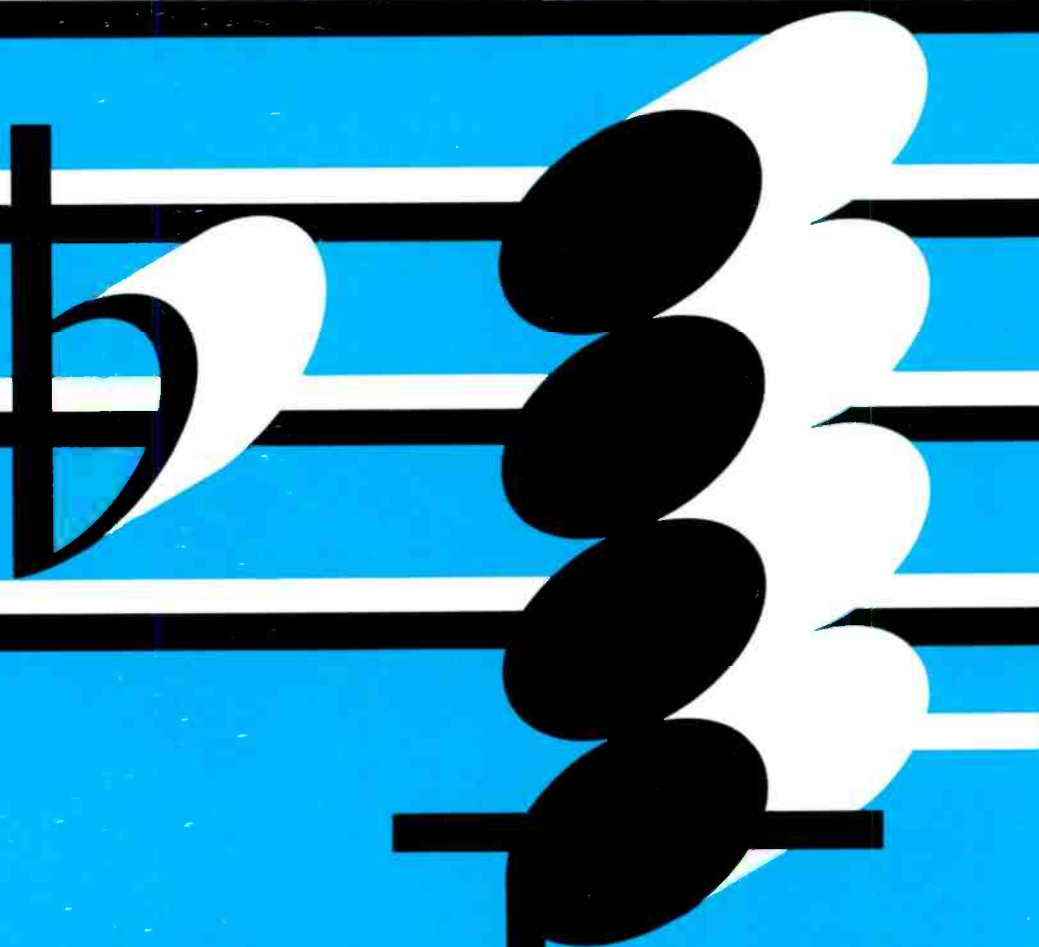


# studio sound

June 1978 50p

AND BROADCAST ENGINEERING



SPECIAL EFFECTS

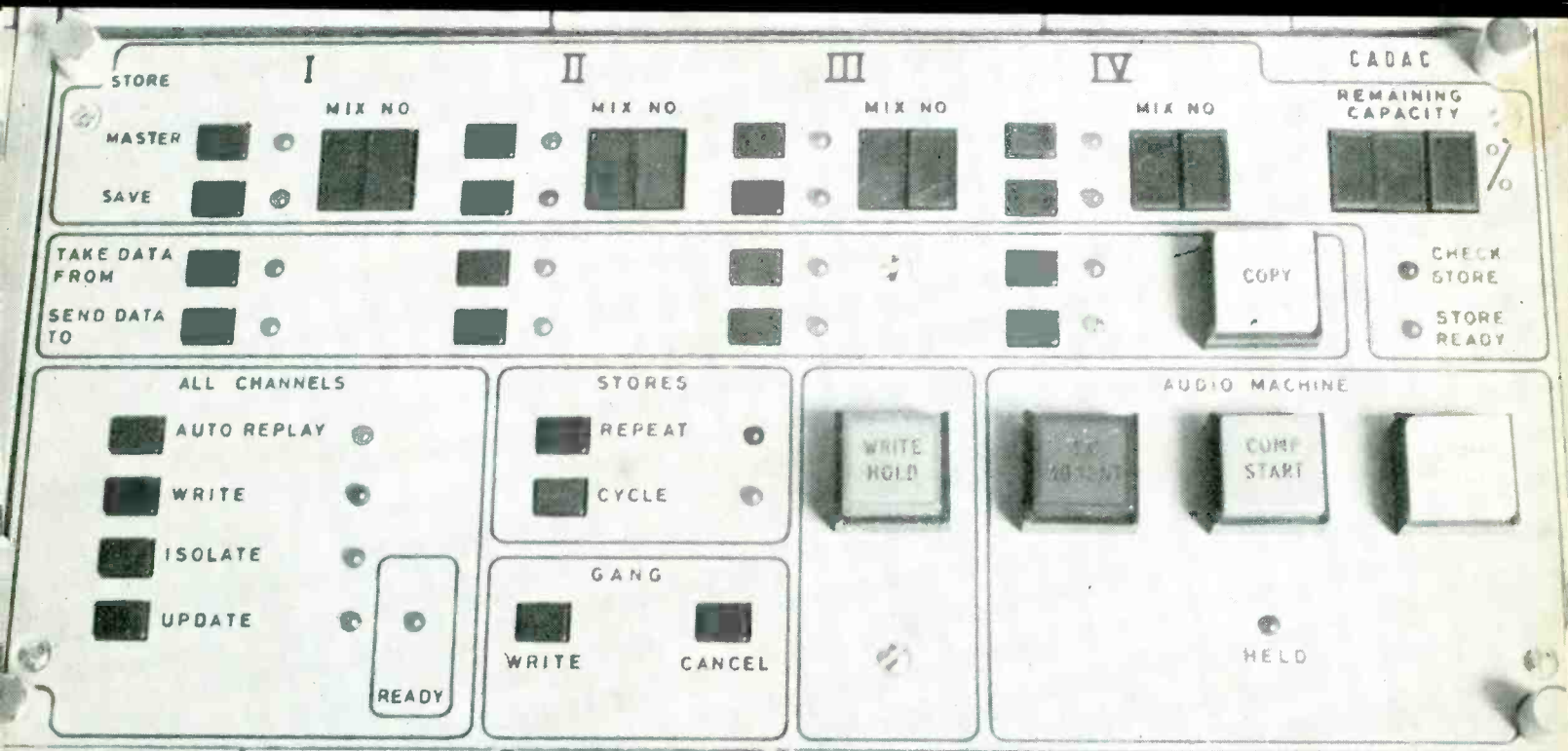
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# studio sound

**AND BROADCAST ENGINEERING**

## **Musical innovation**

Recent conversations and letters received tend to indicate a lot of interest and agreement with our November and December '77 editorials. It therefore seems appropriate to continue the discussion about music and technology. (Remember music—that much abused five-letter word?)

Popular music is going through an extremely derivative phase again, and we would suggest that this situation is being generated by the record companies once again playing excessively safe. (Who, no doubt, will place it at the door of the world economic recession.) The *music* in the record charts now could well have been in the charts of yesteryear/decade—and in several cases was!

The innovative records that we hear today are usually courtesy of some nice sounds effectively created by electronics and not musical instruments. So maybe the present policy of record companies is that in light of the new generation of equipment in the studios we can change the sound of last year's music sufficiently to make it sell again this year—and they're succeeding.

We can't believe that there isn't any good new music around and that the world of musical entertainment is being saved by technology. So, no doubt, there are a lot of demo tapes around which contain some very nice sounds—but they've got little further than the reception desks of record companies.

But demo tapes need engineers, and engineers read **STUDIO SOUND**. So if you've heard some great sounds this year that you believe should have 'happened', let us know.

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**JUNE 1978 VOLUME 20 NUMBER 6**

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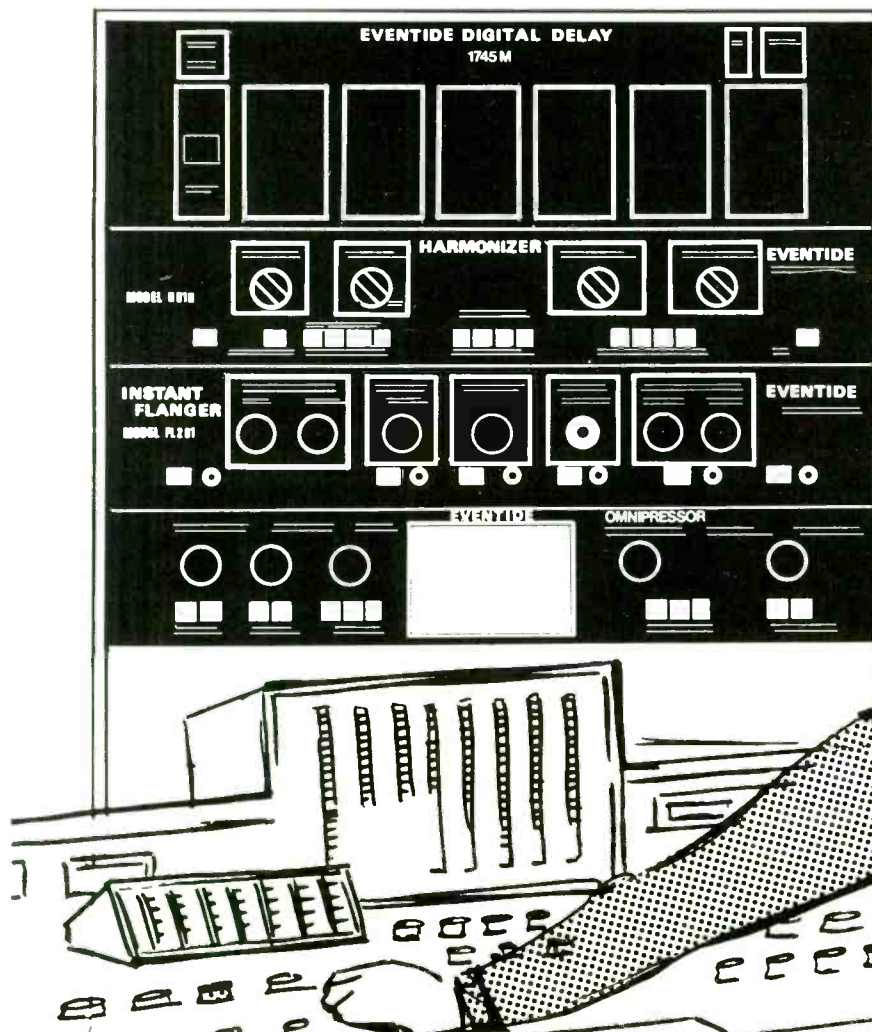
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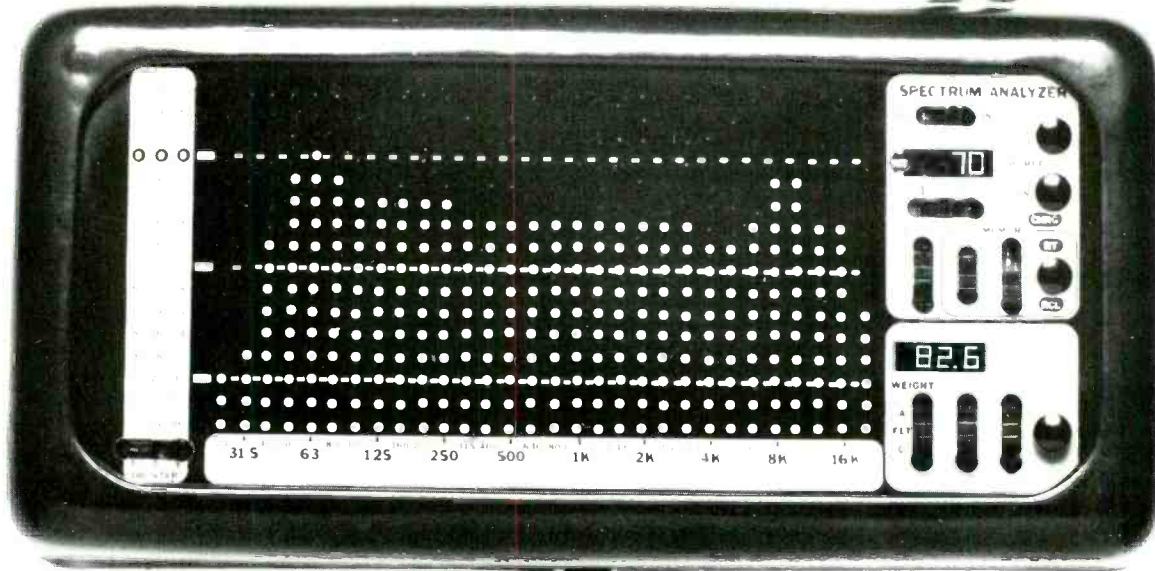
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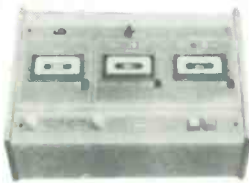


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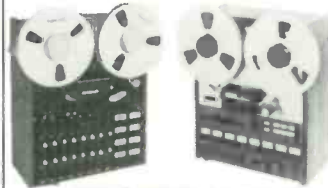
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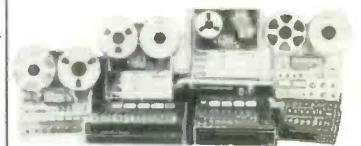
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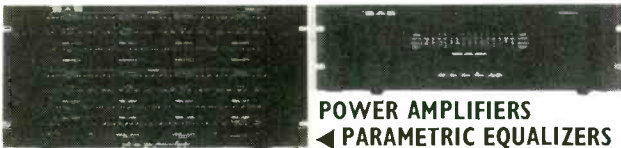
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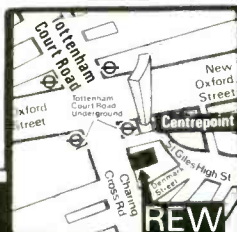
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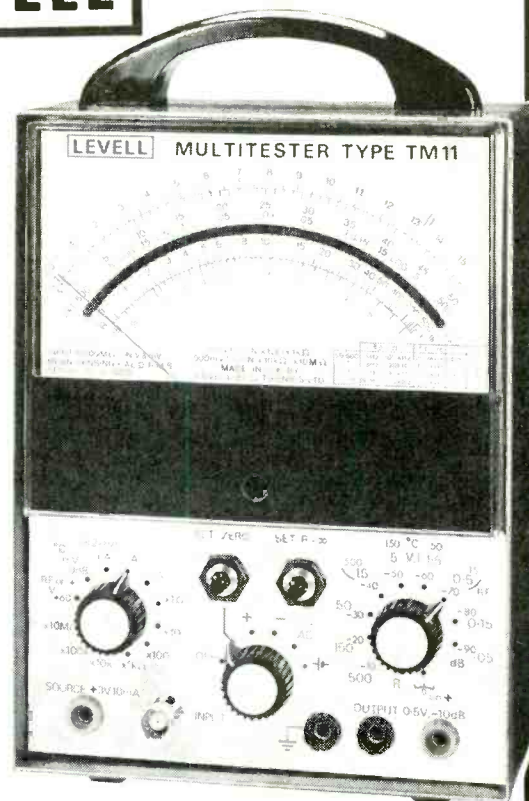
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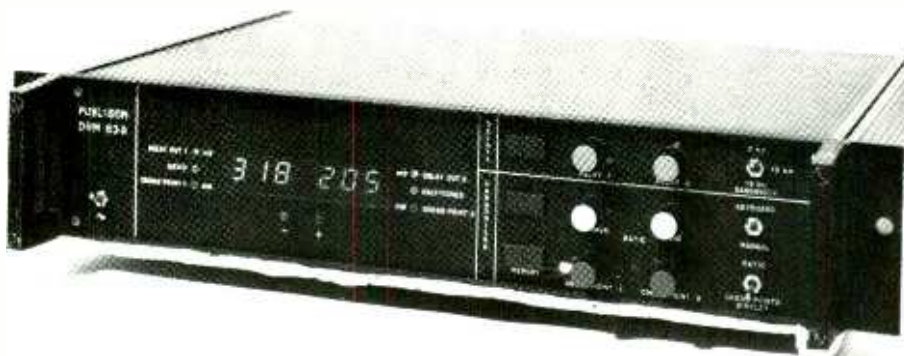
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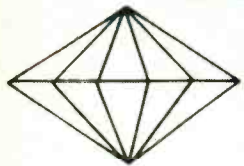
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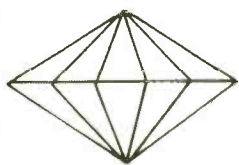
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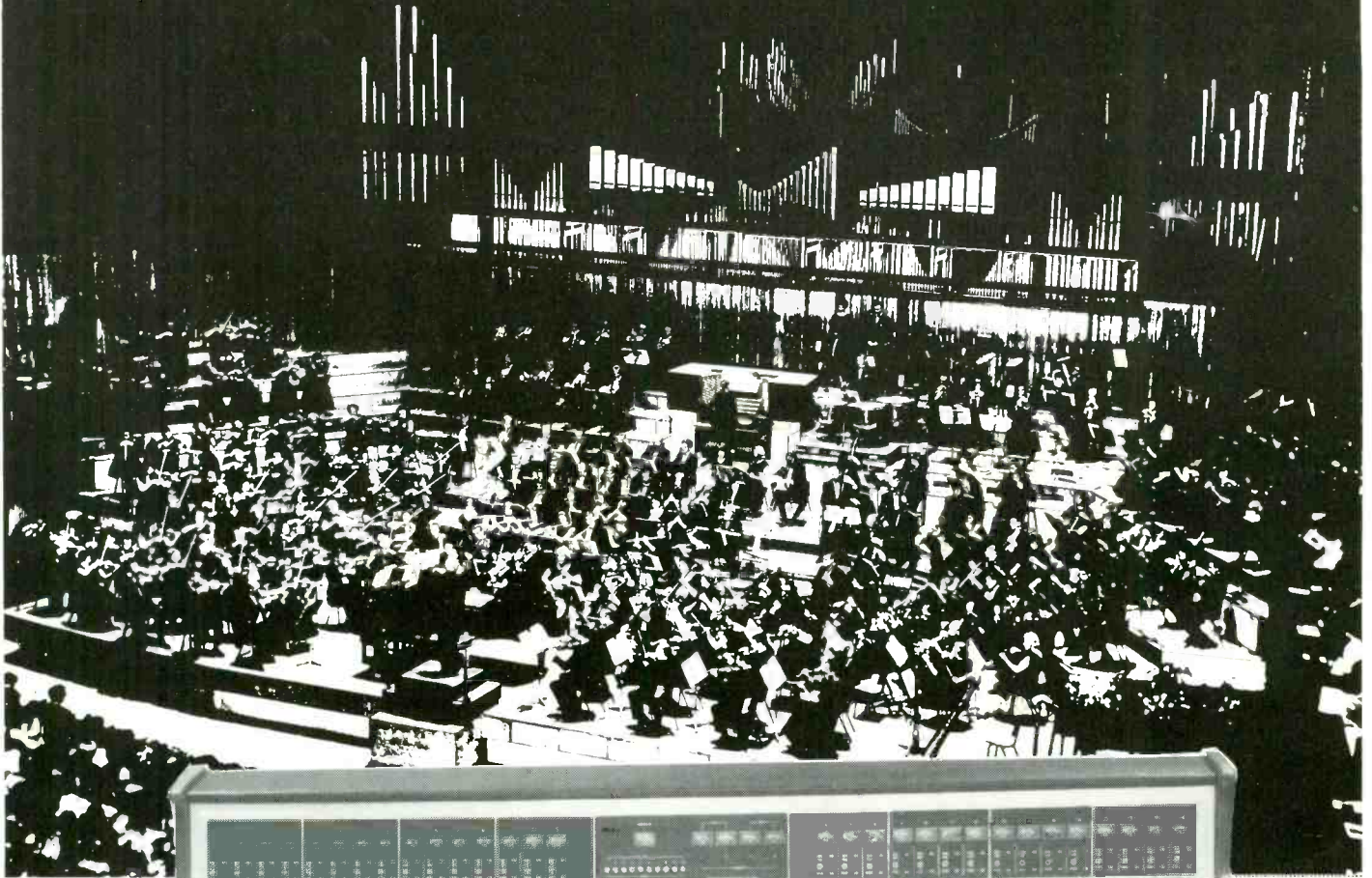


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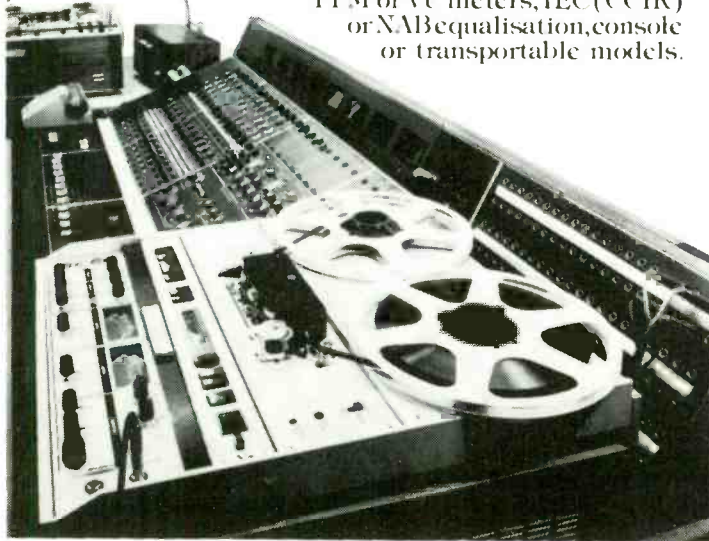


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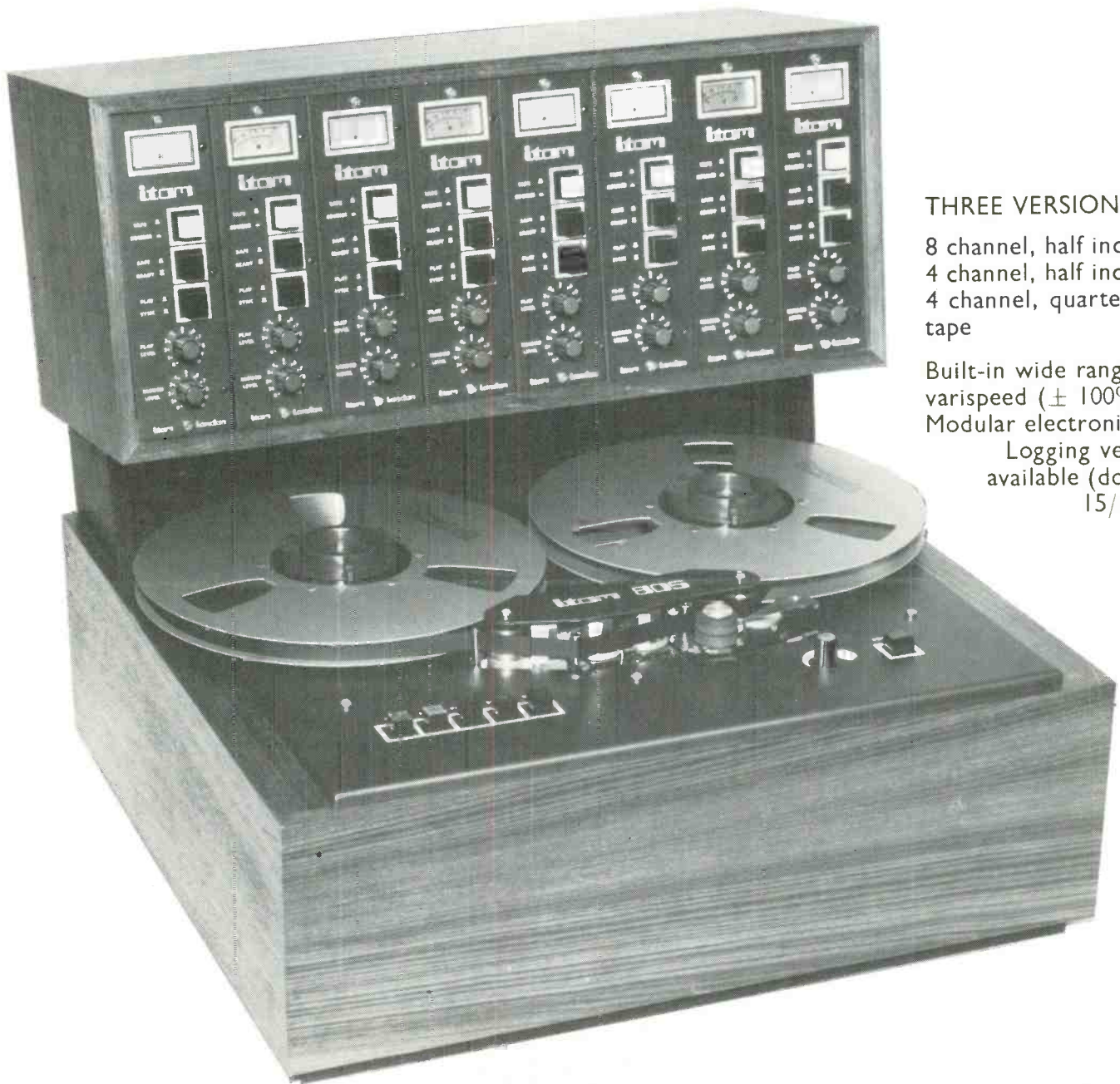
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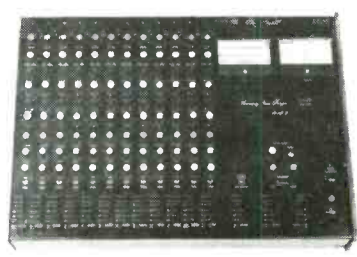
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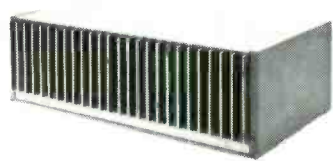


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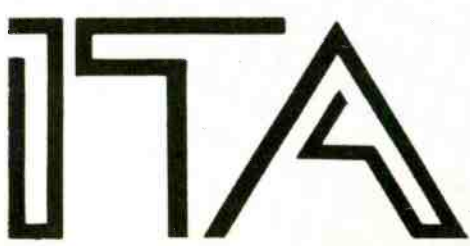
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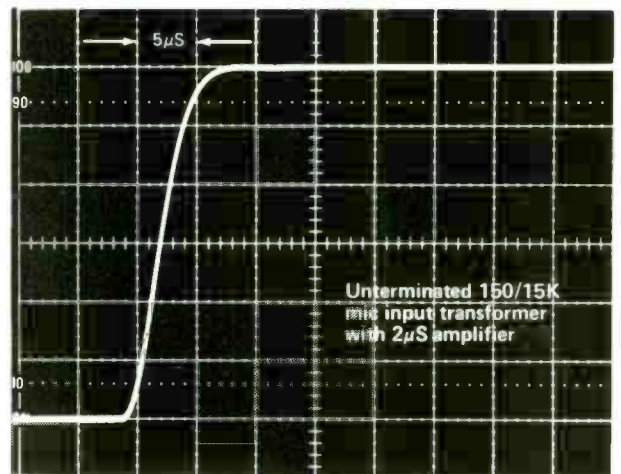
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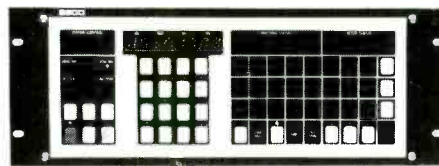
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| Rack-mount                     | O       | O       | -       |
| Portable case                  | -       | O       | -       |
| Video Layback Head             | -       | -       | O       |
| Multi-point Search-to-Cue      | -       | O       | O       |
| Disc Mastering Preview Version | -       | O       | -       |
| MQS Synchronizing Equipment    | O       | O       | O       |
| Variable Speed Oscillator      | O       | O       | O       |
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| NAB/CCIR Switchable            | -       | O       | -       |
| Additional overbridge          | O       | -       | O       |
| Mono                           | O       | O       | -       |
| Stereo                         | O       | O       | -       |
| 4-track                        | O       | O       | -       |
| 8-track                        | O       | -       | O       |
| 16-track                       | -       | -       | O       |
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O = Option    S = Standard

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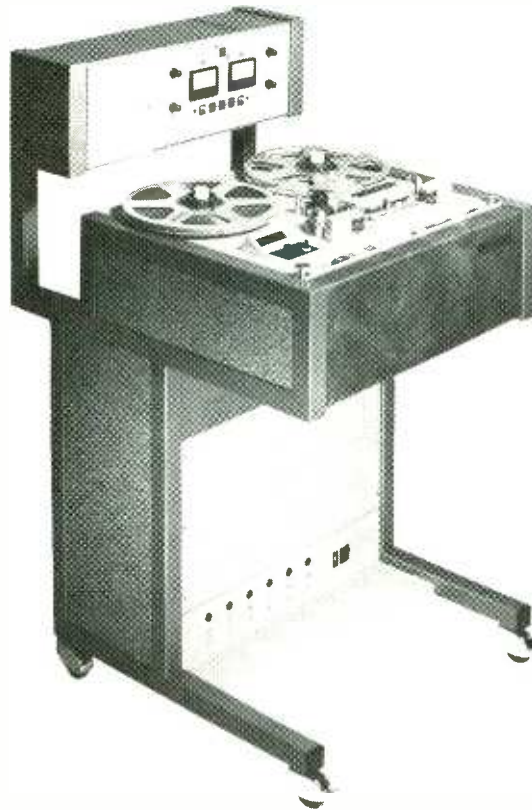
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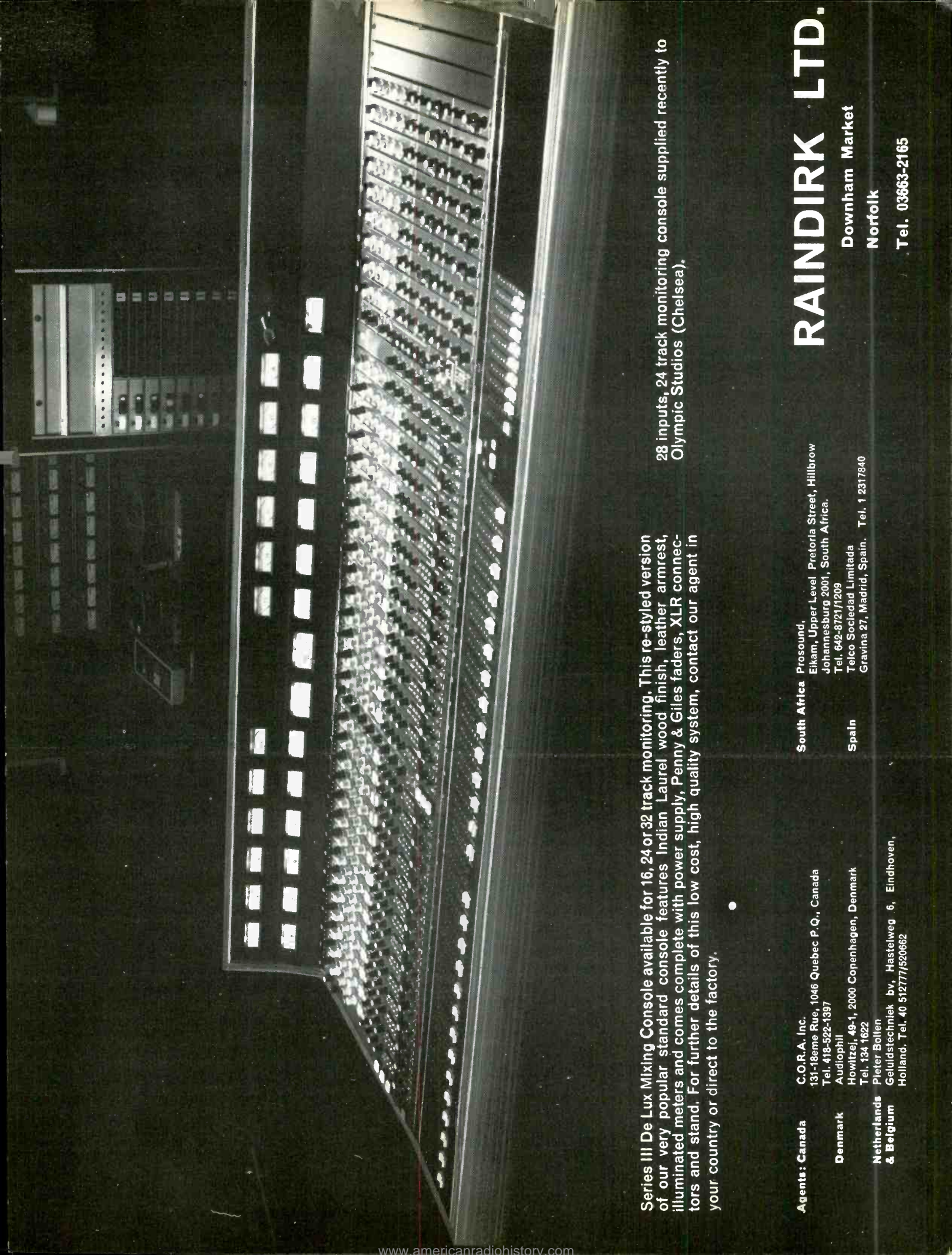
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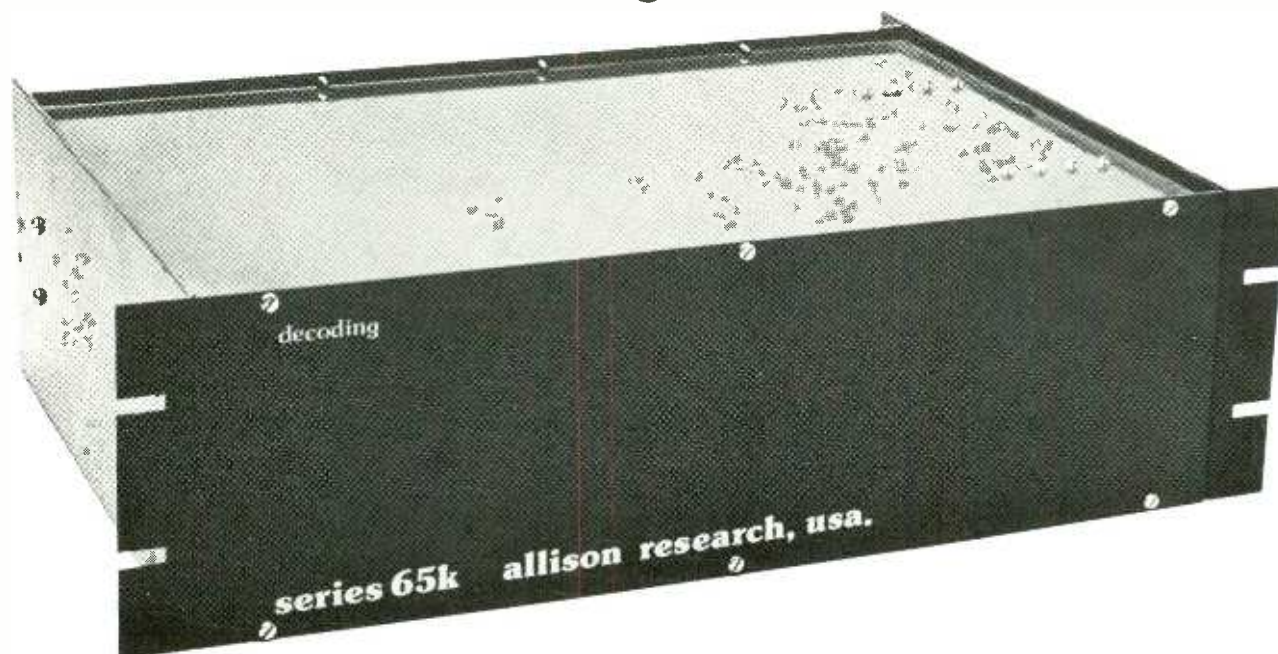
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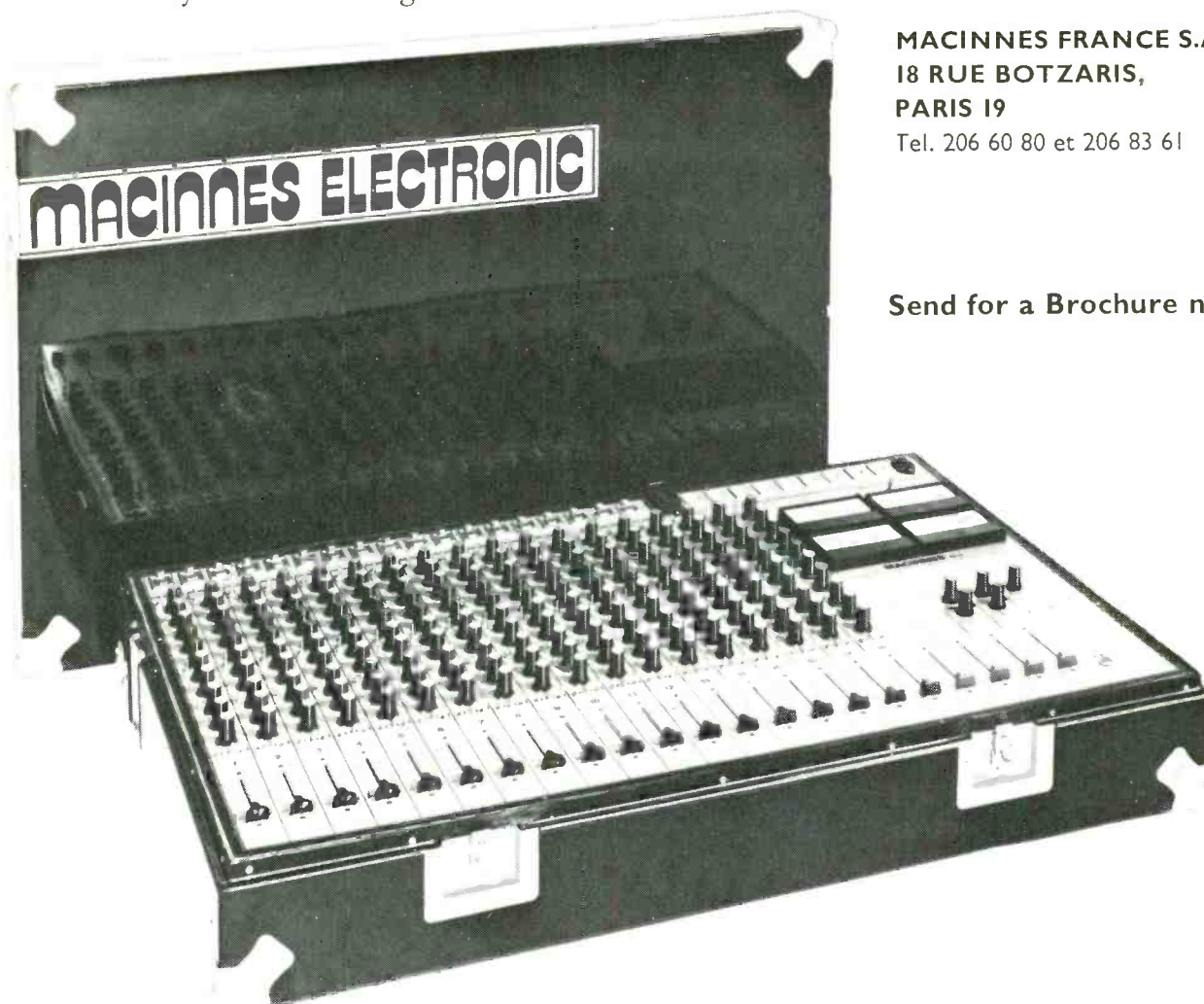
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# news

## Electronic reverb

A new electronic reverb unit has come on to the market that appears to do everything required of this type of instrument in a studio environment at a price of around \$3000.

Produced by an American company, Ursa Major, the *SST-282 Space Station* is a digital delay line, reverberation processor and a 9-input signal mixer. The processed reverb output can be tapped at up to eight independent points to be subsequently mixed into the main signal path. The manufacturer claims 'virtually any pattern of direct sound, early reflections and reverberations can be obtained by suitable adjustment of the control.' The *Space Station* is said to be capable of providing effects ranging from simple slapback, through room simulation to special effects.

The instrument uses a combination of analogue and digital techniques to obtain the various effects. The specification quotes a dynamic range of 80 dB with a distortion factor of around 0.2%. Frequency range is 30-5k Hz. The integral delay time extends to 256 ms, which is modified by the reverb processor to give a decay range of up to 4s. Ursa Major plans to exhibit the unit for the first time at the Los Angeles AES exhibition (see page 40).

Ursa Major, Box 18, Belmont, MA 02178, USA.  
Phone: (617) 489 2039.

## Italian show

The 12th Salone Internazionale della Musica e High Fidelity will be held from September 7 to 11 this year. SIM is the most important musical instrument and consumer audio show in the Italian exhibition calendar.

Five buildings, with a total surface area of some 40 000 m<sup>2</sup>, will house over 800 different brands of musical equipment, sound amplification, professional audio, domestic audio and video equipment.

Further details from Segreteria Generale, 20149 Milano, Via Domenichino 11, Italy. Phone: (02) 49 97 519.

## Bath Festival

This year's Bath Festival will run from May 19 to June 2. High points will be the performance of works by Vivaldi, Schubert, Janacek and Messiaen, whose anniversaries are celebrated this year. The music programme will span six centuries, covering everything from pre-Renaissance *chansons* to modern orchestral works.

The recently-formed Rye Spring Opera will perform new productions of two Mozart comic operas and the Ballet Rambert will also make an appearance. Should be *bijou*. Full details from Bath Festival Office, Linley House, 1 Pierrepont Place, Bath BA1 1JY. Phone: 0225-22531.

## Scamp adt/flanger

Audio and Design has added an adt/flanger module to its *Scamp* range of mini-rack sound processor units. It does most of the things that one has come to expect from time domain modifiers—flanging and phasing with or without feedback from the output to the input—as well as a time modulation facility by envelope control.

The basic delay element operates over a 1.2-45 ms range and offers a claimed 80 dB of dynamic range at any delay setting. An input limiter, set at +6dBm, is said to preclude any possibility of overloading the *Time Shape Module*, a useful feature in a recording environment where signals do tend to get out of control at times.

The ability to control time delay (and hence flanging) through use of an envelope follower is probably the most interesting aspect of the instrument. As with most effect units, it is much better to get out and hear it rather than to read about it in magazines, such as this. In common with the rest of the Scamp range, the *Time Shape Module* is low priced at £480, but retains full interface spec for use with other studio equipment.

Audio & Design Recording Ltd, St Michaels, Shinfield Road, Reading RG2 9BE.

Phone: 0734-53411. Telex: 847605.  
US: Audio & Design Recording Inc, PO Box 23047, Honolulu, Hawaii 96822.  
Phone: (808) 845 7226.

## AKG move

The new address of AKG Acoustics is 191 The Vale, London W3 7QS. Phone: 01-749 2042. The telex number remains unchanged at 28938.

## BBC order tape machines

According to Hayden Labs, UK agents for Telefunken, the BBC has ordered 72 two-channel *M15AHS* tape machines. Among the machine's many notable features is the provision of 'clickless and gap-free' drop-ins, which is achieved by suitably-timed ramped switching of the erase, record and replay amps. The Beeb has also ordered 26 Nagra *IV-S* portable machines, complete with *QGB* adaptors for handling 26.7 cm NAB reels.

## Still doing well

Neve has won an order from HTV in Bristol worth over £75 000 for two custom-built 30-input stereo consoles. One desk will be installed in a brand new 16-track film dubbing theatre. The other console is destined for Studio 5 as part of a major re-equipping of the HTV centre at Bristol.

## Montreux Music Encounter

The University of Miami School of Music, in cooperation with the Montreux International Music Festival, the Mountain Recording Studio and the NARAS Institute of the National Academy of Recording Arts and Sciences, plan to hold what they call the Montreux Music Encounter in (not surprisingly) Montreux, Switzerland, from July 2-30 1978. The programme of events during the four weeks includes basic and advanced courses on arranging, improvisation, jazz guitar, percussion technique, commercial and film scoring, sound mixing, microphone technique, plus legal and management practices.

Full details from Montreux Music Encounter, University of Miami, School of Music, PO Box 248165, Coral Gables, Florida 33124, USA. 30 ▶



*RM Recording is a company formed in 1976 to provide a professional public address service for exhibitions or other forms of mobile promotion work where a 'professional' radio-style presentation is required. Shown above is their studio layout for the recent Custom Car Show held at Alexandra Palace, London. Full details of the facilities that the company can offer are available from Mike Matthews or Dick Jones at RM Recordings, 24 Westbourne Court, Westbourne Avenue, North Cheam, Surrey. Phone: 01-405 7494 & 01-641 0056.*

# Four of the Best from Orban



## Model 245E Stereo Synthesiser

Uses a unique and patented process to create a realistic and mono compatible synthesised stereo from a mono source.



## Model 516EC Dynamic Sibilance Controller

Three independent channels of easily adjusted and effective de-essing. Tracking automatically over a wide range of input signals.



## NEW Model 622B Parametric Equaliser

Two channels of overlapping four band parametric equalisation with continuously variable tuning, equalisation level and bandwidth. 'Constant Q' rather than reciprocal equalisation curves for musically useful extremes of EQ



## NEW Model 418A Stereo Compressor/Limiter

Variable time-constant H.F. limiter section. Accurately ganged stereo controls. 'Programme controlled' attack and release times. Simple and sensible front-panel controls.

For full information or a demonstration of any of the Orban products, contact:

### Scenic Sounds Equipment

97-99 Dean Street, London W1V 5RA. Telephone: 01-734 2812/3/4/5

Sweden: Tal & Ton Musik & Elektronik AB,  
Kungsgatan 5, 411-19 Gothenburg Tel: 130 216

### Broadcast limiter system

The new *Optimod-AM* processing system from Orban Associates is designed 'to enable the best commercial use of the am broadcast channel'. No, it doesn't play advertising all the time, but enhances the signal to provide 'maximum obtainable fidelity, along with loudness, high average modulation, improved coverage, clarity and freedom from audible processing action'. Sounds like just what am broadcasting needs.

The system is intended to operate as the only item of equipment connected between the final broadcast console and the audio input to the transmitter. The incoming signal is processed through a series of six basic sections: an input-conditioning filter; a broadband compressor; a program equaliser; a 6-band limiter; a polarity follower; and Orban's own '*Smart Clipper*' peak-limiting circuit. A bypass switch is also provided for 'proof of performance'.

*Optimod-AM* cost \$4000 and can be adapted for am stereo broadcasting.

Orban Associates Inc, 645 Bryant Street, San Francisco, Ca 94107, USA.

Phone: (415) 957 1067.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

Phone: 01-735 2812. Telex: 27939

### Parasound marketing Orange County

The sale and marketing of Orange County's range of signal-processing equipment, which includes combined compressor-limiters/noise gates/expanders, is now being handled in the US by Parasound. However, Orange County will continue to sell its broadcast-related products direct from the company's office in Winnipeg, Canada. Bob Patrick will become the new Broadcast Products Manager.

Orange County Electronics Corporation Ltd, 1125 Empress Street, Winnipeg, Manitoba R3E 3H1, Canada.

Phone: (204) 775 8151

Parasound Inc, 680 Beach Street, San Francisco, Ca 94109, USA.

Phone: (415) 673 4544

■ We also hear that the agreement by which for the last 10 years Parasound was acting as sales and marketing agent for Orban Associates has now been terminated. In future the word 'Parasound' will be dropped from the company's products, which will now be known solely as 'Orban'. Further details



Orban Optimod-AM broadcast processor

from Frank Santucci, Orban Associates Inc, 645 Bryant Street, Ca 94107, USA.

Phone: (415) 957 1067.

### Lyrec/Neve US deal

The range of 16 and 24-track tape machines manufactured by Lyrec are now being marketed in the US by Rupert Neve Inc, Berkshire Industrial Park, Bethel, Conn 06801. Phone: (203) 744 6230.

### Sigma Sound's new studio

Next month will see the opening of a new 24-track recording and mix-down room next to Sigma's Manhattan studio complex. The architect was Maurice Wasserman and the general contractor Daniel Denno of La Cour-Denno Associates.

Sigma's first New York studio—it has others in Philadelphia—opened in January last year and is claimed to be the only automated

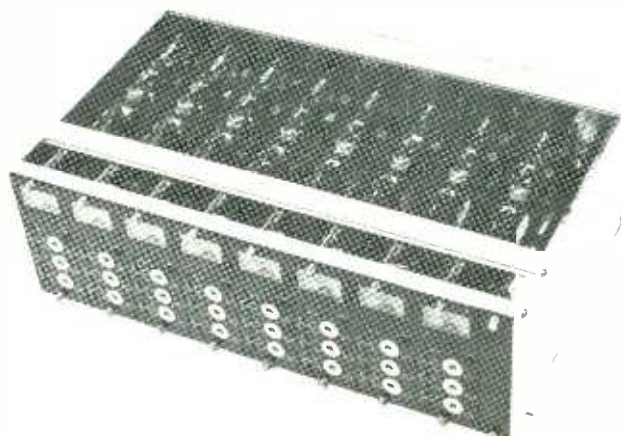
mixdown music recording studio in the Big Apple. Automation is handled by the Allison *Memory Plus* electronic fader system. In the past year Ashford & Simpson, Village People, Stevie Wonder, Baby Grand, Roy Ayers, Ritchie Family, Brecker Brothers and Brass Construction, to name but a few, have passed through Sigma Sound-New York.

### Portable reverb

The new *BX10* reverb chamber from AKG features two independent channels based on a torsional transmission-line principle. Three decay times of 1.5, 2.5 or 3.5s can be set independently for each channel. Crosstalk between channels is quoted at better than 35 dB at maximum reverberation.

Bass and treble controls on each channel offer up to 8 dB cut and boost at 150 Hz and up to 4 dB at 5 kHz. Frequency response with tone controls flat is claimed to be within  $\pm 6$  dB, 50–8k Hz. The *BX10* measures (wxhxd) 43x30x49 cm, weighs only 21 kg, and costs £1225.

Tape electronics module under development by Soundcraft Magnetics



AKG GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.

Phone: (222) 921647. Telex: 118390.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.

Phone: 01-749 2042. Telex: 28938.

US: Phillips Audio Video Systems Corp, 91 McKee Drive, Mahwah, NJ 07430.

Phone: (201) 529 5900.

Telex: 138022.

### EMI order for Nigeria

EMI Sound and Vision Equipment has won an order worth over £1 million from the Nigerian Broadcasting Corporation to supply 12 outside-broadcast vans. Each van will be based on a Ford *Transit* chassis, and is to be equipped with a 10-channel/mono or stereo output *1800 Series* mixer. Each channel has hf and lf cut and boost, pfl, echo send and foldback controls. Standard equipment will also include a vhf transmitter to link each ob van to fixed-location high-power transmitters for improved coverage.

### AES British section

Forthcoming meetings include a lecture on June 13 by Henning Möller of B&K entitled 'Multi-dimensional audio'. The lecture, which was also presented at the recent Hamburg AES Convention, will discuss the six 'measuring domains' that strongly correlate to the subjective perception of audio. The venue is the Institute of Electrical Engineers, Savoy Place, London WC2.

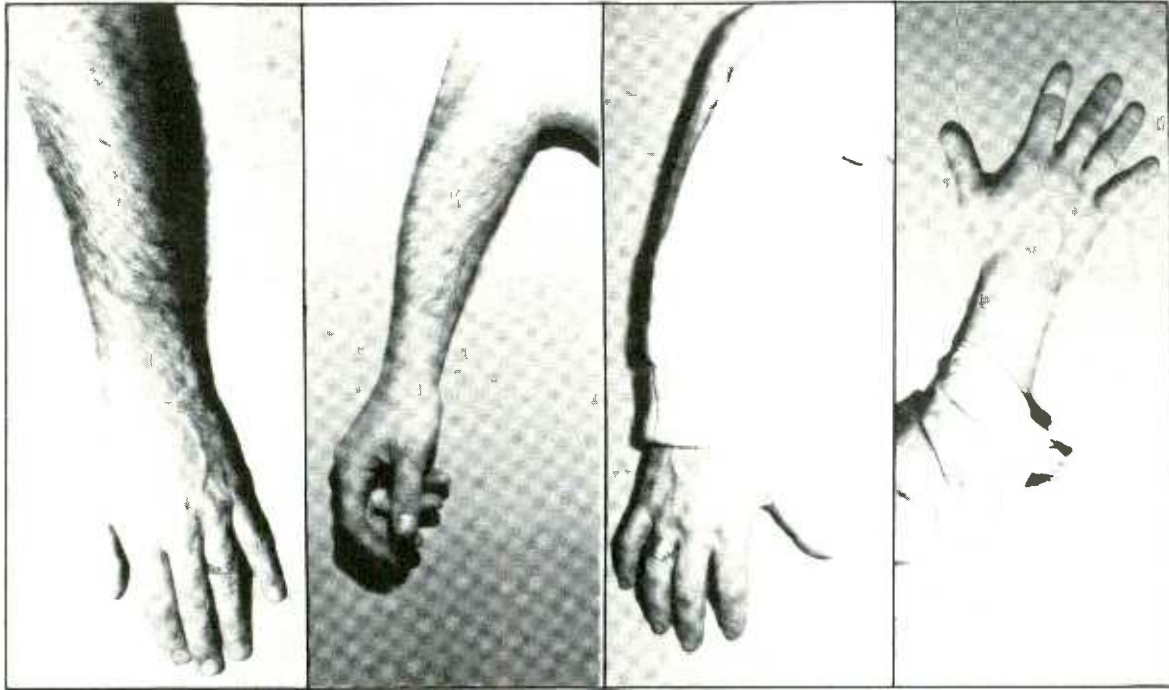
Further details of this and other meetings from Brian Atkinson, 32 Knoll Rise, Orpington, Kent BR6 0EL. Phone: Orpington 25423.

### Soundcraft Magnetics

is the name of a majority-owned subsidiary, set up recently by Soundcraft Electronics to develop a range of multitrack tape machines. A rack-mounting electronics unit comprising eight record replay amp modules has already been developed for updating existing machines from other manufacturers. It is anticipated that the first complete machine will be introduced by the end of the year. Soundcraft Electronics Ltd, 5 Great Sutton Street, London EC1V 0BX. Phone: 01-251 3631. Telex: 21198

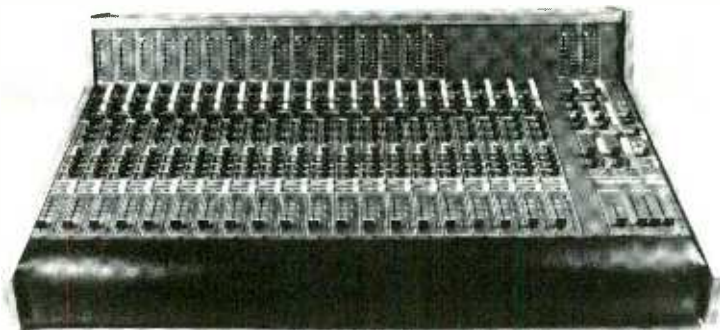
32 ▶

# Sound Workshop introduces its arms.



## The Auto-Recall Mixdown System brings computerized mixing to the Sound Workshop Series 1600.

The Series 1600 is a high-performance, automation-ready audio recording console available in several mainframe sizes, all fully expandable to a maximum configuration of 36 x 32, and all ready for direct interface with both the VCA input sub-group package and the **ARMS** Automation Processor.



During mixdown, **ARMS** stores fader levels which can be recalled for track by track update of the mix.

**The Sound Workshop Series 1600 Recording Console. A new philosophy in console design. Now with arms.**

Tapes processed with ARMS are compatible with MCI's JH-50 Automation System.

**Sound Workshop**  
PROFESSIONAL AUDIO PRODUCTS

**Bringing the technology within everyone's reach.**  
1324 Motor Parkway, Hauppauge, New York 11787 516-582-6210

## NEWS

### James Yorke moves

By the time you read this James Yorke, the Gloucestershire-based cassette duplicating company, will have moved. At the time of writing, they occupy a beautiful old farmhouse with adjoining barn, next to Lord Vesty's estate in Fossebridge, near Cheltenham.

Since the company's inception in 1973, it has handled both programme and blank duplicating and winding, to custom or standard length requirements. The move, a few miles up the road to North-leach, will expand the company's duping capacity, and permit growth in related fields.

Managing Director James Scarlett, after a stretch with Marconi Telecommunications, and 14 'happy years' with the British Army, has an electronic knowledge to be reckoned with. As well as designing the Company's transfer and monitor amps, he does a good line in pulse synchronising counters and standards converters for audio-visual application. The standards converter is in active service, tandemmed to a 16 mm cine projector, and is claimed to satisfy all the pulsing standards in common use. All of these electronic packages for

the cassette duplicating industry will be marketed soon.

The present staff of seven is to be doubled, but the duplicating ratio of 32 : 1 is to remain the same, 'until they can come up with a decent 64 : 1 system'. The loop bin and slave system is British-made Crowmay throughout, designed and built by ex-Precision Tapes man John Gardner. Scarlett commends the machines for their 'ease of servicing, conversion to cartridge format, and simplicity'.

Loop bin masters are produced on an Otari MX7300 fed by a standard or high-speed Revox, via a house-built mixer. Quality control comprises Nakamichi 700 cassette deck, house-built power amps and Spondor monitors. Scarlett plans to install a separate qc facility in the new building, this section sharing space with Otari tape winding machines at present. The Otari winders, although 'extremely reliable', had a 'painfully slow splice cycle'. Operating cycle camshafts on all machines are in the process of being speeded up.

Now that the company is moving, what will Scarlett, who lives on site in the old farmhouse, do with the sudden abundance of space? 'I've always been interested in building myself a dinghy,' he replied as I

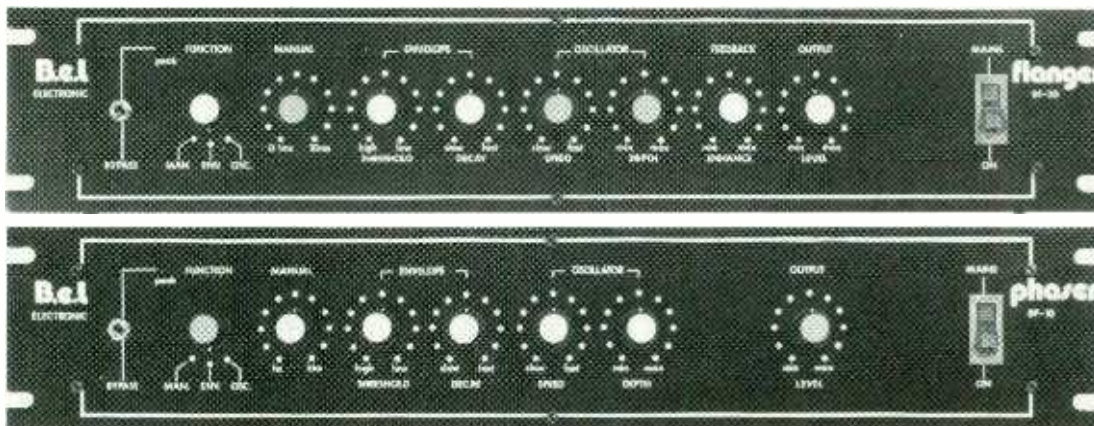
started to recognise the faint, sweet smell of glass fibre resin. 'And now at last I shall have a decent bit of space in which to finish it!'



James Yorke's new address is Oak House, High Street, North-leach, Near Cheltenham, Gloucestershire.

Richard Dean

# QUIET AND SHY?



The first in a new range of 19in. rack mounting studio effects by B.E.L. Electronics. Two nice and quiet units each with three function modes including an envelope with an adjustable threshold level and decay time.

**TEK SPEK.** Input levels up to +8db. Output level to +6db variable gain. Noise -70db. Envelope threshold -15db to +4db. Oscillator speed 0.7hz-7hz. Supplied unbalanced jacks or balanced 600 ohms and cannons.

**FLANGER.** Freq. Direct 20hz-20khz. Delayed 20hz-12khz + 3db. THD. Direct 0.06% Delayed 0.5%. Delay range 0.1ms to 10ms. Low pass filter at input to prevent aliasing.

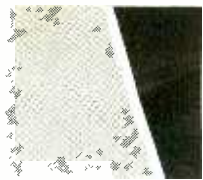
**PHASER.** Freq. Direct 20hz-20khz. Phase shifted 20hz-18khz. + 3db THD. Direct 0.06%. Phase shifted 15%. Phase shift 2160 deg.

**DON'T BE SHY.** Write or call for information or even a demo at your place you may find that the quiet ones are not as shy as they look.

Sole Agents: **R. D. G. Audio Visual Productions Ltd.**

Reg. Office: 12 Hill View, Newport Pagnell, Bucks. Sales: 104 High Street, Houghton Regis, Beds.  
Telephone: Dunstable (0582) 607192. Office hours. 0908 613009 or 0525 403528. After hours.





# fact: you can choose your microphone to enhance your individuality.

Shure makes microphones for every imaginable use. Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects. Take, for example, the Shure SM58 and SM59 microphones:

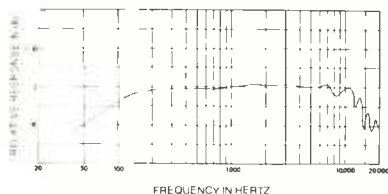


## SM59

**Mellow, smooth,  
silent...**

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted for critical studio productions. In fact, you'll see it most often where accurate, natural sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged—it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

**Some like it essentially flat...**

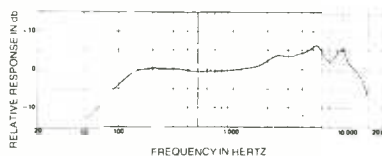


## SM58

**Crisp, bright  
"abuse proof"**

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications... especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreen eliminates pops. The first choice among rock, pop, R & B, country, gospel and jazz vocalists.

**...some like a "presence" peak.**



professional microphones...by



Shure Electronics Limited, Eccleston Road, Maidstone ME 15 6AU—Telephone: Maidstone (0622) 59881

# MCI



**MCI JH-110A**

**MCI JH-110A** recorder features a new variable profile cabinet that facilitates easy operation by permitting the deck to tilt through an angle of 22 degrees in seven steps. A tape counter, displaying minutes and seconds in real time, can be combined with the JH-36 "Return to Zero" (CUE-UP) function. For precise electronic editing, there are new bias and erase timing generators eliminating clicks, gaps and overlaps for all three speeds. Tape markers and scissors can also be supplied. The recorder can handle 14-inch reels as an option. It is capable of handling mono and stereo configurations on quarter-inch tape as well as eight channels on one-inch tape.

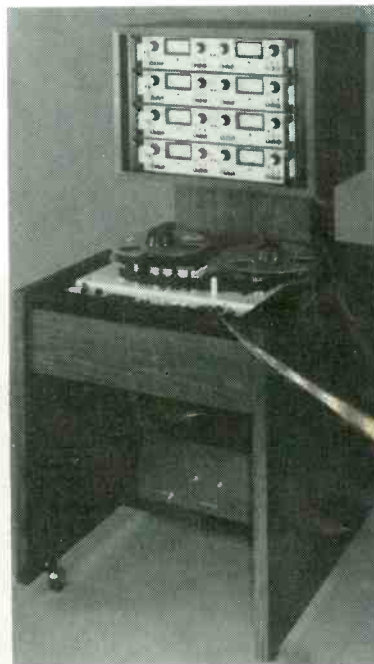
**MCI JH-110A BROADCAST MACHINE** has the same superb tape handling and reliability found on all JH-110A Series recorders, plus many new features—Professional quality built-in monitor amplifier—Phase correction circuitry for reduced phase distortion—Switchable NAB/CCIR equalisation that does not need readjustment when switched—plus new Tape marker and scissors.



**MCI JH-110A/BC**

A recent Billboard survey confirmed that MCI is now the USA's Number One manufacturer for tape recorders of 16-tracks or more. The performance of the JH-110A/8 is making MCI the USA's Number One manufacturer of quality low cost 8-track recorders.

New to the JH 110 range is the **JH-110M DISC MASTERING DECK** for both stereo and quad. It is used either as a component in a Tape to Disc Transfer System or as a Tape Delay System. It is available in two basic delay configurations with delays normalised for either the Neumann system or the Capps/Scully system. In addition to the normal Tape Break Optical Sensor, a second Optical Sensor is located just ahead of the Prelisting Head. When the



**MCI JH-110A/8**

Master Tape has been prepared with clear leader tape between songs, this sensor signals the Banding unit approximately one revolution before the end of the song.

**MCI JH-110A/8** recorder is MCI's answer to the industry's need for low cost—but high quality—multitrack system. The professional recording industry's leading multitrack system has been scaled down to fit the needs of schools, music groups and others who wish to take advantage of multitrack recording techniques without the high cost of a complete 16- or 24-track system. Full professional level specifications are retained throughout this new low cost 8-track system. MCI is now the Number One manufacturer in the USA for tape record-



**MCI JH-114-24**

ers of 16 tracks or more. With the JH-110A/8, MCI will soon become the Number One manufacturer of 8-track recorders.

**MCI JH-114-24** multitrack is expandable from 8-track to 24-track. The standard of recording studios and broadcast stations throughout the world now features standard control card with all F.E.T. switching (for improved reliability and performance) and also with a phase compensation circuit for improved phase response off tape. A new optional Quior Bias Amp Card provides quiet punch in/punch out on tape while eliminating the bothersome "hole" in music continuity. Separate BIAS and ERASE amplifiers are independently timed to ensure that all erased tape is re-recorded. Switching adjusts timing for each speed.

# MCI

**MCI (PROFESSIONAL STUDIO EQUIPMENT) LTD.**  
**MCI House, 54-56 Stanhope Street,**  
**London NW1 3EX. Tel: 01-388 7867/8. Tx: 261116**

# HH S500-D



## The Perfect Power Amplifier for Top Sound Systems....

Since its introduction, the HH S500-D has become established as one of the world's leading power amplifiers. Many prestigious organisations have confirmed the amplifier's unique performance and dependability under tough operating conditions.

The list of users is long and varied but here are a few of interest:

Installers — Scenic Sound Limited, in co-operation with Eastlake Studios (for world-wide recording studio use); Martin Audio Limited (P.A. systems builders); Harold Fielding Limited (Theatrical use); International Sound (Italy); Virgin Record Hire; Dolby Laboratories.

The London Palladium; The Grosvenor House Hotel, London (S500-Ds in the main ballroom); Colac P.A. Hire Co. (S500-Ds on Dr. Hook European tours); The Duane Family (Winners of the Variety Club of Great Britain Award 1977); E.M.I. Publicity Department; Supertramp (U.S.A. and European tours); The Rubettes; Colosseum II; Black Sabbath; Liverpool Express; Simon Townsend Band; Island Records; Gallagher and Lyle; Tangerine Dream; Five Hand Reel; Horslips; The Barron Knights; . . . . the Admiralty Surface Weapons Establishment (for hush, hush use!)

### POWER CAPABILITY:

|                 |                |                         |
|-----------------|----------------|-------------------------|
| 500W RMS        | -2.5 ohms      | 900W RMS - 5 ohms Mono  |
| 320W + 320W RMS | -4 ohms Stereo | 640W RMS - 8 ohms Mono  |
| 200W + 200W RMS | -8 ohms Stereo | 400W RMS - 16 ohms Mono |

### TECHNOLOGY AND COST

Professionals are buying the S500-D for two reasons — firstly, the superb performance and advanced technology and secondly, the price which is lower than other less advanced amplifiers of similar power rating.

HH gives unbeatable performance — the best value for money.

### PERFECT POWER FOR YOUR SOUND SYSTEM

Please send me full information on the S500-D

NAME.....

ADDRESS.....

.....

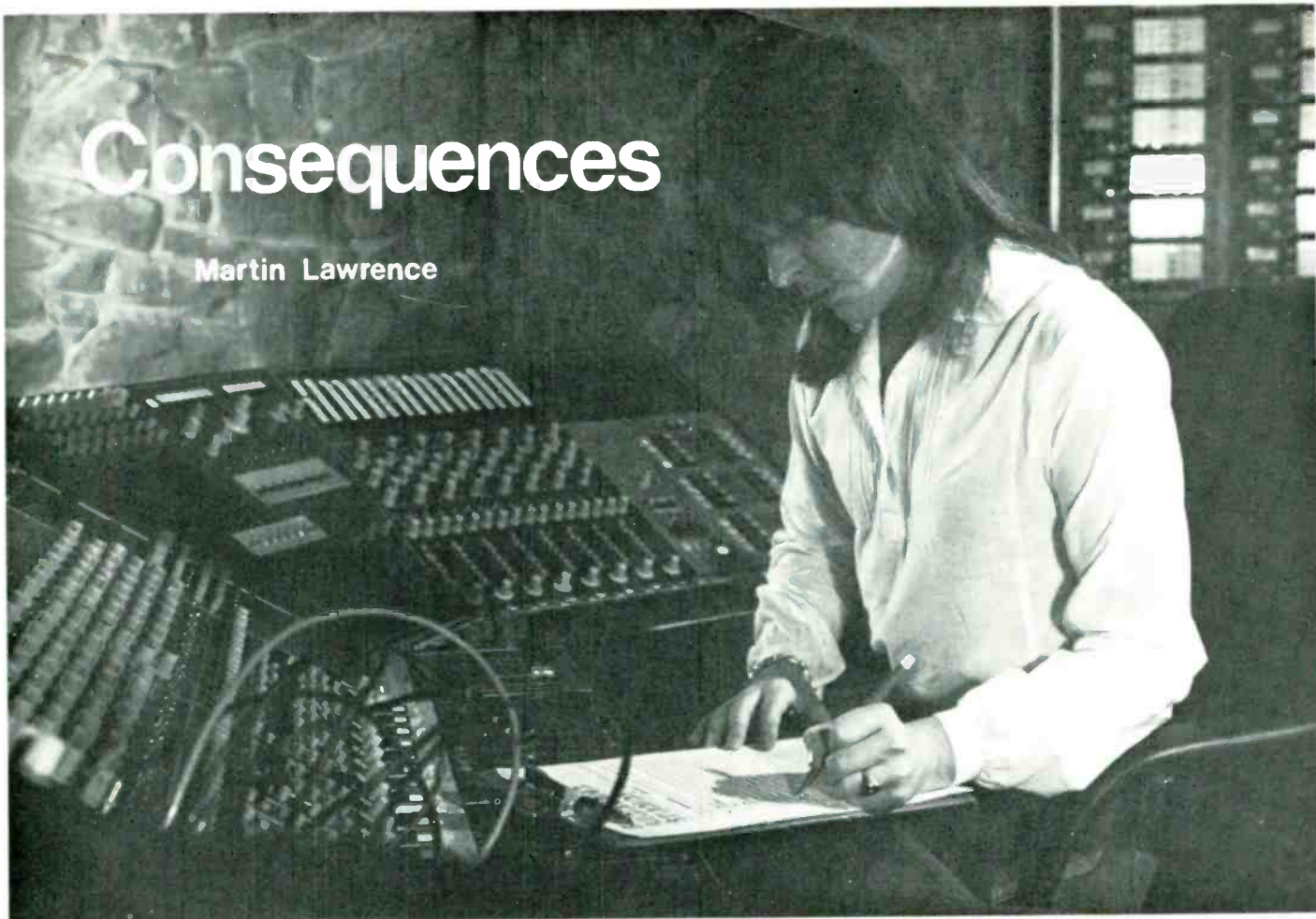
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H.H. Electronic  
Viking Way, Bar Hill, Cambridge CB3 8EL  
Telephone: Crafts Hill (0954) 81140  
Telex: 817515 HH ELEC G

# Consequences

Martin Lawrence



*The whole concept of making a triple album using one particular instrument for most of the musical sections sets quite a task in engineering. To make a guitar fitted with the Gizmo sound like a 200-piece orchestra, a brass section, the wind, voices and more unusual sounds (either musical or atmospheric) needs a wide scope of subtlety, trickery, experimentation and the odd gimmick here and there.*

**L**ET'S begin with the *Gizmo* itself. It consists of six toothed wheels, each one attached to a button or key. When a button is pressed the turning wheel makes contact with a string and a sustained note is produced. Single strings or chords can be played while the lefthand work is the same as normal.

So to build up a string section: first of all violins were 'achieved' by the use of the first three strings of the guitar recorded at normal speed and also at a slower speed, played back at normal speed, for the high-edge of the string sound. Violas and cellos were recorded at normal speed using the remaining three strings and basses were recorded at a faster speed played back at normal speed giving a very rich bottom end. Obviously this calls for great technique on the part of the guitarist, and the use of noise reduction and limiting for the bass sound, due to the erratic peaks and increase of noise when playing something back at a slower speed than it was recorded.

The actual building up of these sections usually consisted of recording 20 tracks of each string on the guitar, bounced to two tracks in stereo on the 24-track-machine; then recording 18 of the next strings, again being bounced to stereo. And so on, until I was left with four sets of stereo pairs (1st, 2nd, 3rd and speeded up strings) which were then bounced to one stereo pair and so on with the violas, cellos and basses. Obviously with doing this amount of bouncing, quality tends to suffer but, by the use of stereo graphics,

frequency loss was kept to a minimum. Also by using various fader techniques, noise was reduced to a minimum.

When strings were required on a section of *Consequences* where the tracks were not available I would do a rough stereo mix of the backing track which I would transfer onto a clean piece of 24-track tape, do the necessary recording, then mix the whole string section, minus the track, onto 6.35 mm tape and then drop that back onto the master 24-track, a task which is easier said than done. If pizzicato strings were required, they were achieved by placing a piece of gaffa tape lightly across the bridge of the guitar and then equalising to accent the plucking sound, with echo added to smooth it out. Pizzicato sections would be recorded using varispeed techniques (slowed down for highs, speeded up for lows).

The whole procedure of recording a *Gizmo* orchestra was a lengthy and somewhat repetitive task—sometimes two days would be taken overdubbing 20 seconds of *Gizmo* orchestra. But the end product is a totally unique sound and when one considers it's made by a guitar fitted with a *Gizmo* it must surely be impressive.

Different string arrangements called for different string sounds, something that could not really be done using conventional string players. Sometimes I would equalise the finished stereo pair of strings to make it more unusual or just add an effect to it, such as stereo vibrato, phase, Cooper Time Cube, Marshall Time Line, etc.

And occasionally innovative ideas were necessary. For example, one evening we wanted to wah-wah a particular string section we had recorded but we didn't have a wah-wah pedal. So eventually we used a 16-way graphic with all the low frequency faders attached to a small piece of wood and all the high frequency faders attached to another piece of wood. We could then increase or decrease frequencies on the graphic very easily. I then played the recorded string section through the graphic and found I had a great deal of control over the depth and speed of the wah-wah effect due to the operational simplicity of this set-up. This method of attaching several faders together was used on many occasions in conjunction with tape loops.

A lot of musical passages were, in fact, played on faders. This process consisted of laying down 20 tracks, each one with a *Gizmo* chord loop on it. A chord sequence would be played by fading in and out various notes to a rhythm track. Obviously if a fast run were required I had to literally dive round the desk pushing up and pulling down faders, and sometimes crossfades between chords were required, sometimes very staccato. A painstaking task but the end product is a totally unique sound.

The idea was taken further and a keyboard consisting of touch sensitive buttons was made, the principle being that each button was selected to one track of the 24-track. When you touched the button, whatever was on that particular track could be heard and as soon as you removed your finger it stopped. Therefore it was actually possible to play a 24-track tape like a piano though obviously the limitations are endless. Each track can have a totally different sound playing the note required: for instance, middle C could be played by strings, D by trumpets, E by flutes, F by a choir, and so on. It is just a case of laying down 24 tracks of the loops you wish to hear, tuned by varispeed to the required notes.

Loops also played a large part in the atmospheric sounds of *Consequences*. Approximately 500 loops were made, each one consisting of sounds produced by the *Gizmo*. The loops were used for various musical passages and effects. For example, using the *Kepex* noise-gate a loop would be fed into the device and, using the triggering apparatus on the *Kepex* (the key), a percussive backing track was built up. A beat would be played on a snare drum which in turn would open the gate of the *Kepex* and the loop would sound out. The release time of the *Kepex* would be very short so as to keep the sound very percussive—these beats or accents would be recorded. Then another loop would be fed through, different accents played and so on until a full percussive rhythm would be built up, but with each accent being played by a musical sound rather than a drum. The advantages of using this technique are that things can be played on a tight drum skin which could not be played using a keyboard, and therefore musical rolls, parradiddles, flams, etc are possible. As well as loops, tones from a generator were fed through the *Kepex* giving a range from a 50 Hz bass drum to a 15kHz hi-hat using the same principle.

The backing track for the flood consisted of tempoed loops of dripping water, the basic sound being produced by dropping pieces of Plasticine into a bucket of water. These loops were then laid on to 24-track at normal, double and half speed. A digital delay was used to build up cross rhythms from the same loops but with an additional tempoed or rhythmical delay. Once this backing track was recorded it was just a case of overdubbing bass, electric guitar, etc to the tempo. At the end of the flood the impression of drowning was achieved by analysing the difference in sound when something is heard under water. The first thing noticed was that high frequencies were lost and everything became very muffled, so I put the backing track through stereo graphics and removed everything above 6kHz. The next step was to record the sound of air bubbles, which was achieved by miking up a basin of water and blowing bubbles via a small tube. All that it needed now was the human heart-beat, eventually stopping to signify death. A bass drum with backwards echo achieved this very successfully although it took several takes before it was realistic enough to satisfy Kevin's warped sense of humour!

The microphone techniques used varied from close miking to ambience microphones, dummy-head techniques and even miking up instruments the other side of a door. Neumann, AKG, Beyer and Sennheiser microphones were all used. Drums were mainly close miked with two hanging overheads for slight ambience: although on the flood just three microphones were used, one close miking the

bass drum and two slung approximately 3 metres away in a stereo pair.

The sound effects were recorded using various techniques: for instance, the wave which can be heard on the flood and *Honolulu Lulu* was recorded live, the actual wave sound consisted of buckets of water thrown against a brick wall outside the studio. This had to be recorded during the early hours of the morning due to traffic noise etc, but as time went on the morning rush-hour began and a policeman kindly offered to stop the traffic during the takes. The wall was miked up in stereo using reasonably directional microphones wrapped in plastic to protect them from the water. Then about 400 buckets-full of water, two at a time were thrown at the wall and recorded onto multitrack, doing the necessary bouncing until eventually we were left with a stereo wave on two tracks. (Well, it impressed the policeman.)

Another unusual technique was the use of a Sennheiser dummy-head on the stampede section of *Consequences*. An idea which cropped up was to recreate the atmospheric sounds that a monkey would hear swinging from tree to tree in the jungle, so what better way than to swing the dummy-head past specially positioned foldback speakers. Eight speakers were placed alternating between left and right approximately 1.5 metres apart. Then the dummy-head was attached to a cable in the centre of the studio and swung through the gap between the row of speakers, which had various atmospheric sound effects being played through them. The effects produced were a kind of stereo wind noise as the microphones attached to the head swung through the air, plus alternating peaks of the atmospherics being played back through the speakers as the microphones passed them. This was obviously only an artistic impression of what we were trying to simulate, but an interesting effect all the same. It led me to try other techniques such as mounting the head on a revolving turntable. This was then placed in front of a guitar speaker cabinet giving an almost unusual stereo Leslie effect to the sound it was being applied to.

'Let's recreate being buried alive' was the cry (yes you guessed it, Kevin!), so what better way than to lay the dummy-head in a home-made coffin and shovel earth on it. Which is exactly what we did. With the coffin placed neatly in position at the foot of some stairs, soil was brutally shovelled from the top directly on to it and the effect recorded. Having never been buried alive I cannot say how authentic it was, but it certainly didn't sound pleasant. When I had recorded that we then built up a sonic picture around it, using thunderclaps and the sound of heavy rainfall. We then added a rather ominous loop of *Gizmo* string basses, nicknamed the 'Oh Brother' loop. The final touch was added when an actor was brought in to speak the last rites.

When all this had been recorded the whole scene was immediately mixed on 24-track. The idea was to put the listener in the coffin, so as each shovel of earth landed the outside world became quieter. All this required was to route everything but the earth landing on one stereo group and with every shovel-full, lower the level of the outside world until the last thud left you with silence.

But let's return to the music. The stampede section on side one contains most of the effects used on *Consequences*. For instance, the track begins with the firework display and all the fireworks were actually recorded in a park near Strawberry Studios. A pair of stereo microphones were placed in the firing area and each firework identified on tape and then released. When all the necessary recording was done the tapes were taken back to the studio and each one dropped on to 24-track to simulate an actual display. Once again the *Kepex* was used: certain *Gizmo* loops were fed into the *Kepex* which was triggered by a specific firework thus giving a musical interpretation as well as an actual recording of a firework—so each firework had its own musical sound whenever it appeared.

Within the rest of the track small scenes are set including a man in a rocking chair humming to himself who is then confronted by a fly which he subsequently swats. This scene was made up of 24-track overdubs as were the others: first of all the humming was recorded, then we start to build up the picture, a few creaks from a rocking chair and the sound of crickets in the background. The fly was the old comb-and-tissue trick faded up to make it sound as though it was coming closer; and then a clap was the actual swatting. Then we edited that small scene into the middle of a recurring melody which had been recorded previously.

## CONSEQUENCES

The next scene change is a disco. About 15 seconds of funky music (two days work) was recorded, then the sound of clinking glasses, people chattering, dancing feet and a dj making conversation was again dubbed over it. Each effect was recorded separately, then dropped onto the disco track, edited as a section into another part of the melody and onto the last scene.

This was a man driving along in the rain and is a ten second scene full of subtleties. For instance, the tempo of the previous melody is held by the windscreen wipers which were recorded outside the studio on Kelvin's car—and are even in stereo! I took a microphone for a drive to record the sound of tyres on a wet road, and then the Doppler effect was recreated by actually going out in two cars to a long stretch of road, one stationary with a Nagra and microphone in it with the other car driving past at about 100 kph sounding its horn to give the required effect. This was then varied to the same pitch as the previous melody, and again occurs within the correct tempo. Finally the radio is switched on and the first two bars of the next section of music are heard through a car radio speaker. Then the sound quality becomes normal and opens out into stereo—all done by graphics to simulate radio quality and panning from mono to stereo.

On the final section at the end of the stampede, the crackling fire was reproduced by using a protective packaging that consisted of lots of small air bubbles. When crushed in the hand it sounded very similar to burning logs. A loop was made of this sound and again the *KepeX* was used to activate vocals by the loop, breaking up the voices with each crackle.

This kind of attention to detail and engineering techniques was maintained throughout the albums but there are far too many to write about.

All vocals on *Consequences* were sung by Lol and Kev so an effort was made to vary the vocal sounds to prevent it sounding like just two people.

Full choral arrangements were written and the technique of recording was to lay down certain harmonies at normal speed with various eq and actual changes in the way they sang the parts. To achieve girl-like voices higher harmonies were recorded at a slightly slower speed which when played back had a female quality about them. Tenors and basses were achieved by simply reversing the process and applying a 100 Hz bass lift which when massed tend to sound like a Welsh Miners Choir! Most backing vocal passages consisted of somewhere in the region of 120 bounced tracks using all these techniques, with the end product sometimes being ad'd. Again it was nearly always necessary to use the process of a clean piece of 24-track tape with the backing track on one, and using the other 23 tracks to build up the harmonies. They would then be mixed down to stereo tape and dropped back as a stereo pair on the actual 24-track master. As I have already said, this facility of using clean pieces of 24-track tape allows you an endless scope of overdubbing.

Voice loops were also made of monotone *mmm's* and *aah's* which could then be varisped to produce any note. This also means that whole vocal arrangements can run through a track, following all the musical chord changes and giving an extremely lush sound. (10cc's *I'm Not In Love* backing track used this principle.)

All the dialogue on the album was performed by Peter Cook. The recording methods used were: each character had his own track and each speech would be recorded, then played back to Peter when he would play off his own acting, continuing the story. Various characters had various eq and slight varispeed changes, so each character had his own microphone and channel preset with the necessary eq.

At the same time as recording on 24-track, simultaneous recordings were done on stereo tape, which were used when dialogue was inserted over music. The music would be recorded first and then the dialogue dropped in almost word for word over it so as to fit rhythmically. We were fortunate, in fact, because all these particular sections worked very well considering that they were not acted with the intention of going onto music.

All the sound effects were dropped in on the dialogue 24-track master, one by one as they were needed and atmospheres built up

by the use of various loops. For example, Blint's room in the story is portrayed by a radio in the background, the sound of a fridge humming in the corner, musical rain (which was actual rain sound *KepeXing* a *Gizmo* loop) and a clock ticking. All these sounds had echo on them and if anyone went into his room, they too acquired the same echo, but Blint himself had a 2½ second EMT plate wherever he went! Another small attention to detail was Blint's lift. As it rose up from his room it became dry and as it went down again back into echo.

As well as effects, hundreds of 24-track edits were also necessary to tighten up certain lines, pauses, etc so that the dialogue flowed quite naturally. We attempted to recreate many sounds using the *Gizmo* and expand on various ideas. One such idea was a voice box as used by Peter Frampton, but on a larger scale. The device consisted of a JBL mid-range driver, a Hoover pipe and the overflow-tube off a vending machine. The Hoover tube was 'gaffered' over the mid-range driver and at the other end of the rubber overflow pipe was used as a mouthpiece. This device was nicknamed 'The Bag'.

Various loops were played back through the mid-range driver down the pipe, and by using Lol's mouth as a soundbox the effect was achieved. We found that, because we were using a constant sound, words became reasonably audible and by massing (multitracking) we built up quite a powerful sound which was to become a musical interpretation of the wind (which can be heard on side one). This same device was used with various sounds, including tymps which gave talking drums. Using the same idea, loops were made of tuned tymp rolls and played through 'the bag'—again a very unusual sound.

All the time we were searching for more sounds from the *Gizmo*, two of which spring to mind. First of all one nicknamed 'Bertha'. This was *Gizmo* played with a bottleneck, and then what I call butterfly echo was added. This is achieved by placing a small lump of editing tape on the capstan of a stereo machine being used for tape delay. This just adds a slight wobble or vibrato to the echo repeat, and when mixed with the natural sound it resembled the quality of a solo soprano singer. The second effect, and probably the most interesting, was that used to obtain a saxophone sound. After spending a day of trial and error using various eq, effects and heavy limiting to decrease the attack of the guitar, we decided that the only way to achieve the required sound would be to record each note separately. The principle was that Lol would strike a note fractionally earlier than required, then I would fade it up, in order to lose the percussive attack associated with a guitar. Musical runs would be worked out and then recorded, note by note over three tracks, to allow time to drop in. Eventually we had the licks required but the sound still wasn't quite right—in fact the thing that was missing was the natural rasp associated with saxophones. After a great deal of thought the old idea of the comb-and-tissue was used. We played back a particular lick we had recorded through 'the bag' with the comb-and-tissue attached to the end of it. This gave us the rasp effect and we then found that we could vary the amount of rasp depending on the level at which we were playing back the lick. We were therefore able to control this effect and by using a combination of the guitar sound and the rasp achieved, we got very close to what we would call a reasonable saxophone sound.

Finally the mixing of *Consequences* was a lengthy procedure but it was made far simpler because most of the desired echoes, effects, etc had already been recorded on 24-track, and most *Gizmo* and vocal sections were already mixed and in stereo pairs. For the most part of sides one, two and six the faders invariably ended up pretty well in a straight line with very little if any, added eq or echo.

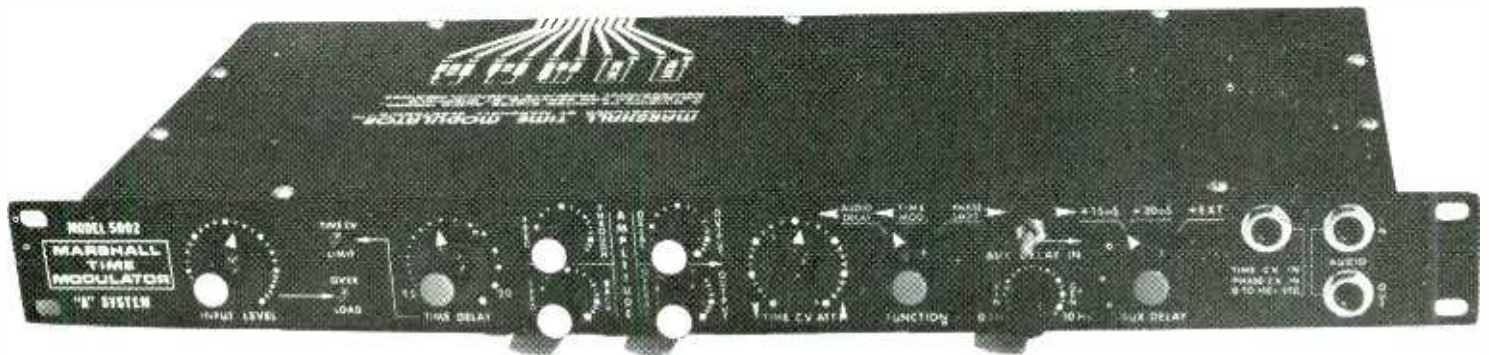
Due to the lengthy sections of music and dialogue, many edits were required during the mixing, and again the process of pulling out faders when there is no signal on that particular track was used to reduce noise, even to the extent of pulling out breaths recorded on lead vocal tracks because auxiliary gating could not be used.

In total about two months were spent acquiring the final mix on all six sides. When the album was cut the only necessary adjustment made was an additional 2 dB at 12 kHz on side one. The rest was cut completely flat with no compression or limiting, as care had been taken to eliminate all problem peaks during the recording without losing any dynamics in the overall sound. ■

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# AES 60th Convention, Los Angeles~a preview

The 60th Convention of the Audio Engineering Society will be held from May 2 to May 5 at the Los Angeles Hilton Hotel. Well over 100 manufacturers will be showing a wide range of their products. A full list of exhibitors is to be found on page 48

The Model AS2400 tape duplication system, which is available with master transports to handle two and four tracks on 6.35 mm, four tracks on 12.7 mm or four and eight tracks on 25.4 mm tape, will be demonstrated by **Accurate Sound**. Slaves are available for cassette or cartridge formats: up to 10 slaves can be connected to one master. Also on show will be the AS2600 tape transport and various electronics packages.

Examples of their latest control room and studio designs, including a recently-finished computerised film mixing suite, will be displayed by **Acoustic Design** by **Jeff Cooper**.

**Acoustilog** are to demonstrate the Model 232 reverberation timer that makes measurements in seven octave bands between 125 and 8k Hz. Results are provided on a front-panel digital display, and system excitation is by means of a pink-noise generator. Accessories are now available for  $T_{60}$  measurements and true rms analysis of studio acoustics.

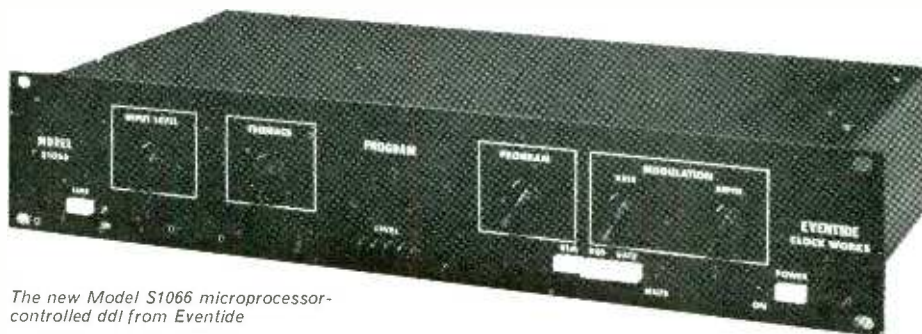
**AKG** are to show several new condenser microphones, including the C33 dual cardioid, C414EB with switchable polar response, C424 quadrasonic system, and the C422 and C34 remote-controllable, variable-pattern stereo models.

**Allison Research** plan to show the 65k Series automation programmers and the new VCA 5 voltage-controlled attenuator, as well as the *Kepex* expander noise gate and *Gain Brain* compressor-limiter.

The Model 4400A multipurpose portable audio test set to be demonstrated by **Amber** comprises a log sweep generator, function generator, noise generator, tone-burst generator, spectrum analyser, digital dBm meter, amplitude and phase response plotters, and frequency counter - all in one case. An accessory to connect the 4400A to an X-Y recorder can also be seen.

**Anvil Cases** are showing a wide selection of custom-built and off-the-shelf cases for instruments and mixers, plus a range of amplifier racks.

**Audico** will be demonstrating the 751 Series of cassette loaders, cartridge loaders and other models for filling *Betamax* and *Umatic* video



The new Model S1066 microprocessor-controlled ddi from Eventide

cassettes. All the loaders can handle blank tape (to within a claimed 0.5s of the prescribed time) or pre-recorded tape complete with cue tones.

The new S24 adt/flanger module from the *Scamp* range will be demonstrated by **Audio & Design**. The *Time Shape Module* has a built-in limiter to prevent overload, and delay is continuously variable up to a maximum of 45 ms. Both negative and positive flanging is available. Examples of the company's range of limiters, compressors, filters, equalisers and other signal-processing gear can also be seen.

**Audio Illusions** will demonstrate the *Stylophone 350S*, a miniature synthesiser that uses a metal stylus to select notes on a metal 'keyboard'. Switches allow simulation of violin, clarinet, piano, flute and other instruments.

**Auditronics** will be exhibiting the new 501-32 mixer, which is available in 32-in 16 or 24-out configurations with quad monitoring and mixdown. Features include ppm displays, in-place solo and group muting.

A range of road cases for portable rack-mounting equipment and loudspeakers, including a lightweight series, will be shown by **Bobadilla Cases**.

The new model 4500 synchroniser system to be exhibited by **BTX** uses the SMPTE timecode to lock-up two tape machines with an accuracy of 50 ms. Codes as low as 12 dBm in level can be read by the system.

The *Big Tweet* (sic), an ultra-high-frequency

loudspeaker, is to be demonstrated by **Cetec**. Also on show will be the *Gauss* 64:1 tape duplication system, which now features motorised tape wiper, a Packer arm on the slave, and reflective tape sensor.

A range of intercom systems for use between pa staff can be seen on the **Clear-Com** stand. Of particular interest should be the Model SB-8 that can monitor eight channels, and be expanded to accommodate up to 32 or more channels. Three modes are offered: 'party line' for talking to everyone; 'cue' which allows the switchboard operator to talk to all stations; and 'out' for private chats between stations.

The *Artech* radio microphone system, which features a claimed frequency response of  $\pm 2$  dB, 80-20k Hz, a 100 dB dynamic range and a 64 dB unweighted signal-to-noise ratio, can be seen on the **Coherent Communications** stand. Also to be seen: a range of portable mixers and other equipment manufactured by **Audio Developments**; **Jensen** transformers; and **RTS** intercom systems, mixers and mic pre-amps.

A new range of horns and enclosures with glass-fibre and foam construction are to be seen on the **Community Light & Sound** stand, including a new midrange enclosure for 25 and 30 cm drive units.

**dbx** will be showing the Model 155 four-channel noise reduction system, each channel of which can be switched individually to encode, decode or bypass; and the Model 158 eight-channel system with simultaneous encode and



decode on each channel. A demonstration of dbx-encoded discs with a claimed 100 dB dynamic range and zero audible surface noise has also been arranged.

Products to be shown by **Diversified Concepts** include the *Decade* range of cluster pa loudspeaker systems, and a vca-controlled production desk for potential broadcast use.

The noise-reduction units to be exhibited by **Dolby** include the *361* single-channel and *M1611* multichannel systems; the *CP50* and *CP100* cinema processors for replaying Dolby stereo optical sound tracks; the *334* broadcast processor for Dolby *B*-encoded 5  $\mu$ s fm transmissions; and the *330B* processor for Dolby *B*-encoded tapes.

The *Series 400* conductive plastic faders to be exhibited by **Duncan Electronics** can be supplied in two lengths with single or dual elements.

Linear, audio and balance (dual-channel) tapers, with or without a choice of cue switches, are also available.

The new *System 21* automated switching system with crosspoint control for audio and dc signals can be seen on the **Dynair Electronics** stand.

**Electro Sound** will be showing a range of tape duplication systems, including a new machine for recording 9.5 cm/s masters intended for 64:1 and 19 cm/s masters for 32:1 duplicating ratios. Overall frequency response at 9.5 cm/s is a claimed  $\pm 2$  dB to 18k Hz, with under 0.4% second harmonic distortion. Also to be seen: the *ES-200* automatic tape splicer; *ES-500* automatic 8-track cartridge loader; and the *6400* high-speed duplicating system.

The *E11500* and *800* exponential horns are to be exhibited by **Emilar**. Coupled to the *EA175* or *EC175* compression driver the horns cover the range 500-15k Hz, with a maximum spl of 109.5 dBA at 1m or 101.8 dBA at 3m.

The new *Model S1066* ddl with random-access memory will be exhibited by **Eventide**. Amplitude, phase and delay of the 16 outputs are controlled by programmes stored in the unit's read-only memory. Selection of programs is by means of front-panel switches or by remote-control. All the normal delay-line, reverb and special effects can be duplicated. The *Model 1745M* ddl, *Harmonizer*, *Omnipressor* and *Instant Flanger* are also to be displayed.

An Amek *2000 Series* mixer, plus advance details of the new *30000 Series* automated console, can be seen for the first time on the **Everything Audio** stand. Drawings and photographs of studios that EA have recently

designed and constructed will also be displayed.

The *Model PQ-3* parametric pre-amplifier/ equaliser to be exhibited by **Furman Sound** features three overlapping ranges with variable bandwidth, centre frequency and boost and cut on each range. Also on show will be the new *Model TX-2* turntable bandpass/crossover filter, which has two selectable crossover points between 20 Hz and 20k Hz, and the *RV-1* reverb system.

The Telefunken *M15A* tape machine, available in 8-track on 25.4 mm or 16, 24 and 32-track versions on 50.8 mm tape, will be demonstrated by **Gotham**. A brushless dc capstan motor with quartz-controlled speed control is featured, resulting in a rated wow and flutter at 38 and 76 cm/s of less than  $\pm 0.04\%$  to DIN 45507. Ramp voltages control timing of bias and record functions to ensure click-free, gapless drop-ins. Space is provided in the lower pull-out electronics drawers for up to 24 channels of *Telcom e4* noise reduction. Also to be seen: Neumann disc-cutting lathes and microphones; EMT turntables and reverb units; and K - H monitor speakers.

**Hammond** will be demonstrating two new products from the range they distribute in the US: Beyer *ET1000* stereo electrostatic headphones, which have a claimed frequency range of 10 Hz to 25k Hz and an output of 100 dBA spl from a 2V input; and the Klark-Teknik *DN36* analogue time processor, which features a continuously variable delay from 0.5 to 50 ms. The delay can be set manually or swept by means of a built-in modulator. Effects include reverb, phasing, vibrato, Doppler shift, flanging, repeat echo and chorus.

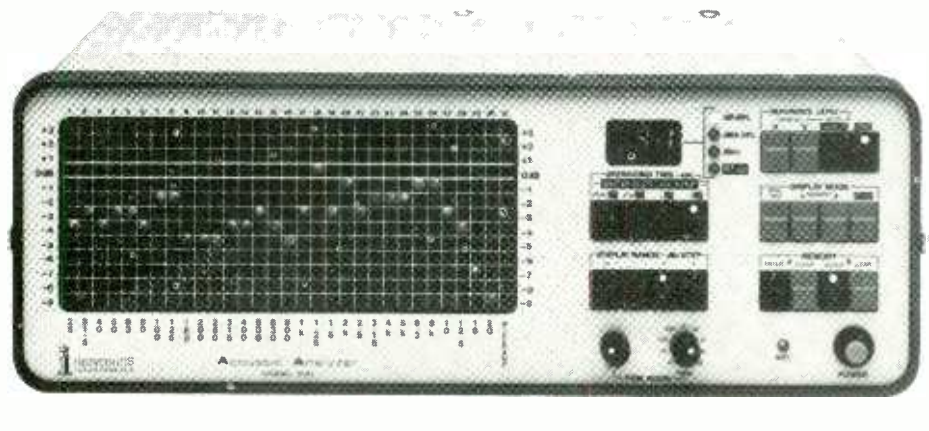
**Harrison** will demonstrate the new microprocessor-controlled *Model 864 Auto-Set*, which operates in two modes: fader automation and 'snap-shot'. In the latter mode 630 static views of up to 64 channel faders and controls can be recorded on a built-in data cart. Also on show: the new *4432B* remote recording console and *4832B* automated recording/mixdown console.

A range of in-cassette duplication systems can be seen in operation on the **Infonics** stand.

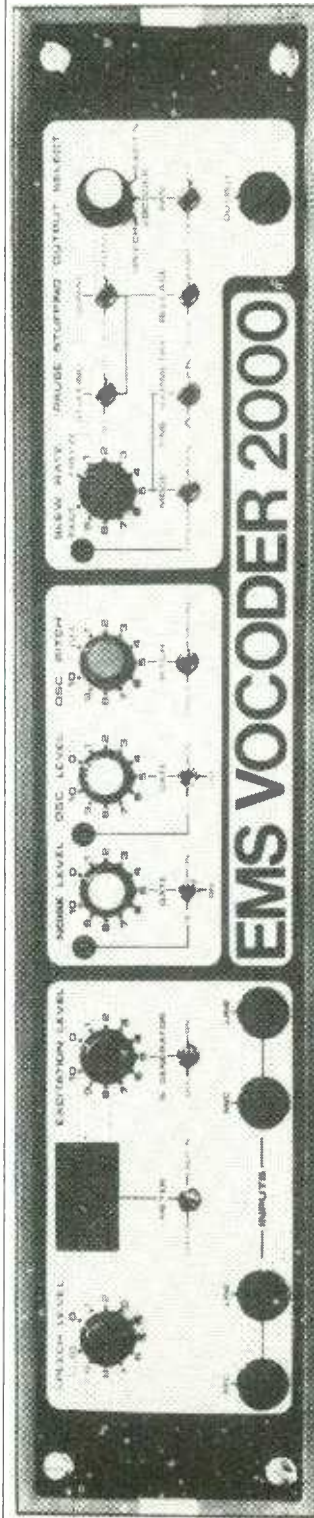
The new *Model 500* acoustic analyser, which is designed for  $\frac{1}{3}$ -octave real-time spectrum and reverb analysis, will be demonstrated on the **Inovonics** stand.

Modular mixers that can be supplied with between eight and 32 inputs and between two and 16 outputs can be seen on the **Interface**

Inovonics Model 500 acoustic analyser



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## AES PREVIEW

Electronics stand. Input and output modules can be swapped for various applications. A newly-introduced vca module allows any input fader to be assigned as a submaster group.

International Electro Magnetics are to demonstrate the *Model 213* octave and *Model 231*  $\frac{1}{3}$ -octave graphic equalisers. Also to be seen: a complete range of video and audio tape heads; the *306* dual-band limiter; the *740* audio processor; and the *Series 1000* and *1100* multitrack tape machines.

The *Model 602 Aural Exciter* will be demonstrated by ITX/Aphex Systems. The sound processor has applications in recording studios, tv and radio broadcast stations, cinema dubbing and sound reinforcement.

Ivic will be showing the new *IE-30A* portable octave and  $\frac{1}{3}$ -octave analysis system, which combines in one hand-held package an spl meter and a realtime spectrum analyser. The system can be used to measure frequency response, acoustics, output power, sound-pressure level etc. and is calibrated in both dB microvolts and dB spl. With accessories the system will measure distortion and reverb time. The smaller *IE-10A* octave spectrum analyser, *IE-15A* distortion analyser and *IE-20B* pink and white noise generator can also be seen.

JVC will be demonstrating a prototype pcm (pulse code modulation) processor that allows stereo signals to be recorded and replayed on the *VHS* video tape recorder.

Klipsch & Associates have arranged a demonstration of the new *III-SM* sound reinforcement loudspeaker for 'the performing arts'. Three drivers are used: a 305 mm bass unit, a horn-loaded midrange plus a hf unit. Maximum spl is quoted at 120 dBA from 125W input, and frequency response  $\pm 5$  dB, 100-17k Hz.

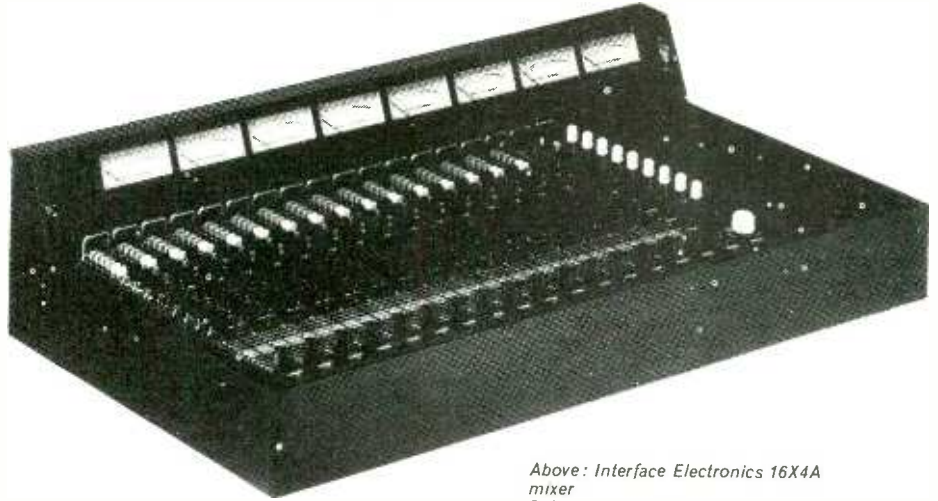
LaSalle Audio Products will be exhibiting the new *Chiltern QM2* range of consoles manufactured by Magnetic Tapes. Various configurations are available, ranging from 12 or 24-in 4-out 8-track monitoring to 16 or 24-in 8-out 16-track monitoring. Other features include standard or parametric eq, pfl, peak-reading vu meters with led overload, plus four auxiliary channels. The smaller *Chiltern M10 2* 'broadcast-quality' desk can also be seen.

*Prime Time*, a new combined ddl and special effects unit, will be demonstrated by Lexicon. Also to be seen: a prototype reverberation synthesiser, a new pitch shifter and *Delta-T* delay systems.

Magnifax will be demonstrating a range of high-speed tape duplicators and automatic tape degaussers. Pride of place will be a new tape loop bin system linked to seven cassette pancake slaves. Duplicating speed is 114 and 228 cm s, and throughput is a claimed 2500 *C60* cassettes per 8-hour shift.

Two new pre-reverb delay lines will be exhibited by Marshall. The *Model 250* features continuously variable delay in the range 10-250 ms, while the *Model 500* has extended delay to 500 ms. A mains-powered version of the *Model 5002 Time Modulator* and the *Model 5050* effects expander and master controller can also be seen.

The new *JH-110A-8-HP* 8-track, 25.4 mm tape machine can be seen on the MCI stand. 44 ▶

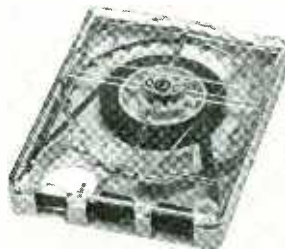


Above: Interface Electronics 16X4A mixer



Below: Lexicon's new Prime Time digital delay processor

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**ONLY FIDELIPAC® GIVES YOU A CHOICE**



**MODEL 300**  
 The most popular NAB cartridge...performance and price make it the mono broadcaster's first choice.



**MASTER CART**  
 For the modern stereo broadcaster satisfied with nothing less than the ultimate in performance.



**MODEL 350**  
 For use in stereo machines with inadequate tape guidance. The precision is provided by adjusting the cartridge.

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...with **SCAMP**

# The SCAMP S24

## EFFECTS POSSIBLE

- \* *Automatic Double Tracking*
- \* *Flanging, pos or neg*
- \* *SPIN, pos or neg*
- \* *Limited SPIN*
- \* *Hall effect*
- \* *Hollowing*
- \* *Cardboard Tube*
- \* *Wow-Wow*
- \* *Vibrato*
- \* *Motorbiking*
- \* *Dalek voicing*
- \* *and many, many more.....*

Carefully considered development the watch word of Audio & Design (Recording) Ltd. has given rise to yet another '1 inch wonder' —the SCAMP S24 Time Shape Module. This ADT/FLANGER effects package is ready to join the ranks of the SCAMP system and outperform its 19" rack mounting contemporaries. In less than 20% of the space taken up by most processors ADR have managed to cram in all the electronics necessary for time domain modification — and then some more!

We are talking, of course, about the S24's front end limiter which will happily allow anything up to 100% audio feedback without howling off into hyper-space. We call this Limited Spin and its the nearest thing to a programme controlled synthesiser yet. Modulating 100% Limited Spin via Aux or main input will create effects with a kick that can be held indefinitely and modified infinitely.

**OPERATIONALLY** the SCAMP S24 Time Shape Module performs all the tasks currently available from other analogue time domain processors. These are accomplished with ease via the neat, clean and functionally uncluttered front panel controls. It also brings the concept of the front end limiter to reality for delay line protection. This in conjunction with feedback control and positive or negative direct, feedforward signal mixing, realises the unique Limited Spin capabilities. 100% feedback without overload is now possible for synthesiser effects —you can lay a whole backing track from one hand clap!

But not all operational goodies are on the front panel. Via the rear connectors it is possible to route the delay or half delay output elsewhere, extend the delay by inserting further S24's in series (45mS chunks max), produce stereo reverb by cross coupling two S24's or drive the delay swing about manual centre from a different function generator. All of this can be normalised on a standard jack field for line level interface in the mix.

**TECHNICALLY** the SCAMP S24 Time Shape Module uses half stressed compander chips to give excellent frequency response figures throughout the delay range. Distortion is better than 0.3% overall @1kHz referenced to the limiter threshold and, referenced likewise, signal to noise ratio is better than -80dB. The delay chips themselves are bucket brigade technology with 1024 'buckets'.

The Oscillator provided for programmed effects will smoothly sweep down to one tenth of a cycle per second for ultra slow passes, or up to ten cycles per second for siren, wow-wow and other effects. The delay ranges provided accurately reflect where flanging ends and ADT begins to aid speedy mode selection.

The front end Limiter stands guard at all times to eliminate delay line clipping, a restricting factor on other analogue delay units, yet contributes creatively by making the synthesised effects of Limited Spin possible.

**Very competitively priced, the SCAMP S24 Time Shape Module is just the first in ADR's planned series of effect units, all for slotting straight into the SCAMP System!**

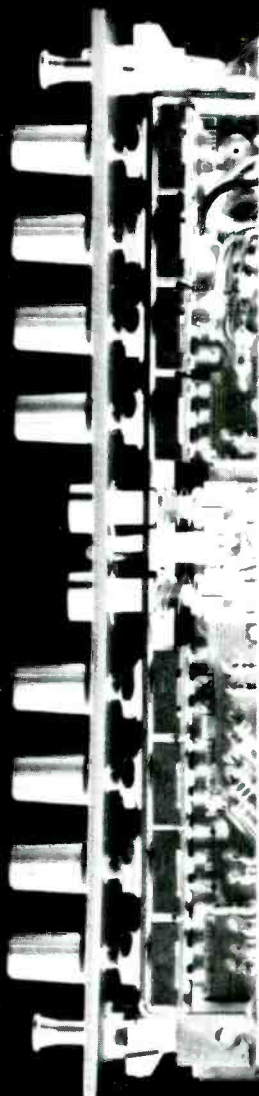
**If you haven't already, get your SCAMP rack installed and join the 'Scampaign' for creative, quality music.**



# Technical Specification

|                    |   |                         |
|--------------------|---|-------------------------|
| FREQUENCY RESPONSE | : 20Hz — 15kHz, + 0, -0.5dB<br>20Hz — 17kHz, + 0, -3dB  | } —At any delay setting |
| SIGNAL - NOISE     | : Better than -80dB ref Limit threshold   |                         |
| DISTORTION         | : Better than 0.3% THD @ 1kHz ref Limit threshold   |                         |
| MAX. INPUT         | : + 24dBm   |                         |
| MAX. OUTPUT        | : Controlled by limiter to + 6dBm rising 3-4dB in FLANGE mode. + 24dBm in bypass mode — balanced. |                         |
| LIMIT THRESHOLD    | : + 6dBm  |                         |
| DELAY              | : RANGE I 1.2mS—11mS<br>RANGE II 11mS—45mS  | } —Variable pot         |
|                    |   |                         |

**And here are nine more reasons for wanting SCAMP**



### S 01 Compressor-Limiter

A simple-to-operate multi-ratio compressor with overall peak limiter and l.e.d gain reduction meter.

### S 03 Sweep Equaliser

A 3-band sweep equaliser offering 40dB control range switchable on each section. Input attenuator and optimum modulation indicator.

### S 04 Parametric Equaliser

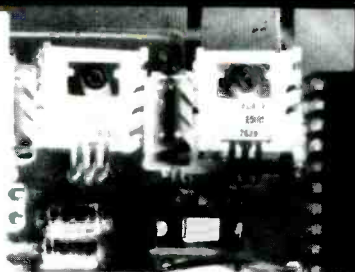
A 3-band fully parametric equaliser with 40dB range; shelf option with variable slope on Hi and Lo sections. Each section switchable with optimum modulation indicators.

### S 05 Dynamic Noise Filter

This programme controlled high-pass filter automatically attenuates hum and rumble. It has variable slope (0—18dB/oct) and three t/o frequencies. Can also be used as a 20/40dB noise gate.

### S 06 Dynamic Noise Filter

Similar to S 05 but being the low pass version, cleans up hiss and HF splash without affecting wanted HF transients. Alternatively acts as a wide-band noise gate.



### S 07 Octave Equaliser

Ten-band octave equaliser set on standard ISO centre frequencies from 31.25Hz—16kHz. Optimum modulation indicator.

### S 08 Distribution Amplifier

Features 2 in, 8 out with discrete amps on all outputs.

### S 14 Quad PPM l.e.d column

Has brightness control and can be ganged with other S 14 modules.

### S 23 Pan Effects Module

Offers different *pan* patterns with *trigger, speed and envelope* following functions.

### F 300 Expander Gate

Peak and averaging side-chains; variable slope with up to 40dB range; adjustable release/attack and external trigger create the most sophisticated unit available.

**all fitting the standard rack to join the S 24 Time Shape Module in the SCAMPAIGN for better sound.**

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# "OUR GAUSS EQUIPMENT IS BETTER TODAY THAN THE DAY WE BOUGHT IT."

George R. Jones, Vice President  
MCA Records Inc.

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At Cetec Audio/Gauss, we think we ought to grow with you. Just as we've grown with MCA. That means we offer you our equipment in modules. Not just master, tape bins, and slaves; but, electronic and reproduction modules. That



means you can upgrade your equipment as we upgrade the technology. You remain state-of-the-art because we're state-of-the-art.

But don't take our word for it. Ask anyone who owns Gauss equipment... instead of something else. The answer will probably be that they can't afford to own anything cheaper. Because Gauss delivers.

Where do we go from here? Straight ahead. With better sound reproduction, even greater reliability and state-of-the-

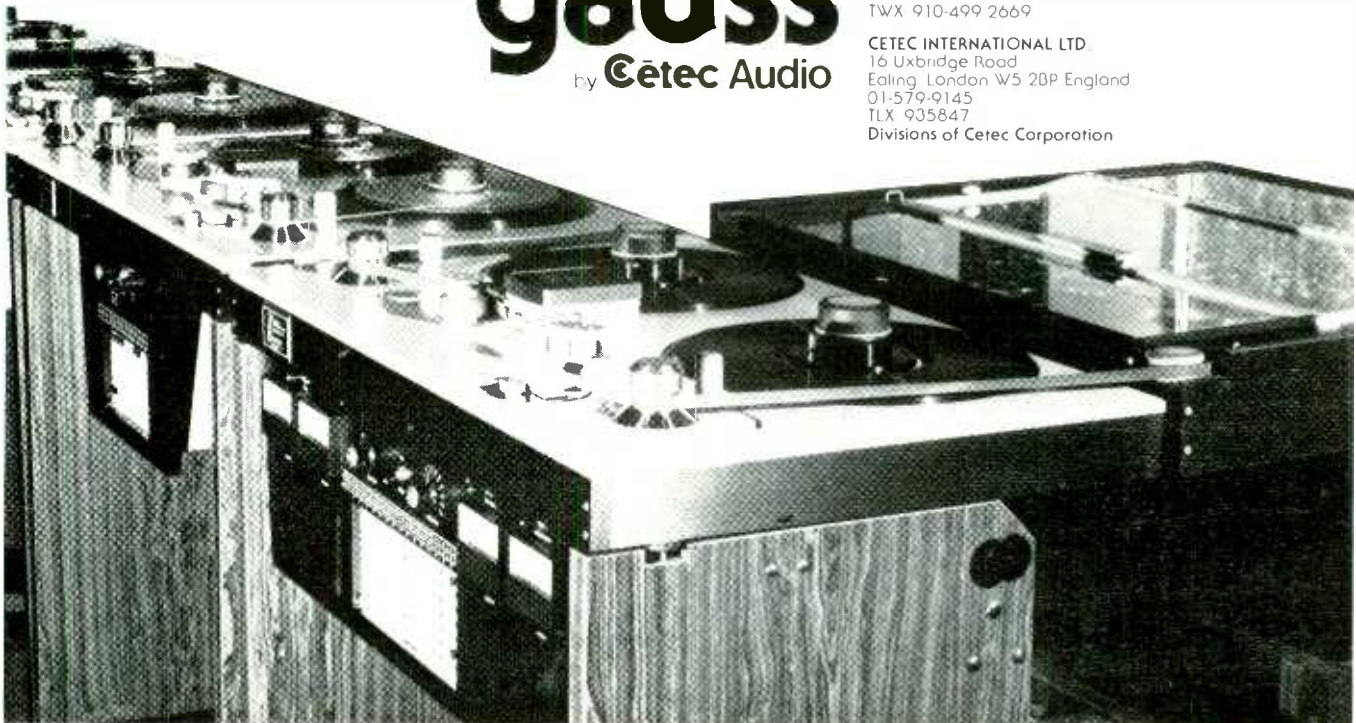
art technology. Modularly. Which means you can plan to own your Gauss high speed tape duplicating system for a long, long time. Ask anyone who owns Gauss equipment.

Write for our Tech Sheet. 32:1 or 64:1. Gauss is a better system.

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## AES PREVIEW

Three speeds of 19, 38 and 76 cm/s are featured, plus a return-to-zero facility. The *JH-400* and *JH-500 Series* automated consoles, plus the new *JH-45* tape synchronisation system will also be exhibited.

**MicMix** are to introduce at the LA Convention a new time domain processor that allows flanging to be controlled by the spectral content or amplitude of the input signal or by a built-in oscillator. The *Dynaflanger* features a comb-filter notch variable from 200 Hz to 2k Hz, with depth of notch greater than 40 dB. Unweighted noise is a quoted -78 dBm. Also to be seen: the new *Master Room* reverb units and audio meters.

**Micor** will be introducing the new *Coupland* digital synthesiser, described as a 'performance-orientated' unit that accepts direction in 'musical terms not computer ones'. Features include quadraphonic output; totally-controlled amplitude and frequency modulation; waveform generator input for 200 selectable harmonics; up to 12 waveform generators; and preset and control sequencing.

**Midas** plan to exhibit a new series of consoles with direct-out modules for 16 to 40-track recording; a portable multitrack recording mixer; and mixers for sound reinforcement applications.

**3M** will once again be showing their 32-channel digital recording system developed in cooperation with the BBC. Tape speed is 114 cm/s. Specifications include a claimed 90 dB signal-to-noise ratio, 'zero' wow and flutter, and less than 0.03% im and harmonic distortion. The 'conventional' analogue *M79* tape machine plus *Scotch* recording tape and accessories can also be seen.

**Mitsubishi** are once again to demonstrate their digital tape machine which uses 6.35 mm tape running at 38 cm/s. A preview head for disc cutting applications has also been incorporated. Signal-to-noise ratio is claimed to be greater than 90 dB, wow and flutter of the same accuracy as the crystal oscillator, and total harmonic distortion 0.01% at full output.

Portable tape machines to be shown by **Nagra** include the low-cost, single-speed *E*; the single-track *IS-D Series*; the stereo *H-S Series*; and the miniature *SN Series* which uses 3.8 mm tape.

**Neve** will show a 40-channel 24-buss 32-track *Model 8078* console, which is equipped with 4-band equalisation and two mute busses. It can be supplied with vca-subgrouping or *Neacam* servo-fader automation.

The *Synclavier* computer-controlled synthesiser to be shown by **New England Digital** features digital frequency control (1000 steps, octave); 61-note keyboard; 8-track digital sequencer with up to 3000 'events'; floppy disc sequencer memory; envelope control with 1 ms resolution; and 24 programmable instruments and effects.

Portable loudspeaker systems with a new horn design are to be demonstrated by **Northwest Sound**. They include the model *571* floor monitor, model *501* enclosure with a single 38-cm drive unit, and the model *590* enclosure with two 38-cm drivers.

The *Model 111B* dual-spring reverb system, which features a delay time of approximately 30 ms between direct sound and first reflection,

will be demonstrated by **Orban Associates**. Frequency response is a claimed  $\pm 3$  dB, 80-5.5k Hz. *Models 622A/B* parametric equaliser, *418A* stereo compressor-limiter, *516EC* dynamic sibilance controller, *245A* stereo synthesiser and *Optimod-FM* and *-AM* broadcast units can also be seen.

**Otari** will be demonstrating the *MX-5050-8* eight-track, 12.7 mm tape machine, which features full motion sensing and logic interlock, dc servo capstan, and 19 plus 38 cm/s tape

speeds.

The *Mark 2 Series* of portable mixers, available in eight, 12, 16 and 24-channel versions plus a rack-mounting system with seven channels, can be seen on the **Peavey** stand. Each balanced input channel is equipped with an overload led indicator, 4-band eq, stereo pan, pfl and cue buss send. Channel output can be routed to two submix busses and on to the master fader. The company will also be showing the *CS-400* 2-channel power amplifier rated at

46 ▶



Right: The new digital tape machine from 3M handles 32 tracks on 25.4 mm tape.



## ASTONISHING STEREO DISC AMPLIFIER 2

FOR BROADCASTING, DISC MONITORING AND TRANSFER WITH THE HIGHEST QUALITY

Stereo Disc Amplifier 2 is a self contained mains powered unit which accepts cartridge inputs and produces balanced line level outputs. Permanent rumble filtering and switched scratch filtering is included.

1 KHz at 6 mV set for 0dBV.7 output. Loaded 600 ohms.

**Total harmonic distortion**  
Output +10 dBV.7 30 Hz-20 KHz below noise  
Output +20 dBV.7 1 KHz -88 dB, 0.004%  
30 Hz-20 KHz -82 dB, 0.008%

**Static intermodulation distortion** 50 Hz+7 KHz, 4:1 Output +10 dBV.7 -90 dB, 0.003%

**Dynamic intermodulation distortion** 3.18 KHz square wave (single pole -3 dB at 100 KHz) +15 KHz sine wave, 4:1. Relative to 15 KHz component. Pre-emphasised input 500 mV pk-pk -70 dB, 0.03%

**Frequency response RIAA accuracy**  
30 Hz-20 KHz Within 0.5 dB

**Cartridge impedance interaction on frequency response**  
High inductance cartridge, 1H Less than 0.2 dB.

**Clipping at 1 KHz** Output +24 dBV.7

**Clipping point complementary to RIAA curve**  
30 KHz-20 KHz Within 1 dB.

Clipping determined by onset of peaky distortion products or THD exceeding -80 dB.

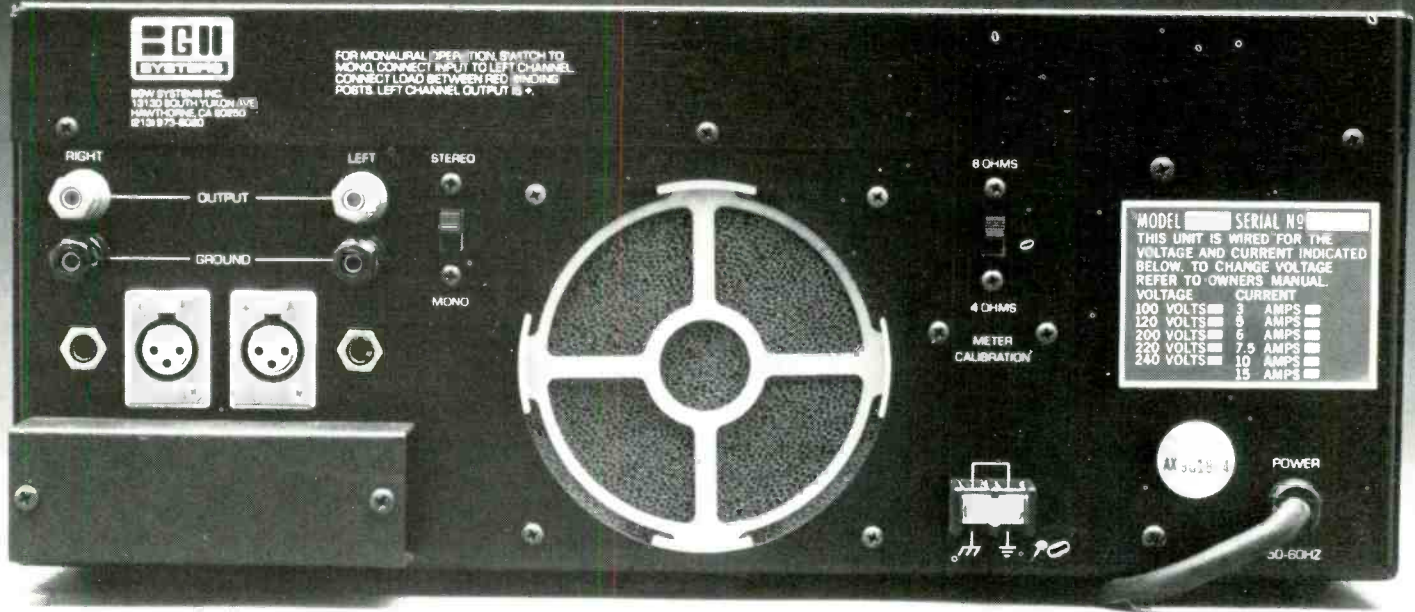
**Differential phase shift**  
50 Hz-20 KHz Within 0.5°  
Worst error at LF and HF Within 5°  
filter turnovers

**SURREY ELECTRONICS**

The Forge, Lucke Green, Cranleigh, Surrey GU6 7BG (STD 04866) 5997



# BGW AMPS PROS GET BEHIND



Over the past seven years BGW has turned a lot of professional heads around. We came out of nowhere to successfully challenge the stand-pat technology of the aging monarch of professional amplifiers. The most demanding buyers in the music business now rely on BGW: Studio owners. Recording engineers. Serious musicians. Everyone who makes his living from recorded or live sound. Performers and technicians alike have gotten behind BGW's legendary power, impeccable performance and workhorse reputation.

Here's what's made BGW the most imitated product in the pro sound business:

A full professional line starting with the MODEL 100: 30 watts per channel into 8

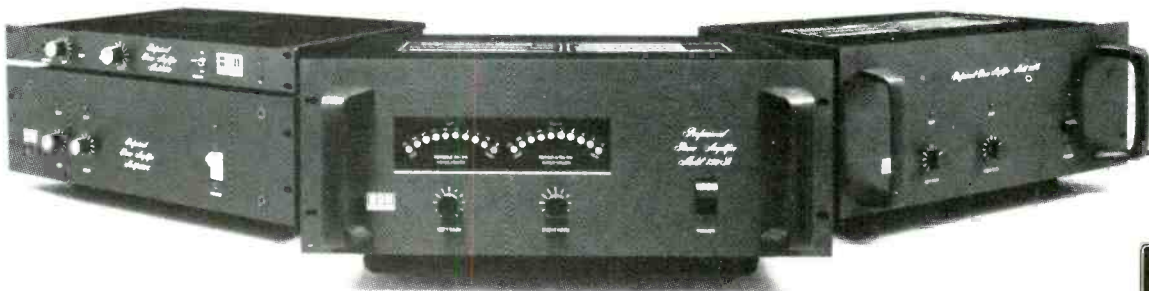
ohms, 20 Hz to 20 kHz, at less than 0.1% THD (80 watts mono);

The MODEL 250 C: 100 watts per channel into 8 ohms, 20 Hz to 20 kHz, at less than 0.1% THD (251 watts mono);

The new MODELS 750B and 750C: 225 watts per channel into 8 ohms, 20 Hz to 20 kHz, at less than 0.1% THD (720 watts mono).

For the true sound professional, quality isn't a luxury. It's a necessity and something we build into every BGW amp.

Contact our home office for complete technical specs. You'll understand why so many of your professional peers get behind BGW. And why the competition stays behind.



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Audio & Recording, Holden Hill, S.A.  
Tel: 261 1383

## Austria

Soundmill Vienna, Peter J. Müller.  
Tel: 222 Telex: 75922.

## Brazil

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Noresco (Mfg) Co. Ltd., Ontario.  
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Telex: 065-24478, a/b Norescomfg.

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Copenhagen. Tel: (01) 341 622.

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## Switzerland

Jim Duncombe, Zurich. Tel: 72 56 877.

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Reading, UK. Tel: (0734) 53411.  
Telex: 847605 a/b Tillex G.

## AES PREVIEW

200W/channel. Specifications include a quoted total harmonic distortion of 0.05%, inter-modulation distortion of under 0.01%, and a frequency range of 20-60k Hz.

A range of high-speed cassette and reel-to-reel tape duplication equipment will be shown by **Pentagon**. New units include the new *Model C-32S* cassette duplicator system, which comprises three slaves and a master in one unit. Throughput is a claimed 72 *C60* cassettes per hour. Automatic stop and rewind of the master tape is featured.

Two new products from Neutric will be shown by **Philips AV Systems**: the *AD-4* analogue delay line with four separate delayed outputs adjustable between 12.5 and 200 ms in four ranges; and the *Model 3201 Autotracer* test set. The *Autotracer* features include a voltage-controlled oscillator with a 20-200k Hz range that can be driven by a 5 Hz warble generator; a 1k Hz reference oscillator; an input amplifier with calibrated attenuation; a 3W output amplifier; and a built-in chart recorder.

**Quad-Eight** are to exhibit a model *MS-3624CX Coronada* console equipped with *Compumix III* automation. Thirty-six mic line inputs are provided, plus four equalised echo/send modules. The *CPR-16* computer-programmed reverb system can also be seen.

The *QM-168* console to be shown by **Quantum Audio** is of a 16-input/8-output configuration, with a six-frequency equalisation section and echo and cue sends on each channel. Control room monitoring, cue and solo buss level are on separate master potentiometers.

The new *Spectrum Master Model 3535* automatic 8-input microphone mixer will be exhibited by **Rauland-Borg**. Also to be seen: the *Model 6209* octave equaliser; *Model 6226* 1/3-octave equaliser; *Model 6101A* 1/3-octave equaliser, test set; and the *Model 7205* turntable notch filter.

A new dynamic microphone and a new series of capacitor microphones with 48V phantom powering will be shown by **Sennheiser**. The *MD-431* dynamic model is said to have been designed for live performance, with particular attention to a specially-tailored response and suppression of handling noise and feedback. The capacitor mics are claimed to handle higher SPLs than earlier models.

**Sescom** will be exhibiting a wide range of professional and semi-professional accessories,

including mic splitters, line balancers and combination input transformer/line amps.

The company's complete range of high-frequency horns and lenses will be demonstrated on the **SFW Audio** stand, including the radial *A255*, *A250* and *A245* range, and the *290* horn series.

**Shure** will be exhibiting the *Model 50AC* telephone acoustic coupler; the *M615AS* equalisation analyser system and companion *SR107* octave-band equaliser; and the *SM59* cardioid dynamic microphone.

The improved *Series One S* portable mixer, which features sweep eq and two monitor busses, will be shown by **Soundcraft**. Also on display: new modular automation-ready *Series Two M* desk; the new *EX4S* 4-way stereo electronic crossover; and a *Series Three* console for 16 and 24-track recording.

**Soundstream** plan to demonstrate their 4-channel digital tape machine. The use of full 16-bit straight binary analogue-to-digital converters results in a claimed 90 dB unweighted signal-to-noise ratio, less than 0.03% harmonic distortion and 'unmeasurable' wow and flutter.

**Sound Technology** plan to show once again the *Model 1410A* audio-frequency generator, which has a balanced output and is capable of producing composite im tones plus single tones from 10 Hz to 110k Hz. A range of distortion analysers can also be seen.

A *Series 1600* automated console with 'auto-recall mixdown system' (arms) can be seen in demonstration on the **Sound Workshop** stand. Also on show: the *242A* stereo reverb systems, *Model 421* broadcast mixer, and *1280B* 8-output desks.

Products to be shown by **Spectra Sonics** include the *Model 712* 2-channel power amplifier and *Model 1024B-24* console. Also on demonstration will be a high-power loudspeaker system, *Model 3085*, which features built-in power supplies, amplifiers and crossovers for tri-amplification. Up to 100W of low-frequency, 60W of mid-frequency and 60W of high-frequency power is provided; crossover is at 500 and 4k Hz.

A new range of automated consoles can be seen on the **Sphere Electronics** stand. The *Eclipse C Series* is of modular construction and is available with a choice of five combinations of eq, including parametric and graphic. Automation is controlled with an Allison *65k Series* programmer. Each input can be grouped to one of nine selectable vca groups with separate submaster if needed. Other channel features include three programmable mutes:

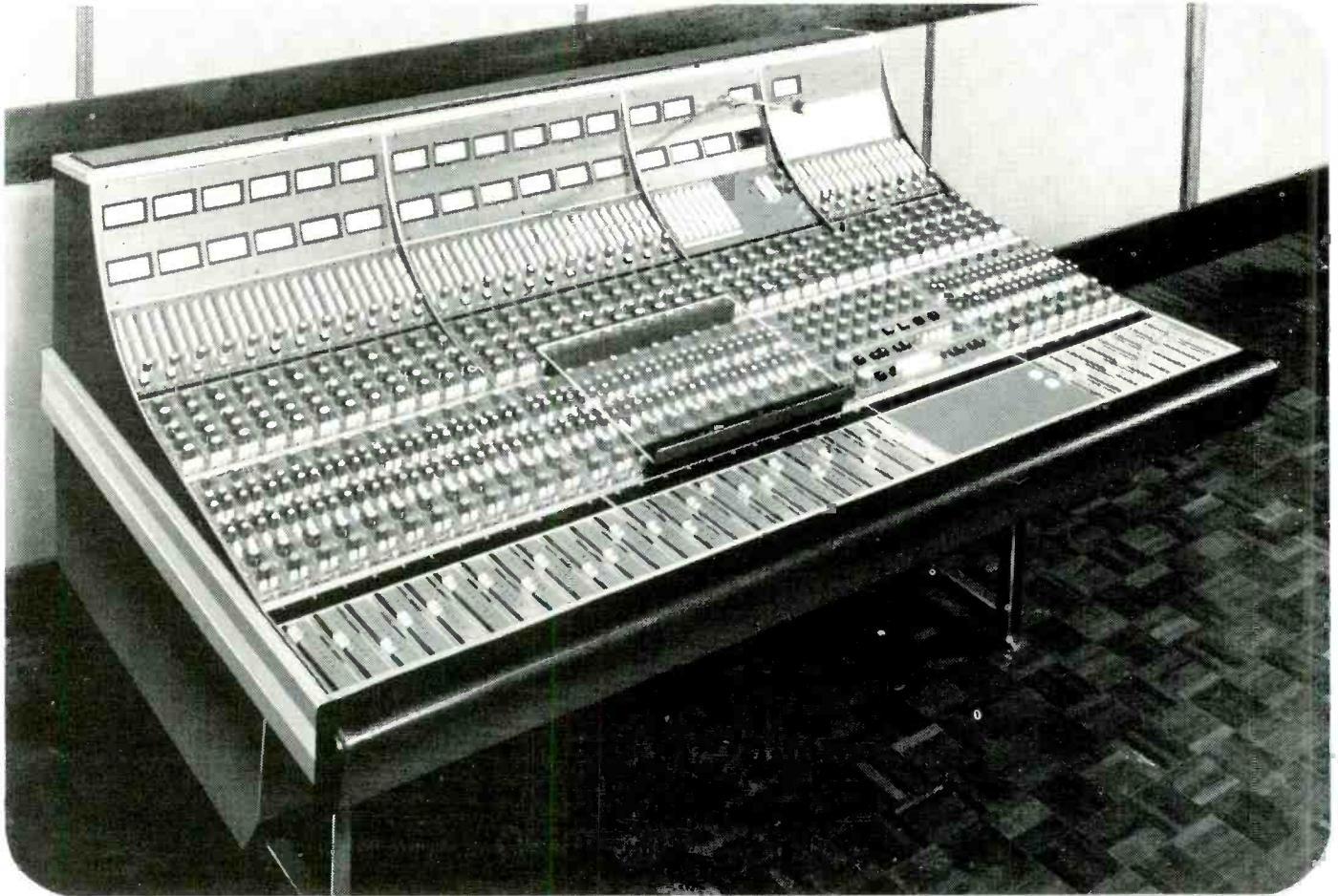
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Tangent's Model 3216 mixer with 16 submasters and 3-band parametric eq

 **Neve** supreme in sound

## superior in multi-track music recording consoles



Neve multi-track recording consoles enjoy a worldwide reputation for their high standard of performance, reliability and operator convenience. Realistic price tags make them a good long term investment too.

#### MODELS INCLUDE:

The 8078 with 40 inputs and 32 tracks — probably the world's most sophisticated music recording console available as a standard item.

The 8068/8058 — 24 track consoles featuring a compact in-line layout.

The 8066 — an 8 or 16 track full facility console for the modest budget.

The 5315 with a versatile 4 track or stereo capability ideal for broadcast production and film use.

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Tel. 416 6776611. Telex 21 06 983502

**Rupert Neve GmbH.**  
D-6100 Darmstadt, Bismarckstrasse 114, W Germany  
Tel. 6151 87038. Telex 419581.

# Neve

## AES PREVIEW

echo send and return mutes; three stereo sends with pan; four mono sends for cue, echo etc; quadraphonic pan; and switchable insert.

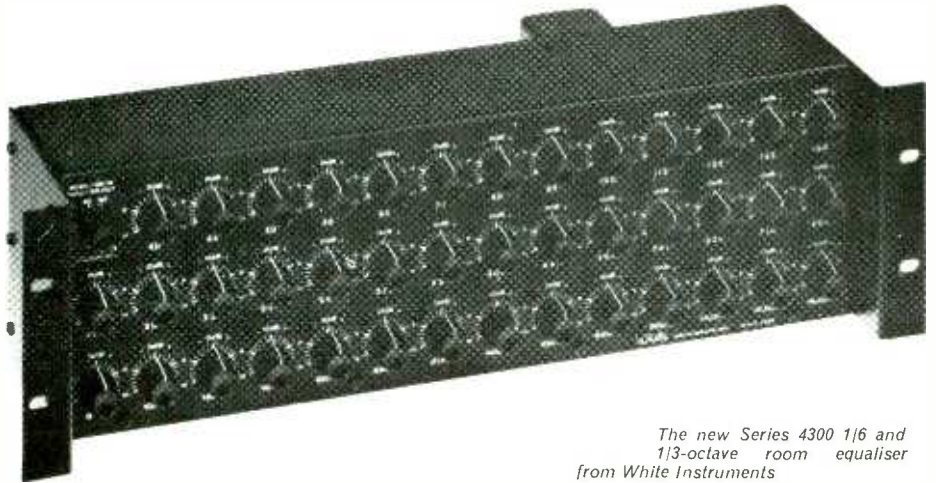
The new *Dynaphase model 35* stereo headphones will be demonstrated by **Stanton**. Sensitivity is a quoted 100 dBA SPL from 0.1V input, impedance 15 ohm at 1k Hz, and distortion under 0.5% at an SPL of 110 dBA.

**Studer** will be demonstrating for the first time in the US the new *A800* multitrack, which features microprocessor control of transport and audio functions, plus built-in autolocator and varispeed (see last month's issue, page 40). Also on show will be the new *269* console and other Studer/Revox products.

The *Model 1341.1* automatic cassette loading system can be seen in operation on the **Superscope** stand. The system will load cassette sizes from *C3* to *C120* at a speed of 610 cm/s, and automatically checks the length and tension of the leader tape.

Don and Carolyn Davis will be available on the **Synergetic Audio Concepts** stand to discuss their sound engineering seminars. Also on display will be their book entitled 'Sound System Engineering', which was updated in September 1976.

The *Model 3216* mixer, which is available with either 16, 24 or 32 input/output channels, is to be shown by **Tangent Systems**. Features include parametric equalisation, five echo cue monitor busses, and 16 sub groups.



The new Series 4300 1/6 and 1/3-octave room equaliser from White Instruments

The **Tascam Series** of mixers and tape machines to be found on the **Teac** stand include the new 24-in 8-out *Model 15* mixer, which has selectable pre or post-fade cue and echo send, 6-section equalisation, and two separate or cascaded 8-in, 2-out submixes for buss or off-tape monitoring. Also to be seen: the *90-16* sixteen-track, *80-8* eight-track, *40-4* four-track and *25-2* two-track tape machines; and the *Models 1, 3* and *5* mixers.

The model *T2-1120-ML* tape tension gauge to be shown by **Tentel** allows head and tape wear, excessive wow and flutter and skewing crosstalk

to be monitored and corrected.

**Technics** will be showing a new 'professional' version of the company's isolated-loop tape machine, *Model RS-1520*, and also a 4-track version with simul-sync, *Model RS-1800*. In addition, a linear-phase studio monitor loudspeaker, plus various 'domestic' amplifiers, tuners and turntables, can be seen.

**Trident** and their US distributors **Studio Maintenance Service** will be showing the new *TSM* console, plus the *Fleximix* portable mixer with new P & G conductive plastic faders, meter overbridge and compressor-limiter options. 78 ▶

## LIST OF EXHIBITORS

B = Booth, D = Demonstration Room

|                                       |                    |                                 |                 |                                  |                 |
|---------------------------------------|--------------------|---------------------------------|-----------------|----------------------------------|-----------------|
| <b>AB Systems</b>                     | B113               | <b>EI-Tech</b>                  | B106            | <b>Quad/Eight</b>                | Majorca Room    |
| <b>Accurate Sound</b>                 | B100 & 101         | <b>Emilar</b>                   | B15             | <b>Quantum Audio</b>             | B27 & 28        |
| <b>Acoustic Design</b>                | B55B               |                                 | La Paz Room     | <b>Rauland-Borg</b>              | B110 & 111      |
| <b>Acoustilog</b>                     | B109               | <b>Eventide</b>                 | B33             | <b>SAE</b>                       | Cleveland Room  |
| <b>ADI</b>                            | B114               | <b>Everything Audio</b>         | B6 & 7          | <b>Sansui</b>                    | B66             |
| <b>Agfa-Gevaert</b>                   | B31                | <b>Ferrofluidics</b>            | B116            | <b>Scully</b>                    | D475 & 477      |
| <b>AKG</b>                            | B81, 81A & 82      | <b>Furman Sound</b>             | B101A           | <b>Sennheiser</b>                | B2 & 3          |
|                                       | Majorca Room       | <b>Gotham Audio</b>             | B20-23          | <b>Sescom</b>                    | D429            |
| <b>Allison Research</b>               | B56 & 57           | <b>Harrison</b>                 | B55 & 55A       | <b>SFW Audio</b>                 | B63 & 63A       |
| <b>Altec</b>                          | Mission Room       | <b>Heino/Ilsemann</b>           | B71             | <b>Shure</b>                     | D569            |
| <b>Amber</b>                          | B26                | <b>Infonics</b>                 | Malaga Room     | <b>Sierra Audio</b>              | B36 & 37        |
| <b>Ampex</b>                          | B14-14D            | <b>Inovonics</b>                | B54             | <b>Sontec</b>                    | B46             |
|                                       | Madrid Room        | <b>Interface Electronics</b>    | B95             | <b>Soundcraft</b>                | B19             |
|                                       | San Clemente Room  | <b>International Audio</b>      | B64             | <b>Soundstream</b>               | B69 & 70        |
| <b>Anvil Cases</b>                    | D119               | <b>International Electro-</b>   | D424            | <b>Sound Technology</b>          | D428            |
| <b>Audico</b>                         | D465               | <b>Magnetics</b>                | D568            | <b>Sound West</b>                | B53             |
| <b>Audio Illusions</b>                | B49 & 49A          | <b>ITX/Aphex Systems</b>        | B88 & 89        | <b>Sound Workshop</b>            | D473            |
| <b>Audio Concepts</b>                 | B123               | <b>Ivie</b>                     | St Louis &      | <b>Spectra Sonics</b>            | Yosemite Room   |
| <b>Audio &amp; Design</b>             | B86 & 87           | <b>JBL</b>                      | Foy Rooms       | <b>Sphere Electronics</b>        | Cordova Room    |
| <b>Audio Industries</b>               | D469               |                                 | Washington Room | <b>Stanton</b>                   | Stage Left      |
| <b>Audio/Tek</b>                      | B38 & 39           | <b>JVC</b>                      | Pecos Room      | <b>Stephens Electronics</b>      | B59 & 60        |
| <b>Audionics</b>                      | Stage Left         | <b>Klipsch &amp; Associates</b> | B127 & 128      | <b>Straita Head Sound</b>        | B70 & 80        |
| <b>Auretone</b>                       | B104 & 105         | <b>LaSalle Audio Products</b>   | Muir Room       | <b>Studer/Revox</b>              | B4 & 5          |
| <b>Automated Processes</b>            | B72                | <b>Lexicon</b>                  | B119A           | <b>Studio Maintenance</b>        | B77 & 78        |
| <b>Barclay/Analytical Ltd</b>         | B16 & 17           | <b>Magnefax</b>                 | B94             | <b>Service</b>                   | B120 & 121      |
| <b>BGW</b>                            | B73 & 74           | <b>Marshall</b>                 | B83, 84 & 85    | <b>Superscope</b>                | B61             |
| <b>B&amp;K</b>                        | B117 & 118         | <b>MCI</b>                      | Assembly Room   | <b>Swintek Enterprises</b>       | B67             |
| <b>Bobadilla Cases</b>                | B112               |                                 | Centre          | <b>Synergetic Audio Concepts</b> | B58             |
| <b>BTX</b>                            | B96                | <b>MicMix</b>                   | B107            | <b>Tangent Systems</b>           | B98 & 99        |
| <b>California Switch &amp; Signal</b> | B93                | <b>Micor</b>                    | B122 & D482     | <b>Tannoy/Ortofon</b>            | D 467 & 468     |
| <b>Capitol Magnetic</b>               | Patio Room         | <b>Midas</b>                    | B102 & 103      | <b>Teac</b>                      | Boston Room     |
| <b>Cerwin-Vega</b>                    | B47 & 48           | <b>3M</b>                       | B11, 12 & 13    | <b>Technical Audio Devices</b>   | Hartford Room   |
| <b>Cetec</b>                          | B68A               |                                 | D527 & 529      | <b>Technics</b>                  | D474            |
| <b>Clear-Com</b>                      | B90                | <b>Mitsubishi</b>               | Yuda Room       | <b>Tentel</b>                    | B32             |
| <b>Coast Recording Equipment</b>      | D480               | <b>M&amp;K Sound</b>            | El Soreno Room  | <b>Trident</b>                   | B120 & 121      |
| <b>Coherent Communications</b>        | Dalhart Room       | <b>MXR</b>                      | B100A           | <b>Uher</b>                      | D471            |
| <b>Community Light &amp; Sound</b>    | B75 & 76           | <b>Nagra</b>                    | B68             | <b>Uni-Sync</b>                  | B124, 125 & 126 |
| <b>Crown</b>                          | B97                | <b>Neve</b>                     | Assembly Room   | <b>Urei</b>                      | B24 & 25        |
| <b>David Clark</b>                    | B95                |                                 | East            | <b>Ursa Major</b>                | Dallas Room     |
| <b>David Lint Associates</b>          | Assembly Room Left | <b>NW Sound</b>                 | D462            | <b>Valley People</b>             | B100B           |
| <b>dbx</b>                            | D563               | <b>New England Digital</b>      | D427            | <b>Wasatch Music Systems</b>     | B61             |
| <b>Delta Lab</b>                      | B92                | <b>Orban Associates</b>         | B62             | <b>Westac Audio-Video</b>        | Stage Left      |
| <b>Diacoustic Laboratory</b>          | D463               | <b>Otari</b>                    | B8, 9 & 10      | <b>Westlake</b>                  | B100B           |
| <b>Diversified Concepts</b>           | B51 & 52           | <b>Peavey</b>                   | D479            | <b>White Instruments</b>         | B34, 35 & 40-42 |
| <b>Dolby</b>                          | B108               | <b>Pentagon</b>                 | B29 & 30        | <b>Yamaha</b>                    | B1              |
| <b>Duncan Electronics</b>             | B18                | <b>Philips AV Systems</b>       | B81, 81A & 82   |                                  | Buffalo Room    |
| <b>Dynair Electronics</b>             | Longhorn Room      |                                 |                 |                                  |                 |
| <b>Electro Sound</b>                  | New York Room      |                                 |                 |                                  |                 |
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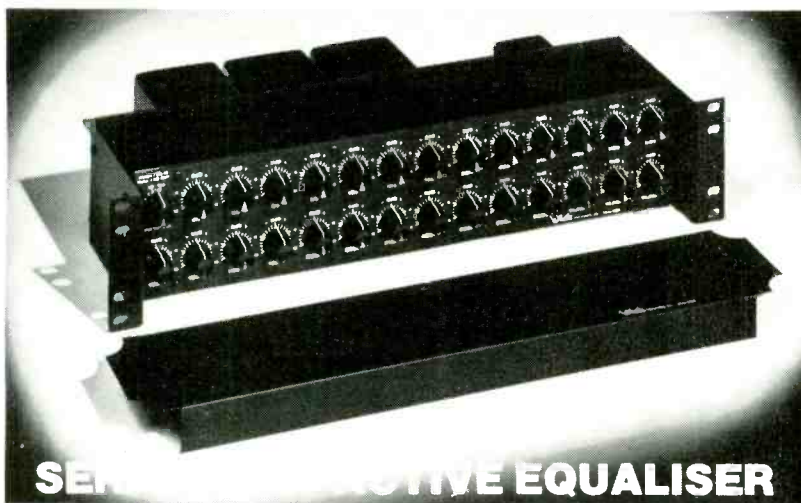
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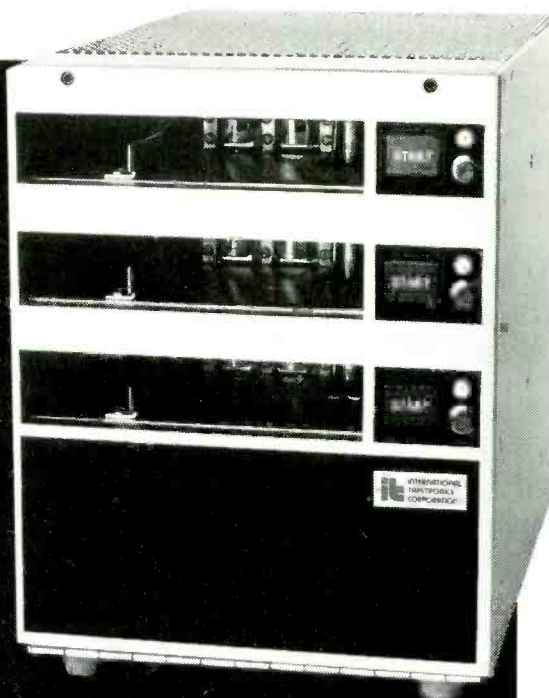
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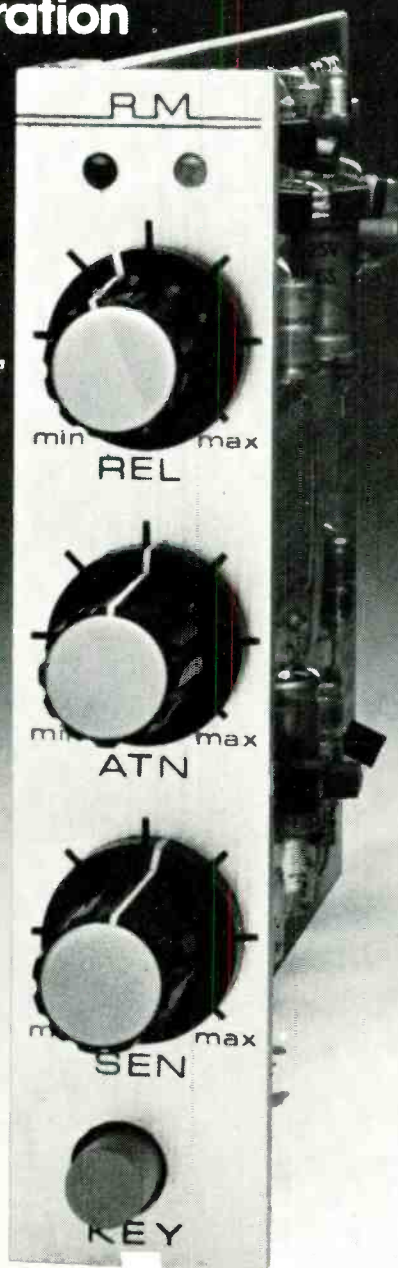
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Model RM68



Model RM68X  
(Retrofits into Kepex Rack)

# Recording Abba

Michael Tretow

*A year before Abba presented the world with their Eurovision winning song ('Waterloo') they had recorded a number called 'Ring! Ring!'. On receipt of a copy the Swedish Broadcasting Corporation called the producer to complain 'it sounds enormous—there's just too much sound'. That's Abba.*

**T**HE SOUND of Abba can basically be described as a mixture of the Phil Spector sound and modern technology—it is definitely a *big* sound. In concept they are a recording group who are quite happy to work in their home territory; but the recordings still have to be made at several different studios, due to the fact that it's impossible to book the same studio two days in a row. (One company has all the Mondays, another all the Tuesdays and so on.) Most of the work is done at Marcus Music, Metronome Studio and Glen Studio in Stockholm. But this isn't as bad as it sounds because the only piece of gear that has to be 'dragged' around is the *Polymoog*.

This article has been written to describe the techniques I use to get the sound. The typical set-up for the basic tracks is as follows: drums, bass, piano or Polymoog, electric guitar, two or more ambience mics and one or two mics for the vocals.

## Drums

The drums are nearly always recorded in the drum booth and very seldom out in the studio. I much prefer the relative dryness of a drum cage, to the uncontrolled leakage which usually occurs in the studio. I try to compensate for the dead drum-sound by placing the ambience mics very carefully, the idea being to get a good overall picture of what's going on in the studio, even without using the close-up mics. (That is also the reason for using an amp for the bass guitar, although the amp is not miked-up. The bass is recorded by direct injection into the desk, with a few dBs of limiting.)

For drums I usually prefer to use *U47 jets* on the tom-toms, *RE20s* on the bassdrum and under the snare, *KMSi 85* for the top snare, and *whatever* for the overall set. I'm constantly trying out new mics for the overall set, so I take whatever I find in the studio and try them. Sometimes I'm lucky, sometimes I'm not.

In most cases I don't use any mics on the hi-hat—I always seem to get enough, or even too much, hi-hat anyway. By the way, this must be the time for someone to say something about the annoying brass-plates that every drummer carries around! I do not regard the cymbal as a musical instrument. I regard it as a tool with which the drummer can ruin a good drum sound in the overall set mics. It's about time somebody put a stop to them. Put a tax on cymbals, that would do the trick!

So the best solution I've found is to place the overalls underall.

down at the floor some two metres apart. It sounds like a weird idea, and when I read about this technique in a US magazine, I thought it must be totally wrong to do it that way. But I tried it—and it really works.

I never use limiting or compression for the drums onto the tracks, except for good old tape saturation.

## Guitar

I always try to place the electric guitar in a different room, if the studio has access to a storage room or something like that. I believe that to get a really loud sound, you must play loud and literally let the sound fill the room. I use one close-up mic in front of the amp and one omni, out in the room, to pick up rattling windows and the like. You can control the amount of leakage into the ambience mics by closing or opening the door. However, if the studio isn't equipped with a separate room for the guitar we normally re-do the guitar parts out in the studio when the session is over. The room mic will almost certainly have a boomy character, so it is rather heavily eq'd. Sometimes I also use the MXR flanging unit on this mic to get a 'singing' sound, but the amplifier mic is always cut flat. These will usually be the *U47 jets* again, or maybe some good dynamic for the amp, and a condenser for the room.

## Piano

The grand piano is cut with three *KM85s* in the sound holes. The middle mic is limited and fed through the MXR flanger to the middle of the stereo pattern on the two piano tracks. One useful feature of the MXR, in fact, is the possibility to feed the signal through the bucket brigades only, without summing the direct sound to it. If the signal that's going via the bucket brigade has no phase relationship to the rest of the sound when you finally sum it, you will just get a pitch variation with no phasing. This is the reason for using a separate mic to feed the MXR.

And that is what makes it possible for the engineer to turn a \$20 000 grand piano into a \$100 honky-tonk upright. Amazing how you can make technology work for you!

By the way, you might be interested in how to make a 25-piece string section sound like a 25-stringed banjo? Well, the secret is to run the violins through a *Kepex* and key them with the hi-hat. Not a very useful feature, I'm afraid, but it's yours for free! I mean, if it worked the other way round—turning a 25-stringed banjo into a 25-piece string ensemble—it could have been very useful.



## Synthesiser

The Polymoog creates very special problems. The crosstalk in the instrument is probably around 3 dB or so, so I used to feed it through a Dolby 361 unit in the decode position. If you're careful with the level this will not affect the sound but you have to level out the dynamics, if there are any, and then compensate for the lost dynamics in the mix. Anyway, it's a good method for cleaning up noisy tracks. The Polymoog's got its own balanced line output so I used that, sometimes with a miked amp as well.

On one song—*Arrival*, the Moog is picked up by two ambience mics only. To get a 'natural' sound, as if it were a bunch of real instruments playing out in the studio, I moved the amp in the room for every overdub we made, and recorded each harmony in stereo on two tracks. If you listen to the record it's very hard to tell what instrument it is: it sounds like all-metal bagpipes—or something.

## Ambience

As I said earlier, I try to put the ambience mics where I can get a good sound on all of the instruments, but of course this is impossible. Usually you lose all the low end in the drums and all of the highs in the piano. However these tracks are only used to beef-up and bring a little 'air' to the recording.

A few years back I tried desperately to get a very dry and tight sound on my recordings. But nowadays as studios get tighter and tighter, I try desperately to get further and further away from the dead sound. I believe it's all a question of how much control you have, and back in the old days you didn't want any leakage purely because you couldn't handle it. Now you can.

When we've recorded the final take, I usually try to convince the musicians to do an overdub of all the instruments and record them with the two ambience mics only. When doing so, I change the speed of the 24-track some 0.5% to get a very subtle pitch deviation. This broadens the sound and makes the overdub more obvious, and makes it really sound doubled.

Recording the basic tracks will take approximately one full day's work per song—that means 10 to 12 hours for just the drums, bass, piano and guitar.

## Vocals

Bjorn and Benny (producers and members of the group) are both very conscientious people and true pros—they never stop until they've found what they're looking for. They try every song in different tempos, moods and instrumentations until they get what they want. This of course leaves a lot of time for the engineer to try out new sounds—you have time to correct mic placements and time to optimise each track. And, no doubt, every engineer is sadly aware of the fact that most of the time the situation is quite the opposite. The vocalists are usually permitted to sing the songs hundreds of times, but when did you hear of an engineer who was allowed 40 takes in order to get the *Kepeves* right?

Either Bjorn or the girls will sing a guide track with phoney lyrics like:

I love you,  
Please, love me too,  
Don't be untrue,  
Say 'I do',  
Cause I lo-o-o-o-ve you so.

Next day we start with the instrument overdubs, and the boys are trying to fill up the tracks as fast as the machine will go. That means that there are two empty tracks left at lunchtime, and it's time to reduce the 16 Moog-tracks to make room for the vocal track that the record-buyers so urgently demand. No-one's ever interested in leaving tracks open for the vocals, so it usually falls on me to erase one of my 'unnecessary' drum tracks to put the vocals on. Since I'm aware of this, I always put the hi-hat on a separate track, even though I never intend to use it. But it certainly gives me an unselfish image, to 'give up' one of my drum-tracks; and the effect on the producer is always most pleasing to watch.

If there's going to be acoustic guitars on the song, we usually re-do the guitars afterwards. I always try to record them on a hard surface, eg with the carpet rolled off. The U87 always seem to work fine on acoustic guitar, so that's mostly my choice; and again I always try a pair of mics at some distance to get the spaciousness, together with close-ups for the 'body'.

Other overdubs which we often do are with a lot of glockenspiels, for which I prefer the old RCA *DY66*. It's a ribbon mic that I find virtually impossible to overload with high energy treble instruments, like the glockenspiel, and it's also my favourite trumpet mic for the same reason.

The instrument overdubs will almost certainly take up another full day, so the next day it's time for the vocals. All background harmonies and choir parts are sung by the group and are nearly always doubletracked. For vocals I use the *U47 Jet* on the boys and *U87* on the girls, with quite a lot of Teletronix *LA 3A* limiting. Each member of the group has his/her own mic and limiter, with the four mics placed in a square pattern. We do a lot of ping-ponging with the voices to save tracks for the Moogs. (Every song can be improved by adding a few Moogs!)

## Mixing

Another day has passed before we're through with all the vocals, and the next day we start to mix. I would like to point out that although this seems to proceed very slowly, it is not because of any lack of energy. This whole time-consuming business is created because *everything*—I mean *everything*—is tried out. The group can arrange and record full 4-part harmonies, doubletrack them, and, if it doesn't come out right, erase them and start all over again! The last album (*Move on*) had four completely different sets of lyrics, with harmonies and all, before the final one was recorded.

The mixdown session usually starts with the boys leaving the control-room and with me setting up a basic mix. After a while they can't keep away anymore and come into the control room saying 'That sounds great! Let's take it exactly like it is'. And then slowly they start to change everything. We do most of our mixdown sessions at Metronome in Stockholm. It's equipped with a Neve 24/8 desk which has a truly distinctive sound. I can tell that console from any other because of its extremely clear and crisp sound: it adds a certain something to the highs, which gives a very special spaciousness to the mixes. (This sounds like an ad for Aphex!)

Anyway, this very fine studio is also the proud owner of a pair of Universal Audio *LN 176* valve limiters, which are a very important part of the Abba sound. I use them on the rhythm tracks, drums, bass and percussion, which I assign to two of the outputs; compress them and send them back again. This gives a very thumping sound to the rhythm which can be controlled by sending part of the same signals straight to the mix output busses, without any compression.

The tracks on the '24' are normally recorded with as little eq as I can get away with, so that most of the equalising can take place in the mix. Most of the time, it's a matter of matching the different characteristics of all the studios in which we've been working, in order to make it sound as if all the tracks were recorded in the same studio. That's one reason (and just one) why I've given up Dolby, and recorded at 76 cm/s instead. Every studio seems to have their own Dolby level and due to all the track-bouncing I have to do, I've sometimes ended up with tracks which are impossible to decode. If, for instance, you decode five vocal tracks a few dB out and put them onto another track, there's no way to get it right afterwards.

I never limit or compress the total—it never works—but I always try before I give up.

After 10 hours nobody knows what he is hearing anymore. 'I think the bass is too loud, or, wait a minute, no, it's too soft', or 'I let's have some echo on the snare!'

'It's already there.'

'Are you sure?'

So sometimes we go back and remix but not very often. Thus, an average Abba song will take some four days to complete, or even five, if you include the cutting.

## Cutting

I always cut my own recordings and since I used to work at Metronome some years back, I'm very familiar with their system. They've got the Westrex *3D II A* cutterhead and Westrex amps to drive it, and to my ear, nothing can match the Westrex. It's the last chance you've got to correct your miss-takes, and even-out the differences between the mixes you've made in the middle of the night by taking off some 15 dBs of treble, and the mixes you've done in the morning after a full night's sleep.

And then—take a listen!

## Trackability

IT'S ALL TOO easy for studio engineers to forget what happens to their recordings—the master tape is mixed, the lacquer cut, and the production run of discs pressed. What happens is that those pressed discs are bought and played by the general public. Of course producers and studio engineers are constantly reminded by cutting engineers that too much modulation velocity on the master lacquer can mean problems for Mr Average record buyer. His average record player won't accurately track excessively high modulation levels, and the reproduced sound is roughened with tizz or buzz—the stylus may even skip a groove. Mr Average then takes the record back to the shop and complains. If enough records from enough average customers come back it may be necessary to recut and repress. This annoys the hell out of the record company, so their pressing plant normally keeps an eagle eye on the master lacquers which it receives for plating, and rejects anything that is likely to produce customer problems. But as the average hi-fi system improves, so the average record buyer cannot only 'cope' with hotter cuts but grows to want and then need them. For this reason what happens in the hi-fi market place is of immediate relevance to studio engineers.

Obviously this predominantly studio magazine cannot report every advance on the hi-fi front, but in the light of the above comments the recent launch of a new generation of Shure *V15* cartridges is clearly relevant, as Shure took the opportunity of incorporating the launch of the *V15 Type IV* into a technical seminar encompassing all aspects of disc production and reproduction.

The original Shure *V15* was introduced in 1964 and could track 15 cm/s at 400 Hz and 10 cm/s at 10 kHz. The *V15 Type II* was introduced in 1967 following a study by Shure of the problems surrounding mistracking. Although most people will realise that mistracking of a modulated record groove by a stylus is failure of the stylus to follow every undulation of the groove, it is not generally recognised that mistracking does not always produce obvious and immediately recognisable or even audible results. If the stylus mistracks the groove on transients, the effect may pass unnoticed except to the groove itself. The vinyl will be irreparably damaged as the stylus tip skips along over the mistracked undulations and literally chisels pits out of the groove wall every time it lands. These pits are permanent and are there to be tracked by any good quality cartridge subsequently used on the record. (Moral: Never lend your gramophone records and never buy second-hand gramophone records if you are interested in fidelity reproduction.)

One way to solve the tracking problem is to increase the force or weight at which the cartridge tracks the record; and hardly surprisingly this increases overall wear. (Incidentally damage due to skip-mistracking caused by an excessively low tracking force is probably less desirable than the overall increase in wear caused by a slightly greater tracking force.) The *V15* types *II* and *III* progressively improved trackability with reduced tracking force and the *Type IV*, which should now be in the shops at around £80 a time, claims further gains in trackability. These are best shown by the following comparison at 1.0g tracking force:

| Frequency (Hz) | V15 TYPE III<br>Peak Velocity (cm/s) | V15 TYPE IV<br>Peak Velocity (cm/s) |
|----------------|--------------------------------------|-------------------------------------|
| 400            | 26                                   | 29                                  |
| 1000           | 38                                   | 42                                  |
| 5000           | 35                                   | 47                                  |
| 10 000         | 26                                   | 37                                  |

As it seems fair to say that a large number of hi-fi enthusiasts will buy the *V15 Type IV* cartridge, these are figures worth noting for studio engineers, whose purpose in working life is, after all, nothing more than to keep the owners of gramophone cartridges as happy as possible. Note also that Shure acknowledge the *V15* as not yet perfect (on the Thelma Houston direct-cut disc there are velocities of up to 50 cm/s) and admit to currently looking at improved trackability at high frequencies. Meanwhile what a sad comment on the record industry that Shure have found it necessary to build mechanical compensation for warps into the cartridge.

The compliance of the stylus makes any arm-cartridge combination a resilient body when tracking a record, and any resilient body has a natural resonant frequency. In a well designed system, with a sensible match between stylus compliance and arm mass, this resonance will be at a frequency so low that it is inaudible (for instance around 5 Hz). But if this resonance is excited, and the pickup arm and cartridge oscillate up and down at the resonant frequency, audible effects and mistracking can result. The reason is simple if you think about it, but is presumably overlooked by those who churn out warped pressings. As the cartridge moves up and down the stylus will tend to scrub backwards and forwards in the groove, and this scrubbing motion will frequency-modulate the reproduced sound at the frequency resonance. So an excited resonance at 5 Hz will produce 5 Hz scrubbing and 5 Hz frequency modulation. This is audible wow.

At the same time the up and down oscillation of the cartridge and arm will soak up tracking force, so that the cartridge will effectively oscillate into and out of mistracking as the effective tracking force changes. And

of course if a record is warped and its fluctuation in size (when played at 33½ rpm) produces a vertical motion at exactly the resonant frequency of the arm, that record can all too easily excite the arm resonance. While some people lobby the record companies for flatter pressings, Shure have built a stabiliser into the *V15 Type IV* to overcome the effect of warps. Briefly this is the small viscous damped bar which is pivoted to the cartridge body and carries a small brush which presses against the record surface just ahead of the stylus. The damped movement of this brush combines with the cartridge to damp down the vertical motion of a warp so that the cartridge follows the slowly undulating hill-and-dale shape of the warp without going into resonant oscillation at that frequency.

Another incorporated feature makes another, equally sad, comment on the record industry which has not yet managed to develop a static-free disc-pressing material. Shure make the brush out of 10 000 electrically conductive fibres which are connected to earth via the cartridge circuitry. The idea is to drain off static charges on the disc and so reduce just two more problems with disc fidelity reproduction: a) the accumulation of dust from the atmosphere due to the static charge acting as a magnet; and b) alteration of the effective tracking force of the stylus by static attraction between the cartridge and the disc, again in the manner of a magnet.

For my money Shure have not yet produced sufficiently hard factual data on tests run under controlled conditions of humidity to prove conclusively their point on static. But the damping certainly seems to work and availability of the *Type IV* should push the average level of disc trackability up quite a few centimetres per second and open the door to hotter cuts.

## The unkindest cut

WHERE HAVE all the single-sided razor blades gone? Musicians rely on them for trimming reeds, and studio engineers rely on them for tape editing. Until quite recently you could buy a packet of *Ever Ready* or *Corrux* single-sided blades from Woolworths, and most chemists. Then suddenly they disappeared and shops started saying that they no longer stock them. The simple truth is that single-edged blade just aren't being made in the UK any more.

The *Ever Ready* brand was made by Personna International who had addresses at both Maidenhead and Glasgow. I wrote to Maidenhead but my letter was returned, marked 'Gone away'. So I wrote to Glasgow and received back a letter from a firm of chartered accountants 'regretting to advise me that Personna is ceasing trading', and 'all stocks have been disposed of'.

Already some engineers are having blades brought in from countries where they are still available, for instance Belgium and the USA. So any studio with a visitor coming over from the Continent or the States would be well advised to ask him to bring in a stockpile of a thousand or so blades. ■

# A REALLY PROFESSIONAL MICROPHONE

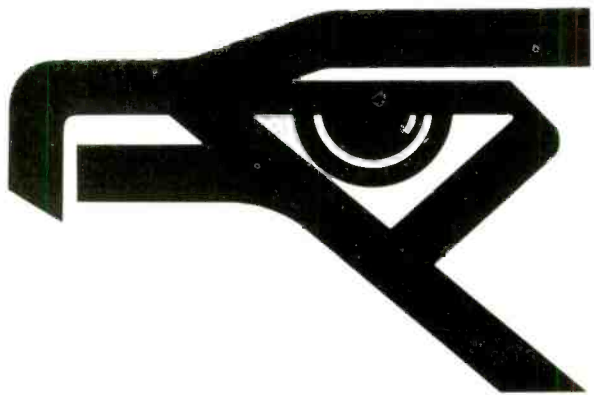
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SS1

# Doing it for effect ...time delay

Len Lewis\*

\*AUDIO AND DESIGN

'We were all standing around in the control room at Olympic Studios with Glyn Johns engineering when this technician, George Chkiantz, burst in and demonstrated a new technique he'd been working on using loads of tape machines all hooked up together. The sound was really quite amazing, so we put it in on the single we were doing at the time'—Ronnie Lane, *The Small Faces*. The single Ronnie referred to was, of course, *Itchycoo Park*; released in 1967, it takes its place in audio engineering history as the first very obvious use of phasing for effect.

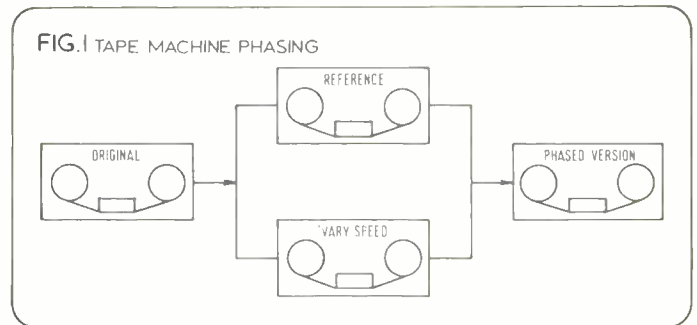
AT THE TIME George Chkiantz (now chief engineer at KPM Studios, London) was working on multiple tape loop delays at various speeds for achieving reverberation. He had calculated that as a side effect, given short delay differences between original and delayed signal, phase cancellation would occur if the two signals were subsequently mixed. This work was given added impetus by the arrival, at Olympic, of George Martin working on the Beatle's television special, 'All You Need Is Love'. George Martin's requirement was for an artificial double tracking (original meaning of *ad lib*) technique that had been developed some three years previously at EMI Studios Abbey Road, courtesy of Ken Townsend.

After much mathematical calculation and electronic improvisation George Chkiantz was able to rig up, using enormous power amps, a varispeed on the synchronous motor of Olympic's Ampex AG300 tape machines. The big flywheel on the Ampex made possible really smooth sweeps of delay which, when tested on Pat Arnold's *The First Cut is the Deepest*, gave rise to the most spectacular effects, including phasing. Glyn Johns, a freelance engineer, heard this and suggested using the effects on a single he was mixing that evening with the Small Faces. Although subsequently to be remixed by Andrew Oldham, the effect remained substantially unchanged and gave *Itchycoo Park* its (then) unique sound.

It is of interest to note that some four to five hours of studio time was expended on setting up the effect. In addition, use of the mixer and of Olympic's tape machines at the time was severely restricted—to the extent that some fader settings were actually taped into place!

Phasing became a '7-day wonder' and the technique was soon refined down to four tape machines and three easy steps (fig. 1). Step 1: take a signal and feed it to two machines. Step 2: mix the output from the replay of both, and varispeed (or use a crude device such as leaning on the capstan or pinching the feed spool, etc) of one machine. Step 3: lay the mixed phased output down on the fourth machine.

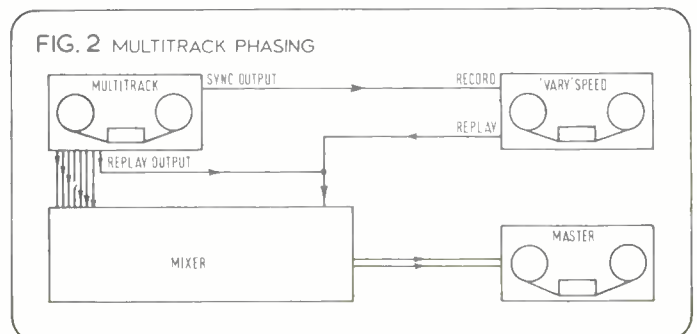
There were problems, however. Notably that: (a) the phased master would be out of sync with the original master by the time interval between the record and replay heads of the two intermediate machines; and (b) the effect was not easy to manufacture without a certain amount of trial and error and was certainly difficult to duplicate on subsequent mixes. These problems could be overcome, but it was fiddly and very time consuming. Later, multitrack tape machines with separate sync outputs allowed real-time phasing (fig. 2). Nevertheless, ease of repetition was still a problem, it being common practice at the time to phase mixed masters, snip out the interesting bits and splice them into the original!



But returning to the history of phasing, if only to destroy a myth perpetuated, albeit unknowingly—specifically, the origin of the term 'flanging'.

In 1963–4 (memories fade) George Martin, tired of the endless hours of studio time expended on real double tracking, asked Ken Townsend of Abbey Road if some mechanical system could be devised to repeat the original signal but delayed slightly. That evening, while driving home, Ken hit on the idea of using the sync output of the new Studer J37 machine that had recently been installed (STUDIO SOUND August 1976, p30, para 5). By a happy coincidence it transpired that the time delay between the head gap of EMI BTR2s running at 76 cm/s (yes, even in those days) was the same as the J37s at 38 cm/s. On remix, therefore, it was possible to come off

58 ▶

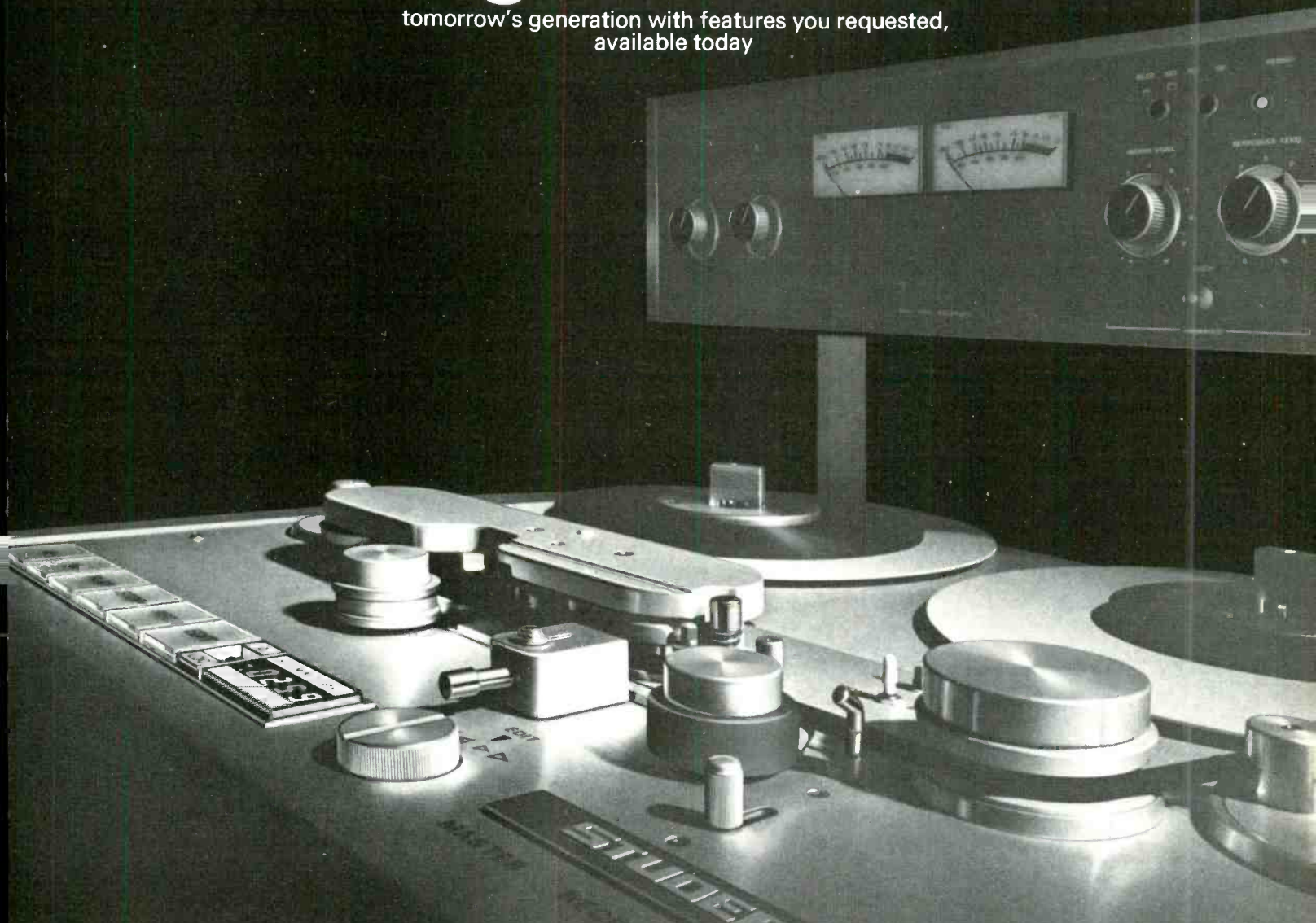




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## DOING IT FOR EFFECT... TIME DELAY

the sync head of the 'send' J37 to 'line in' of the varispeed BTR2, out of 'line out' and into the desk to be mixed with the original J37 replay signal.

The first tape to have 'artificial double tracking' (adt, owing to Abbey Road's penchant for naming effects) added was a Cilla Black master demonstrated that morning to George Martin. It is a credit to the skill abounding at Abbey Road that the Beatles used adt that very evening, within 24 hours of its conception! John Lennon, who was long on special (especially voice) effects, was enchanted and asked George how the system worked. 'Oh', replied George, perhaps suffering from over exposure to Peter Sellers at the time, 'it's a double bifurcated splashing flange, fed forward and mixed with the original!' From that day onwards adt was, to the Beatles at least, 'Ken's Flanger' or simply 'flanging'; the term as in common parlance not being coined for at least another five years. (Incidentally, the first digital delay line was developed by the Central Research Laboratories of EMI in an attempt to reproduce the effect. Unfortunately, technology was not quite ready and the device never sounded quite as good. Now, of course, it is a different story.)

### Of delay lines and like devices

The first commercially produced delay lines were introduced at the beginning of the Seventies. Having first converted the analogue signal to digital form through the obsequious a/d converter, the lines consisted of multiple shift registers. However, much power was necessary to drive these registers, making the units inherently unreliable. Also, owing to their design architecture, delay had to be varied in steps of up to 5 ms at a time. This meant that any variation of the delay setting, while the signal was actually passing through the registers, would create gaps (audible as clicks or 'glitches') on the track—highly undesirable. For this reason early ddls were not suitable where sweeping effects (as in phasing) were necessary. Instead, devices were developed which comprised 'comb' filters (a regular collection of notch filters resembling the shape of a comb's teeth) to be swept up and down the audio frequencies, giving rise to even, pre-determined phase cancellation.

In the mid-Seventies, however, the first ddls featuring random access memory (ram) were introduced. These were far more versatile and, since their delay steps were typically measured in microseconds, could be freely varied because the clicks or 'glitches' were of sufficiently short duration as to be inaudible. Delay line phasing had arrived and rapidly saw the demise of 'electronic' phasers.

At roughly the same time as ram-based ddls were becoming commercially viable, Philips announced the first 'capacitive-discharge' analogue delay chips or 'bucket-brigade' devices. By passing the signal through a series of capacitors, each storing and discharging the signal to the next in line, so a delay is introduced. (Analogous to fire-fighting chains where buckets of water are passed down the line; hence the name.) It took a few years before the performance specifications of bucket-brigade chips were sufficiently improved to meet professional standards, a task made easier with the advent of noise reduction compander-type chips. There are now several devices on the market that can equal ddls in performance on short delay applications (up to, say, 50 ms) at a very economic price. However, where long delays are necessary (up to 1s) ddls still reign supreme—as yet.

The advent of time delay of one sort or another almost phased-out

(awful pun!) the use of tape delay, since all devices overcome the two major problems discussed earlier—synchrony and repeatability. With ddls you simply dial up the effect you want.

### Studio application

The most interesting effect soon to be discovered with the variable ram-based ddl (and later bucket-brigade) was the ability to simulate the Doppler effect at will.

Since it is now possible to increase or decrease the delay settings of a delay line inaudibly, we can effect Doppler pitch changes simply by increasing or decreasing the delay while the signal is passing through the line. On increase the same number of cycles must stretch to fit the new time, and vice versa for decreased delay.

Doppler effect, then, can be created by a changing delay time—and here lies the snag. Let us assume that 25 ms change per second of signal results in the desired pitch. After one second the output signal from the delay line will be 25 ms out of sync with real time. After 4s the discrepancy will have reached 100 ms, and so on to the point where it becomes totally unacceptable.

To overcome this problem we must arrange for the delay line to act like a tape loop, whereby the delay change is reset to zero before it reaches the point at which the brain detects 'out of sync' conditions. If the delay line is designed to cycle from zero to 20 ms, for instance, then the pitch-changed signal is never audibly out of sync. Of course, on reaching 20 ms the 'return-to-zero' condition creates a momentary gap (data seam) or 'glitch'. Since the appearance of the data seam is directly proportional to the rate of cycling, a small pitch change, say  $\frac{1}{3}$ -octave, will not become intolerable.

The Eventide *Harmonizer* allows variable pitch changes of the order 0.5 to 2, where 1 is unity this represents one octave up or down. Doppler effect on the *Harmonizer* is generated by using a fixed-rate write into the ram, with a variable rate read. Obviously faster or slower read versus write will give pitch change, whereas when read and write rates are matched a delay simply occurs. Devices achieving Doppler effect by varying delay time while passing signal typically belong to the bucket-brigade or analogue delay class, such as the Audio & Design *Time Shape Module*, Klark-Teknik *DN36* analogue time processor, or Marshall *Time Modulator*.

Thus the aforementioned Eventide unit allows automatic harmony, since the signal can be pitch-changed to a harmony part normally selected (ie a fifth up) and mixed in real time with the original signal to produce 2-part harmonies. The harmony interval, however, will always retain the same relationship with the original. As a result chord changes on other tracks may create some very unnatural musical combinations. This can be simply overcome by changing the pitch ratio by means of an external source, such as a synthesiser, electronic keyboard, potentiometer or even switches, at oft-used intervals. In this way it is possible for a solo vocalist to accompany himself. Alternatively, after an initial run through, it is possible to correct flat (or sharp) notes and restore frequency to tapes whose running time has been altered!

Phasing, adt and echo are all possible with delay lines, since it is simplicity itself to establish one delay and hold or vary this in relation to the other. With feedback around the delay circuitry, echo of a duration proportional to the feedback level is established; even now we are seeing the introduction of microprocessor-controlled delay lines (digital only) to set, hold and instantly recall the characteristics of, say, an echo plate, a spring or even a room.

Phasing is achieved by sweeping one delay of short duration (about 10 ms) against another, while adt uses fixed delays of up to 40 ms to fool the brain into thinking there are more people singing than there really are. These two latter effects are predominantly the domain of inexpensive analogue devices based on bucket-brigades; the longer shift is still the province of ddls—although who knows what technology has around the corner?

### Time delay in level-control equipment

Although this is not yet, to my knowledge, a widely-used practice, it is as well to consider how easy the delay can make life for single-ended signal processors of the class, 'level control equipment'. The BBC possess a handsome lead in this field, having employed delay line limiters since at least 1973 and, I suspect, earlier on in their highly sensitive pcm links. In this instance, the delay of the order of

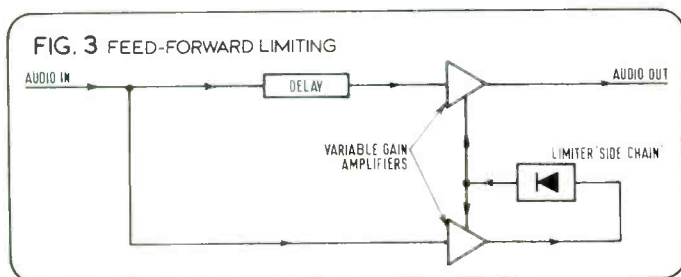


FIG. 3 FEED-FORWARD LIMITING

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## DOING IT FOR EFFECT . . . TIME DELAY

a few milliseconds is provided by an expensive RC ladder network (not unlike a bucket-brigade in practice) to weigh-in with high specifications.

The object of the exercise is to pass a delayed version of the original signal through a limiter, having first forewarned the limiter using the original signal as input to the gain-reduction circuitry (fig. 3). Provided the delay exceeds the attack time of the limiter, gain reduction sufficient to prevent overshoot will have taken place *before* the delayed signal arrives at the gain-reducing element. Hence absolutely no overshoot and no initial transient distortion. In addition, if the delay does not exceed a couple of milliseconds (ample time for 'attack' of any limiter) no out-of-sync condition will be experienced. This can be achieved simply in the control room by feeding the original signal to one half of a matched stereo pair of compressor-limiters, with the delayed signal (2 ms sufficient) as input to the other half. In this way considerable compression or limiting is possible without tell-tale initial transient distortion or fear of overshoot. It should be noted, however, that *all* peaks will be caught for limiting. Hence overload distortion is eliminated but lower modulation level could result. There will be occasions when it is preferable for ultra-fast transients to saturate tape rather than modulate programme content.

What applies for compressors and limiters also holds true for expanders and noise gates. It will be especially useful to 'tip off' with time delay an expander's attenuating element in situations where speed and unfamiliarity of programme content predominate. But it should be remembered that the expander/gate's release time must take account of the delayed signal or loss of decay time may occur, as a result of the pre-disposed gate closing early in relation to the delayed signal.

### In sound reinforcement

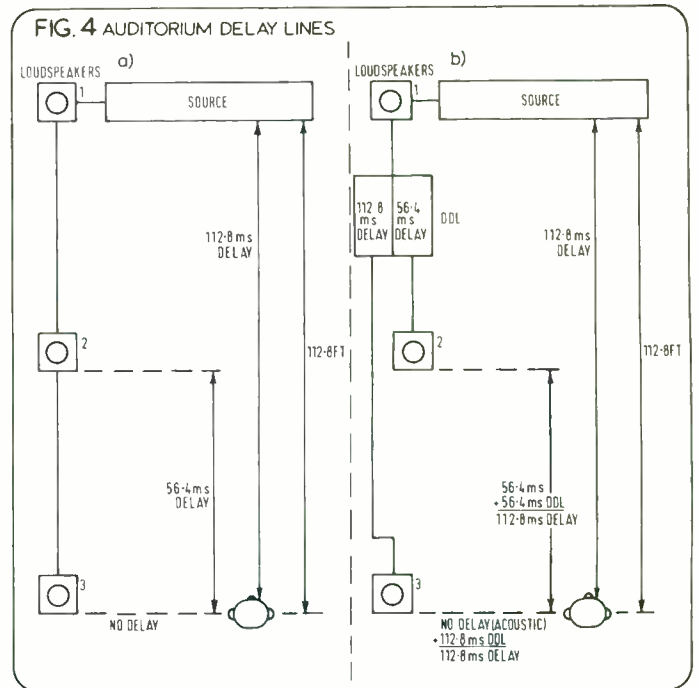
In free air sound travels at 1128 ft/s. It is correct to assume, therefore, that a listener in a large auditorium sitting 112.8ft from the sound source will not hear any sound produced from that source until just over 0.1s has elapsed. This in itself does not necessarily present a problem, except we must remember that in order to hear the signal at 112.8 ft or more a fairly high spl must be employed at source—to the detriment of the auditory faculties of the front row! I'm sure this never seems to matter at some rock concerts, but in public address or sports events it would be considered unacceptable.

The answer is to stagger the sound source at intervals throughout the auditorium and use lower spl at the source. Fig. 4a gives a bird's eye view of such a system. The problem now is that the person stationed at the back will receive an initial signal from loudspeaker number 3, followed by number 2 about 0.05s later and number 1 0.1s after that; all adding up to a pretty confusing echo. A delay line can be employed to delay the signal in such a way that the output from the three loudspeakers is synchronised (fig. 4b).

### Enter Dr Haas

An interesting innovation to consider, at this point, is the Haas effect. Dr Haas' theory suggests that a blindfold listener will judge the direction from which a sound has arrived not by amplitude but on a 'first arrived' basis. To reconsider fig. 4b, if the signal at loudspeaker number 2 was delayed by, say, 70 ms and at loudspeaker number 3 by 140 ms, the nett effect would be for the signal from loudspeaker number 1 to arrive first, admittedly at low amplitude, approximately 14 ms before that from number 2, and 28 ms before that from number 3. On the basis of direction finding by the 'first arrived' method, the listener's attention will be directed at the sound source—very desirable if you happen to have spent thousands on lasers, in the case of rock bands, or 'image', in the case of public figures. With experimentation, no doubt, this effect would be further utilised to direct stereo placement in a large pa, swinging the apparent sound source around the hall.

To close (and I hope I haven't left much out) time delay, be it bucket brigade, digital, tape or other, has opened up a whole realm of audio skulduggery. Playing tricks with time, pitch, phase response and harmony are rapidly becoming standard practice in modern studios. But they'll never replace innovative engineer/producer



combinations who, after all, were doing it strictly for effect in the first place!

*I would like to thank Mike Gardiner of Eden Studios, London, for getting me started, Phil MacDonald, Ronnie Lane, Noel Jesudian at Pye Studios, Keith Grant of Olympic, George Chkiantz of KPM for tipping me off about the George Martin incident, Dave Harries of Air London, George Martin (and Ken Townsend at Abbey Road) for having a good memory, Kenny Schaffer for filling me in on the Haas effect, and Dave Burgess of Feldon Audio for straightening me out on the Harmonizer.*

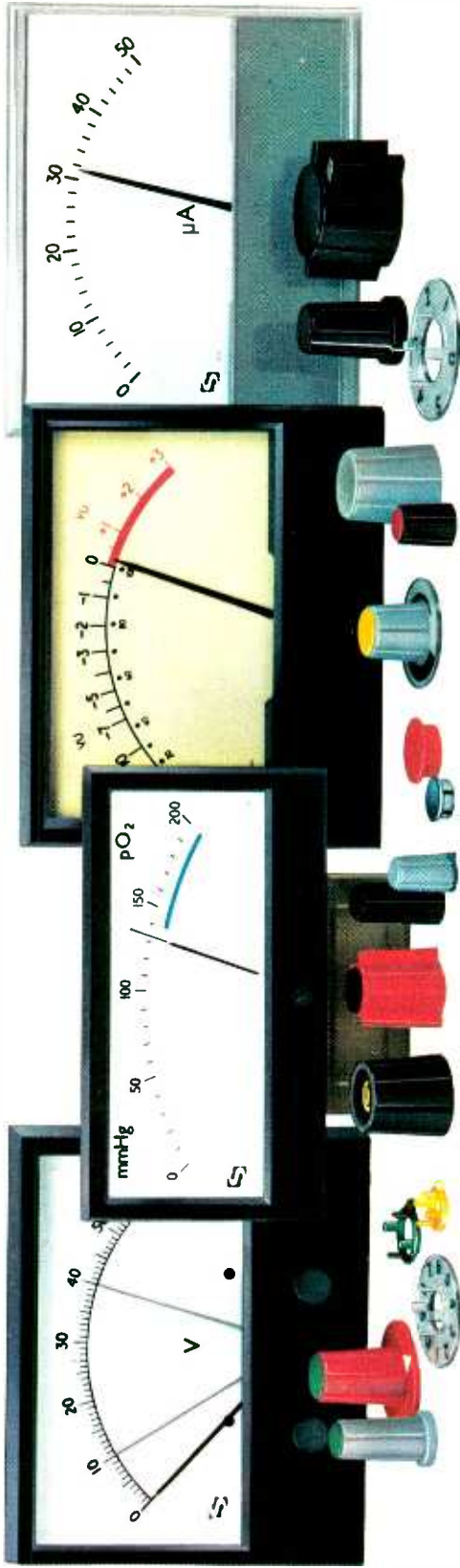
# agony

The recent spate of power cuts and wildly fluctuating mains supply voltage in the UK caused at least two tales of assorted woe.

At a well-known cutting room the mains voltage suddenly decided to take a look at the other side of 300V. The result was one ever so interesting looking acetate—a spiral that bucked around like a roller-coaster, and pieces of aluminium swarf from where the stylus had developed a taste for this metal in preference to vinyl. A few millivolts more abuse and the cutter head would have departed for that perfect room in the sky where all albums are instant platinum and all producers are happy with the first cut.

Meanwhile, at an all-music ilr station, one of their super-duper, crystal-controlled turntables showed up what was in fact not a fault, but what it had been designed to do. It appears that if the mains supply to one of these beasts is interrupted for even a short amount of time, the logic reverts back to its standard operating speed, which is 33 1/3 rpm, and not the 45 rpm necessary for singles to sound as they should. It took the dj a good 15 seconds to suss out the fault and eventually hit the speed change button.





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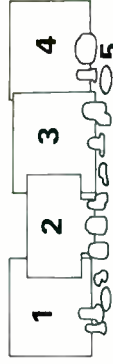


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Sifam meters and collet knobs also feature on the control panel of this portable laboratory for analysing water quality. It is made by Simac Ltd., Walton on Thames.



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## One of those days...

WELL here we go again. Off to sunny Brighton for the third time in two months. Not this time the bitter haranguing of Party Conferences or Union debates. No, a much lighter affair: the 'Battle of the Sexes', or 'Which one do you fancy?' And to heighten our pleasure, it is to be staged in the luxurious setting of the Promenade Hotel which from the outside looks like Colditz, complete with floodlights and a barbed-wire fence. Ah well, they must have done up the inside since we were here last year and the food (we were told) would be better.

Wrong! When I finally carried my luggage to my room (I couldn't find a porter) it was like turning the clock back twelve months. There was cold and cold running water in every room, the windows provided plenty of ventilation (even though they were closed) and the radiator, boiling away gently, was impossible to turn off because the valve was padlocked! I cleared the contraceptives out of the wash basin and had a wash. Perhaps I'd feel better after a good lunch.

Perhaps I would have done if I'd got one—I'll never know. We (along with the fare-paying guests) were served an unusual pie—lots of pastry and gravy but no meat—and, though my culinary knowledge is limited, I failed to guess the origins of any of the vegetables. What the large red blob in the middle of the rice pudding was I shall never know either, for I declined to sample that. Still, for three days full-board at only £7, what can

you expect? *Sole Bonne Femme?*

And so to work... 'You rig the band with him, we'll do the rest...' We were off. By six o'clock everything was in an absolute shambles. But we'd had enough and decided to pack up; it could bloody-well wait till morning. The thought of feeding once more on the hotel's fare was too much, and a hasty conference decided that we should all head for town and a 'posh nosh'. We arrived at a place called *L'Escargot*—excellent French Cuisine, tasty waitress, good wine and less than a fiver each. Much recommended.

Back to the hotel, not entirely sober, to find the Disco in business, complete with lonely 'contestants'. 'Yum, yum, don't like yours though', etc. 'Ev'ry man for himself, lads, last one in the sack's a cissy!' All a load of rot really, because none of us stood an earthly. But the Ale had swollen our egos and the thrill of the chase could not be denied.

Crawl into bed at 2 am, pissed and alone. Awakened at 8.30, feeling like the contents of a seagull's jockstrap. Inject Alka-Seltzer intravenously and stagger down for breakfast. Silly mistake.

Back to work at 9.30—why the hell hadn't I finished the rig the day before? All those cables look terribly similar, and trying to get jack-plugs into those tiny little holes is a sod. Perhaps I'll perk up after another coffee.

Enter the talent to practise walking around on the set and the lads start eyeing-up the form. 'God, is that what I was chatting-up last night? I was in a bad way.' The draw is made—another waste of money. Mine walks with a limp 'cos one part of her anatomy is heavier than the other!

And so lunchtime goes by, and the afternoon

drags on. The band, due to rehearse at three, is not ready until half-past, so we'll go on cameras and you can do a balance during tea-break, eh? 'Piss off' we say, but that's the way of the world, and we get no tea-break.

Eventually, it's dinner and line-up time, while one member of the crew is dragged away to have his picture taken in very suspicious circumstances!

This is it. Roll vtr. Cue the fanfare. Wrong fanfare, let's start again chaps. Bring them all on... don't fall off the catwalk, dear... interview the judges (load of poofs, how do they know?)... the presenter sets off taking the wrong mic with him and sound man (holding the cable) gets dragged into shot. None of the girls hit 'the mark' so all the close-ups were soft. (That's Camera's excuse and they're sticking to it!)

'Ladies and Gents, Miss Television! Here's your first prize' (Two British airline tickets so big you could read the name in a wide-shot! So much for the Advertising Code.)

'Leave the lot, lads, we'll clear up in the morning.' So off to the bar, where the crew were on free drinks; on the Company, no less! So hospitable were they that we had more than one drink each, and the girls thought it so very kind of us to keep buying them gin-'n'-tonics to drown their sorrows. Evil buggers, we get them stoned and try to make up for last night. This is your last chance.

Crawl into bed at 3 am, pissed and alone.

Ah well, it was fun trying. Tomorrow we wrap and go home. Thank God. *This 'story' originally appeared in the Journal of the Guild of Television Cameramen. We wish to thank the Editor for allowing us to republish it in STUDIO SOUND.*

## letters

### Can you help?

Dear Sir, I am writing to ask the help of your readers. I plan to hold a course of education in the processes involved in pressing gramophone records. The school involved in the project already has a very good programme in studio recording, which includes the use of an excellent 16-track facility. But the processes of record pressing are not familiar enough to the current faculty that we can proceed on our own. Therefore we are asking the help of the industry at large in the following matters, and such additional areas as your readers may think helpful.

First, we need to know what instructional texts and aids may be available, plus suggested outlined courses of instruction from those with practical familiarity of the technologies.

Secondly, we would like suggestions on the selection of equipment which will allow us to plate our own masters, press the recordings, fabricate our own jackets and sleeves from printed sheets, and perform such additional operations as are found in modern pressing plants. Because of limitations of the school day and class size we are

considering a plant with 24 automated or semi-automated presses (12 'single' and 12 lp units). We would also entertain suggestions on subsidiary equipment for the production of Stereo-8 and Philips Compact Cassette shells.

Thirdly, we could use practical advice on the layout of such a works, and operational details, such as resources for matrix silvering solutions, vinyl record blends, plating supplies and sundry materials, plus steam plant, hydraulic and chilled-water supply arrangements.

Yours faithfully, Andrew A Griffin, Center for Gifted and Talented Children, 2145 West Central Avenue, Springfield, Missouri 65802, USA. (Or by telephone from 8.00 to 4.30 Central Standard Time at: (417) 836 2447.)

### Direct cut

Dear Sir, I am amused—and not a little saddened—to see the current wave of hysteria over direct-cut recording. As you say, direct-cut isn't just about quality. And it is particularly appropriate that your editorial in the January 1978 issue should draw out so clearly the benefits of live

recordings, when STUDIO SOUND has itself campaigned against the 'plastic' musical creations of some of today's producers. What you are saying, of course, is what every good producer knows already—that live performances, warts and all, invariably sound better than synthesised offerings which have taken three months to 'polish' via 24 tracks and six sessions of backing musicians.

'Ah', we hear the cry, 'but what happens if something goes wrong with the balance?' It may be that the modern studio engineers would feel lost without the standby of 'one more take'. But in broadcasting we have lived with this for years and just accept the extra stimulation of getting it right first time. Recently I recorded a top London group (who were out here on tour) with our 16/4/2 music studio desk, mixing straight down into stereo. Their initial reaction was one of incredulity that such a 'primitive' facility could possibly do justice to their music. The end results, however, aroused only favourable comments and a mental note on their part to be more wary in future of producers who insist on umpteen sessions per three-minute lp track.

I am not so naive as to suggest that multiple tracking is a thing to be avoided per se—I am fully aware of its creative and financial implications—but I wonder if we will soon see the emergence of a New Wave of direct-cut engineers with lightning reactions and red-hot fingers... as the broadcasters laugh quietly up their sleeves? Yours faithfully, Dave Harris, Chief Engineer, Radio Botswana, PO Box 52, Gaborone, Republic of Botswana.



# The CPR-16

## Computer Programmed Reverberation

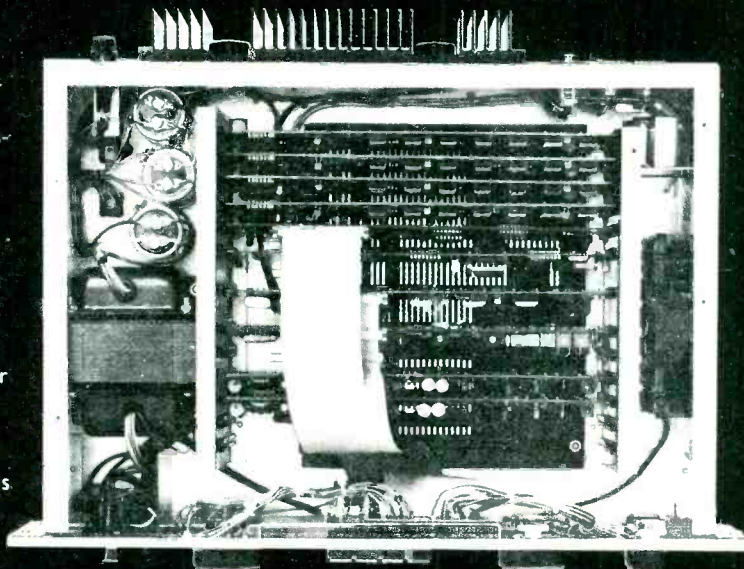
The Quad Eight CPR-16 represents a revolutionary breakthrough in the application of advanced computer technology for the professional audio marketplace.

Two years in development, the CPR-16 is the first product to embody advanced digital technology in a configuration which will allow an unprecedented degree of control over the reverberant field by signal processing.

It offers the user a flexibility beyond the now ordinary mechanical methods; every possible aspect of the reverberant field is capable of alteration by the engineer. Reverberation time can be changed from zero to twenty seconds in sixteen steps, even during operation, without signal degradation. High and low frequency damping rates can be controlled over a wide range which previously was only achieved by time-consuming and clumsy rearrangements of complex arrays of absorption splays in live chambers or rooms. The simulation of "room size"

can be modified with a single control which adds a variable delay before the first echo or reflection signal.

And, most importantly, the CPR-16 allows the prominence and density of resonant modes to be altered. Thus, the density and diffusion rate of echoes can be tailored to match any room, electromechanical device, or whim.



The CPR contains two individual reverb programs and one "open" program provision for future custom sound processing effects. Program 1 is analogous to a live acoustical chamber, and Program 2 creates a simulation of an artificial plate. Program 3 switching facility is pre-wired for a plug-in programming module and Program 4,

ECHO allows a "Tape-Echo" simulation that is unobtainable by present mechanical methods.

The CPR-16 incorporates control over every critical aspect of the reverberant field. If you have a special application which requires a previously unavailable sound processing effect, information on custom programs is available from the factory.

Write us or call for a detailed brochure on the revolutionary CPR-16. The age of affordable digital processing for audio has arrived. If you've been waiting for technology to catch up with your imagination, your time has come.

# Survey: reverberation, delay and special effects units

Forthcoming surveys include power amplifiers (August), monitor loudspeakers (September) and studio ancillaries (October). Manufacturers and agents are invited to submit product details for publication to reach the editorial offices (address page 3) at least eight weeks before the issue publication date (preferably a lot earlier).

## AKG

**AKG GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.**  
**Phone: (222) 921647. Telex: 118390.**  
**UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.**  
**Phone: 01-749 2042. Telex: 28938.**  
**US: Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, NJ 07430.**  
**Phone: (201) 529 5900. Telex: 138022.**  
 Agents in most countries.

## BX10

**Type:** two-channel 'portable' mechanical reverb unit.  
**Reverb decay time:** 1.5, 2.5 or 3.5s measured with 1/3-octave pink noise at 500 Hz.  
**Frequency response:** within  $\pm 6$  dB, 50-8k Hz.  
**Crosstalk:** better than 35 dB.  
**Noise:** better than 65 dB rms weighted to DIN 45505.  
**Features:** bass ( $\pm 8$  dB at 150 Hz) and treble ( $\pm 4$  dB at 5k Hz) controls; independent reverb/mix control.  
**Price:** £1225.

## BX15

**Type:** two-channel 'portable' mechanical reverb unit.  
**Reverb decay time:** 1.5-3.5s in 0.5s steps.  
**Crosstalk:** better than 35 dB.  
**Noise:** better than 66 dB unweighted.  
**Features:** as BX10.  
**Price:** £1675.

## BX20E

**Type:** two-channel mechanical reverb unit with remote control.  
**Reverb decay time:** 2-4.5s, continuously variable.  
**Frequency response:** within  $\pm 5$  dB, 20-8k Hz.  
**Crosstalk:** better than 60 dB.

AKG BX10 portable reverb unit



Model dmx 15-80 programmable ddl from AMS

**Noise:** better than 63 dB unweighted at +8 dBm output.  
**Price:** £2450.

## 4400 REVERBERATION SYSTEM

**Type:** 'low-cost' two-channel mechanical reverb/equaliser unit.  
**Reverb decay time:** 1.9s to -60 dB.  
**Features:** 4-section eq with 15 dB cut/boost on each channel; 0-100% reverb mix; input level vu metering; Hi-Z input.  
**Price:** £426.

## ALLEN & HEATH

**Allen & Heath Ltd, Pembroke House, Campsbourne Road, Hornsey, London N8, UK.**  
**Phone: 01-340 3291. Telex: 267727.**  
**US: Audio Techniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902.**  
**Phone: (203) 359 3212.**  
 Agents in most countries.

## ADT UNIT

This unit uses an analogue bucket brigade technique to provide two channels of delay of up to 24 ms delay/channel in 6 ms increments. It incorporates XLR connectors and is designed for 0 dBm nominal line level operation. Quoted frequency response is  $\pm 3$  dB, 30-12.5k Hz with a corresponding distortion factor of less than 0.5% thd. A front-panel switch enables serialisation of delay channels.  
**Price:** £280.

## ALTEC

**Altec Sound Products Division, 1515 South Manchester Avenue, Anaheim, Ca 92803, USA.**  
**Phone (714) 774 2900. Telex: 655415.**  
**Europe: Altec Sound Products Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK.**  
**Phone: 0438-3241.**  
 Agents in most countries.

## MODEL 1640 TIME DELAY SYSTEM

This unit is intended primarily for sound reinforce-

ment applications where delays are needed for loudspeakers within a rig. Six outputs provide delays at fixed 20 ms intervals up to a maximum of 120 ms. Units can be cascaded to provide a maximum delay of 600 ms. Frequency response is a quoted +1, -3 dB, 20-12k Hz, dynamic range 89 dB 'typical' and total harmonic distortion less than 1% at +18 dB input.

## MODEL 1660/1661 TIME DELAY SYSTEM

These units use digital ram-type circuits to provide up to six delayed outputs continuously variable in the range 0-510 ms. Delay time setting is by means of front-panel thumbwheels. Frequency response is a quoted  $\pm 1$  dB, 20-15k Hz, dynamic range 93 dB and total harmonic distortion less than 0.1% at +18 dB input. Model 1661 is a tamper-proof version of Model 1660 with a cover fitted over the thumbwheel controls.

## AMS

**Advance Music Systems, 66 Ightenhill Park Lane, Burnley, Lancs BB12 0LH, UK.**  
**Phone: 0282-36943.**  
**US: Everything Audio, 7037 Laurel Canyon Boulevard, North Hollywood, Ca 91605.**  
**Phone: (213) 982 6200.**

## DM 2-20 FLANGER/VIBRATO/DELAY

This unit simulates phasing and flanging, either manually by a front-panel knob or by a combination of ramp and sine modulation. A function control titled 'phase/stereo/delay' splits the signal in the stereo position producing a moving frontal image which, among other things, claims to simulate a 'Leslie cabinet' sound. Other controls include modulation depth and speed. It is supplied with XLRs and will operate at normal line level; the output is unbalanced.  
**Price:** about £330 either rack-mounting or portable format.

## DMX 15-80 PROGRAMMABLE DDL

This unit is a microprocessor-controlled digital delay line. Delay times are entered by means of a front-panel keyboard. It is modular and accepts up to ten memory boards, giving a maximum delay of 1s in 1 ms steps. (A broadcast version with a

maximum profanity delay of 10s is also available for live broadcasting.) Signal-to-noise ratio is a claimed 93 dB and bandwidth 18k Hz at all delays. A family of micro-processor effects cards are also available, including a 'harmoniser' card and a programmable reverb card. The latter is capable of electronically duplicating plate and spring echoes.

#### AUDIO & DESIGN

**Audio & Design Recording Ltd, St Michaels, Shinfield Road, Reading, Berks RG2 9BE, UK. Phone: 0734-53411. Telex: 847605.**

**US: Audio & Design Recording Inc, PO Box 23047, Honolulu, Hawaii 96822. Phone: (808) 845 7226.**  
Agents in most countries.

#### S24 TIME SHAPE MODULE

This is an adt/flanger and time domain processor from the *Scamp* range of rack-mounting units. Features include input limiter to prevent overload of delay line; 1.2-45 ms delay range; positive and negative flange; spin control for 100% feedback effect; programme-controlled delay/flange; oscillator control of delay time with variable modulation and frequency effect; and stereo reverb and delay capability with two or more modules. Frequency response is a quoted  $\pm 0, -0.5$  dB, 20-15k Hz at any delay setting. Price: £480.

#### S23 AUTO-PAN

A new module from the *Scamp* range offering different pan patterns with trigger, speed and envelope-following functions. Track reversal and normal modes are indicated by two leds that also show speed of panning action. Noise level is claimed to be below  $-96$  dB ref  $+8$  dBm and frequency response  $\pm 0.5$  dB, 20-20k Hz.

#### AUDIO PULSE

**Audio Pulse Inc, Bedford Research Park, Crosby Drive, Bedford, Mass 01730, USA. Phone: (617) 275 1595.**

No information received.

#### DATATON

**Dataton AB, Box 257, S-58102 Linköping, Sweden. Phone: 013 100711.**

#### SYSTEM 3000

Dataton manufactures a series of 13 modules which include a 1000-step, microprocessor-based 'program sequencer' providing analogue voltage control through internal d-to-a converters of up to four vc units directly. There is also a serial addressed digital output capable of instructing 56 peripherals such as slide projectors, lighting, etc. Other modules include:

#### 3001 input amplifier

Four channels of pre-amplification each with pad, phase reverse and limiter.

#### 3002 vc sound generators

Four voltage controlled sound generators, each adjustable from 10 Hz to 10.24k Hz. Control is either linear (1000 Hz/V) or exponential (1 octave/V). Each channel has variable waveform and preset level.

#### 3101 graphic equaliser

Ganged 2-channel (stereo) operation of eight octave centres.

#### 3102 stereo echo unit

All-electronic two-channel design with variable delay between 10 and 30 ms. There is a reverb/clean feed variable pot.

#### 3103 filter

Four channels of vcf networks with selectable notch lowpass, bandpass and highpass. There are internal

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# Lexicon Digital Delays THE CLEANEST SOUND MADE



When you want a really clean, sweet-sounding delay for your lead vocals and instrumentals... and professional quality equipment that works *reliably* month after month and gig after gig... call us.

Our stereo 102-S is both versatile and exciting to use. Two independent delay lines in a single chassis. Couple them with our VCO module and you get special effects like you never had before. Vibrato, doubling with time delay and pitch shift time delay panning, doppler shift and a whole lot more.



Our single-channel, two-output Model 92 is superb for multi-tracking, ambience enhancement and echo send with sound just as clean as the 102-S. Its low cost, reliability and portability makes it ideal both for studios and entertainers.

Write on your letterhead for AN-3, our 24-page application note and demo record on a wide array of audio effects achievable by delay processing.

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Massachusetts 02154 USA

F W O Bauch, Ltd 49 Theobald St., Boreham Wood, Herts. WD6 4RZ. Telephone 01 953 0091

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## SURVEY: REVERBERATION, DELAY AND SPECIAL EFFECTS

limiters that squash amplitude peaks created under high operating 'Q' conditions. Q variable between 0.7 and 50.

### 3104 envelope shaper

Four-channel envelope shaper with a 'versatile' triggering system. Main functions include attack, decay, release and off time variable from 0.01 to 10s.

### 3105 ring modulator

Two-input single ring.

### 3203 joystick module

Two joysticks each expanding from two to four channels. Signal paths are voltage-controlled enabling interface with other vc busses.

### 3205 mixer module

Four-input/four-output unit, cascadable to arbitrary number of inputs/outputs. Two pan controls included on each channel and one echo-send control. Outputs may easily be grouped to stereo or quad outputs.

## DIC

Denon Instrument Company, Japan.

UK: CineSound International Ltd, Imperial Studios, Maxwell Road, Borehamwood, Herts.

Phone: 01-953 5545. Telex: 923274.

US: Jack Evans & Sons, PO Box 866, Valley Forge, Penn 19482.

Phone: (215) 935 1014.

### EM-2000 ECHO MACHINE

Tape speed: 19-57 cm/s, continuously variable.

Delay time: 37.5-150 ms for head 1, 94-280 ms for head 2, 132-397 ms for head 3, 168-502 ms for head 4.

Frequency response:  $\pm 3$  dB, 50-12k Hz at 38 cm/s.

Wow and flutter: within 0.15%.

Signal-to-noise: better than 56 dB at recording level of 0 vu.

Distortion: less than 2%.

Price: £990; \$2200.

## EMT

EMT-Franz GmbH, Postfach 1520, D-7630 Lahr, West Germany.

Phone: 078-25512. Telex: 754319.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

Phone: 01-953 0091. Telex: 27502.

US: Gotham Audio Corp, 741 Washington Street, New York, NY 10014.

Phone: (212) 741 7411. Telex 129269.

Agents in most countries.

### EMT 140TS/Q

Delay principle: plate.

Reverb period: 1-4s, adjustable.

Controls: reverbation time (remote control optional).

Other features: quadraphonic (140Q); stereo (140TS).

Noise: 50 dB below full output, for 2s reverb time.

### EMT 240

Delay principle: stereo plate.

Reverb period: 1-4s, adjustable.

Controls: reverbation time.

Noise: 60 dB below full output, unweighted.

Resistance to external noise: 80 phn max ambient level.

### EMT 250

Reverberation principle: digital electronic.

Decay time (at 1k Hz): 0.4 to 4.5s controllable in 16 steps.

Decay time at bass frequencies: time factor of between 0.5 and 2 times nominal decay period.

Decay time at treble frequencies: time factor of

between 0.25 and 1 times nominal decay period.

Initial delay: from 0 to 315 ms in five steps; there is an additional delay of up to 60 ms in 20 ms steps.

Outputs: four each programmable with individual delay characteristics.

Special effects: phasing, chorus (tonal duplications), super long delay (up to 10s) and echo (single shot from 5 to 315 ms).

Noise: better than 70 dB.

Frequency response:  $\pm 1$ , -3 dB, 30 to 10.8k Hz.

Total harmonic distortion: less than 0.5%.

### EMT 244

Reverberation principle: digital electronic.

Decay time: 0.4-4.5s in 16 steps (frequency dependent).

Frequency response:  $\pm 1$ , -3 dB, 30-8k Hz.

Dynamic range: 65 dB at 2s decay time.

### EMT 444

Type: digital delay unit with multiple outputs.

Delay time: 1-255 ms in 1 ms steps.

Features: 'echo' and 'phasing' programs.

## EVENTIDE

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA.

Phone: (212) 581 9290.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.

Phone: 01-580 4314. Telex: 28668.

Agents in most countries.

### MODEL 1745M DIGITAL DELAY

Delay time: 0-320 ms, continuously variable.

Controls: front-panel 'delay set' using digital read-out to indicate delay period; 'double' switch to double delay and halve bandwidth.

Features: options for pre-wiring delay periods;

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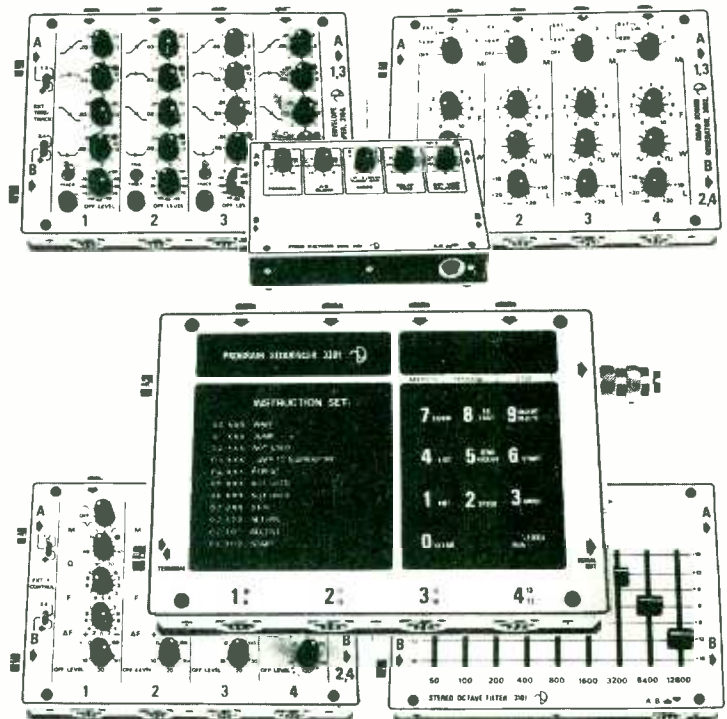


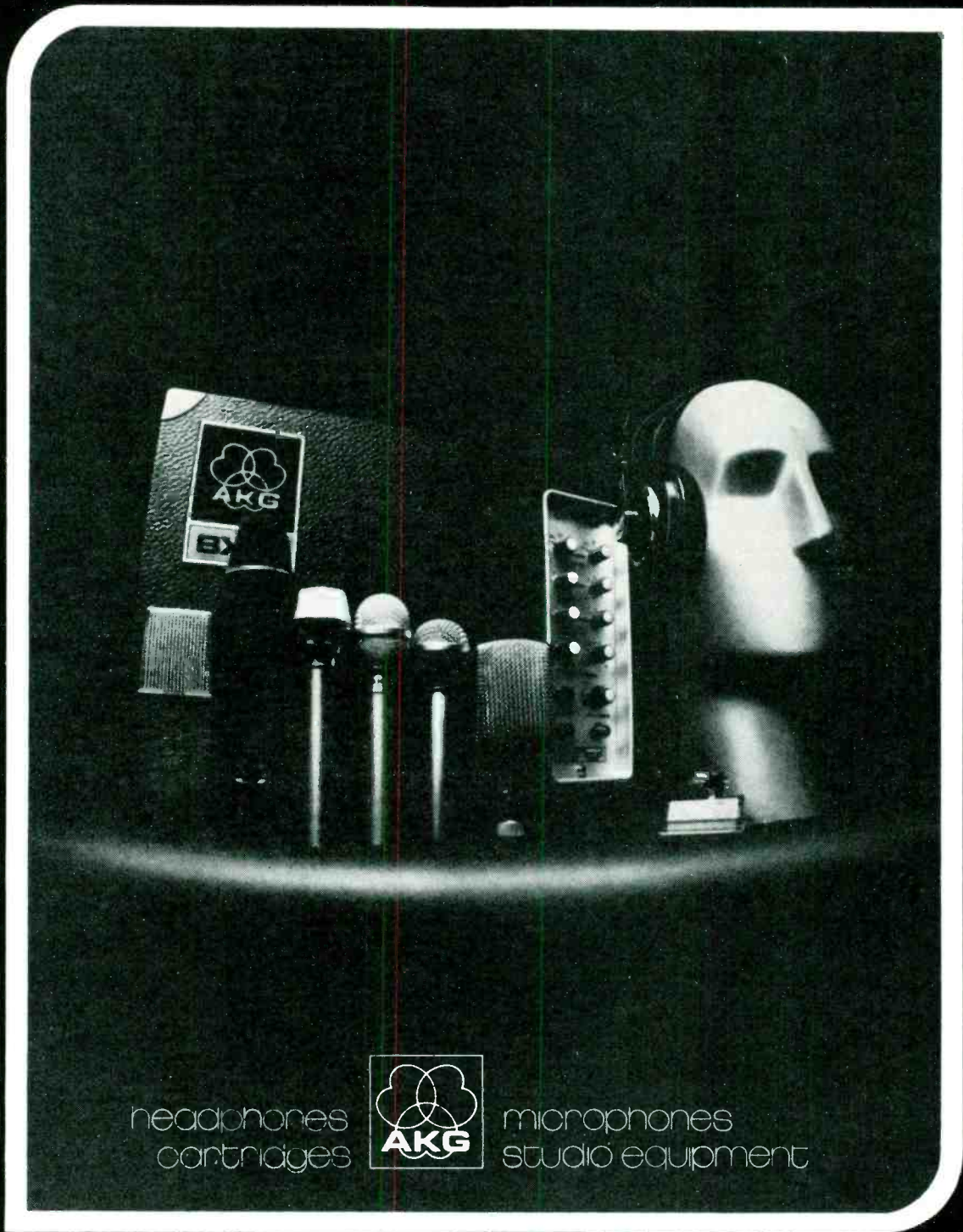
Above: Eventide Model H910 Harmonizer.

Right: the new EMT 444 digital delay unit.

Below left: The new S24 adt/flanger from Audio & Design's Scamp range.

Below right: modules from the Dataton System 3000 of microprocessor-controlled effects units.





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35 Britannia Row  
London N18QH England  
Tel: 01-359 0955/6  
Contact: Robbie Williams

Aphex West  
7801 Melrose Avenue  
Los Angeles  
Calif. 90046  
Tel: 213.655.1411  
Contacts: Kent Beyer  
Pat Taylor

Aphex New York, Ltd.  
1400 Pleasant Valley Way  
West Orange  
New Jersey 07052  
Tel: 201.736.3422/212.964.7444  
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102 46 Stockholm  
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CH-1052 Le Mont-sur-Lausanne  
Switzerland  
Tel: 021-33 3355  
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21 Pier Street  
Sydney 2000 Australia  
Tel: 261381  
Contact: Ron Purvis

Aphex Hawaii Ltd.  
679 Auahi Street Honolulu  
Hawaii 96813  
Tel: (808) 521-6791  
Contact: Sam Holt

## SURVEY: REVERBERATION, DELAY AND SPECIAL EFFECTS

remote control unit with ANSI/IEEE interface bus (see April '78 issue, p24).

**Frequency response:** -1 dB, 30-16k Hz.

**Noise:** 78 dB below output.

**Price:** £2575.

### MODEL H910 HARMONIZER

This unit modifies the time domain of the input signal. Through digital processing it effects a plus or minus 1-octave pitch change, the actual pitch change being shown on a 3-digit front-panel readout. The integral delay lines may be used independently of the pitch shift for straight delay effects such as slap-back, flanging and reverb.

**Delay time:** 0.3-60 ms in pitch-shift mode; 0-112 ms in 7.5 ms steps for straight delay.

**Frequency response:** -1dB, 20-12k Hz in the delay mode.

**Dynamic range:** greater than 90 dB.

**Price:** £940.

### MODEL 2830 OMNIPRESSOR

This unit is described as a 'professional-quality' dynamic modifier, combining the characteristics of a compressor, expander, noise gate and limiter in one unit. Its dynamic reversal feature makes high-level input signals lower than corresponding low-level inputs. Musically, this reverses the attack-decay envelope of plucked string and similar instruments, and gives the effect of 'talking backwards' when applied to a voice signal.

**Price:** £388.

### MODEL FL201 INSTANT FLANGER

This is a successor to the well-known *Instant Phaser*. It uses what is described as a true time delay circuit, producing many more nulls and thus much deeper effect than previously available.

**Delay time:** 200  $\mu$ s to 10 ms, front-panel adjustable or via external control voltage. (Up to 50 ms maximum by internal adjustment.)

**Oscillator:** 0.05-20 Hz, continuously variable, to alter flanging effect.

**Features:** 'bounce' control to simulate effect of tape-machine flanging by varying delay in the same manner as a motor or servo 'hunting'.

**Price:** £397.

### MODEL S1066

This is basically a 16-output digital delay line. Instead of each delay time being set by knobs or switches—making the unit rather cumbersome to use—a programmable read-only memory selects the time of each output and its amplitude and phase. For one input the 16 delays are spread to two outputs in a sequence determined by the roms, en-

abling stereo effects to be achieved. Up to 32 individual programs can be selected by means of a front-panel switch block or keyboard.

**Price:** on application.

### HAECO

Holtzer Audio Engineering Corp, 14110 Aetna Street, Van Nuys, Ca 91401, USA.  
**Phone:** (213) 787 7733.

No information received.

### INDUSTRIAL RESEARCH PRODUCTS

Industrial Research Products Inc, 321 North Bond Street, Elk Grove Village, Ill 60007, USA.  
**Phone:** (312) 439 3600.

**UK:** Knowles Electronics Ltd, Victoria Road, Burgess Hill, Sussex.  
**Phone:** 04446-5432.

### DA-4000 AUDIO SIGNAL DELAY

This is the basic rack-mounting model in a range of three delay units; models *DA-4006* and *DA-4007* have an added compander which is claimed to extend their dynamic range.

**Delay principle:** electronic/digital.

**Delay capacity:** no limit by tandem connection to additional chassis.

**Frequency response:** 2 dB, 40-12k Hz.

**Dynamic range (at 400 Hz):** 63 dB (*DA-4000*); 80 dB (*DA-4006*); 90 dB (*DA-4007*).

**Distortion (at 1 dB below max output at 400 Hz):** less than 1% thd (*DA-4000*); less than 0.5% thd (*DA-4006/7*).

**Noise (20-20k Hz bandwidth):** less than 45 dBm (*DA-4000*); 80 dB below max output (*DA-4006*); 90 dB below max output (*DA-4007*).

**Price:** between \$1k and \$4k.

### DA-4003 AUDIO PROGRAM DELAY

Similar in specification to the *DA-4008* unit.

**Delay principle:** electronic/digital.

**Delay capacity:** 240 ms max in single chassis.

**Outputs:** 1-5 per chassis, switchable in 10 ms steps (5 ms option available).

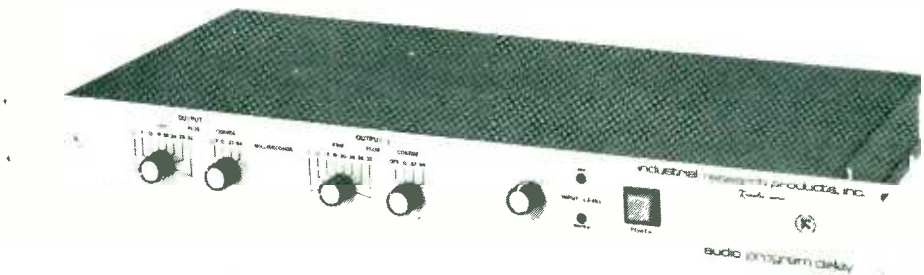
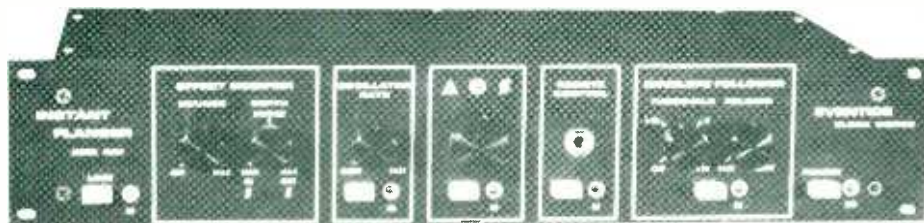
**Frequency response:** 2 dB, 40-12k Hz.

**Dynamic range (at 400 Hz):** 80 dB (*DA-4003*); 90 dB (*DA-4008*).

**Distortion (at 1 dB below max output at 400 Hz):** less than 1% thd (*DA-4003*); less than 0.5% thd (*DA-4008*).

**Noise (20-20k Hz bandwidth):** less than 62 dBm  
70 ▶

Eventide Model FL201 Instant Flanger.



The model DC4011 delay unit from Industrial Research Products





# This tape has been Aurally Excited.

The <sup>®</sup> Aphex Aural Exciter is an astonishing signal processing instrument, which brings sound to life and makes it louder without any actual level change.

This is the principle behind it.

Sound waves enter our ears with subtle phase information relating to the location of the sound source—left or right, up or down, front or back, direct or reflected. By using a sum and differencing technique, the brain provides us with our critical aural perception.

But collecting sound, mixing it and then recording it often destroys or masks much of the subtle information resulting in a "flatter sound" than the original.

However, the Aphex introduces phase information in the form of a series of minute delays, whose magnitude depend on frequency.

The formula by which Aphex selectively processes the audio signal is not random; it has been designed after considerable research into the mechanisms of the ear, in particular the reflections and minute time delays caused by its shape.

Aphex is best used on selected channels, normally in the remix stage of production, fed from the echo or foldback send. The output from Aphex is then mixed back into the main signal at about -15 to -30dB.

Aphex is already famous for what it does to vocals. But any instruments with natural sound (ie not electronically produced) like snare drums, cymbals, acoustic guitars, strings and brass sound amazing when Aphexed.

Call it what you will, this effect causes no changes in level, confirming that it is truly a psychological effect.

Because the Aphex principle is young, we expect to replace it continually with new and even more exciting versions, so you can't buy it; you must lease it.

Contact us for more details, or to arrange for a demonstration.



**APHEX**

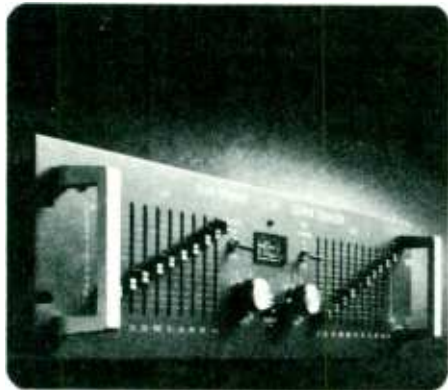
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AEC C-41 Dual Channel Equalizer

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## SURVEY: REVERBERATION, DELAY AND SPECIAL EFFECTS

(DA-4003); 90 dB below max output (DA-4008).  
Price: between \$1.8k and \$5k.

### DA-4009 SOUND DELAY MODULE

Similar in specification to the DA-4010 unit.  
Delay principle: electronic/digital.  
Delay capacity: 50 ms max (DA-4003); 72 ms max (DA-4010); both selectable in 10 ms increments.  
Outputs: one.  
Frequency response: 2 dB, 30-12k Hz (DA-4009); 2 dB, 30-8k Hz (DA-4010).  
Dynamic range: 80 dB at 400 Hz.  
Distortion: less than 0.3% thd (no conditions).  
Noise (20-20k bandwidth): 80 dB below max output.  
Price: \$900.

### DC-4011 AUDIO PROGRAM DELAY

Delay principle: digital ccd.  
Delay capacity: 96 ms in 4 ms increments.  
Outputs: two.  
Frequency response:  $\pm 2$  dB, 20-15k Hz.  
Dynamic range: greater than 90 dB.  
Noise: 90 dB below maximum output level.  
Price: \$1.2k.

### DD-4012 SOUND DELAY MODULE

Similar in specification to the DC-4011 unit.  
Delay principle: digital ccd.  
Delay capacity: 64 ms (96 ms optional) adjustable in 4 ms increments.  
Outputs: one (second optional).  
Frequency response:  $\pm 2$  dB, 20-15k Hz.  
Dynamic range: greater than 90 dB.  
Noise: 90 dB below maximum output level.  
Price: \$1.0k.

## KLARK-TEKNIK

Klark-Teknik Research Ltd, MOS Industrial Estate, Summerfield, Kidderminster, Worcs DY11 7RE, UK.

Phone: 0562-64027. Telex: 339821.

US: Klark-Teknik, 155 Michael Road, Syosset, NY 11791.

Phone: (516) 364 1900. Telex: 961396.

Agents in most countries.

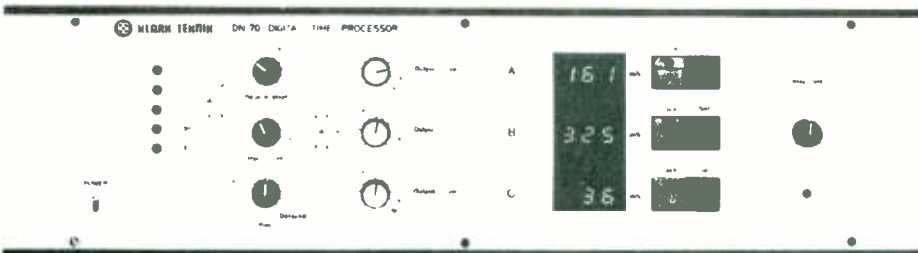
### DN36 ANALOGUE TIME PROCESSOR

This unit is a dual-channel voltage-controlled delay system. The delay (0.5-50 ms continuously variable) can be set manually or controlled automatically. A built-in modulator allows the delay length to be swept in various function patterns at variable rates and depths. Multipath feedback controls are included to enable synthesis of several time-related effects, including reverb, phasing, flanging, vibrato, chorus, single/double repeat echo, doppler shift, adt, modulated delay etc. Price: £790. Also available as a single-channel unit, model DN34, with slightly simplified controls. Price: approx £700.

### DN70 DIGITAL TIME PROCESSOR

This unit combines three separate digital delay lines, the delay of which can be a maximum of 163, 326 or 652 ms. Separate ddl outputs are provided, plus a mixed input/delayed output. Front-panel controls include ddl output, mix and regeneration level. The high clocking speed of 50kHz is claimed to extend frequency response to 15kHz without the need for an excessively sharp filter. Dynamic range is a quoted 90 dB. Prices depend on delay option: between £1.8k for 163 ms and £2.4k for 652 ms delay; expander kits to extend delay cost £400.

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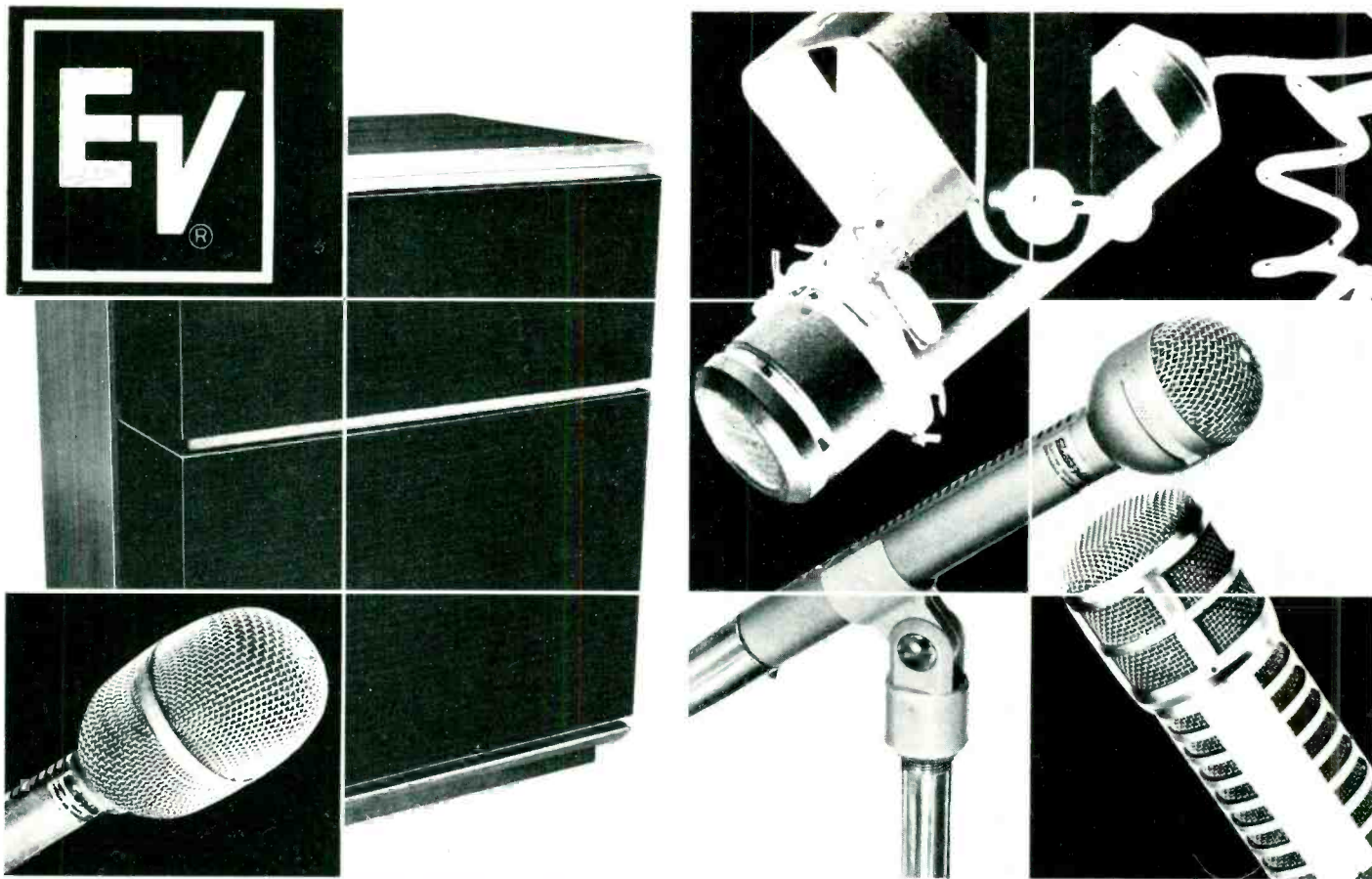
The new Klark-Teknik DN70 digital time processor



Lexicon Delta-T model 102 stereo ddl



Low-cost Lexicon model 92 mono ddl with two outputs



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## SURVEY: REVERBERATION, DELAY AND SPECIAL EFFECTS

### LEXICON

Lexicon Inc, 60 Turner Street, Waltham, Mass  
02154, USA.

Phone: (617) 891 6790.

Export: Gotham Export Corp, 741 Washington  
Street, New York, NY 10014, USA.

Phone: (212) 741 7411, Telex: 129269.

UK: FWO Bauch Ltd, 49 Theobald Street,  
Borehamwood, Herts WD6 4RZ.

Phone: 01-953 0092. Telex: 27502.

### MODEL 102-S DIGITAL DELAY

Type: two-channel ddl with built-in voltage-  
controlled oscillator for special effects, including  
vibrato, 'doubling with varying time delay and  
pitch shift', 'time-delay panning', Doppler shift,  
flanging, chrous etc.

Delay time: 48-192 ms per channel in 3 ms steps  
(each channel may contain up to four delay modules  
of 48 ms each), plus mono delays up to 384 ms by  
cascading channels.

Output: one or two per channel.

Frequency response: 2 dB, 20-15k Hz.

Dynamic range: 95 dB 'typical'.

Distortion and noise: less than 0.2% at limit  
reference and 1k Hz.

### MODEL 92 DIGITAL DELAY

Type: single-channel ddl with two independently  
adjustable outputs.

Delay time: 0-120 ms in 7.5 ms steps.

Frequency response: 1, 2 dB, 20-12k Hz.

Dynamic range: 95 dB 'typical'.

Distortion and noise: less than 0.08% at limit  
reference and 1k Hz.

### VARISPEECH MODEL 27

This unit shifts pitch in real time from two times  
higher than normal to 0.4 times lower. It also incor-  
porates a recirculation feature and a front-panel  
mixer for mixing direct with shifted signals. The  
manufacturer quotes a dynamic range of 58 dB and a  
frequency range 100-5k Hz. The signal interface  
is 0 dBm nominal.

### PRIME TIME

This is a new ddl system that combines 'two out-  
puts, sophisticated time-base processing and  
complete mixing facilities in a single package'.  
(See photograph on page 42.)

### LOFT

Loft Modular Devices Inc, 91 Elm Street,  
Manchester, Conn 06040, USA.

Phone: (203) 646 7806.

### SERIES 440 ANALOG DELAY LINE/FLANGER

This unit will provide a wide variety of effects  
including slap-back, loudness enhancement, 'stereo  
synthesis', Doppler, flanging, Leslie-type sound,  
vibrato, altering reverb chamber characteristics,  
tunnel inversions, feed-back control, and double and  
triple tracking, with voltage-controlled pitch and  
timing errors 'for added realism'. The manufacturer  
claims bandwidth is 18k Hz at 40 ms delay and 9k Hz  
at 80 ms. A noise reduction system is incorporated.  
The sweep ratio is 10:1 and works in all four delay  
ranges to any degree desired. No quantising noise,  
step error, or offensive non-harmonic distortion  
are present as in digital delay systems. Three jacks  
are included for external control of line in/out,  
external voltage control of delay time, and for the  
voltage control of another secondary unit.

Frequency response: (bandwidth set control to  
18k Hz) 2 dB, 30-18k Hz in delay mode; -0.5 dB

20-20k Hz 'dry-only'.

Delay time: 0.5-150 ms in four ranges.

Noise: less than 75 dBm.

Distortion: typically 0.4%.

Price: \$750.

### MARSHALL

Marshall Electronic, Box 177, Joppa, Maryland  
21085, USA.

Phone: (301) 679 4837.

UK: Scenic Sounds Equipment, 97-99 Dean Street,  
London W1V 5RA.

Phone: 01-734 2812. Telex: 27939.

Agents in most countries.

### MODEL 5002 TIME MODULATOR

This is a time domain modifier incorporating two  
analogue delay lines that can be used serially or in  
conjunction with each other. A voltage controlled  
clock and an internal (0.1-10 Hz) sinewave generator  
enables delay control effects to be produced. In  
conjunction with both delay lines the time modula-  
tion effect produces a triple-track sound with or  
without harmonisation. Use of a common mixing  
buss creates the usual flanging effects between  
the delay lines and the cleanfeed signal. The maxi-  
mum delay period is 105 ms. Dynamic range is a  
claimed 80 dB and frequency range 15k Hz.  
Price: approx £1k.

### MODEL P250 500 PRE-REVERB DELAY

These two units are intended to head the input to  
a conventional plate or spring, thus offering pre-  
reverb delay variable between 10 and 250 ms (*Model  
P250*) or 10 and 500 ms (*Model P500*). Because they  
will inevitably be used with mechanical plates  
having a restricted specification, frequency range is  
limited to 8k Hz.

### MICMIX

MicMix Audio Products Inc, 2995 Ladybird Lane,  
Texas 75220, USA.

Phone: (214) 352 3811.

UK: Scenic Sounds Equipment, 97-99 Dean Street,  
London W1V 5RA.

Phone: 01-734 2812. Telex 27939.

Agents in most countries.

### DYNAFLANGER

This unit is claimed to possess the unique feature  
of being able to dynamically control the flanging  
effect in response to the program material. This is  
achieved by measuring the spectral or amplitude  
energy content of the input signal and 'instant-  
aneously developing and applying a corresponding  
control voltage to modify the resulting output  
signal'. Three modes of operation are offered:  
highpass filter, lowpass filter and envelope follower.  
In the filter modes the internal time delay for the  
flanging effect is dynamically varied according to  
the spectral distribution of the input signal. A  
tracking switch allows the notch spacings to  
increase or decrease with increasing input fre-  
quency. In the envelope-follower mode the flanging  
effect is dynamically controlled in accordance with  
the instantaneous peak amplitude envelope of the  
input signal. An unweighted residual output noise  
(20k Hz bandwidth) of less than -90 dBm is quoted  
for the direct signal output, and less than 78 dBm  
for the delayed.

Price: £492; \$800.

### MASTER ROOM SERIES REVERB

Reverb principle: spring.

Decay times: 3, 5 and 7s.

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The new MicMix Dynaflanger



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sound  
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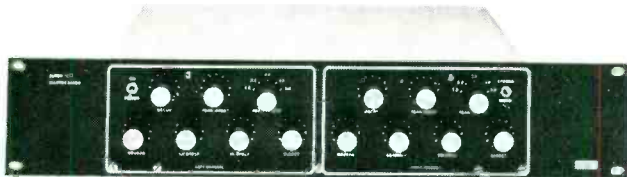
WILL BE  
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24

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APRS

# Master Room's Super 'C'

## Super 'C' Series Dual Channel Variable Decay Time Reverberation Unit

- Two independent channels with variable decay time of 1-3 seconds or 2-4 seconds
- Comprehensive reverberation return equalisation
- Provision for internal mixing of direct and reverberant signals
- Remote control capability



Other MICMIX Products Include :-

### Studio 'B' Series Reverberation Units

Single channel units with variable decay plus equalisation. In 1-3 or 2-4 second models.

### Master-Room Studio Series Reverberation Units

Fixed decay time single input/ stereophonic return. Available in 2, 5 and 7 second optimised fixed decay time models.

### Master Audio Meter

Stereo L.E.D. bar panel mounting meter switchable between peak or V.U. indication.



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Scenic Sounds Equipment,  
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Phone : 01 570 600

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S411-19 Gothenberg  
031-13-02-16

MIC-MIX Audio Products  
Dallas Texas



## SURVEY: REVERBERATION, DELAY AND SPECIAL EFFECTS

**Signal interface:** nominally +4 dBm.  
**Resistance to external noise:** 110 dB spl.  
**Controls:** 'brilliance'.  
**Price:** Master Room II £871; III £935; IV £1059.

### STUDIO B SERIES REVERB

Regarding signal interface and acoustic isolation, the Studio B series are similar to the Master Room Series. They also have the following operational features:

**Decay time:** B2 nominal 2s adjustable 1-2s; B3 nominal 3s adjustable 2-4s.

**Echo delay:** B2 20 ms, B3 50 ms.

Both models have a remote electronics box fitted with metering and decay, level and extensive middle frequency eq.

### SUPER C SERIES REVERB

Mainly as Studio B Series but with comprehensive equalisation facilities.

**Decay time:** as Studio B Series with same adjustment range.

**Distortion:** less than 0.1% on direct signal path; less than 5% reverb path.

**Noise:** better than -66 dB unweighted.

**Acoustic isolation:** 110 dB.

**Delay on echo:** 15 and 30 ms (Models 2 and 3 respectively).

**Price:** around £1380.

### MXR

**MXR Innovations Inc, 227 North Goodman Street, Rochester, NY 14607, USA.**  
**Phone:** (716) 442 5320.

**UK:** Rose Morris & Co Ltd, 32/34 Gordon House Road, London NW5 1NE.  
 Agents in most countries.

No information received.

### ORBAN

**Orban Associates Inc, 645 Bryant Street, San Francisco, Ca 94107, USA.**

**Phone:** (415) 957 1063.

**UK:** Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.

**Phone:** 01-734 2812. Telex: 27939.

Agents in most countries.

### 111B REVERB

**Type:** two-channel spring reverb unit with four spring lines per channel.

**Decay time:** about 2s to -40 dB.

**Delay time:** 30 ms between direct path and onset of reverberation.

**Features:** built-in limiter can operate in fixed or floating threshold modes to eliminate unwanted noises (eg 'twangs' and 'bongs') due to step changes in programme levels; bass-shelf eq at 500 Hz and parametric eq on middle giving control of frequency, boost and bandwidth.

### 245E STEREO SYNTHESISER

This unit is for the generation of simulated stereo from mono sources. Front-panel controls comprise 'dimension' (high-and low-frequency processing), 'separation' and 'gain'.

### PUBLISON

**Publison Audio Professional, 5-11 Rue Crespin Du Gast, 75011 Paris, France.**

**Phone:** 357 6408.

### HDM 83A HARMONIZER

This unit has a digital random-access memory and can operate in three basic modes: stereo delay up to 360 ms (5k Hz bandwidth); real-time frequency shifting up to .1 octave; 'harmonisation on memorised sound'.



Quad-Eight CPR-16 programmable reverb

### QUAD/EIGHT

**Quad/Eight International, 11929 Vose Street, North Hollywood, Ca 91605, USA.**

**Phone:** (213) 764 1516. Telex: 662446.

**UK:** Audio Kinetics (UK) Ltd, Verulam Road, St Albans, Herts AL3 4DH.

**Phone:** 0727-32191.

**Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.**

**Phone:** 01-580 4314. Telex: 28668.

Agents in most countries.

### CPR-16 REVERB

**Type:** programmable electronic reverb system.

**Effects:** acoustic chambers, mechanical plates, spring lines and tape loops.

**Reverb decay time:** 250 ms to 20s, adjustable.

**Controls:** decay time ('room size'), high-frequency damping, low-frequency filtering and program select.

**Noise:** less than 80 dBm.

**Dynamic range:** better than 80 dB.

**Price:** \$6.5k.

### QUANTUM

**Quantum Audio Labs Inc, 1905 Riverside Drive, Glendale, Ca 91201, USA.**

**Phone:** (213) 841 0970.

### QA-201 REVERB

This stereo chamber utilises two Accutronics reverb units, with each channel being provided with its own input level and high-frequency tone control. A built-in compressor-limiter is said to permit optimum drive to each reverb unit.

### SOUND WORKSHOP

**Sound Workshop Professional Audio Products, 1038 Northern Boulevard, Roslyn, NY 11576, USA.**

**Phone:** (516) 621 6710.

No information received.

### STRAMP

**Peter Strüven GmbH, Bornheide 19, 2000-Hamburg 53, West Germany.**

**Phone:** 040-801028.

### ECHO-700

This is a combined stereo echo (plus reverb), phaser and vibrato unit. Also because the delay and effects sections can be linked other special effects may be created. Delay time for the first

echo is continuously variable to a maximum of 300ms. Frequency range of the delay chain is claimed to exceed 8k Hz 'flat' (original signal: 20-20k Hz).

### SURREY ELECTRICS

**Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG, UK.**

**Phone:** 04866-5997.

Agents in France, Greece, Holland, HongKong, Singapore and Switzerland.

### SPECTRUM SHIFTER

Shifts the audio spectrum up or down by any amount between 0.1 and 1000 Hz for special effects on music or speech. Over very small frequency increments, it can be used for pitch correction; however, the frequency shift is an absolute value for all input signals resulting in an atonal output.  
**Price:** £170, \$290.

### UREI

**United Recording Electronic Industries, 11922 Valerio Street, North Hollywood, Ca 91605, USA.**

**Phone:** (213) 767 1000. Telex: 651389.

**Export:** Gotham Export Corp, 741 Washington Street, New York, NY 10014.

**Phone:** (212) 741 7411. Telex: 129269.

**UK:** FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ.

**Phone:** 01-953 0091. Telex: 27502.

### COOPER TIME CUBE

**Delay principle:** acoustic.

**Delay period:** 14 ms and 16 ms, separate channels.

**Frequency response:** ±2 dB, 40-10k Hz.

**Controls:** input gain (2), meter switch.

**Other features:** channel separation 40 dB. Can be cascaded for total delay of 30 ms.

**Noise:** 70 dB below full output. 15.7k Hz bandwidth.

### URSA MAJOR

**Ursa Major, Box 18, Belmont, Ma 02178, USA.**

**Phone:** (617) 489 2039.

### SST-282 SPACE STATION

This is a digital reverb system comprising a 10-input mixer, digital delay line and reverberation processor. Eight outputs from the delay line are returned to the mixer where they can be combined with the source in any desired mix and ratio. Specifications include 80 dB dynamic range, 0.2% maximum distortion and noise, and 30-7k Hz frequency range. Maximum delay time is 256 ms; reverb decay time is adjustable from 0 to 4s. Price: approx \$3k.

### WMS

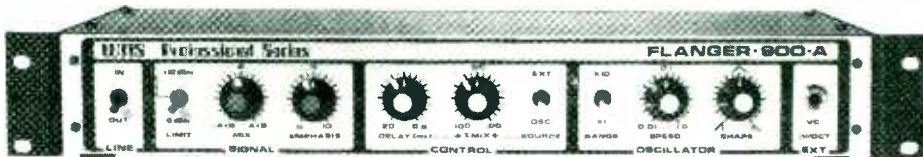
**Wasatch Music Systems, Box 9175, Salt Lake City, Utah 84109, USA.**

**Phone:** (801) 467 4722.

### 900-A

This is a digital delay capable of producing a variety of effects, including negative and positive flanging, Doppler, vibrato and chorus, pitch shifting, adt, 'Leslie speaker simulation' and cardboard tube echo. Delay is variable up to a maximum of 20 ms. Price: approx \$350.

WMS model 900A delay line/flanger



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| 1 Ampex MM1100 16 track with auto locate ...             | £9,750  |
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| 1 Tascam 80-8, DX 8, remote new                          | £2,600  |
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| 1 Neve 20-16 mixing desk ...                             | £15,000 |
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| 2 Grampian 636 Reverb ...                                | £60     |
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| Telefunken M9 valve stereo ...                         | £300   |
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| ITA compliment comp/lim ...                            | £177   |
| Audio Developments 20-4 desk as new                    | £3,500 |
| Rosser 10-4 Broadcast desk ...                         | £1,800 |
| Allen & Heath 16-8-16 desk ...                         | £1,900 |
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| A & D scamp racks & PSU ...                            | £200   |
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| Racal Zonal 1/4" on cores ...                          | £2.75  |
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# work

## Roundhouse

You've all heard of the Roundhouse in Chalk Farm, haven't you—the circular engine shed built in 1847, designed by Robert Stephenson for the London and North West Railway, later used in 1869 by W and A Gilbey as a liquor warehouse, before being acquired by the Roundhouse Trust charity in 1964. In the ten years since it was first used as a public venue, the Roundhouse, huge at a volume of 93 000m<sup>3</sup>, has been noted for its excellent rock and theatrical offerings. (Remember those legendary 'Implosion' Sunday rock sessions of the late Sixties?) All in all, this magnificent 1000 seater-by-default has Chalk Farm-ed up quite a name for itself to theatregoers and music fans alike.

Next door, however, is a very modern block housing, among other things, Roundhouse Studios. This is where a lot of people first start to get confused. They think Roundhouse Studios are owned by, residing in, or dependent on, the Roundhouse Theatre. Well, they're not. The only connection with The Roundhouse Theatre is the name and, incidentally, 24 balanced audio plus video monitor lines from the theatre for live recording.

Roundhouse Studios were purpose-built in 1974 by Gerry Bron, of Bronze Records, whose offices are accommodated in the same building. Bronze book into the studio like any other client, and account for around 30% of the

studio's business. Bron's record company and later studio blossomed from the fruits of his father's music publishing business, which specialised in part arrangements of pop music for dance bands and light orchestras—a fraternity otherwise on the decline. Bronze's best-known act is the gilt-edged Manfred Mann's Earth Band, whom they acquired during the band's first tastes of chart success in the late Sixties.

During my visit in early March the studio complex reception area was being re-built. 'People that use us a lot get the impression we're always in the process of building,' said Peter Gallen, who was an engineer at Lansdowne Studios before joining Roundhouse as studio manager two years ago. 'But we're nearing completion now, and will effectively re-launch the studio when work is complete to dispel that image'.

The Studio comprises a large control room, elevated by one storey with respect to the high-ceilinging studio, onto which it looks via a double glass panel. The studio proper backs onto the new mixing room and overdubbing just-lounging

lounge, recently converted from an air-conditioning plant area.

Let's start with the mixing room. A Harrison 32/32 desk, the only one in the UK, faces four JBL 4343 monitors (two left and two right) powered by Yamaha B1 and Studer A68 amplifiers for top and bass-mid spectra respectively. The mastering A80 and 4-channel B62 tape machines occupy recessed bays. Over the shoulder from the desk are effects and ancillary devices mounted in a wall of recessed 483 mm racks. Units installed include Eventide *Harmoniser* and *Flanger*, Marshall *Time Modulator*, dbx and Universal Audio limiters, Orban Parasound sibilance limiter, Lexicon *Delta-T* ddl... an inventory of auxiliary gear without which it seems no big studio is complete. In jockey position is a tv monitor panel housing three miniature screens and their controls. These are connected, via video landlines, to remote-controlled cameras installed in the Roundhouse Theatre. A plug-in box provides joystick control of the cameras, the entire installation serving to visually monitor live recording from the

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Left: Trevor Halley at the controls of the Lyrec autolocator in the Harrison-equipped remix room.



Right: Mark Dearnley tweaking the L-shaped Cadac desk in the studio control room.





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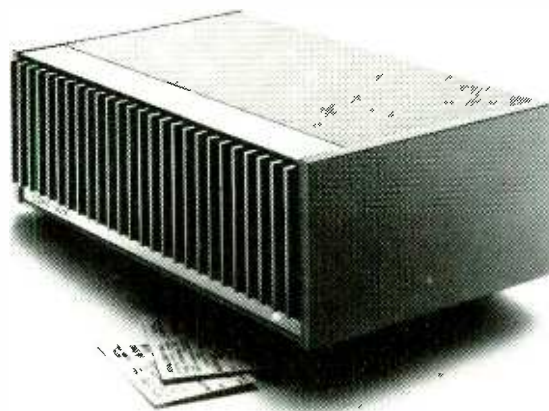
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## WORK

theatre. Control and monitor panels are ultimately to be moved to a point above the desk, in the cause of ergonomics.

Standing majestically to the right of the desk is the Lyrec 24-track tape machine, chosen for its combination of quality and ease of servicing. (They also liked the remote control box.) A solid-state EMT 250 reverb unit stands nearby, on loan from UK agents FWO Bauch. It's going back soon, having been considered too expensive for the studio's need. Conventional reverb is provided by three centrally-patched quadraphonic EMT 140 plates located next door in the new air conditioning room.

At the time of writing the Harrison desk was hooked up to the Allison 65k automation system. 'That's in fact going back', Peter Gallen told me. 'We're expecting the Harrison [Auto Ser] system shortly. The Allison system digitalises the 32 vc fader positions and encodes that one mix option on one track of the 24-track tape. If you want to store an alternative mix you use another track. But with the Harrison system you can encode four mixes onto one track. You end up with seven mix options over two tracks, which is an improvement, and you can mix between mixes. It also has a system where you needn't use tape at all; you can store a total of 630 of what they call "snapshot mixes", on a cartridge.'

Pete Oswald, Roundhouse's chief technician, took up the story: 'It's just the same as writing all the positions of the faders and channel mutes down on a piece of paper, or rather a writing pad with 630 sheets. On the automation module there's

a fader which can fade the console between any of the snapshot settings. If at a certain time you wanted to bring, say, a certain track up, you would go to the next snapshot which was arranged to bring that track up. It's a very useful system—without using tape.'

'If the automation system is anything like the Harrison desk we use,' commented Peter Gallen, 'it's got to be good.'

The desk features 4-band parametric eq on each input channel, with 'very nice' parametric high and lowpass filters which, between them, cover the entire audio spectrum; hence comprehensive narrow-bandpass or notch shapes can be selected easily. The vu metering is of the plasma display light band type, mounted vertically, with red tinting above zero vu. These can be switched to compare snapshot levels when linked to the Harrison automation unit for level matching.

Two stereo foldback and echo sends are selectable per channel, and the entire desk is wired for quad. A 24+8 Dolby noise-reduction unit feeds the Lyrec 24-track and patch panel respectively.

'The desk in the studio is a Cadac. We feel there is something to be gained by having two different desks', said Peter Gallen, 'when both are as good as the Cadac and the Harrison. The two respective eq systems look at the sound in slightly different ways, giving us flexibility.'

The mixing room, quite small at 18m<sup>2</sup>, is wood panelled throughout, creating a 'bright' but natural impression. 'The whole thing about acoustics,' philosophied Pete Oswald, 'is to maintain a natural sound. If your mind is all the time fighting against alien acoustics, you get tired very quickly. It's

something that totally untechnical people feel as well, without perhaps realising why.'

'We had a client in on Sunday,' Peter Gallen recalled. 'And he was in here for 14 hours. When he came in he said he thought it was going to get claustrophobic. But when he left at two in the morning, he said he hadn't been conscious of the room at all. Which of course is the kind of compliment we are looking for, to back our judgement! Whose judgement? Peter Gallen, Pete Oswald, and architect Ken Worrell, who between them designed the acoustics. The studio is literally just the other side of the wall, yet no crosstalk problems have been experienced to date.'

In passing I was impressed by the mighty spring-closing single doors that isolated adjacent rooms: all at least 30 cm thick and fitted with double-glass panels which somehow disguised the true weight and thickness of the door. They were also highly sound-proof.

And so onto the control room; with 55m<sup>2</sup> of floor area it's larger than average. The relaxing spaciousness, I was happy to note, remained intact rather than being ruined by a clutter of equipment everywhere, or over-furnishing. JBL 4350 monitors stand on redundant Cadac enclosures either side of the double-glass panel, powered as in the mixing room by Yamaha and Studer amps. The Cadac 28/24 desk facing these is the same as when the studio first opened and there are no plans to automate. Small-speaker, 'domestic reference' monitoring is via cheap but genuine lo-fi units from Radio Spares, preferred to their Auratone brothers in the mixing room, which may be replaced. On the back wall are an army of ancillary devices, duplicating the mixing room com-

plement with one or two extras.

Sissal acoustically-transparent cloth coats a selection of absorbents randomly distributed on the walls, the studio and control room suite acoustics originally being designed by Eddie Veal and later modified by Roundhouse Studios.

On the other side of the double-glass, the studio, with 104m<sup>2</sup> of floor area and high ceiling, is an imposing sight. A central, elongated circle of vinyl tiling makes for a bright, reflective characteristic, while the surrounding carpet provides a more subdued sound. Screening, where necessary, is provided by a stock of Sonaplan mobile acoustic screens. Accommodating '40-ish with comfort' musicians, the studio offers them a Steinway B Grand piano, in addition to a range of electronic keyboard instruments. The studio ceiling is a Rockwool/perforated aluminium combination, inset with independently dimmable lights of various colours to suit most moods. Normal and reverse talkback mics and loudspeakers lie hidden behind the perforated aluminium. Microphone and foldback panels are provided in logical positions on the walls. Foldback-to-cans level is controlled via plug-in boxes, a technique employed also in the mixing room's overdubbing lounge.

All in all, an enjoyable visit. The new mixing/overdub suite was obviously an afterthought, and for this reason is perhaps smaller than one built-in from scratch. But as Peter Gallen said it seems to work. The prospects of 46-channel updating is already being considered and once the whole installation has settled in and lost its brand-new image, it will be a useful asset to what is, by observation and all accounts, a good studio.

Richard Dean

## AES PREVIEW

Also to be seen: the company's parametric equaliser, stereo compressor-limiter and low-frequency oscillator with frequency counter.

Two new stereo power amplifiers can be seen on the Uni-Sync stand: the Models 50 and 100 capable of delivering 50W and 100W respectively. Features include individual input attenuators; mono/stereo bridging switch; peak/protect indicator; and separate power supplies for each channel. A stereo version of the Troupier 1 pa mixer and the Model 1003 microphone splitter will also be exhibited.

The Model 539 room equalisation filter set to be demonstrated by Urei features up to 20 dB make-up gain, plus band-end high and lowpass filters. A better than 110 dB signal-to-noise ratio at maximum output is claimed.

The new SST-282 Space Station digital reverberation system will be shown by Ursa

Major. It comprises a digital delay line (maximum delay 256 ms), reverberation processor (0-4s reverb) and 9-input to stereo mixer, with facilities for combining up to eight delayed signals with the original sound. The manufacturer claims that virtually any pattern of direct sound, early reflections and reverberation can be obtained by suitable adjustment of the controls. These include initial delay, decay time, 'room size' and high and low-frequency equalisation. The digital processor is switch-programmable for many different reverb and delay effects. Specifications in the delay mode are a quoted 80 dB dynamic range, 0.2% maximum distortion and noise, and 30-7k Hz frequency range.

The new Trans-Amp LZ channel amplifier to be seen on the Valley People stand is described as a 'fully-balanced, differential-in/differential-out device using symmetrically opposed feedback loops.'

The Model 900-A flanger, which is said to be

capable of producing six octaves of flanging without input aliasing or quantisation noise on the output, will be demonstrated by Wasatch Music Systems. Available effects range from pitch shift, vibrato, and adt to chorus and 'Leslie cabinet' simulation etc. Also on show: the company's range of equalisers, phasers and flangers, including the Models 1080A and 1080B 'interphasers'.

The new Series 4300  $\frac{1}{3}$ -octave band active equalisers and the model 200 real-time analyser are to be exhibited by White Instruments. Features of the Series 4300 include  $\frac{1}{3}$ -octave resolution from 40 to 894 Hz and  $\frac{1}{2}$ -octave resolution from 1k Hz through 16k Hz. Control range is  $\pm 10$  dB. The model 200  $\frac{1}{3}$ -octave analyser may be used in both average and peak-reading modes, and has three selectable time constants, eight memory registers, and a 40-140 dB range. Plug-in options are also available for RT<sub>60</sub>,  $\frac{1}{3}$ -octave and octave measurements. ■

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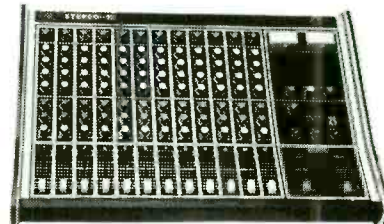


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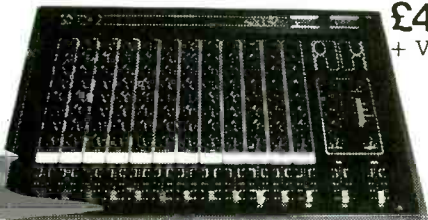
on demonstration with companion echo/effects module.



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# reviews

## Studer B67 tape machine



Hugh Ford

### MANUFACTURER'S SPECIFICATION

**Tape speeds:** 38 cm/s, 19 cm/s, 9.5 cm/s  $\pm 0.1\%$  or 76/38/19 cm/s version.

**Reel types:** DIN, NAB, Cine up to 265 mm.

**Tape slip:** 0.1% or less.

**Wow & flutter:** 38 cm/s 19 cm/s  
Measured with 0.06% or less 0.08% or less  
EMT 420, 9.5 cm/s  
DIN 45407, peak value weighted 0.12% or less

**Starting timer:** 0.5s or less, to reach double specified wow and flutter value.

**Tape timer:** 0.5% timing and repeated timing accuracy; indicating minutes and seconds, realtime indication for 19 cm/s.

**Rewind time:** approximately 120s for 700m reel.

**Stopping time:** 5s or less from fast winding mode.

**Operational tape tension:** 600P at start, stop and change of wind direction; 90P  $\pm 10P$  during play or fast winding modes.

**Line inputs:** balanced and floating; input impedance 5k ohm; minimum input level  $-20$  dBm; maximum input level  $+22$  dBm.

**Line outputs:** balanced and floating; output impedance 50 ohm or less (minimum load impedance 200 ohm); maximum undistorted output level  $+22$  dBm/600 ohm;  $+20$  dBm/200 ohm.

**Equalisation:** switchable for NAB or CCIR.

**Frequency response:** 38 cm/s 19 cm/s  
 $\pm 2$  dB 30-18k Hz 30-15k Hz  
(record/reproduce)  $\pm 1$  dB 60-15k Hz 60-12k Hz  
9.5 cm/s  
 $\pm 2$  dB 40-12k Hz  
 $\pm 1$  dB 60-10k Hz

**Signal-to-noise ratio:** record/reproduce rms  
38 cm/s 19 cm/s 9.5 cm/s

**CCIR equalisation\***  
full track (320 nWb/m)  
weighted 61 dB 58 dB 55 dB  
unweighted 61 dB 58 dB 55 dB  
stereo 2.75 mm track width (510 nWb/m)  
weighted 61 dB 58 dB 55 dB  
unweighted 61 dB 58 dB 55 dB  
two-track 2 mm track width (320 nWb/m)  
weighted 56 dB 54 dB 52 dB  
unweighted 56 dB 54 dB 52 dB

**NAB equalisation\*\***  
referred to 6 dB above operating level; unweighted noise in accordance with NAB standard  
full track 65 dB 65 dB 63 dB  
stereo 62 dB 62 dB 60 dB  
two track 61 dB 61 dB 59 dB

**Distortion at 1k Hz:**  
38 cm/s 19 cm/s 9.5 cm/s

**CCIR equalisation\***  
320 nWb/m 1% or less 1% or less 2% or less  
510 nWb/m 2% or less 2% or less 3% or less

**NAB equalisation\*\***  
185 nWb/m 1% or less 1% or less 1.5% or less

**Crosstalk** 40 dB or more, 80-12k Hz

**rejection, stereo:** (1k Hz  $-45$  dB).

**Erase efficiency:** 75 dB or more at 1k Hz and 38 cm/s.

**Bias frequency:** 150k Hz at all tape speeds.

**Erase frequency:** 150k Hz at all tape speeds.

**Weight:** 34 kg.

**VU meter option:** ASA Standard, meter switchable  $+4$  dBm,  $+6$  dBm,  $+8$  dBm, peak indication (led) by IEC recommendation.

**Price:** £2465.

\*Measured with Agfa PER 525 or equivalent (38 and 19 cm/s), 3M 207 (9.5 cm/s).

\*\*Measured with 3M 207 or equivalent; operating level 185 nWb/m tape flux.

**Manufacturer: Studer International AG, CH-5430 Wettingen, Switzerland.**  
**UK agent: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts.**

THE Studer B67 is based on the tape transport which was originally used in the Revox A700 (see October 1975 issue of STUDIO SOUND) and subsequently in the Studer A67. However, the three machines all have differences in the transport, with the Studer B67 being the most 'professional' of the three versions.

In addition to the transport differences, the B67 electronics in the signal path are new, and include equalisation switching between CCIR and NAB by means of jumpers on the circuit boards. A choice of record amplifier sensitivity and also vu meter sensitivity is also available by means of other circuit-board jumpers.

The review machine was a console version of the B67, including a 'penthouse' with vu meters and a monitor amplifier. This can be pushbutton-switched to monitor either of the two tracks or the sum signal on a small loudspeaker. Input and output sensitivities can be altered by means of potentiometers on the penthouse, there being a fixed/variable sensitivity switch for the input and output (simultaneously) of each channel. Also included in the penthouse are switches for selecting the source of the line output between input, reproduce or sync where this facility is fitted. In addition there are 'safe record' buttons with nearby green 'ready' lights and red 'record' lights.

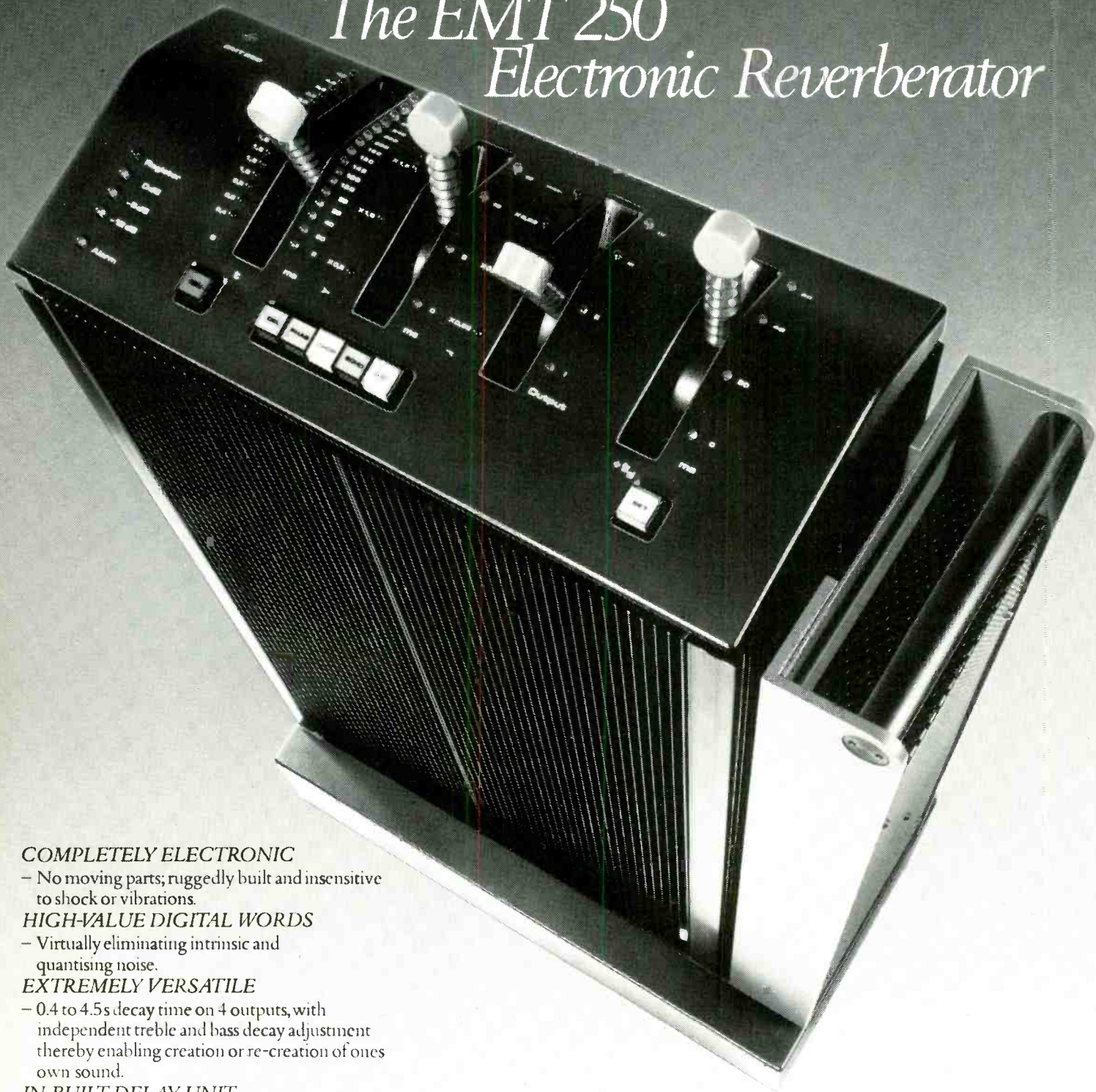
In fact there are a very large number of versions of the Studer B67 available, including eight portable versions, a console for housing portable versions, monitoring facilities within the tape transport etc, plus of course headblocks for mono, stereo or twin-track and also pilot-tone facilities.

The tape transport is based on a substantial flanged alloy casting, to which the major tape transport components are mounted, including the plug-in headblock. The reel motors are of the outer-rotor type with band brakes on separate drums mounted onto the motor shaft. NAB adaptors are provided for spools up to 267 mm diameter.

From the pay-off spool the tape passes over a tension-sensing roller that electronically servo-controls the tape tension (found to remain constant at 60 gm), over a large diameter roller and thence to the headblock. This is a solid alloy casting that bolts down onto the main transport casting at three points. The bolts are Allen screws without retainers, such that they were easily lost when changing heads. Within the headblock the tape first passes the ferrite erase head and then a manually-operated tape lifter, which can be used to drop the tape onto the record and erase heads. Next comes the record head, a precision flutter roller and then the replay head, followed by a fixed guide with a spring-loaded lower reference face and the automatic tape lifter. The capstan is directly driven from a servo motor, the latter having the usual Studer feature of a very long shaft coupled to a solenoid-operated pinch roller. After the capstan there is another feature of Studer machines—a pair of pushbutton-operated editing scissors for use with an editing block mounted on the head cover. The tape passes a solid-state optical tape presence sensor, another fixed guide and then the large diameter tape counter

82 ►

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## REVIEW: STUDER B67

roller onto the take-up spool. This is provided with a tape tension sensor that provides a constant tape tension found to be 80 gm.

Both the record and the replay heads are well shielded. The replay head has a hum shield that can be positioned manually by pushing it down to lock out of the tape path. A similar shield is provided for the record head on sync-equipped machines. The overall standard of finish of the machine is excellent. The *B67* version is equipped with phosphor-bronze bearings for the tape guides, while the head azimuth can be adjusted by means of Allen screws that oppose tension from disc springs on the other side of the heads.

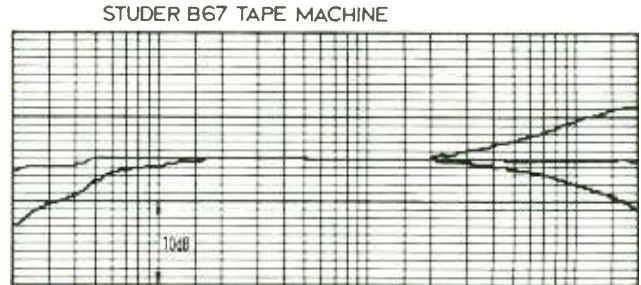
An electronic tape time indicating hours, minutes and seconds in realtime for all three tape speeds is provided. The time is derived from the exit roller after the headblock, this roller being fitted with an optical sensor that feeds the tape timer logic. Adjacent to the tape timer is a reset button and the three speed selection buttons, one of these being illuminated when capstan synchronism has been achieved. While the review machine was a 76/38/19 cm/s version, an alternative slow speed version is available with 38, 19/9.5 cm/s.

The basic tape transport control is by means of the usual replay/record/stop and fast-wind buttons, all of which are electronically interlocked such that it was found to be impossible to damage the tape. In addition there are six further pushbutton controls, including power on/off and pause. One of the extra buttons rewinds the tape when depressed, and the machine reverts to the play mode when released—a useful feature for finding edit points without having to operate the rewind and start functions.

A 'motor off' switch disables the right-hand reel motor and thus provides a dump edit mode. The two further buttons are unusual features. The first is a 'fader start' function, whereby the local start button and the remote control functions are inhibited, such that the tape transport can only be started in the play mode from external connections. The other transport control is an 'auto' mode. In this mode the transport stops if it finds leader tape on the reel and rewinds. It may then either stop or re-enter the play mode and repeat a section of tape according to the jumper positioning on the transport control board.

To the rear of the machine all connections are mounted on a sub-frame, such that they can point to the rear of the machine for console mounting or to the bottom of the machine when rack mounting is required. The audio inputs and outputs are by means of standard *XLR*-type connectors which provide floating signal connections; male and female connections can be interchanged by internal connectors—a useful feature. In addition to the IEC standard power connection there are three multiway connectors. One of these feeds the penthouse containing the gain controls, monitoring and level indicators. The other connectors provide for external capstan speed control and remote control respectively. The speed control includes remote indication of capstan synchronisation, plus control of capstan speed by means of a 0–5V external pulse train. Remote control by

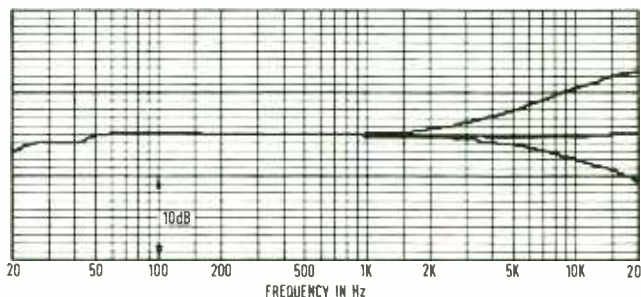
**FIG. 1**  
REPLAY  
EQUALISATION  
RANGE



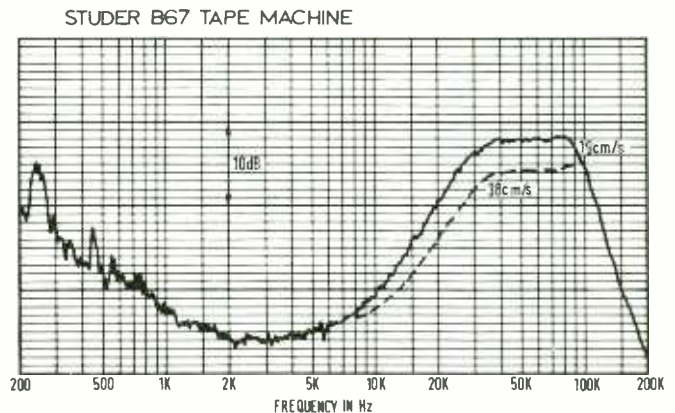
**FIG. 3**  
OVERALL  
FREQUENCY  
RESPONSE  
ZERO LEVEL: -10dB  
ref 200nWb/m



**FIG. 4**  
RECORD  
EQUALISATION  
AT 38 cm/s



**FIG. 2**  
SPECTRUM  
ANALYSIS OF  
OUTPUT NOISE



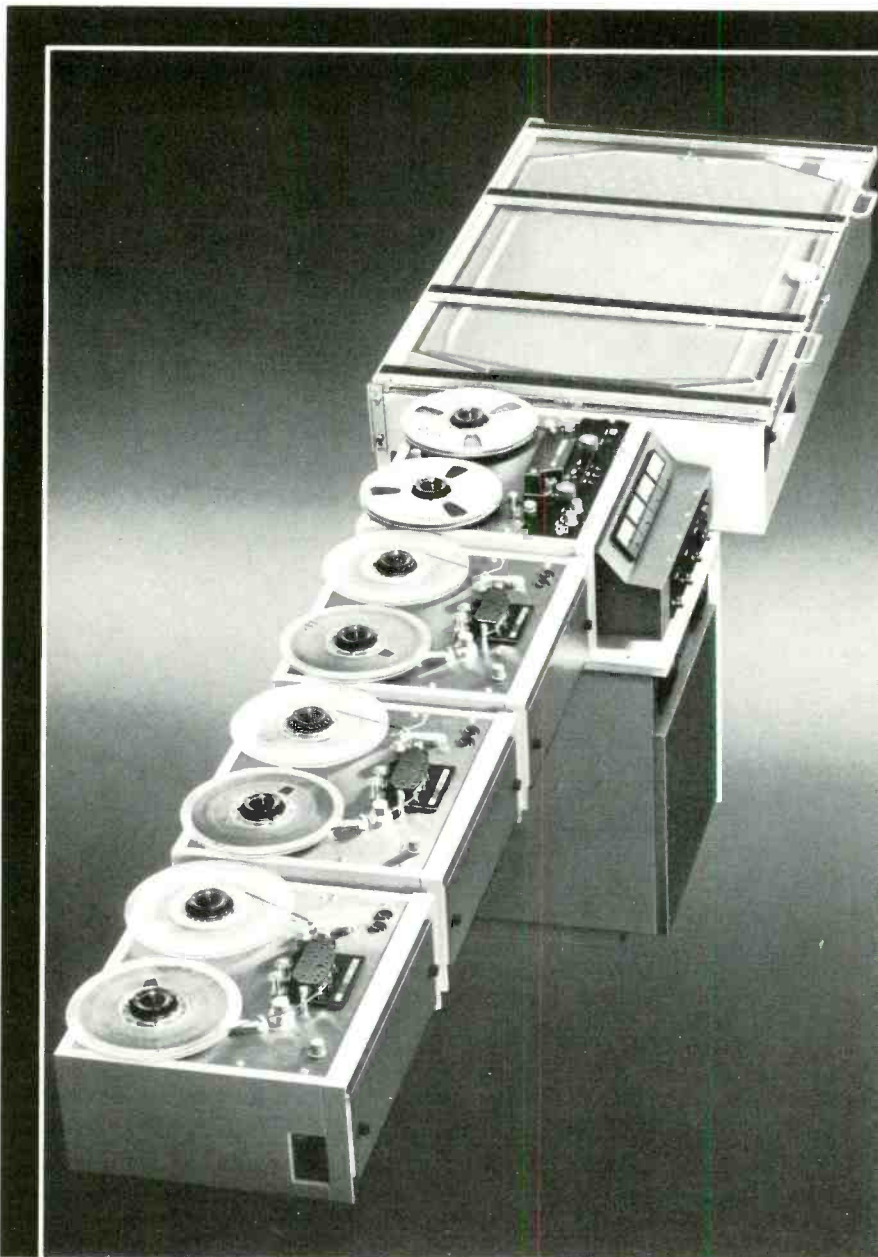
the other connector includes the usual tape transport functions, together with the appropriate indicator lamps and the 'fader start' feature.

While all the logic for the transport controls, the tape time electronics and the capstan servo are mounted on printed-circuit boards within the tape transport housing, the signal electronics are contained within a separate card

frame which can be mounted in different positions depending upon the configuration of the machine. This card frame has a rear mother board into which the signal electronics boards are plugged by means of very good quality pin-type connectors. Good quality, double-sided glass-fibre pcbs are employed to house the components, which are all of professional quality. 84▶

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## REVIEW: STUDER B67

In the review machine there were seven boards, comprising a voltage stabiliser, master oscillator, overload detector and two each replay amplifier and record amplifier. Although the overload detector board has only two controls (one for each channel) to adjust the point at which the red led overload indicators are illuminated, each of the signal electronics boards has nine potentiometer controls. In the case of the replay amplifiers each of the three tape speeds has an equalisation control for the treble and bass, plus a playback level control for each speed and a single crosstalk correction control. On the board there are two sets of jumpers for each tape speed. One set provides a choice of two high frequency equalisations for each speed, and the other 3180  $\mu$ s bass equalisation in or out.

On the record amplifier board there are bias, level and high frequency equalisation controls for each tape speed, plus a 'pre-adjust' control for overall record gain. Like the replay amplifiers there are jumpers for choosing one of two record equalisations, but there is an additional jumper for changing the record gain in 10 dB increments from 'normal' to -10, -20 or -30 dB line input level.

The remaining operational features are to be found in the penthouse housing the vu meters. Jumper facilities provide for zero vu to correspond to 0, +4, +6 or +8 dBm. In addition there is a 600 ohm termination that can be jumper selected.

### Replay performance

The replay frequency response, as supplied, was set to the AES standard at the highest tape speed of 76 cm/s and to the NAB standard at the two lower speeds. Checking the response by means of MRL calibration tapes showed the the machine was within  $\pm 1$  dB of the calibration tapes over their full frequency range, with the replay amplifier equalisers having a wide range. Typical of this is shown in fig. 1 for the tape speed of 38 cm/s, where there is  $\pm 5$  dB range of adjustment at 15k Hz.

An indication of zero vu was found to correspond to a recorded fluxivity of 200 nWb/m, which measured +4 dBm at the outputs, the replay amplifier gain controls giving a range of outputs from -2.5 to +23 dBm. The maximum drive capability of the replay amplifiers was found to be +25.4 dBm, either loaded into 600 ohm or into an open circuit. Similarly, the point at which the replay amplifier overloads was such that at 18 dB above a fluxivity of 320 nWb/m there was no sign of distortion; so there is a very adequate margin for future tape types.

Measurement of replay noise without tape and with 3M 206 tape recorded on the machine without any audio signal gave the results in table 1. However, it was found that particularly at the lowest tape speed the machine's noise spectrum was such that A-weighted measurements are unreliable. Part of the cause for this can be seen from fig. 2, which is a spectrum analysis of the machine's noise output at tape speed settings of 38 cm/s and 19 cm/s. It can be seen that particularly at the lower tape speed there is substantial high-frequency energy above 20k Hz; it is in this area that the

specification for the A-weighting is 'loose'. In order to eliminate this effect the following A-weighted results in table 1 include a 22k Hz lowpass filter, since it is not felt that these very high-frequency noise components are of subjective significance. It is understood, however, that Studer are paying attention to this problem.

TABLE 2 REPLAY NOISE

|  | Reference level<br>(320 nWb/m to noise ratio) |         |                   |         |
|--|---|---------|-------------------|---------|
|  | Machine only                                  |         | Machine with tape |         |
|  | 19 &<br>38 cm/s                               | 76 cm/s | 19 &<br>38 cm/s   | 76 cm/s |
| Band limited                             |   |         |                   |         |
| 20-20k Hz                                | 60 dB   | 60 dB   | 58 dB             | 58 dB   |
| A-weighted rms<br>(see text)             | 74 dB   | 79 dB   | 65 dB             | 70 dB   |
| CCIR-weighted<br>rms ref 1k Hz           | 69 dB   | 72 dB   | 57 dB             | 61 dB   |
| CCIR-weighted<br>quasi-peak<br>ref 1k Hz | 64 dB   | 67 dB   | 52 dB             | 56 dB   |

The weighted results in table 1 show an excellent margin between the inherent machine noise and noise from a low-noise tape such as 3M 206. Furthermore, while the results are an average of the two channels there was little difference between them, and the hum shield on the replay head was effective.

### Record replay performance

All record/replay parameters were determined using 3M 206 tape in the NAB equalisation mode (as suggested by the manufacturer). The overall frequency response for the three tape speeds is shown in fig. 3. It can be seen that the overall frequency response is flat at all three tape speeds and well within the manufacturer's specification. While there is no adjustable equalisation at low frequencies, the range of the treble equaliser at the tape speed is satisfactory, as shown in fig. 4. Furthermore, the range of the bias level control was found to be wide.

At all tape speeds 3% third harmonic distortion at 1k Hz was found to occur at +9.5 dB reference 320 nWb/m, the third harmonic distortion at the reference level of 320 nWb/m being 0.6%. Fig. 5 shows the relation between third harmonic distortion and frequency at 38 cm/s.

Intermodulation distortion to the CCIF twin-tone method with 70 Hz separation between the tones and looking at the third-order difference frequency component is shown in fig. 6, which illustrates a 'clean' performance.

Crosstalk resulting from recording tone on one track, bias and erase only on the other track and then replaying the tape was remarkably good. Fig. 7 shows crosstalk at -68 dB at mid-frequencies with the expected rise at very low frequencies. Similarly the erasing capability was found to be excellent, with a 1k Hz tone at 38 cm/s tape speed being erased to -90 dB on the first pass with the 3M 206 tape.

The result of recording and reproducing a 1k Hz squarewave is given in the oscillogram, fig. 8, which shows slight ringing but otherwise a clean reproduction of the original squarewave.

### Inputs and outputs

Both the inputs and the outputs are floating connections that had been adjusted such that



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## REVIEW : STUDER B67

200 nWb/m fluxivity on tape corresponded to +4 dBm and to an indication of 0 vu. The output drive capability was found to be +25.4 dBm for the onset of waveform clipping into either an open circuit or 600 ohm, there being no significant difference in level due to the nice and low output impedance of 40 ohm. Similarly the input had an adequately high input impedance which was constant at 15 700 ohm. The input sensitivity for an indication of 0 vu was variable from -8.7 dBm (286 mV) for the standard setting of the vu meters.

Checking the performance of the vu meters showed that they were average reading meters as per the ASA Standard C16.5, and that their risetime was also correct to the standard. The fall time, however, was on the long side and not very well damped.

The red led peak indicator light was found

to be a fast acting device which operated in about 5 ms for mild overload conditions, the onset of indicated overload being adjustable and being set to +7 dB reference 320 nWb/m as received. Clearly this is a very useful feature in conjunction with vu meters and the setting as found was good for the recommended tape.

### Wow, flutter and speed

Measurement of the weighted wow and flutter to the IEC quasi-peak method yielded extraordinarily good results at all speeds (table 2).

88 ▶

FIG. 8 Replayed squarewave at 38 cm/s.

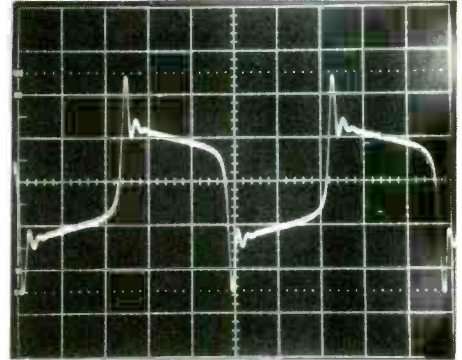


TABLE 2 WOW AND FLUTTER

| Nominal speed | beginning | middle | end    |
|---------------|-----------|--------|--------|
| 76 cm/s       | 0.015%    | 0.015% | 0.02%  |
| 38 cm/s       | 0.015%    | 0.015% | 0.023% |
| 19 cm/s       | 0.03%     | 0.025% | 0.032% |

FIG. 5  
THIRD HARMONIC  
DISTORTION  
AT 38cm/s

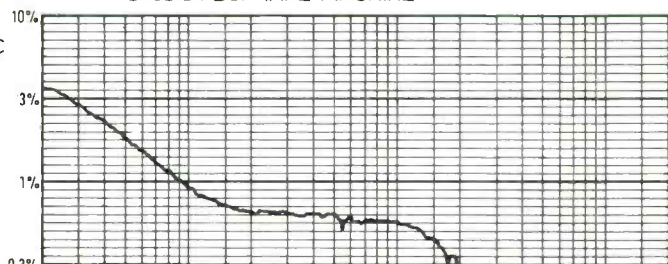


FIG. 6  
INTERMODULATION  
DISTORTION  
AT 38cm/s

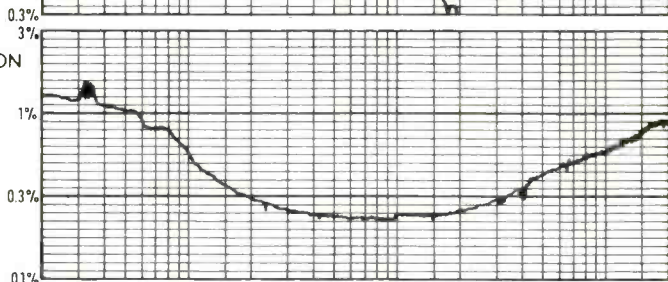
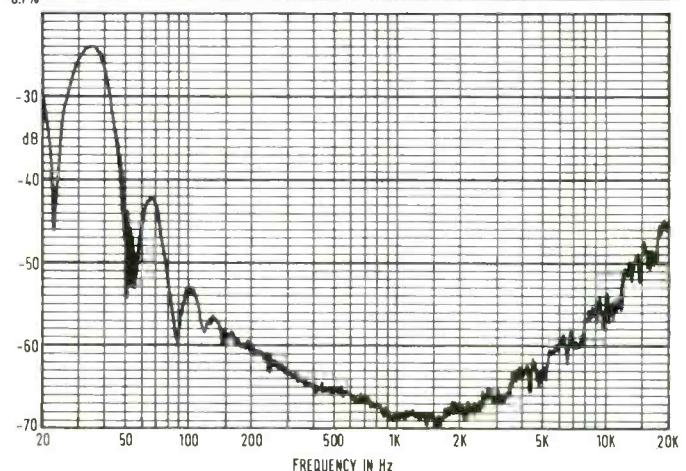


FIG. 7  
CROSSTALK  
AT 38cm/s



FREQUENCY IN Hz

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|                    |   |
|--------------------|---|
| THD                | +4dBu line input to any line output at +4dBu, 20Hz <0.03%, 1kHz <0.01%, 20kHz <0.05%<br>Signal at mic input with 50dB gain (200Ω at source), 20Hz <0.1%, 1kHz <0.01%, 20kHz <0.1% |
| Frequency response | +4dBu line input to any line output at +4dBu, 25Hz: -3dB, 20kHz: -1dB<br>Signal at mic input with 50dB gain (200Ω at source), 25Hz: -3dB, 20kHz: -1dB                             |
| Noise              | Relative input noise with 20kHz Bandwidth, < -126dBu<br>Mixing noise, 24 channels routed to mix all at unity gain, < -80dBu (DIN audio weighted)                                  |
| Input impedance    | Mic input, 800Ω (1,5kΩ with pad)<br>Any line input, not less than 5kΩ   |
| Input gain         | Maximum mic, 85db<br>Maximum line, 70dB   |
| Output capability  | +22dBu into 600Ω  |

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**REVIEW: STUDER B67**

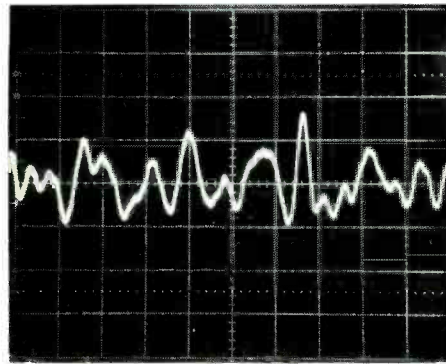
This machine ranks among the very best tape machines for wow and flutter. Furthermore, the tape speed variation from end to end of a NAB reel was good at less than 0.01% change at 38 cm/s.

The accuracy of the tape timer in terms of indicated time against actual elapsed time was also respectable with 0.2% error.

**Other matters**

Checking the phase jitter by recording a 10k Hz tone at 38 cm/s on both tracks and

**FIG. 9** Phase jitter at 38 cm/s. Horizontal scale: 0.5 s/division. Vertical scale: 50/division.



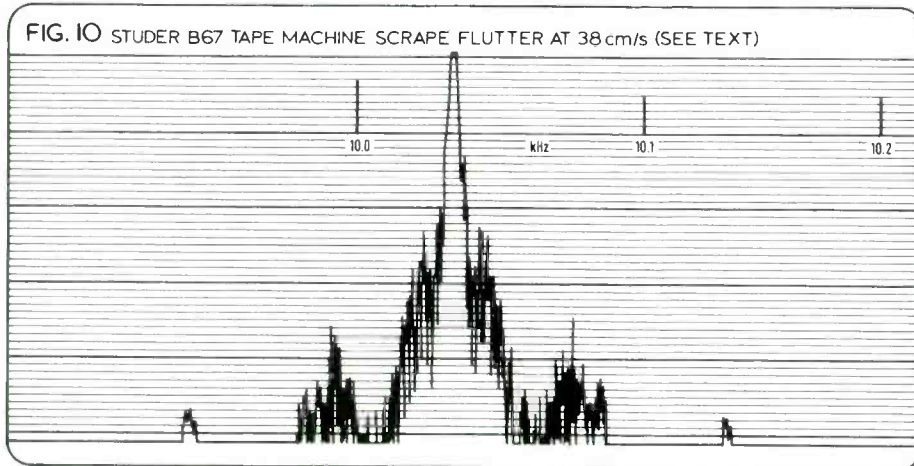
then replaying the tone from each track into a B&K phasemeter produced **fig. 9**, which shows that the phase jitter is in the order of only  $\pm 5\%$ —a very high standard of performance. Similarly, a spectrum analysis of a 10k Hz tone with a 3.15 Hz swept filter showed that the scrape flutter was also to an unusually good standard, as is shown by the spectrogram **fig. 10**. It can be seen that the sidebands 50 Hz and 100 Hz from the carrier are very low in level and that the area around the carrier is unusually free from sideband noise.

Other than a low level tone from the capstan system the machine was very quiet in operation. Generally operation was a delight, as was the ease of access of the controls for setting-up the machine.

There are, however, two slight criticisms of the tape transport: firstly that the fast wind is very fast, with a consequently not very good quality of winding even with matt-backed tape; secondly that at the end of the fast wind the spools take rather a long time to come to rest, with the end of the tape flaying about.

**Summary**

The Studer *B67* tape machine performed to a very high standard in virtually all respects and was a very pleasant machine to use. It is well built to the best traditions of mechanical and electronic engineering, as one has expected from the Studer stable for many years. Of course, one has to pay the price for such a machine. But on the other hand it not only out-performs cheaper machines, it is also certain to be more reliable and to have longer life. ■

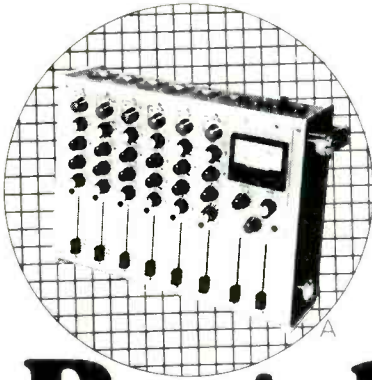


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ATTACK TIME Adjustable - 0 25ms 0.5ms 1ms 2ms 4ms  
rms  
FREQUENCY RESPONSE 1dB 20 Hz to 30 kHz NO  
COMPRESSION  
DISTORTION 0 1% at 1kHz to 10kHz NO COMPRESSION  
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# Brenell mini 8 tape machine



Hugh Ford

## MANUFACTURER'S SPECIFICATION

|                               |   |   |  |
|-------------------------------|---|---|--|
| <b>Tape width:</b>            | 25.4 mm.  | <b>response:</b>                                      | $\pm 2$ dB, 30–20k Hz (better than).   |
| <b>Tracks:</b>                | eight.  | <b>Frequency response:</b>                            | $\pm 2.5$ dB, 20–20k Hz.   |
| <b>Reel size:</b>             | 26.25 cm NAB  | <b>Crosstalk:</b>                                     | – 60 dB at 1k Hz (adjacent tracks).  |
| <b>Tape Speed:</b>            | 19 and 38 cm/s.                                     | <b>Power:</b>   | 220–250 volts, 50 Hz (export versions 110 volts 60 Hz).                                  |
| <b>Fast wind:</b>             | for 730m of tape approximately 100s.                | <b>Weight:</b>  | 32 kg.   |
| <b>Line input (for 0 vu):</b> | adjustable from –10 to –20 dBm, 10k ohm unbalanced. | <b>Dimensions (hxxwx d):</b>                          | 55x42.5x21.25 cm.  |
| <b>Line output:</b>           | adjustable up to –20 dBm into 600 ohm unbalanced.   | <b>Remote control:</b>                                | plug-in type unit for all deck and electronic functions; available with digital counter. |
| <b>Record level:</b>          | 0 vu at 320 nWb/m.                                  | <b>Price:</b>   | £3500; remote control £200.  |
| <b>Sel-sync output:</b>       | up to –20 dBm into 600 ohm.                         | (All measurements made using <i>Scotch 206</i> tape.) |  |
| <b>Wow and flutter:</b>       | 0.05% (DIN).  | <b>Manufacture:</b>                                   | Allen and Heath/Brenell Limited, Pembroke House, Campsbourne Road, Hornsey, London N8.   |
| <b>Signal-to-noise ratio:</b> | –60 dB, unweighted, reference 0 vu.                 | <b>US Agent:</b>                                      | Audiotechniques Inc, 142 Hamilton Avenue, Stamford, Conn 06902.                          |
| <b>Overall frequency</b>      |   |   |  |

THE Brenell *Mini-8* is an 8-track machine which uses 25.4 mm wide tape on NAB reels up to a diameter of 267 mm, the reels being directly mounted onto the shafts of Papst reel motors. The reels are slid onto the hub, which has a locating spigot, and a large alloy cap is then screwed onto the hub to expand a rubber O-ring, thus providing a positive location.

From the pay-off reel the tape passes a tension arm associated with a microswitch to signal that the tape is loaded. The tape then passes a fixed guide post and thence to the erase head, a tape lifter, the record and replay heads and a further fixed guide post. After this it passes a belt-driven capstan with its associated large solenoid-operated pinch roller, a tape timer roller and then the take-up reel.

All major transport components are mounted onto a 6.3 mm thick alloy plate which forms the basis of the tape transport. The heads are mounted onto this plate via smaller plates that have screws for the alignment of head azimuth and zenith.

The operational controls for the tape transport are the usual fast wind, record, play and stop pushbuttons in the form of coloured buttons. All the controls can be remote

controlled, since the tape transport has integrated circuit logic control that provides full interlocking between modes.

In spite of the simple transport layout and the very fast wind functions the quality of the tape wind was always good. The tape was handled gently but at perhaps a rather low tension of about 200 g in the play mode, with a tension boost to about 400 g during the initial start of tape motion.

As a result of the use of solenoid-controlled band brakes on the reel motors, mains power failure did not upset the tape even in the fast wind modes. However, run-out from the fast rewind mode was rather alarming, since the tape took a long time to come to rest with the inevitable result that bits of tape were knocked off the end. (It took 10s for the reel to stop rotating.)

The tape transport is mounted onto a metal frame to which are attached wooden ends with good solid carrying handles, and a metal rear cover housing a very noisy cooling fan. The latter is far too noisy and no air filtration is provided. Underneath the tape transport is an electronics frame containing the eight plug-in channel electronics boards. The transport electronics are mounted onto the rear of the

tape transport, with the power supplies in a separate remote unit.

Each electronics board was quite neatly laid out, but was not provided with component identifications. The provisional instruction manual did not have any layout information, although circuit diagrams were provided together with practical operating and alignment instructions.

The black front panel of the electronics boards had clear control identifications in white screen printing. The operational controls comprise input and output level potentiometers, plus two toggle switches. The upper one of these is the record on/off switch, and has an associated red indicator lamp. This flashes when channel record is selected, and stays on permanently when the record mode is activated on the tape transport. The second switch selects the source of the line output between line input, replay head output or sync output—the latter reverting to the line input if the record function is activated.

Access to the alignment controls is through holes in the front panel of the electronics boards, the controls being single-turn, screw-driver-operated potentiometers for bias, sync level, record level, replay level, and high-frequency equalisation controls for record, sync and replay. While the tape transport can operate at either 19 or 38 cm/s, there is only a single speed adjustment for the electronics and the replay equalisation is fixed to the NAB standard of 50  $\mu$ s and 3180  $\mu$ s.

To the right of the channel electronics boards are the eight meters that indicate the level being sent to the line output buffer amplifier, and hence the signal selected on the individual channel electronics board. These meters are of Shinohara manufacture and, in view of the use of a single diode as the rectifier, do not meet the standard for vu instruments.

The input and output connections on the rear of the machine are in the form of 6.35 mm standard unbalanced jack sockets. In addition there are two multipole connectors for the remote power supply, and a larger multipole connector for the remote control unit. The review machine was provided with a remote tape timer to indicate tape time at a speed of 38 cm/s in minutes and decimals of a minute to a maximum of 99.99. It seems rather a shame that this unit does not indicate minutes and seconds, and also that the indicated time is only correct for the one tape speed.

The separate power supply had fixed leads or connections to the tape machine plus a standard IEC mains connector. There is also a mains-voltage selector and three fuses, none of which had any indication of the current fuse values. It was felt that the exposed mains voltage selector was a hazard in two ways: firstly it could be easily broken in transit; and secondly it is all too easy for someone to inadvertently alter the selected voltage, with potentially disastrous results!

Overall, the machine is tidily put together, with the form of construction being perhaps more solid than many in the price range. Control layout was found to be practical and functional. Maintenance should not present any problems due to the use of plug-in electronics boards throughout and easy access to all mechanical parts.

92 ▶

# More than just a new microphone. More a new way to record.

The Calrec sound-field microphone represents a new departure in microphone technology, giving unprecedented operational flexibility and accuracy of stereo recording.

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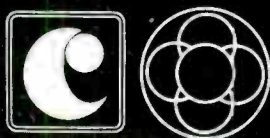
minus right, front minus back, and up minus down). From these four signals, known as B-format, any first-order microphone characteristic can be synthesised. That is to say—any combination of omni-directional, cardioid, hyper-cardioid, or figure-of-eight.

Any number of such microphones can be synthesised simultaneously and the microphone control unit provides, in addition to mono and multi-channel feeds, the output of a stereo pair. Controls are provided which enable the angle between the two microphones of the pair to be varied, as well as the directivity patterns of the

individual microphones. The whole stereo pair can then be panned or tilted in any direction. These controls can be exercised either live, or in post-session processing of the B-format tape.

This new facility goes of course much beyond the capability of the usual kinds of variable-pattern microphone. An additional advantage is that over most of the audio spectrum the virtual microphones of the stereo pair are strictly coincident. This gives worthwhile improvement over the usual kind of close-spaced stereo pair in which phase-errors can exceed 180° at the top of the audio band.

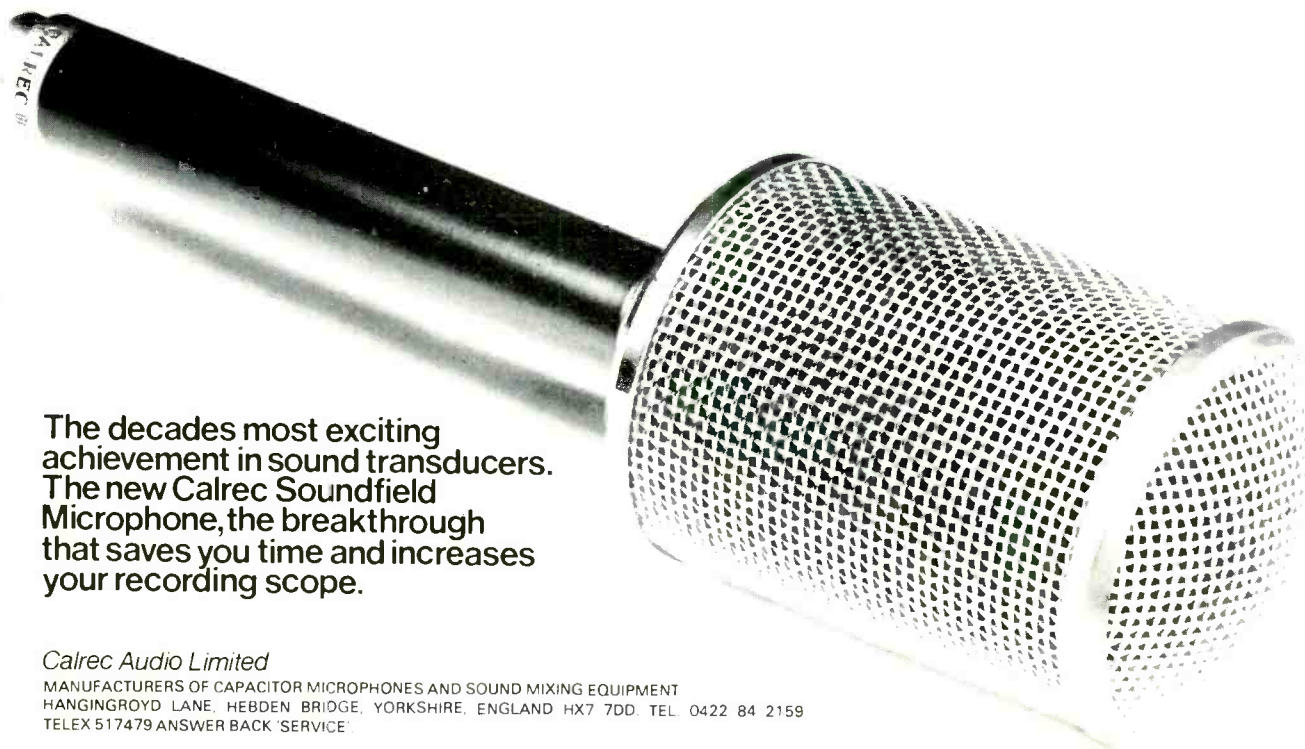
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## REVIEW : BRENELL MINI-8

### Replay performance

Investigations into the replay frequency response in both the normal replay modes and the sync modes showed that the machine was correctly equalised to the NAB standard of 50  $\mu$ s and 3180  $\mu$ s for the tape speeds of 38 or 19 cm/s. the equalisation and adjustments having a range of  $\pm 1$  dB at 10k Hz and no significant effect below 1k Hz (as is desirable).

The replay amplifier was found to be capable of delivering 22.5 dBm into 600 ohm at the onset of serious distortion, with a recorded level of 320 nWb/m giving a maximum output of +10 dBm, which also corresponded to an indication of 0 vu on the level meters. It is felt that this adjustment of the 0 vu indication does not allow sufficient headroom in the record mode, and that an additional margin of the order of 4 dB would be desirable between 0 vu and the 3% third harmonic distortion point from tape. On the other hand, the available headroom in the replay amplifier of more than 18 dB above a fluxivity of 320 nWb/m for the onset of serious distortion is excellent, and will easily cope with any tapes that are likely to appear in the foreseeable future.

As can be seen from table 1, the replay noise performance was a bit of a variable feast depending how the noise was measured; the figures are the average performance of a number of channels referenced to a recorded fluxivity of 320 nWb/m at a speed of 38 cm/s.

TABLE 1 REPLAY NOISE

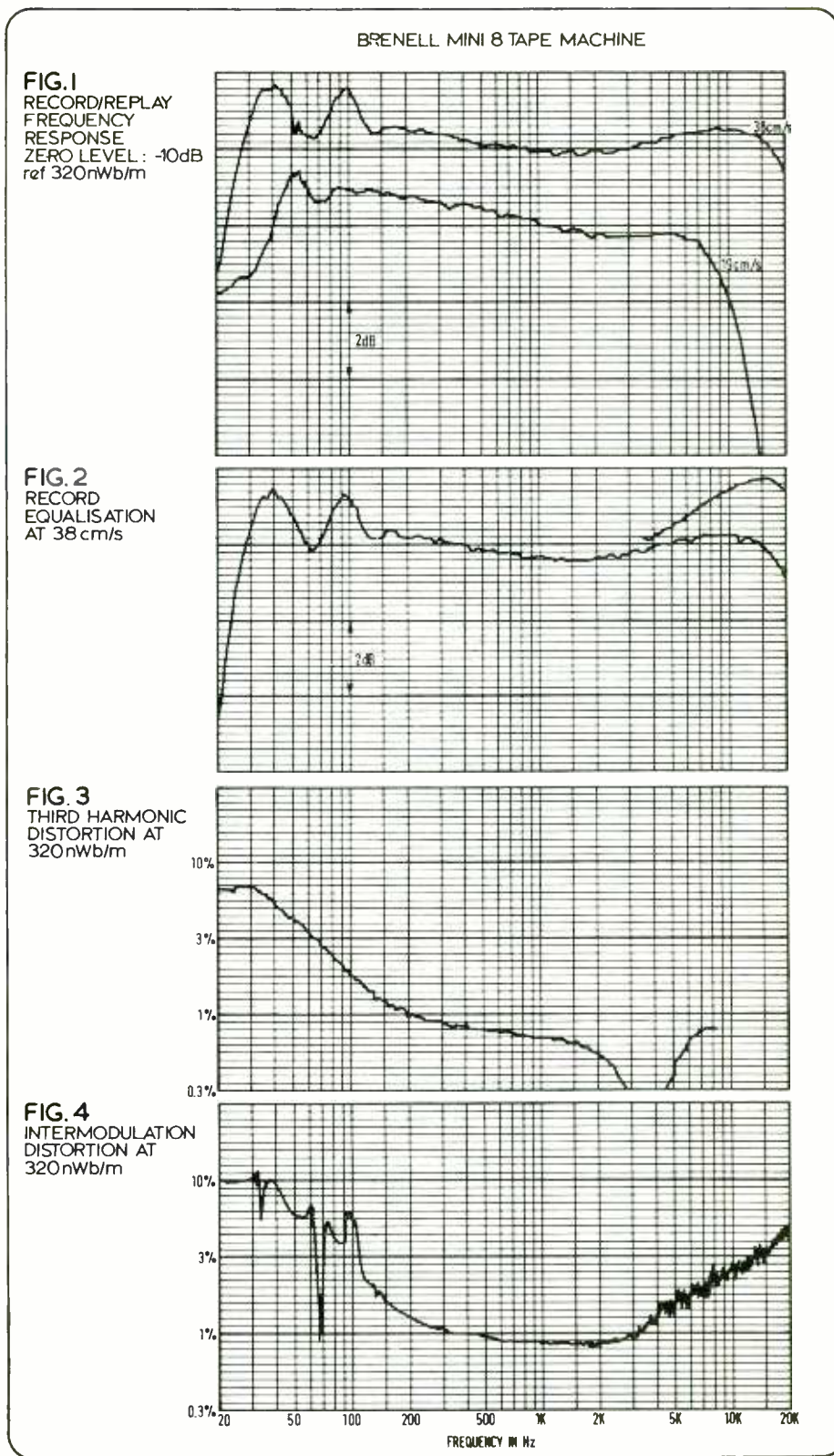
|                                    | Reference level (320 nWb/m) to noise ratio |           |              |           |
|------------------------------------|--|-----------|--------------|-----------|
|                                    | Replay                                     |           | Sync         |           |
|                                    | machine only                               | with tape | machine only | with tape |
| Unweighted rms noise, 20-20k Hz    | 53 dB                                      | 53 dB     | 49 dB        | 49 dB     |
| A-weighted rms noise               | 70.5 dB                                    | 63 dB     | 66 dB        | 62 dB     |
| CCIR-weighted rms ref 1k Hz        | 65 dB                                      | 54 dB     | 62 dB        | 53.5 dB   |
| CCIR-weighted quasi-peak ref 1k Hz | 60 dB                                      | 49.5 dB   | 56 dB        | 49 dB     |

Table 1 shows that the margin in noise between the replay amplifiers and the noise from *Scotch 206* tape recorded with bias and erase but no audio signal is good when using the CCIR weighting, but apparently not so good when A-weighted or unweighted. This effect was caused by relatively severe mains hum in the machines output, this being due partially to the location of the cooling fan within the machine. Since identical replay equalisation is used at both tape speeds the machine noise is therefore equally satisfactory at 19 cm/s, but with equally poor hum performance.

### Record/replay performance

All tests were undertaken using *Scotch 206* tape for which the machine had been aligned by the manufacturer, the noise performance with this tape being shown in table 1.

The overall record/replay frequency response for both tape speeds when aligned at 38 cm/s



is shown in fig. 1, which shows a good flat response at 38 cm/s but a poor high-frequency performance at 19 cm/s. Attempts to align the machine for 19 cm/s by re-biasing and equalising the record amplifier rendered little improvement; it was felt anyway that the range of record equalisation was inadequate. This range

at a tape speed of 38 cm/s is shown in fig. 2, which illustrates a maximum range of equalisation of a mere 2 dB. Such a very small range certainly restricts the machine to a limited number of tape types and gives no margin for the improved high-frequency performance of

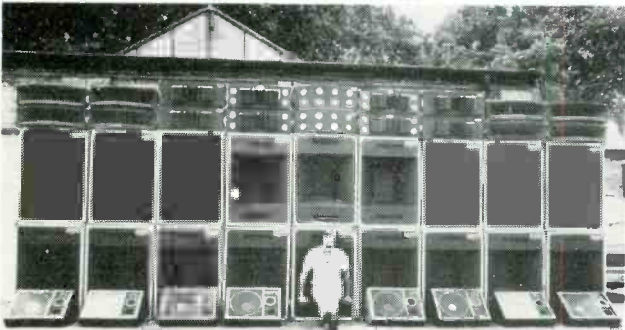
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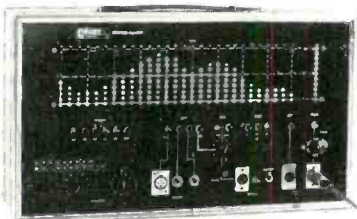
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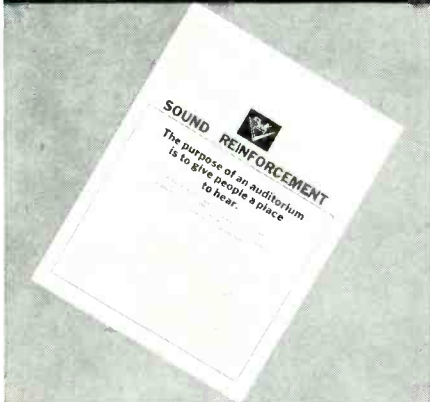
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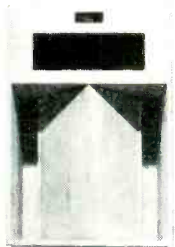
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## REVIEW: BRENELL MINI-8

future tapes. However, the range of adjustment of the bias level was found to be more than adequate.

Three percent third-harmonic distortion at 1k Hz at the tape speed of 38 cm/s was found to occur at a level of 8 dB above 320 nWb/m, which corresponds with the tape type in use but to only 8 dB above an indication of 0 vu on the machine's level meters. It is felt that this margin should be increased to about 12 dB since although they are not standard vu instruments the meters are slow. The third harmonic distortion from 20 Hz to 8k Hz at a fluxivity of 320 nWb/m is shown in fig. 3, which shows that the performance at 1k Hz is very good with only 0.7% third harmonic distortion.

Similarly the intermodulation distortion at

320 nWb/m, as shown in fig. 4 for the CCIF twin-tone method with 70 Hz separation between the tones, is good in terms of the third-order difference frequency component.

As is common the recording and reproduction of square waves at 1k Hz exhibited overshoot due to the phase shifting but, as fig. 5 shows, there is no ringing, which is an undesirable feature of some machines. Switching in and out of the record mode and other usage did not magnetise the heads and lead to second-harmonic distortion. As received, however, the replay head was not properly degaussed and it is felt that Brenell might pay attention to this detail in manufacture.

The arrangement of the record-ready switches on the channel modules and the master record button was such that when the machine was in the record mode tracks can be inserted by operating the record-ready switch alone for dropping in. Unfortunately, the flashing lights to show the 'ready' mode caused a mild ticking noise in the replay output, but it is felt that this matter could be improved.

Crosstalk was investigated in two ways. Firstly, channels 4 and 6 were recorded and the inbetween channel 5 replayed with no previous recording, this worst-case situation producing fig. 6, which illustrates a respectable crosstalk performance. Secondly, the crosstalk in the sync mode was investigated by recording channel 1 and replaying channel 4 in the sync mode, the results being shown in fig. 7.

### Inputs and outputs

The output impedance of the unbalanced jack

FIG. 5 Replayed squarewave.

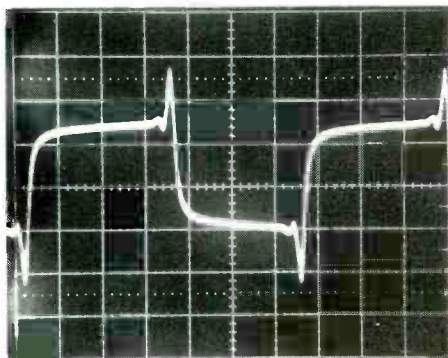


FIG. 6 WORST-CASE CROSSTALK AT 38cm/s

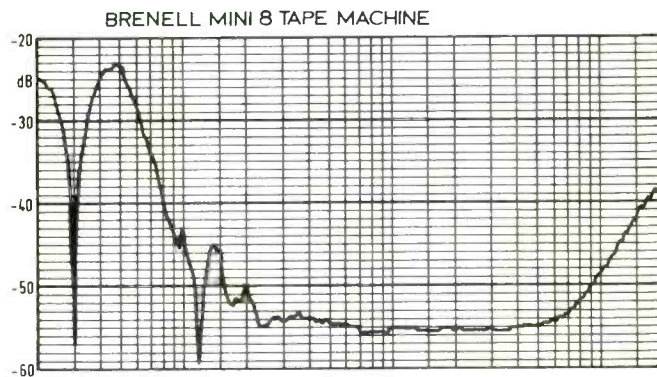
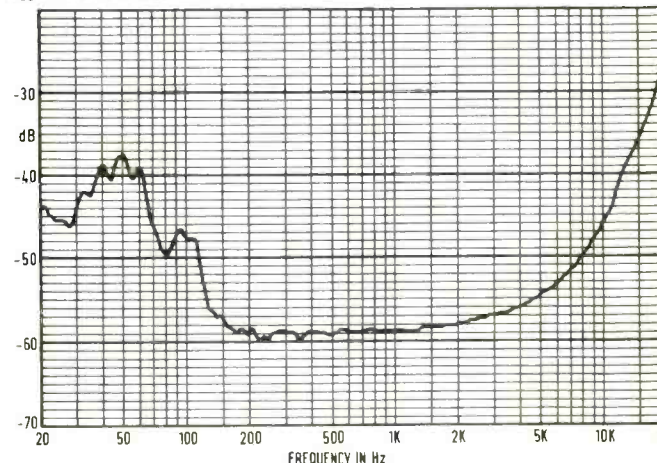
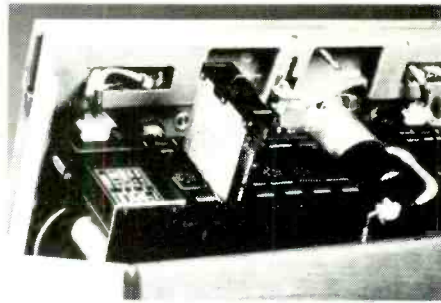


FIG. 7 SYNC CROSSTALK AT 38cm/s





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## REVIEW: BRENELL MINI-8

outputs was found to be very satisfactory at about 10 ohm, with a maximum drive capability of +22.5 dBm into 600 ohm. The output level for 0 vu indication was adjustable over the range +0.5 to -10 dB referred to a recorded fluxivity of 320 nWb/m. The input impedance varied from 9.5k ohm at minimum record gain, down to 7.3k ohms at maximum record gain—a reasonable situation. Input sensitivity for recording a fluxivity of 320 nWb/m at maximum input level gain could be varied from -3 to -24 dBm by means of the record level pre-set controls on the channel modules. The operational control was of the full-range type situated at the input itself.

### Wow, flutter and speed

Measurements of wow and flutter to the IEC quasi-peak weighted method at the beginning, middle and end of a full reel of *Scotch 206* tape gave the results in table 2.

TABLE 2 WOW AND FLUTTER

| Tape speed | beginning | middle | end   |
|------------|-----------|--------|-------|
| 38 cm/s    | 0.11%     | 0.08%  | 0.12% |
| 19 cm/s    | 0.2%      | 0.18%  | 0.2%  |

The values, which were found to be rather variable, are well outside the manufacturer's specification and not particularly good for a modern machine at these tape speeds. A slightly more detailed investigation showed that the main flutter component at 38 cm/s was about 7 Hz, which appears to correspond with the speed of rotation of the pinch roller. It was thought therefore that something had gone wrong in this part of the system. Checking a second machine showed that this remained the predominant flutter frequency, but that the wow and flutter was improved (table 3).

TABLE 3 WOW AND FLUTTER ON SECOND MACHINE

| Tape speed | beginning | middle | end   |
|------------|-----------|--------|-------|
| 38 cm/s    | 0.05%     | 0.05%  | 0.07% |
| 19 cm/s    | 0.15%     | 0.17%  | 0.13% |

Checking the tape speed by means of the tape timer indicated that the machine was running 0.9% fast at 38 cm/s. The use of an accurately-recorded 6.35 mm wide tape also

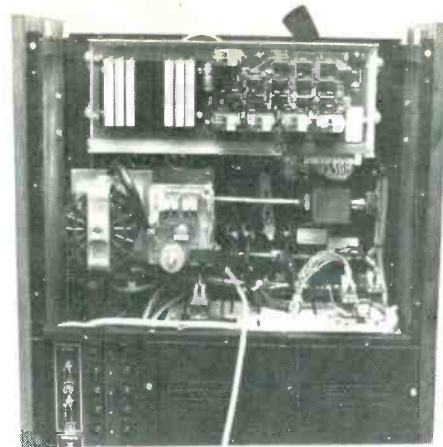


FIG. 9 Phase jitter at 38 cm/s. Horizontal scale: 0.5 s/div. Vertical scale: 100 /div.

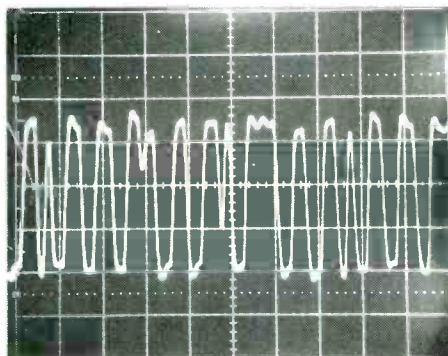
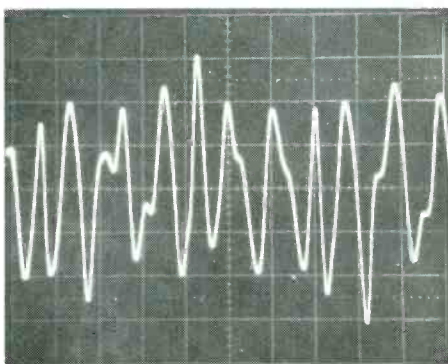


FIG. 10 Phase jitter at 38 cm/s for the second tape machine. Horizontal scale: 0.5 s/div. Vertical scale: 20 /div.



showed that the machine was fast, but to a lesser degree—probably due to tape stretch.

### Other matters

Checking the scrape flutter performance by a spectrum analysis of a 10k Hz recorded tone at 38 cm/s produced the spectrum shown in fig. 8, which demonstrates considerable random flutter together with sidebands 50 and 100 Hz either side of the 10k Hz 'carrier'. This situation is likely to be brought about by the virtual absence of any rotating parts in the tape path, with the sidebands probably originating from the 50 Hz ac reel motors.

Another matter symptomatic of inadequate tape guidance is the phase jitter between the outer tracks. Recording tracks 1 and 8 with 10k Hz tone and then investigating the phase difference between the two replayed signals gave a phase jitter in excess of 360°. This is shown in fig. 9, which is an oscillogram of the phase meter's output. The second sample of the machine exhibited an improved jitter of 120° peak-to-peak, as shown in fig. 10.

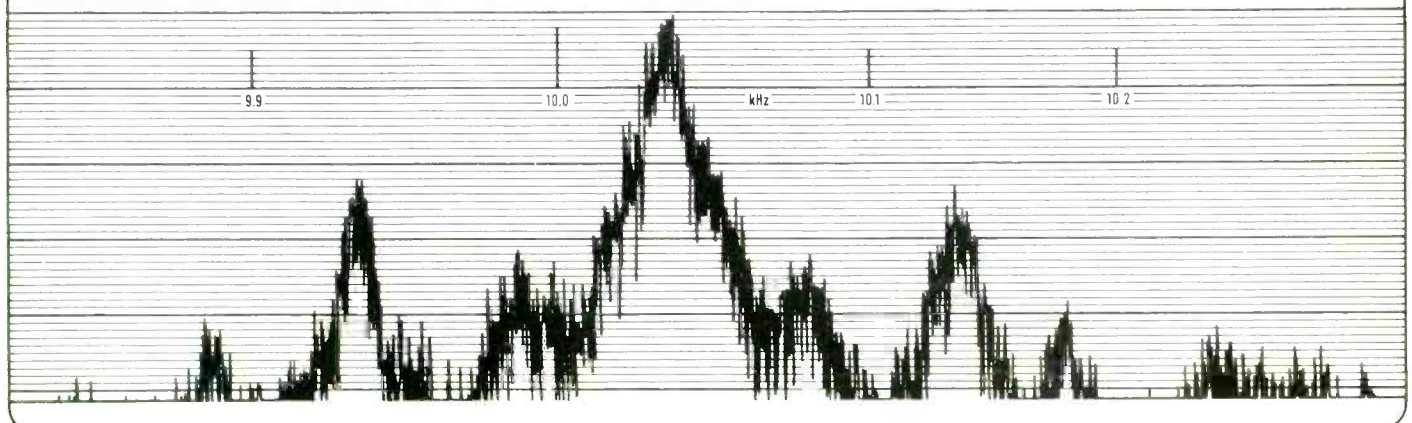
Erasure of a 1k Hz tone recorded at 320 nWb/m was found to be 74 dB on the first pass over the erase and record heads, the level increasing with further passes (as is to be expected).

A final matter of interest was the level of bias frequency signals at the replay outputs when in the record mode. This was found to vary widely between channels with a maximum level of 300 mV peak-to-peak, which is felt to be undesirably high. Furthermore, there was some bias frequency leakage into the replay chain without any channels being in the record mode.

### Summary

With top-flight multitrack machines now costing well in excess of £1000 per track, a mere £3500 for eight tracks on 25.4 mm tape is clearly an attractive proposition. As has been seen, however, this machine suffers from a few severe restrictions. Potentially, the machine can be very good value for money but it is felt that the manufacturer can easily sort out some of the limitations and make this a very attractive proposition. Many of the performance figures are excellent, and such matters as replay hum and the restricted range of record equalisation are matters that can be easily improved. ■

FIG. 8 BRENELL MINI 8 TAPE MACHINE SCRAPE FLUTTER AT 38cm/s (SEE TEXT)



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### BRENELL MINI-8 OPERATIONAL ASSESSMENT



PATHWAY borrowed the *Mini-8* from Brenell to record some backing tracks for the new Motors album. The tape was eventually taken down to Island's Basing Street Studios where the backing tracks were transferred onto twenty-four track, and then the vocal and overdub tracks added. To give you some idea of what we were up to, on most of the album I laid drums over four tracks—bass drum, snare drum and stereo kit—and used four tracks for bass guitar, a couple of electric guitars and a guide vocal track.

But recording backing tracks isn't all we do at Pathway. Dr Feelgood did their whole album here, completely on 8-track. Originally they were going to do the backing sequence and then go on to twenty-four, but eventually decided to do it all on eight.

Normally we use an old Brenell *Type 19* deck that I have a sort of love/hate relationship with. I loved it when I was paying for it; hated it when it went wrong. We're probably going to replace it eventually with a *Mini-8*—or maybe just the deck, because we would like to keep the Richardson electronics from the *Type 19*. The Richardson has a separate sync output, which the *Mini-8* doesn't. This is useful for giving a very nice tape phasing, or a single 38 cm/s repeat on any track.

I particularly like the tape transport controls. The smaller buttons have a much better feel than the earlier Brenell deck, and the logic system works very well. The other controls on the *Mini-8* were also very easy to operate. With a safe/ready switch per track you can either drop-in off the master record button, or off the individual safe. A little light flashes when the safe/ready switch is pressed, and stays on when you then press the record button. One thing I noticed was that in the replay mode there is a very slight leakage, which causes a click at the output each time the light flashes. This is not too much of a problem because for most of the time you are using the safe/ready switch during recording and overdubs, the machine will be almost certainly in the sync mode. In any case the slight leakage does not get onto tape but you

need to remember to release the ready buttons when mixing down off the replay output.

The *Mini-8* has two speeds of 19 and 38 cm/s. I can see that if you're very fussy about tape noise you might want to run at 76 cm/s, but this can be rather uneconomical on tape and is not likely to appeal to the budget-oriented studio. Recordings here are done at 38 cm/s without noise reduction since we don't need it. I'm using *Scotch 250* which takes a lot of level and is a low-noise tape anyway. I record with a minimum of headroom on peaks to take full advantage of the dynamic range of the tape. It'll be Dolbied during the transfer at Island so it works fine. They use a 3M 16-track machine with an 8-track head block to replay the tape recorded here, and track compatibility is no problem. We've done the same thing at several other studios.

The friction-fit NAB spool hubs were easy to use, and stayed on if you did them up nice and tight. One thing I would like to see on the *Mini-8* is an edit button. I do a lot of tape chopping and it really would be handy.

One thing we haven't tried with the *Mini-8* that we did once with the *Type 19* was to record three sets of tracks and sync them up afterwards. We did that on an album by the JALN Band where circumstances demanded a less expensive recording—£8 an hour here as opposed to £50 an hour in a 24-track studio—so they did it in three stages. The backing was recorded over seven tracks plus a *Maglink* track, and these were then transferred to a 24-track machine. The seven backing tracks were bounced down to a single guide track, and the band came back here to record six more tracks when that was done. The 8-track tape was re-synchronised via the *Maglink* with the 24-track tape, and the six new tracks transferred. The band did that three times in all until they had filled up the tape. An extreme case maybe, but it shows what can be done if money is fairly tight—because about 50% of the recording costs for an album are in laying down the basic tracks.

All in all at £3½ thousand the Brenell *Mini-8* is good value for money, and a lot cheaper than other 8-track machines. It's very compact and really easy to operate. I wouldn't consider buying an 8-track machine that uses 12.7 mm tape because it's not the standard format yet. You can't take the tapes anywhere else to use them unless you lug along the machine you recorded it on.

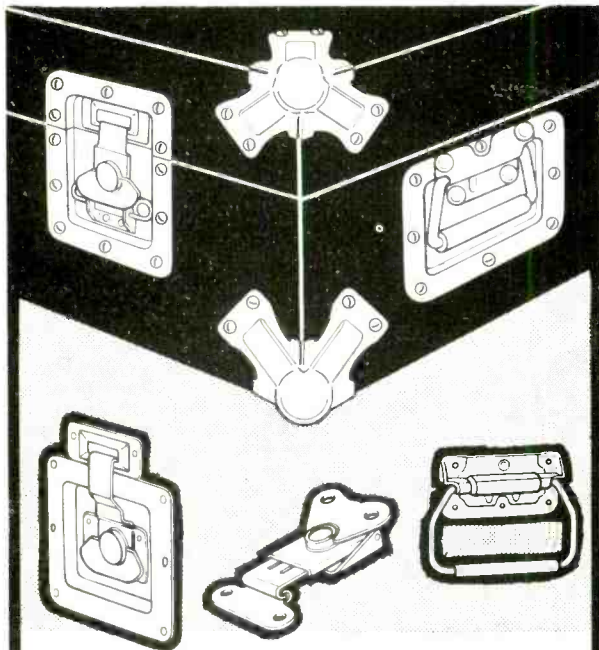
Peter Ker

## agony

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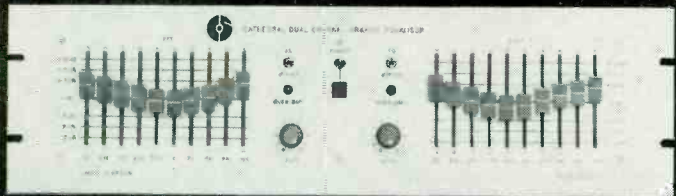
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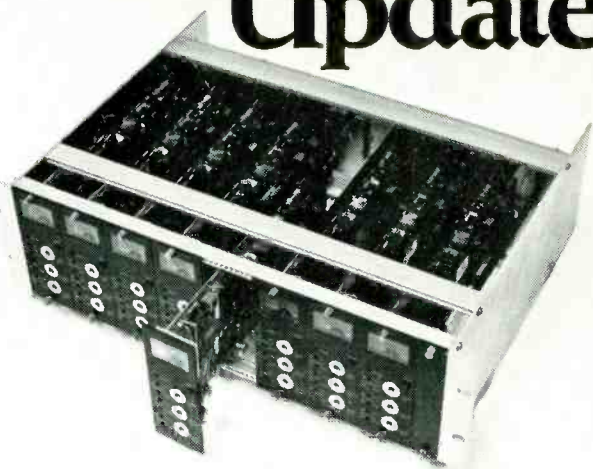
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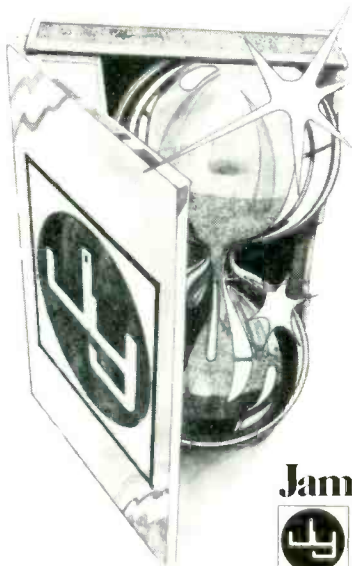
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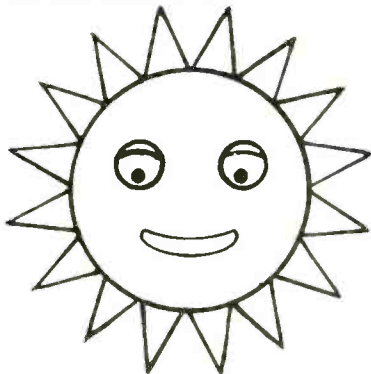
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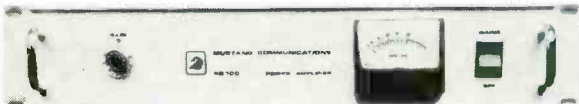
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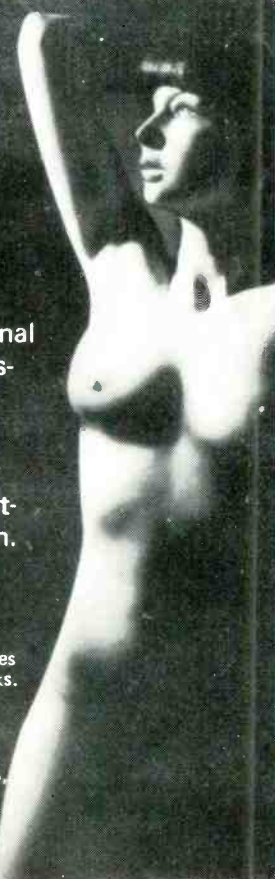
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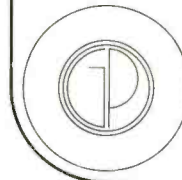
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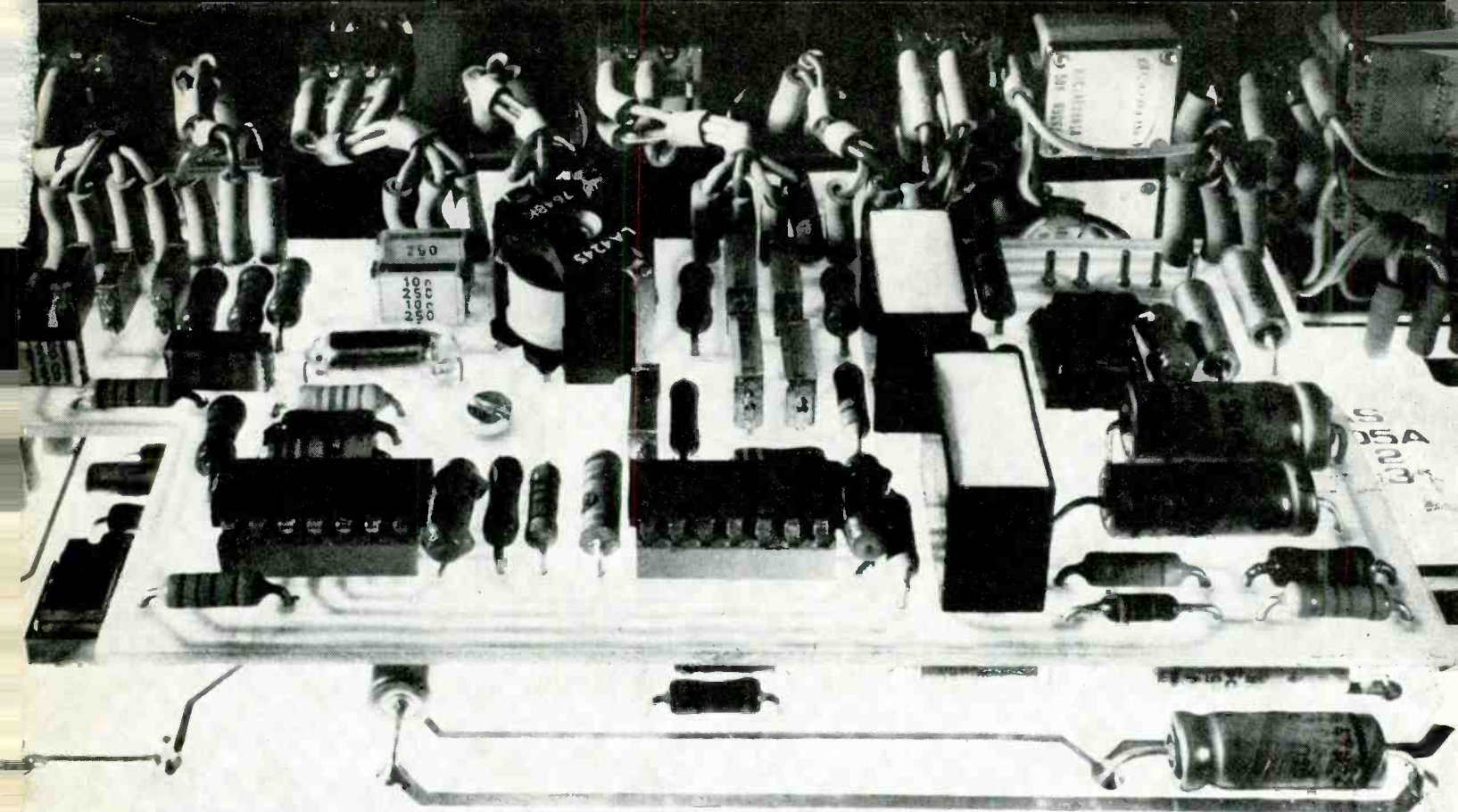
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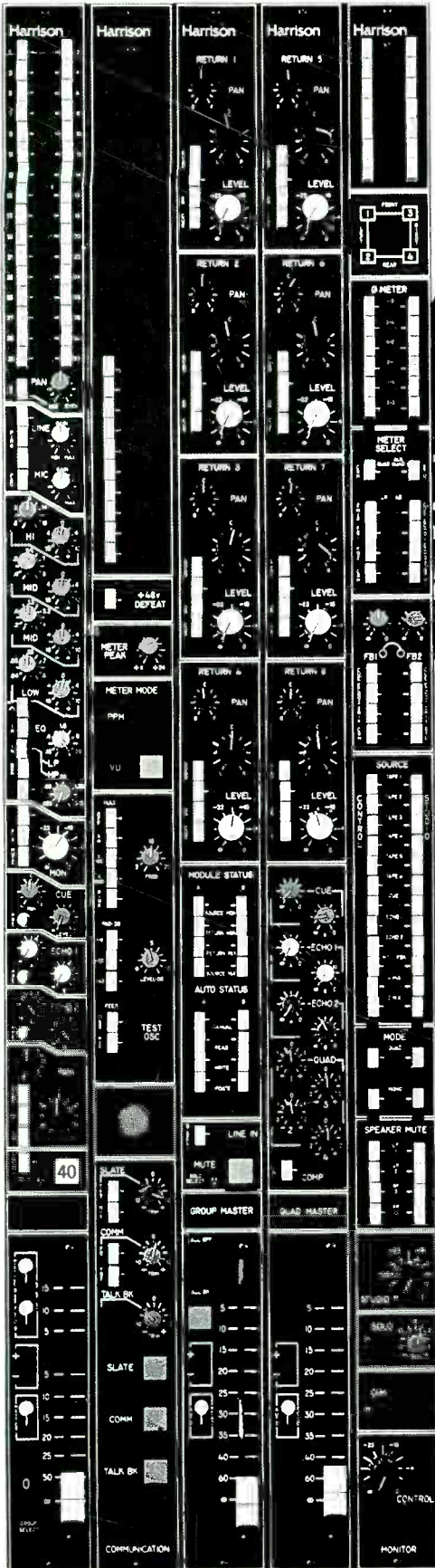
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