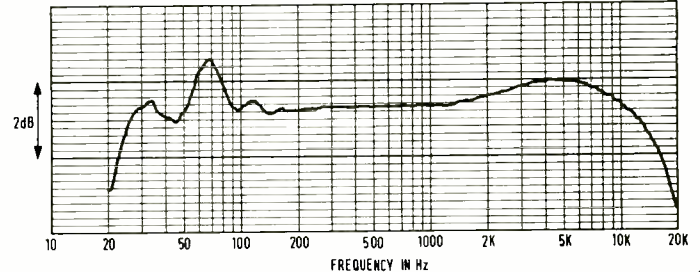
### Wow, flutter and speed

Wow and flutter as measured to the weighted quasi-peak standards was absolutely consistent throughout a reel at 0.014% at 76 cm/s or 0.024% at 38 cm/s—a very high standard of performance. Furthermore, as is shown in **fig. 8** which is a narrow band analysis of a 10 050 Hz recorded tone, there is little indication of fixed sidebands around the tone and only general noise. In addition, the noise is in a narrow band about the tone. In fact, this performance is quite markedly bettered at 76

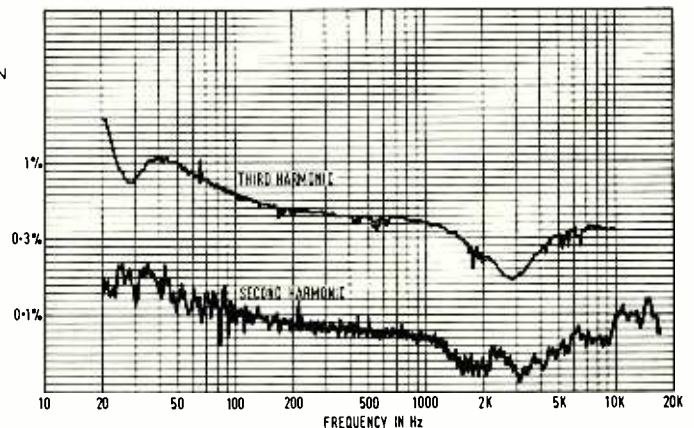
**FIG. 2**  
ATR-100  
OVERALL  
FREQUENCY RESPONSE  
WITH EQ SHELVES



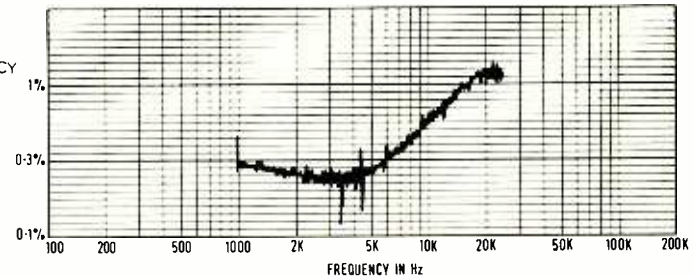
**FIG. 3**  
ATR-100  
OVERALL RESPONSE  
38cm/s



**FIG. 4**  
ATR 100  
HARMONIC DISTORTION  
320 nWb/m



**FIG. 5**  
ATR-100  
DIFFERENCE FREQUENCY  
DISTORTION  
320 nWb/m  
76 cm/s  
DIFFERENCE FREQUENCY 200Hz OR3+



cm/s where the 'rubbish' is about 10 dB lower.

The tape speed consistency was within 0.01% from one end of a reel to another and, while it is noted that the absolute speed accuracy is quoted as  $\pm 0.03\%$ , this was not checked.

### Input/output unit

The input/output unit is essentially an inter-

face unit which will normally be fitted when the ATR-100 is used for studio work. Not only does it provide impedance and level conversion for the inputs and outputs, but also it includes a level meter which can operate either as a vu or peak programme meter.

In addition the input and output levels can be switched between a 'Fixed' level or a variable



level, which is controlled by potentiometers on the input/output unit. A headphone monitor jack is provided. The final facility includes two light indicators which show the proper operation of the erase and bias current.

As supplied, the pre-set input sensitivity was +4 dBm for recording the reference level of 320 nWb/m, which matched the output level, but in the 'manual' modes there was an available gain variation from zero to +10 dB on both the input and the output. There are, however, a very wide variety of linkable options in both the input and the output such that they can be direct or transformer coupled, floating or unbalanced etc. The detail of these options is too lengthy to describe here, but it is fair to say that every likely combination of impedance and level is available; anyone want more than +30 dBm at output clipping?

A further important feature of the input/output unit is that the level metering can be switched between a vu and a peak type meter. It was found that the 0 vu point corresponded to -6 dB on the peak function.

In the vu meter mode the meters were found to be genuine vu meters to the ASA standard, while, in the 'peak' mode, the meters read peak and became a fast rise time instrument reading -3 dB on a 5 ms tone burst and having a slow return time of 3.5s.

The meter sensitivity in relation to tape fluxivity is of course fully adjustable, but it is perhaps surprising that the 'headroom' between 0 vu and zero in the peak mode is fixed; in particular I am surprised that only 6 dB difference has been allowed.

#### Other matters

Completely click-free operation when dropping into record together with a link-selected PURC were strong features of the machine. It was however found that a small click could be put on to tape if it were in contact with the heads when the machine was switched on; Ampex are aware of this defect and a cure is imminent.

In spite of extremely hot weather at the time of reviewing the machine it always ran remarkably cool and the cooling fan in the main case was effectively silent in operation. Furthermore, the machine was very quiet, the only noise being a slight squeaking from one of the reel motors.

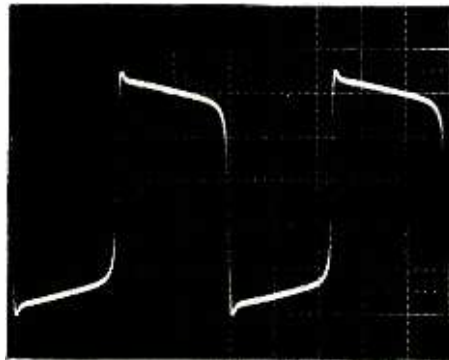
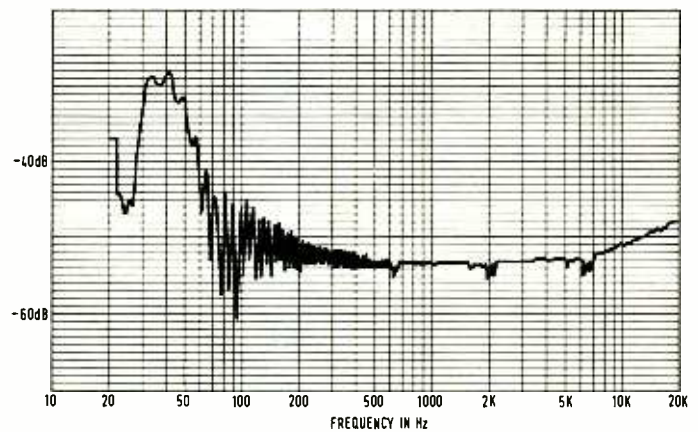
The phase jitter between tracks at 10 kHz and 38 cm/s is shown in fig. 9, which shows that the jitter is normally about  $\pm 10^\circ$  and cyclic in nature which suggests that this already good performance might be bettered with alternative tape or rotating parts.

#### Summary

Because of the extreme flexibility of this machine this already lengthy review has only dealt with two of the four available tape speeds, and even then there are many novel and interesting features of this machine which either have not been mentioned or have not had due justice done. From a mechanical point of view the ATR-100 is not only a completely novel design, but its handling of tape is superb—just for fun we ran some C90 cassette tape at 38 cm/s and in fast rewind and we couldn't damage the tape! In spite of these comments the full speed rewind is in my opinion excessively fast, and a good quality backed tape is desirable if this feature is to be used.

**FIG. 6**  
ATR-100  
CROSSTALK

38cm/s

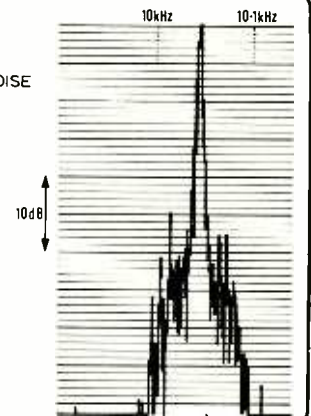


Above: Fig. 7, 1kHz

Below right: Fig 9,  $\pm 36^\circ$  1 sec/div

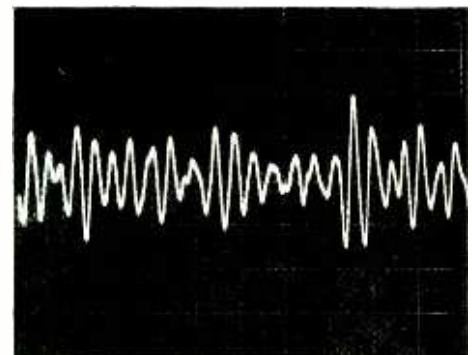
**FIG. 8**  
ATR-100  
SIDE BAND NOISE

CARRIER 10050Hz  
38cm/s  
AMPEX 456 TAPE

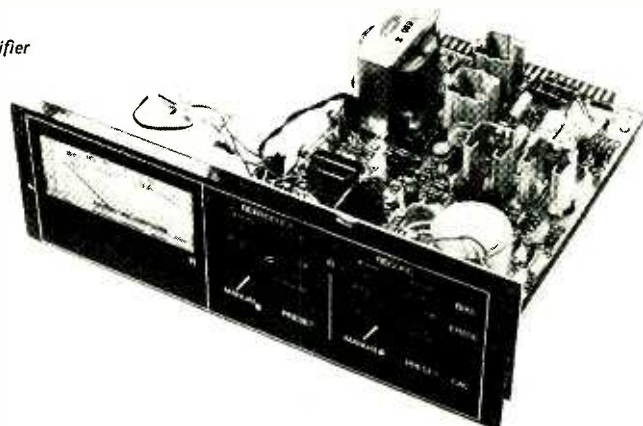


With the one or two minor exceptions which have been mentioned the operation of the machine is simple and very flexible and, furthermore, completely foolproof. The only area of criticism is the accessibility of the heads for editing, which could well be improved.

In the electronics department I have never come across such a versatile machine and the capabilities of the electronics are far ahead of any current tapes. Without any doubt the ATR-100 is a step ahead in recorder design techniques and, all things considered, Ampex should be congratulated in producing such a 'bug free' machine in the early production stages. ■



Input output amplifier  
module





# DT 440

## Dynamic Hi-Fi Stereophone

### Specification

Type	DT 440 dynamic transducer
Frequency response	20 – 20.000 Hz
Electrical impedance	2 x 600 ohms ± 10%
Power requirements	1 mW per system for a sound level of 100 dB SPL (2 PA) at 1 kHz equal to 775 mV at 600 ohms
Maximum undistorted continuous sound pressure level (DIN 45582) at given harmonic distortion	116 dB SPL per system equal to 42 mW or 5 V at 600 ohms
Distortion level at 1.000 Hz	≤ 1%
Sensitivity at 1.000 Hz	63,24 PA/√V · A equal to 102 dB/V = 2,5 Pa/V at 600 ohms

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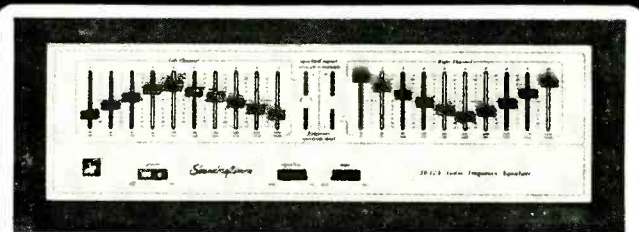
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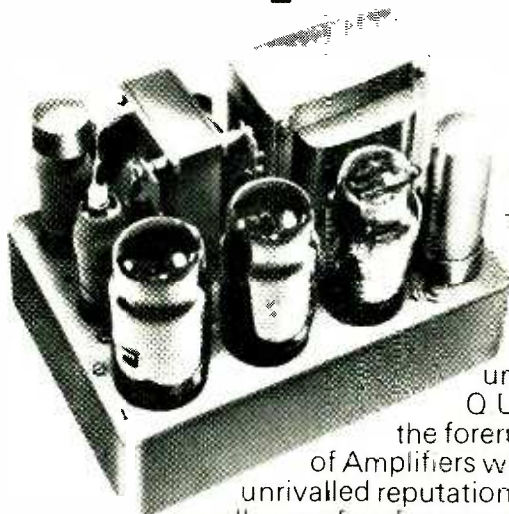


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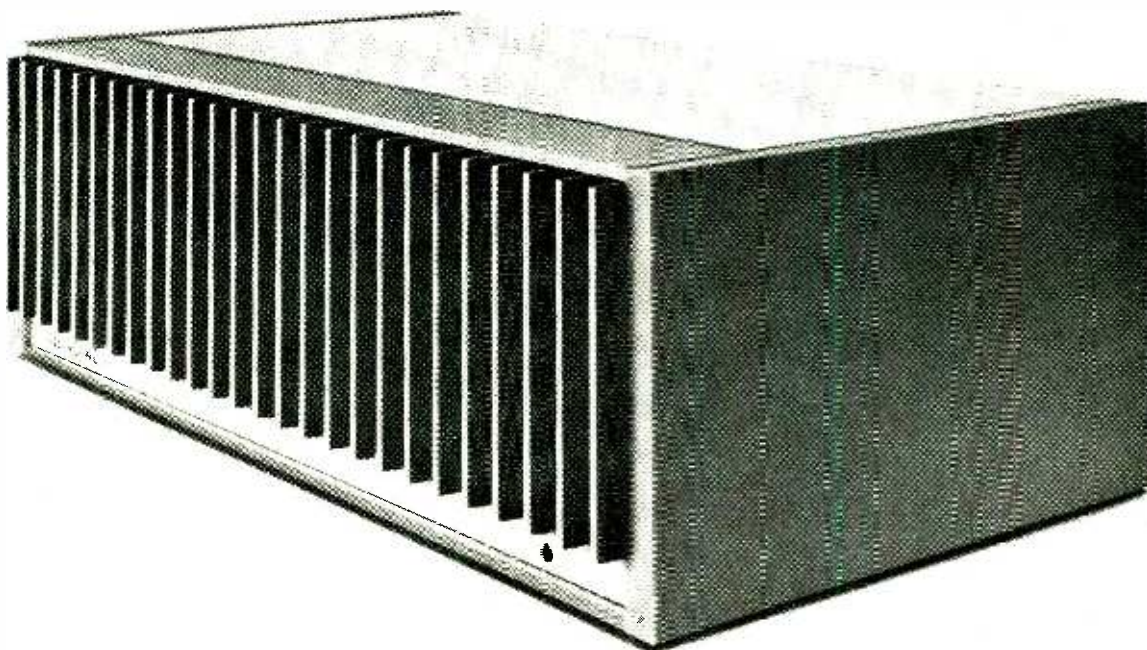
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# Ferrograph Studio 8

Hugh Ford

## MANUFACTURER'S SPECIFICATION

**Tape width:** 6.3 mm.  
**Spool types:** NAB, European or Cine up to 270 mm dia.  
**Tape speeds:** 381 and 190.5 mm/s or 190.5 and 95.25 mm/s controlled by adjustable capstan servo. Speed stability  $\pm 0.1\%$ .  
**Wow and flutter (DIN 45507):**  
381 mm/s not greater than 0.06% (pk. weighted)  
190.5 mm/s " " 0.08% " "  
95.25 mm/s " " 0.1% " "  
**Start time:** not greater than 200 ms to full speed. (Record and line outputs inhibited until tape is up to speed.)  
**Rewind speed:** pre-set, constant. Maximum: 6.1 m/s. Stop time from spooling less than 3s.  
**Tape tension:** run: 0.7N (nominal). Adjustable approx 0.5 to 1.0N. Spool: 1.0N (nominal). Adjustable down to approx 0.5N.  
**Tape timer** (referred to nominal tape speed): accuracy (run or spool):  $\pm 0.1\% \pm 1$  digit. Maximum reading:  $\pm 199$  min 59s. Switched auto-stop at zero.  
**Head blocks:** interchangeable. Full track; stereo 2.75 mm track. Two track 2 mm width.  
**Mic inputs:** to suit 50/200 ohm balanced or 5k ohm unbalanced sources, selected by links. Level ranges (referred to source impedance): -78 to -33 dBm (high gain setting). -52 to -7 dBm (low gain setting). Noise, unweighted, 20 kHz bandwidth: -120 dBm.  
**Line inputs:** earth-free, balanced. Bridging impedance 10k ohm (sources not greater than 600 ohm). Level range -20 to +24 dBm, falling to +18 dBm max at 30 Hz.  
**Line outputs:** earth-free, balanced. Normal setting: nominal output impedance 75 ohm (not less than

600 ohm load). Maximum level +24 dBm, falling to +18 dBm at 30 Hz. On 600 ohm setting (selected by link) levels are 6 dB lower. Line output amplifier protected against any incoming signals up to +24 dBm.

**Monitor facilities:** power to external speaker: 10W (8 ohm, 0.3% distortion) either channel. Total power, both channels driven, 15W above 100 Hz. Power to internal speaker(s) limited to 2.5W each. All ratings are nominal values, rms, continuous sinewave. Phones jacks for stereo and mono.

**Bias frequency:** 120 kHz  $\pm 2\%$ . Level sufficient for modern low-print tapes.

**Erasure** (120 kHz): at least 75 dB from 3% distortion levels at 1 kHz.

**Frequency response:** graphical data shows overall settability. Worst case (extremes of temperature)  $\pm 2$  dB 30 Hz to 18 kHz at 381 mm/s  $\pm 2$  dB 30 Hz to 15 kHz at 190.5 mm/s  $\pm 2$  dB 30 Hz to 12 kHz at 95.25 mm/s

**Amplifier distortion** (excluding monitor amplifier): less than 0.1% at 1% tape distortion levels. Less than 0.3% at 3% tape distortion levels.

**Equalisation:** plug-in units for NAB and IEC.

**Signal/noise ratio:** dependent on tape, record level and equalisation. Performance exceeds current requirements of DIN 45511 and NAB standards. Example: using Agfa PER 525 and CCIR equalisation, flux level 514 nWb/m, weighted to DIN 45405: 381 mm/s 62 dB, 190.5 mm/s 59 dB.

**Stereo separation:** overall (record-play); better than 40 dB (100 Hz-12.5 kHz).

**Working position:** any, between horizontal and vertical.

**Ambient range:** 5°C to 35°C.

**Power input:** 110-130V/220-240V, 50 Hz or 110-130V/220-240V, 60 Hz (2 models). Consumption approx 320 VA.

**Dimensions:** portable case: 482 mm wide x 559 mm deep x 280 mm high. Overall, including 270 mm spools: 540 mm wide x 590 mm deep.

**Weight:** approx 37 kg.

**Price:** portable version £1764 (\$3180). As reviewed £2040 (\$3680).

**Manufacturer:** Wilmot Breeden Electronics Ltd, Durban Road, South Bersted, Bognor Regis, West Sussex.

**US Distributor:** Elpa Marketing Industries Inc, New Hyde Park, NY 11040.

However, the choice of hinging point is far from ideal as the unit is very much unbalanced when not in the horizontal plane and, in spite of the facility for locking it in the inverted position, this can be an inconvenience.

Access to the signal electronics section for maintenance is reasonable, as the majority of components are mounted on plug-in fibreglass printed boards which are screen printed with component identifications. However, in spite of the availability of a good maintenance manual and the supply of various tools and other 'goodies' with the machine, no card extender is supplied. The same remarks apply to the electronics control for the tape transport, but in this department there are a number of fixed boards and some components are very well buried—but they are at least clearly identified.

The tape transport is based on a substantial alloy casting, the upper surface of which is machined to form the reference face for the headblock and other components. The headblock is secured by three screws which clamp the block on to pillars which, in turn, clamp on to the casting. Thus, it is relatively easy to remove the headblock which has a mating connector for all but the replay head connections which use two miniature coaxial connectors.

Tape tension control is rather ingenious as no tension sensing arms or other tension sensing devices are used. What happens is that the tape speed is known and the rotational speed of each reel motor is detected from an optical detector, and from this information the transport control 'computes' the current diameter of the tape on the spools. With this information, the electronics decides upon the required reel motor torque.

Speed sensing of the two reel motors and the capstan motor, in addition to the optical tape presence detector, is achieved by using optical tachometers which derive their light from a single lamp fitted with light guides to the required positions. Should this lamp fail, a spare lamp is automatically switched into operation and a warning shown on the tape transport.

From the pay-off spool the tape passes over a retractable damped and spring-loaded arm equipped with a tape guide. From this, it passes round the tape timer roller which is fitted with an optical pickup driven from the previously mentioned light source. There is, next, a light spring-loaded tape 'pusher', the optical tape presence detector, a fixed edge guide and the headblock. From the headblock there is the capstan, a fixed post guide, a damped arm and then the take-up spool. The capstan is of fairly small diameter and is engaged with a large diameter pinch wheel of interesting design. As is common, the pinch wheel is mounted on a solenoid-operated arm, but, unlike conventional arrangements, the arm is engaged to a fixed position and the pinch pressure is controlled at the pinch wheel bearings.

Reverting to the headblock, this is a particularly solidly made component with positive head mounting and a head azimuth adjustment which was found to be both stable and easy to adjust accurately. The tape enters the headblock at the ferrite erase head from where it passes a tape lifter pin, the record head, a

THE Ferrograph *Studio 8* is a 6.35 mm recorder which is available in a very large number of different configurations including the choice of twin track, stereo or full track headblocks, vu meters or ppms, internal monitor amplifiers, microphone inputs etc.

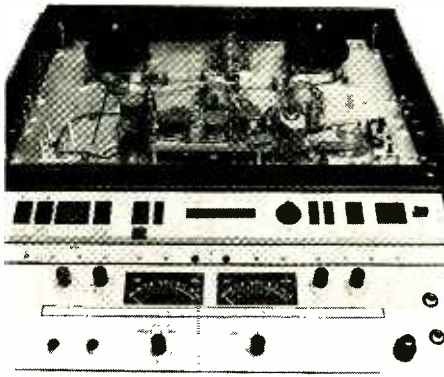
As such it is a two-speed machine with the option of a high or low speed version, the high speed version working at 38 cm/s and 19 cm/s and the low speed version working at 19 cm/s and 9.5 cm/s. Either NAB or IEC equalisation is available, but the changeover is very simply achieved by substituting new plug-in modules on the amplifier printed circuit boards.

The *Studio 8* is available in five different mechanical layouts all of which use the same electronics and tape transport. The review machine was a trolley-mounted version which is probably most appropriate to studio use, but portable, rack mount, console and pent-house versions are available as standard configurations.

This versatility is achieved by manufacturing the machine as two separate parts, the signal system and the tape transport and control system. These are connected together by plug-in leads; in the trolley version, the signal electronics section is connected to convenient receptacles on the trolley by jumper leads. In



addition, in the trolley version, the signal electronics section and the tape transport section are a single mechanical unit which is hinged on the trolley such that the complete recorder can be tipped up for maintenance.



flutter roller, a second tape lifter pin and then the replay head and finally a fixed edge guide. This layout provides positive control of the tape near the record and replay heads and gives a clean tape path which is good for lacing the tape and editing when the access to the replay head is excellent.

Tape motion is controlled by the conventional arrangement of full electronically interlocked fast forward and rewind functions together with the usual replay control and record control which is only operative if it is depressed simultaneously with the replay control. As an additional feature each channel has a record ready button, so that the record function can be inhibited on either or both channels—furthermore, an additional button allows dropping out of record 'on the fly'.

In practice the interlocking is such that the tape is always well controlled and any combination of instructions will be followed without any tape snatching—even pulling out the power plug gives a controlled stop by means of the mechanical parking brakes which are normally inoperative. However, once or twice during the evaluation of the machine, it was persuaded to go into a fast wind record mode—a decidedly dangerous habit.

Very sensibly the manufacturer has provided Revox type spool clamps, but a distinctive feature is that these have shims fitted so that the turntable height is correct for both NAB and cine type spools. Unfortunately, as the turntables are mounted directly on to the reel motors, they became very hot in operation (25°C above ambient) and it is felt that this can well lead to tape storage problems. The spooling speed is variable by means of a screwdriver-operated potentiometer on the tape transport top plate (which also includes a tape tension switch for large/small reels). Slowest spooling speed is ideal for archiving tapes, but the highest speed gave a poor wind with shiny-backed tapes such as the EMI 815 supplied with the machine. Both EMI type 832 and 3M 250, which are matt-backed tapes, spooled very well and I would recommend the use of back-coated tapes if the highest spooling speeds are to be used.

In addition to the already mentioned tape motion controls, there is an edit button which activates the reel motors without the capstan, thus the tape can be easily rocked in the conventional manner for editing, with tensions applied to the spools as in the replay mode.

Other than the power on/off switch and the speed selector switch the remaining transport controls are associated with the tape timer.

The timer is in the form of a series of seven segment displays which indicate minutes and seconds up to 199 minutes 59 seconds, with the display automatically corrected for the selected tape speed. In addition to the function of being a tape timer, there is a 'stop at zero' switch which in all modes stops the tape transport when the tape timer indicates zero (or thereabouts). This feature, in addition to being able to pre-set the tape timer to either positive or negative times, provides the valuable feature of automatically winding the tape to a given point—a sort of basic auto-locator.

Directing attention to the signal system, the review machine was a line input/output machine without microphone amplifiers but with two monitor amplifiers. The centre of the signal control panel is occupied by two meters which can be optionally either vu meters or ppms, the review machine having vu meters. In either case individual meters can be switched to read input, output or bias, the output position reading the signal after the two potentiometric output level controls which control both the power amplifier output and the two headphone monitor jacks on the control panel. In addition there is a dual concentric control for headphone monitor level, the actual jack connectors consisting of a tip ring and sleeve 6.35 mm socket for stereo monitoring and a normal two-pole socket for monophonic monitoring.

On the input end there are two pairs of level controls, one pair being normal potentiometers and the second pair being recessed pre-set level potentiometers. In addition to these manual controls there are ready/safe pushbuttons for each track, and a number of screwdriver-operated pre-set controls which are hidden under a removable strip. These controls provide for record and replay high frequency equalisation for each speed and each track, and also bias setting for each track and speed.

Further pre-set controls on the printed boards within the electronics provide for meter adjustment and gain setting, and also within the transport electronics there are pre-set controls for tension adjustment and power supply voltage adjustment.

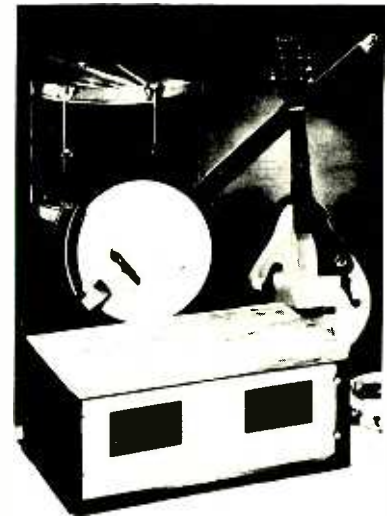
Generally the number of available adjustments are the minimum which one would expect of a professional machine, and the methods of alignment are clearly set out in the operating instructions. In this connection it is pleasing to note that all required test points are clearly identified and are accessible from the front of the machine so far as the signal electronics are concerned.

While 'button thumping' to try to defeat interlocks could produce unwanted effects without disastrous loop throwing or tape snatching, normal operation of the machine was delightful and the current status was always clearly indicated on a series of lamps associated with the transport controls.

#### Replay performance

As is my normal practice, the initial investigation was directed at the replay frequency response as measured at the line outputs, which in common with the line inputs, are XLR type connectors at the rear of the machine and which are accompanied by the XLR type power connector and a multi-way remote

70 ►



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## FERROGRAPH STUDIO 8

control connector. The latter provides for all the normal tape transport functions to be remote controlled by ttl logic levels and also for a remote tape counter and vari-speed.

To return from this diversion, the replay frequency response was checked using BASF calibration tapes to the IEC standards of 35  $\mu$ s at 38 cm/s and 70  $\mu$ s at 19 cm/s with the rather amazing results that at 38 cm/s the upper track was within  $\pm 0.6$  dB from 63 Hz to 18 kHz and the lower track within  $\pm 0.4$  dB from 31.5 Hz to 18 kHz—however, as full track test tapes were used the actual practical response would show some bass boost due to fringing effects. At 19 cm/s the story is not so good, for as is only to be expected, there was some apparent loss at 31.5 Hz and also an apparent -2 dB at the higher frequencies. While these results are within normal calibration tape tolerances, further investigation was warranted.

Subsequent investigations using a flux loop suggested that the calibration tapes used at 19 cm/s were on the low side at 19 cm/s, and I am quite prepared to agree that the recorder was in fact set to the correct standard, but readers be warned—the odd decibel at short wavelengths is very difficult to agree.

Signal handling capabilities of the replay chain were found to be excellent, with the

tape speed	condition	reference level to machine noise	
		UPPER TRACK	LOWER TRACK
38 cm/s	20 Hz to 20 kHz rms	-58.0 dB	-62.4 dB
	'A' weighted	-73.2 dB	-73.5 dB
	CCIR weighted rms	-69.8 dB	-70.1 dB
	CCIR weighted quasi-peak	-64.8 dB	-65.2 dB
19 cm/s	20 Hz to 20 kHz rms	-56.1 dB	-61.3 dB
	'A' weighted	-69.6 dB	-70.6 dB
	CCIR weighted rms	-67.9 dB	-68.5 dB
	CCIR weighted quasi-peak	-62.7 dB	-63.8 dB

replay amplifier capable of handling fluxivities of 20 dB above 320 nWb/m before clipping occurred—this performance will cope with any tapes likely in the foreseeable future. Also, regarding noise, the replay amplifiers offered a respectable performance so far as weighted noise was concerned, but the unweighted figures were affected by two discrete frequencies in the output; these were the 50 Hz hum and an approximately 30 Hz tone. The former was on the upper track 56 dB below 320 nWb/m depending on the precise position of the replay headshield, with the 30 Hz component 4 dB lower—no other discrete frequencies were apparent in the output. It is felt that the 50 Hz hum level and also the sensitivity to external 50 Hz fields is rather marginal, and that some improvement is desirable.

The following reference level (320 nWb/m at 1 kHz) to noise ratios confirm this comment:

Generally these performance figures give a 10 dB margin on the noise (bias noise) from the currently best available tapes, so there is no cause for complaint in this direction.

### Record/replay performance

Because the machine had been aligned by the manufacturer for EMI 815 tape the evaluation of the record/replay performance was directed at this type—however, this did little for the potential of the machine as far better tapes are available including the EMI 830 series of tapes.

The overall frequency response at 38 cm/s and 19 cm/s as received is shown in **figs. 1 and 2** respectively from which it is to be seen that, while the overall response is very flat, there is a difference between tracks at low frequencies. Probably this difference is of little practical significance, and it is notable that the low frequency 'secondary gap' effects are unusually well controlled.

A further undesirable effect to be noted from the overall frequency response data is that the uniformity of reproduction at high frequencies is rather poor. As is shown in **fig. 3** the use of alternative tape types produces far better uniformity than that exhibited by either the sample of EMI 815 or 832.

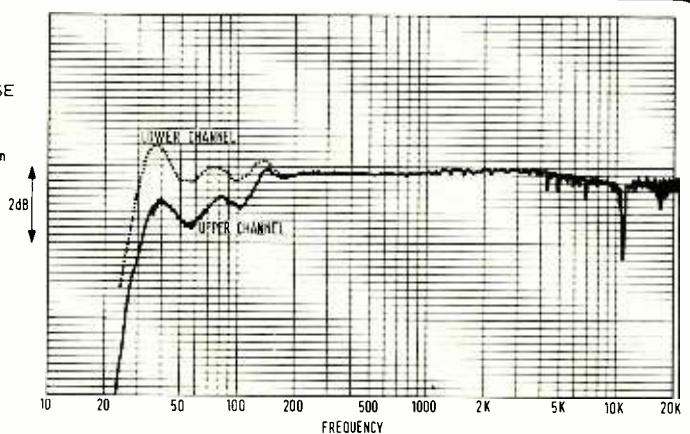
Using the original sample of *Emitape 815*, the maximum output level for 3% third harmonic distortion was found to be +5.5 dB above 320 nWb/m at a tape speed of 38 cm/s or +4.5 dB at 19 cm/s. These figures are well and truly tape limited and using modern high output tapes +10 dB was readily achieved, the actual record amplifier saturation point being 16 dB above the drive required to record a reference level of 320 nWb/m on 815.

This represents a fairly substantial margin for new tape types and there was no shortage of available bias adjustment, but it is felt that there could be some further latitude in the available range of record equalisation which is shown in **fig. 4**. Undoubtedly the existing range will cope with all current tape types, but the trend for higher sensitivity at short wavelengths may mean that future tapes will be too sensitive.

The relation between second and third harmonic distortion when recording at 320 nWb/m at 38 cm/s with 815 is shown in **fig. 5**, which illustrates a sensible performance, as does the swept CCIF intermodulation distortion with Ampex 356 tape at 320 nWb/m shown in **fig. 6**—this plot with the B & K 1902 analyser is of course considerably degraded with low output tapes. SMPTE type intermodulation distortion was rather difficult to determine with 815 due to the poor uniformity, but a figure about 1% at 320 nWb/m appeared to

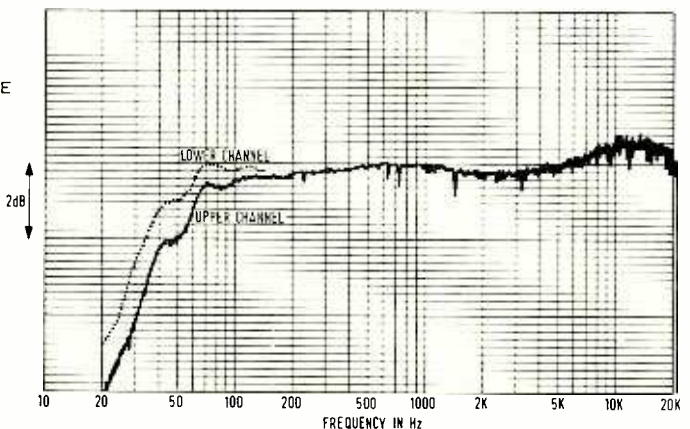
**FIG. 1**  
STUDIO 8  
OVERALL  
FREQUENCY RESPONSE

38 cm/s  
ZERO LEVEL: -20dB REF 320nWb/m



**FIG. 2**  
STUDIO 8  
OVERALL  
FREQUENCY RESPONSE

19 cm/s  
ZERO LEVEL: -20dB REF 320nWb/m



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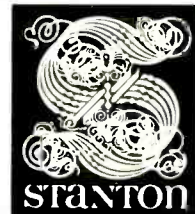
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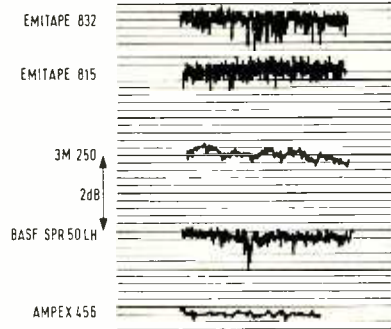
SS10

# FERROGRAPH STUDIO 8

**FIG. 3**

STUDIO 8  
UNIFORMITY OF  
REPRODUCTION

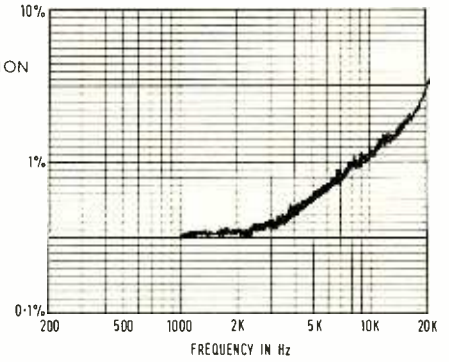
19 cm/s  
10 kHz



**FIG. 6**

STUDIO 8  
CCIF INTERMODULATION  
DISTORTION

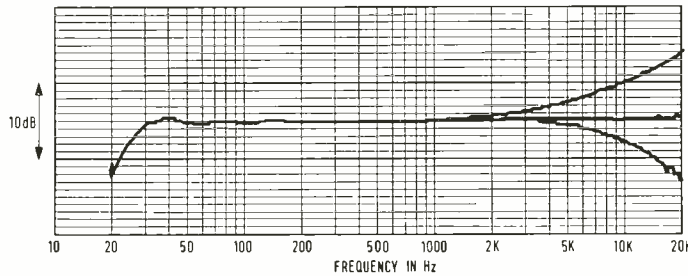
DIFFERENCE FREQUENCY 200Hz  
OF3 + PLOT  
38 cm/s  
320nWb/m  
TAPE AMPEX 456



**FIG. 4**

STUDIO 8  
RANGE OF RECORD  
EQUALISATION

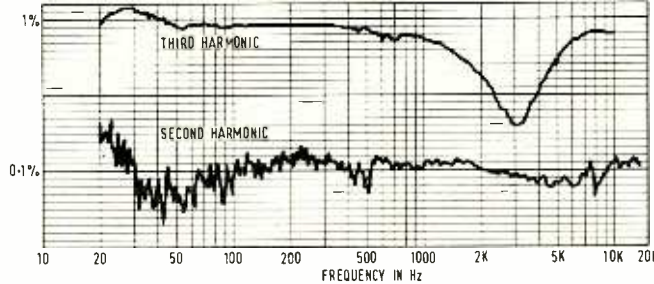
38 cm/s  
EMI 815



**FIG. 5**

STUDIO 8  
RECORD/PLAY  
DISTORTION

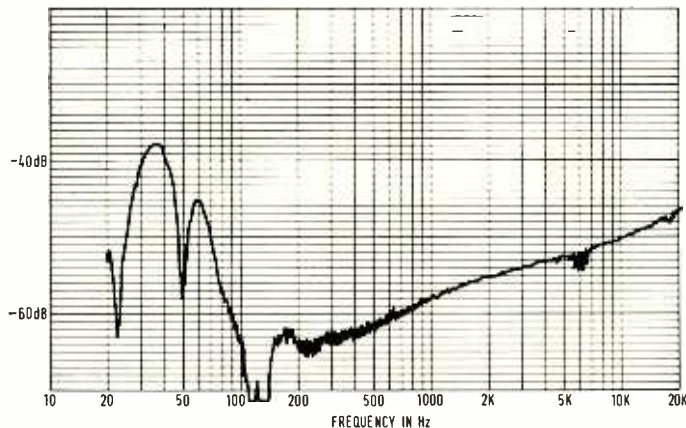
320nWb/m  
1kHz



**FIG. 7**

STUDIO 8  
CROSSTALK

38 cm/s



be the order of the day.

As is shown in fig. 7 the crosstalk between channels with a twin track headblock when recording both tracks (one without signal) is to a very high standard with well controlled low frequency behaviour, and the erasing capability was also very good with 84 dB erasure of a 1 kHz tone being measured at 38 cm/s using 815.

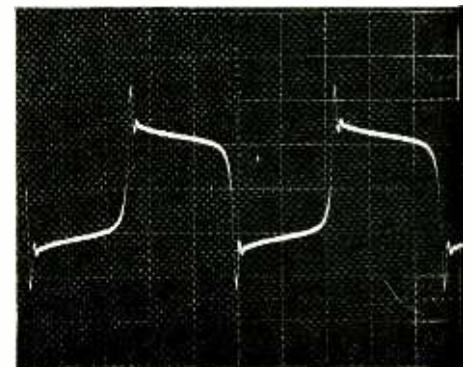
On the final aspect of the record/replay performance, fig. 8 shows the result of recording and replaying a 1 kHz squarewave at 1 kHz at 38 cm/s. It is noted that in this figure the overshoot of the edges is pronounced, but the ringing is minimal—I leave it to others to decide if such an effect is audible, but would remark that there is a school of thought that recorders should be optimised for phase response.

### Wow, flutter and speed

The measurement of wow and flutter to the weighted quasi-peak standards gave consistent results at the beginning, middle and end of a NAB spool of tape, and very good results at that. At 38 cm/s the wow and flutter was found to be 0.014% increasing to 0.022% at 19 cm/s—this performance ranks among the best available recorders.

The extent of scrape flutter is shown in fig. 9, which represents a narrow band spectrum analysis of a 10 050 Hz recorded tone. While the result is better than many machines, it is as usual a clear indication of the normal shortcoming of all recorders. 74 ▶

**FIG. 8** 1 kHz 38 cm/s







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## FERROGRAPH STUDIO 8

Tape speed variations within a NAB reel of tape were minimal and less than 0.01% with the actual speed being absolutely constant from day to day and with temperature. Minor speed adjustments are made by two controls on the transport, but at 19 cm/s the available variation was only +0.34% - 0.15%; however, a variable speed can be obtained by using the remote connector.

Checking the tape timer showed that this also was very accurate, with a measured error of only 1 part in  $10^4$  over 20 minutes at 19 cm/s.

### Inputs and outputs

The line inputs and the line outputs are both transformer coupled floating connections at the XLR connectors at the rear of the console. Input sensitivity is variable over a very wide range, the maximum sensitivity being -35 dBm input for recording 320 nWb/m and the minimum usable sensitivity being controlled by the performance of the input transformers which are realistically limited to a maximum of +18 dBm at 30 Hz. The input impedance varied according to the control panel gain setting, but was always above 12 000 ohms, which is generally satisfactory.

On the output end, the output impedance is low at 60 ohms with a capability of producing +21 dBm from a recorded level of 320 nWb/m—more than satisfactory.

The only remaining signal connections are the headphone and the loudspeaker monitor outputs, which both derive their signals from the monitor power amplifiers. Working into headphones, there was 10V rms available from an impedance of 270 ohms, which should be suitable for any common headphones. A brief resume of the monitor amplifier performance is as follows: the power available into 8 ohms was 11.5W 1 kHz rms sinewave with one channel driven or 10.4W with both channels with the available power increasing as the load impedance decreased—therefore no problems with awkward 8 ohm speakers. Harmonic distortion at 1W into 8 ohms was exceedingly low and CCIF intermodulation distortion was always less than 0.9% in the audio band, with its peak at 5.3 kHz. Amplifier noise was well below tape noise, so all round the amplifiers are more than adequate as monitor amplifiers.

### Other matters

As shown in fig. 10, the phase jitter between

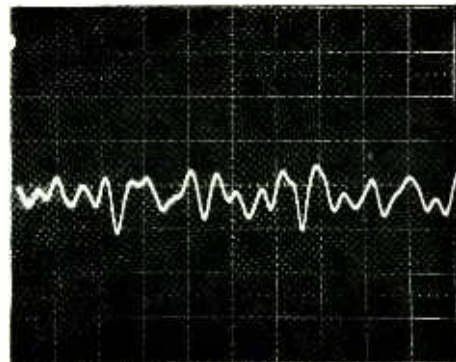


FIG. 10  $\pm 36^\circ$  Fsd  $\cdot 5s/div$ , 10 kHz 38 cm/s

tracks was unusually low, with a peak to peak deviation of only  $14^\circ$  or so with a 10 kHz recording at 38 cm/s.

The two vu meters were found to be genuine instruments to the ASA (Bell) specification with a more than adequate range of adjustment of the zero vu point.

### Summary

The Ferrograph *Studio 8* is by many standards a very cheap studio machine, but its performance and general facilities are by no means in the 'cheap' bracket. Performance figures quoted by Ferrograph do not do justice to this recorder, which is capable of making full use of the latest low noise and high output tapes.

Probably the main shortcoming of this machine is that because it is also available in a portable version it has been made small, with the result that many parts are none too easy to reach for maintenance. However, it is a solidly built machine which is the product of substantial research, and it should therefore be reliable.

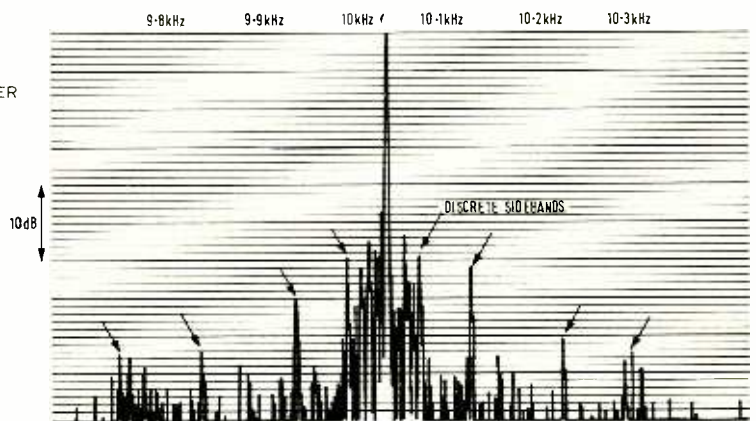
A great advantage of this machine is the fact that it is available in so many configurations, so that the cost for a particular application can be kept to a minimum. ■

*It had been intended to publish a review of the Telefunken M15A along with those of the Ampex and the Ferrograph; however, lack of magazine space prevented this. It will now appear in the next possible issue.*

FIG. 9

STUDIO 8  
SCRAPE FLUTTER

ANALYSIS OF 10050 Hz  
RECORDED TONE  
3-16 Hz BANDWIDTH



# Classified Advertisements

Advertisements for this section must be pre-paid. The rate is 14p per word, minimum £2.80. Box Nos. 35p extra. Semi-display rates on application. Copy and remittance for advertisements in November 1976 issue must reach these offices by 19th September 1976 addressed to: The Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA.

**Note:** Advertisement copy must be clearly printed in block capitals or typewritten.

Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality. **SEX DISCRIMINATION ACT 1975:** No job advertisement which indicates or can reasonably be understood as indicating an intention to discriminate on grounds of sex (e.g. by inviting applications only from males or only from females) may be accepted, unless (1) the job is for the purpose of a private householder or (2) it is in a business employing less than six persons or (3) it is otherwise excepted from the requirements of the Sex Discrimination Act. A statement must be made at the time the advertisement is placed saying which of the exceptions in the Act is considered to apply.

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Tel: 02813 84409

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★Fanfare Records. Tape-disc pressings, demo's, masters, any quantity. Studio/mobile Neumann disc cutter. S.A.E. brochure. 1 Broomfield Close, Rydes Hill, Guildford. Tel. 0483 61684. X

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★Your Tapes to Disc, Mono or Stereo cutting. Vinylite pressings, Sleeves/Labels. Top professional quality. S.A.E. for photo leaflet. Deroy Records, "Eastwood", Cove, Dunbartonshire, Scotland. X

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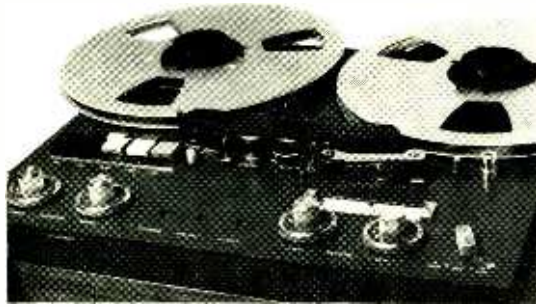
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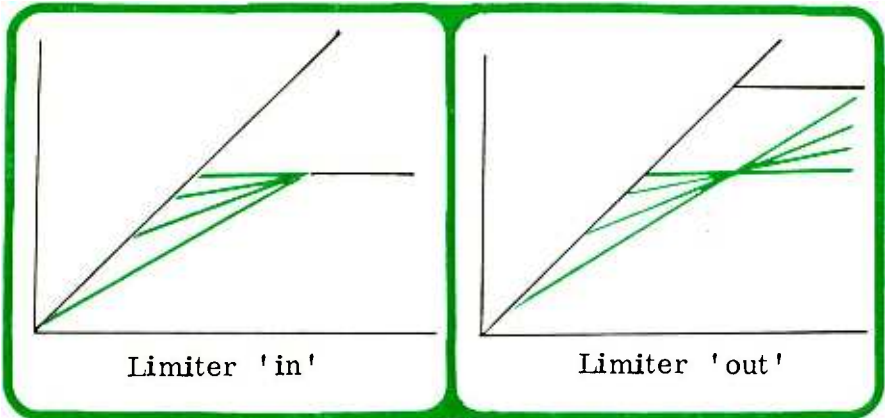
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- \* SUPERB DYNAMIC PERFORMANCE



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