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NOVEMBER 1975 VOLUME 17 NUMBER 11

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FEATURES

COLUMNS

REVIEWS

Education is a difficult subject for the recording industry. The traditional way is the apprentice one, tea making as appropriate (or cleaning the tea machine in up-to-date establishments). There are three options. The first has been mentioned, and while selection can be rather erratic, it has worked pretty well up to now. Then there is the vocational course, which can present the information needed up to a point but can suffer from shortage of experienced teachers: centres of knowledge in the recording industry tend, unlike Medieval English, not to be associated with centres of learning. The third path to an 'education' is the relatively rarified university course where, if the subject matter is not relevant, at least in principle the students are taught to learn.

It is, however, the conspicuous failure of such higher education to provide satisfaction in both cultural and vocational aspects. The product is generally a raw graduate equipped to enter the real commercial or technical world but is uninspired, or alternatively a character bursting with irrelevant and impractical ideas. The paper qualification at the end shows a certain exposure but little more, as employers in general have been discovering for the past few years. But the laziness that this can encourage in organisations who filter prospective employees by qualification is considerable, a deficiency which the universities themselves are far from free in their own selection procedures.

So far, this is pretty irrelevant to the recording industry. But with the increase in conventional education applications it must beware that paper qualifications are never assumed obligatory: they may be helpful, but are never any guarantees of performance in this or any other field. The impotent arrogance of some US organisations in claiming that qualifications will become necessary is unfortunate. In the UK, the BBC has suffered from the no qualifications-no entry syndrome since anyone can remember and presumably ignored a few people they might have afforded not to, although the gain was probably that of the London recording industry. Thus, while there have been successes in recording techniques courses, there have also been pretentious failures. The latter would never provide a good judge of would-be engineers, but they must not divert from the occasional very valid professional effort that appears. But even the best courses must avoid pushing the paperwork. It may imply respectability, but that in turn usually leads to fossilisation.

STUDIO SOUND is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.

DISTRIBUTION
STUDIO SOUND, published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. It is available without charge to qualified readers; these being directors, managers, executives and key personnel actively engaged in the sound recording, broadcasting and cinematograph industries in any part of the world. Non-qualifying readers can buy STUDIO SOUND at an annual subscription of £5.80 (UK) or £6.00 overseas.

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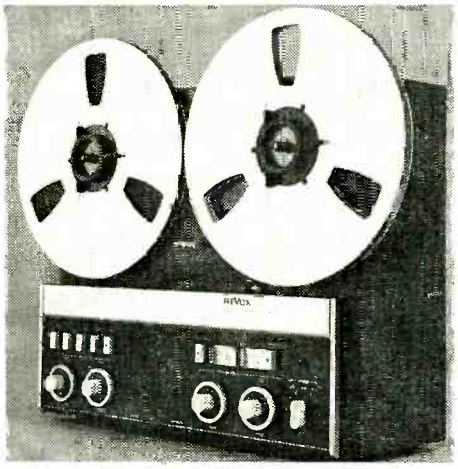

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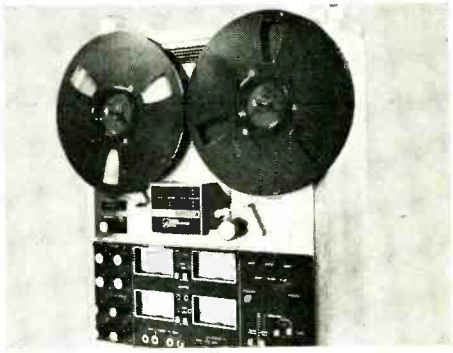

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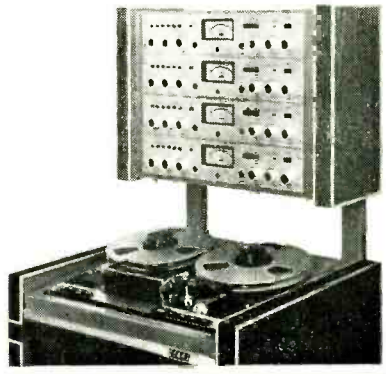

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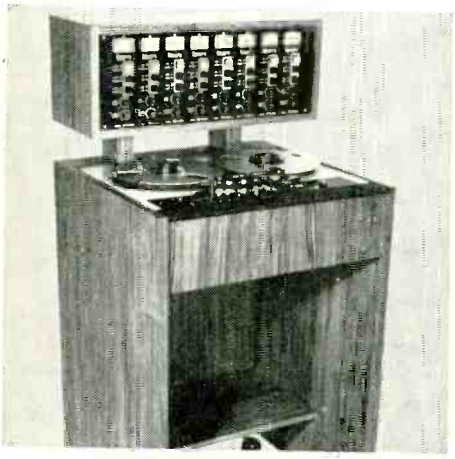

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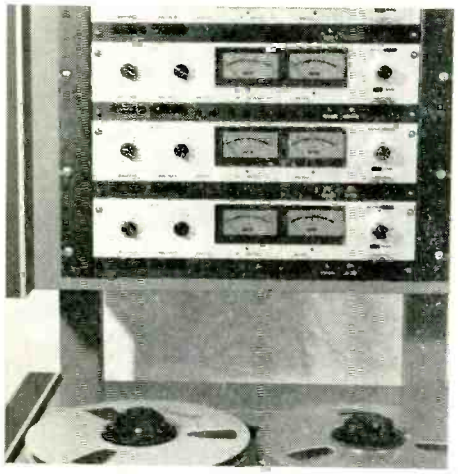

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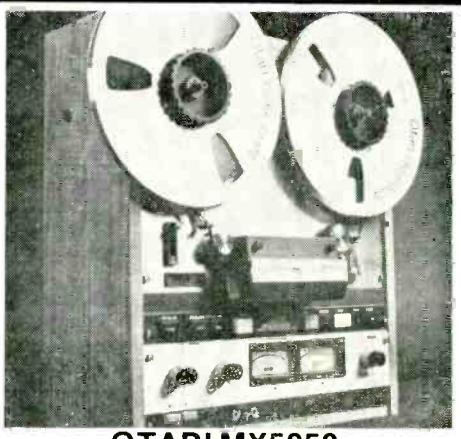

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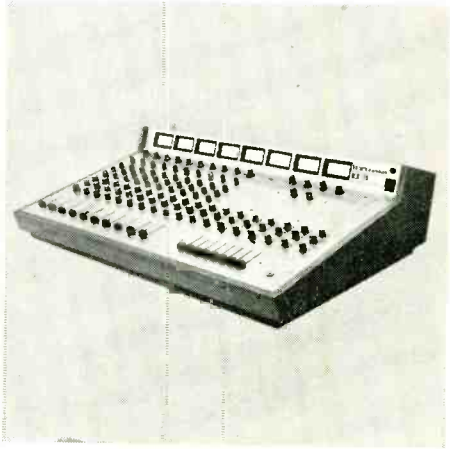

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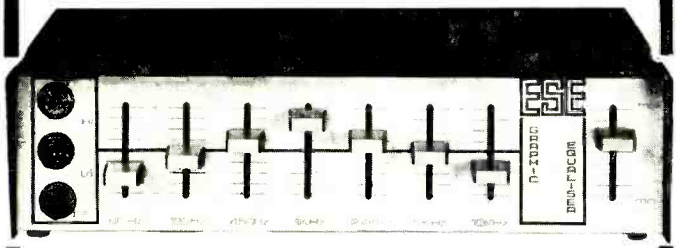

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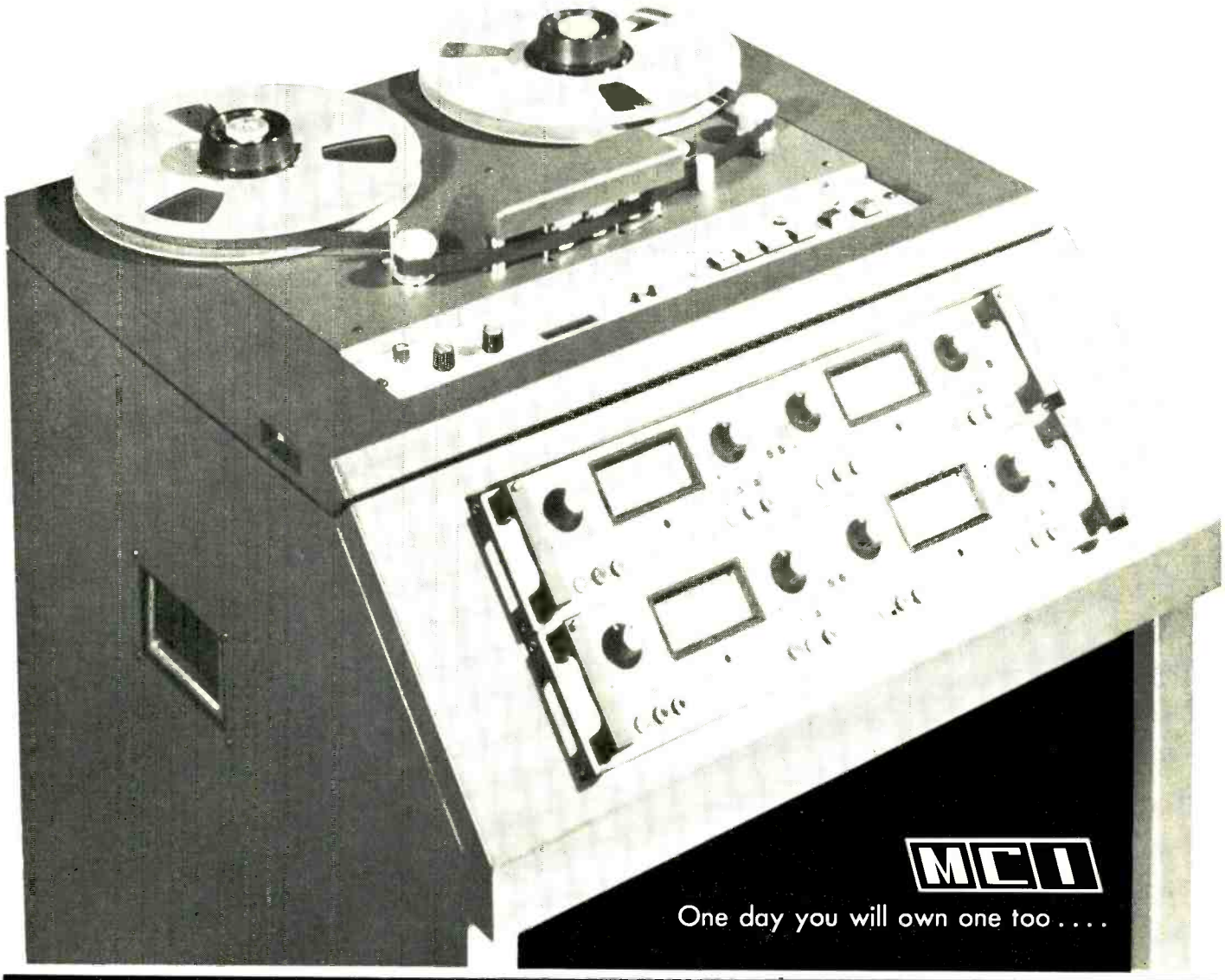

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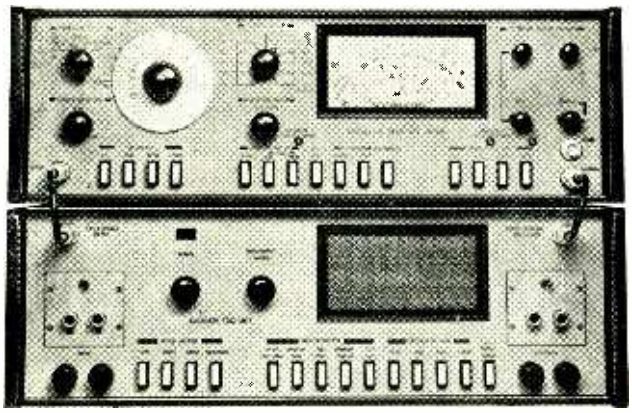

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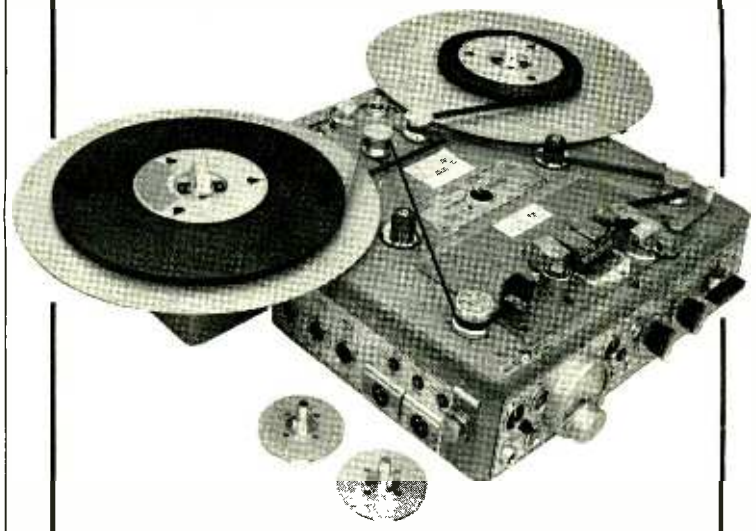

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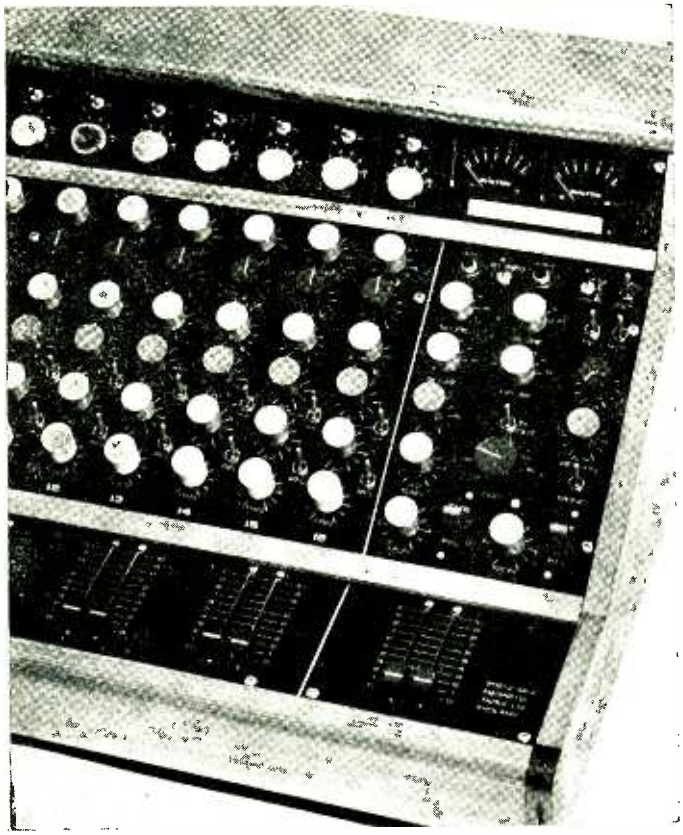

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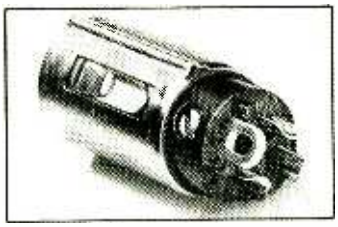

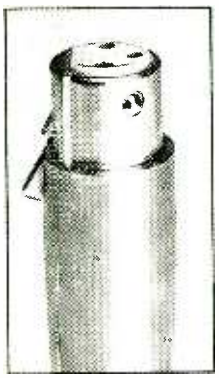

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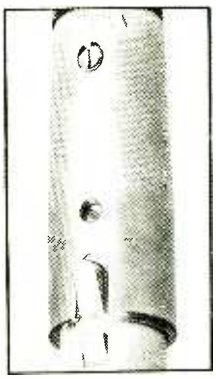

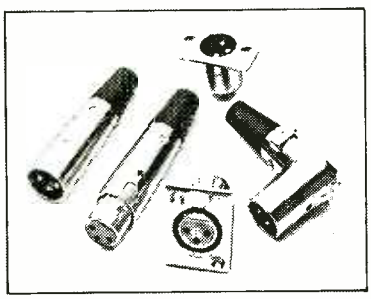

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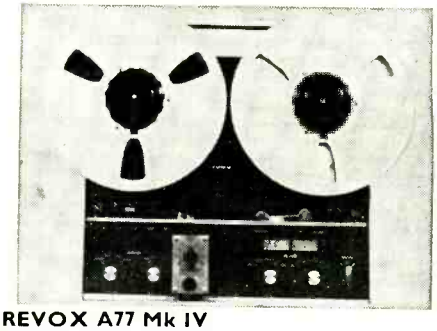

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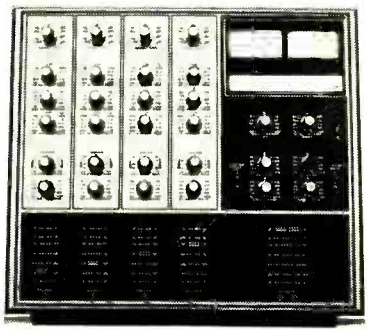
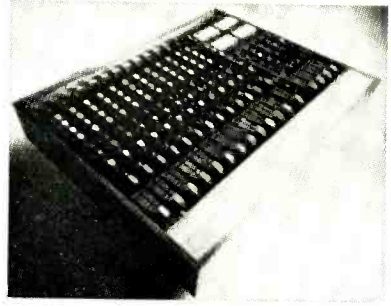


SPECIAL OFFER FAMOUS MIXER

This high quality inexpensive 4/2 mixer incorporating 3 band eq, pan pots, faders, limiters and echo send controls make it a good starting point for the basic mini studio set up.

R.R.P. £139 + VAT
REW Nett Pro Price
£99 + VAT
Power supply extra



SOUNDCRAFT 12/4

Just arrived—12/4 Recording Console which is built into a teak case, incorporating 12 input and 4 output channels, output limiters, and full monitoring facilities. All input and output connectors are Switchcraft (XLR equiv.) except line input which are $\frac{1}{4}$ jack. 200 ohm mic. inputs are balanced. 4 band E.Q.; f/b send; echo send; pfl; channel switch; pan pots and faders.

NETT PROFESSIONAL PRICE
£975 + VAT

ALLEN & HEATH POP MIXER 16/2. ALLEN & HEATH MINI MIXER 6/2. ALLEN & HEATH MON MIX. BOX 5/2. SOUNDCRAFT 12/4. SOUNDCRAFT 16/2. ALICE AD62 6/2. AUDIO TECHNICS MM42 4/2. SONY MX16 8/4. LAMB PML422 4/2 (PROVISION FOR 8/4)

NEW TRADE PRICE LIST JUST OUT — SEND FOR YOUR FREE COPY NOW

REW Audio Contracts, 146 Charing Cross Road, London WC2. Tel: 01-240 3064/5

VIDEO, INDUSTRIAL AND STUDIOS AT

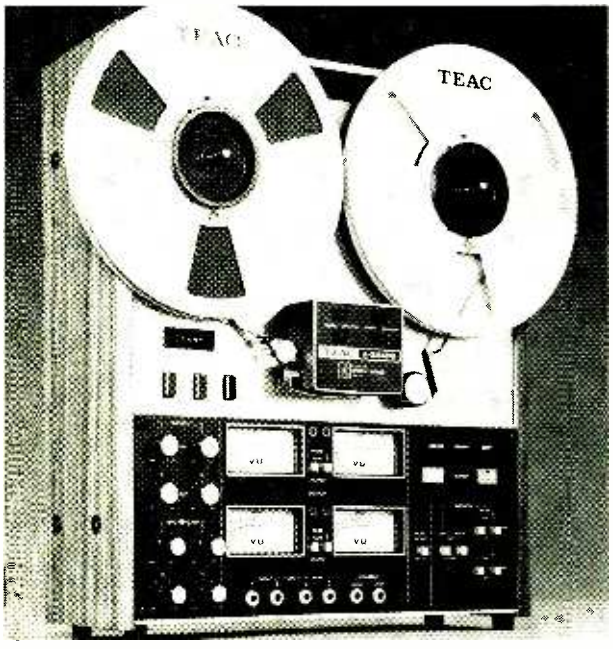
REW Video Contracts, 10-12 High St., Colliers Wood, London SW19. Tel: 01-540 9684/5 Telex 896194

Meet the creator. The TEAC A-3340S.

Think of a professional recording studio engineered into a 50 lb package — at a fraction of its cost — and you'll have an idea of the capability of the TEAC A-3340S 4-channel tape deck.

Consider its versatile features. Like Simul-Sync. It allows you to record several instruments and voices at once or at different times *individually*. And each track of the Simul-Sync record head can be electronically switched to permit monitoring of the previous tracks as each new track is being recorded. Since the A-3340S is a 4-channel deck, you can lay down four individual tracks at the exact recording levels you desire. This material may be mixed and subtly blended together at a later date until the desired end result is achieved.

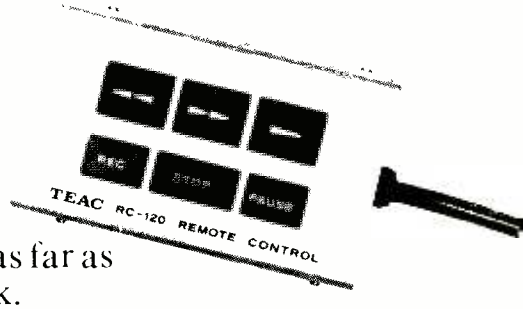
TEAC is innovator of the 3-head/3-motor tape transport system. A 4/8 pole, dual speed synchronous motor powering an extra heavy, balanced flywheel drives the capstan. This motor assures a stable and constant tape run, impervious to line voltage fluctuations or other external factors.



TEAC's own Permaflux heads, specifically designed for 4-channel operation, are notable for their excellent frequency response and low distortion.

Simple and positive touch-button controls enable you to move through directional functions (play, fast forward, stop, record, pause and rewind) with a mere touch of the finger. All of the six control buttons are positioned for easy operation.

With the RC-120 remote control unit (optional extra) you don't have to hang over the A-3340S. All the basic transport functions will be at your finger tips as far as 16 feet away from the deck.



Separate Bias and EQ switches maintain a compatible adjustment between the tape deck's electronics and the different types of tape.

The "Punch-in" record feature permits you to go directly from play mode to record mode (running splice). This facilitates creative recording and editing, and is a valuable, unique feature of the A-3340S.

Signals from 8 sources (4 line and 4 mic inputs) may be recorded simultaneously. Independent mic and line preamps, each with its own level control, provide maximum flexibility for creative recording, and permit input from a combination of line/source and mic signals.

The A-3340S with its 10½" reel capacity is an inexhaustible partner in the creative process — one that opens up a realm of original sound limited only by your imagination.

TELEDYNE ACOUSTIC RESEARCH High Street,* Houghton Regis, Dunstable, Bedfordshire LU5 5QJ Telephone: Dunstable (0582) 603151

Tandberg 10XD.

In the field of professional audio equipment, you can spend a lot of time piecing together information, comparing notes on standard and optional features, across so many different tape decks.

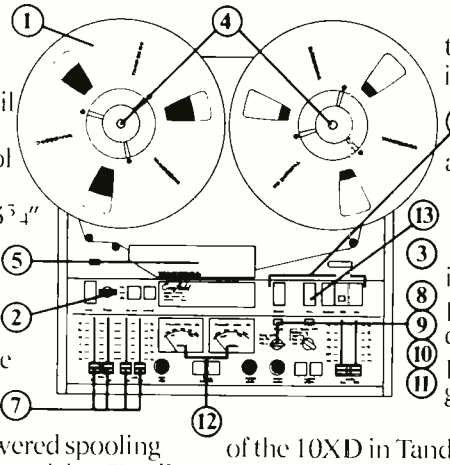
With all its refinements, the 10XD means you've hit the nail squarely on the head first go.

1. The 10XD will take any spool up to the 10½" size you see here.

2. The three speeds 15", 7½" & 3¾" all have the benefit of Tandberg's Crossfield recording technique, along with the unique Dolby B facility.

3. High speed accuracy from the electronic drive with tachometer control.

4. Behind here are two high powered spooling motors and over here **(5)** are four precision Tandberg heads – one more than you'll get on many units.



All the operating functions of the 10XD are electronically controlled, with the facility for remote control wherever needed **(6).**

7. Four input controls, including two for balanced microphone inputs that allow you to mix in stereo.

8.9.10.11. Facilities for echo, sound on sound, editing, cueing and A & B tests.

12. Peak-level meters.

13. Photo electric stop.

The nice thing about the 10XD, is that you don't need to be a professional to appreciate all these qualities. Anyone with an ear for precision sound reproduction, will get a thrill out of this machine.

There's a detailed breakdown of the 10XD in Tandberg's special colour leaflet.

Use the coupon to get your free copy, and the name of your nearest Tandberg dealer.

The working man's tape.

To:- Tandberg (U.K.) Limited, Farnell House, 81 Kirkstall Road, Leeds LS3 1HR.
Please send me complete details of the 10XD and all other Tandberg sound equipment.

Name _____

Address _____

SS/10/170

TANDBERG
Legendary perfection

Sparta broadcast gear

Designed for broadcast applications, the *3310* 10/1 format mixer employs solid state voltage controlled switching to expand the effective inputs to 10 microphone or 18 line level inputs. A bridging input for channel eight accommodates up to five tape cartridge playbacks without interaction. Other standard facilities include high power intercom, precision step attenuators with cue dent and split output lines offering identical programme and audition busses. The ten microphone inputs appear at faders 1 to 4; the line level inputs, terminating at faders 5 to 10, include two channels selectable to five sources each. Audio from either buss can be sent back down any of the five remote lines, or can assign the selected remote line to a particular fader.

Other new products from the company include a new 35 kW fm transmitter capable of providing 100 kW erp when coupled through an eight inch transmission line to a six-bay antenna. The *635* utilises a *605B* 5 kW exciter/driver unit which, in the event of pa failure, can provide useful back-up power. The installation is fully protected against damaging vswr and incorporates a 'tally light' troubleshooter system.

The *3310* mixer costs $2600 fob, *635* basic transmitter $38 000. Sparta Electronic Corporation, 5851 Florin-Perkins Road, Sacramento, Ca 95828, USA. Telex: 377488.
UK: CEC Ltd, Shaftesbury Street, High Wycombe, Bucks. Phone: 0494-37529.

Electret pickup cartridge

Using capacitor motor elements, the Micro Acoustics *QDC-1* requires no high Z preamp or phantom powering. The unit develops an emf of 3.5 mV (5 cm/s peak recorded velocity) at a purely resistive output impedance of 8k ohms and requires identical eq to conventional moving coil or magnet pickups.

The manufacturers claim that the frequency response of the basic transducer is flat (eq RIAA) from 5 to 50k Hz; they suggest that CD-4 response can be obtained from the stereo unit simply by changing the stylus. The advantages the pickup system may accrue from the lower output impedance which could cut noise by more than 3 dB, and improved transient performance from the low tip mass (0.35 mg) due to the absence of magnets or coils on the transducer side of the cantilever.

The importers are the Webland Group who also handle KLH speakers, Superex headphones and BGW amplifiers. Webland Group of Companies, Mirabel House, 117/121 Wandsworth Bridge Road, London SW6. Phone: 01-736 0987/8/9 0.

Flying Studio Sound

An express subscription service is now offered whereby Studio Sound can be air mailed anywhere in the world, to arrive within a few days of publication. Costs for all the countries covered should be detailed next month, but USA/Canada will be £10 or equivalent and Japan £13.60 or equivalent for 12 issues.

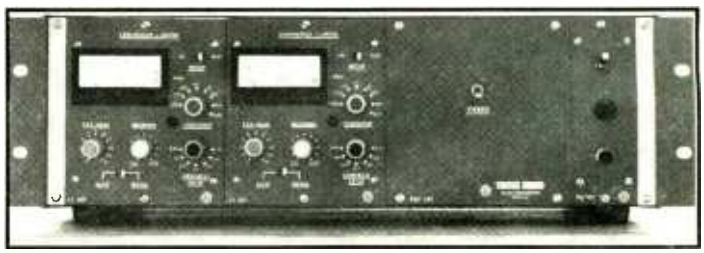
Should the subscriber not qualify for free issues (see p3 'Distribution'), an additional subscription charge is also payable.

New Tweed products

The first of these is a compressor/limiter *CL601* with an attack time of about 5 ms and a release time variable over a 30:1 ratio; the release time can also be set for automatic operation dependent on programme time within the limiting area. Extract from specifications:

Fixed gain: 0 to 10 dBm
Max output: 24 dBm
Noise: —87 dBm at 0 dBm
Distortion: less than 0.03% residual, 0.1% operating
Compression ratio: between 1.5 and 20:1
Threshold: —20 to 10 dBm
Release: 100 ms to 3s
Mounting: two *CL601s* and a side mounting power supply occupy a standard 19 inch rack

The second product is a stereo 100W/channel monitor power amplifier specified to deliver the rated power over a 20 to 20 kHz bandwidth. The noise figure, measured over the same bandwidth, is claimed to be 100 dB below 100W. Input attenuators, led overload indicators and short circuit protection are standard features of the 19 inch rack mounting amplifier. Inputs, outputs and



mains power interface via *XLR* connectors. Tweed Audio, Rosewood Industrial Estate, Kelso, Roxburghshire, Scotland. Phone: 057 32-2983.

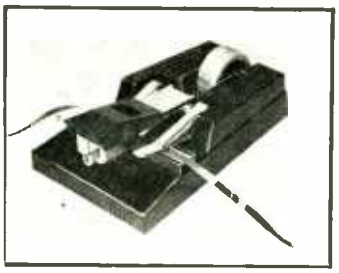
Sandy Brown Associates

Following the death of founder-member Sandy Brown, the partnership of acoustic consultants comprising David Binns, Dick Bowdler, Neil Spring and Alec Burd states that it will continue under the same name from the original address: 12 Conway Street, London W1P 5HP. Phone: 01-388 2571/5.

Nice splice

They call it a 'Gibson Girl' for reasons best known to themselves for the unit is a 6.25 mm splicer with a renewable cutting blade and pad assembly. Manufactured by the Robins Industry Corporation, the *R26038's* claimed benefits include a slight trim to the edges of the spliced tape thus keeping adhesive off the tape path.

Other features include a single knob with 'cut and trim' positions. Spring loaded arms lock down to



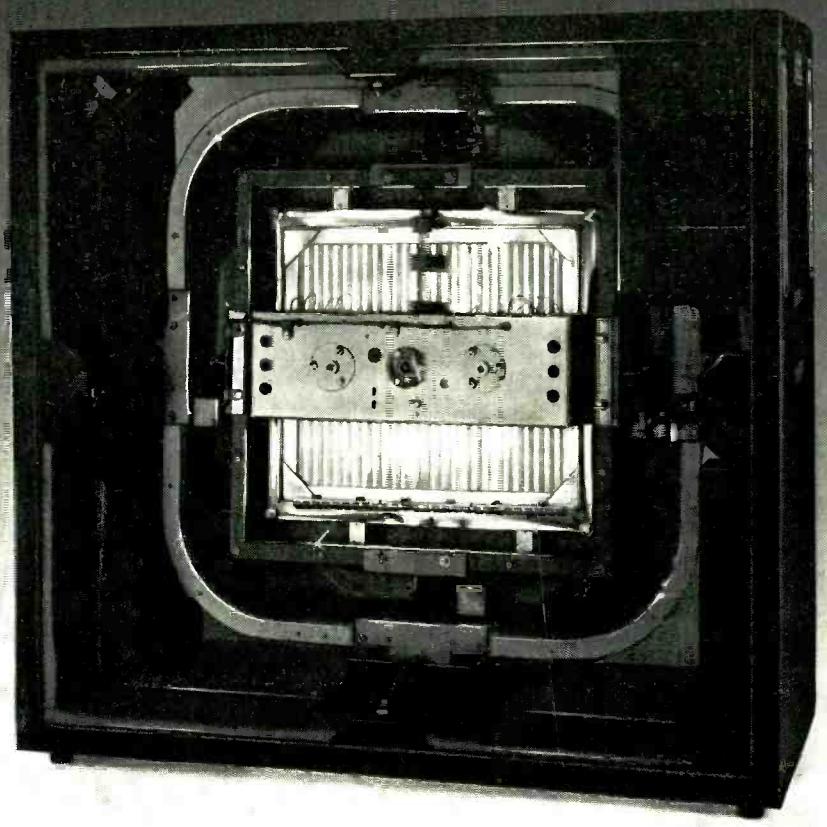
hold the tape in position and the cutting blades, protected by rubber pads, are exposed only when actually splicing. Blade adjustment is provided. Consumer Products Division, Robins Industries Corporation, 75 Austin Boulevard, Commack, Long Island, NY 11725, USA. Phone: (516) 543-5200.

Grovel

Recently the *Melody Maker* carried a block advert from the Beecham Group, apologising to Charles Aznavour for 'any inconvenience or embarrassment which may have been caused to him' by the voice-over used in a Silvikrin television commercial. The implication of the advert was that it came as a complete surprise to Beecham when it was suggested to them that the voice sounded like that of M. Aznavour, and they immediately 'willingly changed the soundtrack to meet his objection'. As it is widely believed that the voice used was that of singer Nick Curtis, who normally sounds nothing whatsoever like Charles Aznavour and must therefore have been deliberately adopting a silly voice for the commercial, the apology has an odd ring to it. Even odder is the fact that Beecham's grovel was probably quite unnecessary anyway. Perhaps the company doesn't know or remember that way back in 1959 the British actor, Alistair Sim failed, both in the High Court and the Court of Appeal, to secure an injunction to prevent Heinz, of baked bean fame, from continuing to use Ron Moody as the voice-over on a commercial that everyone assumed was Alistair Sim. As Sim had always publicly voiced his view that actors should not prostitute themselves by 'publishing insincere recommendations of commercial products', he was understandably highly piqued to hear Ron Moody sounding like him in six different Heinz commercials. But Mr Justice McNair refused to grant an injunction, saying that he was not convinced that it was libel or passing-off for Ron Moody to

24 ▶

The EMT 240 Reverb Foil



has a heart of gold

Synonymous with the world's finest reverberation system is the name EMT and their latest model 240 has the Midas touch.

An electrolytically produced gold foil only 12 inches square lies at the heart of this unit which ensures constant resonance density through the audible range, no flutter echo repeats, minimum dispersion and smooth decay.

Easily transportable the 240 weighs a mere 67kg and is isolated against shock, vibration, ambient noise; it is ideally suited to O.B. use with no need for recalibration.

DATA:

Reverberation time at 500 Hz	min. 0.8s ± 0.2s
Variation of reverb time is effected by a damping plate which is varied in its distance from the reverb foil.	max. 5s ± 0.5s
Density of resonances	3/Hz
Maximum ambient noise level	80 phon
Frequency response from 40 Hz . . . 15 kHz relative to standard curve	± 2 dB
Total harmonic distortion at 1 kHz and max. output	0.5%
Signal to noise ratio (unweighted)	65 dB

F.W.O. Bauch Limited
49 Theobald Street, Boreham Wood,
Hertfordshire, WD6 4RZ
Tel: 01 953 0091 Telex: 27502

sound like Alistair Sim. Soon after, three appeal court judges upheld McNair's decision. Such is the isolation of the British Law Courts that they now find it impossible to say whether the case went any further. But, for anyone interested, the original injunction reference is RPC 1959 No.3 (available from the British Patent Office).

Adrian Hope

IBA appointments

Two appointments have been announced to Independent Broadcasting Authority's General Advisory Council. They are Miss Dorothy Hyman MBE, an athlete who established records for 100 and 200m in 1963 and Miss Shirley Muir who works in a retail store.

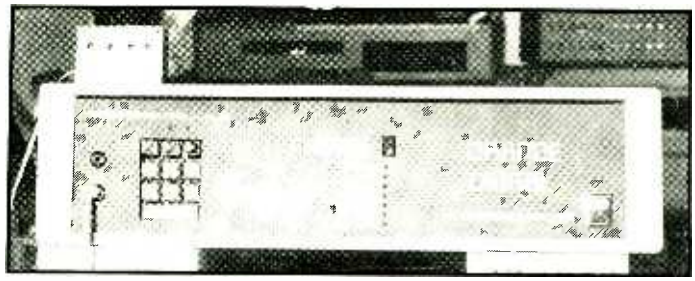
The GAC is made up of people from public and private life to give impartial advice to the Authority on the general content and pattern of IBA programmes.

Programmable Orange

Cliff Cooper, speaking about the latest addition to the Orange range of guitar amplifiers, says that the company's programmable amplifier is the very first of its kind in the world—and that it will sell for under £300. The amp enables the user to programme four combinations volume/eq/reverb/expanding sustain/other effects and then switch them at the push of one of four buttons on a small remote-belt pack style.

The unit is programmed by a front-mounted calculator type keyboard numbered one to six. Three other buttons select the programming mode—channel, function and control setting. For the last, the user can select one of six possible settings for volume, eq etc. The logic organisation allows the operator to update the level on a specific function on a given channel combination without having to cancel everything and start again.

If the idea takes off, designer Peter Hamilton of Orange says that the, at present, discrete logic circuitry will be integrated on to a custom designed mos lsi chip opening the way to a new generation programmable equipment. Specifically, he has in mind applications in programmable mixers, principally for live use, enabling instant change to one of four possible channel settings per channel. Very useful if the line up includes several bands. Orange Musical, 3/4 New Compton Street, London WC2. Phone: 836 7811.



Move for US AKG agents

Previously based at Montvale, New Jersey, the AKG/Philips US distributors, Philips Audio Video Systems Corporation, have moved to a new address: Audio Division, 91 McKee Drive, Mahwah, NJ 07430. The new phone number is (201) 529-3800.

AM TX to FCC ruling

The June FCC ruling created a new am power classification enabling sales in the US of a solid state transmitter already in worldwide service since 1967. The unit is the Sparta *703B* 2.5 kW with optional power reduction to 1000 or 500W for night time cutback.

The transmitter uses the 'tally-light' fault locator system common to other models in the Sparta range. Sparta Division of the Cetec Corporation, 5851 Florin-Perkins Road, Sacramento, Ca 95828, USA. Telex: 377-488.

They've moved

Lee Engineering have moved from Ashley to Napier House. The new address and telephone number is: Lee Engineering, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Phone: Walton-on-Thames 43124/5/6.

The company states that the move was due to growth over the last few years.

Seven state sequencer

The custom built sequencer incorporates 4k of words in seven parallel streams to provide control information for amplitude and pitch, oscillators, gates, generators etc. The manufacturers, Paice of Cambridge, claim the storage capacity of the instrument to be more than 13 times that of any other device on the market. Some of the other products developed by the company include ratio-stable pitch shifters to provide automatic harmony, finger or stick operated drum synthesisers and a guitar pattern resistor network for use with vc synthesisers. Tony Gipp, Paice, French's Mill, French's Road, Cambridge.

Vatmen rule OK?

Provisional rulings have been obtained for some equipment relevant to the recording industry.

Instrumental amplifiers greater than 30 watts rms capability are subject to the standard rate (8%). Effects units are dependent on whether they are for use with amplifiers charged at the standard or higher rate (25%).

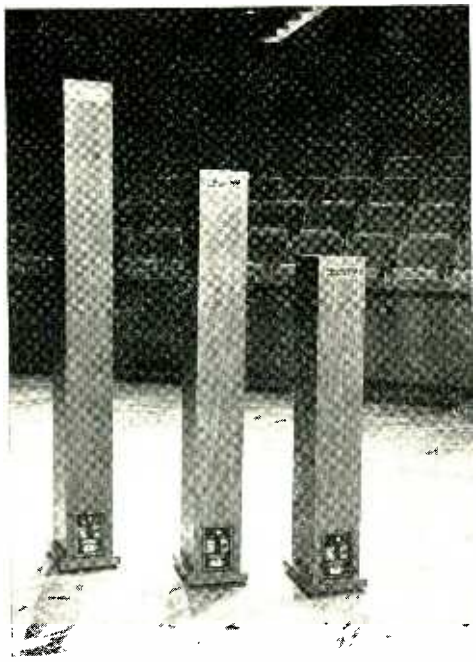
Microphones are charged at the higher rate, unless they form an integral part of standard rated equipment. Radio mics are charged at the standard rate. Ancillary parts (such as stands, shields etc) attract the higher rate.

Synthesisers attract the standard rate if they are for professional use and not held out for domestic or recreational use. They must also not be controlled either wholly or partly by preset tabs bearing the specific name of an instrument whose sound is being reproduced when the synthesiser is played with that tab depressed. This ruling remains subject to review if vendors attempt to be evasive.

MASTER-ROOM

Simply the most realistic and practical alternative to natural reverberation.

Available in optimised 7, 5 and 2 second decay models –the equivalent of acoustic environments of 4,000, 200,000 and 750,000 cubic feet volume – and the new Series B variable decay format for broadcasting and P.A. applications.



Among the U.K. users of Master-Room are:
BBC Television
Ivan Berg Associates
Chandos Music
Craighall Recording Studios
Decibel Studios
Essex Music Studios
Fat Cigar Music Co.
Island Studios Mobile
Leader Sound
Lee Sound Studios
Maison Rouge Mobile
Manor Recording Studios
Manor Mobile
Nova Sound Studios
Mike Oldfield
Pye Recording Studios
Radio Victory, Portsmouth
Sarm Studios
Threshold Studios
Pete Townsend
10 c.c.

For further information or a demonstration of the Master-Room series, contact the sole U.K. agent:
Scenic Sounds Equipment
27-31 Bryanston Street, London W1H 7AB. Phone 01-935 0141

In France: **3M France, Mincom Division**
Germany: **Audiolive, Cologne.**
Italy: **Telav S.a.s., Milan and Rome.**
Scandanavia: **Ing. Firma Jan Setterberg, Gothenberg.**

MicMix Audio Products Inc., Dallas, Texas.

PATENTS

The following list of complete Specifications Accepted is quoted from the weekly *Official Journal (Patents)*. Copies of specifications may be purchased (33p) from the Patent Office, Kent BR5 3RD.

August 6

1406141 Ball Bros Research Corporation.
Antenna assembly.

1406243 General Electric Co. Ltd.
Loudspeaking telephone instruments.

1406256 Baldwin Co. D. H.
Multitone arpeggio system for electronic organ.

1406257 Baldwin Co. D. H.
Arpeggio system for electronic organ.

1406309 RCA Corporation.
Multiplex systems.

1406343 Vockenhuber, K. and Hauser, R.
Playback device.

1406364 Philips Electronic & Associated Industries Ltd.
Arrangement for television signal delay.

1406377 Eminent, NV.
Electronic musical instrument.

1406405 Matsushita Electric Industrial Co Ltd.
Television receiver.

1406425 Rigby Ltd, Robert
Film synchronisers.

1406427 Ferrograph Co. Ltd.
Bass reflex loudspeaker enclosures.

1406438 Marconi Co, Ltd.
Oscillators.

1406484 EMI Ltd.
Synchronous replay and recording of audio signals with video signals.

1406495 Eastman Kodak Co.
Gain control apparatus.

1406496 Western Electric Co, Inc.
Optical devices.

1406500 Lichtblau, G. J.
Electronic security systems.

1406510 Gendrot, J-C
Method and device for recorded audio-visual programming.

1406574 Vockenhuber, K. and Hauser, R.
Method and apparatus for obtaining synchronous movement between two media.

1406588 Bushnell, N. K.
Video image control system for amusement device.

1406619 Vockenhuber, K. and Hauser, R.
Method and apparatus for scanning a colour picture.

1406625 Matsushita Electric Industrial Co Ltd.
Signal-selecting system for a keyboard type electronic musical instrument.

1406674 Messerschmitt-Bolkow-Blohm GmbH.
Arrangement for measuring the distance between successively located objects on a track.

1406685 Baird-Atomic Inc.
Sensing matrices for radioactivity-distribution detectors.

1406691 Nippon Gakki Seizo KK.
Semiconductor storage device.

1406712 Commissariat A L'Energie Atomique.
Device for emitting or receiving sonic or ultrasonic acoustic waves.

1406720 Sperry Rand Corporation.
Apparatus and method for reducing multiplicative gain variation distortions.

1406753 Hughes Aircraft Co.
Cable television systems.

1406754 Hughes Aircrarft Co.
Cable television system.

1406756 International Business Machines Corporation.
Electromagnetic transducer assembly.

1406829 Fuji Xerox Co. Ltd.
Bandwidth reducing system by way of extreme value dectection.

1406831 Cambridge Research & Development Group Greenberg. S.D.DT. Liquidating.
Partnership and Schiffman, M.M.
Controlled delay line signal processor for sound reproduction.

1406880 Werk Fur Fernsch-Elektronik, VEB
Hermetically sealed and sealable cells.

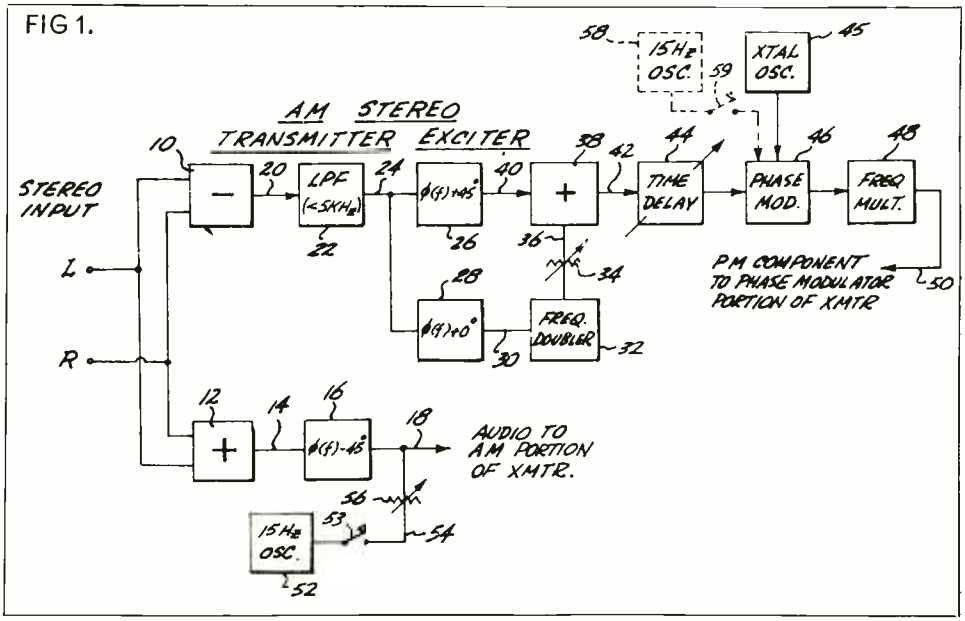
AM stereo transmission and reception

NEW BRITISH PATENT 1379698 from Leonard Kahn of New York, USA, provides some useful source references on prior work relating to am stereo transmission and reception techniques. Various British and American patents are listed, along with the June 1971 IEEE Transactions on Broadcasting. The new proposals centre round the transmitter of **fig. 1** and the receiver of **fig. 2**. For transmission L and R signals are fed to sum circuit 12 and difference circuit 10. The sum output is phase-shifted by –45° at 16 and fed to the am portion of a conventional transmitter. The difference signal is filtered at 22 and phase-shifted at 26 to advance the phase 45° and thus provide a 90° relationship with the shifted sum signal. The difference signal is also applied to frequency doubler 32 and fed to sum circuit 38 at 13% of the amplitude of the phase-shifted fundamental component. The combined signal is used to phase-modulate an oscillator signal which is multiplied and employed as the phase modulated carrier wave in the am transmitter.

It is suggested that the crux of the new idea is development of the phase-modulated component by phase-shifting and frequency doubling the audio frequency component. Oscillator 52 also impresses on the sum signal an infrasonic signal (eg 15 Hz), which serves as a pilot tone.

A conventional am receiver produces a mono output from the sum signal. But in the stereo receiver of fig. 2 the if signal 70 is applied to fixed frequency upper and lower side band filters 72 and 74, and a double side band detector 76. The double side band detector output is used for agc and the lower side band filter slope-detects the infrasonic component. The latter is fed to a comparison gate circuit 102, along with the dc outputs from envelope detectors 94 and 96, active on the upper and lower side bands. When the receiver is correctly tuned and the infrasonic tone is present, the dc voltages from the two detectors 94 and 96 are equal and the comparison gate passes the tone to amplifier 108 to light a stereo beacon.

FIG 1.



1406889 Philips Electronic & Associated Industries Ltd.
Video signal output of an opto-electronic transducer to simulate the effect of an electrical filter on said video signal.
1406925 Sensormatic Electronics Corporation.
Surveillance system and method utilizing both electrostatic and electromagnetic fields.
1406936 Sanyo Electric Co Ltd.
Transducer arrangements for recording and/or playback devices utilizing disc records.

August 13
1407036 Sony Corporation.
Magnetic recording and/or reproducing system.
1407037 Sony Corporation.
System for magnetically recording and reproducing television signals.
1407038 Sony Corporation.
Magnetic recording and/or reproducing system.
1407039 Sony Corporation.
Magnetic recording and reproducing system.
1407049 International Business Machines Corporation.
Waveguide.
1407088 Siemens AG.
Telecommunications systems.
1407133 Imperial Chemical Industries Ltd.
Devices.
1407136 Dainippon Screen Seizo K-K.
System for reproducing and recording a plurality of colour originals.
1407196 British Broadcasting Corporation.
Apparatus for changing signal pitch.
1407223 Philips Electronic & Associated Industries Ltd.
Deflection circuits for cathode-ray tubes.
1407238 Sony Corporation.
Magnetic recording and/or reproducing system.
1407239 National Research Development Corporation.
Transducer housings.
1407243 Elektroakusztikai Gyar.
Sound radiating system.
1407266 Western Electric Co Inc.
Directional microphones.
1407271 Tektronix Inc.
Video amplifier for a colour television apparatus.
1407299 Suwa Seikosha, KK.
Display device.
1407300 Suwa Seikosha, KK.
Display device.
1407364 Hammond Corporation.
Arpeggio keyboard.
1407468 International Standard Electric Corporation.
Clamping circuit.
1407487 Hell GmbH, Dr-Ing Rudolf.
Method and apparatus for producing screened rotary forms.
1407492 Philips Electronic & Associated Industries Ltd.
Line standard converter.
1407498 Ellanin Investments Ltd.
Method and apparatus for the horizontal resolution of electronically scanned images.
1407575 Oak Industries Inc.
Cable television converter.
1407657 Werk Fur Fernsehelektronik, Veb.
Indicators.
1407666 Matsushita Electric Industrial Co Ltd.
Electrical musical instruments.
1407678 Groove Consulting Co Ltd and Groom, A. N.
Telecine systems.
1407681 Commissariat A L'Energie Atomique.
Acoustic wave collector device for determining the direction of a wave source.
1407683 Nippon Hoso Kyokai and Nippon Electric Co Ltd.
Synchronising system using oscillators of high frequency stability.
1407824 Elektroakusztikai Gyar.
Overload protection circuit for loudspeakers.
1407845 Motorola Inc.
Electronic control circuit.
1407855 Intrenational Business Machines Corporation.
Vacuum tube.

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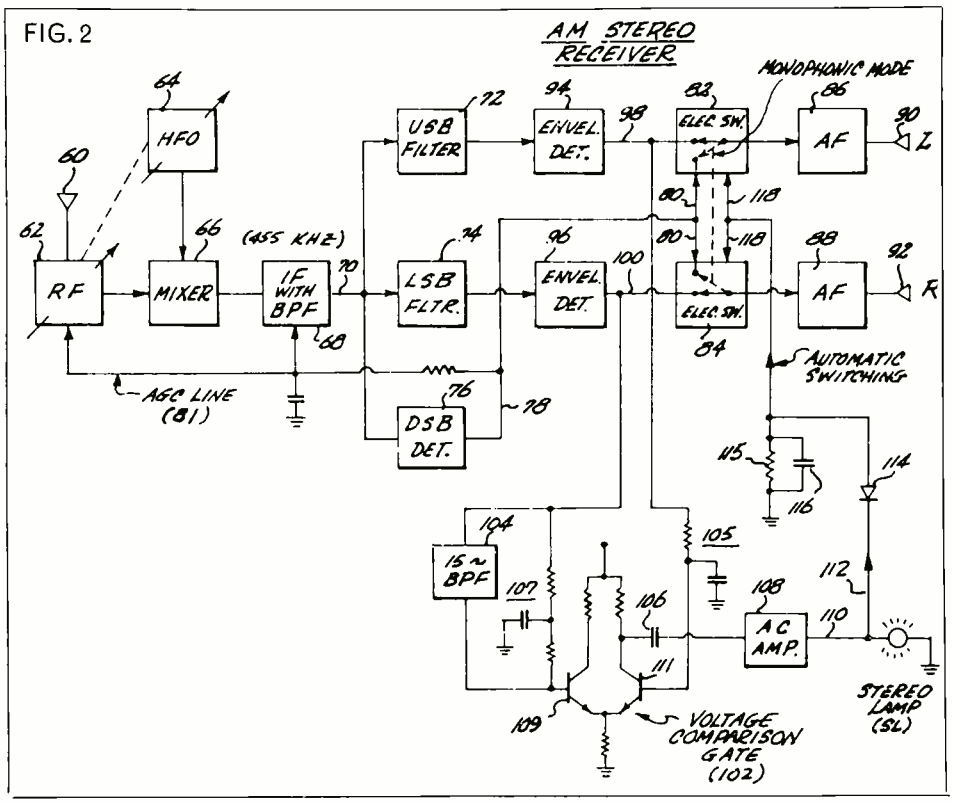
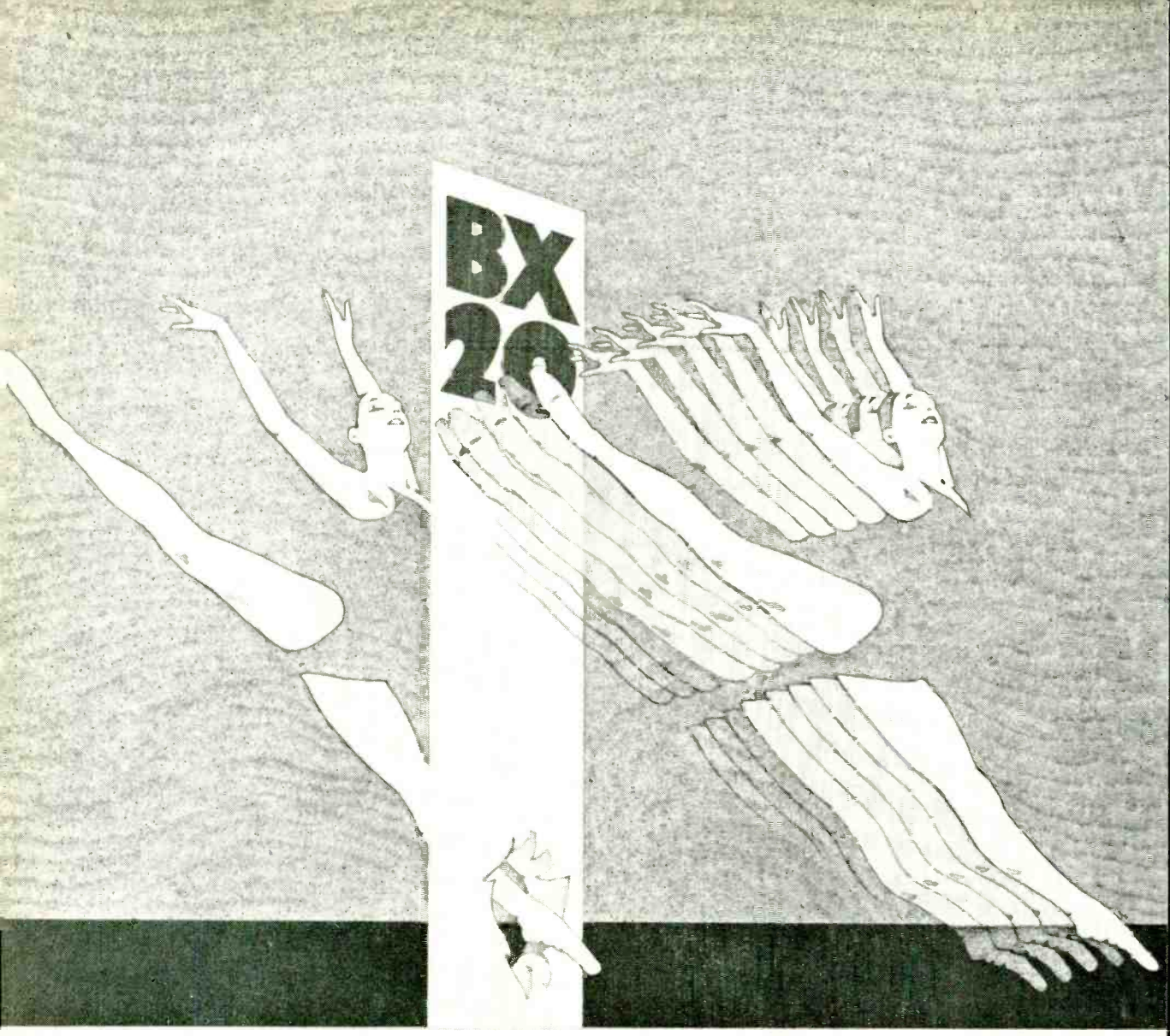
1407882 Nortronics Co Inc.
Magnetic transducers.
1407886 Defence, Secretary of State for
Whip aerials.
1407891 International Standard Electric Corporation.
Asynchronous time division multiplexer and demultiplexer.
1407892 International Standard Electric Corporation.
Frame synchronisation system.
1408017 Bell & Howell Co.
Azimuth adjustment particularly for magnetic heads.
1408029 Siemans AG.
Recording strips for corpuscular beam apparatus.
1408055 Sperry Rand Ltd.
Recording systems and recorders.
1408065 Sony Corporation.
Tape cassette.
1408103 Sony Corporation.
Magnetic recording and/or reproduction apparatus.
1408163 Eastman Kodak Co.
Perforation sensor.
1408167 Philips Electronics & Associated Industries Ltd.
Colour television camera.
1408185 International Standard Electric Corporation.
Resolution enhancement of image intensification apparatus.
1408206 MAV (Methodes Audio-Visuelles)
Sound pick-up device for playing back records of small diameters on electric gramophones or any other reproducing apparatus provided with automatic stop means.
1408268 Marconi Co Ltd.
Signal processing systems.
1408419 Hughes Aircraft Co.
CATV system.
1408423 Marconi Co Ltd.
Signal handling arrangements and frequency diversity combining arrangements utilising the same.
1408626 Hoffman-La Roche & Co AG, F.
Ultrasonic transducer assemblies.
1408654 Arvin Industries Inc.
Take-up hub and tape combination for tape transport.
1408656 Fuji Photo Film Co Ltd.
Production of cine photographic film having a magnetizable layer thereon.

FIG. 2





Jump into genuine reverberation

AKG REVERBERATION UNIT BX 20

We are used to three-dimensional hearing. Good recordings do include the third dimension. But in your studio a necessarily "dead" recording is created. With the AKG-BX-20 Studio Reverb Unit you can put as much "life" into the recording as is needed. A high degree of diffusion results in natural reverberation quality. Separate electronic damping for varied decay time from 2 to 4.5 seconds (1.5 to 3.5 sec also available). Remote control obtained over 5000 metres. Undelayed variations of decay time during operation. Two independent channels (channel separation >60 db). No danger of feedback. Full isolation against vibration and structure-born sound. No locking or re-adjustment for transportation necessary. Available in 104 countries all over the world.

AKG

ADV 19/FI

EXCERPT OF OUR LONG B X 20 USER'S LIST

Austria
ORF
Salzburger Festspiel-Haus
State Opera
Volksopera

Belgium
BRT-Brussels

Czechoslovakia
CS Broadcasting Corp., Praha

Denmark
Danmarks Radio

Finland
Oy, Yleisradio Ab.

France
ORTF
RTL
SEED

Germany
Bayrischer Rundfunk
Deutsche Grammophon Gesellschaft
Deutsche Welle
Deutschlandfunk
Hessischer Rundfunk
Norddeutscher Rundfunk
Opernhaus Köln
Polydor International
Radio Bremen
Saarländischer Rundfunk
Süddeutscher Rundfunk
Südwestfunk
Staatstheater Wiesbaden
Westdeutscher Rundfunk
Zweites Deutsches Fernsehen

Great Britain
Anglia Television
BBC
BRMB Birmingham
Palace Theatre London
Radio Recording
Radio Telefis Eireann DUBLIN
S. B. Independent Radio London

Greece
Columbia

Hongkong
Pearce Commercial Studios

Hungary
Magyar Radio, Budapest

Italy
CAM
CAP

Japan
CBS-Sony

Luxembourg
Radio Luxembourg

Netherlands
Eurosound
Radio Nederland

Norway
Norsk Rikskringkasting

Peru
Sono-Radio SA Studios

Philippines
Audio Empire Studios

Sweden
Sveriges Radio

Switzerland
PTT Radio Basel
PTT Radio Bern
PTT Radio Zuerich

USSR
Bolschoj Theatre, Moscow

USA
Bobby Sherman
Eastman School of Music
NBC
New York Philharmonic

EXCERPT
OF
OUR
LONG TDU 7202
USER'S LIST

Australia
Opera House, Sydney

Austria
ORF-Vienna
Siemens AG, Vienna
Austrophon, Vienna

Belgium
Broadcast

Cuba
Recording Studio

Czechoslovakia
Broadcast

Denmark
Recording Studio

Egypt
Broadcast

Finland
Broadcast

France
Recording Studio

Germany
Siemens AG, Bremen
Bavaria Atelier Ges.m.b. Munich
ZDF, Mainz
Siemens AG, Karlsruhe
SWF, Baden-Baden
Radio-Bremen, Bremen
Nordwestdeutsche Musikakademie, Detmold
Hessischer Rundfunk, Frankfurt
ITR, Hamburg
NDR, Hamburg
WDR, Cologne
Thomson CSF, Munich
Telfo, Munich
Saarländischer Rundfunk, Saarbrücken
Südeutscher Rundfunk, Stuttgart
Stadttheater Wiesbaden, Wiesbaden
Barbarossa-Studio, Munich
Bundeswehr-erprobungsstelle Greding
Norddeutsches Werbe-fernsehen, Hamburg

Great Britain
Sound Studio, London

Greece
National-Theatre, Athens

Hongkong
Recording Studio

Indonesia
Recording Studio

Iran
Broadcast, Teheran

Israel
Sound Recording

Japan
KTD-Postal Authorities, Tokyo

Luxembourg
Broadcast

Netherlands
NOS (Broadcast)
Phillips-Eindhoven

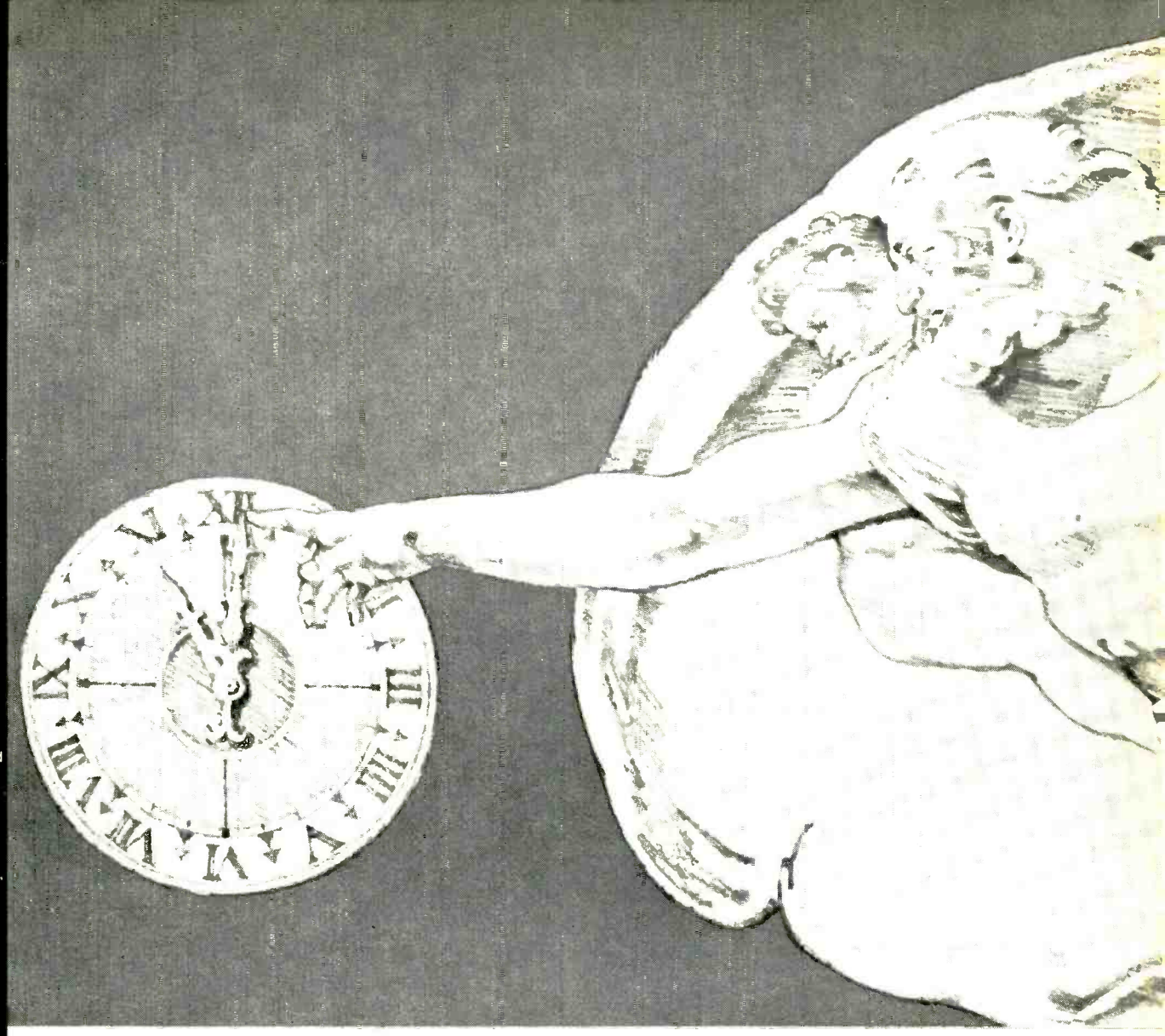
Norway
Recording Studio

Singapore
Recording Studio

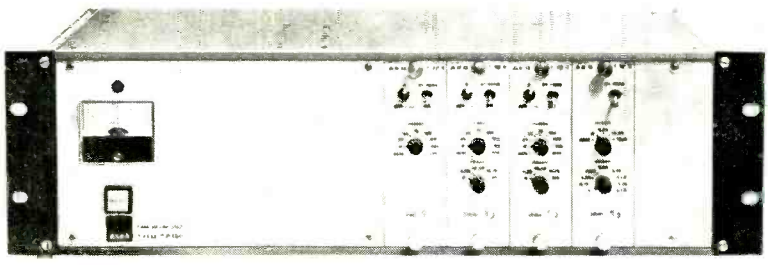
South Africa
Broadcast

Spain
Recording Studio

Tunesia
Broadcast



That professional touch...



AKG TIME DELAY UNIT TDU 7202

Whenever you require time delayed information within the sound path – this Delay Unit may solve all your demands in various applications. Delay times of 0.75 ms to 400 ms are possible. Up to 4 outputs from 1 input. Delay time is independently adjustable for each output from front panel or remotely controlled. Module technique for ease of maintenance. Continuous variation of delay time is possible within the limits of plus 0 and minus 20%. May be used free-standing or rack-mounted.
Available in 104 countries all over the world.

AKG

ADV 1907/E1

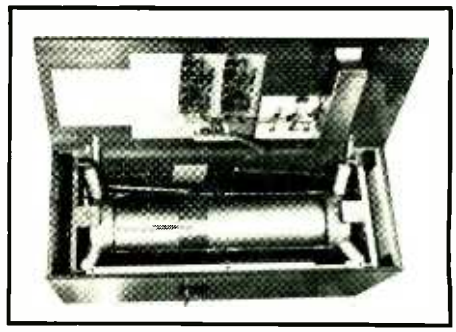
Survey: reverberation and delay units

AKG

AKG Akustische und Kinogerate GmbH, 1150 Wien, Nobilgasse 50, Austria.
AKG Equipment Ltd, 182/4 Campden Hill Road, Kensington, London W8 7AS.
Phone: 01-229 3695.
US Agent: Philips Audio-Video Systems, Audio Division, 91 McKee Drive, Mahwah, NJ 07430, USA. Phone: (201) 529 3800.

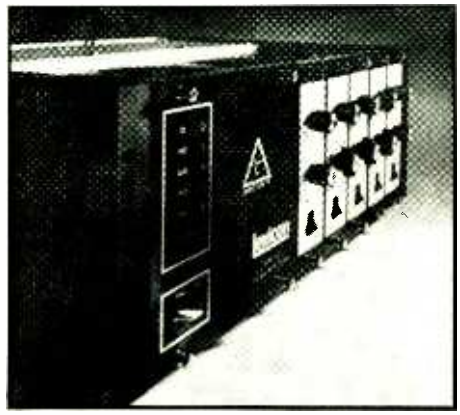
BX 20E

Delay principle: spring.
Reverb period: 2s to 4.5s adjustable.
Frequency response: 20 Hz to 8 kHz ±5 dB at ⅓ octaves.
Input: +6 dB at 2k ohms.
Output: +6 dBm at 200 ohms.
Controls: reverberation time by remote control.
Other features: stereo separation better than 60 dB.
Noise: 69 dB below + 6 dB output.
Resistance to external noise: 100 dB spl for feedback.
Power requirements: 110/220V ac, 24V dc at 0.5A.
Auxiliary amplifier: integral.
Size: 43 x 50 x 110 cm.
Weight: 50 kg.



Above: *AKG BX20E*

Below:
Lexicon Delta-T 102-B



TPU 7202

Delay principle: electronic.
Delay period: 0 to 375 ms adjustable in 6.25 ms steps.
Frequency response: 30 Hz to 12 kHz ±3 dB.
Input } standard 0 dBm 600Ω line.
Output }
Controls: output level, delay period.
Companding: internal.
Other features: 200 µs pre-emphasis.
Metering: moving coil.
Noise: 72 dB below rated output.
Power requirements: 110/220V ac.
Size: fits into standard 48 cm racks.
Weight: 10 kg.
Price: £1530 basic.

DELTA-T

Lexicon, 60 Turner Street, Waltham, Mass 02154, USA. Phone: (617) 891 6790.
Gotham Export Corporation, 741 Washington Street, New York, NY 10014, USA. Phone: (212) 741 7411.
FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091.

102-B

Delay principle: electronic.
Delay period: 40 ms to 320 ms adjustable in 5 ms steps.
Frequency response: 20 Hz to 15 kHz ±2 dB at —14 dB below limit.
Input: +4 dB at 20k ohms.
Output: +10 dBm at 50 ohms.
Controls: 5 adjustable delay period take offs.
Distortion: less than 0.3% thd 34dB below limit.
Other features: up to 90 dB of dynamic range.
Metering: led.
Power requirements: 115/230V ±10%.
Size: 48.5 x 17.7 x 40 cm.
Weight: 21 kg.
Price: $6320, £3771 for largest system.
Other: model *102-A* intended for pa applications, features upper frequency limit of 12 kHz. Model *102-C* offers main-frame delay from 16 to 128 ms.

EAGLE

Eagle International, Precision Centre, Heather Park Drive, Wembley, Middlesex HA0 1SU.
Phone: 01-902 8832. Telex: 922131.
Eagle International SA, 147 Rue du Midi, Bruxelles I, Belgium.
Phone: Bruxelles 513 0477.

RA 589, RA 586

Delay principle: spring.
Input: 5 mV at 10k ohms.
Output: 0.5V at 100k ohms.
Controls: input level, reverb level.
Other features: *RA 589* features dual mic inputs.
Resistance to external noise: user warned against operating unit near loudspeaker.
Power requirements: 9V dry battery.
Auxiliary amplifier: integral.

EMO

EMO Systems Ltd, Neville's Cross, Durham City DH1 4JF.
Phone: 0385 68278.

Custom Delay

The units are custom-built according to application; normally a resolution of 12 bits is used. The audio output can be tapped anywhere along the line to give coarse control of delay period. A voltage controlled clock enables special effects such as phasing and true vibrato. An instant tape loop facility allows line contents to be set in a re-circulation mode, suffering no degradation with time. A phase indicator enables capture of the loop without clicks.

Approx price: £320 for basic frame, £5.20 per ms of delay. Each audio output costs £87 and the tape loop and phase indicator facility £42.

Forthcoming Surveys

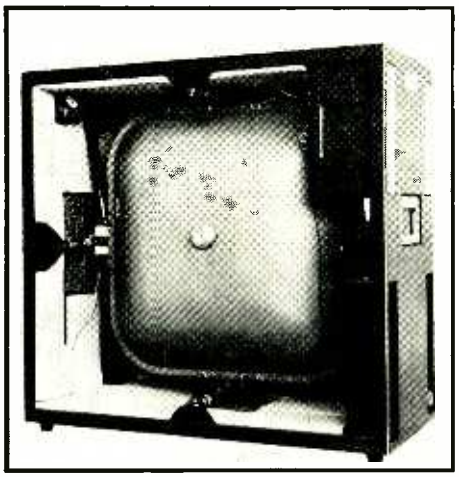
Although we automatically send out a comprehensive circular requesting information, it cannot reach everyone. Therefore, manufacturers of the following products should let us know as soon as possible, and in any case not later than the date given in brackets.
December: *monitor loudspeakers (October 2).*
January: *tape machine controllers—eg synchronisers, auto-locates, remotes (November 3).*
February: *compressors and limiters (November 28).*
March: *sound reinforcement (January 2)*
We need full address, phone, telex etc of manufacturer and all agents worldwide, in addition to product details.

EMT

Franz Vertriebsgesellschaft mbH, 763 Lahr I, Postfach 1520, West Germany.
Phone: 07825-512. Telex: 754319.
Gotham Audio Corporation, 741 Washington Street, New York, NY 10014, USA.
Phone: (212) 741 7411.
FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

EMT 140TS
Delay principle: plate.
Reverb period: 1s to 4s adjustable.
Input: +1 dB at 5k ohms.
Output: +12 dBm at 200 ohms
Controls: reverberation time (remote control optional).
Other features: stereo output.
Noise: 50 dB below max output level, reverb time =2s.
Power requirements: 110/220V ac.
Auxiliary amplifier: *EMT 162TS.*
Size: 2.5 x 0.3 x 1.4m.
Weight: 190 kg.

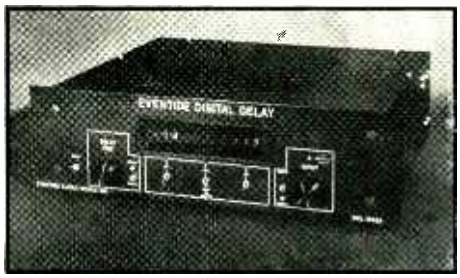
EMT 140Q
Delay principle: plate.
Reverb period: 1s to 4s adjustable.
Input: +1 dB at 5k ohms.
Output: +12 dBm at 200 ohms.
Controls: reverberation time (remote control optional).
Other features: quadraphonic, 4 inputs, 4 outputs.
Noise: 50 dB below full output, reverb time=2s.
Power requirements: 110/220V ac.
Auxiliary amplifier: *EMT 162Q.*
Size: 2.4 x 0.34 x 1.32m.
Weight: 180 kg.



EMT 240

EMT 240
Delay principle: plate.
Reverb period: 1s to 4s adjustable.
Input: 0 dB at 5k ohms.
Output: 0 dBm at 200 ohms.
Controls: reverberation time.
Other features: stereo.
Noise: 60 dB below full output, unweighted.
Resistance to external noise: 80 phon max ambient level.
Size: 63 x 67 x 30 cm.
Weight: 60 kg.
Other: small in size, suitable for mobile use.

EMT 440
Delay principle: electronic.
Delay period: 0 to 120 ms adjustable in 7.5 ms steps.
Frequency response: 40 Hz to 12 kHz ±3 dB.
Input: +6 dBV at 10k ohms.
Output: +6 dBm at 200 ohms.
Controls: delay period.
Companding: integral to increase 10 bit resolution by 12 dB.
Other features: anti crumble circuitry operative below 2 mV input.
Noise: 66 dB below +6 dBm output.
Power requirements: 110/240V ac.
Weight: 18 kg.
Other: 60 ms total delay optional.



Eventide 1745A

EVENTIDE

Eventide Clock Works Inc, 265 West 54th Street, New York, NY 10019, USA.
Phone: (212) 581 9290.
Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314.

1745A
Delay principle: electronic.
Delay period: 0 to 199 ms adjustable in 1 ms steps.
Frequency response: 30 Hz to 16 kHz ±1 dB.
Input: } 0 dBm standard 600 ohm line.
Output: }
Controls: front panel 'delay set' using digital readout to indicate delay period. 'Double' switch to double delay and halve bandwidth.
Other features: options for pre wiring delay periods.
Metering: led overload indicator.
Noise: 78 dB below output reference level.
Power requirements: 115/240V ac.
Size: 14 x 48 x 40 cm.
Price: $4100, £2512.

C200
Delay principle: electronic.
Delay period: 7.5 ms to 1080 ms preset adjustable in 7.5 ms steps.
Frequency response: 40 Hz to 12 kHz ±1 dB.
Input: } 0 dBm nominal, balanced or unbalanced.
Output: }
Controls: input level.
Other features: 10 bit resolution.
Metering: overload indicator.
Noise: 60 dB dynamic range.
Power requirements: 115/230V ac.
Size: 48 x 13 x 20 cm.
Weight: 5 kg.
Price: basic frame $576. Cards from $99 to $570.

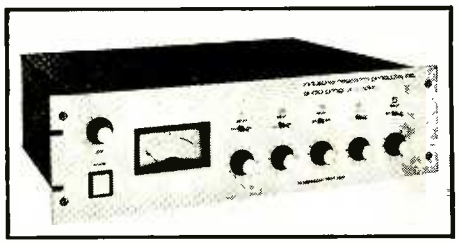
FL201 instant flanger
Delay principle: electronic.
Delay period: 200 µs to 10 ms adjustable.
Frequency response: 50 Hz to 15 kHz ±1.5 dB.
Input: } standard line.
Output: }
Controls: vc clock oscillator (hanging control). Low speed modulating oscillator. Envelope follower controls.
Other features: many, for special effects.
Power requirements: 115/230V ac.
Size: 48 x 8.8 x 23 cm.
Price: $615.

GRAMPIAN

Grampian Reproducers Ltd, The Hanworth Trading Estate, Hampton Road West, Feltham, Middlesex.
Phone: 01-894 9141.

636 Reverberation Unit
Delay principle: spring.
Reverb period: 2s.
Frequency response: 100 Hz to 6 kHz ±3 dB.
Input: 10 mV at 50k ohms.
Output: 600 V at 600 ohms.
Controls: reverb level, input levels (2).
Other features: overload lamp. Direct signal path.
Noise: 68 dB below 0 dBm at output.
Power requirements: two 9V batteries.
Size: 45 x 14 x 16 cm.
Weight: 5.4 kg.

666 'Ambiophonic' unit
Delay principle: spring
Reverb period: 2s.
Frequency response: 100 Hz to 6 kHz ±3 dB.
Input: 2 dBm at 10k ohms.
Output: 0 dBm at 5 ohms.
Controls: output level.
Other features: produces 3W across 5Ω output load.
Metering: overload indicator.
Noise: 45 dB below 0 dBm output level.
Power requirements: 100 250V ac.
Size: 46 x 12 x 13.5 cm.
Weight: 3.2 kg.



Industrial Research Products DA 4003

IRPI

Industrial Research Products Inc, Elk Grove Village, Illinois, USA.
Phone: (312) 439 3600
Knowles Electronics Ltd, Victoria Road, Burgess Hill, Sussex.
Phone: Burgess Hill 5432. Telex: 87460.

DA 4003
Delay principle: electronic.
Delay period: 0 to 120 ms adjustable in 10 ms steps.
Frequency response: 40 Hz to 12 kHz ±3 dB.
Input: } 0 dBm standard 600 ohm line.
Output: }
Controls: two or five output delay controls.
Companding: integral to increase dynamic range.
Other features: dynamic range 80 dB at 800 Hz.
Metering: moving coil.
Noise: —62 dBm at output over 20 to 20 kHz.
Power requirements: 115/230V ac.
Size: 48 x 13 x 31 cm.
Weight: 13 kg.

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■ SURVEY REVERB UNITS

Other: distortion less than 1% at 1 dB below full output at 400 Hz.

DA 4002
Delay principle: electronic.
Delay period: 0s to 120 ms adjustable in 10 ms steps.
Frequency response: 40 Hz to 12 kHz ±3 dB.
Input: } 0 dBm standard 600 ohm line.
Output: }
Controls: two variable delay outputs. Input level adjust.
Other features: fitted in neat transportable carry case.
Metering: led overload indicator.
Noise: –62 dBm, 20 to 20k Hz.
Power requirements: 115/230V ac.
Size: 48 x 35 x 21 cm.
Weight: 13 kg.

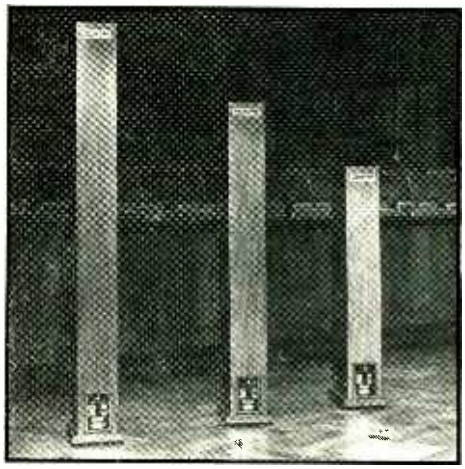
DA 4000
Delay principle: electronic.
Delay period: 0s to 140 ms preset.
Frequency response: 40 Hz to 12 kHz ±3 dB.
Input: } 0 dBm standard line level.
Output: }
Controls: essential functions preset.
Companding: integral.
Other features: for permanent installations.
Noise: 80 dB below max output level.
Power requirements: 115/230V ac.
Size: 48 x 13 x 33 cm.
Weight: 8.5 kg.
Other: for use in pa applications. Connectors of screw block type.

MASTER ROOM

Mic Mix Audio Products Inc, 9990 Monroe Drive, Suite 222, Dallas, Texas 75220, USA.
Phone: (214) 352 3811.
Scenic Sounds Equipment, 27/31 Bryanston Street, London W1H 7AB.
Phone: 01-935 0141.
3M France, Mincom Division, 135 Blvd Serrurier, Paris, 19e, France.
Phone: 202 8090.
Audiolive, 5000 Koln I, Kyffhauser Strasse, 10/46-48, West Germany.
Phone: 0221-2309.

MR-2/3/4
Delay principle: spring.
Reverb period: 2, 5 and 7s.
Input: +4 dB at 10k ohms.
Output: +4 dBm at 150 ohms.
Controls: brilliance.
Noise: 66 dB below rated output.
Resistance to external noise: 120 dB spl.
Auxiliary amplifier: integral.
Size: 14 x 25 x 100/120/145 cm.
Weight: 10/11/12.5 kg.
Price: $1225/1310/1480. £666/686/777.

Studio B-2
Delay principle: spring/plate/electronic/acoustic.
Reverb period: 1s to 3s adjustable.
Input: +4 dB at 5k ohms.
Output: +4 dBV at 600 ohms.
Controls: input level, reverb level, decay tme eq centre and lift control, power.
Other features: model *B-3* reverb time 2 to 4s.
Metering: moving coil.
Noise: 66 dB below rated output.
Resistance to external noise: 110 dB spl.
Power requirements: 105/250V ac.
Auxiliary amplifier: console mounting 48 cm rack.
Size: 12 cm dia x 100 cm.
Price: $1275, £658. Electronics $75, £43.



Master Room MR-2/3/4

MULTITRACK

Multitrack, PO Box 3187, Hollywood, Ca 90028, USA.
Phone: (213) 467 7890.
Mellotronics Ltd, 35 Portland Place, London.

CCD delay line
Delay principle: spring.
Reverb period: 2s.
Frequency response: 45 Hz to 7 kHz.
Input: –40 to +5 dB at 30 kΩ.
Output: +20 dBm at 600 ohms.
Controls: input level, output level, shelving at 20 Hz and 20 kHz.
Noise: 70 dB below 0 dBm cutput.
Power requirements: ±15V at 165 mA.
Size: 48 x 9 x 33 cm.
Price: $650.

Analogue delay line

The unit uses charged coupled device technology utilising quantative charge transfer from element to element below an 'n' type diffusion layer within a 'p' type silicon lsi substrate. Although the input signal is sampled at regular intervals in the three phase clock cycle, there is no quantatisation error of the type occurring with digitising circuits. This is because the voltage sample is shifted down the 'bucket brigade' shift register as an absolute quantity rather than resolving into so many discrete levels proportional to the number of data bits employed.

The first model from the company employs two channels, each with a maximum delay of 50 ms, divisible into steps of 1 ms. Cascadable to a maximum delay of 100 ms, each channel has an external input and output level control. The manufacturers claim a flat response to 15 kHz with a signal to noise ratio better than 70 dB. The projected retail cost will be less than $1500.

PANDORA

Pandora Systems Inc, PO Box 964, Nashville, Tennessee 37202, USA.
Phone: (615) 320 0623.
Feldon Audio Ltd, 123 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314.

Time Line
Delay principle: electronic.
Delay period: 1 ms to 493 ms adjustable.

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Eventide Clock Works
your next step

Instant Flanger

Old model phasing units used analog circuitry to modify the frequency spectrum. The instant flanger uses a true time delay circuit, producing many more nulls and thus a much deeper effect than previously available with any electronic unit.

Omnipressor

is a professional quality special effects dynamic modifier. It combines the characteristics of a compressor, an expander, a noise gate and a limiter. It can generate new effects such as dynamic reversal. Musically, this reverses the attack-decay envelope of instruments and gives the effect of talking backwards when applied to a voice signal.

Digital Delay Line

represents the optimum solution to any delay line requirement. Its unequalled versatility and portability combine with any studio quality specs to create a package currently used by top recording studios, sound contractors and recording groups in live concert.

Feldon Audio Ltd, 126 Gt Portland Street, London W1 01-580 4314

ELECTROSONIC

SENIOR AUDIO DEVELOPMENT ENGINEER

SALARY NOT A LIMITING FACTOR

A **Senior Engineer** is required to head up the Audio side of a development team engaged in new product designs for the audio and audio visual markets. A knowledge of the standards required in studio mixers and professional audio equipment is essential and it is expected that the selected applicant will have qualifications to at least HNC level, coupled with specialist audio training and a minimum of five years experience in industry.

An attractive salary will be negotiated in line with the responsibilities of the position. Experience and qualifications.

Applications should be made by telephone, or in writing to:

Mr. R. D. Naisbitt, Personnel Director
ELECTROSONIC LIMITED,
815 Woolwich Road, London SE7 8LT
Telephone: 01-855 1101

HI-FI EQUIPMENT

RESLO Cabaret Radio Mike as new **£200.** AKG D190C Mike **£18.** AKG D707C Mike **£16.** Shure Unisphere B 5885A **£15.** Eagle LL2 Private Telephone, four stations two as new **£80.** Alice BD8 Limiter two Alice CNS Unit **£250.** Reslo Ribbon Mike **£6.** Philips EL3549 **£15.** Quantity P.A. Speakers **£2** each. Two damaged Hi-Fi Speakers **£5** pair. All plus VAT. **01-586 0064.**

NEW—AKG K160 phones **£19.** REVOX illuminated Remote Control **£15.** REVOX Remote Control 30ft. lead **£15.** D10L Mike **£7.50.** D190E Mike **£25.50.** Ferragraph Defluxers **£4.20** each. Audio Techniques Mixer MM42A **£77.** Quad 50 power amp. **£45.** Quad 303 Power Amp **£65.** REVOX A78 Power Amps Mk.3 **£185.** Koss ESP6 Phones **£30.** REVOX A77 Dust Covers **£6.** REVOX W/proof Cover **£6.** REVOX vulcanised Carry Case **£12.** Spendor BC1 Speakers with stands **£180** pair. All plus VAT. **01-536 0064.**

SURVEY : REVERB UNITS

Frequency response: 14 kHz —3 dB point.
Input: } standard 0 dBm line.
Output: }
Metering: overload indicator.
Noise: 72 dB below rated output level.
Power requirements: 120/230V ac.
Weight: 8 kg.

PARASOUND

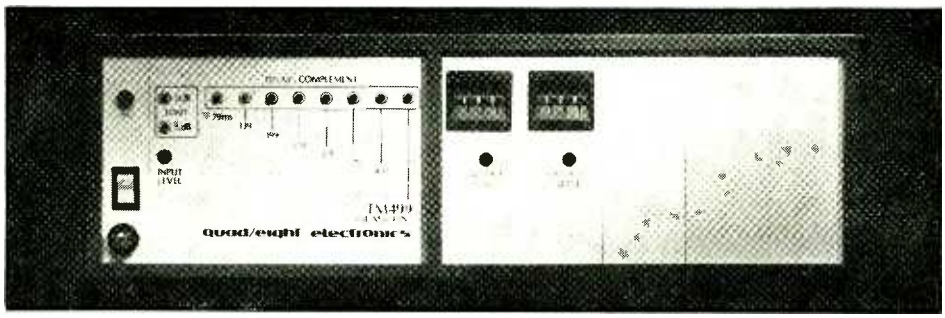
Orban/Parasound, 680 Beach Street, San Francisco, Ca 94109, USA.
Phone: (415) 776 2808.
Helios Electronics Ltd, Browells Lane, Feltham, Middlesex TW1 3ER.
Phone: 01-977 7841.
Audio Products International, Viale Rimembranze di Lambrate 13, 20134 Milano, Italy.
Phone: 381965/355506.

106CX
Delay principle: spring.
Reverb period: 2s.
Frequency response: 80 Hz to 5.5 kHz ±3 dB ⅓ octave.
Input: —12 dBV at 12k ohms.
Output: +4 dBm at 600 ohms.
Controls: eq and limiting at 10:1 compression.
Noise: 76 dB below +4 dBm output.
Auxiliary amplifier: 115/230V ac.
Weight: 4 kg.
Price: $695.

Rank Ind. Australia, 58 Queensbridge Street, S. Melbourne, Victoria, 3206, Australia.
12 Barcoo St, E. Roseville, NSW 2069, Sydney, Australia.
Siv. Ing. Venum & Co, Boks 2493, Solli Oslo 2, Norway.

TM499
Delay principle: electronic.
Delay period: 0 to 499 ms adjustable in 1 ms steps.
Frequency response: 20 Hz to 16 kHz ±1 dB.
Input: } standard 600 ohm line.
Output: }
Controls: delay set, pre-emphasis.
Companding: integral giving dynamic range of 82 dB.
Other features: low level muting circuitry.
Metering: led overload indicator.
Noise: 90 dB below rated output.
Power requirements: 115/230V ac.
Size: 48 x 13 x 40 cm.
Weight: 12 kg.

RV 10
Delay principle: spring.
Reverb/delay period: 1s to 5s adjustable.
Input: } standard 600 ohm line.
Output: }
Controls: decay period.
Other features: three-position hipass filter.
Resistance to external noise: 'will operate in control room'.
Power requirements: 117V ac.
Size: 48 x 10 x 24 cm.
Weight: 7 5 kg.



Quad/Eight TM 499

QUAD/EIGHT

Quad/Eight Electronics International, 11929 Vose Street, North Hollywood, Ca 91605, USA.
Phone: (213) 764 1516.
Cinesound International, Imperial Studios, Maxwell Road, Boreham Wood, Herts.
Phone: 01-953 5545.
Studio Equipment SARL, Rue de L'abbe, Groult, Paris 15, France.
Phone: 224-76-74.
Auvis Asona KG, Stollbergstrasse 15-17, D8 München 22, West Germany.
Phone: (0811) 225057.
Century 21 Audio, 754 King Edward St, Winnipeg, Manitoba R3H OP2, Canada.
Phone: (204) 775-8231.
Commercial Elec, 1305 Burrard St, Vancouver, 1 BC, Canada.
Phone: (604) 685-0301.
Delta Equipment, Lucien Velu, 112 Rue de Calevoet, 1180 Brussels, Belgium.
Electori Co Ltd, Mondo Building 1-19-3, Kamiochiai Shinjuku-ku, Tokyo, Japan (161).
Phone: 03-950-6266.
Electronica Gramcko, Av, Sanz Edif, Escar Local B —El Marques, Caracas.
Laboacustica, Via Luigi, Settembrini 9, 00195 Roma, Italy.

UREI

United Recording Electronic Industries, 11922 Valerio Street, North Hollywood, Ca 91605, USA.
Phone: (213) 764 1500.
Gotham Export Corporation, 741 Washington Street, New York, NY 10014, USA.
Phone: (212) 741 7411. Telex: 129269.
FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

Cooper time cube
Delay principle: acoustic.
Delay period: 14 ms and 16 ms, separate channels
Frequency response: 40 Hz to 10 kHz ±2 dB.
Input: 0 dBm at 600 ohms.
Output: 0 dBm at 600 ohms.
Controls: input gain (2), meter switch.
Other features: channel separation 40 dB. Can be cascaded for total delay of 30 ms.
Metering: moving coil.
Noise: 70 dB below full output. 15.7 kHz bandwidth.
Power requirements: 110/240V ac.
Size: 48.5 x 9 x 19 cm electronics only.
Weight: electronics 5 kg, delay line 15 kg.
Price: $1142, £555.

All our equipment has been designed for performance with reliability, maximum flexibility and real economy in mind. Various systems are available from Stereo to 24 track recording, with comprehensive metering and monitoring.

TWEED AUDIO
ELECTRONICS
ROSEWOOD INDUSTRIAL ESTATE, KELSO, ROXBURGHSHIRE
SCOTLAND. TELEPHONE 2983 STD 057 23

Alice IS BROADCASTING

AM 82/B. Continuity Desk

A complete range of Ancillary Rack Mounting Equipment. Multitrack Mixing Consoles and Transcription Units are available at our usual speed and guaranteed deliveries.

Alice **(Stancoil Limited) Alexandra Road, Windsor, England**
Tel. Windsor 51056/7

Survey: audio mixers, addendum

AENGUS

Aengus Engineering Inc, Box 297, 50 Oakhill Rd, Fayville, Mass 01745, USA.
Phone: (617) 481-7600.
No information received.

ALLEN & HEATH

Allen & Heath Ltd, Pembroke House, Campsbourne Road, London N8, UK.
Phone: 01-340 3291.
USA: Audiotechniques Inc, 142 Hamilton Ave, Stamford, Connecticut.
Canada: Chromacord Corpn, 2343 43rd Ave, Lachine, Quebec H8T 2K1.
Belgium: Audio Consultants, Av Lambeau 17, 1200 Bruxelles.
France: CB France, 23 Rue Berdinet 75014, Paris. Phone: 533 22 17.
Germany/Austria: R. Barth KG, 2 Hamburg 76, Grillparzerstr. 6a.
Phone: 229 88 83. Telex: 02-12-095.
Greece: C. Lilis & Co, Audiolab Hellas, 8 Enianos St, Athens 104.
Phone: 825 222. Telex: 5800.
Italy: Reli Electronica SRI, 13100 Vercelli.
Portugal: MEL, Praceta de Cabinda, Lote 38, 7° DTO, Oeiras.

Minimix
Six channel miniature mixer with one aux box, one monitor mix unit and six compressors.

16-8
Unit mixer with usual facilities (reviewed Oct). May be supplied in any configuration, also special order 24 channel version. Ex stock for all except 24 channel option, which is ten-day delivery.

Quasi
Supplied as either 8/4 or 10/2, unit mixer for portable and studio applications at level below 16/8.

AMEGA/RANGERTONE

Amega/Rangertone, 1195 McCarter Hwy, Newark, New Jersey 07104, USA.
Phone: (201) 667-4190.
No information received.

AMEK

Amek, 8 Stockport Rd, Altrincham, Cheshire WA 15 8ET, UK.
Phone: 061-928 8688

S Series
Modular mixing consoles. Balanced mic and unbalanced line input to channels, each of which have: mic gain and attenuate; mic/line switch; fixed frequency four-way eq; two es, two fb; pan with routing for up to 16 groups; channel cut with led indicate; led overload indicator; pfl/afl solo; slide Echo fader returns, with eq also on fb. Separate modules available for pa interface, with hi/lo filtering at fixed frequency and electronic crossover in various options. Meters switchable crossover and recording points. Peak reading vu or ppm metering. Prices eg 24/16 (ppm) £4356, 16/8 (vu) £2604.

M Series
Studio modular consoles. Balanced mic and line inputs, with phase reverse. Insert in/out and on eq. Eq four ranges switchable three frequencies in each. Switchable Q, top/bottom ranges with swichable shelf/bell. Two es groups, two fb level sends; pan with routing up to 16 groups; channel overload led; afl/pfl; Waters plastic faders. Fb and es returns with hi/lo filters adjustable shelving. Comprehensive monitoring including osc, and full tb/slate facilities. Peak reading vu or ppm available. Prices eg 24/16 (ppm) £6576, 16/8 (vu) £3992.

APOLLO

Acoumat/Apollo Electronics, 22 Rue Ste Ambroise, Paris 75011, France.
Phone: 357 16 97.
No information received.

Range of plug in modular units of standard dimensions 190 x 45 mm, with Penny & Giles *1520* series faders. Modules may be used for scratch-built consoles or for incorporation into present desks. All are constructed on moulded castings, supply needed 24V. In addition are three hybrid modules: *HM80* general purpose ac control module, with applications book, *HM70* low noise preamp and *HM30* compressor/limiter.

Additional services include auxiliary power amps, special effects units, and other studio equipment.

Altec 1220A

AUDIO DESIGNS

Audio Designs and Manufacturing Inc, 16005 Sturgeon, Roseville, Michigan 48066, USA.
Phone: (313) 778-8400. Cables: Audex.

Range of unit and modular systems based on the following audio modules: *301* noise suppressor; *ADM 302* limiter; *660* spectrum analyser; *ADM 560* Vue-Scan, tv monitor of up to 28 bars; *770* input module, with input attenuate, cue send pre/post, 3+4+4+3 eq in/out, input overload led and solo, with channel slider; *ADM 1500/1501* eq similar.

BC Series
Stock consoles up to 16/4 formats, chassis with four vu meter display, for sound reinforcement. Standard desk console $2950.

BC-5 Series
Broadcast production consoles. Format up to 16 low level inputs or 28 high; four outputs with individual vu and monitor, es and return, flexible monitoring. Standard $6425.

TV-32
Broadcast production console up to 32 input and four subgroups; 20 low level inputs or up to 104 high, echo return on both masters, metering of all group functions; machine controls; selective groups mic muting. Price standard $18 725.

NRC Series
8-16-24 track recording consoles, in identical design but format as appropriate. Pcb mother board interconnection reduces cost of hand wiring; simultaneous quad, stereo and mono mix-down, 'total' op-amp circuitry; Vue Scan metering; full talkback and slate; four cue, two solo systems; four quad joysticks; sync interface. Prices eg 28/24 $54 700, 16/8 $33 825.

1641
Remix console for simultaneous four, two and one channel mix from 8/16 source. Sixteen dual concentric quad pots, four joysticks, with full group routing; four remote tape controls; solo on all inputs; quad matrix break points; four es. Price $26 600.

RMX 921/1721
Remix consoles with 16 or eight line inputs plus single mic channel. Prices $12 975 and $19 300.

AUDIONICS

Audionics Inc, 10035 NE Sandy, Portland, Oregon 97220, USA.
Phone: (503) 255-8846.
No information received.

AUDITRONICS

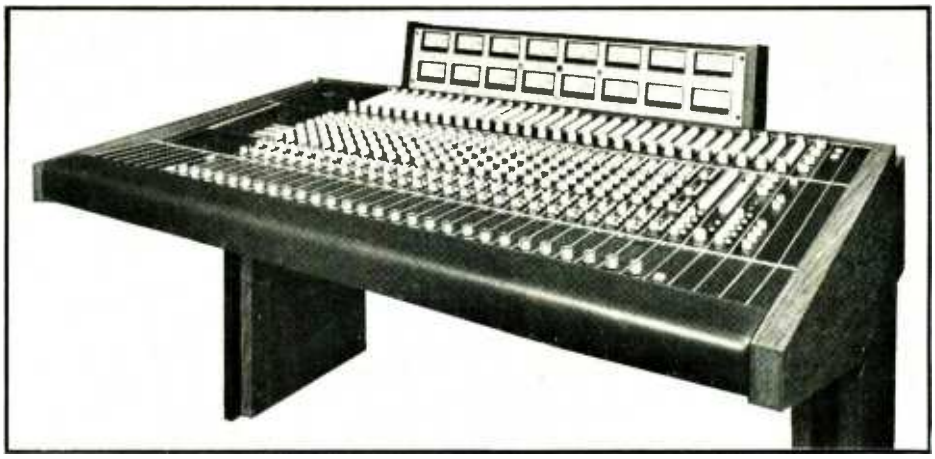
Auditronics Inc, 207 Summit St, Memphis, Tennessee 38104, USA.
Phone: (901) 276-6338.
UK: Information from Scenic Sounds, 27-31 Bryanston St, W1.
Phone: 01-935 0141.

Consoles for multitrack recording applications.

Grandson II, Model 110-8
New expandable, modular console for recording, remix and broadcast purposes. Designed 'for budget eight and 16 track' and expandable to 24 (48 inputs overall) in approx 1.3m width. Complete metering; two echo send/receive; talkback and fb; eight or 16 channel monitor matrix; test osc; monitor submix; patch bay. Model *110-8* comes with eight group output with associated vus. Monitor and mute are ttl logic controlled: may be programmed by owner to meet specific requirements.
Channels include: linear attenuator; stepped line control —70 to +20 dBm; three position/six frequency eq at 80/150 Hz, 1.8/4 kHz, 7.5/12 kHz, in/out switch with led indicator, hi/lo cut filter. Stereo control channels provide for one line level pair, mono switchable mic/line. Solo/cue.

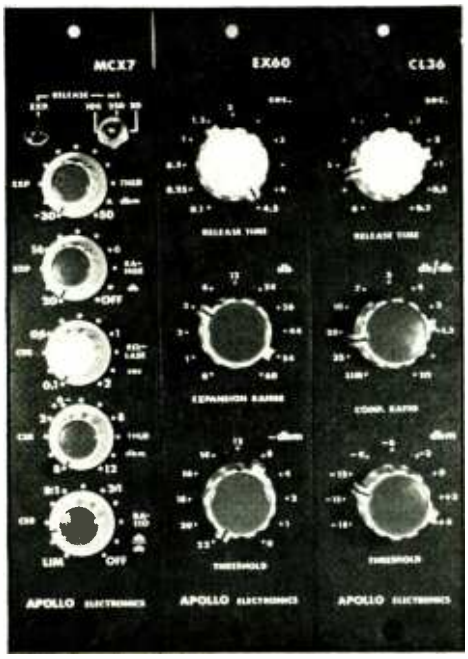
Son of 36 Grand, Model 501
Expandable, modular record/remix console for 24 track recording and quad mixdown. Up to 26 channels, mic/line, with linear slider, mic gain, input off/on switch, solo, two cue mixes, echo from monitor or channel, four es, four-way eq, full monitor control, with sync interface, quad pan, quad source (matrix/program). Independent assign to main 16 output channels. Sixteen vu meters, switchable around groupings, phantom power supply built-in, tb, slate, osc etc. Electronic switch functions.

Grandson II, Model 110A
Console for recording and broadcast. Thirty-six inputs in less than 1m width. Complete metering, two es/return, tb, osc, monitor etc. 'Full capacity system at moderate price,' to fill gap between conventional broadcast consoles and large recording desks.



Son of 36 Grand, model 501, Audiotronics Inc

Apollo MCX7, EX60, C136



BOGEN

Lear Siegler Inc, Bogen Division, PO Box 500, Paramus, New Jersey 07652, USA.
Phone: (201) 343-5700. Telex: 710-990 5047.

CA/CAM Series
Range of simple mic preamps. Four mic inputs, balanced or unbalanced, hi or lo impedance plus one hi Z aux input to master out. Choice of connections between phone jacks and *XLR*. Can be interconnected for multiple working. May also be wall mounted in folding drawer.

CALREC

Calrec Audio Ltd, Hebden Bridge, Yorks, UK.
Phone: (0422) 842159.
USA: Edcor, 3030 Red Hill Ave, Costa Mesa California 92626.
Canada: Canadian Fidelity Sound Corp Ltd, 4237 Dundas St West, Toronto, Ontario MX8 1YC.
Italy: Laboratorio Elettro Musicale, Via Delle Rose, 47048, S Giovanni in Marignano.
Phone: 0541 652 52.
Portugal: Tecla Sociedad Commercial de Discos Ltd, Rua Sousa Martins 5, 1 , Lisboa.
Phone: 56.04.05/56.28.50. Cables: Teclarecords.
South Africa: Tru-Fi Electronics SA (Pty) Ltd, PO Box 31801, Braamfontein, Transvaale.
Phone: 838-4930.
Pakistan: Electronix, 21 Plot FT 2/24, Kurrie Rd, Freretown, Karachi-4.
India: Cinerama Private Ltd, Metro House, PO Box 1232, Mahatma Gandhi Rd, Bombay No 1.
Phone: 293893/4. Telex: 011-4198. Cables: Supersound.
New Zealand: Theatrelight Ltd, 104 Abel Smith St, PO Box 9366, Wellington.
Australia: Crest Record Co., 122 Chapel St., St. Kilda, Victoria 3182.
Phone: 91 3238.

Modular mixing desks. based on full range of standard units.

J Series
Stereo broadcast equipment, in three basic units assembled as required: channel unit with eq, gain, filter and route; groups unit for mixing and subrouting; and monitor/output unit with line amp as appropriate.

K Series
Consoles for large studios, up to 32/4 format with up to four subgroups. Full eq and grouping on all channels, monitor with vu/ppm pfl/afl/compressor/limiters, osc, tb, phantom power provision.

T Series
Portable desks in basic formats of 8/1, 8/2, 10/2(4). Ppm/vu monitoring, switchable monitoring. Osc, tb, pfl/afl, compressor/limiters available. Phantom powering available.

CHADACRE

Chadacre Electronics Ltd, 63 Stratford Broadway, London E15 4BQ, UK.
Phone: 01-534 1207.
No information received.

CHILTON

Magnetic Tapes Ltd, Chilton Works, Garden Rd, Richmond, Surrey, UK.
Phone: 01-876 7957.
USA: Freedom Electronicx Inc, 3540 E Lake St, Minneapolis, Minnesota.
Canada: Radio Service Inc, 2500 Bates Rd, Montreal H3S 1A6.
Italy: Audio Consultante, Via Sabbatini 13, 41100 Modena.
Switzerland: Hi Fi Electronics, Idastrasse 3, 8003 Zurich.
Sweden: HZ Studio, AB Box 6099, 171 09 Solna.
South Africa: Tru Fi Electronics SA (Pty) Ltd, PO Box 31801, Braamfontein, Tvl, 2017.
Holland: Totaa Theater Techniek BV, Egelantiersgracht 30, Amsterdam.
Denmark: Conquist Recording Studios, Holtebakken 63, 2990 Niva.
Norway: Siv Ing Benum & Co, Boks 2493, Solli, Oslo 2.
Greece: Christos Lllis, 8 Enianos Str. Athens 104.
Germany: Amptown Sound Equipment, 2000 Hamburg 60, Alte Wohr 20a.

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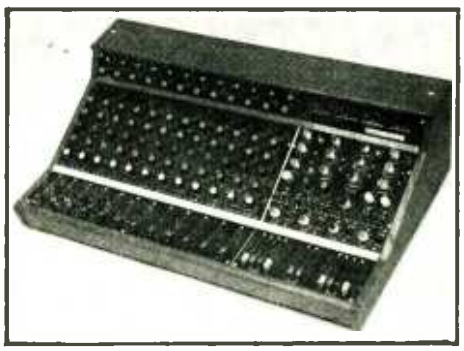
Chilton M12/4



SURVEY: ADDENDUM

M12/4 Portable
For recording, portable or pa applications. Channels include: balance mic/line with gain, hf and lf eq, subgroup with pre/post facility; pfl; pan; channel fader. Output panel includes line/monitor meter switch, aux master send/return, switchable osc, monitor and headphone gain controls each with tape/line/pfl selector. Different input modules optional; extension unit and multicable input socket for music balancing.

M10-2 Mark 3
Similar M12/4 series, with appropriately reduced routing facilities.

ELECTROSONIC
Electrosonic Ltd, 47 Old Woolwich Rd, London SE10, UK.
Phone: 01-858 4784.
No information received.

EL-TECH
Electronic Technology, 112 17th St, Knoxville, Tennessee 37916, USA.
Phone: (615) 546-5509.
No information received.

GATELY
Gately Electronics, 57 W Hillcrest Ave, Havertown, Pa 19083, USA.
Phone: (215) 449 6400.
No information received.

GELOSO
American Geloso Electronics Inc, 251 Park Ave Sth, New York, NY 10010, USA.
Phone: (212) 254-2282.
No information received.

JBL
James B Lansing Sound Inc, 3249 Casitas Ave, Los Angeles, California 90039, USA.
Phone: (213) 665-4101.
UK: C E Hammond & Co Ltd, Lamb House, Church St, London W4 2PB.
Phone: 01-995 4551.

Series of simple, high quality rack mounted mixers.

5306
Mixer/preamp in 8/1 format; channel overload indicator; balanced low impedance inputs on six channels, others unbalanced hi Z program sources. treble/bass controls, master gain, single vu meter.
5308
Eight channel mic expander unit for use with *5306*.
5600-2B
Expandable mixer-preamp. Similar *5306*, but with fascia provision for two-mic expander unit. Mic channels, normally unbalanced, have standard conversion for lo Z balanced working.

MAVIS
International Entertainment Services, 11A Sharpleshall St, London W1, UK.
Phone: 01-722 7161/2/3/4. Telex: 27655.
USA: IES Inc, 3702 Astoria Bvd, Long Island City, NY 11103.

Minmix 12/2
Compact portable mixer with channel buss and master controls on left, right phones and subgroup return. Channel facility includes mic/line input, with gain/trim pot; three range eq; es and fb bussing from each channel; channel fader. Headphone jack outlet for monitoring.

Portable
15/4 mixer for mobile use. Channels with full eq with two additional high level aux input channels. Configuration may be as basic four track full range or two track split into three channels per track, in conjunction with electronic crossover. Further sub groups for external echo and for two fully equalised monitor circuits. Phone jack output for headphone.

PAS 30/30
Comprises two wings similar 15/4 mixer unit above, but with group positions reversed in one instance. Central console incorporates four ppm meters and necessary switching and subgroup control. For use as up to 30/30 recording/remix system. With extra stereo crossover, each wing may drive quad pa.

MILLBANK
Millbank Electronics, Uckfield, Sussex TN22 1PS, UK.
Phone: 0825-4166. Telex: 95505.

Disco III
Stereo sound mixer for custom dj consoles, two disc, one stereo aux and single mic input. Bass/treble control, mic bass cut, comprehensive monitoring Balanced outputs. Panel size 18.4 x 31 cm cutout.

MCC Mark III
Self powered mixer with 10 input channels and two output groups. Channels arranged two groups of five, fader only control. Pfl on each group and all channels, with stereo monitoring. Monitoring vu broadcast, vu peak reading or ppm. External battery or mains operation. DIN standard or *XLR* connectors. Rack mounting.

Musicmaster Three
For use in discos, small theatres etc. Two sections: one for stereo music reproduction, one for music pa (stereo). Pa section includes six channels with hi/lo Z input, pan, hi, lo, mid eq. Push button selection of channel monitor, balanced mc/unbalanced line, coarse sensitivity, es with gain, mute. 61 x 51 x 21 cm.

MM
MM Electronics, French's Mill, French's Rd, Cambridge, UK.
Phone: (0223) 66559.

MP175
Twelve channel stereo console for recording. Semi-modular channels include mic/line switch, gain, four ban eq, fb, es, pan and channel slider. Master groups include return, es and fb master controls and vu metering. Size 72 x 39 x 8 cm, weight less than 3 Kg.

WA600/2
Simple 6/1 portable mixer in case. Single es subgroups, two eq bands on each channel. Short sliders for both channels and groups, with single pot for echo return. Size 50 x 21 x 52 cm.

PARTRIDGE
Partridge Electronics Ltd, 23-25 Hart Rd, Benfleet, Essex SS7 3PB, UK.
Phone: 03745-3256.

Range of mixers for various scale operations in broadcast and recording between 5/1 and 24/8 formats. Wide range of possible design and configuration based on the following modules: preamp combinations from lo Z balanced mic to disc, with gain and hi, lo boost/cut; virtual earth mixer; eq with mid control also; compressor/limiter with input gain, threshold and recovery controls; autofade; monitor; selection of groups and subgroups; fb, es, pan; lineup osc; tb. Wide range metering as required. Wide range of standard chassis frames.

Mini
Five channel mini mixer in 5/1 format. Meter switchable, single bass/treble and gain controls.

PRECISION
Precision Electronics Inc, 9101 King St, Franklin Park, Illinois 60131, USA.
Phone: (312) 678-5350.
No information received.

PULTEC
Pulse Techniques Inc, 1411 Palisade Ave, Teaneck, New Jersey 07666, USA.
Phone: (201) 837-2575.
No information received.

RCA
RCA Commercial Communications Systems Div, Front & Cooper Sts, Camden, New Jersey 08102, USA.
Phone: (609) 963-8000.
No information received.

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The Neve way to real economy in up to 16 track recording

The Neve way to real economy is the 8034. It is a flexible sound mixing console that has all the facilities for a modern studio working with up to 16 track techniques on original recording or for multi-track reduction.

The 8034 offers real economy and this should be critical in your investment decision making this year. The price is right and your investment in Neve's quality of performance and service assures that the real costs are lower over the life of your console.

There's plenty of value for money in these 8034 features:

- 16 track metering and recording
- 20 input channels using either the 1073 or 1084 amplifier
- 4 output groups with reduction to stereo and mono modes of operation
- amplifiers built in full enclosed and shielded modules.

Everything about the 8034 is in the Neve tradition of excellence. And the best is what you need to save money in the long run.

Neve

The Sound of Neve is Worldwide

Rupert Neve & Co., Ltd., Cambridge House, Melbourn, Royston, Herts., SG8 6AU England. Tel. Royston (0763) 60776 Telex 81381 Cables NEVE Cambridge
Rupert Neve Incorporated, Berkshire Industrial Park, Bethel, Conn. 06801, USA. Tel. (203) 744-6230 Telex 969638
Hollywood: Suite 616, 1800 N. Highland Ave., Hollywood, Ca. 90028. Tel. (213) 465-4822
Rupert Neve of Canada Ltd., 2719 Rena Road, Malton, Ontario, Canada. Tel. (416) 677-6611 Telex 0696 8753
Rupert Neve GmbH 6100 Darmstadt Bismarckstrasse 114 West Germany. Telefon (06151) 81764

SURVEY: ADDENDUM

RICHARDSON

J. Richardson Electronics Ltd, 57 Jamestown Rd, London NW1, UK.
Phone: 01-267 0723.

Eight channel mixer
For portable or studio use, in cabinet form and 8/2 format. Channel and group sliders, groups select, mic pad on floating 600 ohm input. Ppm metering. Price £400.

Discotheque mixer
With mic, two aux, gram 1 and 2 inputs; master and cue outputs. Tone controls and twin vu metering. Monitoring and sound/light outputs provided. Price £250.

MC6000
Modular system offers compact system to appropriate requirements. Channel facilities include line/mic and gain, hipass filter, three band eq, three mid range mid frequencies selectable, es and two fb, four output groups, ppm switch, 10 cm fader with auxiliary and alternative modules for monitoring and line outputs.

SOUND TECHNIQUES

Sound Techniques Ltd, Industrial Estate, Mildenhall, Suffolk IP28 7AS, UK.
Phone: 063871-3631.
No information received.

SPHERE

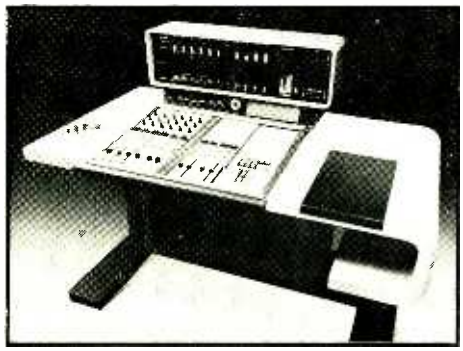
Sphere Electronics, 20201-A Prairie Ave, Chatsworth, California 91311, USA.
Phone: (213) 349-4747.

Standard and custom mixers for various applications including recording and broadcasting.

Eclipse Series
Available with configurations up to 24/24, for recording studios. MIXLOG automation programmer available as option, for which information should be shortly available. Comprehensive facilities and monitoring, fully modular design. Options include 24 track monitor on 16 track console, slide monitor units and seven frequency osc. Prices eg 16/16 $27 802, 24/24 $34 677.

Alpha Series
Consoles designed primarily for radio and tv broadcast production. Alpha B is stereo broadcast console, Alpha T for tv. Alpha *1* and *11* are portable, with full facilities in small format for smaller stereo and quad recording situations. Features include long throw faders, solo, mic/line selection, switchable pad, es and return, cue mix, pan, quad output option, tb, slate option, monitor, osc. Consoles also available custom for sound reinforcement. Optional extra module is *900* graphic in channel fitting, nine frequencies.

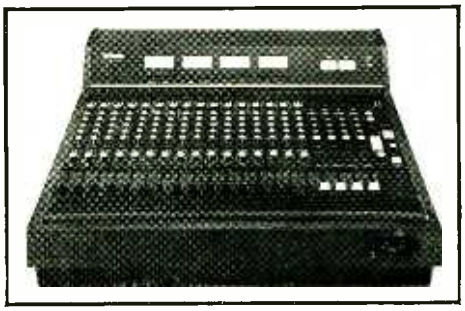
Schlumberger programmable console (R)



2005 AD

2005 AD, Naudain St, Philadelphia, Pa 19146, USA.
Phone: (215) 545-3488.

2022
20/2 mixer for live music and pa situations. Any number of channels up to 20 as required. Channels include: mic input 150 ohms balanced, with hi impedance mic and aux options; 20 dB mic pad, 30 dB preamp range; eq hi/lo shelves and mid bell; pan; cue mix; echo mix; mute; solo with indicator; led overload indicator; long throw plastic faders. Four digital led vu meters: left, right, solo/echo, cue. Headphone/monitor output gain. Two aux inputs with pan, solo and mute. Cue master, and echo return. Outputs 600 ohm balanced; external echo breakpoints. Modular construction on aluminium chassis. 74 x 38 x 14 cm, weight 18 Kg. Vinyl scribble strip.



Yamaha PM1000

TDP

TanDen Productions, PO Box 382, Gainesville, Texas 76240, USA.
Phone: (817) 665-4026.
No information received.

VORTEXION

Vortexion Ltd, 257-263 The Broadway, Wimbledon, London SW19, UK.
Phone: 01-542 2814. Cables: Vortexion SW19.
No information received.

ZOOT HORN

Zoot Horn Sound Equipment, 31 Station Road, London SE25 5AH, UK.
Phone: 01-653 6018/8483.

Non-modular Series
Various formats incorporating mic/line, 600 ohm floating or 3k ohm unbalanced, eq ±15 dB at three fixed frequencies and presence of up to +15 dB at 3 kHz. Single limiter per output with variable level outputs and release time. Prices 10/4 £895, 16/4 £1195, 20/4 £1395.

Modular Series
Offered in recording studio and public address options, to custom requirements. Sound reinforcement/public address options include: switchable and continuously variable eq turnover frequencies, hi/lo pass filters, integral limiters, up to four fb subgroups, quad pan. The recording studio options include bell/shelf curves, variable slope filters, multitrack output, vu/ppm metering and patch bays.

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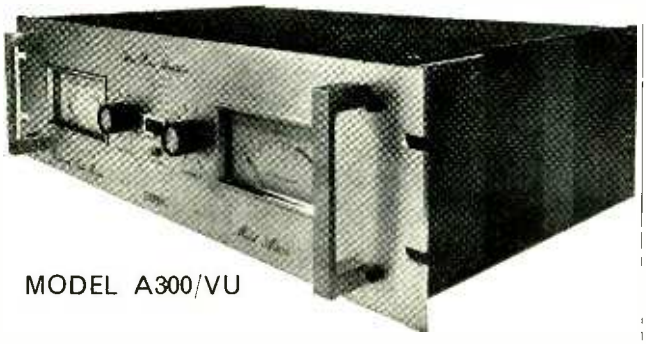

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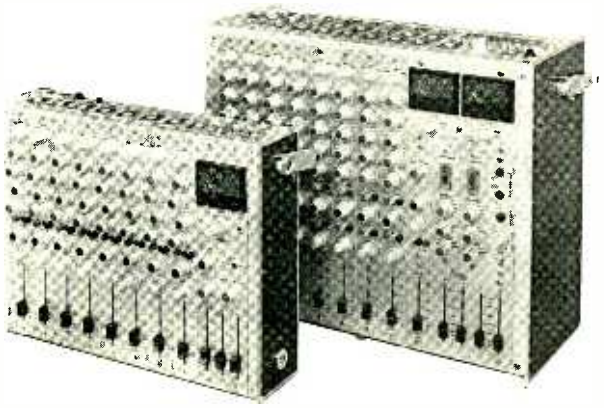

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Despite the common associations, broadcasting in Soviet bloc countries varies considerably in programme content, organisation and domestic technical level.

Radio in Eastern Europe

JOHN FISHER

THE East European communist countries, excluding Albania and Yugoslavia, are members of the economic grouping centred on the Soviet Union, the Council for Mutual Economic Aid (CMEA). Yugoslavia has observer status with the CMEA. Since its break with the Soviet camp, Albania has relied largely on China for economic and technical assistance.

The CMEA countries have their equivalent of Eurovision—Intervision. The broadcasting co-ordinating body is the OIRT (u. Mrázovky 15, Prague 5, Czechoslovakia). Albania is not a member and Yugoslavia is a member of the EBU. The German Democratic Republic (GDR) has not adopted the OIRT television standards and for historical reasons—principally the possibility of reunification of the two German states at the time when frequencies were being decided for FM broadcasting—the GDR adopted the Band II frequencies used in the West and by Yugoslavia rather than the OIRT frequencies. This has created a market for dual-standard receivers in for example Czechoslovakia, where German is widely spoken and where GDR (and West German) transmissions can be received.

The CMEA countries are developing their own telecommunications and data transmission system, VAKSS, to be built in three stages of five years each from 1976 onwards; this will embrace existing cable and radio links, which are to be updated, and there will be provision for video-telephones, stereo radio programme transmission and the exchange of television programmes and data. The system will use digital techniques. In 1974, one of a series of microwave television links was opened between Gyoer in Hungary and Bratislava in Czechoslovakia, as part of a series of such links to improve the quality of programme exchanges.

There are some important differences between the fm transmission system of the OIRT countries and that of the EBU countries, most particularly as regards stereo transmission. The OIRT system provides for peak deviation of ± 50 kHz (peak to peak deviation of 130 kHz with a 15 kHz audio bandwidth) with 75 μs pre-emphasis. Polar modulation is used for stereo broadcasting, using a 31.25 kHz partially suppressed sub-carrier. For colour TV, the OIRT countries use the French SECAM system.

USSR

Broadcasting is government controlled through the State Committee for Radio and Television, with its headquarters in Moscow. The main radio and television programmes are originated centrally, from Moscow, with further broadcasting centres in the capitals of the constituent republics and other major cities.

The Soviet Union's domestic and foreign service broadcasts are among the world's most extensive in terms of programme hours and languages broadcast. Most of the USSR's radio broadcasting is on short and medium waves, with some on long waves and vhf. Priority has been given to full national coverage of the Central and republican television programmes; requiring the use of satellite relay stations, these in turn may one day make the spread of vhf-fm broadcasting that much easier. Meanwhile, plans for a fifth tv programme for the Moscow area by 1990 are already being discussed.

The VHF network (66-73 MHz) at the moment provides four main programmes on vhf in the Moscow area, with a special stereo programme and local vhf radio; there are up to three programmes from transmitters elsewhere. Vhf-fm broadcasts can be received in 250 cities and at least 16 centres radiate special stereo programmes.

There are 55-60 million radio receivers in use (no breakdown for fm) and 50-60M wired radio points. In addition there are some 65M tv sets in use and the combined output of the 130 principal tv centres has been variously put as 1250-2000 hours a day of programmes, reaching 75 per cent of the population in 60 languages. Six programmes from Moscow Television's 21 studios are relayed all over the country by a network of about 1500 stations and satellite links. According to Soviet statistics, 98 per cent of families who live in 'areas of reliable reception' possess a TV set and the potential audience is over 170M. Videocassette recorders and prerecorded cassettes are promised for the near future and videorecorders are in production, one example being the Elektronika *VE 301* by Pozitron of Leningrad which uses 12.7 mm tape.

Moscow radio broadcasts four main programmes in its domestic service, which are relayed to the various republics of the Union. The first and second programmes are subject to various regional subdivisions.

The First Programme is destined primarily for listeners in the Western USSR and is broadcast for about 20 hours a day; there are parallel services for listeners in the Soviet Far East, in East Siberia and West Siberia. The individual republics relay Moscow 1 with the addition of regional programmes in Russian and the main language of the republic. The First Programme is subdivided into three by geographical and time zones. A typical day's output on the first programme might include about 2½hrs of news and press reviews, half an hour of political comment, five hours of mainly serious music by mainly Soviet composers, 4½ hours of broadcasts for children and young people, some 2½ hours of features on science, industry, economics or political history, an hour of literature and drama, as well as some 40 minutes devoted to physical training and nearly half an hour of sports news.

The Second Programme (Mayak) is broadcast round the clock and consists mainly of light music with news, comment and interviews every half-hour, as well as sports commentaries and features on road safety and agricultural techniques, for example; some items are repeated during the night for listeners in the Soviet Far East and Siberia. In the republics of the USSR, much of the programme is in the main language of the republic.

The Third Programme is broadcast for about 14 hours a day and carries serious music, literature, drama and news. The Fourth Programme, broadcast on vhf only, covers a similar cultural range to the Third Programme, without the news.

Listeners' reactions to programmes are sometimes reflected in mailbag or diary type programmes. There are also programmes dealing with industrial and social shortcomings. Women's programmes are pretty traditional. Regional Third Programme transmissions differ from the Central Third Programme put out from Radio Moscow.

The special stereo programme (about four hours a day) broadcasts mainly music and appears to form part of the Fourth Programme which is vhf only. There is a Fifth Programme, am only, mainly repeating the First Programme for nationals working abroad. Regional Programmes are also broadcast for several hours a day from the main republican stations; on the whole these are am but there are a number of regional fm transmissions as well. Special local programmes are also broadcast for some major cities.

According to information given in Radio Moscow's external service broadcasts, the radio has 1300 transmitters throughout the country (not all fm). It broadcasts for 3200 hours a day in 68 languages of the USSR and 70 foreign languages.

The USSR is at the heart of the communist block's Orbita network of satellite communication stations and Molniya communications satellites. By the end of 1975 there will be approximately 60 Orbita ground stations, com-

pared with about 50 in mid-1974. A geostationary Molniya 1s satellite launched in July 1974, was in a circular orbit 35850 km from the Earth's surface, with a period of revolution of 23 hours 59 minutes; it carried equipment for experimental long-range television and radio broadcasts. In November 1974 the USSR announced its intention of launching a communications satellite to provide the necessary coverage from the Olympic Games in 1980. The Moscow to Irkutsk radio link is probably the world's longest TV communications channel and is being extended to Vladivostok.

Bulgaria

Control of broadcasting is vested in the Committee for Television and Radio of the Council of Ministers, and is at Blvd. Dragan Tsankov, Sofia. There are three main domestic radio programmes and an external radio service with broadcasts in 12 languages. In addition there are local am broadcasts of news in 7 languages for holidaymakers on the Black Sea.

There are two programmes on both am and fm, with a third cultural programme on vhf only. The two principal programmes, carrying news, information and entertainment, are the 'Horizont' and 'Khristo Botev' services. The cultural programme 'Orphey' now reaches an estimated 35-40 per cent of the country; the 'Orphey' programme broadcasts much of its music in stereo. A local radio broadcast for the Sofia area goes out on the 'Orphey' frequency on weekday afternoons, and in all there are about 48 hours of domestic service broadcasting a day. The 'Horizont' programme became a round-the-clock transmission from September 1974. The 'Khristo Botev' programme is on the air 17½ hours a day, from early morning.

Radio is still the primary broadcasting medium, although television is developing fairly rapidly and there are now about 1½ million television sets in use for a potential audience of 8½ millions. The maximum audience is normally about 6 million. Bulgarian Television broadcasts about 76 hours of programmes a week from 11 transmitters. A new tv centre is being built in Sofia and a second television channel came into service in 1975, with more colour programmes. According to a report in the OIRT journal, Bulgaria has developed its own video recorder at the Institute of Physics of the Academy of Sciences; it apparently uses a fixed head and conventional tape, but little other information is yet available.

A relay link between Sofia and Athens, opened in June, will provide television and radio exchange facilities between the two countries as well as enabling Bulgaria to use Greek earth-stations for satellite communications.

Czechoslovakia

The broadcasting authority is the Czechoslovak Radio, Prague 2, 12099 Vinohradska 12. Prior to the Warsaw Treaty intervention in August 1968 Czechoslovak radio and television, in common with certain sections of the press, had enjoyed a degree of independence of the establishment and became quite adventurous in its current affairs programmes. After the invasion a number of journalists and others found it necessary to leave the country and things have not been as free as they were in the Prague Spring.

Since the death this year of the old liberal President Svoboda, who managed to stay in the presidency after August 1968 despite the many other leadership changes, there has been a marked cult of the personality of the new President Gustav Husak in the press and media. Indeed, this cult began before Svoboda's death and probably indicates that hard-liners are now firmly in control of the media after the many overt and covert purges. It may be some while before the media again becomes so liberal. But if anything, the intervention by Warsaw Treaty Forces has perhaps linked the Czech and Slovak Republics, which together comprises the federation, a little more closely. The careful balance of the federation, the equal treatment of Czechs and Slovaks is, however, still slightly self-conscious in the alternation of items in the Czech and Slovak languages in the national news bulletins and current affairs programmes broadcast by the main 'Hvezda' service.

Radio broadcasting in the domestic service is on both am and fm. In addition, there is an extensive television service (there are about as many tv as radio licences) and external service am broadcasting.

The national programme is the 'Hvezda' programme, which is Prague-based. There is, separately, the Czech-language Prague home service, and the Czech news and culture programme 'Vltava'. Correspondingly, there is the Slovak-language Bratislava Home Service and Slovak 'Devin' news and culture programme. 'Vltava' also carries foreign language programmes — Russian, German, English, French and Spanish—primarily for language students.

'Hvezda' broadcasts throughout the 24 hours. Prague Home Service broadcasts for approximately 20 hours a day, as does Bratislava Home Service. 'Vltava' is on the air for about 15 hours a day and 'Devin' for about an hour less.

There is a 'Central Bohemian Studio' regional programme from Prague on vhf and medium wave; the main Prague Home Service is am, but is broadcast on fm by Ostrava. Almost all the main transmitters carry local options from their stations on the home or 'Hvezda' services. Programmes are also transmitted over a wired network.

Domestic broadcasting was rescheduled in September 1974. Prague home service and 'Vltava' carry more music, unpopular programmes being dropped, and Saturday morning broadcasts on the Prague home service include foreign correspondents' dispatches, interviews and talks, a listeners' views programme on Saturday evenings, and popular music, poetry and short stories precede the Saturday evening newsreel. The Bratislava and 'Devin' services continue to carry current affairs and literary programmes, but the amount of music has increased and there are to be more audience participation programmes. In all the domestic services broadcast about 120 hours of programmes a day; about 72 per cent of the population are regular listeners.

The amount of stereo broadcasting has doubled since the autumn of 1974 on the 'Vltava' and 'Devin' vhf networks and is to be extended to the whole country in the period 1976-80.

Over 90 per cent of the country can receive the television First Programme and 40 per cent of the country can or should be able to receive the Second tv programme. There is approximately one television set for every six people and evening tv audiences are estimated at 3-6M. First colour transmissions took place in Prague in May 1973 and regular colour transmissions began shortly after on the second programme. Also during 1973, Czechoslovak television became able to exchange programmes in colour with Intervision and Eurovision. By 1980 there should be 120 hours of colour transmissions a week, with regular First Programme transmissions in colour from May 1975 and 70 per cent colour coverage by December. A new radio and tv centre has been opened in Bratislava and this will broadcast both television and vhf radio programmes from its transmitter; the centre will form part of the Intervision programme exchange network. Czechoslovakia's first (Cosmos) satellite communications station was opened in 1974 in time to enable a direct May Day Rally relay from Moscow; it will also provide links with Cuba and Mongolia.

German Democratic Republic

Broadcasting is in the hands of the State Committee for Radio and Television of the GDR Council of Ministers, 116 Berlin, Nalepastrasse 18-50. In addition to two television programmes, external radio broadcasting and a service in Russian for Soviet troops in Germany (am), there are four domestic service radio programmes, supplemented by regional transmissions on second programme frequencies. There is stereo broadcasting on the vhf first and second programmes in several areas.

There is home service broadcasting 24 hours a day. The 'Voice of the GDR' programme consists mainly of news, comment, information and entertainment throughout the 24 hours. The Radio 'GDR' first programme carries information and entertainment, including light music in stereo, while the 'Radio GDR' second programme consists of culture, education and news and includes serious music in stereo. The 'Berliner Rundfunk' programme is relayed by many of the vhf transmitters outside Berlin; it carries news and entertainment for about 21 hours a day, linking up with 'Radio GDR I' for the remaining three hours. The Radio 'GDR II' transmissions have regional as well as central programmes.

Television is well developed. The First Programme broadcasts an average of 12 hours a day and the Second Programme about 23 hours a week, a large proportion of this at the weekend in colour. Colour is also being introduced experimentally onto the First Programme. At the moment over 60 per cent of the population can receive the second programme in colour and by the end of 1975 nearly 90 per cent of the population should be able to receive the First Programme colour transmissions. There are about 5M tv sets in use, but only 10000 or so are colour sets.

There is considerable co-operation between the GDR and the USSR in the video, optics and medical electronics fields. A joint enterprise, Assofoto, was set up by the GDR and USSR towards the end of 1973, and it was stated at the time that it would eventually be responsible for 90 per cent of film and tape production in the CMEA countries. The GDR produces studio

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equipment and hopes to be exporting recorders to Britain and other countries by 1978 or earlier.

Hungary

Under a resolution of the Hungarian Council of Ministers in September 1974, Hungarian Radio and Television are in future to function as two separate independent bodies. The Government ordered the setting up of a state Committee for Radio and Television to act as an advisory, consultative and co-ordinating body. The intention is that the 'efficiency' of programme production and the 'political and technical conditions of management' should be improved by this step, which replaced the former single Hungarian Radio and Television authority (also government controlled), whose address was Brody Sandor 5-7, Budapest 7.

There has been a serious effort in recent years to popularize vhf-fm radio; in mid-1973 about 472 000 of Hungary's 2.5M radio licence holders had vhf sets and incentives were being given in the form of hire-purchase facilities, bank loans and a year's licence exemption to encourage the purchase of vhf sets. Annual total radio sales (mainly imported sets) are estimated at about 500 000 on the domestic market.

There are two main programmes in the domestic service, 'Petoefi Radio' and 'Kossuth Radio', plus a Third Programme on vhf-fm only. The Third Programme is currently the only one on which there is any stereo broadcasting. There are five transmitters at present, with 10 further scheduled.

'Petoefi Radio' carries news, information and music. 'Kossuth Radio' is a news and information programme which carries some advertising. The Third Programme is a news and culture programme. Additionally, regional programmes are broadcast on am.

There is a considerable programme of capital construction work for Hungarian Television in hand at present. At present television is limited to a few hours' programmes on weekday evenings and 10 hours or so on Saturdays and Sundays. Nevertheless, there are an estimated 2 250 000 tv sets in use, including 7000 or more colour sets; at least one relay, at Tatabanya, has been built with voluntary labour. Nippon Electric of Japan supplied equipment for the new Tokaj television second programme transmitter, relaying Budapest, which will have a service area of about 80 km radius.

On the studio equipment side, one item which Hungary manufactures and exports is multichannel recorders; these are used as much industrially as by broadcasting organizations.

Poland

Broadcasting is controlled by the State Committee for Radio and Television Broadcasting, ul. Woronicza, Warsaw. In addition to the two television programmes and a proposed third, as well as extensive external service am radio broadcasting, there are three domestic radio programmes transmitted both on am and vhf-fm, with regional opt-outs, and there are am transmissions by a Pathfinders' (similar to Boy Scouts) station and an amateurs' station.

A new high-power (2000 kW) long-wave transmitter has been brought into service at Konstantynow, near Gabin, to broadcast the First Programme. This will free the present First Programme vhf transmitters to carry a new Fourth Programme from Warsaw. The Konstantynow transmitter is now operating 24 hours a day; its mast, believed to be the world's highest, is 648m high. At present, the vhf service carries the First Programme for 18 hours a day. Additional vhf transmitters are being provided to improve Third Programme coverage and towards the end of 1975 there will be 95 per cent coverage of the country by vhf-fm services providing three programmes; all transmitters will be stereo-capable.

Stereo broadcasting is progressing rapidly (nearly 2000 hours by 1973), two of the most important recent developments being the start of stereo broadcasting by the Bialystock transmitter and the opening of the first stage of the giant Szczecin radio and tv centre in June 1974. The Szczecin centre will be housed in an 18-storey building and will be completed by the end of 1975. The centre will be equipped to originate colour television programmes and to provide sound productions in mono, stereo and quadraphonic formats.

Polish radio has been experimenting with quadraphony since 1972. The first quadraphonic recording by the radio was made during the Warsaw Autumn Festival of 1972, a piece by Kazimierz Serocki entitled *Sontinuum*. Experimental tests have been carried out with a view to quadraphonic broadcasting and it is claimed that satisfactory means have been found to provide high-quality quadraphonic reproduction. Preparations are also said to be in hand for the production of quadraphonic radios and gramophones for the consumer market.

Progress in a slightly different field: it emerged during a French National Assembly foreign affairs debate in November 1973 that the French Embassy in Warsaw had been found to be 'stuffed with microphones' and 'a little marvel of miniaturized electronics' which enabled all the diplomats, commercial and military attaches to be overheard in their own offices, 'some even in stereo'. Apparently 42 of these bugs were discovered, but we are not told how many were stereo ones or indeed whether quadraphonic bugging appeared to have been attempted.

The electronics industry is one of the most rapidly developing in Poland; the value of production has increased more than four fold in the past 10 years, mainly since 1971, and trade in electronics with the other CMEA countries has increased eight fold. There has been a complete restructuring of the industry, and considerable progress in semiconductor production. Consumer products manufactured include stereo equipment, radio and TV sets—and shortly quadraphonic equipment as well. Reel-to-reel and cassette recorders are produced and designs for colour video-cassette recorders are in hand. Work is also in progress on the development of liquid crystal devices produced at the Institute of Organic Chemistry of the Polish Academy of Sciences, with a view to their eventual use in flat-screen tv sets. Stereo fm receivers and mono portables are being produced in conjunction with Sanyo of Japan.

On the telecommunications front, an important event was the opening of Poland's first communications satellite station at Psary, in the Swietokrzyskie Mountains, on 17th July 1974. The station will be part of the Intersputnik system and will be used for radio and television programme exchange and long-distance telephone communications. The station was opened several months ahead of schedule and will provide programme exchanges with the USSR, Czechoslovakia, Cuba and Mongolia, and shortly Bulgaria and the GDR as well. The station has been built with Soviet assistance.

There are well over 6 100 000 tv sets in use in Poland; by late 1974 the number of tv sets owned exceeded the number of radios (5 900 000). Demand for colour tv sets is increasing rapidly and there is a shortage. About 95 per cent of the population are or shortly will be covered by First Programme transmissions. By the end of 1975 some 45 per cent of the population will be able to receive Second Programme transmissions, the whole of the tv network should be converted to colour and about half the tv programmes should be in colour. All programmes are expected to be in colour by the end of 1978.

In common with other OIRT countries, Poland uses the French SECAM colour system, and a great deal of the colour equipment is bought from France. Colour tv began in Poland in 1971 and towards the end of 1974 30 per cent of live transmissions were in colour. At present 50 per cent of the films shown on television are in colour.

Romania

Broadcasting is carried out by Romanian Radio and Television, Bucharest, 60-62 Str. Nuferilor—PO Box 111. In addition to the three domestic service radio programmes, broadcast am and on shared vhf-fm frequencies, there are two television programmes and external service radio broadcasts; the second television programme is limited to a few hours a day. Regional radio broadcasting is am only. The external service broadcasts for nearly 197 hours a week, including multi-language bulletins for tourists and relays in Russian from Moscow radio.

In the vhf transmissions, Third Programme transmissions share First Programme frequencies. The Second Programme is broadcast on vhf by only the Bucharest, Cluj and Constanta transmitters. The First Programme carries news, information and light music; the Second Programme news, sport and serious music; the Third Programme news, information, music and poetry, etc.

There are 20 television transmitters, but of these only two are 100 kW or more and several are only a few kilowatts each. At present there are some 2000 000 tv sets in use. No information is at present available on plans for stereo broadcasting in Romania.

Yugoslavia

The central body responsible for broadcasting in Yugoslavia is the Government controlled Yugoslav Radio and Television, 70 Borisa Kidrica, Belgrade. However, there is a considerable devolution of control and management to the republics and autonomous provinces of the federation and, like the country's politics and economics, the structure and

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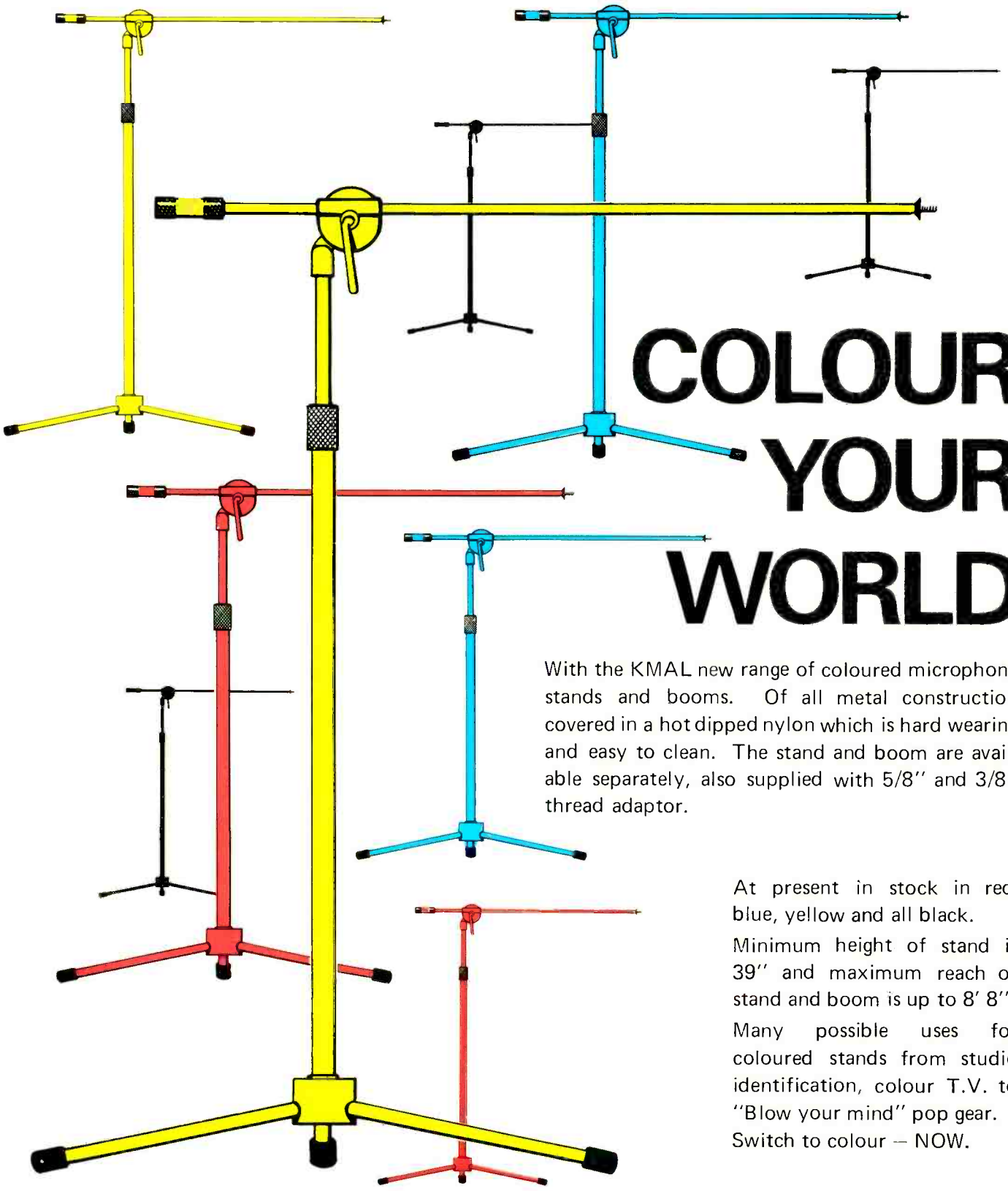

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RADIO IN EAST EUROPE

functioning of broadcasting in Yugoslavia is complicated. There are Government sponsored external service transmissions from Belgrade, as well as independent external transmissions from some republics of the federation.

The essence of Yugoslavia's brand of communism, under its founding father President Tito, has been 'socialist self-management'—Marxist ideals coupled to national independence, the decentralization of authority and decision-making, the collective responsibility of all members and groups of society. This implies self-management within the media, but in recent months there have been drastic purges where individuals have allegedly made use of this philosophy to direct their paper or programme in a way that falls foul of the League of Communists. The League itself has been purged of many who abused the fact that the best jobs went to League members. Yugoslav thinking, or at least that of President Tito, remains puritanical.

There are three basic home service programmes originating from Belgrade, with corresponding-programmes or local variations from the republican and provincial centres and their relays. In addition Belgrade broadcasts two Studio B programmes, one in stereo on vhf-fm and the second on am only, and the '202' programme. There are in addition a considerable number of local transmissions, mainly am.

The First and Second Programmes of the home services are basically news, information and entertainment programmes. The Third Programme is a serious music and talks programme. '202' is a non-stop light-and-pop music programme, with news flashes as they are received. Studio BI is an entertainment programme, with commercials, and the Studio BII programme (am) is a news and folk-music mixture. This is something of a gross oversimplification but may give an idea of the structure of the radio system. Belgrade radio broadcasts a news bulletin every 30 minutes, including 10 newsreels a day. During 1975 the radio will put out some 22 000 hours of programmes in its domestic service, an average of about 60 hours a day. Programmes are financed by licence fees, but in addition there is some commercial advertising.

As mentioned earlier, Yugoslavia has not adopted OIRT standards; for television it has adopted the system used by most of West European members of the EBU and the PAL colour system. Both its television programmes are in colour; transmission is again organized on a republican basis, with common material. The Koper-Nanos transmitter in Slovenia broadcasts colour programmes in Italian for Italian speakers every day, and the newly completed Novi Sad radio and tv centre will be putting out programmes in five languages; its radio programme facilities have already been completed and transmissions will be in Serbo-Croat, Hungarian, Slovak, Romanian and Ruthenian, and can be in stereo. Television set ownership has still not caught up with radio: there are something over 2 500 000 sets in use, one per eight inhabitants, compared with over 6M radios.

In June 1974 a satellite communications station, providing television relays, became operational at Prilike, in Western Serbia; construction had begun two years earlier. The station will work within *Intelsat* using a geostationary satellite over the Atlantic. It will provide links with the USA, Canada, Britain, Spain and other European countries, Africa, South America and other distant European countries. Equipment for the station was supplied by Nippon Electrical and Mitsubishi.

Further Reading

Readers wishing to keep abreast of broadcasting developments in Eastern Europe may be interested in the weekly document *World Broadcasting Information* published by the BBC Monitoring Service, Caversham Park, Reading, Berks. RG4 8TZ, UK. Collated information on transmitters, frequencies, programme hours and broadcasting organizations, is published annually in the *World Radio and TV Handbook*, (Soliljevej 44, 2650 Hvidore, Denmark) (distributed in the UK by Billboard Publications, 7 Carnaby Street, London W1V 1PG). The ITU *International Frequency List* with its suppliments gives exhaustive details of frequencies and other technical data.

COUNTRY	Number of FM transmitters (mid 1975)	Frequency Range MHz	Maximum transmitter power (kw)	Number of transmitters radiating stereo
ALBANIA	none	—	—	—
BULGARIA	11	65.84 - 72.44	...	4
CZECHOSLOVAKIA	14	66.32 - 72.74	10	3
G.D.R.	15	88.25 - 99.70	100	7
HUNGARY	7 (+10 planned)	66.02 - 72.86	...	1
POLAND	20 (+8 new or scheduled for completion shortly)	65.90 - 73.01	120	12
ROMANIA	10	66.36 - 72.74	16	—
USSR	(Numerous)	66 - 73	...	16
YUGOSLAVIA	57 (+33 low-power repeaters)	87.70 - 103.10	100	6

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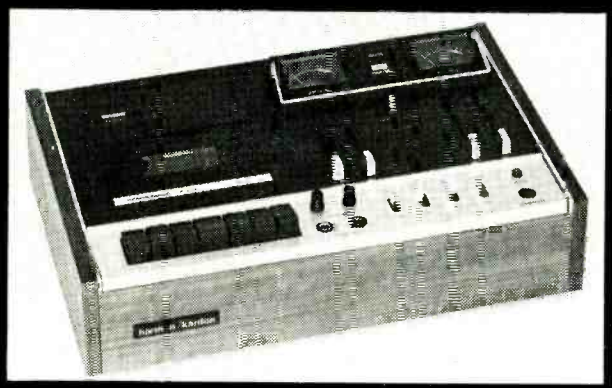

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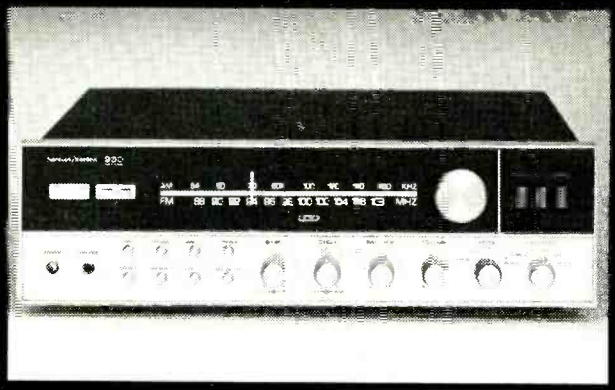

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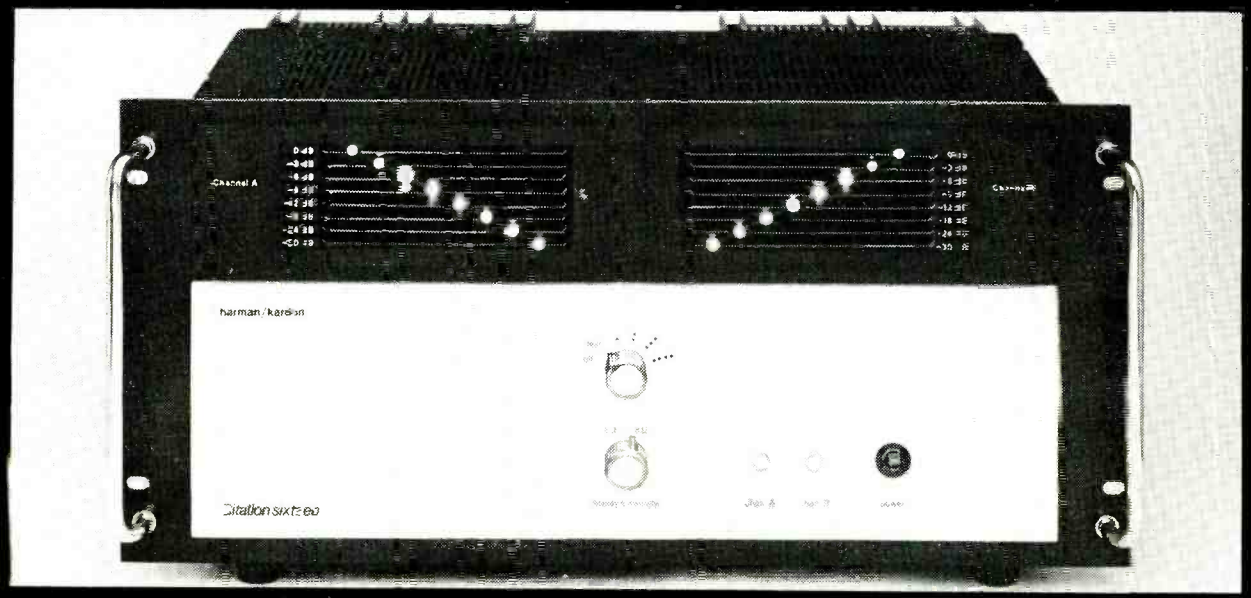

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Eire is a country of contrasts; rotting terraces and picturesque villages, donkey carts and superbikes, and archetypal characters from a thousand jokes with some outstandingly articulate people within their ranks. This same theme typifies the Irish recording industry. Control rooms that would make a British or American engineer throw up his hands in horror can produce sounds calculated to brighten any producer's face providing, of course, that the hardware doesn't give out mid-take. This implies that the engineers who work in this environment develop a very broad understanding, not only of straight balancing skills, but also of the technical aspects of recording hardware.

In Eire, at present, the industry is in a state of flux. The current marketing forces act impartially to produce change upon a small but growing industry; within the last year, two completely new 16 track studios have been opened, with plans drawn up for a third. Similar pressures are forcing and have forced existing studios to update or go under. Until recently, there was little need for the sophistication of modern studios since record production was very much a cottage industry due to the limited marketing potential for the finished product—the population of the country is only 3M. With a small volume of sales, the industry was geared to a 'record today, cut tomorrow and release the day after' policy, since the Irish record companies simply hadn't got the money to finance large-scale productions. This reflects on the studios leaving themselves short of self-generated investment cash. Irish studios have reacted in different ways.

Trend Studios

Situated in a mews off Lad Lane—a picturesque cobbled street approached through an archway in a line of shops—the studio seems well situated; although located towards the centre of Dublin, there is minimal traffic noise and no obvious flight paths. The building is not modern, suggesting that at other times it must have been many things to many people. The inside presents a similar impression even though Trend Studios has resided there many years. The only Irish studio with a longer pedigree is the Eamonn Andrews Studio in Harcourt Street—training ground for many engineers within the Irish recording industry.

The inside of the building would raise the eyebrows of anyone used to the padded environment of better-known international recording studios. It must be said that the first impression was one of ceiling wax and string, an impression which is unfortunate in view of the prodigious output of choice quality material from the sixteen track studio. One enters the working areas by a side door opening directly onto the studio floor; there is no separate access to control room. Things which detract from the aesthetic appeal include a mass of dexion iron work of no discernible function situated beneath the control room window, but most of all a collection of very tatty acoustic screens. These are of conventional appearance and dimensions apart from the windows; these are constructed from polythene which not only looks unsightly but which inevitably must reduce the obtainable acoustic isolation. In fairness, at the time of the visit, the studio was littered with the wreckage of a late night session which never helps much.

Resident engineers are Fred Meijer and Paul Waldron. Fred, who has been in the business eight years following a C and G electronics course, described the origins and functions of the custom console situated in a long and narrow control room. 'It's a 20 in 16 out designed by John Hodson and Dave Maynard of Mayfair Sound Studios although we've added to it and modified it a bit ourselves.' Each mic channel comprises routing by eight way rotary switch with a separate 1 to 8 or 9 to 16 switch to make up the 16 output groups. Panning is fixed between groups one and two or nine and 10 only. Next come two foldback circuits followed by a double echo circuit. Channel gain is variable between +10 dB and -65 dB, with adjustment of ±5 dB available on a trim control. Eq comprises the usual bmt and hipass; what wasn't expected was the middle to be fully parametric between 0.7 and 7 kHz.

At present, the desk is fitted with eight 25 mm master faders although these are due to be replaced by 16 12.5 mm units. Didn't this cause Fred problems? Shrugs: 'The group masters (faders) are switchable to two sets of line out . . . I can lay sixteen tracks down if I go back into the mic amp and switch across using the patch . . . It becomes all sixteen straight in.'

Both the 16 and two track mastering machines are unusual. The former, based on a Scully transport, uses electronics designed by Roger Paton. The heads for the detachable blocks were manufactured by Branch and Appleby. At present, the studio uses no noise reduction on multitrack masters. Fred claims that modern tapes such as EMI *815* alay potential noise buildup to the point where it's unnoticeable. However, John D'Ardis, managing director, states that the purchase of a rack of Dolbies has high priority on the shopping list*. A modified high speed Revox *A77* handles reductions through *301* Dolby A units.

The monitoring system comprises, for each side, a JBL (perhaps the *1315*) monitor chained to the ceiling with an even larger bass cabinet mounted below. Both are coupled by split drive/active crossover to a Quad *303*. The unusual

**These have now been purchased.*

Previous page bottom left: *Trend control room, L to R John D'Ardis, Paul Waldron, Fred Meijer.*
This page below: *Eamonn Andrews Studio, Philip Begley and Brian Masterton.*

arrangement derives from the rather awkward acoustics of the room: 'This control room was very bad . . . you can see from the line under the speakers the height of the original ceiling. It was terrible. We had this chappie in from the BBC—can't mention any names—gave us the basic dimensions for what we wanted.' To flatten the resonances, fibre blocks, covered with slotted plastic material, line the walls from about one metre above the floor to ceiling height of three metres. Fred and Paul continue: 'We're going to rip it out and start again from fresh because we're not 100 percent happy with it . . . it's too live at the moment so we're not really hearing what's happening.' How do the acoustics affect the resulting mixes? Fred: 'Having been in the control room so long, we know how it's going to affect the master and so make the necessary adjustment.'

John D'Ardis, himself a producer and writer, comments on what is required of Irish studios: 'When recording, they try to put as much down as quickly as possible and push it out as fast as they can . . . sales of a single would be (typically) in the order of three to four thousand which means that they can't afford to spend as much money over here. The home market is too small to support a big recording industry—our rates are £15 an hour so we have to be very cost conscious ourselves.'

How does tight finance affect the quality of the finished product? Fred: 'Having been here so long, I am used to the breakneck pace . . . I know that five minutes lost means that the clients moan viciously.' John: 'If we're not rolling on the first backing track within half an hour of the band coming into the studio, there'll be complaints. The first take is usually 15 minutes after they enter the room.'

Does Trend handle much foreign work? John: 'On the price factor, we used to advertise in England, but with the troubles in the North, there was no way that we could get the bands to come over . . . It's a shame, Ireland is a nice place to record. I think that within a couple of years, you will find a couple of studios like the Manor because, over here, prices can definitely be kept down and the session men are much cheaper. Their rhythm sections are particularly tight.' What about the stories of legendary quantities of beer consumed on session? Fred: 'In the old days, yes, a tremendous amount. In fact, it was one long drunken orgy the whole way through . . . The last half-hour of a three hour session was the take. But now people have become very money conscious. They come in, do the take and then go out for a drunken orgy.'

There has been much criticism of the quality of Irish pressings. Fred and John felt that the blame could be shared equally between the producers, cutters and manufacturers over extending the service-life of the stampers: 'About a year ago, we did a session that cost about £2000 in recording fees. We worked on it like hell . . . got everything perfect. The tape leaves here, went to a cutting place in England—I won't mention the name—and was duly cut and sent back here. The A side was cut in mono and the B side was cut backwards.' There could be just a slight excuse in this case; the recording was on an Uillean pipe ensemble—this instrument is a cross between a tenor sax and a small set of bagpipes—which, one imagines, would sound rather similar played backwards or forwards. In this case, the tape was unaccompanied during the cutting which, according to John, is something that should never happen.

Although value judgements should have no place in an article such as this, they are sometimes unavoidable. Apparent shortcomings in the hardware ('we use this old Gaumont-Kalee compressor if we really want to squash something') whether real or imaginary, place no restriction on the quality of output produced at the studio. John played some masters, in some cases written and produced by him, recorded at Trend which were of subjectively equitable quality with any other masters that the author has ever heard. And all at £15 an hour.

Eamonn Andrews Studios

Although no longer a major force in Irish recording, the Eamonn Andrews Studios deserve the credit for being one of the first multitrack studios to be set up in Ireland. In a way, the eight track studio reflects the requirements of the much larger organisation to which it belongs. The Eamonn Andrews Organisation — named after the director, Thames TV and *This Is Your Life* man—comprises Dublin's Gaiety Theatre and a string of about twenty dance halls as well as the successful tv club situated in the same building as the tv and recording studios. The organisation aims to promote local talent by the inevitable process of signing up, providing venues and, naturally, making records.

The recording studio facility, with the control room situated between the sound (one) and television (two) studios and with a view of both, seems fully equipped although the hardware looks rather dated. The functional Neve 20/8 console feeds an eight track Ampex *MM-1000*, through a set of eight Dolbies. This tape machine resembles, at first glance, a broadcast vtr and dominates the 3 x 4m control room. Engineers Brian Masterson and Philip Begley report that it's a fine and dependable machine. Reductions are done on a Studer *B62* with the monitoring handled by ceiling suspended Tannoy Lockwoods driven by a Quad *303*. In addition, a pair of aerial JBL *4310* cabinets keep a check on the bass end. Philip Begley explains: 'We use them just to check the bass end . . . we find that, using the Lockwoods, when we put enough bass on here, it's bass heavy anywhere else.' Studio I (the sound studio) could almost be a suburban living room, mainly due to the wall to wall fitted red carpet and the white skirting board. Divided into two rooms with a removable partition, the 4 x 3 x 3m rear section actually has a sash window looking on to the outside.

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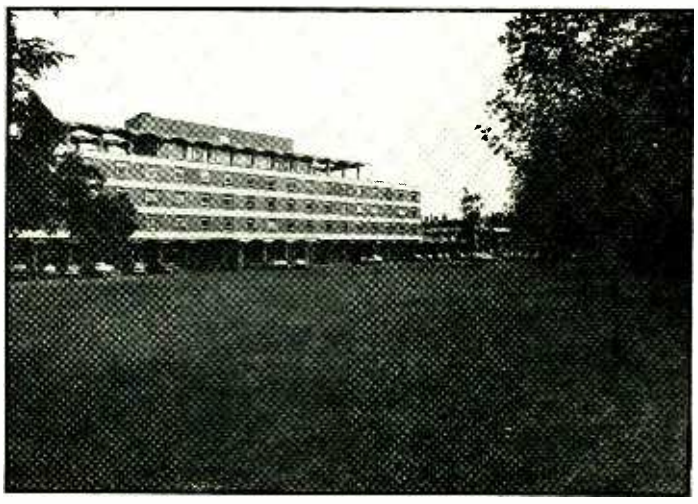
Dublin Sound Studios (see over) in a monastery garden.



There is no air conditioning. The main section, with a very fine Bechstein standing in the corner, measures 7 x 4 x 3m; inevitably, the much smaller rear section finds use mainly as a drum or vocal booth.

Dependent as they are on local, as opposed to imported, talent, Tom Walsh, general manager of the complex, was asked about the role of broadcasting in the records and recording business. He suggested that Radio Telfis Eireann the national broadcasting network, did not give enough needle time to home produced music: 'We don't think that RTE play their part at all . . . It would take more than one day to tell you and I'm not going to damn myself on tape because RTE is the only station that's here.' He pointed out that only about 20% of the station's needle time was given to all categories of music of Irish origin. He made the analogy of BBC Radio 1 with an 80% American playlist. Tom stated that this was all part of the 'national inferiority complex'.

Dublin Sound Studios

In Eire, one expects the unexpected but some things remain a surprise. Like walking into the reception of the building that houses Dublin Sound Studios and finding, in place of the encouraging young lady, a rubicund young priest of the Order of the Redemptionists: 'Er, excuse me but I'm not trying to be funny but I thought that this place was a recording studio.' 'Sure it is' said the Father breaking into a wide grin: 'It fools them all . . . Go straight down the passage and thro' the swing doors and 'tis on your left.' Which was where the encouraging young lady was seated.

Completed in September 1974, the 16 track studio represents the first Irish recording facility equipped to the usual international standards. At an aggregate cost of over £200 000, the hardware complement includes a custom Neve 24/16 format console expandable to 24 output groups at a later date, one 16 track and two stereo *M79s* plus a corresponding rack of Dolby *361* units. In addition, there is the usual complement of gear such as plates, echos, springs and companders etc. There are three engineers: Pat Morely, late of Eamonn Andrews Studios; an Englishman, Bob Harper, who held a prodigious track record at Pye, and assistant engineer Keith Mansfield.

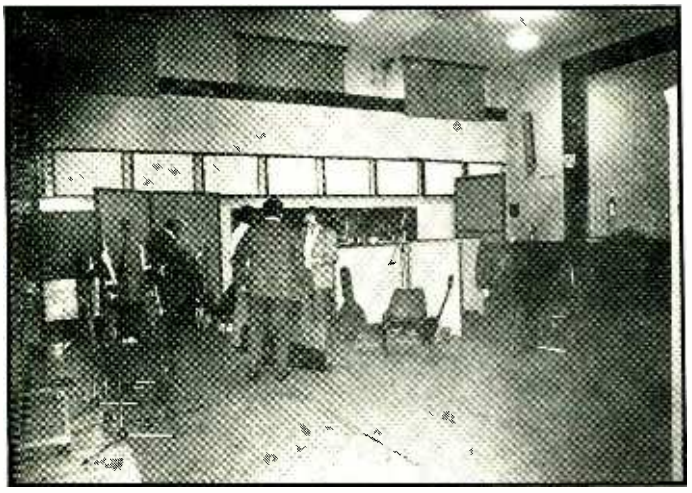
The studio is housed in a wing of a building leased from the Church including a theatre/hall, complete with stage, which forms the basis for the recording floor. The very high ceilings, inherent in the immutable design of the auditorium, cause a few problems ('Can you try to keep them out of the photographs?') However, these are readily surmountable by using acoustic screens of varying sizes to damp down the otherwise excessive reverberation times. Similar screens are used to blank off parts of the studio, in all large enough to accommodate a full symphony orchestra, when not required. There are compensations—the studio can produce excellent recording conditions for strings just by heaving a few screens. The design of the studio provides another spin-off. Pat says that he has recorded a band playing on the stage and an audience in the auditorium for a really live production. For heavy isolation, there is a purpose-built drum booth opposite the double glazed window through to the control room.

Why was it decided to invest £200k in a studio situated in Dublin? Philip Green, writer of scores for 200 feature films, producer of 6000 records and, recently, owner of Dublin Sound explains: 'Why not . . . Before I came to live in Dublin, I had done a bit of recording here and I found that it was the only capital city without a major recording studio.' Was this expansionist thinking? 'The Irish recording industry is looking out more and more . . . It is getting into other markets and, getting well in . . . particularly Europe and USA.' Green stated that it was more than just an ethnic revival on the part of ex-patriot Irishmen living in America. He said that the current work situation was so good that he was definitely going to build another studio, along the same lines as Dublin Sound, within the next few months. At present, the kind of work handled by the studio includes mostly Irish clients. This was certainly correct at the time of the visit. The Wolf Tones, a talented band who rose to fame with songs about the evils of the Brits, debated heatedly, via the talkback, whether to finish off the session or go over to Mooney's Lounge and get fluted.

Philip Green said that he would, in due course, be bringing foreign artists over to record backed by local session musicians. Once again, he pointed out the session men were particularly strong on brass and rhythm although there were fewer top rate people than there are in London.

Above: *Dublin Sound working.*

Below: *Dublin Sound off to Mooney's.*



Montreux Casino

To do it, they had to airfreight 32 tons of building materials and equipment. The result was that the Mountain Recording Studio, situated at the foot of Lake Geneva, Switzerland, took a mere 3½ months to install. 'Install' because the control room and studio are housed within the Montreux Casino building, which also includes a recording hall with space for 300 musicians and a seating capacity in excess of 2000. Mic, foldback, talkback and cctv lines connect with the Westlake-designed underground control room which has no direct visual access to either the hall or studio.

The control room houses a large 32 in 24 out Neve console feeding into two Studer *A80* 24 track machines in a master/backup arrangement. The room employs a symmetrical design with Westlake *TM-1* monitors mounted at each corner to match the quad capability of the Neve desk. There are three more Studer *A80*s, one four track, the others stereo, to handle quad and stereo mixdowns. Mountain Studios uses Dolby noise reduction. The studio itself, with a capacity for about 20 musicians, features a complete slate floor, an active trap ceiling system and various tunable enclosures to control the character of the environment.

Husband and wife team Alex Grob and Anita Kerr (as in Anita Kerr Singers) own the new recording facility which they would like to promote as an international centre, although they point out that the Mountain Studio fulfils a peculiarly European need that has arisen since the inception of large scale concert promotions. They describe their studio as 'state of the art'; something which chief engineer John Timperly, late of Chappell's Studios, London, would not disagree with.

The man in charge of the instal-

lation work was Ron Balmer, the Westlake Audio foreman, aided by Scenic Sounds Equipment and Mercury Electronics who provided the system interface for all the electronic equipment.

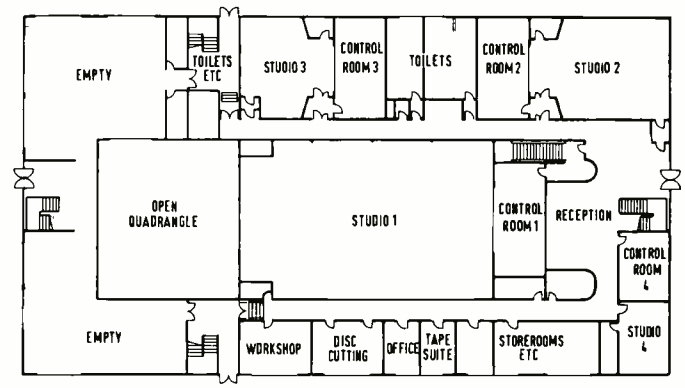
On the road again

Once again, the Music Centre, Wembley seems set for success. This time, though, the chances appear a lot better following the timely intervention of chief executive Louis Elman and ex-CTS sound engineer Peter Harris. The good word seems to have got around and the confidence has returned, and with it the clients lost after the false start of the operation in mid 1971.

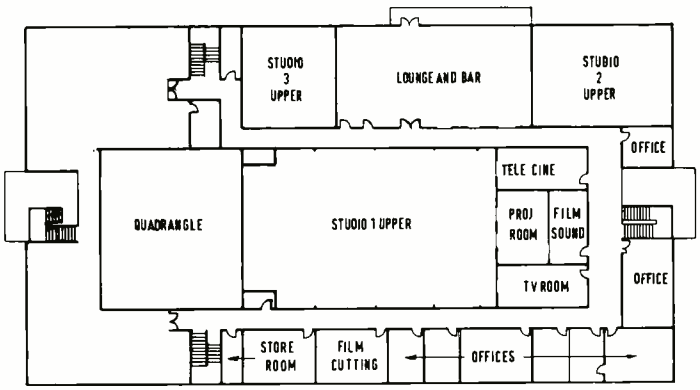
The basic complex comprises four studios; the last of them re-equipped in June 75. The event was marked by a very friendly champagne party attended by the smart young set and even some of the shabbier ones. The guest list included most of the board of Neve (who supplied the consoles) Roy Wood and Labi Siffre (recording at the Music Centre) and 'Big Jim' Sullivan (offering other guests refills from a Pyrene fire extinguisher). In spite of the amount that has already been written about De Lane Lea in general and The Music Centre in particular, the story would not be complete without reference to the events that led up to the re-equipping.

The idea behind the Music Centre was conceived by Dave Siddle in 1969 while he was in charge of the highly successful De Lane Lea Kingsway studios. At the time, the clients list was impressive, ranging across Mickie Most, Fleetwood Mac and Deep Purple. The late sixties was anyway the golden era for the studio complex—it was around this time that Command and CBS Whitfield Street were built—following the immortalisation of the EMI house studios, Abbey Road, by the Beatles. Perhaps it was this wide publicity that made the idea of a complex the day's bandwagon with the merchant bankers. In the event, Humphries Holdings, effectively De Lane Lea cash box, gave the go-ahead to design and build a studio complex from the ground up. This is when the troubles started.

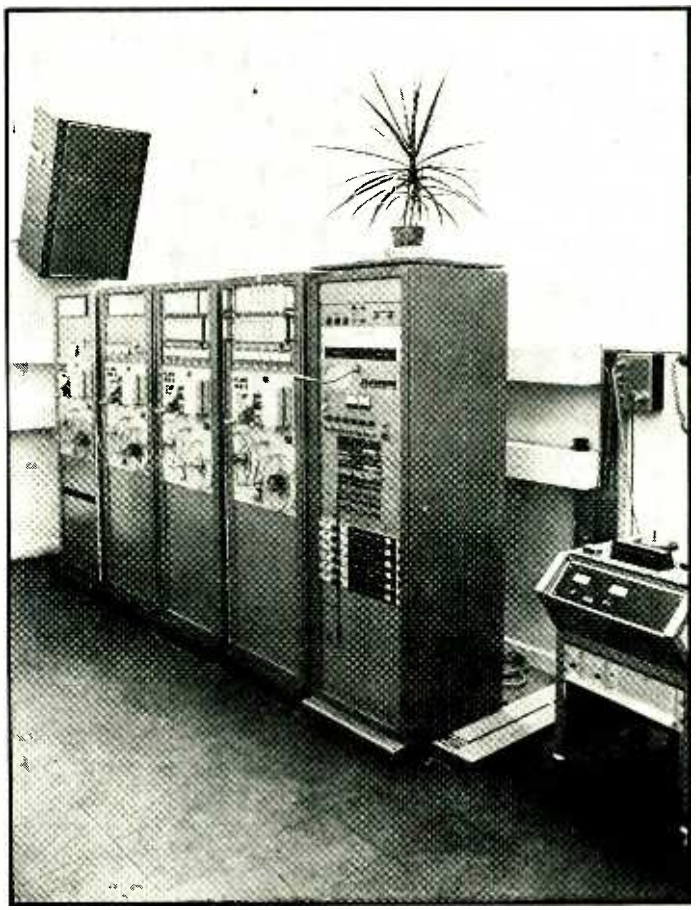
The basic problems arose out of the specifications for the hardware. Siddle's concepts for the structure of the building would seem to have been reasonably on course since there have been few subsequent modifications by Peter Harris. In each of the control rooms, choice



Above: *Music Centre, ground floor*
Below: *First floor*



Man against nature



was a combination of Sound Techniques desks and the ill-fated Unitrack 16 track tape machines. While it is uncertain what the specific equipment failings actually were, it is certain that the clients found great difficulties in producing reasonable standards of work. A former engineer at the Centre describes the problem in terms of 'having to fight the control room.'

Because of these troubles, there occurred a mass exodus of clients who expected results similar to the De Lane Lea, Kingsway studios, which, in the meantime, had been sold to Ian Gillan and have since resurfaced successfully as Kingsway Recorders. The presence of a white elephant, lacking in expected turnover, naturally upset Humphries Holdings who foresaw their investment being fitted for a pine box. The board's decision was to send in someone to find out what was going on. So in September 1972, Louis Elman, who started in De Lane Lea Ltd as assistant studio manager in 1957 and later joined the board in 1964, took over the position of chief executive of the Music Centre from Dave Siddle, who resigned a few months later. It had been too much for Siddle who had attempted to run everything single handed, seldom delegating to anyone else, and he was quoted in 'Music Week' (28/10/72) as saying that the task which he had set himself was 'bloody impossible' and that he resigned from admin duties so that he could concentrate on his 'first love'—the technical operation of the Music Centre. Within a few weeks, Dave Siddle left for Germany to join Studio 70 in Munich, where he is at present.

Louis Elman consulted with the engineers, at the time Martin Birch, David Hunt and Louie Austin, to find out about the staffing and equipment situation. It was fortunate for Elman and the Music Centre that, two months prior to Dave Siddle's departure, the group had acquired CTS, the well known and respected film people, displaced from their premises at Bayswater due to site redevelopment. Some, including Peter Harris, were transferred to the Centre thus strengthening the film side and, at the same time, providing an able sound engineering man. Having been pursuaded that the Music Centre could be made viable, Humphries released more money to re-equip the sound studios.

Peter Harris went through the complex, starting with Studio 1, pulling out the Sound Techniques desks and Unitrack tape machines. He also modified the Dolby

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switching arrangements and changed the existing Sound Techniques monitor system for a Crown/Tannoy Lockwood installation, using the original speakers. Some alterations were made to the acoustics, both in the control room and in the studios, notably establishing a permanent drum cage in Studio 2. The modified equipment line up, with a few variations applies to all the studios in the complex.

Studio 1
Neve 30/16 format console with 24 monitor groups.
Studer 16 track *A80*. Also eight track head block.
B62 two track
Eventide Instant Phaser
Universal Audio and Neve compressors
EMT stereo plates
Autostart (for film sync)
Full 35 and 16 mm film dub
Full Dolby complement

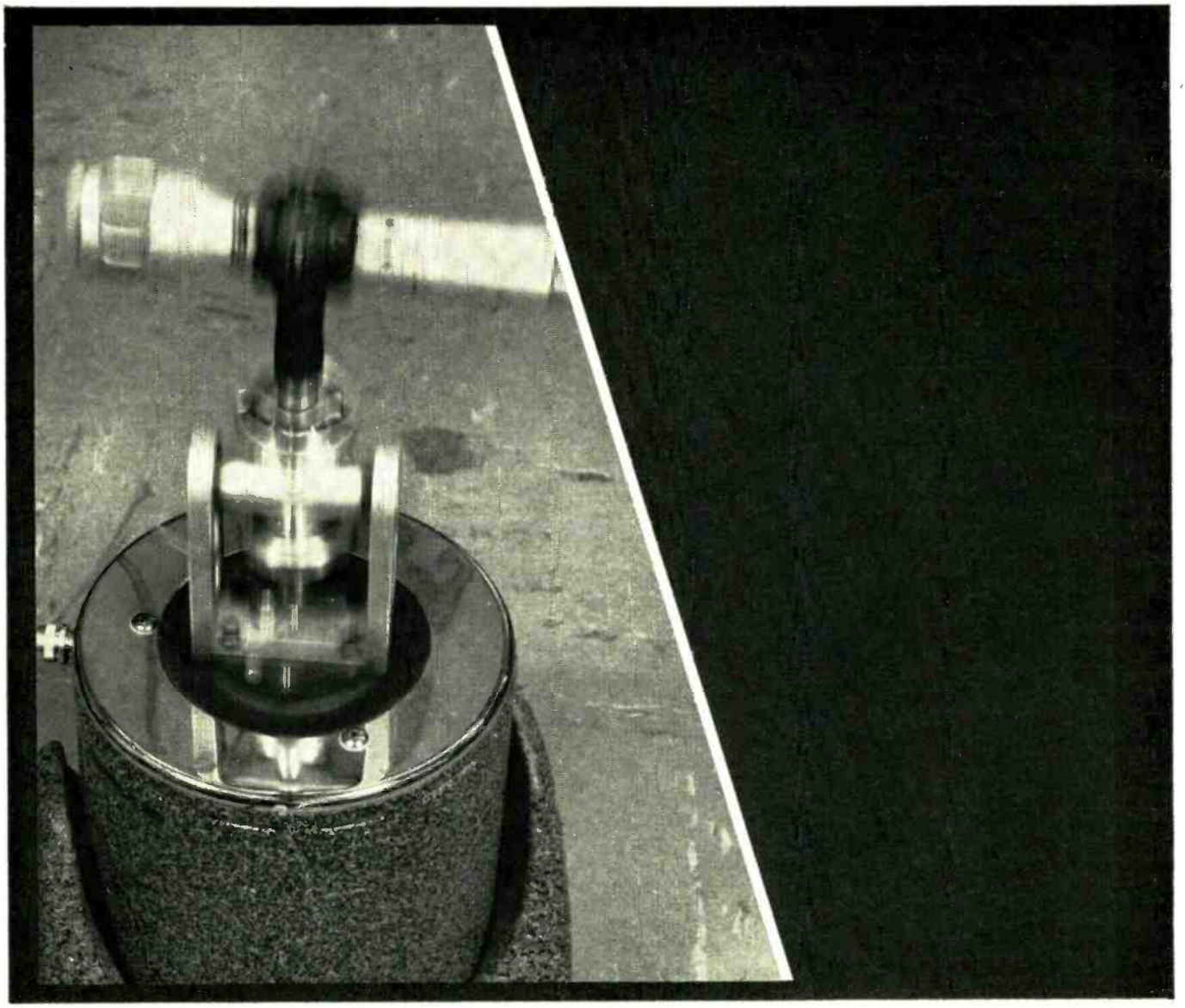
Microphones have increased and diversified over and above the initial complement, but still maintain the *U87* in larger numbers. Studios 2 and 3 are similarly equipped, with the exception that 3, the 'pop' studio is fitted with a Studer 24 track. Studio 4 is equipped with 20/4 desk with 16 monitor groups and is used for remix and overdub work.

Elman says that more things than the hardware have changed: 'This place had a clinical atmosphere . . . one thing that I am proud of is having achieved a family atmosphere . . . we bend over backwards to make clients happy.' This has not always been the case: 'The terrible thing was that we had the pop scene in our grasp but we lost it. But now, it's started to come back.' Very true. The list of new or returning clients since the rebuild reads rather like the Radio 1 playlist. Lynsey de Paul, Andy Williams, Shirley Bassey, Showaddywaddy, ELO, Shadows, Three Degrees etc. This doesn't include the prodigious number of scores for feature films for which the Music Centre is now particulary well known: *Rollerball*, *Tommy*, *Return of the Pink Panther*, *Murder on the Orient Express*, *Stardust* etc.

There are few concrete plans for expansion in the future although the options are open. Situated among faded and often derelict pavillions of the 1924 British Empire Exhibition, the starkly new Music Centre building has much room in which to expand. Regarding the existing facilities, the next update would probably be to automated mixing. This should be a great asset in view of the time saved, especially if plans for a house record label, in conjunction with Ben Nisbet, succeed. The indications are that they will.

Frank Ogden

Music Centre's Studio Three.



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A banquet will take place on Sunday November 2 at 8 pm (following an hour's relaxation) to celebrate with the award-winning AES members who showed notable progress at the Convention. Banquet tickets are $22.50.

If you wish to visit places of interest, a social programme has been arranged to include Soho and Orchard Street. Theatre tickets will be available and further attractions easily visited by the Cultural Loop Bus Service, both cheap and convenient.

AES preview

DRUSILLA DALRYMPLE

Friday, October 31
9.30 am

AUDIO IN MEDICINE
Chairman: **Philip Kantrowitz,** Queensborough Community College, Bayside, New York.

Spectral Analysis of Heart Sounds in Children—A. J. Dozer, J. Bettinger, A. C. O'Riordan, B. Kingsley and E. Eshaghpour, Hahnemann Medical College and Hospital, Philadelphia, Pennsylvania.

Graphic Findings in Artificial Pacemakers—Samuel Zoneraich, Olga Zoneraich and Jai J. Rhee, Queens Hospital Center, Jamaica, New York.

Energy Origin of the Sound Wave—Wilbur James Gould, Lenox Hill Hospital, New York, New York.

Cerebral Hemisphere Dynamics Imaged by a Radiopharmaceutical—Arthur S. Trappier, Jewish Hospital and Medical Center of Brooklyn, Brooklyn, New York.

Ophthalmic Applications of Diagnostic Ultrasonography—Clyde R. Locke, Long Island City, New York.

Auditory Aid to Deaf Speakers in Monitoring and Controlling Voice Pitch—Edgar Villchur, Foundation for Hearing Aid Research, Woodstock, New York.

Friday, October 31
9.30 am

DISC RECORDING
Chairman: **Charles Repka,** Vanguard Records, New York, New York.

Lacquer Warp, Advanced Ball, and Disc Cutter Dynamics—Daniel W. Gravereaux and James V. White, CBS Technology Center, Stamford, Connecticut.

Manufacture of State of the Art Lacquer Masters—Joseph Kempler, Capitol Magnetic Products, Los Angeles, California.

Variable Pitch and Depth: Its Latitude and Its Limits—Ronald R. Marcucci and Santo G. Galatioto, Capps and Co, Inc, Valley Stream, New York.

The Electro-Forming of Phonograph Record Stampers: A Need for Reappraisal and Redirection—Stephen F. Temmer, Gotham Audio Corporation, New York, New York.

Role of Polymer Science in Developing Materials for Phonograph Discs—S. K. Khanna, RCA Records, Indianapolis, Indiana.

New Factors in Phonograph Preamplifier Design—Tomlinson Holman, Advent Corporation, Cambridge, Massachusetts.

Friday, October 31
2.00 pm

SIGNAL PROCESSING
Chairman: **Irving L. Joel,** Joel Associates, Teaneck, New Jersey.

A Versatile Memory System for Console Automation—Carl De Wilde, Automated Processes, Inc, Huntington, New York.

New Devices for Equalisation—G. R. Thurmond, G. R. Thurmond and Associates, Austin, Texas.

The Computer Aided Console—G. A. C. Watts, Rupert Neve and Co Ltd, Cambridge, England.

A Variable Frequency Limiter/Compressor/Expander—Larry Blakely, dbx Inc, Waltham, Massachusetts.

Development of a Wide Range Universal Frequency Equaliser—Kiichiro Watari, Shiniciro Ishii and Kenichi Takahashi, Matsushita Electric Industrial Company, Ltd, Osaka, Japan.

The Practice of Fully Programmable Mixdown Automation—Paul Galburt, Automated Processes, Inc, Huntington, New York.

Friday, October 31
2.00 pm

MAGNETIC RECORDING
Chairman: **J. G. McKnight,** Magnetic Reference Laboratory, Mountain View, California.

More Signal, Less Noise, Not Always a New Tape—Tom Daniel, Nagra Magnetic Recorders, Inc, New York, New York.

Distribution of Maximum RMS Spectrum Levels in Live Music Samples—Daniel Queen, Daniel Queen Associates, Chicago, Illinois.

Control of Modulation Noise in Magnetic Recording Tape—David Mills, Helge Kristensen, Virgilio Santos, Ampex Corporation, Magnetic Tape Division, Redwood City, California.

NAB Cartridge Tape Recording and Reproduction Standards—John P. Jenkins, International Tapetronics Corporation, Bloomington, Illinois.

Third Octave Presentation of Time Constants in Audio Engineering—Edward R. Hanson, Philips Audio Video Systems Corp., Mahwah, New Jersey.

Friday, October 31
7.00 pm

PSYCHOACOUSTICS
Chairman: **Herman Silbiger,** Bell Laboratories, Holmdel, New Jersey.

Detection of Phase-Shifts in Harmonically Related Tones—Richard Cabot, Douglas Dorans, Michael Mino, Ira Tackel and Henry Breed, Acoustic Research Laboratory, Rensselaer Polytechnic Institute, Troy, New York.

On 'Out of Head Localisation' in Headphone Listening—Naraji Sakamoto, Toshiyuki Gotoh and Yoichi Kimura, Matsushita Electric Industrial Company, Ltd, Osaka, Japan.

Towards a More Natural Sound System—L. R. Hay and John Hanson, University of Waterloo, Waterloo, Ontario, Canada.

Localisation Effects in the Quadraphonic Sound Field—Richard Cabot, David Wilson and Henry Breed, Rensselaer Polytechnic Institute, Troy, New York.

Friday, October 31
7.00 pm

AUDIO IN BROADCASTING
Chairman: **Eric Small,** Orban / Broadcast, San Francisco, California.

New Improvements in Audio Signal Processing for AM Broadcasting—Oscar J. Bonello, Sistemas Solidyne, Buenos Aires, Argentina.

A Dynamic Noise Reducer for FM Stereo—Richard C. Cabot, Acoustics Research Laboratory, Rensselaer Polytechnic Institute, Troy, New York.

The papers will be followed by a panel discussion,
Broadcast Audio Quality: The Sound and The Fury
moderated by **James A. Lippke,** Editor, Broadcast Management Engineering. Among panel members who are expected to participate are: **Richard Schumeyer,** Chief Engineer, WAVZ, New Haven, Connecticut; **Glen Clark,** formerly Assistant Chief Engineer, WLS, Chicago, Illinois; and **Eric Small.**

Saturday, November 1
9.00 am

INSTRUMENTATION
Chairman: **Anthony Schneider,** B & K Instruments, Cleveland, Ohio.

Electroacoustic Free-Field Measurements in Ordinary Rooms Using Gating Techniques—Henning Moller, A/S Bruel & Kjaer, Naerum, Denmark.

A New Method of Measuring the Directivity Factor, *Q, Re, Df,* **etc., of a Commercial Sound Loudspeaker**—Don Davis, Synergetic Audio Concepts, Tustin, California.

Spectrum Analysis of Tape Recorder Distortion—Howard A. Roberson, Sound Measurements, Pittsfield, Massachusetts.

Swept Electroacoustic Measurements of Harmonic Distortion, Difference-Frequency and Intermodulation—Henning Moller, A/S Bruel & Kjaer, Naerum, Denmark.

The 'On-Line' Application of Programmable Calculators to Audio Frequency Measurements—Hugh D. Ford, Sunbury-on-Thames, Middlesex, England.

On the Measurements of Phonograph Cartridges by the Pulse-Train Method, Part II—Teruo Muraoka, Hideo Onoye, Victor Company of Japan, Ltd, Tokyo, Japan, and John M. Eargle, JME Associates, Los Angeles, California.

Saturday, November 1
2.00 pm

ELECTRONIC MUSIC
Chairman: **David Friend,** ARP Instruments, Inc, Newton, Massachusetts.

Analog Circuitry for Linear Frequency Modulation—Robert Moog, Moog Music, Inc, Williamsville, New York.

Man-Computer Interaction as a Creative Aid in the Formulation of Digital Sound Structures—Barry Vercoe, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Floating Point Digital to Audio Conversion—Richard J. Steiger, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Electronic Music Applications of Slew-Limited and Cascading Sample-and-Hold Units—Bernard A. Hutchins, Jr, Electronotes, Ithaca, New York.

Use of the Multi-track Recorder as a Composing Aid in Electronic Music Systems—Roy A. Pritts, University of Colorado at Denver, Denver, Colorado.

Modulation Techniques for Timbre Control in Analog Electronics — Allen Strange, San Jose State University, San Jose, California.

Sunday, November 2
9.00 am

SOUND REINFORCEMENT
Chairman: **Robert Lin,** Sound Systems, Inc, Long Island City, New York.

Proper Acoustic Response From the Front Row to the Rear Row—Glen M. Ballou, United Technologies Corporation, Hartford, Connecticut.

360-Degree Symphonic Concert Halls and Music Pavilions—Christopher Jaffe, Jaffe Acoustics, Inc, Norwalk, Connecticut.

Noise Rejection in Audio Equipment for the Performing Arts—Charles Richmond, Richmond Sound Design, Ltd, Vancouver, B.C., Canada.

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AES PREVIEW

Power Ratings for Sound Reinforcement Loudspeaker Systems—Robert B. Schulein, Shure Brothers Incorporated, Evanston, Illinois 60204.
Audio Systems for Life Safety—Waton N. Hershfield, Consulting Engineer, Corte Madera, California.

Sunday, November 2
2.00 pm

VIDEO DISC systems and their impact on audio
Engineering representatives involved in the following systems will take part in a discussion of what lies ahead in the video disc. The systems to be described are: Philips and MCA Video Disc; RCA SelectaVision Video Disc; Teldec; and Zenith Radio's Transmissive Optical Disc. Les Brown of the *New York Times* is Chairman.

Monday, November 3
9.00 am

TRANSDUCERS I
Chairman: **Louis Abbagnaro,** CBS Technology Center, Stamford, Connecticut.
Development of a Loudspeaker System with Omnidirectional High Polymer Tweeters—Koji Hatakeyama, Shozo Kinoshita, Akira Haeno and Tadaatsu Asanuma, Pioneer Electronic Corporation, Tokyo, Japan.
The Sound Field in Home Listening Rooms II—Roy F. Allison, Allison Acoustics Inc, Natick, Massachusetts.
Design of a Flat-Phase Multi-Way Loudspeaker System—Shinichiro Ishii and Kenichi Takahashi, Matsushita Electric Industrial Company, Ltd, Osaka, Japan.
Frequency Response of an Electrostatic Horn - Tweeter with Electret — Naraji Sakamoto, Toshiyuki Gotoh, Nobuhisa Atoji and Takahisa Aoi, Matsushita Electric Industrial Company, Ltd, Osaka, Japan.
A Technique for Observing Loudspeaker Wave Front Propagation—Isama Nomoto, Makoto Iwahara and Hideo Onoye, Victor Company of Japan, Ltd, Tokyo, Japan.

Monday, November 3
2.00 pm

TRANSDUCERS II
Chairman: **Louis Abbagnaro,** CBS Technology Center, Stamford, Connecticut.
Advance in Turntable and Tone Arm Design—Hisashi Suwa and Nick Morris, Sony Corporation of America, New York, New York.
Four-Channel Bi-Radial Point Playback Criteria—Harry B. Shaper and Donald Litcher, Empire Scientific Inc, Garden City, New York.
A New Ceramic Inertial Pickup for String Instruments with Mass-Controlled Frequency Response Adjustments—Alan Hofer, George J. Sebesta and K. Isabelle, Dynamagnetics Devices, Inc, Hicksville, New York.
Development of a Voice Projection System for Masked Firefighters — Thomas A. Giordano, EPSCO Labs, Stamford, Connecticut, and Mark McClean, Naval Ship Engineering Center, Hyattsville, Maryland.
Three New Noise-Cancelling Electret Communications Devices — Paul M. D'Amico and Philip Kuhn, Telex Communications Inc, Minneapolis, Minnesota.
Non-Destructive Conversion of Approved Ear Defenders Into Communication Headsets—Abraham Cohen, George G. Sebesta and Alan Hofer, Dynamagnetics Devices, Inc, Hicksville, New York.

Monday, November 3
2.00 pm

ARCHITECTURAL ACOUSTICS
Chairman: **Ranger Farrell,** Ranger Farrell and Associates, Irvington-on-Hudson, New York.
Acoustic Criteria for Studio Facilities—Robert A. Hansen, Robert A. Hansen Associates, New York, New York.
An Owner's View of Studio Acoustics—Robert Walters, Media Sound Inc, New York, New York.
An Operator's View of Studio Acoustics—Roff Anthony May, Generation Sound Studios, New York, New York.
A Universal Monitoring System Design Criteria—Carlos Piriz, RZS Producciones s.a, Buenos Aires, Argentina.
Assisted Resonance—Geoffrey Berry and Gordon L. Crouse, Acoustical Investigation and Research Organisation Ltd, Saratoga, California.
Design and Construction of a Studio in a Large Multi-Purpose Building—William H. Unger and William Thompson, Tenafly, New Jersey.

Saturday, November 1
9.00 am-10.30 am
SEMINAR I-A—COMPRESSORS AND EXPANDERS
Discussion of terms and definitions . . . Similarities and differences between compressors, limiters, and expanders . . . Introduction to 'companding'; the foundation of the noise reduction system.

Saturday, November 1
10.45 am-12.15 pm

SEMINAR I-B—ECHO AND REVERBERATION
Differences between echo and reverberation . . . Control room simulation of echo, reverberation, delay and decay . . . Complete echo/reverberation system.
Instructor: **John Woram,** Institute of Audio Research, Inc, New York, New York.

Saturday, November 1
2.00 pm

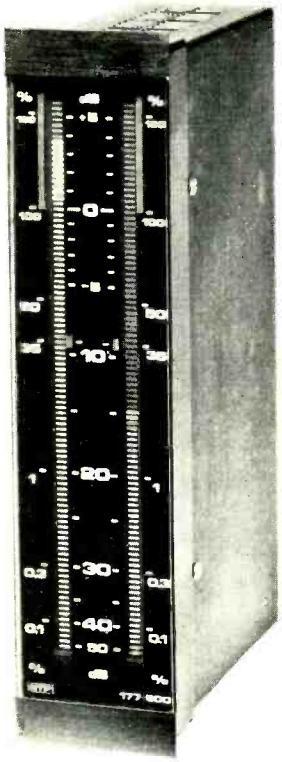
SEMINAR II—THE NEW TAPES AND NOISE REDUCTION
Discussion on how to best take advantage of the new tapes as they apply to particular recording requirements . . . How to interface these new products with noise reduction systems.
Instructor: **Irving Joel,** Joel Associates, Teaneck, New Jersey.

Sunday, November 2
9.00 am

SEMINAR III—PROGRAMMING THE ELECTRONIC MUSIC SYNTHESISER
Interfacing requirements of the electronic music synthesiser in the studio . . . Over-view of the basic programming possibilities.

FRIDAY OCT 31 1pm to 9pm	9am	9.30am	2pm	7pm
	ANNUAL BUSINESS MEETING	**AUDIO IN MEDICINE**	**SIGNAL PROCESSING**	**PSYCHOACOUSTICS**
		DISC RECORDING	**MAGNETIC RECORDING**	**AUDIO IN BROADCASTING**
SAT NOV 1 10am to 7pm	9am		2pm	7pm and 9.30pm
	INSTRUMENTATION		**ELECTRONIC MUSIC**	**NEW YORK SECTION**
	SEMINAR I COMPRESSORS AND EXPANDERS ECHO AND REVERBERATION		**SEMINAR II THE NEW TAPES AND NOISE REDUCTION**	**THOSE MAGNIFICENT MEN AND THEIR MUSIC MACHINES**
SUN NOV 2 10am to 5pm	9am		2pm	7pm and 8pm
	SOUND REINFORCEMENT		**VIDEO DISC SYSTEMS SYSTEMS AND THEIR IMPACT ON AUDIO**	SOCIAL HOUR
	SEMINAR III PROGRAMMING SYNTHESISERS IN THE STUDIO			AWARDS BANQUET
MON NOV 3 10am to 5pm	9am		2pm	7pm
	TRANSDUCERS I		**TRANSDUCERS II**	END OF CONVENTION
	ARCHITECTURAL ACOUSTICS			

NEW LOWCOST PPM STEREO TYPE 177-800



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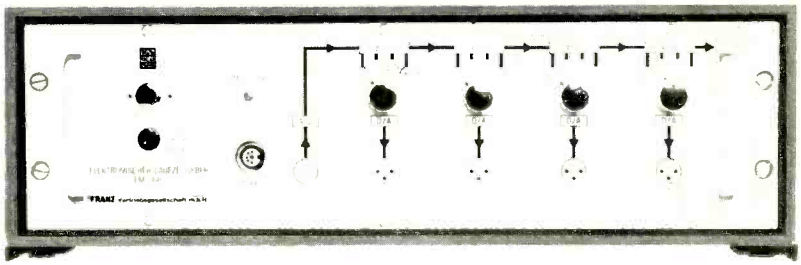


A modern audio frequency delay unit, which converts an analogue signal at first into multi-stage digital information. With a certain delay, this signal is sent through a multiple storage network of integrated shift registers and subsequently converted back into an analogue output signal. The advantages of this system compared to conventional tape delay machines lie in its fully electronic construction without moving parts. This therefore, results in wear free operation with no wow and flutter and considerably lower noise and distortion figures.

AKG TDU 7202 DELAY UNIT

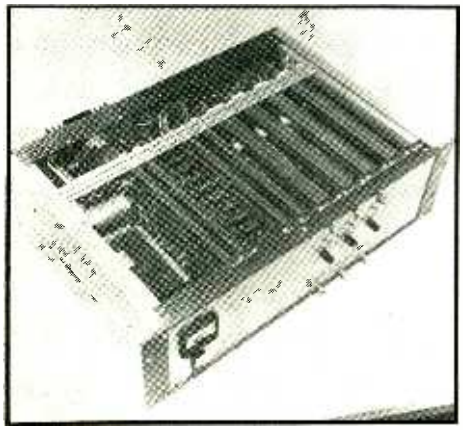
Hugh Ford

MANUFACTURERS' SPECIFICATION

Inputs: symmetrical via input transformer, impedance ≥ 10k ohms.
Input sensitivity: —22, —6, 0, +6, +12 dB (selectable via switch inside cabinet).
Limiter: frequency dependent (pre-emphasis 200 μs). 100 Hz: operation at 12 dB above nominal level. 10 kHz: operation at 10 dB below nominal level. Limitation: 20 dB.
Outputs: 0 to 1.55V adjustable, impedance ≤ 50 ohm.
Frequency range: 30 Hz to 12 kHz (—3 dB).
Unweighted signal-to-noise ratio: related to set sensitivity: ≥ 72 dB effective.
Distortion: related to set sensitivity: ≤ 0.5% at 1 kHz.
Output unit T 72/1: with digital/analog converter, automatic level control, pre- and de-emphasis network filter, output amplifier with transformer, coarse tap switch with steps at 0; 25; 50; 75; 100; 125; 150 and 175 ms. Connectable basic delay time of 200 ms. Switchable 'by-pass' to by-pass set delays.
Output unit T 72/2: as unit T 72/1 but with additional 25 ms delay line. Delay time values set by coarse switch can be incremented in 4 steps of 6.25 ms each.
Output unit T 72/3: delay time is only obtained via built-in delay line. Coarse tap switch increments: 0; 6.25; 12.50; 18.75 ms and with fine tap switch by increments of 0.75 ms each up to a total delay time of 24.75 ms.
Mains supply: 110/220V, 50/60 Hz.
Power consumption: approx 70 VA.
Ambient temperature range: 0° to +45°C.
Width/depth/height: 483 mm racks/340 mm/133 mm (equivalent to 3 units in standard system);
Weight: approx 10 kg, according to fitted units.

Prices:		
Basic unit TDU 7202	£ 1530	$ 3700
Delay line card M 72	90	250
Output unit T 72/1	180	610
Output unit T 72/2	410	1155
Output unit T 72/3	440	1155

Manufacturer: AKG Akustische und Kino-Gerate GmbH. Wien, Brunhildengasse 1, A-1150 Wien, Austria.
UK Agent: AKG Equipment Ltd, Eardley House. 182/4 Campden Hill Road, London W8.
US agent: Philips Audio-Video Systems. Audio Division, 91 McKee Drive, Mahwah, NJ 07430, USA. Phone: (201) 529 3800.



THE PRINCIPLE OF the AKG delay unit is that the audio input is converted into eight digital bits of amplitude information and two bits of range information which is derived from an input level detector which switches into one of four 10 dB steps. The digital data is serialised and passed to a digital shift register in the form of 10 digital bits (eight amplitude plus two range bits).

From the digital shift register, 15 taps at 25 ms intervals are fed to the output units which in some instances provide a series of finer delay tappings derived from extra shift registers. The output units then convert the serial digital data into an eight bit amplitude word and a two bit range word, these being fed to a digital/analog converter followed by a digitally controlled attenuator which restores the range information.

While this describes the 'bones' of the AKG unit, reference to **fig. 1** shows more detail, and also one very important feature which I have so far omitted. Starting at the input, which is balanced and followed by a switched attenuator, there is a pre-emphasis unit which in turn is followed by what is described as a 'limiter'. It is this 'limiter' which is of particular interest, for digital systems are unable to tolerate any overload and go crazy if they are over-driven.

The AKG 'limiter' is perhaps better described as an automatic gain control with relatively fast attack time and a slow release time. A front panel led indicator is used to show when the 'limiter' has been brought into action, and a front panel meter calibrated in decibels shows the degree of limiting which is permitted to reach 20 dB. Quite properly, the 'limiter' is located after the rather hefty 200 μs pre-emphasis—such a long time constant is in my opinion somewhat excessive, for even at 6.3 kHz the boost is about 14 dB relative to low frequencies; however, if the 'limiter' has a good performance this may be acceptable.

Limiting is followed by a low pass filter, which presumably is an anti-aliasing filter, which is then followed by the level detector actuating the range attenuator and provides the two digital bits of range information. From there the functions include the normal sample and hold circuit and the eight bit analog/digital converter, the output of which is serialised and fed to the shift registers.

Timing pulses for the analog/digital converter are derived from a divide by ten output of a 328 kHz crystal oscillator, thus providing a sampling frequency of 32.8 kHz which is adequate for the specified 12 kHz upper limit of the audio frequency specification. The original 328 kHz, of course, works out at the precise frequency required to shift the 10 bits of digital information along the shift register. Where it is required to run several delay units in parallel and to avoid phase errors in the audio outputs, a back panel connector enables a single master crystal oscillator to be used for several delay units. Alternatively, an external oscillator with a frequency tolerance of +0 −20% can be used to produce special effects by modulating the delay time.

A maximum overall delay time of 375 ms can be fitted to the mainframe in the form of 15 printed circuit delay boards each of which provides 25 ms of delay, and altering the possible delay time in the field is simply accomplished by fitting extra delay boards.

The output of each delay board is fed to the output modules which may be a mixture of three types. The review sample was fitted with three type *T71/2* modules which do not contain any extra delay facilities and provide delays from nominal zero to 375 ms in 25 ms steps using the tappings of the mainframe delay shift registers. Two alternative output modules are available the first of which provides a maximum additional delay of 25 ms which can be selected in 6.25 ms steps, and the second of which provides a similar extra delay capacity which may be selected in increments of 6.25 ms up to 18.75 ms, and in addition increments of 0.75 ms up to 6.00 ms.

The three types of output modules contain a serial/parallel converter which feeds the two gain control bits to a digitally controlled 10 dB step attenuator and the eight amplitude bits to a digital/analog converter, the output of which is passed to a level control potentiometer, followed by a low pass filter to remove sampling frequencies, de-emphasis, and finally to an output stage which provides a floating low impedance output.

Mechanics

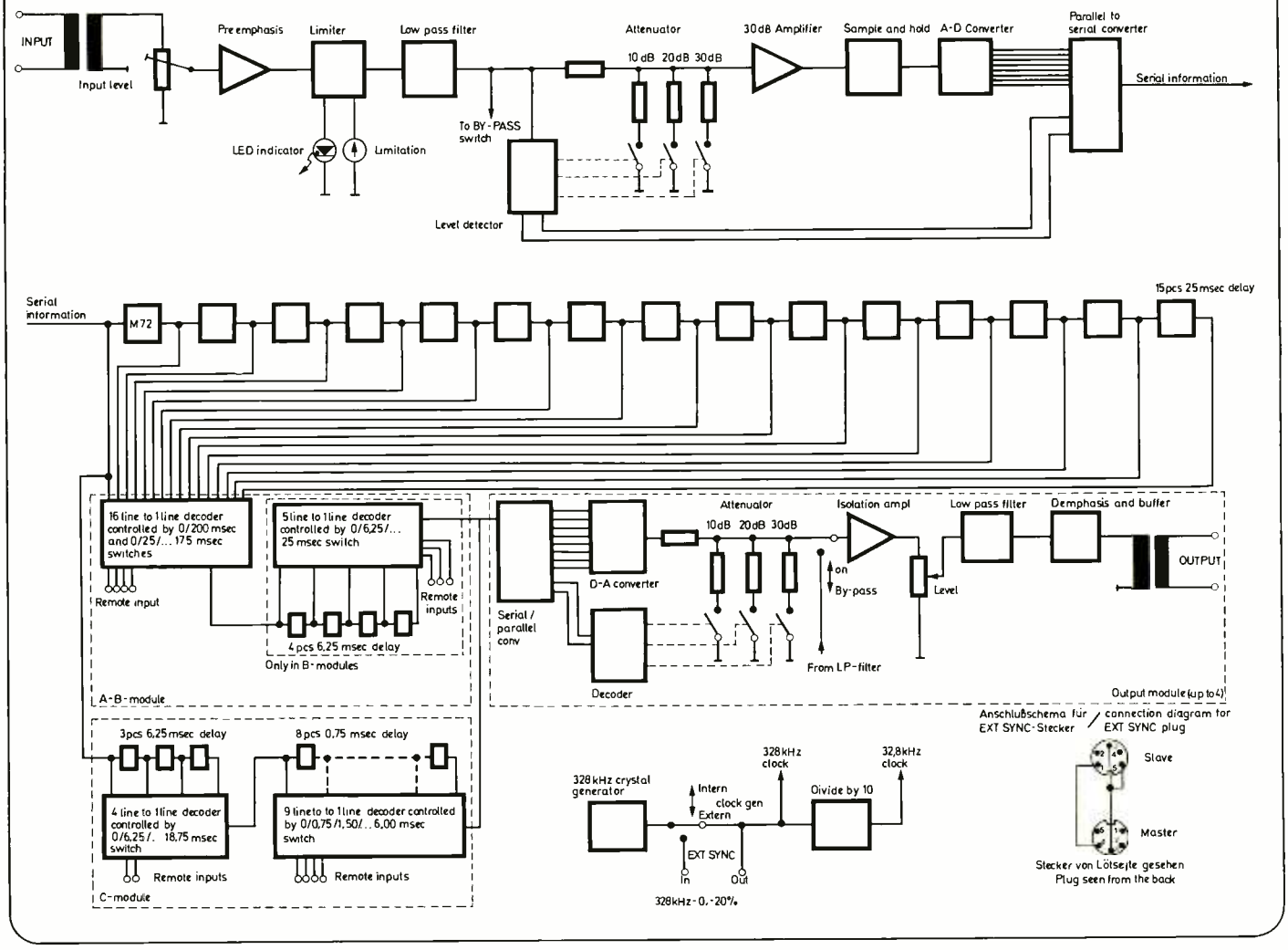
The form of construction of the unit is based on a standard modular system which is compatible with the standard 483 mm rack and provides a strong and well finished unit. Overall the standard of construction is excellent and high quality glassfibre circuit boards and professional components are used throughout.

While the use of modular plug-in assemblies which may be easily removed from the front of the unit makes servicing easy, it is a shame to find that the input gain control switch and the various power supply fuses are only accessible when the top cover has been removed. Furthermore, my *bête noir*, the four internal power supply fuses, are not identified with their values—anyone got a paper clip, 20A rating?

Looking at the front of the unit the left hand half of the front panel is a removable section upon which is mounted the illuminated mains on off switch, the 'limiter' meter and its associated led indicator. Behind this front panel is a removable module into which plug the possible 15 delay shift register boards, and also a separate board for the internal reference oscillator.

At the right hand half of the front panel are positions for up to four output modules which each take the form of plug-in modules

Fig.1 AKG TDU 7202 BLOCK DIAGRAM



containing two printed boards. The type *72/1* module which was supplied with the review sample has four front panel controls. One of these is a miniature toggle switch providing for bypass of the digital section of the delay unit, but leaves the filters, pre- and de-emphasis and the 'limiter' in action in the bypass mode.

A second miniature toggle switch is a coarse delay control giving delays of zero or 200 ms to which is added the delay setting of a rotary switch, providing delay increments of 25 ms up to a maximum of 175 ms. The fourth front panel control is an output level potentiometer which is screwdriver operated and gives a nominal output range from zero to 1.55V.

Turning to the rear panel facilities, the input and the four outputs take the form of *XLR-3* type connectors, in addition to which there is a Tuchel 5-pin connector for external or synchronous timing, and the most enormous Tuchel mains plug.

Four further multi-way connectors are wired for remote control of the delay times of the four possible output modules, these facilities being activated when the rotary time delay selectors of appropriate channels are set to a 'remote' position.

The final rear panel facilities include an unidentified mains fuse and a sensible facility for disconnecting the mains earth and earthing the unit to a common bussbar. Last of all mention must be made of a small heatsink which is blown by a miniature fan —this is not the very quietest of fans and might be a cause of unwanted noise.

Input and outputs

Measurements on the input sensitivity at 1 kHz showed that while the input impedance was always in excess of 10k ohms (and greatly exceeded this sensible impedance at low input sensitivities) the measured input sensitivity for the onset of limiting was somewhat greater than the specification would suggest; however the sensitivity range switch offered a wide range over useful sensitivities. The following input voltages at 1 kHz were found to produce the onset of limiting *see below*:

Range switch position	Nominal sensitivity	Measured sensitivity
1	+12 dB	+18.5 dBV
2	+6 dB	+12.5 dBV
3	0 dB	+6.6 dBV
4	—6 dB	+0.8 dBV
5	—22 dB	—15 dBV

It was comforting to note that the input impedance was substantially constant with frequency, and also that the output impedance, measured as 53 ohms, was low enough to drive into heavily loaded lines at levels between 0 and +17 dBV which could be controlled by a multi-turn potentiometer on the front panel of each output module.

Both input and the outputs are fully floating transformer-coupled circuits, and to improve further the isolation there is a mains earth shorting link on the rear panel. This link may be removed, and separate earth leads used to ground the delay unit to the central studio earth.

The 'limiter'

Technical investigations into the 'limiter' were restricted initially to investigating its behaviour with tone bursts, or to be more exact bursts in level. **Fig. 2** shows the result of applying a steady tone of 1 kHz just below limiting level and then driving the unit at +18 dB relative to limiting

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■ AKG TDU 7202

level for 10 ms. It is seen that the limiting action is instantaneous, and examination of **fig. 3** that after this level burst the 'limiter' recovers to almost its original state within around 150 ms.

The above performance is fine for dealing with transients, but what happens if a prolonged high level burst is applied? Part of the answer to this is shown in **fig. 4**, the result of applying a 100 ms burst, and which shows that the 'limiter' effectively has two time constants, a short time constant for strictly limiting transients and a long time constant for dealing with long term high levels. This situation was confirmed by listening tests where it was found to be impossible to produce significant distortion, but all too easy to produce noise 'breathing' effects if a large amount of limiting was involved.

It is therefore concluded that the 'limiter' and its associated led indicator are fine for dealing with accidental overloads, but the delay unit should preferably be operated just on the verge of limiting—it is therefore unfortunate that provision has not been made for remote mounting the meter and its associated led indicator on the console.

Frequency response and noise

So far as frequency response is concerned the inclusion of pre-emphasis followed by the 'limiter' makes the measurement of sinewave frequency response partially invalid. However, at low levels where the 'limiter' is not acting, the sinewave response is valid. The lower curve in **fig. 5** illustrates the low level response, while the upper curves show the effect that the pre-emphasis and the 'limiter' have on the sinewave response.

The frequency response as measured by the narrow band analysis of the output resulting from a random noise input is shown in **fig. 6**, which was found to apply to all input levels up to 20 dB limiting. I do not propose to now enter into the arguments about the valid frequency response with this 'limiter' arrangement, but I would re-iterate that I feel that the 200 μs pre-emphasis is too fierce.

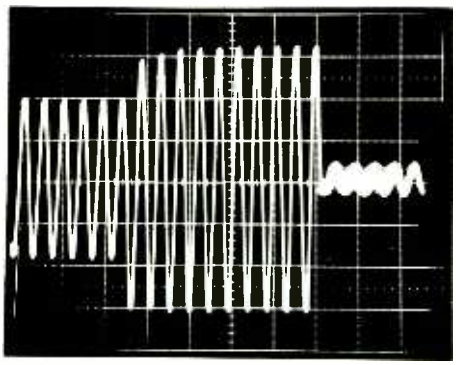


FIG. 2 *1 kHz 10 ms burst +18 dB limiting*

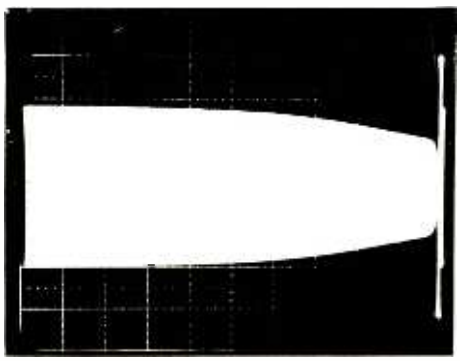


FIG. 3 *50 ms/div 1 kHz 10 ms burst +18 dB limiting*

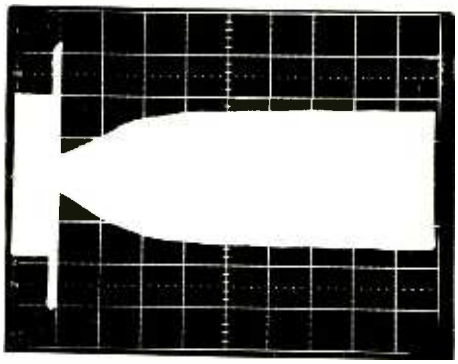
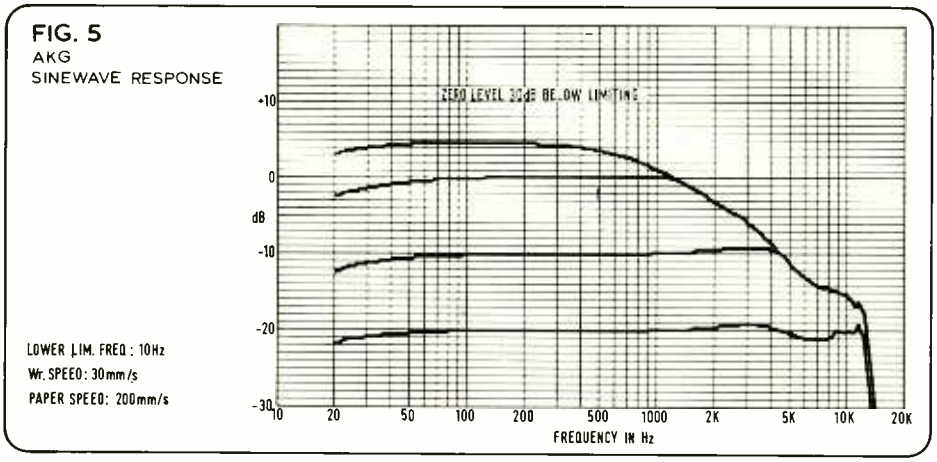
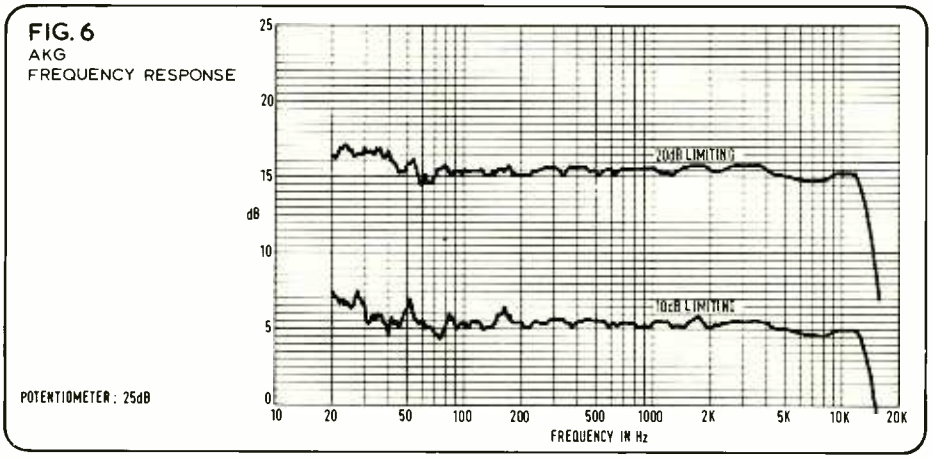


FIG. 4 *1 s/div 1 kHz 100 ms burst +18 dB limiting*





The above matters also reflect upon the measurement of dynamic range, and here I have taken the easy way out by relating noise to maximum output which is controlled at low frequencies by the digital limitations. I have therefore taken the maximum output at 1 kHz as reference level for noise measurements, but I would remind readers that the maximum output at higher frequencies is considerably lower as the result of de-emphasis (nominally 17.9 dB at 10 kHz).

Condition	Reference output to noise ratio (see text)
Band limited 20 Hz to 20 kHz rms	—69.0 dB
'A' Weighted rms	—78.0 dB
CCIR weighted rms	—74.5 dB

Provided that care was taken in the earthing arrangements, the level of mains hum and its harmonics was found to be well below noise and it is felt that the noise performance is generally satisfactory.

Distortion

The measurement of harmonic distortion is also complicated by the 'limiter', and to avoid difficulties distortion was measured at low frequencies at the onset of limiting (the result being **fig. 7**) and at 30 dB below limiting over the passband of the unit as shown in **fig. 8**. From these figures it is to be seen that at high levels the low frequency distortion is rather high, the pattern being

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GUESS WHO JUST IMPROVED ON BASF LH TAPE?

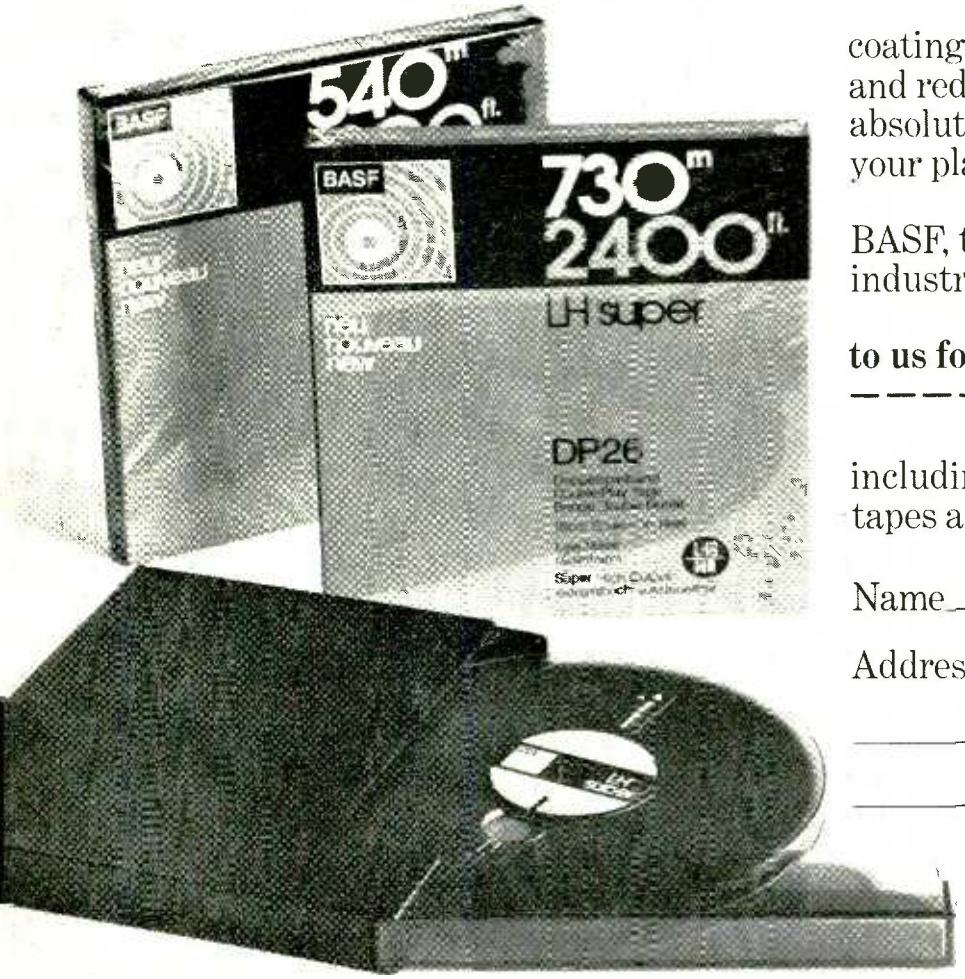
It's eight years ago now since BASF invented Low noise/High output (LH) tape.

And BASF LH tape quickly became the country's best-selling reel-to-reel tape. Small wonder – it was also the best tape money could buy.

But no more. Because although everyone else was delighted, BASF kept searching for something better still.

And (eight years of research later) here it is: BASF LH Super tape.

The principle is exactly the same as LH tape. Smaller particles for less noise, packed in at a greater density for higher output. So the signal-to-noise ratio is widened in both directions.



But instead of the normal ferric oxide, LH Super uses a refined oxide called Maghemite, which has smaller and more evenly-sized particles.

And with the completely new High Density Coating process, it improves on both sides of the LH principle.

The result is a 3dB higher maximum recording level and some 2dB less noise than BASF LH tape (measured at 5% harmonic distortion, as per Din 45 500).

Or taking a different parameter, LH Super gives a mere 2½% distortion at OVU recording level. (The Din standard allows 5%). And that means a full 50% increase in sound quality.

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LH Super. It just had to come from BASF, the people who started the tape industry forty years ago.

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■ AKG TDU 7202

repeated to a lesser extent at low levels. Rather more disconcerting is the sudden rise in second harmonic distortion at low levels above 1 kHz, followed by a lesser rise in third harmonic distortion.

At first I thought the measuring gear had gone crazy, but the plotted information really is genuine and the distortion clearly audible on sinewave and not insignificant on program.

Curiously, this distortion is not present in the by-pass mode, so it would appear to result from some shortcoming in the level detecting system and its associated amplifiers.

The final distortion measurement was that of intermodulation distortion to the SMPTE method using 50 Hz and 7 kHz tones in the amplitude ratio 4:1. Because of the nature of the testing signal this is a valid measurement at high levels, and the following table shows that the intermodulation distortion is quite respectable at all levels.

Equivalent peak sinewave input related to the onset of limiting	IM distortion
+20 dB	0.08%
+10 dB	0.16%
0 dB	0.17%
—10 dB	0.20%
—20 dB	0.20%

Other matters

As a result of the internal timing clock being crystal controlled, the delay accuracy is beyond criticism, and being a modular unit the delay need only be purchased with the required amount of delay and number of outputs. Should subsequent expansion be required, it is simply a matter of plugging-in the extra facilities.

Clearly, the ability to remote control the delay on individual channels is a useful facility; however, it would be a considerable asset if the headroom indicator could also be duplicated remotely.

Summary

From a point of view of overall construction the AKG Digital Delay is manufactured to a very high standard, and the modular method of construction offers considerable flexibility.

The inclusion of a 'limiter' at the audio input is a valuable feature, so far as I am aware not to be found in competitive products; However, while I feel that it is generally valid to include pre- and de-emphasis in delay units I do think that 200 μs is excessive.

Considering frequency response and noise, the unit is to a standard which is perfectly adequate for most likely applications; however I do feel that AKG should unravel their distortion problems.

FIG.7 AKG DISTORTION AT LIMITING

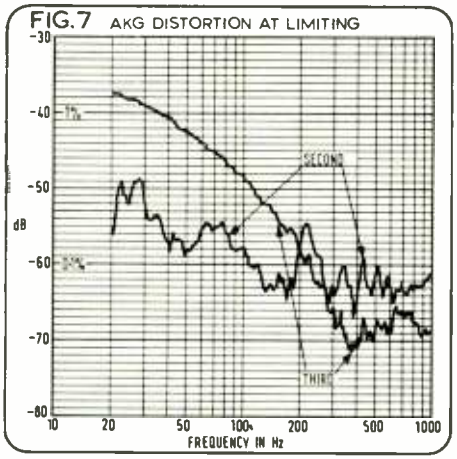
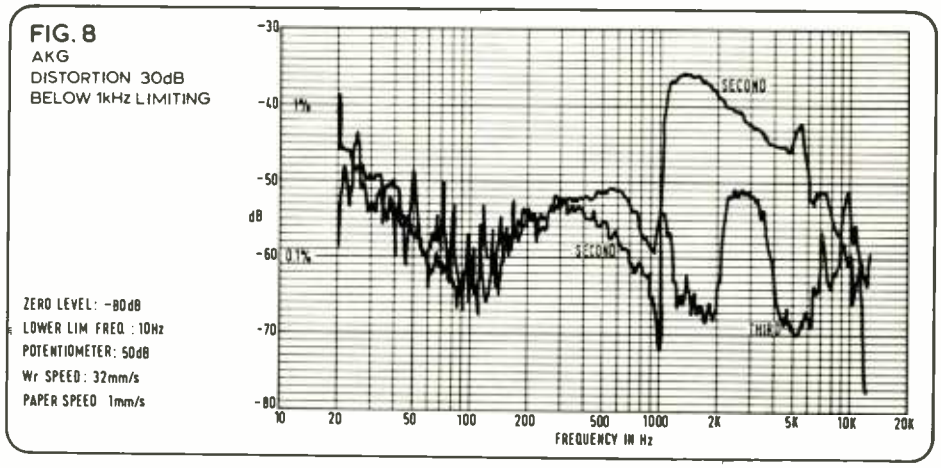


FIG. 8
AKG
DISTORTION 30dB
BELOW 1kHz LIMITING



COOPER TIME CUBE

Hugh Ford

MANUFACTURERS' SPECIFICATION

Frequency response: ± 2 dB 40 Hz to 10 kHz (typically ±1.5 dB).
Total harmonic distortion: less than 1% (typically less than 0.5%) at all program levels up to +4 dBm output. Distortion does not increase at low levels. (Because of hf pre-emphasis, distortion measurements should not be made at full output.)
Signal-to-noise ratio: greater than 70 dB (15.7 kHz noise bandwidth).
Input sensitivity: −20 to +20 dBm for +4 dBm output.
Input impedance: 600 ohms transformer isolated (floating).
Output impedance: designed to work into 600 ohm load; transformer isolated (floating).
Number of inputs: two.
Number of outputs: two.
Channel separation: greater than 40 dB.
Time delay: channel A: 16 ms, channel B: 14 ms.
Wow and flutter: zero.
Mains voltage: 110-120V ac, or 220-240V ac (switch on rear panel).
Controls: input gain (2). Output meter transfer switch. Power on/off.
External connections: line cord. Input jacks (2) tip-ring-sleeve. Output jacks (2) tip-ring-sleeve, normalled to rear panel barrier strips for permanent installations.
Interconnections: two 7.6m standard *XLR-3* type microphone extension cables furnished.
Price: £608. $1142.
Manufacturer: UREI, 11922 Valerio Street, North Hollywood, California 91605, USA.
UK Agent: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.

THE Cooper Time Cube is a delay unit as opposed to a reverberation unit; thus, it should delay a signal input without introducing significant degradation of the original signal input. Such devices find applications as signal delays before reverberation units which commonly do not contain the inbuilt delay which is an important part of the characteristic of a real live room. Other uses include simulation of stereo and quadraphonic recordings, time delay in pa systems and loudness enhancement. Such applications have in the past been satisfied by tape loop delay units which have not proved entirely satisfactory, and the alternative digital delay unit has so far been rather expensive. 64 ▶

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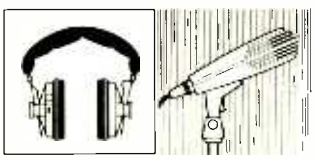
- Peak Power Load: 1W or 20V per cartridge
- Impedance: 2 x 400 Ω (2 x 8, 2 x 100, 2 x 800, 2 x 2,000 Ω upon request)



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Tel: Haywards Heath 51003

COOPER TIME CUBE

The Cooper Time Cube works on an entirely different principle in that the signal delay is obtained from an acoustical delay line comprising a length of polyethylene tube fitted with a transmitting transducer at one end and a receiving transducer at the other end. Since sound travels at approximately 330 m/s in air it is obvious that the required length of an acoustic delay line is 0.33m per millisecond of delay, which means that a relatively small coil of tube can be used to obtain delays of tens of milliseconds. While it is simple to obtain such delays, there are severe problems of matching transducers and damping unwanted resonances, and it is here that the Cooper Time Cube relies on the work of Dr. Duane Cooper and Mr. T. Putnam.

In its practical form, the delay unit consists of a stereo (or two channel) delay unit, with each channel having a slightly different delay so that artificial image effects may be synthesised. The specified delays are 14 ms and 16 ms, the average of 15 ms corresponding to a distance of approximately 5m in air, and the difference of 2 ms corresponding to the lower limits of delays required in order to make use of the Haas Effect for image shifting.

Two separate units connected by two three-core leads equipped with *XLR-3* connectors are involved in the Cooper Time Cube. The actual delay coils and the transducers occupy one unit which takes the form of a wooden box measuring about 620 mm x 620 mm x 230 mm and weighing only something in the order of 20 kg. The second unit is a 483 mm standard rack mounting unit 89 mm high and contains all the electronics of the delay channels.

The majority of the electronics in the second unit are located on four identical printed boards which plug in behind a cover which bears a block diagram of the unit on its outside. Two of the printed boards are used as output line amplifiers, and the other two as delay unit drivers. While the boards are of good quality and professional components are used, it is a shame that the components are not identified on the boards by component references, as no layout diagrams are supplied for servicing. The remaining electronic components comprising the stabilised power supply and two input attenuators (plus three frequency response presets per channel) are located on the main chassis.

The left-hand end of the front panel is occupied by the four plug-in boards, which are followed by two uncalibrated input attenuators, a single vu meter and a pair of tip-ring and sleeve jack inputs and outputs, the mains on/off switch and a switch for connecting the vu meter to the output of either channel. The neat layout of the panel, together with its black anodised finish and white markings, gives the unit a clean and professional look.

Turning to the rear panel, this houses two barrier strips which duplicate the front panel jack inputs and outputs, and also has the *XLR-3* connectors for feeding the delay unit. In addition there is the well identified mains fuse, the mains voltage selector and a fixed mains lead—my preference, though, is for plug-in leads with IEC connectors.

Having dealt with the layout of the Cooper Time Cube, it is necessary to add that while the standard of construction is generally excellent, the design of the mains voltage selector switch is such that the electrical safety is suspect for 240V operation. The mechanical clearance between the live parts of the switch and those directly connected to the chassis is well below the requirements of British Standard 415:1972 and other British Standard requirements.

Inputs and Outputs

Both the inputs and the outputs are floating transformer-coupled arrangements, the input transformers being preceded by a shielded constant-impedance variable attenuator. The measured input impedance was to all intents and purposes constant at 601 ohms on one channel and 607 ohms on the other. For people who use 600 ohm line arrangements this is fine, but generally a higher input impedance, in excess of 10 000 ohms, is far more convenient when interfacing with modern equipment.

A wide range of input signal levels could be accepted, the input sensitivity for 0 dBm output being variable from in excess of +25 dBm to −22 dBm for one channel and −24 dBm for the other channel.

On the output end the impedance was satisfactorily low at 107 ohms on one channel and 112 ohms on the other channel, the output level being standardised by the vu meter which is connected directly across either output line such that 0 vu corresponds to +4 dBm. Assuming that the unit behaves properly as a delay unit and does not show any tendency to be a reverberation unit, the input signal level should be directly related to the output level so far as the signal handling capability is concerned; to this end it was found that no excessive waveform distortion at 1 kHz occurred until the output level reached +23 dBm (loaded into 600 ohms), which is a more than adequate level.

Frequency Response and Noise

The overall sinewave frequency response at various input levels is shown in **fig. 1**, which includes curves for +4 dBm output, 0 dBm output and 10 dB increments below 0 dBm. It is to be observed that the response at these levels is identical and within ±1.5 dB from 25 Hz to 10 kHz with the exception of a small dip at 8.5 kHz. The other channel presented a virtually identical curve, but was slightly better in the bass and worse in the treble.

At higher input levels the effect of pre-emphasis within the unit has some effect upon the frequency response as is shown in the following table *above right*:

FIG. 1
COOPER TIME CUBE
FREQUENCY RESPONSE

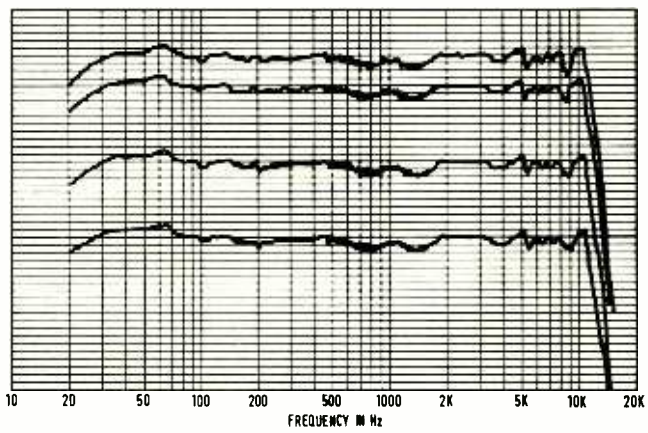


FIG. 2
COOPER TIME CUBE
DISTORTION CHANNEL 1
AT 0dBm IN AND OUT

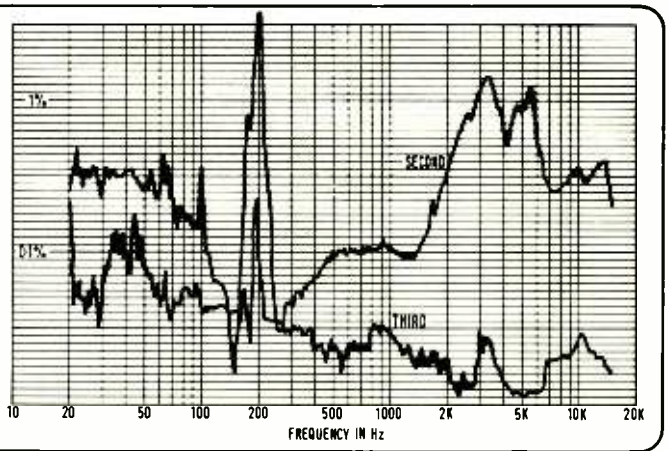
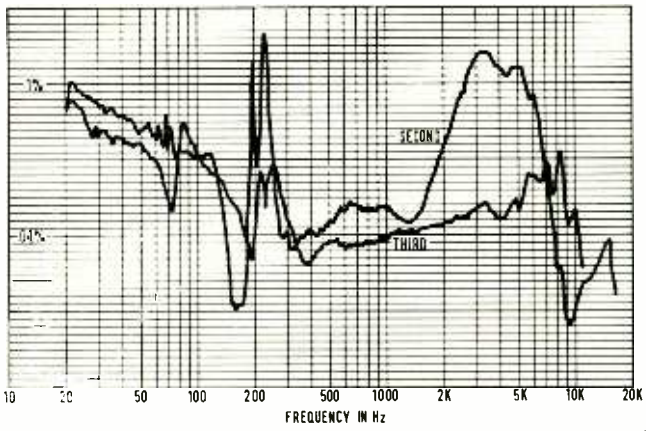


FIG. 3
COOPER TIME CUBE
DISTORTION CHANNEL 2
AT 0dBm IN AND OUT



POTENTIOMETER RANGE: 50dB
RECTIFIER: RMS
LOWER LIM. FREQ.: 10Hz
Wr. SPEED: 32mm/s
PAPER SPEED: 1mm/s
ZERO LEVEL: -80dB

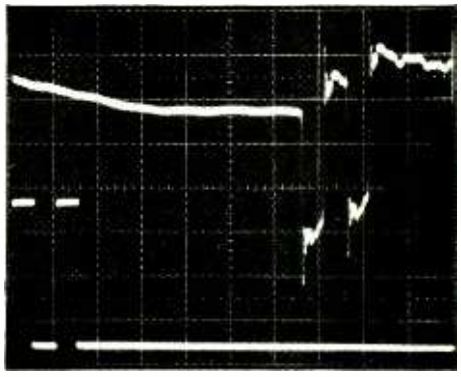


FIG. 4 *1ms double pulse delay (2 ms/div)*

Expected Output	Compression at 10 kHz Relative to 1 kHz
+4 dBm	0
+6 dBm	1 dB
+8 dBm	2.5 dB
+10 dBm	4 dB

Provided that the normal level of -4 dBm corresponding to 0 vu is observed no compression will be apparent on normal musical material, and for much material a higher level will be quite acceptable.

Initial investigations into the noise performance showed that the noise at the output was unaffected by the setting of the input attenuators and that the output noise was generated by the receiving transducer and its amplifiers. It was also observed that the delay module was somewhat prone to acoustic pickup of low frequency ambient noise and thus particular care was required when measuring unweighted noise at the output.

Having taken suitable precautions, the noise level at the output was measured as follows with reference to 0 dBm and with the outputs loaded into 600 ohms *see right.*

Considering signal-to-noise performance it is quite legitimate to add *at least 4 dBm* to the above figures, as no compression up to 10 kHz occurs at this level, so provided that the delay unit is fully driven the signal-to-noise performance is more than adequate for the intended uses. However, the sensitivity of the delay module to acoustic noise pickup makes it imperative to locate the delay module out of the control room and preferably in the bowels of the earth! As a rough guide, subjecting the delay module to 74 dB spl of white noise gave an output from the unit of -40 dBm, and listening tests indicated that very low levels of traffic noise were clearly audible in the output—placing anything on the delay module was disturbing.

	Channel A	Channel B
Unweighted rms noise, band limited 20 Hz to 20 kHz:	—61 dBm	—60 dBm
'A' weighted rms noise:	—66.6 dBm	—66 dBm
CCIR weighted rms noise, ref 1 kHz:	—60 dBm	—60.2 dBm
Mains hum components:	less than —70 dBm	

Distortion

Measuring the harmonic distortion proved an interesting exercise, as the distortion characteristic of the two channels was found to be completely different, and furthermore the distortion/frequency characteristics were found to be peculiar, probably as a result of the use of electroacoustic transducers.

While the distortion varied with level, and was difficult to define, there tended to be an increase with increased level. **Figs. 2** and **3** show the situation at 0 dBm output for the two channels, and while the distortion is generally below the specified 1% and does as expected increase at high frequencies, very peculiar things happen around 200 Hz on both channels.

Intermodulation distortion as measured by the SMPTE method with 50 Hz and 7 kHz tones in the amplitude ratio 4:1 produced consistent results for the two channels:

Equivalent Peak Sinewave Output	Channel A	Channel B
+4 dBm	0.54%	0.58%
0 dBm	0.48%	0.50%
—10 dBm	0.37%	0.40%

Delay characteristics

The delay time as measured with a 5 kHz tone burst was found to be very close to specification at 15.9 ms for one channel and 14.1 ms for the second channel. **Fig. 4** shows this delay as seen with a double 1 ms unidirectional pulse which, considering 66 ▶

FIG. 5 *5kHz, 0 dBm response 1 ms/div*

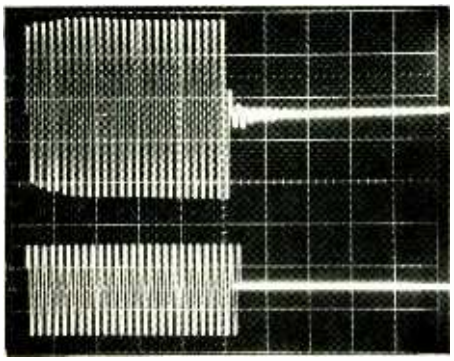
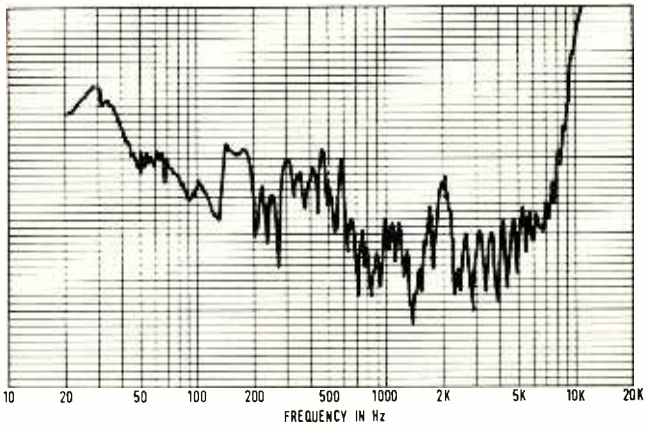


FIG. 6
COOPER TIME CUBE
CROSSTALK AT 0dBm
IN AND OUT



POTENTIOMETER RANGE: 50dB
RECTIFIER: RMS
LOWER LIM. FREQ.: 10Hz
Wr. SPEED: 200mm/s
PAPER SPEED: 3mm/s
ZERO LEVEL: -80dBm

■ COOPER TIME CUBE

that electroacoustic transducers are involved, is reproduced at the output remarkably well as seen in the upper trace.

Fig. 5 similarly shows the input and output of a 5 ms burst of 5 kHz at 0 dBm. Here, it is to be seen that some build-up time is required and that there is some hangover —I feel, however, that these features would not be audible on program.

Other Matters

The crosstalk between channels with one channel driven for an output of 0 dBm is shown in fig. 6, which confirms the manufacturer's crosstalk specification, and furthermore shows that the practical performance at mid frequencies where crosstalk matters most is far better than suggested by the specification.

As supplied, the operating manual is quite adequate and contains a description of the modus operandi of the Cooper Time Cube, together with a full circuit diagram and alignment procedures.

Summary

So far as pure time delay units are concerned for audio applications we are all too well aware of the severe limitations of tape loops and magnetic drums—these have now been succeeded by devices such as the Cooper Time Cube and the digital delay line. While the latter has a great deal to offer it is my opinion that some manufacturers are designing marginal units in order to make the price competitive—the cost of digital storage is falling at a fantastic rate, and I feel that this type of delay is the unit of the future. However, the current climate makes electroacoustic delay devices an attractive proposition.

One of the prime advantages of the Cooper Time Cube is the limited distortion at any input level: something with which a fixed number of digits cannot compete. However, it is limited in its distortion performance at high levels, and also is severely affected by extraneous noise. Furthermore, when functioning as a pure delay unit, the frequency response is comparatively restricted —in reverberation applications and when used for the synthesis of stereo and quadraphonic sound this is unlikely to matter, but in other applications this may cause trouble.

Overall, the Cooper Time Cube may be a current solution to existing problems at a reasonable cost, but its economic life may be limited if the digital enthusiasts wake up to the trends of cheap digital storage and make use of enough bits per sample.

MASTER ROOM REVERBERATION UNIT

Hugh Ford

MANUFACTURERS' SPECIFICATION

Input impedance: 10k ohms.
Output impedance: 150 ohms.
Input level: (0 vu) +4 dBm.
Output level: (0 vu) +4 dBm.
Saturation level: peak +18 dBm.
Noise: —66 dB.
Acoustic susceptibility: 120 dB spl.
Base dimensions: 146 mm x 248 mm.

	MR-II	MR-III	MR-IV
Equivalent room vol:	113	5660	21200 m³
Decay time (nominal):	2	5	7 s
Height:	965	1194	1448 mm
Weight:	9.98	11.34	13.15 kg
Price:	£666	£686	£777
	$1135	$1220	$1390

Manufacturer: Micmix Audio Products Inc, 9990 Monroe Drive—Suite 222, Dallas, Texas 75220, USA.
UK Agent: Scenic Sounds Equipment, 27/31 Bryanston Street, London W1.

THREE versions of the Master Room reverberation unit are available, with nominal reverberation times of 2s, 5s or 7s; the review sample was the 5s nominal version which had also been fitted with the optional floating 600 ohm input and outputs. The units accept a single input and provide two outputs which the manufacturer claims can be used to provide 'stereo perspective'.

The input and output signal connections are standard *XLR* series, the input being a three pin socket and the two outputs being available at a five pin plug. The latter could be more conveniently arranged if two three pin connectors had been used. Powering is from either 230V or 115V ac mains, the voltage being selected by an internal switch and the mains connections being a standard IEC plug.

Protection is by a single mains fuse of the imperial variety, and the value of the fuse is not shown on the unit—certainly the fuse value should be identified adjacent to the fuse holder, and I would have preferred a metric fuse to have been fitted.

The remaining 'controls' comprise an illuminated rocker type mains on/off switch and a rotary potentiometer which is described as a 'brilliance' control and affects both outputs.

The three models take an identical amount of floor space and differ only in height and weight, being minimal when compared with any other types of reverberation unit in common use. In fact it is quite easy to carry one of the units under one arm.

All the electronics, controls and connectors are located at the bottom of the unit which is surmounted with an alloy case which is finished in 'wood grain' material giving a pleasant appearance. Access to the innards is by removing four screws which secure the cover, and then removing further screws to gain access to the electronics printed circuit board. The latter is a good quality fibre glass board which houses all components except the optional input and output transformers. As is good practice for simple servicing, all components are identified on the printed board and a full circuit diagram, parts list, and servicing instructions are provided in the service manual.

Above the electronics department in the base of the unit are two hermetically sealed tubes which contain the reverberation elements, one for each output channel. The nature of these elements is not disclosed by the manufacturer, but logic (rather than listening tests) suggests that spring type units are used, and it is guessed that the tubes contain a special type of helical spring. Overall the standard of construction is to a high standard.

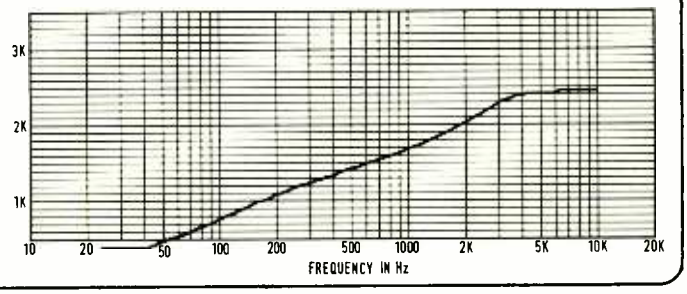
Inputs and outputs

Initial investigations were directed at the input and output arrangements which so frequently demonstrate troublesome characteristics—unfortunately the 'Master Room' is no exception. Whilst the input was quite capable of accepting its specified +4 dBm at all audio frequencies, the input impedance was inconveniently low at around 1500 ohms at mid frequencies and demonstrated wild variations with frequency, as is shown in fig. 1. Examination of the circuit suggests that this feature is peculiar to the floating input version of the unit and is caused by the characteristics of the input transformer.

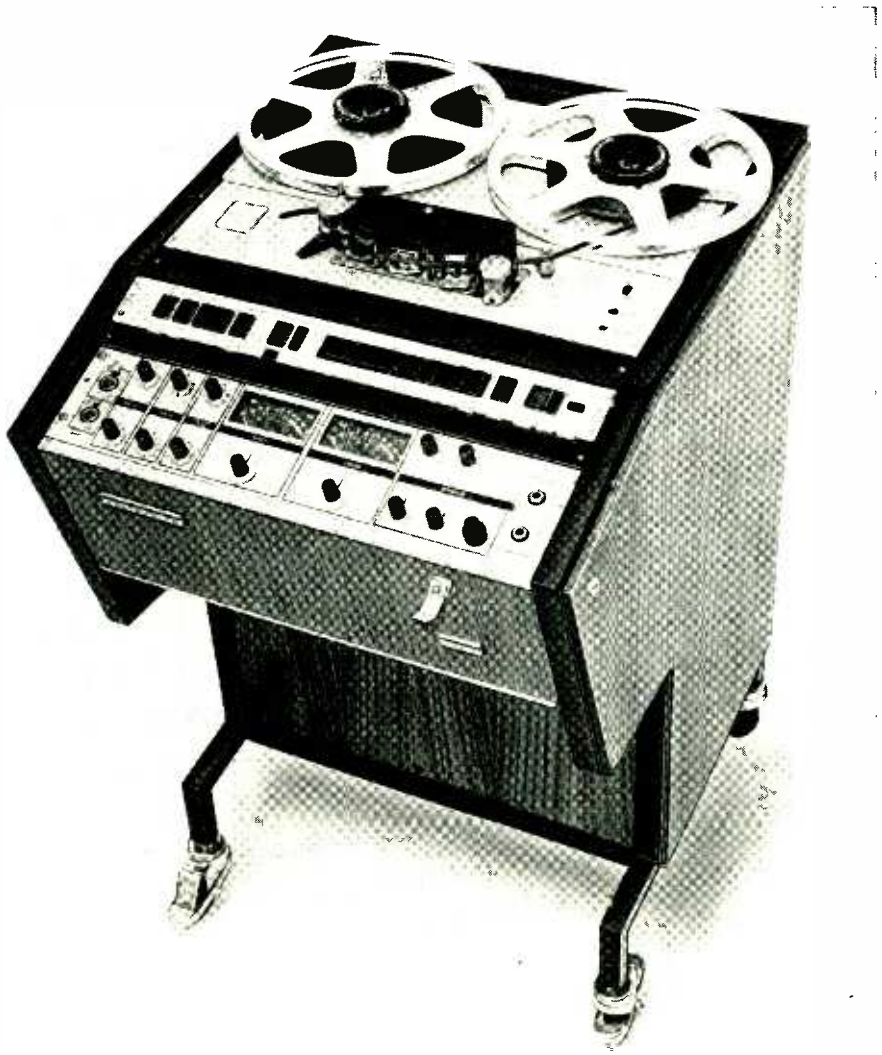
A characteristic of reverberation units, as opposed to delay units, is that the output must be capable of handling considerably

68 ▶

FIG. 1
MASTER ROOM
INPUT IMPEDANCE



Ferrograph Professional Studio 8 Console



Full logic control. Tape motion sensing. Two speeds. Servo-controlled capstan. Constant tape tension. Direct-reading tape timer (minutes and seconds). Three editing modes. Provision for synchronisation, remote control and remote display panel. Available for line-in/line-out or with mixing and monitoring facilities. IEC or NAB equalisation. Full or half-track mono, dual track or stereo. Easy access for maintenance. Also available in transportable and rack-mounted versions.

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larger signals than the input, the result of the addition of reverberant signals in and out of phase. Listening tests showed that the Master Room could deliver an output of + 14 dBm peak (genuine peak) into 600 ohms, which is considered adequate. Similarly the output impedance, which was measured as 183 ohms at 1592 Hz, was adequately low but might benefit from being reduced to a lower value still.

Noise

The noise measured at the outputs of the unit depended to a large extent upon the setting of the 'brilliance' control, and was found to be as follows into a high impedance ref 0.7746V.

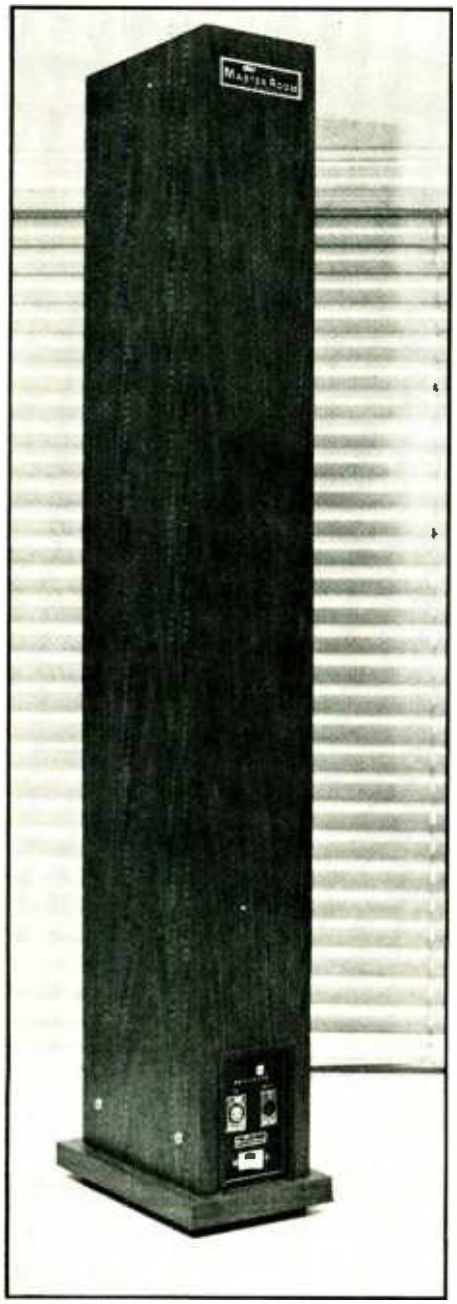


FIG. 2a
MASTER ROOM FREQUENCY RESPONSE TO RANDOM NOISE BRILLIANCE ANTICLOCKWISE

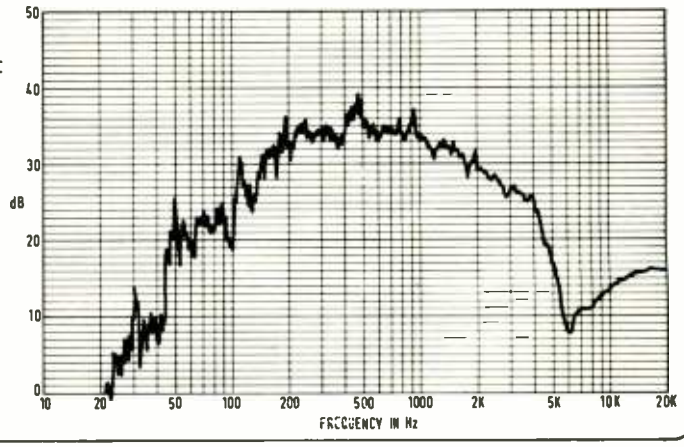
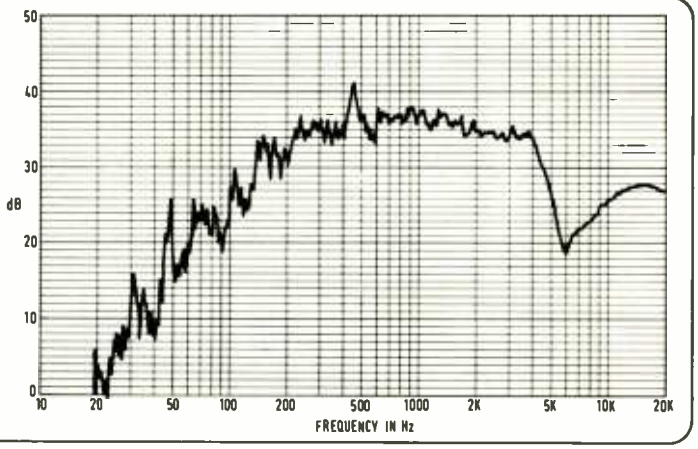


FIG. 2b
MASTER ROOM FREQUENCY RESPONSE TO RANDOM NOISE BRILLIANCE CENTRAL



Brilliance setting	Channel 1	Channel 2
Clockwise		
20 Hz to 20 kHz rms	—50.6 dB	—51.3 dB
'A' weighted rms	—55.2 dB	—56.1 dB
CCIR weighted rms ref 1 kHz	—47.1 dB	—47.1 dB
Anticlockwise		
20 Hz to 20 kHz rms	—60.1 dB	—58.4 dB
'A' weighted rms	—66.0 dB	—65.0 dB
CCIR weighted rms ref 1 kHz	—60.1 dB	—59.4 dB
Central		
20 Hz to 20 kHz	—58.4 dB	—57.8 dB
'A' weighted rms	—66.2 dB	—65.3 dB
CCIR weighted rms ref 1 kHz	—53.4 dB	—53.2 dB

In relation to the peak output capability of +14 dBm the above figures are quite good, but it may be debated which output level is realistic when considering signal-to-noise performance. It was however found that mains frequency harmonics, in particular the 5th harmonic at 250 Hz, were at an unduly high level in the output and could be audibly objectionable. The 250 Hz level was measured as −63/−64 dB at the two outputs.

Frequency Response

The frequency response of the two outputs was found to be within a total deviation of 2 dB over the spectrum 20 Hz to 20 kHz with the 'brilliance' control at either end position, or at its central position. As is to be seen from figs. 2a, b and c, the overall response at high frequencies is affected by the 'brilliance' control, but the mid frequency response remains substantially constant, as does the low frequency roll off. The latter has been intentionally introduced to avoid the boomy coloration associated with some reverberation units.

Figs. 2a, b and c were obtained by feeding the reverberation unit with random noise, and then doing a narrow band spectrum analysis of the output. It was therefore rather surprising to find a response dip at 5 kHz with all settings of the 'brilliance' control; however this did not appear to have any particularly objectionable effects on listening tests. The effect of the 'brilliance' control which, as has been seen, alters the high frequency performance, gave a useful and substantial change of character to the reverberant sound without altering the actual reverberation time.

Reverberation Characteristics

Measurement of the reverberation time by conventional means produced fig. 3, which shows the relation between reverberation time and frequency, the reverberation time being defined as the time for the reverberant signal to drop 60 dB

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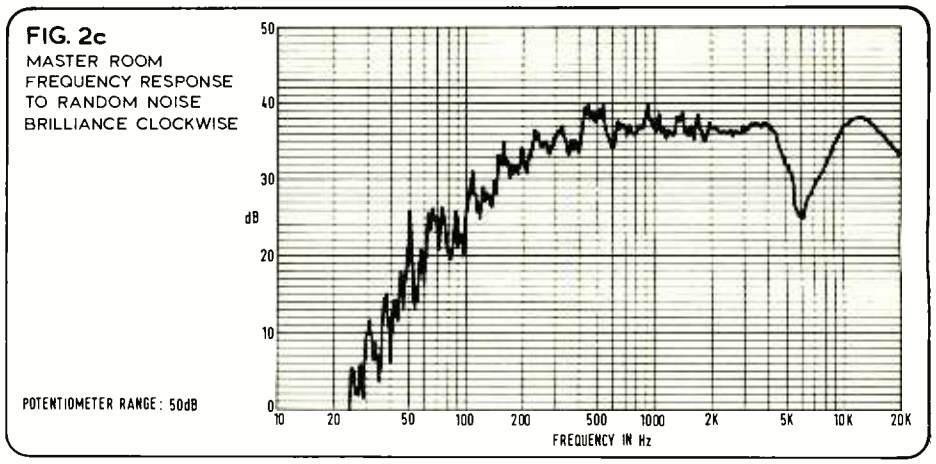
■ MASTER ROOM UNIT

after the termination of the input signal. It will be noted that the measured reverberation times are considerably less than the manufacturer's specification; raising this problem with the UK agent revealed that the unit's specification hinges on the reverberation time of a typical room with the volume quoted in the specification and the quoted reverberation time is somehow related to the volume of this room.

It was found that the two output channels had slightly different reverberation times but, more interesting, the decay characteristics of the two outputs were completely different as is shown in **fig. 4.** This factor clearly has a substantial influence on the stereo perspective of the output and is a situation which would be expected in a live room; in fact, one channel appeared to have a slight audible flutter.

Oscillographic examination of the decay characteristic produced **fig. 5,** which shows a clean exponential decay of a burst of white noise, but more interesting is **fig. 6,** which demonstrates that there is a delay between the end of a burst and the appearance of the first reflection. This delay which is shown to be in the order of 25 ms undoubtedly contributes to the natural sound of the Master Room, for in a practical room there is always a delay before the reverberant sound—this is a feature which most reverberation units lack.



Other Points

Limited subjective tests were done on the Master Room, and it was found to have a very natural sound without the twang or boom which is commonly associated with mechanical reverberation devices. The 'brilliance' control provided a wide range of room characteristics, but it is a shame that no facilities are provided for remote control of the 'brilliance' so that it could be controlled from the desk.

The acoustic isolation of the unit was such that it required 100 dB(A) spl to induce an output signal 6 dB above the inherent unweighted noise level—a creditable performance. It was however found that the unit could not tolerate mechanical shock, such as the ubiquitous coffee cup and the odd boot. It follows that whilst the Master Room may be kept in the control room, it should be located with some care.

LEXICON DELTA-T

Hugh Ford

MANUFACTURERS' SPECIFICATION

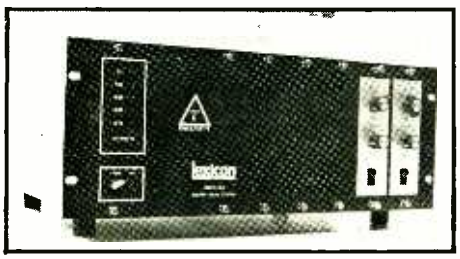
Frequency response: 20 Hz to 12 kHz ±2 dB Model *102A*.
20 Hz to 15 kHz ±2 dB Models *102B* and C. (Measured 14 dB below limiting)

Delay capacity per main frame: 40 to 320 ms Models *102A* and B. 16 to 128 ms Model *102C*. (Each main frame may contain 1 to 8 delay modules. Up to maximum may be added in field by module plug-in.)

Extended delay capacity: up to 3200 ms Models *102A* and B; up to 1280 ms Model *102C* (up to 9 *EX102* extension chassis may be cascaded via digital connection with no additional degradation of audio output signals).

Delay steps: 5 ms Models *102A* and B. 2 ms Model *102C*.

Dynamic range: 95 dB(A) typical; 90 dB(A) minimum. 90 dB typical; 86 dB minimum unweighted 20 Hz to 20 kHz (related to 1 kHz limit output).



Total noise plus harmonic distortion: less than 0.2% at limit reference level and 1 kHz. Less than 0.3% (including quantization error) at 34 dB below limit.

Number of inputs: one.

Number of outputs: one to five per main frame. Outputs may be added in field by module plug-in.

Delay accuracy: 0.01% of setting.

Input sensitivity at limiting: +4 dBm to +22 dBm, adjustable at 1 kHz.

Output level: +10 dBm to +22 dBm, adjustable at 1 kHz.

Input impedance: 20k ohms minimum, balanced, transformer coupled.

Output impedance: 50 ohms maximum, balance transformer coupled.

Wow and flutter: zero.

Pre-emphasis/de-emphasis: 75 µs.

Headroom indicator: 5 position instantaneous acting led indicator showing 0, —10, —20, —30 and —40 dB operation levels relative to limiting.

Controls: each output module equipped with coarse and fine front panel rotary switches for delay selection and a delay in/out switch. Power switch and pilot light on front panel. Input and individual output level adjustments are accessible through the front panel.

Remote control capability: delay settings may be remotely programmed by digital means or by optional remote console-mounted delay selector switches. An optional remote headroom indicator may also be connected.

Connectors: Standard professional *XLR-3* type.

Power requirements: 115/230 volt ±10%, switch selectable. 50/60 Hz, 125 VA max.

Size: 483 mm wide x 178 mm high x 400 mm deep suitable for rack or table top mounting.

Weight: 14.5 kg net, 20.4 kg shipping.

Environmental conditions: 0-40 °C operating, 0-70 °C storage, humidity up to 95% without condensation.

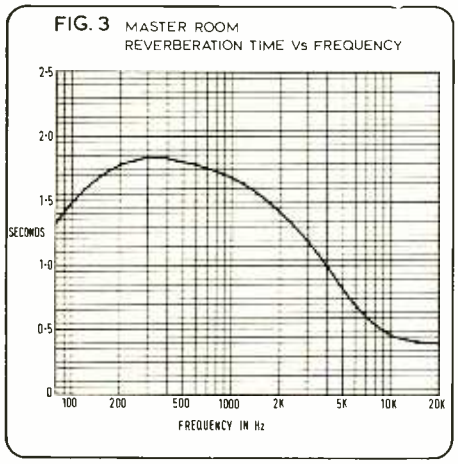
Price: £2454 as reviewed. U.S. $4000.

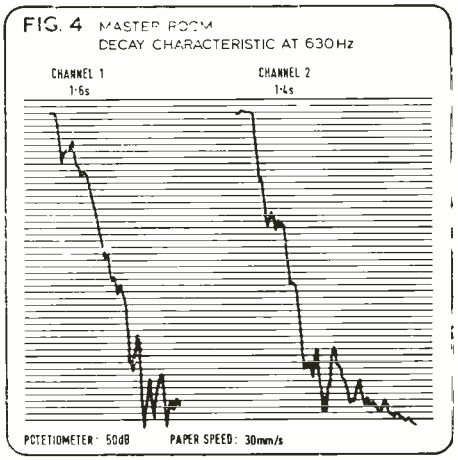
Manufacturer: Lexicon, 60 Turner Street, Waltham, Mass 02154, USA.

UK Agent: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.

IN essence the Delta-T is a digital delay unit with the capability of accepting a single input and providing up to five outputs which may be delayed with respect to the input by differing amounts. I do not propose to reiterate the basic workings of digital delay units for audio signals, as I have already covered this ground in an earlier edition of Studio Sound. (Oct 74, p60).

However it is only proper to describe the workings of the Delta-T itself, as it has some interesting features which enable it to have a very large dynamic range, which is specified as typically 90 dB unweighted. Reference to **fig. 1** shows the basic block diagram from which it is to be seen that the audio input is fed to the input module which is itself driven by the control module and the timing module. The timing module contains a crystal oscillator as the main timing reference, and the output of this is divided down to produce the necessary timing pulses for the logic and the analog/digital converter. If it is required to make small alterations





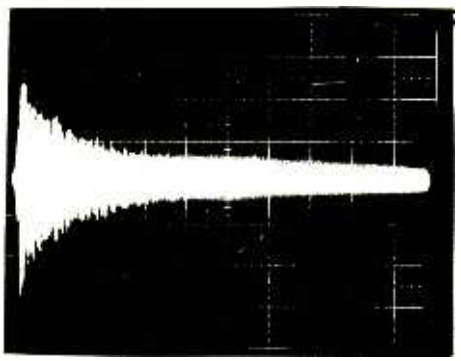
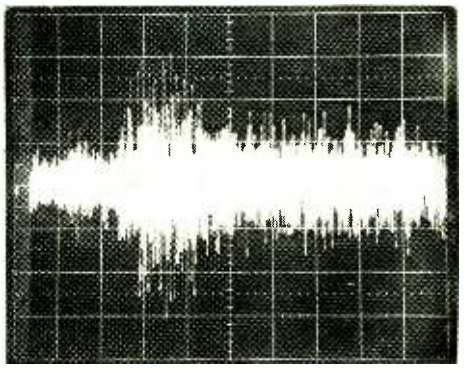


FIG. 5

FIG. 6



Summary

From the points of view of performance, bulk, weight and price the Master Room offers outstanding value. In spite of having a fixed reverberation time the 'brilliance' control gives the opportunity of a large variety of room characteristics.

The only real difficulty found with the Master Room was the low and variable input impedance, but it is expected that this problem could be quite simply overcome by the manufacturer.

FIG. 5 *20 ms/div white decay reverberation characteristic*

FIG. 6 *reverberation onset delay after pulse at left*

to the delay times, the timing module may be fed from an external source in the form of a variable frequency oscillator.

Returning to the input and control modules, the input signal is first subjected to pre-emphasis to the extent of 3 dB at 2.1 kHz and 12 dB at 12 kHz. This increases the potential dynamic range at lower frequencies at the expense of a reduced signal handling capability at high frequencies. Before anyone shouts 'high frequency compression' it must be emphasised that if it is required to handle material with a substantial high frequency content the input level may be reduced with little effect—a few dB loss of signal-to-noise ratio is hardly to be troublesome when one starts with a 90 dB dynamic range! The other form of treatment of the audio signal which occurs in this part of the world is that it is fed through a low pass anti-aliasing filter which removes high frequency signals which would lead to errors in the analog/digital converter.

The next process in this part of the device is analog/digital conversion which is achieved by sampling the audio signal at 42 600 Hz with a sample and hold circuit, which in turn feeds a 10 bit analog/digital converter. Ten bits will give a dynamic range only around 60 dB, and it is here that the cunning is used to get the 90 dB dynamic range and also to provide a virtually instantaneous level indicator. At this stage the Delta-T looks at the audio signal and selects one of four ranges which are (see right):—

What happens is that the Delta-T tries to maintain the 10 bit encoded signal between 25% and 75% of full scale (digit-wise); if the encoded signal exceeds full scale there is an instantaneous range change and if the signal falls below 25% for more than 100 ms there is also a range change. The range in current use is encoded into two binary bits, which together with the 10 bits from the analog/digital converter for a 12 bit composite word which is passed to the shift register delays in the form of a stream of 12 bit words.

Rather conveniently, the two bit range information may be decoded in terms of four ranges of 10 dB separation, and this information together with an overload indication from the analog/digital converter is used to feed the headroom indicator. Because the headroom indicator is driven from the digitally encoded signal it indicates true headroom allowing for pre-emphasis and also indicates peak signal as is vital in a digital system which by its nature cannot have any peak overload tolerance.

Further cunning is used in the shift register delays in order to reduce the necessary number of shift registers. The 12 bits of information from the input section are first

Range	Signal Level
1	Full level to —12 dB
2	—12 dB to —22 dB
3	—22 dB to —32 dB
4	Less than —32 dB

fed to the first 5 ms delay section of the shift registers, after which the digital signal is time division multiplexed in the ratio 8:1 and fed back into the first 5 ms shift register section. After eight circulations of the first 5 ms shift register section (a delay of 40 ms) the digital signal is fed to the second 5 ms shift register section where the process is repeated. The process is further repeated in 5 ms shift registers up to the capacity of the equipment, whence the digital data may be further delayed by an extension module.

The output modules which have a coarse and fine delay switch are fed from the digital data at the output of each 5 ms shift register. The coarse delay selection is accomplished by selecting the output of a particular 5 ms shift register (which as it is time division multiplexed gives delay steps of $5 \times 8 = 40$ ms), and the fine time delay control selects the time at which the output is taken from the selected 5 ms shift register and thus effects delay steps of 5 ms.

The selected 12 bit word is then separated into the 10 data dits and the two range bits which are used to control the gain of the output module after the 10 data bits have been subjected to digital/analog conversion. Finally, the restored audio signal is passed through a low pass filter to remove sampling frequency components, and through two further filters to compensate for high frequency losses resulting from aperture loss and to restore the original pre-emphasis.

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■ LEXICON DELTA-T

Unfortunately this description of the functioning of the Delta-T has to be brief, and I have not attempted to cover many details and subtleties such as the timing of the digital sections. It is however hoped that readers will appreciate the overall modus operandi.

Mechanics

The form of construction of the Delta-T is an alloy frame designed for mounting in a standard 483 mm rack. The rear of the frame contains the power supplies and the front of the frame is in the form of a series of slotted guides for fitting printed circuit boards which plug into a printed mother board. All boards and components are to the best standards and the printed boards have adequate component identifications for servicing. Furthermore, all controls and connectors are properly identified with their functions.

At the left of the front panel is a removable cover which provides identifications for the power switch and its associated indicator, and also access to a screwdriver-operated input gain control. In addition the headroom indicator is associated with this cover and comprises five led indicators which are illuminated at 0 dB, −10 dB, −20 dB, −30 dB and −40 dB relative to maximum input. These leds are in fact mounted on one of the printed boards behind the removable panel, which together with two other printed boards form the basic electronics of the Delta-T.

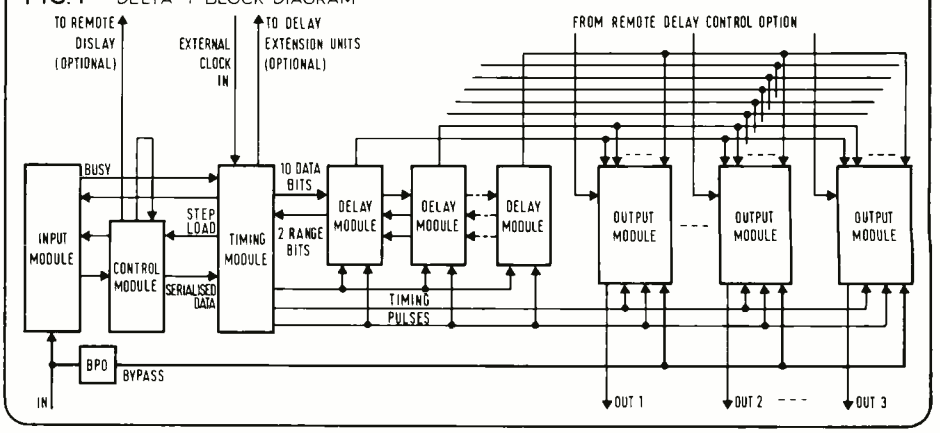
Adjacent to these boards are eight slots for delay module boards, each of which provides a delay of up to 40 ms: in practice only the required number of boards need be fitted, and it is only necessary to plug in further boards to extend the delay capacity.

The remainder of the frame provides space for up to five output modules, again it only being necessary to fit the required number of modules. Each of these modules has three switches on its front panel, a delay on/off switch, and a coarse and fine delay switch. In the delay off mode the audio signal passes through the analog/digital and digital/analog processing but not through the delay modules, a bypass option being available to bypass completely the digital electronics. The selection of the required delay is accomplished by combining the coarse and fine delay switches, the former providing delay times up to 280 ms in 40 ms steps, and the latter providing delays up to 40 ms in 5 ms steps. Naturally, the potential five ouput modules may all be set to different delays, an essential requirement for sound reinforcement systems.

Turning to the rear of the unit there is the single *XLR-3* type input connector and five *XLR-3* output connectors, one for each output module. In addition there is an IEC standard mains connector and an imperial size mains fuse, plus a slide type mains voltage selector for 230/115 volt operation. Unfortunately, the latter seems unsatisfactory from the point of view of electrical safety because the mechanical clearance between parts connected to the mains and parts connected to the chassis is far too small in relation to British safety standards.

The only other thing which worries me about the mechanical aspects of the Delta-T is that there is a finned heatsink on the rear panel. I feel that this heatsink could be very easily damaged in transit or during handling; furthermore, the case of the transistor which is mounted on the heatsink is not insulated and can be easily shorted to any flying leads or connectors.

FIG. 1 DELTA-T BLOCK DIAGRAM



Inputs and Outputs

The input was found to be adjustable in level such that signals between +3.5 dB.7 and +21.2 dB.7 at 1 kHz could be set to produce overload of the digital section. Because of the use of internal pre-emphasis the overload level is of course dependent upon frequency at higher frequencies. A fully floating input is used, as opposed to the specified balanced input, with an input impedance in excess of 22 600 ohms at any input sensitivity setting. This high input impedance is of course most convenient, as is the low output impedance which was measured as 27.2 ohms.

Like the input, the output is fully floating and adjustable in level such that the maximum 1 kHz output may be set anywhere between +8.6 dBm and +21.9 dBm when loaded into 600 ohms.

Headroom Indicator

As has been previously explained the headroom indicator derives its signals from the digitally encoded data and is therefore correctly located after preemphasis and is a strictly peak reading indicator. Unlike to single overload indicator fitted to some digital devices, the Delta-T has five indicators arranged in 10 dB steps such that one really knows how much margin is to hand—an excellent arrangement.

The speed of the indicator system was found to be such that an overload of only two cycles of 10 kHz sinewave gave a readily observable indication; thus, the indicators are very much faster than any common form of program meter and consequently it is advisable to use the inbuilt headroom indicator for level adjustment. In fact the 10 dB steps of the headroom indicators were extremely accurate, and certainly better than ±0.1 dB either between steps or overall.

Frequency Response and Noise

The overall frequency response of the Delta-T in relation to level is shown in **fig. 2**, which demonstrates that the response is certainly better than ±1 dB relative to 1 kHz from 20 Hz to 15 kHz at levels less than −15 dB relative to overload. The upper curve in fig. 2 shows the result of driving the

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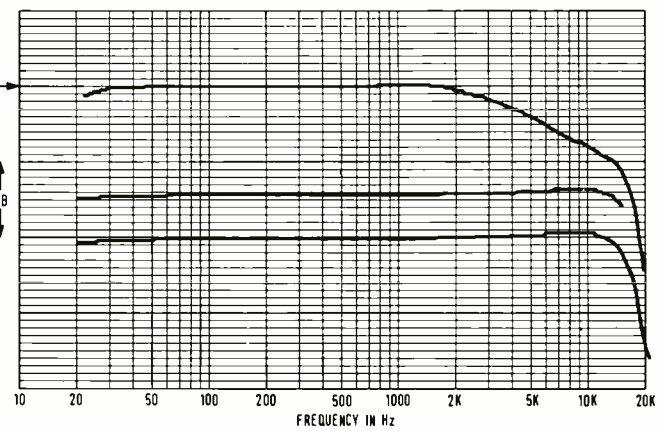
FIG. 2
DELTA-T
FREQUENCY RESPONSE



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Specification:

Input	200 255 volts 40- 60Hz Direct
Output	230 volts ± 1% No load to 500 watts. (60 Hz output on request) 50Hz ± 0.01%
Waveform:	Sinusoidal
Distortion:	2% Max
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Efficiency:	60% at full load.
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Delta-T at limiting level, and consequently demonstrates the pre-emphasis curve and the resulting compression when the unit is over-driven.

Noise measurements were related to this level and may be fairly specified as the dynamic range at 1 kHz and lower frequencies, the following results being measured on both output channels and being unaffected by the delay time selectors:

Condition	Dynamic range at low frequencies
Band limited 20 Hz to 20 kHz, rms	86.5 dB
'A' weighted, rms	98.8 dB(A)
CCIR weighted, rms reference 1 kHz	90.5 dB

Investigations into mains frequency components in the output showed that mains harmonics were at extremely low levels, but that the band-limited 20 Hz/20 kHz noise measurement was effectively restricted by 50 Hz hum. The overall noise performance can only be described as excellent, but perhaps the mains frequency hum level might be easily improved.

Distortion

Attention was first given to the harmonic distortion performance of the unit, which is specified by the manufacturer only at 1 kHz. Reference to **figs. 3 and 4** shows the second and the third harmonic distortion at levels of 14 dB and 34 dB below limiting, in both cases the distortion performance being to a very high standard and considerably better than the manufacturer's specification would imply.

A further interesting test was to apply two single cycles of 1 kHz sinewave to the delay unit, and to observe the output—the result of doing this is shown in **fig. 5**, where the upper trace is the input and the lower trace the delayed output. The similarity of the input and output are excellent and there is no trace of any form of instability.

Further tricks were tried with the intention of catching-out the gain switching electronics, but the worst damage that could be obtained is shown in **fig. 6**, which shows in the upper trace the input waveform as a continuous low level 10 kHz signal which is interrupted with a high amplitude burst. The resulting output is shown in the lower trace which illustrates some minor disturbances at the leading and trailing edges of the high amplitude burst.

The final aspect under the heading of distortion is the intermodulation distortion as measured by the SMPTE method with 50 Hz and 7 kHz tones in the amplitude ratio 4:1. Here the im distortion was found to be 0.035% just below limiting level, increasing to in the order of 0.8% at lower levels.

Other Matters

In purely scientific applications, as opposed to normal audio applications, the manufacturer's specification of 0.01% accuracy of delay setting could cause confusion: I do not have any argument about the incremental delay between switch settings meeting this specification, but unfortunately the propagation delay in other parts of the system is of the order of 120 μs and therefore makes nonsense of the specification at short delay time settings!

Whilst the various optional accessories were not submitted for review, I feel that it is only fair to mention that not only can the headroom indicators be remoted, but also remote delay selection is offered.

Summary

This is a very fine delay unit, offering outstanding noise performance which is really important for applications in sound distribution systems.

The headroom indicator system is a valuable part of the Delta-T, as it is properly engineered and lets the operator know where his levels are aimed well before he approaches maximum permitted level, above which audio disaster occurs as in all analog/digital devices.

Another nice feature is the expandability of the system, such that the initial order need only include the minimum of delay boards and output channels, and further delays and output are simply added by plugging in printed boards.

FIG.3
DELTA-T
HARMONIC DISTORTION
AT 14dB BELOW
LIMITING

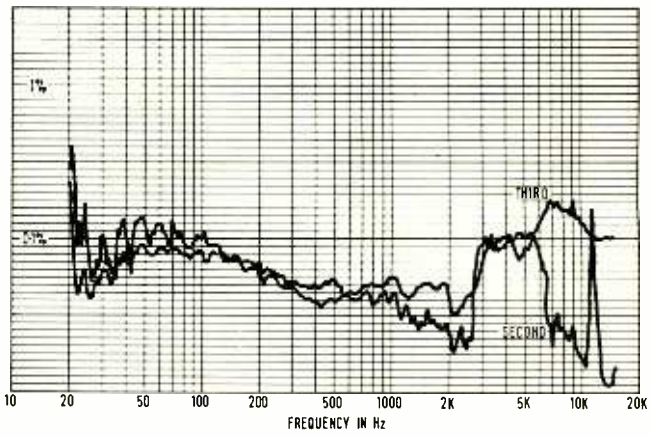


FIG. 4
DELTA-T
HARMONIC DISTORTION
AT 34dB BELOW
LIMITING

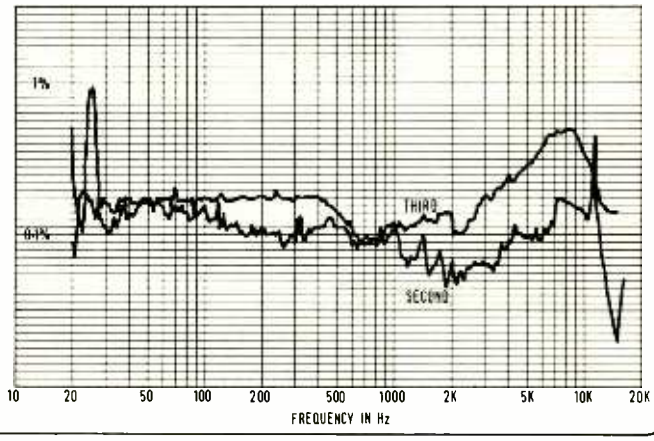


FIG. 5 *Single sine cycle response 1 kHz delayed 10 ms 2 ms/div*

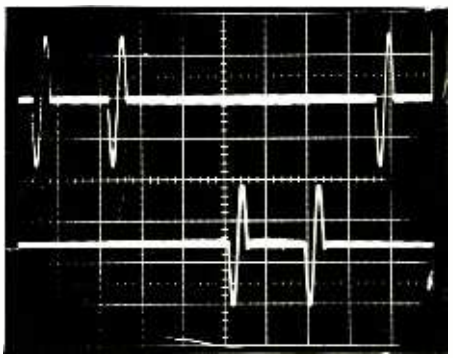
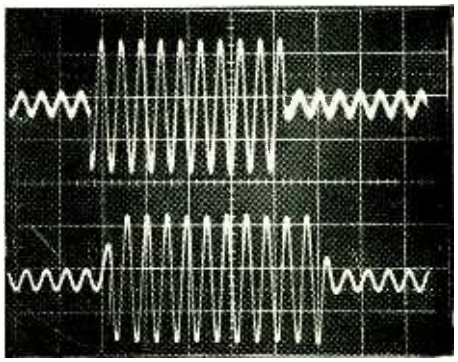


FIG. 6 *10 kHz burst response*



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Shifters are proving effective in the following situations:
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Actual sustained howling is suppressed even by very small shifts as low as 1 Hz.
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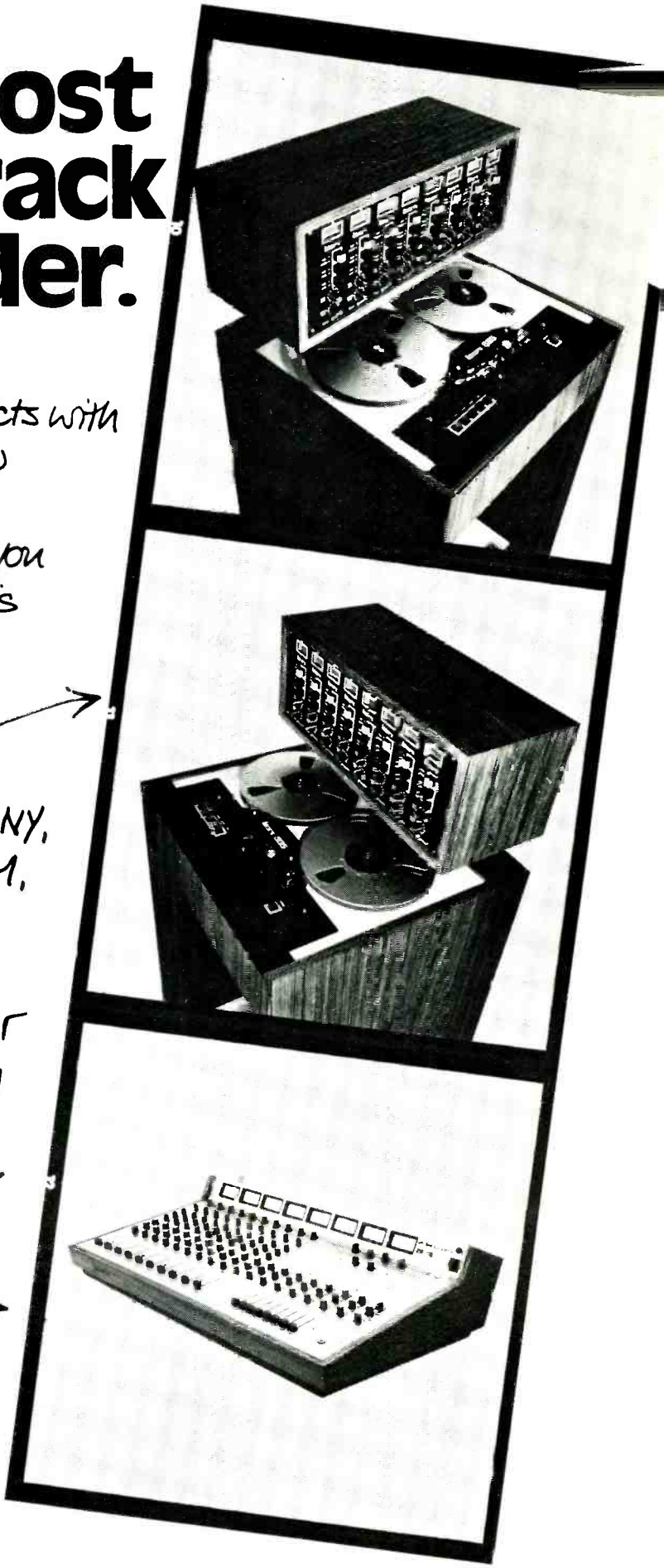

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