November 1978 60p

studio sound

AND BROADCAST ENGINEERING

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THE LINK HOUSE GROUP

studio sound

AND BROADCAST ENGINEERING

While it is still true that the majority of music recording studios specialise in the production of records, there is still a very large market for film and television dubbing. Film sound track albums are perpetually near the top of the charts and production companies now market film and album as a complete package with publicity for each assisting profits in the other. Television programme production has reached the stage where dubbing (and editing) are often performed off-line using multitrack recorders and timecode synchronisation to video recorders and this development is discussed elsewhere in this issue as are synchronsiers.

But until now, most film dubbing has been performed using perforated magnetic film on electrically or mechanically locked multiple magnetic film drives also locked to 35mm or 16mm projectors. Commonly termed the dubbing suite, only a few relatively specialised studios can justify the totally different technology's expense. Until now that is! The synchronisers appearing in many studios also allow a video recorder to be locked to a multitrack—so transfer the film to video tape, hire a video recorder and you can dub film. The completed multitrack can be directly used for the album and locked to a portable magnetic film recorder to provide the final sprocketed master. No fuss with 35mm film spools, projectors with arc lamps, dubbing theatres, screens, umpteen mechanical transports and so on. Versatility is the word. *Studio Sound* will be taking a closer look at film sound and dubbing next February.

Imperialisation

Although *Studio Sound* has been a stout advocator of metrication for many years, intensive research (reading a few back issues) shows that most companies still manufacture 2in not 50.8mm tape recorders using 10½in rather than 26.7cm spools and that these still run at 30ips. Facts are facts—surprising the only manufacturers using metric advertisements are generally British, not European where metrication originated. Also bearing in mind that about 90% of *Studio Sound* readers reside in 'Imperial' countries, I intend to abandon metric units for such colloquial measurements as tape dimensions, spools, and room sizes from early in 1979. We will however retain metric units for technical measurements such as equipment sizes. If British public houses can continue to pull imperial pints, so will *Studio Sound*!

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SENNHEISER

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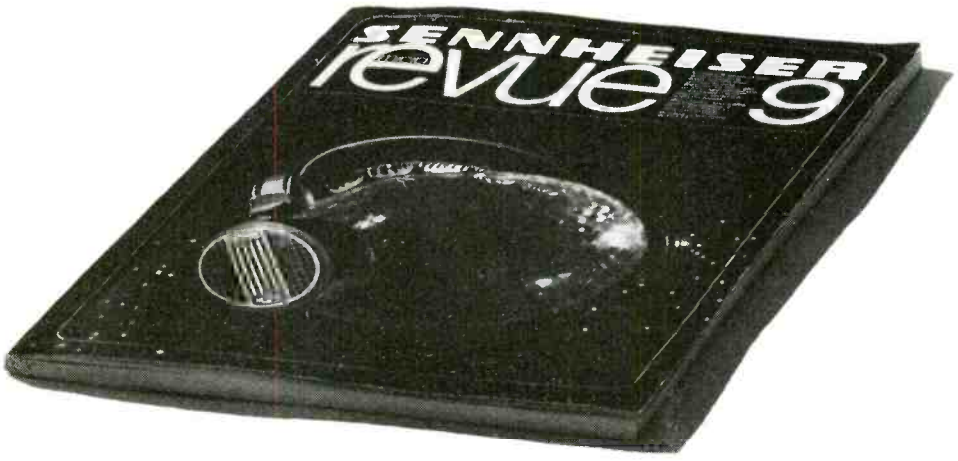

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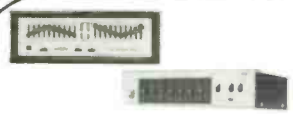

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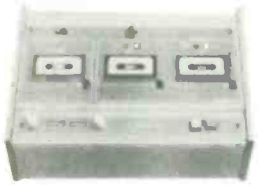

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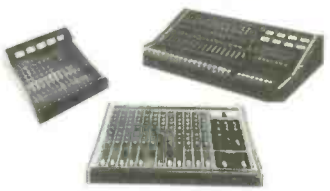

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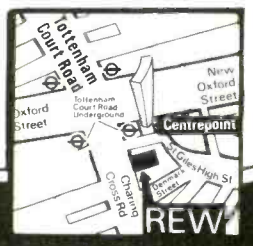

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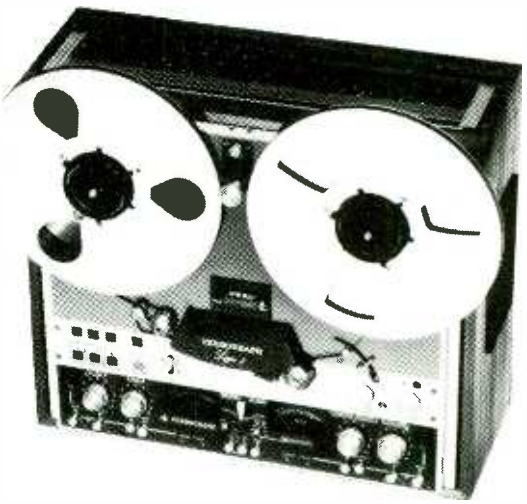
Incorporating a 3-motor mechanism, controlled by a full solid state logic system actuated by ultra light touch buttons, this is the machine used by top recording studios and broadcasting stations, for quality cassette copies and for in - cassette duplication masters.



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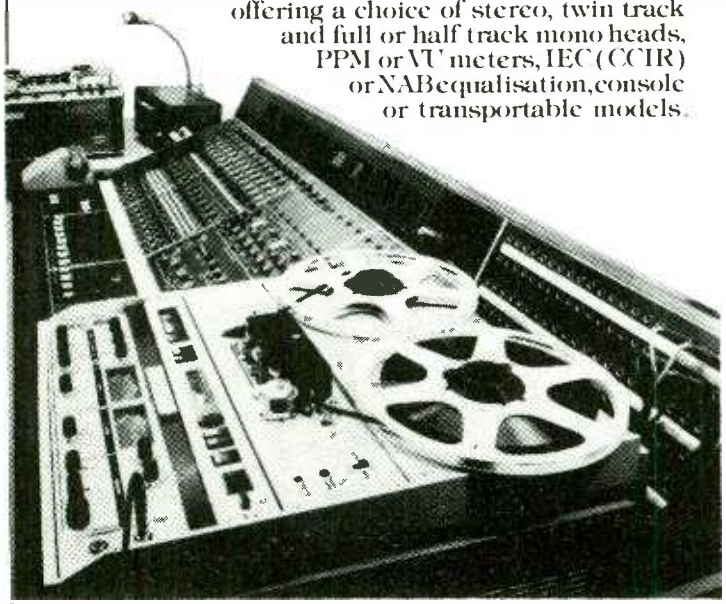
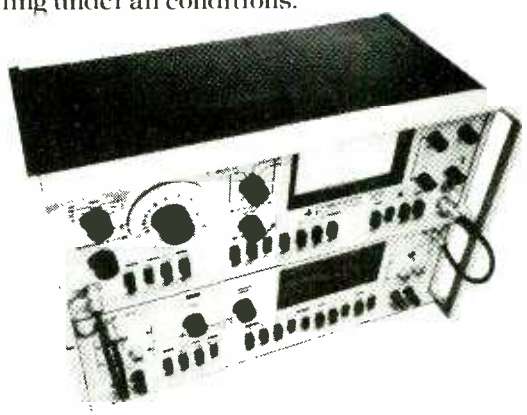
A professional studio tape recorder logic controlled for superb tape handling characteristics, offering a choice of stereo, twin track and full or half track mono heads, PPM or VU meters, IEC (CCIR) or NAB equalisation, console or transportable models.





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Combines in one easy to use compact instrument the measurement of gain, noise, frequency response, input sensitivity, output power, distortion and the parameters relating to recording equipment, such as wow and flutter, crosstalk, drift and erasure. Its range of application can be extended even further by the addition of the Auxiliary Test Unit **ATU 1.**

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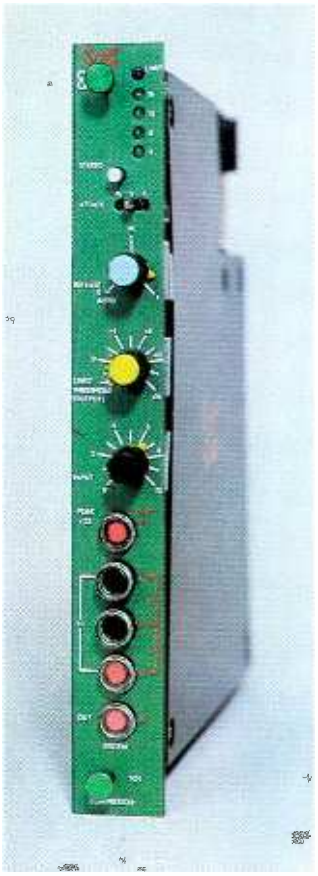
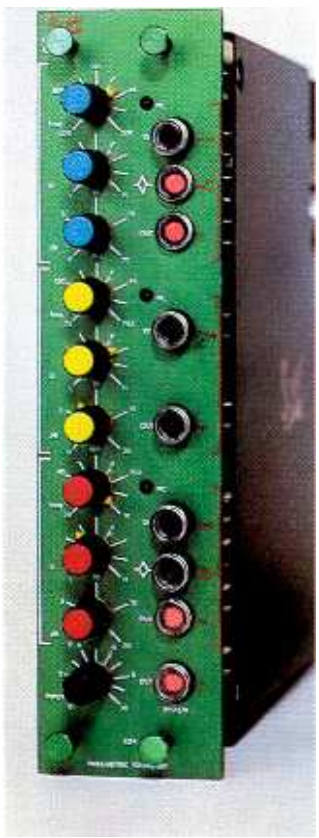
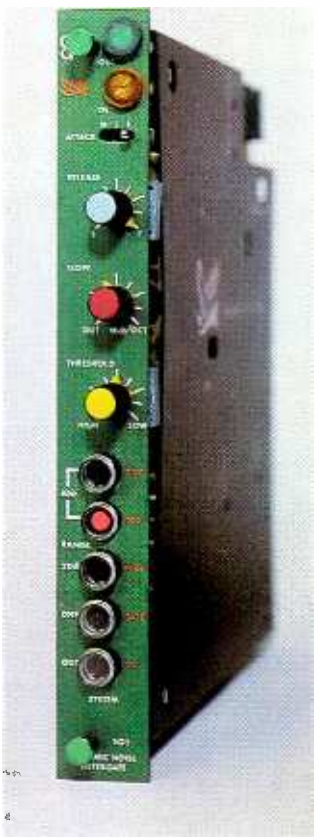


The **S 01 Compressor-Limiter** has all the necessary refinements of a sophisticated studio device, whilst retaining a simplicity of operation that will delight the hard-pressed engineer. It offers compression ratios from 1.5:1 to 10:1 plus a peak level limiter with a slope of 30:1. Thus the system can provide subtle compression for classical work or vocals where the retention of dynamic range will be valued, whilst at the same time it will give overload protection for unexpected input levels. The tighter ratios will be found effective on instrumental tracks to aid in the creation of impact and intensity. The **S 01** has variable attack and release controls; stereo couple facilities with a column to indicate compression and the operation of the peak limiter. It is only necessay to set the output level required into the following system and increase the input control to determine the amount of compression.

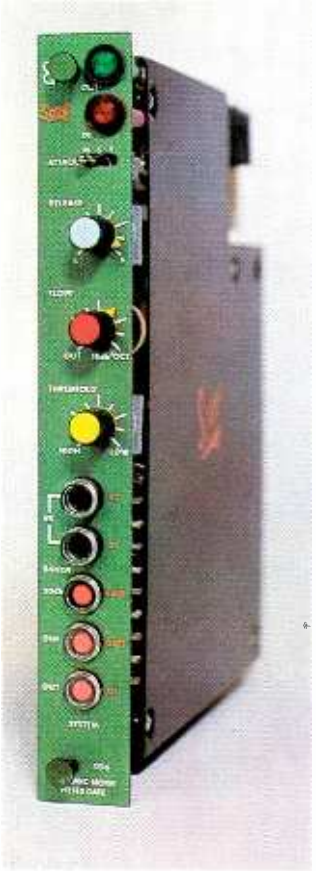
The **S 03 Sweep Equaliser** is an attractively simple form of parametric equalisation that has the virtue of being easier to work with than a fully parametric unit, yet equally effective in studio applications. There are three continuously variable frequency controls each covering an audio bandwidth of some six octaves. The bandwidth between 75Hz and 7.5kHz is covered twice, whilst frequencies from 400Hz to 1kHz can be obtained on all three sectional controls. Most important for studio users is the range of amplitude control available on each section: The 20dB range has proved to be invaluable when used on instrumental tracks. A 'peak-off-dip' switch enables amplitude pots to be pre-set and switched in for momentary effect when required.
The advantages of sweep equalisation are really self evident, the operator being able to select exactly the area that requires attenuation or accentuation without the inevitable compromise of fixed positions.



The **S 04 Parametric Equaliser** offers the ultimate in flexible equalisation within a small yet ergonomically sensible package. It has three independent fully parametric sections with overlapping coverage of the audio bandwidth (as described for the S 03 Sweep Equaliser).
This unit however, besides having sweep frequency control, has a variable bandwidth of one-fifth to five octaves, whilst the same range of amplitude is provided as on the S 03 (20dB lift or cut). The response curves of the HF and LF sections have an assymetrical relationship between lift and cut; they may be switched to a variable slope shelving filter characteristic, the depth of shelf being defined by the amplitude control.
The system gives very flexible overall control of sound spectral balance, particularly in controlling the relationship between fundamentals and harmonics.



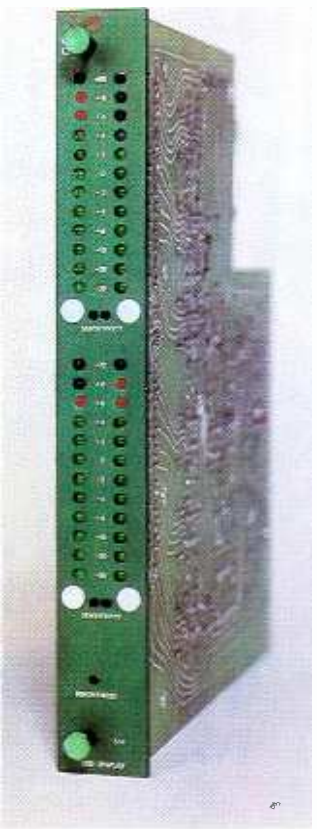
The **Dynamic Noise Filter-Gate** has been an extremely successful concept that has found a useful place in many areas of sound production and processing.
The **S 05** is the high-pass system which acts as a selective expander in the low frequency band. The attenuation is level dependent, such that as the LF content drops below a selected threshold it is increasingly attenuated. Rather than use a conventional fixed filter which will affect all programme levels, the **S 05** can be adjusted to attenuate such source noise as rumble (often the plague of the mobile recording) and hum (electronic amps), whenever insufficient LF programme signal fails to mask it. In this way there is no effect on higher level LF signal, since a flat response prevails above threshold level.
Complementary to the S 05; the **S 06** is a low-pass filter-gate, which will progressively and selectively attenuate high frequencies below the prescribed threshold. It works well with electronic instruments, attenuating noise and hiss with no apparent effect on the transient quality of the signal. Units are well suited for use on instrumental tracks and have been used successfully in reprocessing older classics and on film sound tracks.



On both these devices the area for processing is determined by the variable slope filter; each unit having three turnover frequencies from which to choose. The slope control (0dB to 18dB per octave) sets the maximum rolloff; the setting of the threshold will control the point at which the filter moves from the flat response towards the maximum slope set. Attack and release parameters being variable in order to facilitate optimum dynamic characteristics.
Alternatively these units can be used as a full frequency band, programme **gate** with frequency conscious side-chain; giving an optional 20dB or 40dB attenuation range.

The **S 07 Octave Equaliser** has been devised primarily as a system equaliser for monitor speakers or transmission lines. For general recording use, the S 03 or S 04 will be found more applicable.
The idea of equalising the monitoring environment is excellent, although electronic correction should be kept to a minumum. There is a growing body of opinion that favours the use of octave rather than third-octave systems; claiming the improved transient performance to be preferable to a definitive equalisation.
Frequency points adopted on the standard units run from 61.25Hz to 16kHz at octave intervals. The amplitude can be varied by 12dB (lift or cut) at each frequency, with l.e.d indicator to assist in maintaining optimum modulation levels throughout the system.

The **S 08 Distribution Amplifier** (not illustrated) provides 2 in/8 out distribution amplifier facilities via discreet independent line amps with excellent, front panel, troubleshooting access via mono/stereo jack sockets.
Either of the two inputs can be routed to any of the eight outputs, is strappable for 600Ω termination (balanced or unbalanced) and features ±4dB gain through a multiturn front panel preset. In addition an optimum modulation indicator of peak sensing, slow decay characteristic operates at + 12dBm for efficient line utilization.



The **S 14 L.E.D. Display Column** has four 12-section displays that are accurately calibrated and provide adequate information around peak level; indicating signal levels down to −30dBm. A sensitivity control allows variations about the calibrated markings of some 10dB higher or lower than indicated. The ballistics have a PPM characteristic, though they can be modified simply to read as a VU device. Where a number of columns are used, they can be linked together and brightness controlled from one pre-set point.

The **F 300 Expander-Gate** module preceded the concept of the SCAMP system. Although it does not have a SCAMP reference, it is entirely compatible with the other modules in the SCAMP range.
Without doubt the **F 300 Expander** is the most sophisticated device of its kind available at the time of writing. It is produced for multi-track work in systems of eight, sixteen and twenty-four units, including rack and power-pack.

Those starting a multi-track studio with limited budgets will realise that the **F 300 Expander System** offers a far more flexible response to studio problems than does a conventional noise reduction system: sixteen-track tapes made without noise reduction have been mixed-down through the **F 316-R System** and have proved most satisfactory. It is suggested that it could make good sense both from an engineering and management stand-point, to invest initially in an **F 308 / 316 / 324** system — the package that not only facilitates dramatic effects possiblities and dramatically attenuates source noise, but also prevents tape noise build-up, tightens the sound and brings a degree of automation to the mix-down. All at a price that is delightful to the ear!

Being a single-ended processor, it works well with a complementary system to clean-up source noise and to provide a useful degree of automation on mix-down (tracks only opening in the presence of wanted signal). In many instances where dynamic requirements are more limited (as in most pop work), complementary noise reduction system will be unnecessary, since the **F 300 System** will prevent tape noise build-up.
In addition, units have been found very useful in the wider context of Broadcast, TV, film location and theatre work

The S 23 Pan Module has been devised to create sensational panning effects. It will accept two inputs from a stereo source or a dual track/group signal which can then be switched to provide varying output configurations. Functions available are **'Alternative Pan'** which "criss-crosses" outputs (or pans a mono signal) at a regular rate determined by the *SPEED* control and **triggered sweep** which pans according to available, pre-determined L-R-L, L-R and vice versa. Both programme controlled and manual triggering is possible with *RATE & SPEED* variable also front panel LED indicators show normal/track reversal modes, speed and trigger rate.

The **S 24 Time Shape Module (ADT/Flanger)** is the result of a carefully considered development programme that has resulted in an exceptional unit at a competitive price. Its unique feature is the use of a limiter on input to prevent overload of the delay line. Not only does this ensure optimum modulation and noise parameters are maintained effortlessly, but also opens up a whole new range of effects possibilities. Used with 100% feedback around the delay line, the limiter controls the level and creates a sustained signal that can be further modulated by another input signal with varied delay. The unit is divided into two sections: Audio frequency chain & controls and Delay section & controls featuring 0 — 45mS delay, pos/neg flange, programme controlled or manual delay setting, modulation, frequency and feedback. The **S 24** easily competes with all contemporary analogue time processors and outdates a few.....a must for any SCAMP system!

SCAMP is a fully professional modular system operating on a 60v supply (stabilised to ±24v), having electronically balanced inputs and outputs, with an output drive capability in excess of + 24dBm. Great care is taken in the design stage to use 'state-of-the-art' techniques in order to optimise system performance; especially in respect of noise and distortion.

The SCAMP frame will accept up to seventeen, one inch modules. It is recommended that the system be hard-wired from the 'motherboard' to a distibution patch field at the mixer console; or ideally — have it built-in to the body of the mixer itself.

SCAMP is flexible allowing easy between session reconfiguration from a basic pool of modules. These can be inexpensively updated with the latest addition to the SCAMP range.

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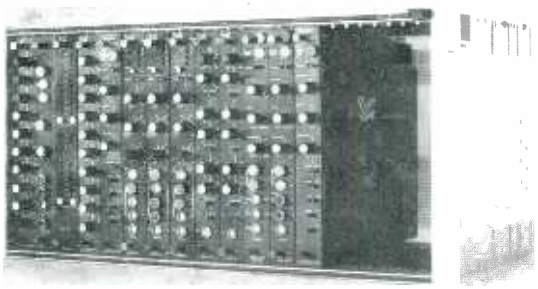

Full information on the individual module is available in the **SCAMP update pack available from:**

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Telephone: **Reading (0734) 53411** **Telex: 847 605** a/b Tillex G.

There is a Dolby noise reduction unit for every professional application

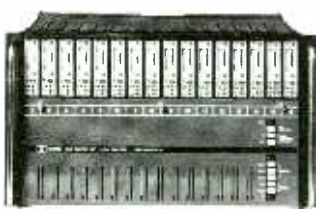
Professional recording and transmission applications

360

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

361

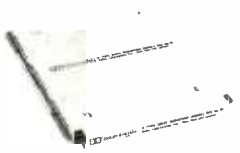
The Dolby 361 is similar to the 360, providing a single channel of A-type noise reduction, but with relay switching of operating mode and tape recorder connections The changeover can be controlled automatically by the recorder



M-Series

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

Noise reduction module



Cat no. 22

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

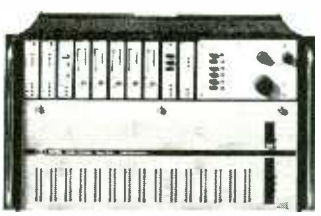
Motion picture industry

364

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

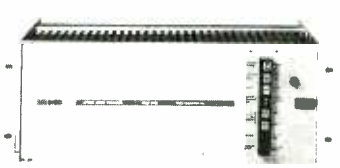
E2

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



CP100

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



CP50

The new Model CP50 is intended for the reproduction of all optical soundtrack formats, Dolby encoded and conventional, mono and stereo The unit is designed to interface with an existing fader and magnetic stereo installation A wide range of accessories is available

Professional encoders for consumer media

330

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

334

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

Test set (A-type)

Cat no. 35

The Dolby NRM Test set, Cat no. 35, permits rapid verification of performance of Cat no 22 noise reduction modules without their removal or the need for additional test equipment

Noise weighting filter

Cat. Nr. 98A

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

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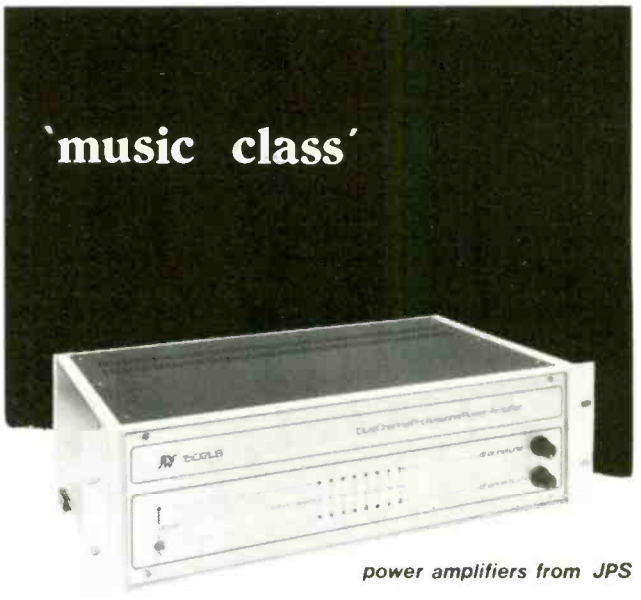

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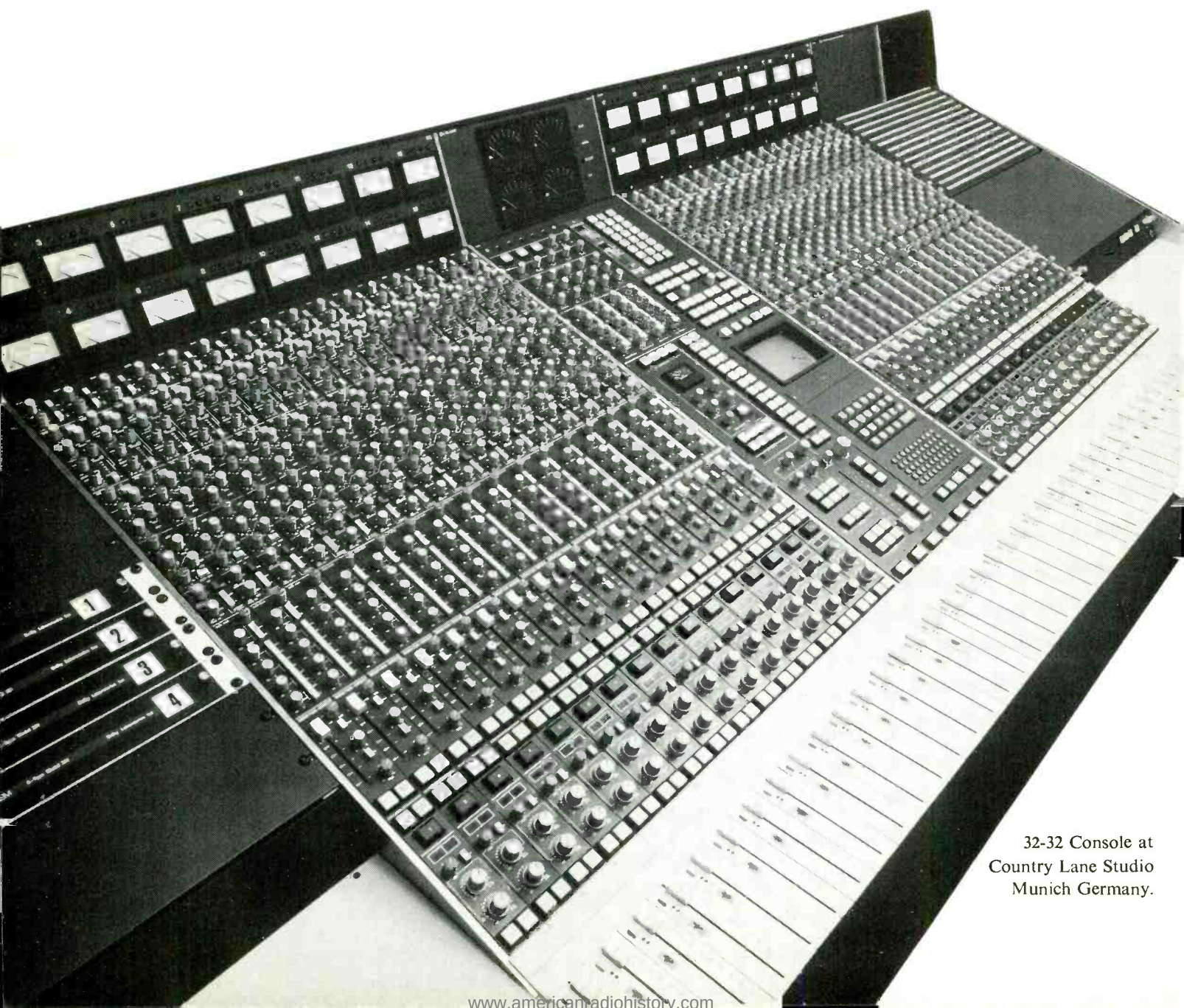

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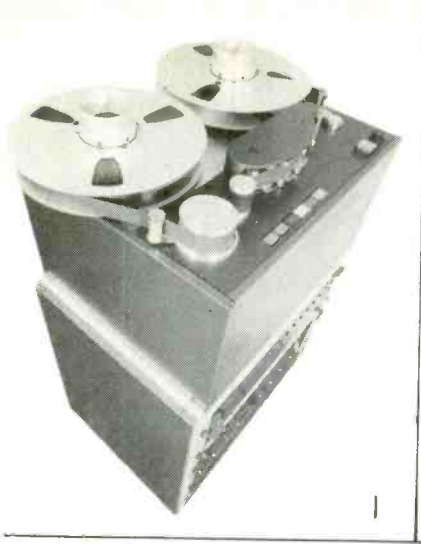
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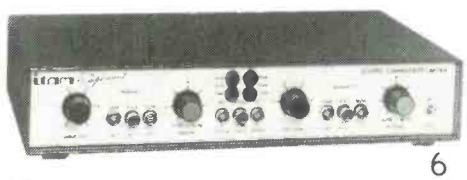
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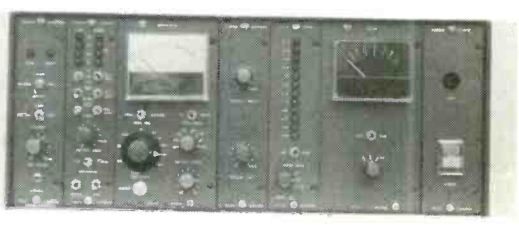
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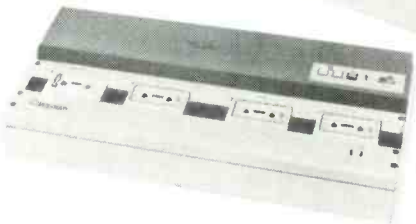

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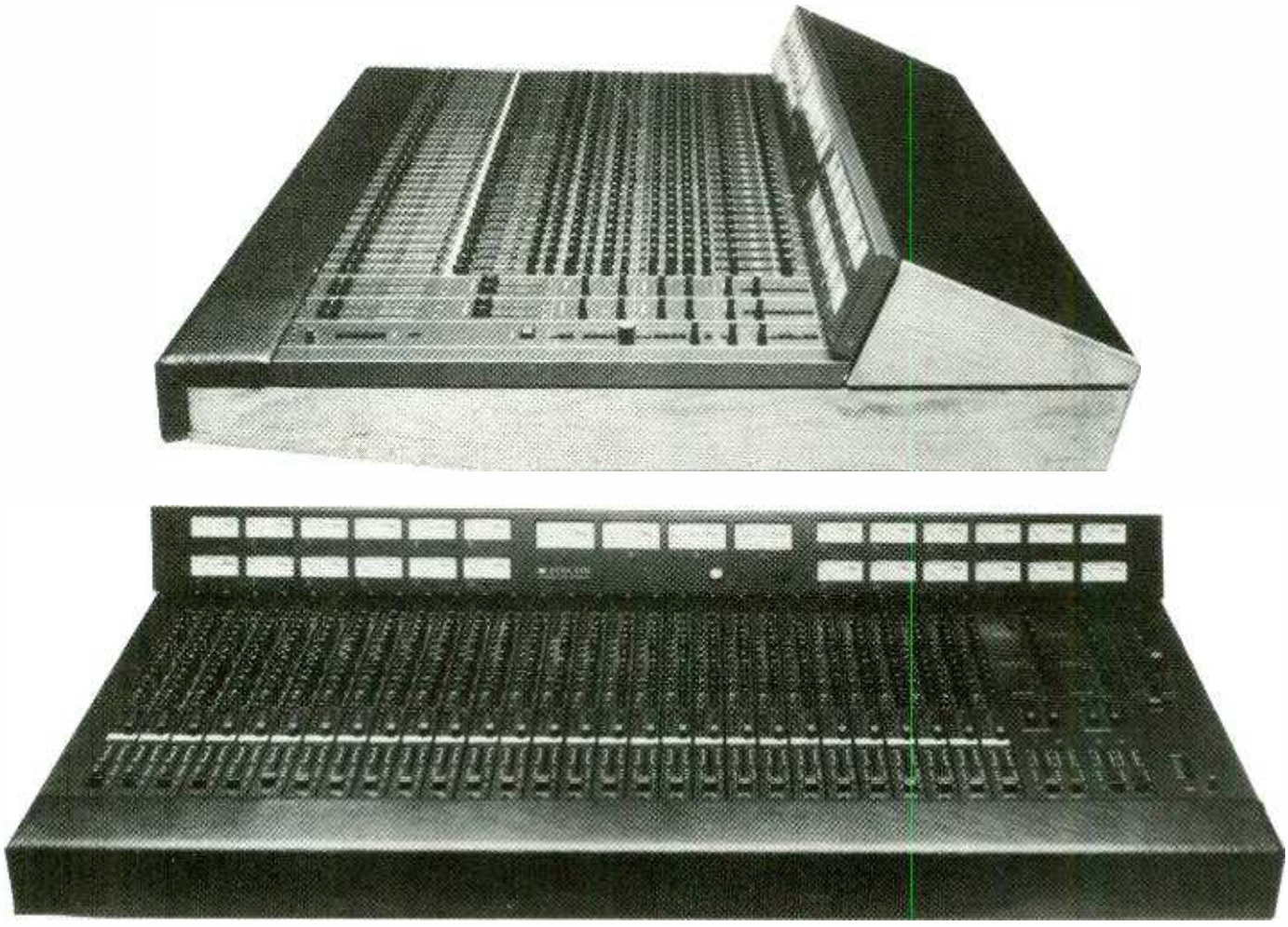

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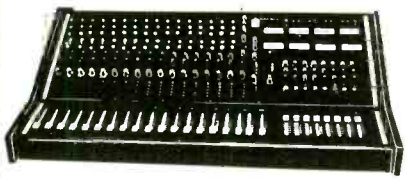

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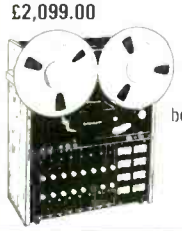

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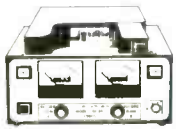

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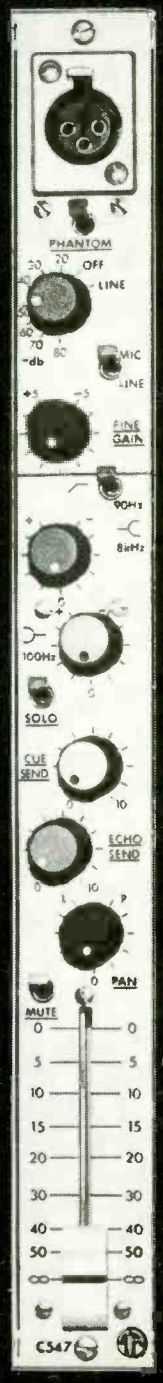

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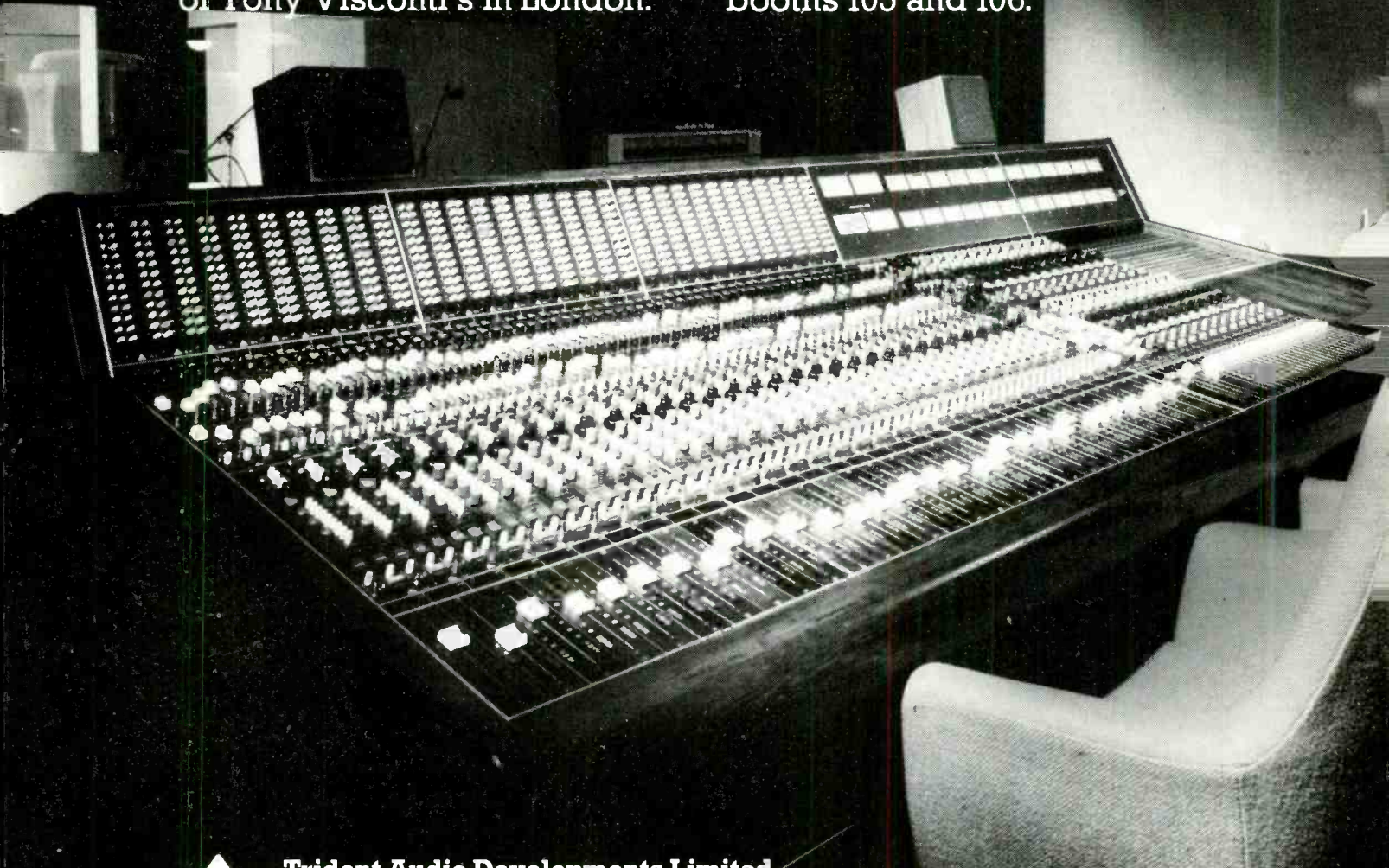
. . . and these TSM consoles are in pretty good company – worldwide – like this studio of Tony Visconti's in London.

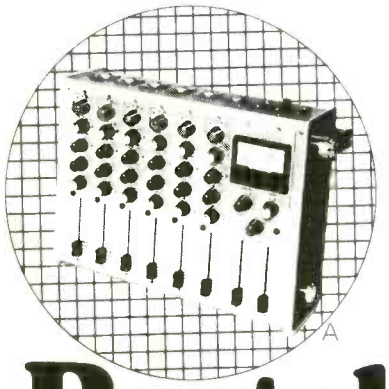
Join this recording elite! See the TSM in action at the New York A.E.S. on 3-6 November, booths 105 and 106.



TRIDENT

Trident Audio Developments Limited
Shepperton Studios, Squires Bridge Road, Shepperton, Middlesex, England.
Telephone: Chertsey (09328) 60241

Audio Developments



Portable professional mixers

Designed to team up with professional equipment for studio sound on location

A - Picomixer AD 045
B - Micromixer AD 031
C - Minimixer AD 007

Of advanced design and proven performance these are purpose built battery powered portables, of solid 1/8" aluminium with carrying handles. Top quality components, modular construction and stringent quality control ensures the highest degree of reliability. For use on location with professional tape recorders — Nagras/Stellavox etc, outdoor broadcast, stage mixing or to supplement studio consoles when added capacity is required. Over 300 in trouble free use world wide.

MINIMIXER AD 007
8 in 4 out. Compressors. size 540 × 480 × 225mm Weight 22.7 kg
MICROMIXER AD 031
8 in 2 + 1 out + options size 420 × 335 × 127mm Weight 10 kg
PICOMIXER AD 045
6 in 2 out size 340 × 265 × 110mm Weight 6.2 kg
PICOMIXER AD 045
Mk II
AD 075 SuperSystem
AD 055 Stereo Compressor Limiter

New
Studio Compressor Limiter

The ADO55 Compressor is a dual channel compressor/limiter with a comprehensive range of useful facilities. The two identical systems may be linked for stereo operation.

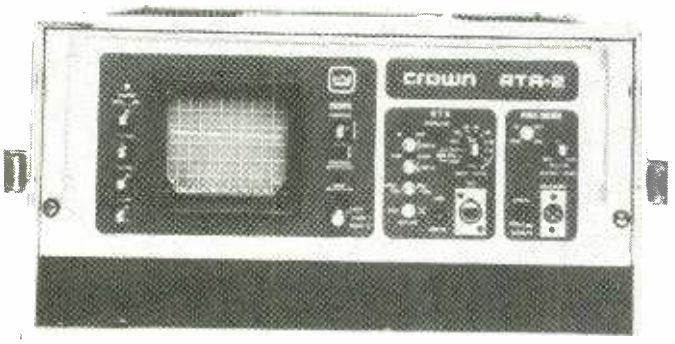
Specification
RATIOS 2 1 3 1 5 1 Limit (20 1)
RELEASE TIME Adjustable — 75mS 150mS 300mS 600mS 1 2 sec 2 4 sec
ATTACK TIME Adjustable — 0 25mS 0 5mS 1mS 2mS 4mS 8mS
FREQUENCY RESPONSE 1dB 20 Hz to 30 kHz NO COMPRESSION
DISTORTION 0 1% at 1kHz to 10kHz NO COMPRESSION +8dB input
MAX. COMPRESSION 25dB
MAX. OUTPUT + 19dB at 1kHz + 12dB at 20Hz
MAX. INPUT Dependent on the MAX OUTPUT and MAX COMPRESSION
NOISE Wideband — 68dB Band Limited — 71dB

Audio Developments
Hall Lane, Walsall Wood
WALSALL, W. Midlands, WS9 9AU
Telephone: Brownhills 5351/2/3 (STD Code 05433)
Telex: 338212 Audio

Coherent Communications
Ivan Kruglatt
13733 Glenoaks Boulevard
Sylmar California 91342 USA

NEW *from* amcron

REAL TIME ANALYSER RTA 2



* 5" CRT Display
* Internal Pink Noise Source
* $\frac{1}{3}$ or 1 octave Display
* Frequency range 20-20 kHz
* Outputs for X-Y Recorder
* Compatible with any microphone
* Price £1960 ex. VAT

The Amcron RTA2 Real Time Analyser is designed as much for use as a production tool as it is for on-site audio analysis of Theatres, and Recording Studios. A flight case is available.

POWER AMPLIFIER D75

The Amcron D75 power amplifier replaces the previous model D60. Employing completely new type circuitry it offers also many new features, but without any increase in the price.

* New Amcron 10C comparator.
* Balanced XLR input connectors.
* Signal presence indicators.
* Separate Signal/chassis earth.
* 45 watts into 8 ohms per channel.
* Price £230 ex. VAT

Other Amcron Products include:

DC300A 500 watts/channel	**£550**
D150A 200 watts/channel	**£350**
VFX2A Crossover unit	**£270**
EQ2 Equaliser unit	**£599**
IC150A Preamplifier	**£260**
IMA Intermodulation Distortion Analyser	**£610**

MACINNES LABORATORIES LIMITED
Carlton Park Industrial Estate,
Saxmundham, Suffolk. Tel. Sax. 2262/2615

Macinnes France
18 Rue Botzaris,
Paris 75019.
Tel. 206 60 80
206 83 61

Multitrack Consoles by AMEK

AMEK M2000: 28 inputs; 16 busses; 8 direct assigns; 24 meters

AMEK M2000: the purpose-built multitrack console — mainframe for 28 inputs, with 24 track-reading meters — 16 buss outputs and 8 direct assigns.

In-line format with panning between live busses; mic and two line inputs; 4 band equalizer with switched frequencies; 4 auxiliaries; Penny and Giles faders; in-place solo on channel and monitor.

Stereo buss for remix; 4 separately addressable stereo subgroups to remix; eq. to monitor facility; separate studio and control room monitor selection systems; built-in oscillator and talkback systems; 240 point jackfield; 48V phantom power supply.

Excellent performance specifications.

AMEK M3000: Favourably comparable to any console currently available, the M3000 features VCA faders with DC subgrouping; overall status commands for desk operation; 32-track monitoring; complete quad mixdown; comprehensive reciprocal-curve 4-band parametric equalization on all i/o modules; + 24 dBm headroom on the mic amp, and a favourable price.

A computer will be available by Advanced Music Systems using time-lock to tape via SMPTE code and floppy disc store, with access to several mixes.

Contact — UK: Nick Franks and Graham Langley, AMEK SYSTEMS AND CONTROLS LTD. Islington Mill, James Street, Salford, Lancashire M3 5HN. Tel: 061-834 6747. Telex: 668127

Or—Australia:
Con Psorakis,
AUDIO CONTROLS,
22 Finnis Street,
North Adelaide,
Tel: 08-267-4529
Telex: 88729

Benelux:
Luc Ardyns,
JUST BORN STUDIOS,
Terlindenstraat 76,
1790 Hekelgem,
Belgium.
Tel: 053-70 50 03

France:
Francis Linon,
SOCIÉTÉ CYBORG,
72 Ave. Lenine,
Gentilly 94250.
Tel: 161-657 0812
161-366 1772

Germany:
Manfred Brunwey,
RECORD STAR STUDIO,
Bernstorffstrasse 123,
D-2000 Hamburg 50.
Tel: 40-439 7254

USA:
Brian Cornfield,
EVERYTHING AUDIO,
7037 Laurel Canyon Boulevard,
North Hollywood,
California 91605,
Tel: 213-982-6200
Telex: 651485

SYNTOVOX 221

The Intelligible Machine

- 20-channel analysis and synthesis
- 54 dB/octave filters
- real time analysis LED read-out
- matrix patching
- fill-in facility
- built-in audio pulse generator
- random vlf and step modulation
- lfo modulation
- 56-way multiconnector for external control and computer applications
- 19" case
- £ 3,000

Syntovox 221 is one of the latest developments in sound effects equipment by Synton Electronics, also the creator of the famous 903 Phaser/ Band Filter.

Syntovox 221 is a 20-channel electronic effects vocoder which features a range of fascinating new sound effects for everyone who is involved with music, film, television, radio or theatre.

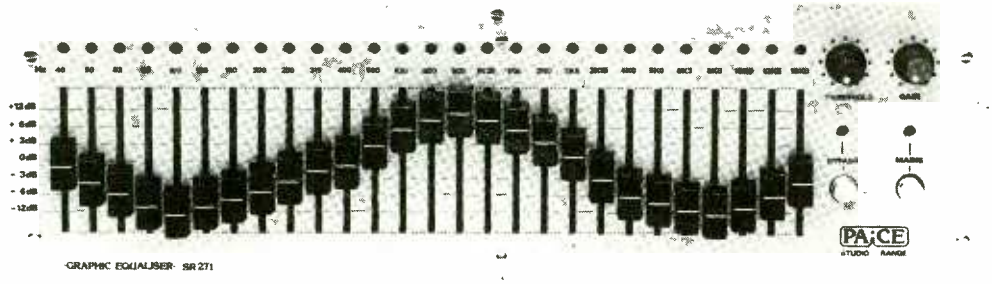
One of the most distinghuishing qualities of Syntovox 221 is its intelligibility which can be considered as a standard for technical quality in a vocoder.

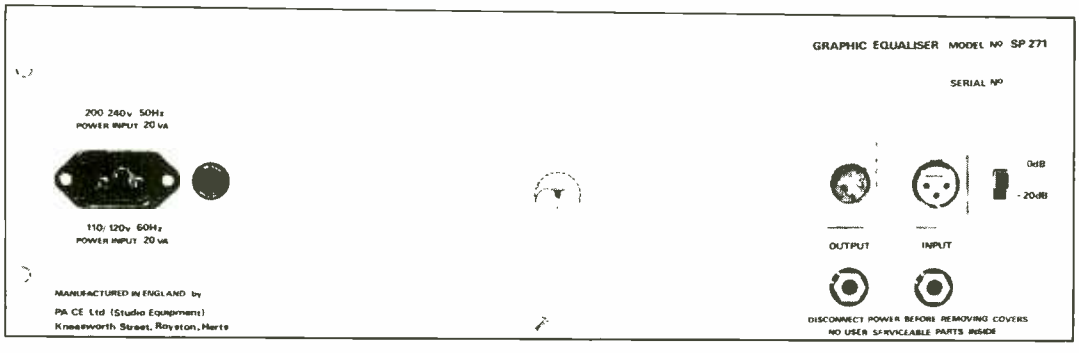
More than one year of research resulted in a highly accurate analyzing and synthesizing system which is the heart of Syntovox 221.
An extensive control system was designed to make Syntovox 221 sound more natural than any other vocoder.

synton® electronics b.v.
HOLLAND

breukelen holland
P.O.B. 83 TEL. 03462/3499

Some of Us are More Equal...





The PA :CE Studio range of graphic equalisers represent the technical solution to the equalisation requirements of users in the field of professional recording and sound reinforcement system. They provide uncompromising performance and reliability through state of the art circuitry incorporating ultra-linear gyrators and the unique "current sourced filtering monitoring technique" (pat pend).
The twenty seven bands provide third octave equalisation at the ISO standard frequencies, giving calibrated cut and boost characteristics via smooth operating 60mm faders. They may be noiselessly switched in and out of the circuit, even during live use, and signal level within each band is continuously monitored by means of variable threshold LED monitoring circuits. These circuits are exceptional in that they provide monitoring at no expense to the noise and distortion characteristics of the filters and give an invaluable indication of acoustic feedback, or system response.

PA:CE
STUDIO RANGE

PA:CE LTD., ROYSTON ENGLAND
TEL: ROYSTON 45214

The full-function one-inch eight-track. Otari MX7800.

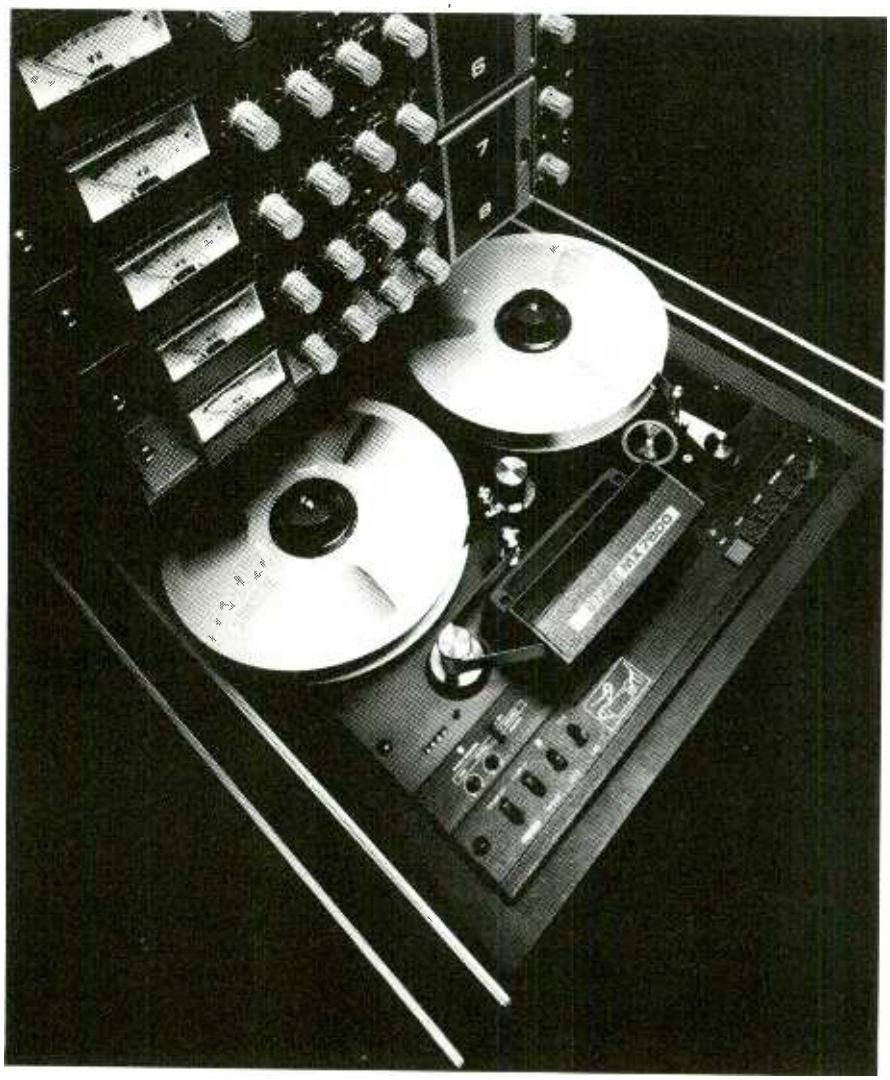
The sophisticated machine is the new criterion for one-inch eight-track mastering. It comes with the latest electronics and every function indispensable for heavy-duty applications.

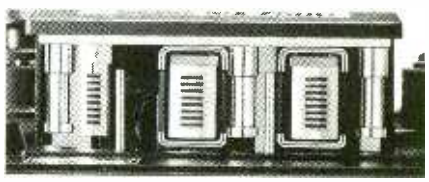
DC-servo 15/7-1/2 or 30/15 ips direct drive with minimum wow/flutter and ±12% pitch control. Constant-tension reel servo with motion-sensing control logic for minimized tape shock and tighter timing.

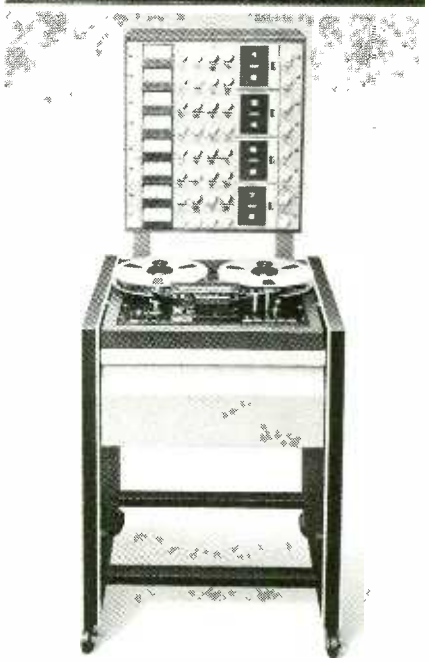
And it features perfect remote controllability. Full remote selective synchronous reproduce on all eight tracks. Automatic monitor switching to the preset mode— record, reproduce or synchronous. Remote coarse/fine pitch control for variable speed playback. Precise remote timing with return-to-zero memory. Remote position locator with automatic click-free punch-in/punch-out function.

Easy to access transport and plug-in electronics for improved serviceability, and heavy-duty design for extra reliability.

If you've been looking for a full-function one-inch eight-track machine, this is it. For the full story about the ingeniously designed masterpiece, contact your nearest Otari distributor and ask for demonstration.







OTARI

U.K.: Industrial Tape Applications, London
Phone 724 2497
France: Reditec, Paris Phone 300-9630
West Germany: Peter Struven GmbH, Hamburg
Phone 801028/29
Belgium: Trans European Music S A , Brussels
Phone 569 1823
Italy: Exhibo Italiana S.R L., Monza
Phone (039) 360021
Switzerland: Audio Bauer AG, Zurich
Phone. 643230
Australia: Klarion Enterprises Proprietary Ltd ,
South Melbourne Phone 613801
Japan: Otari Electric Co , Ltd . 4-29-18 Minami Ogikubo,
Suginami-ku, Tokyo 167

Otari 8-track

A new 25mm 8-track 'full function' tape recorder has been introduced by Otari. Termed the *MX-7800*, price is $8,695 (including floor console) and it features full remote control capability including selective reproduce and varispeed, remote LED readout tape timer with return to zero feature, total freedom from clicks and pops when punching into record, automatic monitor switching to properly match input or tape to record, reproduce or sync mode, constant tension system for better tape handling and timing, dynamic braking for smooth stops, direct drive DC capstan servo with 76 and 38cm/s speeds, and built-in 700Hz and 15kHz test oscillator. Otari has also introduced a completely new version of the popular *MX-5050* series 2-channel professional recorder, the *MX-5050-B* which sells for the same price ($1,795) yet includes newly designed TTL logic noise free punch-in and out, 28dBm maximum output, three calibrated record levels, DC capstan servo providing ±7% speed control, field selectable 38/19cm/s or 19/9.5cm/s with automatic equalisation switching, peak reading LED inditors, XLR connectors, and many other features.

Otari Corp, 981 Industrial Road, San Carlos, California 94070. Phone: (415) 593-1648.

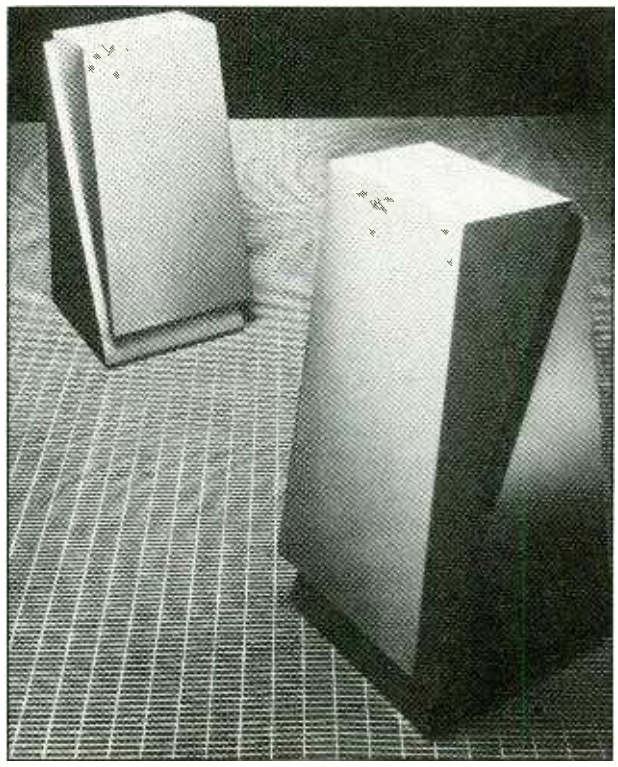
Eventide/Feldon

Recent Sunspot activity has been upsetting the *Studio Sound* typewriters! Yes, Feldon Audio is still British distributor for Eventide and particularly the 6.4s broadcast delay line featured in News last month. Sorry.

Acoustic Transducer speakers

Two monitor speakers omitted from the recent survey, were the Acoustic Transducer Co *S50*, and *S85*. Maximum input power of each is 300W with a nominal impedance of 6Ω—the *S50* has a bass reflex 4th order Butterworth enclosure (50 litre) while the *S85* is infinite baffle (85 litre). Sensitivities are 10W and 8W respectively for 96dB. Designed to go with every speaker is an electronic package incorporating Bessel filter technology with optimised phase and frequency response matched to the drive units used. The speakers include rear panel switching from the built-in passive crossover to this optional external active crossover.

Acoustic Transducer Co Ltd, Pier House Laundry, Strand on the Green, London W4. Phone: 01-994 3654.



People

● Peter Moody has been appointed regional sales manager at Helios Electronics Ltd covering the development of Helios standard and custom desks in the UK and Europe.

● Gerald Solberg has been elected to the board of directors of Technology for Communications International in California. He is now vice president responsible for structural engineering, manufacturing and antenna activities for the company.

● Richard Chilvers has been appointed sales manager of the public address division of Amdio Ltd, an associate company of Keith Monks Audio.

British AES meetings

Winter meetings for the British Audio Engineering Society are provisionally planned as: November 14 *Microphone Techniques*, December 12 *Tuners*, January 23 *Digital Audio*. Meetings are held at 7pm at the IEE, Savoy Place, London WC2. Information about the AES from 32 Knoll Rise, Orpington, Kent BR6 0EL. Phone: 0689 25423.

Pop and click eliminator

KLH Burwen Research has introduced the *TNE7000A Transient Noise Eliminator* which is now available in a rack mount. The unit was designed to eliminate ordinary medium and small clicks and pops transmitted from records due to scratches, dirt and imperfections in vinyl, and static build-up. KLH Burwen Research, the new brand name for Burwen Research products (the company was acquired by KLH two years ago), has also patented a music simulation circuit which keeps the musical signal smooth without introducing its own noise when taking out impulse noise.

KLH Burwen Research, 145 University Avenue, Westwood, Mass 02090 Phone: (617) 326-8000.

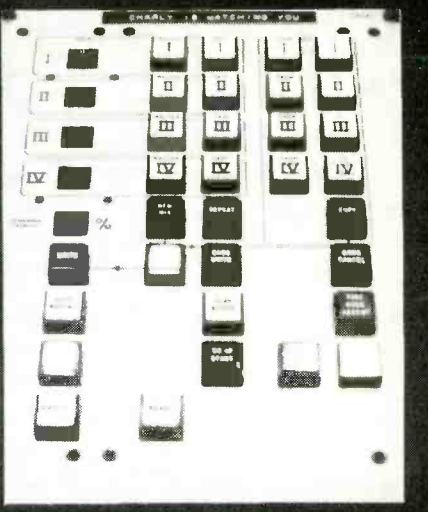
Mustang amplifiers

Omitted from the recent amplifier survey were Mustang Communications who manufacture 50W and 100W amplifiers either free standing or rack mounting. The *SS100* claims 100W rms into 15Ω, 150W into 8Ω or 175W into 4Ω, while the *SS50* offers 50W, 80W or 100W respectively. Input is zero level unbalanced on jack while outputs are on a barrier strip. Options are available for output transformers, balanced inputs, locking DIN or XLR input and output connectors.

Mustang Communications, Nelson Street, Scarborough, Yorkshire YO12 7SZ, UK. Phone: 0723 63298.

Union Studios Munich take C.A.R.E.*

with the new inline D40/40 (WITH 32 TRACK BUSSING) console for 38 track recording



Cadac (London) Ltd.
141 Lower Luton Road, Harpenden, Herts, England
☎ 05827-64351 Telex 826323

Cadac (Holland) B.V.
G.V. Amstelstraat 97, Hilversum, Holland
☎ 035-17722 Telex 43834

*Cadac Automated Recording/Remix Equipment

cadac

Deltalab digital delay

Scenic Sounds Equipment has concluded a representation agreement with Deltalab Research Inc of Massachusetts, covering the *DL-1 Digital Delay Unit* and forthcoming products. The use of new generation digital semiconductors has resulted in a unit which offers: delay from 5ms to 160ms in 5ms steps, full 20Hz to 15kHz frequency response at *all* delay settings, dynamic range greater than 80dB (broadband) on long delay settings, greater than 85dB on short settings, THD 0.2% (0.4% on long delay settings), and also offers a variety of effects. Price is £726 and applications are seen in recording studios and PA installations.

Deltalab Research Inc, 25 Drum Hill Road, Chelmsford, Mass 01824. Phone: (617) 458-2545.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812.

Contracts

● The Harris Corporation has received a $6¾ million contract for FM broadcast transmitting equipment for National Iranian Radio and Television. It includes 144 FM transmitters to be installed at 24 sites throughout Iran.

● Neve has supplied Polyvideo in Switzerland with a 20/16 *8066* console which will be used for television and film production work both in the studio and mobile, based in Guibiasco, near Lugano.

● Technology for Communications International has announced the completion of a joint contract with Siemens in Germany for a $1½ million 1.2MW antenna system for the Government of Syria's Broadcast & Television Authority. A further order for a 2MW four tower antenna system valued at $2 million has also been received.

IBA Technical Reviews

Two new Technical Reference books have been added to the Independent Broadcasting Authorities series of occasional texts. No 10, *A Broadcasting Engineer's Vade Mecum*, contains 17 sections ranging from light units and TV camera photometry, to preferred viewing conditions and metric units and conversions, the loudness of sound and relationships between power, voltage or current ratios, decibels and nepers, noise definitions and measurement. No 11, *Satellites for Broadcasting*, provides an introduction to the practices, possibilities and problems of using artificial earth satellites for television broadcasting and for national and international interchange of programmes. The 72-page book includes a description of the compact satellite receiving station built at the IBA's engineering centre. Each volume costs £1.50 and can be ordered from: Chief Accountant, IBA, Crawley Court, Winchester, Hampshire SO21 2QA, UK.

Loft Delay Line/Flanger

Connecticut based Loft Modular Devices Inc has introduced the *Series 4400 Delay Line/Flanger* which is claimed to provide greater depth of effects than earlier analogue delay lines, but without sacrificing sonic quality. VCO time based processing combines with straight delays from 0.5ms up to 160ms (switchable ranges v bandwidth) to provide a wide range of unusual effects as well as regular delays. Effects include slap-back, loudness enhancement, Doppler, flanging, Leslie-type sounds (with different speaker speeds), vibrato, altering reverb chamber characteristics, tunnel inversions, feedback control and realistic double and triple tracking with the important pitch and timing variations. Bandwidth is 18kHz at 40ms, and 9kHz (same as most reverberation systems) at 80ms. A noise reduction system (compander) is incorporated for increased dynamic range.

Price is $800 from Loft Modular Devices Inc, 91 Elm Street, Manchester, Connecticut 06040, USA. Phone: (203) 646-7806.

Ivie acoustics analyser

A microprocessor controlled acoustics analyser whose broad capabilities include the measurement of reverberation time in ⅓-octave or 1-octave bands has been developed by Ivie Electronics Inc. Used as an accessory to Ivie's *IE-30A*, the *IE-17A* has a built-in source control which provides tracking ⅓-octave or 1-octave bandwidth filters for pre-filtering room signals. Room delays are measured accurately to tenths of milliseconds for the direct wave, or for any reflection. Using the time gated feature of the *IE-17A*, the sound pressure level and spectral content of a given reflection can be isolated, measured and compared with the direct wave.

Ivie Electronics Inc, 500 West 1200 South, Orem, Utah 84057, USA. Phone: (801) 375-6200.

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

Harman Kardon Citation 16A

It has been pointed out that the Harman Kardon amplifier reviewed in September *Studio Sound* was in fact the *Citation 16A*, not the *Citation 16* as the front panel testifies. Principal differences over the *16* (not reviewed) include decreased transient intermodulation distortion, darlington output transistors, reduced crossover distortion, and no integrated circuits in the input stages. The version without the output level LED indicator on the front panel is the *Citation 16S*.

North London Polytechnic studio course

Roger Driscoll is organising a part time *Sound Studio and Recording* course at the Polytechnic of North London which commences in October. The course is run for two hours each Thursday afternoon for three terms leading to an examination next June and provides a knowledge of both the fundamental principles and techniques of the subject to the standard required by City and Guilds subject 271 Part III. The syllabus includes sound fundamentals, microphones, loudspeakers, acoustics, sound studios and outside broadcasting equipment, communications equipment, disc and tape recording and reproducing equipment, sound and noise limiting systems, simplified equivalent circuits of transistors and simple circuits, gain, noise etc, principles of transmission lines, equalisation, attenuators, power supplies and filters, regulation and acoustic standards and references. Course fee is £17.

Dept of Electronic and Communication Engineering, The Polytechnic of North London, Holloway Road, London N7 8DB. Phone: 01-607 2789.

MXR price reductions

It isn't often that it happens, but Atlantex Music Ltd has reduced the price of the MXR *Digital Delay* unit from £998 down to £783.16—this includes one memory board which provides 40ms delay with 20kHz bandwidth, while extra boards cost £116.78 each. The MXR *Dual Fifteen Band Equaliser* comes down to £275.67, while the *Thirty-One Band Equaliser* is now £293.73.

Atlantex Music Ltd, 16 High Street, Graveley, Herts. Phone: 0438 50113.

Actilinear recording system

Tandberg has introduced its new *Actilinear* recording system which is designed to accommodate the new iron metallic particle tapes which are expected to become available later this year such as 3M Metafine. *Actilinear* recording is available on the NAB open reel *TD20A* and *TCD340A* stereo cassette deck. Basically, the process uses a transconductance converter (active current generator) for optimum matching to the record head—this allows up to 20dB better signal capability with less intermodulation caused by slew rate limitation. Additional filtering helps to prevent bias current from mixing with the signal current thus reducing oscillator interference. When used in the cassette format with pure metal tapes, a 10dB better signal to noise at 10kHz can be achieved and 5dB at lower frequencies.

Tandberg (UK) Ltd, 81 Kirkstall Road, Leeds LS3 1HR. Phone: 0532 35111.

Stellavox In-line head blocks

John Page is now offering a new head block type *SIS* for Stellavox portable tape recorders that features two high quality sound tracks with a central cue track, all in-line in the same head. Advantages include only three heads instead of four, enabling an additional flutter roller to be added. larger gap and lower impedance heads, no time lag between different tracks, simultaneous record and replay even from cue track. Stellavox has also intoroduced a new *Universal Tape Deck TD88* designed for film sound location recording that can, very unusually, accept 6.25mm, 12.5mm and 16mm sprocketed audio tape (film) by replacing headblock and tensionmeters. It also features remote control, electronic counter, 36cm spools for 6.25mm, 26.5cm spools for 12.5mm and up to 610m of polyester perfotape.

John Page Ltd, Wesley House, 75 Wesley Avenue, London NW10. Phone: 01-961 4181.

Deltalab Research DL-1 Digital Delay Unit

Better Performance...

Full 20-15Khz frequency response, all delay lengths. 5 m/s to 160 m/s.

Better Dynamic Range ...

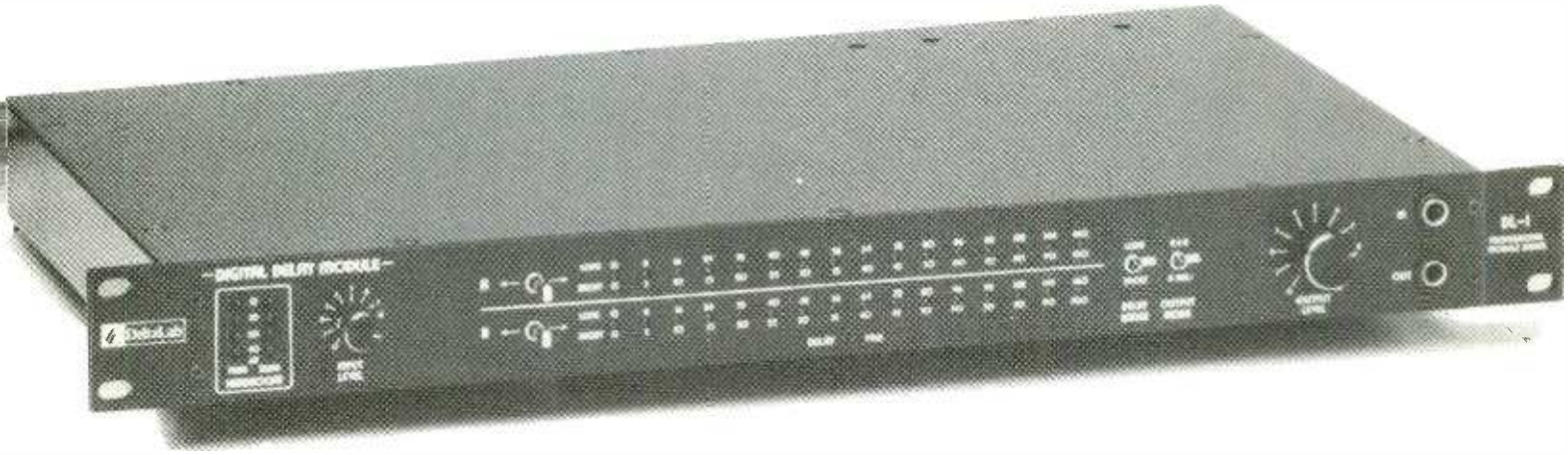
Over 90db 'A' weighted on delay settings to 100 m/s, over 85db to 160 m/s.

Better Operational Flexibility...

Delay variable in 5 m/s steps to 160 m/s.

Best Value in Digital Delay Devices Today!

UK Professional User List £726.



Fully professional 'no performance compromise' Digital Delay has at last become available at a reasonable cost with Deltalab Research's DL-1 Delay Unit. Equally suitable for high quality recording or PA use, the DL-1 is flexible (3 outputs each with selectable delays) easy to install (balanced input/outputs) and small in size (19" × 1¾").

U.K. Distributors
Scenic Sounds Equipment,
97–99 Dean Street,
London W1V 5RA
Tel: 01-734 2812

Spain:
Mike Llewelyn-Jones
AP Postal 8178
Madrid 8
Spain

Denmark
Lake Audio APS,
Artillerivej 40,
DK-2300 Copenhagen S
Tel: Copenhagen 570 600

France
3M France SA, Mincom Div.,
Boulevard de l'Oise,
95000 Cergy
Tel: Paris 749 0275

Holland
Pieter Bollen Geluidstechnik,
Hastelweg 6,
Eindhoven
Tel: Eindhoven 512 777

Norway
Kvam Audio,
Tollbugt 7,
Oslo 1
Tel: Oslo 412 996

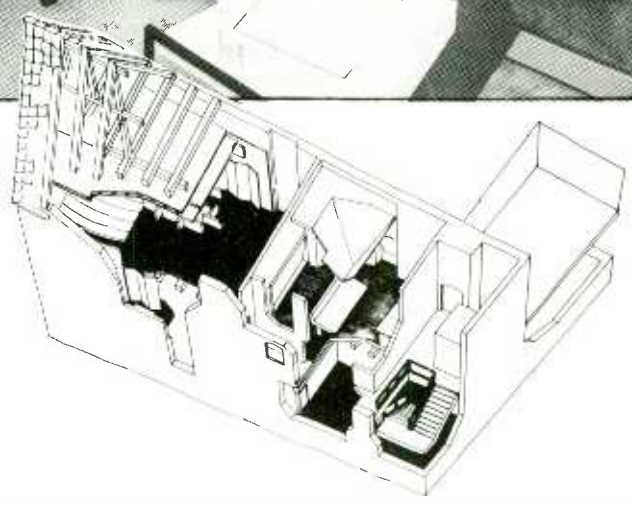
Sweden
Tal & Ton Musik & Elektronik AB,
Kungsgatan 5,
411–19 Gothenburg
Tel: Gothenburg 130 216

Scenic Sounds Equipment, 97/99 Dean Street, London W1V 5RA.
Tel. 01-734 2812. Telex 27939.

studio diary

Soundtrack Studio, Copenhagen

The Danes have always managed to produce the most up to date studio designs, well finished and, to the English, very expensive — Soundtrack is no exception to this rule. It is beautifully designed and finished and it did cost a lot of money. Situated just a stone's throw from the harbour and the walking street, Soundtrack's 24-track studio is located in an 1810 storage house. Its 0.6m thick walls, 35mm beams and general appearance have been preserved throughout but, apart from this character, a completely efficient aesthetic modernisation has been completed for £150,000. The acoustics, which were designed by Eddie Veale and completed in Denmark, cost another £40,000 and the studio area of 150m² incorporates every different acoustic effect desired, from parquet flooring with concave ceiling, to heavily carpeted, oblique-angled corners made up from screens. Egg boxes are back, or so it seems. The walls are made of slightly larger, egg-box shaped, high density sponge with slightly larger pointed protrusions. The control room is 100m², big enough to accommodate the new Trident TSM 40/32 desk, and Lyrec 24-track machines, with amplification by Harman and Kardon, and speakers by JBL.



The owners are Ole Hanen, who looks after the business side and engineers occasionally, and Klaus Asmussen, son of Sven Asmussen, the famous gypsy violin player. Klaus is a member of Shubidua, the largest selling Danish pop group ever, and it was after that group's association with Ole and Klaus, in their smaller 16-track studio, that everyone decided to get together a more ambitious project.

Soundtrack Studios incorporates all the good things in a studio, with very high finish and an almost Germanic attention to detail and technical excellence whilst being warm and charming, well designed and clean. And all this for £40 per hour. Yes, Ole Hansen tells me, the Danish record companies won't pay more, even if you gave them automation!

Jeremy Rose

MCI for Powerplay

Powerplay Recording Studios, in Horgen, Switzerland, expect delivery at the end of September of a new MCI *JH114* console, with 24-track and stereo *JH110* tape recorders. The console is MCI automated and is prepared for 32-track (MCI 76mm tape) operation. Booking information from Jim Duncombe at *Powerplay Recording Studios AG, Tödistrasse 68, CH-8810 Horgen, Switzerland. Phone 01 725 68 77/87.*

New Studio in El Paso

Howard Steele, co-owner of Los Angeles's Studio 55 and designer and co-owner of Quantum Audio Labs, has opened a new recording studio in El Paso called El Adobe. The new studio is equipped with a Quantum Audio Lab console, MCI 24-track and 2-track tape recorders, JBL monitor loudspeakers and a wide range of outboard accessories.

Audiogenic takeover Sun Recording Services

Audiogenic best known for their cassette duplication and record pressing handling service have taken over the recording studios of Sun Recording Services in Reading. Audiogenic had been operating in association with Sun for the past three years but now take control of Sun. With the takeover the Sun studio and control room have been completely rebuilt. Whereas previously there was no visual contact with the studio from the control room, this has now been rectified. In addition the control room has also been enlarged and new flanging and delay line units installed.

Portland Recording Studio

First appointment to the newly-named Portland Recording Studio, formerly IBC and now part of the Barn Group of Companies, is George Peckham as Chief Cutting Engineer. George, who joined Portland at the beginning of September, previously ran the cutting rooms at Apple and latterly the Master Room. This appointment is the first step in Barn's plans to redevelop the facilities at Portland, including the 24-track main studio, cutting room and tape-copying facilities.

Sea-West goes 32

Sea-West Studios of Seattle have gone 32-track, with the addition of two Ampex *MM-1200* 16-track recorders with full SMPTE interlock for the two machines. Sea-West president Richard Keefer seems well pleased with the new arrangement remarking that, 'one of the nicest features of the two recorder 32-track operation is that once the basic tracks are recorded, a monitor mix is bounced to the second machine, and the original basic master is put away in the tape vault until mixdown. All the overdubbing is done on a new 50mm tape, and the two machines are finally locked together for a mix. This format really saves the quality of sound on the basic tracks when compared with single master 24-track operation'. Other news from Sea-West is that the Heart album *Magazine* is enjoying chart success and that the group have just completed their new album *Dog and Butterfly* for CBS/Portrait, using the new Sea-West 32-track facilities.

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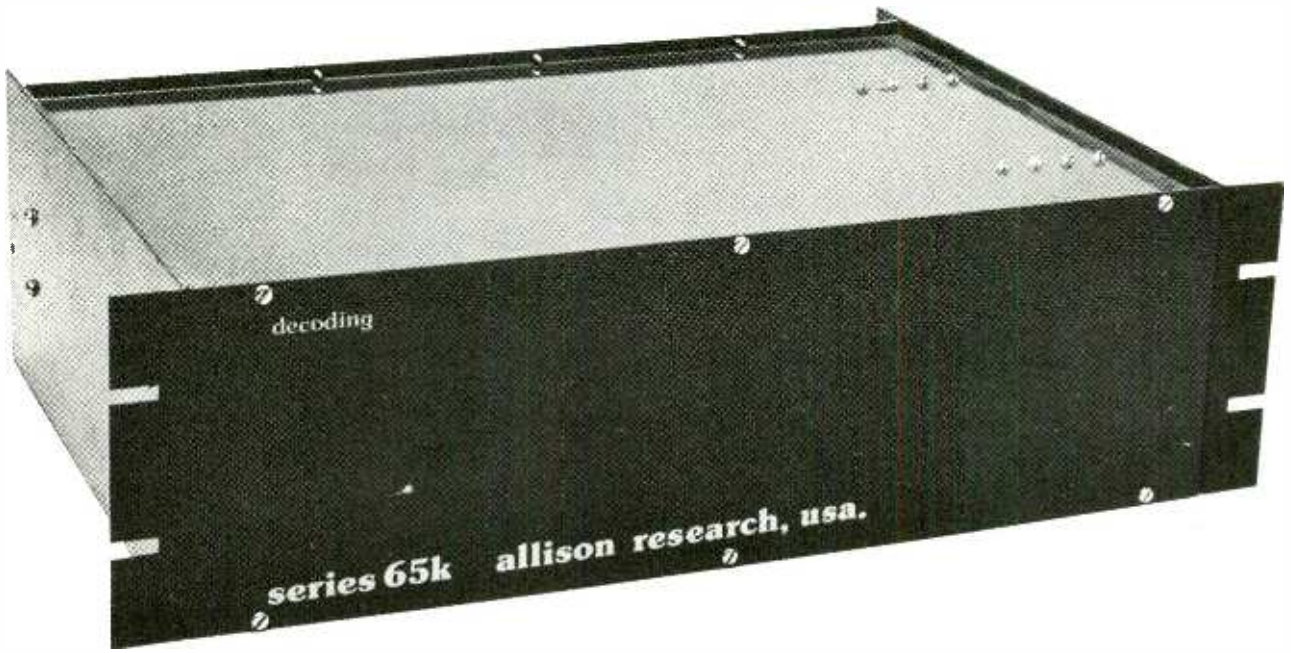
The Industry Standard

Allison Research 65k Console Automation Programmer –

Nearly one hundred units in world-wide daily use with API, Harrison, Helios, Sphere, Trident and other fine mixing consoles.



Allison Research's 65K second generation programmer accepts and processes control voltages in the range 0 to + 5.6 VDC from VCA type faders. These analogue control voltages are converted by the 65K Programmer to data words which can be stored on any non-critical tape medium. Upon replay of the data the original DC levels are re-created . . . . accurately and unerringly.

Applications of the 65K Programmer to any recording console fitted with suitable VCA faders permits comprehensive and reliable level automation. The 65K Programmer illustrated can be expanded from a basic 16 fader capacity (UK list £2362) to 64 fader capacity (UK list £3153) simply by the insertion of expander cards.

Unlike other console automation programmers, the Allison 65K when fully expanded can handle 8000 analogue functions or 65,000 digital bit functions – sufficient capacity to allow it to be used with subsequent generations of programmable equalisers and other devices.

For full information on Allison Research's Industry Standard Automation Programmer contact:

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West Coast recording scene

While there are obviously exceptions, Los Angeles is primarily responsible for the recording of much of the known world's music, film, and video. However in many ways it is San Francisco (a much smaller area) which sets the pace in an industry which continues to thrive and expand throughout the West Coast — by West Coast I mean from San Diego on the Mexican border to Seattle north on the Canadian border. It is San Francisco where much innovation and experimentation take place and the studios are 'risk-takers' in terms of trying new ideas and equipment which, when proven 'worthwhile', can then be safely adopted by Los Angeles. This isn't to knock LA but the competition between studios there is much greater allowing less risk-taking. There are approximately four studios in Los Angeles for every one in San Francisco — a total of 120 odd. It is also true that the industry is expanding at an extraordinary rate in San Francisco's Bay Area with numerous smaller eight track studios (including a lot of Teac Tascam) along with larger 'State of the Art' 16 and 24-track studios opening almost monthly. Meanwhile, the existing studios are continually upgrading.

Naturally it is in LA that the large corporate enterprises base their studio complexes (A&M, Capitol, CBS, Filmways/Heiders etc). It's an interesting contradiction that it is these giants who find it hard to make ends meet in San Francisco. A case in point is Columbia Records (CBS) who finally closed their SF facility at the end of 1977 due to unacceptable losses, leaving only Wally Heider Studios (a legendary independent studio now absorbed as a branch of the Filmways giant) as the last bastion of corporate enterprise in San Francisco . . . and the rumours fly about the future of SF Heiders.

Finally, when appraising the West Coast recording scene, it would be a mistake to omit the Pacific Northwest Area as a new recording centre, primarily based around Seattle in Washington state. While still in its teething stage, the industry in this area is expanding at a faster rate than anywhere else in the country—given its size now compared to two years ago.

Enbee

Canadian developments

From Canada comes news of two studios, Eastern Sound of Toronto and Studio Experience of Montreal, both of which have an eye to the future. Both have recently improved and extended their facilities, and now plan to actively promote themselves abroad.

Eastern Sound has had a major exterior and interior facelift and now boasts a second 24-track studio to complement the previous one. Their Studio One now has a custom built 24-track Neve console with JBL *4350* loudspeakers and Studer recorders, whilst Studio Two which was formerly a 4-track studio has been enlarged and now has a standard 24-track Neve console with JBL *4350* loudspeakers and Studer recorders. In addition to these Eastern also have a small production studio with an 8-track Neve, JBL *4311* loudspeakers and Studer recorders. All control room designs were done by Jack Edwards, the Los Angeles based studio design team.

Studio Experience, formerly known as Studio Six before recently changing hands, has undergone extensive alteration and expansion. The studios are now operated by CAM Canada Ltd, a company which offers record production, film recording and editing, commercial production, and music publishing facilities. The remodelling of the studios now means that Studio A has a Neve 28/24 mixing console with a Lyrec 16/24-track recorder, JBL *4343* loudspeakers and Studer mixdown machines; whilst Studio Two now has a Neve 16/24 console, a Studer recording desk and tape recorders, JBL monitors and an Intercine film editing table for 16 and 35mm film.

Westlake Studios, Los Angeles

Westlake Studios control room with Harrison console, 3M 24-track and Studer 2-track and TMI monitors

One year on!

Soundmixers (New York City) celebrated their first anniversary recently and dropped us a line about their progress to date. All is well on Broadway it would seem for the studio has been kept busy with a host of users, including John McLaughlin, Kenny Loggins, Meatloaf, Television, the Shirts, Fotomaker, Ben E. King, the Werewolves, and Ace Frehley of Kiss.

Housed in a studio complex offering two 24-track studios; a 16-track studio (soon to be upgraded to an automated 24-track); an automated 24-track reduction room with SMPTE timecode lock-up and overdub studio; and with film and video transfer, Soundmixers is well endowed in facilities.

Equipment in use includes MCI mixer desks (two *538*'s a *528* and a *432*), MCI tape machines, custom designed built-in monitor loudspeakers utilising a variety of Altec, JBL, and other components powered by Phase Linear amps, and Dolby and dbx noise reduction. Microphones available are the usual assortment of Neumann, AKG, Electro-voice, RCA, Beyer, Sony and Sennheiser. Ancillary equipment includes Eventide and Lexicon DDL's and harmonisers; Marshall time modulator; MXR and Eventide phasers and flangers; Aphex aural exciter; Audio and Design, dbx, Urei *LA-3A* and *1176*, and Allison limiters and compressors; Pultec, Klein and Hummel, and Orban parametric outboard equalisers; and Kepexes. Echo is provided by a selection of EMT plates and AKG springs, and the studio inform us that they have a Lexicon digital reverberation unit on order.

For film, video and advert work each studio boasts a Sony colour monitor and videocassette deck with full screen video projection in Studio A. The Soundmixer studios were designed by John Storyk of Sugarloaf View, in conjunction with Soundmixer president Harry Hirsch, and his staff, with special attention being paid to aesthetic considerations as well as technical performance. A more unusual feature of the design is that all the studio rooms have been acoustically designed to be not just 'flat' but acoustically identical to allow producers to move from room to room without the need to make any mental adjustments. All in all Soundmixers would appear to be in good health. It only remains to wish all concerned 'Happy Anniversary, and many more of them.'

More Than Great Specs, Great Ideas.

For the past three years we've been telling you about the benefits of using graphic equalizers; now we've made it even easier to appreciate them. Introducing the MXR Dual Fifteen and Thirty-One Band Equalizers. Two equalizers designed with the imagination and understanding to solve your toughest equalization problems. Designed for use in either studios or sound reinforcement situations, our new eqs offer features not previously available at any price.

The Dual Fifteen Band Eq features two channels of equalization with the bands set two-thirds of an octave apart. By breaking the frequencies down further than conventional octave equalizers, you now have the flexibility to contour your music with much greater selectivity. As most musical information occurs in the midrange, this is where you need even more definition, and the Dual Fifteen Band Eq gives you six bands of contour in this area rather than the usual four. In addition, each channel has its own level control.

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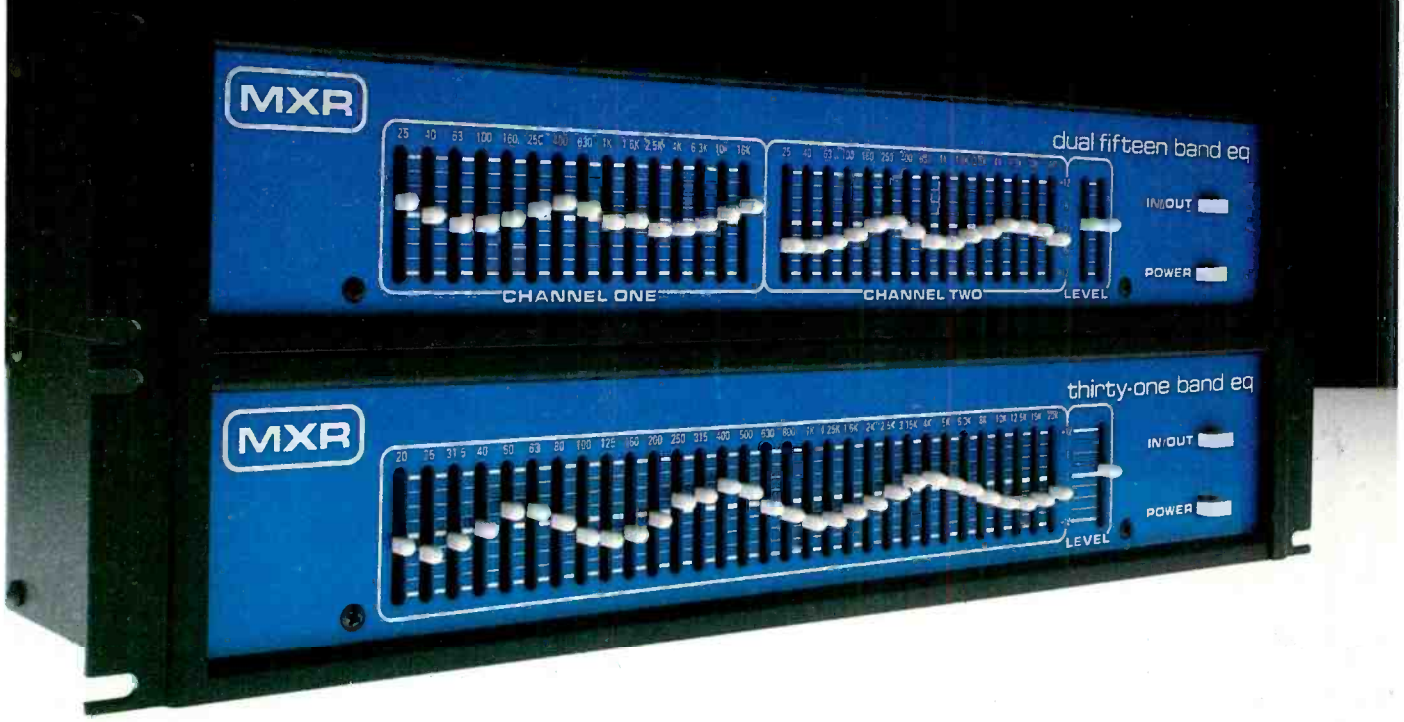
When used in conjunction with any PA system, our equalizers can make a bad environment sound good, and a good performance sound great. Unlike parametric equalizers, the frequency response change is immediate and easily visible, so that when you shape a response curve you know what it's going to sound like.

Both units feature a range of −12 to +12 decibels on each band, standard 19" rack mount, and the rugged construction you always get with an MXR product. Both units also feature phone plug input/output connections, (the Thrity-One Band also features Cannon type XLRs), high slew rate (7V/microsecond), and incredibly low noise (better than −90 dBM). But not only do we offer great specifications, we produce great ideas...you wouldn't expect any less from us.

Atlantex Music Ltd., 16 High Street,
Graveley, Herts., England, (0438) 50113

MXR Professional Products Group



Tape synchronisers

Richard Dean

Timecode synchronisation was primarily developed for video tape editing, but in recent years has been applied to audio recorders providing 46-track capability using two 24-track machines. Richard Dean describes the basis of the two systems (SMPTE and Maglink) and examines the capabilities of various synchronisers on the market. The Television Sound Dubbing and Production feature on page 64 gives an insight into the practical use of timecode for stereo television programme production.

THE SYNCHRONISATION OF two or more tape machines to a common time index is still a relatively new practice in the studio industry and certainly one which baits a good deal of controversy among engineers and managers in the business. Although the early seventies boom in recording tracks has passed, a perhaps surprising amount of 'up-tracking' momentum is still active. While many engineers pursue a renaissance in minimum track recording (or even direct cutting), the more-tracks-the-better faction has split into two groups:— those who favour larger multitrack machines (for instance the Telefunken 32-track model), and those who prefer the 'locking' of existing multitrack machines. Right now it looks as though the latter's preference may win, not least because it's cheaper to accomplish — but of course the situation could change, particularly with the imminent dawning of a digital recording age where more discrete tracks can be stored with acceptable results for a given track width.

Like so many items of audio hardware, synchronisers were initially born in an allied industry and later adopted by the inertia-ridden sound world. The allied industry in this instance was film and TV. Ever since the advent of 'talking' movies in 1926, a system of synchronising sound to pictures was required. Initially this was achieved physically — an optical soundtrack accompanied the visual image. As post production techniques developed, constituent soundtrack tapes had to be processed in sync with action, and for years the equipment used relied heavily on the mechanical locking of separate transports — only relatively recently have pulse synchronising techniques been adopted, a sort of electronic equivalent to sprocket holes. But pulses, whilst being fine for keeping various slave sources in step with a master tape or generator, do not index the separation to time. Winding and rewinding (*rock and rolling* in the film trade) can be tedious because of the system's consequent blindness to slip. So a more complex code had to be derived — one which provided the essential synchronising pulses while additionally placing the pulses in a time context. Such a code would allow error to not only be detected, but also quantified. With the auspicious use of relatively simple comparator electronics, 'slave' machines could be speeded up or slowed down until the time reading from their code tracks matched that of the 'master' code track or generator. An operating schematic appears in **fig. 1.**

The two codes in extensive use for tape synchronising are Maglink, and the code pioneered by the Society of Motion Picture and Television Engineers called, unsurprisingly, the SMPTE code (also termed EBU code in Europe). This is by far the most widely accepted code for automated mixdown systems, audio tape machine synchronisation, and is also used for television and film post production sync requirements. Hence, a wonderful though often rare attribute — compatibility! But so much for this code's popular usage — what exactly is SMPTE? The digital waveform appears in **fig. 2.** Time values are superimposed on the basic waveform, which you will notice by its squarewave appearance is purely digital, by a technique called bi-phase encoding. Rather than simply recording a pulse in the time section of the waveform only when a binary 0 or 1 needs to be written in, this method of encoding uses a regular pulse pattern changed by 1s and 0s. In this way, the likelihood of error is reduced because, in simple terms, the dynamic range of the waveform is constant. Hence time values are recognisable as shape changes in the 'silent' waveform. **Fig. 2** shows a time value of 20 hours 47 minutes, 58 seconds, and 19 frames. While most of us know the meaning of hours, minutes and seconds even if we don't know what day it is, 'frames' may be a bit of a mystery. The word is borrowed, as far as the sound engineer is concerned, from time code's parents of invention — film and TV. Film equipment expose or project 24 frames of photographic emulsion each second. Just to be awkward, UK television equipment scans 25 complete pictures or frames every second — not a deliberate incompatibility but one dictated by mains frequency (50Hz in the UK). In countries where mains power alternates at 60Hz, the number of frames per second is 30. For sound synchronising purposes only, such as is the case in most studio situations, all this is rather irrelevant and the frame count serves simply as ostensibly arbitrary divisions of one second.

The other code, Maglink, pioneered by Automated Processes Inc of New York, USA, is not directly SMPTE compatible. Perhaps the best way to outline characteristics of the two codes is to compare one with the other. As an aside, Maglink is now manufactured in the UK by a company hitherto AP Ltd, specialising in welding electronic control units used for North Sea oil rigs, now called Maglink Audio Products Ltd. A SMPTE code comprises an 80 bit word every frame. Hence where mains frequency is 60Hz, and the frame rate is consequently 30 per second, the date rate is 2,400 bits per second. European versions, designed for 50Hz mains systems where the frame rate is 25 per second, comply with EBU Standard (European Broadcasting Union) and a data rate of 2,000 bits per second. This data is recorded at, or near, saturation on a spare tape track and is relatively easy to generate and decode since at no time does the data stream deviate from a purely digital format. Although a widely accepted and adapted code, SMPTE does suffer a couple of drawbacks.

FIG. 1 BASIC SYNCHRONISER OPERATION

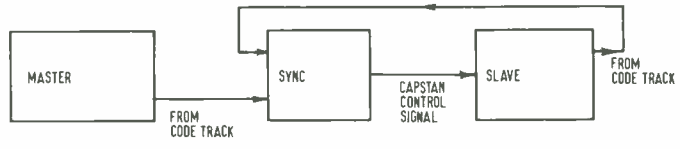


FIG. 2 SMPTE TIMECODE

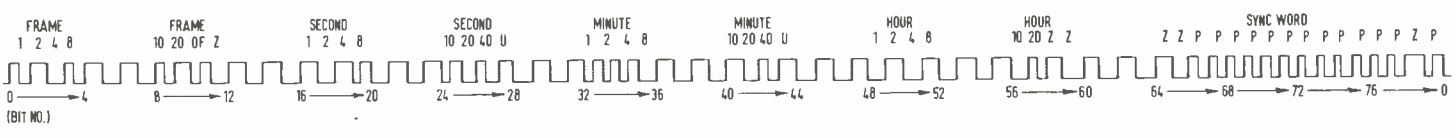


ILLUSTRATION SHOWS: 20 HOURS, 47 MINUTES, 58 SECONDS, 19 FRAMES
DF = DROP FRAME BIT (USED FOR COLOUR VIDEO ONLY)
P = PERMANENT ONE U = UNASSIGNED BITS Z = PERMANENT ZERO

Firstly, since the major component of the data stream is a 2.4kHz squarewave recorded at high level, the recorded code tends to be very sociable — it can crosstalk to the adjacent track, as indeed the reverse is true — one moral of this story is never to record bass drum on the adjacent track (usually this is track 23 on a 24 track machine, code going on track 24). Conversely sounds centred around the mid range are best diverted from the adjacent track to avoid a reverse crosstalk — audio to code. Another aspect is that at even moderate rewind speeds of 50 times play speed a bandwidth of 120kHz (30 frames/sec) or 100kHz (25 frames/sec) was required. Such code track bandwidths had to be detectable by the replay system to permit search facility (location of a preselected time position) and completely synchronous operation of linked machines in all modes. Hence a modification of replay electronics and head contact during wind modes was required. This problem has largely been overcome by the superimposing of a low frequency signal on the data corresponding with the frame rate. During rewind, the low frequency signal (by now of course approaching mid frequency), is reasonably easy to count without intimate head contact. Adding or subtracting the stored previous decoder reading permits coarse positioning of tapes prior to play mode selection.

The Maglink code however, is significantly different in concept. It comprises a 3.2kHz sinusoidal carrier frequency superimposed with another sinusoidal carrier of equal amplitude, this time alternating at 30Hz. The higher frequency is nominal, as data is encoded by a technique called Frequency Shift Keying, FSK for short. This means that the carrier is modulated by rapid changes in frequency, a maximum shift of ±600Hz. In coding each data bit is divided into four equal parts — the first quarter will always contain the highest frequency (3.8kHz) while the last quarter always contains the lowest (2.6kHz). The second and third quarters contain either the highest or lowest frequency according to their designated value — low frequency representing a binary 1 and high frequencies representing a binary 0. The 3.2kHz carrier is modulated in this way by 32 bit words consisting of a sync word and 20 data bits at a rate of 300 bits per second. The 30Hz carrier is switched on or off for a binary 1 or 0, in 32 bit word format, but has a data rate of 1/128 that of the HF carrier, and each word contains only the 13 most significant bits of the high speed data word. Hence, the low frequency element is used for coarse tape location, in rewind while the high frequencies define the point more exactly during play mode.

So what does all this mean? Well, firstly Maglink claim that crosstalk is reduced by their code being firstly sinusoidal and secondly recorded at something like 10dB below saturation level. Also the code need not be reprocessed on transfer from machine to machine and, the company claim, can stand a number of transfer generations. But because each Maglink 'frame' occurs every 0.107 seconds against SMPTE's 0.04 seconds, a microprocessor is essential for precision applications to count the 32 bits of information that occur in each frame and calculate finer increments of time. Maglink frames are labelled with a single digital number running from 0 to 2^{20} (because there are 20 data bits), rather than SMPTE's system of labelling hours, minutes, seconds and frames. There is no straight forward relationship between Maglink frames and SMPTE frames, although a conversion unit is available. A schematic of Maglink code appears in **Fig 3.**

Maglink code synchronisers are made only by Maglink Ltd but synchronisers interfacing SMPTE codes are available from a number of manufacturers. Probably one of the best known SMPTE synchronisers is the *TLS 2000* (Tape Lock System) by Studer **fig 4.** As hardware veterans may expect, this unit provides a wealth of facilities — perhaps more than those of a studio requiring purely straight audio to audio lock-up. In common with most synchronisers, the unit provides an offset facility which permits the shifting of time position between master and slave tape machines. In the audio context, this could be useful for simply correcting a time code mismatch between two tapes. If, for example, the two 24-track component tapes of a 48-track production were engineered at different studios using a guide track, exact 'slating' (as in film clapperboard) of each tape's timecode would be made less critical as discrepancy could be corrected by offsetting the lock between machines during mixdown. However, the *TLS 2000* is unusual in providing an offset swing of ±24 hours where most provide substantially less. The unit is designed to 'slave' a number of *A80* tape machines with a video tape recorder, film equipment, or any other SMPTE source — which in this case would be another audio tape machine. The manufacturers claim a synchronisation accuracy of ±100μs with a parking accuracy of ±1 frame — which could be 24, 25, 29, 30 or 97 per second.

As you might expect, synchronising devices require a run-up to the synchronising point to achieve lock. While film and video engineers call this period 'preroll', sound buffs prefer (quite logically) 'lock-up phase'. During the lock-up phase, master tape machine timecode is generally compared with slave code, and relatively drastic slave capstan speed changes effected until codes match. On the *TLS 2000*, however,

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Above: Seltech timecode generator and reader.

Below: **Fig. 4** *Studer Tape Lock System TLS 2000.*

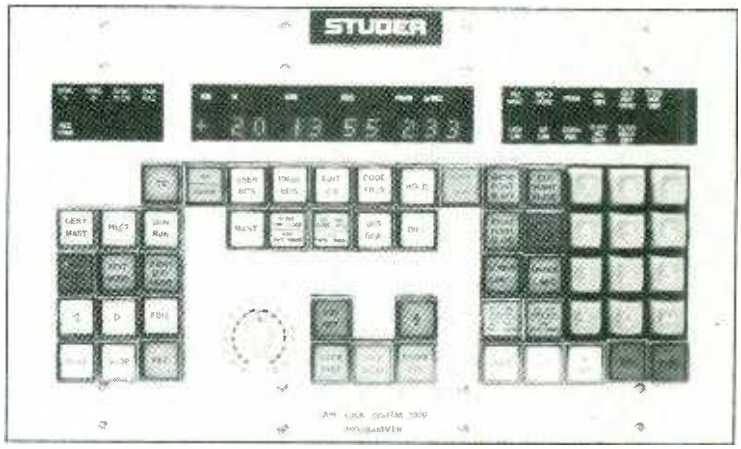
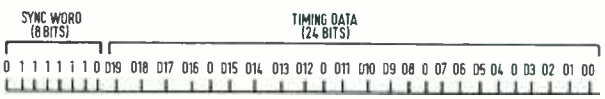


FIG. 3 MAGLINK CODE FORMAT



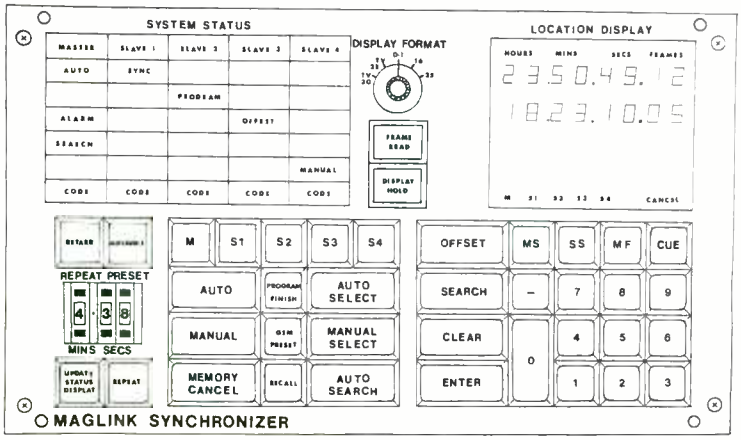
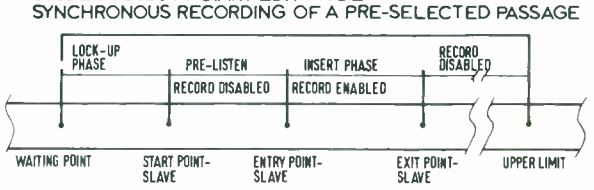


FIG. 5 STUDER TLS2000 'START EDIT MODE'- SYNCHRONOUS RECORDING OF A PRE-SELECTED PASSAGE

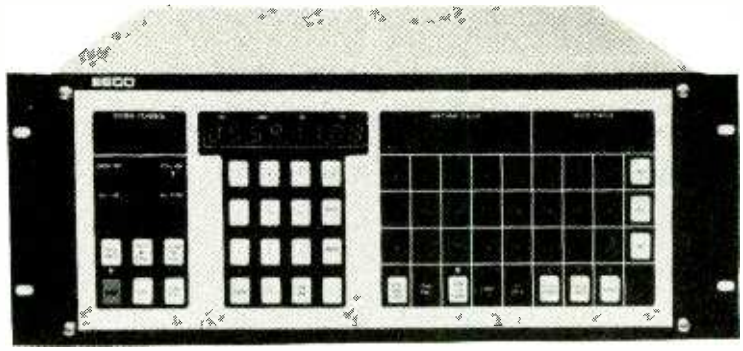


the master is cued ahead of the slave, whose timecode value is known. When the master code matches this stored value, the slave machine is cued. The synchronous record cycle for this device is shown in **fig 5.** Clearly machines are locked ahead of the required sync point (see prelistening). This allows a stabilising period between the machines — on some synchronisers this has to be dialled up manually. At any given point, machines can be locked immediately irrespective of the procedure in **fig 5** by selecting 'lock fast' on the centre tracking behaviour button group — a 'lock slow' facility is provided in addition where an unobtrusive lock-up is required. Where code is unavailable or not continuous, the system alternatively can work with tape time counter pulses for take searching.

MCI's *JH45* operates a similar synchronous recording procedure as the Studer device, with the fast or slow lock options. In the latter case, slave capstan speed variations are restricted to less than 1.45% (¼ semi-tone) for an imperceptible pitch change lock. The unit offers nine memories which can be used for storing park and offset values and which are entered by keyboard. Offset can additionally be introduced incrementally by advance and retard buttons whose momentary actuation introduces a one frame offset. Holding either of these keys introduces offset at the rate of three frames per second. The device will synchronise one MCI master/slave combination. Some video tape recorder interfaces are also available.

BTX Corporation produces an admirably simplified synchroniser for use between two machines (or code and machine). Offset is easily entered on thumbwheel switches, doing away with a numeric offset display. In fact, no readout displays are included on their *4500* model. Instead, *LEDs* indicate slave lag, sync and lead (relative to master). Offset can be quickly introduced or cancelled by a sync/offset toggle on the front panel.

The unit provides two control outputs — a DC voltage for DC controlled capstans, and a square-wave for frequency controlled capstans. An external source of SMPTE code is required for code track laying on tapes to be synchronised. Such a unit is the *4100*, which includes a numeric display. But back to the sync unit. Three modes of operation are provided:—sync, frame and auto. In sync mode, the *4500* simply matches sync components of the SMPTE code — actual time values are ignored. In frame mode, the unit operates as a full time-locking synchroniser. Auto mode initially operates as frame mode and then switches to sync mode once the exact time locking has been achieved. The offset thumbswitches offer ±29 seconds and +29 frames adjustment. However because hours and minutes code information is ignored, the unit can lock still profoundly differing tape codes — the proviso being that master and slave must be cued within ±30 seconds of the desired sync point. Calibration software, in common with more expensive synchronisers, is built into the unit to provide a tape machine response earning facility. This means that the characteristics of tape machines (such as braking and accelerating speeds) are learned, resulting in a speedy location of tape code values. A synchronisation of ±50μs is claimed.



EECO MQS-103 synchroniser for three machines

Massachusetts - based Adams-Smith manufactures a tape synchroniser, the *605*, marketed in Europe by Pye TVT Ltd. This model is designed to synchronise one or two slaves with one master, and like the Studer system, offers ancillary control outputs triggered by preselected time values. Here, a time value is entered on the keyboard and stored in a memory. When the master code matches the stored value, a relay changes over in the unit permitting the cueing of external equipment (such as a cartridge machine or another tape machine) at a specified time — four values can be stored in this way. The feature is particularly useful where music compilations, complex mixing or audio visual post-production requirements have to be met. A comprehensive range of search and cue facilities are available, and offset may be entered by numeric keyboard. Three synchronising modes are selectable for each slave, these being normal, freewheel and external. In normal mode, the synchroniser is fully active but when freewheel is selected, the device is active only as a frame-pulse driven servo controller, allowing operation with breaks in timecode. In external, the slave servo is referenced to an external input for use with a pilot tone or special effects. The unit is claimed to synchronise to one frame for 24, 25 or 30 frames per second standards and, incidentally, offers an optional teleprinter output!

Finally, EECO of California manufacture a tape synchroniser type *MQS-100* series which is marketed by Ampex outside the USA. The unit costs around £7,000 to £9,000 (as against the Studer *TLS 2000* at around £14,000 with options) and includes offset adjustment, fast and slow sync lock buttons, and two preselectable memories for ancillary equipment cueing. The unit operates on the familiar technique of initially locking machines on time information in the codes, where slave capstan speeds are radically corrected by as much as 50% (where slaves were seriously mismatched to master code, a wind mode would be selected). When lock has been achieved, the *MQS-103* uses the tape code as electronic sprocketing, that is, achieves synchronisation by so-called 'flywheel lock'. At this point, sync accuracy is a claimed ±100μs. One or two features are provided such as single button functions where other units would require separate specified instructions. One such example is the 'store direct' facility enabling time codes for all three machines to be captured into store simultaneously and 'on the fly' (whilst machines are running) and hence a log of cue points could be assembled in one pass. A 'roll back' button cancels the mode at time of actuation and rewinds all machines back by a predetermined period of code time. Roll back time is normally set at 30 seconds, but can be adjusted to any lesser period to the nearest frame. After roll back, machines are automatically engaged in synchronous play mode.

A 'chase' feature permits control of all transports from the master machine control panel where manual tape positioning is desired. A matching CRT is available, the *D400*, to interface with *MQS-103* — this provides a detachable keyboard which can be used instead of the synchroniser controls and of course a CRT screen which displays machine status alpha-numerically as opposed to the sync unit's *LED* status lights. A slightly cheaper model is the *MQS-102*, which synchronises a single master/slave pair.

Synchronisers seem to be providing an answer to the industry's apparent hunger for more tracks in addition to allowing off-line video and film dubbing. The first question must be, do we need 48, or even 72 tracks (46 and 69 respectively excluding code tracks) to record music? If the answer to that is yes, then the choice is diverse — varying from an electronic variation on a toothed fan belt theme to minicomputers that know more about your tape machines than the best tape operator, and even print you a note telling you so! ■

Central Dynamics ED200 being used at Ewart Studios to synchronise Sony Video tape recorder and A80 8-track

Publison Audio Professional Manufacturing

DHM 83 – DIGITAL DELAY LINE – HARMONIZER – MEMORY MODE

STEREO DIGITAL DELAY LINE with continuous variation, 0 to 600 mS for option A and 0 to 1,2 second for option B.

HARMONIZER: from —1 to + 1 Octave – a micro computer operates a sophisticated phase coincidence of joining points, taking into account both the instantaneous phase and the envelope phase, so that transition "glitches" are eliminated.

VARIOUS REMOTE CONTROLS include in particular two digital V.C.A. inputs allowing separate voltage control of the gain of the two outputs.

REVERSE POSSIBILITY, by setting crosspoint I, smaller than crosspoint II, reading direction is inverted, which is the electronic equivalent of a magnetic tape running reversed.

MEMORY MODE with keyboard remote control, one can play any memorized sound – it is also possible to obtain rhythms with any existing sound.

TRUE DYNAMIC RANGE 100 dB by means of a quasi 16 bits flying comma A/D converter of prime quality.

E.C.L. 20.A – EXPANDER – COMPRESSOR – LIMITER – NOISE GATE

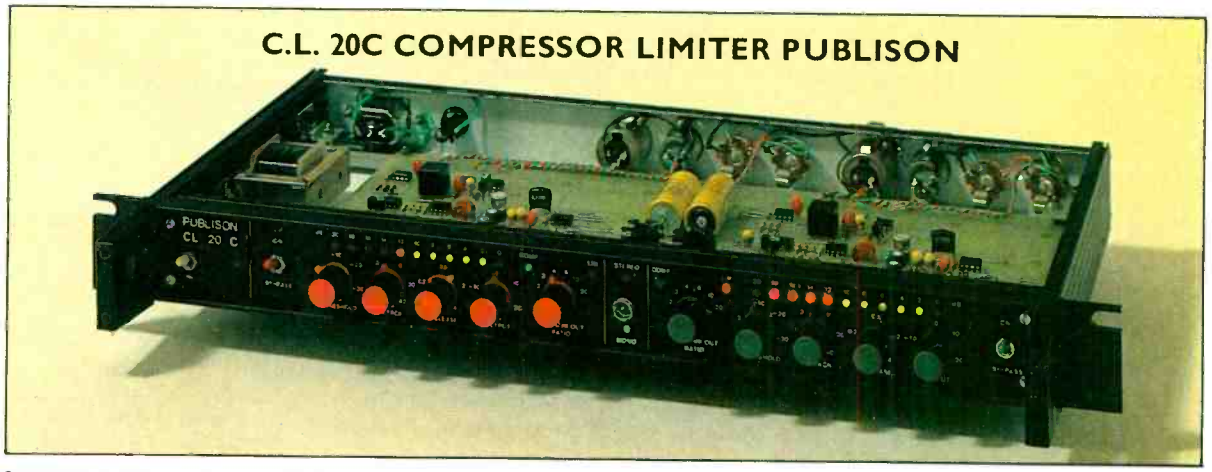
The heart of the system is an exclusive digital V.C.A., featuring: very low noise (—96 dB), very low distortion (0,02%), fast response time (1 microsecond), logarithmic response.

Compressor Limiter: threshold from +20 —30 dB – Attack time from 0,01 to 20 mS – Release time from 0,05 to 4 S. – Ratio (1–2–4–6–12–20).

Expander: Threshold from + 10 to —40 – Attack time from 0,01 to 40 mS – Release time from 0,03 to 2 s – Gain reduction from 0 to 30 dB – Ratio 2.

Noise gate: Uses previous setting but ratio is 20.

C.L. 20C COMPRESSOR LIMITER PUBLISON



Stereo-Compressor Limiter with fast photocel – very low noise: 102 dB and low distortion when compression operates: 0,05% – use FET operational amplifier bandwidth 100 kHz even for +20 dB – insertions in side-chains – stereo-coupling – display of compression 6 ratio 2 – 3 – 4 – 6 – 10 – 20 – by 11 led – special circuitry to suppress distortion on low frequencies – X.L.R. connectors.

FOR FURTHER INFORMATION CONTACT PETER DEAN

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5-7-9-11 RUE CRESPIN DU GAST 75011 PARIS – TEL (0-11-33-1) 357 64 08

AES 61st Convention New York, a preview

The 61st AES Convention will be held from November 3 to 6 at the Waldorf-Astoria, New York. This year over 125 manufacturers will be showing a wide range of products, which is a substantial increase on the number of exhibitors at the last New York convention. A series of technical seminars will be running concurrently with the convention, which opens at the following times:

Friday	November 3	1pm to 9pm.
Saturday	November 4	10am to 7pm.
Sunday	November 5	11am to 5pm.
Monday	November 6	10am to 5pm.

Measurement

The new *Model 232A* reverberation timer to be exhibited by **Acoustilog** features many optional facilities including outputs for hard copy data. In addition the company will be showing the *TR-300* multichannel metering and spectrum analysis system.

New from **Amber** will be the *Model 4405* fully automatic, programmable distortion analysis system. This measures harmonic and IM distortion, and difference frequency distortion, with automatic ranging, tuning and nulling; nonvolatile storage of test sequence programs; and sweeping capability. Also on show: the *Model 4400A* multipurpose audio test set.

Audio Developments International (ADI) will be exhibiting their new *Model 1103* ⅓-octave real time analyser, with 127mm CRT and eight nonvolatile memories. Also on display will be the *Model 1500* automatic graphic equaliser with ten band centres; the *Model 1503* ⅓-octave graphic equaliser; the *Model 1252* Class A reference amplifier; and the *Model 1000* octave analyser.

Barclay Analytical will be showing their *Badap 1* audio testing and display system. This uses a 230mm colour CRT display, has microprocessor control, and shows simultaneous peak and average readings on 31 ISO ⅓-octave bands, allowing for peak versus average mixdown control, overcut versus cutter-head heating properties, and many other control, test and alignment programs. A memory analysis program will allow RT60 analysis, and the checking of room absorption and reflection properties. All data can be stored for later analysis.

Ivie will be introducing the *IE-17A* microprocessor-controlled acoustics analyser for use with their *IE-30A* spectrum analyser. Attached to the *IE-30A*, the *IE-17A* will allow measurement of reverberation time in ⅓-octave or single octave bands; room delays being measured to tenths of milliseconds for the direct wave or any reflection. The unit features a built-in time gate which allows the SPL of any reflection to be isolated, measured, and compared with the direct wave. It can be programmed to control the pulse width of the source, the time that the *IE-30A* begins and stops analysis, and will also transfer any *IE-30A* screen pattern to an X-Y or strip chart recorder.

On display from **Kenwood Electronics** will be the *SE-3000* acoustic measuring system, which uses an automatic sweep warble oscillator connected to a recorder for reverberation time and sound field transmission measurement at each frequency. The unit has a calibrated oscillator and recorder to check all audio equipment performance; and full facilities for measuring sound insulation characteristics, noise level, and other acoustic and electronic data.

Neutrik Products are to show the *Audiotracer 3201* which measures and makes hard-copy recordings of the audio response of electronic and electro-acoustic systems. The unit includes a two range (20Hz to 20kHz and 200Hz to 200kHz) voltage controlled oscillator (VCO) which can be driven by a 5Hz warble generator; a 1kHz reference oscillator; 3W output amplifier; input amplifier with calibrated attenuation; pen-drive with switchable amplitude and writing speed; and adjustable paper speed. Also on display will be the *AD-4* analog audio delay line which is a bucket brigade design with four discrete delayed outputs, commonly adjustable over a 4:1 range (12.5ms to 50ms, 25ms to 100ms, 37.5ms to 50ms, and 50ms to 200ms), and independently adjustable in level. Input sensitivity is continuously adjustable from 10mV to 10V for +18dB output.

A new distortion measurement system, *Model 1701A*, can be seen on the **Sound Technology** stand. The system which automatically measures IM and THD has a claimed residual distortion as low as 0.0009%. A wide range of other instrumentation products will also be on show.

White Instruments will be showing their new *Model 200* signal analyser. This features two microprocessors, eight memories, multiple LED display, plus calibrated dB-SPL and three 7-segment alpha-numeric displays. The unit can analyse in octaves, ⅓-octaves, and ⅛-octaves in both peak and average modes. Functions are software controlled so the unit can be updated by reprogramming. Also to be shown will be the *Series 4300* active equalisers.

On display from **Xedit** will be an RMS/DIN version of their drift and flutter meter which has a sensitivity of 0.05% full scale flutter and autocal function for fast drift measurement. In addition they will also be showing a new range of splicing blocks together with their film strip pulser and converter.

Microphones

AKG Acoustics are to exhibit their *Model C-414EB* condenser microphone, which features four switchable directional patterns (omni, cardioid, figure-of-eight, and hypercardioid); three stages of preattenuation (0dB, −10dB, and −20dB); and three low frequency roll-off points (0Hz, 75Hz, and 150Hz). Frequency range is rated 20Hz to 20kHz, with a claimed sensitivity of −44dBm at 1kHz. Also on show will be the company's new studio condenser microphones including the *C-424* large diaphragm quadraphonic unit; the *C-422* and *C-34* remotely controlled variable pattern stereo microphones; the *C*-33 dual cardioid; and the *C-414/EB* remote.

Hammond will be showing a new ribbon microphone from **Beyer**, the *M260S*. This is a new version of the *M260* which incorporates a four stage pop and blast filter; a refined steel mesh top basket for increased durability; and an on/off switch.

Electro-Voice will be introducing two newly developed internally shock-mounted dynamic microphones, the *RE18* Variable-D super cardiodi and the *D056* omni. In addition they will be showing their *System C* condenser microphone system which features a number of interchangeable elements that can be variously assembled for a variety of different applications.

Shure will be previewing their new *Model SM81* unidirectional condenser microphone which has been designed to withstand extreme physical abuse. The unit features a built-in low frequency response switch and attenuator. Also on display will be their full range of microphones and cartridges, including the *V-15 Type IV* phono cartridge.

Swintek Enterprises will be demonstrating their range of low power communications equipment including the *DB-S* wireless microphone with a claimed signal-to-noise ratio of 86dB.

Mixers

On display from **Acoustic Design by Jeff Cooper** will be examples of their latest studio and control room designs including details of the new recording and mixing complex which the company designed for Polydor Records in Mexico City.

Allen and Heath will be presenting the USA launch of *Syncon*, a series of 16/24-track recording consoles intended for medium-budget studios. Available with up to 28 in-line modules, with free routing and grouping based on the switching system and function designation; the unit features completely discrete circuitry utilising plug-in amplifier cards; and includes parametric equalisation, stereo auxiliaries, 48V phantom powering, and single button control of master record or remix status. The company hope to have a *Syncon* equipped 24-track mobile studio available for inspection. Also on display will be the Brenell *Mini 8*, 25mm 8-track tape recorder packaged with the *Mod III* console. In addition to these the *SD12-2* stereo mixer, *S6-2* broadcast production mixer, and the new *SR 20* sound reinforcement console will be shown.

Allison will be showing *Kepex II* a second generation version of the original *Kepex* keyable, program, wide band gain expander. It has VCA gain control, adjustable expansion ratios, attack times, and release time law. The unit has facilities for automated control and offers many effects additional to the original system. Also being shown is *Fadex*, a programmable fader system designed for inclusion in new equipment, or for retrofitting into conventional nonprogrammable audio consoles. This unit can be interfaced with the *65K* automation programmer, and provides programmable grand master, groups, mutes, and solos.

Audio by Zimet will be displaying professional and semiprofessional recording studio packages, in-

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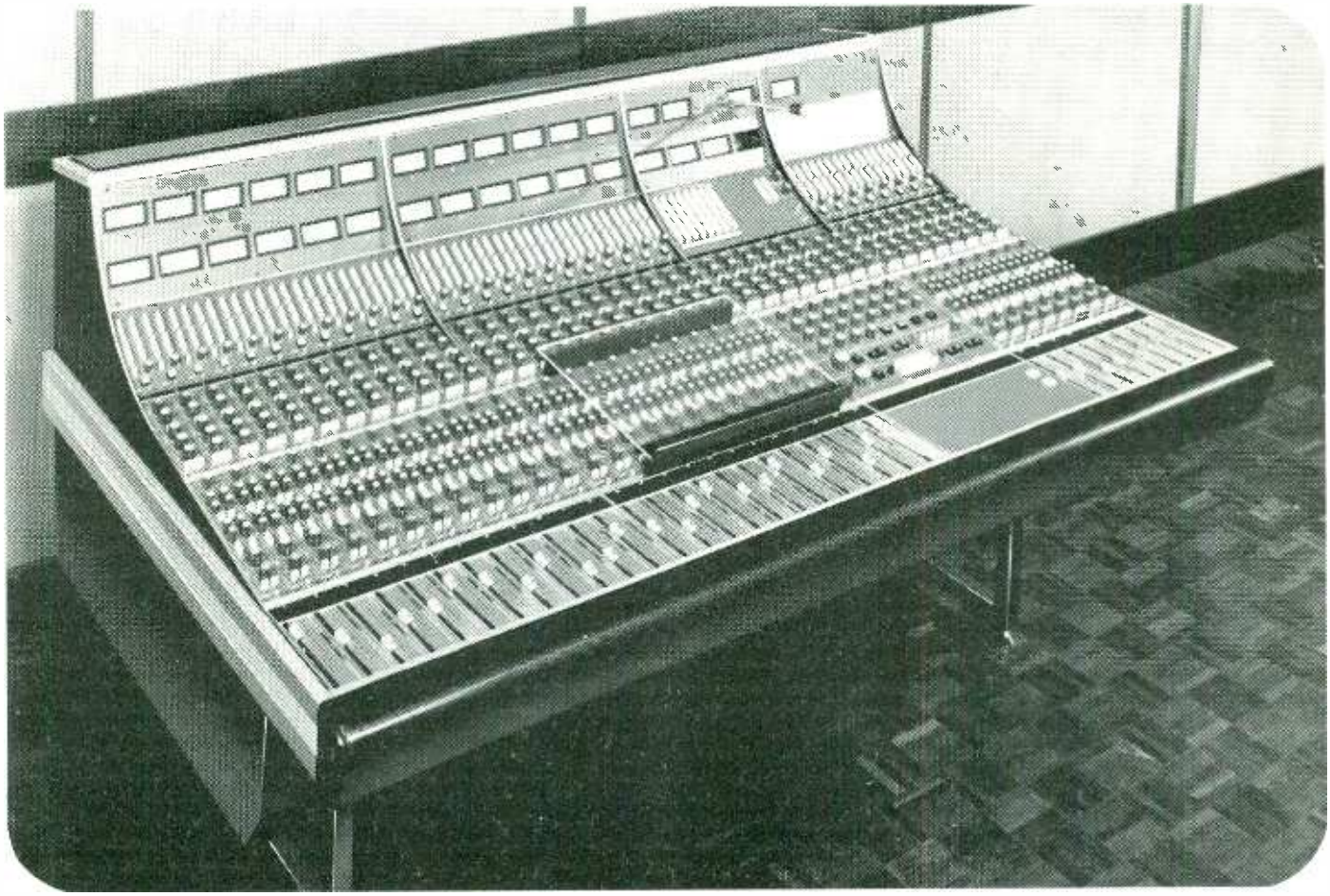
Neve supreme in sound

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.

Neve

Rupert Neve & Co. Ltd.,
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Cables NEVE Cambridge.

Rupert Neve Inc.,
Berkshire Industrial Park Bethel Ct 06801 USA
Tel. (203) 744 6230 Telex 969638

Rupert Neve of Canada Ltd.,
2721 Rena Road Malton, Ontario
Tel 416 6776611 Telex 21 06 983502

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

cluding recording consoles, tape recorders, signal processing equipment, and professional sound reinforcing equipment. In addition they will also be highlighting construction techniques for studios.

H/H Electronics will be showing their range of consoles including: the *SM200* designed for small club or mobile applications; the *Stereo 8* and *Stereo 12* consoles with 4-band active equalisation on each channel; and the *Stereo 16*, 16-in, 2-out mixer which has multiway connectors for remote control usage and 7-way graphic equalisation on each output group. All these mixers accept the company's plug-in digital effects module, capable of producing a wide variety of effects including echo, reverberation, flanging, and automatic double tracking. Also to be displayed are the *S500-D* stereo power amplifier; their 305mm and 381mm, 150W loudspeaker chassis drivers; their *HF200* bullet radiator; and their *CD400* compression driver.

Harrison will be demonstrating their *Model 864 Autoset* microcomputer-based control system for multitrack recording, live performances, television production, master control, and other applications. Other products being shown include their *Third Edition* automated consoles, including the *3624 series* and the *Model 3232C*.

A selection of mixers with 8 to 32 inputs and 2 to 16 outputs will be shown by **Interface Electronics** with the main emphasis being on the *Series 400* mixer and the *Model BC104* for radio stations. The *Series 400* has 8 inputs, two main outputs, plus echo and cue, and equalisers including a four-frequency mid-equaliser and four position 12dB per octave low frequency roll-off. The *Model BC104* has 10 inputs, four stereo outputs with slider masters, talk slate module switchable to any output, and a monitor module which can monitor any output or input.

IRV Joel and Associates will be showing a **Cadac** *Inline* mixing console with *CARE* automated recording/remix system, and *V-cat* voltage controlled attenuators; the Calibration Standard Instruments *MDM-4* mixdown monitor loudspeakers; Inovonics acoustic analyser *Model 500*, multiband audio processor *Model 230*, Dynex noise suppressor *Model 241*, magnetic recorder electronics *Model 375*, the **IRV** automatic broadcast console *JL-412;* **MRL** precision test tapes; and the Tape Strobe tape speed measuring devices.

New from **Loft Modular Devices** will be the *Series 800* recording console with the *SIMI-VU* meter system which shows both RMS and peak functions simultaneously on an LED column. Also on show will be their *Series 440* delay line/flanger which offers short delays for flanging, Leslie-type sounds, vibrato and loudness enhancement, plus long delays for automatic double tracking, Doppler, echo/reverberation simulation and slap-back.

MCI will be exhibiting their complete line of recording/mixing consoles and tape recorders; and will introduce a number of new products including the *JH-45* SMPTE digital synchroniser; the *JH-110M* disc-mastering machine which is intended for use with the CBS DISComputer mastering system; the *JH-600* automated mixing console; the *Model 111* micro-processor controlled auto-locator; and the *JH-60* real time counter with four memory locations and a return-to-zero function.

Midas Audio will be showing their range of purpose-designed, semicustomised audio mixing consoles, including designs for portable and permanent applications with 24-track master recording systems, and 4-track and 8-track production units for high quality broadcast, film or video requirements.

Ampex MM-1200 24-track with EECO synchroniser

Neve will be introducing their new 40-channel, 32-track version of their *Model 8068* music recording console. This console will be fitted with a new VCA submaster system. In addition the company will be showing the *Model* 5422 location suitcase mixer and the **Lyrec** range of multitrack studio recorders featuring in particular the *TR532* 24-track studio recorder.

Quantum Audio Labs will be displaying several consoles from their range, including a 4-buss model, an 8-buss model; and a demonstration of 8-track mixdown using headphones.

On exhibition from **Raindirk** will be their *Series 111* mixing console with 28 input channels, eight group outputs, plus master remix group outputs and 24-track monitoring. Features include mic and line inputs, equalisation, four independent fold back/echo send lines; a routing module allowing each group output to be sent to any of the tape tracks nine through to 24, and a remix module allowing each group output to be submixed in the master remix outputs.

Sierra Audio will be introducing their new *Series 4000* automated master recording console with fully distributed logic control of all console states, multitrack tape remotes, compressor/limiter/expander/noise gate on each channel, a computer system with a level memory, timing auto-location, editing and record keeping. Also to be shown will be details of the company's studio design, construction and interface projects completed in Tokyo, Australia, Chicago, Boston, Los Angeles, Toronto and Montreal.

Sontec Electronics will be exhibiting their new *DTC-400* console for tape-to-disc transfer. The unit features all discrete, high slew rate circuitry, A/B channel switchover and identical processing of program and preview signals. Also on display will be the *Nova 2428* stage monitor board; the *DRC-200* dynamic range controller; and the *MEP-250A* parametric equaliser.

Soundcraft will be showing their *Series Three* mixers and studio consoles, in stereo and four-channel output versions, with particular emphasis being put on their 24-track studio console. In addition they will be displaying their latest model of their *Series Two* studio consoles; and an 8-track 25mm recorder, the first from the company.

Sound Workshop will be displaying the *Series 1600* automated recording console with their *Audio Machinery* shared-access memory system based on random-access memory. The console can accommodate up to eight plug-in modules to access the memory, for such functions as delay, pitch shift, and reverberation. Also on display will be the *1280* recording console and two new stereo reverberation systems.

On display from **Tangent** will be the *Model 3216* console, available with options for 16, 24 and 32 channels. It has parametric equalisation, 16 submaster groups, five echo/cue/monitor busses, low-cut, phase reverse, solo, mute, and FET switching.

Teac will be showing their *Model 15* console, with 16 input modules, eight output busses, 4-band equaliser on each input, solo and mute on each input; 100mm slide controls, echo receive control on every program buss, and many other features.

Trident will be exhibiting their *TSM Series* console; the *Fleximix* expandable free-standing or flight-cased mixing desk; their parametric equaliser, stereo limiter/compressor, and low distortion oscillator/frequency counter.

Monitor Loudspeakers

Newly introduced by **Community Light and Sound** will be two new radial horns for mid-bass and midrange frequencies. Both are 60° radial horns: the mid-bass uses a 305mm cone loudspeaker operating from 120Hz to 1.5kHz; whilst the midrange uses a 254mm cone operating from 350Hz to 2.5kHz. There is also a 60° and 90° unit for both 25mm and 50mm exit drivers. All the drivers have structural foam sandwiched between the horn flare and outer shell; are equipped with two spring-loaded handles; and have interlocking bumpers for stacking and handling.

Emilar will be showing their *Model EA 175* high frequency compression driver and *Model EH 800* exponential horn. The driver is rated for a 40W input (500Hz to 5kHz) and has a claimed frequency response of 500Hz to 15kHz with a lowest recommended crossover frequency of 500Hz. Distortion is claimed to be less than 0.5% at 100dB-SPL when coupled to the *EH 800* horn. The horn pattern is 90° horizontal, 40° vertical, with directivity *Q* equal to 4.31 at 1kHz; cut off frequency is 800Hz.

Hammond will be exhibiting the *Audio Guard* speaker protection and power limiting unit from Meteor Light and Sound. The unit can limit power from 10 to 1000W peak using either the high or low power range switch, and can protect against such amplifier faults as latch-up, DC offset and RF instability.

On display from **KEF** will be their *Model 105* three-way loudspeaker system with all three drive units mounted in specially designed enclosures. With a nominal impedance of 8Ω, power rating of 200W, and a claimed sensitivity of 86dB SPL for 1W at 1m on axis (anechoic) the loudspeaker has already established itself as a popular unit. Also on display will be chassis driver units from the company's range.

Spectra Sonics will be showing a new portable self-powered loudspeaker system designed to serve a group of approximately 100 people at any site, with no on-site preparation or supporting services. Batteries supply all power for amplification and the system requires only a microphone or other source for the programme material. The company will also be showing their *Model 1026-26* audio console with new light-bar level indicators for the audio processing system.

New from **TAD (Technical Audio Devices)** will be

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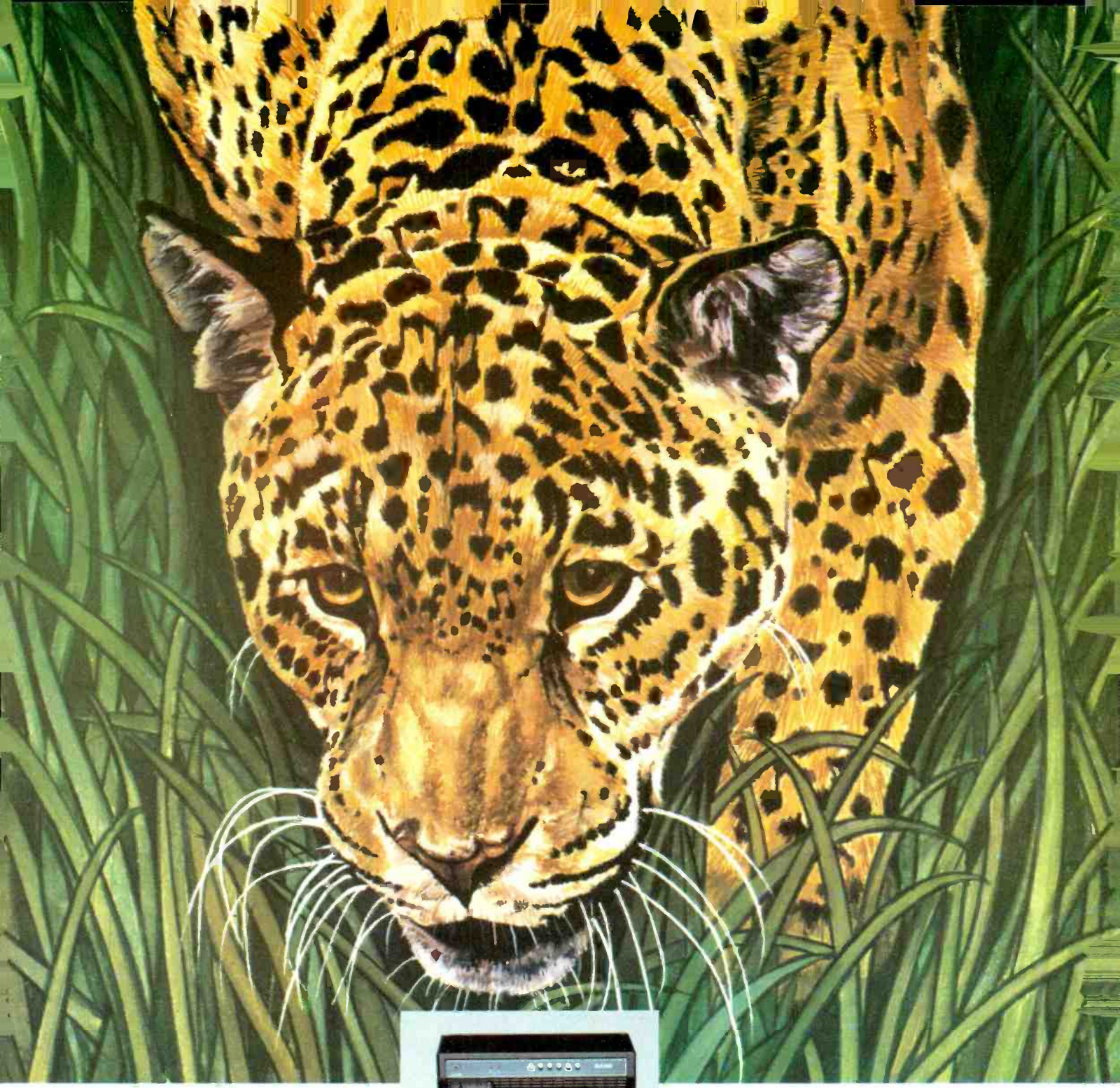

A sad fact, proved to be true night after night, is that without proper amplification, good guitarists with expensive instruments will sound bad. The worse the sound, the worse the playing and everyone suffers. It's a waste of good money and talent.

Since Yamaha make excellent musical instruments they naturally needed amplifiers of compatible quality to do them justice, and since only the best is good enough for Yamaha, they built their own.

Like the rest of their instruments, Yamaha amplification is a satisfying blend of sophistication and reliability; characteristics not shared by a lot of their rivals.

But then Yamaha is a breed of its own.

YAMAHA

Craftsmen to the world's musicians since 1887.

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a new high efficiency loudspeaker system with dual 300W 400mm woofers, 101mm beryllium diaphragm compression driver and 38mm beryllium compression super tweeter.

Power Amplifiers

On show from **AB Systems Design** will be a range of pre-amps and power amplifiers. They will also be introducing the *Model 2400* dual-channel electronic frequency divider, with assignable multifrequency slope capability; and their new *Model 730* self-contained tri-amplifier with assignable crossover to the 350W bass, 100W mid-range, and 50W treble power outputs.

Crown International will be introducing the *PSA-2* self-analysing power amplifier, which is rated at 250W per channel into 8Ω, 400W per channel into 4Ω, and 450W per channel into 2Ω. Features include balanced XLR inputs, adjustable threshold compressor, and high pass and low pass filters.

Grampian will be showing their range of sound reinforcement systems together with examples of their *G100* power amplifiers and their *G50* tuner amplifiers.

Sansui will be introducing their *Model B-1* power amplifier which is rated at 250W per channel into 8Ω (at 0.005% THD), or 350W into 4Ω; rated slew rate is 300V/μs; frequency response DC to 300kHz; and signal-to-noise ratio 125dB. In addition the *E-1* phono playback equalisation unit will be shown, which has switchable inputs for up to three magnetic or three moving coil pickups, with adjustable input impedance, and an equivalent input noise for the MC inputs of −157dB (IHF, A-weighted). Rated distortion for the unit is 0.005%, with an output impedance of 75Ω or less, to deliver +28dBm into a 600Ω load. Also on display will be the *Model P-1* parametric equaliser, with four individually tunable boost/cut circuits with overlapping centre frequencies, adjustable *Q*, switchable shelving response, and high pass and low pass filters.

To be introduced by **Scientific Audio Electronics** will be a new series of power amplifiers: the *P400* rated at 400W per channel; the *P300* rated at 300W per channel; and the *P50* rated at 50W per channel. All the amplifiers have stepped attenuation, gold plated edge-card connectors, and automatic bridging for mono. Distortion is rated at 0.05%, signal-to-noise ratio 100dB, and input sensitivity at 2.12V.

Unisync will be showing their new *Model 100* power amplifier, rated at 100W per channel into 8Ω, with a claimed distortion rating of under 0.03%. It has a distortion indicator, an LED that lights up at any distortion level above 0.05%, and separate power supplies for each stereo channel.

Tape and Tape Duplicating

Agfa-Gevaert will be exhibiting their audio and video magnetic tapes, including their *PEM 468* studio mastering tape; their *PEM 526* mastering tape for bin loops; and their *PE 36* tape for high speed duplicating. In addition the company will be exhibiting their bulk cassette tapes and their 12mm, 19mm, 25mm and 50mm video tapes.

On display from **Audico** will be their cassette loader which loads up to 80 C60 cassettes per hour and handles either blank or prerecorded tape; and their 8-track cartridge loaders which load up to 400 cartridges per hour automatically. The cassette loader gives exact lengths in minutes or seconds, or cue-tone sensing. Also on display will be their automatic roll-on splicers for cassettes and 6.25mm tape; the *Model 441* cassette duplicator which can produce four C60 cassettes in two minutes from a cassette master; their video tape loaders/unloaders for U-Matic and Betamax; their splicing blocks; and their cassette label sheets.

Audio Kinetics will be introducing their *XT-24 Intelocator*, a tape machine autolocator capable of improving search action by computing and storing the ballistics of a tape machine. Capable of being interfaced with the 3M *M79*, Studer *A80*, Ampex *MM1100/1200/ATR*, and MCI *JH-16*, the unit features an inches-per-second speedometer, and programmable routines for hands-off sequenced operations.

Capitol Records will be displaying their *LT-1600B* high speed tape duplicator, which will drive up to ten slave units, producing between 640 and 840 8-track cartridges, or 320 to 420 cassettes per slave, in eight hours. The master accommodates up to 267mm reels using 6.25mm to 25mm tape; and the slave units accommodate reels up to 356mm with 6.25mm or 3.1mm tape. Also on display will be the *CW15S* cassette tape winder and *CW25* cartridge winder, which have automatic cutter, capstan driven tape, and a loudspeaker for hearing cue tones and programmes at high speed. Speeds are 3.05m for cassettes and 6.1m for cartridges.

New from **Grandy** will be the *Promix II* adjustable multitrack head assembly with independent control of azimuth, zenith, tape height, and wrap. Other new products will include head replacements for all track formats and a range of single crystal ferrite record heads for high speed duplicating.

Heino Ilsemann will be demonstrating their cassette packaging machine *Type KZM3*, a fully automatic loader of compact cassettes and descriptive literature into cassette library cases. The loader has a capacity of up to 80 cases per minute. Also on show will be their *Type ETK 1* and *ETK 1S* cassette labellers.

3M will be showing their complete range of *Scotch* products including their *250* studio mastering tape, which has a dynamic range of 78dB; their reel-to-reel duplicator tapes, duplicator cartridges and cassettes; their bulk cassettes, 6.25mm tapes; and their magnetic film products.

New from **Magnefax** will be a master tape loop bin/seven slave cassette duplicator. This unit operates at 2.30m and 1.15m per second, will produce recorded material for 2500 C60 cassettes in an eight hour period, and has automatic cue tone injection, master pass counter, and a common capstan drive system. Also on display will be their range of high speed common mandrel 6.25mm tape duplicators and automatic tape degaussers.

Pentagon will be introducing a new stereo copier, *Model G-34S* with a master and three slave positions and a handling capacity of 72 C60 stereo cassettes per hour. The copier has single button operation, solid state logic controlling a two position DC servo motor for automated tape stop, and duplication carried out at 16 times normal speed.

TDK will be showing a new tape head demagnetiser for cassette tape recorders. Built into a cassette shell for easy insertion into cassette recorders the unit operates from a 1.5V dry cell battery which is enclosed in the cassette shell together with all the unit's associated electronic circuitry.

On exhibition from **Tentel** will be their range of gauges for measuring tape tension under operating conditions, including the *T2-H20-ML*, adaptable

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Can you believe your Ears ?

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Tape Machines

On view from **Ampex** will be their *ATR-100* recorder, their *MM-1200* multichannel recorder, the *VPR-2* helical videotape recorder, the *MQS-100* synchronising system, the *ATR-700* recorder, and *AG-440C* series of recorders.

Itam will be exhibiting a series of multitrack recorders and mixers including the *Model 806*, 8-channel, 12.5mm recorder intended for the budget market; the *Model 1610*, 16-channel recorder; and their range of four and eight channel output mixers.

Mericka Audio will be showing the new *Stellavox SP 8* portable tape recorder, with plug-in module amplifiers, resolver and head assembly. In addition the company will be showing the *Stellavox AMI 48* portable 5-input mixer, with panpots, equalisation, sensitivity input switch, FET limiters, and powering for any type of condenser microphone in each channel.

Otari will be exhibiting their current range of products including the *MX-5050 series*, full track, 4-track and 8-track recorders; the *DP-4050* cassette duplicator; and the *DP-1010* high speed duplicator. In addition the company will be showing the new *MX-5050B* 2-channel tape recorder, with new control circuitry for noise-free punch in and punch out, a maximum output level of 28dBm, three calibrated record levels (185, 250 and 320nWb/m), DC capstan servo, peak reading LED indicators inside the standard VU meter housing, return to memory rewind, and plug-in heads. Also being introduced will be the *MX-7800*, 25mm 8-track recorder with optional full function remote controls and a digital tape timer.

On display from **Stephens Electronics** will be their new *Q-11* autolocator for tape machines, with microprocessor control for tight tape handling and automatic cue locations with no overshoot. Ten memories store the locations together with the commands (search, play, etc.) and they can be sequenced to cycle automatically. The system has abort and 'dumb' buttons and is available in a hand held control unit or in a complete remote electronics package. Also on display will be their capstanless 24 and 16-track tape machines.

New from **Tandberg** will be the *TD20A* open reel tape deck with four motor, solenoidless tape transport, a transconductance converter to reduce slew rate, adjustable tape formulation switching (including the new metal particle tape), 'free' mode and edit/cue switch, peak reading VU meters, and PROM electronic speed control. Also being shown will be the new *TCD 340 AM* cassette deck; the *TR 2060* FM/AM receiver; the *TR 2045* receiver; and the *TR 2030* receiver.

Signal Processors

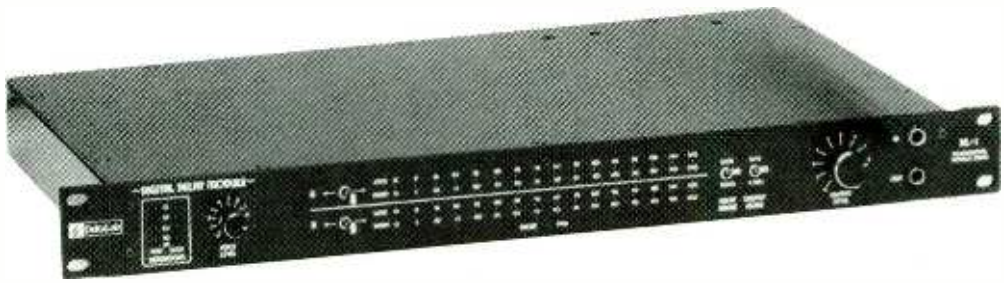
Aphex Systems will be introducing their *Aural Exciter* and will also be displaying the *EQF-2* tunable peak/shelf equaliser with tunable high/low pass filter; and the *202*, a VCA which incorporates the *1537A* VCA chip.

On show from **Ashly Audio** will be their complete range of *SC* series signal processors: including parametric equalisers, peak compressors/limiters, electronic crossovers, and a musical instrument preamplifier.

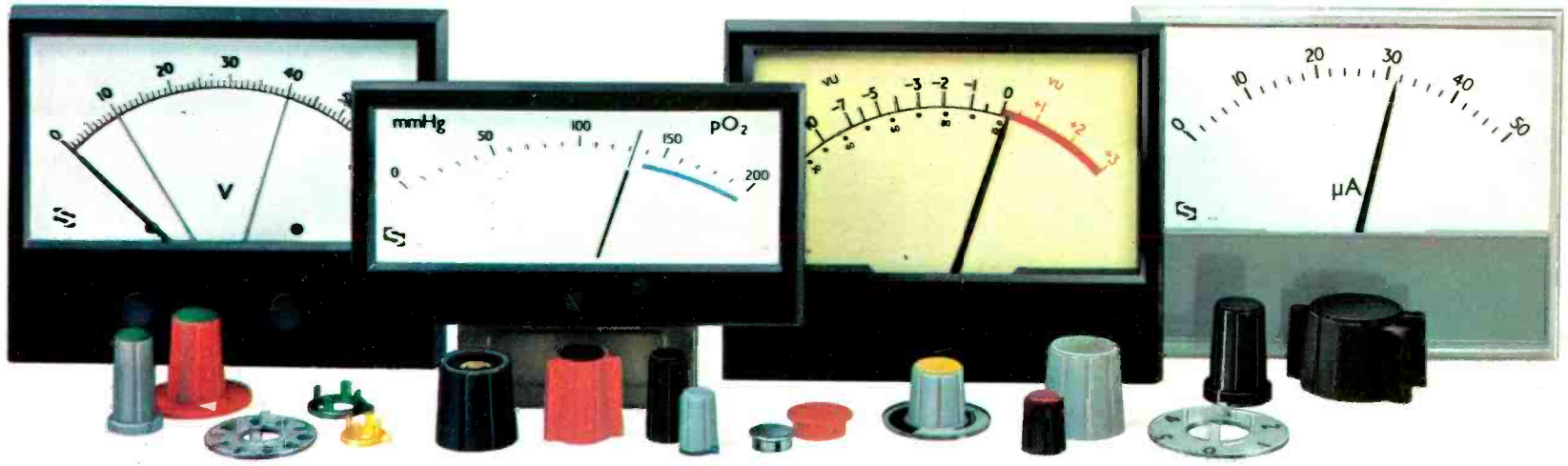
Audioarts Engineering will be showing their *Model 4100* (*Model 4200* stereo) parametric equaliser, with four dual-range filter sections (each range with a 10:1 scope, for 100:1 in each filter), bandwidth control calibrated from $\frac{1}{8}$-octave to 2-octaves, 32dB of boost/cut which can be increased by cascading, and 600Ω output at +20dBm. Also on show will be their *Model 2100A* parametric electronic crossover, with continuously variable crossover frequency, 70Hz to 8kHz, and continuously variable crossover depth for bi-amplifier and triamplifier systems. This unit has high and low level controls and an optional centre channel bass output. In addition the *Model 5200A* mixer for disco use, with synchronous mixing, balanced monitoring and dual talkover will also be shown.

Deltalab Research will be introducing their *DL-1* digital delay unit designed for professional and semiprofessional recording studio and sound

Above: Otari MX4050 2-track



Below: Deltalab Research DL-1 digital delay unit



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Please send for our short-form meter catalogue and the full-colour catalogue which gives complete specifications and sizes for all our knobs and accessories.

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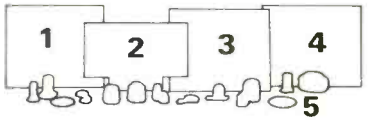
(Photograph by courtesy of Zoot Horn of London)

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.



1 The Sifam Meter Relay enables any measurable parameter to be used also for alarm or control purposes.
2 One of the Sifam 'Monitor' range, presenting an attractively proportioned, slim appearance.
3 Distinctive Sifam styling and matt-black finish are combined in classical proportions in the 'Director' range.
4 The transparent moulded front on 'Clarity' range meters presents an appearance which appeals to many equipment designers.
5 A representative collection of Sifam collet knobs showing a few of the numerous combinations of accessories and colours.

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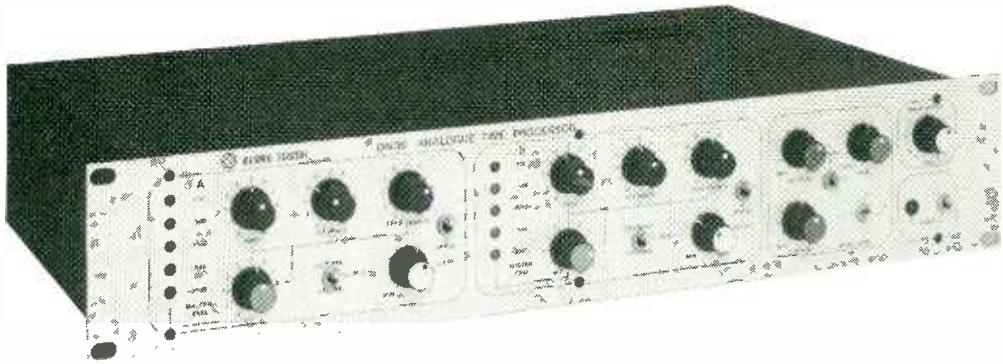


Klark Teknik DN36 analog time processor

AES PREVIEW

reinforcement applications. The unit has three outputs with independently selectable delays ranging from 5ms to 160ms, a frequency response of 30Hz to 15kHz at all delay lengths and for all outputs, a dynamic range of 90dB with a claimed THD of less than 0.2%, and front and rear panel inputs permitting easily controllable feedback effects for studio or live performances with internal tamper-proof controls.

On demonstration from **Dolby Labs** will be a system for FM stations which can be used to switch receivers automatically to Dolby FM, QS, SQ or any other special receiver or decoder mode. The system uses tones in the vicinity of 15kHz which are approximately 80dB below 100% modulation.

A wide range of equipment will be on display from **Eventide** including their new *Model BD955* digital broadcast delay line. This new model offers a frequency response to 15kHz and delay up to 6.4s; and for policing live radio shows, it has a 'catch-up' function allowing the programme to continue in real time while the unit regains the delay margin. Other units on display will be the *Model 1745M* delay line; the *H910* harmoniser; the *2830* omnipressor; the *FL201* instant flanger; and the *S1066* special effects device.

Furman Sound will be exhibiting the *PQ-6* two channel parametric equaliser/preamplifier, which has three continuously variable broadly overlapping bands per channel, with 20dB boost and 40dB cut. Bandwidth is adjustable from $\frac{1}{10}$-octave to 4-octaves; ranges are from 25Hz to 500Hz, 150Hz to 2kHz, and 600Hz to 10kHz; signal-to-noise ratio is a claimed 99dB with equalisation in and set flat; and distortion is a claimed 0.025% under the same conditions. In addition the company will be exhibiting the *Model RV-1* reverberation system with limiter, and the *TX-2* tunable crossover/bandpass filter.

Future Film Developments will be showing their portable noise reduction unit for location recording. This has provision for two Dolby A-type modules with associated buffer amplifiers, automatic record/play and power switching, and battery supply.

Hammond will be showing the Klark-Teknik range of graphic equalisers, together with the *DN36* analog time processor, a dual channel voltage controlled delay system capable of producing a wide range of effects.

On demonstration from **International Electro-Magnetics** will be their *Model 231* graphic equaliser, which offers control of 31 $\frac{1}{3}$-octave bands with ±12dB cut or boost; a claimed distortion level of less than 0.1% THD (20Hz to 20kHz) at peak dBm output; and a claimed signal-to-noise ratio of 95dB below +24dBm output. Also on show will be the *Model 213* 10-octave graphic equaliser; a range of audio and video magnetic heads; and a range of dual-band limiter/compressors, audio processing units, and multitrack tape recorders.

JVC will be introducing and demonstrating their PCM digital audio system and their latest *Q-Biphonic* equipment. In addition they will also be displaying a low distortion power amplifier and a broadcast *CD-4* demodulator.

Newly introduced from **Klark-Teknik** will be the *DN70* digital time processor and the *DN34* analog time processor (a mono version of the *DN36* introduced last year). The *DN70* is a digital delay line with one input and three outputs which can be mixed; the respective delays being 163ms, 326ms, and 652ms, with a bandwidth of 15kHz. Also on display will be the company's range of graphic equalisers.

MXR will be exhibiting two new graphic equalisers, a dual channel 15-band equaliser and a 31-band equaliser. The 15-band equaliser has alternate $\frac{1}{3}$-octave (ISO) centres with ±12dB cut or boost; a frequency range of 25Hz to 16kHz; +20dBm maximum input and output levels; a slew rate of 7V/μs; and a claimed THD of less than 0.02% at 0dBm output. The 31-band equaliser has $\frac{1}{3}$-octave (ISO) centres; a frequency range of 20Hz to 20kHz; a slew rate of 7V/μs; and a claimed THD of less than 0.01% at 0dBm output.

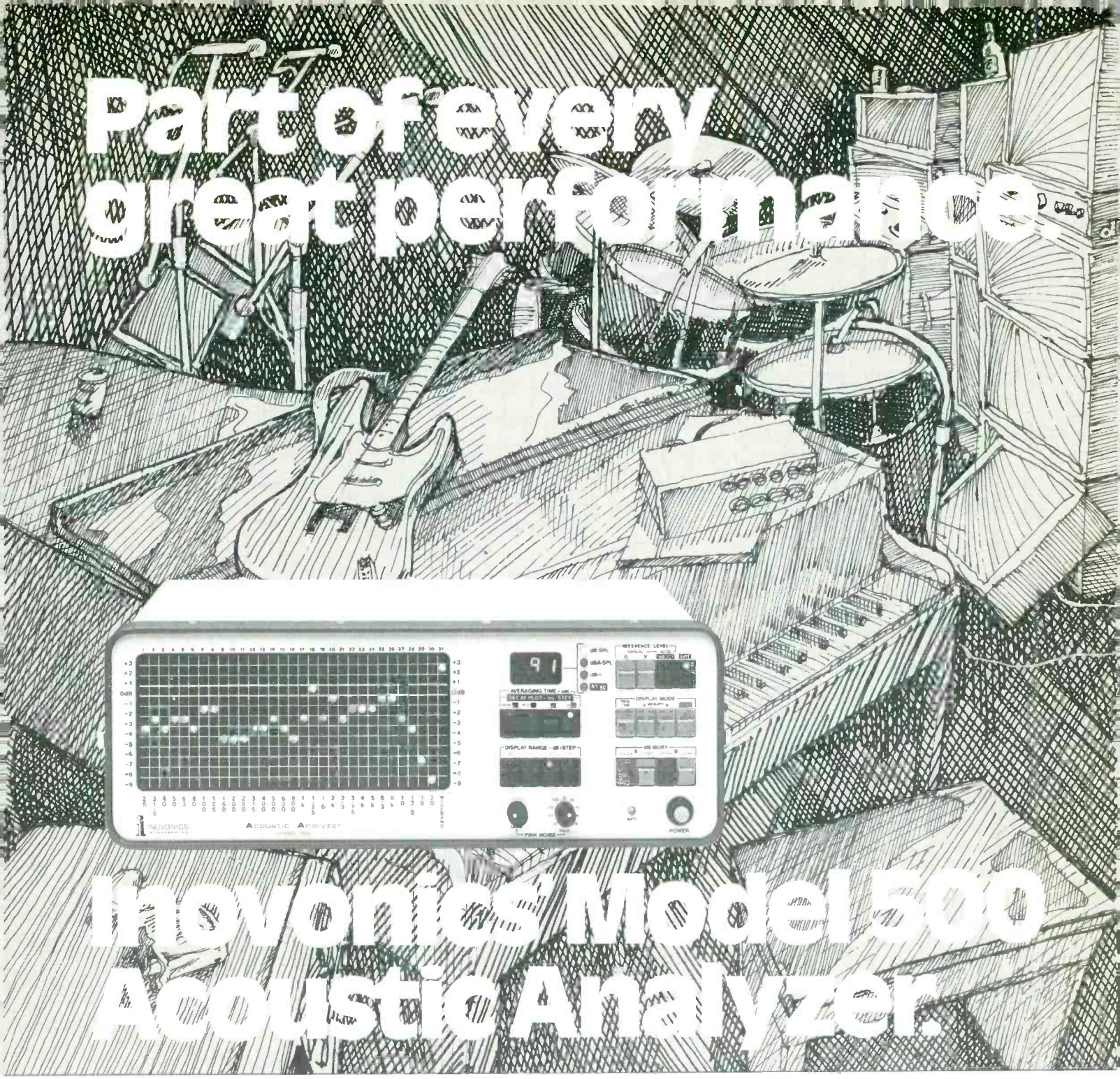
New from **MICMIX** will be their *Dynaflanger*, which allows control of flanging and other effects by the spectral content or peak amplitude of the signal, or by a built-in oscillator with variable rate and depth. The unit's input sensitivity is adjustable; it has a claimed unweighted noise figure of –78dBm; and a comb filter notch peak which varies from 150Hz to 3900Hz, with depth exceeding 45dB. One unit can be slaved to another for dynamic cross flanging, or units may be controlled by a synthesiser. Also to be shown are the company's series of reverberation chambers and master audio meters.

Orban will be showing their *Model 245E* stereo synthesiser; *Model 418A* stereo limiter/compressor; *Model 622* parametric equaliser; their *Optimod-FM* and *Optimod-AM*; and other sound processing products.

On exhibition from **Symetrix** will be their *Phase Filter*, a phaser with 12, 90° notch filter stages and two independently variable low frequency oscillators for a great variety of phase effects. With this unit the mix control determines the ratio of LFO's; the resonance control recirculates the output to intensify peaks and notches; and the depth control determines the amount of phase effect.

50 ▶

Part of every great performance.



Inovonics Model 500 Acoustic Analyzer

Here's everything you need for one-third-octave sound-level and reverberation-time analysis in one easy-to-use package... Inovonics' Model 500 Acoustic Analyzer.

In the real-time mode, Model 500 shows you wideband or weighted SPL readings in each one-third-octave band from 25 Hz to 20 kHz. You set the reference level you want, or Model 500 will seek the proper level automatically over a 100 dB range in 1 dB steps. The built-in pink-noise generator supplies you with wideband or octave-band test signals.

Then, touch a button for the RT_{60} mode. The digital display shows reverberation time up to 10 seconds with 10 ms resolution, while the LED matrix plots the decay characteristic.

Rear-panel connectors provide an external oscilloscope output, an auxiliary test signal input, and digital I/O interface. The Inovonics 500 is ready for peripherals.

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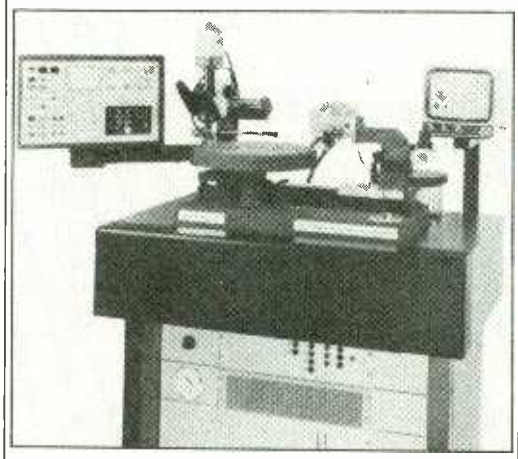
AES PREVIEW

UREI will be demonstrating their production models of the new *Model 927* digital delay line. This has four separate individually adjustable delay outputs; instantaneous floating point converters; a full-power bandwidth of 12kHz with a claimed THD of less than 0.07%; and 125dB per octave filters for a 90dB dynamic range. Also being shown are the *Model 537* and *Model 539* equalisers, and production units of the *Model 950* ANCA (ambient noise controlled amplifier).

Ursa Major will be showing their new *SST-282* digital reverberation system. This consists of a digital delay line and digital reverberation synthesiser, with controls for all relevant parameters, including initial delay, decay time, room size, and high and low frequency equalisation. The system can be used as a straight audio delay unit with built-in mixer, and has a rated bandwidth of 5kHz. Dynamic range is quoted as 80dB with claimed noise and distortion levels of 0.2%.

Miscellaneous

On demonstration from **Gotham Audio** will be the new Neumann *VMS-80* automated disc mastering lathe. This has a crystal controlled DC-servo drive turntable; servo controlled pitch drive; optimised



automated pitch control based on phase detection and optimum adjacent groove space utilisation; and an automatic function control system which stores lathe commands and allows recall at the push of a button. Other features of the lathe include the elimination of all roller components and the provision of a Teflon glide bearing for the carriage ride. Also on display will be the EMT *244* rack mountable reverberation unit and the Telefunken *M15* 24-track/32-track tape recorders.

Martin Audio/Video will be showing their 14kHz film sync generator introduced at last year's show, together with their ranges of toroidal power transformers, metal rack cases, and other components and hardware for the recording and broadcast industries.

Micor International will be exhibiting the new Coupland *Digital Music Synthesiser* system, a system with all functions being digitally controlled. The system has a quadraphonic output; up to 12 polyphonic waveform generators; 20 resident presets; digital tape cassette backup; pedal controls in real time for volume, envelope timing, low frequency oscillator speed, frequency modulation, and waveform amplitude; two independent low frequency oscillators operating from 0.01Hz to 99.99Hz; and a standard 88-key keyboard.

Keith Monks will be displaying their range of microphone stands and studio accessories including their record cleaning machine, impedance meter and phase tester, and cable drums. In addition the company will be displaying the Luther range of portable stands for which the company have recently become sole USA distributors.

On display from **Nexus** will be their range of sound baffles, offering noise reduction from 13dB to 52dB, with an absorption characteristic of 0.99 and an NRC of 0.95; and an 'instant drum booth' for use in small studios.

A new range of products will be available from **Sescom** consisting of their *SB-1* stereo balance box; *LS-1* line level splitter; *IB-1* input balancer; *OB-1* output balancer; and their *MLD-1* microphone line driver. In addition to these the company will also be displaying their range of audio transformers, microphone splitters, and other products.

Studer Revox will be showing their new *B790* tangential tracking turntable with 33.33rpm and 45rpm speeds. The turntable has a quartz controlled optoelectronic servo drive mechanism, speed accuracy is claimed to be within ±0.01%, wow and flutter better than 0.05% (DIN weighted), rumble-to-signal ratio better than 68dB (weighted), and tangential tracking angle error less than 0.5°.

Tannoy will be displaying their conference audio equipment system for speech amplification, and simultaneous translation and recording. The system uses digital circuit technology, has lightweight cordless headsets and can use an unlimited number of microphones.

Technics will be showing their range of studio and disco turntables; isolated-loop open reel recorders (including half track, quarter track and automatic reverse); cassette equipment; monitor loudspeakers; broadcast reference tuners; parametric/graphic equalisers; and power amplifiers and control amplifiers.

Pioneer will be demonstrating their PCM audio disc system, a two channel, optical read-out design intended to be compatible with both audio and video disc formats. The 300mm diameter disc rotates at 1800rpm for a maximum playing time of 30 minutes per side.

The **Wireworks Corp** will be exhibiting their range of microphone cables and multicables together with a number of other audio accessories.

Yamaha will have a wide range of audio products on display, including their *Model E-1010* analog delay unit, offering continuously variable delays from 10ms to 300ms in five ranges, with modulation frequency covering the range 0.5Hz to 10Hz and a modulation depth range of 0% to 30%; their *CP-80* portable electric grand piano, with piano strings, full 88-key keyboard, piezoelectric pickup for each note, and volume, tone and tremolo controls; their *P-2050* power amplifier, offering 45W per channel for 0.05% THD; their *P-2201* power amplifier, offering 200W per channel into 8Ω for a claimed THD of less than 0.05%; their *EM-300* mixer, with 12 input channels, built in reverberation, four meters, a 9-band graphic equaliser and a 200W stereo power amplifier; their *EM-200* mixer, with eight input channels, built in reverberation, a 9-band graphic equaliser and 120W power amplifier; and their *Model PM-2000* mixer, with 32 inputs, five position 4-band equalisation, and 14 x 8 matrix.

Finally, **Studio Sound** will be making their presence felt in the persons of Editor Angus Robertson and Ad Manager Mike Stormer. In addition to these august personages, Richard Elen, Editor of our sister magazine **Sound International** will also be on hand to liven up the proceedings. ■

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The international sound

Malcolm Addey

Back in the Fifties, British recording engineers were desperately attempting to mimic the 'American Sound', while during the Beatles era, the 'British Sound' finally arrived. Malcolm Addey, who began his recording career at Abbey Road moving to New York 10 years ago, here compares recording techniques from both sides of the Atlantic.

'THE American Sound' — 'The British Sound'. Apart from artistic considerations, do such things exist any more? Is there really such an enormous difference in recording techniques between the two sides of the Atlantic? I doubt it! My original concept was to discuss such differences but the more I thought about it, the more I realised that the validity of the premise was in doubt. Thumbing through the various technical magazines there is a veritable supermarket of internationally available equipment. Producers needs are not only dictated by creative requirements but by the fact that they also read those monthly catalogues. In fact the studio that does not have available at least one piece of everything the state of the art produces, is doomed to go out of business.

Seemingly we have reached a stage of almost boring predictability. Recording studios are not only beginning to look alike but all over the world it seems that the modus operandi of recording sessions seldom varies. The rhythm tracks are laid down, reference vocals made, and an arranger scores for strings, brass, woodwind and such like. The vocalist returns to put down the final tracks and remixing takes place for what seems like an eternity. Perhaps the biggest contributory factor to this virtually monomorphous situation is that the freelance engineer and producer move freely from studio to studio across all international borders. Major differences today appear to be mainly those of nomenclature but this has not always been the case. Let's take a look at the times when things were very different.

Prior to the Beatles phenomenon (and the British satellite groups of the period) the pop recording industry was very much a one-way traffic system. I can only concern myself here with recording techniques and resist the temptation to make judgements on the artistic content of records coming from the States at that time, but suffice to say that an enormous percentage of British products were of American cover records. And how Britain struggled to get that 'American Sound' working almost completely in the dark and with very little of the proprietary equipment available to American studios.

My entrance into recording engineering was at Abbey Road and that much sought after first chart entry was Cliff Richard and The Shadows *Move It* with Norrie Paramor as producer. Those were exciting days —EMI just about dominated the British charts. True, if you haven't the right song and singer, you don't have a hit—but take away the engineering and you don't have a record. Ever since Edison recited *Mary had a little lamb* into his cylinder, individual record companies engineering and production staffs have been collaborating to make their records sound better than their competitors. The independent recording studio and engineer (or producer for that matter) was a rarity in the late Fifties and early Sixties and I remember an occasion when the late Joe Meek was forbidden entry into the studio at Abbey Road for fear he may learn something of our techniques. This may seem bizarre now, but such was the prevailing climate at the label-owned studios. Rather than steal our ideas, he could un-

Above: Phil MacDonald cutting a master lacquer disc on a Scully lathe at Abbey Road (mid-sixties).

Left: Johnny Kidd centre, his manager extreme left, Peter Sullivan foreground left, Malcolm Addey at console. Malcolm Davies behind Malcolm Addey and Henry Moss behind Johnny Kidd (late fifties).

Right: EMI rather monopolised the charts around 1960!

NME MUS

BEST SELLING POP RECORDS IN BRITAIN

(Wednesday, July 13, 1960)

Last Week	This Week		
1	1	GOOD TIMIN'	Jimmy Jones (MGM)
3	2	PLEASE DON'T TEASE	Cliff Richard (Columbia)
2	3	AIN'T MISBEHAVIN'	Tommy Bruce (Columbia)
9	4	SHAKIN' ALL OVER	Johnny Kidd (HMV)
6	5	MADE YOU	Adam Faith (Parlophone)
5	6	ROBOT MAN	

doubtedly have taught us something—remember he made the multi-million seller *Telstar* with the most primitive of equipment in one of the rooms of his apartment—conditions that would horrify anyone today, but it happened!

At Abbey Road, 1958 (the year that 'Chick' Fowler, manager at that time, hired me) there was not a single transistor to be found. Stereo was still in the experimental stage—78s had finally been ousted completely by the single (45rpm)—the LP was well established. EMI *BTR2* machines were everywhere—mono and stereo—4-track had not yet arrived. I had the honour of being chosen to work with the 'pop' recording team.

We were a very tightly knit community dedicated to making EMI's pop product technically equal to that of American imports. During the period I am speaking of (up to and including the Beatles' first release, at which time that one-way traffic system became two-way) the team consisted of Peter Bown, Stuart Eltham, myself and Norman Smith (later to become Hurricane Smith) in the studios and Michael Grafton Green, Harry Moss and Malcolm Davies in the cutting rooms. It would have been impossible to achieve anything, though, had we not had tremendous support at high managerial level from the A & R department. The staff producers were Norman Newell and John Burgess (all labels), Wally Ridley and Peter Sullivan (HMV), Norrie Paramor and John Schroeder (Columbia) and George Martin and Ron Richards (Parlophone). Of the technical personnel, ever helpful in making up black boxes for special effects and achieving impossible hook-ups, I particularly remember Gus Cook, Ken Townsend, Michael Grey, Gwynn Stock and Bernard Speight. Waiting in the wings (but not all at the same time) were the young assistant engineers operating tape machines—Geoff Emerick, Peter Vince, Vic Gamm, Jerry Boys, Tony Clark, Phil McDonald and Tony Bridge and others.

Much of our knowledge of American recording was guesswork. Often we would get together and listen to piles of singles from the States discussing, arguing and speculating on how certain sounds were produced. "How is it we can't get that sound?"—the question so often asked by the A & R people—frankly could sometimes only be answered with "If you give us that particular singer with those musicians we'll come pretty close!". When I moved to New York in 1968, where I've been ever since, it was possible for me to judge to what degree that answer was valid, but that subject I'm leaving for another time. Because of EMI's ownership of Capitol we had access to the scene at the Capitol tower but apart from Sinatra and Peggy Lee type big band records, for which they were the best, I always thought that company to be very conservative especially with their attitude towards rock and roll which was looming over the horizon. Some of those funky small labels, of which there seemed to be thousands at any given moment, excited me much more.

So what did we know about the States that was so different from what we were doing? Well, we knew that the standard monitoring speaker was the Altec: with certain notable exceptions studios tended to be much smaller and drier than in the UK; a thing called peaking EQ (the Pultec) at frequencies not available on the EMI curve bender; obviously some excellent limiters (Fairchild *660*) and in my opinion perhaps the most important of all—the VU meter! Now that last statement will no doubt raise the eyebrows of some of the up and coming young purists among us but I'll just relate one of my experiences to show that where PPM's are concerned one can get too clever by half.

One day I was being pressured by the producer to try and get that heavy, thick snare drum sound so common on American records. Having always been of the opinion that almost any kind of subterfuge is justified to get the sound you want, I took the risk and pushed the fader up and stopped when the producer smiled. The PPM was going berserk—reading about plus six—but I let it go through and much to my surprise it transferred perfectly well to disc. Later on, VU meters were added to our consoles side by side with a Siemens light beam PPM and the reason for the success of that experiment was clearly obvious. The VU meter was not in the slightest disturbed by a heavy snare drum. The only conclusion I could come to, was that if the meter being used as a level indicating device unnecessarily restricts the engineer from getting the required sound, then that device is unsuitable for the medium.

Monitor speakers. Now there's a subject everybody can get their teeth into and because it's such a personal subject it is pointless my dwelling too much on this. There are hundreds of good speakers around—speakers that sound fantastic on programme material already created but choosing the tool on which to make important subjective decisions every minute of the day is quite another problem.

Primitive equipment with John Burgess left, Malcolm Addey right. Probably an Adam Faith session (late fifties).

Tannoy fans will be glad to hear that Abbey Road used Tannoy monitors for pop recording until about 1960. Now bearing in mind our knowledge that the Altec was heavily favoured in the US and after many futile attempts on the part of EMI's research department to come up with something similar, we did change over to Altecs. I remember what a pleasant experience it was to mix on them. Interestingly many of the popular monitor combinations in use in the USA—the UREI *813* and the *Big Red* for example—still use an updated version of the Altec *604E* as the basic component.

An engineer who has never worked in a studio where his tapes are mastered to disc in the same building is truly at a disadvantage. Frequently I hear horror stories from mastering engineers of tapes from independent studios that are almost impossible to transfer to disc. The studio engineers at Abbey Road worked in close co-operation with the cutting engineers and should we do anything outrageous the word would soon get down to us. Because we were constantly aware of the medium—the end product was a disc and if the work we were doing in the studio didn't sound good on disc—well, we were wasting our time. We were fortunate to be in the same building and work for the same company.

Equalising and limiting at the time of mastering to disc was the order of the day. In fact the first time I wanted to use a limiter on vocal only in the studio, a memo was shown to me, expressly forbidding such a thing and I had to have that order waived at managerial level just to get it patched in! Remembering that everything had to be home made (there was no such thing as going out to buy what you wanted, for it wouldn't have been available anyway) and the only limiter around was the EMI *RS114* which was a real thumper. So the *RS114* coupled with the EMI curve bender and a modified Leak *TL12* power amplifier driving an Ortofon head mounted on a Scully lathe, was the equipment used to cut countless EMI hit records. It still amazes me how those boys upstairs achieved what they did with the tools they had to work with.

As was the case with so much equipment at Abbey Road, the curve bender seemed to be designed more with classical recording in mind. From all accounts, though, it was the envy of our British competitors but what strange frequencies of operation—32, 64, 128, 256, 512, 1,024, 2,048, 4,096, 8,192Hz etc. They were mounted in the cutting room racks and I remember Malcolm Davies complaining bitterly that the curve bender wasn't much use when trying to match the sound of an American pressing for release in the UK. It was pretty useless to us in the studio also. For some reason the manufacturer of the best available programme equaliser (as they were officially called) in the States was Pultec and they had decided to choose round figures like 50Hz, 100Hz, 3kHz, 5kHz and 10kHz (what was wrong with the kilocycle?) etc. Capitol Tower, United Recorders on the coast and Bell Sound in New York already had two or more of Pultec's peaking EQ frequencies, built into their consoles in the late Fifties. Until we followed, we had to have locally made little black boxes for shelving EQ.

I could go on reminiscing about the everyday 'live' recording of 30 and 40 piece orchestras, emerging new microphone techniques, echo chambers, 4-track recording, artificial double tracking, phasing etc, but that would probably take up a whole book. Looking back at some of the formative years of rock and roll recording in Britain, I realise that they really were exciting and challenging days.

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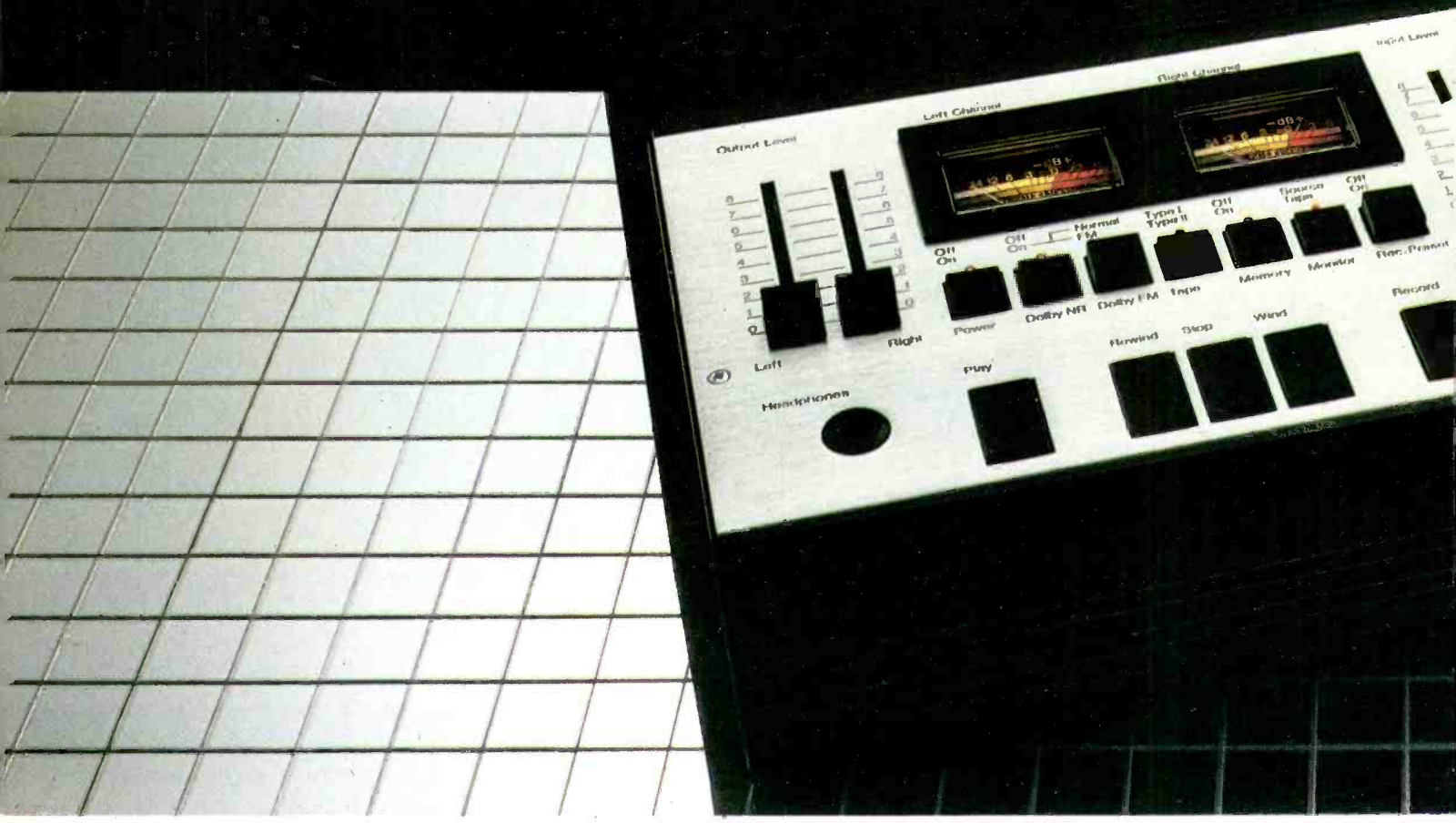
A REVOLUTI
HEARI



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From AUDIO magazine, July 1978.

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ARGENTINA The government is considering a bill to denationalise most of Argentina's radio and television stations; a minimum of stations would remain under government control to provide what is described as the 'traditional' broadcasting service. The Communications Secretariat announced recently that there was to be a considerable expansion in radio broadcasting, both on VHF/FM and on medium wave. There are at present FM transmissions from stations in Bahia Blanca, Cordoba, Mendoa, San Juan and Santa Fe, as well as experimental transmissions from stations in Salta and Tacuman.

BANGLADESH The resident representative of the UN Development Programme in Bangladesh announced in August that a $2,800,000 project to develop radio and television broadcasting in the country had received approval. The three and a half year project will concentrate mainly on the training of programme and engineering staff and will be carried out by UNESCO and the International Telecommunications Union.

BULGARIA Plans for the development of broadcasting in Bulgaria in the period up to 1990 include a fourth programme on VHF according to the Communications Ministry. A radio and TV transmitter complex is to be built on Mt Vitosha; in addition to providing five TV channels it will provide four VHF/FM radio programmes for the Sofia and Pernik areas, two of them in stereo. Another transmitter complex is also under construction near Belogradchik; it will improve reception of the three domestic radio services on VHF in the north-west parts of the country and test transmissions have started.

COLOMBIA Stereo FM transmitters are to be installed in the cities of Carmen de Bolivar, Monteria and Valledupar during the latter part of 1978.

GERMAN DEMOCRATIC REPUBLIC Stereo transmissions on the four VHF/FM radio programmes increased to 203 hours a week in 1977 from 186 hours in 1976. It is reported that quadraphonic test transmissions are now also in progress.

JAPAN The Minister for Posts and Telecommunications has announced increased allocations of VHF channels for FM radio broadcasting in the near future; he also indicated, however, that problems of interference and the relative powers of transmitters, with particular regard to broadcasts to remote areas, would have to be examined and resolved before such allocations were finalised.

LIBYA A 9,000,000 dinar contract has been awarded to an Italian contractor to build a new Libyan radio and TV centre over the next two years. A 32,000,000 dinar contract has also gone to Yugoslavia for the improvement of radio transmitter facilities in Libya.

MOROCCO Sofratev is to carry out preliminary studies for a new radio and television centre to be built in Morocco, probably in Rabat.

NAMIBIA/SOUTH WEST AFRICA An interim Radio Board took control of radio services in the territory towards the end of August. The board consists of prominent non-political South West Africans and will control the content of broadcasts; these will include material designed to counteract broadcasts to Namibia from Angola and Zambia. Local broadcasting in Namibia/South West Africa is on VHF/FM.

POLAND Official government statistics released earlier this year showed that there were some 7,900,000 registered radio licence holders as against 7,275,000 licensed TV receivers. The four domestic radio services are broadcast on VHF/FM as well as long, medium and short wave and there are plans to set up a fifth radio programme on VHF. A stereo radio studio has come into service at Zielona Gora, but the new radio studio at Szczecin, which will specialise in coastal and maritime programmes, will not come into use until early in 1979. According to the Polish radio's DG there have been persistent FM reception problems in the Premsyl and Novy Sacz basin, which it is hoped will be eliminated through new transmitter facilities during the year ahead. There has also been considerable criticism of the quality of stereo and experimental quadraphonic broadcasts; this has been blamed on the absence of a proper national stereo distribution network at present; one is due for completion next year.

SWEDEN Proposals for the reorganisation and restructuring of broadcasting in Sweden include allocations for the introduction of community radio, on an experimental basis. This would probably make use of VHF frequencies.

TURKEY Two new Third-Programme transmitters have been opened in Antalya and Mugla, both transmitting on VHF/FM with a 30kW output. There are now 12 Third-Programme (TRT-3) transmitters in Turkey, broadcasting music some 16 hours a day.

YUGOSLAVIA A local radio station broadcasting on VHF and medium wave is to be built at Slavonska Pozega by the end of the year. The station is being built as a joint project by the town council of Slavonska Pozega and the Etok company of Zagreb.

A new radio and TV transmitter has been opened on Mt Trovrh, to provide improved coverage to eastern parts of Bosnia-Herzegovina; a further transmitter opens on Mt Majevica in October. The transmitter at Mt Trovrh will relay the first and second TV programmes on VHF and UHF respectively, with the radio first programme on 90.3MHz and second programme on 99.5MHz. Radio and TV reception quality has hitherto been particularly poor in eastern Bosnia; this is reflected in the low ownership of receivers relative to other areas in Bosnia-Herzegovina. The new transmitters will provide coverage over 90% of the area of the republic. Zenica Radio, now second in size to Sarajevo Radio in Bosnia-Herzegovina, has recently opened a second studio; this will enable it to produce its own programmes for transmission 10 hours a day.

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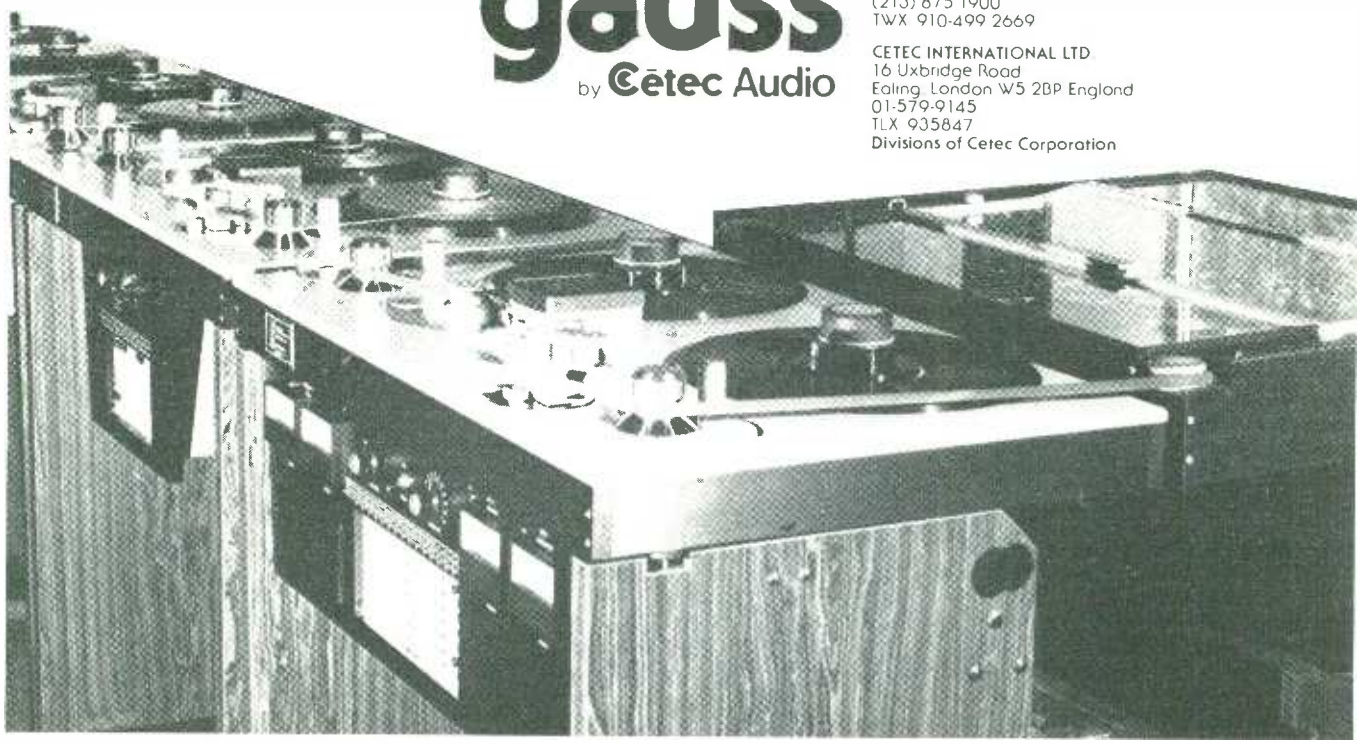

Philips digital audio disc

PHILIPS RECENTLY made news with a press release on the company's new compact disc digital system for optimum sound reproduction. The sound disc is of course a development of Philips' long promised, but never quite realised, video disc system which uses a laser to read variations in the reflective character of a shiny disc. Philips have so far given only a few details of the audio disc system: the disc will be of 110mm diameter and carry sound recorded in 14 bit linear PCM, however other pieces of the jigsaw are available and fit neatly together.

A video disc is, of course, an ideal carrier for digital sound but is tied to TV standards that vary from country to country, so rotational speed is usually 1,500rpm in Europe but 1,800rpm in the USA and Japan. This makes for problems over international compatibility and obviously no new audio disc system will ever get off the ground unless it is compatible on a worldwide basis. Imagine an imported LP being unplayable at home. Video discs also have a heavy surplus of bandwidth since not all the 5MHz is required to record stereo sound in PCM so one Philips line of research has been into a system for extending the playing time of a video disc to take full advantage of the spare bandwidth capability. Philips claim to be able to squeeze over 70 hours of mono PCM audio out of a single side of a 5MHz video disc rotating at 1,500rpm on a video disc player by tracking each rotation of the disc a 100 or more times. One sequence of digital words is extracted on the first time round, another sequence the second time round, and so on.

The new Philips disc however abandons the idea of a single player for both video and digital sound use. Philips is now backing the concept of a custom built digital sound player. The company is also abandoning the concept of a fixed rotational speed, clearly with an eye to worldwide standardisation. Instead of a fixed rotational speed (1,500 or 1,800rpm) Philips goes for a fixed linear or tangential tracking velocity. At all times, and on any player anywhere in the world, the optical information is tracked at a constant linear velocity of 1.5m/s meaning that the rotational speed of the 110mm disc varies from around 400rpm near the periphery to around 800rpm towards the centre.

Older members of the recording profession will doubtless recognise this as an old idea brought up to date. Way back in the Twenties there was a scheme to cut records with linear velocity and a rotational speed increasing towards the inner grooves and Garrard of Swindon made the necessary player. The *World Record Controller* doubled the available playing time and reduced inner groove distortion of a shellac disc by varying the rotational speed either side of 78rpm. Changing speed control in those days was achieved purely mechanically which presented all manner of practical problems. Few records were issued in *WRC* format and the idea never caught on.

Although details are not yet forthcoming, Philips will probably build speed control into the digital code.

French pirates

LIKE THE UK a decade ago, France recently enjoyed (or suffered from, depending on your point of view) a spate of pirate radio broadcasts. But whereas the British air pirates of the Sixties got round the law by broadcasting from outside territorial waters, the French stations found a land-based loophole.

In 1974 the French passed laws intended to guarantee the state a broadcasting monopoly. Anyone who has viewed French television knows what that means. Talking heads simply repeat what they said earlier when they run out of fresh comment so that programmes seldom run to time. Other times mothers must explain to noisy children that their favourite programme finished before they switched on because it started too early. One spot on the radio dial has an all-music programme for drivers enlivened by the occasional interruption from what sounds like a zonked-out announcer reporting a traffic jam and advising motorists "to grow wings and fly". Closedown is an equally casual affair. At around the specified time the station just switches off, often in the middle of an LP track.

The pirate radio stations were trying to offer an alternative to talking heads and music-while-you-drive. The first round of the inevitable pirate-versus-state battle was won by the pirates when a Montpellier station won its right to broadcast an appeal. The station satisfied the court that the French state broadcasting monopoly was contrary to liberty and human rights. Pirates also argued that the law only prohibits the transmission of messages "from one place to another" and because their stations use omni-directional aerials they are within the law. The French government has now hurriedly redrafted the law, just as the British government did a decade ago, to nail the pirates once and for all. Legally the French government will win, just as the British Government won. But the French public has now had a taste of local style radio and it is already on the cards that, again just as in the UK, the final outcome will be a network of legitimately licensed local radio stations. This is, of course, all many of the pirates wanted in the first place.

More pirate cassettes

HARDLY a day seems to pass without some official pronouncement on how much money the business of piracy is estimated to be losing the record industry every year and how much legal effort is being devoted to stopping the rot. To the considerable concern of some of the legal profession, many court cases on piracy are held in secret. The argument is that a public court hearing would alert other pirates to imminent raids. This may be so but some pirates seem to continue about their business quite openly, even ostentatiously, without legal problems.

There is, for instance, a street market in London that is famous for selling animals. In amongst the stalls selling tortoises, cats, dogs and goldfish there's a large stall that specialises in what are quite obviously pirate cassettes. At this stall you can choose from a wide range of prerecorded cassettes, unlabelled except for a few felt pen scribbles. Cost of a collection of jazz', 'rock' or 'easy listening' music is 50p per cassette with the chance to hear some of the cassette before purchase on an old ICE stereo player run from a 12V car battery. The stall sign boasts 'factory recorded tapes'. This is doubtless true, because there are so many on sale that they could only come from a small factory. The stock isn't all nondescript compilation music, either. On the weekend before the film of *Thank God It's Friday* opened in the West End of London the stall was selling pirate versions of *Thank God It's Friday Parts I and II* for 75p a time or £1.50 total. Cost of a legitimate version of *Thank God It's Friday Parts I and II* is £6.99.

It would be nice to say that the quality of the pirate cassette is atrocious compared to the legitimate version. In fact the pirate quality is almost as good as the legitimate version and a great deal better than some legitimately produced musicassettes sold to the poor, long-suffering public. And the legal position? Well, as I bought *TGIF Part II* (illegitimate) for 75p, a couple of uniformed policemen on the market beat were browsing through the stall stock. I wish I could think they were preparing a report for the BPI—but I can't, more likely they were wondering what to buy for their kids. (For the legal record I did notify Pye Records of the incident, prior to publication of this report.)

RIP Caruso

FOLLOWING MY story on the Memorex glass shattering advertisements, several readers kindly sent in a cutting from a Scottish newspaper. According to the paper, a cabaret artiste by the name of Helen McBennet had startled drinkers in the Snug Bar at Bellshill near Glasgow, by shattering a whiskey bottle with the sheer power of her unamplified voice. She had done the trick for charity, the bottle containing a hundred pounds worth of coins. Here at last, I thought, is what I have been looking for—the chance of first hand authentication of the Caruso legend. Whereas everyone knows that Caruso is 'supposed' to have broken glasses with his unaided voice no-one can point to a reliable source reference.

A Scottish colleague bravely volunteered to check out the Bellshill story. In the Snug Bar he found any number of eye witnesses to the event. They had all definitely seen Ms McBennet stand at one end of the bar and shatter the bottle at the other with ear-splitting vocal ease. But, as my Scottish colleague remarked, "By closing time in a Glasgow pub on a Saturday night, most people are firmly convinced they can walk on water". Ms McBennet, though present and willing to talk, confirmed that she only did the trick once a week and that night wasn't the night. My colleague duly agreed to return on the appointed night accompanied by a photographer to check the bottle, witness the event and report it for posterity in the pages. Sadly no such story was ever published and the Caruso legend remains still unconfirmed. When crunch time came, Ms McBennet admitted that it was in fact all a trick. Although understandably no details of the trick are available, it seems likely that some kind of detonator was planted in the bottle. Pity.

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Hearing matters

Bob Harris (Acoustic Technology, Southampton)

A working understanding of psycho-acoustics (the way the hearing mechanism works) can go a long way towards intelligent microphone and loudspeaker placement and the much sought after 'good' sound. Bob Harris of Acoustic Technology Ltd, explains one or two fascinating fundamentals and suggests a few practical solutions.

THE ART OF sound engineering, whether studio balancing or live system operation, is ultimately based on subjective assessment of the sound, and most studio and reinforcement engineers are justifiably proud of their discriminating abilities. However a quantitative understanding of the subjective effects is also important. When setting up location recordings or concerts, for example, there is often little or no time allowed for a 'sound check', let alone trial microphone or loudspeaker placement, and in these cases some appreciation of what may or may not be heard with a particular arrangement can be invaluable.

The science of psycho-acoustics has identified a wide range of subjective effects, all of which hinge on analysis of the signal received at the ears by the brain. Some effects are obvious, such as loudness masking of one instrument in a mix by another, others very subtle, for example the interpretation of the (microsecond) delayed reflections from the inner and outer pinnae of the ear, an effect exploited by the currently intriguing Aphex process unit. Each effect is remarkable when one remembers that at any instant the only information incident on the ear is a single sound pressure value.

It is hoped that this article will clarify what remains a largely grey area to many engineers—the 'Haas' tusion (integration) and precedence effects. I offer also my 2dB's worth on the apparently controversial subject of vertical sound localisation, and on the important matter of hearing damage risk.

What is the Haas effect?

Haas' work at Gottingen in 1950[1,2] in fact quantified two interrelated effects—the *fusion* effect, due to the integrating characteristics of the ear, and the *precedence* effect. When most people talk about the 'Haas effect' they mean the *precedence* effect, but we will consider fusion first.

Suppose a listener is sitting in a theatre or concert hall, as shown in **fig 1a.** When the performer produces a sound, the listener will first hear the direct sound which follows the straight line path PL between the performer and listener. The direct sound is followed by a number of reflections (R_1, R_2, R_3, etc) which arrive later, the relative levels and arrival times of these being dependent upon the length of the corresponding reflection paths between performer and listener. Briefly, the reflected sound arriving at the listener within about 35ms after the direct sound will be fully integrated by the hearing mechanism to add to the apparent loudness and intelligibility (or quality) of the source. The direct sound is thus 'enhanced' by the reflected energy. Longer delayed reflections are only partially integrated and depending on their relative level, may even be heard as echoes. Discrete high level reflections arriving more than 95ms after the direct sound are not integrated at all, and are generally detrimental to the sound quality. Lower level reflections are perceived as reverberation, which may or may not be desirable, depending on the nature of the performance. In S/N terms, sound arriving within 95ms may be considered as contributing to the effective signal, whereas later major reflections constitute noise as shown in **fig 2.**

In the above example, it is the sound which arrives first at the listener (the direct sound) that determines the apparent location of the performer. This is the precedence effect which is easily demonstrated in any studio control room, whether or not a delay unit is available. Indeed the phenomenon was first reported by Henry in 1849. Consider the control room shown in **fig 3,** with an engineer sitting symmetrically between two identical monitors (or even better, try it!). If both monitors are fed the same speech signal and there is no phase shift between channels, then the engineer will hear a single voice image on a horizontal plane connecting the two loudspeakers at a point determined by their relative output levels. Now suppose we match the channel levels, but at the same time insert a time delay of greater than 1ms, say 10ms, into one of the monitor lines. The "midway" image disappears, and instead the sole apparent source is the undelayed monitor.

The same effect will occur, without artificial delay, if another listener (say the producer) stands such that the sound from one monitor reaches him more than 1ms before the sound from the other, whence he will probably complain about the balance! If the delay time is increased to around 40ms a separate echo is heard, but the voice remains localised at the undelayed loudspeaker. Haas found that the two loudspeakers will sound equally loud only if the level of the delayed loudspeaker is increased to a critical positive value (less than 10dB, depending on the delay time), with respect to the undelayed channel. Even then the normal panpotted midway image does not occur. To quote from Haas himself, "This does not produce any direct-in-front impression . . . rather the sensation of two sound waves emitting from different directions, coinciding with the position of the loudspeakers, is produced." Clearly, in multitrack mixdown a delay unit may be used as an interesting alternative to the panpot, in addition to the usual ADT, phasing and Doppler effects.

In sound reinforcement design, there are two major applications in addition to playing around with the apparent source location (surround-sound effects). Firstly, the sound quality may be optimised by ensuring that the direct (performer) and loudspeaker signals are more or less synchronised in their arrival time at the listener. Further, natural sound reinforcement has been described as "reinforcement of the original programme material such that the listener in the audience is unable to distinguish that a reinforcement system is being used"[3]. The precedence effect suggests that where natural sound reinforcement (as distinct from overt amplification) is the goal, then delaying the loudspeaker signal so that it arrives a few milliseconds after the direct sound, could result in a sound image firmly at the location of the performer with no apparent contribution from the loudspeakers.

Haas' results have been widely quoted and applied, particularly in high quality speech reinforcement systems design for churches, large conference halls and similarly reverberant auditoria. Delay units are today becoming fairly commonplace in theatre installations and touring PA rigs, and examples of their usage have appeared in previous editions of *Studio Sound*. So what's new, you ask? The essential point is that there are definite limitations to the possible applications, and failure to appreciate these has led to a number of disappointing (and expensive) results.

As mentioned in the control room example, Haas found that for delays between 10ms and 25ms it was necessary to have the delayed loudspeaker 10dB up on the undelayed for equal loudness. This figure of −10dB appears to have subsequently taken on magical significance, for it has been widely assumed that the precedence effect will work provided the loudspeaker signal level is not more than 10dB up on the direct (unreinforced) signal level at the listener. Unfortunately, this overlooks two important facts.

Firstly, the criterion shown is for equal loudness. The perception threshold for the loudspeaker will occur at a lower loudspeaker output level, as low as −5dB relative to the undelayed sound level, depending on the delay time and the nature of the signal.

Secondly, Haas' results apply directly only to anechoic speech.

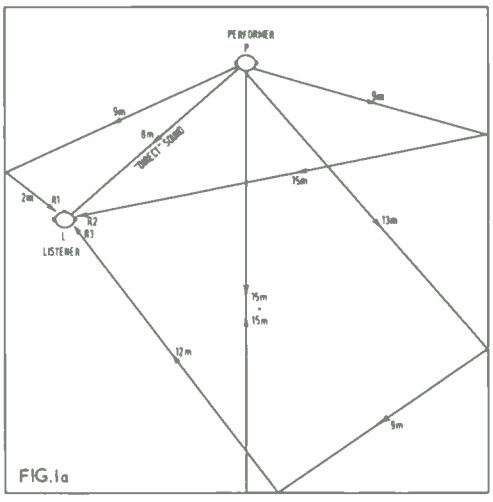

FIG.1a

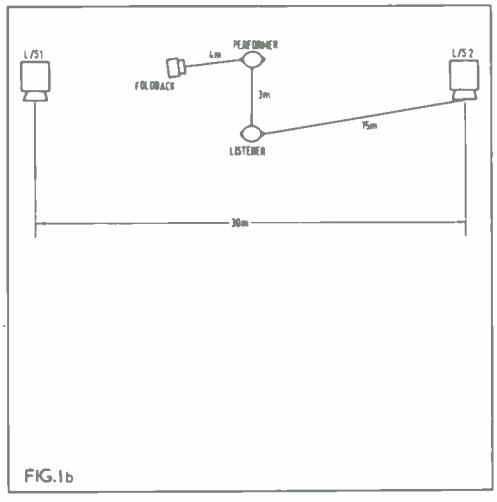

FIG.1b

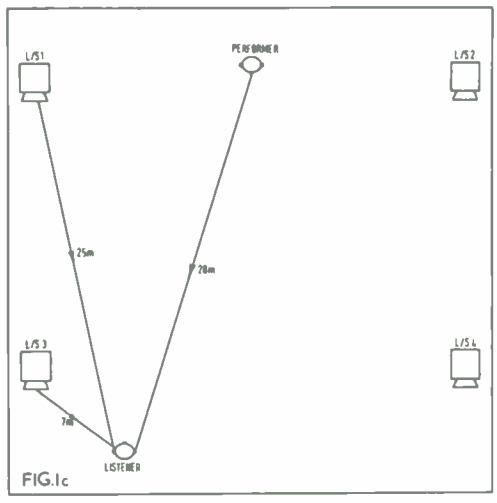

FIG.1c

Wallach[4], a contemporary of Haas, showed that the precedence effect was less evident with a music signal. He found that, at matched delayed and undelayed levels: "recorded orchestral music was localised in the region between the loudspeakers, if anything closer to the more distant (delayed) one". I recently undertook the design of sound reinforcement systems for the choirs of two large cathedrals, and as part of this work repeated Haas' tests, but with choral music (long syllables) in a highly reverberant environment. The maximum relative level for a delayed loudspeaker with delays between 10ms and 100ms was −4dB. A maximum level difference of +4dB before the image switches to the delayed loudspeaker has also been recently reported by Cremer[5], who suggests that the whole phenomenon may be a learned ability rather than a physiological effect.

Ecclesiastical agony

To digress, one of the cathedral jobs provided an entertaining example of subjective acoustics—worthy perhaps of an Agony—when a colleague and I were asked to evaluate the existing sound system.

Listening to the choir there was no indication that they were reinforced, so either the sound system was very good or it was doing nothing at all. Suspecting the latter we asked the MD if we could turn the system on and off as a decisive test. His reaction bordered on the violent. We were wasting our time, we were told. Had he not himself set the optimum level, in conjunction with the (much revered) system designer? How could things possibly be improved? Turning to electronic skullduggery we proved the point—the loudspeaker signal was 25dB (A) down on the unreinforced sound, and inaudible above the ambient background level!

What were we to do? Prepare a technical report on the system performance, as requested, or remove the amplifier boards and just leave the mains neons for the MD to faithfully switch on each morning with a confident smile?

Returning to Haas, the fact of the matter is that the precedence effect is strongly dependent on both the relative amplitude of the undelayed and delayed signals and the nature of the signal itself. The fusion effect is also amplitude dependent, as shown in **fig 2.** The values shown apply to speech and instruments with a transient waveform, such as the piano. For strings, and so on, the curve will shift a little to the right, ie the energy of the delayed components is added to that of the direct sound over a greater period.

Guidelines—for delay lines

With the aid of some very basic mathematics, and **fig 1** and **2**, we can now add some numbers to the theory. Hopefully a feel for the times and distance involved, and a few quick on-site calculations, will help produce the best possible sound. Otherwise things may sound okay at the sound desk in the stalls, but how about in the corner of the gallery? Even if you do wander around during the sound check, it's then often a bit late in the day to move the PA around!

Sound waves travel in air at a speed of 340ms^{-1}. Thus they take 1/340s or 2.9ms, to travel 1m. As sound waves spread out from a source, the sound pressure level (SPL) falls off at a rate of -6dB for each doubling of distance, so if a loudspeaker produces 100dB at 1m, the level will be 94dB at 2m, 88dB at 4m, 82dB at 8m, etc, (This is not always the case, but we will assume it here. We will also assume that no energy is lost when sound is reflected at room surfaces, although generally there is some loss.) The fall-off is written mathematically as

$$\Delta \text{ SPL} = 20 \log_{10} \frac{r_1}{r_2}$$

where r_1 and r_2 are the distances in metres from the source.

In each of the following examples, all quoted dB levels are relative to the level of the direct (performer's) sound at the listener unless specifically stated otherwise. Thus the direct sound level at the listener corresponds to 0dB in **fig 2.** Similarly the arrival time of the direct sound at the listener is taken as t=0 in **fig 2.**

In **fig 1a,** the listener is 8m from the performer. This is the length of the direct sound path. The path length for reflection R_1 is (9 + 2)= 11m. Thus the difference in the path lengths travelled by the direct and reflected sound waves is (11-8−3m. Since a distance of 1m corresponds to a time delay of 2.9ms, the reflection will arrive after a delay of 3 x 2.9=8.7ms, at a level of 20 log (8/11)=-3dB. Plotting these values on **fig 2,** we see that the sound energy of the reflection is fully integrated to add to the loudness and quality of the direct sound. Reflection R_2 arrives after (9 · 15-8) x 2.9−46ms, with a relative level of 20 log (8/24) =-9dB, and is partially integrated, further improving the direct sound, as is reflection R_3 (75ms at -13dB). All three reflections appear under the curve in **fig 2,** and hence no echo is heard by the listener. Will the performer be disturbed by an echo off the rear wall? Clearly not, since by the time the sound has travelled to the rear wall and back again (around 87ms) the level will have fallen off by nearly 30dB.

In **fig 1b,** listener and performer have moved to a larger auditorium, with dimensions twice those of the first venue. The new hall is 30m from stage to rear wall, so there is a fall-off of 20 log (1/30)=-30db between the level produced by the performer and the level heard at the back of the hall. To overcome this problem a twin-channel sound system has been installed. The signal from the performer has been panned centrally, and the SPL 1m in front of each loudspeaker is 20dB higher than that 1m from the performer. If the level from the foldback loudspeaker is also 20dB above the performer's own level the performer will hear a relative foldback level of 20 log (1/4) · 20= · 8dB, after a delay of (4 x 2.9)=12ms. This falls under the curve in **fig 2,** so no problem. It is clear that for any given foldback distance there is a limit to the possible foldback gain before a disturbing echo is heard by the performer. In general the distance should be as short as possible, certainly less than 5m. This limitation applies in principle also to the performer−main loudspeaker spacing, but for a directional loudspeaker system facing away from the performer there is rarely any problem. If the performer was in front of the loudspeaker, the limiting distance would be around 12m, for a 20dB loudspeaker/performer output level difference.

In an attempt to hear the best sound, the listener positions himself directly in front of the performer, at a distance of 3m. Assume the loudspeaker output at the angle to the listener is 5dB down relative to the on-axis level. The loudspeaker sound is then heard at a level of 20 log (3/15) · (20-5)=- 1dB, after (15-3) x 2.9=35ms. This is just on the limit of integration! It follows that in order to optimise sound quality, stereo stacks or columns placed on each side of the stage should ideally be no more than 15m apart, with an absolute maximum separation of 30m. With wider stages the only satisfactory answer is overhead mounting.

In **fig 1b,** there still remains a drop of 6-7dB in the direct sound between the middle and rear of the hall. In long halls, a second pair of loudspeakers is therefore often installed to improve the sound level distribution, as shown in **fig 1c.**

Without electronic delay, the lis-

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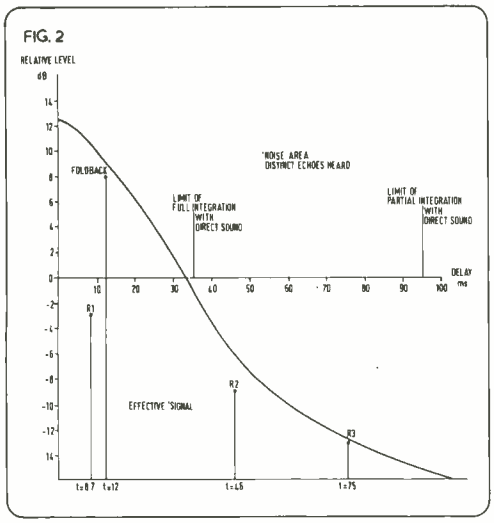

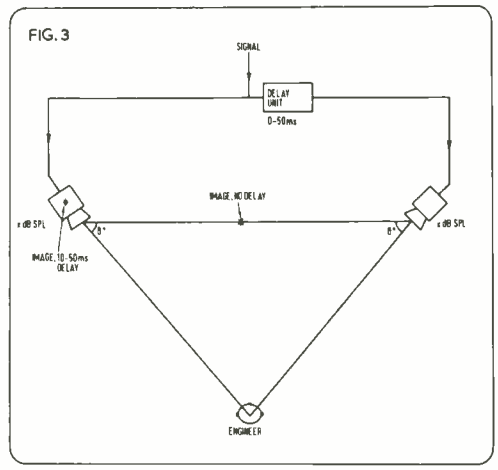

HEARING MATTERS

tener at the back will first hear the signal from L/S3, followed 52ms later by the sound from L/S1 and after a further 9ms by the sound from the performer. All rather unsatisfactory and the signal will be localised at the nearest loudspeaker. If we delay the signal to L/S1 by 10ms, and that to L/S3 by 65ms, then the three contributions will arrive more or less together, and the sound quality will be improved. It is unlikely, however, that the listener will localise the sound at the performer, even though the sound from the performer arrives first. This is because the relative level of L/S3 at the listener is likely to exceed the +4 to +8dB maximum above which the image switches to the loudspeaker. For example, if the performer produces 80dB at 1m and L/S1 at 90dB at 1m, the combined level at the listener will be 63dB. Increasing the level with L/S3 by the permitted maximum of +8dB, to 71dB, will leave the total level too low for many performances (9dB corresponds approximately to a doubling of loudness). A compromise must then be made between the desired listening level and 'natural' location of the source.

In summary, live sound systems should be designed such that as much sound energy as possible arrives at as many listeners as possible below the Haas fusion curve. If the precedence effect can also be utilised, so much the better, but be prepared for disappointing results with high level systems, notwithstanding the effect of visual clues, as discussed below.

Finally, we come to our studio engineer, sitting forlornly in **fig 3.** When introducing time delay into one channel in order to locate, broaden or otherwise enhance an instrument in a mixdown, a delay of between 5ms and 25ms should be used. With shorter delay times, phasing (interference) effects will occur and at longer delay times quality may be reduced. Conversely, delays in reverb unit send lines should be selected so that the echo return signals arrive later than 50ms.

Violinists on stilts—and flying trombones!

So far our discussion on localisation has been limited to the horizontal plane. There is disagreement between many engineers, however, on the ability of the ear to localise vertical sources. In the control room this is of little consequence, but the question crops up in the theatre—where best to mount the PA? Stephen Court[6] appears to favour the central overhead approach: "... the natural place from which to radiate the sound is above the proscenium arch ... since our ears are on a lateral plane we have little sense of vertical displacement in a sound source, so the image is retained where it should be—on the stage". Tim Foster[7] disagrees: "it has been shown that the ear is almost as sensitive to vertical displacement as it is to horizontal, and therefore speaker positions above the proscenium arch would only increase the disjointed effect ..."

It may be that both these gentlemen are believing their own ears. Research by the BBC[8] showed great deviation between subjects in their vertical localisation judgments. The BBC report concluded that the precedence effect was not applicable outside the horizontal plane, and cited complaints from listeners in concert halls with large overhead reflectors (and hence strong early vertical reflections), where the sound appeared to come from above the performers' heads. My personal experience is somewhat contrary—I find that the ear will accurately locate a loudspeaker source in the vertical plane, unless the performer is actually seen to be firmly on the stage floor, whence the visual clue has an important and often overriding effect. To my knowledge, little work has been undertaken into the effect of visual clues, although many American sound system designers take great pains to disguise their vast overhead horn clusters! Perhaps readers better informed than myself may care to comment.

Hearing damage?

It is more than three years since *Studio Sound* published Adrian Hopes' excellent summary of the hearing damage risk to engineers, musicians and audiences[9]. To quote the article: "If 10 sound engineers expose themselves eight hours a day for five years to equivalent noise levels of 107dB(A), then one of them is likely to suffer a hearing loss of 18dB at 1kHz and a staggering 38dB at 4kHz. The 107dB(A) level is high but not unknown by studio standards. I find this quite horrific ..."

Suppose we take 40 brand new 18-year-old tape ops, each with dreams of doing the first 256-way mixdown, and expose them to an equivalent continuous sound pressure level (L_{eq}) of 106dB(A) over an eight hour day. According to British Standard 5330:1976 (Estimating the Risk of Hearing Handicap due to Noise Exposure) two of these would-be engineers will probably have permanent impairment of hearing for conversational speech (sufficient to cause handicap, ie a hearing loss of 30dB arithmetically averaged at 1kHz, 2kHz and 3kHz) by the age of 22.

Despite the clear warning, little progress has been made in the last three years, either to reduce the risk or to accurately establish exposure levels. If studio engineers wish to risk deafening themselves with high monitor levels, that is their concern. Live sound engineers have a further moral responsibility to musicians (foldback levels) and the audience. Studio management risk future common law actions for compensation brought by deaf engineers (albeit with probably substantially reduced damages on the grounds of contributory negligence). Surely the time has come to commission one or two studies—firstly a measurement study to determine actual exposure levels (and predict their probable effects) and secondly an audiometric survey of engineers hearing both in the studio and the auditorium. Such research will of course be of little value if not carried out in a carefully controlled manner, with a thorough understanding of the complex acoustic, audiometric and statistical factors involved. Perhaps the APRS could oversee the work? Or the MU? I should, perhaps, declare my personal interest in conducting such research.

One final practical suggestion—hearing loss is proportional to the total sound energy incident on the ears. Hence pulling down the monitor (or PA) masters by just 3dB permits twice the exposure time before the same L_{eq} dose has been received. Alternatively, peak limiting monitor signals will produce similar results. In our example, we go from two probably deaf engineers to one. Take the level down another 3dB and we probably have none! ■

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Television sound dubbing and production

Des Bennett and Roger Guest (BBC)

Numerous stereo television programmes have been broadcast by linking TV and radio networks together, but most have been relatively simple multitrack music productions. Early in 1978, BBC Television produced a stereo 'melody-rock' programme entirely on location at the University of Birmingham, and here Roger Guest (sound supervisor) and Des Bennett (dubbing mixer) describe the sound aspects of the production of *Curriculee Curricula* and how BBC Wales has developed Stacey Road Studio, used for dubbing the programme. At the time of writing, a repeat showing has not been scheduled, but we will endeavour to give advance warning in News if we receive sufficient notice.

The building of Stacey Road Studio

ABOUT four years ago, we, that is the BBC Film Unit in Wales, were given the temporary use of a former TV News studio as a film music recording area. This rapidly proved itself and aroused much interest, so much so, that within a few months we hired a 25mm multitrack. As the demand grew—not just for film but also for TV prerecorded material—so the machine took root, and Stacey Road Studio had arrived.

John Lanchester (manager at Film Wales) gave us the go-ahead and we spent our spare time building up the recording capabilities of the studio and demonstrating to production staff the programme possibilities of multitrack facilities. However, as the weeks went by it became apparent that the Studio was not being used to the full by us, and the the idea of hiring the studio out commercially was suggested. John and several others, including Des arranged with BBC Enterprises for an agreement to be drawn up. This agreement enabled us to hire the studio for commercial recording, through BBC Enterprises, when we weren't using it—this arrangement still stands today.

At this time there were only two other BBC television multitrack recording facilities, both in London. The Television Music Studio at Lime Grove was 8-track and the Sypher Suite at Television Centre was for Video Dubbing. The Sypher Suite enabled TV producers to add music, speech or effects to television video productions using multitrack techniques in conjunction with a helical scan 25mm VTR.

The idea is that a finally edited Quadruplex VTR (50mm) programme requiring sound dubbing has the sound separated from the video, dubbed and then put back in sync. The Sypher Suite uses a system of locking the various machines based on SMPTE timecode originally designed for video editing. The Quad VTR picture is transferred to Sony 25mm video tape and the sound to one track of a 25mm 8-track. SMPTE timecode is simultaneously recorded on both machines. This code is derived either from a generator locked to the Quad VTR or is a facsimile of the code already recorded after editing is completed. During a dubbing session, the two 25mm machines are locked together using timecode. On completion, the mixed sound is then transferred back in sync, onto the Quad VTR using timecode to lock the 8-track to the Quad VTR.

Since we were fully equipped for normal film recording and dubbing in Wales using both sprocketted transports and Pilot tone for sync between machines, we were asked about the possibility of dubbing film material transferred to Quad VTR using timecode, and the 25mm multitrack at Stacey Road Studio.

We knew about the Sypher Suite system and had access to a 25mm helical scan VTR, but the lock-up system is very complex and we didn't have a code generator. We learnt from Sypher that the 25mm 8-track would need modifications to enable it to read code when in spool, thus requiring wideband amplifiers and a spherical replay head. The 8-track at Stacey Road was on hire, and so these modifications could not be carried out.

Due to pressure of work and curiosity, we then considered Maglink which would be capable of locking our machines together—and if we hired the appropriate 25mm helical scan VTR, we wouldn't need to alter our hired 8-track.

So Tony designed and built the necessary interface between machines, John made the major decisions (for example to standardise on 38cm/s for dubbing on multitrack and the very early use of Dolby noise reduction) and Des became the main operator of the system.

Dance sequence with Philips TV cameras

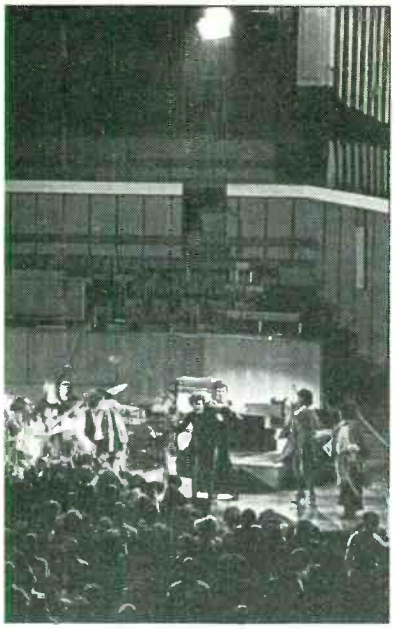
As Maglink's main advantage is its portability, it is possible to set up a video simulcast/dubbing suite wherever there is a need. This was proved when we transmitted the first simulcast on the continent for NOS TV in Holland. The programme, Verdi's *Requiem*, was recorded in Amsterdam and edited three weeks later in Hilversum using our multitrack machines, Maglink and Quad VTR from NOS Hilversum. It was transmitted as a simulcast by NOS TV using Maglink to lock the stereo sound for radio to the TV transmission.

Today we have two Maglink dubbing suites, the latest at Broadcasting House Llandaff—which is an integral part of a normal Film Dubbing suite; and Stacey Road is now an 8 and 16-track music recording studio combined with Maglink (which is also a video dubbing suite capable of 22-track with particular emphasis on music dubbing).

We have also developed a very comprehensive system of recording discontinuous stereo or multitrack sound in conjunction with normal TV recordings, and at a later date dub editing the stereo on multitrack back into sync with the mono TV pictures and sound for eventual simulcast. All edits are made by using the multitrack drop-in capability.

Programme production

When BBC Birmingham decided to produce their first TV stereo simulcast, they consulted Stacey Road on the methods to be used to record, edit and dub using Maglink code as the lock-up. The stereo problem is one well known to radio engineers—compatibility. Quadraphonic or binaural sound must be compatible with mono. In television broadcasts with stereo radio, the panning of



Above left: *Finale concert recorded in University of Birmingham Great Hall with MD Dave Greenslade on keyboards. Note stereo mic pairs behind each drum kit*

Above: *Stacey Road Studio with Des Bennett at Midas 20/8/16 desk with 10 channel Audio Developments compressor/limiter bay by window, stereo Nagra and Maglink control unit monitored by TV camera mounted above for remote display of code*

Left: *Sound crew protected against weather with pair of C451s mounted within dome windshield on fish pole*

Below: *Sonja Kristina (with her boots) and Chris Farlowe in the opening sequence*

sounds to match the television picture must also make sense to the radio only listener. In practice this means that the director must think carefully about his sequence of shots so that the images do not jump about the screen, and consequently the stereo, in a way that would be confusing when listening to stereo sound only. This applies rather more to dialogue scenes than to music where movement just for effect seems quite acceptable so consideration for radio sound is necessary at the writing stage.

The sequence of sound events for our stereo TV production *Curriculee Curricula* is broken down as follows:

1. Record music backing tracks for location playback.
2. On location:
   (a) playback of backing tracks.
   (b) record dialogue sequences in stereo.
   (c) record the live concert finale.
3. VTR editing: note the picture takes used.
4. VTR dubbing: adding to original playback tracks, recording sync effects, adding wild tracks, and final mix.
5. Transmission on BBC2 and Radio 4 stereo.

Fortunately *Curriculee Curricula* had only short dialogue scenes involving no more than four artists at one time and these scenes were covered using a coincident pair of AKG *C451's* each fitted with the *A51* capsule swivel joint inside a large windshield on a handheld boom arm. This gave the overall stereo image for each take. In addition, *Micron* radio microphones were used on each actor covering shots where the boom could not be worked close enough. The output of each radio microphone receiver was recorded onto a separate track of an 8-track tape, with one track carrying Maglink timecode. A mono guide mix was also recorded on the VTR for editing, the only final sound recorded of VTR at this stage being that of Magnus Magnusson as the narrator. This arrangement worked for every scene except one. On a very cold Saturday morning, even with a sound crew well experienced with the problems of radio mics used every day, we could not get a usable output from any of the usually excellent *Microns*. For this scene we had to cheat with mono from a Sennheiser *805* gun mic and dubbed stereo wild track.

The only music recording on location was the finale. This was in the form of a live concert in the Great Hall of Birmingham University with a student audience. On stage were Dave Greenslade with clavinet, CAT synth, the drum kits of Ian Moseley and John Lingwood, Tony Reves on bass, Mick Rogers on guitar, and vocal mics for Chris Farlowe, Sonja Kristina, Richard Barnes and Gaye Brown. As we had no ready access to a 16-track machine, the concert was recorded with the help of the RAK mobile. The 16-tracks that we used were just adequate by submixing each drum kit to two tracks. The other tracks were filled by two direct injects for the keyboards, bass, guitar, and four vocals, stereo audience, a guard track and Maglink.

All the other music numbers were done to playback. This was not as simple as it may sound as Dave Greenslade needed to leave the final instrumentation and writing until the post dubbing sessions so that he could add whatever he felt was needed to suit the edited pictures. What had to be in final form for location playback were the vocals. Two weeks prior to the OB we recorded these with a basic backing track of drums, bass and one keyboard onto an 8-track in Studio 1 at Pebble Mill, a radio studio better known for the Friday evening *Music*

66 ▶

Television sound dubbing and production

from Pebble Mill concerts on Radio 3. Location playback needed a stable, accurate speed machine as different takes, sometimes from different locations, would be edited together for the finished sequence. The studio recordings were therefore mixed down to a Nagra 4s with pilot tone, and at the same time Maglink code recorded onto the 8-track. Thus the Nagra, with its pilot tone synchroniser on location, would run at exactly the same speed at the 8-track tape with Maglink in the dubbing studio. Several cassette copies were then made for the artists to rehearse to.

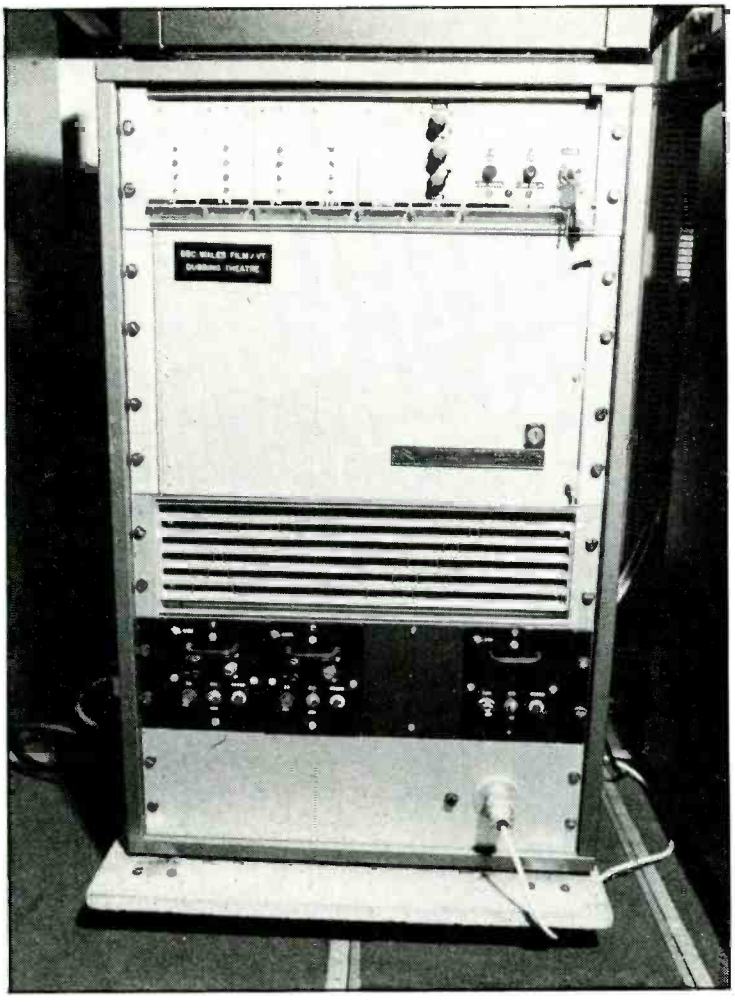
For most location playbacks, we used Shure foldback loudspeakers which give a clean, high volume output, are small enough to hide easily in a set, and also light enough to be hand tracked if necessary.

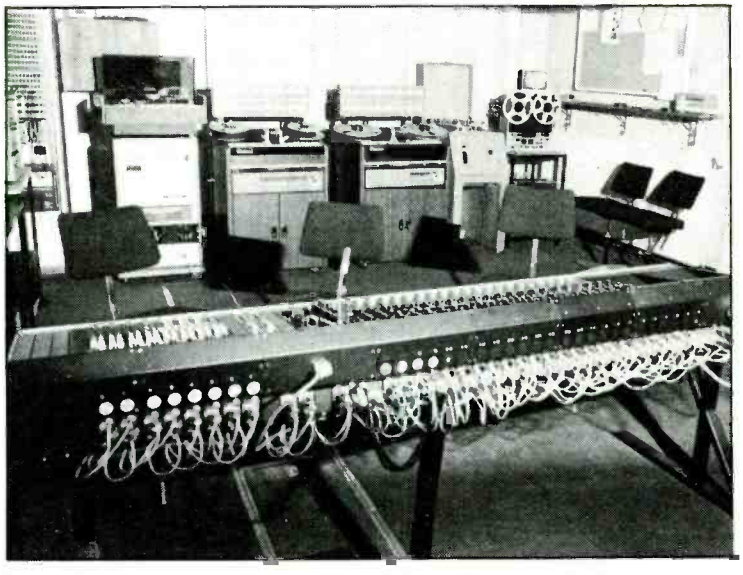
One number, the *Tunnel of Love* song, was done in a single three minute shot with the cameraman and his Fernseh portable TV camera sitting in a wheelchair and tracked backwards for about 70 metres inside one of the University's narrow central heating tunnels. For this, even the Shure was too big, and a battery powered Goodmans between the cameraman's feet provided plenty of volume in the reverberant (and hot!) tunnel.

After finishing on location, Roger Willcox (the grams operator for the programme) followed the VTR editing session and noted the picture takes used by the director, Alastair Reid. We could then find the correspondsound takes on the 8-track in the dubbing studio.

All the sound dubbing of *Curriculee Curricula* was done in Stacey Road Studio. Although our original recordings had no noise reduction, all the dubbing at Stacey Road was with Dolby.

Before we arrived, the edited VTR pictures had been copied onto IVC 25mm video tape, and the guide sound track from the VTR onto one track of an 8-track tape, with Maglink code converted from the VTR's SMPTE timecode recorded on track eight. The first operation was to copy the basic 8-track music tapes to 16-track, add Dave Greenslade's other Keyboards, and sync sounds such as handclaps. We then put backing vocals onto the finale and repaired one keyboard track where the direct inject had decided to hum. Dave's overture and underture was then recorded complete. The 16-track music tapes were then mixed down onto two tracks of the 8-track tape containing the VTR guide sound. Synchronisation was achieved by programming the Maglink with an offset that is, the difference between the timecodes of the 8- and 16-track tapes. The mix could thus be done to picture, the 25mm VTR and multitracks being sync-locked by Maglink.





Top: *Maglink control bay with control units for IVC video recorder, two multitracks and Tandberg stereo*

Above: *Stacey Road Studio again showing IVC 711 video recorder on Maglink bay, 16 and 8-track 3M M79 recorders, BBC stereo gram unit, and stereo Tandberg 10XD recorder. When all locked together, provide total of 23 tracks*

Location recorded dialogue tapes were transferred to another 8-track tape onto which the correct takes needed to make up each sequence were laid. Although the scenes were short, this made them time consuming to dub, and it proved quicker in some cases with short (five second) pieces to run them in wild rather than spend time calculating the offset. It was during this part of the dubbing that Des Bennett achieved apparent miracles with the Maglink in getting sync with only one second of run-up in places where, in error, enough timecode had not been recorded before the action.

Finally, after adding wild track effects in places, the stereo dialogue was recorded onto the 8-track with the mixed music. All we had to do now was to mix the music and dialogue tracks together with narration from the VTR guide sound track. The final stereo mix was recorded onto tracks four and five of yet another 8-track tape (thank you, Mr. Dolby!) with, of course, Maglink code on track eight. This was then played back in sync-lock with the Quadruplex VTR and A + B derived mono recorded in place of the original guide sound.

The transmission on May 22 was done from Pebble Mill, Des and Tony having brought the 8-track and Maglink gear up from Cardiff. A standby stereo copy was held in Radio 4 Continuity in case of line failure (although, had this been used, the stereo viewer might have been surprised as there was no facility to sync this copy with the picture).

The programme was certainly an interesting technical venture, during which we learned a great deal, especially about electronic sync. But, if we do another, I hope the OB won't be in the coldest week of the year. ■

agony

Near the end of a long session Steve and Dick were adding the final vocal overdubs to a highly produced number. Everybody was tired and getting a bit silly, but trying hard nonetheless. The two vocalists were sharing a mic, so the vocal balance depended on their respective volume and mic distance.

The engineer, mesmerised by the job in hand on this, his first major session, wasn't quite happy. He took it upon his by now sunken shoulders that this was the acid test of his career. So he had to get it right. Fumbling alternately between eq and solo buttons with his left hand, he explored vigorously the crumpled bag of Granny's Comforts in his pocket with his free hand and popped yet another of these in his mouth. Deciding that the controls were correctly set, he keyed the talkback. Below in the studio the sucking, spluttering voice boomed 'More Dick . . . Can I have more Dick please?'

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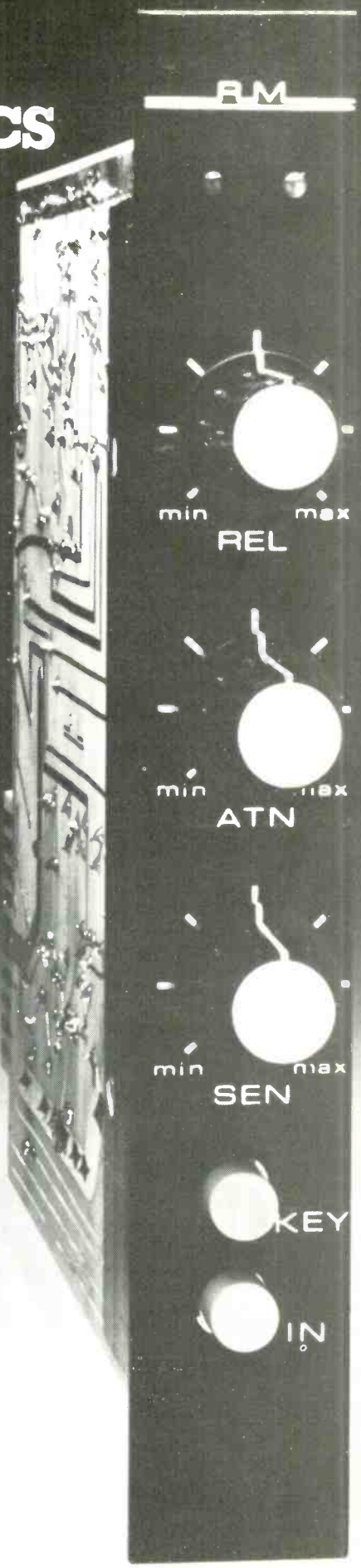


Model RM68X
(Retrofits into Kepex Rack)

Commercial radio in Britain

PART TWO—TODAY

Tony Attwood

Last month Tony Attwood described the build-up to the launch of Independent Local Radio (Commercial) in Britain, and here he examines in detail the different approach taken to broadcasting by three representative stations—Capital, Clyde and Swansea Sound. Next month we will look at several different routes that might be followed when commercial and local radio expand.

"AND over here we have an Alice module, modified of course to our own specifications . . ." Get yourself shown around an ILR studio and it's a thousand to one that you'll hear that said. Everyone it seems has an Alice, along with Spendor speakers, ITC cartridge machines, Technics *SP10 Mk II* turntables and BASF tape.

It is of course quite possible that when the second generation of commercial stations start to appear in a few years time, in response to the 1978 Government White Paper, the equipment available will be more varied although it will still be for the IBA to decide the exact specifications of what may, and what may not be used. It was, of course, the IBA who insisted that every station monitors off-air with Spendor speakers in the rather odd belief that everyone should monitor output through the same design of woofers and tweeters. However, since they didn't specify the exact size of the rooms in which the monitoring should be done, it appears with hindsight to have been a rather silly suggestion.

Assuming that I would find the same sort of equipment in all the ILR stations it was most refreshing to discover on a brief tour of three stations, that in spite of this enforced similarity of equipment, the ways in which the studios and control rooms had been put together varied enormously from one part of the UK to another. It was in order to get an idea of just how far this individuality of design had gone, since the IBA Act was passed five years ago, that I visited the studios of Capital Radio, Radio Clyde and Swansea Sound.

In all three stations I found a feeling of optimism. The 1978 JICRAR figures showed a continued growth in the ILR share of the market, and all ILR stations are now making a profit. Even in cases where the detailed figures showed a slight decline in recent audience numbers there is no sign of panic. It is, in fact, the overall picture that attracts the big spending national advertisers to the stations. More money from the ads means more money available to improve the services which (in theory at least) means more listeners.

According to the JICRAR survey 32% of all radio listening within areas served by ILR stations is attributable to the commercial stations themselves. By comparison Radio 1 gets 25%, Radio 2 20%, Radio 3 a mere 2% and Radio 4 13%. Where BBC local stations exist in the same areas as ILR stations the Beeb get 5% of the audience, whilst Luxembourg get 1% and foreign, illegal mainland and offshore stations make up the remaining 2%. Turning the percentages into actual populations, it seems that nearly 28 million people aged over 15 live in areas served by ILR whilst 14 million of them listen to an ILR station at least once a week.

Of the three stations I visited, Capital is clearly doing least well in capturing its target audience—only 43% of them listen once a week or more. Clyde does significantly better with 59% whilst Swansea Sound scores 62%—a figure only bettered by Plymouth Sound. It is particularly interesting to see that Capital's biggest appeal is to the 15 to 24 year old age group, whilst Clyde and Swansea score much more heavily with the 35 to 54 and 54+ groups. In all cases it is these two groups that make up the bulk of the population served by the station thus revealing the specialist nature of Capital's appeal.

The physical structure of the three stations is extraordinarily diverse. Capital, for example, presents a trendy swinging image. Situated in one of the most expensive tower blocks in the country, the station is hard to miss with its logo splashed along the top of the giant smoked glass windows on the ground floor. Passers-by are invited to step into the foyer where they can buy Capital tee-shirts, Capital notebooks, and Capital pens, clocks, watches and books. For the young unemployed there's a job information desk. There are gold discs on the wall from Polydor and EMI given for the station's playing of *Sugar Baby Love* and *Wuthering Heights*. Music comes out of the potted plants, and visitors are quite welcome to just sit down and watch the comings and goings. No one throws anyone out, but then again no one invites visitors upstairs to where it all really happens, without a very good reason. When I was there some 50 schoolgirls were gathered around the main door. It was apparently just like any other day.

In Glasgow they do things differently. The radio station is in a shopping precinct about 800m from the main railway station, but even with a large scale map it's impossible to find without help from the locals. Even when I found the right building, there were no signs up and the list of companies next to the lift didn't include Clyde. In fact they are on the third floor and there is actually a small sign up there, but the door into the station is kept locked on the inside, and it is necessary to attract the attention of the receptionist in the office across the corridor before the door can be opened.

Swansea Sound keep the main door locked too, but they at least have their name up...in letters several feet high written right across the top of their building. But despite the sign it can still be hard going finding the station as it is not in Swansea at all, but just outside the small town of Gorseignon, 11km from Swansea. It is actually in a field, surrounded by a lot of other fields, with enough land owned by the company to build a second radio station out the back.

Of course there are explanations. Capital want to be seen to be an active part of the community. Clyde claim that the local kids keep stealing their nameplates so they've given up putting them up. Swansea went into their field to be mid-way between the two cities they serve (Swansea and Llanelli) which is sensible when you remember that the inhabitants of the cities are well known for their sometimes less than friendly inter-city rivalry. Besides which Swansea Sound is one of the few stations in Europe to really possess adequate parking facilities.

Inside the differences continue. All three stations are still working in their original studios and trying to make changes within the confined space available. (Swansea of course could expand into their field but lack the finances to do so.) Capital found themselves in a great rush at the start of operations with control desks covered in concrete dust as engineers and builders tried to complete their work. Now, with the dust settled it is possible to make out two DJ studios of the standard type, feeding programming into the master control room, which is manned 24 hours a day by at least two operators (in addition to the four maintenance staff who cover day and night programming between them).

According to Steve Turner (assistant chief engineer: operations) the value of a master control room is that it enables the engineers to make much finer judgements of both MF and VHF signals as well as on the levels coming from the studios, than might otherwise be the case. Added to this the engineers can also take over many of the chores of the DJ, such as playing ads and jingles and even (as sometimes happens) starting and stopping the records, thus leaving the DJ free to concentrate on the enormously difficult task of speaking. All of which presents rather a different picture from that I witnessed recently in the BBC Radio London studios when presenter Malcolm Laycox loaded the tape machine, set the levels, played a record, read the news, conducted two interviews with studio guests and slipped in a couple of jingles and community service ads for good measure.

Besides the master control room and DJ studios, Capital also have a talks studio which doubles as a standby master control room, a production area and a music studio with a modified Helios desk, plus a commercial production studio with a 4-track desk. This produces some 20 to 25% of the commercials broadcast by the station (but excluding one's done by Kenny Everett which are produced in a cowshed in the Cotswolds). There's also a line from the downstairs foyer to master control enabling the foyer to be used once a month for discussion programmes with up to 100 people taking part. Future plans include the development of a talks department—a self-contained drama studio developed with facilities for one-to-one phone interviews as well as discussion recordings.

All in all Capital employ 13 station operators catering for the day-to-day needs of the station (including one person who works with the OB unit's disco equipment designed to be operated by a DJ and a technical helper) plus five engineers, one assistant chief engineer for maintenance and development, another of the same for operations, and on the top

Above: *Dougie Donnely of Radio Clyde, Studio A*

Above: *Bill Black of Radio Clyde*

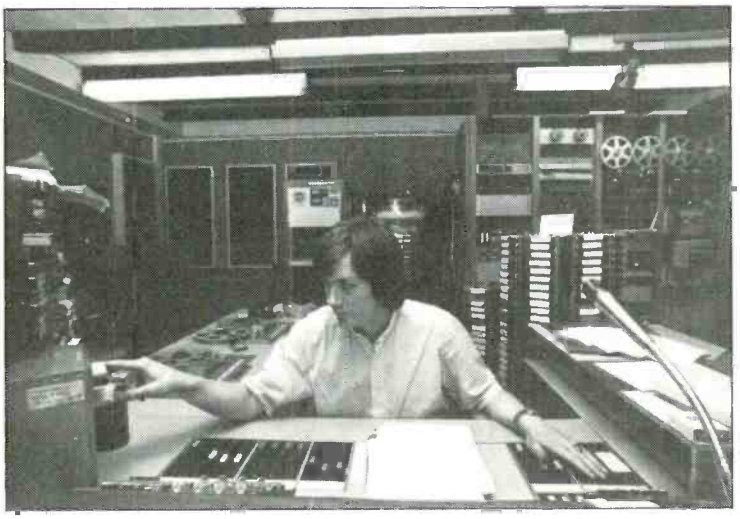
of the pile the chief engineer. When I suggested that this was rather a large number of people to be tied up on one station there were knowing nods. It is of course master control that is largely to blame, for it appears that if it weren't manned 24 hours a day, Capital could drop at least six technical staff.

Looking into the future, Capital plan to introduce noise reduction on their programmes of classical music in 1979. They have already put out all their FM programmes for a fortnight with Dolby encoded signals, as a test to see what reaction there will be from listeners who obviously will not have decoders fitted to their tuners. There being no reaction at all, Capital feel they will be encouraged to look farther into the matter. Also in '79 Capital will be experimenting with quad broadcasts of the classical music concerts. This distinction between classical and the rest is interesting, and very much a part of Capital thinking these days. Classical concerts for example get recorded on BASF tape whilst everything else goes onto the cheaper and lower specification Racal Zonal tape.

In Scotland, engineering at Clyde is in the hands of John Lumsden with his team of four technical operators and five engineers. Clyde have made the decision to move away from the notion of a master control room, and all the necessary monitoring is now done from the small central apparatus room. Lumsden's reasons for moving away from master control are the obvious ones—waste of manpower and boredom, it being clear that unless the master control operator does take over many of the DJs traditional jobs, he really is going to find it hard to stay awake watching the levels and listening to the shows.

Clyde's master control, now liberated from its original function, has been equipped so that it is identical to the main on-air studio and can thus be brought into play at any time. The two studios are tied in with a very neat studio switching system through which the on-air studio has to offer the facility to the next studio before it can be taken over, thus effectively removing the possibility of the wrong studio coming on-air at the wrong moment. The system even extends to the OB wagon in the car park which is available for immediate use as a back up studio should the need arise.

In addition, Clyde also boast a talk studio with another neat touch —the mics are colour coded and so are the corresponding faders. Simple but effective. In one corner is a phone-in booth with the facility to select any one or more of 10 lines—thus allowing two callers to chat to each other whilst half of Glasgow listens in. (Actually, judging from the phone calls I made in Glasgow I thought this facility already existed as part of the normal PO service.) Clyde's little device has a running cost estimated at just over £100pa compared with the charge for the official PO system available to stations which is around £1200pa.



Top: *One of the Capital engineers in the master control studio.* **Above:** *Kenny Everett in the "live" studio*

Clyde's news department also has its own studio—and several acoustic booths are currently being built to facilitate the editing and assembling side of the work. There is also a separate studio for music recording linked to a 4-track mixer. 4-track may not seem much these days but it was certainly enough to produce the top-selling *Ally's Tartan Army* earlier this year.

Lastly, at the other end of the building is the most recent of the station's studios used for dubbing voices on to commercials. Like Capital, Clyde offer their local advertisers every facility they can—including in this case the service of their own jingle writer Dave Murriance. However the station readily admits that it is often simply impossible to record the jingles in their own studios for lack of the right calibre musicians in Glasgow. Trips to London are thus inevitable. But despite this problem Clyde is fast becoming known as one of the main centres of studio work in Scotland and this reputation looks like being enhanced by a joint project currently operating between Clyde and Proline for the development of new tape decks suitable for the special requirements of ILR. But even that is small-fry compared with the development by Clyde of Europe's biggest ever mobile unit, which even before com-

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pletion has brought enquiries from as far away as the USSR. Clyde aim to rent out the 24-track giant in England and Europe when completed, whilst waiting for a suitable market demand to arise in Scotland.

Such enterprises as a 24-track mobile are, naturally, beyond the realms of possibility for a station the size of Swansea Sound. It was the first of the small ILR stations (potential audience 417,000 in the VHF area) going on the air in September 1973. Of all the 19 ILR stations now in operation only one (Plymouth Sound with a potential audience of 262,000) is serving a smaller population. Furthermore, as everyone remembers, trying to set up any new venture in the economic climate of 1973-4 was hard going, and the smaller stations obviously suffered the most. So it is not surprising that in some aspects, equipment at Swansea is marginally behind that of their bigger colleagues. The turntables for example are Sparta, although the station do plan to introduce the Technics instant starters that most stations have in the near future.

However, having made that point, it is important to realise that Swansea Sound is by no means a broadcasting backwater. Pride of place in Swansea goes to the 8-track Alice modified for 16-track usage, accompanied by a 16-track Scully recorder. Not only is this set-up handy for the production of jingles and commercials, it also brings in extra revenue for the station from private hire. What's more Swansea Sound use the studio housing this equipment as a major feature in their PR work. Approaching a Nissen Hut in the middle of a swamp, walking into a reception area which only has room for two rather uncomfortable chairs, going through a door on which the paint is peeling off, and into a corridor which is just a bit too narrow for comfort, didn't lead me to expect too much from this station, and the people there are fully aware of this. Therefore visitors are led at once to the studio housing the Alice. It is spacious, comfortable, the seats are plush and the lighting multi-coloured. (In fact the lighting in all the studios can be varied through every shade of the rainbow. The DJs and presenters make the most of the effects preferring to work in an environment where colour reflects the mood of the programme.) Kefs and Spendors hang elegantly from the ceiling, and everything is neat and tidy, with not one old coffee cup or beer can in sight.

Before Swansea Sound came on the scene there were of course recording studios in Wales—most notably Rockfield. Naturally they still attract the top name groups that want to record in that part of the world, but there are still many bands playing the club circuit who may never get a recording contract with a national company and who are thus attracted to the idea of making a record with a very small company, which they can then flog off at a small profit at their gigs.

Stan Horobin, the station's chief engineer, appreciates the market well enough to be able to offer clients of Swansea Sound any advice they might need regarding getting their album printed, the sleeve designed and so on; and also through running Swan Records, his own company, which hires the Swansea Sound studio from time to time in order to produce records for local bands. As Stan points out, there is no conflict of interests, as the station always get priority booking for the studio when they need it to record jingles, ads and the like. If his company purchases the use of the studio when it would otherwise be standing idle, so much the better for the station. However it now seems that there is such a demand for the use of the studio that were they able to build a second 16-track setup in the field at the back, they would be able to fill it up almost throughout the year as the station take over the recording of more jingles and music beds every month.

From the 16-track control room you can see the rest of Swansea's studio operation. Next door is a small news studio, and both look out on to a large central production area. On the far side are the two standard DJ studios. But just in case someone in one studio doesn't want to look at what's happening elsewhere they can pull down the blinds and become totally isolated. The sound proofing is so good that even with a rock group going full blast in the central area the silence in the studios is maintained.

However there are space problems, and the station is already overflowing into the inevitable Portacabins in the carpark. In one corridor I bumped into an old tape machine being used for tape reclamation. Down another, the way is blocked by the photocopier—there apparently is nowhere else for it to go.

In common with other ILR stations Swansea has an OB unit but it is used solely as a transporter, offloading the recording gear at a suitable hall near the required location. Among several places they have used for recording programmes are the department stores in Swansea. However this activity has now ceased, possibly because the station made a charge to the store to cover the cost of transporting the equipment to the location—a charge that is perhaps just a bit too close to the dreaded sponsorship which the IBA Act forbids.

The Swansea Sound technical operation is run by just five men, but even so there are plans in abundance for future development. Quadraphonic experiments are to be expected soon. Preparations are also underway for the station to initiate discussions with the local education authority with the aim of setting up a training course for would-be radio technicians. The courses would be run at local colleges and at the station itself. Clearly if the expected expansion of local radio in the next four to five years does occur, there is going to be a desperate shortage of men trained in this line of work. The fact that little Swansea Sound have made a move in the direction of answering this future need speaks volumes for the station since the course will take many man-hours to set up, and not bring in any major publicity. Nor will it put up the ratings, but it is exactly the sort of thing I look to ILR to be involved in, but which generally they aren't.

With just five on the technical staff it is not surprising that Swansea, like

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Above: *LRP studio showing hessian covered acoustic foam—acoustic insulation.*
Below: *A general view of the LRP studio*

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Commercial radio in Britain

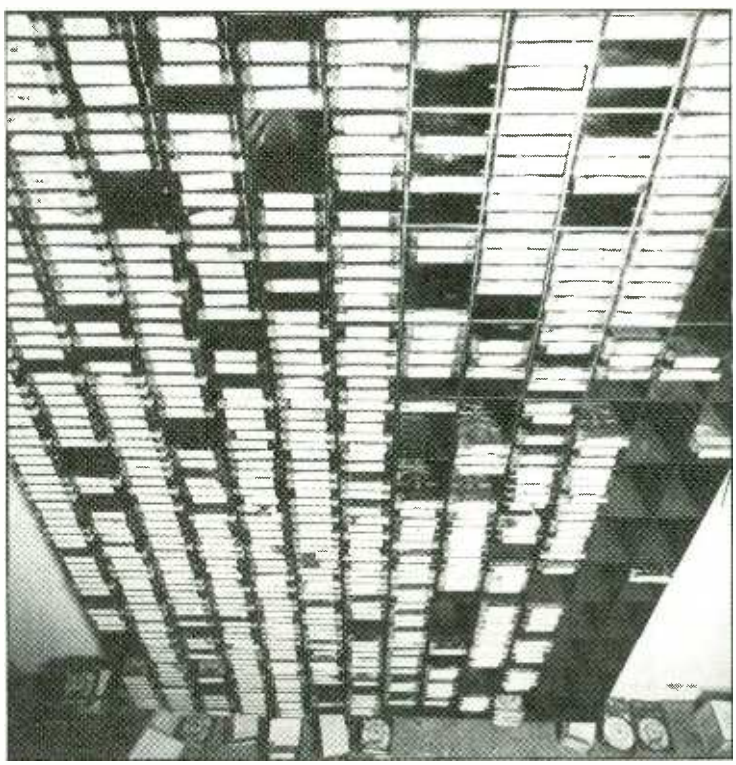
Clyde, has no time for master control unit. Off-air monitoring can be done in any studio, and the DJs are able to monitor their levels all the time, although off-air monitoring on MF is always a problem—as expected in such a hilly region as south Wales. It is one of the quirks of the transmitter sighting that reception at the station itself is not all it might be, although it is easy to pick up on the North Devon coast 80km away.

That then is the studio set-up in Capital, Clyde and Swansea. What about programming? For much of the time, despite all the desires of the IBA to get truly local programming, all the ILR stations except LBC operate a programme format based on records, jingles, ads and mundane DJ chit-chat, along with occasional phone-ins and requests. The fact that the callers actually live within 32km of the station hardly seems to be a valid justification for the desire to make commercial radio in the UK a local affair. Annan's comment on Capital Radio that it "seemed to be the type of station which, though financially successful, was the antithesis of what a local radio station should be" hit the nail on the head. However to be fair to Capital it must be pointed out that they got the franchise to operate in London by submitting programme plans to the IBA in which they specifically stated that "popular music will be the main ingredient". Annan was thus right on target when the committee concluded that "the IBA have failed in their duty to safeguard the public interest". Indeed the most obvious conclusion to be drawn from much ILR programming at the moment is that commercial radio is based locally, simply to attract local advertisers who would not wish to advertise on national commercial radio.

According to their initial programme plans, Capital were to promote good music, playing little top 40 material and carefully selecting their music according to the time of day. Today they operate a playlist of 50 records, largely from the charts, selected weekly by executive producer Tim Blackmore, with the DJs left to decide how to use the list in their particular shows.

Obviously Capital do other things to. There's a half hour phone-in to an expert on one particular style of music (Jack Good turned up once to talk about 20 years of rock), there are in-depth features on record producers, marketing directors from record companies and so on; and getting away from music, the famous series of dramatisations of texts being used in GCE English language exams. Much of the information is very interesting, and always slickly presented (with none of the "not so tidy approach to programming" promised in 1973). But the main question is—is all this relevant to a local station? If the dramatisations were as good as everyone said, why didn't they go out on a national network?

At Clyde it is slightly different, for there I got the impression that everyone firmly believes that Glasgow is the centre of the Universe. But when I probed a little more deeply into what keeps pushing up the ratings at Clyde (in the past year they have gained between 1 and 4% from the four national BBC stations) the answer is not the 'Glasgowness' of the station but its unashamed 'Scottishness'. It seems that if Tony Blackburn appears on Radio 1 and reads out a request for a listener in Alloa, he mispronounces the town's name, and then makes a joke about it, that is worth more to Radio Clyde than five years of their own publicity.



Above: *Some of the available cart sound effects at Molinare.* **Below:** *Studio B control room at Molinare*

Knowing this, it is not surprising to find that Clyde has, until quite recently, been willing to let the English BBC act as an unwitting publicity agent (it should be remembered that even Radio Scotland carries English Radio 4 programmes for most of the day), and it is only now, with the launching of a weekly station magazine that anything resembling a publicity department is being put together at Clyde.

But having said all that, the net result is what Radio 1 would have sounded like had it been based in Glasgow. There are some locally oriented programmes, such as the weekly phone-in on matters relating to local education, interviews with local personalities, programmes on local political issues and so on, but these are a minority. There are also some programmes which appear on the surface to be local but which in reality are Scottish rather than Glaswegian, such as *McLaughlin's Ceilidh* which is in effect a two-hour send-up of the traditional view of the kilt-wearing Scotsman. (Talking of traditional views of the Scots, it is interesting to note that Radio Clyde does not give away tee shirts and records as prizes in its competitions but actually has cash prizes. I'm told the listeners prefer it that way.)

If Clyde are a Scottish station and Capital are undoubtedly very English, you might expect to find Swansea Sound a very Welsh station. In fact they aren't. As Colin Mason, programme director told me, "It's British". It seems that when it first became known that Swansea Sound were to go on the air, many local people expressed the fear that they would indeed be a "very Welsh station". What this meant for English speakers was a distaste for a station full of presenters with Welsh accents, which was associated by many people, with amateurism. The Welsh-speaking part of the community however were afraid that the station would broadcast their Welsh programmes in a language they couldn't understand! The problem here seems to be that spoken Welsh varies enormously from one part of the country to another. In their efforts to help the Welsh language along the BBC created their Radio Cymru service on VHF, but then proceeded to devise an artificial tongue which they hoped would be understood throughout Wales, but

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which is in fact comprehended by few outside the BBC.

The locals need not have worried. Swansea Sound's Welsh programmes (which occupy 12% of the total programming time) are in the local dialect and the English is in the language of Radio 1 (except that the names of local towns are properly pronounced). The two languages are often presented in close proximity, and there is none of the total separation favoured by the BBC except between 7 and 9pm when all programming is in Welsh. It is noteworthy that whereas virtually every other ILR station is reduced to 1 or 2% penetration at that time of night, Swansea's Welsh programmes grab around 5% as a matter of course.

Swansea Sound were the first ILR station to develop an access policy for local groups which meant more than talking to a DJ on a phone-in. Each year six or seven half-hour programmes are made totally by local groups given complete editorial freedom, provided they stay within the law of the land. Technical and programming advice is always available, and the station have devised their own access kit to help the groups understand what broadcasting actually is all about. It's an encouraging piece of work, and it remains a shame that the station is only able to produce this limited number of shows per year. Nevertheless full marks to Swansea Sound for not tucking the result away in the 11.30 to midnight slot—the shows actually go out twice—in the afternoon and evening.

As I might have expected the Chapels exert an influence on Swansea's programming, although that certainly doesn't mean that Sunday on Swansea is nonstop preaching and hymn singing. From 2-5pm on Sundays for example there is the Swansea Sound Top 40. Strangely enough when I looked at Clyde's Sunday schedules I found the Tartan Top 30 from 4-6pm. Capital join in with a UK Top 30 from 2 until 4pm on Sundays. Which means that whether you live in London, Glasgow or Swansea you can hear the top selling records of the week on Sunday afternoon just before you tune in to Radios 1 or 2 in order to catch . . . the top selling records of the week. What on Earth is the point of that?

Swansea and Clyde may claim that they are producing a local chart, which is fair enough, except that by and large the local chart is the same as the national one, and where there are differences they are caused by the radio station plugging certain records and thus creating a local demand, which they can then respond to on Sunday afternoons.

As for Capital, they don't even bother to play the local game, and instead devote themselves to playing a cynical "beat Radio 1" game. (Either that or they haven't got enough wits to realise that it is *not* a God-given fact that radio stations must play the Top 20 on a Sunday afternoon; there are other things that can be done.) It is indeed significant that on June 28, 1978, Capital put out a press release with as much publicity as they could muster which began: "An independent survey published today reveals that Capital have beaten BBC Radio 1 in the battle for London listening".

Judging from the sort of programmes that the ILR stations do put out for much of the day there must be something of a desire among producers to put out nothing but music all day long. In this desire there are, of course, agreements which limit the number of hours of recorded music that any station is allowed to play each week. Given that and the fact that some stations were not particularly interested in generating their own local material, the rise of the independent radio production company was bound to happen sooner or later.

In the early days of ILR these companies tended to consist of little more than a man, a Uher and a Revox. However, things are now starting to change. Leaders in the field are London Radio Productions who started trading last March. The studio operated by LRP is 14m square overlooked by a 17m square control room containing an Alice *ACM* taking four mic and eight stereo lines and offering self-op facility. Monitoring comes from the inevitable Spendors driven by Quad *405s*; the tape machines are Leevers Rich *E200*, ITC cart and Technics turntable. In short, a small interview studio such as might be found in any ILR station.

The aim of the company is to produce professional programmes which are sponsored by an interested party and then given away to the radio stations free of charge. Obvious potential sponsors are publishers who are willing to pay for their authors to be interviewed upon the release of a new book, and indeed publishers have made up a large part of LRPs trade so far.

But of course the programmes produced are not local. The managing director of LRP, Charles Hoste, claims that local stations (both BBC and ILR) require a mixed variety in their programmes and his company gives them the opportunity to have just that. No one, he says, ever refuses to play the tapes they produce because they are not local. To check this out I asked Colin Mason of Swansea Sound for his reaction to the sort of material put out by companies like LRP. He agreed that he did use the occasional interview with an author, but insisted that the station would not use anything that resembled such a thing as consumer advice. "If someone sends me a tape on how to do wall papering it's just a free advert for a company. Why should we broadcast that when they can buy time on the station if they want it? Besides, there must be half a dozen experts on wall papering in Swansea whom we could talk to instead."

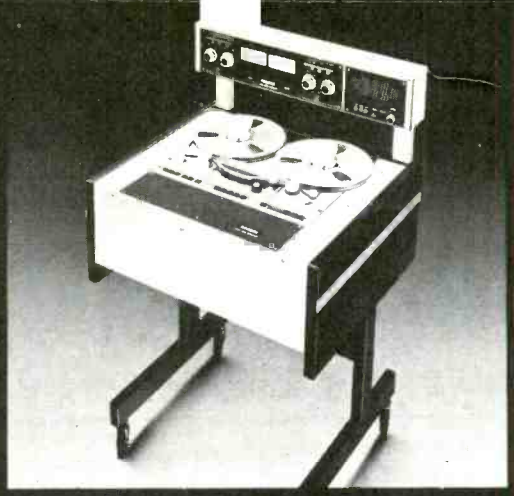
However there is a clear case to be made for the likes of LRP in the ILR market, although I rather suspect that it is going to take quite a while for the role of such companies to be clearly defined. In the meantime it is not surprising to see LRP moving into other fields such as the production of programmes for the overseas market and the manufacture of voice-overs for commercials. However in the latter field LRP have a long way to go before they can begin to rival the front runners in the radio ad business—Molinare.

It was Molinare who opened the UKs first purpose-built radio commercials studio in 1973 and who now have undisputedly the largest single course of commercials produced in the UK, running six studios five days a week. One of Molinare's greatest attributes is a gigantic collection of sound effects, each one individually cartridged which must save hours when dealing with an advertiser who suddenly wants "a bit of thunder in the background".

Both Molinare and LRP are able to offer special help to those they deal with—Molinare suggesting ways of putting the message over and LRP offering their own specialist knowledge of what the local stations will use and what they will throw in the bin. Both companies look forward to the expansion of local radio in the UK although neither expect it to mean a particularly great increase in their turnover since neither advertisers nor sponsors are likely to be impressed into using radio as a medium by the increase in the number of stations if they have not already taken the plunge.

So, that is the scene and I wonder when the development of the second generation of ILR stations will start. Perhaps it is fitting to conclude this brief look at the situation today with a quote from the report of the Annan Committee, who conducted what is, after all, the most detailed survey of the ILR scene yet produced by an independent body. This comes from paragraph 11.32: "Too many stations are trying to find the cheapest form of programming which would attract the maximum audience". It's not always true, but those Sunday afternoons keep cropping up to remind us. ■

Ian Sandall at Radio Tees



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Magnetic tape: a permanent recording medium?

David B Hancock

Studio Sound will be taking a serious look at magnetic tape next April, but meanwhile David B. Hancock, a New York recording engineer, outlines some of the potential pitfalls awaiting unsuspecting engineers as they produce the one and only, and often irreplaceable, master tape.

MOST OF US are so used to the convenience and stability of magnetic tape that we tend to lose sight of its possible liabilities. These appear to fall into three general categories: user negligence, manufacturer's error, and some shortcomings that are just inherent.

In the first category, some accidents are so bizarre as to be almost humorous. A colleague had recorded some tapes of Landowska—one day he noticed that they looked a little grimy, so he cleaned them off with carbon tetrachloride. The cleaning was rather more effective, perhaps, than he had intended. Or, there was an instance where some master tapes were temporarily placed on a large JBL loudspeaker which unfortunately possessed an extensive external magnetic field. Some mishaps are more subtle than these. I was once editing with a composer and mysterious thumps began to appear on the tape. It was established finally that he was using a ballpoint pen with a magnetic attaching device, and had put it down where I was editing.

In the second category, several questions, legal and ethical, arise. One of them concerns the precise degree to which a manufacturer is responsible for the behaviour of his product. Tape manufacturers are very much aware of this issue, hence the conventional legal disclaimer that appears on each box. Translated into plain English, its gist is that the maker's only guarantee is that the tape within is the type specified, and that his responsibility in the case of defects extends only to replacement of said tape. Thus, if you record a symphony orchestra and the magnetic coating subsequently falls off the tape (unlikely, but not impossible), the manufacturer will cheerfully replace your tape with fresh unrecorded stock. Problems crop up with all brands of tape, though they are seldom as serious as the hypothetical one above. In the following examples, the products of just one US manufacturer will be dealt with, a large Midwestern Corporation, since most of my experience is with them.

Perhaps the most devastating example that I know of occurred as follows: a colleague was engaged in lengthy sessions recording a piano. He ran out of the polyester-backed tape that he was using and was unable to obtain an immediate supply to replace it. However, he did have on his shelf some acetate backed tape with the same oxide and binder formulation, so he used it to continue the recording. Owing to the complexity of the music, extensive splicing was done resulting in what a friend of mine calls a 'Zebra' tape, owing to the alternation of white splices and black tape. The tape was approved, stored for a period, and then taken off the shelf for further processing. Upon rewinding, the engineer discovered that at every point where the acetate backing was wound adjacent to the polyester coated tape, the oxide had stripped completely off! Many segments of the tape were completely transparent somewhat hampering their sound reproducing ability. When the aggrieved engineer informed the manufacturer, he discovered as he might have predicted, that although sympathetic, the Large Midwestern Corporation was not willing or able to insure its customers against such a happening.

However, in another instance, this company's attitude struck me as indeed shortsighted. A certain plastic leader tape, sold in huge quantities, has a black plaid pattern printed on it at regular intervals. The ink used for this pattern seldom dries completely and is quite capable of stripping part of the oxide from any magnetic tape lying adjacent to it. I found this out the hard way over a decade ago when upon playing a tape I heard a small, impolite noise from the *leader* tape just prior to the programme and then a corresponding drop-out in the magnetic tape. Visual examination of the tape showed a faint pattern on the tape, the characteristic plaid pattern of the leader tape.

Once understood, the problem is simply avoided by giving the leader a half twist so that at no point will the inked pattern lie next to the magnetic oxide. I demonstrated this to the Large Midwestern Corporation salesman, asking if he didn't think it would be a good idea to send out a letter informing the customers of this hazard, and its remedy? No, he didn't think it was a good idea. So, aside from people to whom I have spoken, and others who have discovered it on their own, there are probably in existence thousands of tapes that exhibit such flaws in the initial portion of the programme.

We come now to the Mystery of the Tape that Could Not be Spliced. A well-known recording company recorded some music, and discovered that they could not splice the tape! At each attempted splice, a thump was invariably introduced. Aha! You will say—DC magnetisation introduced while recording. And you will be wrong because not only did the 'back-up' tape, made on another machine, behave similarly, but also a sample of unused tape gave the same result. Editing was eventually achieved by transferring the entire session to another batch of pretested tape, a far from desirable procedure.

Many phenomena are covered by the third category—inherent drawbacks. Most early tape recordings were made on acetate backed tape which is not uniformly stable—some tapes will remain in good condition indefinitely while others will exhibit severe physical deformation, often to the point where the tape cannot be played with uniform head contact. Some of us have discovered that such tapes have a 'long' and a 'short' edge, so that, in the case of mono, a careful playback with the proper half of a stereo head can recover the recorded material. With stereo, things can be rather more difficult.

Another common problem is that the adhesive used for splicing tape in its early days deteriorated with age so that the present-day engineer often has to deal with splice adhesives that have the consistency of honey. It is not uncommon for such splices to part during the playback process, provoking much aggravation especially if a lacquer master is in progress. The only sure remedy is to replace each splice, attempting to clean up the ooze as you go but not with carbon tetrachloride!

This problem tends to be accompanied by drop-outs produced by the adhesive's effect on adjacent layers of recorded tape. Some happenings seem designed to cause the engineer to tear his hair. I got a call from a colleague who was playing a master tape on a dandy new Swiss machine. The weather was cold and dry, and at intervals sparks were discharging so violently that clicks were imposed on the tape. I had no remedy, and to this day do not know how the problem was solved, or if it was solved. (The answer was metal spool carriers on the MkII—Ed.) And there is the case of a modern, very highly developed recorder that, until modified, put a click on the tape when the power was switched off.

In the realm of clicks and ticks, we now come to a problem I never encountered prior to about three years ago, and that I tend to associate with the new highly potent oxide formulations now in use. I call it 'tick-printing'. A small piece of magnetised material adheres to the rubber capstan puck (pinch wheel), and proceeds to print a series of ticks on the tape during playback, the intervals being determined by tape speed and puck circumference. These ticks are usually not loud, but are distinctly audible, especially at high monitor levels. I have encountered three instances, two produced in my studio, and one on a tape from outside. Since, as an individual, I encounter a limited number of tapes, I have to assume that other engineers have produced this, perhaps in some cases without knowing the cause. The best remedy seems to be extra care, alertness, and cleanliness. I have installed a urethane puck, which will probably be helpful; but I am not taking anything for granted.

One of the insidious things about this problem is that the tape sounds clean the *first* time that you play it—it is only on the second pass that you hear anything. Also, European machines seem less likely to produce this problem, since in most of them the puck makes contact with the *back* of the tape.

So it can be seen that in addition to the difficulties of producing a fine tape recording, we may find it often equally difficult to preserve it! And, aside from the disaster areas dealt with above, there are other problems, such as print-through and high-frequency bleeding, that have not even been touched on. So, before we consider magnetic tape recording as a permanent medium, we had better define how 'permanent'. ■

Series III De Lux Mixing Console available for 16, 24 or 32 track monitoring. This re-styled version of our very popular standard console features Indian Laurel wood finish, leather armrest, illuminated meters and comes complete with power supply, Penny & Giles faders, XLR connectors and stand. For further details of this low cost, high quality system, contact our agent in your country or direct to the factory.

28 inputs, 24 track monitoring console supplied recently to Olympic Studios (Chelsea).

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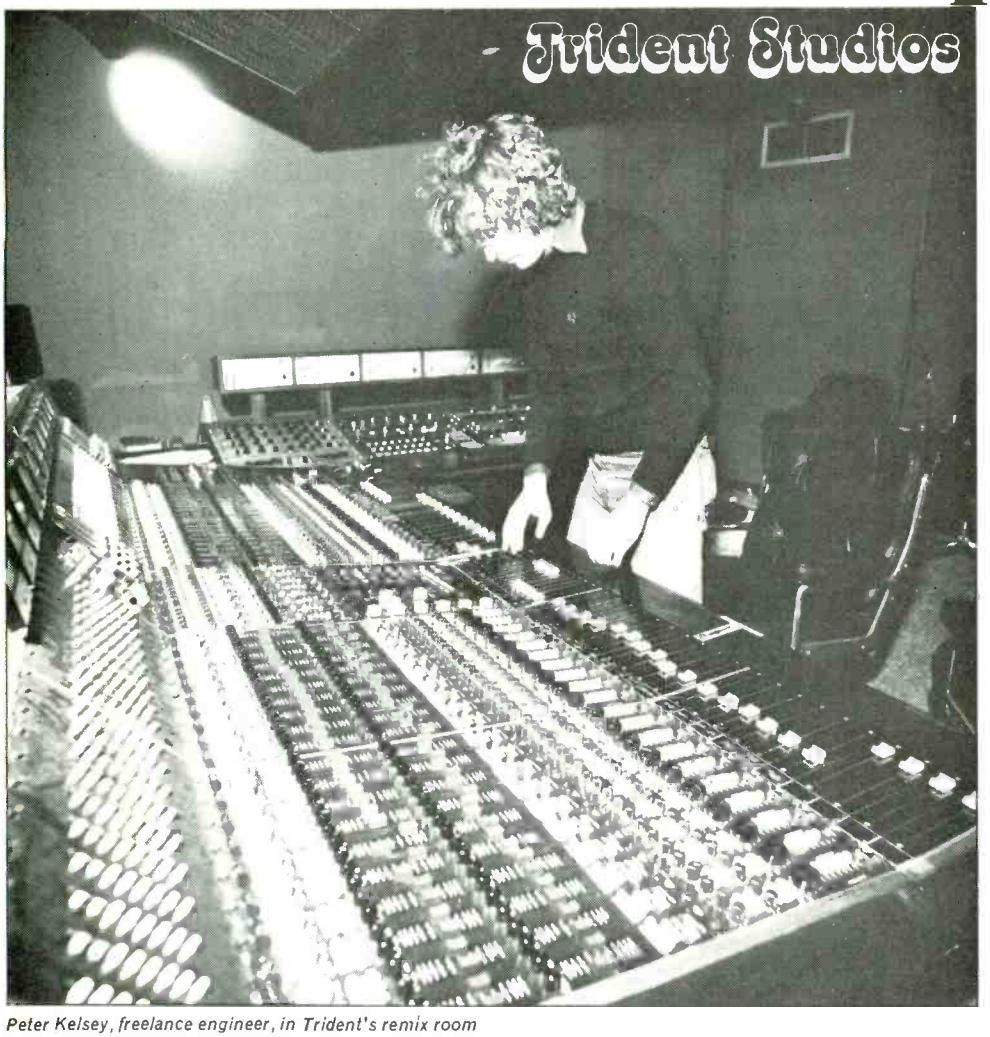
studio profile

Trident Studios



Peter Kelsey, freelance engineer, in Trident's remix room

ALONG A SMALL alley called St Annes Court leading off Wardour Street in central London, is a dirty looking building that doesn't exactly demand attention as you walk by. But be that as it may, this happens to be the home of one of London's busiest recording complexes—Trident Studios.

The studios were originally created by Norman and Barry Sheffield back in 1968, when 3-track recording was only an exciting possibility. Designed by Sandy Brown, they served the Centredisc label as house studios over three floors before becoming the open-to-all-comers Trident Studios with the acquiring of two more floors in 1970. Since that time, trading activity has diversified, and now several companies trade under the Trident banner. Trident Audio Developments (Triad) manufacture mixing consoles, and were largely borne out of the studio having to modify equipment to suit their requirements, Trilion Video make TV productions, Trident Tape Services Ltd duplicate cassettes and cartridges, and of course, Trident Studios record sound—the most well known client probably being David Bowie, who made most of his heyday albums at Trident. In those days, a silhouette wall mural of Fred Astaire danced the stairs inside.

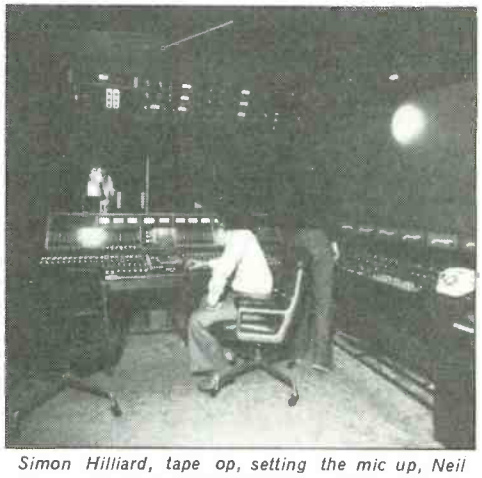
Since those times it's not just the decor that has changed. In 1976, disc cutting and tape copying facilities were rebuilt. Last November, the Preview Theatre was stripped right down and is to become an extra remix room—work will start in July. Also the original remix room was rebuilt earlier this year, and has been busy since re-emerging in March. One thing that hasn't changed is the semi-automatic lift—ordinary room doors on each floor that unlock when the lift is present, manually operated cage door—but that only goes to preserve the pioneering 'feel' to the place, as does the fact that Trident have been 48-track since last September.

Behind the studio's progress is studio manager Peter Booth, a man who has moved into the experienced engineer bracket without becoming dogmatic and inflexible. Watch his eyes as he tells you about the 400 tonne 10m reach mobile crane they used to throw a three tonne standby generator onto the roof, and you'll see the boyish enthusiasm bubbling away inside. Booth started as an EMI electronics apprentice at Abbey Road in 1964, on a course lasting five years. Feeling the urge to 'understand a bit about computers', he joined ICL for a year in 1969, his EMI training completed. Sorely missing the many attributes of studio life, he moved to Trident for around two years as a maintenance engineer, switched to the ill-fated Command Studios for 18 months, before returning to Trident as studio manager in 1974, where he has remained ever since.

Peter tries to retain a personalised studio environment rather than the more standardised Eastlake approach, and this he achieves with the help of Eddie Veale Acoustics, who supersede Sandy Brown in all aspects of acoustical treatment. Looking around, it would appear that our Eddie has been pretty busy! "You might think our finishes are an Eastlake rip-off", remarked Peter, "but in fact they are not. We've got shaggy pile carpet underfoot, but that's where the similarity ends." He was right. On closer inspection, even the carpet was of a different type to Eastlake. I noticed a splendid array of custom wooden enclosures. "Nice new office equipment," I commented.

"Office?" retorted Peter, "that's the brains of the bloody studio, that is!" Ahem. It turned out these were the new home of the central patching system occupying a small room next to the reduction room. "Originally this room was to be an area for clients to switch between various control rooms and listen to what was going on," commented Peter, "but that idea was shelved when we went 48-track. Now it contains multiplug terminations of all studio machines and control areas—it's basically a master control area." A Studer *A80* 24-track fitted with 48-track linking equipment (Studer *TSL2000*) jealously guards the room which also contains 24-channels of *MR* series Dolby.

Moving into the reduction room, we met with a session in progress, so took refuge in the 2.5x5.5m overdub booth at the far end. Sliding shut the double glazed tinted door, Peter commented, "We were a bit worried about the isolation of this booth from the studio at first—it didn't seem enough. But in practice it has worked very well." The plush interior was complete with cordpull drapes, and monitoring facilities: 50W stereo foldback and 50W mono talkback, both powered by H/H amplifiers. Ah! It was safe to re-enter the 7x5.5m reduction room. Facing the glass was a 40/8 Triad *A series* console topped with a standard pair of Auratone small speaker monitors. Wait a minute. Surely to mix 48-track work you need a 48-track mixer? "We use a 20/4 Triad *Fleximix* to make up extra channels", said Peter. "Originally we got a 40 input desk installed because 32-track single machine recording was mooted. When we convert the old projection room into a second reduction room, we will fully equip it for 48-track working and return this room to 24-track operation."



Simon Hilliard, tape op, setting the mic up, Neil Ross, engineer, twiddling the knobs and Peter Kelsey on the right in the remix room

On the right of the console stood a large panel, packed with an A to Z of ancillary equipment. "The fish and chip bay, as I like to call it," said Peter. Overhead an attractive landscaped rosewood enclosure housed Universal Audio *176*, Urei *1176*, Teletronix *LA3A* limiters, an Orban dynamic sibilance controller, and Gotham *101* and Eventide DDL units. Kepex and Gain-brain (four of each) noise gates were also available in the console. To the left was an array of tape machines: a Studer *A80* 24-track linkable to the one in the master control area, three *A80* 2-track versions, two with vari-speed, and—what was this—two Studer *C37* 2-track machines? "We've kept the *C37* valve machines because some people prefer to mixdown on the old valve jobs," explained Peter. "We wanted to offer as flexible an arrangement as possible. Between them, we've got three machines capable of 76cm/s work, three machines for 38cm/s, and two for 19cm/s. The two 2-track *A80's* are permanently Dolbied, unless overridden; they're used mostly for loops." Each machine has its audio in/out mains and remote connections brought out on military standard multipin connectors which can be patched to other operational areas in the complex.

Next to this 'wall of tape' by the door was a rack containing Amcron *DC300A* and *DC150A* units amplifying bass and top spectra respectively. These powered Cadac monitors via a JBL crossover unit. Three EMT stereo and one EMT quad plates were quietly filed away, providing reverb for the entire complex.

We shuffled on into the studio area. I felt this was a splendid example of the British studio approach—imposing, solid, spacious—the antitheses of Eastlake. Where the latter would seek to create a soft, intimate, feel-at-home environment, this style suggested a dash more discipline and simplicity; the subtlety of relaxing whilst working rather than working whilst relaxing. The control room was inset to the 12x5.5m studio at elevated level, the 'blind spot' underneath being used chiefly for drum kit recording. "That area used to be a drum booth in fact," remarked Peter, "but when we came to extend the control room out into the studio last Christmas, we didn't replace the doors. It's great for overdubs; musicians feel quite 'big' looking into the studio, and for extra separation we have a selection of Audio Kinetics acoustical screens. It works very well. We plan to install CCTV eventually, but for the moment lack of visual contact with the control room isn't a problem."

Cue lights were positioned at intervals around the rockwool packed walls to ensure visibility from any point—there was even one in the ceiling. Foldback and talkback systems were completely separate. Foldback to cans was handled by three Quad *303* amplifiers providing four service and two standby channels. The amps had been modularised inside by Trident to facilitate swift maintenance access. Two 100W amplifiers feed JBL *4320* monitors for studio foldback, whilst talkback came up on JBL *Century* monitors powered by two 80W Audix amplifiers. Should musicians require localised studio foldback, auxiliary monitors could be plugged into the cans' channels, the Quad *303* amplifiers providing 'more than ample power for the purpose'. A selection of

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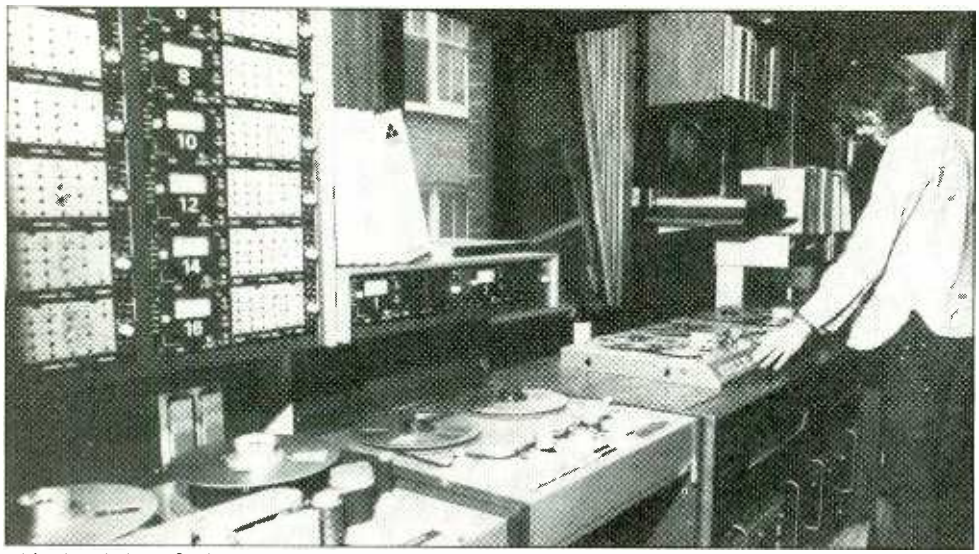


24-track and stereo Studer A80s in remix room

MOS phantom powered FET and passive direct-inject boxes were available for use on any of the 28 studio terminated input channels. Microphones by Neumann, AKG, Electro-voice, Beyer, Sony, ITT and Sennheiser were stocked (the Neumann complement including a hefty 15 U67s), musical facilities including a Bechstein Grand piano, a Hammond *C3* organ and an ARP *2500* duophonic synthesiser.

Just off the studio was a freshly plastered room with a very bright acoustic. "Some people like a live quality on guitar or Leslie tracks," said Peter, "so we built this booth with that in mind. We've also wired up the toilets on the first floor so that, although it may sound strange, people can record in a toilet if they want to". Viva la means to an end! (If it sounds right, it *is* right.)

Upstairs in the control room, a Triad *A series* console looked down into the studio end on. The 5x5m room, carpeted throughout, followed a similar decor theme to the remix room, with overhead rosewood enclosures containing EQ, Dolby, and limiters, and a restrained selection of ancillaries neatly racked by the console. This time, tape machines were behind the console operator, these consisting simply of a Studer *A80* 24-track and Studer *A62* 2-track. Interesting to note that, unlike many studios, Trident evidently took test pressing replay seriously with a Revox *B Y90* direct drive turntable. "We also like listening to records occasionally," added Peter. An Aiwa *AD1250* machine provided cassette facilities. But back to the console—by any standards a mighty beast, processing 28 inputs into 48 outputs; and if trying to work that out makes your eyes water don't worry. I've got Peter here to explain it all—I hope.

"Really it's been done this way purely for flexibility. As you know, we do a lot of 48-track work here (46 after SMPTE timecode tracks). Right. We couldn't record 46 tracks at once even if that were how producers worked, because we haven't the musician space; so we opted for 28 inputs, which seemed about right. Producers operate on a basic-tracks-plus-overdubs basis anyway, so more channels would have been unnecessary. Now, the idea of having 48 outputs was to eliminate confusion over tracks. Using the principle of one 24 output desk switched between two machines causes problems; channel 12 today would be channel 36 tomorrow, on the second machine. On this desk channel 12 is always channel 12, channel 36 is always 36, and so on. It's much easier to work with. I can see the time when recording would be done on both machines simultaneously. This output configuration would be essential in such a case. We've also got 48-track monitoring on the desk. On a 24-track output desk you would have to treat machines separately and rely on a stereo guide mix transferred from the first machine to the second. Here that isn't necessary. Our monitor channels can be brought up onto the main faders and an automated monitor mix made (when we get the automation system!) to accompany the master tapes to the remix room for final mixing."

Fitted into the console was a house built touch sensitive tape machine remote and auto-locate panel. At present, the slave 24-track will glibly follow transport and electronic commands made to the master 24-track machine perfectly (which is fine) but the icing on the flexibility cake will come when the Studer remote unit, permitting frame slip and independent vari-speed, is delivered. A blanked console aperture waits patiently.

Once again, Auratone monitors were observed nestling cosily on the console top frame, these being additionally switchable to ceiling mounted studio mics for reverse talkback listening irrespective of desk status. Monitor amplification was provided by another bi-amplifying Amcron arrangement, Amcron *DC300A* and *DC150A* units handling bass and top spectra respectively via a JBL crossover unit. But this time JBL *4350* units satisfied the function of main monitors.

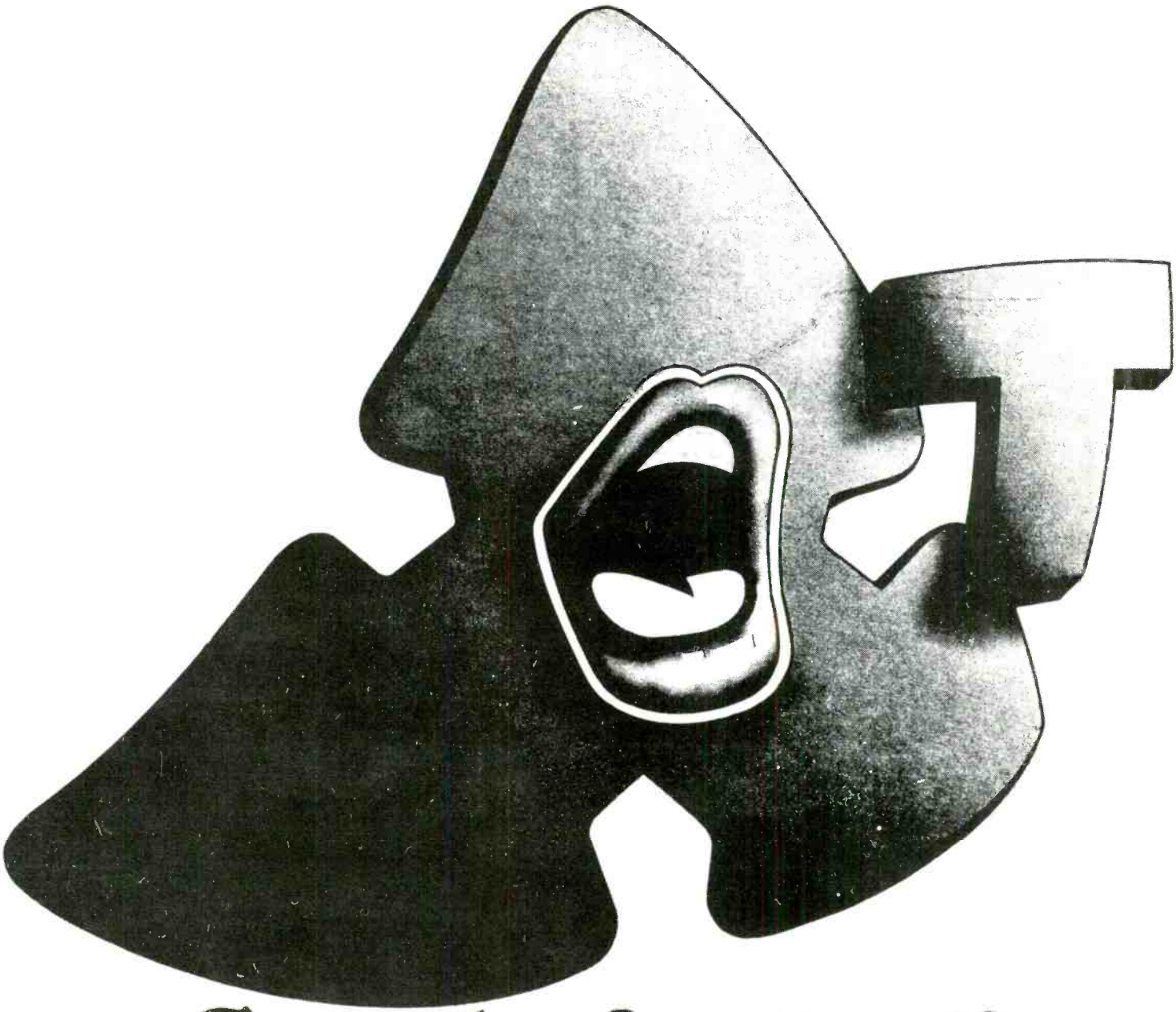
Trident's 6x5.5m cutting room is equipped with a Neumann *VMS66* lathe fed by the new Ampex *ATR100* (cutting version) tape machine running at up to 76cm/s via a custom built dual system control desk. A Dolbied Studer *B62* stands by for copying. Monitor amplification is performed by four Quad *405* amplifiers (that's eight channels) in a tri-amplifier configuration. In November of last year Trident made their first direct-to-disc recording with a band called Warsaw Pact. Now they are laying talkback and CCTV lines to streamline the process. Another 'direct' angle they are pursuing is direct mixing to disc. But where you might not expect disc cutting facilities in a studio complex, it's not so amazing to find a tape copy room. Trident's room uses a Triad *B series* 12/4 console and a predictable range of Studer stereo tape machines. A Garrard *401* turntable and Tandberg *TCD330* cassette machine complete the picture.

PO landlines run into Trident and can be patched as required to permit outside broadcasting pick-up of live studio performance or, by routing via the nearby PO Tower and operating in reverse, live recording of music or other events from overseas. The one thing missing but already touched on, was automation. Surely with 48 channels of sound, automated mixing would be essential? "If we'd automated two years ago," said Peter, "it would have been totally useless for what we need now. Even a year ago would have been no good by now. That's part of the reason why we've held back on automation. The other factor was that, up to the time of rebuilding remix and control rooms we hadn't decided on the number of channels to opt for—24, 48, 76—we didn't know. Now that we've chosen to pursue 48-channel operation, and had some experience of working with it, we are ready to look seriously at automation systems available. Any particular system favoured? "It looks as though we'll opt for the Allison *65k programmer*, hooked up to our own console VCAs", he said. Of course, the comment about 76-channel working was a joke—*wasn't it*? "I must admit we did have one client who wanted me to lock up another Studer for recording", replied Peter. "That would have been 60 channels which certainly makes you think."

The first pertinent thought was whether that would be possible. "Today, no", said Peter, "but it certainly won't be that much of a problem to do it once we get another slave machine. We could lock up to I think about six machines with the Studer system. And the beauty of this Studer remote panel, we are getting, is that you can issue start commands to other machines, so if you want to bring in loops or effects or whatever, you can set the unit to do so at preset times, that is, specified frame counts. This means you can set up an extremely complex mix, possibly starting off on 24-track, and bring extra 24-track machines in as you go along. The mind boggles, in fact. But I honestly can't see the number of tracks going up and up; certainly not for a while yet!"

Now that Trident have opted for 48-channel operation, have they made the right decision? "I can only go by what clients have said," replied Peter, "and the only reaction I've had so far is that they will never go back to 24-track working. And it's not as though they are wasting the 46 tracks; they are using them fully. Not just filling them up, but doing it properly." And when did Peter expect the system to pay for itself? "It's paid for itself already," he said. "When we first re-opened with 48-track, we had two months of solid booking—within weeks the investment was recovered." The facility goes out at £85 per hour. "We've had about eight albums that were recorded on 48-track released so far," Peter continued, "and we've recently started two more, one called Arabian Nights and the other by Brand X. They'll probably be tied up for a couple of months finishing the albums off."

All in all, Trident struck me as quite a success story, in particular their far-sighted belief in 48-track. "We went out on a limb with 48-track recording," concluded Peter, "but it seems to be paying off!" **Richard Dean**



~Speaks for itself...

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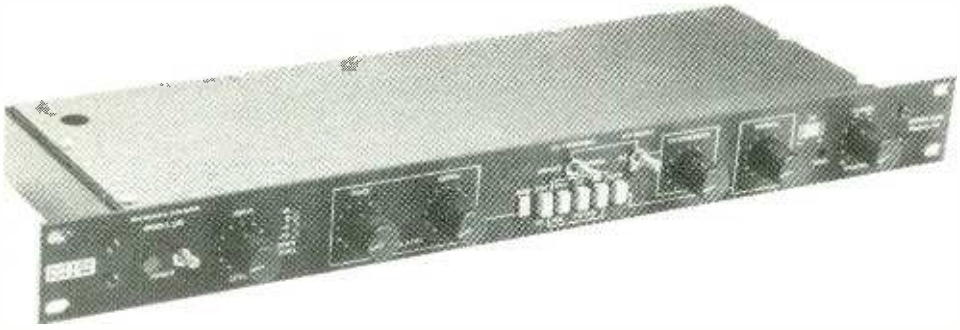

MicMix dynaflanger

MANUFACTURER'S SPECIFICATION

Input impedance: unbalanced input 47kΩ, balanced and floating input 600/5kΩ.
Maximum input level: (0dB = 0.775V) +18dB.
Minimum input: for 'O' operating level —40dB.
Output impedance: unbalanced output less than 10Ω balanced and floating output less than 40Ω.
Maximum output: into 600Ω load +18dBm.
Frequency response: reference 1kHz level, direct signal 20Hz to 20kHz +0, —2dB, delayed signal 20Hz to 13kHz +0, —3dB.
Distortion: at +18dBm into unbalanced 600Ω load; direct signal at 20Hz 0.20%, 200Hz to 20kHz 0.03%, IM SMPTE 0.03%. Delayed signal total harmonic distortion, delay mid point 0.5% maximum, 0.3% typical.
Dynamic range: flanging mode 82dB(A) minimum.
Residual output noise: direct signal less than —90dBm (A), delayed signal less than —76dBm(A).
Internal delay time range: 0.26ms to 6.4ms.
Comb filter: notch spacing 160Hz to 3.9kHz, depth at 1kHz 40dB minimum.
Modulator sweep rate: 0.25Hz to 4Hz.
Frequency mode amplitude rejection: greater than 30dB.
Control voltage range: 0 to +8V.
Power mains: voltage 50/60Hz, +15%, —10%, 120/240V, power consumption 10W.
Price: £569.
Manufacturer: MICMIX Audio Products Inc, 2995 Ladybird, Dallas, Texas 75220 U.S.A.
UK: Scenic Sounds Equipment, 97/99 Dean Street, London W1.

THE *Dynaflanger* effects generator has a number of unique features but is based on the relatively common method of generating electronic 'flanging' shown in **fig. 1.** It is to be seen that the audio input signal follows two paths to the output, the upper path in the figure being via an input buffer amplifier, and adder and an output buffer amplifier. The second path produces a signal which is added to the first path but is delayed via the voltage controlled delay. Furthermore, the second signal may be varied in amplitude and phase relative to the first signal by means of the 'flange' control.

Delay time may be varied manually by means of a potentiometer or by an external control voltage which, because there is a control voltage output fitted, may be used to lock two units for stereo operation. In addition there is an internal low frequency triangle wave oscillator which can be used to derive the control voltage in adjustable amplitude and frequency over the range 0.25Hz to 4Hz.

The unusual features of the *Dynaflanger* are the remaining three means of controlling the delay time in relation to the audio input signal. The first is an envelope follower mode in which the control voltage is derived from the wideband peak value of the input signal. In the other two modes the input signal is passed through an automatic gain control and highpass or lowpass filters before being subjected to peak detection to derive the control voltage. Thus, the delay time may be controlled by either the peak input signal amplitude or the high or low frequency spectral content of the input signal. In all three cases the control signal may be inverted and the decay time of the peak detector and input level to the detector varied.

All these facilities were found to produce some unusual and interesting effects with the unit being very easy to use, however the delay time range of up to 6.4ms restricted the depth of 'flanging' and other effects in comparison with other 'flanging' units.

In construction the unit is designed for mounting into a standard 483mm rack, is only one rack unit in height and does not require any special attention to cooling. All operator controls are at the front which consists of a dark coloured brushed alloy panel with exceptionally clear white markings being used to identify and group the controls.

To the left of the front panel are the mains power indicator and the on/off switch followed by a potentiometer input level control. Adjacent is a four LED level indicator which is sensibly red for +5dB, yellow for 0dB and green for −5dB and −10dB levels. Next comes the internal modulating oscillator which consist of a rate (frequency) control and a depth (level) potentiometer. To the right of these are six interlocked pushbutton switches for selecting the delay line control voltage source which is either by means of a manual potentiometer, from an external source via a rear panel jack socket, from the modulating oscillator or from either of the three input signal derived sources described above. These pushbutton switches are adjacent to a normal/invert toggle switch which inverts the control voltage and a three position toggle switch which selects the control voltage decay time in conjunction with a 'control voltage dynamics' potentiometer for the control voltage level when it is derived from the input signal.

A miniature set of four indicators gives an indication of the control voltage at any given time

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FIG. 1 MICMIX SCHEMATIC

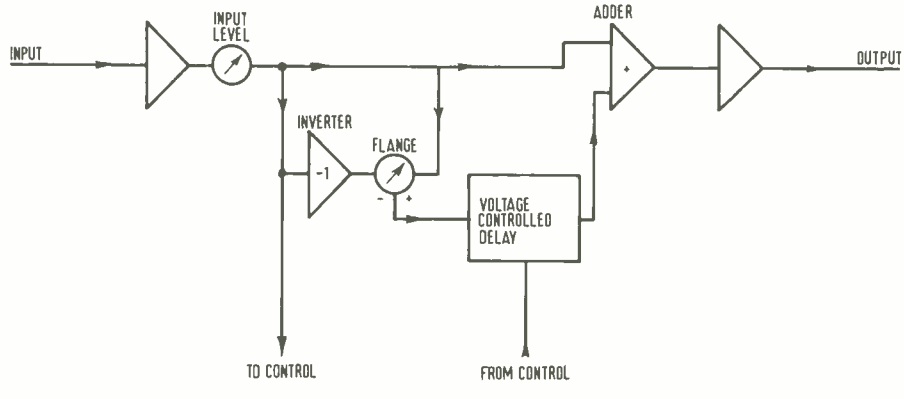
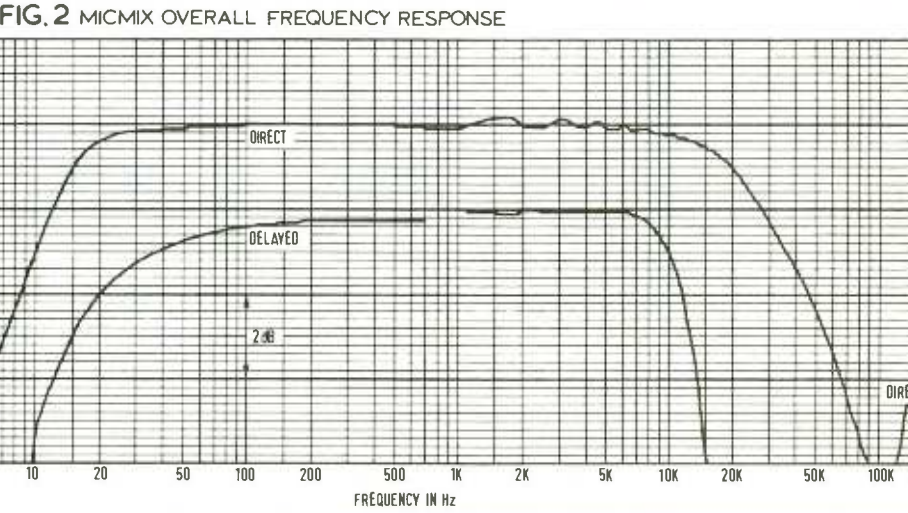


FIG. 2 MICMIX OVERALL FREQUENCY RESPONSE



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with yellow indicators showing small deviations and red indicators showing the limits of the control voltage. The remaining controls consist of the 'flange' potentiometer and a screwdriver operated preset gain control behind the front panel.

To the rear of the unit, the input and output signals can be either balanced (floating) connections via XLR connectors or unbalanced connections via standard 6.35mm jack sockets. Further jack sockets provide connections for the control voltage input where external control is required and the control voltage output for stereo operation. In addition there is a further jack which defeats the flanging operation when a plug is inserted. Future production versions will duplicate this function on a three position front panel switch which will select normal operation, the delayed signal only or the direct signal only. The final features of the rear panel are the standard IEC mains power connector and its adjacent imperial size mains fuse which is clearly identified in rating.

Internally, with the exception of the front panel indicators, the unit is based upon a single good

86 ▶

FIG. 3
MICMIX RESPONSE OF LOW AND HIGH PASS FILTERS

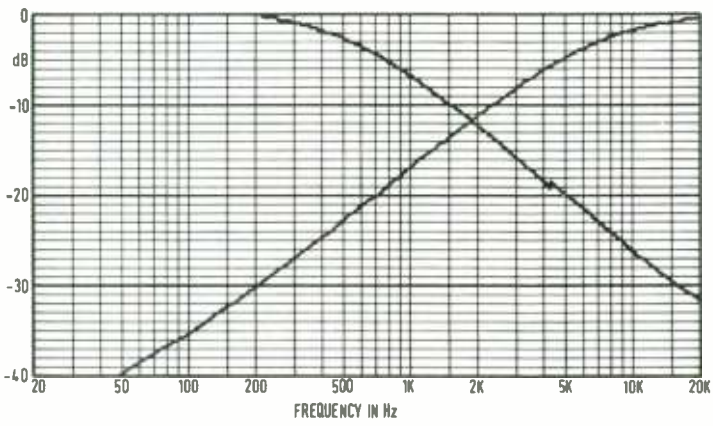


FIG. 4
MICMIX DIRECT CHANNEL DISTORTION (HARMONIC)

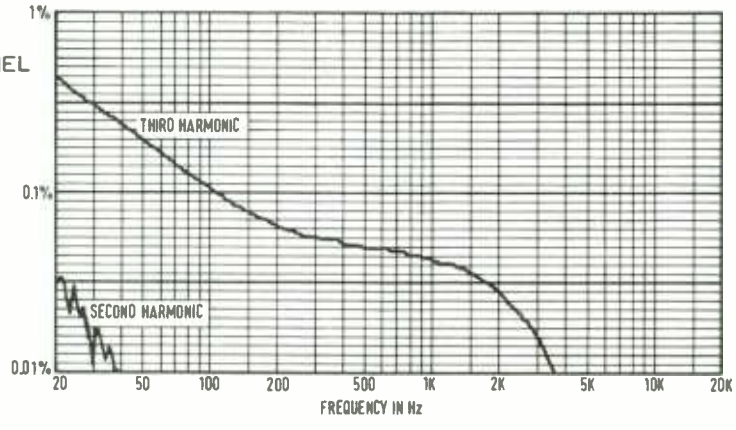
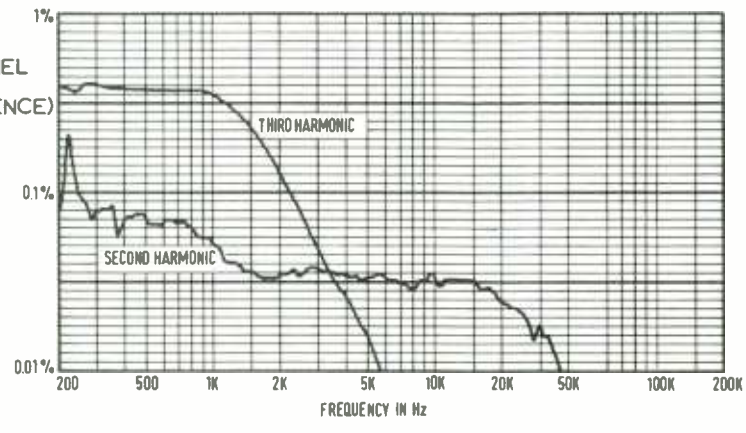


FIG. 5
MICMIX DIRECT CHANNEL DISTORTION (CCIF DIFFERENCE)



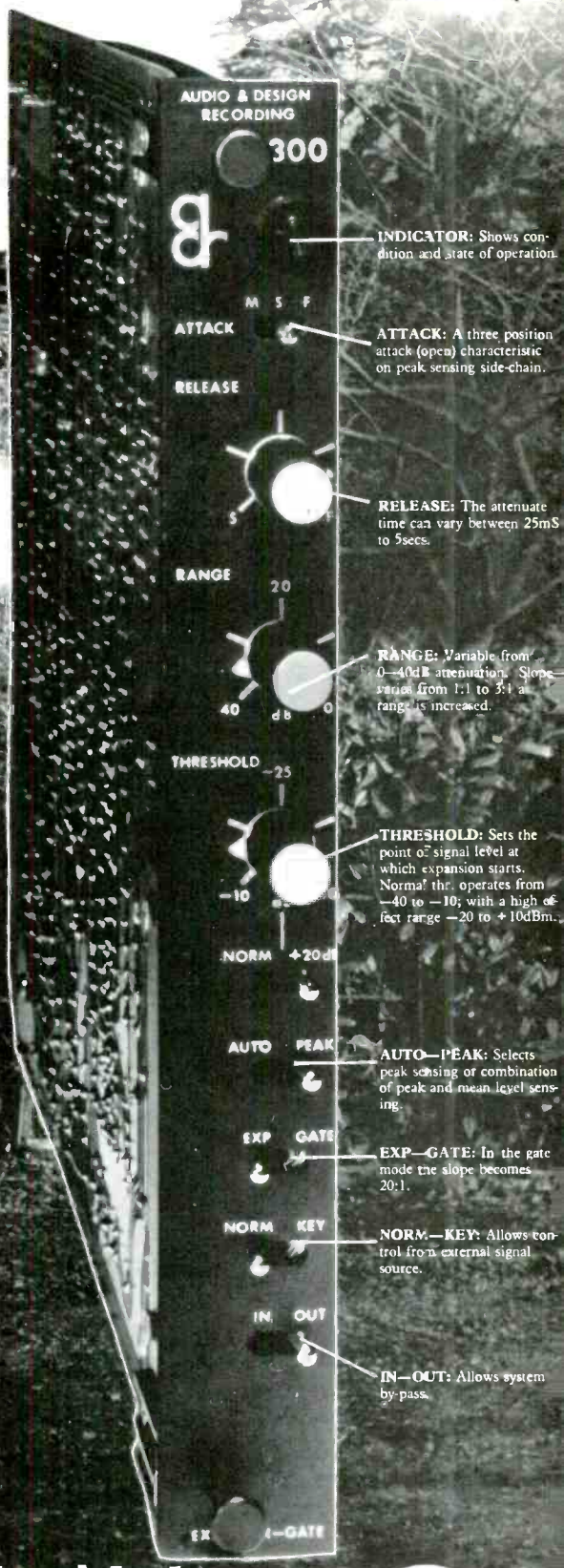
George Martin's choice...

SCAMP

— The F 300 Expander/Gate System

*'WHEN I originally sat down to plan the equipment installation for my new studio, **Air Studios Montserrat** my initial inclination was to draft a list of, shall we say, 'established' names. But then other, equally important, factors like price, performance, reliability, and availability have to be considered. That's why I personally opted for the **Audio & Design SCAMP F 300 Expander/Gate** system for the new venture. Very competitively priced, I believe that the **Audio & Design SCAMP F 300 Expander/Gate** system offers performance and flexibility that is hard to match.'*

George Martin of AIR Studios London, internationally successful record producer, arranger and musical director is presently producing and arranging the musical soundtrack and album of the forthcoming RSO film 'Sergeant Pepper's Lonely Hearts Club Band' in his London Studios and Los Angeles



The **F 300 Expander/Noise-Gate** system is simple to operate yet highly sophisticated in its dynamic performance with an unequalled flexibility for effects use.

In the AUTO mode really smooth dynamic characteristics are obtained with freedom from 'hunting' on the most difficult of signals. This means that these units can be used with confidence on multi-track mix-down to provide noise reduction and a degree of automation.

As non contributing tracks are being automatically attenuated, added tape noise is kept to a minimum, and in most applications involving limited dynamic range signals (ie pop), the noise will be masked by the signal.

Perhaps most important, especially to systems already equipped with a complementary noise reduction system, objectionable source noise (ie instrument amps, hiss from electronic devices, general studio ambient noise and crossmic pickup) will be eliminated — a very significant area in which established noise reduction units can do nothing.

Technical Specification

INPUT:
10KΩ balanced.
OUTPUT:
<1Ω source balanced clip level +24dBm.
DISTORTION:
<0.1% THD at line levels for unity gain.
FREQUENCY RESPONSE:
±0.5dB, 30Hz — 20kHz.
NOISE: (Ref. + 8dBm)
Normal: < −103dB
Effect: < −86dB
RANGE:
0 — 40dB variable.
SLOPES:
Expand: 1:1 to 3:1 variable
Gate: 20:1 with hysterisis.

- **Auto-Dynamic Characteristics**
- **Expander & Noise Gate slope options**
- **Keyable from external signal**
- **Variable release, Range & Threshold**
- **Superb performance**
- **Ultra compact (17 units to a rack)**

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quality double sided printed circuit board with the minimum of hand wiring to connectors and controls. Virtually all components are clearly identified for servicing and adequate test points are provided for alignment of the electronics.

Frequency response and noise

The overall frequency response of the direct and the delayed channels differs substantially (**fig. 2**) with the high frequency response of the delayed channel falling to −3dB at about 13kHz as specified by the manufacturer. Clearly this dissimilarity between the channels will have a subjective effect as flanging will not be effective at very high audio frequencies.

The effective frequency response of the envelope follower control circuit was found to be flat within ±0.5dB from 20Hz to 20kHz with the frequency response of the high and lowpass control filters being that shown in **fig. 3.**

Noise in the output under static conditions was respectable, as seen in **Table 1.**

TABLE 1 OUTPUT NOISE

Measurement method	Noise at output
22Hz to 22kHz rms	—72.0dBm
'A' weighted rms	—74.5dBm(A)
CCIR weighted rms	—66.5dBm
CCIR weighted quasi-peak	—62.3dBm

These noise levels did not vary with control settings, but the use of a 2:1 compander in the delay channel did result in a mild degree of noise breathing although this was not found to be subjectively objectionable.

Distortion

As is to be seen from **fig. 4,** the second harmonic distortion of the direct channel is at a low level within the audio frequency band, but the third harmonic increases rapidly below 100Hz to 0.4% at 20Hz, similarly the CCIF difference frequency distortion of the direct channel rose at lower frequencies (**fig. 5**) but in neither case is the distortion considered to be really excessive for a unit of this kind.

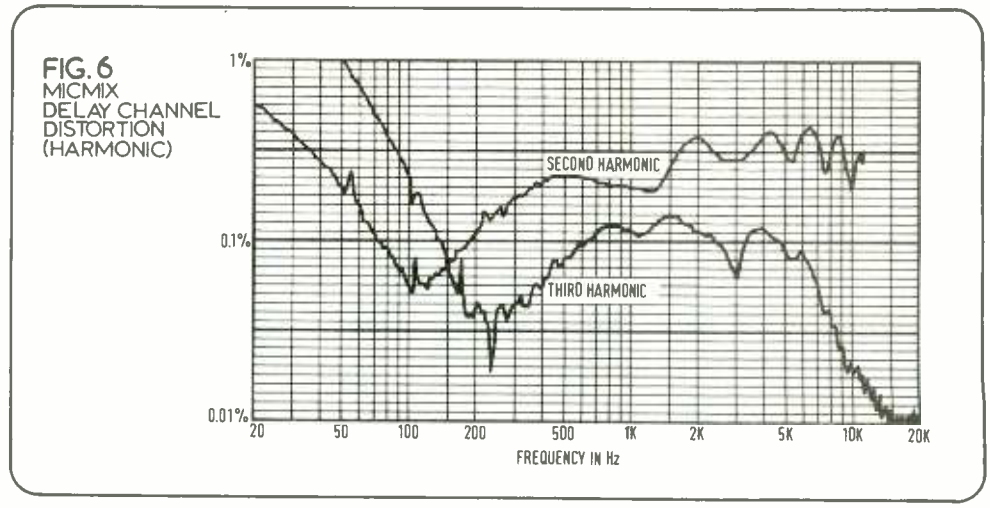
Naturally the harmonic distortion of the delayed channel is higher than that of the direct channel, but as is seen from **fig. 6** which is a plot of second and third harmonic distortion at the mid-point delay setting, the situation is quite reasonable but the distortions do rise at low frequencies to rather high levels. Checking intermodulation distortion of the delayed channel to the CCIF twin tone method showed that the second order difference frequency distortion was virtually constant at 1% from 200Hz upwards, whilst the third order components average out at 10dB lower—all these levels being rather high.

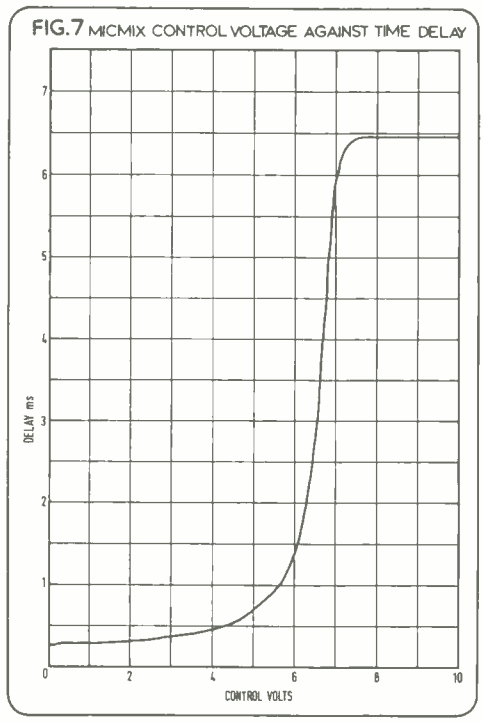
Inputs and outputs

The maximum input voltage at the onset of input clipping was found to be +19.8dBm for the floating input or +18.8dBm for the unbalanced input, the impedance of the latter being virtually constant at 48.1kΩ with input level setting. The input impedance of the floating input was found to be 588Ω but production versions will have the option of this nominal 600Ω termination or 5kΩ input impedance.

Zero level indication was obtained at −11dBm input to the floating input at maximum setting of the preset internal gain control with the other extreme setting requiring only −51.2dBm for zero level and the unbalanced input requiring 0.8dB less level.

Onset of clipping at the floating output occurred at an admirable +20.5dBm from a very low source impedance in the order of 1Ω, the unbalanced output clipping at +21.4dB reference 0.775V with a source impedance of 34Ω.





Other matters

The control voltage output exhibited a range from −0.148V to +8.25V with the operation of the manual delay control, but it was found that clockwise operation of this control decreased the delay time which would appear to be illogical.

Fig. 7 which is a plot of control voltage input versus the time delay, shows that the useful change in delay time is over a very small control voltage range—say from 6V to 7V, and it is felt that this factor restricts the use of the external control voltage input unless input signals are accompanied by a DC offset.

Looking into the internal modulating oscillator showed that this is a triangle wave generator covering the frequency range 0.28Hz to 4.03Hz which provided a useful range of subjective effects.

The choice of fall times (90% to 10%) of the control voltage according to the setting of the decay time switch was found to be 100ms at the fastest with the X2 setting giving 1s, and the X4 setting 2s fall time. Level metering was such that zero level corresponded to −10.5dBm input at the floating input with the 5dBm increments of the indicator being within 0.5dB. The large margin between the zero level indication and the onset of input clipping is required due to the 700μs response time of the indicators.

The MICMIX *Dynaflanger* is certainly a useful effects device with a versatile catalogue of available effects, but like all such devices the electro-acoustic performance has limitations as compared with such items as desk modules.

From an engineering point of view, the *Dynaflanger* is constructed to a very high standard of both wiring and mechanical assembly with servicing having been clearly borne in mind.

Operationally the unit is simple to use with clearly identified controls which are easy to operate and positive in their functions. **Hugh Ford**

Manufacturer's comment

In the preproduction model tested, clockwise rotation of the manual control does decrease delay time because, when flanging, the ear perceives the *spacing* in frequencies between the created notches (or reinforcements). Shorter delay times therefore result in the perception of a higher frequency fundamental flanging effect as the control is turned 'up' or clockwise. Production units, however, do feature control voltage slope reversal capability in all modes of operation.

The comment regarding useful change in delay time vis-à-vis external control voltage input is a question of application and preference. Typical production units range between 256 and 300μs within the 6-7V mentioned ('normal' tracking), representing a fundamental flanging frequency of 3300 to 3900Hz, which is outside the lower mid-range frequencies of the majority of flanging applications where lower control voltages would be utilised.

The comment concerning limitations imposed by a maximum 6.4ms delay time for flanging applications must be questioned. Longer delay times produce a tunnelling effect which is best produced by a delay line intended for that purpose and which was not a design objective of the Dynaflanger.

In regard to the 'limited' bandpass of the delay section (13kHz), fundamental interference frequencies in excess of approximately 4kHz are extremely difficult to obtain in a single delay line, whether digital or analog, because all technologies exhibit a minimum delay time in the order of about 250μs. With this restriction in mind, a bandpass exceeding 13kHz in the delayed channel represents little subjective improvement to the end user in the majority of applications.

fact: you can choose your microphone to enhance your productions.

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...

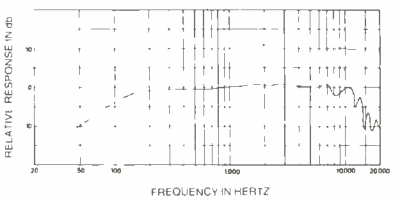
The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted for critical studio productions. In fact, you'll see it most often where accurate, natural sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response 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!

SM58

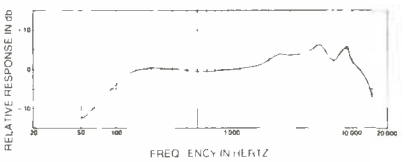
Crisp, bright "abuse proof"

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 it essentially flat...



...some like a "presence" peak.



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Audio Developments ADO55 compressor -limiter

MANUFACTURER'S SPECIFICATION

Threshold: as curves supplied, 0dB input for limiting, —10dB for onset of compression.

Compression: adjustable in 2dB steps from 0dB to +20dB.

Ratios: 1:1 2:1 3:1 5:1 limit 20:1.

Release time (TR_{12}): adjustable 75ms, 150ms, 300ms, 600ms, 1.2s, or 2.4s.

Attack time (TA_{12}): adjustable 0.25ms, 0.5ms, 1ms, 2ms, 4ms or 8ms.

Frequency response: at +10dB input from 600Ω source no compression load 10kΩ ±1dB (20Hz to 30kHz), load 600Ω ±1dB (25Hz to 20kHz).
10dB compression load 10kΩ ±1dB (20Hz to 30kHz).

Distortion at 300ms release time:

Frequency	Output level	Degree of Compression	Distortion
100Hz	+8dB	0	0.075%
1kHz	+8dB	0	0.04%
10kHz	+8dB	0	0.08%
100Hz	0	8dB	0.3%
1kHz	0	8dB	0.06%
10kHz	0	8dB	0.12%

*This reading falls to 0.1% when TR_{12} = 2.4s.

Input impedance: 10kΩ balanced and floating via transformer.

Output impedance: 75Ω balanced and floating via transformer.

Maximum output: +19dB at 1kHz, +12dB at 20Hz.

Noise: independent of ratio or threshold setting, wideband —68dB, band limited with lowpass filter of 12dB/octave with a turnover point of 25kHz —71dB.

Maximum input: worst case +20dBm.

Power required: 240/110V 50/60Hz.

Weight: 4.5kg.

Price: £450.

Manufacturer: Audio Developments, Hall Lane, Walsall Wood, Walsall, West Midlands, UK

THE Audio Developments *ADO-55* compressor/limiter is a twin channel compressor/limiter designed such that the two halves can either be used independently or switched such that their control signals are ganged for stereo operation. Other than the 'link' switch and its associated LED indicator and the mains power on/off switch at the centre of the standard 483mm rack mounting front panel, both halves of the compressor/limiter have identical front panel layouts horizontally opposed.

To the left are rotary switches for selecting attack time in 2:1 steps from 0.25ms up to 8ms and for release time also in 2:1 increments from 75ms up to 2.4s. Moving to the right there is a very clearly marked rotary switch for selecting the threshold of limiting or compression. This works in conjunction with a 'ratio' switch which either activates limiting or compression with a choice of compression

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FIG. 1 RESPONSE AT +10dBm, AGAINST LOADING (NO LIMITING)

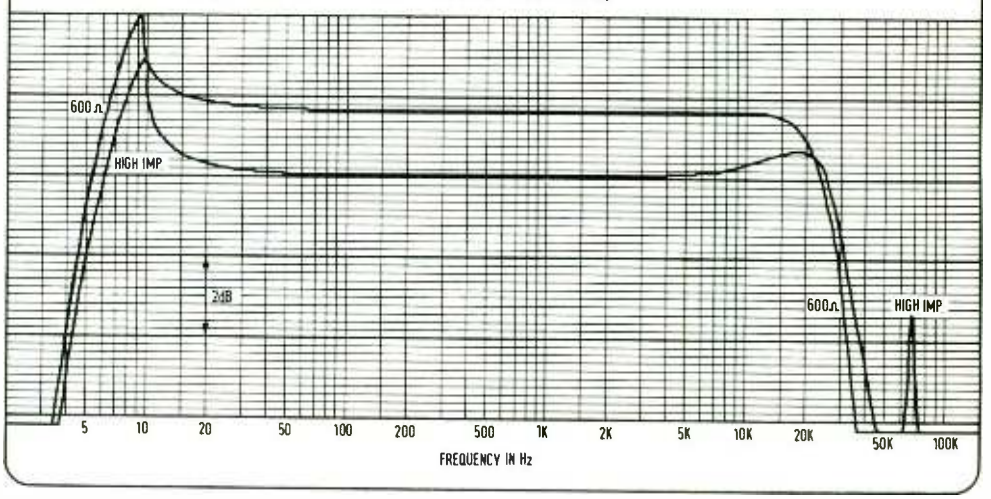


FIG. 2
RESPONSE AT 10dB GAIN REDUCTION

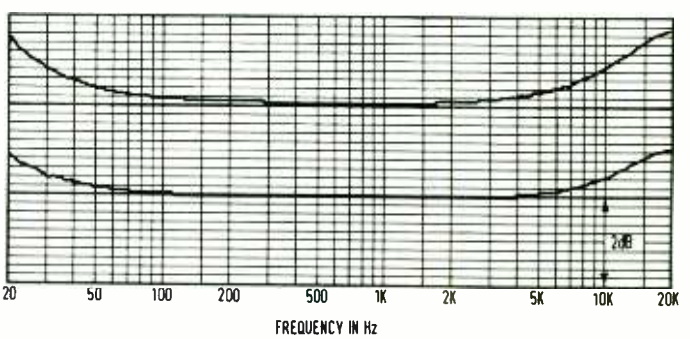
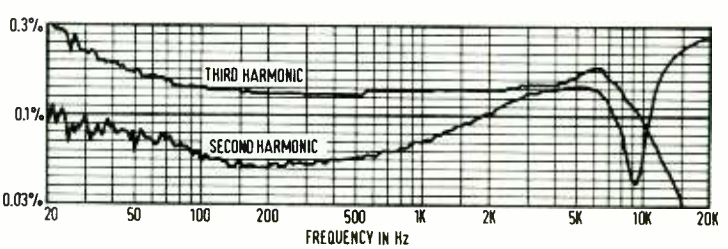
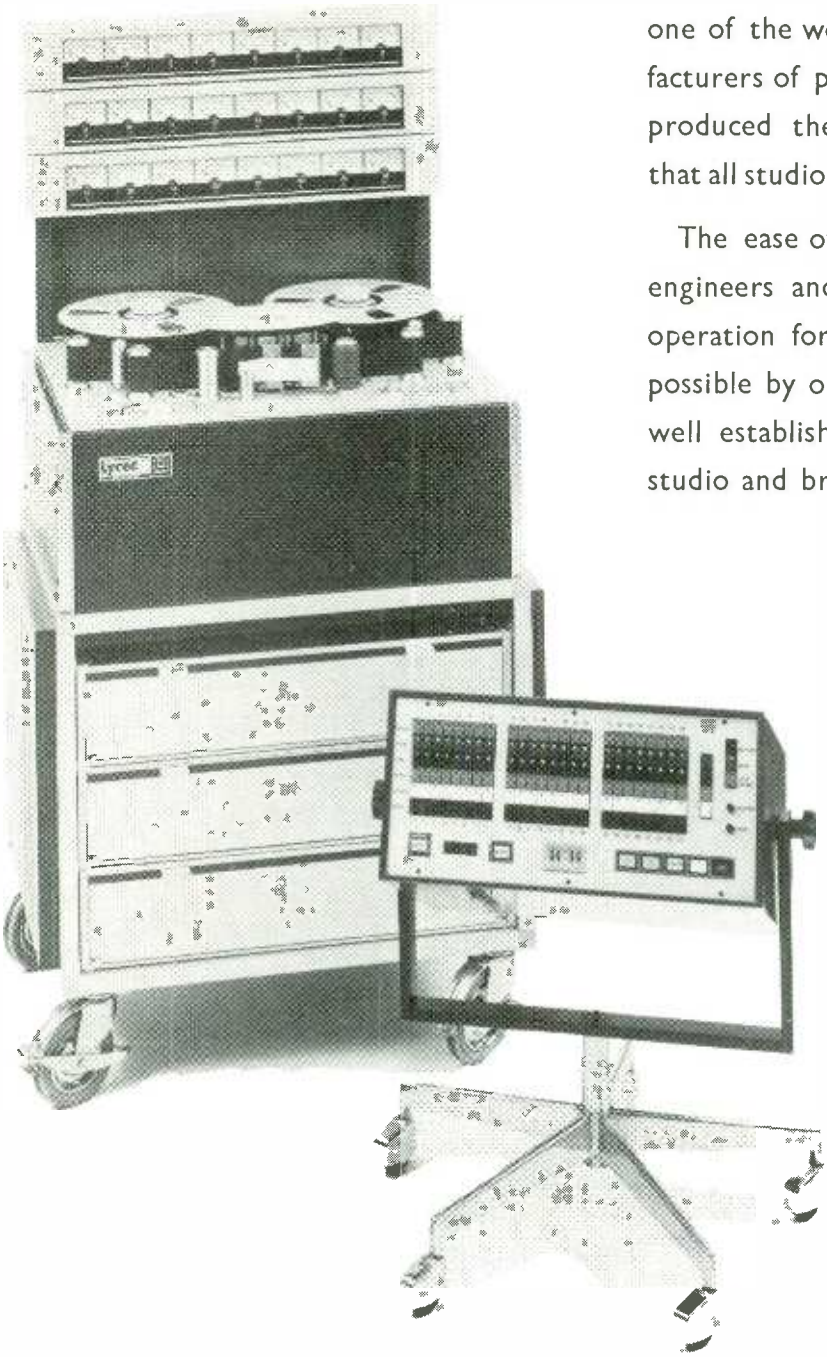


FIG. 3
DISTORTION AT +8dB, NO GAIN REDUCTION



Lyrec of Denmark . . .



one of the world's oldest established manufacturers of professional audio recorders has produced the model TR532 which assumes that all studio engineers are equally important.

The ease of serviceability for maintenance engineers and smoothness and flexibility of operation for recording engineers, all made possible by our 30 years experience and our well established contacts with users in the studio and broadcasting fields.

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Germany: Studiosound & Music GmbH, Schöne Aussicht 16, 6000 Frankfurt/M 1. Tel. 0611 28 49 28 (*local agent*)
Norway: Siv.ing. Bjorn Benum A/S, Boks 2493, Solli, Oslo 2. Tel. 02 56 57 53.
Spain: Mike Llewellyn-Jones, Ap. Postal 8-178, Madrid-8. Tel. 01 637 07 52.
USA: Rupert Neve Inc., Berkshire Industrial Park, Bethel, Connecticut 06801. Tel. (203) 744 6230.
Rupert Neve Inc., Suite 616, 1800 N Highland Avenue, Hollywood, Calif. 90028. Tel. (213) 465-4822.
Canada: Rupert Neve of Canada Ltd., 2717 Rena Road, Malton, Ontario. Tel. 416-677 6611.
Japan: Nissho Electronics Corporation, Konwa Bldg, 12-22 Tsukiji 1 Chome, Chuo-Ku, Tokyo. Tel. (03) 544-8311.
Australia: Rank Industries Australia Pty. Ltd., P.O. Box 632, Chatswood. Tel. 406 5666.

ratios of 1:1, 2:1, 3:1 or 5:1 with the choice of compression threshold ranging from —10dBm to +10dBm input level in 2dB steps, or that of limiting from 0dBm to +20dBm also in 2dB steps. A further rotary switch selects the function to be displayed on the unit's meters which can display either the input or output level or the degree of gain reduction in use. These meters have the characteristics of the BBC type peak programme meter, but are scaled in 4dB steps ±12dB for input or output level indication, or from 0dB to 20dB in 5dB increments for the indication of gain reduction.

Four LED indicators are used to indicate the status of each half of the compressor/limiter; a red LED shows that gain reduction has been activated, a yellow LED that the limiting function has been selected and a further red LED indicating that the input overload limit is being approached, the fourth green LED being illuminated when the individual bypass switch has been positioned to bypass the compressor/limiter electronics.

The use of coloured knobs and colour in the front panel graphics makes use of the unit very easy and the layout clear and uncluttered with readily operated knobs. Equally good are the facilities at the rear of the unit where the mains power input is via a standard IEC connector with two properly identified metric fuses providing protection. Very sensibly, the inputs and the outputs to the compressor/limiter are by three types of paralleled connectors, XLR, 6.35mm tip ring and sleeve jacks and Tuchel connectors with all connections being of the floating transformer coupled type.

Internally the construction of the electronics is based on a large glass fibre mother board which housed the power supplies and the input and output transformers and to which are soldered by means of pins sub-boards which support the signal circuits. Whilst no circuits are provided and the components on the boards are not identified, a good instruction manual provides alignment instructions and the location of the alignment controls on the printed circuits.

Frequency response and noise

As is to be seen from **fig. 1** which represents the overall frequency response without limiting or compression into a high impedance load and into 600Ω, the response varies slightly with loading, but to no significant extent being sensible flat within the audio frequency band. With gain reduction in action, the frequency response was found to depend to an extent on whether limiting or compression were selected, these differences being shown in **fig. 2** for 10dB gain reduction; it can be seen that the limiting condition is rather 'toppy'.

On the noise front, noise in the output did not change at all with any of the front panel control settings with the two channels exhibiting a similar performance as **Table 1**:

TABLE 1

	Noise in Output Channel 1	Channel 2
Band limited 22Hz to 22kHz rms	—72.5dBm	—72.5dBm
'A' weighted rms	—75.5dBm	—75.5dBm
CCIR weighted rms	—66.2dBm	—66.5dBm
CCIR weighted quasi-peak	—62.0dBm	—62.2dBm

Having regard for the fact that the maximum output level is in the order of +19dBm, the above noise performance figures represent a good dynamic range.

Distortion

The individual second and third harmonic dis-

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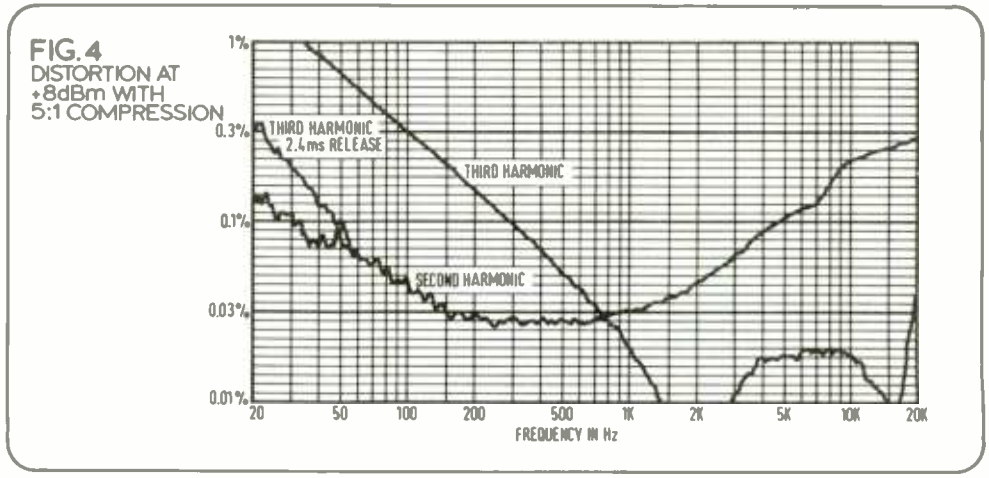
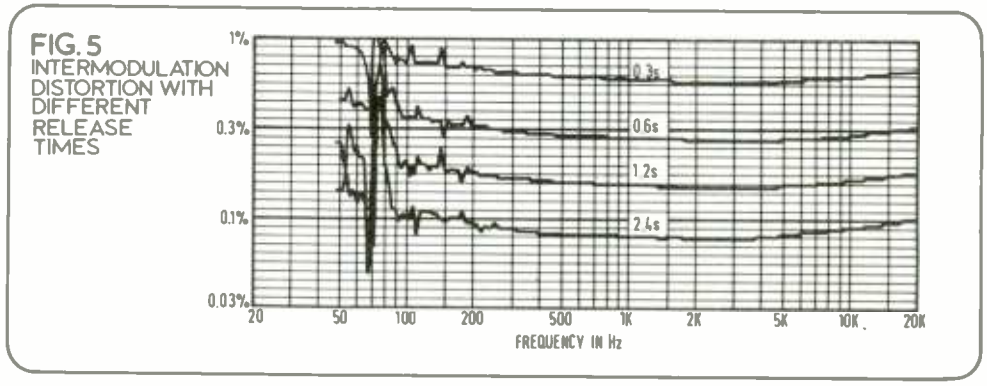
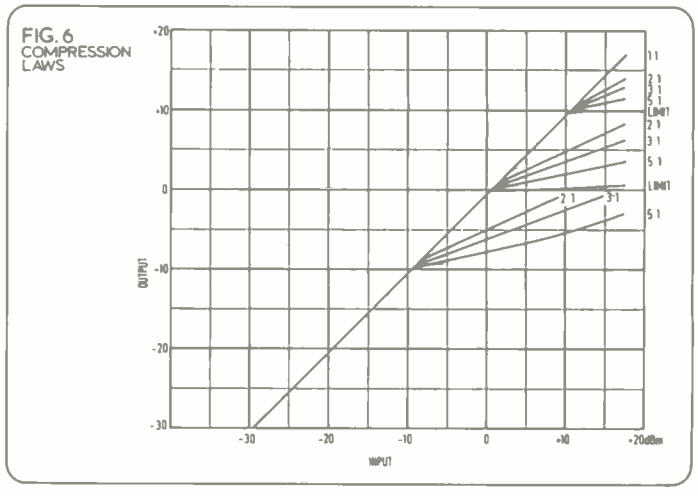
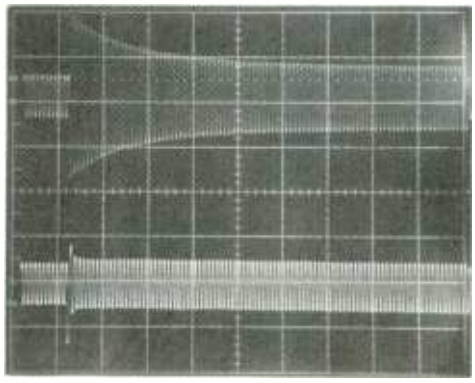


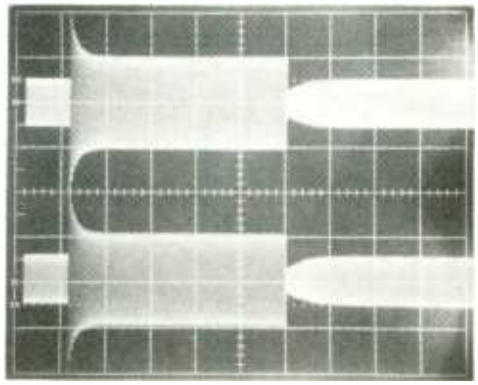




Below left:
FIG. 7 Top 8ms, Bottom 25ms. Limit 10ms/div

Below right:
FIG. 8 Top unlimited. Bottom unlimited, 2ms/div 8ms attack, 75ms release





FIRST CHOICE

ems dmx 15-80

The Advanced Music Systems model dmx 15-80 is a microprocessor controlled digital delay line of high technology and sophistication, developed by research engineers (originally from the Aerospace industry) with a discipline of uncompromising high performance and reliability.

Rugged construction, to take all the pressures of studio use and the extra hard knocks of life on the road.

No other DDL can be so easily adapted to provide extra effects cards. Entire families of new microprocessor controlled effects. Available soon will be a "glitch" free Harmoniser plug-in card, and a digital reverberation card. The dmx 15-80 unit will have an interesting future.

User orientated features suggested by extensive feedback include :–
1) Keypad entry of delay with instant recall of 9 preset delay times, displayed on a Digital readout.
2) "Nudge" buttons allow silent sweeping of delay, upwards or downwards to enable "flanging" or "tunnelling" effects to be produced.
3) Internal Delay+ Original mixing to avoid tedious external patching.
4) In Phase/Anti Phase switching of the delayed signal.
5) Feedback level control for repeat echo.
6) VCO/Crystal selection to allow internal voltage controlled oscilator to produce frequency shifting for enhancement of ADT effects.
7) Delay times expandable from 0.1 seconds to 1 second, in 20 microsecond steps.
8) Easily modified to provide a maximum delay of 10 seconds for Broadcast "Profanity" purposes, with 18kHz bandwidth.
9) Small size requires only $3\frac{1}{2}$" of rack space to accommodate the best value in DDL Technology available.

Your inquiries about the dmx 15-80 are welcome.

MCI

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

tortions without any gain reduction in action and at +8dBm output are shown in **fig. 3** from which it can be seen that the more objectionable third harmonic predominates at levels just over 0.1% from 100Hz upwards. This situation was not particularly sensitive to signal level, but the introduction of compression or limiting made dramatic changes in the distortion pattern, **fig. 4.**

In **fig. 4** the plots were made with the attack time set for 1ms and release time set to 300ms except for the second section of a plot of the third harmonic where the release time was to be 2.4s to reduce the low frequency distortion which is inherent with fast release times in any compression system. Generally the performance shown in **fig. 4** is very good for a device of this kind.

A further form of distortion, which it is not generally realised depends to a large extent upon release time, is intermodulation distortion, even to the CCIF twin tone method. **Fig. 5** shows the different frequency distortion of two tones separated by 70Hz at 8dB gain reduction as a function of release time from 0.3s to 2.4s—the difference in distortion levels being precisely related to the release time in 6dB steps for 2:1 release time variations.

Inputs and outputs

The input impedance of the unit was found to depend upon three factors, the meter function selected to input or otherwise and the position of the bypass switch. When the bypass mode was selected the input impedance was identical to the output load, whilst in the normal mode the input impedance was found to be 8.9kΩ with the meter switched to monitor the input or 9.8kΩ in other positions—these impedances being sensible.

Whilst the fact that the bypass mode completely bypasses the electronics can be useful for fault finding, clearly the change in input impedance can have undesirable and confusing results if the load on the output is of a low impedance. Input levels in excess of +20dBm could be coped with from 20Hz up to 20kHz without excessive distortion.

On the output end, the output source impedance was found to be adequately low at 52Ω in the normal mode, but as explained above, the impedance in the bypass mode becomes that of the unit driving the compressor/limiter. Output levels of +17.5dBm into 600Ω were available before waveform clipping, or +19dB ref 0.775V into high impedance.

With the unit operating at unity gain (1:1 compression) the input overload light operated at +16dBm input, allowing a 3dB margin before the onset of serious distortion. Being a fast acting indicator this lamp provides a useful function and was easily seen when illuminated.

The meters

Examination of the ballistics of the two meters showed that they corresponded to the standard BBC type peak programme meter as specified in British Standard 4297:1968 within the specified tolerances by a good margin. However it was found that the scale calibration was poor as received and shown in **Table 2.**

TABLE 2

Meter Indication	Actual Input Level	Actual Output Level
+12dB	+12.5dB	+12dB
+8dB	+8.4dB	+7.9dB
+4dB	+4.3dB	+3.8dB
0dB	+0.2dB	—0.5dB
—4dB	—3.9dB	—4.5dB
—8dB	—8.2dB	—8.9dB
—12dB	—12.7dB	—13.5dB

Recalibration, as recommended in the unit's instruction manual, cured these evils and after that the level accuracy complied with the standard requirements and the indication accuracy of gain reduction was found to be within 1dB which is perfectly adequate. The onset of gain reduction was also accurately shown by the red LED which, like the overload indicator, was a fast acting device which was readily seen.

The compression laws and controls

Examination of **fig. 6** plots the input/output levels for the three available degrees of compression of 5:1, 3:1 and 2:1, and shows that the characteristics are all within 1dB of the perfect characteristic at threshold settings of +10dBm, 0dBm and −10dBm which are accurately calibrated.

In addition, the limiting characteristics at threshold levels of 0dBm and +10dBm show near perfect limiting with measurements on the accuracy of the 2dB steps of the threshold control showing that it was always within 0.3dB of the calibration. Calibration of the attack and the release time controls is in terms of the CCITT specification for T_{A12} and T_{R12} respectively; that is, in the case of attack time 'the time taken after the sudden application of a tone, for an initial overshoot of 12dB at the limiter output to be reduced by 4dB' and in the case of release time 'the time, after the cessation of a signal, for the gain to return within 4dB of its normal value from an intial reduction of 12dB'. Measurement of the unit's release time in these terms gave the following results which are reasonably accurate to the calibrations see **Table 3.**

TABLE 3

Release time setting	Actual release time
2.4s	2.7s
1.2s	1.8s
0.6s	0.64s
0.3s	0.23s
0.15s	0.15s
0.075s	0.06s

Measurements upon the attack time produced results which were accurate within the readability of the instrumentation used which is probably within ±5%. The range of attack times is shown in **fig. 7** for a 1kHz tone in the limiting mode, the upper trace showing an attack time of 8ms whilst the lower trace shows the attack time set to 0.25ms and demonstrates only a minor overshoot.

In the stereo mode with the control voltages of the two halves of the unit combined, the half of the unit demanding the maximum gain reduction controls the other half of the unit with its time settings taking control. In order to eliminate stereo image shifting it is of course important that the gain of the two halves of the unit should track accurately and this was investigated by applying tonebursts to the two halves of the unit with the threshold settings at different levels and listening to the two outputs for image shifting—the results being excellent. **fig. 8** shows the outputs under these conditions with 8ms attack times and 75ms release times, the top trace being the output from the unit not requiring gain reduction whilst the bottom trace is the output of the 'master' channel controlling the gain of the two channels, there being no evident tracking errors.

Summary

This is a versatile true compressor/limiter with a very wide range of timing and threshold settings available. Generally the performance was to a very high standard as was the standard of construction and in view of its most reasonable price, the unit is to be strongly recommended.

Hugh Ford

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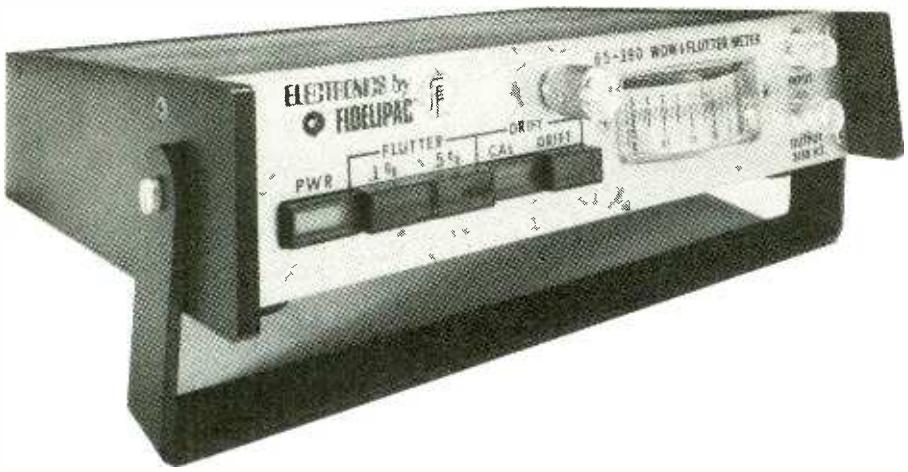

Fidelipac 65390 wow and flutter meter

MANUFACTURER'S SPECIFICATION
Input voltage: 50mV or greater.
Input frequency range: 2kHz to 4kHz.
Input impedance: 300kΩ.
Input configuration: unbalanced BNC connector.
Flutter meter ranges: 0.1% and 0.5% full scale, switchable.
Flutter meter accuracy: within 3% of reading.
Drift measurement: frequency variation in relation to precision internal oscillator.
Drift meter range: ±5%.
Drift meter accuracy: within 1% of reading.
Internal oscillator frequency: 3,150Hz ±0.1%, sinewave.
Oscillator output level: 1V.
Oscillator output impedance: 50Ω.
Oscillator output configuration: unbalanced, BNC connector.
Oscilloscope output: 5Vp-p @ 0.5% flutter.
Weighting characteristic: switchable.
Power requirement: 110 or 220V, 50 to 60 Hz.
Dimensions: 235x197x48mm (WDH)
Weight: 1.82kg.
Price: £285 approximately.
Manufacturer: Fidelipac, 109, Gaither Drive, Mt Laurel, NJ 08057, USA

THE FIDELIPAC wow and flutter meter is a very small mains powered unit having two flutter ranges and a single drift range both indicated on a single edgewise mounted meter. The meter is scaled for ±5% drift measurement and 0.5% and 0.1% full scale wow and flutter ranges.

Five self indicating pushbutton switches are mounted on the front panel, one switch being the power on/off control and the remaining four interlocked switches selecting the wow and flutter meter's function. These consist of the 0.5% and 0.1% full scale wow and flutter ranges and the ±5% drift range which may be calibrated by means of the calibrate function and a calibrate potentiometer on the front panel. In the calibrated state, the zero drift indication corresponds to an input frequency of the standard 3,150Hz. However the range of the calibration control does not allow the zero indication to be set for the old 3kHz standard frequency.

The remaining front panel features are BNC sockets which provide for the meter input and output from the internal 3,150Hz oscillator, all features being clearly identified.

At the back of the meter is a standard 6.35mm single pole jack socket which provides an oscilloscope output to observe the wow and flutter waveform, but not drift. A small locking pushbutton identified as 'flat/in' is provided to disconnect the wow and flutter weighting network, but in the review instrument this had no effect. The final features are a 'zero drift' screwdriver operated preset control and the fixed two core mains lead.

Cabinet construction was extremely strong and provided excellent access to the internal parts for servicing; a tilting handle/foot was fitted so the meter was easy to read if placed flat on the bench. Within the meter, all electronic components are mounted onto a single high quality printed circuit board with clear component identifications but with the important exception of the value of the mains power fuse.

Inspection of the printed circuit layout revealed that the clearance between conductors carrying mains voltages and those connected to the body of the instrument was inadequate in terms of British Standard 4743:1971 (Specification for Safety Requirements of Electronic Measuring Apparatus) and this potential hazard should be corrected by the manufacturer. Similarly printed circuit soldered connections attached to the mains supply are far too close to the metal base of the instrument.

Drift measurement

With respect to the standard IEC wow and flutter measurement frequency, the drift meter zero point could be offset +4.35% to -2.09% with the drift meter giving a ±5% indication about these offsets. As the drift meter has a single range of ±5%, it is

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not possible to read drifts of less than say 0.2% with any useful accuracy so the application of the drift meter is rather restricted for professional use.

Similarly, as is to be seen from **table 1,** the drift indication with respect to 3,150Hz after calibrating the drift meter is not particularly good.

TABLE 1 MEASURED DRIFT

Indicated drift	Actual drift ref 3150Hz
+5%	+5.07%
+4%	+3.96%
+3%	+2.99%
+2%	+1.96%
+1%	+0.91%
0	+0.02%
—1%	—1.10%
—2%	—2.26%
—3%	—3.07%
—4%	—4.24%
—5%	—5.14%

The damping of the drift meter was completely satisfactory such that short term speed variations did not appear at the meter but could be observed as wow and flutter. As has been briefly mentioned there is no output from the meter for recording drift on a chart recorder or similar instrument.

Wow and flutter

The indicated wow and flutter was checked by applying a frequency modulated 3,150Hz carrier to the instrument, the modulation frequency being 4Hz which is the unity gain point of the standard IEC (DIN) weighting curve, the depth of modulation being accurately measured (**table 2**).

FIG. 1: ·1% actual scope o/p 50° mV/div

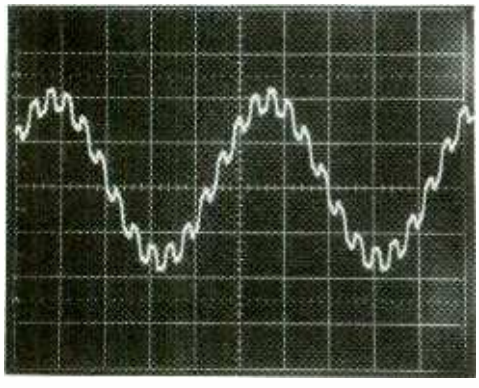


TABLE 2 MEASURED WOW AND FLUTTER

Wow and flutter range	Indicated wow and flutter	Actual wow and flutter (peak)
0.5%	0.5%	0.39%
	0.4%	0.32%
	0.3%	0.25%
	0.2%	0.17%
0.1%	0.1%	0.102%
	0.08%	0.083%
	0.06%	0.0613%
	0.04%	0.0428%
	0.02%	0.0243%

It is clear from the above that the calibration of the 0.5% range was substantially incorrect, but the performance on the 0.1% range was quite reasonably accurate. The manufacturers' claim of an accuracy of 'within 3% of reading' is obviously stupid as it's impossible to read the meter within 3% of its reading, so maybe the claimed accuracy should be within 3% of range?

Checking the internal weighting curve with respect to the IEC (DIN) standard showed that above the unity gain point at 4Hz, the weighting was well within the standard requirements, but at very low frequencies the meter was only just within the standard requirements. Operation of the rear panel switch for obtaining a 'flat' response failed to remove the weighting filter from circuit.

The peak indication of the meter was checked by the standard method of applying rectangular bursts of frequency modulation with varying burst length and a fixed repetition rate of 1Hz (**table 3**).

TABLE 3 PEAK INDICATION

Burst length	Meter indication	Standard requirement
100ms	100%	100% ±4%
60ms	90%	90% ±6%
30ms	68%	62% ±6%
10ms	25%	21% ±3%

Table 3 was obtained by setting the 100ms burst to read full scale on the 0.5% range because of the calibration error on this range, as opposed to the proper method of setting the frequency modulation depth for 100% indication. Thus the marginal nature of the performance on the two shortest burst lengths may not be a true reflection of the performance.

Similar comments apply to the measurement of the meter's fall time using the 100ms bursts at 1Hz repetition rate where the meter fell to 50% full scale as opposed to the standard requirement of 41% ±4%.

Input and outputs

The input to the instrument was found to have an adequately high impedance of 340kΩ with proper wow and flutter indications being obtained with input voltages above 7mV. The oscilloscope output voltage bore a constant relation to the percentage of wow and flutter independent of the selected range with an output of 4.45V peak-to-peak corresponding to 0.5% actual wow and flutter. Whilst the oscilloscope output is after the weighting filter, it contained a substantial amount of 3,150Hz carrier, as can be seen from (**fig. 1**) which shows 0.1% wow and flutter from sinewave modulation as seen at the oscilloscope output which had an output impedance of 2500Ω.

The unbalanced oscillator output was found to deliver 1.1V rms from a source impedance of approximately 10Ω, this arrangement being quite adequate for testing most tape recorders. However, the frequency of the output after a lengthy warm-up period was 0.13% above the standard 3,150Hz which is outside the manufacturer's specification of ±0.1% which itself is too wide in tolerance for checking professional studio equipment. Furthermore, as can be seen from **fig. 2,** the frequency stability is not particularly good even after a 10 minute warm-up period.

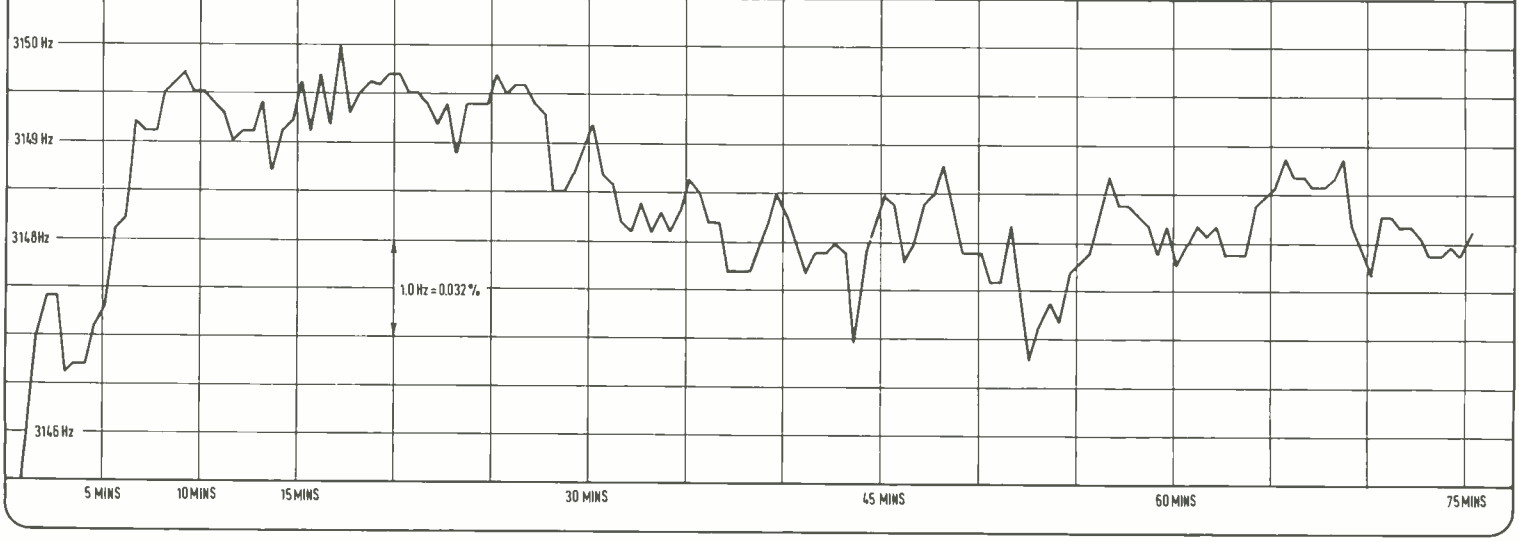
Summary

Clearly the calibration of the 0.5% wow and flutter range was incorrect in the review instrument and had this been correct the review would appear in a much better light. Overall the instrument is within the IEC requirements but cannot be regarded as a precision instrument, it is however well made with the exception of the electrical safety problems.

The wow and flutter ranges of 0.5% and 0.1% are adequate for most professional requirements but the drift range of ±5% is far too coarse for use with anything but the worst professional equipment and indeed it is of little use with anything but cheap domestic equipment.

Hugh Ford

FIG. 2 FIDELIPAC OSCILLATOR STABILITY



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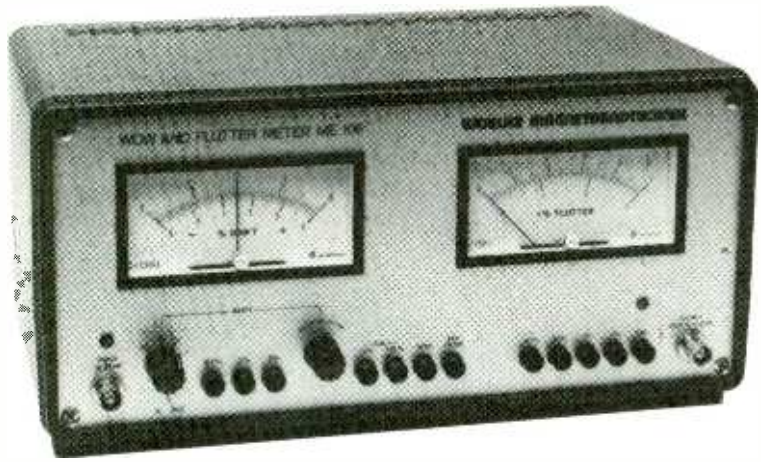

Woelke ME106 wow and flutter meter

MANUFACTURER'S SPECIFICATION
OSCILLATOR
Test frequency: 3,150Hz (constant within ±1Hz).
Measuring voltage: 'output' jack approximately 0.5V, source imp approx 200Ω. DIN phono jack approx 8mV, source imp approx 8kΩ.
Calibration: detuning of ±5% for static calibration (drift), detuning of ±0.1% for dynamic calibration (flutter).
MEASURING SECTION
Input Voltage: 30mV to 30V (no selecting required) 3,150Hz ±5%
Input Impedance: approx 75kΩ.
MEASURING RANGES
Flutter*: ±0.1%, ±0.3%, ±1%, ±3% peak value indication according to DIN/CCIR/ANSI/IEC.
Drift: ±0.5%, ±2%, ±5%.
Variation of flutter indication with frequency: 0.5-600Hz (—3dB). In 'WTD' position according to DIN/CCIR. In 'Ext-filter' position according to external filter characteristics.
TEST OUTPUTS
Output 1: absolute pitch (DC component) + flutter (AC component) linear indication, 0 to 600Hz ±5% or ±100mV.
Output 2: AC components only, according to bandwidth or weighting filter selected. Filter measuring range selected equivalent to ±1V.
Output 3: value indicated by flutter meter full scale deflection equivalent to +1V.
Output impedance: 10kΩ for all outputs.
Mains supply: 110-125/220-240V (switchable) 40-60Hz, 9VA.
Dimensions: 300x200x150 (WDH).
Weight: Approx 2.3kg.
Price: £455.
Manufacturer: Woelke Magnetbandtechnik, Woelke-strasse 2-3, 8069 Schweitenkirchen, West Germany.
UK Agent: Lennard Developments Ltd, 206, Chase Side, Enfield, Middlesex.
*The *ME106E* version of this instrument includes rms indication to NAB/JIS and operates at 3,150Hz ±10%. In addition to including all the features of the *ME106* the *ME106E* has the additional weightings required for NAB/JIS and an addition drift range of ±10%.

WOELKE wow and flutter meters (previously known as Miniflux) have always been well regarded and are widely used both as laboratory and production line instruments. The new *ME106* reviewed here, and its companion the *ME108* are similar instruments but the *ME108* has restricted drift indication and fewer monitoring outputs. In both cases there is an 'E' version available if it is required to measure to the old NAB or Japanese JIS standards in addition to the quasi-peak IEC (DIN) standard.

The instruments are based on a two part moulded plastic case, the two halves of which bolt together to retain the front panel with the rear panel connections being secured to the lower half of the case. Internally the electronic components are mounted onto three good quality printed circuit boards; there being a mother board which occupies the base of the instrument and to which two smaller boards are soldered by means of pin connectors. Good quality components are used throughout but with the exception of the mains fuse, the position of which selects the input voltage. There are no component identifications to aid servicing and no servicing data was provided.

Front panel facilities are basically divided into two sections, drift measurement and wow and flutter measurement sections, both of which have clearly calibrated meters. The drift section has a centre zero meter which has scales calibrated ±5 and ±2 working in conjunction with three interlocking pushbuttons which select the drift ranges of ±5%, ±2%, and ±5%. In addition there is a drift zero set control which can be used either to set the zero indication to an input frequency of 3,150Hz or to offset the zero indication. Finally there is a potentiometer which varies the turnover frequency of a lowpass filter in the drift meter for obtaining a steady indication in the presence of severe drift; the potentiometer being calibrated in frequency from 0.1Hz to 1Hz.

The separate wow and flutter indicating meter also has two calibrated scales giving full scale deflections of 1 or 3 operating in conjunction with four interlocking pushbuttons which provide wow and flutter ranges of 3%, 1% 0.3% and 0.1% full scale deflection. Wow and flutter calibration is achieved by pushing a calibrate button which provides a reference wow and flutter of 0.1% derived from a mains frequency squarewave, the meter being calibrated by means of a screwdriver operated potentiometer which can be reached through the bottom of the instrument's case. Similarly the drift meter can be calibrated from a +5% internal reference and the frequency of the internal oscillator adjusted.

Further front panel pushbuttons allow weighted or unweighted measurements, insert an external filter socket for a Woelke wave analyser or similar and switch the mains power on/off with an adjacent power indicator light.

The meter input is via a front panel BNC socket adjacent to a green indicator which is illuminated when the signal level is sufficient for proper operation of the meter, there being a secondary input/output on the rear panel which duplicates the front panel input and also provides a lower level DIN compatible output as opposed to the high level front panel BNC output from the internal oscillator.

In addition to this DIN compatible input/output the rear panel has a further 5-pin DIN connector for connecting an external filter. In addition to these there are three BNC output connections on the rear panel for recording or analysing unweighted drift and flutter, AC components of drift and flutter or the meter indicated flutter—all very useful features.

Drift measurement

The available offset of the drift meter zero was found to depend upon the selected drift range. With respect to the standard measuring frequency of 3,150Hz, the meter could be offset —5.95% to +7.24% on the ±5% range or —2.13% to +2.03% on the ±2% and ±0.5% ranges.

For the measurements of absolute speed or drift with respect to 3,150Hz, the drift meter is set to zero with no input signal to the instrument in which circumstances the output of the internal oscillator is fed to the input—thus the accuracy of the drift meter depends upon the accuracy of the internal oscillator which will be discussed later.

Table 1 shows the accuracy of indication using the internal oscillator set as the instrument was received, it being observed that if the zero error is compensated for the accuracy is very good.

TABLE 1 DRIFT ACCURACY

±5% Range		±2% Range		±0.5% Range	
Indicated	Actual	Indicated	Actual	Indicated	Actual
+5%	+4.87%	+2%	+2.07%	+0.5%	+0.451%
+4%	+3.86%	+1.5%	+1.55%	+0.4%	+0.359%
+3%	+2.86%	+1.0%	+1.06%	+0.3%	+0.264%
+2%	+1.87%	+0.5%	+0.52%	+0.2%	+0.040%
+1%	+0.89%			+0.1%	+0.047%
0	—0.016%	0	—0.025%	0	—0.051%
—1%	—1.10%			—0.1%	—0.149%
—2%	—2.09%	—0.5%	—0.46%	—0.2%	—0.257%
—3%	—3.09%	—1.0%	—0.97%	—0.3%	—0.356%
—4%	—4.06%	—1.5%	—1.45%	—0.4%	—0.441%
—5%	—5.11%	—2.0%	—1.97%	—0.5%	—0.549%

The unusual addition of the lowpass filter in the drift meter proved to be an excellent practical feature with a wide range of damping of the meter

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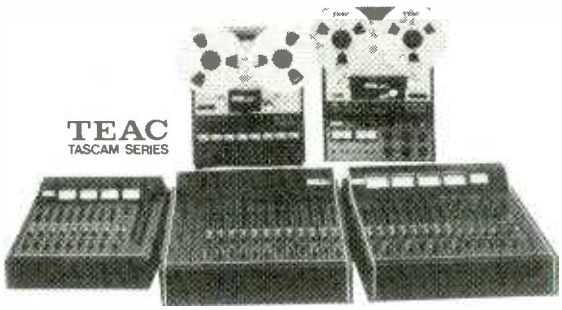

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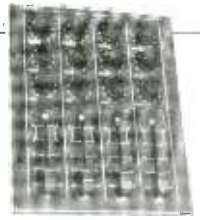

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resulting from the variable cut off frequency control.

Wow and flutter

Using a 3,150Hz carrier modulated to an accurately known depth at 4Hz, the weighted and unweighted measured wow and flutter were found to be identical, as should be the case.

Checking the frequency response of the IEC weighting curve showed that at all specified frequencies the instrument was close to the centre line of the curve and well within the allowable tolerances. Similarly, in the unweighted condition, the frequency response of the instrument was flat up to a flutter frequency of 400Hz falling to –3dB at 670Hz.

As is to be seen from **table 2**, the indicated wow and flutter on all ranges was close to the actual wow and flutter as derived from a 3,150Hz oscillator frequency modulated to an accurately known degree at 4Hz with the instrument's weighting in circuit.

TABLE 2 WOW & FLUTTER ACCURACY

Wow & flutter range	Indicated wow & flutter	Actual wow & flutter
3%	3%	2.93%
	2%	1.96%
	1%	0.997%
1%	1%	0.990%
	0.6%	0.609%
	0.3%	0.306%
0.3%	0.3%	0.300%
	0.2%	0.201%
	0.1%	0.101%
0.1%	0.1%	0.102%
	0.06%	0.0613%
	0.02%	0.0204%

The peak indicating ballistics of the meter were checked using the standard method of applying bursts of frequency modulation at a repetition rate of 1Hz and varying the burst length, the results being shown in **table 3** which also shows the standard IEC tolerances.

TABLE 3 METER BALLISTICS

Burst length	Meter indication	Standard requirement
100ms	98%	100%±4%
60ms	86%	90%±6%
30ms	60%	62%±6%
10ms	22%	21%±3%

As is evident, the instrument is generally well within standard requirements and furthermore it was found that the fall of the meter between 100ms bursts was precisely to 41% of full scale which is the centreline requirement.

Inputs and outputs

The minimum input voltage for operation of the instrument was found to be 28mV with an input impedance of 100kΩ, both of which are to specification and completely satisfactory.

The source impedance of the three monitoring outputs was satisfactorily low at the specified 10kΩ within 1% with the output voltage of the 'output 1' absolute pitch + flutter being fixed at 100mV for 5% error.

The output voltage of the 'AC components' output and the 'meter indicated flutter' depended upon the use of weighting and was directly related to the wow and flutter range in use. The 'meter indicated flutter' output is a DC output with +1V corresponding to full scale meter deflection whilst the 'AC components' output was ±1V for full scale deflection.

Turning now to the 3,150Hz oscillator output, this was found to be 540mV from a very low impedance at the front panel connection or a DIN compatible 11mV from a source impedance of about 8kΩ at the rear panel. Whilst as shown in **fig. 1** the frequency stability of this output is reasonable, but could well be bettered for use with professional recorders, the absolute frequency averaging 3,146.66Hz was too low as received. Attempts to correct this using the preset control in the base of the instrument showed that this control was far too coarse in action and that it was almost impossible to set the oscillator frequency to better than about ±1Hz (0.03%). The replacement of this potentiometer type control with a multiturn potentiometer would clearly be an advantage.

Summary

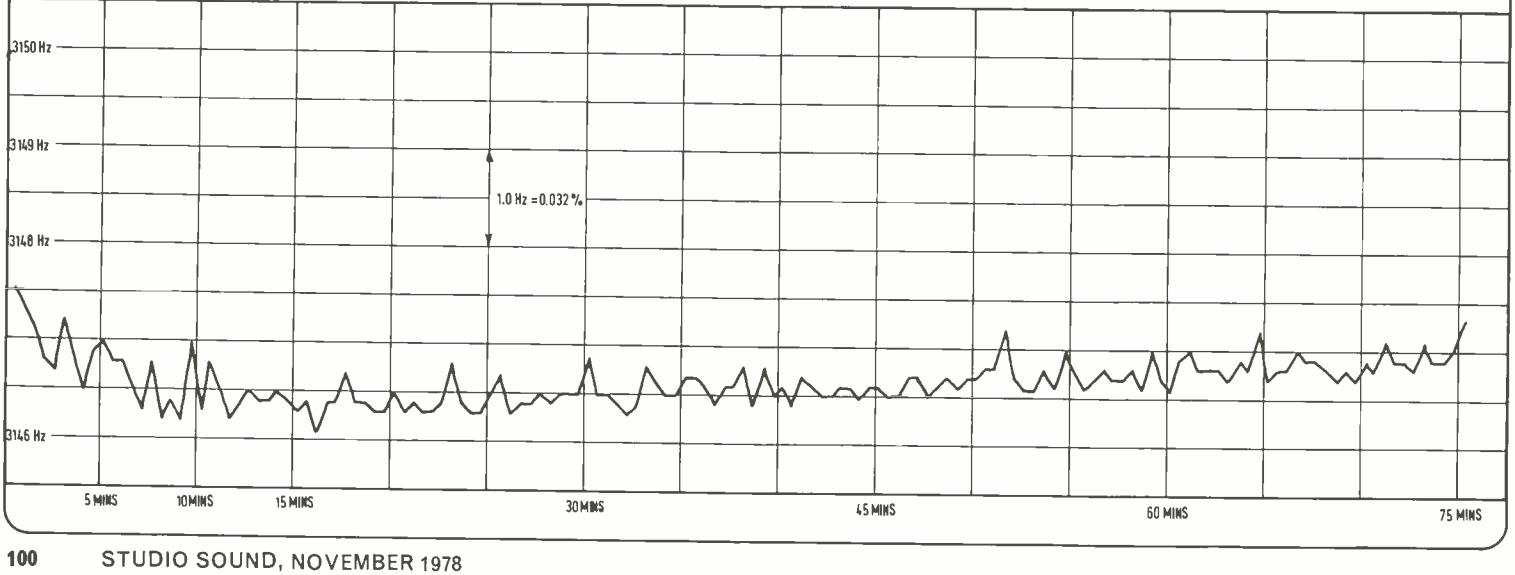
For the purposes of measuring wow and flutter to the IEC (DIN) standard, this is clearly an excellent instrument which is capable of accurately measuring the wow and flutter of all but the very best professional tape recorders, in addition to which it has the capability of using a frequency analyser for locating faults components.

Considering the drift measurement feature this depends upon the accuracy of the internal oscillator and in these circumstances it is felt that the use of the instrument to measure less than 0.2% drift with any useful accuracy is a doubtful proposition in terms of absolute drift from the 3,150Hz tone. However drift measurements which do not require an absolute reference, such as drift from end-to-end of a reel of tape, are completely satisfactory.

As with all previous Woelke instruments this is a practical instrument to use and is very well constructed.

Hugh Ford

FIG.1 WOELKE OSCILLATOR STABILITY



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THD	+4dBv line input to any line output at +4dBv, 20Hz < 0.03%, 1kHz < 0.01%, 20kHz < 0.05% Signal at mic input with 50dB gain (200Ω at source), 20Hz < 0.1%, 1kHz < 0.01%, 20kHz < 0.1%
Frequency response	+4dBv line input to any line output at +4dBv, 20Hz to 20kHz: −1dB Signal at mic input with 50dB gain (200Ω at source), 20Hz to 20kHz: −1dB
Noise	Relative input noise voltage, 20kHz Bandwidth, now −128.5dBv true RMS (200Ω source). Mixing noise, 24 channels routed to mix all at unity gain,< −80dBv (DIN audio weighted)
Input gain	Maximum mic, 85dB Maximum line, 70dB
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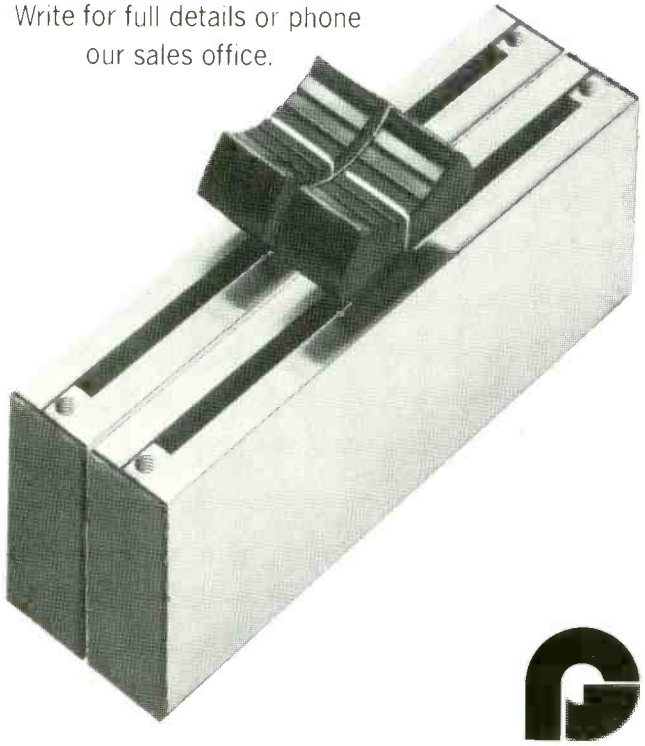

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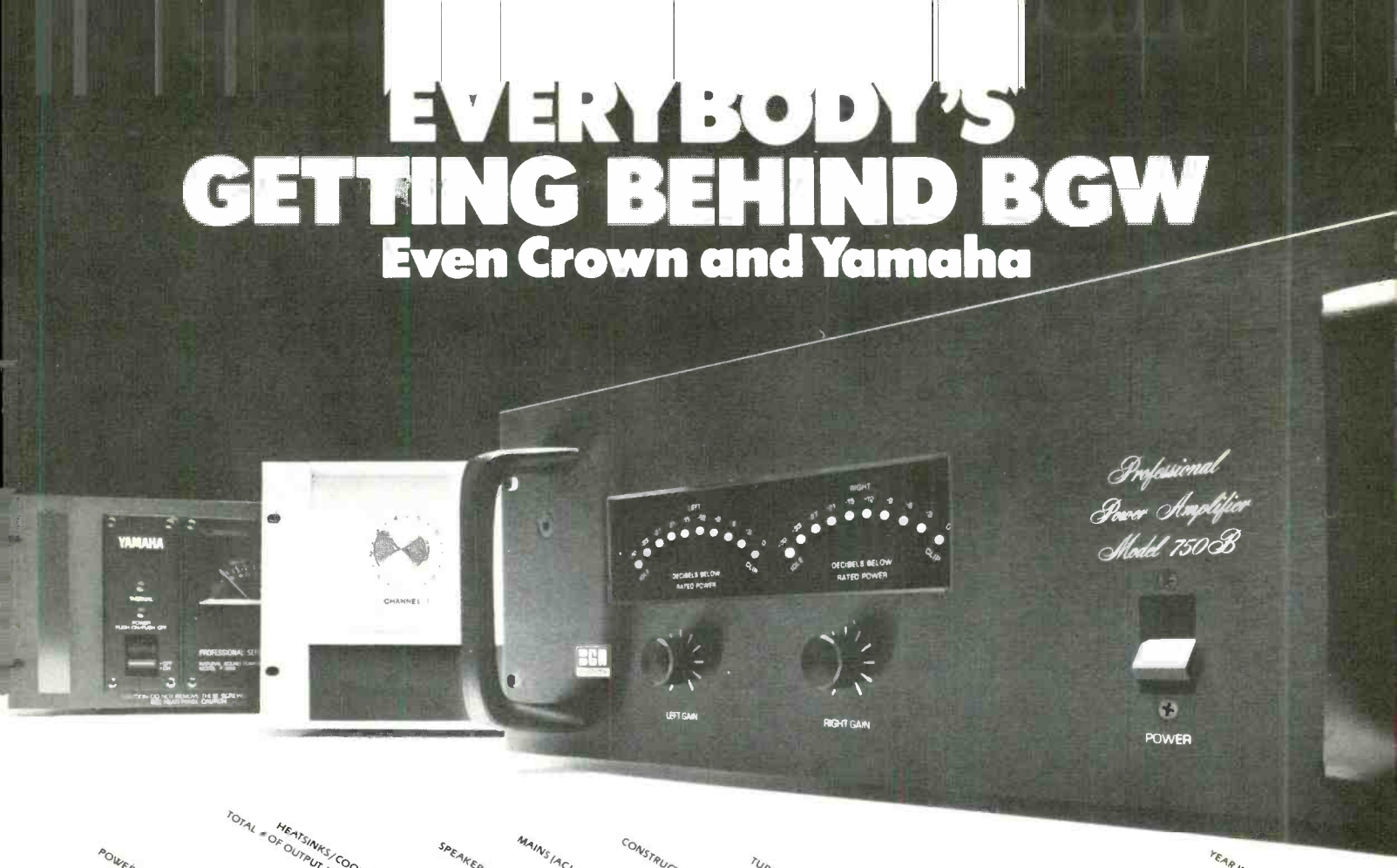

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CROWN DC300A	155 Watts/ch.	NO FTC RATING	16	Passive airflow only	None provided	Rear panel fuse only	Hard-wired, non-modular	None	Quasi-complimentary	Not specified*	$ 919	1974
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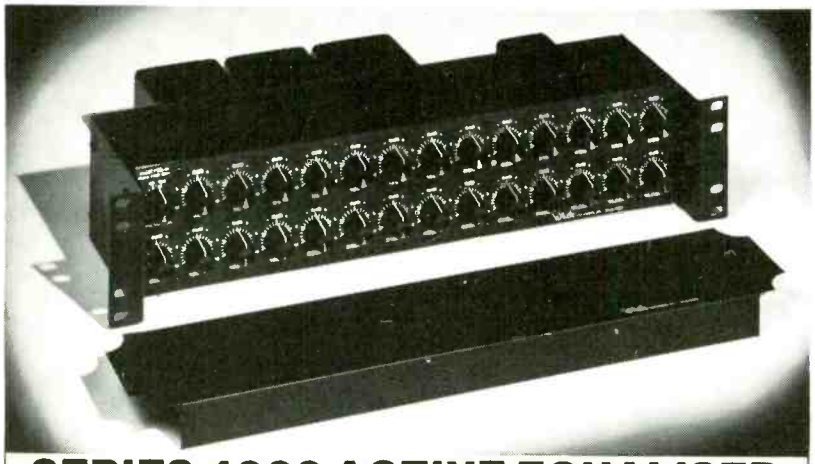

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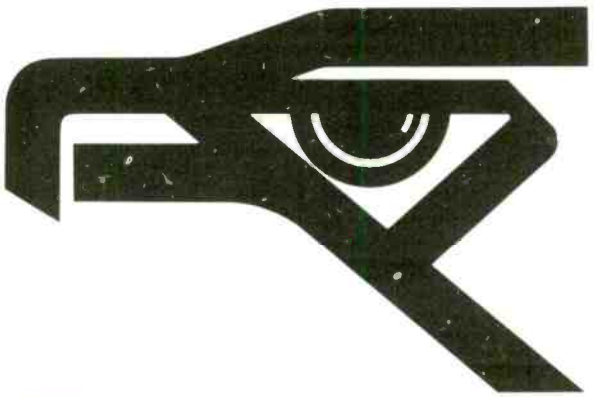

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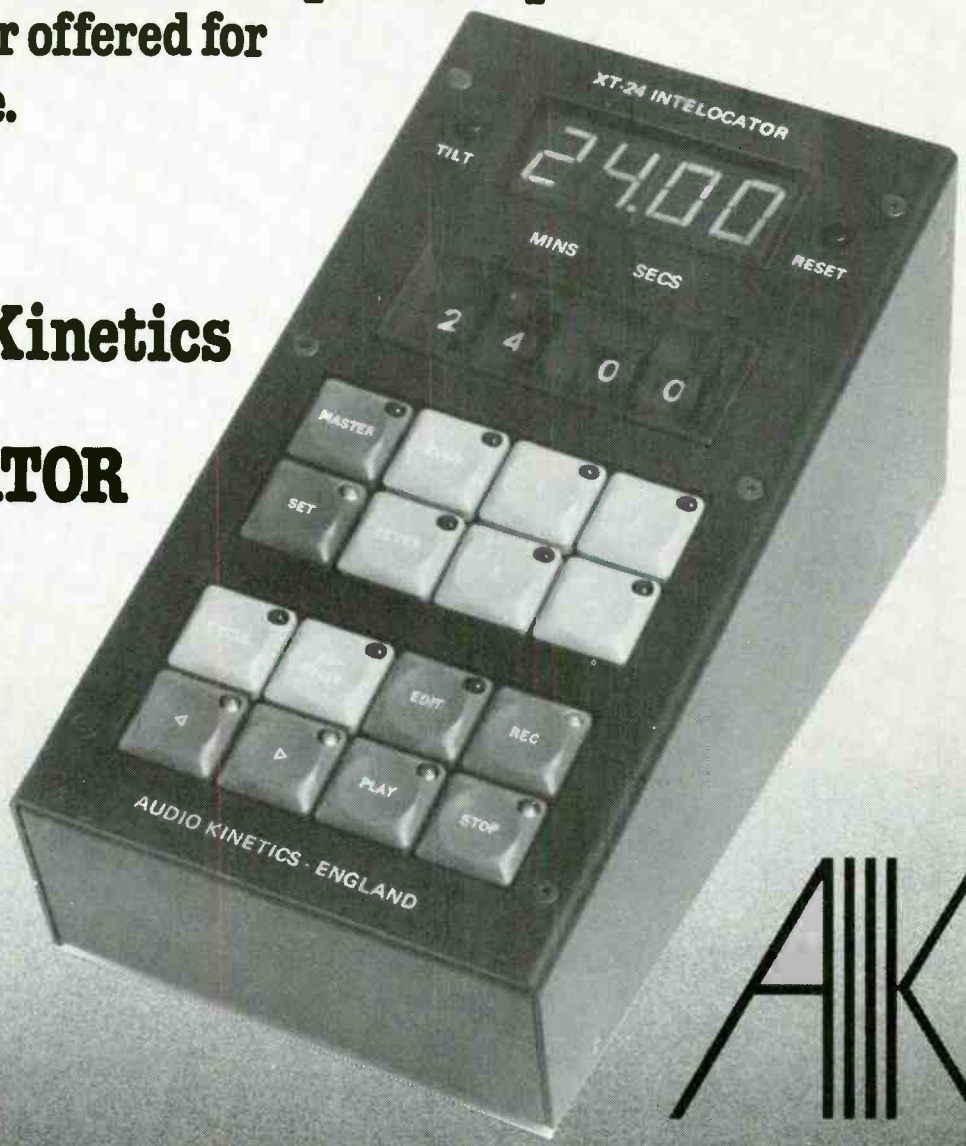

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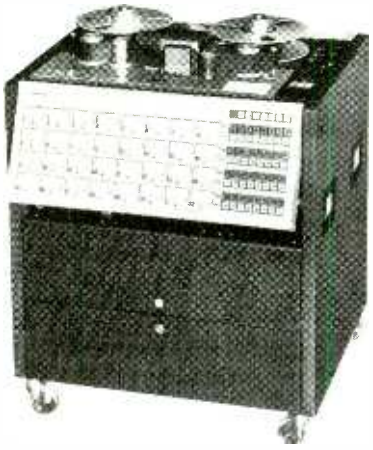

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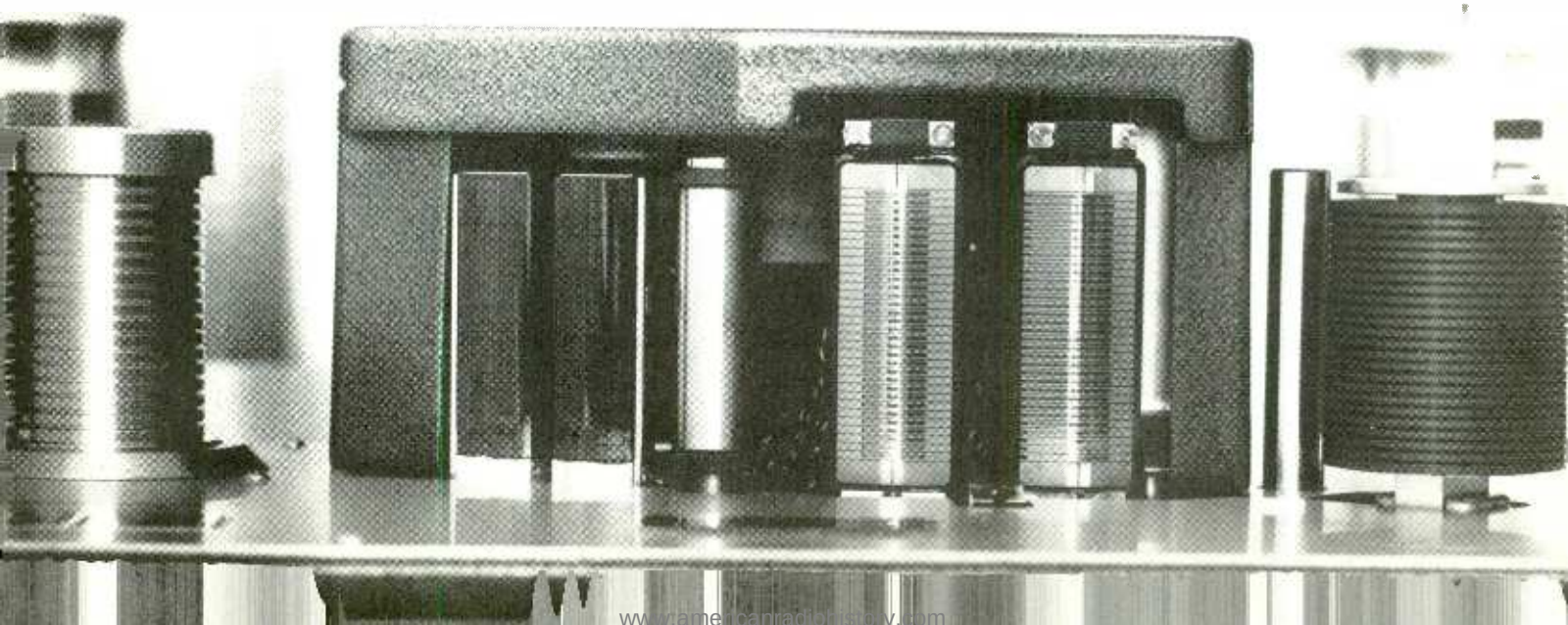

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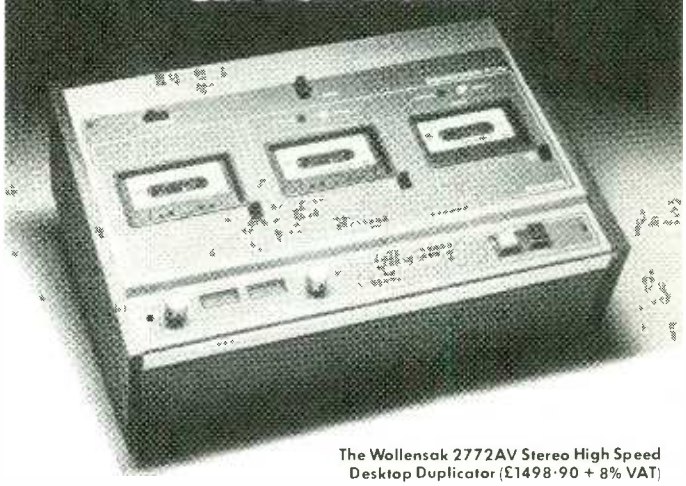

The Wollensak 2772AV Stereo High Speed Desktop Duplicator (£1498·90 + 8% VAT)

Quality The 3M Wollensak 2772AV Duplicator is a high speed cassette to cassette duplicator for fast stereo (or mono) copies – two stereo copies in under four minutes.
If you need to be technical: Crosstalk 45dB, frequency response 50–10,000 Hz±3dB, wow and flutter 0·15% rms max., speed accuracy ±1%, s/n ratio within 3dB of master.
Versatility Because these copies have such professional quality, leading recording Studios like **Dick James Music** use them. They've a rapidly growing place in university or college music departments, local radio stations, and advertising agencies, too.
Simplicity This duplicator sits happily on any desk or table. Its colour-coded illuminated push buttons interlock to prevent accidental damage. Old programme material on copies is automatically erased. Automatic rewind, manual rewind switch, visual and aural monitoring facilities.
From Fraser Peacock Associates – the audio visual specialists Use the coupon for more about this machine's ruggedly reliable quality. And remember the Fraser Peacock name for advice on conference presentations, film strips, recording sessions and a complete range of audio visual equipment for sale or hire.

Please tell me more about the Wollensak 2772AV Duplicator.
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Address_____

fpa
To Fraser Peacock Associates Ltd.
94 High Street, Wimbledon Village, London SW19
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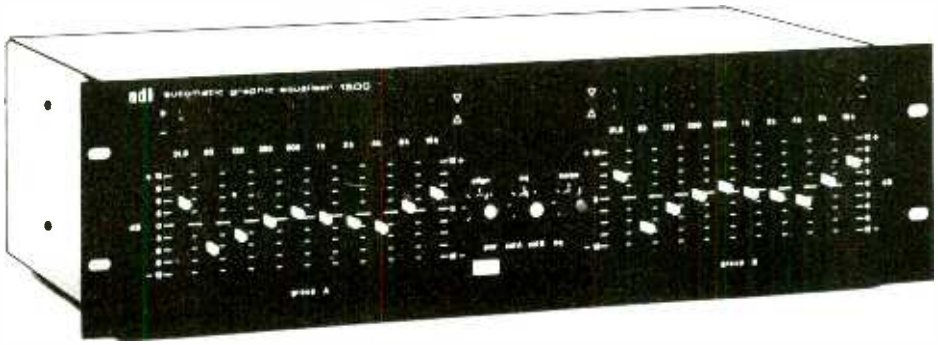

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★**If quality** and reliable, prompt service matter, study our comprehensive quotation for pressings (short runs, too!) from your or our Mastertapes. Studio facilities (Steinway Grand), mobile units, sleeve printing service. Please detail immediate requirements to Mike Bull, Sound News Studios, 18 Blenheim Road, London W.4. 995-1661. L

★**Disc cutting.** Masters and Demos, Pressings, Cassettes, Mobile Recording Studio. Free brochure. TAM Studio, 13a Hamilton Way, London, N.3. Tel. 01-346 0033. F

★**Your tapes to disc.** Vinyl pressings, sleeves, labels. In our own pressing plant. Top quality. S.a.e. for photo leaflet. Deroy Records, Cove, Dunbartonshire G84. X

★**Printed circuits.** Euro circuits are specialist manufacturers of printed circuit boards for the industry. We understand your problems and can offer you a considerate and first class service. When you need fast prototypes or small/medium runs in an impossible delivery time, give Pat a ring on West Kingsdown (047485) 2344. Euro Circuits Ltd., Highfield House, West Kingsdown, Kent. K

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★**Attention northern recording studios,** we are looking for creative recording facilities. We need a studio with an extensive library of music and voices, both male and female for the production of AV Sound Tracks. Contact Robert Bowhill, giving full details at 2a Prospect Crescent, Harrogate, North Yorkshire. Tel. 0423 502518. K

★**Wow and flutter meter,** Rank Kalee type 1740, similar to latest model, calibrated and in good working order. £150 plus VAT. Burgess Lane & Co. Ltd., Thornton Works, Thornton Avenue, London, W4. 01-994 5752 and 5953. X

★**Revox, Teac,** Otari, Brenell, Tascam, Nakamichi, Tannoy sales and service. The Music Laboratory. 01-349 1975. X

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STUDIO FAC. (contd.)

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★**Spectra Sonics 1024-24 Recording Console,** 24 in-out, producer's desk, 18 months old, excellent condition, $25.000. Phone (805) 966 6630, 966 1271, U.S.A. K

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★**3M's M79** 16+24 H/blocks, 4 x JBL 4311 WX's and an Otari MX 7300 series 8T recorder. Offers—tel. 0203-21000. X

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★**Wanted. Revox and Teac** Tape Recorders. Best prices paid. R.E.W. Professional Audio. 01-836 2372. X

★**Teac 3340 (S) urgently wanted.** The Music Laboratory. 01-349 1975. X

★**Tannoy Speakers Wanted.** The Music Laboratory. 01-349 1975. X

★**Revox's urgently wanted.** The Music Laboratory. 01-349 1975. X

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★**Major New York City** recording studio seeking top notch creative maintenance engineer. Excellent opportunity. All enquiries confidential. c/o Studio, P.O. Box 275, Old Chelsea Station, New York (New York 10011), U.S.A. L

★**Sound Mixer** required by top audio and video facilities house. Must be experienced in professional sound recording or broadcast work. Preferably under 30 and prepared to work overtime. Basic salary £5,000 plus bonuses. Contact Stefan Sargent, Molinare Ltd., 43 Fouberts Place, London W.1. 01-439 7631. K

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★**Capable, creative electronics** engineer, 30, conversant in analogue and digital, seven years varied industrial experience, plus three years with 16-track studio, seeks well paid position with London Studio or similar. Write Box 795, c/o STUDIO SOUND. K

WANTED

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★French experienced maintenence engineer seeks position in English recording studio. Philippe Melkonian, 27 Rue Jacques Richard, 24500 Champigny, France. K

★Maintenance Engineer required urgently for Gus Dudgeon's beautifully equipped private studio near Maidenhead. Salary negotiable. Working conditions probably the best in the country. Please contact Sue Cooke on Bourne End (06285) 20286/20259. Address: Sol Mill, Mill Lane, Cookham, Berkshire. K

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sound equipment, contact

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Audio & Design (Recording) Ltd.

have a vacancy for a

UK SALES ENGINEER

based in READING, Berkshire

The person we are after should preferably be single, educated to 'A' level Physics/Maths and/or OND Technology standard and possess a current driving licence.

Since the work involved will require close contact with our customers previous experience as an audio electronics engineer or in a recording studio will be considered an advantage.

After an initial familiarisation period of about six weeks the successful applicant will be responsible for fitting customers options to standard equipment and the after sales service/repair schedules, both in the workshop and on site. Additionally some degree of sales support and overseas travel will be required.

Salary is negotiable depending on applicant's experience and qualifications and will include a car allowance.

If you are interested please write to:

The Personnel Director
Audio & Design (Recording) Ltd.
84 Oxford Road
Reading RG1 7LJ

quoting reference (KJB/SESS/0978) giving curriculum vitae and current salary.

Applications for this post should reach us no later than December 31st, 1978.

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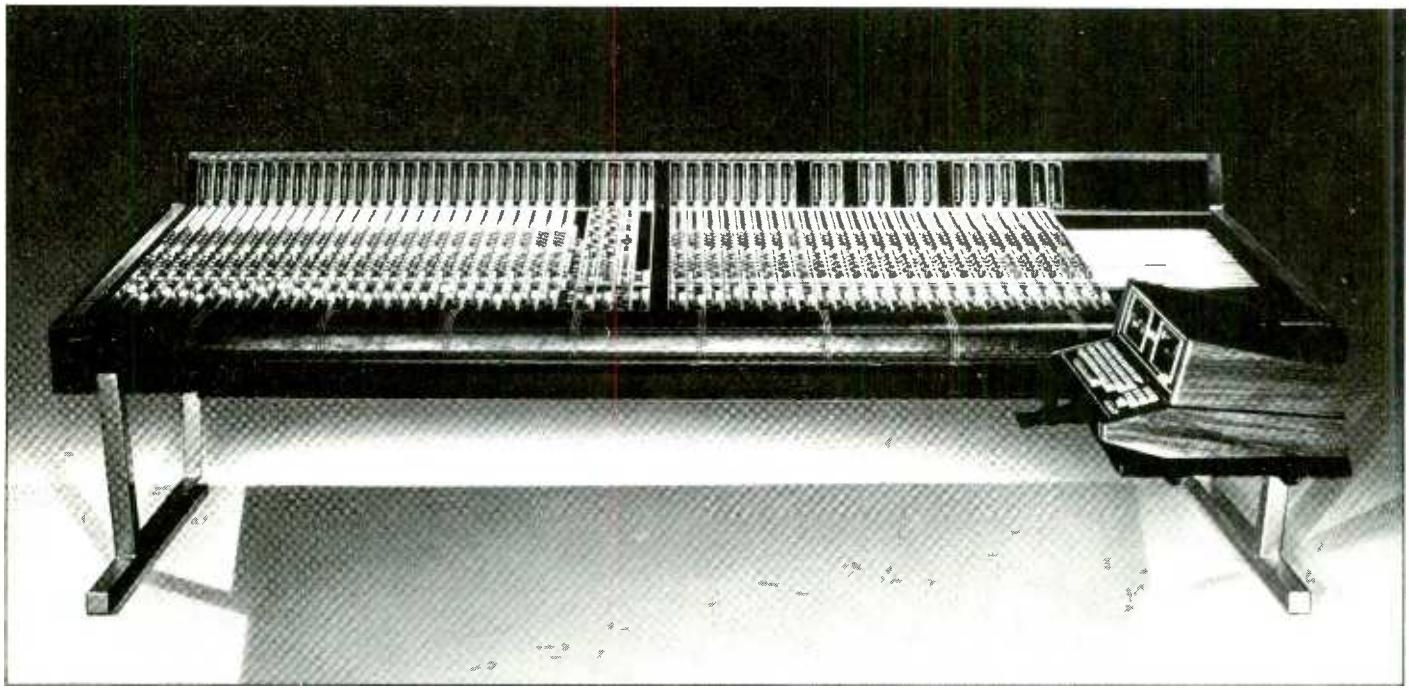

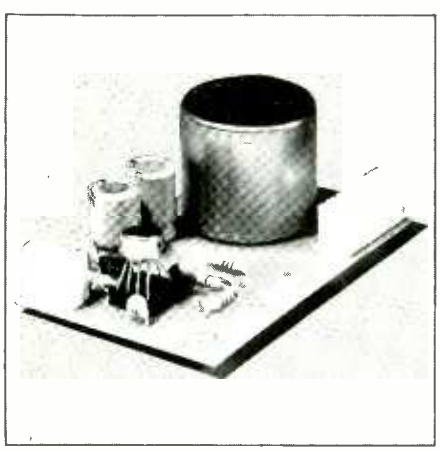

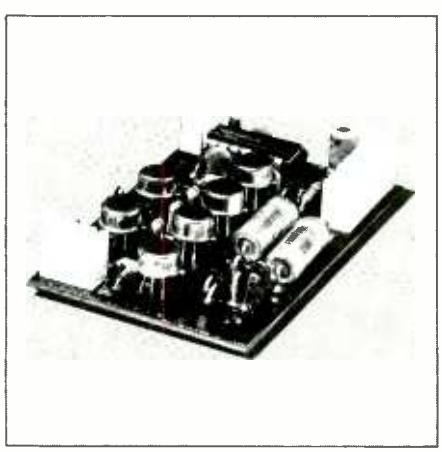

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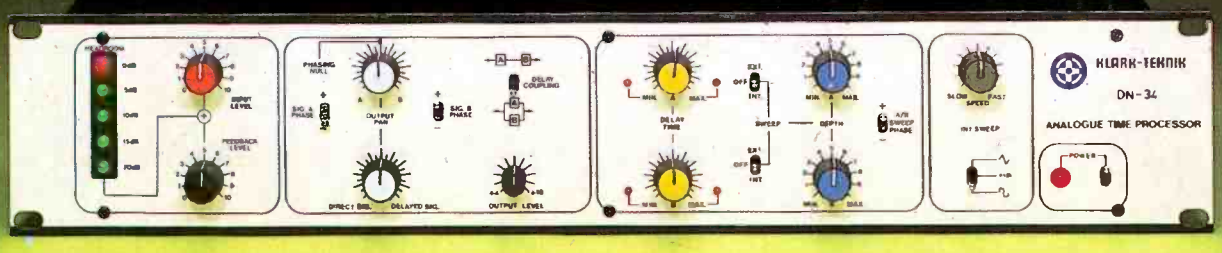
The new DN34 analogue time processor.



Think of the effect you'll have.

The new DN34 analogue time processor is an exceptionally versatile signal processing and special effects unit, designed around two discrete, independently controllable delay sections.

Like other Klark-Teknik products, the DN34 is the result of intensive research and development – the best there is in state-of-the-art analogue delay technology.

With a product of this stature you can achieve all these effects cleanly and noiselessly.

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- Negative flanging.
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- Resonant flanging.
- Triple tracking.
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- Pitch shifting.
- True vibrato.
- Chorus.
- 'Cardboard tube' echo.
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And, if this isn't enough, the DN34 can give you such new effects as:–

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