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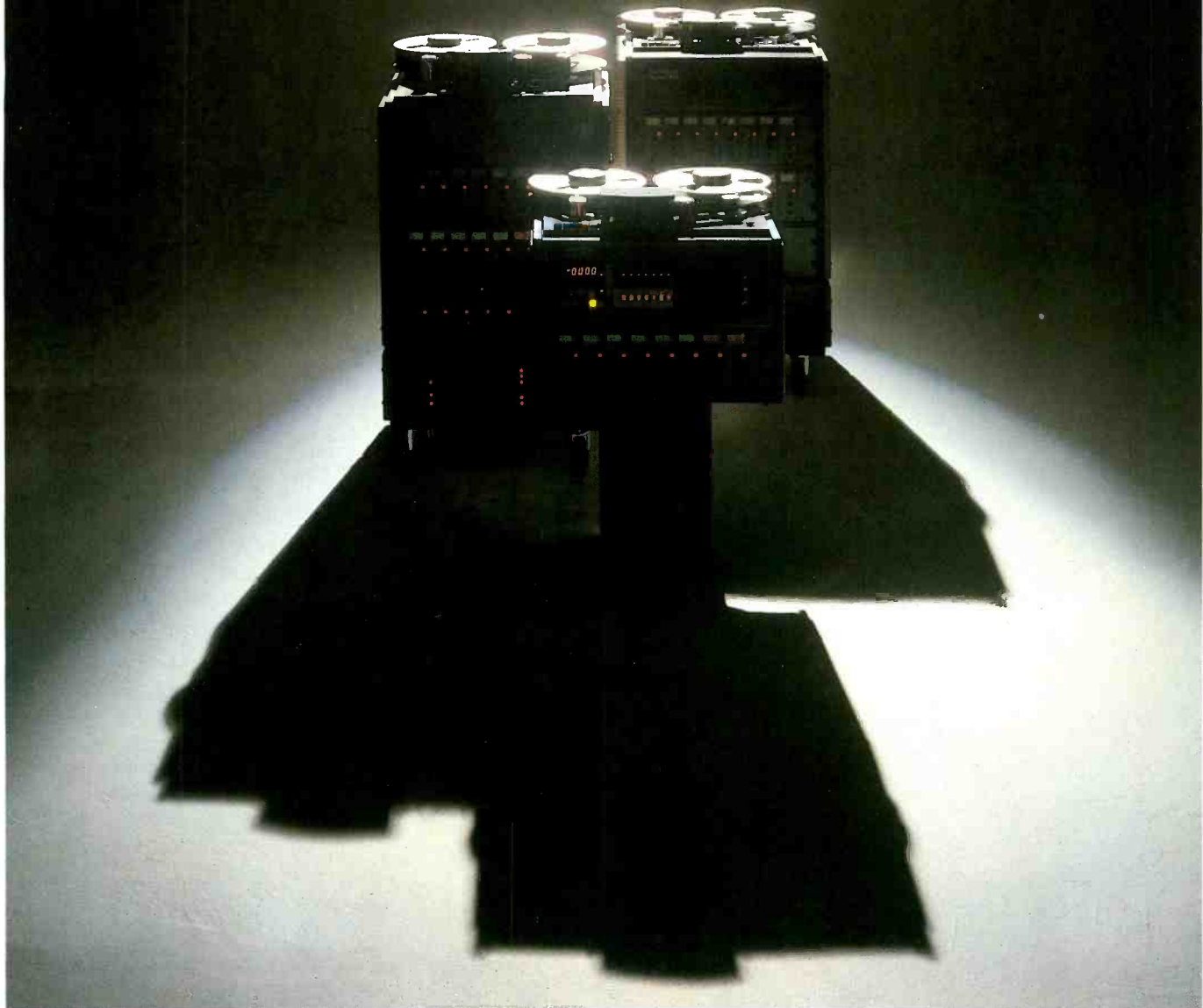
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# STUDIO SOUND

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## SPECIAL FEATURES

**42** **Machine control:** Jim Smith and Antony David of Solid State Logic outline the criteria to be considered when designing tape machine control systems

**48** **Tape machines:** Details of some of the latest products available

## REGULARS

**5** **Editorial:** With so many format changes likely as the digital generation evolves, can you be sure you'll be able to revive those oldies in two or three years' time?

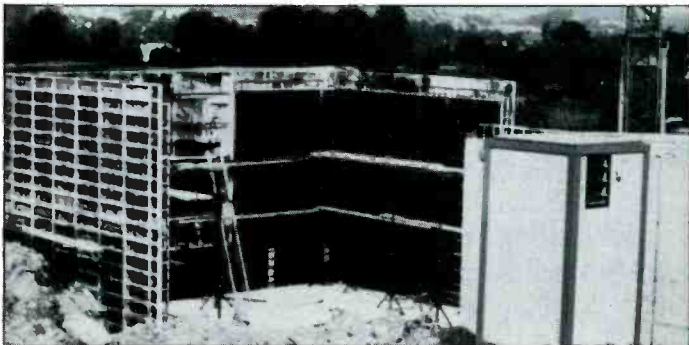
**34** **Diary:** Channel Four frequency fears—AES news—Address changes—TFA with Dylan at Wembley—Literature received—More Gateway courses—Forthcoming events—Contracts—Agencies—APRS column—People

**38** **New products:** Fender miniature mic—Furman Sound quad noise gate—The SynthAxe—First aid kit—Otari options—Phoenix Systems L-R+delay—Shure SM87—PZMs from Crown—Lexicon 1200C modification

**52** **Business:** Be warned—The meeting of the ways—Radio free-for-all. By Barry Fox

**58** **Studiofile:** Powerplay, Zurich—Music Works, London

Powerplay under construction



## FEATURES



**54** **United Western, Hollywood:** Founded in 1958, this facility is well versed in every aspect of sound recording. Music, film scores and jingles present no problems. Bob Anthony takes up the story

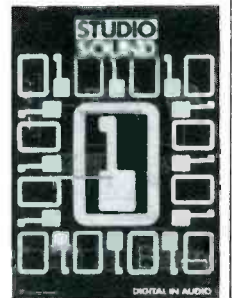
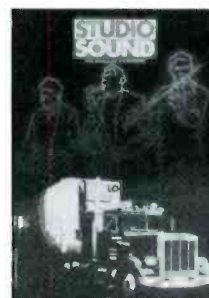
**64** **Handling and storage of tape:** Hugh Ford gives advice on how to look after your tapes

**74** **Factor on record:** Early morning interviews are not everyone's idea of fun but Terry Nelson and Eventide Clockworks' founder Richard Factor seemed to get on quite well

**78** **Insights:** Views from Richard Elen on fashions in owning mixing consoles, and new CD pressings

**80** **Ergonomic aspects of mixing console design:** Part two of Gerard Paul Hodgkinson's article

**96** **Index:** Your guide to Studio Sound features, etc, during 1984



### EDITORIAL

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December 1984 Number 12  
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# Graham Gouldman has recorded in the world's best studios.

(That's why he recorded his latest album at home)

Graham Gouldman, as a leading member of 10cc, has recorded in many world-famous studios, and certainly knows what makes a good recording, and also when he's achieved one. "But," he says, "I've always felt that the most creative recording environment is at home, in one's own space and in one's own time."

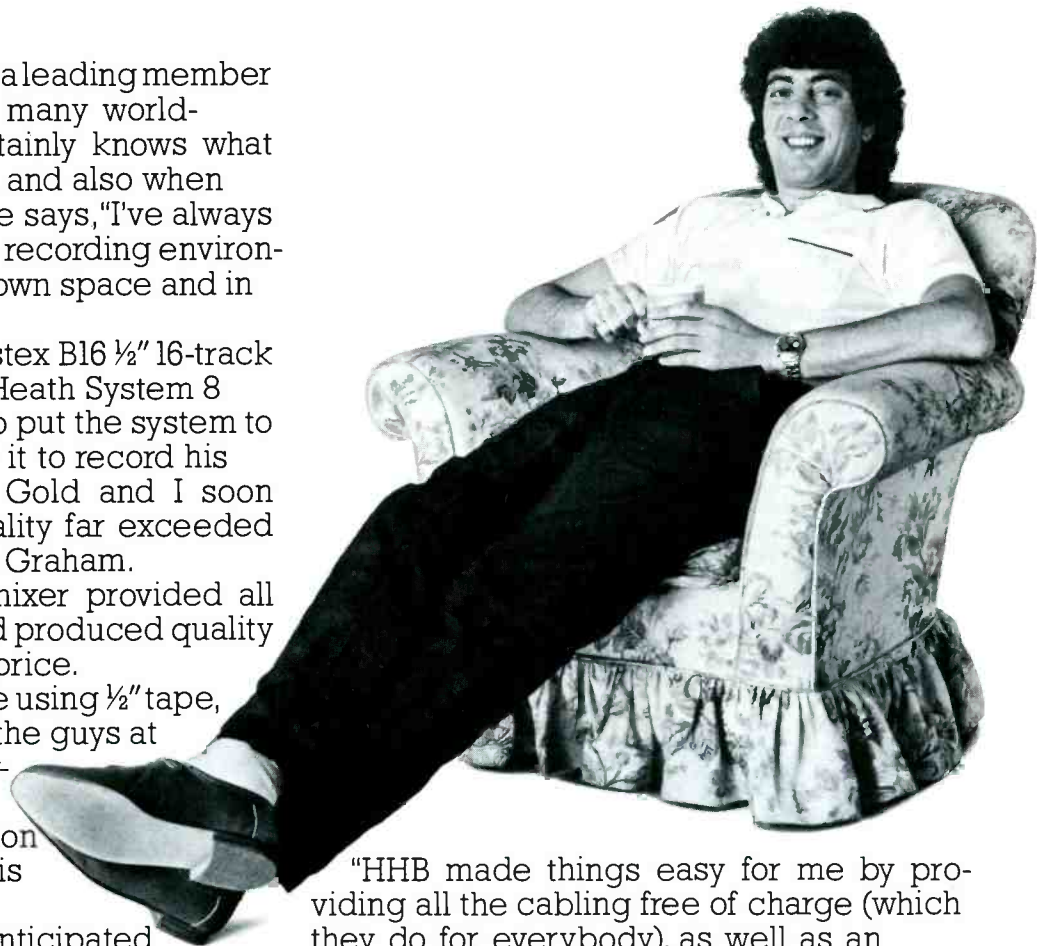
When he bought a Fostex B16 ½" 16-track recorder and an Allen & Heath System 8 16/16 mixer, he decided to put the system to the ultimate test and use it to record his current album. "Andrew Gold and I soon found that the sound quality far exceeded our wildest dreams," says Graham.

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# EDITORIAL

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This month's comment from Keith Spencer-Allen

## Format-A-Go-Go

Without wishing to strike an overtly reactionary pose, there are times when some aspects of past years of sound recording look decidedly more appealing than the rather uncertain technical directions of the future—for all the technical improvements and excitements in store.

A short walk around the tape vaults of a major record company or the tape library of any of the longer established studios will demonstrate one aspect of this. Virtually all the tapes that were used to master discs from will be easily replayable—even those of 25 to 30 years old provided the tape itself has stood the test of time. At worst there may be slight problems with the equalisation curve, speed, level or noise reduction system—most of these are fairly easy to cope with or allow for. They will all be playable to a certain degree and given time it would be possible to make adjustments to optimise the replay. These tapes could have been recorded almost anywhere in the world and there would be little in the way of major problems.

The original recordings in all their various formats would pose a little more of a problem—machines with 3-track, 4-track 1 in; 12-track, etc, are a little harder to find although if you really need one, it is possible, or there will be some manufacturer that will make heads to allow adaptation of a standard tape deck. They are possible to replay although there may be the odd exception to this rule.

If we look forward in time, how many of the non-analogue recordings made in say, the last week, will it be so easy to replay in five, 10, 15 or 30 years time. You may say you will copy across to the new format all those tapes that might be needed in future but is that economic, practical or even likely to happen? Future recording formats, ie digital, may differ widely if we extrapolate from the current situation. On the other hand they may not change at all but it is not really the audio electronics side that will present the greatest difficulty.

At present we are using video recorders for the information storage medium and it may be that these machines in their differing formats will be the problem area. Almost all the manufacturers of these recording systems have long backgrounds within the consumer field and histories of ceasing production of certain systems when demand is deemed to be insufficient. The numbers of VHS, Beta (against the consumer field) and U-matic type (against the video industry) machines used within the pro-audio market is very small. Should the demand within the principal markets change, there is no reason to believe that the companies involved would maintain production for the small quantities consumed by the pro-audio market. It is a situation that is not without recent parallels.

Should you find yourself in the position of trying to replay yesterday's recording in 25 years time, the problems you may face will quite likely be far more than just track spacing/tape width and needing far more than a pair of custom made heads—more a complete working machine.

It may be that the introduction of 2-track digital machines is the way out of this potentially tricky situation as at least the manufacturers are not selling the unit in large quantities outside the pro-audio market. This means the user can be more certain that format availability will reflect professional demand rather than be at the whim of demand outside the industry.

The variety of formats is becoming greater and although the DASH format has brought a degree of rationalisation to some aspects of the reel-to-reel digital format debate, the mastering standards are still expanding, although for commendable reasons, JVC are promoting the use of VHS systems with their VP-900 system as a longer playing time version of a normally U-matic based system. The dbx 700 system is being used with all manner of video systems. We are developing a proliferation of standards that parallels (or is worse than) the video industry except they (the video industry) really don't know any better never having been in the worldwide compatibility situation that used to prevail within the pro-audio industry.

There is little I can say that will have any great impact on standards or compatibility or reverse the directions in which we are headed—even if I wanted to—however I do suggest that after having adopted a format for mastering, always ask yourself how you might handle recordings made within it, in 25 years time. And remember that unlike the subject of many of these editorials, this concerns the complete span of pro-audio industry thanks to Sony's financially democratic PCM F1.

On a slightly different topic, it is a pleasure to welcome the new generation of analogue tape machines whose introduction next year will hopefully realise their manufacturer's opinion that there is still plenty of room for a whole new generation of mastering machines. This is particularly welcome, since it did appear that 18 months ago we were going to be stuck in a limbo between a too-fast declining choice of analogue tape machine manufacturers and a financially unsuited digital alternative. The cost of this new generation appears to be far higher than we are used to for analogue machines. I will however leave you to decide whether this is due to the cost of refinements necessary to squeeze the remaining greater performance out of the analogue system; or to accustom us to the type of cost that the digital inevitable will require.

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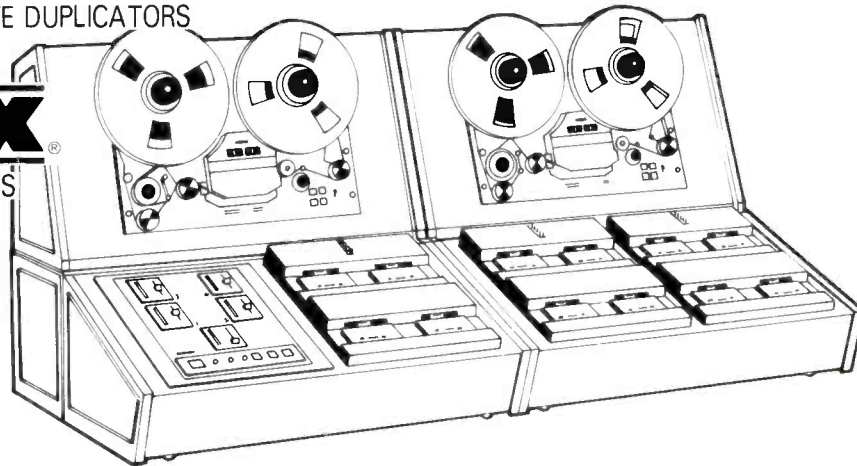
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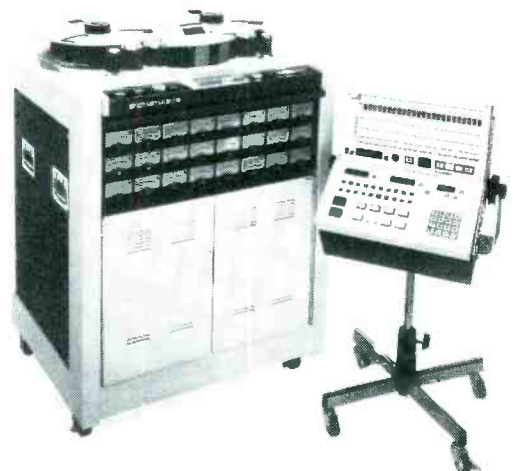
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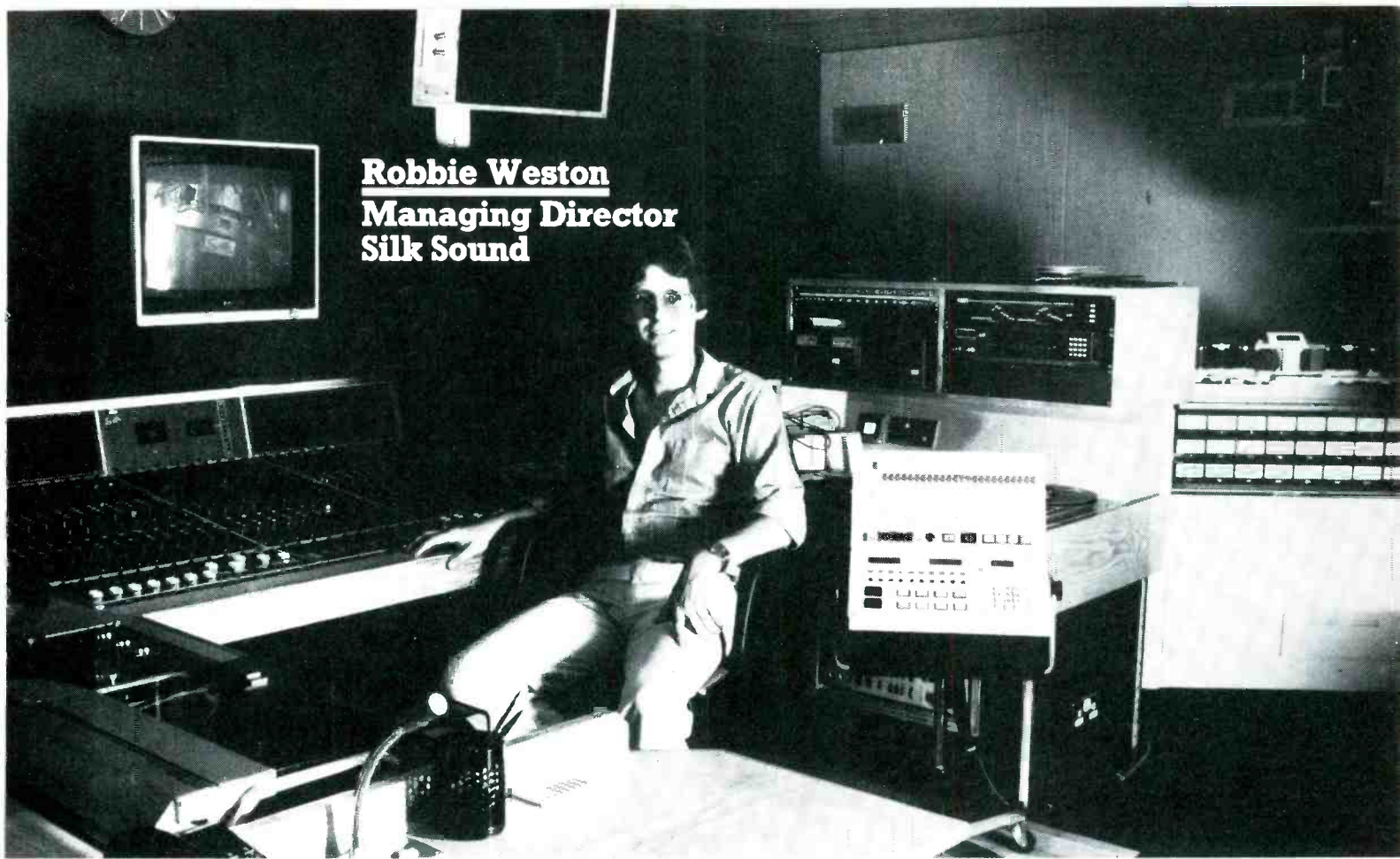
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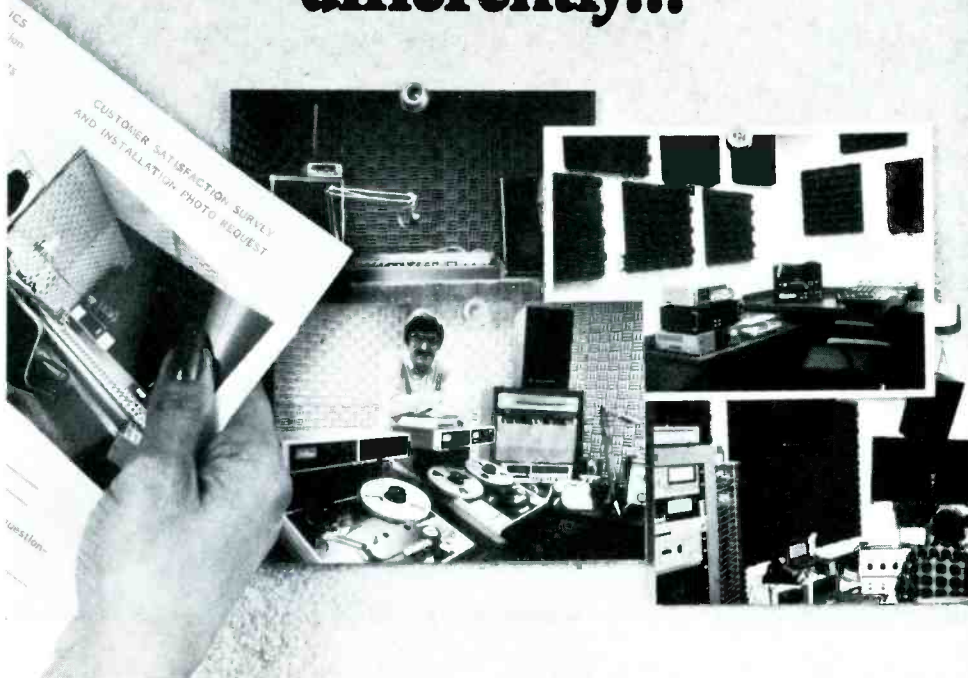


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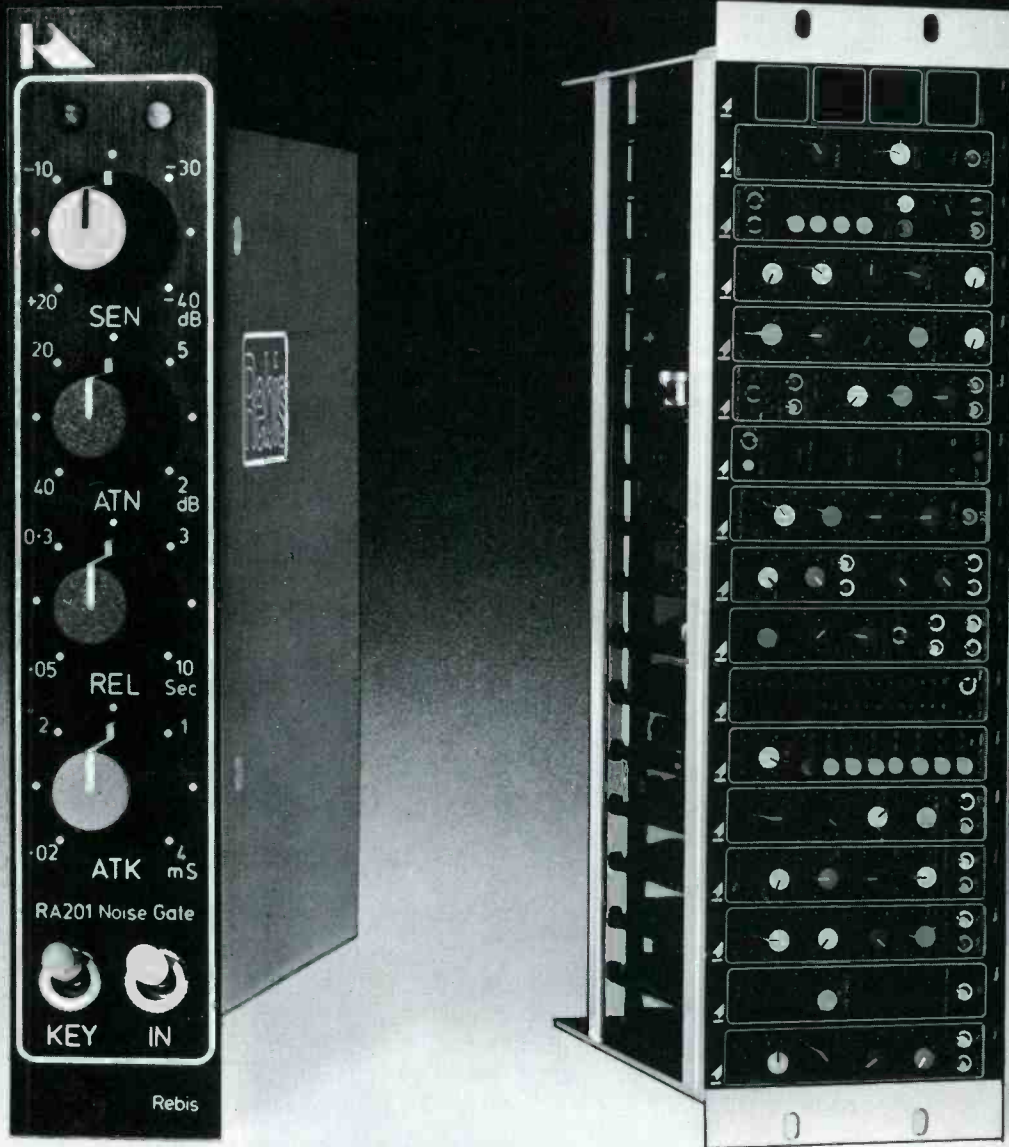
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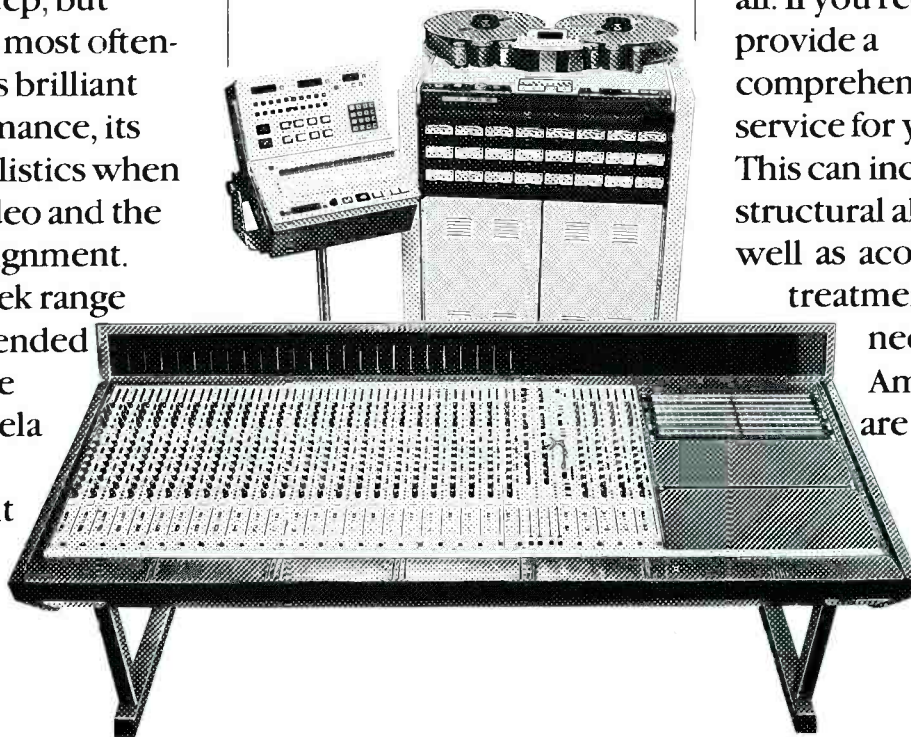
ITA can supply you with both an MTR90 and an Angela but that's just the start. We specialise in putting together complete systems for every application. This can include monitoring,

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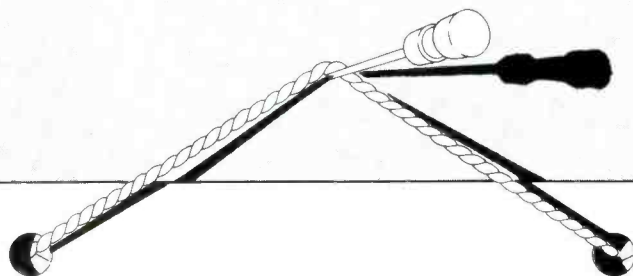


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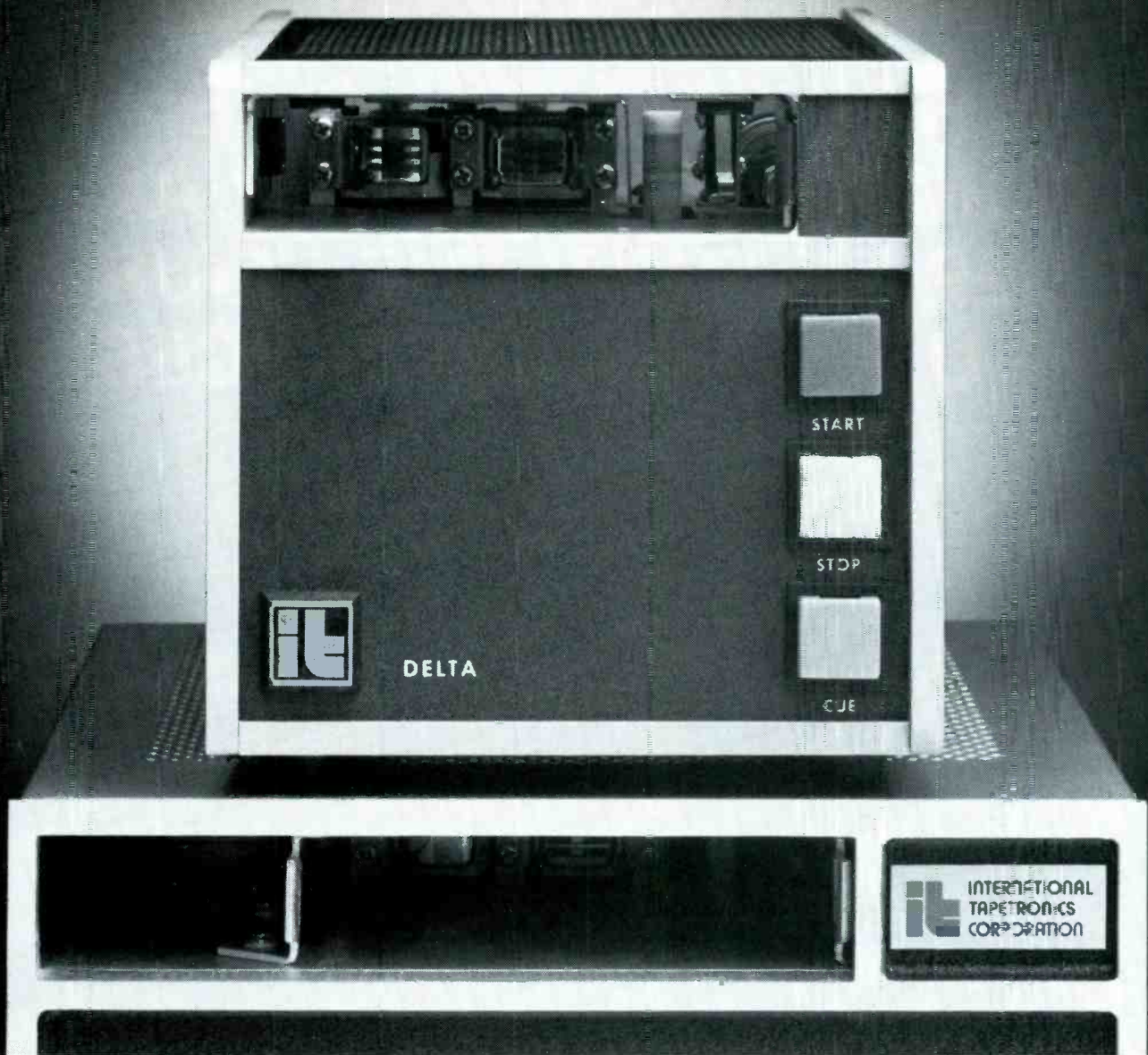
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Of modular construction, Delta Series units are easy and convenient to align and service. Sound quality is optimum,



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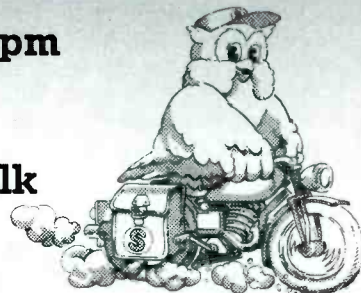


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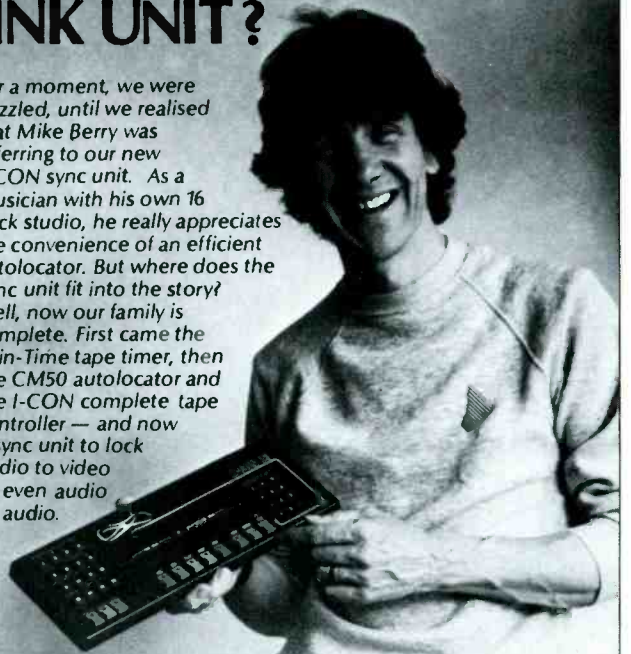


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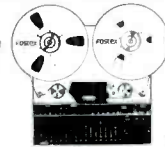
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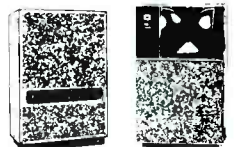
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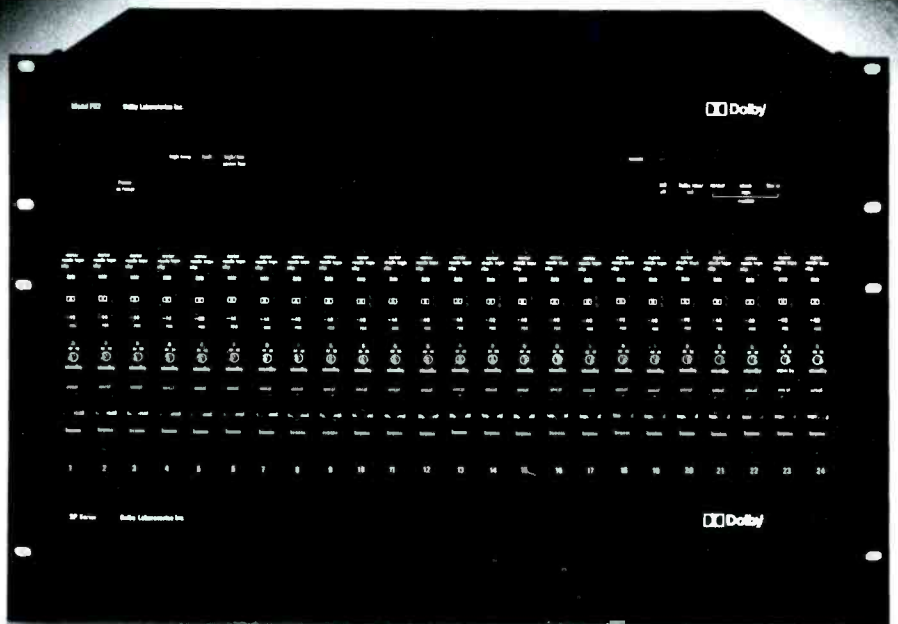
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For further information on the SP Series and other professional noise reduction equipment, contact Dolby Laboratories.

### Highlights of the Dolby SP Series:

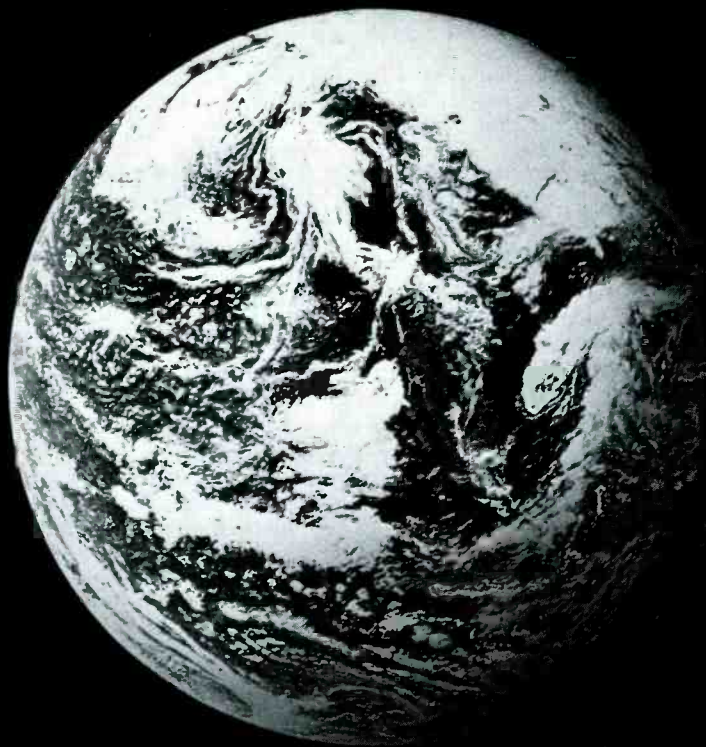
- Up to 24 tracks in only 12¼" of rack space, including power supply.
- Dolby A-type noise reduction characteristics utilizing standard Dolby Cat. No. 22 modules.
- Separate regulated power supply unit with electronically-controlled output protection.
- Low-noise fan cooling.
- LED display for each track permits accurate Dolby level calibration (within ±0.1 dB if desired) by matching intensity of LED pairs; further LEDs

indicate the presence of signals and clipping, and assist alignment with high-level reference tapes.

- Front-panel "UNCAL" control for each track permits rapid resetting of Dolby level for playback and punch-in on nonstandard-level tapes, then instant restoration of preferred preset studio Dolby level without recalibration.
- User-selectable option of "hard" or electronically-buffered bypass of individual tracks and of all tracks simultaneously.
- Snap-fit connectors on rear panel for rapid disconnection and reconnection.
- Balanced and floating input stages.
- Output stages drive either single-ended or balanced 600-ohm loads at levels up to +28 dB (19.5 V) before clipping.
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# DIARY DIARY

Addresses, events, AES, training

## Channel Four frequency fears

Channel Four, Britain's newest independent television channel, is worried that it may be unable to make some programmes unless independent producers can obtain new frequency allocations for their radio microphones.

At the moment independent producers usually rent their radio mics from equipment hire companies. However, these operate on spare frequencies inside band III (174 to 225 MHz) which will almost certainly be allocated to mobile radio when 405-line TV closes down in January 1985. Because of the difficulty in obtaining licences, many companies have been forced into DIY frequency allocation in contravention of the Wireless Telegraphy Acts.

A joint study group of the Department of Trade and Industry's Radio Regulatory Division (RRD), the BBC (British Broadcasting Corp) and the IBA (Independent Broadcasting Authority), has proposed that there should be

six blocks of frequencies for radio mics in band III, each 700 kHz wide, providing 18 channels. The study group also wants a 4 MHz allocation in band I (41 to 68 MHz), providing a further 19 radio mic channels.

Unfortunately, because of the snail-like pace of Whitehall, the study group calculated the demand for radio mic channels long ago, when Channel Four and cable TV were not operating, so the study took no account of the needs of independent producers. The proposed 37 channels are for the exclusive use of the BBC, ITV and Independent Local Radio.

The Independent Programme Producers' Association is calling on hire companies to form a group to press the RRD for a radio mic allocation. Non-broadcast users of radio mics, such as theatres, clubs and PA companies, are also seeking an increased allocation: at the moment they are limited to very low power in the band 173.6 to 175 MHz.

## AES News British Section moves

The British Section of the Audio Engineering Society has moved from its Sevenoaks home to offices shared with Minim Electronics Ltd. The new address is: AES British Section, Lent Rise Road, Burnham, Slough SL1 7NY. Tel: 062 86 63725.

## Educational Foundation

The recently chartered AES Educational Foundation has named the first three recipients of grants for graduate studies in audio engineering and related fields. They are: James M Mastracco, presently lecturer in physics and acoustics at Rensselaer; N Charles Podaras, currently on the technical staff of Bell Laboratories; and Anthony J Romano, currently enrolled in the graduate programme in acoustics at Pennsylvania

State University.

The AES grants will be awarded annually. Completed applications (including supporting faculty recommendations) are due no later than May 1 each year. Further information may be obtained from the Foundation offices, 60 East 42nd Street, New York, NY 10165, USA.

## Lectures

The British section has announced the following lecture programme: **December 11** Active Loudspeaker Systems—Bob Stuart, Boothroyd/Stuart (Meridian); **January 8** Some Aspects of Digital Sound Recording Techniques—Tony Griffiths, Decca International; **February 12** Music Sound Synthesis—Fairlight; **March 12** A Critical Look at the Audio Scene, and Some Ideas—Peter Baxandall; **April 9** Digital Audio Processing—Dr Roger Lagadec; **May 14** A Digital Audio Stationary Head Tape Recorder—Sony Broadcast; **June 18** Satellite Television—IBA.

## Address changes

● Audio Systems Components have moved to new offices in Berkshire. The full address is Audio Systems Components, 4a King Street, Mortimer, Berks RG7 3RS, UK. Tel: 0734 333100.

● PRS has opened up a Scottish office in Edinburgh. Initially this office will limit its activities to licensing

operations, although some specialised licensing activities will still be attended to in London for the first few months. Head office will also continue to deal with membership and distribution.

The new office is at Miller House, 18-20 George Street, Edinburgh EH2 2PF. Tel: (031) 226 5320.

## TFA with Dylan at Wembley

In the 'We're only human department' we have to make amends for errors in the above article which appeared in the November issue.

In the first diagram on page 36, items F and G should have referred to 'Boxes' not 'Boses'.

On page 37, column 3, line 25, should have read 'connectors. Debalancing boxes.'

Page 37, column 4, line 31, should have read 'purple boxes, multicoloured'.

Page 42, col 2 line 80, should have read 'C3—two E-V 15L (ported), two'.

We apologise for any typographical errors which may have confused readers.

We would also point out that Santana's monitor desk is an *Electrotec* not a *Series III*.

## Literature received

● From AB Engineering Company, 34 page catalogue listing nearly 500 tools. AB Engineering Company, Timber Lane, Woburn, Milton Keynes MK17 9PL. Tel: 052 525 322.

● From Peavey Electronics the latest issue of their *Monitor* magazine, with interviews, features and equipment advice and equipment catalogue. The magazine may be obtained free of charge from Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX and (USA) Peavey Electronics Corporation, 711 a ST./PO Box 2898, Meridian, MS 39301. Please send A4 SAE.

● Brüel & Kjaer have

produced a 10-page booklet of application notes entitled *The Use of B&K Omnidirectional Microphones for Modern Recording* by David Rideau.

The applications discussed include vocals, acoustic piano, percussion, strings, wind instruments, guitars and drums. This is followed up with a look at 'special applications and considerations'.

Brüel & Kjaer (UK) Laboratories Ltd, Cross Lances Road, Hounslow, Middx TW3 2AE, UK.

USA: Brüel & Kjaer Instruments Inc, 185 Forest Street, Marlborough, MA 01752.

## More Gateway courses

Gateway, having established their multitrack courses are planning to expand. They would like to hear from anyone interested in synthesiser courses with a view to how they would wish a course to be structured, and what information they would like the course to give.

It is intended to incorporate as much hands on experience as possible. Ideas should be sent to Gateway, 1a Salcott Road, London SW11 6DQ.

## Forthcoming events

● November 21 to 24 13th Tonmeisterstagung, Munich, West Germany  
● November 29 Sound Broadcast Equipment Show, Birmingham, UK

### 1985

● January 28 to February 1 MIDEM '85, Cannes, France  
● March 5 to 8 AES Convention, Hamburg, West Germany  
● February 19 to 21 Sound Eighty Five, London, UK

# 360 Presents the Best Acoustic Instrument Sounds in the World

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**I**ntroducing a keyboard that doesn't synthesize its sounds – it duplicates real ones. Imagine strings with the rich sound that only the best acoustic instruments have. Now you can have them, and almost any other sound you can think of. We've recorded a whole catalog of instruments in the studio and stored them on digital memory chips. They're as real as the master tapes they're made from. Now you can cut your album, score your film, or perform live with some of the world's most impressive sounds.

The 360 Digital Keyboard is eight voice polyphonic, and holds up to thirty-two instruments. You can even play two instruments at once – two under each key, or divided by a player-selected split point. We've included vibrato and pitch bend wheels, filtering, and an expression pedal so your performance can really come alive.

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as many or as few as you want: it's always expandable, and you can add new instruments yourself at any time. Check our current Available Instruments List to find out what's deliverable now.

The sound of the 360 Digital Keyboard is unlike any other because we use full-length notes (some are eight seconds long) with no looping, no audible transpositions and no synthesized envelopes. L.A.'s top session players are called for our sessions, and we engineer their performances under tightly controlled studio conditions.

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Telex: 826967

*360 Systems*

# DIARY DIARY

Contracts, agencies, APRS

## Contracts

● MetroGnome, the Nashville based software firm, has supplied two software packages to the University of Colorado for use in their music business management courses. The packages are 'Sessions Plus' and 'Catalog Plus'.  
● The Audio Kinetics MasterMix Console Automation System has recently been supplied to a number of studios including Polar Music in Sweden (on their new Calrec console); Surrey Sound, Olympic Studios and Marcus Music in the UK (on Harrison MR4, Raindirk

and Harrison MR3 consoles). Two Q.Lock synchronisers have been supplied to RAI in Italy.

● Digital Entertainment Corp has supplied a Mitsubishi X-800 32-track and two X-80A 2-track mastering machines to The Village Recorder, California. They also announce the first X-800 machine available in New York: Clinton Recording have completed installation of Mitsubishi digital audio equipment including an X-800 32-channel multitrack and an X-80A.

## Agencies

● Klark-Teknik have appointed Expotus Ltd to coordinate the sales for the West German market where distributorship has been allocated as follows: Amptown Electroacoustics GmbH, Wandsbekerstrasse 26, D-2000 Hamburg 71; Hausmann Electronic, Berlin, Alt Tegel 12, D-1000 Berlin 27; Hausmann Electronic, Munich, Alpspitzstrasse 16B, D-8130 Starnberg 2; Studio Technik, Alter Teichweg 61, D-2000 Hamburg 70; Thum & Mahr Audio GmbH, Konrad Adenauer Platz 6-8, D-4018 Langenfeld; Peter Wolff

Enterprises, Herenerstrasse 15B, D-4350 Recklinghausen. Trans European Music of Belgium has been appointed exclusive importer for Benelux (Belgium, Holland and Luxembourg). Norway: Lyd Rommet, St Olavsgate 27, Oslo 1. Austria: Audio Sales GmbH, Neusiedlerstrasse 19, 2340 Mödling.

● Drawmer have announced the appointment of Martin Audio/Video Corp, 423 W 55th Street, New York NY 10019, Tel: (212) 541-5900. Telex: 971846, to represent Drawmer as East Coast agent and importer.

## People

● Neotek Corporation of Chicago IL, have appointed Gregory G Davis as vice president of manufacturing. Previously a production engineer with Harrison Systems, he will be involved in production capacity, delivery times, and dealer and customer service support programmes.

● Unique Recording studios in New York have appointed Pally, an African Grey parrot of impeccable background, as their mascot. His timely arrival coincides with an equipment update including a Yamaha REV-1 reverb, and a prototype Emulator II.

● Andrew S Munitz has been appointed eastern regional manager for Sony Professional Audio Division and will coordinate sales to the broadcast and OEM markets.

Mr Munitz has been involved in studio design and

construction, sound engineering and film production, and most recently was western regional sales manager for BGW Systems. He will be based in Sony's regional offices in Paramus, New Jersey.

● Two more new appointments at Sony Professional Audio Division: Richard Lee becomes national product and systems manager, and Scott Spector becomes engineering manager/digital audio west coast.

Mr Lee was, most recently, vice president/general manager of Criteria Recording, Miami; Mr Spector previously technical supervisor with Sony's Video Communications division.

● Joiner-Pelton-Rose, Dallas based consultants in acoustics, have appointed Cecil Smith to be responsible for all telecommunications and video design projects. □

## APRS COLUMN

After a decade as a reliable and successful annual event the APRS Engineers' Course at Surrey University is very much part of the recording industry diary in the UK. It's hardly surprising that no-one these days asks why a mature industry, requiring large numbers of technically competent personnel, still relies to a great extent on its trade association to provide a training course—and one which cannot, and does not attempt to be anything other than a densely packed refresher for those who have already entered the industry in one capacity or another.

Although there are some excellent short courses being run by individual studios, and the new maintenance-biased engineering course at Salford College is just into its second year (and of course the well-established Tonmeister Course also at Surrey University) the annual week-long APRS course still stands alone in offering the kind of teaching and practical demonstrations that studio engineers need.

APRS Education Subcommittee chairman Clive Green, who annually has the mammoth task of organising and running the course, would like everyone to give a little thought to why this should still be so.

Speaking to a full house of students (the full 45 plus one, in fact, because a last minute place was found for an engineer making a rare visit to England from his home in India) at the end-of-course dinner, Green commented: "The APRS is a trade organisation, and we get involved in this education work because no-one else is doing it. We protect the interests of the businesses which are our members, and we believe it is to the

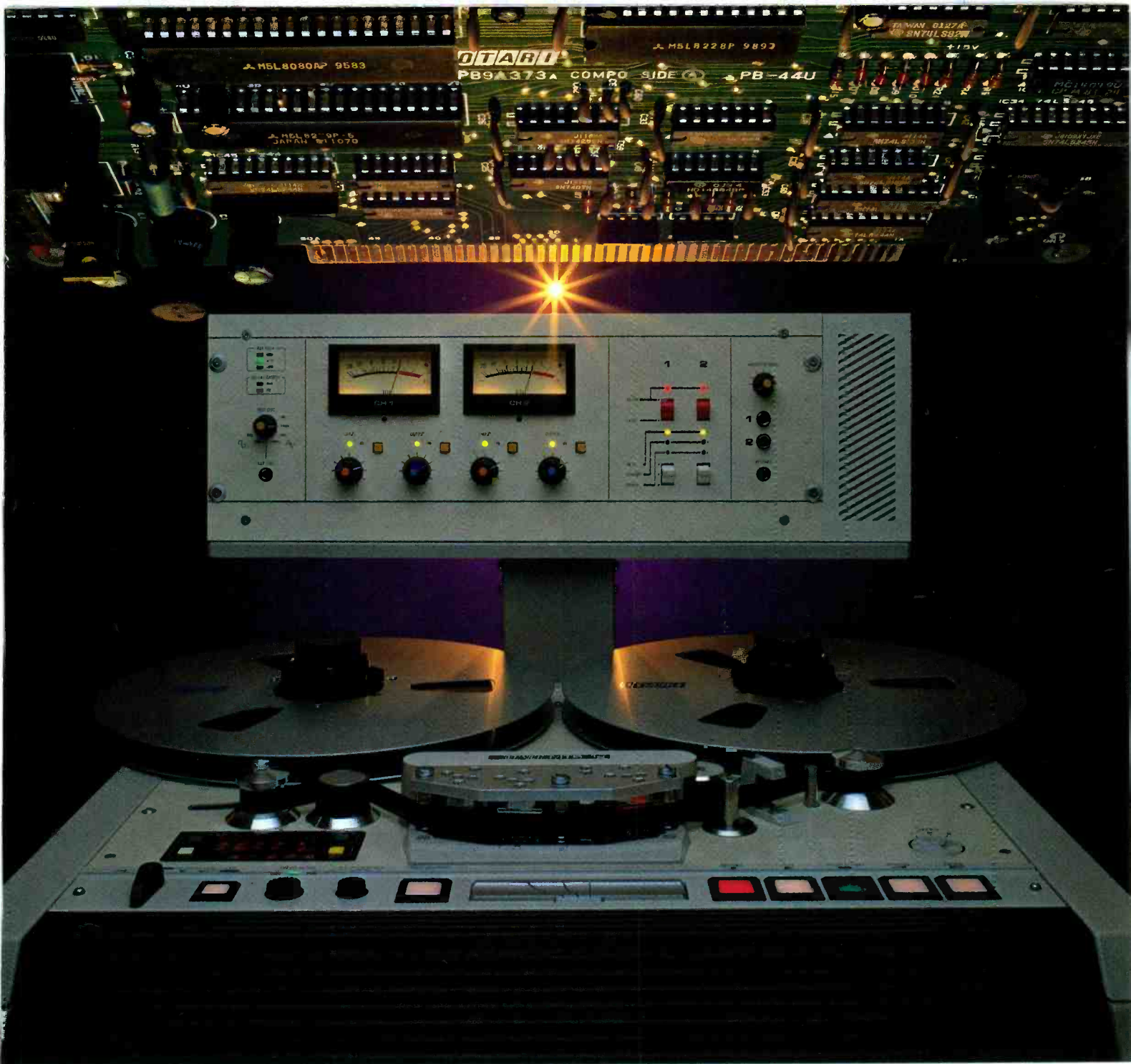
commercial advantage of those businesses to have better trained engineers."

Again he stressed a point which he has made before—and with which many of the studio industry professionals agree (without knowing how to begin doing anything about it), which was—"What we need in this country is a permanent establishment for the training and retraining of engineers; we need a professional institute for this purpose."

Despite the unfortunate clash of dates with the International Television Symposium in Montreux next June, the APRS 85 show will go ahead on the planned dates of June 12, 13 and 14, at Kensington Exhibition Centre. The APRS show dates were fixed before the Montreux show dates were announced, and it was then discovered that the two events ran consecutively, without any break in between to allow manufacturers to bring equipment back from the first in order to set up at the second. It proved impossible to alter the dates of the APRS show (even though the changing of the venue was considered) to any other reasonable time. While the APRS is aware of, and much regrets, the problems that this coincidence of dates will cause there is strong hope that the usual major exhibitors will be at the UK show—and that the generally excellent turn-out of visitors can be counted on.

APRS will again be running a joint venture with the BOTB to sponsor UK companies wishing to exhibit at next year's AES show in Hamburg (March 5 to 8). Interested parties should contact APRS secretary Edward Masek.

Sir Georg Solti, a past president of the Association since his resignation brought George Martin into the presidency, will be celebrating the 25th anniversary of his first recording of *Der Rosenkavalier* by conducting a new production of the opera at Covent Garden on December 4. Some opera loving APRS members who are saving up for seats are expecting a night to remember. □



## THE OTARI MTR-12 SERIES

# *The Super-analogue Mastering Recorders*

The fully microprocessor-controlled MTR-12 Master production recorders are now available in all professional 1/4" and 1/2" formats including the new 1/4" two-channel with time code SMPTE/EBU centre track configuration and Nagra\* compatible mono and stereo Pilotone\* versions.

Based upon the advanced design of the acclaimed MTR-10 recorders, the new MTR-12 Series feature expanded 12.5" reel capacity. Interface provision for time code based video editing systems, tape machine controllers or synchronizers have been augmented to now include an optional plug-in resolver module (Model EC-402) for film and video applications. In

addition, a DIN head version and 10 memory, full-function autolocator are available.

To receive comprehensive data and price details, or to arrange a demonstration, ring one of our authorised dealers now or contact us directly on 0735-822381.

Otari Electric (UK) Ltd., Herschel Industrial Centre, 22 Church Street, Slough SL1 1TP, Berkshire  
Tel: 0753-822381 Telex: 849453 OTARI G.

#### Authorized Dealers:

ITA 1, Felgate Mews, Studland Street,  
Hammersmith, London W. 6. Tel: 01-748-9009 Telex: 21879  
TURNKEY Brent View Road, London NW9 7EL  
Tel: 01-202-4366 Telex: 25769

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Otari Singapore Pte., Ltd., 294-5370 Telex: R5 36935. Otari Electric Deutschland GmbH, Neuss, F.R. Germany 02101-274011 Telex: 41 8517691 OTEL D.

# NEW PRODUCTS NEW PRODUCTS

Equipment, modifications, options, software

## Fender miniature mic

The Pro-Sound division of Fender Musical Instruments has introduced a new miniature mic, the *M-1*. This is a mic 1¼ in long and 12 grams in weight. The polar pattern is directional with the mic having a max SPL of 148 dB.

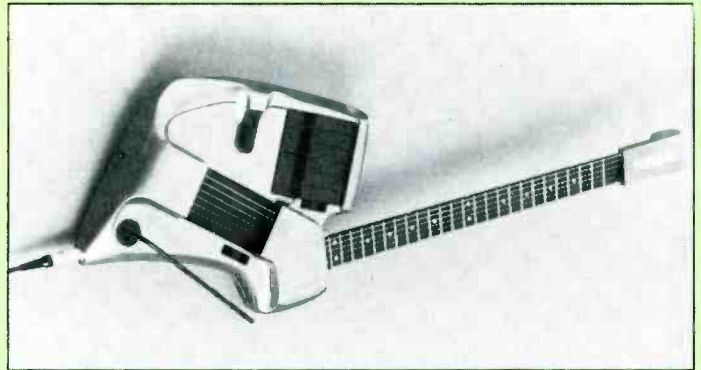
The *M-1* interfaces to mixers via a shirt pocket-sized battery electronics box which provides a switchable highpass filter in addition to a notch filter tunable from 50 to 320 Hz that is useful for feedback and resonance control. The unit will operate on internal battery or phantom power. The accessories supplied with the mic include a tie clip, foam windshield and a hard carrying case.

To make maximum use of the *M-1*, Fender are also offering mic kits that allow specialised mounting of the mic. *A-kit* includes a

detachable mic clip, a telescoping antenna section and a spring loaded clamp with rubber-lined jaws for attachment to a variety of stands and instruments; *B-kit* includes a mic holder, flexible wire for custom 'gooseneck' use, and small padded clip making the mic useful for singers; *C-kit* is designed for attachment to flat surfaces such as guitar tops. It consists of a mic holder, flexible wire and a special felt-lined spring clip which slips onto the edge of thin flat surfaces.

**Fender Musical Instruments, 1300 East Valencia Drive, Fullerton, CA 92631, USA. Tel: (714) 879 8080.**

**UK: CBS/Fender Musical Instruments, Fender House, Centenary Estate, Jeffreys Road, Enfield, Middlesex EN3 7HE. Tel: 01-805 8555.**



## The SynthAxe

*SynthAxe* is a wholly new kind of instrument controller for guitar players, which allows access to all manner of synthesiser effects which have previously been the domain, more or less exclusively, of keyboard musicians. The development project began back in 1978 when Bill Aitken, composer and producer of soundtracks for BBC Television, and Mike Dixon, senior engineer in the studio Bill was using, decided between them to tackle the limitations guitarists were faced with as regards their use of synthesisers. One of the many problems of interconnecting conventional guitars and synths is the rich harmonic structure of the guitar, which makes it difficult to achieve unambiguous resolution with frequency-sensing circuits; also, the envelope of a vibrating string severely limits the dynamic response of the synth. Clearly something radically new was required.

*SynthAxe* does not plug into a conventional guitar amp; rather, it connects directly to any synthesiser 'with an interface powerful enough to

interpret the more demanding musical codes created by the subtleties of the guitarist's technique'. The instrument senses the player's string bending, hammers, pull-offs, chromatic slides, finger and arm vibrato, left and right string damping, etc, and sends this information to the synth, either on a MIDI interface or via some other suitable computer interfacing system. Additional features available include infinite sustain, instant capo, and left-hand only automatic triggering.

Pure digital pitch-code generation is used in *SynthAxe*, which means it can never go out of tune, and the overall pitch can be transposed, and stored, under pushbutton control. The company is liaising with a number of synth manufacturers, including Oberheim, E-mu Systems, Fender-Rhodes and Fairlight, regarding the MIDI interface, and the response is apparently enthusiastic.

**SynthAxe Ltd, 34 Avon Trading Estate, Avonmore Road, London W14, UK. Tel: 01-603 0929.**



Fender M1 with C-kit



## Furman Sound quad noise gate

The *QN-4* quad noise gate features a fade time control for each of its four independent channels allowing the user to set the slope of the muting action (from fast drop off (5 ms) to unobtrusive fade (5 s)) to suit the programme material.

It is designed for use anywhere in the audio chain that a line level signal is present. Optimum results can be achieved by using a separate channel of noise gate

for each mic/input although Furman also recommends use on submix channels and entire programme mix.

*QN-4* is available with optional balanced inputs and outputs, and is also available in a 230 V, 50 Hz version. **Furman Sound Inc, 30 Rich Street, Greenbrae, CA 94904, USA. Tel: (415) 927-1225.**

**UK: Atlantex Music Ltd, 3 Caldwell Lane, Hitchin, Herts SG4 0AG. Tel: (0462) 31511.**

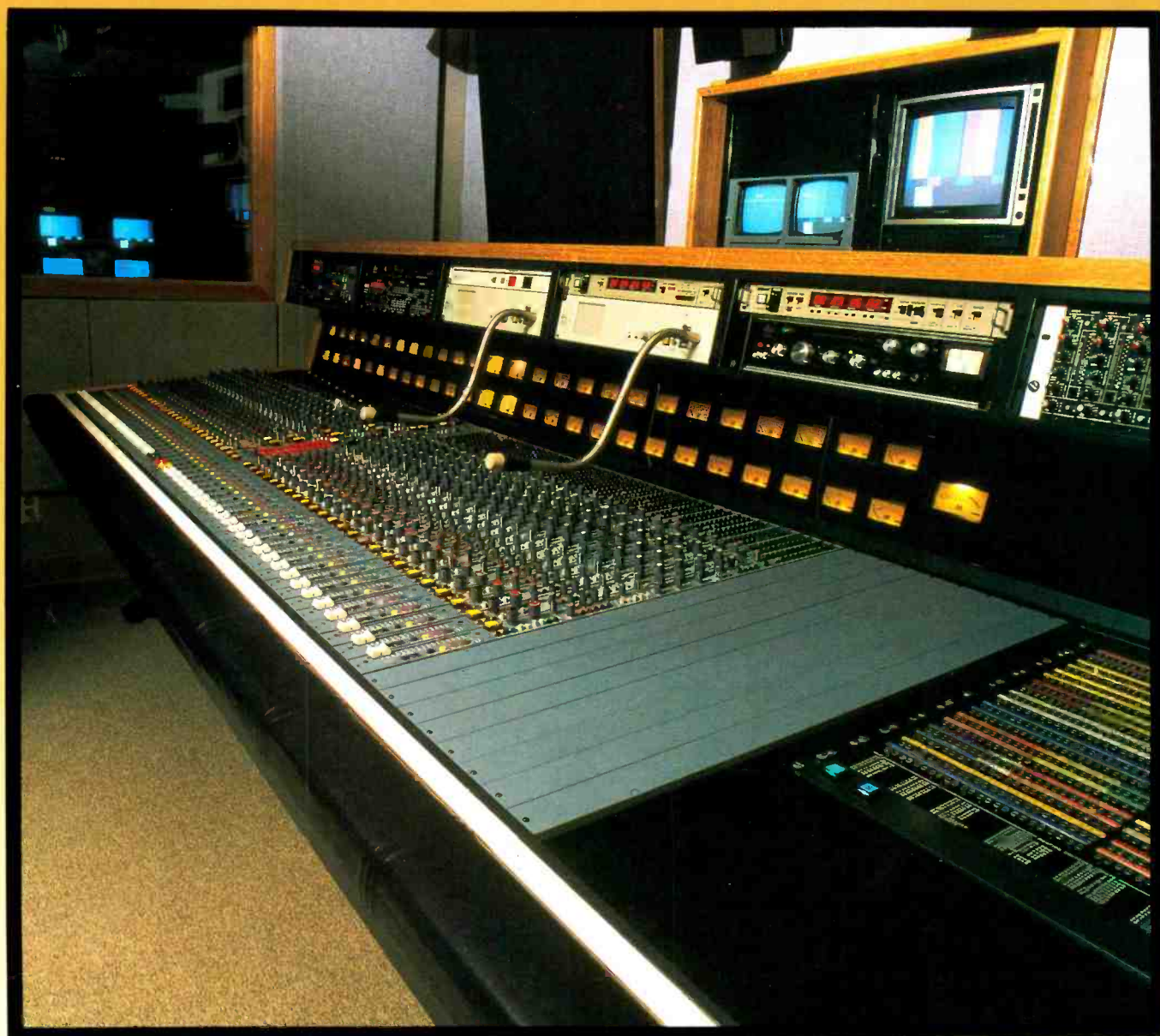
## First aid kit

Due to British parliamentary legislation in the Health and Safety (First Aid) Regulations 1981 Act, not only is every employer in Britain required to ensure that adequate first-aid equipment, facilities and trained personnel are available to his employees but *self-employed persons* are also required to have available adequate first aid equipment to 'render first-aid to themselves'.

tam have assembled a first-aid kit incorporating everything any studio or 'self-employed person' might need should they be injured or become ill at work.

There are three basic kits: 1-5, 6-10 and 11-50 (personnel) in a range of colours as well as refills for the various models. **tam, 13a Hamilton Way, London N3 1AN. Tel: 01-346 0033.**





# PARAMOUNT CHOSE AMEK

Audio control room of Stage 29 in the new \$11 million audio-video complex of Paramount Pictures, Hollywood, current home of the smash hit pop weekly "Solid Gold!"

The console is an AMEK M2500 with a 56-input chassis configured 48/48, and with special overbridge for outboard equipment. The world's best-selling mid-price console, the M2500 features the most musical and responsive equalizer available, a 4-band fully-parametric unit with swept high and low pass filters, on all i/o modules. The M2500 is automation-ready with a VCA-fader system and 10 DC subgroups.

A complete solo system, with mono and in-place solo with solo grouping facilities, gives the engineer full control at all points in the signal chain. Two metering system, either VU and LED-display with switchable ballistics and spectrum analysis, are available.

Chassis sizes range from 36-input through to 56-input, and the mechanical construction is absolutely unequalled for strength, precision and rigidity.

The choice of recording studios and post-production houses worldwide, AMEK M2500 is part of a large range of ultra-high quality audio products from one of the world's recognized leading manufacturers.

# AMEK

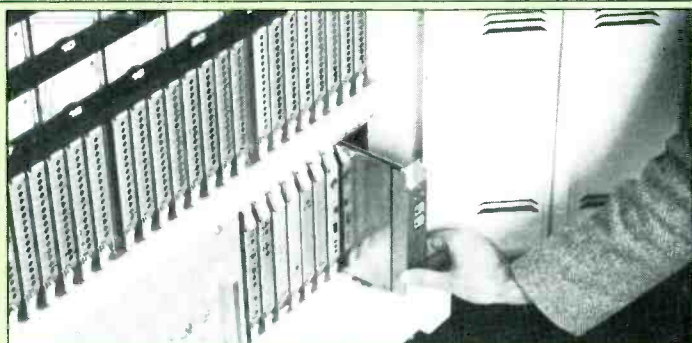
Sales office:  
 AMEK SYSTEMS & CONTROLS LTD  
 Islington Mill, James Street  
 Salford M3 5HW, England  
 tel: 061 834 6747  
 telex: 668127 AMEK G

In the USA:  
 AMEK CONSOLES INC  
 10815 Burbank Blvd  
 North Hollywood, California 91601  
 tel: 818 508 9788  
 telex: 662526 AMEK USA

# NEW PRODUCTS

# NEW PRODUCTS

Equipment, modifications, options, software



## Otari options

Otari have recently announced a number of options, versions and preliminary information on a number of new products. The first new item is an in-machine synchroniser module designed to take advantage of the capabilities of the *MTR-90* transport. The *EC-101* will plug into an empty space in the *Series II* electronics bay and will offer features that include optimisation of the synchronisation performance of the *MTR-90* transport; bi-directional frame lock from 0.2 to 2.5 times play speed; timecode only interface from the master; ability to park tape within two frames of the master; offset storage in  $\frac{1}{80}$  frame increments; *RS-232C* interface; external speed reference selectable; and a number of optional interfaces. The *EC-101* is expected to be available from February 1985.

Preliminary information has also been released on two special versions of the

*MTR-90*. The first is a low speed extended performance version for the preparation of 1 in, 4-channel bin loop duplication masters. The machine is designated the *MTR-90/II-4* and has speeds of 3% and 7½ in/s. The second is a retrofit conversion kit that allows the *MTR-90 Series II* to be used for 1 in C-format video tape audio layback. The kit includes a new head assembly, guide rollers and a capstan control servo modification card. Availability will only be on a custom order basis.

**Otari Electric Co Ltd,**  
4-29-18 Minami Ogikubo,  
Suginamiku 167 Tokyo,  
Japan. Tel: (03) 333-9631.  
Telex: J26604.

**UK:** Otari Electric (UK) Ltd,  
22 Church Street, Slough,  
Berkshire SL1 1PT. Tel:  
0753-822381. Telex: 849453.

**USA:** Otari Corporation; 2  
Davis Drive, Belmont, CA  
94002. Tel: (415) 592-8311  
Telex: 910-376-4890.

## Shure SM87

Shure have recently introduced the *SM87* supercardioid condenser mic designed as a live use vocal mic. The design is the result of many months of practical testing within the sound reinforcement industry with particular care being taken over the frequency response and the polar pattern. The result is claimed to be a mic with very high gain before feedback. It apparently also has a response that has been optimised for vocal use which in many cases removes the need for external equalisation.

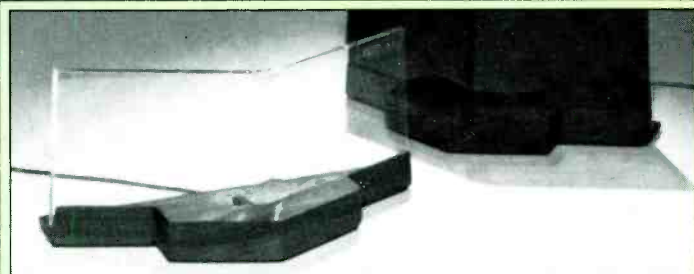
The *SM87* can be phantom powered and will operate over a range of voltages from 11 to 52 VDC, covering both DIN standard 45 596 voltages of 12 and 48 V. The mic has a built-in wind and pop filter with the



body being a rugged lightweight aluminium casing finished in grey. It will be available in versions with and without cable.

**Shure Bros Inc, 222 Hartrey Avenue, Evanston, IL 60204, USA.** Tel: (312) 866-2200. Telex: 724381.

**UK:** HW International Ltd, 3-5 Eden Grove, London N7 8EQ. Tel: 01-607 2717. Telex: 299710.



## PZMs from Crown

The *PZM 2.5* range of microphones aim to improve directional pickup, by combining a precision-calibrated pressure capsule with a nearly invisible corner boundary. Thus it captures and emphasises sounds approaching from its front whilst rejecting sounds from behind.

The 2.5 plugs into a 12 to 48 V phantom PSU and includes a transformer-balanced, low-impedance

output and an attached 15 ft cable.

Suggested applications are theatre, conferences and public speaking as it will eliminate audience noise.

**Crown International, 1718 W Mishawaka Road, Elkhart, IN 46517, USA.** Tel: (219) 294-5571.

**UK:** HHB, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Tel: 01-961 3295.

## Phoenix Systems L-R+ delay

Designated model *P-250*, this is a second generation delay enhanced ambience/surround sound decoder, and replaces the earlier *P-25* for extracting ambience from stereo sound recordings and surround sound from encoded film. The *P-250* includes a new centre channel output in addition to conventional left, right and surround, for 4-channel reproduction. It may also be used in mono mode for lo-fi

mono sources. Delay time is adjustable from 5 ms to 50 ms to match room size and speaker placement, and will drive 600 Ω lines for small theatre application.

The unit is available factory assembled (*P-250-DLA*) or in kit form (*P-250-DL*).

**Phoenix Systems Inc, 71 Old Farm Road, Tolland, CT 06040, USA.** Tel: (203) 643-4484.



## Lexicon 1200C modification

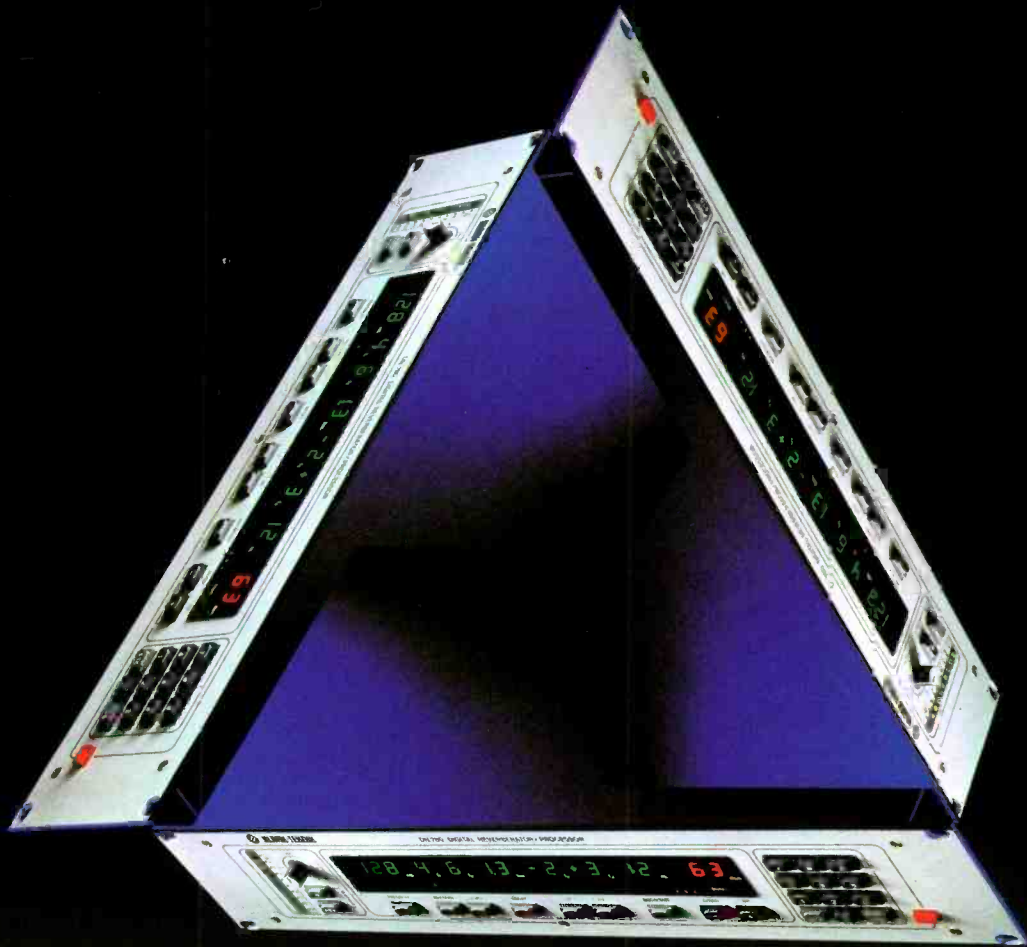
Lexicon have introduced a new version of the *1200C Audio Time Compressor* allowing it to communicate with a wide variety of 1 in VTRs and editors via an *RS422/232* port. This allows the *1200C* to tie into automation systems and respond to remote instruction. The timing capability of the *1200C* has been improved to better than 1 s/hr of play time. Additionally input level

matching and signal-to-noise characteristics have also been improved. A retrofit is available for earlier *1200* versions.

**Lexicon Inc, 60 Turner Street, Waltham, MA 02154, USA.** Tel: (617) 891-6790. Telex: 923-468.

**UK:** Scenic Sounds Equipment, Unit 2, Comtech, William Road, London NW1. Tel: 01-387 1262. Telex: 27939.

# A small universe



## Create space The DN780 – Reverberator/Processor

Klark-Teknik's ongoing investment in research leaps into the age of variable space with the new DN780 reverberation simulator. Its *Very Large Scale Integration* technology and a superfast *Digital Signal Processor (DSP)* allow the world's first practical application of specifically developed algorithms, creating "added density"™ reverberation: reflections with much smaller intervals between them.

The result is simply — greater realism.

From natural concert hall reverberation through remarkable small room and plate sounds to an impressive "infinite space" effects programme, the DN780 will uncannily place you in the musical environment of your choice.



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Coppice Trading Estate, Kidderminster DY11 7HJ,  
England. Telephone: (0562) 741515 Telex: 339821

Klark-Teknik Electronics Inc.  
262a Eastern Parkway, Farmingdale,  
NY 11735, USA. Telephone: (516) 249-3660

Distributed in the UK by Autograph Sales Limited  
2 Spring Place, London NW5 3BA.  
Telephone: 01-267 6677

# MACHINE CONTROL

**M**achine control is one of the key areas in the smooth operation of a studio. As more and more studios change from a single multitrack to 40-, 48- (or even 72-track operation) and/or sound for video, the problem of making all the machines appear to be a single, well integrated system multiply with each extra component that is added. While it seems on first sight that some of the new products on the market are offering the answer to life, the universe and everything, you soon realise as you look into the implications, that they have to be used with care to produce the rewards they promise.

How should manufacturers strike the right balance between providing an economical machine for a single non-automated studio while meeting the stringent requirements of national broadcasting organisations?

The earliest tape machines used a single motor to drive the capstan and all the take-up and spooling functions. This motor was usually synchronous with the mains, so that varying the play speed was not viable unless you happened to have a friend at the power station. The various functions were engaged by a mechanical system of clutches, controlled directly from the back of the tape transport keys. The physical size of the machine, and the slow wind

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**With more components in the recording chain and larger mixing consoles, there is an increasing need for adequate remote control.**

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**Jim Smith and Antony David of Solid State Logic discuss the many points to be considered when designing tape machine control systems**

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speeds involved made it necessary to have a dedicated operator for the machine, and even he had to take care not to engage fast rewind and play at the same time.

With the advent of three motor transports, one for the capstan and one for each tape spool, the mechanical system was simplified to pulling in the pinchroller and the tape guides when in play or record. The spooling motors drove the spools directly, their torque being controlled by tension sensors in the tape path. This allowed much higher wind speed and better acceleration without endangering the tape. The addition of some electronics to prevent mishaps like recording during rewind, and to deal smoothly and safely with operations such as pressing the play key while in fast forward, made the machine a much more familiar and friendly thing. The removal of the mechanical link

between the control keys and the motors also allowed the machine to be controlled remotely simply by wiring external switches in parallel with those on the machine.

Now that the machine does not need so much continuous attention, it is easy to wire the transport control lines to a small panel fitted in the console and give the operator full control of the machine. The basic functions are essentially the same for all machines, so if you change machines, you probably need only change the plug on the back of the machine to get the system going again. The set up forms a tidy, easy to use system. The operator has full control of the machine, and the machine indicates clearly what it is doing by the transport function tallies, and, of course, by the programme recorded on the tape.

The shortcomings of this system become apparent when

you sit down to use it. Going from the beginning of the programme to the end is no problem, usually you're either playing or recording. Going from the end to the beginning requires a fair deal of concentration to slow the tape down and stop it where you need to be. If you can see the machine there is no real problem, at least at the beginning of the session, but after 12 hours, it's just boring!

## Autolocator

The solution comes in the form of an autolocator. These are available from the simplest return to zero system, often in the machine itself, through to comprehensive, multiple cue point systems, which allow for cycling over a given section of the programme. More sophisticated systems will allow you to enter an overdub sequence which can be executed at will.

The interface to the machine is really the same as that needed for the manual system, except that the autolocator needs to be able to keep track of the tape movement. This information comes in the form of two signals: tach and direction. These two signals are normally derived by putting two optical movement sensors, 90° out of phase, underneath one of the tape idler rollers. One of these sensors is used to provide tach and by looking at the phase relationship of the two signals, direction can be deduced. Some

machines let you decode direction sense yourself; they output the two signals directly as bi-phase.

By counting the number of tach pulses from any given start point you always know where you are, and if you measure the rate of the incoming pulses, you can measure tape speed as well. This is all pretty basic stuff but if the information gathered by the autolocator is presented to the operator in an easy to use manner it provides just about everything you need for single machine operation.

## Timecode

At what point do you trust the autolocator to actually put the tape machine into record? In theory, the idler pulse system is quite accurate enough to protect your programme if you take time to line up the beginning of the tape but in practice, tape slip against the idler means that after a few passes through a drop-in point the autolocator will be munching away at the end of the previous chorus. What's needed is a system of reference actually on the tape so that any error in the system will be corrected when the tape is played.

The problem of accurately logging recorded material has always existed in video work, and the solution produced is very tidy, and provides everything we need here to counter our tape slip problem.

Timecode is a signal generated to uniquely identify every video frame in a 24 hr period, normally the time of day. This signal is recorded on to an audio or special timecode track as the programme is recorded, and it can then be used at the editing stage to identify which take is which. In music recording, identifying a take is not usually difficult, but if timecode starting at zero is recorded on one track of the multitrack, the autolocator can then use this for accurate reference to cue points.

There is one stumbling block with timecode and that is that the European and American video standards are not the same. Each standard can be shown to have definite advantages but the extra equipment and loss of programme quality involved in standards conversion makes a worldwide standard a very desirable goal, preferably one of the existing standards, rather than a new one!

The difference, as it affects the timecode, is the number of frames per second. The European standard is called EBU timecode (European

Broadcasters Union) and has 25 frames per second (f/s). The American standard is called SMPTE timecode (Society of Motion Picture and Television Engineers) and runs at, nominally 30, actually 29.997 f/s. The frames are numbered from 0 to 30 each second, but over the period of one hour there will be an error of 108 frames (about 3½ s) between tape time and elapsed time. To correct this error, there is a technique of missing out two frames every minute except every tenth minute, you don't do anything to the video, you just increment the frame counter by three instead of one, that gets rid of 108 (f/hr). This is the infamous drop frame code in case you hadn't guessed.

Note that drop frame code should run at the same frame rate as non drop frame SMPTE code, it's just that drop frame corrects the timing error. Most, if not all, autolocators will handle any of these timecodes, but beware the differences; the problems become more complicated the more we try to use the timecode.

With this accurate time reference recorded on to the tape it's possible to do a range of other things. Automated mix information no longer needs to be stored on the tape itself, but can be stored on floppy disk or some other medium. This reduces the number of tracks required for mix information to one, which in turn leads to other advantages such as the ability to edit between different takes or mixes.

It is also possible to activate external devices at a given point. An event controller reads the timecode from the tape, and at a predetermined point, initiates an event, usually by providing a relay closure. The flexibility for entering and modifying these timecode values varies from unit to unit. Probably the most familiar use is the automatic drop in/drop out, while the repeatable firing-in of effects from tape or cartridge machines is a big help in the post-production process.

Note that at this stage you should not have given control of the tape machine to the autolocator, but you can use the autolocator to do some of the tape handling for you. The operator should still have final say in what the machine does; he should not find that when he changes his mind after issuing a locate command and presses stop that the autolocator ignores him and says 'We're going to the top!'

## More tracks, more tracks

There are many people who argue 'Bring back mono', but if you listen to the clarity and feeling of space that can be produced on a well engineered multitrack tape, then its proponents must be allowed their case too. So if we record each drum on its own track of the tape and double track in stereo a couple of the other backing track instruments that's 20 tracks gone, where can we put the backing vocals,

synth overdubs and so on? The timecode we already have on the tape is used to synchronise video machines so we should be able to do the same for audio machines.

Yes, we certainly can, but we must be prepared to sacrifice some of the speed we have gained by letting an autolocator locate the machine in the first place. A full reel of audio tape is a lot heavier than a reel of video tape and the power to weight ratio is smaller. Whereas video machines are designed from the outset to be synchronised, with many audio machines varispeed is still regarded as a kind of option.

There are two possible approaches to synchronising audio tape machines. The first method is to leave the first multitrack connected to the console exactly as it was, and to feed tach, direction and timecode to the synchroniser as well as to the autolocator. The second, and any subsequent machines, are then wired directly to the synchroniser. Whenever the first machine, the master, is moved, the synchroniser detects the movement and makes the slave machines follow as well as it can. When the master is playing, the synchroniser will read good timecode, and will put the slaves into play. It will line up the actual transitions in code read from the two machines using the varispeed on the slave machine(s) to achieve sync. This is called a chase synchroniser. (Fig 1).

The second method is to feed all the commands from the console directly to the synchroniser. Each machine is wired directly to the synchroniser, and timecode for an automated mix system can be taken from any machine. In this sort of system, the autolocator is normally incorporated into the synchroniser. When a command is issued from the console, the synchroniser issues the same command to all the machines. If the command is play, the synchroniser varispeeds all the slave machines to the master, exactly the same way as the chase synchroniser does. (Fig 2).

The choice between the two systems largely depends exactly on the application. The second system generally handles locates better, because it sends each machine back to the required point simultaneously, but if the synchroniser is not well designed, it can be very obvious that you are not controlling the machines

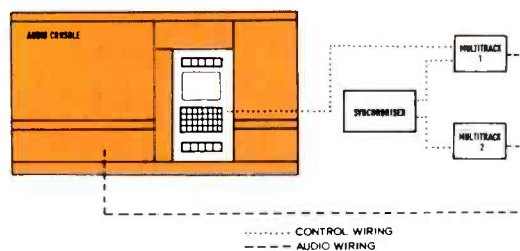


FIG. 1  
TWO MACHINE CHASE MODE SYNCHRONISER

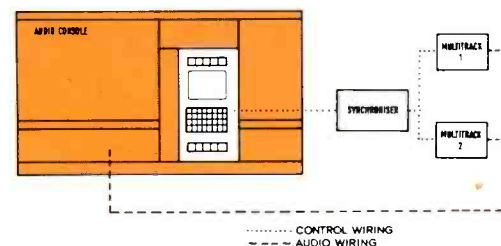


FIG. 2  
TWO MACHINE SYNCHRONISER SYSTEM

directly, but are asking a computer to do it for you.

The main advantage of the first system is that the fundamental structure and hence the method of operation stays the same. The extra facilities are simply added on. If the master is able to output timecode while it is winding, there is often little modification needed except to patch timecode to the synchroniser.

With both systems, bear in mind that we cannot just press play and expect the music to start. The synchronising process does take time, and it can be pretty painful to listen to repeatedly unless the synchroniser is good at its job. There are few things more off-putting to a singer trying to drop into a tricky key change, than to have the preceding four bars played back at an unpredictable and varying pitch.

The basic controls needed for such a system are the same as for a single machine: play, stop, record, etc. It would be convenient if the operator could just carry on as he did before but with more tracks. We should make the best use of the facilities available but keep the layout as similar to

# MACHINE CONTROL

the single machine system as possible. To optimise the speed of operation, we should be able to mix down from the first multitrack onto two tracks of the second multitrack, then do more overdubs with only the second machine running, so there is no lockup delay and no pitch variation. This may involve swapping the reel unless you have a system of switching which enables you to return control of the second machine to the console remotes.

During mixdown, we should be able to select and de-select machines at will. It's no fun trying to get a sound on a three second tom fill if the lockup time is 5 s.

Recent synthesisers and drum machines can also make use of the timecode we have recorded on tape. With these it

is possible to key in an effect, a drum fill, or even a complete instrumental part. As the timecode is already on the tape we don't lose a track, and since the part is stored complete in the synthesiser, we don't add any tape noise by recording it on the multitrack.

## Audio for video

The term 'Audio for Video' seems to appear everywhere today. Since television was first invented there has always been audio for video, but it has always seemed to get the short end of the stick. With small budgets for equipment, the sound man always has to do the best he can with what he's got.

The advent of the domestic video cassette machine and the commercial value to the record industry of the pop promo is changing all that. The demand for high quality audio to be packaged with video has introduced the need to integrate the highest quality audio facilities within the commercial video houses.

At the moment, it is sensible to handle the video production separately from the audio, whether or not actually in the same building, but it must be possible while working on the audio to have a good working print of the edited picture. This means bringing a video machine into the audio room.

The U-matic cassette format is well suited to this application and looks for the most part easy to install but look out for the hidden pitfalls. The other commonly used type is the 1 in C-format system. This is certainly the best solution since the transport characteristics of these machines are so good, but the high cost has prevented these from becoming the norm this side of the Atlantic.

Once the picture has been cut and the audio has been striped with timecode, you cannot varispeed the audio. When you have produced your final audio mix it will have to be laid back on to the video master (usually a 1 in). If the video master is in a different studio, the stereo master you make will need the timecode

to allow it to be synchronised to the picture. There are now several centre track timecode machines available, but watch out for compatibility particularly with tapes from other studios—timecode sounds particularly unpleasant as a crosstalk source.

So much for the actual programme. Integrating a video machine into an existing audio studio also has one or two hidden traps. The basic control functions are the same as for an audio machine, but a video machine has one or two extra requirements. The first is that before you can get any picture out of it, you must lace the tape around the rotating head. This takes one or two seconds.

Most autolocators expect to see the tape move after they issue a play command. If they don't they may assume something has gone wrong, and give up control. This means that the autolocate programs have to be substantially different and this in turn has implications for the speed of the entire system. Second, if you are trying to mark a cue point and you play up to the point and hit stop, the tape unlaces and the picture goes away, are you at the point you want or not?

Video machine manufacturers usually supply a remote control unit for their machine which will allow you to still frame instead of stop, and will allow you to shuttle at low speed forwards or backwards to find the cue point you're after, but the system of control we have previously been aiming for in the audio studio is to house the machine controls in the console—now we have another control box to accommodate. (Fig 3).

Video machines can be wound in one of two ways, either laced or unlaced. If the machine is left laced, picture is still available during the locate, but the wind speed is usually quite slow (about 10 x play speed). Most machines will output timecode under these conditions, since the tape is in contact with the head, so if the autolocator/synchroniser you are using can read code at wind speed, the locate can be made very accurate.

If the tape is wound unlaced from the heads, the actual wind speed is faster, but it has to unlace before the locate can start, and lace-up again before any picture is available. No timecode can be recovered during the locate, and since some machines use the video control track which is actually recorded on the tape instead of idler pulses, tach may not be

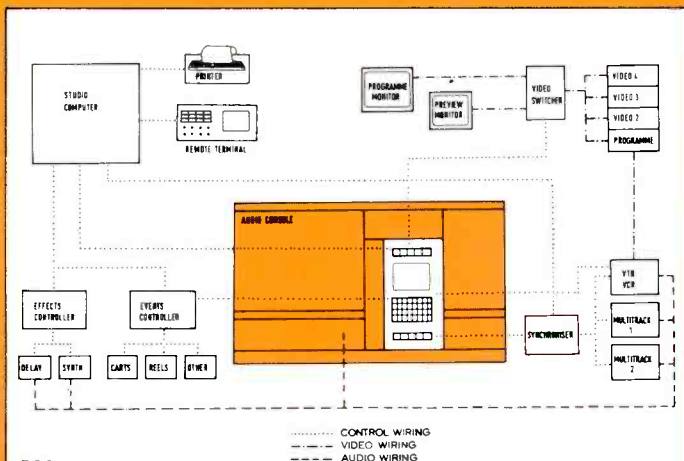


FIG 3  
A LARGE MULTIFUNCTION SYSTEM

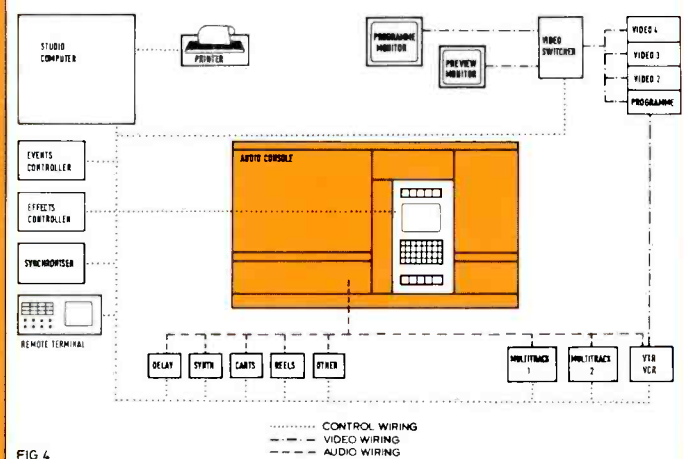


FIG 4  
A BUSED SYSTEM

available. This may involve play-to-park routines to ensure accurate location. Most synchronisers however provide a good operating system for most of the common cassette machines.

## Digital mastering

The need to be able to synchronise the stereo master back on to the video master provides at least part of its own solution. Since we have the video machine incorporated into the studio already, we can encode the stereo audio to digital and record this as a video signal on to our video machine. At the same time we can record an analogue version of the mix on to one of the audio channels and timecode, preferably regenerated to ensure good quality, on to the other audio channel.

## Prospects

For each of the developments described above, individual solutions have been found for very specific tasks. Each area has developed away from the starting point of a single tape machine, but the lines of development are still there to see. As the projects which are undertaken have become more

and more complicated, it gets more and more difficult to make the system, and what it's doing, understandable by the operator. We have drifted away from the simplicity of a remotely controlled tape machine. Isn't it possible to standardise the method of interconnection?

The machines all use groups of a finite number of commands, so we ought to be able to make use of current computer techniques which allow flexibility in the configuration of control networks. In a computer system the data and control networks are integrated but in a studio the programme is the prime concern, and the control network is there to support this.

The first serious attempt at rationalisation of the problems of machine control and interfacing in general, is the SMPTE machine control bus standard. The idea is to run a single RS 422 communications line around each studio complex, and to connect tape machines, machine controllers and other equipment to this bus. (Fig 4).

Using the communications protocol the operator should then be able to use any controller to select and control any tape machine. Since the

protocol is available to everyone, every manufacturer can produce equipment that will connect to the bus. So anyone's controller should be able to talk to anyone else's machine.

Do you really want a high speed data communication line running through the same duct as all your audio wiring with all the potential problems that it may create? The SMPTE bus is designed so that if it is correctly installed, there will be no crosstalk problems, but to achieve this the data rate has to be restricted.

Commands to a tape machine are very short and can be sent very quickly, but equally important in a control network is feedback. The nature of the network makes it ideal to have all the machines grouped together in one room, out of sight of the operator. This makes the feedback from the machine even more important. At the permitted data rate, the time between a request from the controller and the response from the machine can be up to 4 ms. That's assuming that there is only one machine in use, and that there is no delay between the machine receiving the request and it sending its reply. For each extra machine

in use, this problem compounds.

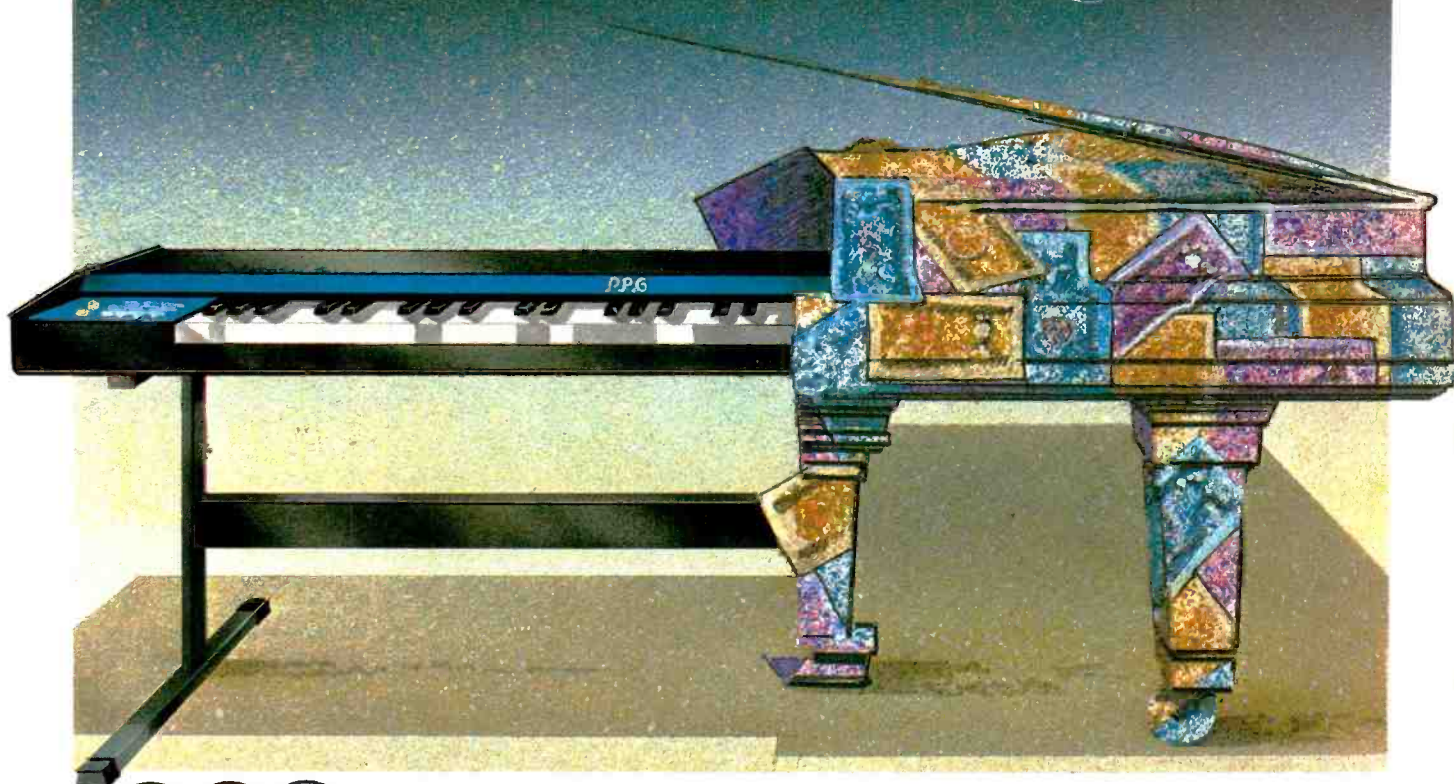
At what point does this delay become unacceptable? Before you answer that question, consider the simple interface at the beginning of the article. When I press the record switch, as soon as the machine has responded to the command, the tally is available back on the transport remote. If the bus is being used to control a system with five synchronised machines, the need to be able to see immediately what each machine is doing is surely more important than ever; the controller should provide the operator with the rapid response of the simple system.

## Conclusions

It would seem that there are limitations to using the SMPTE bus for larger installations. We can use the bus as a very useful tool in the simplification of machine control, but in doing so must be careful not to lose the performance of a single machine system.

We are rapidly approaching the time when we will install a new machine simply by plugging in one standard connector, but we're not quite there yet. □

# A little more than a grand



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# TAPE MACHINES

## Studer introduces new analogue machine

Studer's new machine is the first in the A820 range of analogue recorders. They have been looking, in the face of all the 'digital talk', to develop the concept and capability of the analogue machine, by improving the audio electronics and incorporating microprocessor electronics and software into the design.

Available in ¼ in or ½ in versions in several configurations, including a version with centre track timecode, the A820's heavy duty transport has three direct drive DC motors and 14 in reel capacity.

Transport control electronics incorporate separate processors for tape transport, transport management and audio management (master processor) for the capstan servo and for surrounding circuits.

The DC capstan motor (microprocessor controlled) will reverse its rotation as well as accelerating and decelerating. This feature recommends the machine for synchronising applications.

The closed loop processor control for the spooling motors automatically detects reel inertia for starting and braking as well as regulating the motor speed in the fast wind modes. This enables constant winding speeds or programmed speeds for library pancakes. The various tape tensions can be software programmed and stored.

Moving on to the audio electronics: available options are timecode channel, mono-stereo switch, signal generator, serial interface RS232/422 (SMPTE/EBU format) for remote control applications and service computer.

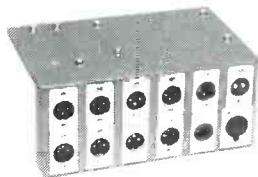
Internal alignments are possible with the multifunction control SET/CUE. With the multifunction control it is possible to leaf through the menu or to enter any of the different parameters, with LCD readout on the face of the transport mechanism.

There are over 40 user programmable audio and transport functions and all operating keys are programmable. Any programming you instigate will be protected by a service lock from unauthorised tampering.



Studer A820 2-track

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# TAPE MACHINES

## Studer audio layback machine

Studer recently introduced a new model to the A80 series for audio layback—the technique of recording the audio track of a video tape using an audio only machine. The machine is designated the A80VU-3LB and is designed to handle 1 in helical video recording tape on either C or B format, PAL or NTSC.

**Studer International AG, CH-8105 Regensdorf, Althardstrasse 10, Switzerland. Tel: 01-840 2960. Telex: 58489.**

**UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.**

**USA: Studer Revox America Inc, 155 Avenue of America, New York, NY 10013. Tel: (212) 255-4462  
Studer Revox America Inc, 14046 Burbank Blvd, Van Nuys, CA 91401. Tel: (213) 780-4234.**

**Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 254 5651.**

## Mechanikai Laboratorium multitrack machine

Hungarian company Mechanikai Laboratorium has been adding to its range of tape machines. Exported by Elektroimpex of Budapest, the range includes the STM-600 and STM-610 (stereo) machines and the STM-631 editing machine.

The most recent addition, however, is the STM-700 professional multitrack. It comes in 8-track 1 in and 16- and 24-track 2 in formats, at 7½/15 or 15/30 in/s. It will accept up to 14 in NAB spools.

Features include varispeed, and meter indication of erase and bias currents. **Elektroimpex, H-1392 Budapest POB 296, Hungary. Telex: ELIMP H 22-5771.**

## Otari previews new range

Otari have announced preliminary information on a new range of mastering tape machines. These machines are either designated as the MTR-20 models for studio use and audio post-production or as BTR-20 models for broadcast production, on-air use and editing. The machines will be available in six formats: ¼ in full track, 2-channel, 2-channel with centre timecode track and stereo; and ½ in, 2- and 4-channel. All versions have a heavy duty cast deck plate with microprocessor based transport control. There will be a 4-speed capability with a reverse play mode, and a library wind mode. MTR models will be able to accept 14 in reels while the BTR will take up to 12½ in reels. The machines will operate from fader start and have facilities for 4-point cue storage, search and return to zero.

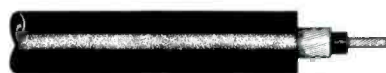
Audio record calibration is automatic including level, bias, HF, MF and phase compensation. Equalisation is switchable NAB/IEC on record/replay. There are two master select positions for all memories (two set-ups per speed, per channel). A cue speaker is also included.

There are a number of user selectable features available including punch in/out selectable on one or two buttons; amplifier record ready—add on or double hit; search optimisation—max accuracy or max speed; adjustable fast wind; transport control switch order—four variations; and switchable monitoring for different modes. Finally there will be optional photo and foil proximity sensors, and a full function autolocator.

At present no date has been given for the release of this range of tape machines and it may be some months before they are available.

**UK: Otari Electric (UK) Ltd, Unit 2 Herschel Industrial Centre, Church Street, Slough, Berks SL1 1PT. Tel: (0753) 822381. Telex: 849453 OTARI G.  
USA: Otari Corporation, 981 Industrial Road, San Carlos, CA 94070. Tel: (415) 593 1648. Telex: TWX 910 376 4890.** ▶

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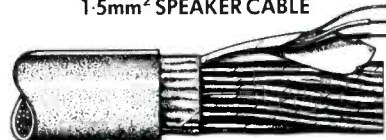
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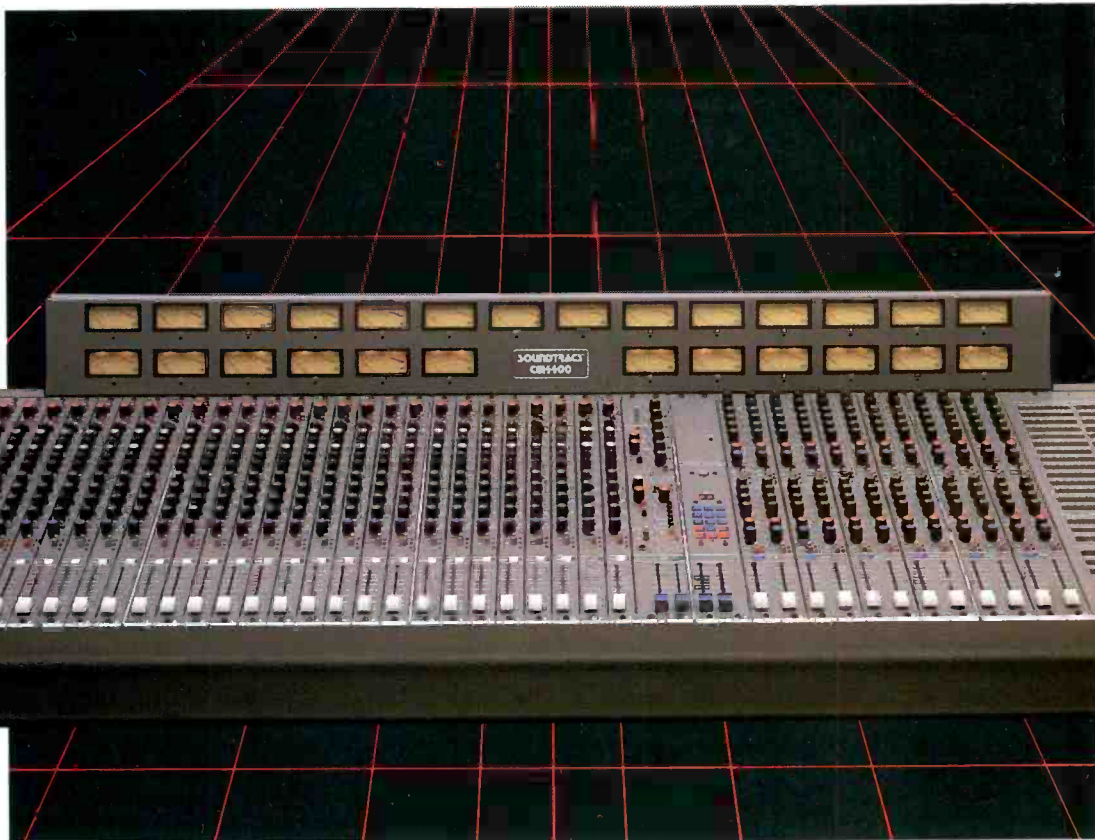
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# BUSINESS BUSINESS



Barry Fox investigates the facts behind the industry news

## Be warned!

In any large city the sight of an expensive car phone is an invitation to theft. Chicago already has a cellular radio service. Each phone can be electronically locked when the car is left so that it is usable only after a secret code has been keyed in. Even if the phone is stolen while electronically unlocked, the thief is still in trouble. An identity number is burned into the internal microprocessor. The system control centre registers this when that phone is used for a call. Already the Chicago police have caught two thieves, by using radio detection finding techniques to pinpoint cars using stolen phones. Anyone subscribing to cellular radio in Britain would be well advised to check first on what happens if their car is stolen. A joy rider with a car phone capable of dialling calls direct to any country in the world could soon run up an horrendous bill for the unfortunate owner if there is no guaranteed safeguard against such abuse.

## The meeting of the ways

The new hi-fi video systems record FM stereo along with the picture signals. So hi-fi engineers have had to learn about video technology. Video engineers have had to learn about hi-fi, because inconsistencies in the speed of rotation of the small video drum corrupt the FM signal and introduce noise on demodulation. Also the FM signal has to switch between heads at 50 Hz. A 2:1 compander is needed to get the claimed dynamic range. Audio engineers are well familiar with the audio nasties you can get from a 2:1 system, unless it is carefully engineered. Video people are newer to the game.

Sound studio engineers have also had to learn about video, because CD production is standardised on the use of ¾ in U-matic video cassette tape to carry the digital recordings up to the disc mastering stage. They have learned the hard way that a video cassette recorder can be relied on to produce drop outs at the most inconvenient time. If the drop out is big enough to throw the digital processor into muting, then the disc master is ruined.

Normally, U-matic cassette tapes offer one hour's playing time at the most. This is one reason why most compact discs run for under an hour. It is possible to buy a long play U-matic cassette, which is loaded with a longer run of thinner tape. But unless the recorder drive system is carefully set up, or modified, running and braking tension can stretch the tape and create dropout after several passes through the machine. That's well known. But less well known is the mysterious and

unpredictable appearance of drop out on normal thick U-matic tape. When the tape is run again there is no drop out. The root cause of this is well known to TV broadcasters.

The more you use a video recorder, the less likely it is to suffer from drop outs. When left unused, the heads can coat with a very thin surface film of oxide. This prevents the heads from bedding down close on to the tape surface, at least until the naturally slightly abrasive tape coating has polished the heads clean again. Some tapes are more abrasive than others, but if you think I'm going to risk a libel action saying which, you are mistaken. The BBC used to keep a stock of their most abrasive tape for just the purpose of head cleaning. If you are working with digital masters on U-matics, and are troubled by unexplained drop out, then try two things. Use your machine every day, even if you don't need to. If you have to leave the machine for several days without using it, then do a dummy run through a full tape before doing any real mastering work.

## Radio free-for-all

Sound engineers should bite the bullet and beg, borrow or buy a copy of a recent Government Green Paper (discussion document) that goes out under the offputting title, "Proposals for the exemption from licensing of four categories of low power radio devices."

The Government plan is to make life easier and cheaper for everyone, by giving a free rein to anyone who wants to use low power radio equipment for telemetry, telecontrol, speech communication and emergency alarms. On the face of things that sounds like good news. Existing licences cost more to administer than the fees payable and any cutback on unnecessary bureaucratic red tape is welcome. But buried in the paper is a point that may interest, and possibly alarm, sound engineers.

The proposal is that radio microphones should be exempt and the frequencies to

be freed from licensing range from 173.8 MHz to 175.02 MHz. Stage sound engineers check your frequencies. You may like the idea of seeing them thrown open for anyone to use. But before cheering too loudly bear in mind what may happen.

If hi-fi buffs start using radio mics or wireless links on these frequencies, for instance to provide a free space connection between a record or tape deck and amplifier, then the band could become cluttered with transmissions. Professional stage set ups may then be blocked out by amateur users. If you think this is scaremongering, just try using a legal CB set in any built-up area in Britain. The congestion and interference is now so bad that speech is seldom intelligible. The proposal is still only a proposal. The Government is asking for comments. If you have any, write to the Department of Trade and Industry, Radio Regulatory Division, Room 613, Waterloo Bridge House, Waterloo Bridge Road, London SE1. But I fear the Government is, as so often the case, out of touch with reality. The final deadline for comments is September 30, 1984, exactly two months after the Green Paper was published. Most people likely to have valid comments will have heard about the proposals through monthly trade magazines, like *Studio Sound*. Monthly magazines have a lead time of nearly two months, that is to say words written for the magazine may take two months before they appear in print. Also the Green Paper was published at the height of the holiday season, when many people, including interested specialist journalists, were likely to be away on holiday.

My bet is that most reports of the Green Paper will not find their way into specialist magazine print until after the deadline for comments has expired. For instance I have written this report as urgently as possible, but there is no guarantee that *Studio Sound* will be able to find space for it early enough to stimulate comments before September 30th. (*Sadly true—Ed.*)



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# UNITED WESTERN HOLLYWOOD

**O**ne of Hollywood's landmark recording studios, United Western, was founded back in 1958 by American recording pioneer Bill Putnam, who also started another historical facility, Chicago's Universal Recorders, in the 1940s before moving westward to California. The Hollywood studio was originally called United Recorders. The 'Western' part of the name didn't appear until four years later, when Putnam purchased a second studio, Western Recorders, which was located just down the street from United at 6000 Sunset Boulevard.

Although the Western Recorders building houses the present United Western Studios, the old United facility played an important role in the new studio's overall history. The original address is where Putnam started his Universal Audio manufacturing operation, which later blossomed into the prestigious UREI Corporation. Western Recorders, however, was the studio that attracted the top talent of the day, such as Dean Martin, Frank Sinatra, and the Beach Boys who recorded virtually all of their hits in Studio 3. In more recent years, those same rooms are hosting artists as diverse as George Benson, Blondie, America, Hubert Laws, and Donna Summer. With attention focusing increasingly on Western, the United building was eventually leased out, and currently operates as OceanWay Recorders.

As UREI became a major pro-audio manufacturer, Putnam left the day-to-day operation of his recording studio to concentrate on research and development of the new UREI products. (Incidentally, the entire United Recording Corporation, which includes Teletronics and UREI, the two Hollywood studios. Coast Recorders in San Francisco and United Western Scoring Services, was purchased recently by Harman International.)

Since 1972, United Western Studios has been managed by

## All aspects of sound recording are United Western's specialities—music, film and TV scores, jingles. Bob Anthony reports on this long established facility

the affable husband/wife team of Jerry and Joan Barnes. The couple are responsible for the genuine 'down home' atmosphere that makes United Western a very pleasant place to visit. Jerry's office is more like a family living room with sofas and coffee tables replacing the usual desk and file cabinets. The Wild West décor of the room and Jerry's comfortable drawl reflect his Texan origins. One cannot help but comment that the Barneses and their staff really do seem like a family. "That's exactly right," says Jerry Barnes. "And we have our little family squabbles, too, but I suppose that's healthy. Perhaps some people would think it's a little *too* laid back here, yet anything else for us would be forced."

Regardless of outward appearances, 'laid back' is really not a totally accurate assessment. 'Relaxed efficiency' is the name of the game. "The potential for stress and pressure in this business is number 1 on the list of ambushes," says Barnes. "Sure, we have all the same problems that everyone else has but we deal with them, and try not to let clients feel like they've walked into an institution. When it's time to get the job done, these people really jump to it."

**T**he studio is involved in virtually every aspect of audio recording, as Jerry Barnes explains: "The percentage tips one way or the other almost quarterly, but right now (spring/summer 1984) I'd say we're at about 60% record projects, about 10% to 20% jingles, and 20% to 30% film and television music."

There have been times when 80% of United Western's volume was records. For many

years, Warner Brothers had their recording office on the premises, and WB record projects occupied a good 40% to 50% of the studio's time. On any given night, the log might read like this: Mamas and Papas in one room, Johnny Rivers in another, Frank Sinatra in the big studio, and his daughter Nancy down the hall.

Such was the case until about 1980, when the mixture of projects began to change. "Although the overall volume of the business has remained the same," says Barnes, "we began to make serious attempts to focus on where our market really was, and how we could reach them best. We realised that many people using the studio had first come in as session singers or

musicians, but now were also doing the production of projects like national-commercial campaigns. They introduced us to the jingle element of the music business."

United Western's involvement in film and television work stems from their earliest years. A company named TBR, which handled music production for several of the popular TV shows and movies, was located at 6050 Sunset Boulevard, right next door to the United facility. They naturally started using United's Studio A—then the hottest room in town—for many of their projects, such as the classic *Gunsmoke* series. Over the years, the tradition continued. All the music for another long-running series, *The Beverly Hillbillies*, was recorded in what is now the coffee room.

More recently, the studio has attracted television clients like *Hill Street Blues*, *Matt Houston*, and *Laverne and Shirley*, as well as the annual pre-recording for the Grammy Awards Show, a sizeable body

Studio 1 includes a screen for film scoring



Control room studio 1 with a view through to tracking room



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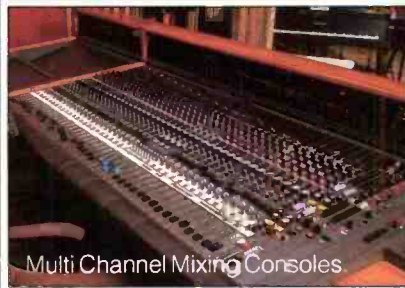
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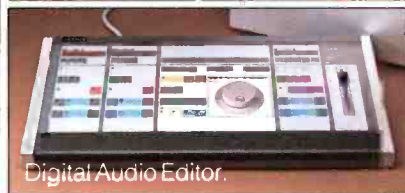
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of film-for-television work, and some theatrical releases.

**F**or Jerry Barnes, a central factor in United Western's success has been the characteristics of the individual recording rooms, which he readily compares with those at Abbey Road in London, England. "What we have here and what probably couldn't be duplicated anywhere else, are some of the best sounding rooms ever built. That's all attributable to Bill Putnam, of course. Apart from a little paint and touching up, we just don't dare do too much to disturb the acoustics. We certainly are not going to get into any heavy-duty renovation, which has destroyed good rooms the world over."

United Western has four recording studios, along with assorted production/duplication studios. Their largest tracking room is Studio 1, a high-ceilinged space that can seat up to 75 musicians, and is used for most of the scoring work. During the 1930s, the room hosted radio productions with live studio audiences. The original engineer's booth survives from those days in the form of an iso booth. Louvred panels on the wall were once operated by machine, but now stay in pretty much the same position, according to Barnes. Today, Studio 1 is equipped to handle scoring to film or to videotape, and of course, any project that demands a large room.

The only exception to United Western's policy of 'no structural changes' is Studio 7, which was heavily deadened during the 1970s when the 'tight' rock-and-roll sound was in vogue. "That room was quite popular for a while, but now the trend has come full circle, and people want natural ambience again," says Jerry Barnes. "We have people coming in just to do drum tracks in our biggest room."

**L**ike many Los Angeles-area studios of this calibre, United Western has taken the plunge into digital recording. The studio started with a Mitsubishi digital 2-track recorder in October of last year, and soon after purchased Mitsubishi's X-800 32-track digital machine. To make their decision, United Western worked with the same demo machine that was loaned to Lion Share, superstar Kenny Rogers' studio complex in Los Angeles. In going 'digital', both studios worked together closely to develop

# UNITED WESTERN HOLLYWOOD

interface cables for use between the machine and their respective consoles. This is the kind of inter-studio co-operation that Barnes is trying to promote as the current president of SPARS (The Society of Professional Audio Recording Studios).

"Just like everybody else, we took a very long look before we made our move into digital," he says, "and we finally came to the conclusion that 24-track digital is probably adequate for some people but not for us. We had to have the 32-track capability for our clients. From an operational point of view, and in terms of our clients' favourable responses to the sound quality, the Mitsubishi has proven to be the right choice.

"Now there's no question that digital technology costs a lot of money," Barnes continues, "and purchasing a digital recorder is a roll of the dice. There's no guarantee that it's a safe investment for the long term. But we've already had occasions where we wished we had a second digital machine, because we've had to turn away digital business on more than a couple of occasions. This Mitsubishi machine is making it happen for us right now."

United Western's large room

Studio 1, is equipped with an all Magna-Tech film recording chain, which comprises a 35 mm Magna-Tech projector located in a booth above the control room, and two Magna-Tech 6-channel mag recorders. The system has 6x rewind capacity, and also includes a Magna-Tech 8-LB controller for running the projector and mag recorders from the mixing console, a 40-input Harrison 4032 with Allison automation.

"We've got a projectionist up in the booth to load and cue the projector, and a supervisor in the mag room to keep track of what's going on during the sessions," says studio manager Jerry Barnes. "But calling the booth on the talkback for every rewind can be a lot of headache for the engineer on the date. Instead, we've interfaced the equipment so the engineer can operate all the film gear in the booth from the console. It saves a lot of time."

Additional equipment in Studio 1 includes an MCI dual playback machine, a btx Shadow synchroniser, a JVC 8500 ¾ in videocassette desk and Sony Trinitron monitors that have been modified by Videotech. The Magna-Tech film system can be locked up to the room's analogue audio recorders and videocassette

deck via SMPTE timecode that's generated on the outside edge of the mag stock.

The remaining rooms are equipped (console-wise) like so: Studio 2—Harrison 4032 console with Allison automation; Studio 3—a 56/40 Neve 8108 with NECAM automation; Studio 7 (which is actually the fourth tracking room in the facility)—an MCI 416 desk.

**A**ll the multitrack analogue tape machines throughout United Western are MCIs, while the ½ in and ¼ in 2-track machines are a combination of MCI and Ampex ATR 100s. The studio also has a Mitsubishi X-80 digital 2-track and an X-800 digital 32-track recorder. Theoretically, the X-800 'floats' from room to room but Barnes has found that it interfaces particularly well with the Neve NECAM equipment in Studio 3. "The Neve has been a moneymaker since we got it," he says. "But the combination of the Neve with the Mitsubishi machine is a delight. The X-800 operates with the NECAM system so much faster and smoother than any analogue machine we've ever tried. (In addition to the 32 audio tracks, the Mitsubishi X-800 features five extra data tracks dedicated to recording timecodes and other sync signals so the client doesn't ever have to sacrifice audio tracks to tie audio and visual gear together.) And the punch-in and punch-out capabilities are incredibly fast and clean."

The principal monitoring in each studio is provided, not surprisingly, by UREI Time Aligns powered by McIntosh 2300 and UREI power amps. Each studio is fully stocked with outboard gear. Recent acquisitions include Quantec room simulators, Publison pitch changers and ADR Vocal Stressors. Other outboard equipment: Lexicon Prime Time and Super Prime Time, EMT 250 reverberation, Eventide Harmonizer and Instant Flanger. Naturally enough, the studio has a full selection of UREI (1176s and 1178s) and Teletronics (LA-3s, LA-4s and LA-2s—tube version) limiters. Further limiting and compression is provided by dbx compressor/limiters and Kepex Gain Brains. □

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Studio 3 control room with Neve 8108



Studio 2 looking toward control room





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# STUDIO FILE

# STUDIO FILE

In May 1976, Jim Duncombe, an expatriate London musician and recording engineer, and Jürg Peterhans, an engineer at Radio Zürich decided to open a recording studio in Zurich. After months of looking at 'suitable' buildings they finally settled with some doubt on the old Dow Chemicals premises in Horgen, a picturesque village overlooking lake Zurich.

During the ensuing years local business flourished and Powerplay updated from the 16-track Studer A80 and Midas desk to an MCI 536 package using JH24 and JH110B machines. But overshadowing this update were a number of other problems, much more difficult to remedy because they were so inter-related it was impossible to give priority to any one: the acoustics were less than good, but improvement would take up too much space; the loading requirements for a floating floor were not met by the building; the air conditioning; the noisy lift; the neighbours; the fire authorities. An endless list of obstacles forced Jim and Jürg to the conclusion that the only way to long term acoustic excellence is to build from scratch.

Armed with a list of 'don'ts' as long as your arm, Jim Duncombe set out to collect some 'dos' from a number of the most successful studios and producers in the UK and USA. Tom Hidley, then based in Montreux with Eastlake Audio, appeared to be building consistently successful studios with the charts being full of material recorded or mixed in studios of Hidley design or copies thereof. Voices against this design concept seemed to emanate from his competitors and not from the producers or musicians using the studios.

Tom's first advice was to build two studios with identical control rooms but very different acoustics in the recording areas. They should be separated by the service and administration areas and there should be adequate residential and leisure facilities. The whole of the recording area should be one level. Early Eastlake studios were specified by the clients, to be pretty dry but Powerplay

## Powerplay, Zurich



View of the lake and (below) a general view



Studio A



wanted a much livelier approach with the same predictability.

As a result all floors in Powerplay are rough sawn walnut except for the magnificent 'string' room (which gets used for everything, especially drums) which has a marble floor, polished walnut walls and hard ceiling. There is less trapping and no cork in the control rooms.

The familiar 'diffusing' rock spreads back to the half room point on a line with the engineer giving about 50% more stone area. This is then continued with polished walnut around the back of the control room, only possible in a stereo, ie non quad, room, and makes for a comfortably live listening environment. To attract clients to record in Switzerland, the studios would have to be unique in as many ways as possible and to take advantage of the obvious beauty of Switzerland, land was acquired with a lake and mountain view but within

15 km of Zurich and the airport.

Before the final purchase of land was made, a company of acoustic engineers was consulted to take noise readings over a period of 14 days. The architect forwarded a method of building a two 'room in a room' studio/control room unit which he guaranteed, based on the long term noise readings, to give a noise floor of 22 dBA. A large air conditioning company was assigned to come up with their best noise figure and they subsequently guaranteed 24 dBA at 1 metre from the main large cross section, low velocity in/out airfeeds to the shells. It was then up to Dave Hawkins of Eastlake, London, who undertook to improve this figure by 1 dBA with his ducting from the shell over the whole studio and control room areas. The architects and structural engineers found it best to build the house shell first and then add the inner shells.

The 26 tonne concrete slab

ceilings of the inner shells were then cast on hydraulic jacks 4 ft above the ground and subsequently raised to their final position of 4 metres. While still being held in place by the jacks, the steel sprung floor was laid and the walls built up to meet and support the ceiling.

The jacks and champagne corks were then removed and much yodelling could be heard in the village of Maur that night. In the cellar the giant air conditioning units, one for each studio and control room stand on hydraulically supported concrete blocks. Supported in the same way are four 4000 VA mains transformers/filters supplying very clean mains. The temperature and relative humidity of either of the studios or the control rooms can be individually adjusted in seconds to the producer's preference, which is usually 20° C; although when Tom Dowd flew in from Miami to check Powerplay with Dexy's Midnight Runners, he raised it to 23° C.

The choice of equipment was inevitable. The studio was designed 'non plus ultra', so the equipment philosophy had to follow, Studio A is equipped with a Solid State Logic 4000 with *Total Recall*, and two A800 MkIII (one hired in for 48-track). The master machines are Studer A80 ½ in and A810 and Sony F1. Digital 32-track is offered on a hire-in basis. The monitoring is UREI 813B and Yamaha NS-10M.

A very attractive addition to the working climate is the lake view from any point in the studio and control room. The lighting is remote controlled and there is a live chamber available to either studio.

Studio B is at present MCI 536 LM automated with MCI machines but a second SSL/Studer package is on the horizon. The control room is identical to control room A except that it has sliding doors to the 5 x 7 metre studio. B also has daylight and a lake view, like Studio A.

The rates in Studio B are much lower than in A and clients can save by laying basic tracks in A, overdubbing in B and mixing in A.

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# STUDIO FILE

# STUDIO FILE

Powerplay is residential, offering attractive chalet rooms, a large leisure area with snooker, TV games, pinball, *Sky Channel* and a kitchen with microwave, deepfry, fridges, laundry and airing facilities.

Powerplay aims to cover a healthy portion of British overseas productions, which for various reasons would be produced out of the UK in any case. To attract this clientele, their marketing is aimed at letting people know that there is a world class recording complex 90 min from London

Jim and Jürg



## Powerplay (continued)

yet in the heart of Switzerland and offering everything that the artist, producer, engineer would expect from his favourite London studio, including British management.

Rates are lower than most London studios with similar equipment including residential facilities.

Since opening in June last year with two major German acts doing albums which both charted, Brian Tench has been in with OMD and Andy Hill

more or less lives at Powerplay, working with Bucks Fizz, Chris Norman and G.I. Orange. Saga followed Andy Hill in Studio A for three months and Studio B was booked through August by Martin Pearson (Krokus) producing German heavy metal group MASS, with one of the four in-house producers.

Jim Duncombe: "We're especially interested in working with 'hi-tech' producers."

There's good skiing just one hour away and Jim says that in December they might need to branch into the travel agency business to cater for all artists and friends who have said they'll be over again in the skiing season.

Incidentally, Powerplay is probably the only studio in the world with an atomic underground fallout shelter, at no extra charge.

**Powerplay Recording Studios, Fallendenstrasse, 8124 Maur, Zurich, Switzerland. Tel: 419 80.15.21.**

J Dee

Leisure area complete with pinball machine



Control room B



Situated just off north London's Holloway Road, the most distinctive things about Music Works' studio complex are its size and the *real daylight* in every room!

Music Works started up in 1979 with its main studio (Studio 1). Director Joe Julian and his partner at the time Alan Williams, got together with Andy Munro (who was then working for Allen & Heath) and between them they came up with the design.

The recording area consists of a main room with varied acoustics, a separated live room and an isolation booth. The ceilings throughout the building are over 20 ft high, and this, combined with the windows and skylights, lends an unusually light and airy atmosphere.

The studio occupies the top floor of what was once a Fry's chocolate factory/warehouse, and when Joe Julian first arrived it was just an open shell. Thus the studio design was unrestricted.

Approximate dimensions of

## Music Works, London

the main 'dead' room are 22 x 22 ft. All the walls are angled with degrees of thickness varying between 6 and 8 ft with vast quantities of Rockwool and chipboard behind them. The front (control room) end has an absorbent covering whilst the back wall has wooden panels. This wall also has two smallish recesses which may be used to prevent spillage.

Angled across one corner is a drum booth with a wooden floor and heavily trapped ceiling which, although not totally physically separated off (there being only a lower-half partition), is separate soundwise and, indeed, many sessions have been executed with all the instruments live, the separation is that good.

On the other side of the room, through double sliding patio doors is a large live room (approx 22 x 16 ft) which has many different ceiling angles to give various types of sound.

At one end there is a Kawai 6 ft 1 in grand piano; above this the ceiling is even higher and more reflective. The piano is a fairly recent acquisition and, having tried a number of different makes and sizes Music Works decided on the Kawai as being the best rock music type sound. This room has two large triple glazed windows and is altogether very bright. "It's very popular with drummers," remarked Joe, "Stewart Copeland, Bev Bevan, Simon Phillips—lots of session drummers love it."

All over the building there are lots of funny little (and sometimes big) areas which are frequently utilised for yet more different acoustics. For example, it's pretty dead between the two studio doors! Also, there is a fairly large storage area at the back of the building which houses, amongst other things, a chain hoist (left behind by Fry's I guess); this is just bare

concrete and is sometimes used by bands.

The chain hoist is still in working order, and, although the building is furnished with lifts, it is sometimes called for when extra large pieces of equipment need to come up (a desk for example).

Round in the control room the first thing that strikes you is how small the Amek M2500 console looks stuck in the middle of such a large room (20 x 18 ft). The high ceiling once again contributes to the feeling of space. The walls are variously clad in wood, acoustic tiles with chipboard panels and Rockwool in the back wall and under the monitors for bass trapping. Round the circumference of the room where walls join ceiling there is a band of wood for high frequency reflections. The room's design means that monitoring sounds uniform wherever you stand according to Joe. This was not put to the test as there was an engineer installing a telephone answering system in the

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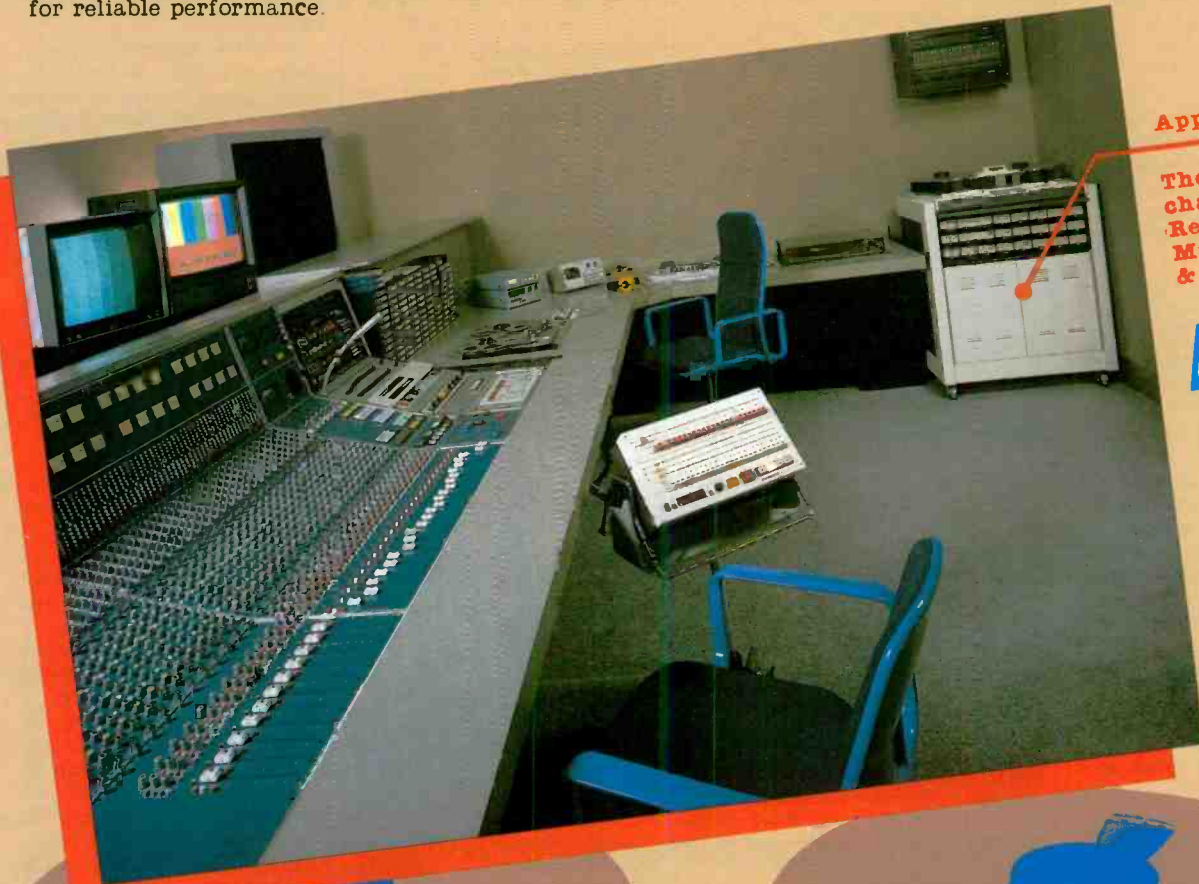
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# STUDIO FILE

# STUDIO FILE

control room at the time!

At the back of the control room there is another room, separated by double sliding patio doors which is semi-live and about 22 × 10 ft. This may be simply an area for visitors and unwanted musicians to lounge around in, or it provides yet another recording area.

When the studio was first built they installed a prototype Allen & Heath *Syncon A* with Lyrec 24-track machine and Klark-Teknik 2-track. Eighteen months later they upgraded to the Amek *M2500* automated 32-channel in-line desk. This console was chosen for facilities and price. They must be pleased with it because they have just installed another one in their new second studio.

Monitoring is on Eastlake *TM3* (with JBL and TAD) and Auratones. Tape machines are Lyrec 24-track, MCI and Otari 2-tracks (½ in mastering available) and Aiwa *3800* cassette.

On the day of my visit everyone was recovering from a party the night before to celebrate the opening of Studio 2, designed principally as a remix suite. The decision to build a new room was taken because the existing studio could have been filled twice over during the preceding year. Music Works clientele consists of a stream of fairly regular visitors, and is therefore quite predictable: the demand is presumably here to stay.

So the now-well-established-in-Turnkey-2 Andy Munro came in, once again, to design the rooms. The recording area, designed for overdubbing, is therefore considerably smaller than others in the building. None of the walls are parallel and the surfaces are very varied: one wall of brick, one of hemlock (wood), by the control room window a reflective fabric, maple floor. "This is a very bright sounding room," said Joe, "it's especially good for vocals and guitar and with all these different surfaces it's great for using *PZM* microphones." The ceiling is totally dead and filled with Rockwool.

To get into the recording area you have to approach it through a smaller room which is attractively finished in

## Music Works (continued)

cedar. The original plan was that this would be another overdub room but, I suspect that this is no longer the case because it now houses all the power amps and equalisers and air conditioning unit which would probably make too much noise. However, the mic boxes here are not necessarily wasted because opening another door reveals a very long corridor which you can sit and play in if you so desire!

The control room is approximately 20 ft long × 16 ft wide and feels quite different to Control Room 1. The monitors (JBL/TAD as in the other room) are placed on either side of the recessed Lyrec 24-track machine over brick walls. Above the machine is a video monitor, and when required a *Q-Lock* synchroniser is hired in for video post production work.

The back wall is the most interesting feature of this room. It consists of wooden slats placed at various opposing angles, with all the

gaps being of differing widths. Thus the combination of absorption and reflection means that you can still hear properly at the back of the room. There is a seating area here which is itself angled, and has similar panelling running underneath it.

According to Joe, this is the first treatment of its kind carried out by Andy Munro and it has worked very well. "It means you don't have to stand up for hours when you're mixing!"

All the rooms are tie-lined so that the ancillary equipment may be used in either studio and the various recording areas may be utilised by either control room.

The outboard equipment list includes EMT 'Goldfoil' reverb; Lexicon *224* and *PCM 42*; DeltaLab *Acousticomputer* with four memory extender cards (2.5 s); AMS 1.6 s and 408 ms delays; AMS *DMX 15-80S* dual pitch changer digital audio processor; Eventide *Harmonizer*; Drawmer and Roger Mayer

noise gates; Rebis parametric equaliser; UREI *1178*, dbx *160* and Audio + Design compressor/limiters; and MicMix and AMS phaser/flangers. Mastering in the new studio is on MCI and they also have a Sony *PCM F1* system.

The Music Works microphone collection is suitably large and varied including Neumann, Shure, AKG, Sennheiser, Calrec, Electro-Voice and *PZMs*. Particular pride and joys are some old AKG *C28* valves, a Shure *SM5B*, a huge old BBC microphone (which apparently Jools Holland fell in love with) and an old Sennheiser ribbon mic.

On the instrument side, apart from the aforementioned piano, there is also available a Yamaha *CS80*, Roland *System 100*, *JP4* and *MicroComposer* and a selection of Fender amplifiers.

Moving out of the studios, there is a large sunny (well it was then) kitchen fully fitted and presumably filled. Other facilities include a TV lounge area with video games, etc, and there is also loads of free parking.

The administration offices house studio manager Fay Samuell as well as Harry McGee and Jim Cook who run A&R, production and record companies from the same premises.

The rest of the studio staff are engineers Ben Ward and Neil Drake, Mike Donovan who is the business director, and maintenance is taken care of by Tim Owen who also works for Scenic Sounds.

Copying facilities are available on another floor of the building courtesy of Azimuth Productions who have recently moved in and will eventually be offering cutting facilities as well.

At the time of the interview Amek had not completed manufacture of the new console and had lent Music Works an *Angela* 28-channel desk to be going on with. By the time you read this the *M2500* will have been installed, and the studio will be ready to offer their clients the works (groan).

**Janet Angus**  
**Music Works Studios, 23**  
**Benwell Road, London N7**  
**7BW. Tel: 01-607 9495/6/7.**

Control room 1 showing Amek console through to isolation booth



Kawai grand and through to control room 1



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# HANDLING AND STORAGE OF TAPE

Hugh Ford explains how easily tapes can be damaged and offers advice on care

If the best performance is to be obtained from magnetic tape, digital or analogue, strict attention must be paid to the handling and storage of the tape from the manufacturer's factory floor to the archival store and thereafter.

To fully understand the problems it is necessary to consider a number of factors relating to the material itself, recorder design and maintenance and the effects of the environment. The latter embraces tape spools (reels), temperature, humidity, stray magnetic fields and other forms of radiation.

This article starts with consideration of the magnetic tape and its component parts which affect its performance, and peruses potential mechanical hazards—the normal cause of failure of the recording medium—as it's very unusual for a professional audio tape to become 'worn out' through proper use.

Consideration is then given to the electromagnetic properties and 'damage' that may be done to an original recording. This not only includes the well known phenomenon of print-through but also accidental demagnetisation which may occur due to a number of causes—stray magnetic fields are not the only culprit.

## Magnetic tape

Historically magnetic recording materials have taken a number of forms ranging from steel tape or wire to coated paper.

All modern tapes are coated materials consisting of a backing called a base film to which is applied a coating consisting of, or containing, a ferromagnetic material.

The overall performance of a tape is affected by the mechanical and electrical properties of the base film plus the nature of the coating applied. All modern studio tapes use polyethylene terephthalate commonly known by the trade names of *Melinex* (ICI) and *Mylar* (du Pont).

Two other types of base film are of interest as they will certainly be found in archives and have been used in comparatively recent times. Polyvinyl chloride (PVC) was a very common form of base film as at one time it was much cheaper than polyethylene terephthalate which in the early days was not made in a suitable quality for magnetic tape manufacture—it was fine for wrapping packages.

The third base film of interest is cellulose triacetate which preceded the age of modern plastics and is commonly associated with photographic film and

was very popular for magnetic recording film in the 35 mm and 16 mm formats.

Cellulose triacetate has fallen out of use as a base film material for a number of its properties, PVC being superseded for other reasons. Comparison of the mechanical properties reveals some of these factors.

From Table 1 it can be seen that cellulose triacetate in comparison with PVC and polyethylene terephthalate has not only poor coefficients of expansion but that its yield strength is close to its tensile strength. The latter means that it snaps rather than stretches—considered to be an advantage by some people in film editing work, but a disadvantage for recording tape.

A further disadvantage of cellulose triacetate is that it becomes brittle with age and suffers from severe moisture absorption. Thus great care is needed when handling this material, particularly if it has been archived.

PVC offers significant improvements in terms of strength as it stretches rather than snaps. However, it remains temperature sensitive and suffers from pinholes which are an undesirable feature for manufacturing recording tape. Also the temperature coefficient remains on the high side.

Turning to the currently almost universal base film material that is now used, polyethylene terephthalate can be stretched considerably without permanent deformation (it is in other words elastic). It is relatively immune to changes in humidity and temperature and it doesn't age.

Whilst the performance of the general groups of materials varies within a group, particularly with polyethylene terephthalate, Table 1 shows typical values and the difference between materials is well defined.

In all cases the uncoated base film is a very good electrical insulator and is difficult to control when winding due to the build up of electrostatic charges. It follows that the characteristics of the magnetic coating must control this factor

TABLE 1 Approximate comparison of the properties of base film materials (¼ in standard play tape)

Parameter	Cellulose triacetate	Polyvinyl chloride	Polyethylene terephthalate
Tensile strength (kg)	2.5	4.0	5.0
Yield strength (kg)	2.4	2.2	2.5
Elongation at break (%)	25	50	>100
Longitudinal temperature coefficient per °F	$5 \times 10^{-5}$	$4 \times 10^{-5}$	$2 \times 10^{-5}$
Longitudinal humidity coefficient per % RH	$12 \times 10^{-5}$	Negligible	$1 \times 10^{-5}$

FIG.1 SLITTING

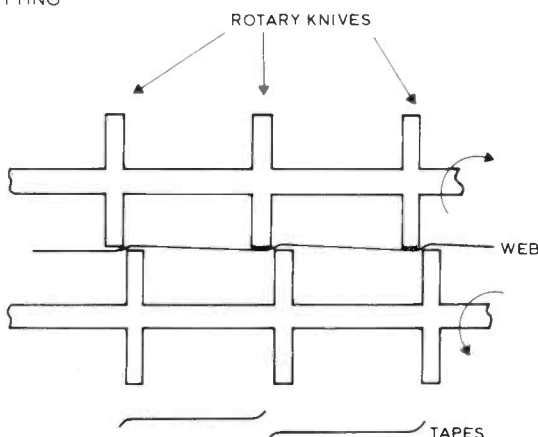
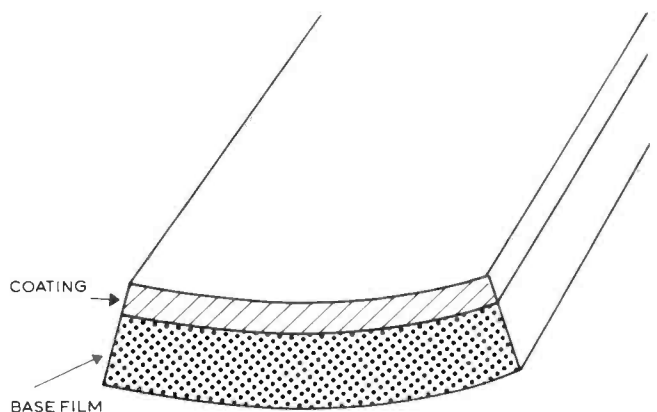


FIG.2 CUPPING— cross section of tape





and it is now common to back coat the final product to further control the winding properties. The very thin back coating is designed to be electrically conductive in addition to having surface roughness characteristics to improve winding in terms of both layer to layer frictional properties and the expulsion of air between the turns when winding.

Whilst good back coatings do not leave any deposits on the magnetic coating when on a spool, this is certainly not an unknown problem which can be aggravated by storage at high temperatures.

For the purposes of this article we will ignore vacuum deposited magnetic coatings as these are not currently of interest in the context of studio recording tapes (video and cassette applications are another matter) but the magnetic coatings of all tapes have a number of ingredients, some of which affect handling and storage.

In addition to the magnetic material which is commonly gamma ferric oxide in the form of acicular (needle shaped) particles, the coating contains a binder to hold the particles within the coating, plasticisers, solvents, lubricants, anti-static agents and other tasty ingredients.

If the manufacturer gets either the recipe or the cooking wrong the oxide and/or the ingredients may escape in use or storage. Oxide 'dust' and sticky deposits can build up on the recorder and cause tape damage. Plasticisers can exude from the tape in storage and cause layer-to-layer adhesion. I've even got some samples that have lost their anti-static properties in storage and play with an accompanying mini thunderstorm.

Just what can the user do about these problems? Unfortunately the performance of a particular batch of tape depends upon which cooking pot was used to make it. Thus the reliability of the manufacturer is of paramount importance in terms of batch to batch constancy and ageing performance. Hopefully a reputable manufacturer will have done artificial ageing tests and the base film and coating won't separate in 10 years' time!

In all cases problems with materials themselves are aggravated by high storage temperatures and exposure even for short periods to temperatures which would be uncomfortable to humans, will frequently cause tape damage.

All magnetic tape is manufactured in wide widths called 'webs' and wound into large rolls commonly called 'jumbos'. The width is then slit down to the nominal 1/4 in by rotary knife slitters which give a characteristic to the tape edges as shown in Fig 1.

This characteristic is inevitable with rotary knife slitters, but with good cutter box maintenance it is not a problem. However, if strict quality control is not exercised a tape may have significantly stretched edges which will eventually lead to deformation of the wind on a spool. There's nothing a user can do about this except inspect new tapes for poor edges.

A manufacturing defect over which the user does have a degree of control is known as 'cupping'. If, when the base film is being coated, the solvent attacks one side of the base film or the drying process after coating is not properly

controlled, the web will become deformed due to shrinking or expansion of one side of the base film.

An exaggerated result of this is shown in Fig 2 where the tape is not flat across its width. Provided that the tape is wound oxide in or out as received all is well but reversing the wind provokes disaster just like trying to wind a steel tape measure inside out.

## Spools, reels, hubs

Whether you care to call it a spool or reel is of little consequence according to the *Oxford English Dictionary* so for the sake of consistency I'll call the thing a spool if it consists of a hub and one or more flanges. Hubs just fit on the turntables on the recorder and do not have flanges and are therefore cheaper than spools.

There appears to be a fairly common misconception that the flanges of a spool are intended to act as tape guides. This is certainly not the case and any tape touching the flanges of a spool will be damaged to some extent; the flanges are intended purely as protective devices.

Any good recorder is capable of winding a good tape at high speed on to a hub whilst forming a flat pack without the odd turn of tape protruding from the pack—a complaint called 'leafing' as shown in Fig 3 and without sections of tape protruding from the pack called 'blocking' as shown in Fig 4.

I will come to the causes of leafing and blocking in relation to the tape and the recorder but leafing may well be associated with the design of spools and

hubs. The use of plastic electrically insulating hubs can have severe effects on tape winding and if leafing is to be avoided it is advisable to use conductive hubs. There are quite a few spools around with metal flanges and non-conductive plastic hubs which are to be avoided as they can build up tremendous electrical charges which affect winding.

Three standard types of spool are in common use with the recommended dimensions to be found in International Electrotechnical Commission Publication 94, these being the ciné centred spool, the NAB type spool and the single sided European type spool/hub which is comparatively little used and requires special adaptors for most recorders.

A common problem which leads to tape touching the flanges of a spool is the difference in dimensions between the ciné-type spool and the NAB type spool so far as the overall width is concerned. Reference to Fig 5 shows the basic standard tolerances which relate directly to tape winding.

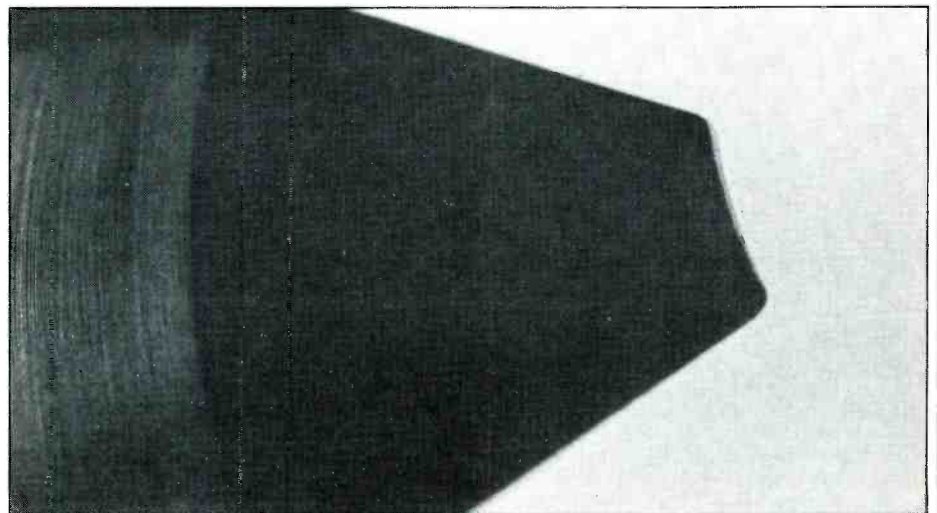
Considering the overall width the minimum is 11.35 mm for an NAB spool and the maximum 13.50 mm for a ciné spool leading to a spool turntable to tape centreline difference of just over 1 mm in the worst case. This deviation is intolerable from the point of view of tape guidance and it is essential that the recorder's turntable height be adjusted for the centreline dimensions of the type of spool in use.

Alternatively a recorder may be aligned for ciné type spools and a shim of 0.82 mm thickness put on the turntable when NAB type spools are in

Fig 3 Leafing



Fig 4 Blocking



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Features include:

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use. It is of course advisable to set turntable height by measurement rather than relying on the dimensions of any particular spool. This is, however, rather difficult with many cheaper recorders where no suitable reference face is available for making measurements.

The final factor about spools in relation to tape handling is the hub diameter. As shown in Fig 5 this is standardised for

# HANDLING AND STORAGE OF TAPE

NAB spools about 82 mm but varies for ciné type spools between 35 mm and 100 mm depending upon the overall diameter which may range from around 75 mm to 250 mm. The consequence is that depending upon the design of a particular recorder the tape tension may vary widely at the start and end of a tape—another source of tape damage.

Before departing from the subject of spools it is of paramount importance that only spools in good condition should be used. Damaged hubs, bent flanges, burrs on the flanges and dirt on the hubs or flanges can all cause severe tape damage.

## Tape winding defects

There are unfortunately no standard terms for types of tape defect and any comments would be welcome from readers about alternative terms. I have already mentioned leafing and blocking but include these defects again to give a comprehensive list of common defects and their causes.

- **Leafing:** (Fig 3) the throwing up of individual turns within the tape pack, easily leads to tape damage in handling. If the leaves are turned over, the edge of the tape will suffer permanent damage in addition to which, the tape will often hit the spool flanges when being wound.

The cause of leafing is a combination of the winding characteristics of the tape itself (which may depend upon temperature and humidity) and the performance of the recorder. High winding speeds encourage leafing and should be avoided as should too low a tape tension.

If you are plagued by this defect it is well worth trying alternative tape types. Back coated tapes are generally better than shiny backed tapes and thick standard play tapes are better than the thinner tapes. Conductive spools also assist in reducing leafing.

- **Blocking:** (Fig 4) like leafing this is aggravated by high winding speeds but may be a function of particular reels of tape where the slitting is below standard with consequent curvature of the tape.

Another cause of blocking is pack slip. If, for instance, a spool of tape is dropped or jolted, part of the pack may slip laterally with repeated jolts leading to severe blocking. This may be associated with too low a winding tension or wide temperature variations during transportation.

- **Lipping:** (Fig 6) the turning up of one or both edges of the tape, may be associated with poor slitting as shown in Fig 1, or cupping as shown in Fig 2. These are tape manufacturing defects which can be readily seen in new spools of tape.

Subsequent lipping will occur if the winding tension is excessive with resultant stretching of the edges of the tape which can also occur due to dirt on the tape transport or worn heads or guides. Once lipping has started the tape cannot be recovered and it will deteriorate with use.

- **Cinching:** (Fig 7) also known as accordioning or pleating, takes the form of a cinched turn or more within the wound tape pack. This is caused by one section of the pack moving radially with respect to the adjacent section and

FIG 5  
BASIC DIMENSIONS

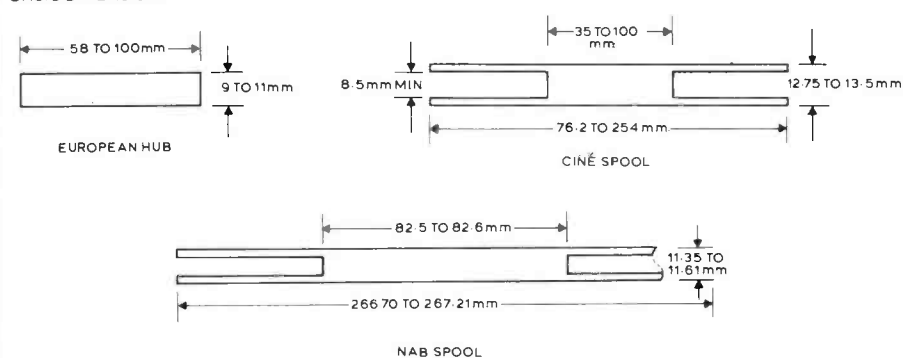


Fig 6 Lipping on left edge

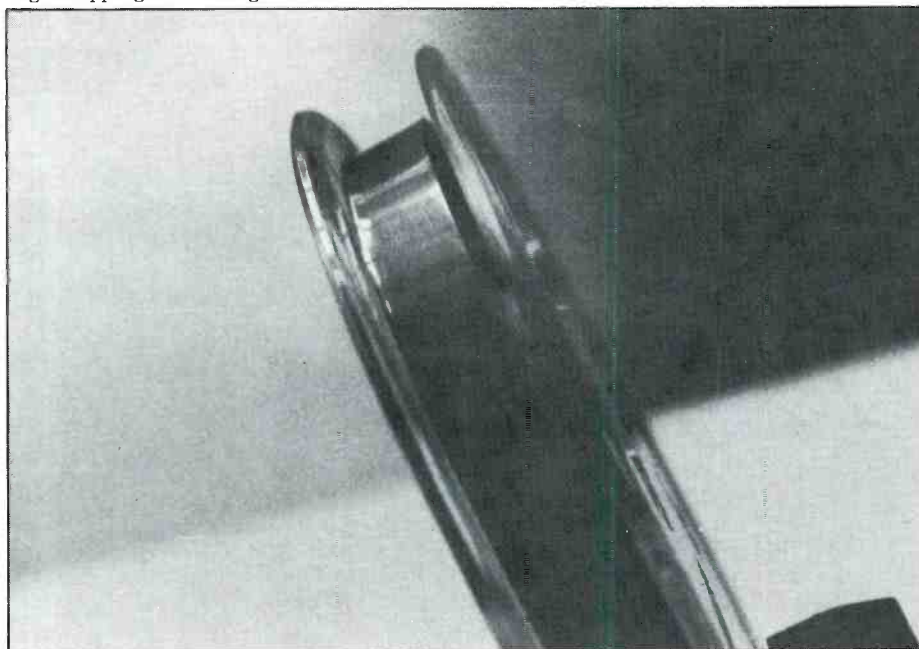
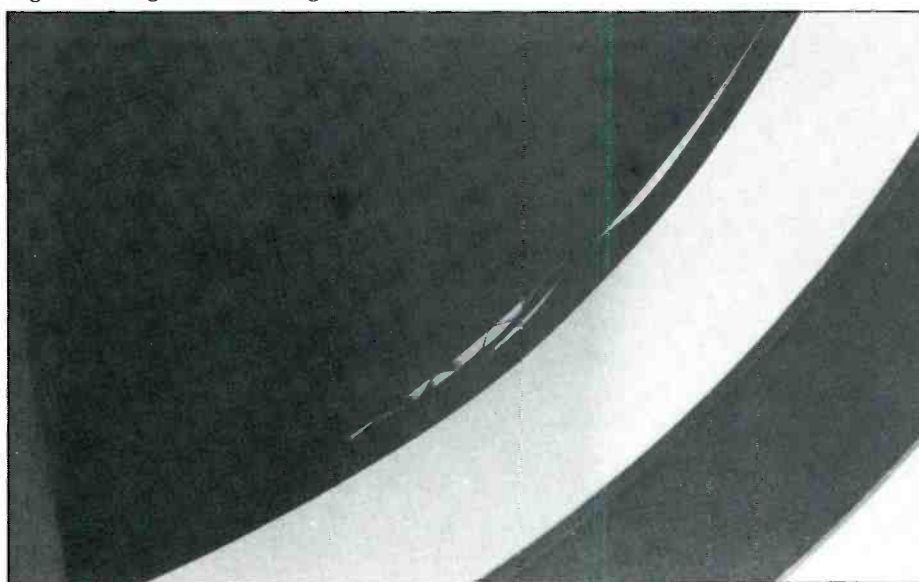


Fig 7 Cinching and windowing



results from excessive acceleration of the spool, possibly in conjunction with too low a winding tension or temperature variations.

Extreme low winding tension may lead to cinching under normal pay-off tension conditions and tapes with obvious poor winding should be rewound to normal tensions with great care.

Whilst severe cinching cannot be 'repaired' rewinding a cinched tape at low speed and at proper tensions may provide adequate recovery.

● **Spoking:** (Fig 8) the formation of radial spokes (like the spokes of a bicycle wheel) may be caused by the initial winding being at a low tension with the final winding being at increased tension causing severe radial compression at the centre of the wind—a common complaint with very thin tapes.

Further causes are debris within the wind or poor splices—both can be readily avoided. If severe damage has not occurred spoked tapes may be recovered by careful rewinding at low speed, possibly in conjunction with the use of a tape cleaning material.

● **Windowing:** (Fig 9) very loose winds with voids that can be seen through may result from very severe temperature cycling in storage or transport.

Windowed tapes should be rewound with great care to avoid cinching and can usually be recovered as windowing is not caused by other forms of tape damage.

## The importance of recorder maintenance

Both mechanical maintenance and maintenance of electronic speed control and tension servo systems are very much related to the good handling of tape. The modern trend is to run tape at constant tension on both spools rather than reduce tension as the spool becomes full and this trend overcomes the problem of differing spool hub diameters, providing that the recorder is well designed.

Checking the tape tension is very important and it's not much good measuring static tension with a spring balance and a piece of string. A proper tape tension gauge such as a Tentelometer is essential. As a general rule the tape tensions should be set as shown in **Table 2** for different tape thicknesses.

An operating tension of 70 g per ¼ in width and pro rata is a good compromise if the tension servo can hold this tension accurately in both the play and fast wind modes.

Where possible very fast winding should be avoided with a speed of 3 m/s (say 120 in/s) usually being a safe maximum. For archival storage it is better not to fast wind but to do the final wind in the play mode with the tape being stored tail out to minimise the effect of print through.

Many modern recorders have control over the tape acceleration and braking. These should be adjusted for minimum snatching, and violent acceleration and deceleration should be avoided even if good tension control exists.

Cleanliness of the tape guides and heads is of prime importance not only to minimise dropouts due to head tape separation but also to avoid tape

# HANDLING AND STORAGE OF TAPE

and tape material on the heads and guides, smoking, food and drink are prime enemies which can be avoided. Regular cleaning and inspection for wear of all parts in contact with the tape will avoid tape damage, particularly to the edges.

damage. Fig 10 shows the relation between dropout depth and head to tape separation for a 15 kHz tone recorded at 15 in/s using the formula for dropout depth:

$$\text{Dropout (dB)} = \frac{(55 \times d)}{\lambda}$$

Where d is the head/tape separation, λ is the recorded wavelength.

Other than tape debris in the form of base film material from the edges, oxide

Tape type	Typical thickness	Tension per ¼ in width
Standard play	50 μm	50 g to 100 g
Long play	35 μm	40 g to 80 g
Double play	25 μm	30 g to 70 g

Fig 8 Spoking

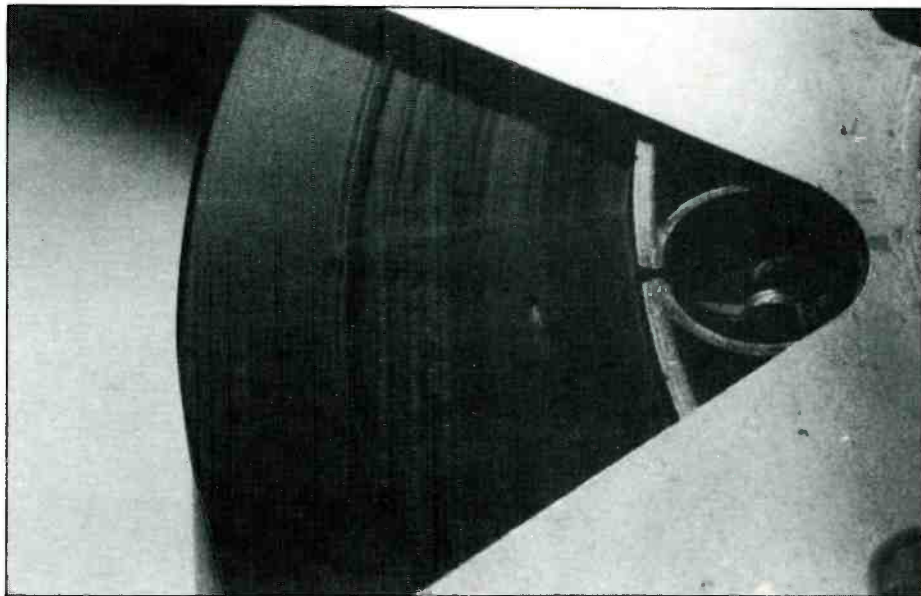
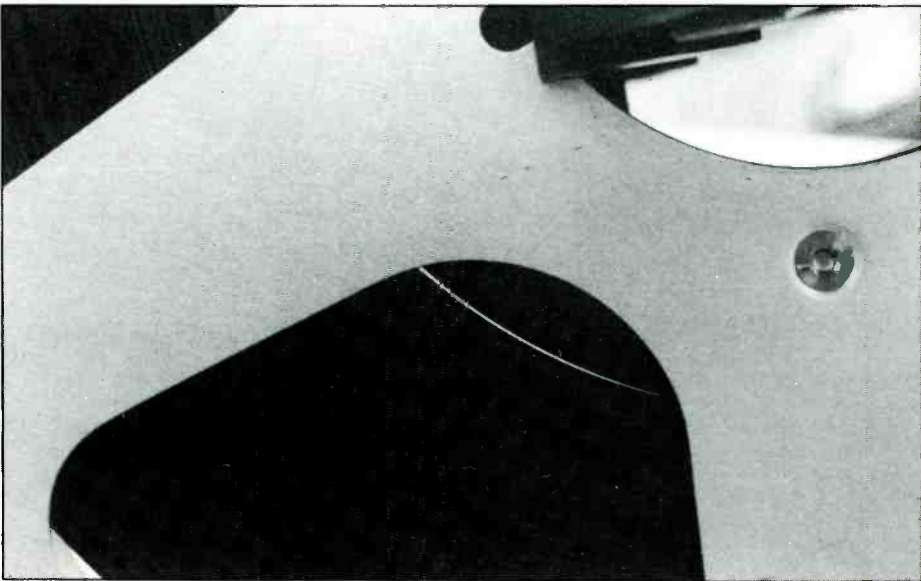


Fig 9 Windowing



Whilst the head azimuth adjustment has little effect upon tape the adjustment of the zenith (tilt in the vertical plane from the front to the back of the heads) is important as it can severely affect tape guidance.

The matter of spool turntable height has already been mentioned but it is most important that the turntable should be accurately horizontal. A 0.1° alignment error will transpose into a 0.5 mm offset at the edge of a 10½ in spool.

Heads and guides should of course be regularly demagnetised as any residual magnetism will increase tape noise even in the replay mode. Some ferrite heads are difficult to demagnetise with the normal head demagnetisers and it is necessary to use a bulk eraser.

In summary, good mechanical alignment and cleanliness are

alignment and cleanliness are

# MIXING MASTERS?

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essential—dirt breeds more dirt—dirt in the tape pack causes dropouts and tape damage such as spoking.

## Tape splices

Whilst splicing is fine for editing, any splices are best avoided in archive material as they only provide a weak link in the chain and may lead to tape damage.

The use of wax pencils such as Chinagraph is common for marking audio tapes but alcohol type markers as used in video splicing are to be preferred as they leave very little debris on the tape. Surplus marking material should always be removed with care.

Splicing tape is another matter. To start with, the likes of office adhesive tape should never be used for splicing. Good magnetic splicing tape will stick well and not exude adhesive in storage. Like the magnetic tape itself it is difficult to know what will happen upon long term storage, but again excessive heat is an enemy.

Splices themselves should be smooth with no overlap as not only does this produce dropouts but may also lead to spoking and other tape defects.

Cleanliness during editing is important and ideally the tape should not be touched on either side as fingers inevitably leave deposits of oils and salts which may spoil the adhesion of splicing tape and have other undesirable effects.

## Print-through

Print-through, the effect by which one turn of tape imprints its signal on to adjacent layers at low level, causes very

# HANDLING AND STORAGE OF TAPE

irritating post- and pre-echoes. The printing effect depends upon the tape type, its thickness and sometimes upon particular batches of tape.

As shown in Fig 11 the printing consists of a number of post and pre-echoes with the pre-echoes being slightly larger than the post-echoes in the case of common oxide-in winding. This is unfortunate as pre-echo is subjectively more annoying than post-echo which is a natural phenomenon.

Whilst the user has no control over the performance of a tape type, the choice of tape type being a compromise of many parameters, there are ways of minimising long term print-through. To start with tapes can be stored 'tail-out' such that the pre- and post-echoes are reversed with the pre-echo being reduced in intensity. Alternatively the tape may be wound oxide-out, but this may be inadvisable in view of the effect of 'cupping' described earlier.

The actual recording process has no effect on print-through, recording at lower levels only reduces the print-through in proportion to the recording level, but this may mask the print-through below tape noise. However, the choice of tape thickness and the tape speed is significant as print-through may be derived from the following formula:

$$\text{PRINT} = K \times \frac{(4 \times \pi^2 t) \times e^{-\frac{(2\pi d)}{\lambda}}}{\lambda}$$

Where K is a constant; t = coating thickness; d = layer to layer distance;  $\lambda$  = recorded wavelength.

Examination of this formula shows a couple of useful factors under the tape user's control as print is related to both the recorded wavelength and the base film thickness. The former is dependent upon tape speed with print-through decreasing as shown in Fig 12 with decreasing wavelength or in other words decreasing tape speed.

The second factor is that print-through decreases with increasing base film thickness. As standard and long play tapes have similar coating thicknesses it is a distinct advantage to use standard play tape as shown in Fig 13.

Nothing more can be done in the recording process to reduce print-through as whilst it was at one time thought that winding tension had an effect on long term print-through, this is not the case.

The influence of storage conditions is another matter as print-through is increased with increasing temperature or the presence of mild magnetic fields, both these matters being related to the small low coercivity particles which switch easily and in fact cause the printing effect.

Printing is roughly proportional to temperature, increasing about 6 dB for every 20°C rise in temperature. Thus, cool storage conditions assist in this respect as well as others. External magnetic fields in excess of 5 Oe cause a significant increase in printing but such fields are well above the earth's magnetic field and are unlikely to be

FIG 10  
TYPICAL PRINT THROUGH AT 1kHz  
15 IN/S ON NAB SPOOL

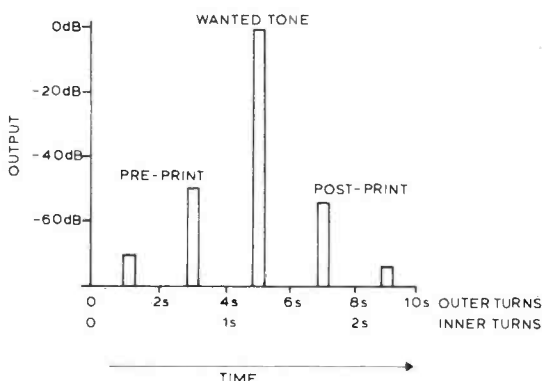


FIG 11  
SEPARATION LOSS AT 15 IN/S-v-FREQUENCY  
with separation as a parameter

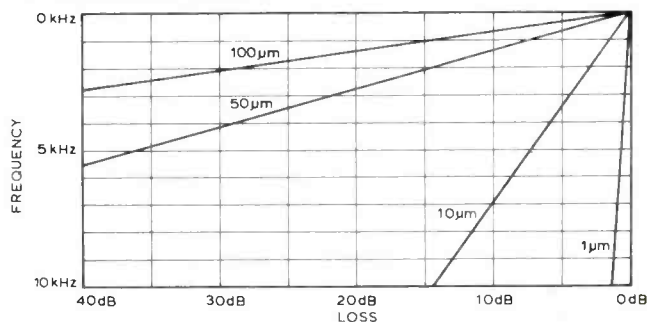


FIG 12  
PRINT-v-FREQUENCY AT 15 IN/S  
with basefilm as a parameter

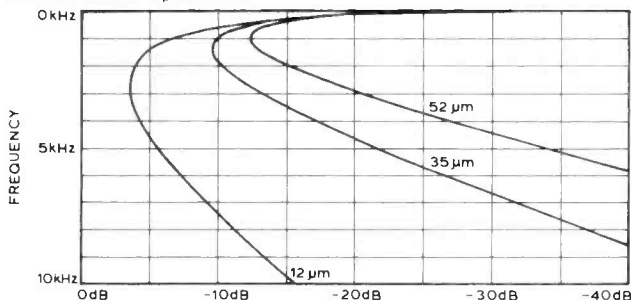
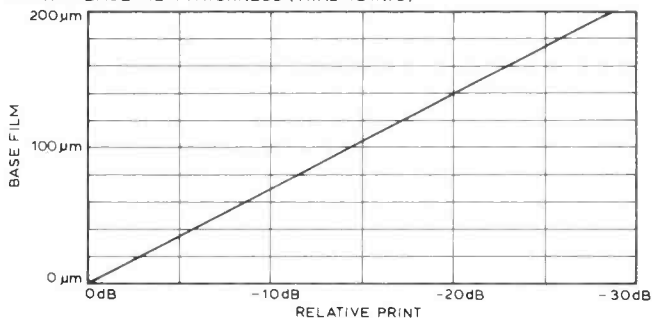


FIG 13  
PRINT-v-BASE FILM THICKNESS (1kHz 15 IN/S)



# IMPORTANT ANNOUNCEMENT

Sony PCMF1/SLF1



Sony PCM701ES/SLC9



To clear any confusion or misunderstanding about the above Sony Digital recording products, please be advised:

**1** The Sony PCMF1 is still in production in Japan, and is available from HHB. The Sony SLF1 video recorder has indeed ceased production, but HHB has managed to secure limited numbers of these desirable machines.

**2** It should also be borne in mind that an alternative system exists for applications where portability is not essential. This system comprises the Sony PCM701ES processor - identical in function and compatibility to the PCMF1 - and SLC9 video recorder.

**3** HHB are pleased to announce ex-stock availability of CLUE (Computer Logging Unit and Editor) which provides editing facilities for PCMF1 or PCM701ES/Betamax recording, as well as intelligent autolocation and logging.

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encountered in normal storage environments.

The printed signal increases exponentially with storage time with the rate of increase being insignificant after a few days and print being quite apparent after less than an hour's storage.

Observing the precautions mentioned will reduce print-through and its subjective effect. However, once printed there are factors which will reduce the printed signals.

One factor is rewinding the tape before playing, another good reason for storing the tape tail-out. A second way of reducing the printed signal is to apply a low level of high frequency erasure. Whilst this will slightly (if carefully adjusted) erase short wavelength wanted signals it will also provide a significant reduction in the printed signal.

## Accidental erasure and signal loss

Once a recording has been made, subject to accident or intentional erasure, it is a permanent feature of a tape and does not fade with time. There are however a number of things that can affect the recorded signal in normal use of the tape.

Whilst playing a tape the recorded signal will be affected if the tape transport is magnetised, thus routine degaussing of tape transports is not recommended if tape noise is not to be increased or high frequencies attenuated as these are the first to be affected.

In the case of multitrack recordings dubbing on to an adjacent track can lead to high frequency loss on some machines. This is due to flux leakage in the erase head between adjacent tracks which may cause loss of high frequency level.

A further matter, which relates mainly to low tape speeds, is the magnetostrictive effect. The mechanical effect of passing a tape over a very small radius guide can lead to short wavelength losses which depend upon the type of magnetic material used in the tape—some are more stable than others.

The above are relatively minor effects which will often remain undetected. What really frightens people is the possible complete loss of a recording. As will be seen this is in practice fairly unlikely—when did you last erase the magnetic stripe on your credit cards?

There are two ways in which a tape can be completely (so far as the audible signal is concerned) erased. Either the recording must be erased by a magnetic field or the tape must be heated beyond the Curie point. The Curie point is the temperature at which a ferromagnetic material becomes paramagnetic with a resulting realignment of the magnetic particles.

For iron oxide tape the Curie point is about 455°C which is unlikely to be encountered except in case of fire but that of chromium dioxide is at around 130°C which could be encountered in other circumstances.

Most people's fears about accidental erasure relate to transporting tapes in cars, trains, aircraft, etc, with the additional possibility of erasure by electrical equipment, power cables and the like.

# HANDLING AND STORAGE OF TAPE

In round figures the coercivity of most recording tape is in the region of 300 Oe and a minimum of this field is required for complete long wavelength erasure. However, short wavelengths (high frequencies) will be erased at considerably lower fields. Studies have shown that in the case of 15 in/s recordings no measurable erasure of signals up to 25 kHz occurs in fields below 50 Oe. This may therefore be considered a safe environment for professional recordings.

Fortunately most electromagnetic devices such as electric motors, generators, transformers, solenoids, etc, are designed for maximum efficiency. This implies that the magnetic field should be contained as much as possible and in practice the stray fields at the surface of such devices rarely approach 50 Oe.

Another source of common concern is power cables. These are normally run in pairs such that the magnetic fields from individual conductors cancel. However, it appears that isolated individual conductors might present a hazard.

Taking the formula for the field  $H$  Oe at a point  $d$  mm from an infinitely long conductor carrying  $I$  A throws some light on this potential source of accidental erasure:

$$H = \frac{(2 \times I)}{d}$$

Taking into account insulation thickness and the distance of the tape from the edge of a spool, say 4 mm total, an isolated cable carrying 100 A would produce a field of 50 Oe. Clearly this is a potential hazard but a more serious matter is the field from small magnets such as those used for notice boards and key rings. If these come into contact with a tape, erasure of a section is certain as is the case with loudspeaker magnets.

The way to virtually eliminate these hazards is to pack tapes in transit with a minimum of 3 in of packing material around the tape. If this precaution is taken it is extremely unlikely that a magnetic field large enough to effect any form of erasure will be encountered.

Should an accident occur it must be remembered that it is almost impossible for the complete reel of tape to be erased and certainly 'bumps' and 'clicks' will remain on the tape. Even using a hand bulk eraser it is difficult to end up with a completely erased tape. The moral here is that in cases I have come across where accidental erasure has been alleged, the source has certainly been accidental—namely, operator error.

Before leaving the subject of accidental erasure, fear is sometimes expressed that magnetism will travel through tape libraries from tape to tape or along steel shelving. Certainly magnetism will not travel from tape to tape and cause erasure and it is most unlikely that steel

shelves would be sufficiently magnetised to cause trouble.

## Effects of heat and radiation

As has been explained elevated temperatures aggravate print-through, but in other respects normal environmental temperatures are of little consequence if they do not vary over a wide range. Provided that the Curie point of the magnetic material is not reached recordings will not be damaged.

Physical damage to the coating and/or base film is another matter. This has been partially covered under the heading of tape defects, but to avoid troubles tape should not be temperature cycled. In any case a tape should be acclimatised to the local room temperature before being used and in general should not be left on recorders when not needed. With some machines the hubs get very hot and this may cause tape damage.

The maximum temperature that a given tape can survive depends very much on the particular formulation but tests on tapes in fireproof safes have shown that the main risk is mechanical damage rather than disintegration of the materials.

Other forms of radiation such as X-rays, neutron bombardment, gamma rays or beta rays have no effect on the magnetic recording or the base film at levels that can be survived by humans. At very much higher radiation levels it is believed that the base films (particularly acetate) become brittle but such levels will not even be encountered in nuclear bomb fallout.

## Handling and shipping

A golden rule is never to handle tapes other than by holding the hub of the spool—grabbing the flanges stands a very good chance of damaging the tape. Similarly, in storage and at other times, the tape should always be supported by the hub and not just left lying about.

When tapes are not on a machine, and always when they are in transit, the free end of the tape must be properly secured with splicing tape. This may be to the outer layer (preferable) or to the spool.

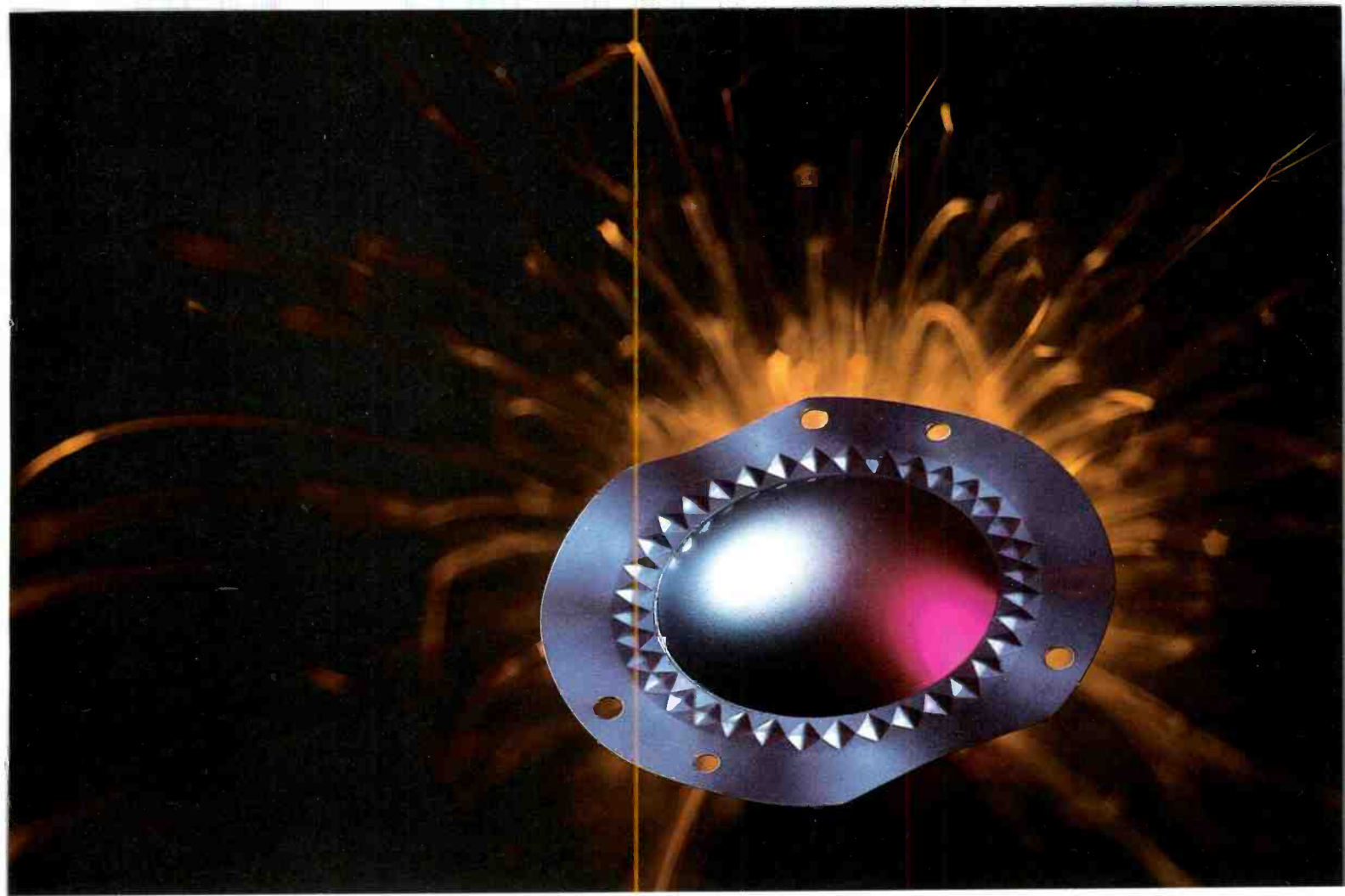
It is good practice to keep tape in a plastic bag to avoid contamination by dust, including paper dust from tape boxes. Spools should be supported by the hub with the spool vertical as this discourages blocking and other mechanical defects.

When archiving tapes they should be wound tail out on to the storage spool after acclimatisation to the storage temperature which should be between 15°C and 20°C with the relative humidity controlled at 20% to 70%.

Where possible similar conditions should be aimed at in transit and certainly rapid, wide changes in temperature should be avoided, as should severe mechanical shocks or excessive vibration—these can be a serious problem leading to mechanical damage to the wind and even the spools.

Recorded tape should be packed with at least 3 in of packing material surrounding the tape to virtually eliminate the chance of accidental erasure. □





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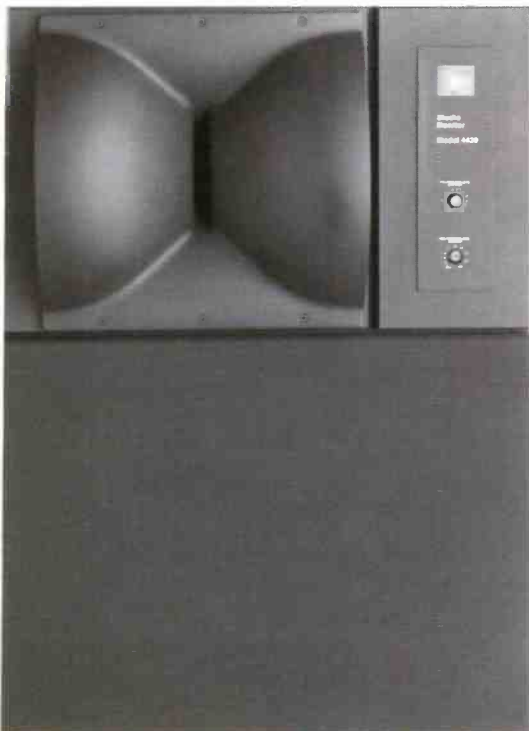
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# FACTOR ON RECORD

**S**ix am Kennedy Airport and I've just flown in from Los Angeles with barely four hours' sleep—and most of that just cat napping. First thing to do is find a telephone and give Richard a ring! "Hi! Welcome to New York—grab a cab and come on in!" There ought to be a law against people being bright and breezy that early in the morning. However, I follow his instructions and make my entrance to the Big Apple with what must be the most uncommunicative taxi driver ever.

Downtown New York and I'm climbing skywards in an elevator to the high rise apartment (50th floor) of Richard Factor, self-confessed chocolate junkie, computer freak and rock'n'roll fan. Mr Factor is also the founder and leading light of Eventide Clockworks (now known as Eventide Inc).

One of the true characters of the audio world, Richard Factor is responsible for many innovations in the recording industry as far as special effects are concerned and the trade name *Harmonizer* is to pitch changing devices what Hoover is to vacuum cleaners.

Although we were in his private flat, it seemed more like a laboratory with benches full of test equipment and prototype circuit boards plus a scattering of computers.

Breakfast consisting of a sort of black coffee and the previous night's cakes was organised and it was decided that I would sit on the floor (well, on the cushion) and Richard at his desk, and away we went.

"Of course, you've chosen the worst possible time to come as I have to be in the office at nine as I'm going away for a couple of days! Well, what do you want to talk about?" When I explained that press secretary Elihu Sternwallow had written saying that my scheduled visit would be fine 'as Mr Factor never goes anywhere or does anything' and that my idea was to get an interview with Mr Factor himself, he came back with, "Well, we sent Sternwallow back to *Mad* for retirement and why interview me? I can't think of anyone wanting to read about me, that would be awfully dull."

OK, this was not the first time I had met Richard so I did have some idea of what to expect. Mumbling something about who does interviews at 7:00 in the morning anyway, we began.

"Ten years ago people didn't realise

## Richard Factor, founder of Eventide Clockworks, agreed to talk to Terry Nelson in New York

how glamorous the signal processing business would be. In those days we all wanted to be engineers, now most people want to be manufacturers. The result of all this is that there is an overkill of products. Too many people are making units that essentially do the same thing, which is a bit of a silly situation. I'm not complaining, Eventide has always done well, but customers sometimes wonder where to turn their heads.

"The question I ask myself is, 'Is there a limit to what you can design in a time-based unit?' This is the challenge!" (eyes flash with demoniacal glee.) "To be able to do a product that is better and more original than the rest—and one that is also not easily copyable. It's no good doing all the research and legwork if someone else is going to take what you have done and come out with his own version of it.

"There is always a better way of doing something, you just have to keep on persevering until you find it."

It was this sort of attitude that led Richard Factor to be the first to use memory chips—or RAMs—instead of shift registers in the 1745 delay line in order to increase versatility. At the time of our talk he had just come across a chip with a RAM capacity of 256K and was very excited about it, to the extent of brandishing a prototype circuit board that already held a batch of them. "Now we can all throw away our

**I can't think of  
anyone wanting  
to read about me,  
that would be  
awfully dull**

disk drives!" Well, not quite, but the memory capacity will open up new avenues to be explored and we can be sure that Mr Factor will be walking—or running—down all of them. The immediate drawback is, of course, cost. However, once the chip starts to sell in large quantities it will become more commercially viable.

We went on to talk about Richard's beginnings in the audio industry and the events that led up to the founding of Eventide Clockworks.

"I actually got into the audio business by helping out in a studio called Sound Exchange, that was owned by my friend Steve Katz (of Blues Project/Blood, Sweat and Tears fame). This had the first Ampex *MM1000* series multitrack and due to the small size of the control room, Steve wanted to have a remote control unit for the recorder rather than have a tape op. There really just was not the room if you didn't want to feel cramped up while working. Anyway, I got hold of an IC 74192 up/down counter chip and made a remote control unit for the Ampex. This worked out amazingly well, to my surprise! Amazingly well enough for me to go to Ampex and sell them the design, which they then marketed successfully.

"At this point I thought that maybe I could even make some money in the electronics side of the business and made a decision. Thus it was at this point that I stopped working for a living and went into business!"

This led to the formation of Eventide Clockworks, the Clockworks coming from the counter function of the remote control unit. And the Eventide? "Well, I did most of my work in the evening so why not Eventide?"

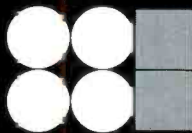
The end of last year saw the company changing the mainspring, as it were, with both a name change and new premises; the name becoming Eventide Inc and the new home being a 20,000 ft<sup>2</sup> factory space in New Jersey. (This also spelt the end of Richard's flat—no more sunrises over Manhattan.) The new premises will give Eventide greater manufacturing facilities and more room to breathe, both from the point of view of making the product and developing it, as well as permitting a much more streamlined organisation. "Organized! Who wants to be organized?" Well, I suppose the old 265 West 54th Street place did have character but it did have

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room for improvement. However, back to Mr Factor.

"People should realise that Eventide have been around a long time and can really be counted as one of the pioneers of the audio world, with products such as the 1745A DDL, which was one of the first digital delay lines commercially available."

A confirmed computer freak, Richard Factor was already working with a personal computer in 1971—a Hewlett-Packard 9810—on projects such as reverberation simulation. However it was found that the computer needed more memory. Rather than change the computer, Eventide discovered they could make their own replacement memory boards better and cheaper than HP were offering at the time. By then the computer market was getting into gear and with the premise that 'if we need them, other people probably do as well', Eventide entered the computer market with replacement memory boards for Hewlett-Packard computers. "This is what you call business by coincidence."

Making memory boards still forms a substantial part of the company's business and other excursions into the computer market include software packages for the APX252 audio spectrum analyser for Apple II and Apple II+ computers. This package, *Specsystem 2.0*, permits the plotting of reverberation decays, RT60 in 1/3-octave bands, 3-D spectral surfaces and real-time analysis with interactive keyboard control of measurement and display parameters. Display is in colour on the Apple HIRES screen and makes for a powerful audio tool for studios already owning an Apple II computer.

At around the same time as the introduction of the memory boards, a gentleman by the name of George Darby provided the introduction that would bring the Eventide DDL's on to the market. In 1972 the first 1745 for broadcast use was installed for the Maryland PBS (Public Broadcasting Service) as a custom project. The unit worked well and it was thought that if one broadcast station needed one, then others probably would too. This led to the commercialisation of the 1745A delay line, with 100 ms of delay as standard and a further 100 ms as an option. "At this time Lexicon were the only competition with the *Delta T* delay line so the market was open and we took advantage of it."

**A**t the same time the 1745A was introduced, the *Instant Phaser* was marketed and therein hangs a tale.

"OK, here's a story of a commercial mistake for you. The '70s also saw the start of the bucket brigade circuits, all of which were fairly useless in one way or another. However, we finally found one that worked quite well and this led to the development of the *Instant Flanger*—flanging being one of the in-sounds at that time. (It's still quite popular now!) The *Instant Phaser* had been an immediate success and was still selling well. Aha, we thought, with the *Instant Flanger* we can better this so the idea was to discontinue the phaser and sell off the remaining stock. We would then

## FACTOR ON RECORD

take a two month pause and at the end of it, come out with the *Instant Flanger*, which would be an instant hit!

"To start with, things went pretty well and we felt we had made the right decision. Then we started getting calls from people who wanted *Instant Phasers* as well. One mistake we had made was in assuming that when people talked about phasing they really wanted flanging, but no! The two effects are, after all, produced differently—flanging being timebased—and also sound different. By the time a couple of years had passed we had quite an accumulation of calls for the phaser, including some pretty desperate ones of the sort, 'if you can't build me one I'm coming down to sort you guys out' type of thing—or where ludicrous sums of money were being offered if we would make the customer one. We realised, a bit too late, that we had made a classic with the *Instant Phaser*—the same way certain musical instruments had become so such as the *Les Paul* or *Telecaster* or *B3*—and that we should never have stopped making it. In order to rectify things we brought out the *Phaser* card for the *Instant Flanger* so that customers could have the best of both worlds. The new card was certainly an improvement on the original but we should never have stopped the phaser in the first place. I hate to think how many lost sales we must have had because of that!" Moral of story: never tamper with success.

Hardly surprising is the fact that Richard Factor is a keen science fiction fan. Once we had found that we had that interest in common, our discussion veered towards the great digital vs analogue debate.

"Well, the scientists say that it is not an analogue world, that space and time are quantised. However, as far as digital and analogue are concerned at the moment, I'm firmly in the middle! Which



is not the same as sitting on the fence. I think that for digital to get better—or to be better—the sampling rates have to be increased. At the present time they are too low and I feel that it's really a bit too early in the day to have fixed standards as they are bound to change within a very short time. I realise that research work has to be paid for but it can also be a mistake to want to commercialise something that new so soon. Try it out by all means but on a limited basis. Personally, I would like to see something like a standard of 100 kHz sampling with 20 to 24 bits, then I think digital will really come into its own.

"Human hearing is something that is not fully explored yet. Though we don't consciously hear the sampling with today's digital systems, the brain probably does and this may be why some people report a certain uneasiness when hearing digital, or that the sound appears brittle and edgy, as well as being tiring after a moment. Good reproduction is a question of bits and sampling rates and we still have a way to go. Like I said, I'm firmly in the middle and watching developments. If you take everything to its logical conclusion you have to take every link of the audio chain into account as well. What do you use for loudspeaker wire? The UREI system is theoretically very good (conductor compensation circuitry used in the UREI 6500 power amplifier in conjunction with the UREI monitors which is claimed to eliminate ringing and other problems, plus providing high damping and good transient response) but what about the actual loudspeakers themselves? They are still the weakest link in the audio chain and ideally every link has to be as good as the others. There again, how many people *really* listen and note the tiny imperfections—especially on the consumer side? Most people listen in far from ideal conditions and then most of the time while they are doing something else. If they are listening seriously, then they are usually more concerned with the music than with catching every little defect.

"All this is not to say 'why bother' but just to bring a little perspective on the situation. So, digital? Yes, but it has to get better and time will tell."

**T**ime was also getting on and a sunny day was actually drawing over New York—maybe we ought to talk about some of the Eventide products before going our separate ways. One of the things that came up almost immediately was the *Harmonizer*. The H910, which was the first of the breed, opened the door for a host of new effects (as well as being the perfect cover-up for 'less than perfect' performers), to be followed later by the H949. Reflecting Richard Factor's involvement with computers, the H949 has an IEEE-488 interface bus allowing one or several units to be controlled by a small computer or automated console.

"There is a lot of fun-potential in a pitch changing device! It's good for a lot of sound effects as well as the more sane applications such as a straight delay line. One of the problems with pitch change effects that may not be evident straight away is that of preserving the

proper harmonic relationships. You can't just change pitch—the musical ratios also have to be kept. Anyway, they're still fun and—they also make a buck!" Such candour.

The *H949* is also part of Eventide's *Timesqueeze System*, a computerised package consisting of an *H949*, an Eventide *PTC945* precision tape controller and a Hewlett-Packard *HP-85* computer 'programmed with proprietary Eventide software'. The basic function of the system is to shorten or lengthen the running time of programme material—be it audio, video or film—without recourse to editing, deletions or other giveaways. Typical applications are fitting material into fixed programme time slots for broadcasting, condensing commercials or clips to give more impact, programme pacing and special effects.

The latest product from Eventide is the *SP2016* signal processor. This can perform a variety of functions due to its ability to use plug-in ROMs for effects such as reverberation, tape echo (including multiple head, just like your old *Copycats!*), delay, chorus, combs, selective band decay, etc.

"The digital reverb took a long time coming. We were dissatisfied with every prototype we made so we just kept on plugging away until we got what we wanted. Our aim was to produce a unit with excellent sound quality and not just another digital reverb. The *SP2016* is the result of years of research and development and as such, offers tremendous flexibility and virtually unlimited possibilities for expansion in the future."

## You have to talk to people, find out where they want to go and then help them get there

One aspect that sets the *SP2016* apart from similar units is the lack of front panel controls in order to avoid confusion. Operation of the unit is much more akin to using a small computer than an effects device, with the computer taking the user through the control functions step by step. The IEEE-488 bus enables an external computer to access the internal capabilities of the unit in addition to the front panel user controls. In fact, if the user is also an experienced programmer, he could write his own software for the *SP2016*. The computer bus also enables Eventide to offer what they call 'the ultimate hand-held remote'.

Due to the programmable aspects of the *SP2016*, the applications are numerous. Not just being confined to the professional audio world, it is equally at home in electronic music, schools and colleges for both musical and educational purposes and other institutions. The unit is open for new and improved programs and this means that it can be constantly updated. An extensive self-test program

is also incorporated into the *SP2016* which will even point out the defective part for you!

As a closing comment, mention should be made of the fact that even though Richard Factor is an engineer and manufacturer, he is also a genuine rock and roll fan. In his bedroom there were about nine TV sets and video monitors grouped at the foot of the bed (all on at once showing a mixture of breakfast shows, cartoons, newscasts, etc) together with a large hi-fi installation, one wall housed his extensive record collection.

"OK, give me a name—a band, a musician and a date." Having done so, he immediately pulled out several records for me to listen to with the artists in question at around the date specified.

Apart from the humorous aspects of the situation, it also shows that Richard understands *what* his equipment (and other people's) is used for and what effects they are trying to create. He may not be able to go to as many concerts as he used to—and as he would like—but he still keeps a very active finger on the pulse, which no doubt is one of the reasons Eventide are still around and doing well.

"You have to talk to people, find out what it's all about and where they want to go—or think they want to go—and then help them get there!"

Well, Mr Factor, it was fun talking to you and yes, I did get to Boston on that striking Greyhound bus! However, I haven't forgotten your bribe for the interview and will give you your Swiss chocolate the next time I see you. □

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# INSIGHTS INSIGHTS

Recording industry comment by Richard Elen

## The logic of fashion

Sound recording is an interesting—perhaps unique—blend of art and technology. Today's recording engineers are largely creative people, with an operational knowledge of what are now very sophisticated tools of the trade. The modern recording console with automation is a massive, complex and expensive piece of technology built in the service of art. How does the studio owner choose the right console for the job?

One would have thought that there was a pretty small set of criteria on which such a decision was based: first, there is the technical one of quality. We might number here a few areas of special interest: signal-to-noise ratio, equaliser design, crosstalk, reliability, ease of maintenance, and so on. It is probably true to say that the majority of consoles built these days by respectable and respected manufacturers will meet 'state-of-the-art' technical criteria and *won't* be noisy or have huge phase-shifts at the bottom end, for example, and we would be surprised if they did.

Then there are two other areas which are distinct but related: console layout and control. The layout—the ergonomics—of a console is what makes the system easy to use successfully under the pressures of studio life: the placing of controls and indicators in the best positions so that they fall under the engineer's hand or eye as naturally as possible, especially when there are 80 musos out there with an MD, and a producer next to you, all waiting for you to get the sounds together and on to sensible parts of the tape machine.

Along with the placing of controls and indicators goes the ergonomics of the control system, the logic which controls how solo buttons work, how VCA grouping is performed, what happens to the main outputs when you do *this*, and so on. It needs to be sensible and as obvious as possible, in conjunction with the layout of the control surface, so that not only do the buttons fall under your hands at the right moments, but also that they do what you expect (or at least what the label says they do). Of course, modern consoles *do* differ, thank goodness, so you can't expect everything to do the same thing and be in the same place on every console you come across in a studio. But you *can* expect it to make sense pretty fast.

The final area of ergonomics is what I call 'software ergonomics', in other words, how well (or badly) the complex computer-controlled systems in a modern automation system or console relate to what you want to do with them. Does the system give you useful messages to tell you what is going on, or flash useful lights at you at the right times? A particularly good example here is the Sony DAE-1100 digital editing system,

which actually tells you, by flashing LEDs, what button you will probably want to press next. Above all, how does the software design affect your way of working? If you are using an automated mixing system, it may either simply automate the usual way you do a mix, remembering what you have done and allowing you to keep some or all of it; or it may offer new operational possibilities which were manually impractical before, thus adding to your creative repertoire. In a worst case, it may force you to work in a different way altogether, perhaps neither better nor worse in terms of the final result than another system, but simply different—and confusingly so.

Then there is perhaps the most important aspect of a console to consider: the sound. Exactly what that is may be hard to quantify. It may be a matter of letting your engineers loose on a number of systems which qualify for consideration in other ways and seeing how they get on. Or talking to other people you know who have a such-and-such and see what they like and dislike about it on sessions (and while you're at it, talk to the maintenance department and see how *they* like the console and ascertain any technical foibles it may have).

From these criteria it should be possible to select, within your price range, a console or system which meets your technical standards and your creative requirements. Shouldn't it?

There are many freelance producers around these days, and on every project they undertake they will have to make a decision as to where to do it. Which studio will suit the artist (and the producer's style) best? Choosing a studio is by no means an easy task because here the equipment in the control room is only *one* of the factors to be considered. Other considerations will of course include the sound of the room, the monitoring, how nice the people are to you, how efficient they are, how good the maintenance is, and how the place 'feels' to work in. Sometimes, of course, a producer will have a relationship with a studio, where some or all of the above criteria are satisfied on the basis of past experience. But however the matter is decided, it's going to involve a lot of different factors, isn't it? Well, it seems the answer is today a decided 'maybe'.

At the top end of the studio market there are only a limited number of basic pieces of equipment which will fit the bill in terms of sophistication, 'state-of-the-artness' and overall quality. On the tape machines side, the decision will involve a small number of digital machines and a small number of analogue recorders. In both cases the possibilities may be counted on the fingers of little more than one hand.

In the console market the choice is even more limited. There are about three. If you are electing to go digital

and you have the money, the Neve DSP may appeal. At the top of the analogue field it's going to be a Neve 8128 or an SSL SL4000 series unless I'm very much mistaken. On the face of it the decision is quite difficult. Both consoles offer a high degree of sophistication and technical excellence, a good automation system, and all the other things discussed earlier.

We might feel that Neve have given themselves a slight problem of image, in that they have effectively eclipsed their top-end analogue consoles with the DSP. It wouldn't have mattered much, were it not for the fact that the DSP is very expensive and that it didn't work first time. The DSP is brand-new technology from the ground up, and as such it would be silly to think that there wouldn't be teething troubles with the design for a time. When you design a new analogue console, you may decide to put different switches or knobs on it in different places, give it different facilities, even give it a completely new control logic—but at least you know basically how an analogue signal path is going to behave and what to do if it doesn't. With digital signal processing there is no such safety net so it is hardly surprising that it didn't work completely from the word go. This has probably done Neve a certain amount of damage, despite the fact that it now works fine. But it *does* mean that it is more difficult today to focus people's attention on the 8128 when there is this digital lump sitting there that someone in the market for an SSL or 8128 can't afford.

So people are going out and buying SSLs. This is of course excellent news for the people out near Oxford, and they probably believe that the massive interest in their consoles is a result of the fact that they are actually marvellous pieces of equipment which produce an excellent sound, and in which all the criteria I mentioned have been handled with exemplary thought and precision. All this is indeed true, but I think there is another reason why SSL consoles are doing so well in the UK (and soon will be in the USA I'm sure) which does not bode so well, either for SSL or for the industry at large, and it would be as well to think about it.

Certainly, the first buyers of SL4000 consoles bought them because they were excellent systems, as we have already discussed at length. Now, I fear, they buy them because they are fashionable. A studio is virtually forced to buy an SSL if it has any excuse in the world, because the Top Producers and others in the industry simply won't come and work at your place unless you've got one. Stuff the acoustics, the tape ops, the quality of the coffee, the atmosphere, the engineers, the car parking, you've got to have an SSL to be seriously considered.

This attitude is plainly stupid and liable to cause a whole load of trouble.

# INSIGHTS

We can consider ourselves lucky that the 'music biz' end of the industry has chosen such an intrinsically good product as the object of its fashion-consciousness. As it happens, it had little choice in the matter from the products available, but the fact remains that it made that decision for the wrong reasons. And a decision based on fashion could change in a moment. It might change to something truly awful overnight. If someone important has a massive hit with a Grumble 60, we may well find ourselves in a position where we all have to change over to Grumble 60s and throw out the *SLA000s*. This could be expensive, and we might not be so lucky next time: the Grumble 60 may be a load of expensive rubbish. Someone out there *owns* one of those things now, and it is lurking in the dark of a nearly-forgotten studio, waiting for some producer or other to be unable to get into his favourite SSL studio and to have it recommended by a friend.

Indeed, the 'everyone has got one' syndrome is likely to cause trouble for SSL in itself. I have already been asked to advise more than one studio on what it should get as its new console, and on recommending the obvious, have heard the remark, 'Yes, but everyone's got one... what else is there?' The fact is that at the moment there isn't much else to choose from up at that end of the market. This situation surely cannot last for long. There must be several manufacturers lurking in the background thinking how they could get into a market which is so unnaturally dominated by one product. Calrec, for example, have a very tasty console on the cards, so to speak, which looks as if it might qualify. A major studio (significantly, not in the UK) has already decided to try the idea.

Calrec will need to make some good PR out of everything to do with the design to become a strong contender: they have an excellent record in the broadcast field and in microphone production, but to many studios they are an unknown quantity. Indeed, PR people are going to have a field-day. The only way to get these consoles into the marketplace will be to make them fashionable, however good they actually sound, or however easy they are to use. I don't regard that as particularly healthy.

With a number of other manufacturers working in this area there will eventually be less of an excuse for fashion in coming months, because all these products will be good! This, surely, is just as well. If you buy something like an expensive console because it is fashionable you are asking for trouble. If you have any long-term business acumen, you should buy because it sounds right and works right. Good sounds never go out of fashion (or at least nearly never, but that's another story...).

## Rock 'n' rollaround

Engineer John Acock is to be congratulated, for his excellent work on the new Steve Hackett album, *Till We Have Faces* (Lamborghini Records LMG4000). The first commercial Ambisonically-mixed release, it is available on CD as well as old-fashioned vinyl. The CDs are some of the first produced by the new Nimbus Records factory in Wales and he has managed to pip me at the post as my Ambisonically-mixed CD-only release, *Surprise Surprise* is following on a couple of weeks behind. Although the Steve Hackett album

contains some exciting surround effects (which, due to the inherent compatibility of the system are not lost on the stereo listener) the technology never intrudes on the music. This is of course as it should be, and we may be lucky in seeing Ambisonics take off without loads of meaningless surround ping-pong recordings. The actual album sleeve hardly mentions Ambisonics, and it certainly doesn't note the fact that one track, previously released as a single, is *not* Ambisonically encoded, as it was mixed prior to the album sessions. It will be interesting to see who notices the difference. □

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16:2:1 12:4:2:1 16:4:2:1

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# ERGONOMIC ASPECTS OF MIXING CONSOLE DESIGN

**A**n important consideration concerns the question of control-display relationships. The relationship between a control movement and its effect which is expected by the majority of the population is known as a 'population stereotype' and control-display relationships which conform to a stereotype are said to be 'compatible'.<sup>7</sup>

In general, up, clockwise, forward or to the right implies increase of a variable or suggests that movements of a machine will be in these directions.<sup>23,7,21,22,10</sup>

Consequently it is recommended that mixing console components be arranged so that the backward-downward displacement of a fader attenuates the sound. This should be indicated by a corresponding backward-downward movement of its associated PPM or VU meter. Conversely, the forward-up displacement of a fader should result in a gain in sound and forward-up movement of its associated display. This recommendation is predicated on the assertion that: "it follows that when an operator moves a control he expects the responding member and the display which represents it to move in the same direction as the control".<sup>24</sup>

Unfortunately a sizeable number of sound mixing consoles are characterised by control-display relationships that depart from this configuration. The majority of sound reinforcement and recording consoles, whilst retaining the recommended control arrangements, employ meters which display 'gain' by means of a right hand/clockwise pointer deflection. Conversely, 'attenuation' is indicated by a right-left/anti-clockwise pointer deflection. Richter and Jones<sup>25</sup> report that where consoles are used for broadcasting purposes, the controlling actions of the faders are reversed, ie the 'open' positions are near the operator in order to reduce the risk of opening a channel by inadvertently knocking its fader.

Clearly these variations will undermine performance. As Loveless cautions:<sup>23</sup> "reversing a habit is not like reversing an electrical connection. The old habit is not so much replaced by the new as overlaid by it. During training, the old response is weakened sufficiently to allow the new response to appear, and the latter is then strengthened by further practice; but the old habit has been suppressed rather than eliminated. . . Even with extensive practice, it may be difficult to ensure that the new response has more than a precarious margin of dominance. . . The suppressed habit may be revived in strength by experience outside the

## PART TWO

Part one of this article in our November issue looked at design considerations for display and controls in the modern sound mixing console. In part two, Gerard Paul Hodgkinson discusses workspace and environment in the control room, with suggestions on overall console construction

working situation. A similar effect may be produced when display-control relationships within the working situation are inconsistent."

In view of this there is clearly a need to adopt standardised control-display relationships throughout the entire industry. In cases where the prevention of accidental operation of the control is a critical consideration, this could be accomplished by incorporating some form of safety button into the fader knob, thus obviating the need to reverse the controlling action of the faders.

### Work space

Ergonomists have devoted considerable attention to the problem of the arrangement of console components. Out of this research has come a body of principles which, if applied to the design of a task, will reduce operator workload—thus facilitating performance:<sup>3</sup> (1) *the sequence principle*—if the operation always follows a *fixed sequence*, the controls and displays should be laid out in that order; (2) *the functional principle*—if, as is commonly the case, the instruments do not have a fixed operating sequence, they should be grouped according to their function; (3) *the importance principle*—this principle deals with operational importance, that is, the degree to which the performance of the activity with the component is vital to the achievement of

the objectives of the system or some other consideration. The more important controls should be located in the most convenient positions; (4) *the frequency of use principle*—as its name implies, this principle refers to the frequency with which some component is used, for example having the sub-group fader controls immediately in front of the sound engineer because of the frequency with which they are used.

In so far as it is possible, controls and displays should be located so as not to exceed the reach and visual capabilities of their operators. Perhaps one of the most fundamental considerations at the outset concerns the height of the mixing console relative to the operator. Where mixing consoles are used on location for sound reinforcement purposes, the console is often placed on a table with arbitrary specifications. The engineer sits on whatever chair happens to be available, rather than a seat purpose-built for the task. A corollary of this is that the engineer may be forced to occupy a position outside his comfortable operating range, thus giving rise to problems of muscular fatigue and cramp, especially in the neck, arms and legs. Moreover, the console may be so high as to render the controls and their associated markings above the operator's sight line. In view of this it is strongly recommended that adjustable tables and seats be employed. These should be so adjusted that the optimum work height can be maintained, this being approximately 2.5 cm below the elbow.<sup>26</sup> Ideally the table's surface should be of minimal thickness.

Das and Grady have argued convincingly that a sit-stand workplace layout is generally more desirable than only a sit workplace because such a layout permits the operator to shift his or her posture at will and thus reduce the muscular fatigue which results from prolonged effort in one position. They suggest that in designing industrial workplace layouts for the sit-stand operator, the following design recommendations should be observed: (1) provide a raised seat, since the operator alternates between sitting and standing positions; (2) make sure that the seat is easily moveable into and out of position; and (3) provide a foot rest for the seated position to minimise muscle soreness and fatigue.

The working area in the horizontal plane for a sit-stand male or female operator is shown in Fig 2a, whilst Fig 2b shows the working area in the vertical plane. Table 1 summarises the design dimensions for workplace layouts for sit-stand operators. The normal and maximum horizontal and vertical





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clearance dimensions for sit-stand operators are summarised in Table 2. Data is given for the 5th, 50th and 95th percentiles.

The term percentile refers to the percentage of a given population whose measurement for a given characteristic (eg height) is at or below a given value. Thus, for example, if the maximum vertical reach for a population of Pygmies were equal to 120 cm (4 ft) at the 95th percentile, this would mean that 95% of the Pygmy population could not reach beyond this height. As Bernotat<sup>27</sup> has cautioned, in most cases a design for the average, that means for the 50th percentile, is a bad design. Rather, whenever possible, designers should use data pertaining to the 5th and 95th, or preferably the 2.5th and 97.5th percentiles, since these will incorporate 90% and 95% of the population, respectively. Tables and chairs for use by sound engineers, should be designed in such a way that their height can be adjusted within the 5th to 95th percentile range. Controls should be

## ERGONOMIC ASPECTS OF MIXING CONSOLE DESIGN

located for the 5th percentile ie so that they can be comfortably operated by all but the very smallest of the user population.

The use of control modules in order to facilitate the production process, has often meant that a console must, except for a meter penthouse, comprise a planar, rectangular surface set at a suitable angle. However as Swettenham observes, as the length and number of modules steadily increases this becomes less and less satisfactory for sight lines and comfortable arm reach: "if one sits upright with the hand resting on a fader, and then extends the arm forward and upward to shoulder height, leaning the body only slightly forward, the hand describes a curve which is part of an ellipse. The practical approximation to this in flat panels is to have two or three

increasing vertical angles rising away from the operator".

It is important that control panels slope up from the horizontal, to the extent that all controls and displays and their associated labels and markings, are clearly visible to the seated operator. Generally speaking, the greater the angle of the control panel, the more visible will be the panel markings and hence control settings, thus facilitating performance. A number of consoles have been designed with horizontal control panels. This has rendered some knobs and their respective labels and markings below the engineers' sight line, thus giving rise to problems in identifying the controls and reading errors (parallax). Recently some designers have attempted to circumvent these problems by placing labels and markings underneath their respective controls. Albeit unwittingly, this has led to problems of control-effect incompatibility arising from the illusion that the controlling action of the console knobs has been reversed.<sup>28</sup> Knobs are expected to rotate and to increase the variable they control when this rotation is clockwise.<sup>10</sup> Presumably errors occur when the engineer is expected to operate controls with inverted labels, by virtue of false perceptual cues furnished by this configuration.

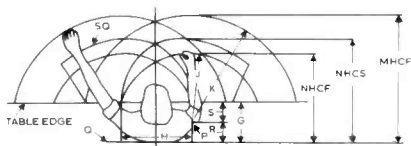
Swettenham correctly advocates the use of angled side panels for large studio consoles in order to enable more controls to be located within convenient access. In cases where the operator is confronted by a three-sided, low control and display array, but is able to maintain visual surveillance beyond the console by having unrestricted vision along the top, there is empirical data that suggests the provision of as great an angle, at least up to 65°, as would be compatible with other requirements. If, however, pairs of operators are to use the console, it appears that difficulties arise with angles greater than 55°. These are especially serious if both operators must see all control manipulations and displays on all parts of the console. On the assumption that the paired operator and the single operator be assigned equal importance, the selection of an angle of 50 to 55° appears to be the best resolution, taking all the conditions of use into consideration.<sup>29</sup>

Whilst the use of 'wrap around' shapes is recommended as a feasible solution to the problem of increasing the operator's optimum workspace, as it relates to recording and broadcasting studio consoles, it is not to be recommended for on location sound reinforcement consoles. Here portability is a paramount consideration. A partial solution would be to ensure that the most frequently used controls are located in the centre of the console (ie *the frequency of use principle*). Popescu<sup>30</sup> has suggested that larger consoles should have their group/sum faders and central operating units placed such that there is an equal number of input channels on each side, as shown in Fig 3.

Popescu believes that without a doubt, this configuration will prove to be more effective than the conventional arrangement of placing the group faders and central operating units on the right hand side of the bank of input channels, which results in there being over 2 m

FIG 2

(a) Normal and maximum working areas and clearances in the horizontal plane for a sit-stand operator. (Source: Ref 28)



(b) Normal and maximum working areas and clearances in the vertical plane for a sit-stand operator. (Source: Ref 28)

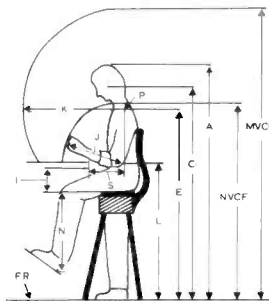


FIG 3 Larger consoles should have an equal number of inputs on each side. (Source: Ref 31)

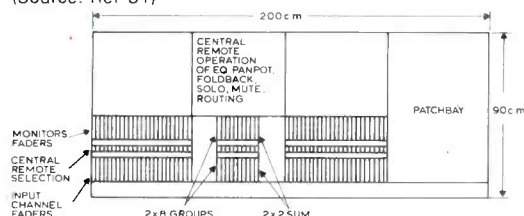


TABLE 1. Dimensions for workplace layouts for sit/stand male and female operators. (Source: Ref 28)

Body features (i)	General male (cm)	General female (cm)	Combination of male and female (cm)	Individual male, percentiles (cm)			Individual female, percentiles (cm)		
				5th	50th	95th	5th	50th	95th
(A) Total height (slump)	186.3	173.8	186.3	166.2	176.1	186.3	153.8	163.2	173.8
(C) Eye height (slump)	160.0	143.6	143.6	160.0	164.9	174.8	143.6	153.5	163.4
(E) Shoulder height	138.0	127.9	127.9	138.0	147.7	156.8	127.9	137.5	146.6
(G) Body depth	34.0	27.6	34.0	26.7	30.2	34.0	21.8	24.6	27.6
(H) Elbow-to-elbow	40.0	35.7	35.7	40.0	45.1	51.7	35.7	38.2	43.8
(I) Thigh clearance	18.5	16.5	18.5	14.2	16.2	18.5	12.4	14.4	16.5
(J) Forearm length (ii)	37.1	32.5	32.5	37.1	40.4	43.7	32.5	36.6	40.7
(K) Arm length (iii)	68.3	60.2	60.2	68.3	75.2	82.0	60.2	66.0	72.4
(L) Elbow height	120.4	111.2	120.4	105.6	113.0	120.4	99.0	105.1	111.2
(N) Popliteal height (sitting)	48.7	43.6	48.7	42.4	45.7	48.7	37.3	40.6	43.6

(i) All dimensions based on the US military population.

(ii) Normal and maximum reach dimensions based on thumb and forefinger manipulations.

(iii) Adjust values in (ii) for: end-of-fingertip add 7.6 cm; push add 5.1 cm; flip add 6.4 cm; and grip subtract 5.1 cm.

TABLE 2 Normal and maximum horizontal and vertical clearance dimensions for workplace layouts for sit/stand male and female operators. (Source: Ref 28)

Population	Horizontal clearance (cm)		Vertical clearance (cm)	
	Norm (NHCS)	Max (MHCF)	Norm (NVCF)	Max (MVCF)
General male	65.9	85.3	157.5	206.3
General female	55.7	74.0	143.7	188.1
Combination of male and female	61.6	77.2	152.9	188.1
5th percentile male	59.3	81.7	142.7	206.3
50th percentile male	65.6	90.3	153.4	222.9
95th percentile male	72.1	99.0	164.1	238.8
5th percentile female	50.6	71.1	131.5	188.1
50th percentile female	57.0	78.3	141.7	203.5
95th percentile female	63.6	86.2	152.9	219.0

Reference points for horizontal and vertical clearances are operator back (Q) and floor (FR) respectively, and normal and maximum reach based on thumb and forefinger manipulation.

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between channel 1 and one of the console's most widely used areas, the group faders. However this solution has yet to be validated empirically.

## Illumination of the task

The majority of sound mixing consoles are supplied without any form of panel lighting. Often the engineer relies solely on light emitted from PPM or VU displays (ie in cases where meters are used). Usually, however, some form of desk top lamp is employed. Ordinarily this is placed in an arbitrary manner across the far end of the console. On one occasion the author witnessed an engineer cover a small fluorescent tube with a coloured transparency in order to reduce discomfort glare!

The ergonomics of lighting is a vast and complicated subject in its own right<sup>31</sup> and hence a thorough consideration of all the factors pertinent to mixing console illumination is far beyond the scope of this article. The following recommendations are made by Diffrient.<sup>32</sup>

The minimum recommended level of illumination for reading instruments on control panels and consoles is 30 to 50 FC (320 to 540 Lux). Control reflectance should range between 20 and 40%. Glare must be kept to a minimum. Small lights can glare in a dark environment, so provide a dimmer control.

Direct glare can be corrected by the following: (1) raising light sources above the upper visual limit; (2) using indirect lighting; (3) using light sources of a large area but of low intensity; (4) using shields, hoods or visors.

Specular glare can be corrected by the following: (1) using diffuse lighting; (2) avoiding glossy and polished surfaces (use matt finish); (3) locating the light so that the viewing angle does not equal the angle of incidence.

## Conclusion

We began this article with the assertion that unless due consideration is given to human factors at the design stage of mixing console development, the sound engineer and the equipment he operates will perform at a sub-optimal level. The sound engineer performs his job with great skill. However, all too often that skill is undermined by poor illumination, cluttered control panels, inadequate seating arrangements, and information overload. No amount of training can compensate for badly designed equipment.

There are many human factors problems which arise in designing a sound mixing console. Yet, as this article has shown, solutions are available. The recommendations outlined are the result of many years of research both in the laboratory and in the field, albeit in other contexts. Ideally these research findings should be replicated in the context of sound engineering before they are fully implemented. However, even in the absence of such primary validation research, these recommendations are preferable to the current practice of designing on the basis of experience and/or operator opinion.<sup>1</sup>

Whilst operating experience gives the designer some insight into human factors problems, it by no means equips him

## ERGONOMIC ASPECTS OF MIXING CONSOLE DESIGN

with the knowledge and skills necessary to mitigate them. If this were so then consoles would not continue to be developed with control knobs so small and so close together that engineers cannot get their fingers between them, let alone turn them accurately. Consoles would not have their input channels labelled with ascending order of magnitude from right to left. Colour coding, if employed, would be consistent from console to console. The operator would be able to read all the control panel markings whilst remaining seated. Furthermore, he would be able to reach and operate all his controls effectively without having to continually lean forward. Consoles would be supplied with adequate lighting.

Opinions and experience are valuable inasmuch as they lead to the formulation of testable hypotheses. Opinions vary not only from one individual to another but within the same person from one period of time to another. In other words, opinions in themselves constitute a very unreliable source of data. For this reason they must be subjected to the rigours of empirical research. Only if such research fails to disconfirm an opinion can that opinion be said to be truly 'valid'. In the words of Popper<sup>33</sup> the role of the scientist is to test hypotheses by attempting to collect data that would 'falsify' or 'refute' a given theory: "Confirming evidence should not count *except when it is the result of a genuine test of the theory*; and this means that it can be presented as a serious but unsuccessful attempt to falsify the theory".

Only when a theory has been subject to research in the manner outlined above can we say that we have ascertained a *fact*, and one experimental fact is worth a dozen opinions.

Finally we turn to the question of further research. A number of human factors potentially critical to mixing performances have been identified. Yet, as we have seen, many of the parameters isolated have been well researched by ergonomists, albeit in other contexts. As we noted earlier, further research is necessary in order to validate these findings in terms of their application to the design of sound mixing consoles.

There are, however, also factors that have not yet been subject to any form of empirical investigation. No research has been conducted into the ergonomics of assignable mixing. Theoretically, at least, the concept is appealing because it represents a serious attempt by designers to reduce the amount of information processing required of the engineer. This is to be welcomed from the human factors point of view.

Generally speaking, an engineer is limited in terms of the number of mental (ie processing) and physical (ie controlling) operations that he can carry out at a given moment (remember the human skill model outlined in Fig 1). Once an operator is confronted with too much data to process (ie information overload) he begins to selectively filter out the most pertinent for further

processing at the expense of knowledge of other aspects of his task and/or environment. Perhaps this is best illustrated with reference to the task of driving a car. When the driver is faced with relatively little traffic, he has little to do other than ensure that he is steering the car in the right direction. His responses are more or less automatic. This leaves him free to engage in other activities simultaneously. For example, he may talk to his passenger, admire the scenery or think about what he will eat for lunch upon arriving at his destination.

Now, suppose that same driver is suddenly confronted with a build up of traffic. He will almost certainly cease conversing, sightseeing or thinking about food and (hopefully!) allocate the whole of his attention to the most important aspect of his task, namely, negotiating his vehicle safely through the traffic. When the driver is not confronted by a build up of traffic and is able to engage in other (ie secondary) parallel activities, we say that he has "spare mental capacity".<sup>34</sup> Conversely, when the volume of traffic is so great as to demand the whole of his mental resources, he is in a state of "reduced spare mental capacity".

Similarly there is an upper limit to the amount of information a sound engineer can handle, especially under stressful conditions. If the number of channels on a mixing console, together with the auxiliary equipment he must operate, exceeds the engineer's attentional capacity, this will result in a decrement in performance. The overload of information on the operator will result in inattention to certain aspects of the task. Just as our car driver ignores his passenger and the scenery and thinks less about food as the density of traffic increases, so the sound engineer must attend selectively to certain elements of his task at the expense of others, when confronted with an excess of equipment to monitor and control. In general the greater the overload, the greater will be the performance decrement and vice versa.

There is another very good reason why assignable mixing may prove to be superior to conventional arrangements in the long run, in addition to solving problems of information overload. Many of the ergonomic recommendations outlined in this article would be unworkable if applied to the design of a 30- or 40-channel console, due to the sheer volume of space it would occupy. This would result in serious tradeoffs between control dimensions and workspace arrangements. With assignable mixing, on the other hand, much smaller consoles are possible. Yet these consoles are capable of retaining operational features similar to their somewhat larger conventional counterparts. Thus assignable mixing, *a priori*, seems to be the way forward.

However, one final word of caution is in order. The advantages of assignable mixing outlined here, will only be realised if due regard is given to the cognitive (ie information processing) characteristics of the human operator, and this will necessitate ergonomics research of a very different order. □

Please see Part One in the November issue for references.

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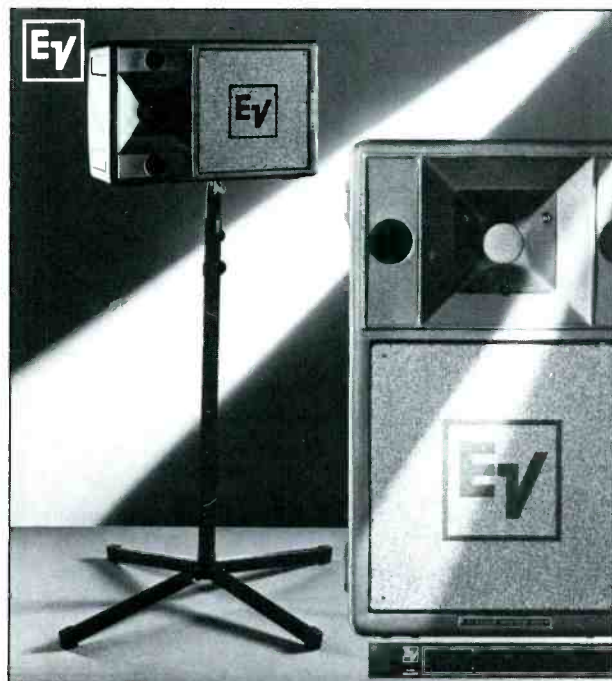
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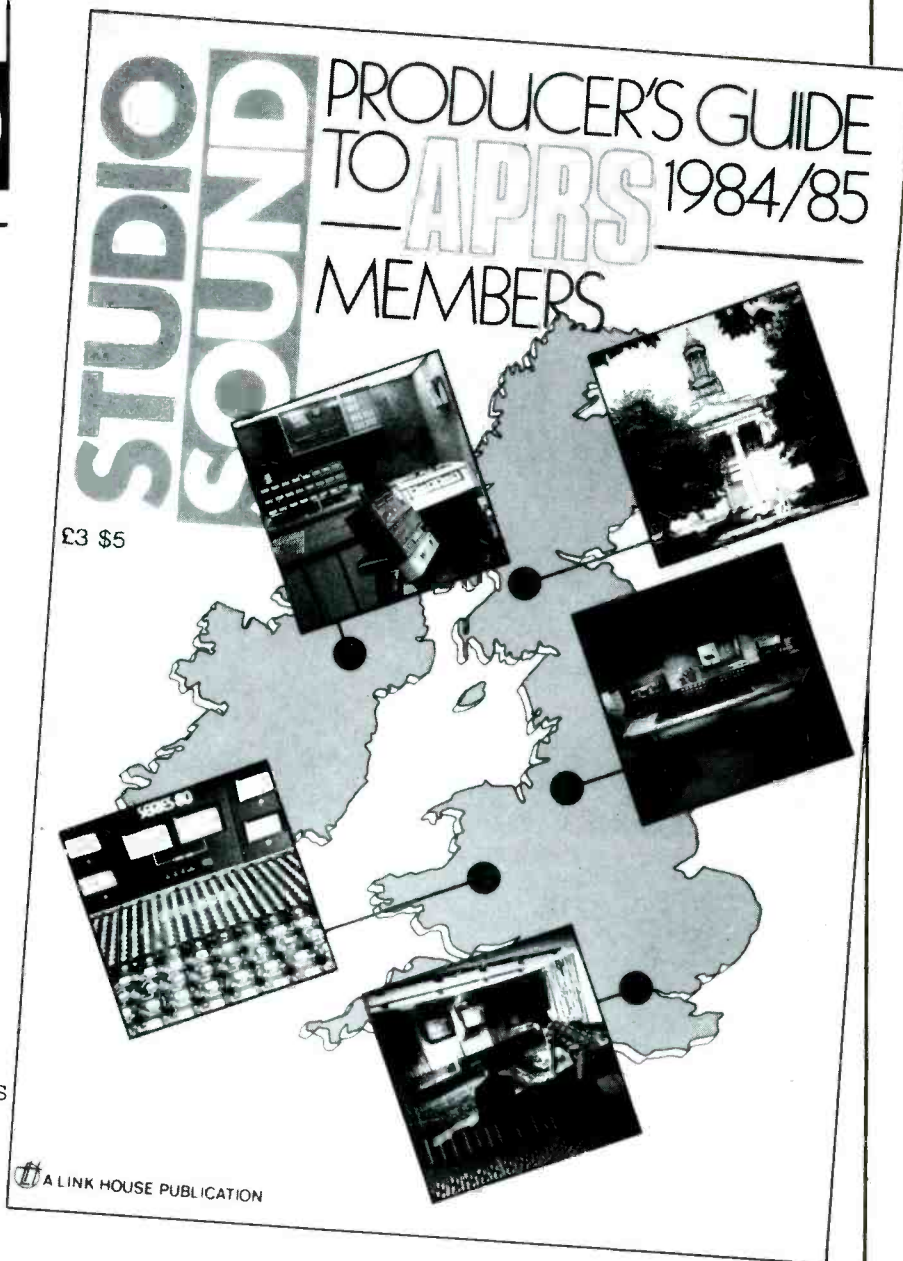
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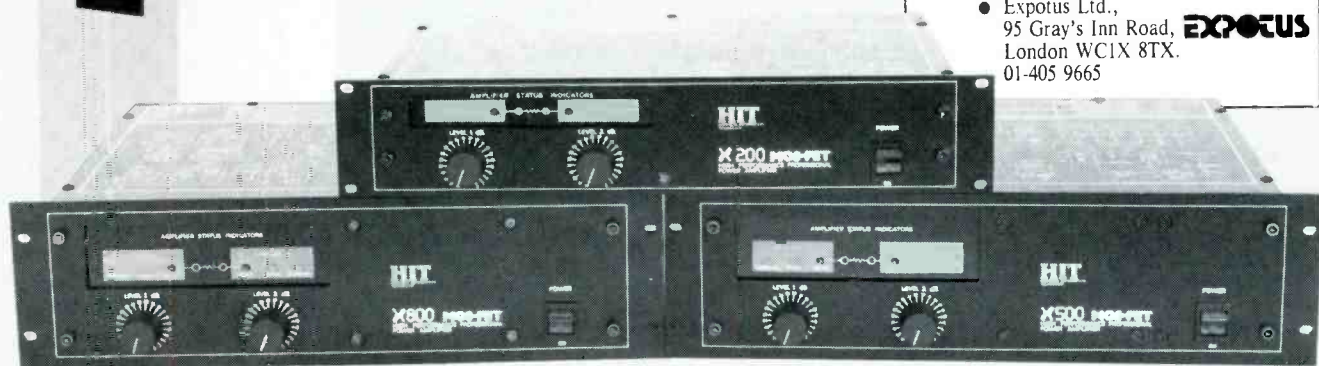
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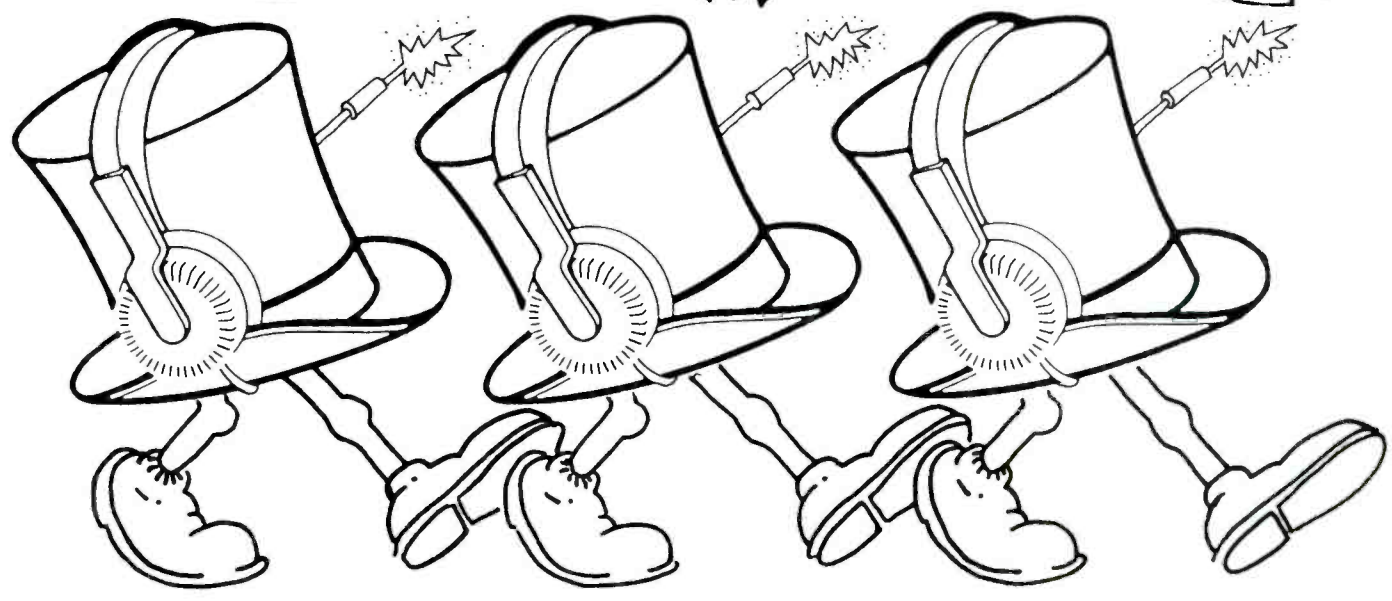
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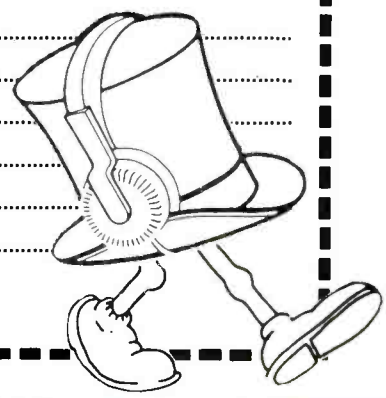
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## CLASSIFIEDS

# INDEX TO VOLUME 26

## Address changes

Alphaton Elektroakustic	30/11
Applied Microsystems	34/1
ASCE	34/2
Audio Systems Components	34/12
Clyde Electronics	33/5
Comfort Sound Studio	30/11
Crystal Clear Records	34/10
Digital Entertainment Corp	38/6, 22/9
EAR Professional Audio	34/2
Eventide	33/5
Gotham Audio Corp	33/5
Hardware House	50/3
Helios Custom Audio	33/5
Joiner-Pelton-Rose Inc	33/5
Maglink Audio Products (MAP)	22/9
Midcom	30/11
NAMM	30/11
Phoenix Systems	34/7
Pilkington Fibre-optic Technologies	38/6
PRS	34/12
Richard Swettenham Associates	33/5
Sandy Brown Associates	30/11
Solid State Logic	33/5
Soundcraft Electronics—Japan	22/9
Soundcraft Magnetics	38/6
Springtide Sounds	38/6
Stage Accompany	38/6
Technical Projects Ltd	50/3
The Infra Noise Laboratory Co	50/3
Uher Sales	30/11

## Agencies

Aces	30/11
ADT Gerd Jungling	50/3
Allen & Heath Brenell	24/9
Allington Audio	32/5
Altec Lansing	36/7
Amber	34/4
Amek	34/4
Aphex Systems	36/7, 24/9
Audio Ltd	34/10
Bogen	34/4
Citec	32/5
Crown	36/12
C-Tape Developments	50/3
David Hafler	24/9
Drawmer	36/12
Fabec	34/4
F M Acoustics	24/9
Future Film Developments	24/9
Gotham	34/4
Harrison Information Technology	36/7
Harrison Systems	30/11, 36/12
Hill Audio	32/5
H W International	38/10
Joiner-Pelton-Rose	36/12
Keith Monks	34/4
Klark Teknik	36/12
Levell Electronics	24/9
Lexicon	34/4
Midcom	30/11
MRL	34/4
Music Laboratory	40/10
Neotek Corp	36/12
Oberheim	36/7
RCF	36/7
Solid State Micro Technology	34/10
Sony Professional Audio Products	34/4
Stellavox	34/4
Sound Technology	30/11
Soundtracs	24/9
Souriau	30/11
Sunn Musical Equipment Co	34/4
Survival Projects	34/1
Switchcraft	34/4
Symetrix	36/7
TAC	34/4
Talk Studio	30/11
Theatre Projects	38/10
360 Systems	36/7
Trident USA	34/4

Unique Recording	36/12
UREI	34/4
Ursa Major	34/1
Valley People	34/4
Wilson Audio	34/4

## Authors

<b>Dan Abramson</b> The view from New York	54/9
<b>Terri Anderson</b> Digital Audio Seminar	30/2
<b>Dan Andlast</b> Eulogy	124/4
<b>Janet Angus</b> Ambiance Studio, Sussex	58/7
Army's Shack, Dorset	60/2
Konk Studios, London	60/5
Music Works, London	60/12
Scarf Studios, London	76/8
Surrey Sound, Surrey	60/11
Trilion sound and vision	56/4
<b>Bob Anthony</b> United Western, Hollywood	54/12
<b>Keith Armstrong</b> Digital misconceptions	62/1
<b>Dr Stuart Arrowsmith</b> Advances in digital microphone technology	42/4
<b>Peter Barnett</b> Electro-acoustic reverberation enhancement systems	48/6
<b>Mike Beecher</b> Changing synthesis	40/2
Digital sound sampling	44/9
Frankfurt '84	86/5, 44/6
<b>David Blair</b> Monitoring	52/10
Power amplifiers	74/6
<b>Robert Bolles</b> The E-V story	54/11
<b>Ray Carter</b> Middle man	103/4
<b>Stephen Court</b> I remember	66/5
Live sound evolution	72/6
<b>John Crabbe</b> In the beginning	101/4

<b>Antony David</b> Machine control	42/12
<b>Richard Dean</b> EVTR Studio, London	68/1
Majestic Studios, London	64/2
<b>Ralph Denyer</b> Jam Studios, London	64/2
Practical Soundfield	74/7
The Garden Studio, London	66/1
The producer series—Hugh Padgham	36/3
Wired for sound	40/6
<b>Vic W Dobbs</b> A remote hand	68/6
<b>Richard Elen</b> CD mastering—how it happened	82/10
Down at Dolby Labs	82/3
Insights	52/8, 60/9, 66/10, 78/12
Into the future	122/4
Surround sound	36/2
Thanks for 25 years	85/4
25 years of Studio Sound	86/4
Ursa Major Stargate 923	74/9
Yesterday and today	103/4
<b>Ted Fletcher</b> A personal view of psychoacoustics	48/3, 82/7
<b>Hugh Ford</b> Crest 5000 power amplifier	82/2
Fender 2244	78/9
Handling and storage of tape	64/12
Klark Teknik DN701 digital delay line	72/1
Lexicon Model 97 'Super Prime Time'	76/1
Matchamp GTX129 microphone preamplifier	76/2
Mini reference monitors	96/10
Sony CY-24 digital tape splicer	70/1
Soundtracs CM4400	86/11
Studiocraft F1 power amplifier	116/7
Tannoy SR840	79/8
TC Electronic TC2240 parametric equaliser	86/1
The modern lacquer disc	70/8
TOA P-300D power amplifier	84/6
UREI 1176LN peak limiter	88/3
Yamaha PC5002M power amplifier	78/6
<b>Bill Foster</b> CD mastering: how it should happen	76/10
<b>Barry Fox</b> Business	58/1, 58/2, 62/3, 140/4, 68/5, 60/6, 114/7, 74/8, 68/9, 60/10, 66/11, 52/12
The Bose direct/reflecting loudspeaker system	66/3
<b>James Francis</b> Modular Acoustics	70/10
The Fallout Shelter, London	56/3
<b>Gerard P. Hodgkinson</b> Ergonomic aspects of mixing console design	70/11, 80/12
<b>David J Holman</b> Aphex Compellor	75/3
<b>Paul Jackson</b> TFA with Dylan at Wembley	36/11
<b>Mike Jones</b> Sinus Musik, Berlin	42/9
The Cut and After	56/8, 90/10
<b>Frank Kejmar</b> Aphex Compellor	75/3
<b>David Kirk</b> From scissors to razor blades	101/4
<b>Joe Klein</b> Aphex Compellor	75/3
<b>Leo de Gar Kulka</b> The mystique of digital recordings	70/5
<b>Paul D Lehman</b> Back to basics	67/7
Bear Creek Studio, Washington	58/5
Digicon 83	46/2
Digital recording for \$239!	84/5
Inside the Synclavier	68/2
Little Mountain Sound Studios, Vancouver	64/4
Multichannel audio production for US TV	34/9
Notebender—the ultimate keyboard?	83/5
The meaning of MIDI (NAMM)	58/10
<b>Carl Levine</b> Rundgren on video	102/7
<b>John Longden</b> Big band sound	56/6





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<b>Dave Malham</b>	
Digitally programmable soundfield controller	75/2
<b>Paul Messenger</b>	
Sax on CD	51/9
<b>David Neal</b>	
Production by numbers	68/4
<b>Terry Nelson</b>	
Bee Jay Recording Studios, Florida	52/3
Factor on record	74/12
LSI Sound Studios, Nashville	38/9
Nashville	142/4
Roxy Recording Theatre & Studio, Nashville	66/4
Studio Miraval—recording a la provencale	54/1
Toy Box/Chelsea Recording Studio, Tennessee	62/4
Treasure Isle Recorders, Nashville	62/7
Warner, Hollywood	66/8
<b>Martin Polon</b>	
In perspective	36/4, 48/8, 76/11
<b>Tony Ryder</b>	
A-1 behind the scenes	62/6
International digital project	96/7
<b>Jim Smith</b>	
Machine control	42/12
<b>Tim Leigh Smith</b>	
Mobile recording—Doug Hopkins	32/8
The view from the top	40/5
Video for audio	74/4
Windmill Lane Studios	62/11
<b>Keith Spencer-Allen</b>	
AES 74th Convention, New York—summary of papers	51/1
Bel BD80 DDL	72/9
Cutec CD-425 user report	78/3
Digital equipment	30/9
Dynamic range control	60/3
Effects, reverb and equalisers	44/1
Hartmann Digital designed	50/5
Lexicon PCM 60	80/11
Microphones	88/7
Mixing consoles	46/11
Noise reduction	58/3
NSF reverb plate	124/7
Vesta Fire RV-1 & RV-2 user report	76/3
<b>Felicity Stephen</b>	
Recording traditional Irish music	62/10
<b>Chris Stone</b>	
The digital business	52/2
<b>Michael B Tretow</b>	
Digital Abba 'The Visitors' album	
<b>Steve Turner</b>	
Recording Genesis live	40/8
<b>Richard Vickers</b>	
TFA with Dylan at Wembley	36/11
<b>Barry Victor</b>	
Aphex Compellor	72/3
<b>John Wase</b>	
Design of the DP80	64/9
<b>Graham Paul Wayne</b>	
The manipulated man	60/1, 136/4
<b>Ernst Weiss</b>	
The Neumann story	52/7
<b>Nick Wood-Dow</b>	
A personal studio	76/5

## Business

Abbey Road	58/1
A little too quiet	70/9
Ambisonically speaking	58/2
Ambisonics	68/5
Barbican reverb	68/5
Be warned!	52/12
Better pictures for better sound	60/10
Big band miking	58/2
Bleeping expensive	68/9
Broadening horizons	60/6
Canned response	66/11
CD sampling standard	140/4
Cinema sound	60/10
Cinema surround sound	114/7
Concert PA	58/2
Customs sheik	58/1
Digital duplication	68/9
Disappearing biography	115/7
Doh, ray, MU	60/6
Entente almost cordiale	58/1
Festival Hall sound	58/1
Franchise fever	60/6
Good business tips	68/5
High speed tape	140/4
Laser sound & vision	70/9
Laservision v CD	114/7
Limehouse sound	62/3
Metric v imperial	115/7
Mistaken identity	70/9
Radio free for all	52/12
Sales jargon	60/10
Satellite systems	74/8
Stop that tune	60/6
Tape tangles	60/6
Tape whine	68/9

# INDEX TO VOLUME 26

The meeting of the ways	52/12
Time base errors and CD	140/4
True or false?	62/3
Undercover	66/11
Video film for digital audio	60/10
Working DSP	66/11
Zuccarelli in print	62/3

## Contracts

Advanced Music Systems	34/4
Alangrove Associates	34/10
Allen & Heath Brenell	34/4
Audio Kinetics	36/7, 36/12
Clyde Electronics	32/5
Custom Mastering Inc	34/10
Digital Entertainment Corp	36/7, 36/10, 30/11, 36/12
Discrete Research	36/10
Elliott Brothers	50/3, 34/4, 34/10
FWO Bauch/Neumann	36/7
FWO Bauch/TV South West	30/11
Harrison	36/7, 36/10
ITA	34/10
Klarion Enterprises	36/7, 36/10
MetroGnome	36/12
Marquee Electronics	36/10
Neumann/FWO Bauch	36/7
Neve	34/1, 50/3
Philips Electro-Acoustics	50/3
Sound Alternators	34/10
Theatre Projects	30/11
Theatre Technology	36/10
Trident Audio Developments	34/1

## Diary

AB Engineering	34/12
AES British Section moves	34/12
AES Educational Foundation	34/12
AES Lectures	34/12
AES publishes 'Digital Audio'	34/10
AKG Studio Sound award	34/1
Aphex Compellor correction	33/5
APRS column	40/10
APRS tightens up membership requirements	50/3
Are you DEAF?	30/11
Audio & Design and Calrec US & UK agreements	34/7
Awards for Soundout and AMS	34/7
BAN Electromusic name change	50/3
BBC experiment with all digital stereo TV sound	24/9
BGW & Nakamichi joint venture	34/7
Brüel & Kjaer	34/12
btx & Harrison Systems agreement	38/6
Cabinet designs from Fane	34/10
Carver in UK	38/10
Changes at Peavey (UK takeover)	34/10
Channel Four frequency fears	34/12
CTS Studio 1 reconstruction	24/9
De Lane Lea change of ownership	34/4
Digital coding for CDs	22/9
Digital console at the BBC	34/7
Disc cutting showrooms	34/2
Electronic mail links the industry	34/4

Electrosonic	34/12
Goodmans Loudspeakers—Thorn EMI sells shares	54/8
HH Electronics & HH Acoustics	38/6
In brief	34/1, 50/3, 33/5, 54/8, 34/10
Information we could never bring you	34/1
In perspective	36/4
Kulka urges truth in labelling	34/2
LEDE workshop	24/9
Lexicon—Scenic Sounds/Bauch distribution	54/8
Literature received	50/3, 32/5
Marquee Electronics	34/1
Marquee Electronics correction	50/3
More Gateway courses	34/12
Name change—Audiotech	40/10
Neve DSP for national sound archive	54/8
New division for Toa	36/10
New E-V cluster for Olympia	22/9
Peavey Electronics	34/12
Point to point prototypes	38/10
Politics of digital	22/9
PPG—UK retail outlet	54/8
Quad/Eight purchases Westrex	34/1
Recent Eastlake projects	32/5
Salford college course established	32/5
SPARS Conference report	34/6
Stolen (REW/Sony)	34/1
Studer A800 price cuts	34/10
Studiofile correction	36/7
Studio Sound Pro-Audio Directory	34/1, 34/10
Tandberg professional products division	34/10
Tannoy UK distribution	50/3
TFA Wembley corrections	34/12
Training	34/7
US Sony digital sales	32/5
Woodgate consultancy	30/11

## Editorials

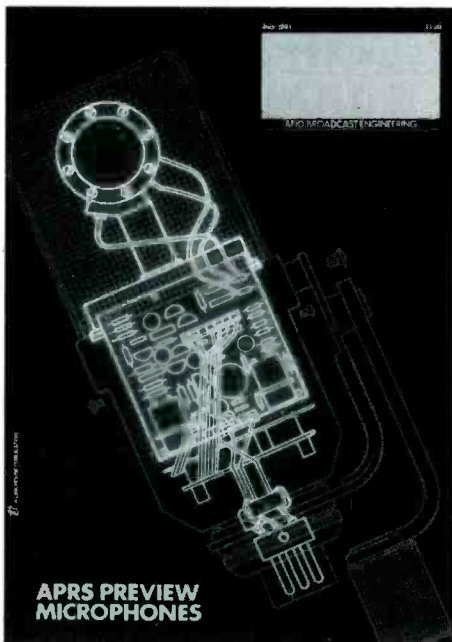
A decade of digital	5/9
A new face	5/7
APRS column intro	5/10
Digital audio enters a new phase	5/6
Diversify and die?	5/2
Electronic instruments and the studio	5/3
Format a-go-go	5/12
Good guys and bad guys	5/8
Hail and farewell	5/7
Little or large—the soft choice	5/11
Just looking is not enough	5/10
News on digital clarification	5/1
Sound for picture	5/4
The science of the art	5/5

## Exhibitions

AES 74th Convention, New York—summary of papers	51/1
AES 75th Convention, Paris—preview	44/4
AES 75th Convention, Paris—summary of papers	108/7
AES 76th convention, New York	46/10
AES 2nd International Conference, Anaheim—preview	64/5
APRS, London—preview	44/7
Digicon 83	46/2
Frankfurt '84	86/5, 44/6
NANMM—The meaning of MIDI	58/10

## Features

A-1 behind the scenes	
Advances in digital microphone technology	42/4
Anniversary section: Foreword, Letters, 25 years of Studio Sound, Musings on the past and future, Bits of the best, Into the future	83/4
A personal studio	76/5
A personal view of psychoacoustics: The quest for the third ball	48/3
Mono, stereo or ambisonic?	82/7
A remote hand	68/6
Aphex Compellor	72/3
Back to basics	67/7
Big band sound	56/6
CD mastering: how it should happen	76/10
CD mastering: how it happened	82/10
Changing synthesis	40/2
Design of the DP-80	64/9
Digital Abba 'The Visitors' album	40/1
Digital Audio Seminar	30/2
Digital equipment	30/9
Digital misconceptions	62/1
Digital recording for \$239!	83/5
Digital sound sampling	44/9
Digitally programmable Soundfield controller	75/2
Down at Dolby Labs	82/3
Dynamic range control	60/3
Effects	44/1
Electro-acoustic reverberation enhancement systems	48/6
Electronic instruments and the studio	83/5
Equalisers	48/1



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Ergonomic aspects of mixing console design	70/11, 80/12
Eulogy	124/4
Factor on record	74/12
Handling and storage of tape	64/12
Hartmann Digital designed	50/5
In perspective	48/8, 76/11
Inside the Synclavier	68/2
Insights	52/8, 60/9, 66/10
International digital project	96/7
I remember	66/5
Live sound evolution	72/6
Machine control	42/12
Microphones	88/7
Mixing consoles	46/11
Mobile recording—Doug Hopkins	32/8
Modular acoustics	70/10
Monitoring	52/10
Multichannel audio production for US television	34/9
Nashville	142/4
Noise reduction	58/3
Notebender—the ultimate keyboard?	83/5
Power amplifiers	74/6
Practical Soundfield	74/7
Production by numbers	68/4
Recording Genesis live	40/8
Recording traditional Irish music	62/10
Reverb	46/1
Rundgren on video	102/7
Sax on CD	51/9
Studio Miraval recording a la provençale	54/1
Surround sound	36/2
Tape machines	48/12
TFA with Dylan at Wembley	36/11
The Bose direct/reflecting loudspeaker system	66/3
The cut and after	56/8, 90/10
The digital business	52/2
The E-V story	54/11
The manipulated man	60/1, 136/4
The meaning of MIDI	58/10
The modern lacquer disc	70/8
The mystique of digital recordings	70/5
The Neumann story	52/7
The producer series—Hugh Padgham	36/3
The view from New York	54/9
The view from the top	40/5
Trillion—sound and vision	56/4
United Western, Hollywood	54/12
Video for audio	74/4
Wired for sound	40/6

## Letters

Ambisonics	46/5
APRS standards	48/5, 53/8
Better listening	53/8
Congratulations	132/4
Digital misconceptions	134/4, 46/5
Holophonics	57/2
Industrial psychology	70/6
Mic reviews	132/4
Multichannel TV compatibility	74/10
Royalties	134/4
Sbelling lesson	48/5
Soundfield mic	132/4
Soundfield stereo reply	70/6
Surrounded	78/7
Thank you... and goodnight	70/6
Training	57/2
Training... a clarification	48/5
Us and them	134/4

## New products

A bigger Yamaha	36/1
Active M-S matrix decoder	36/1
Allen & Heath Impulse One	28/8
Allen & Heath CMC mixer	44/10
Allen & Heath System 8 improvements	28/9
AKG low cost gooseneck	28/2
Alphaton audio products	34/3
Applied Microsystems ICON	34/11
Ariel real-time spectrum analyser	34/5
Audio + Design AD-Mix and Compex 2	32/11
Audio + Design digital PRO 701	30/6
Audio Engineering CNS Micron 500 Series	34/11
Audio tape from Zonal	40/7
Beyer 734	38/1
BGW power amp	32/6
Brooke Siren dynamics processor	42/7
Calrec 'M' Series mini mixers	30/6
Capitol Apollo lacquer masters	40/4
Compact Bryston amplifier	34/5
Connectronics XLR-type connectors	26/9
Connectronics shock isolated microphone mounts	28/8
Crown Delta Omega 2000—active control	32/6
Crown PZM-180	36/5
Crown 12SP microphone	42/10
Crown PZMs	40/12
CRS stereo mixer	30/6
dbx offer CPDM cards on OEM basis	36/5
Digidrums chips	42/7

# INDEX TO VOLUME 26

Drawmer 1960	34/11
Dynafex ICs	28/2
Electro-Harmonix digital sampler	42/10
Electro-Harmonix record/reproduce	40/7
Electromusic Research BBC-B MIDI package	28/8
Electrospace Time Matrix	30/8
Fairlight Series X	36/5
Fane bass-reinforcement	40/7
Fender miniature mic	38/12
Ferrograph head defluxer	28/2
First aid kit	38/12
F M Acoustics FM1000	26/9
Furman Sound MM-series mixers	38/4
Furman Sound QN-4 quad noise gate	38/12
Futterman OTL valve amps	30/6
Gaines Audio active DI box	34/5
Gold Line RTA	34/3
Hafler P220 and P505 power amps	44/10
Harrison Systems The Raven	34/5
HHB's CLUE System	26/9
Historic recording equipment	32/3
IAC two in one door	34/11
In brief: Lexicon chips; Sonosax SX-S	44/10
JBL SLT-1 mini speaker and 4645 sub woofer	30/8
Lexicon 1200c modification	40/12
Lexicon Rich Plate program	28/9
LinnDrum new features	42/7
Milab VIP-50	36/5
Minim expand Ambisonic range	26/2
MSE PUP100 microphone power	30/8
Monolith tape heads	34/3
MXR Drum Computer updates	34/5
MXR 1500 digital delay	32/3
Nady HeadMic	28/2
Neutrik X Series XLR-type connectors	28/9
New connectors from Cannon	36/5
New Otari high speed duplication	40/4
New portable Sony mixer	28/2
New PZM boundary accessories	34/3
New Q-Lock interfaces	26/2
New telcom c4 units	38/7
New version of Urban Stereo Synthesizer	40/4
Oberheim DMX updates	38/4
Oberheim power amp	32/6
Options for BGW power amplifiers	40/4
Orban programmable EQ	36/1
Otari new prototypes at AES MX-70 and BTR 5	30/8
Otari options	40/12
Peter Strueven	32/11
Philips LHH 0425 CD subcode processor/editor	28/8
Phoenix Systems L-R + delay	40/12
Pre-wired jackfields	36/1
Protech 874 and 875 amps	32/11
Psionics—EQ4 and ADI-4	28/9
Rauch X900/FET power amp	32/6
Rebis equaliser redesign	38/1
Remote Sony PCM control	40/7
RMI drum miking system	36/1
Rogers studio monitors	28/9
Sequential Circuits Drumtraks	32/3
Sescom stereo power amp	40/7
Shure SM87	40/12
Spectrum DELTA-G	38/4
Spectrum Emphasizer	28/2
Speiden ribbon microphone	26/9

Stage Accompany B Series	28/2
Studer digital 2-track	38/7
Studer monitor	32/6
Sunn amplification	32/6
Syco SMPTE synchroniser	28/2
Symetrix Model 511 stereo noise reduction	32/3
SynthAxe	38/12
Syntovox SPX216 vocoder	44/10
Tandberg Series TD 50 recorders	42/7
The Infernal Machine	38/1
Trident t.i.l. console	38/7
3M handy dispenser	28/2
3M heat reactive tape	40/7
Tweek contact enhancer	34/3
Ursa Major 8X32 MkII	42/10
Ursa Major Star Gate	38/4
Useful boxes for ADR	26/2
Valley People 430 Series	32/3
Valley people level monitoring interface	42/10
Variohm potentiometer	44/10
Whitewor Spiders	38/1

## People

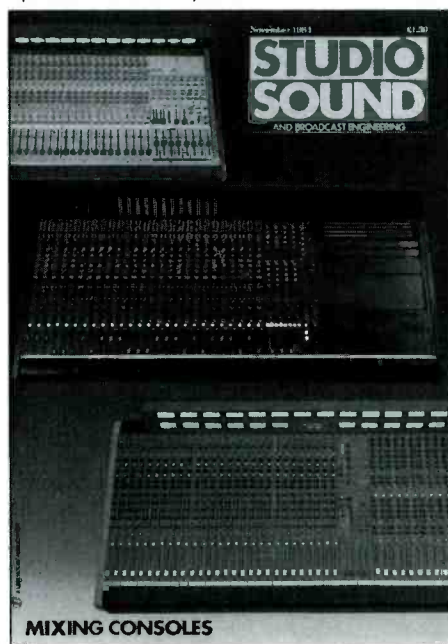
Allen & Heath	40/10
Audiotechniques	34/2
Audix	22/9
BASF	38/10
BBC	22/9
dbx Inc	50/3
DSN/Vitavox	34/7
Gauss Loudspeakers	34/1
Harman Audio	38/10
HHB	38/6
HH Electronics	38/10
ITA	34/1
Magnetik productions	22/9
Michael Stevens & Partners	50/3
Milbank Electronics	22/9, 36/10
Mitsubishi	22/9
Pilkington Fibre-optic Technologies	34/7
Quad/Eight Electronics	34/1
Quad-Eight/Westrex	34/7
Sifam	38/6
Solid State Logic	34/7, 38/10
Sony Broadcast	50/3
Sony US Professional Audio Products	38/6
Soundcraft Electronics	22/9
Soundcraft Inc	34/1
Trackdown Technology Training	22/9
Ursa Major	34/1
Valley Audio	34/1
Vitavox/DSN	34/7
Worldwide pictures	22/9

## Reviews

Bel BD80	72/9
Crest 5000 power amplifier	82/2
Cutec CD-425 user report	76/3
Fender 2244	78/9
Klark Teknik DN701 digital delay line	72/1
Lexicon model 97 'Super Prime Time'	76/1
Lexicon PCM	80/11
Matchamp GTX129 microphone preamplifier	76/2
Mini reference monitors	96/10
Mini reference monitors—listening tests	82/11
NSF reverb plate	124/7
Sony CY-24 digital tape splicer	70/1
Soundtracs CM4400	86/11
Studiocraft F1 power amplifier	116/7
Tannoy SR840	79/8
TC Electronic TC2240 parametric equaliser	86/1
TOA P300D power amplifier	84/6
UREI 1176LN peak limiter	88/3
Ursa Major Stargate 323	74/9
Vesta Fire RV-1 & RV-2 user report	76/3
Yamaha PC 5002M power amplifier	78/6

## Studiofile

Ambiance, Sussex	58/7
Army's Shack, Dorset	60/2
Bear Creek, Washington	58/5
Bee Jay, Florida	52/3
Chelsea/Toy Box, Tennessee	62/4
EVTR, London	68/1
Jam, London	64/2
Konk, London	60/5
Little Mountain, Vancouver	64/4
LSI Sound Studio, Nashville	38/9
Majestic Studios, London	64/2
Music Works, London	60/12
Powerplay, Zurich	58/12
Roxy, Nashville	66/4
Scarf, London	76/8
Sinus Musik, Berlin	42/9
Surrey Sound	60/11
The Fallout Shelter, London	56/3
The Garden, London	66/1
Toy Box/Chelsea, Tennessee	62/4
Treasure Isle, Nashville	62/7
Warner Hollywood Studios	66/8
Windmill Lane	62/11



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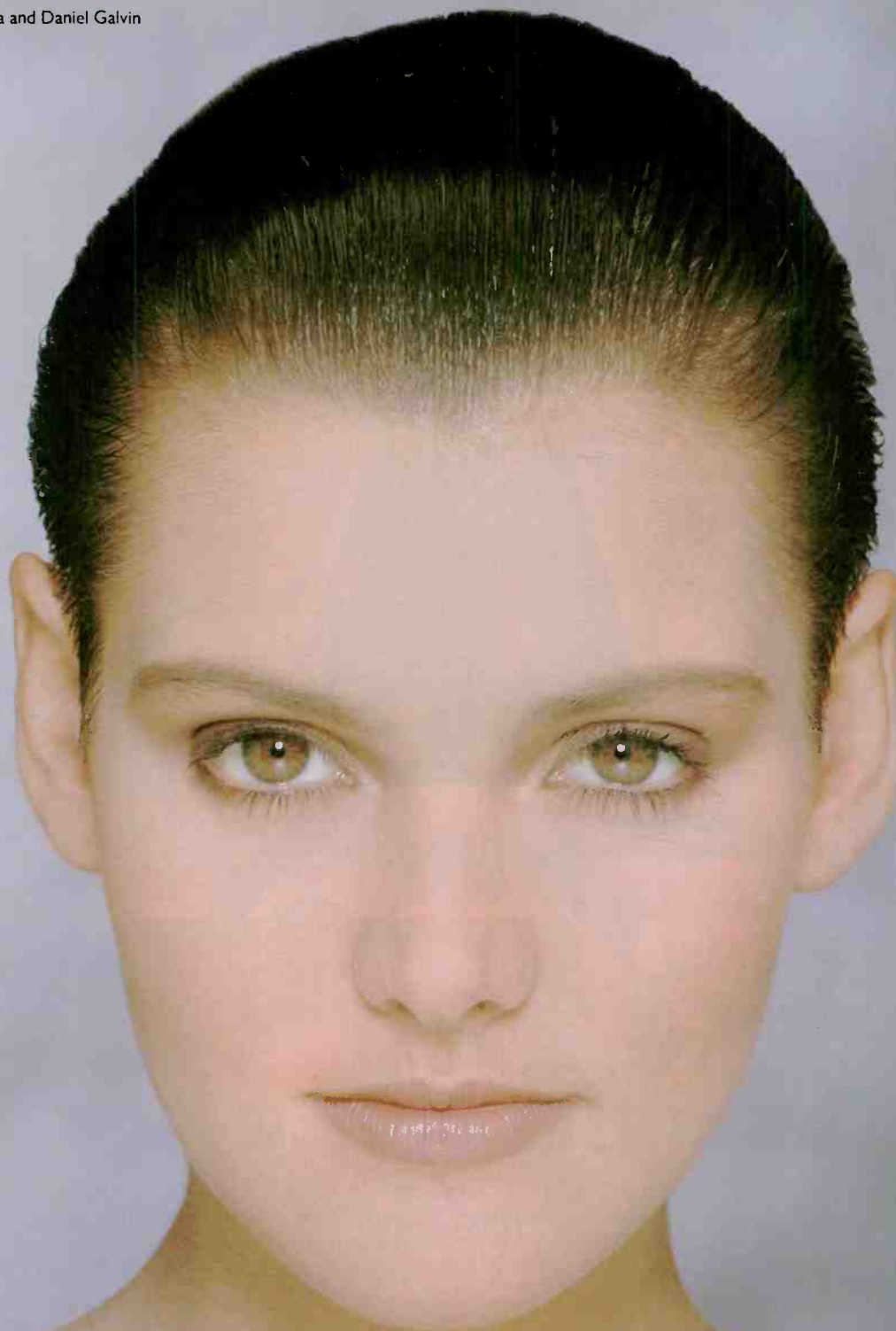
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## INDEX TO ADVERTISERS

APRS	12
Advanced Music Systems	27
AKG	99
Allied International	10
Alpha Audio	14
Amek Ltd	39, 59
Ampex (UK)	63
Aphex Systems Ltd	83
Applied Microsystems Ltd	24
Atlantex	35
Audio & Design (Recording) Ltd	14, 97
Audio Kinetics	53, 69
Audio Service Co.	24, 102
Avcom Systems Ltd	6
B & W Loudspeakers	24
B.F.E.	6
Britannia Row	77
Cable Technology	50
Capitol Magnetic Products	IBC
D.E.A.F.	90
Dolby Laboratories Inc	32
Dominus	52
Don Larking Audio	30, 86
Eardley Electronics	101
Eastlake Audio	33
Feldon Audio	20
Friend Chip	25
Future Film Developments Ltd	18, 86
FWO Bauch Ltd	21, 23, 49, 57, 81
H W International (Shure)	85
Harrison	81
Harrison Information Technology	89
HHB Hire & Sales	4, 71
Hill Audio Ltd	79
ITA	15, 17, 19
ITC	21
J.B.L.	73
John Hornby Skewes & Co Ltd	8
Klark Teknik Research Ltd	41
Kudelski SA	8
Michael Stevens & Partners	27
Minim Electronics	12
Multitrack Hire Ltd	87
N.E.D.	46, 47
Neumann	23
Otari	37, 61
P.P.G. (UK) Ltd	45
Rebis Audio	16
Scenic Sounds	31, 75
Shuttlesound	85, 97
Sony Broadcast Ltd	55
Soundcraft Electronics Ltd	IFC
Soundout Laboratories	51
Sowter Ltd, E.A.	12
Stocktronics AB	18
Studer	57
Studio Spares	22
Surrey Electronics	48
Swisstone Electronics Ltd	18
Sycos Systems Ltd	28, 29
Tandberg A/S	66
Tannoy	49
Technical Projects	101
Theatre Projects Services Ltd	87
Trad Sales & Services	12
Trident Audio Developments Ltd	26
Turnkey	7, 9, 11, 13
Ursa Major	OBC
Walker Singleton	86

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