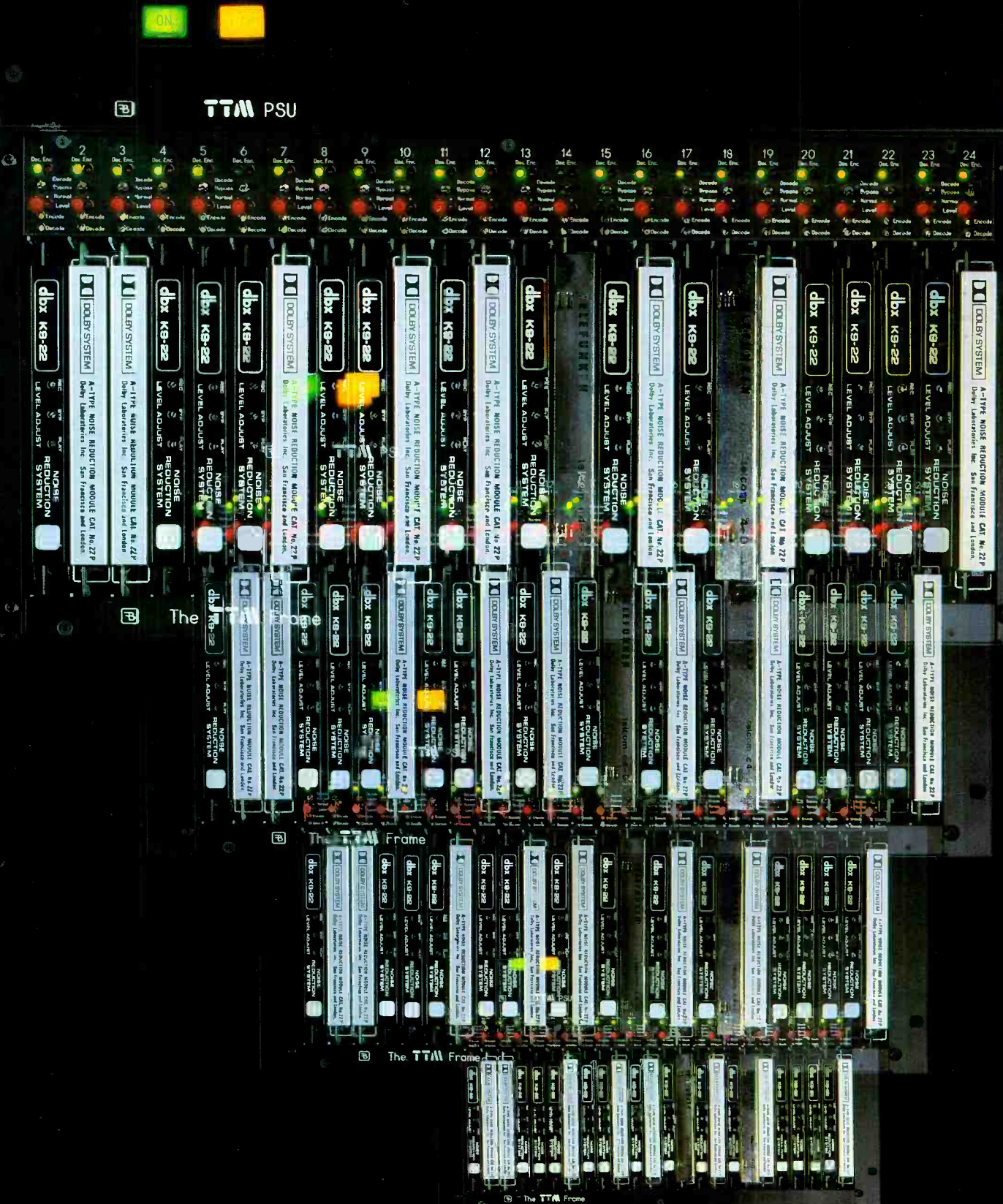


# studio sound

July 1980 75p

AND BROADCAST ENGINEERING



## Noise reduction



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Oscar Peterson, with his 16 into 8 Sound Recording Console. When Oscar decided to build a professional recording facility in his home he chose a MIDAS mixer.

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**EDITOR**

ANGUS ROBERTSON

**ASSISTANT EDITOR**

NOEL BELL

**PRODUCTION ASSISTANT**

ANN HORAN

**CONSULTANT**

HUGH FORD

**EDITOR'S****PERSONAL ASSISTANT**

WENDY SMEETH

**ADVERTISEMENT MANAGER**

PHIL GUY

**PUBLISHER**

DOUGLAS G. SHUARD

**Editorial and Advertising Offices:**LINK HOUSE, DINGWALL AVENUE,  
CROYDON CR9 2TA, GREAT BRITAIN

Phone: 01-686 2599

International: +44 1 686 2599

Telex: 947709

Telegrams: Aviculture Croydon

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# studio sound

## AND BROADCAST ENGINEERING

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The music and recording business is inherently International and many of us spend hundreds of hours each year crammed into aircraft seats (apart from the few lucky enough to travel First Class who aren't as tightly crammed). Everybody has their favourite horror stories about air travel, but I won't bore you with mine, simply remaining fairly general. One cannot help noticing the efficiency and low price of internal flights in America. If a flight is scheduled to leave at a certain time, it is usually taxiing about one minute later, while European airlines rarely leave on time. Most airports are also rather more efficient, with quick check in (often at kerbside) and rapid check out (known as the wait for your baggage, which in London is often an hour or more, even after a flight of shorter duration). Internal fares in America are about half that of Europe, including flights within Britain. For instance London-Glasgow and Los Angeles-San Francisco are similar distances (to within nine miles). The fare for the British route on the British Airways no frills Shuttle (no food or drink of any form served on board) is about \$122, while that on the similar length American route varies from \$64 down to \$32 for different airlines (yes, they have competition in America, something unheard of for most airlines outside America — apart from Laker Airways, of course who only charge \$187 between London and New York). Again, there are considerable fare reductions available on American airlines, and anybody from Britain with the foresight to book seven days ahead can obtain a 40% discount for any internal American airtravel, whether it be single or return, whatever airline. So our American sector is down to \$20 (on Braniff or National, not including tax) some 16% of the British fare, probably for a rather better service.

Although one might have expected fares to be cheaper within Britain than across European borders, for similar sectors the prices are almost identical, although short sectors such as Brussels and Paris are incredibly expensive — relatively eight times more expensive than our American sector. To be completely accurate, fares to Paris have recently been reduced for those prepared to travel in the back of the aircraft with no food or drink service, while first class seats have been replaced by 'Club Class' at a premium on the economy fare. The new service is a success, in the back of the aircraft at least, although on at least one occasion the one passenger in the front (paying Club Class fare) was not sufficient to balance the 180 in the rear and the aircraft couldn't even take off until the balance was properly distributed.

A number of British airlines have attempted to introduce competition to European air travel (as Laker did to trans-Atlantic travel, after several years of legal battles), but they are currently being frustrated by the various European governments, who in each case are attempting to protect the government run airlines — whose efficiency often leaves something to be desired, and thus presumably the necessity for higher airfares than America.

Discerning readers might notice an improvement in the typesetting this month because we have finally abandoned hot metal for more modern photosetting. This is also the largest ever issue of *Studio Sound*, and we should particularly like to thank all our advertisers and contributors who enable *Studio Sound* to remain the leading publication in the pro-audio field. Best wishes to Noel Bell who has just become a father, Drusilla Dalrymple who has just become a mother and special thanks to Wendy Smeech who leaves us this month after five years of holding our editorial department together. It's been a hectic month!

Cover of the TTM Frame with Dolby, dbx and  
Telefunken noise reduction modules, by Peter  
Letts and Ray Hyden.

JULY 1980 VOLUME 22 NUMBER 7



# AKG

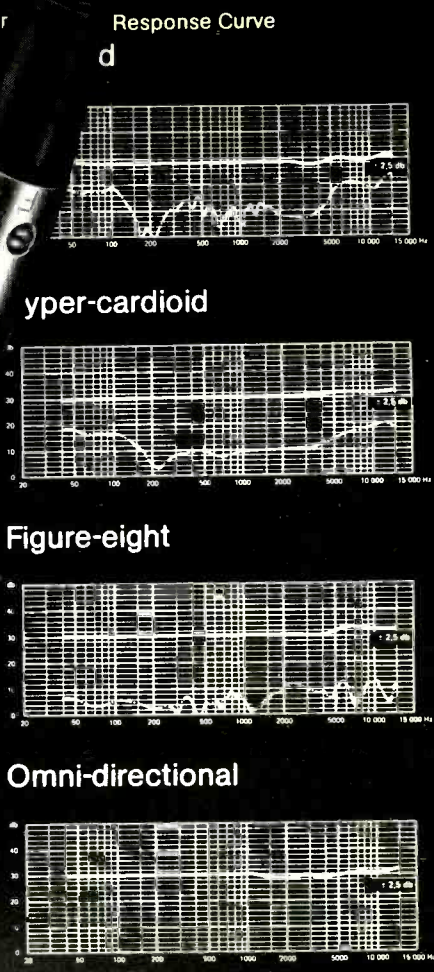
ACOUSTICS



## Studio condenser microphone C414EB

The twin-diaphragm system enables the selection of four different microphone polar patterns. Pre-attenuation before the output stage is incorporated to permit the increase of undistorted maximum

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transmitter stations or in conjunction with wireless microphones or other communication equipment. A recessed switch on the front enables the user to select any one of four different polar patterns to adjust for different recording situations. Four different types of microphones are thus combined in only one C414EB. The chosen polar patterns are almost frequency independent to guarantee the same sound character for all angles of incidence.



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For almost a decade, I.T.A. has provided the recording industry with a comprehensive facility for the supply and maintenance of a large range of equipment. Originally specialising in semi-professional products, the company now supplies everything from a 24 track recorder to a reel of tape, and the back-up facilities have expanded rapidly to cope with the demands of the largest studios.

In addition to an in-house service department, a 999 service is provided for the more sophisticated equipment which has to be maintained on site. This operates nationwide, in fact quite literally from Lands End to northern Scotland. To cope with the requirements of studios running 24 hours a day,



a massive inventory of spare parts and components (currently numbering over 250,000 individual items) is held at Harewood Avenue.

Coping with the latest advances in electronic and electro-mechanical design requires a high level of expertise. Backing up the engineering staff, many of whom have factory training behind them are the latest innovations in test equipment. An extra facility is the machine shop, which was totally re-equipped in 1979 with the most modern lathes, milling machines and drills, thus giving I.T.A. a truly total in-house capability — a unique advantage.

To maximise customer convenience, over 1,000 com-

panies have accounts with I.T.A. A six figure stock level ensures rapid delivery from a very wide range of products which include tape recorders (mono to 24 track), mixers, tape duplicators, signal processors and tape. Most items are on permanent display in the showroom, which is conveniently located, one minute from Marylebone Station with good parking.

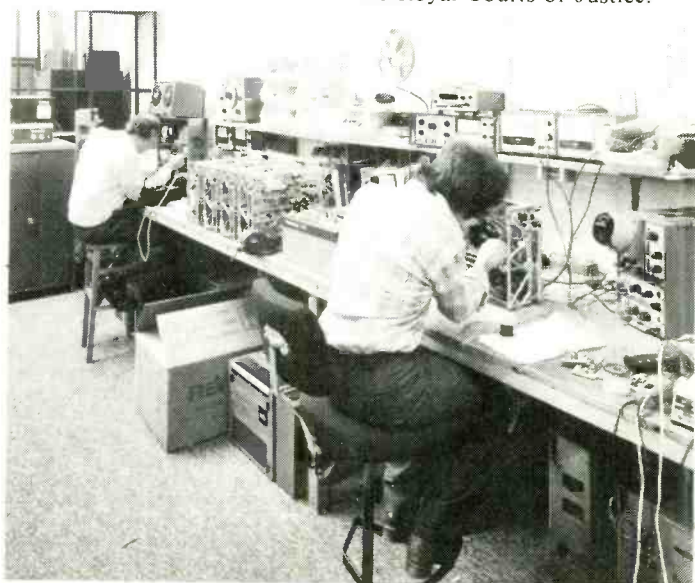
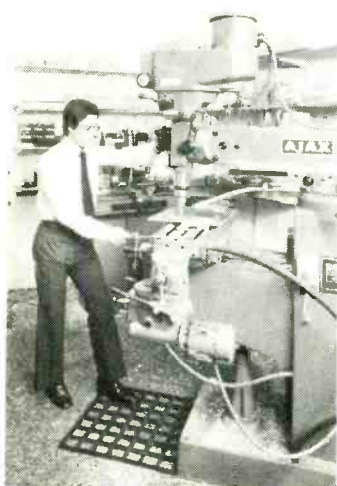
In addition to supplying individual items of equipment, complete studio systems are catered for, from small 4 or 8 track demo-type applications, to the high-technology 24 track full-scale installation. 40% of turnover is exported to over 30 countries from Iceland to

India, and Norway to New Zealand. European distribution is handled through a subsidiary company based in Paris.

The list of customers includes all the top recording studios plus some rather sur-



prising names like Rolls-Royce, British Gas, National Coal Board, C.E.G.B., Ministry of Defence. On a lighter note there's The Who, Queen, The Police, Pink Floyd, to name but a few. Other areas served include Universities (UK and Overseas), Broadcasting Companies, even the Royal Courts of Justice.



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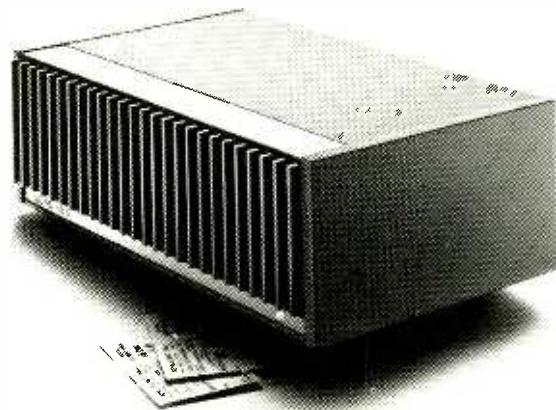
Nevertheless with good amplifiers and loudspeakers (and on those occasions when the people at the recording and transmitting end get it right) a musical experience can be achieved which is extremely satisfying and one of the greatest pleasures of our time.

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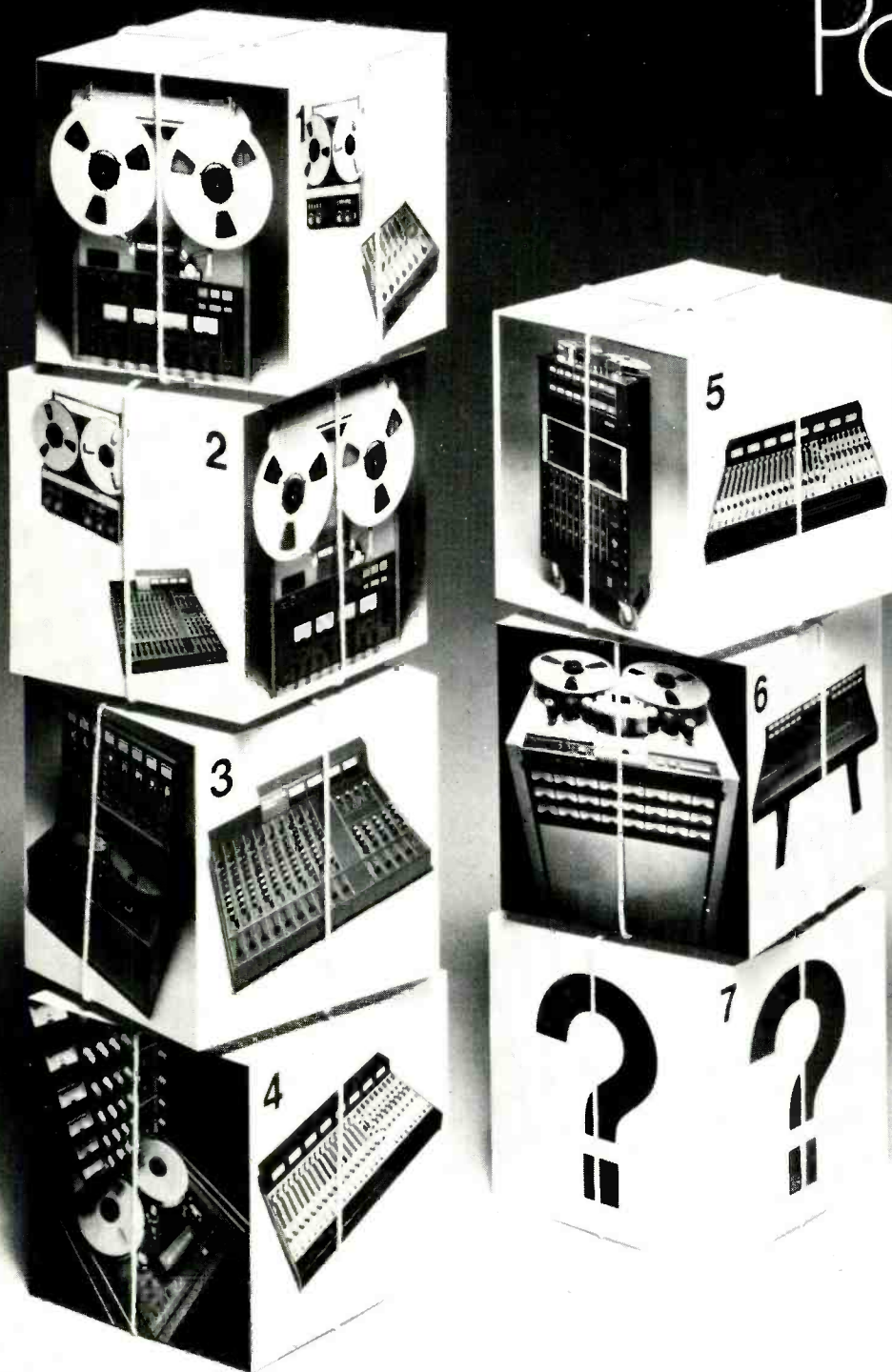
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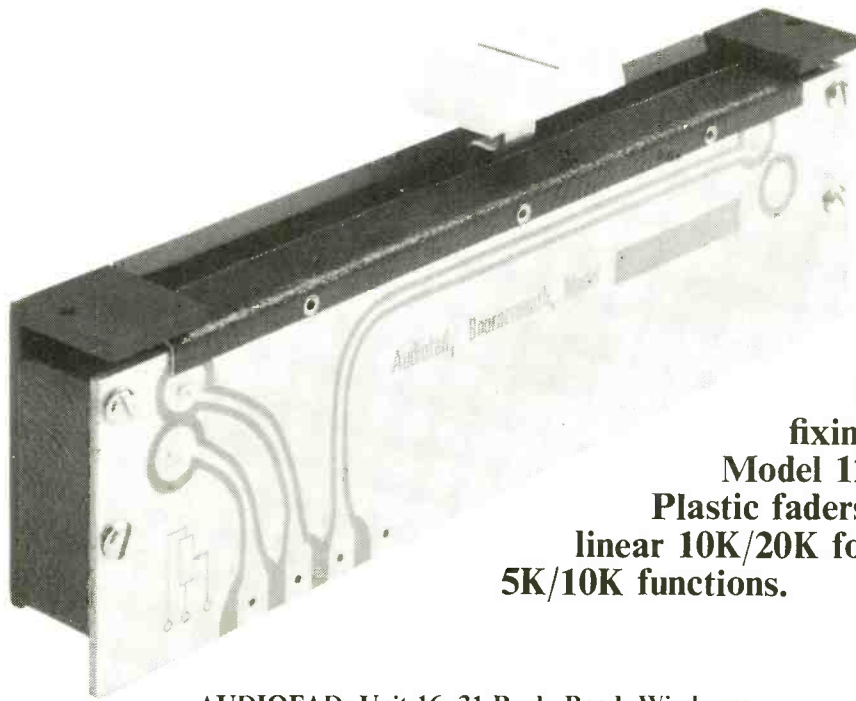


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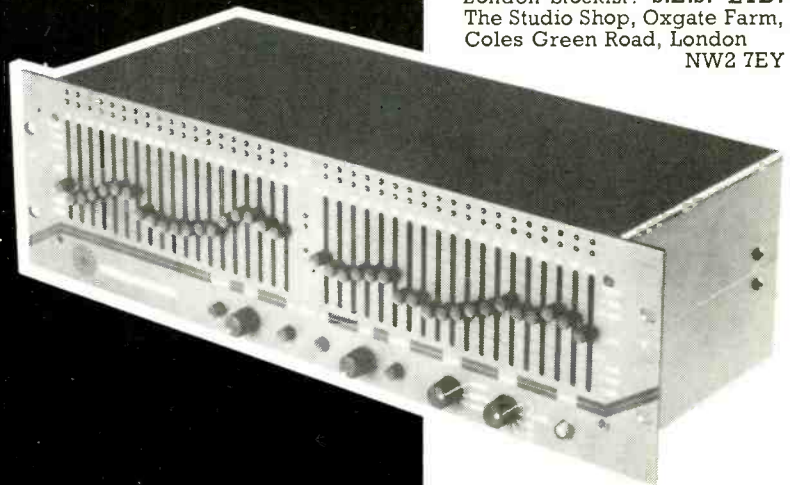
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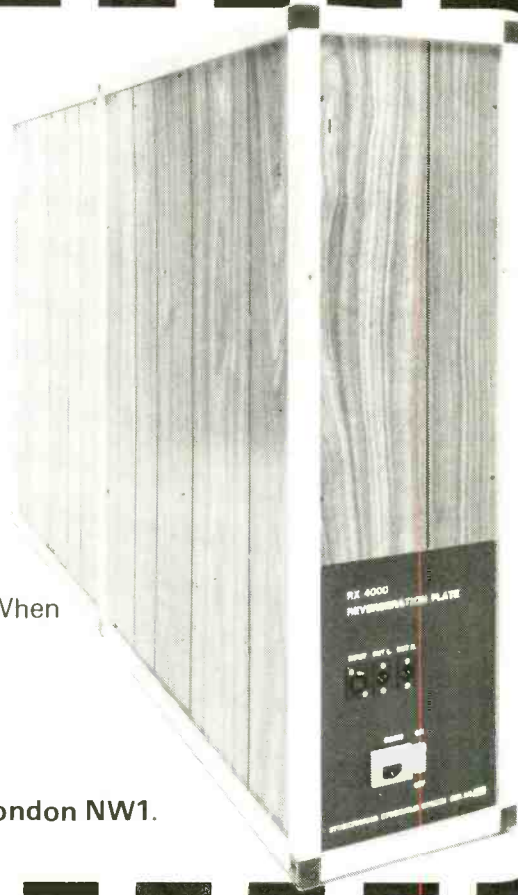
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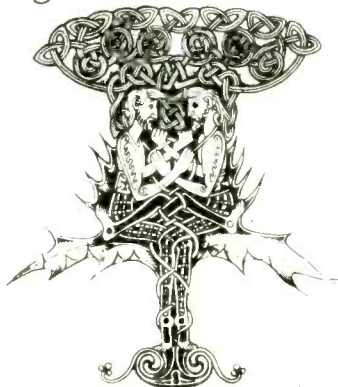
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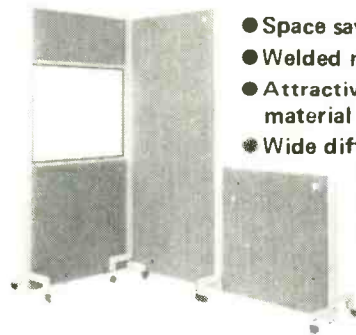
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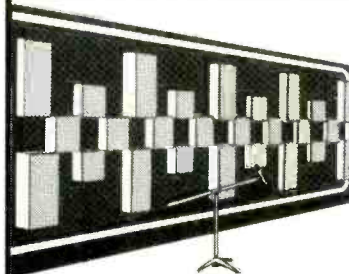
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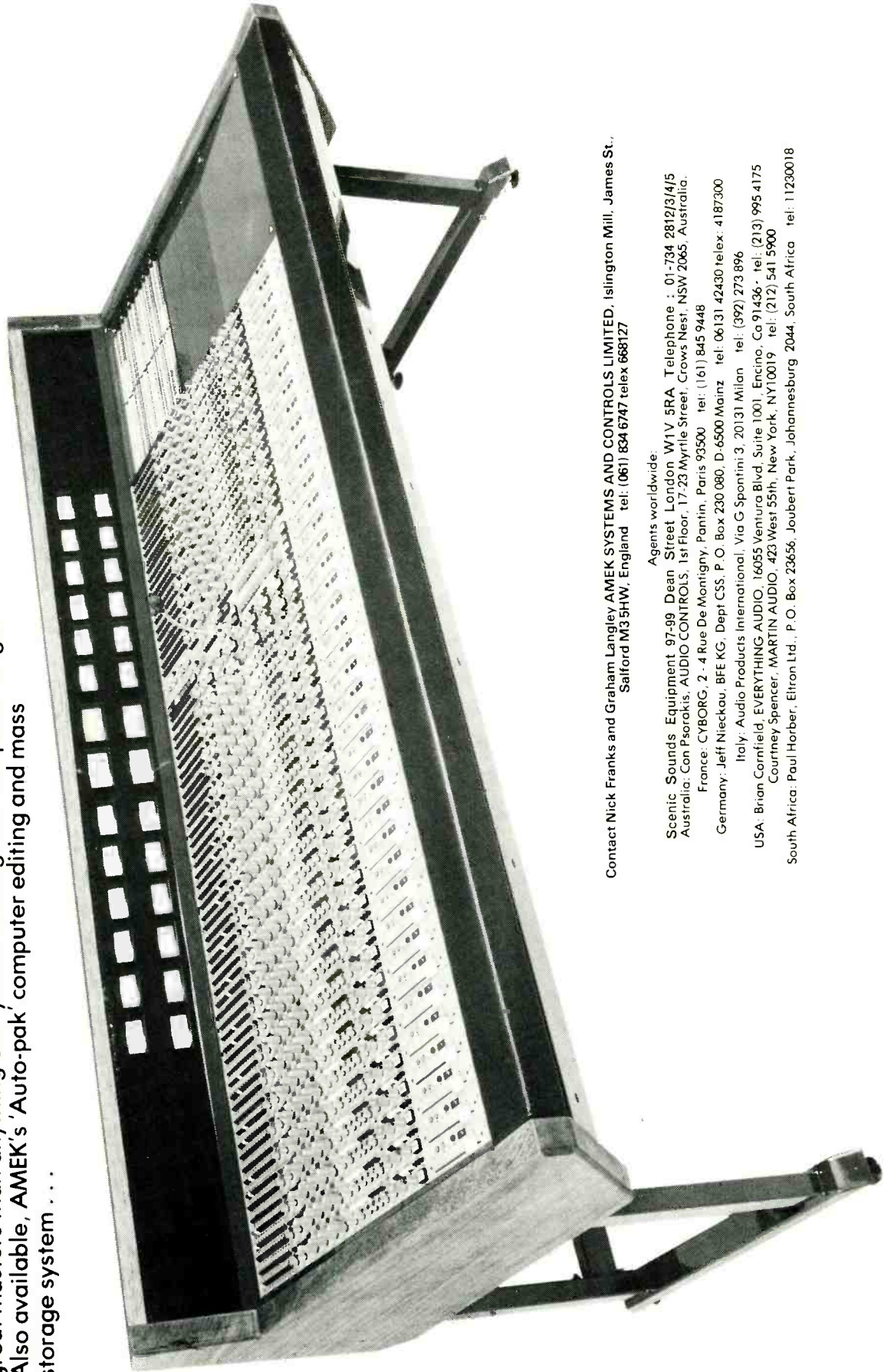
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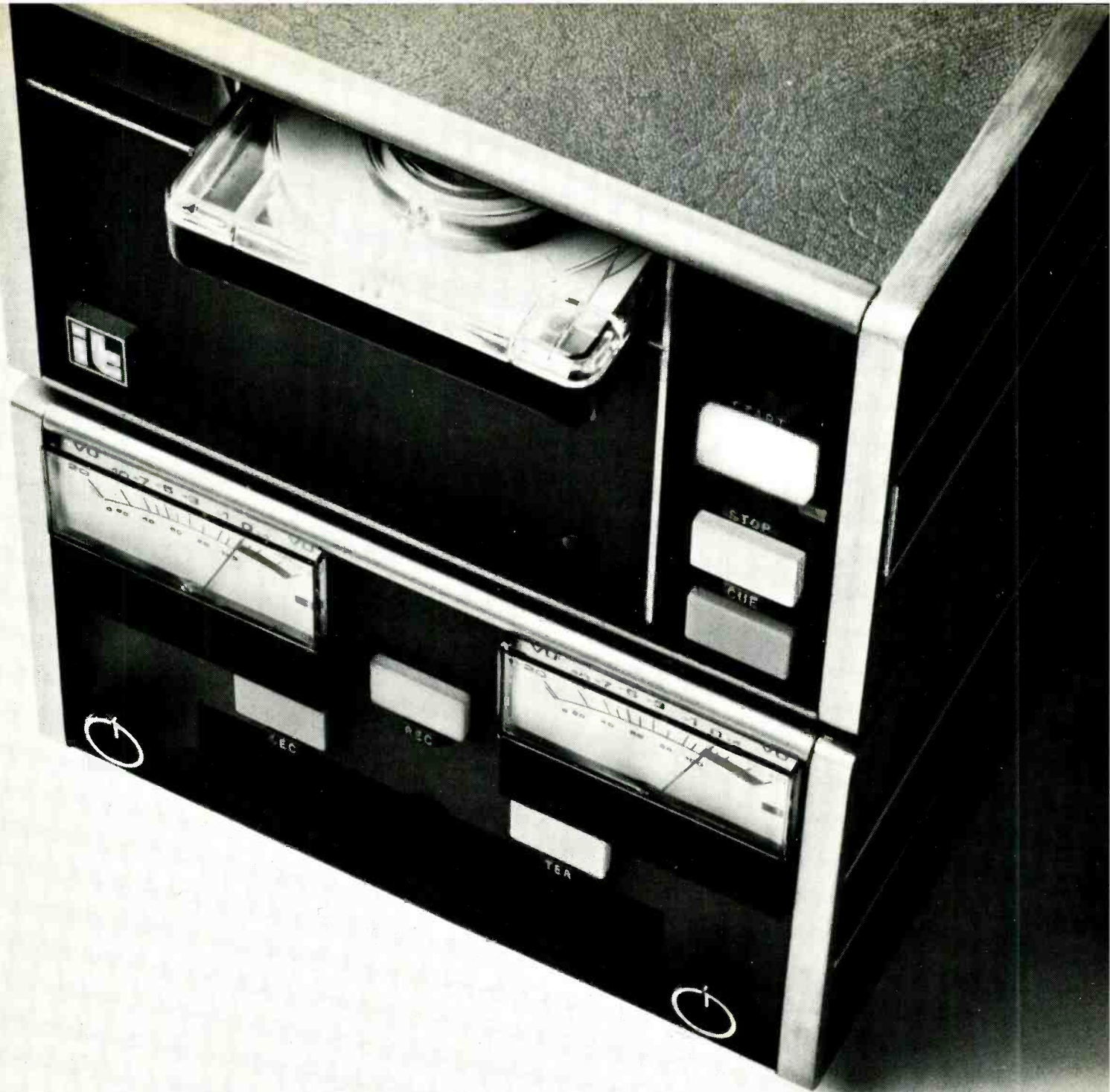
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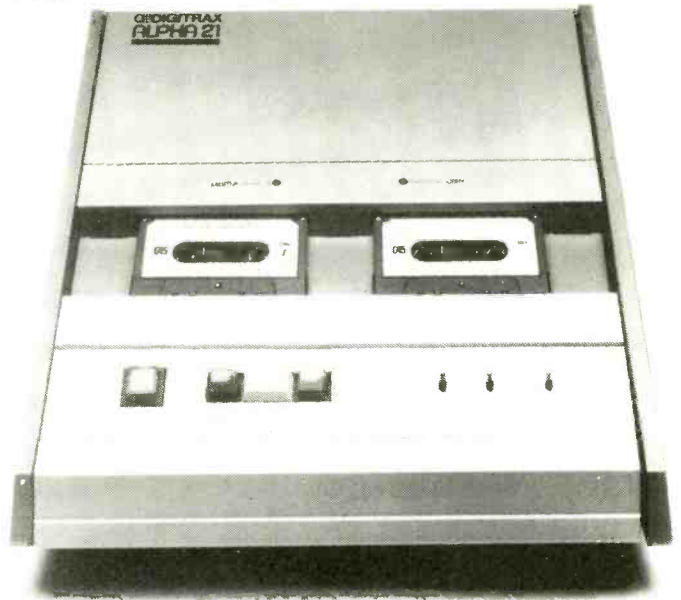
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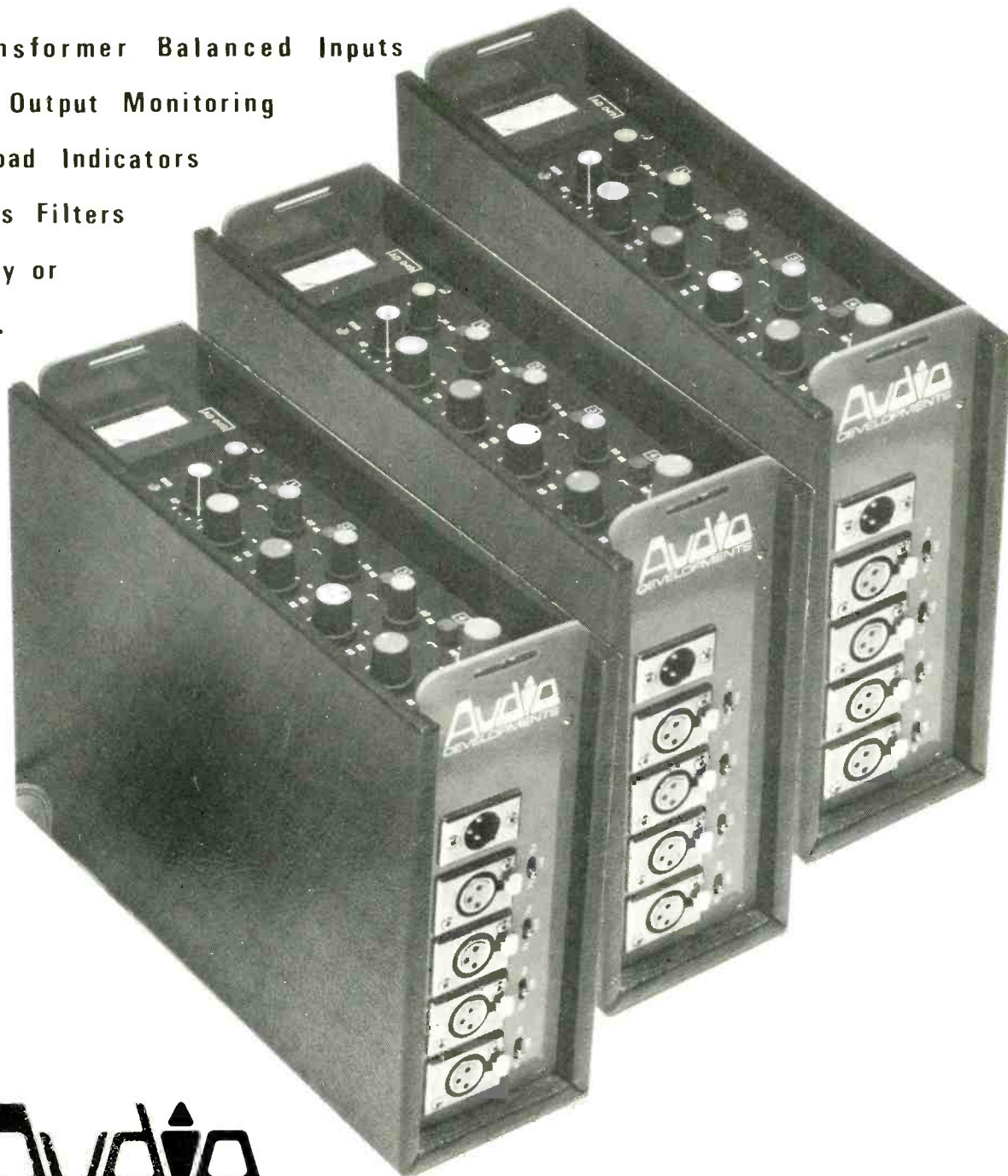
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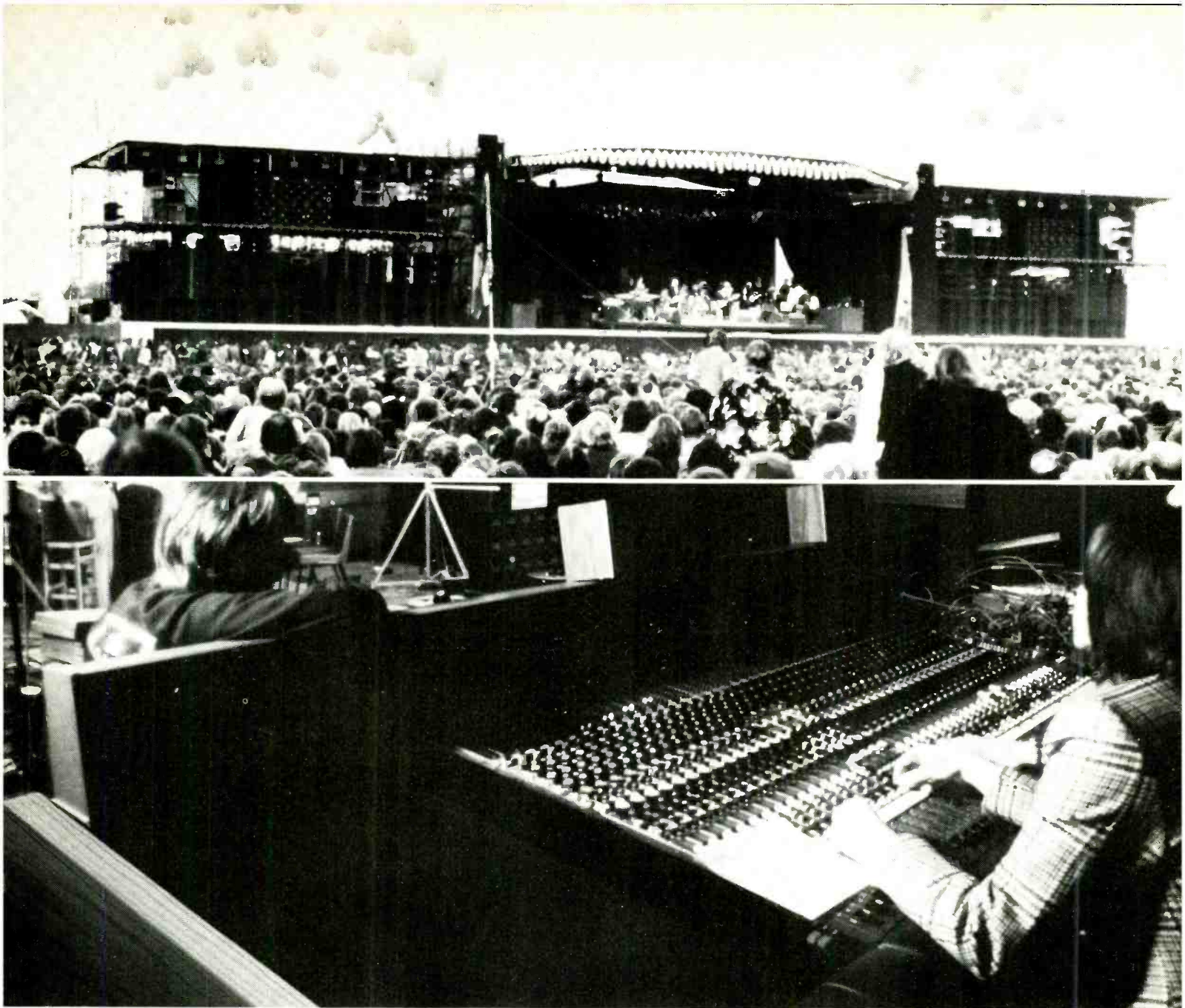
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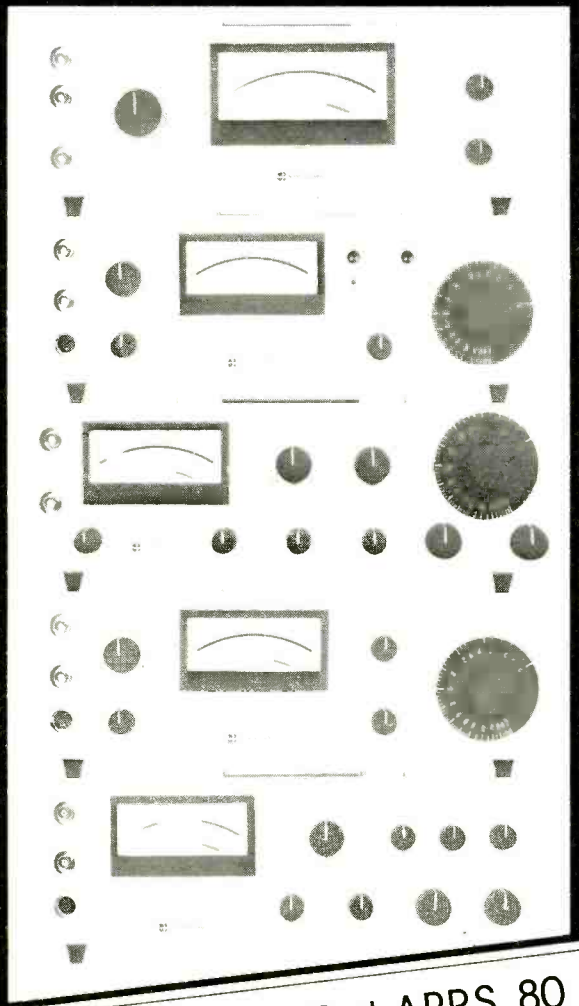
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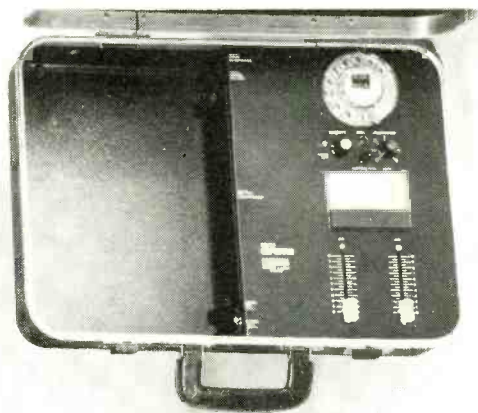
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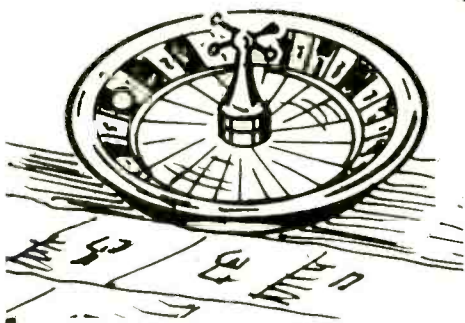
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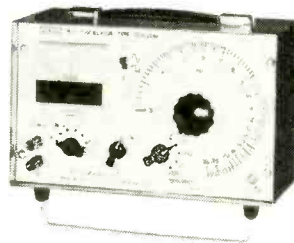
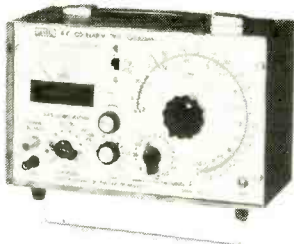
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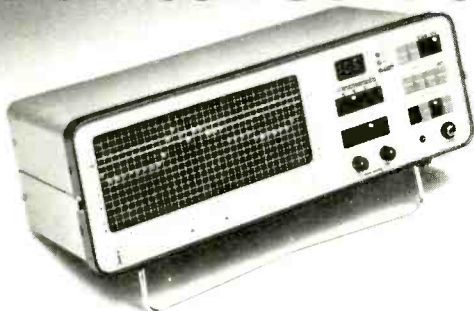
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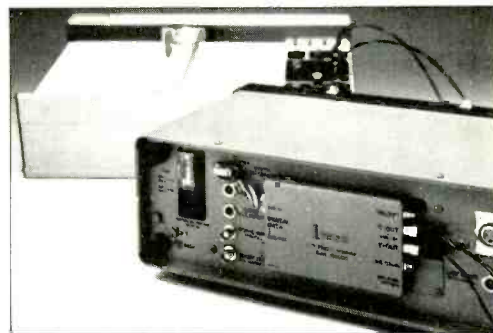
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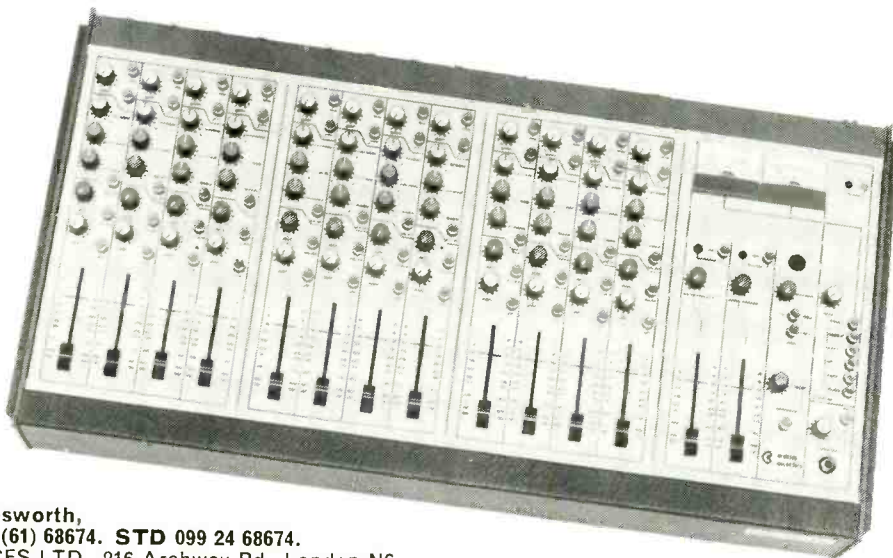
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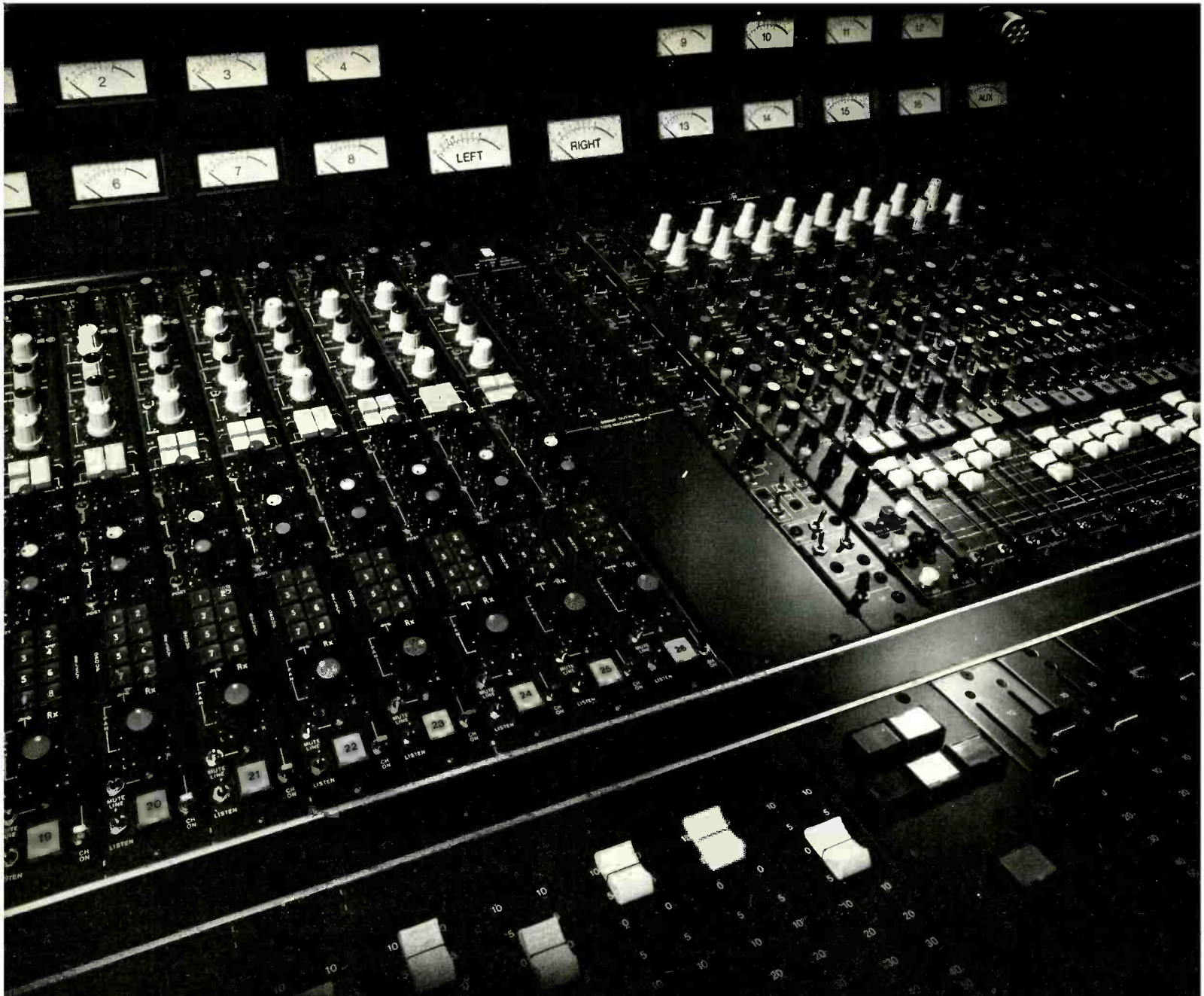


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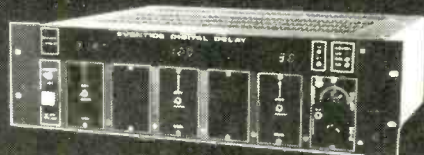
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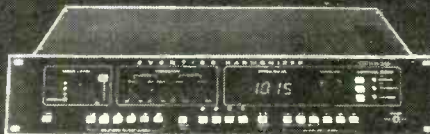
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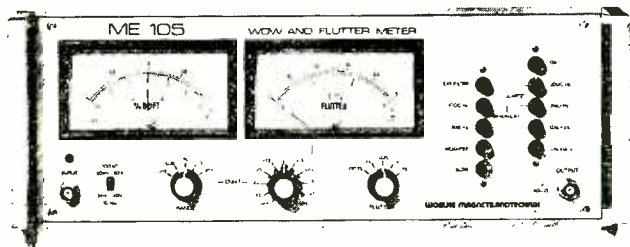
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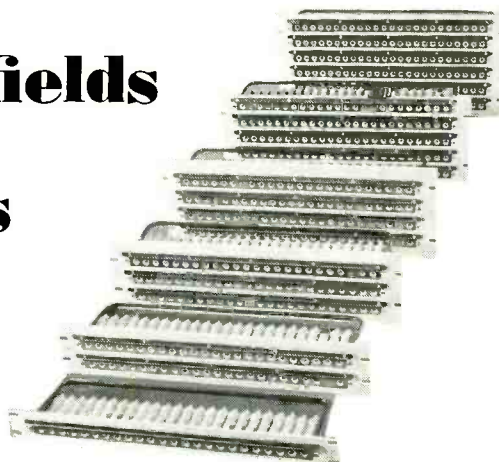
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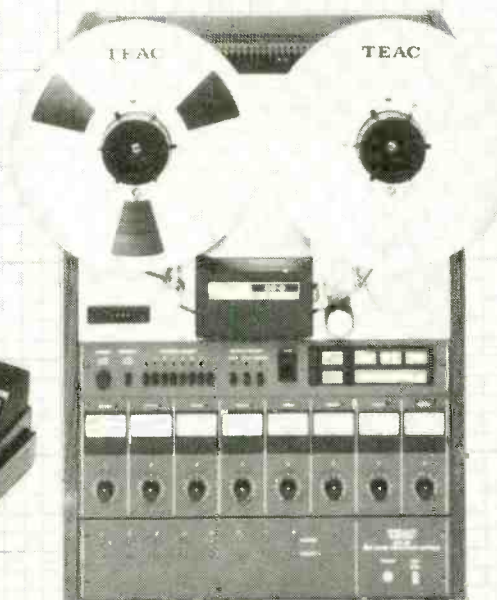
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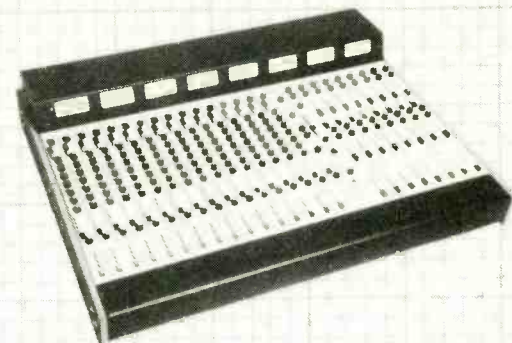
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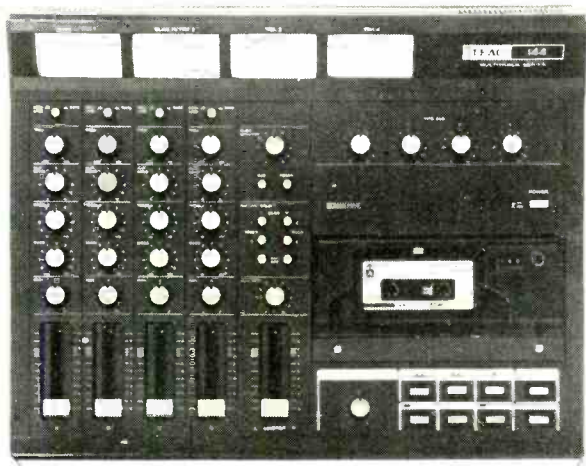
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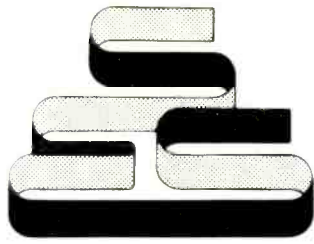
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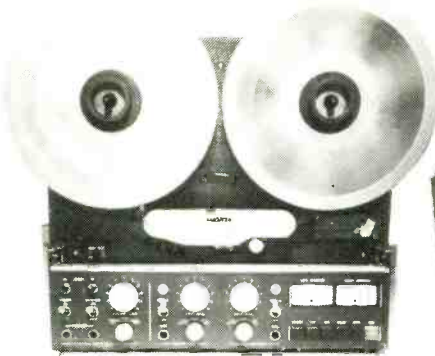
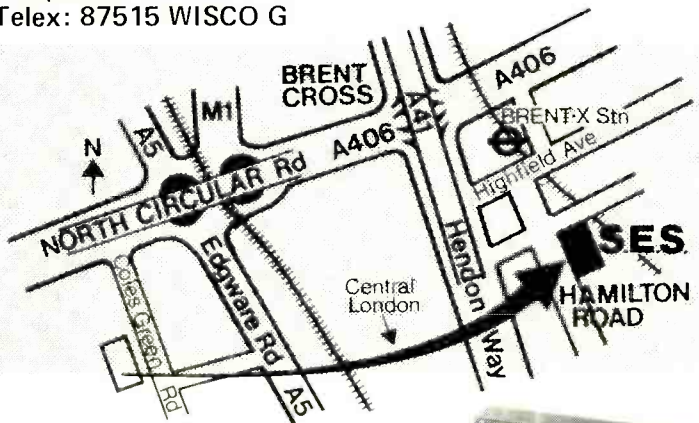
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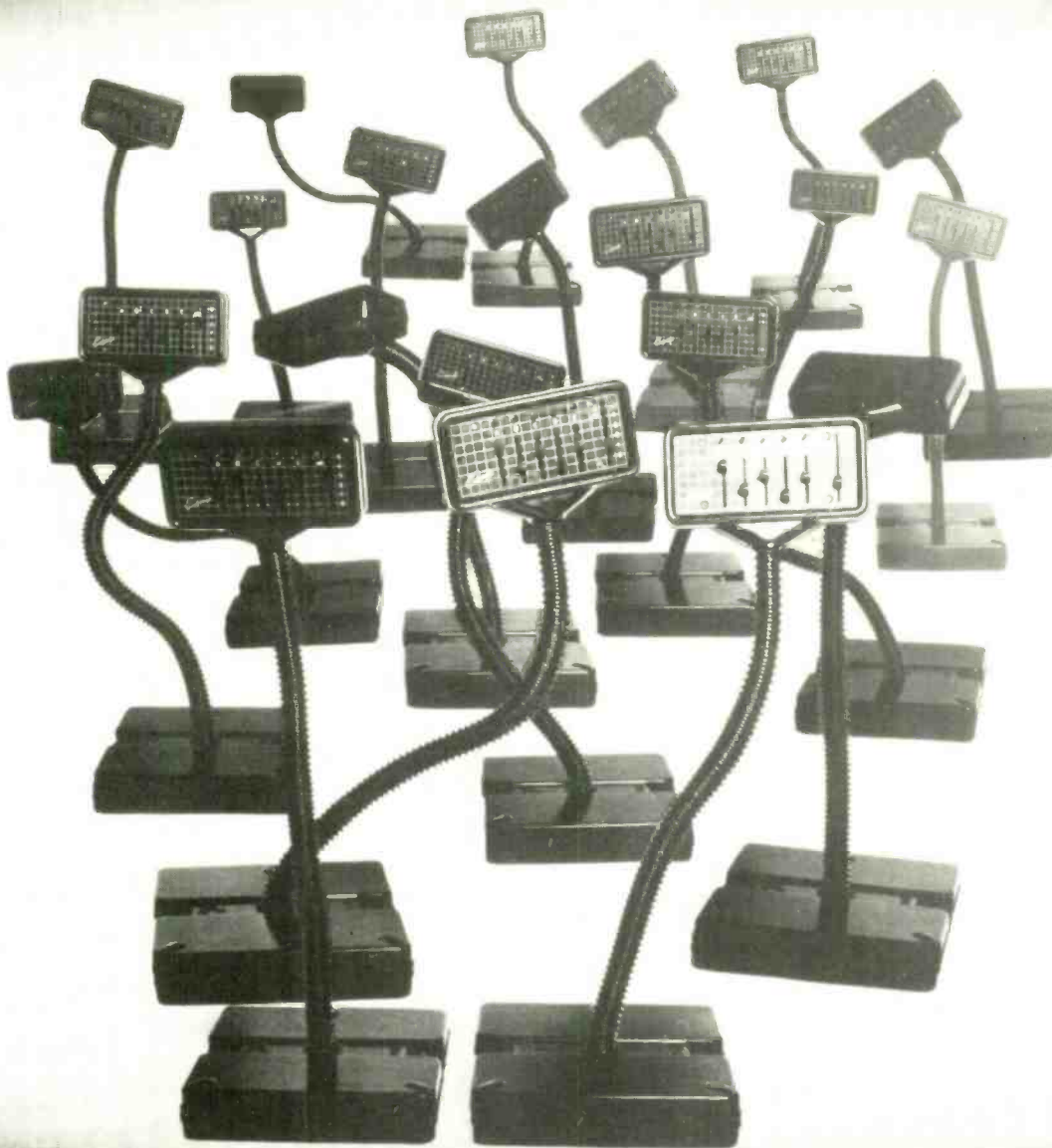
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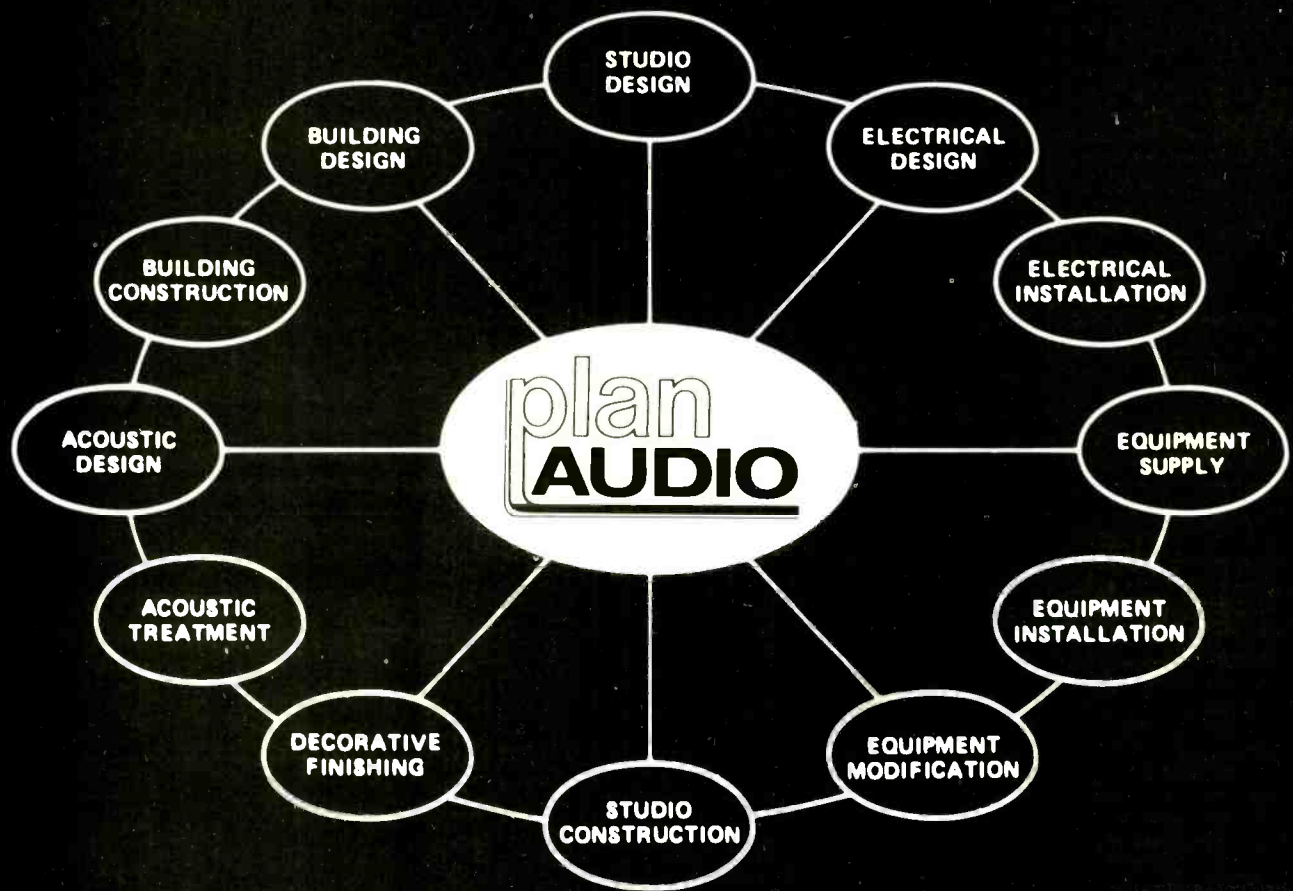
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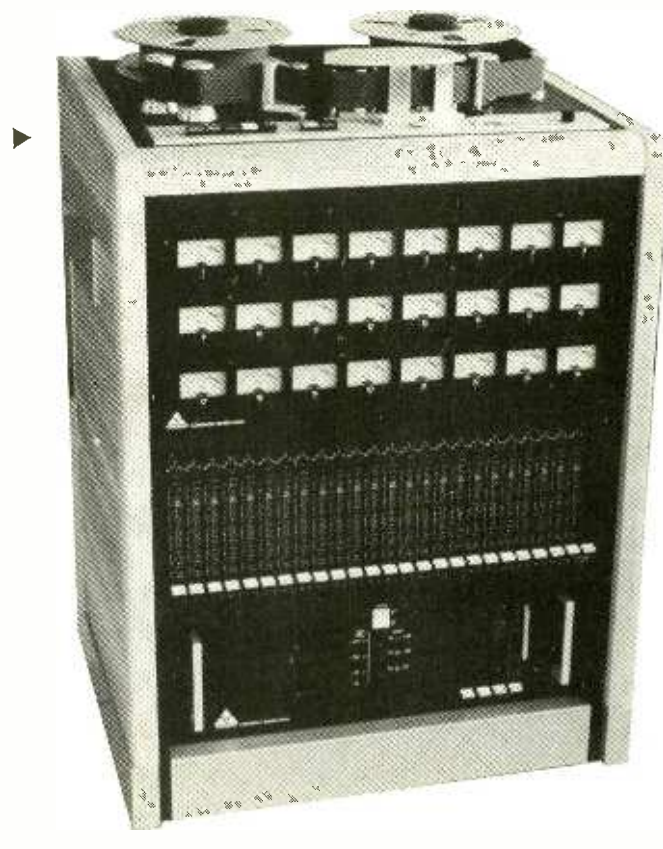
29-30 Windmill Street,  
Tottenham Court Road,  
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Telephone: 01-580 3744  
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## Trident to launch 24-track tape machine at APRS

Apart from the ill-fated Unitrack, no British manufacturer has yet launched a 24-track tape recorder although several 8 and 16-track machines are around. But at APRS, console manufacturer Trident Audio Developments will be launching the first of a promised line of multitrack tape recorders, making Trident only the second company in the world to offer a complete multitrack recording package. (MCI are the other.) The new *TSR* 24-track is floor standing with a natural wood finish that matches Trident consoles, and uses conventional 2in wide tape (with optional 16-track head block). Spool capacity is 14in with switched 15/30in/s or 6 to 45in/s varispeed (with digital display). The capstan motor is a dc printed circuit servo with xtal lock, and uses 9.6kHz frequency for locking, enabling it to be easily interfaced with several synchronising systems. The deck is sloping and hinges for easy access, while the meter panel also hinges for easy access. A logic control system incorporates full motion sensing, while all switching is electronic. Electronics are all modular and plug in, and incorporate separate record and repro hf/lf equalisation settings. Although transformers are used on the repro and drive amplifiers for head matching, output is transformerless, and input is differential balanced. The *TSR* comes complete with a compact remote control unit which provides machine controls, varispeed, status master and monitor status switching, and selection and indication for channel modes. Further details will be available at the APRS exhibition, but price is expected to be around £18,500 including the remote control unit. Trident Audio Developments Ltd, Shepperton Studio Centre, Squires Bridge Road, Shepperton, Middx TW17 0QD. Phone: 09328 60241.

## ADR American trademark

Audio & Design Recording has acquired the US registered trademark *Audio Designs* from Audio Designs Manufacturing of Roseville, Michigan, USA. Audio Designs Manufacturing has ceased using the above trademark and has changed its corporate name to ADM Technology Inc. It is hoped this change will avoid any further confusion between the two companies and their respective products.



## Modular stage link systems

Steve Graham Audio Ltd produces a range of modular stage link systems comprising multipair cables, stage boxes, adaptors, extension units, and cable reels. The multipair cables are foil screened audio and instrumentation cables available in 6, 12, 15, 19, 27 or 31-pair configurations with multipin connectors at each end. Standard length is 25m but other lengths are available to order. The stage boxes will accept up to 31 balanced inputs/outputs, and will optionally accept either 2-pole unbalanced jacks, 3-pole balanced jacks, or 3-pole XLRs. The adaptors have the same configurations as the stage boxes and allow the connection of the company's multipair cables to any console without the fitting of a multipin connector. SGAL also handle the Deltron 2000 range of 3-, 4-, 5-, 6- or 7-way multi-pole XLR connectors with metal housings and silver plated contacts. In addition the company also offers conductive thermo-plastic screened cables and the *8016 Series* and *MRAC* range of multi-way connectors. The former is available with either 56 or 90 contact positions, while the latter are available as either 14-, 18-, 26-, 34-, 50-, 75- or 104-way connectors.

Steve Graham Audio Ltd, 20 Victoria Road, New Barnet, Herts EN4 9PF, UK. Phone: 01-449 3663.

## Electronic Music summer courses

A series of residential summer courses in electronic music are to be held deep in the peaceful Norfolk countryside by Studio 8 (Audio). Studio 8 (Audio) is a partnership set up by Eddie Franklin - White and Johnathan Bunster, two well known British electronic music teachers and performers, with the intention of teaching electronic music and also developing equipment and musical ideas for performance and recording. The courses will give a grounding in electronic music production and recording techniques including extensive 'hands-on' experience. The courses will run from August 16 to September 6, and cost of the courses including full board accommodation is £99.25 per week. Full details are available from Studio 8 (Audio), 55 Buckley Road, London NW6, UK, or by contacting Eddie Franklin - White at the Music Department, Middlesex Polytechnic. Phone: 01-449 9691.

## TCI publication

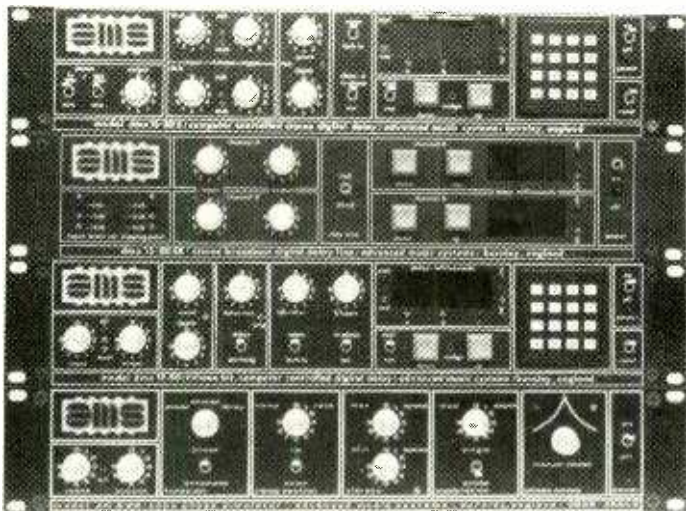
American broadcast antenna manufacturer, Technology for Communi-

cations International, has produced a new technical information note (No. 9) which gives information on the structural and mechanical design of LF, MF, and HF antenna systems in general and TCI antennas in detail. Although of a rather specialised nature, the note is a useful introduction to the problems encountered in the design and construction of broadcast antennas, and will prove useful to anyone using or contemplating purchase of such antennas. TCI's earlier notes are devoted to various aspects of antenna design and in particular electrical design. Copies of TCI's technical notes are available from: Technology for Communications International, 1625 Stierlin Road, Mountain View, Cal 94043, USA. Phone: (415) 961-9180; or from TCI Ltd, Kingston House, Stephenson Way, Three Bridges, Crawley, West Sussex RH10 1TN, U.K. Phone: 0293 510111.

## Radio Caroline

Radio Caroline the first and most famous of the UK's pirate radio stations came to a sorry end in the early hours of Thursday, March 20, 1980. *Mi Amigo* the coaster from which Caroline broadcast off the Essex coast, broke her moorings in a Spring gale and drifted towards a treacherous area of the Thames estuary known as the Black Deep. Here on a sandbank the 60-year-old *Mi Amigo* came to grief and eventually sank. The four DJ/crewmen on the *Mi Amigo* were rescued by the Sheerness lifeboat and upon arrival at Sheerness were detained by police who questioned them about their broadcasting activities. At present the fate of the DJ's is in the hands of the Director of Public Prosecutions who must decide whether to prosecute them under the Marine Broadcast (Offences) Act, introduced by Harold Wilson's government in 1967 in order to protect the then BBC radio monopoly. In her lengthy career the *Mi Amigo* changed her anchorage several times in her efforts to avoid the repercussions of this and similar European legislation, and while Radio Caroline outlived all its pirate competitors, the advent of commercial radio in the UK made Radio Caroline somewhat of an anachronism in recent years. At the height of its popularity Radio Caroline could boast an audience in excess of a million listeners. It remains to be seen whether Radio Caroline's Dutch and Spanish backers will attempt to resume broadcasting from a new vessel. **Noel Bell**





AMS DMX 15-80S, DMX 15-80SB, DMX 15-80 and DM2-20 flanger

### New AMS units

Two new units have been introduced by Advanced Music Systems, the *DMX15-80S* stereo programmable digital delay line and the *DM-DDS* digital disc mastering delay line. The *DMX15-80S* is a stereo version of the original mono *DMX15-80* available at a slightly increased cost. The stereo model is virtually identical to the mono model, but with the addition of two input level controls and two regeneration controls (one set per channel). The *DMX15-80S* employs 12-bit encoding with three switchable gain ranges, has a frequency range of 20Hz to 18kHz, a S/N ratio of 90dB, and typical distortion 0.025% at 1kHz. The maximum delay available is 2.048s per channel and delays may be programmed through the unit's numeric keypad with a resolution of 1ms. Although the two delay channels are independent, delays may be entered simultaneously into both channels to ensure phase coincidence. A broadcast version, the *DMX15-80S*, is also available and 10 of these

systems have been purchased by the BBC. The *DM-DDS* is available in two versions, one having a frequency response of 10Hz to 24kHz  $\pm 0.5$ dB, and the other having a bandwidth of 10Hz to 20kHz  $\pm 0.5$ dB. The unit uses 16-bit linear encoding, has balanced inputs and outputs and will accept either analogue or digital (up to 16-bit) inputs/outputs. Maximum basic delay is 1.6 or 1.3s, expandable up to 10s per channel, and the unit has three preset delay settings plus keypad entry. Dynamic range of the unit is 96dB and distortion is typically 0.02%. Other features include automatic calibration of 0dB level, dual 15-LED displays of digital signal level with switchable peak latching or tracking, operating level offset control to maintain overall system gain, and total remote drive and display capability. Price of a Neumann compatible system is under £5,000. Advanced Music Systems, Units 2-3, Wallstreams Lane, Worsthorne Village, Burnley, Lancs, UK. Phone: 0282 36943.

### mmt noise gate

West German manufacturer mmt has introduced the *2011* noise gate, a modular unit with separate front panel, main panel and control module connected by ribbon cable and 20-pole DIP. It is therefore possible to operate the control module with or without the front panel from a remote position via the main panel. The noise gate has variable controls for attack, release, attenuation, sensitivity, a key input switch, and a gate open/closed switch with LED

indication of gate position. The *2011* has a sensitivity of 20mV to 10V; attenuation 0dBm to 60dBm; release time variable from 5ms to 10s; attack time variable from 5 $\mu$ s to 1s; dynamic range 110dBm; distortion 0.01%; an input impedance of 10k $\Omega$ ; and an output impedance of 200 $\Omega$ . Price of the *2011* is DM345. Medical Measuring Technics GmbH, Im hohen Rain 25, D-7050, Waiblingen, West Germany. Phone: 07151 55240.

### Con Brio ADS100 synthesiser

A new advanced digital synthesiser, the *ADS100* has been introduced by an American company Con Brio. The *ADS100* comprises two 5-octave keyboards, a digital command console, a video display screen, and a control unit incorporating an 8in floppy disc memory. The synthesiser features three microprocessors, 64 digital oscillators each with independent amplitude and frequency control, and 128 separate and extended envelope generators. Anything executed on either of the keyboards or on the digital command console can be committed to disc memory including musical material performed on the keyboards, voice assignment to the keyboards in a predetermined sequence, and alternative — not well tempered — tunings. The digital command console includes controls for 'Synthesis 1', a conventional synthesiser control; 'Synthesis 2' allowing any number of oscillators to be added together or fed into one another (each envelope comprises 16 separately adjustable segments altered by an electronic joystick with video display of the particular frequency or amplitude envelope being adjusted); voice placement; keyboard split; tuning; playback/record; volume; ensemble; and a function which displays the contents of any floppy disc on the video display unit.

Con Brio, 975 San Pasqual Street, Suite 313, Pasadena, Cal 91106, USA. Phone: (213) 795-2192.

### Audio ventilation fans

Airscrew Howden has launched three new *Frilec* brushless dc fans to complement its ac range. Designed for a wide variety of ventilation and electronics cooling applications the fans feature in-built electronic switching circuits which eliminate the need for brushes or inverters. The circuitry also guards against motor damage should the impeller become locked. The three models are an 80mm diameter axial impeller in a Eurostandard 90mm square casing and two 113mm axial impellers in Eurostandard 119mm casings. Volume flow ranges from 16 litres/s to 45 litres/s and all models are available in 12V, 24V and 48V versions. Accessories include finger guards, filters and inlet grilles.

Airscrew Howden Ltd, Weybridge, Surrey KT15 2QR, UK. Phone: 0932 45511.

### Allison/Valley merger

Allison Research, Valley Audio, and Valley People have announced that they have completed negotiations to merge the companies. From May 4, 1980 the companies will operate as one, to be known as Valley People Inc. President of the merged organisation is to be Norman Baker, formerly vice president/general manager of Allison Research. Concurrent with the merger a satellite corporation known as Paul C Buff Inc has been formed dedicated specifically to new product development. Corporate headquarters of Valley People Inc are at 2820 Erica Place, Nashville, Tenn 37204, USA. Phone: (615) 383-4737.

### Lightning Elimination Associates

The elimination of mains-borne surges, transients and noise spikes from power and signal lines is a problem area which requires specialist advice or equipment. Lightning Elimination Associates Ltd is a company which specialises in this field offering consultancy advice and producing add-on units which act as power line filters and select, clip and dump spikes to ground before filtering. Of particular interest to studios are the company's *Kleanpower M85* and *MB10* power line filters, these being respectively 5A and 13A current models. Both units feature high and low energy diverters which dump transients and surges to ground with a response time of under 5 $\mu$ s. Following the diverters the units have a filter of computer synthesised form which obviates ringing and hf transients, and which gives a linear signal frequency response. If necessary a further optional stage may be added, comprising a voltage follower or tracking clamp which is particularly effective in suppressing spikes caused by thyristors or similar devices operating near the zero value of the mains supply cycles. The *Kleanpower* units feature plug-in installation, neon status indication, fail safe operation, and self-restoration to an interference-free state. Both units are designed to operate from a 200/240V ac supply, have a current surge handling capacity of 25kA, and will handle a maximum surge of 1,000 Joules (W/s), ie 1MW at 1ms.

Lightning Elimination Associates Ltd, Vine Cottage, Moreton, Thame, Oxon, UK. Phone: 084-421 3204.

40 ▶

**Crown pressure zone mics**

Crown International has announced that it has been given an exclusive licence to manufacture and market a complete range of pressure zone mics. Pressure zone mic operation is based on the principle that within a few millimetres of a rigid surface, the incident and reflected sound waves from a pair of equal level signals add coherently. Thus, in close proximity to the surface the signals are still in phase as they are reflected from the rigid surface. This creates a 'pressure zone' at the surface. In such a pressure field, the instantaneous pressure is uniform and response is not a function of the angle of incidence. By mounting a pressure calibrated electret capsule within a few millimetres and facing a rigid surface, incoming sound is received indirectly. No signal can arrive on-axis but can only enter at the sides of the opening between the mic's diaphragm and the metal plate. Thus, it is claimed pressure zone mics maintain a flat response for all angles of incidence in the hemisphere surrounding the mic, and the received signal is totally free of anomalies caused by the phase cancellation of direct with reflected sound. Crown is producing four pressure zone mics and all the models will be available in either gold or black finish. The four mics are a general purpose model consisting of an 1/8in thick aluminium plate 5x6in with an electret capsule, mic cantilever and XLR connector; a low profile model using a 2x3in aluminium plate; a flush mount model; and a lavalier model. The mics are equipped with a choice of power supplies — the standard supply being a combination transformer, battery and phantom power supply arranged in a small metal cube approximately 3in square, while the alternative is an active phantom power supply packaged in a cylindrical metal tube with XLR

connectors at either end. The Crown pressure zone mics are capable of handling sound levels of up to 150dB spl allowing them to be placed inside a drum or directly in front of an electric guitar amplifier or other instrument. Suggested retail price of the mics is less than \$350.

Crown International Inc, 1718 W Mishawaka Road, Elkhart, Indiana 46514, USA. Phone (219) 294-5571.

**Beyer MCM System**

The Beyer modular condenser studio mic system which was first introduced in 1978 has now been completed with the addition of the CK706 short shotgun and CK707 long shotgun tubes with accessories. The complete range of condenser mics feature light, gold-vapoured Mylar membrane mic capsules which offer excellent transient response and low sensitivity to body noise. All the mics in the 700 Series are constructed in modular form with the pre-amplifiers CV710 (48V phantom powering) or CV720 (12V phantom powering) as the basic element which also serves as the body section. Four mic capsules other than the shotgun tubes are available: CK701 omni; CK702 omni with elastic suspension and wind and pop filter; CK703 cardioid; and CK704 cardioid with elastic suspension and wind and pop filter. A catalogue giving complete details of the MCM System is available from Beyer Dynamic.

Beyer Dynamic, Theresienstrasse 8, D-7100 Heilbronn, West Germany. Phone: 07131 82348.

UK: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.

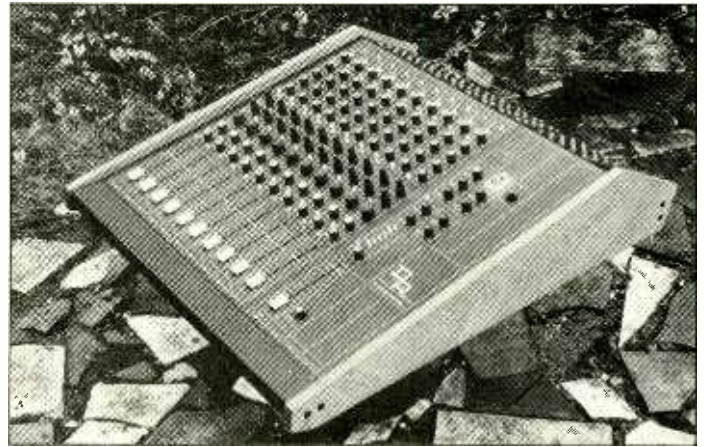
USA: Hammond Inc Ltd, 155 Michael Drive, Syosset, NY11791. Phone: (516) 364-1900.

**D & R Electronica 1000 Series**

Dutch manufacturer D & R Electronica has added the 1000 Series range of in-line consoles to its product line. Derived from the ST1600 console range the 1000 Series is an in-line design comprising a combination of mic/line and equaliser amps, plus group amps, aux sends, routing, panpot and monitoring in one input/output channel. Each channel has a 10cm fader and a 5-segment LED bar graph meter. The master section has a 10-segment stereo LED bargraph meter following the monitor signal,

a talkback amp with balanced XLR input, four aux stereo returns, a 1kHz sinewave oscillator for tape machine alignment, four aux master controls, monitor input selection buttons, mono/stereo switching, and a stereo 10cm fader. All the inputs/outputs and master insertion points are located on the sloping rear panel of the console. The 1000 Series is available in 10/20/30/40 input/output channel configurations and the cost of a 20/20 model is £1,245.

D & R Electronica, keizersgracht 284, NL-1016 EW Amsterdam, Netherlands. Phone: 020 25.01.30.



**Protecting ribbon cables**

3M has discovered a solution to the problem of damage to flat ribbon cables caused by the 'pin-cushion' of cropped wires on the underside of pcb's. Such pcb's when withdrawn from racks can lacerate ribbon cables causing short circuiting and malfunction of equipment. This was a problem Reuters, the international news organisation, was having and to prevent the need to constantly replace ribbon cables, Reuters adopted a simple and low cost method of protection using a high density polythene tape from

3M. Scotch 5423 tape is applied in 2in wide strips to the back of pcb's to form a tough barrier which the wire ends cannot penetrate, but which allows the ribbon cables to move over the pcb surface without damage. The tape doesn't affect circuit operation and can be easily lifted for component replacement without transferring adhesive to the pcb. Scotch HDP tapes are available in 5mil and 12mil thicknesses and a range of widths.

Industrial Tapes Group, 3M UK Ltd, PO Box 1, Bracknell, Berks RG12 1JU, UK. Phone: 0344 58423.

**Contracts**

● Trident is to install two TSM consoles in Canada. Recipients are Studio St Charles in Montreal and PSM Studios in Quebec City. In addition Trident has received an order for a TSM console from Tiare Tahiti recording studio in Tahiti. Trident is also supplying Chas Jankel, bass player with Ian Dury and The Blockheads, with a Series 80 console for his new studio.

● Solid State Logic has received an order for a 56-channel SL-4000 console from Power Station, New York.

● London Weekend Television has ordered two Audio Kinetics Q-Lock 210 audio/video synchronisers from 3M. In addition LWT has ordered

Compex limiters and E900-RS sweep equalisers in custom built flight cases from Audio & Design (Recording).

● Elliott Bros has completed the installation of an Alice turnkey project for Mercia Sound, the Coventry ILR station.

● 3M has delivered M79 24-track recorders to Rampart Recording Studios, Riverside Recording Studios, and Freerange Recording Studios, while David Moss Sound Dubbing Studios has received a 16/8 recorder.

● Neve has delivered two consoles to Thames Television. The first is a modified 5316 24-channel console for use with a sports/entertainment OB unit, while the second is a

custom 24-channel/4-group console for the new Thames news studio at Euston.

● D & R Electronica is to supply Tonstudio Kaiser, Munich with an ST1600 console.

**Agencies**

● Tannoy has appointed BGW Systems, 13130 South Yukon Avenue, Hawthorne, Cal 90250, [Phone: (213) 973-8090], as its American distributor. In addition, Elliott Bros has been appointed a UK Tannoy dealer.

● The Syntovox range of vocoders is now being distributed in the UK by Feldon Audio, 126 Great Portland Street, London W1. Phone: 01-580 4314.

● Telex Communications who took over the Turner Microphone Company last September, has reconfirmed the appointment of Canadian Instruments & Electronics Ltd as UK distributors of Turner's PA systems. CIE can be contacted at: Harris-Bass House, Station Road, Ilkeston, Derby, UK. Phone: 0602 302331. Telex: 377755.

**People**

● Paul Sloman has joined Soundmixers Studios, New York as managing director. Paul was previously at Record Plant (New York).

● Richard Goldblatt has joined Marcus Music UK as studio manager. 42 ▶



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APRS 80  
EMPIRE ROOM

# Turnkey Soundcraft



Start with a demonstration. The Soundcraft series 400 and SL M381-S provide a sophisticated, feature packed basis for eight track recording.

Select microphones, monitors, mixdown and ancillaries from a wide, ex-stock range covering every application.

Acoustics consultation is available, and we will install, wire and commission the system.

As UK main dealers for Soundcraft, we provide a comprehensive backup for the equipment.

Call Andrew Stirling for full details of our turnkey systems. From 4 to 24 tracks, our business is helping you with yours.

**turnkey**

8 East Barnet Road, New Barnet, Herts. EN4 8RW  
Tel. 01-440 9221

**New Orange County units**

Orange County Electronics has introduced two new broadcast processors, the VS-2 AM stressor and the VS-3 FM dynamic range processor. Both units have input and output controls and a meter showing overall gain reduction on the front panel. Inside the units are mini-dip switches which allow the user to change the compression ratio, threshold, attack and release time, as well as expander threshold, range, and attack and release time. The VS-2 has a peak limiter, multi-ratio compressor, and expander, plus a loudness contour switch which introduces a dynamic equalisation network to increase density and intelligibility of modulation, without adding fatiguing side effects. There is also a positive peak asymmetry control which provides optimum modulation. The VS-2 has a frequency response of 30Hz to 30kHz, 97dB signal-to-noise, and less than 0.1% THD at 15dB gain reduction at 18dBm output. Price of the VS-2 is \$976. The VS-3 is a stereo counterpart to the VS-2 with stereo-linked multi-ratio compressors and noise-reducing expanders, together with hard and soft limiters. Each of the limiters works on the sum and difference signals and simultaneously maximises the stereo and mono loudness with no image shift. An optional hf limiter with selectable pre-emphasis of 25, 50 and 75µs is available for the VS-3, together with an optional 8-pole active low pass filter. Specification of the VS-3 is the same as the VS-2. Price of the VS-3 is between \$1,148 and \$1,298 depending on options. Orange County Electronics, 1125 Empress Street, Winnipeg, Manitoba R3E 3H1, Canada. Phone: (204) 775-8151. USA: Parasound Inc, 680 Beach Street, San Francisco, Cal 94109. Phone: (415) 673-4544.

**Microphone museum**

Milwaukee is the site of a comprehensive collection of microphones collected by Bob Paquette, and on museum display to the public. Started as a private collection in 1950 and displayed since 1970, the museum contains over 600 different makes and models the majority of which are pre 1950 vintage. Many items associated with mics and their use are also on display including desk and floor stands, mic enclosures, transformers, pre-amplifiers, amplifiers and test equipment. On file is a collection of specification sheets, patent copies, catalogues, advertising literature,

**New PML stereo mics**

Future Film Developments, importer of the PML (Pearl) range of mics, has announced the availability in the UK of two new PML stereo condenser mics, the MSXY-8 and XY-82. The former has two variable capsules, remote pattern control and ac power supply, while the latter has two cardioid capsules with 24-48V dc phantom powering. The new mics offer 35 to 40dB front to back ratio for maximum instrumental isolation when used as mono mics. This facility also allows up to 40dB maximum gain before feedback. Both mics feature a smooth on/off axis frequency response of 25Hz to 20kHz, FET preamplifiers, and the facility to rotate one capsule through 180°. The XY-82 may have its polar pattern adjusted to either omnidirectional, cardioid, or figure-of-eight. Prices of the new mics are MSXY-8 £750 and XY-82 £450.

UK: Future Film Developments, 36/38 Lexington Street, London W1R 3HR, UK. Phone: 01-437 1892. USA: Cara International Ltd, 4145 Via Marina, 120 Marina de Rey, Cal 90291. Phone: (213) 821-7898.

**Sound Enclosures**

Sound enclosures is an associate company of Buzz Music (the equipment retail company), and specialises in the construction of flight cases, loudspeaker enclosures and other music related woodwork such as console side-cheeks. Many PA hire companies use the company's enclosures, both standard and custom-built, and the company offers a construction service for any other woodwork requirements. Full details are available from: Sound Enclosures, Unit 19, Tarsmill Court, Rotherwas Ind Est, Hereford, UK. Phone: 0432 51278.

technical papers and copies of articles that appeared in early books, magazines and technical periodicals. The museum contains three displays which show the service and rebuilding process of early carbon and condenser mics together with the special apparatus used. Since the mic developed from the telephone, the museum also displays a variety of telephone transmitters and several early telephones. In addition the museum also includes early radios, crystal sets, headsets, horns, loudspeakers, valves, radio parts, keys, sounders, test equipment, phonographs and a library of early wireless and radio

**Scamp SO1 Vocal Stressor**

Audio & Design Recording has supplied details of a modification to its Scamp SO1 compressor/limiter module allowing the module to operate as a Vocal Stressor. The SO1 is manufactured with its 'side-chain' control volts routed and accessible via external connectors, and with its side-chain control volt pins linked such that its side-chain frequency response is flat. To become vocal stressor capable, the link should be broken and the pins 'brought out' to a normalised jack socket. With no jack plug inserted the side-chain control volt line is unbroken, however, if it is desired to modify the frequency response characteristic, any Scamp equaliser may be inserted by cross patching on the jackfield, connecting the equaliser input with 'side-chain send' and the equaliser output with 'side-chain return'. Suggested applications include de-essing using the SO4 parametric equaliser and

general shaping using the SO7 octave equaliser. For de-essing, the sibilant region should be accurately defined (by ear) using the SO4 prior to routing the signal through the SO1 and inserting the SO4 in the side-chain. Best results are obtained by selecting the highest compression slope and fastest attack/release parameters. For general shaping where over-compression due to overloud If requires reduction the SO7 should be inserted to de-emphasise the 'low end' by rolling off with the equaliser. A soft compression slope is recommended. It should be noted that any gain reduction will affect all frequencies (since no band-split occurs) therefore vocal stressor type frequency conscious limiting on mixed masters should be exercised sparingly. Conversely, on single channels, more liberal amounts of gain reduction can be used, since there is less ambient signal present to modulate—the effect being restricted to the process area.

**Plan Audio**

A new professional audio retail outlet called Plan Audio has opened in Epsom, Surrey. Although specialising in the lower end of the professional market, in particular handling 8-track equipment 'off-the-shelf, the company also offer an installation service and a full back-up maintenance service on the equipment they supply. Plan Audio handle a wide range of equipment from manufacturers such as Allen & Heath Brenell, Teac, Tannoy, JBL, AKG, Beyer, etc, with full demonstration facilities. In addition, the company also offers a complete design, construction, supply and installation service for recording studios. Plan Audio, 9 South Street, Epsom, Surrey, UK. Phone: 03727 41822.

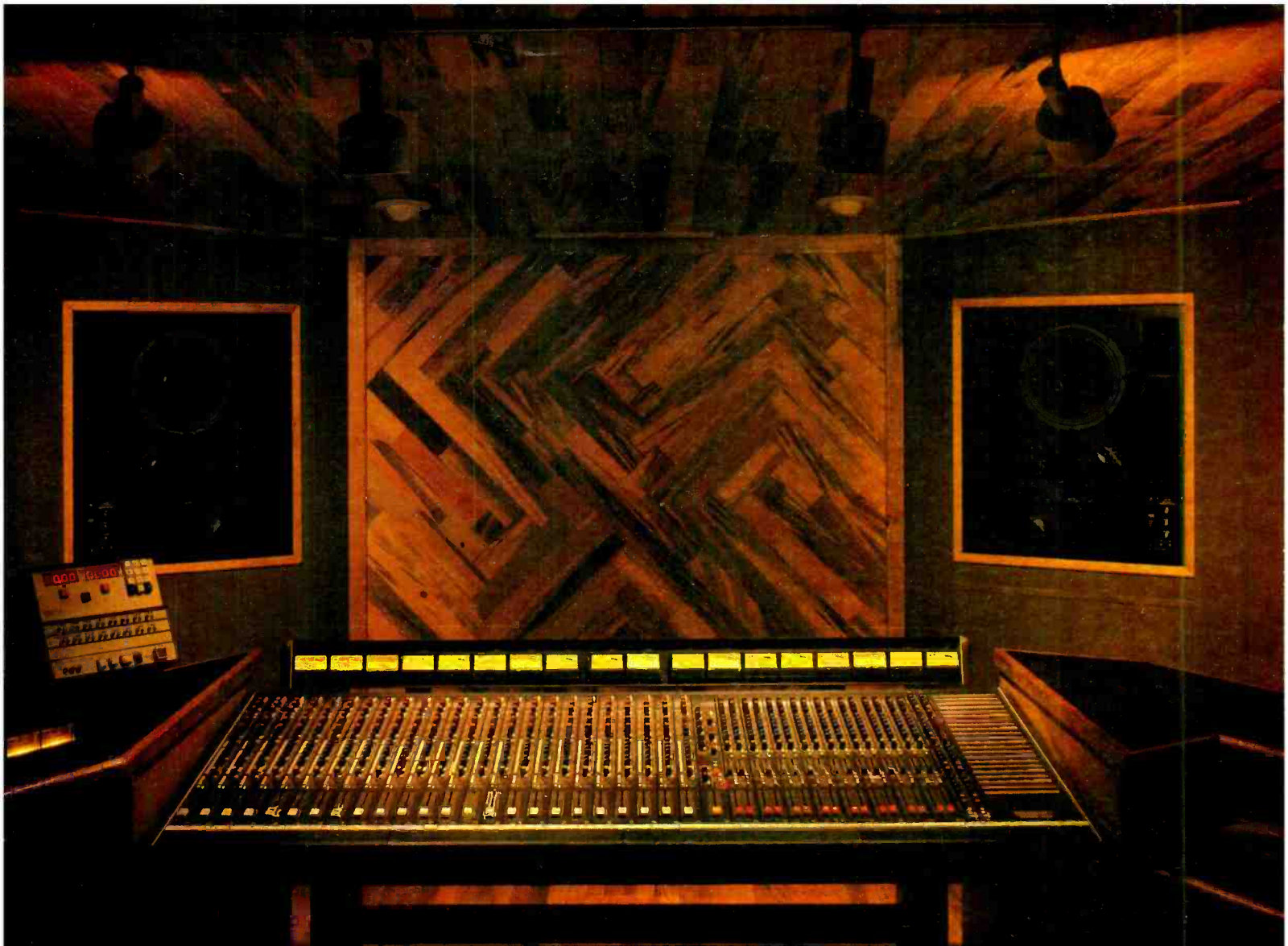
**AKG C567E mic**

AKG has introduced the C567E small condenser tie clip mic. The mic has an omnidirectional pattern and is provided with both a tie pin fixing and a clip, together with a plug-on wire mesh windscreen. The transducer is elastically suspended to cancel clothing and cable noise. A non-detachable cable of approximately 4.5ft length connects the mic to an FET pre-amp, which by using the provided H16 mounting clip may be fastened either to a belt or shoulder strap. The mic accepts phantom powering between 9 and 52V, uses a 3-pin XLR connector, has an impedance of 200Ω, a sensitivity of -65dBV, and has a frequency response of 20Hz to 20kHz ±3dB. Price of the C567E is £92. AKG GmbH, Brunhildengasse 1, A-1150 Vienna, Austria. Phone: 0222 92.16.47. UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Phone: 01-749 2042. USA: Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, New Jersey 07430. Phone: (201) 529-5900.

**Bach-Simpson**

Unfortunately, Bach-Simpson's phone number was omitted from last month's Metering survey. It is Wadebridge, Cornwall, 020 881 2031.





# Soundcraft 1624

Manufacturing:  
Soundcraft Electronics Ltd  
5-8 Great Sutton Street  
London EC1V 0BX  
England  
Telephone: (01) 251 3631  
Telex: 21198

US Distribution:  
Soundcraft Inc  
PO Box 2023  
Kalamazoo  
Michigan 49003  
Telephone: (616) 382 6300  
Telex: 22-4408

West Coast:  
Westlake Audio  
6311 Wilshire Boulevard  
Los Angeles  
California 90048  
Telephone: (213) 655 0303  
Telex: 698645

Canadian Representation:  
McKeen Productions Ltd  
PO Box 4054 Station E  
Ottawa  
Ontario K1S 5B1  
Telephone: (613) 236 7242  
Telex: 053-3381

**SOUNDCRAFT**  
ELECTRONICS LIMITED



Brandon Wade's Crosstown Recording, Kalamazoo, Michigan.

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### ▲ Spectra Sound Model 4000 Instrumentation cable

Spectra Sound has introduced the *Model 4000* flanger designed to produce positive and negative flanging, vibrato, doppler, chorus, pitch bend, double tracking, rotating loudspeaker, and tube effects. The unit produces over five octaves of flanging without input aliasing, output quantisation noise, or the introduction of any hf clock components. A time delay of 10ms will produce over 100 notches in the audio bandwidth for more dramatic flanging effects. An internal variable sweep oscillator may be used to modulate delay time, or alternatively time delay may be modulated via an external control voltage from a conventional foot pedal, joystick, synthesiser, or computer device. Features include balanced and unbalanced inputs/outputs, LED overload indicators, and inputs/outputs for slaving several units. Specifications of the *Model 4000* are: frequency response, delayed channel 20Hz to 16kHz (-3dB); distortion typically 0.1%; and s/n ratio -75dBm, -90dBm with dbx. The *Model 4000* is a 19in rack mount unit and costs \$695.

Spectra Sound, 3750 Airport Road, Ogden, Utah 84403, USA. Phone: (801) 392-7531.

### Consultants and installers

*Studio Sound's* October issue will contain two separate surveys, one covering *Studio Designers and Consultants*, the other *Engineers — Freelance and Consultant*. The former survey will be an updated version of that which appeared in March 78, while the latter will include all companies and individuals offering 'electronic services'. This includes freelance maintenance engineers, servicing companies, installation companies, and electronic design consultants, but does not include companies merely providing back-up for products that they sell. While we will be sending questionnaires to all companies that we are aware of providing the above services, if you have not received a questionnaire by the time you read this, and believe your company's services to be relevant to these surveys, please drop us a line immediately. We require completed questionnaires to be returned by July 25 at the very latest.

Studio Sound Editorial, Link House, Dingwall Avenue, Croydon CR9 2TA, U.K.

Letriflex Cables has introduced a range of multipair and multicore cables to BS5308, Part 2. The cables are shielded, complete with drain wire and armoured. The range available comprises 2-pair to 20-pair multipairs, and 4-conductor to 40-conductor multicores in 0.5, 0.75 and 1.5mm diameters.

Letriflex Cables & Accessories Ltd, The Paddocks, Frith Lane, Mill Hill, London NW7 1PS, UK. Phone: 01-349 2011.

### APRS studio engineers course

The seventh APRS technical course for studio engineers, managers and directors is to be held from September 13-19, 1980, at the University of Surrey. The week-long course of lectures, seminars and practical sessions covers a wide range of technical subjects ranging from mic technique to multitrack mix-down. Included in the course is a visit to EMI Abbey Road. Full details of the courses are available from: The Secretary, APRS, 23 Chestnut Avenue, Chorleywood Herts WD3 4HA.

Phone: 09327 72907.

### Sontec Electronics

Sontec is an American company which specialises in the production of disc transfer equipment. While the company has been briefly covered in *Studio Sound's* exhibition coverage, here we take a more detailed look at Sontec's hard-

### Forthcoming Exhibitions

**June 15 to 18**  
CES, Chicago [(312) 861-1040].  
**June 18 to 20**  
APRS, London [09278 72907].  
**June 28 to 30**  
NAMM, Chicago [(312) 527-3200].  
**August 17 to 23**  
Live Music Show, London [01-428 4700].  
**September 2 to 4**  
Prosound 80, London [01-340 3291].  
**September 12 to 18**  
Photokina, Cologne [Cologne 0221 8211].  
**September 20 to 23**  
International Broadcasting Convention, Brighton [London 01-240 1871].

ware. Other than a number of products which are primarily made to order, the Sontec range consists of the *CD-80 CompuDisk* retrofit lathe control package for Scully and Neumann lathes; the *DRC-400* disc mastering limiter/compressor system; the *DTC-400* tape-to-disc transfer console; the *MES-430B* disc mastering equaliser; and the *MEP-250A* studio equaliser and *DRC-202* dynamic range controller.

The *CD-80 CompuDisk* micro-processor based system was developed by Jerry Block of New York and operates on the principle of 'land control' rather than pitch control. Optimum groove packing is decided by slope analysis and phase interlace programs and the system has adjustable controls for depth, lateral/vertical coupling, and land (groove spacing). Groove set-up parameters are always under operator control and the system provides increased groove density as well as the ability to selectively over cut. The system has displays of time elapsed for each band and cumulatively for an entire side, display of average groove depth, and display of pitch. Other features include self-checking of the system's electronics (digital and internal audio conversion circuits and program memory); programmed lead-in/lead-out diameters; programmed heating current control; vacuum pump control; and the capability to carry out half-speed cutting. Price of the *CD-80* is \$19,600.

The *DRC-400* disc mastering compressor/limiter is a 4-channel (preview and programme channels) dynamic range controller. All the controls are in the form of switches for resetting parameters exactly. Compression gain is adjustable in 1dB steps from 0 to 20dB; ratio can be set from 1.5:1 to 50:1; threshold is adjustable in 1dB steps from 0 to 20dB; crest factor controls absolute peak level from 8 to 19dB in 1dB steps; and there are also controls for attack and release. Accessories in-

### September 30

Sound Broadcasting Equipment Show, Birmingham [0734 53411].

### October 31 to November 30

AES 67th Convention, New York [(212) 661-2355].

### January 23 to 29, 1981

Midem 1981, Cannes [Paris (1) 505.14.03].

### March 17 to 20

AES 68th Convention, Hamburg [(212) 661-2355].

### April 12 to 15

NAB Convention, Las Vegas [Washington (202) 293-3500].

### May 30 to June 4

Montreux 12th Exhibition [Montreux 021 61.33.84].

clude an interface for the Allison 65k system for automated dynamic range control, an expander, and a variable frequency limiter. Price of the *DRC-400* is \$4,500.

The *DTC-400* console is a modular disc cutting console which will handle up to eight simultaneous audio channels. For greater flexibility, many audio and preview functions are available on both an A and B system allowing the complete advance set-up of eq, filter and level functions. Audio interconnection between modules is via plug-in programming cards, each card catering for two channels of modulation and preview signals — changes in signal routing are accomplished by altering or exchanging cards. Price of a *DTC-400* console, for a Neumann system, is \$41,500.

The *MES-430B* parametric disc mastering equaliser is a 4-channel (preview and programme channels) rack-mount unit. Each channel has a 3-band shelving parametric equaliser with overlapping ranges (11Hz to 570Hz, 120Hz to 6.8kHz, and 3.4kHz to 25.6kHz) with  $\pm 12$ dB boost or cut in 1dB increments. A 'Q' selection control varies the frequency band's skirt characteristics from 5dB to 15dB/octave in steps of 5, 6, 9, 11 and 15dB/octave while maintaining constant amplitude. The equaliser additionally has hf and lf shelving, providing  $\pm 12$ dB boost or cut at 10kHz and above, and switch selectable at either 50Hz or 100Hz. Other features include a bypass switch which can be automatically controlled by the banding logic of the mastering system. Price of the *MES-430B* is \$5,300.

The *MEP-250A* is a 2-channel, 5-band parametric equaliser. Each channel has three parametric sections in overlapping ranges covering 8Hz to 25kHz with  $\pm 12$ dB boost or cut. A 'Q' selection control varies the Q from 4dB to 14dB/octave. Additionally the unit has variable frequency hf and lf shelving equalisers in the ranges 800Hz to 25kHz and 10Hz to 500Hz, both  $\pm 12$ dB. Cost of the *MEP-250A* is \$1,490.

Finally, Sontec's *DRC-202* dynamic range controller, a flexible 2-channel compressor/limiter. This unit has controls for threshold (20dB range), crest factor (variable 0 to 20dB), ratio (1.5:1 to 50:1), gain (up to 20dB below threshold), plus attack and release. Cost of the *DRC-202* is \$1,590. Sontec Electronics, 10120 Marble Court, Cockeysville, Maryland 21030, USA. Phone: (301) 628-2283.

### Future Surveys

Manufacturers are reminded that our surveys from November 1980 are: interconnection, broadcast consoles and multitrack consoles,



# turnkey mix

## 24 TRACKS FOR A SONG

The Soundcraft 1624 is the most sophisticated mixer in its price range. The Studer A80 twenty four track is the most reputed, and now at revised prices offers the best value in the market. Put them together and you have a package set for the eighties. Our experience of both private and commercial installations enable us to tailor this package to your exact requirements. Prices start from around £30,000. Call Andrew Stirling on 01-440 9221 for full details.



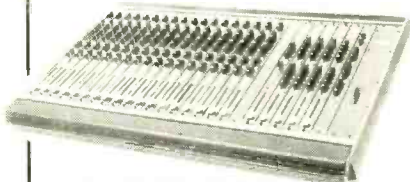
## VARISPEED

Along with lowered prices, TASCAM has introduced the official varispeed modification for the 80-8 Recorder. This consists of a direct replacement DC servo capstan motor and a remote control box. Fit it yourself or we can arrange installation by our service department.



## MOBILE RACK

Our new open style equipment rack for mounting 19" standard ancillaries conveniently. Shown here with a full complement of dedicated Accessit processors. Send for the full line catalogue.



## SOUNDCRAFT UPDATE

The ultimate in eight track has become even better with the introduction of Soundcrafts Series 400 consoles. LED metering, double monitoring, full parametric eq and single cable interface are just some of the remarkable facilities being offered. As main dealers in this country we are offering exclusive packages and installation, call us for details.

## SHORT TAKES

**ADVANCED** Audio Designs appoints Turnkey as exclusive agent for their remarkable digital delay . . . **PROKIT** 104 budget four track mixer with monitoring available now . . . **TEAC** poised to challenge the B77 . . . **PAULINE** Cook, previously of Scenic Sounds joins our sales staff . . . **MXR** Harmoniser now on demonstration . . . daily deliveries in the London area . . . **ECOPLATE's** long high frequency decay proves to be a winner . . . **ROCKBELT** musos staying home and making hits in their attics . . .

## TURNKEY TWO

Andy Munro, previously of Shure and AHB, joins us this month to form TURNKEY TWO. Cost effective acoustic design is the prime objective. Microprocessor aided analysis and design enables system performance to be assessed before installation. In addition to the supply of tailored sound systems, TURNKEY TWO provides a basic control room analysis service, giving studios the facts and means to correct their acoustics.

First projects include a 2kW reinforcement package for the Lakeside Country Club and a complete system for Scotland's National Theatre in Inverness, featuring a novel central cluster speaker array. A £30k PA rig for the Dooley's is nearing completion.

## RADIO BOOM

With the ever increasing commercial country, great demand in studios in the next few months, calling for sophisticated installations combining multitrack equipment with classic production facilities. Our experience of broadcast has resulted in fast installations for YAMCO in London and SSK in Glasgow.

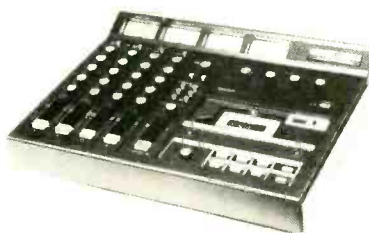
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## CABLE BREAKTHROUGH

A conductive plastic sleeve replaces the normal wire braid in the remarkable 6527 range of cables. Not only is this wire lighter and more flexible but also screening properties are increased a hundredfold. Available in the ten resistor code colours, by the meter or the drum.

## PORTASTUDIO

At last - TEAC'S long awaited PORTASTUDIO. No bigger than a normal cassette machine, this remarkable unit is a four channel mixer and simul-sync recorder in one. Add a microphone and a pair of headphones and you can make four track demos immediately. Available now.



## MOLINAIRE TAKE SEVEN

Great British Springs have been supplied to each of the audio post-production studios at the Molinaire complex. Jingles, Audio Sweetening and AV tape compilation are this rapidly moving company's forte.

## SPRING SALE

Some ex-demo, oddball, and slightly damaged items available once only, on a first come, first served basis;

Green Prokit Assd	£100
AH Minimixer + PSU	£120
Tascam 58ch expander	£295
12x2 PA console, new	£250
MXR Dynamic Expander	£60
TEAC 3300SX stereo	£300
TEAC 3340 Remote	£30
TEAC 108 Syncaset	£172
ASC 15ips 2-track	£350
MXR Doubler, damaged	£272
Ashly stereo comp/lim	£222
16 pair multi + drum	£150
100W mono Quad 303J	£100
WAL Bulk Eraser	£35
Pro Cable tester	£25

Prices are exclusive of VAT and delivery, please call for further details.



## 16 ON 1

The highly reliable Soundcraft Magnetics one inch transport now carries sixteen track heads and electronics. The compact size and sophisticated full function remote control panel feature in the most advanced machine of its kind in the market. On demo. and in stock now.

All the products that we sell can be bought using Access or Barclaycard/Visa. Order by phone for fast delivery. Call or write for a copy of our new "Turnkey by Mail" catalogue or visit our demonstration room in North London during normal office hours. Our business is helping you with yours.



**Turnkey.**  
8 East Barnet Road,  
New Barnet, Herts., EN48RW.  
Phone 01-440 9221  
Telex 25769



# Expression through time delay.

Time delay has become increasingly important to musicians and engineers as a way to color musical sounds and create spatial illusions. MXR's Flanger/Doubler and Digital Delay have proven to be effective tools for the musically creative professional who requires a wide range of performance possibilities from a precise and cost effective time delay unit.

Both the MXR Flanger/Doubler and Digital Delay offer a flexible system of controls which provide ultimate freedom for creative expression. They feature frequency sweep and width controls, a mix control (between the dry and the delayed signals), a regeneration control for additional intensity and multiple repeats on doubling and echoes, and a delay bypass jack which enables the user to employ a footswitch to bypass the unit entirely for instantaneous cut-offs of time delay effects. Both units represent an expandable system, and can be easily ganged together or interfaced with other instruments and recording gear.

The MXR Flanger/Doubler provides a manual control over delay time, and rear panel connections offering full remote delay time adjustments and a VCA output suitable for stereo ganging of two units. The MXR Flanger/Doubler can switch easily between flanging and doubling modes, and two LED indicators are provided for easy visual monitoring of sweep speed and range.

The Flanger/Doubler is capable of producing infinite varieties of flanging, hard reverberation, vibrato, and numerous doubling effects including subtle chorus sounds. It offers a time delay range of .25 to 5 milliseconds in the flanging mode and 17.5 to 70 milliseconds in the doubling mode.

The MXR Digital Delay offers a continuous range of delay times from .08 to 320 milliseconds. This range of delay times is expandable with three optional memory cards, in 320 millisecond increments to 1280 milliseconds, with full bandwidth (20Hz to 20kHz) capability to 160 milliseconds. The Digital Delay features push button controls for varying delay ranges. A level control regulates the input signal to prevent overloading of the unit's circuitry, and LEDs monitor the input level and indicate whether the effect is in or out.

At fixed delay times the Digital Delay is perfectly suited for "traditional" delay applications such as "slap echo," discrete echoes, and synchronization of speakers in PA applications. By adjusting sweep frequency, mix, regeneration, and level controls, the Digital Delay offers additional effects which include doubling flanging, pitch alteration (vibrato, pitch bending), frequency modulating, and infinite (non-deteriorating) repeat hold.

The MXR Flanger/Doubler and Digital Delay are designed for use in the studio and on stage, with line or instrument levels. They're reliable, delivering a clean signal consistently, with a dynamic range exceeding 80 dB. And as with all MXR Pro Group products, optional road cases are available. For the serious artist, the MXR Flanger/Doubler and Digital Delay are the versatile tools which provide the key that will unlock his creative musical imagination.



Professional  
Products Group





# New realms of expression from MXR.

The Pitch Transposer is MXR's newest addition to our professional line. It is one of our most innovative products, and possibly the most revolutionary signal processor in the music industry today. It is a unique, high-quality unit which provides a cost effective and flexible package for today's creative artists.

The Pitch Transposer extends your musical boundaries by creating live instrumental and vocal harmonies. It has 4 presets which allow the artist to predetermine the intervals to be processed. Transposed intervals can be preset anywhere from an octave below to an octave above the original pitch. The chosen interval is activated by means of touch controls or a rugged footswitch. LED indicators display which of the four presets has been selected.

A mix control is provided, enabling the unit to be used in one input of a mixing console, or with musical instrument amplifiers. A regeneration control provides for the recirculation of processed signals, creating more and more notes, depending upon the selected interval. This results in multitudes of voices or instrumental chords. An entire new range of sound effects and musical textures, unattainable with any other type of signal processor, is suddenly at your fingertips.

With many other pitch transposition devices a splicing noise, or glitch, is present. The MXR Pitch Transposer

renders these often offensive noises into a subtle vibrato which blends with the music, and is, in some cases, virtually inaudible. The result is a processed signal which is musical and usable.

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# studio diary

## Paradise Studio, New South Wales

Paradise Studio is a 'no compromise' studio built by the Eastlake organisation and designed by Tom Hidley, world famous acoustician who has built such distinguished studios as Record Plant, Caribou Ranch, Manor Studios, Kendun Recorders and some 200 other rooms. Design and construction supervision was by Sierra Audio Corporation. The studio project was started by A. Richardson, who has since left to form his own production company — Bill Fields, the current owner/manager of the studio, completed the project in June 1979. After many initial problems, which most new studios encounter, the project is now fully operational. This includes the sauna and solarium, which may seem unnecessary to an outsider, but can be vital in long hard sessions, the billiard and pinball machines help as well.

The overall studio and control room complex is based on separate floating concrete slabs. The main studio is completely anechoic with both the walls and ceiling trapped especially for the recording of various instruments. The separation factor is a major design feature. The variable decay isolation room (live room) has an area approximately one third of the interior studio. The floor is marble and the walls and ceiling are covered with mirror panels behind which are acoustic traps to absorb low frequencies. The reverberant characteristic of this room is variable and controlled by the positioning of heavy velvet drapes. It is interesting to note that all walls and roof surfaces in the studio and control room are coincident. Behind two sliding glass-panelled doors is the control room where the monitors are an integral part of the design. A feature for which Tom Hidley is world-renowned.

The studio control room is equipped with the best money can buy. The desk is a 32/24 Harrison with Allison automation. The multi-track and master machines are MCI while the Hidley/Sierra monitors consist of two 15in JBL, a JBL Slot and wooden Sierra midrange dispersion horn. The outboard equipment includes EMT Gold Foil, Orban, Scamp, UREI and Lexicon, and is one of the most comprehensive collections in the business. Console power supplies and monitoring system racks are housed in a completely separate room.



▲ Eastlake designed control room and Harrison console

▼ The spacious studio—again Eastlake to the fore



Equipment maintenance is under the care of Dean Cooper, an important service to have when you are paying \$100+ per hour. Traffic manager Susie Allen, looks after the bookings and adds a personal touch to the studio.

Paradise is a complete facility. Not only is it an ideal studio from a technical viewpoint, but it also has an ideal aesthetic environment. The choice of materials and the standard of construction overall have been very sensitively treated. Practical

features such as easy access of loading dock, adjacent off-street parking and recreational facilities make the studio truly worthy of its name.

On staff is engineer Richard Lush, chief technical engineer Dean Cooper, assistant manager Susie Allen and managing director Bill Fields.

Tom Misner

Paradise Studio, 70 Judge Street, Woolloomooloo, NSW 2011, Australia.

## Long View Farm, Massachusetts

One of the more rural of American recording venues is Long View Farm, near Worcester, Massachusetts. Situated on the north-western edge of the central Massachusetts community among rolling New England hills, Long View Farm is as its name implies, a farm which became a recording studio. The change of purpose is not as drastic as it might seem since Long View's 145 acres remain working farmland complete with horses, cows, goats, chickens, and a sizeable vegetable patch.

Owner Gil Markle, a physics graduate and former professor of philosophy at Clark University in Worcester, bought Long View Farm in the summer of 1972 with the intention of making it his home. However, when he and two carpenter/musician friends renovated the house they also built a sound studio to fulfil Gil's hobby of playing with electronic equipment. His fascination with sound recording eventually ceased to be just a hobby and by 1974 a fully equipped professional studio had resulted. Later on, a second studio was added in the large barn, and the milkhouse became a guest cottage for clients. The result of these developments was that Gil had to find somewhere else to live and Long View Farm became a residential studio complex.

The change of purpose from private residence to studio complex was not unexpected when you discover that Gil's father was an NBC chief engineer for 25 years and that Gil Markle Sr helped build NBC Radio's control room. Also his mother, Connie Gates, was at one time a singer with the Tommy Dorsey Orchestra. With a home background like that Gil's involvement in the recording business is not surprising.

When Long View Farm became operational it followed hard on the heels of Caribou Ranch in Colorado as one of the first American residential studio complexes. It soon began making a name for itself as a rural retreat, but perhaps the most crucial happening in the studio's development was the decision by Stevie Wonder in 1976 to use Long View Farm as the site for his press party announcing the release of his *Songs in the Key of Life* album. This album launch brought more than 100 artists and producers plus 75 members of the press to the farm to preview the tapes and gave the studios a substantial publicity boost.





▲ Gil Markle operates the MCI JH-528 console in Studio A



▼ The barn contains 16-track Studio B

turn-of-the-century wood-built farmhouse and a 16-track studio above the stables of the huge wooden barn. Accommodation is available in the farmhouse and converted milkhouse and the complex is decorated with rustic antique furniture and with wood predominating everywhere. Studio A, in the farmhouse, is an L-shaped room sized 26x26ft, 19ft wide at the control room end and 12ft at the dead end, with a height of 8ft 6in. The studio has an isolation booth and the overall finish is a mixture of curtained walls, hardwood walls and glass with both carpeted and hardwood flooring. The control room to Studio A is 24x15ft and houses an MCI JH-528 28/28 console which is automation ready. Tape machines are an MCI JH-114 24-track, plus Studer A80, Scully 280B and Revox 2-tracks, and an Ampex 440A 4/2-track. A selection of monitor loudspeakers are available including Altec 'Big Reds', JBL 4320s and 100s, and Auratones. In addition dbx (24 channels) and Dolby noise reduction is available plus a wide selection of mics.

Certainly the Stevie Wonder press party put Long View Farm on the recording industry map. Since then the studios have seen many top line artists making use of the facilities. Among studio users have been the J Geils Band, Aerosmith, Johnny Winter, Gary Wright, Cat Stevens, Van McCoy, Arlo Guthrie, Don McLean, and Pete Seeger.

The facilities at Long View Farm comprise a 24-track studio in the

Studio B, in the barn, is a rectangular room of 30x24ft with several bay areas at the rear which are used as isolation bays. This studio is mainly constructed of wood and has a much livelier sound than Studio A. The control room is 14x24ft and houses a Aengus 1608

## McClea Place Studios, Toronto

In a recent statement RCA Limited announced that an agreement has been reached to sell its Mutual Street Studios in Toronto. RCA are selling the studios to McClea Place Studios Limited and with the sale RCA will no longer operate a sound recording facility in Canada. The Mutual Street studios have been renamed McClea Place Recording Studios and the new principals Bob Richards and Phil Sheridan plan to use the two 24-track studios for a wide range of material including big band music, film scores and orchestrated jingles. In addition to the present two studios a third studio is also to be built. The majority of the key studio personnel are to be retained by the new company.

McClea Place Recording Studios, 225 Mutual Street, Toronto, Canada M5B 2B4. Phone: (416) 363-3443.

custom built console with 18 inputs and graphic eq on all channels. Tape machines in Studio B are a 3M M79 16-track, plus Studer B62, Scully 280 and Revox 2-tracks. As with Studio A a selection of monitors are available, in this case the choice comprising Altec 'Big Reds', JBL 100s and Auratones.

Studios A and B are linked by tie lines, permitting 16/16 or 16/24-track transfers between the studios, and these lines additionally allow mutual access to the studios' ancillary equipment. A wide range of ancillary equipment is available and units which are at hand include Allison Kepex and Gain Brain, Roger Mayer noise gates, Modular Audio parametric eq, Aengus graphic eq and API 550 and 560 eq, Orban stereo matrix synthesiser, AKG BX-10 and BX-20 reverb, EMT plate reverb, UREI 1176 and Teletronix LA-3A limiters, Eventide and Loft phasers, Eventide Harmonizer and DDL, Aphex Aural Exciter, and DeltaLab Acoustic-computer and DL-4 Time Line. In addition an acoustic live chamber has also recently been added to the studios' facilities. Instruments available include Baldwin and Steinway pianos, Hammond organs, several ARPs, Elka string synthesiser, a mellotron and various amplifiers. On top of this Long View also offers a rental service that can make virtually any piece of equipment or any instrument available to its clients. Long View Farm, North Brookfield, Mass 01535, USA. Phone: (617) 867-7662.

## Different Fur, San Francisco.

Different Fur recently completed their studio rebuilding programme in time to welcome Brian Eno and David Byrne and their ongoing album project. Fur's studio remains essentially unchanged, but the control room retains only the hardware of its predecessor: MCI 24, 4 and 2 track tape machines, a Harrison 4032 34/32 console with Allison 65K automation, Westlake monitoring and 28 channels of Dolby and dbx noise reduction. The control room has been enlarged to 17x21ft and embodies the live end/dead end concept. John Storyck planned the alterations which eschew overhead spotlights in favour of a large light diffusing panel. Lexicon 224 digital reverberation and White one-sixth octave equalisation join the already impressive list of outboard gear. Situated in a private house, the studio has finally ousted its owners. Pat and Patty Gleeson, who will be moving out to make room for a lounge, sauna and client accommodation. Future plans include an extension of the studio from its current 25x35ft dimensions.

Different Fur, 3470 Nineteenth Street, CA 94110. Phone: (415) 864-1967.

Chris Michie

## Soundmixer Studios, New York

Soundmixers Studios, New York has completed renovation of the second of its four studios, Studio B. The renovated studio now has a Sierra/Hidley designed control room and is equipped with a Trident TSM 40/24/32 console with Allison automation, capable of 46-track recording and mixing. Tape machines are MCI for multitrack and Studer for mixdown. There is a comprehensive array of ancillary equipment including ADR Compex limiters and Scamp rack, Trident limiters, Teletronix LA-2A valve limiters, Pultec valve equalisers, Lexicon DDLs and digital reverb, Eventide Harmonizer, and a variety of flangers. Monitors are Hidley utilising Gauss and Emilar components, plus JBL 4311s and ROR loudspeakers mounted on the console. The studio is designed to have a live feel eminently suitable for rock and roll bands, but flexible enough to accommodate almost any type of session.

Soundmixers Studios, 1619 Broadway, New York, NY 10019, USA. Phone: (212) 245-3100.

50 ▶





◀ Studio 1

Wayne Bickerton (left) and producer Roger Greenaway in the control room of Studio 1 ▼



▼ Studio 2 mixdown room

### Odyssey Recording Studios, London

July 1979 saw the operational debut of a new studio complex in central London. Odyssey Recording Studios. Situated close to the Edgware Road and within easy reach of London's West End, with its plethora of top quality hotels, the complex is ideally placed to take advantage of the UK's musical talent, especially those passing through or based in London.

Odyssey is the brainchild of Wayne Bickerton and its two studios are to a large extent the fulfilment of a dream for him. Wayne is best known as a producer and with some 18 years experience of the music business the studios naturally owe much to his background. A track record which includes the launch and success of the Decca Deram record label; five years as head of A&R at Polydor; and then in 1975 the decision in conjunction with Tony Waddington to start his own record company, State Records; must make its mark when it comes to investing some £1,000,000 in a new studio complex. I asked Wayne whether the success of State had made it imperative to him to have his own studios. His reply was interesting. No, he didn't feel he had to have a studio nor was it simply a way of re-investing profits that otherwise go to the taxman. Essentially, he saw the need for the studios from four different

viewpoints. Egotistically, yes it was flattering to be able to build a new studio complex in central London, and despite the inevitable hassles it was satisfying to be able to do so. When it comes to recording like any other record producer he wants value for money, having his own studios makes this much easier to keep under control. He wanted to be able to nurture up-and-coming talented songwriters and having a studio virtually always on call allows him to test musical ideas in the studios within a 'family' atmosphere. Above all though Wayne sees the studios as essentially being a commercial proposition. After all you can't spend large sums of money and not hope to make a return on your investment.

Having decided in late 1977 to build a studio complex the first problem was finding suitable premises. Fortunately for Wayne the Odyssey site was available in an excellent location and fortuitously presented no planning problems as it is situated in a cul-de-sac with no adjoining buildings, and the building was already in industrial usage as a photographic studio. Accordingly, no change of use to commercial premises was required and the site has the advantage of convenient and unobstructive equipment unloading and car parking. All vital factors in London's central areas. Having obtained the site the next problem

was studio design. Although confined to a fixed floor area there was no problem in gaining space by building upwards. Wayne obtained several designs for the complex which also includes offices for State Records and notably a music room for songwriters on the second floor. Eventually it was decided that freelance acoustic and audio designer, Keith Slaughter, should design the complex and Keith joined State as the studio director to oversee construction.

The design of Odyssey was essentially to make it one of Europe's most modern studio complexes. On the ground floor are situated both studios — Studio 1 mainly for recording and Studio 2 primarily as a remix and overdub studio although it will accommodate up to 10 musicians. Both studios are fully floated on neoprene pads. The control rooms of the studios are basically identical and are approximately 30sq m in size. The most impressive room in the complex is undoubtedly Studio 1. This has a 5.5m high ceiling with an undulating acoustically treated ceiling formed from a patented strip system which gives a random reflective plane. The window from the control room juts into the studio in the left hand corner and above it, reached by steps to the right of the window, is a gallery/balcony which sweeps round in a U-shape. This gallery is especially effective for brass and

woodwind. Opposite the control room window are a drum booth and piano trap. The studio is basically split into two sections — that to the right of the control room window with a wooden floor being the live end, while the other carpeted end is basically dead. The acoustics have been graduated between the two sections whilst additionally a large sectionalised runner curtain which extends from floor to ceiling allows the live end to be cut off from the rest of the studio.

In addition to its sound recording function, Studio 1 is also a hybrid audio/video studio. Full lighting facilities are available and audio and video tie lines are laid in to a central patchboard including a link to the car park for use with mobile units. Incidentally, Wayne Bickerton has plans for a video suite, a broadcast facility, a tape duplicating facility, and a disc cutting room to complement the present facilities.

In keeping with the decision to make the two control rooms basically identical, both rooms are equipped with virtually identical equipment. Consoles are custom built MCI 56-channel 500 Series desks with full automation, VU and PPM plasma display meters, and *Specira Vue* spectrum analyser. Tape machines likewise are MCI and the studios have 24-tracks, 16-tracks, and stereo machines, all with remote control and autolocate on the multitracks. Monitor loudspeakers are *Audicon* units using JBL drivers bi-amped from BGW 750 power amplifiers. Microphones include the usual selection of condenser and dynamic types from AKG, Neumann, etc. Ancillary equipment comprises EMT plates, Dolby noise reduction, and a wide variety of comp/limiters, DDLs, graphic equalisers, time processors, etc from Audio & Design (Recording), AMS, UREI, Eventide, Bel and Klark-Teknik.

Despite construction problems caused by the bad winter of 1979 which postponed opening of the studios until July and led Wayne to forsake record production for most of that year in order to sort out the multitude of problems, Odyssey is now fully functioning. To date artists who have used the complex include Cliff Richard, The Who, The Hollies, Roger Whittaker, The Commodores, The Darts, Mike Batt, Rolf Harris, Jonathan King, Patti Boulaye, The Angelic Upstarts, Biddu, and Brotherhood of Man. Not a bad artist roster for only a few months availability!

Noel Bell


Odyssey Recording Studios, 26/27 Castlereagh Street, London W1H 5YR. Phone: 01-402 2191. Telex: 25740.



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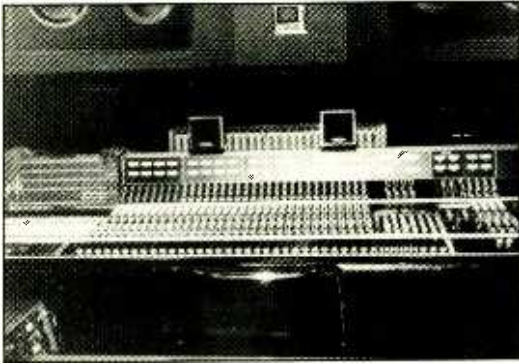
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Control room, Studio 3



Studio 3

### Hitokuchi-Zaka Studio, Tokyo

A recent addition to the Japanese studio fold is Hitokuchi-Zaka Studio, Tokyo. Now in its second year of operation the studio is owned by Nippon Broadcasting System Inc. Housed in a glass-fronted, distinctive, wedge-shaped modern multi-storey building with the names Pony and Canyon vertically emblazoned on the side (these standing for Pony Inc and Canyon Records — both associate companies of the studio), the building houses three studios and a mixdown room.

Hitokuchi-Zaka exhibits a number of unusual features not least of which is the fact that the three studio control rooms plus the mixdown room are all exactly the same size and shape. All the rooms have an area of 46sq m, are 2.65m high, and are roughly hexagonal in shape. A particular advantage of this arrangement is that it allows total interchangeability between studios for mixdown, while additionally it

allows voice overdub monitoring to be consistently to the same tonal standard, whichever control room is used. Although the three studios are not the same size a similar approach to their size and basic shape has been adopted by the studio's designer Takamichi Suzuki. In basic format the studios have a central polygonal floor area, off which are placed various booths for drums, piano, etc. The booths are all glass windowed to the main studio area. An immediately striking feature of the studio's is the size of their control room windows — much larger than the norm and giving excellent vision. Another striking feature is the use of deluxe woods in various shapes and thicknesses as the predominant floor and wall covering. Overall the standard of design and construction work is very high and particular mention should be made of the Kajima Corp who were responsible for construction.

As mentioned above the studios are in a multi-storey building. Commencing from the top, the largest

studio, Studio 1, is on the sixth floor and takes up the best part of three floors. This studio has an area of 166sq m, is 6.29m high, and will handle orchestral recording. To the rear of the control room is an echo-plate room, while additionally there is an echo room. Moving down to the fourth floor, here are situated Studio 2 and the mixdown room. These take up two floors and Studio 2 which is the same size as Studio 3 has an area of 102sq m and is 3.68m high. Continuing downward Studio 3 is on the second floor while the studio's lobby area is on the third floor.

In line with the basic acoustic design of the studios, all the studios are identically equipped apart from one exception. The exception is the console in the mixdown room which is a custom API Automix console with 36 inputs and 4 outputs. All the studios have custom API consoles, these having 36 inputs/24 buss outputs/32 monitors. Tape machines comprise four Studer A800 24-tracks, four A800 16-tracks, four

A80 2-tracks, and four Ampex ATR-100 2-tracks. Monitor loudspeakers are Audio Marketing Super Red double woofer loud speakers powered by McIntosh MC-2300 power amplifiers.

Ancillary equipment in the studios comprises a wide range of units. In addition to the echo room there are EMT 140, EMT 240 and AKG BX-20 reverb units. Effects units include Eventide Harmonizer, Omnipressor, and DDL; Lexicon Prime Time 93; Ursa Major SST-282 Space Station; MXR phaser and flanger; and Marshall Time Modulator. Compressor/limiters are from UREI, Quad-Eight, ADR, dbx and Orban. Equalisers are from UREI, ADR, Klark-Teknik and Klein and Hummel. Finally the studios are fully equipped with Dolby and dbx noise reduction, while mics include the usual selection from AKG, Electro-Voice, Neumann, Sennheiser, Shure and Sony.

The most noticeable feature of Hitokuchi-Zaka Studio is the feeling of spaciousness and its high standard of construction. It isn't surprising therefore to discover that it has already become a very popular recording venue. Its clients include all the large Japanese record companies (Canyon, CBS/Sony, JVC, Nippon Columbia, Toshiba EMI, etc) plus the major production and music publishing companies. As an example of what can be achieved by carrying through an unusual design concept the studios are highly successful. No doubt we will be hearing much more from this source in the future.

Hitokuchi-Zaka Studio, 3-31, 4-Chome, Kudan-Kita Chiyoda-Ku, Tokyo 102, Japan. Phone: (03) 263-1097.

### Trixi Tonstudios, Munich

One of the oldest, if not the oldest, established Munich studios is Trixi. A fact that is born out by the large differences in style between the signed photos that cover one wall in the foyer left by, one presumes, satisfied clients. In the case of Trixi, foyer is the right word as the studios are housed in an old cinema and the entrance hall serves as waiting room as well as fully licensed bar and restaurant. Much of Trixi's work in the past was with variety acts, ranging from big bands to cabaret artistes with all stops in between. The studio being in a converted cinema one would expect projection facilities for doing film work — and one would be exactly right! Studio A is fully equipped with film recording and editing facilities and in fact TV and film now account for about 80% of the studio time, the remaining 20% being for music recording. Studio A, the largest of the two,

takes up the original seating area of the ground floor and thus recording large orchestras presents no problem. The other main advantage is that Trixi have been able to preserve the original ceiling height, giving a very spacious sound, and at the same time have a concert hall acoustic without too much uncontrolled reverberation. As far as acoustic treatment goes, much of the finish is the original cinema decor, ie: carpeted walls and hard wood floor, though the ceiling has been exposed to its original height and the girder framing used to attach panel absorbers and additional lighting. The auditorium still has the horseshoe balcony that was used for upstairs seating and in places this provides the roofs for the isolation booths that have been built underneath. These are of a semi-permanent nature and can be enlarged or made smaller in a short amount of time. Though often used

for percussion and vocals, it is not unusual to see the piano or other keyboard instruments tucked away in the interests of separation, as was the case during my visit. For the majority of the time the booths are left open at the front, the interior absorption being adequate, and in this way the musicians can still feel a part of the other players on the studio floor. However, there are also two small rooms leading off from the right side of the cinema screen for drums and percussion should 100% isolation be required. The acoustics also vary from room to room enabling either a dry or livelier sound to be obtained. Microphones seen around were the usual presentation by Neumann, AKG, Sennheiser and EV, as well as several of the large Neumann mic stands for engineers who like to get on top of the job when they record in true stereo. All in all, the studio has a very pleasant feel to it and

instant mood lighting is available to suit most tastes, from brightly lit hall to an intimate atmosphere. There is certainly enough room to be able to stretch one's legs out! And so into the control room.

Taking up what were probably store rooms, the control room resembles more a large corridor than anything else, there being very little space front to back. Though a far from ideal situation acoustically, careful use of rear wall slat absorbers and ceiling treatment have resulted in a sound that they are fully able to work with. Taking up a good percentage of the floor area is the custom API desk which is a 32/16 complete with full 24-track monitoring, these latter channels being comprehensive enough in facilities to be used as auxiliary returns or extra inputs during mixdown. Metering is a mixture of



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## studio diary

### Queen Village Recording Studios, Philadelphia

The historic area of Philadelphia is presently undergoing renovation — a renaissance which has successfully attracted artists, musicians and a flourishing art community resembling that of Greenwich Village in New York City.

In this setting, Queen Village Recording started as a small 2-track studio with four staff members doing mostly local commercial and word-of-mouth jobs. "There were people virtually in 'Philly,'" says Wally Hayman, studio manager, "who didn't even know we existed, let alone anyone outside the area."

Hayman came to Queen Village Studios, after owning a small production facility, three years ago. The studio's chief engineer, Chuck O'Brien has just completed a tour as road manager for Barry Manilow and assisted in the recording productions of Manilow, Aerosmith and Eric Clapton, to mention a few. Both men are now at the head of a 16 person staff which now makes up Queen Village Studios.

Queen Village has just added a new fully-automated 40-track recording studio. This transformation did not happen by luck or accident but by careful planning and projection of the industry's contemporary needs. "The handwriting was on the wall," as Hayman tells it. "With today's high-fidelity stereo equipment, a studio must continually upgrade its standards to meet industry's demands for quality sound reproduction. We committed ourselves to a huge investment in the best equipment presently

available."

Queen Village operates two studios — a 40-track used mainly for music recording; and a smaller 8-track facility for commercial work. The operation breaks down to approximately 50% music and 50% advertising business. The music studio control room, a small but intimate 12x12ft, has been designed to allow for maximum flexibility and can handle all types of music, from hard rock to classical. The equipment is grouped around a central point from which the engineer can operate it all conveniently. Adjacent to the control room is a studio, which despite its deceptively small size (20x40ft) can accommodate several musicians comfortably. Separating the control room from the studio is a central plate glass window which allows full visibility from the engineer's position. The control room houses a Neve 40-channel mixing console equipped with *Necam* computer automation. This acquisition puts Queen Village among the few studios in the world to own and operate this equipment because its purchase price is now a hefty sum of over \$200,000.

The *Necam* system is without peer due to its obvious advantages. It allows you to store your mixes on floppy discs as you lay down tracks instead of using valuable tracks on the tape recorder. In the final mix, the console faders become motorised and do the work of several people, bringing in the mixes simultaneously as programmed. The computer stores and then groups for you up to 999 mixes.

The smaller studio, an 8-track having been made to the studio's specification so that extra units would be superfluous. A selection of EMT plates provide for the various reverberation requirements.

Adjoining the right side of the control room in an 'open plan' manner is the film recording area which houses an impressive array of film recorders — mono to 6-track — plus editing desk.

Going upstairs to what were the 2/9's and 3/6's — I mean the former balcony seating area, we find Studio B. Much smaller than Studio A, one is rather reminded of a small BBC studio in that it has the same relaxed atmosphere. (Well, most of the Beeb studios that I've been in seemed relaxed, anyway!) Most of the work done in this studio is for commercials, film dialogue and small groups or ensembles. The studio features an elaborate vocal booth that can be used to simulate virtually any condition for film and TV — or for music recording for that matter! The atmosphere, as we said, is very TV/radio studio and though fairly small does offer quite



Neve 40 channel mixing console

facility, is used primarily for local advertising agency radio spots. Locally, Queen Village has been awarded seven "Liberty Bell Awards of Excellence" in 1979 and eight in 1978. These awards are presented by the Philadelphia Television Radio Advertising Club for outstanding performance in various ad campaigns and general competitive categories.

Two years ago, Queen Village came to a crossroad where a decision had to be made as to the future direction of the business. Among the possibilities discussed was a move to the Los Angeles area where recording work was plentiful. (Walter Kahn, the owner of the studios, already maintains an office on the West Coast and so a move would be a fairly easy matter.) However, it was ultimately decided to stay in Philadelphia and invest heavily in the operation. "If you're good, it doesn't matter where you are," Hayman said. "Since we've invested in new equipment, we've begun to see a trend — people are discovering us here."

Clients have mentioned to the Queen Village staffers that they are tired of working in New York City with inflated rate cards, union hassles, and pressures. For them,

a lot in the way of variable acoustics, both for musical instruments and group dialogue. Recording is on Telefunken 8- and 16-track recorders — the original multitracks, the *M10?* — which, though fairly elderly, give sterling service and appear to be indestructible (they just keep on going!). In keeping with tradition, the desk is a mixture of Telefunken, Siemens and Neumann, ie: built like a battleship but still giving quality results.

Adjoining Studio B are the copy room and the original projection room. The latter has been modernised and Trixi are able to give film-shots that any cinema open to the public would be proud of. As well as copying, there are also disc cutting facilities should you want to take an acetate with you after the session though mastering can be done as well.

As can be seen, Trixi offer a wide variety of services in a relaxed yet businesslike atmosphere coupled with long experience in the music and film recording industry. I had the opportunity to have a chat with

Queen Village's competitive edge makes the trip to 'Philly' worthwhile, and that's a good sign.

The studio has recorded various projects for Warner Brothers, RCA, Motown, Casablanca and RSO labels, among which was Karen Young's *Hotshot* (West End label) which became the No.1 song in the US last year. Also some recording was done for disco artists Cindy and Roy on Casablanca, and Queen Village has completed recording a new group Mizz also on Casablanca, released in February 1980. The sound is a crossover blend of R&B, disco, MOR and rock. But since Mizz is an untried commodity, it remains to be seen how successfully it can be marketed and promoted. Nevertheless, it is a high quality representation of recording at Queen Village.

What's next for Queen Village? Possibly a move to 32-track digital recording (when it is perfected). Possibly a move to larger facilities within the same area of Philadelphia. There are a lot of possibilities for this growing outfit. As Chuck O'Brien said, "We've only just started to get off the ground." Queen Village Recording Studios, 800 S.Fourth Street, Philadelphia 19147, Penn. **Claudia Kienle**

### Trixi Tonstudios (contd.)

standard VU's plus large NTP light beam meters on the main quad and stereo outputs. The desk also features quite a splendid phase meter! Recording is handled by either a 3M 24-track or a Studer A80 16-track, no facility being available for the moment to link the two machines together though this remains a possibility for the near future. Mastering is on a Telefunken *M15A*, with monitoring by JBL 4341 speakers. Effects units include Eventide *Instant Flanger* and *Harmonizer* with compression and limiting courtesy of UREI and Audio & Design. Trixi also boast a Sennheiser *Vocoder* which, when not being used to make singing beer glasses, also doubles up as a very comprehensive equaliser! Though the range of effects may seem a little limited for the work that Trixi do these all suffice though it is worth mentioning that the desk itself is very flexible in terms of eq, etc.

a producer who is a frequent Trixi visitor in order to exchange views on current trends. As someone who does a lot of work on both sides of the Atlantic, he felt that the tendency for artists to produce themselves could often lead to over-indulgence, especially if they were not very well versed in the arts of producing. A recent Barbra Streisand album was cited where over 400 reels of 2in tape had been used for about forty minutes worth of music! Though this may be a special case (and something of a record?) it does bear thinking about.

My host for the visit was joint studio manager — with Trude Klimpt — Willi Schmidt who still also does engineering though he now finds that the day to day running takes up more of his time. He also feels that he should let the younger generation get more of a look in!

**Terry Nelson**  
Trixi Tonstudios GmbH, Floriansmühlstrasse 5, D-8000 Munich 45, West Germany. Phone: 089 325350.



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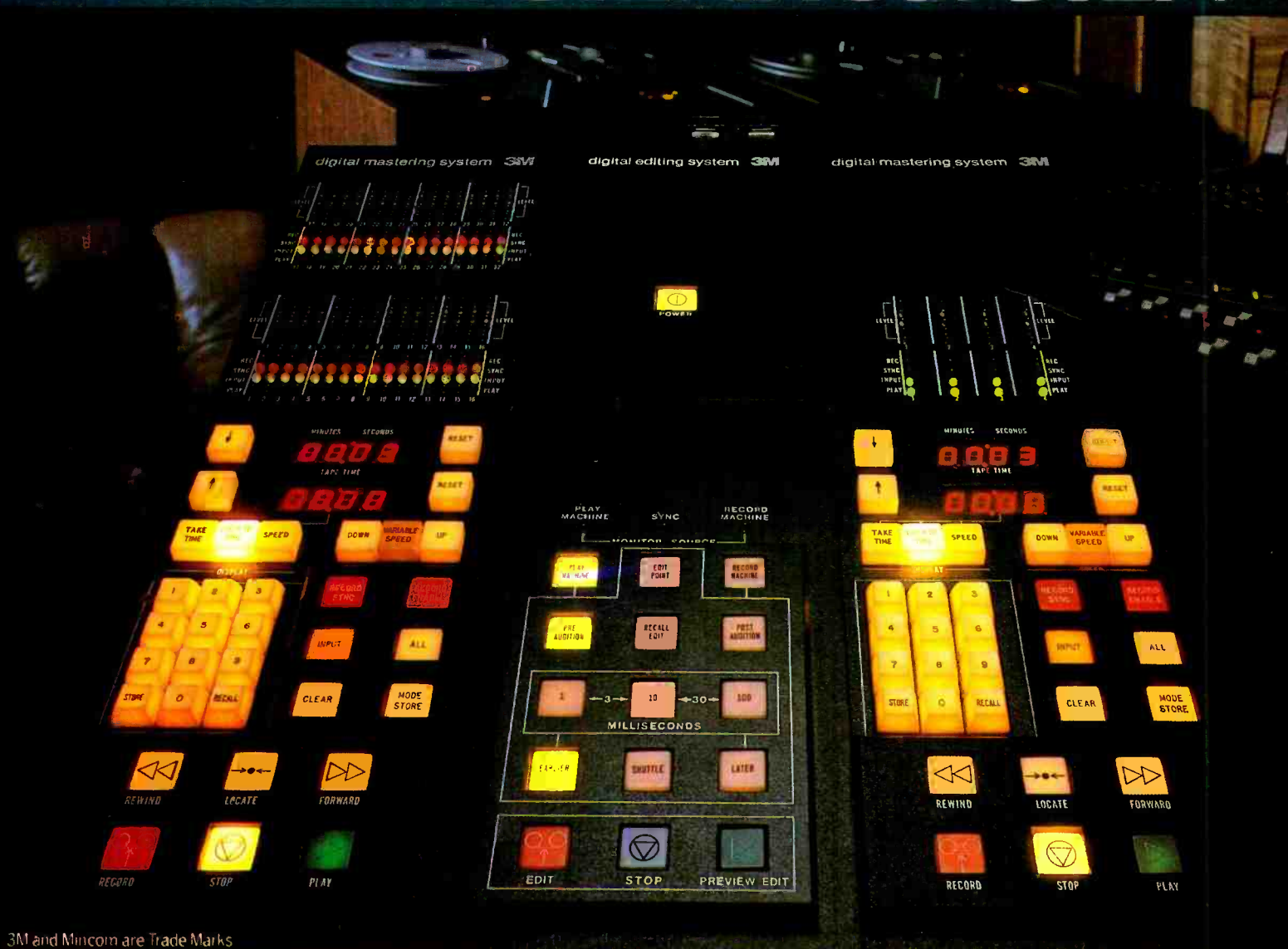
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## studio diary

### Cherry Recording Studio, Croydon

It is a rare event for a recording studio to be opened within a 10-minute walking distance of our editorial offices in semi-cosmopolitan Croydon, Surrey. However, September 1979 saw the opening of a 16-track studio, Cherry Recording Studio, in the somewhat unlikely location of Croydon. I say unlikely because although Croydon is only some 15 minutes south of central London by train (ex-Victoria Station), the area is not renowned as a centre for recording or live music, despite having the Fairfield Hall which has regular classical and popular music concerts.

Cherry is owned in partnership by Rick Simms and John Dendy who have been closely involved in the music business for a number of years primarily as song writers, but more recently as producers too, through their production company Densim Music Productions. Amongst the credits they have behind them are chart successes in Germany, Holland and Japan, and with a song entitled *Time* second place in the 1978 Song For Europe competition. Rick and John have worked in conjunction with a large number of UK studios including EMI Abbey Road, Air, Advision, R G Jones and Rockfield, and this knowledge of studios has been put to good use.

Cherry grew out of what was a small private studio which Rick and John used for song writing and production. They found that as their workload increased they really needed better facilities. In mid-1979 they decided that the answer was to build and open a commercial studio and so started looking for suitable premises in the Croydon



▲ Studio

◀ Control room

area. The search eventually led to a small, triangular-shaped building which had been a church hall. Following purchase, work on conversion to a studio commenced in Spring 1979 and the studio opened for business in September 1979.

Much of the acoustic design and construction of the studio was carried out by Rick and John, themselves. Apart from the shell itself that is, which amongst the alterations required needed new construction at the rear to accommodate the control room. The result is a studio with a playing area of about 450 sq ft and a control room of about 300 sq ft. Both the studio and control room are fully floated and in addition there is a separate drum plinth.

The control room is equipped with an Alice ACM 20/16 console with matrix routing. This desk was originally built for Ken Hensley of Uriah Heep, but after some six months use became available, and

was snapped up by Cherry. Tape machines are an Ampex MM1000 with 2in 16-track and 1in 8-track headblocks and varispeed, together with a Revox B77 and an A77. Monitoring is over Tannoy Berkley loudspeakers and Auratones, these being driven by Amcron D150 and Quad 405 power amplifiers. Ancillary equipment includes units from Audio & Design (Recording), Audio Developments, MXR and MicMix, while noise reduction is handled by two BEL dbx encode/decode units giving 16 tracks of dbx noise reduction. Microphones, incidentally include models from AKG Beyer, Neumann and Sennheiser.

Chief engineer at Cherry is Rick Norton who has recorded Mud, Gary Glitter, Hot Chocolate and Keith Richard among others. To date most of the studio's clients have been semi-professional bands, but much of the available studio time has been taken up by sessions

for Densim Music Productions, hence at the time of my visit only a limited number of outside artists had had the opportunity to use the studio. Since opening, the studio has been extremely busy and such is the level of business that Rick and John are already making plans for expansion. Unfortunately the nature of the studio site entails that any expansion will have to be elsewhere and current intentions are to retain the present 16-track studio primarily for semi-professional and demo work. Currently, Rick and John are hoping to purchase a farm near Purley, which after conversion will become a 24-track studio. However, this is unlikely to reach fruition before the end of 1980. Other plans include the possibility of using the 16-track studio for running three-day courses on studio balance engineering. Noel Bell Cherry Recording Studio, 41 Leslie Park Road, Croydon, Surrey. Phone: 01-654 1197.

### Studio News

● Lucas/McFall Warehouse Recording Studios, New York, has completed its new Hidley/Sierra control room and studio facility. The production facility is equipped for 46-track recording and has a Trident Series 80 automated console, with an Ampex MM1200 24-track interlocked to an MCI JH16 using the EECO MQS interlock system.

● Nashville/North Recording, New York, has installed an Otari 8-track and a 24-channel Trident Fleximix console for remote recording. Additional equipment includes Trident limiters and parametric eq, API limiters and eq, Orban echo, MXR phasers, AMS DDL and a variety of monitors.

● Streeterville Studios, Chicago has undergone a \$2,750,000 expansion. In addition to the previous

four studios, a new 24-track studio and a remix suite have been added. Design of the new facilities was by



Streeterville remix room ▶

consultant George Augsberger and architect Jack Edwards. The remix suite and its associated overdub studio feature a Harrison 4032 console with Autoset automation, 3M M79 24-track, Studer ¼in machines, U-Matic video machines and BTX SMPTE synchroniser. Ancillary equipment includes units from Apex, Audio & Design (Recording), Allison, dbx, Dolby, EMT, Eventide, Klark-Teknik, Lexicon, MXR, Orban, Pultec and Urei. The new 24-track studio is part of a self-contained suite of accommodation rooms and is designed to be used by artists working on extended projects. The studio is equipped with a Harrison console, 3M 24-track and Studer ¼in tape machines, and a wide range of ancillary units.

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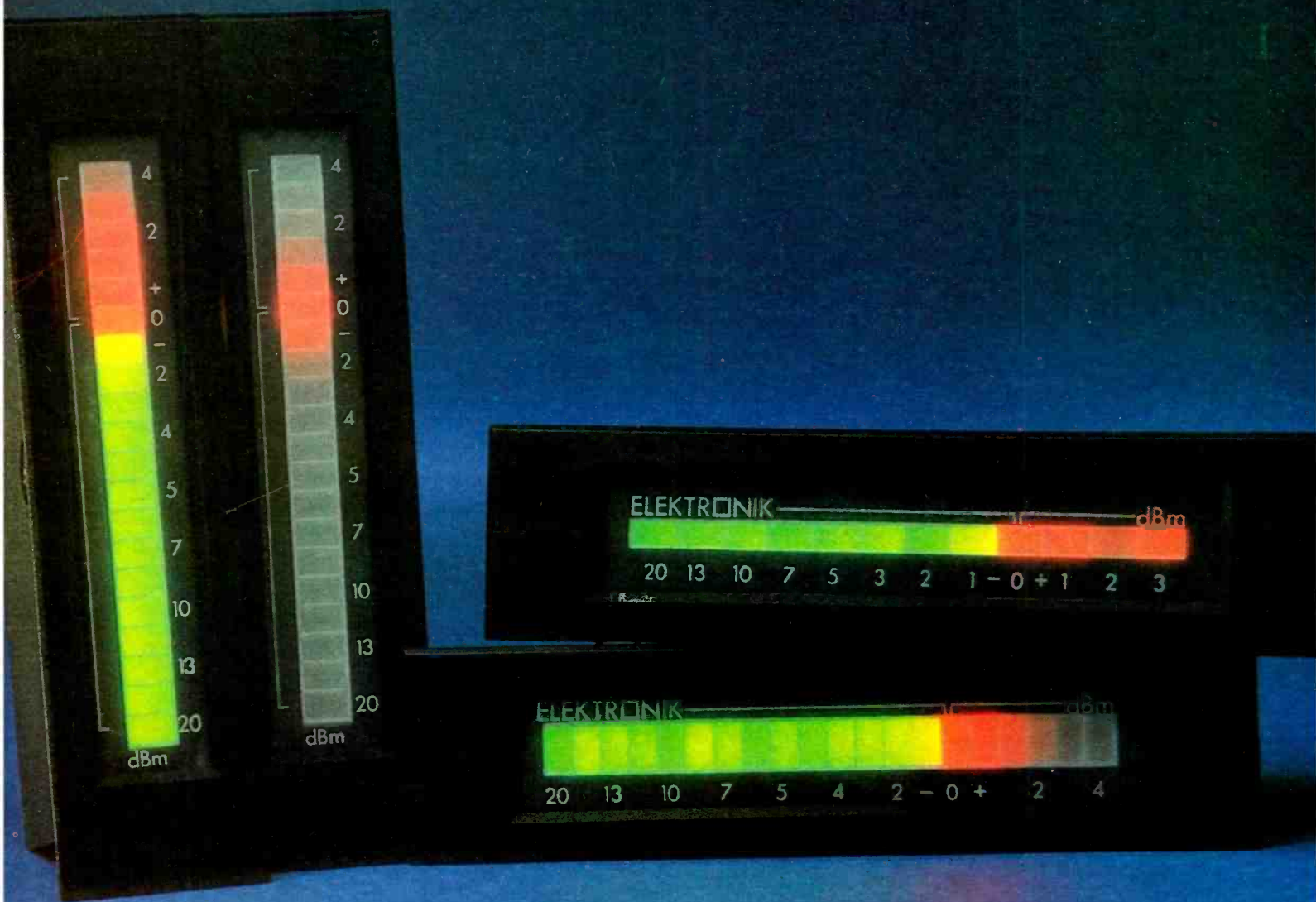
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### Union Studios, Munich

Set out in the semi-countryside of one of Munich's suburbs are Union Studios. From the exterior all one is aware of is a large detached house with its own grounds and nothing at all to give it away as one of the more successful modern German studios. Union are the only people to have a 100% Eastlake control room in Munich which also adds to their notoriety and in fact this has been changed since my visit as the new Eastlake remix room was opened in January. This in fact is part of a long term plan as the new room will become the control room for a studio yet to be built. Prudence seems to be the key word as regards expansion and nothing is rushed into, which, considering today's costs seems like a good idea.

Though the studio do a lot for the home market, they are also fully international, with the USA taking pride of place in the overseas productions. Names such as Mick Jackson and Patrick Gammon (Tamlia) were mentioned as well as a lot of disco. Like everywhere else, it is a question of keeping up with the trends and putting out a commercial product. The chief engineers at Union are both British and as John Lund wasn't available it was Mal Luker who did the honours of showing me round.

In common with other established engineers, Mal Luker is also a producer in his own right as well as having a publishing company. Naturally the productions are realised at Union and the studio hopes to expand the volume of its in-house products — another reason for expanding the recording rooms. Productions are not restricted to Germany and Mal is always interested to hear from people outside the country. Like other expatriate engineers that I know of, Mal was a musician with a group playing in Germany, who decided to stay on and got drawn into the studio world, ending up behind the console. However, he told me that he hasn't left the playing side of things completely alone and likes a good jam now and again. He even does some sessions for the fun of it!

As both studios were occupied at the time of my arrival, what better way to start than to check out the restaurant and the bar! Like many of the Munich studios visited, Union have a very pleasant restaurant for the benefit of clients and one could almost feel sorry that it is not open to the general public! As it was a sunny afternoon we took our drinks out to the covered patio so that I could relax for a moment between my frenzied dashing between

▼ Is this a studio? — the terrace at Union



studios and Mal could give some background on Union while we waited for the session to finish. All else aside, I feel it is an asset for any studio to offer the possibility of putting your feet up for a moment in the fresh air just having lawns and trees to look at. The complete break is often what makes a hard session turn out well.

Access to the control room of the ground floor studio is gained by a door leading off the main hall of the house and placed centrally in the rear wall of the control room. Centrepiece of the room is the large Cadac console and though it is difficult to ascertain whether the Eastlake décor was chosen in function of the desk or vice versa, the overall effect is very harmonious. (Soothe the engineers, I say!) The Cadac features 40 I/O modules with six VCA groups and grand master as

well as the Cadac computerised mix-down system. Mal added that they are very satisfied with the console and to say hello to Clive Green. (Hello. Clive!) Recording is via two Studers — no expense spared — A80 24- and 16-tracks, making the studio 38-track should the desire arise. Synchronisation is achieved with the Studer TLS system which also has an SMPTE timecode generator. Though it can obviously vary from session to session, the preferred method when working with the two machines is to use the 16-track for the rhythm instruments and thus make use of that extra sparkle that a 16-track often has over a 24, and use the second machine for over-dubs. The requisite channels of Dolby are available and mastering is on one of two Studer A80 stereo recorders. All of the tape machines are safely tucked away in their respective



▲ Mal Luker surveys the operation of the Cadac desk

soffits leaving the floor clear for the desk, ancillary equipment rack and seating. As well as being a very useful table the equipment rack also houses some quite nice goodies including EMT filters, Roger Mayer noise gates, Eventide Harmonizer and DDL, Marshall Time Modulator, the almost inevitable ADR F760RS Compex limiter, EMT stereo compressor (which aren't all that common, in fact — nice piece of gear but rather expensive) and two Klark-Teknik DN27 graphics. In common with other German studios the rack also houses an AEC analyser for test and checking purposes.

The control room is fully quad capable though the rear speakers are more there for decoration at the moment than anything else — or for amazing the engineers when they have a bit of time to play around. As might be expected the Cadac sports a pair of Auratones for checking the home-fi quality.

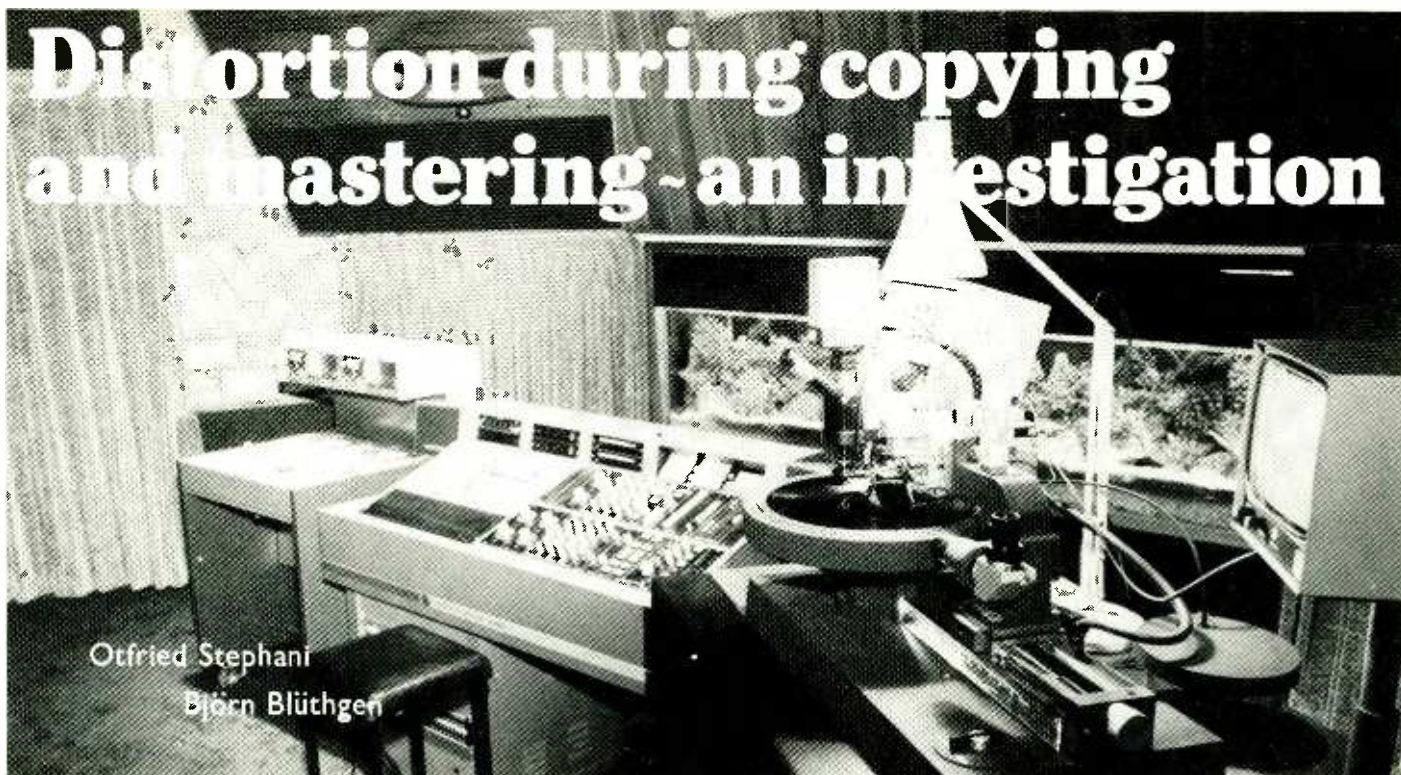
As my visit was being conducted between sessions I really didn't have time to go down into the studio itself, so I contented myself with the view from the wrap round control room windows. The studio is on a lower level than the control room, being sunk into the ground, and provides an austere contrast with its white walls and lack of decoration to the Eastlake installation. Acoustic treatment consists of tiles, panel absorbers and modules, with large use being made of separation screens. The far end of the studio is raised making a platform or stage that can be used for string sessions and the like when a more reverberant acoustic is required. The shape of the studio is rectangular and at a rough guess about 10x15m so space is not too much of a problem. Austerity does not equate a poor acoustic either as some of the tapes I was able to hear quickly proved. Very clear, in fact.

The session was about to start so it was time to move on — I was also cutting it a bit fine for my next appointment. As the upstairs studio, or more to the point, mix-down room, was occupied and rather full of producers and musicians we didn't disturb them so no info was available. However, as mentioned at the beginning of this article, this room has been 'Eastlaked' and open since January. The next stage is to get Tom's men into the adjoining studio in order for Union to become a full two studio operation, but that's another story. Union-Studios, Allescherstrasse 16, D8000 Munich-Solin, West Germany. Phone: 089 798314.

Terry Nelson



# Distortion during copying and mastering - an investigation



Otfried Stephani  
Björn Blüthgen

**T**HIS study was carried out to examine the increase in distortion products arising from the various stages in the recording process from virgin tape, via tape copies, right up to and including interaction with specific record pick-up distortions.

Sinusoidal signals of 1kHz as well as some intermodulation (400 + 4000Hz) and double tone (9,800 + 10,200Hz) signals were recorded at levels increasing in discrete 3dB steps starting in the non-critical range and continuing up to tape compression level. The tape 'original' and first and second generation copies were then transcribed together onto 12in LP's. This made possible a study of the distortion progression and also the second and third order distortion combination products.

The current practice of recording right up to the modulation limits of the tape as well as of the disc seems to result in a total distortion percentage which considerably degrades the sound quality. In order to gain an impression of the audible effect of these distortions, some special musical samples were recorded with the same discrete level steps as the measuring signals. These samples were subjected to the same copying and transcription processes as the measuring signals and were similar in character (single tone, multi tone).

Listening to these musical sample records provided an opportunity to establish perceptibility limits for the human ear regarding amounts of disturbing distortion. From experience it is known that the human ear finds a combination of

**While it is well known that tape copies and direct-to-disc recordings exhibit minimal non-linear distortion, this is not true of the combined distortions inherent in the copying and transcription process leading to record reproduction. Otfried Stephani and Björn Blüthgen of PolyGram, West Germany examine why this should be so.**

even order non-linear distortion (disc playback geometry) and odd order distortion (tape) more disturbing than only one kind of distortion having the same percentage as the above sum. One of the advantages of direct disc recording is based on this fact (ie the absence of typical distortions inherent in tape); on the other hand the excellence of a moderately modulated original tape master is also well appreciated (absence of typical disc playback geometry distortions). The effect of the combination of the above mentioned distortion products is intensified if the transcription to disc is not made from the tape original but from a mixdown copy (or even a second generation copy) as is common practice today.

In order to obtain a correlation between measured distortion figures and subjective aural perception, PolyGram have carried out a major test series with the intention of studying the increase of distortion products (harmonic, intermodulation and double-tone distortions) with increasing level related to copy ordinal numbers. Moreover, musical samples specially selected to correspond to the respective measuring characteristics and level increases, were provided for aural evaluation: they consisted of solo,

duo and piano passages specially recorded for this purpose on seven tracks of a 16-track studio recorder in the mono mode.

## Performance

All the tests were carried out using Agfa *PEM 468* tape. The modulation level, starting from the non-critical region, was raised in 3dB steps up to a maximum of 12dB above 320nW/m, so that the tape original was provided with the following discrete level stages: -6, -3,  $\pm 0$ , +3, +6, +9 and +12dB, ref 320nW/m.

The harmonic distortion measuring signals of 1kHz as well as the intermodulation signals of 400 + 4000Hz (4:1) were suitable for this level pattern, however, due to the diminished modulation capability of the tape at higher frequencies, the double-tone signals of 9,800 + 10,200Hz (1:1), required a level reduction of 6dB and were recorded from -12dB up to +6dB (ref 320nW/m).

The resulting test tape original contained signals of the three kinds mentioned above, recorded in the described level pattern on  $\frac{1}{4}$ in tape via one track of a 16-track record head. From **fig 1** it can be seen that six kinds of copies were made in the normal 2-track  $\frac{1}{4}$ in tape mode so

that the mono information of the signals was identical to a single channel modulation of the conventional stereo recording procedure. Consequently each of these seven tapes contained three kinds of signals, each recorded in seven level stages. It follows that there were 21 takes, each of 30s duration, (60s for the double-tone signals) altogether  $3 \times 7 \times 7 = 147$  takes.

The distortion products were measured in the customary way, harmonic distortions by filtering out the second and third overtones of 1kHz by means of a switchable  $\frac{1}{3}$  octave bandpass filter, the double-tone side bands (of  $DT_2$  as  $f_2 - f_1$  and the  $DT_3$  side bands as  $2f_2 - f_1$  and  $2f_1 - f_2$ ) by means of a narrow band-search frequency analyser.

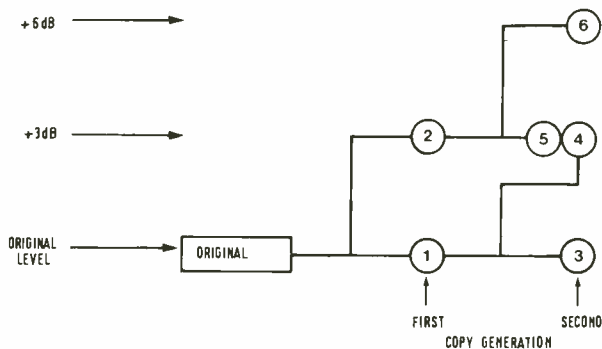
Finally, for optimum simplicity, the intermodulation products were measured using the demodulation principle, this method being permissible for tape distortion products but not for measuring disc playback distortions. In using this method the intermodulation products,  $IM_2$  and  $IM_3$  are measured as a sum which is permissible in this case due to the extremely small size of the  $IM_2$  component compared with the  $IM_3$  component. This fact was confirmed during a preliminary trial.

In view of the large number of curves resulting from the evaluation of the above mentioned seven tapes, the tape original distortion curves may be shown as representative embodying the best attainable tape performance (see **fig 2**).  $HD_3$  readings are shown in **Table 1**. Some conclusions, partly confirming well known facts, are as follows:

1. With regard to the tape *PEM*



FIG. 1  
PATTERN OF COPY GENERATIONS



468, the onset of tape compression may be observed just above +9dB (ref 320nW/m), fig 3.

2. Depending upon the degree of compression due to overmodulation, the HD<sub>3</sub> distortion products increase more sharply than the squared level values, this being the rule in the normal range.

3. Even total magnetic saturation does not result in increasing HD<sub>2</sub> figures.

4. It is insignificant whether a second tape copy is made 1:1 from the first +3dB copy, or a +3dB copy is made from the 1:1 first copy (ref fig 1, ②→⑤ or ①→④).

5. The distortion increase resulting from the step — original/1:1 copy — is approximately the same as would result from increasing the level of the original by 3dB. This increase becomes smaller with the copy ordinal number.

6. The correlating curves of the three measuring methods show a satisfactory agreement.

Due to close similarity of the distortion product figures between copies 4 and 5 seen in Table 1, copy 5 was excluded from further consideration. Subsequently, the six tapes produced, ie the original and copies 1 2 3 4 and 6, were transcribed onto 12in LP's in such a way that one LP side always related to its copy number.

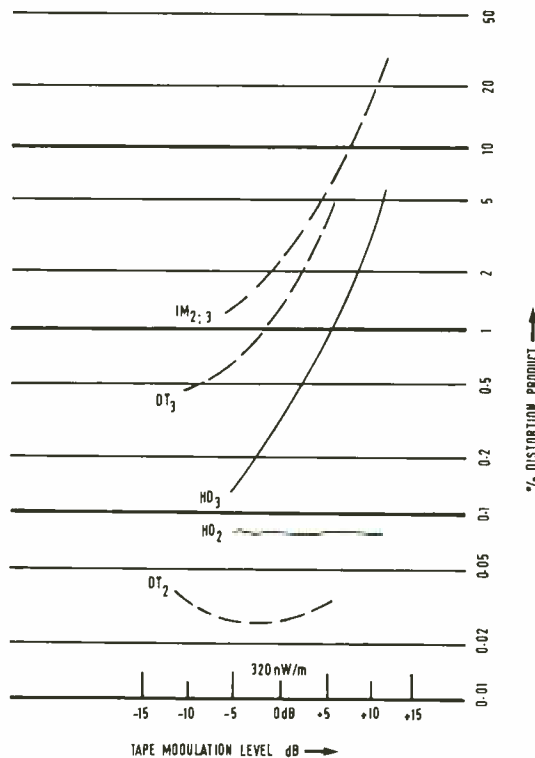
These transcriptions also included groove radius dependent distortion product increase. With regard to the disc playing time limits, each of the

3x7x6=126 takes had to be shortened to 1/5 of its original time. This made it possible to transcribe every series of 3x7=21 short signals in the outer, middle and inner groove ranges respectively. This resulted in 63 signals on each side and 6x63=378 signals on all six LP sides, all of which had to be transcribed and replayed for evaluation after processing.

Bearing in mind tape modulation compression, the transcription level was chosen in such a way that the third level stage before the last in the sequence coincided with a disc level of -2dB (0dB=8cm/s peak at 1kHz) and consequently the maximum tape level coincided with a disc level of +4dB, assuming no tape compression. Naturally, the maximum disc level of +4dB is not reached when transcribing the heavily overmodulated passages. It would be quite pointless to choose a higher maximum disc level than +4dB due to the geometrical playback problems that would result. The processed transcriptions resulted in six LP sides, ie three LP's.

It would have been desirable, in the interests of absolute completeness, to combine every tape level stage of the above mentioned six tapes with every possible disc level related to the three groove diameter ranges — outer, middle and inner. However, such thoroughness would have resulted in an immense quantity of separate information pieces

FIG. 2  
DISTORTION PRODUCTS OF THE VIRGIN TAPE MODULATED



such as to overwhelm the evaluator and would have made presentation and assimilation of results very difficult. So it was decided to restrict the investigation to measurement of HD<sub>2</sub> and HD<sub>3</sub> at 1kHz in the outer, middle and inner groove diameter ranges and to display the results as HD<sub>2</sub>+HD<sub>3</sub> curves, as this seemed to us the best prospect for obtaining facts and conclusions.

In order to study and confirm the behaviour of disc distortion without the influence of tape distortion (ie the situation with direct disc re-

ording) we prepared another LP side using 1kHz sine signals transcribed directly from a generator separately into both stereo channels; the level steps being adapted to the previously cut six LP sides, ie the level stages of this test recording were: -14, -11, -8, -5, -2, +1 and +4dB (ref 8cm/s peak).

The evaluation of this direct to disc test recording (as well as of the previously mentioned six tape to disc LP sides) was carried out by

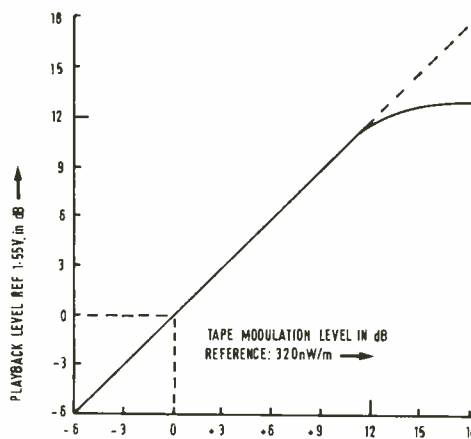
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TABLE 1  
Test tape

Test tape	Sign	Level stage number			
		3	4	5	6
Tape original		±0	+3dB	+6dB	+9dB
1:1 first copy	(1)	0.32%	0.6%	1.4%	2.5%
1:1 second copy	(3)	0.7%	1.2%	2.5%	4.5%
		1.1%	2.0%	3.5%	6.5%
+3dB first copy	(2)	+3dB	+6dB	+9dB	+12dB
+3dB copy from (1)	(4)	1.0%	2.0%	3.6%	7.0%
1:1 copy from (2)	(5)	1.5%	2.8%	4.5%	9.0%
		1.7%	3.0%	5.0%	9.0%
+3dB copy from (2)	(6)	+6dB	+9dB	+12dB	+15dB
		2.3%	4.4%	8.0%	15.0%

Note: Nominal level (dBs) ref 320nW/m

FIG. 3  
TAPE COMPRESSION, AGFA PEM 468



# Distortion - an investigation

**TABLE 2**  
Groove dia.

	-5dB (%)	-2dB (%)	+1dB (%)	+4dB (%)
Outer	1.2/1.1	1.6/1.4	2.1/2.0	2.8/2.6
Middle	1.2/1.3	1.7/1.7	2.3/2.5	3.2/3.8
Inner	2.5/2.1	3.2/2.8	4.4/4.5	6.5/7.0

Note: ref 8cm/s peak

using both the top *V15 III* pick-up cartridge and the good medium quality pick-up cartridge *GP400/II*.

In spite of considerable quality differences, both cartridges yielded nearly equal distortion figures at 1kHz (figs 4 and 5) it seemed that the type *GP400/II* was, at 1kHz, even slightly better due to its vertical tracking angle which lies well within the IEC recommendations of 20°(+5°, -0°), in contrast to the *V15 III*.

Table 2 gives a list of the more important  $HD_2$  readings measured from the direct to disc recording using a *V15 III* pick-up, left/right channels are shown respectively. Contrary to the direct to disc transcriptions, the six sides transcribed from the test tapes (original and copies) are left-channel modulated only.

The curves shown in figs 4 and 5 and figs 6 to 17 allow the following deductions to be made:

1. The second order distortion products ( $HD_2$ ) behaved typically for regular disc playback even when the signals were transcribed from a test tape.
2. The typical third order tape distortion products are essentially transmitted through the disc medium, partially, in connection with irregularities caused by combination products mixed with residual disc errors and noise, as it is believed.
3. Even total tape saturation (copy 6) does not result in higher second order distortion products ( $HD_2$ ).
4. In the low level range the expected curve shape is partially

superimposed upon by disturbances so that the beginning is less steep than the end at high levels.

5. Especially because of the level-linear increase of the second order distortion products, the rise of the sum curve  $HD_2+HD_3$  is more or less linear where  $HD_3$  readings are smaller than the  $HD_2$  readings (root of the sum of both squares).

6. Because, in our test series, the typical disc playback distortions do not exceed a limit of 8% (figs 4 and 5), the influence of groove diameter is masked more and more with the increasing copy order number and increasing level, ie in this case the three curves belonging to the outer, middle and inner groove diameters converge progressively (figs 12-17).

7. From the examples realised by PolyGram it can be seen that, even in the case of the tape original transcriptions, the total harmonic distortion for the inner groove diameter reaches the 3% limit at a tape level of 6dB above 320nW/m. In the case of the first 1:1 copy transcription, the distortion already exceeds 3%. In both examples the disc level was -2dB (ref 8cm/s peak). Choosing a disc level of +4dB, as is current practice today, harmonic distortions reach values as high as 7 or 8%.

## Further investigation

It was felt that the above investigation into non-linear distortion products resulting from measuring signals could usefully be extended to include some properties of the

human ear. However, since the human ear is accustomed to hearing natural sounds and noises which, even in their pure state, are accompanied by their own harmonic and non-harmonic overtones, it was decided to record passages using certain musical instruments to aid further investigation.

For the best possible correlation to the preceding measuring signals special recordings were made as follows:

- 1, solo flute; 2, solo trombone; 3, piano music of solemn character; 4, piano music of more dynamic character; 5, horn duet; 6, muted trumpet duet; 7, struck triangle notes.

The choice of solo and duet passages with a limited frequency spectrum presented an opportunity for listening to distortion products both in a higher range (harmonic distortion products) and in a lower range (IM and difference tone products) than the musical modulation itself.

The approximation in character of the musical signals to the steady state measuring signals was, however, less than perfect due to the continual variations in level and overtone spectrum content of the former.

Nevertheless, the specially made mono recording for the above seven musical passages was adapted as far as possible to the measuring signals by in particular, using the same seven discrete level steps as before, ie -6, -3, ±0, +3, +6, +9 and +12dB (ref 320nW/m). This was achieved by individually adjusting 7-track amplifiers of a 16-track recorder so that each music passage had to be played once only.

Consequently, we had seven passages each in seven level stages totalling 49 takes (each of 15-30s duration). This sequence of 49 takes was then copied to the same pattern as the measuring signal tape original (see fig 1) so, as before, we had six musical sample tapes to be transcribed onto six LP sides. Because it was impossible to shorten such musical samples, we had to abandon our intention of transcribing each sequence onto one LP side three times, ie in the outer, middle and inner groove diameter ranges.

After processing we obtained three further LP's for aural evaluation.

During a pre-selection it was felt that the requirements for completeness had been fully met by transcribing all seven level stages of the seven music passages, but that it was sufficient to listen to the third, fifth, sixth and seventh stages only in order to observe the progress of deterioration and to avoid listening fatigue.

When carrying out a test presentation of music samples it is recommended that a random method is used rather than a given sequence in

order to avoid any subjective biasing of results. Moreover, it was, of course, essential to ensure that the same listening level was used for all samples when making these quality assessments, by reducing the loudness by the same amount as the level step on the disc increased — stages 3-5 by 6dB, stages 5-6 and 6-7 by 3dB each.

The playback quality (ie freedom from distortion of each sample in the four finally selected level stages) had to be judged by the listeners who noted their scores on our prepared questionnaire under the following well-known classifications: 10, unobjectionable; 8, not disturbing; 6, already disturbing; 4, disturbing; 2, very disturbing; 0, very severely disturbing.

From a first preliminary test the following points were noted:

1. It is rather difficult, among a group of people, to establish a common starting point so that, for example, they all rate the tape original performance as unobjectionable except for the last two level stages on the disc. This is due to varying subjective tastes regarding what constitutes a perfect recording and/or ideal playback quality.
2. Similarly, it is almost impossible to answer the question 'How bad is bad?'. This means that there is a problem with scoring at the negative end too.
3. A particularly obvious example supporting point 2 is the case of certain brass instruments producing brilliant sounds with high overtone content which can be mistaken for a certain kind of distortion.
4. Making a synopsis derived from the questionnaires so far completed, it is beyond doubt that the last (consequently the highest) level stage of +12dB is unacceptable, even playing back the transcription of the music passages made from the tape original.
5. Similarly, the performance of the penultimate level stage (+9dB) played back from the first 1:1 copy record is still not acceptable.
6. Only when reaching the third before last level stage (+6dB) did the 1:1 copy record playback quality become tolerable. This means that the +6dB mark (above 320nW/m) should be the maximum level for a tape mixed down from a multitrack original, modulated itself not higher than 6dB above 320nW/m.
7. The tape level limit quoted in point 6 however, seems to be dependent on the kind of musical instrument recorded (consider point 3 too).
8. Finally, it is plausible that the modulation level limits mentioned in point 6 may be shifted upwards in cases where, instead of program material consisting of instrumental solos or duets, there is a full orchestral arrangement which would partially mask the distortion products.

PLAYBACK DISTORTIONS OF A VINYL RECORD MODULATED BY DIRECTLY RECORDED 1kHz SINE WAVES, RECORD REF 8cm/s PEAK

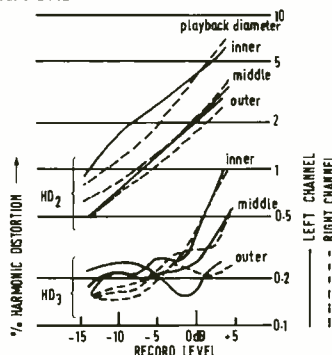


FIG. 4 V15III PICKUP

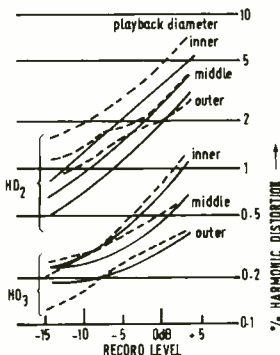


FIG. 5 GP400II PICKUP



FIGS 6-17 PLAYBACK DISTORTIONS OF VINYL RECORD 1kHz/one channel modulated by tapes

PICKUP TYPE V15III

PICKUP TYPE GP400II

PICKUP TYPE V15III

PICKUP TYPE GP400II

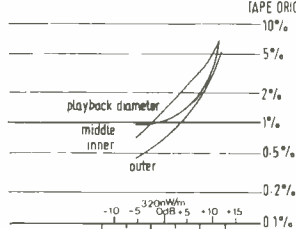


FIG. 6

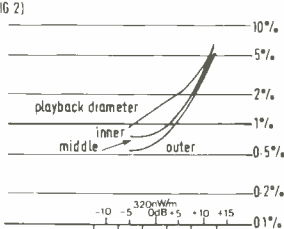


FIG. 7

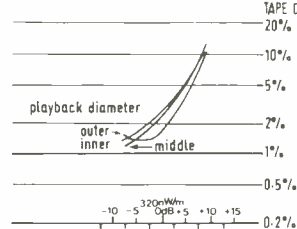


FIG. 12

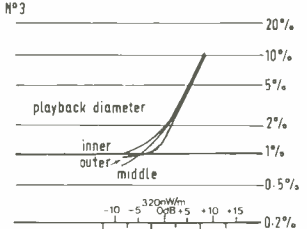


FIG. 13

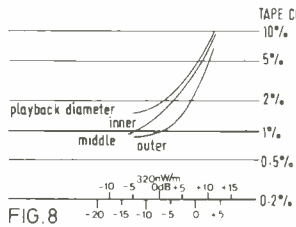


FIG. 8

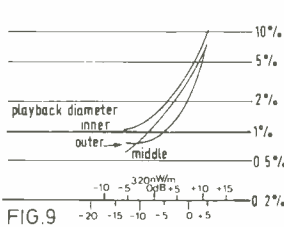


FIG. 9

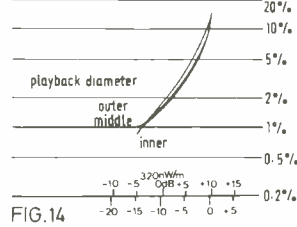


FIG. 14

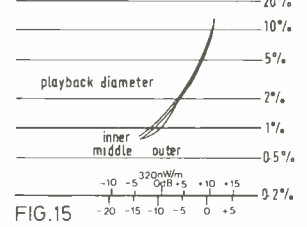


FIG. 15

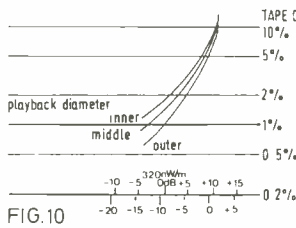


FIG. 10

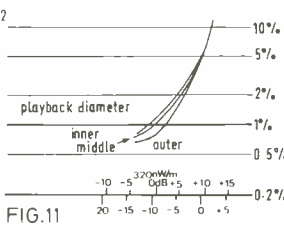


FIG. 11

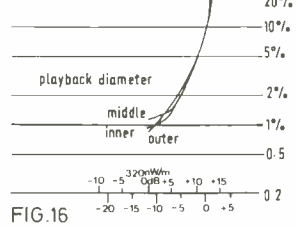


FIG. 16

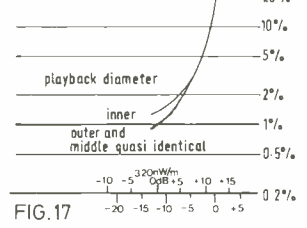


FIG. 17

(ABOVE AXIS) dB TAPE MODULATION LEVEL  
(BELOW AXIS) dB RECORD LEVEL, REF 8cm/s PEAK

TOTAL HARMONIC DISTORTION (%):  $H_{02} + H_{03}$

**Acknowledgements**

The Authors wish to express their appreciation to Mr Gunter Bushke, PhonoGram/Hamburg, for stimulating this investigation and producing the music passages.

This paper was presented at the 62nd Convention of the Audio Engineering Society in Brussels, and is reprinted with permission.

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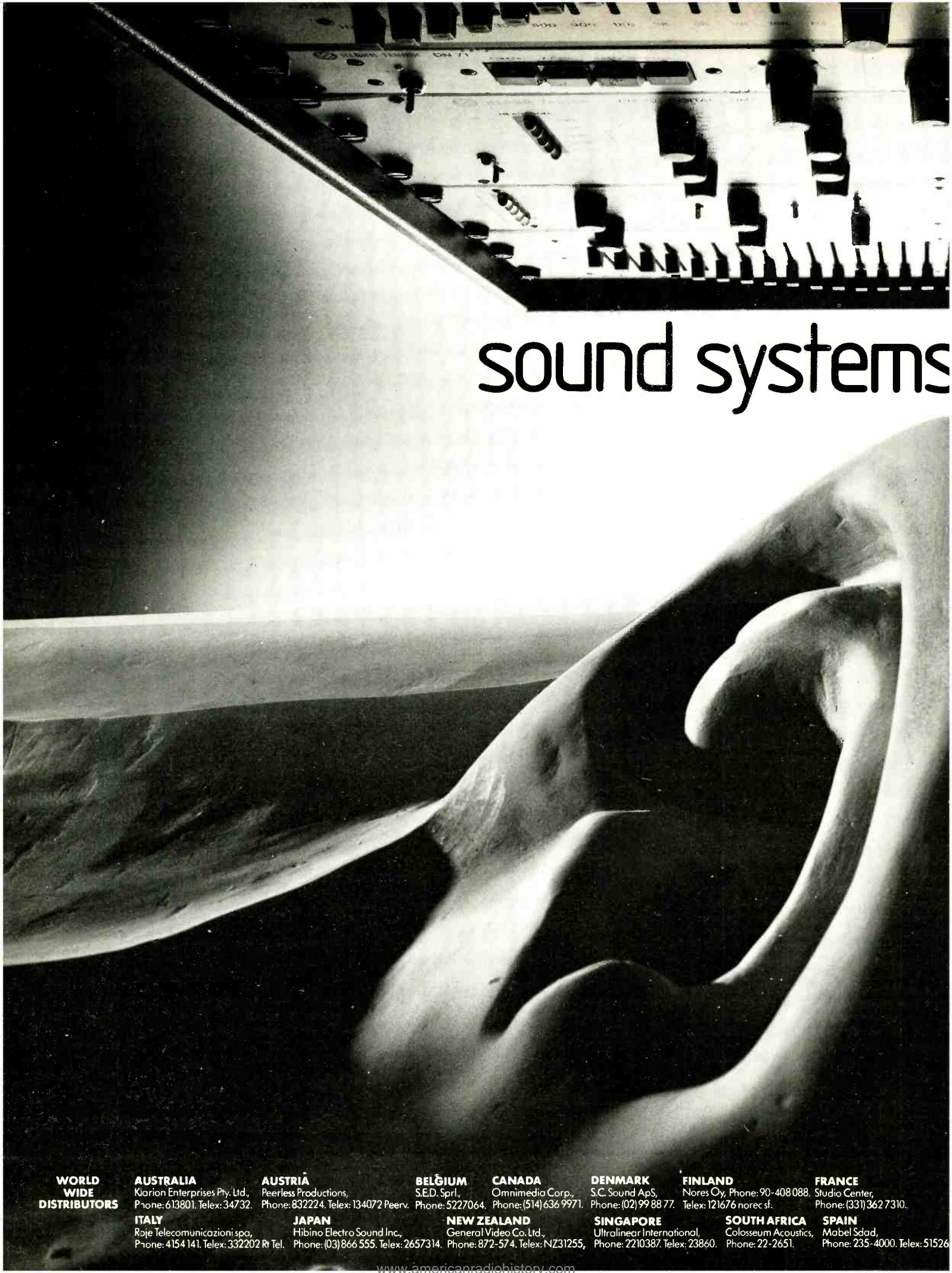


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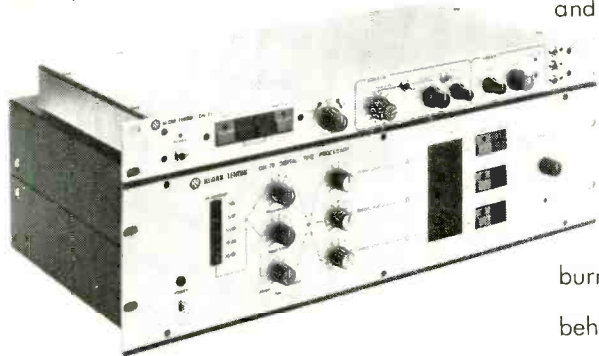
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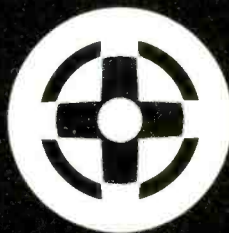
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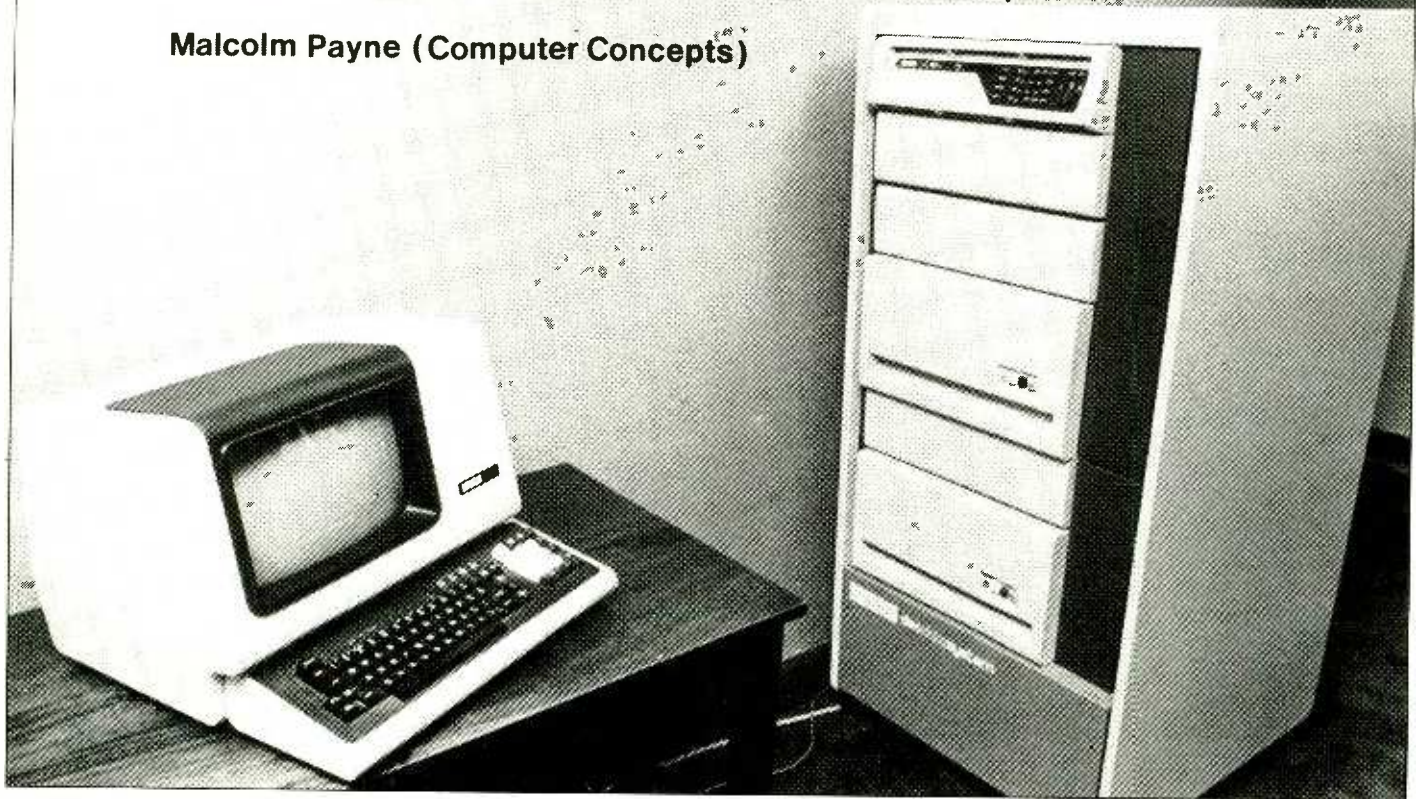
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# Computers in the studio

Malcolm Payne (Computer Concepts)



OVER THE past few years, small business and mini-computers have become available for only a few thousand pounds, a fraction of the cost 10 years ago, and these are beginning to find applications within the recording studio, to look after the administrative and accounting functions, so vitally important to the successful operation of a studio. Computer systems can also provide numerous benefits to both the studio booker and accountant.

For the studio booker, the system operates as an electronic diary. To place a booking the date(s), studio and times required are entered via a visual display unit. At this point, the computer responds with availability details — should any required times not be free then alternative slots are suggested. On acceptance by the computer, all remaining details of

**While computers are often used for automation in the studio, they may also undertake many of the routine administrative tasks. Computer Concepts operate a bureau service and can design systems both for studios and the music industry generally.**

the session such as client, artist, engineer, musicians required, etc. are typed in and held by the computer as an unconfirmed or 'pencil' booking. Having received the information the computer also shows the cost of the session, taking into account overtime, discounts, etc. This information may be recalled at any time, in printed form or displayed on the VDU screen, in various formats.

The computer checks all bookings daily to ensure that all imminent sessions have been confirmed in writing — a visual reminder is given

to the booker of confirmations to chase, complete with client's phone number and details. From the same initial information stored, the engineers log sheets are printed for each day's sessions, all details known by the computer being printed automatically. This is completed by the engineer and countersigned in the normal way.

Finally, on return of the log sheet the computer recalls all its information concerning a session to produce invoices on a daily basis. The only manual intervention is for the booker to enter any extras

shown on the log sheet such as tape usage, extra time worked, etc. The computer applies any discounts applicable, calculates VAT (unless the client is an overseas one) and prints the client's invoice. All tapes invoiced are recorded in the computers stock control records and reminders are given if the tape stock falls below the specified re-order level. As a final safeguard, the computer checks that the number of session sheets issued agrees with the invoices printed so that all sessions are billed and lost time sheets recovered.

As each invoice is produced, the sales ledger is automatically updated to provide all the information required regarding studio debtors. As invoices are printed daily, information supplied to the accountant for credit control purposes is always up to date. The sales ledger printout

13-APR-80		ODYSSEY SALES LEDGER				2
TRANSACTION DETAILS		APR 80	MAR 80	FEB 80	BEFORE	
PAYNE RECORDS		42				
INV	DRS191 26-MAR-80	664.12 :				
INV	DRS198 21-APR-80	506.50 :				
INV	DRS160 18-FEB-80	802.12 :	586.50			
INV	DRS161 18-FEB-80	776.25 :				
INV	DRS199 21-APR-80	362.25 :	362.25			
INV	DRS188 26-MAR-80	802.12 :				
INV	DRS192 28-MAR-80	396.75 :				
INV	DRS200 21-APR-80	414.00 :	414.00			
INV	DRS189 26-MAR-80	843.75 :				
INV	DRS190 26-MAR-80	784.87 :				
AMOUNTS	OUTSTANDING	6,422.73	1,362.75	3,481.61	1,578.37	

**STATE**





# NAB 58th Convention and International Exhibition, A Report

Angus Robertson



PERHAPS the most obvious difference (apart from size) between the American NAB and AES conventions is that the majority of those attending NAB wear suits and ties, while those attending AES tend to be rather more casually dressed. This emphasises the difference between the pro-audio and broadcasting industries, where the former tend to be owners and the latter responsible to someone else (the board). Of course there are exceptions to both. The NAB exhibition is also rather larger than those organised by the AES, and is properly held in purpose designed convention centres with true exhibition halls, rather than small hotel ball-rooms. NAB this year occupied almost 200,000sq ft of hall space (the last IBC in London was about 20,000sq ft) with some 393 companies exhibiting their wares.

Three separate conference sessions were held for radio, television and engineering, but this year there were no outstanding topics under discussion, apart perhaps from AM stereo. After over a year's delay, the Federal Communications Commission finally chose the Magnavox AM stereo system, but the decision has not been well received by the majority of radio engineers who it appears would prefer the Kahn system — apparently the Magnavox system requires a reduction in transmitter output power, and this is something that American broadcasters are incredibly sensitive about. Indeed many stations use multiband audio processors that allow heavy compression to be applied to both AM and FM signals giving an effective increase in range — and range means more listeners which means higher revenues from commercials. We hope to discuss the AM stereo question again in a future issue, when the system to be used becomes clearer.

Satellite broadcasting is also becoming in-

**The National Association of Broadcasters' annual exhibition was held in the Las Vegas Convention Centre from April 13 to 16. 'Studio Sound' here covers the audio aspects of the exhibition, while the June issue of our sister magazine, 'Video', examines the major video developments.**

creasingly important in America, although, primarily for television at present. RCA *Satcom 1* provides 24 transponders ranging in frequency from 3,720 to 4,180MHz, each transponder providing a single television channel. RCA did launch a second satellite for the television industry last December, *Satcom 3* (*Satcom 2* sends telephone conversations to Alaska), but unfortunately this was lost without explanation (it was rumoured that the ground controller kept his finger on the thruster button rather than long, sending it right out of orbit). Until a replacement can be launched, RCA has managed to lease 11 transponders from an AT&T *Comstar* satellite, and this should meet the immediate demand for channels (including allowing Time-Life to broadcast several hours of BBC television programmes each evening to American viewers). Currently, relatively high gain antennas are required (about 9 to 12ft) which would not be economical for home use, so it is cable television operators who receive the programmes (a variety of subscription TV, sport, religious and ethnic programming). In addition to television, a number of the transponders also have 'auxiliary services' which are audio sub-carriers above the video transmitting 'good listening music', and background music.

## Cart machines

D-B Electronics Inc. of Maryland, introduced a new two deck cartridge machine which features individual electronics for each deck (interchangeable), simultaneous record and replay, manual fast forward standard, plug-in board option for secondary and tertiary cues, indirect drive DC servo Hall effect motor, low voltage air damped solenoid, front panel azimuth roller adjustment, accepts NAB A and B cartridges, jumper conversion between 110 and 220V. The *DB-2000* is available in mono or stereo, as a reproducer or with record facilities, and with single or three tones, prices varying from \$1,650 to \$2,860.

Eumig, the Austrian company, were showing the *FL-1000* microprocessor controlled *Compact* cassette deck that may be interfaced to most home computers. The *FL-1000* is a three head front loading deck, has front panel bias level controls for ferric, chromium and metal alloy tapes with a built-in 'Computest' facility with twin LED's to indicate when the correct control setting is achieved. Level metering is with twin horizontal reading fluorescent displays, while the microprocessor provides locate functions and allows the cassette deck to be interfaced to most 8-bit parallel buss computers such as the CBM PET, Apple, Radio Shack, etc. Each deck contains a diode matrix that provides a unique address for up to 16 machines all operated by the same computer. All machines will inter-operate with each other when appropriate index points are reached on each tape, and the computer can generate an index programme giving the title and index positions of the material recorded on each cassette, this then being recorded on the first few inches of the cassette tape itself. Eumig were promoting the deck as part of an auto-

70 ►



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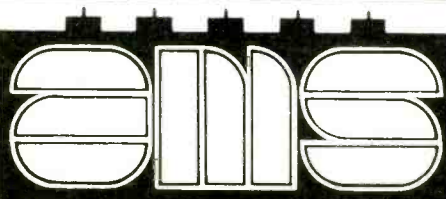
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are rather more important in American radio than in Europe, primarily because European governments (or their appointed agencies) severely limit competition so that few stations have access to large revenues, whether it be government supplied (or controlled) or advertising, so that these stations have little competition and are not encouraged to become particularly efficient — indeed one or two stations are now making such large profits that observers ponder how much larger they could be if the stations weren't so overstaffed. But in America, competition is all, and staff cost money so many stations have automation systems that allow all the music, commercials and links to be preprogrammed, and merely supervised by an engineer. Many programmes are recorded on spools of 1/4 in tape (or even come from specialist companies pre-recorded), while discs are often originated from cartridge, as are commercials. There are basically three types of such automation cartridge replay machines: those like the **IGM Instacart** mechanism which has up to 12 cartridges stacked above each other operating from the same capstan but under individual control or the **SMC Caro-Stat** which also has 12 carts but on their side; mechanisms providing random access to a small number of cartridges held in a moveable track of some form which rotates to find the required cart, this being then loaded into the mechanism such as the **IGM Go-Cart II** which holds up to 72 carts with a single playback deck or the **SMC Carousel** which holds 24 carts — both are limited and usually require duplication

in the station to provide any form of versatility; and then there is the latest product from **International Tapetronics Corp**, the **1K Library Storage System**.

While the previous systems were entirely purpose built, the **ITC** incorporates standard **Series 99** cartridge machines and two large rotating storage cylinders. The two cylinders hold a total of 1,024 standard carts, carts being removed from the cylinders by one of two transfer mechanisms which then insert them into **Series 99** cartridge machines (up to 12 in two stacks for each transfer mechanism) with a total of 24 playback channels. If one transfer unit fails, the programming is automatically distributed among the playback units served by the other mechanism. The **1K** will handle four separate programming operations simultaneously for multiple stations or studios, all under external control. Each cartridge has a bar code sticker attached for visual identification by the system in addition to information from the **FSK** logging track. A reception unit accepts a stack of new cartridges which are first checked for correct cue tones and then loaded into one of the cylinders automatically, noting the location for recall. The **1K** is self diagnosing and self healing for unattended operation, and can be operated from the built-in controller, or externally, either manually or automatically. While the **1K** itself measures five feet cubed, it may be remotely located and feed up to four separate studios simultaneously. Price of the basic **1K** is \$65,000 with a minimum of eight **Series 99** reproducers required (at least a further \$18,000 including interface cards).

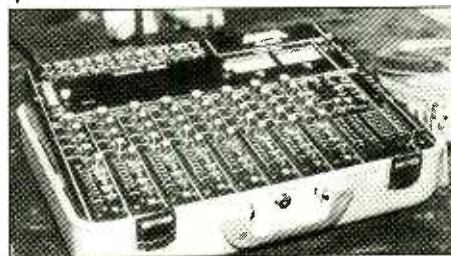
### Consoles

**Ampro Broadcasting** manufactures a range of broadcasting consoles called **Microtouch**. Intended for presenter operation, these are available either with rotary or linear faders, have five or eight channels in mono or stereo, have two inputs per channel with a five input remote selector, built-in monitor, cue and headphone amplifiers, FET matrix switching for input selection, tally outputs, and self indicating coloured key selectors. Prices range from \$2,156 to \$4,219.

**Auditronics** were showing an established console, and a new product. The **Grandson** recording/remixing/production/on air console is an expandable modular console designed for up to 18 or 26 channels and 16-track mixing, will provide separate mono and stereo feeds, monitor muting, will provide four separate multitrack outputs, and provide mixdown from 16-track recordings. The new **700 Series** is available in three basic models, one with a maximum

capacity of 24 input positions and 16-track outputs, with stereo outputs, four effects outputs, two foldback outputs and monitoring outputs, with 24 VU meters; the second model has a maximum capacity of 36 input positions, while the third model lacks a patch panel with reduced meter area. All models include VCA input grouping faders with six subgrouping masters, Trans-Amp balanced transformerless inputs, and transformer isolated outputs.

Although perhaps better known for lighting equipment, **AVAB America Inc** introduced the **FM800** portable mixer constructed in a lightweight aluminium case, which features eight mic/line inputs, each with selectable gain, pre-fade listening, separate monitor level from each channel, separate mono and stereo busses, with level and panning controls respectively, hi and lo eq on each channel, phasing reverse, highpass filter, 48 or 12V mic powering, talkback circuit to the boom man (during filming), tape start/stop, director/script monitor outputs separate from boom output, slate microphone built-in with oscillator, and twin VU meters.



**Broadcast Audio Associates** of California were showing the **System 12** and **16** broadcast mixers. These have a maximum of 12 and 16 'mixers' per console, each with up to three inputs (mic and line), stereo cueing, DC audio switching, with remote on/off, stereo and mono outputs, and slider faders.

**McCurdy Radio Industries**, a Canadian company, were exhibiting a wide range of audio equipment including the new **SS8800** modular stereo audio console which has eight channels each with two inputs, (mono or stereo line, and mono mic input modules), a maximum of three stereo output channels, two programme and one auxiliary output, complete cue, talkback and monitor facilities with remote dc functions, P&G faders, optional PPMs, wide number of other options.

**Listec Television** were showing the **Richmond Sound Design M82BX** expandable broadcast mixer with eight inputs and two outputs. A portable model, each channel has an attenuator, foldback, 3-band eq, echo send, linear fader, cue button providing pfl and solo, three inputs per channel, optional parametric and dual foldback.

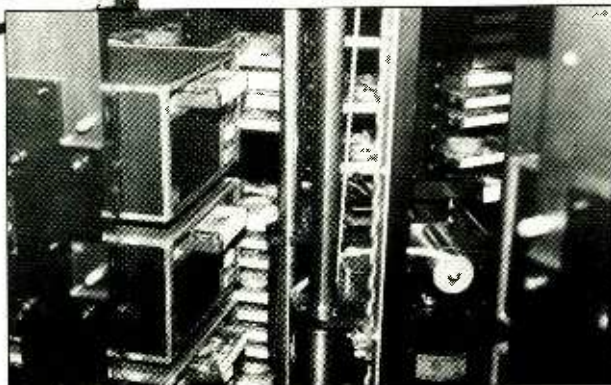
### Signal processing

NAB has never been a show for British audio companies, but this year the turnout doubled — to four! (with perhaps 10 British companies total). **Neve** were showing their range of consoles designed for broadcasters, **Audio & Design Recording** showed a 'fine line' of signal processing equipment, **Audio Kinetics** demonstrated the **Q-Lock** synchroniser while **Advanced Music Systems** showed the latest **DM-DDS** digital disc mastering delay line available with 1.2s delay standard, extendable up to 10s. **AMS** also produce specialised delay lines such as profanity delays where the delay slowly builds up

72 ▶



ITC 1K cartridge storage system. Right: rotating storage cylinder





# The Strong, Silent, Types.

Atlantex products are built for a tough, professional life. They are well-designed and made with the finest components for clean, noise-free circuitry.

Ashly audio processing units represent the technology of the future. The well-designed, easy-to-use layout allows precision control over the audible spectrum. Shown is the SC-50 peak limiter compressor. Other 19" Ashly units are parametric equalisers, electronic crossovers, pre-amp/processors.

Sescom, the world's finest audio interfacing units, are renowned for high quality products, combined with ruggedness and reliability. The wide range of models includes D.I. boxes, audio transformers, cable testers, and many more useful studio accessories.



The Furman range includes mono and stereo parametric equalisers with pre-amps, tunable crossover/bandpass filter, and (shown here) the neat reverb system with limiter and equaliser. The simple layout and wide range of control gives full scope for creative engineering at a price which gives great value for money.

Built to the highest standard, Whirlwind leads are made with top quality Belden cable, with Switchcraft and ADC connectors. Available from 1' patch cords to 24-input multicores, they are sturdily constructed to give years of trouble-free service.

# Atlantex

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Atlantex Music Ltd., 34 Bancroft, Hitchin, Herts SG5 1LA.  
Telephone 0462 31511 Telex 826967

## NAB Report

after the dump button is pressed, and have supplied a 12s delay to the BBC which is used for live editing of broadcasts. For instance, during a long speech such as the British Budget, the problem is to know when to take the speech live, and when to provide background information from the studio — often one then misses something important when taking the speech live again. By delaying the speech for 12s, it is possible to know in advance what is being said, and put the speech back on-air in time to broadcast important points almost live for the listeners.

**Circuit Research Labs** of Arizona, manufacture a range of audio processing gear for AM and FM radio, the range including the *PMC300A* peak modulation controller for AM with precision modulation control, adjustable pre-emphasis, lowpass filter, and phase/amplitude correction; *APP300* audio preparation processor with phase and gain processing, peak overload protection, and adjustable recovery freeze; the *SEP400A* spectral energy processor with dynamic controlled actions and adjustable size process window; *SMC600* stereo FM modulation controller with precision modulation control, adjustable pre-emphasis and lowpass filter; and the *CC300* composite controller which has final control over the baseband input of an FM exciter.



Designed specifically for the production of commercials, the *Lexicon Model 1200* audio time compressor is used in conjunction with a variable speed tape recorder to provide constant pitch while the speed is changed within the range 0.5x to 2x original, recommended 0.9x to 1.25x for broadcast applications. Lexicon suggest that compression of time allows more 'message' to be squeezed into each commercial, with increased impact. A keypad is used for entry of speed factor, percent play time and pitch shift ratio, while pulse rate or dc servo tape machine may be controlled by the *Model 1200*. Other functions include timer function to determine playback time, auto calculation of speed factor based on actual and desired playback times, and frequency contours on input and output to optimise sound quality.

**Urban Associates** introduced the new multi-band *Optimod-FM Model 8100A* processor that claims to provide 'any format with the most favourable balance between loudness, brightness and processing side effects'. The *Model 8100A* includes an input conditioning filter, a crossover, separate compression for 'master'

above 200Hz, and bass below, the combined signal pre-emphasised and then fed to a high frequency limiter, and finally a frequency contoured sidechain overshoot compensator (patent pending), the whole system having two linked chains for stereo.

### Radio microphones

**Cetec Vega** manufacture a wide range of wireless (radio) microphones which are optionally available with *Dynex* dynamic expansion using a 2:1 compander system to provide a claimed 90dB dynamic range and frequency response from 40Hz to 15kHz  $\pm 2$ dB. Unlike many other makes, the new *Models 80* and *81* hand-held radio mics have an antenna incorporated into the microphone housing so there are no hanging wires or protruding stubs. The *Model 80* features a E-V *EV-671* capsule, the *Model 81* a Shure *SM-58*, range is up to 1,000ft in the band 150MHz to 216MHz. Either diversity or non-diversity receivers are available. Other models include the *Professional I* and *II* which are pocket-pack non-diversity and diversity systems respectively, while the *Traveller I* has a packet-pack transmitter but portable receiver.

**HM Electronics** introduced several new products including the pocket sized *PR-1* 49MHz band receiver which includes dynamic expansion to provide a 90dB dynamic range and which may be used for talkback applications or as a half duplex system. *Field-Pac* is a four channel wireless microphone system comprising four *Flat-Pac* receivers mounted inside a sturdy steel box with an antenna diversity box, storage space for dipole antennas and leads and monitoring facilities, and designed for use with up to four transmitters for film or EFP applications. HME has also developed four new UHF systems operating from 400 to 470MHz and which incorporate dynamic expansion, including pocket pack and hand held transmitters, and studio and portable receivers.

### Intercoms and headsets

**AVAB America** was showing the *HS-1* intercom system which does not include a central power supply, but has each belt pack separately powered by two 9V batteries which give 100 hours of service and are provided with LED battery strength indication. The beltpack has a volume control, visual and audible call signal, DIN connectors for headset and a short junction cable leading to an XLR tee connector for stringing stations together — this means cables and connectors don't weigh down the belt pack.

**Farrtronics Ltd**, from Canada, manufacture a range of professional intercom systems that offer a variety of facilities from panel mounted or freestanding stations. All stations incorporate microphone and loudspeaker amplifiers, and are connected to a central 'matrix' via 25 pair cables. Stations are available with up to 24 or up to 42 buttons, headset stations without any calling facilities are available, a hybrid allows the systems to be interfaced to a 2-wire system, while a dual listen amp with programme interrupt is ideal for on-air presenters who normally listen to programme, but who may be sent talkback when required. Interconnection of stations is by hard wired matrices — the semi-programmable matrix is factory wired while the programmable matrix uses plug-in programme boards with soldered jumpers. Farrtronics also produce a belt-pack intercom system with separate power supply.

### TOWARD BETTER UNDERSTANDING ...

The *Model 4240 Active Equalizer* is a hybrid of ONE-SIXTH octave filters, which are concentrated in the *speech intelligibility* region between 250 and 2000 Hz, and broader bandwidth filters on either end. The intended application of the *Model 4240* is the equalization of sound reinforcement systems employing *voice* as the main program material as in corporate boardrooms, meeting halls, legislative chambers and courtrooms.

Extremely high Q room modes which cause feedback, ringing and loss of intelligibility are excited by these mid-range frequencies. Equalization to suppress these modes using one-third octave or broader bandwidth filters can attenuate other frequencies necessary to *voice intelligibility*. Loss of intelligibility can not be compensated by increased gain.

By comparison the ONE-SIXTH octave filters used in the *Model 4240* have TWICE the resolution as one-third octave filters. It is possible to equalize a sound system and affect only HALF as much program material.

The *Model 4240 Equalizer* is highly cost-effective for these applications since it is built on the same chassis as our one-third octave models. It has 27 filters like the one-third octave units, but 19 are ONE-SIXTH octave and concentrated in the midrange. The broader bandwidth filters on either end are more than adequate to shape the extreme low and high ends of the spectrum.

Our new *System 200 Signal Analyzer* features field interchangeable, plug-in filters and may be equipped to match the *Model 4240 Equalizer* making ONE-SIXTH octave adjustment as convenient as one-third octave.

**Remember it, Where Voice Clarity is Important**

**White Instruments, Incorporated**  
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PHONE AREA 512/892-0752

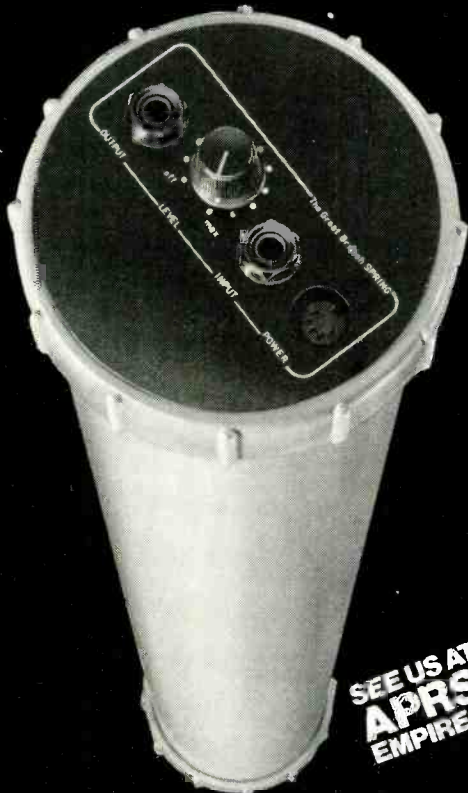
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# THE GREAT BRITISH SPRING

Spring Reverbs are notorious for the odd sounds that they tend to produce. Many manufacturers have tried to remedy this with limiters, equalisers and the like. In the design of 'The Great British Spring' we took a different approach. We started out with a custom spring unit that sounds good without any fancy electronics. The unit simply has a variable line input and a stereo output.

The s:x spring paths produce a natural sounding reverberation that is full at the low end and sparkling on the highs. But don't take our word for it. Fifty pence brings you our demo cassette, or drop in and hear it live.



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Coles Green Rd. London NW2. 01 452 1980.

# Rebis

## About TIME too



The RA200 Series Delay System rationalises the complexities of time domain processing into an expandable modular format capable of producing all the effects associated with its more expensive and inflexible competitors.

RA205 ADT/Delay (80ms).....£195  
RA208 Modulator (Dual O.P.).....£ 62  
RA209 Mixer.....£ 62  
RA200 Rack & PSU.....£158

● Complete Delay Package: 2xRA205, 1xRA208, 1xRA209 £464

For full details of the Delay System and other new RA200 Series modules contact:

Rebis Audio, Kinver Street, Stourbridge, West Midlands  
DY8 5AB, England. Telephone: Briarley Hill (0384) 71865

## NAB Report

**McCurdy** produce the *CS9000* series intercom systems which use solid state balanced cross-point switching with either 10x10 or 20x20 matrices (30x30 to order), input amplifiers accepting carbon, dynamic or line inputs, AGC, 3W output amps and regulated power supplies.

**R-Columbia Products** provide amplified cameraman headphones that directly replace carbon types, using a dynamic mic with an IC amp to provide a rather higher level than carbon mics, and also includes a headphone amplifier, both operated from an integral 9V battery to make them independent of the existing system.

**RTS Systems** manufactures a wide range of intercom systems, and introduced the *Series 4000* IFB system. IFB has two meanings — interrupted feedback or interrupted foldback and the terms programme interrupt or switched talkback are also used. IFB permits the director to talk to an on-air announcer while interrupting the programme or feedback normally being heard, and in practice there may be several different presenters to whom separate communication is required. An RTS IFB typically comprises up to four control panels expandable in blocks of four pushbuttons, a central electronics unit and belpack user stations.

**Television Equipment Associates Inc** were showing a number of **Bang-Campbell Associates** intercom products. These include versatile intercom systems with up to five interphone channels and a variety of stations including a director's console, headset station and belt box, and mike/speaker panels. British Racal Amplivox headsets are normally supplied as standard. BCA also produce IFB cueing systems for up to eight channels with either hard wired earpieces, the *TWIP* induction coil receiver/earphone which fits totally within the ear and a small induction transmitter positioned up to 16in away, or the BCA wireless IFB receivers which use a 50kHz FM loop induction system transmitting to a small belpack receiver which may have a hard wired earpiece or the *TWIP* earpiece.

### Other lines

**Anvil Cases** produces a vast range of standard travel cases which are available in a variety of styles. The retail price list is 70 pages long and quotes prices for almost all types of transportable video, AV and standard audio equipment, by product types. Cases are approved by the Airline Transport Association and are also available as rack mount types.

**Audio Techniques Inc** introduced the *Micro Amp* series which includes dual microphone amps with 72dB gain and various output configurations, dual line amplifiers, stereo phono amps which include a rumble filter with 18 to 26dB rejection in the 10 to 7Hz tone arm resonance range, various audio distribution amplifiers, and a stereo 10W power amplifier.

**Comrex** introduced a new studio/telephone conference integrator system which allows two telephone calls to be put on-air simultaneously. It comprises an Elgin FCC certified coupler, Comrex hybrid which converts the 2-wire telephone line into four wires, a 4-wire termination set and cut through circuitry, and the studio/telephone integrator which accepts the output

from two line sets, takes studio output, and provides the air feed. The whole system is controlled from a panel that may be separate or built into the console, which provides line faders, seize and release, cut-out and indication for each line. The package for two lines costs \$4,200.

**Dictaphone** were showing the *Series 4000* logger which is available in a wide variety of formats from four to 40 channels with a wide variety of options, one of which records a time signal on tape, and then allows auto retrieval using an auto-search facility.

**ESE** manufactures a wide range of clocks and timers for a variety of applications. The range includes standard digital clocks with optional thermometer, six or four digit timers for varying periods, up/down timers, console mounted clocks and timers, jumbo displays viewable at 60ft, programmable clocks for remote switching and master clock systems and accessories.

**James B Lansing Sound** introduced the *7510* automatic microphone mixer which comes standard as a four input module expandable to 24 input capacity, particularly suited to PA applications. Each input channel may be switched to manual level control, automatic with a background threshold/programme discriminator to differentiate between separate signals on individual microphones and common signals on all microphones, and a priority mode which mutes all channels switched to auto. A digital signal attenuator provides feedback suppression by reducing the system's output as more mics switch into circuit. JBL also exhibited the 2-way *4301* and *4301E* (self energising) broadcast monitors, the 3-way *4311* and *4313* control monitors, and introduced the *2441* compression driver with extended bandwidth and power capacity over the previous *2440*, handling 70W continuous programme over the range 500Hz to 18kHz.

**MCI** showed a wide range of products, including the *JH-45 Autolock* synchroniser which has an interesting new facility allowing auto read and write of tape counter position and 10 memory locations recorded in an unused portion of the tape (about 30s worth) for use in later sessions without the figures having to be entered manually.

**Nortronics Co Inc** was exhibiting the *QM-250* professional bulk tape eraser which has a peak magnetic strength of 1,300 gauss at ¼in spacing and accepts up to 1in tape widths.

**Studer** announced a stereo balancing unit that matches unbalanced ins and outs with consoles and phone lines, providing three stereo unbal inputs/outputs on phonos, and XLR balanced inputs/outputs with built-in amplification for level matching.

**Tektronix** introduced the new *AA501* automatic distortion analyser/*SG505* oscillator system that provides totally automatic total harmonic distortion analysis, while an option allows measurement to SMPTE, DIN and CCIF standards.

**Tri Tec Systems Inc**, of Hauppauge, NY, exhibited a range of 'audio components' including a universal line amplifier with up to 49dB gain and +30dBm bal output, a mic amp with 70dB gain with bal in and out, a 10W monitor amp, balanced input amp, eight output distribution amplifier, a 16x1 crosspoint switch card, card frame and VU meter amplifier.

In this short report, it has only been possible to cover some of the new products introduced at NAB, and we shall try and include others in **News** over the next couple of months. ■

# Amcron Professional

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Tel: 01 226 7940

R.E.W. Audio Visual,  
114 Charing Cross Road,  
London WC2.

Tel: 01 836 2372

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1 Thirlmere Gardens,  
Belfast.

B15 5ER

Tel: 0232 772491

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16 St. Alfege Passage,  
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Tel: 01 853 1819

**AMCRON** 



# Why Amcron is demanding protection money.

Over the years, Amcron has earned a peerless reputation as a pioneer in professional sound.

Amcron built the first solid-state four-channel tape recorder back in 1962. Then they developed the first stereo amplifier with direct coupled input and output.

In 1977, they introduced digital logic to the pre-amplifier and achieved another first.

But Amcron's latest first is probably the most significant of all.

The PSA-2 power amplifier is self-protecting.

A Self-Analysing circuit employs an analogue computer which constantly monitors the performance of the amplifier's critical stages.

Should the power transformer begin to overheat, an output transistor fail, or a short circuit occur, then the amplifier will automatically shut down to its 'stand-by' mode without damage to itself or to external equipment.

The protection circuitry also safeguards the PSA-2 against 'chain destruction' and damage caused by mis-matched loads.

As Dr. Mark Sawicki observed in his

review of the PSA-2:

"When reading reports of systems used by The Who, McCartney and Genesis...the Amcron name appears frequently...Why?

Well, reliability and outstanding performance are the answers.

Overall, the performance of the PSA-2 amplifier...is excellent."

Now. Given that you're spending a lot of money on a power amplifier (arguably the most crucial piece of equipment in your system), doesn't it make sense to spend a little



more on a unit which is virtually disaster-proof? We think so.

Which is why we went all out to win the sole British agency for the PSA-2. And, indeed, the whole range of Amcron audio equipment.

Drop in and see us anytime. We'll be delighted to give you an earfull.

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# Introducing a present



Once you go through a recording session with the new ATR-124 24-channel recorder by Ampex, you'll want to go through another. Because with each new session you'll discover something new you can do. Things that you can only do with a recorder that's full of features of the future.

## **ATR-124 gives you the unheard of:**

### **Time on your hands.**

Which means you can use that time to give clients more of what they're paying for—your creative skills. With the ATR-124 microprocessor-based control system, you can pre-program what you want to do ahead of time so you won't waste studio time setting things up. When their time starts, you're ready to record by touching a single recall button.

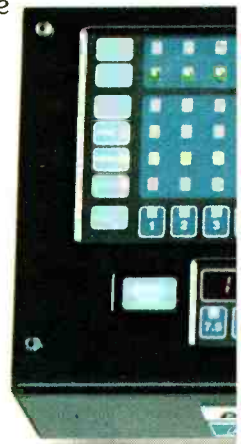
ATR-124 also lets you duplicate a technique you may have used earlier in the session without

having to rethink what you did. Just touch the memory button and it'll all come back to you. ATR-124 lets you rehearse what you've got in mind, without recording it, to make sure what you've got in mind is right. Tape can be manipulated faster which means you'll get the sound you want sooner. And the chance to try something "a little different." All because of the speed and accuracy that ATR-124 puts at your fingertips.

### **ATR-124 doesn't take away your creativity, it adds to it.**

The less time spent setting up, correcting, and redoing, the more time spent creating. And when you add features that help you create to the ones that help you save time, you've got one very potent piece of audio machinery. Take the control panel for instance. It's like nothing you've ever seen. Pushpads linked to a microprocessor give you a new level of creative flexibility. Program a setup, then change it. Then change it back, all with a single fingertip.

A repeatable, variable speed oscillator for pitch correction and special effects is built in. In addition

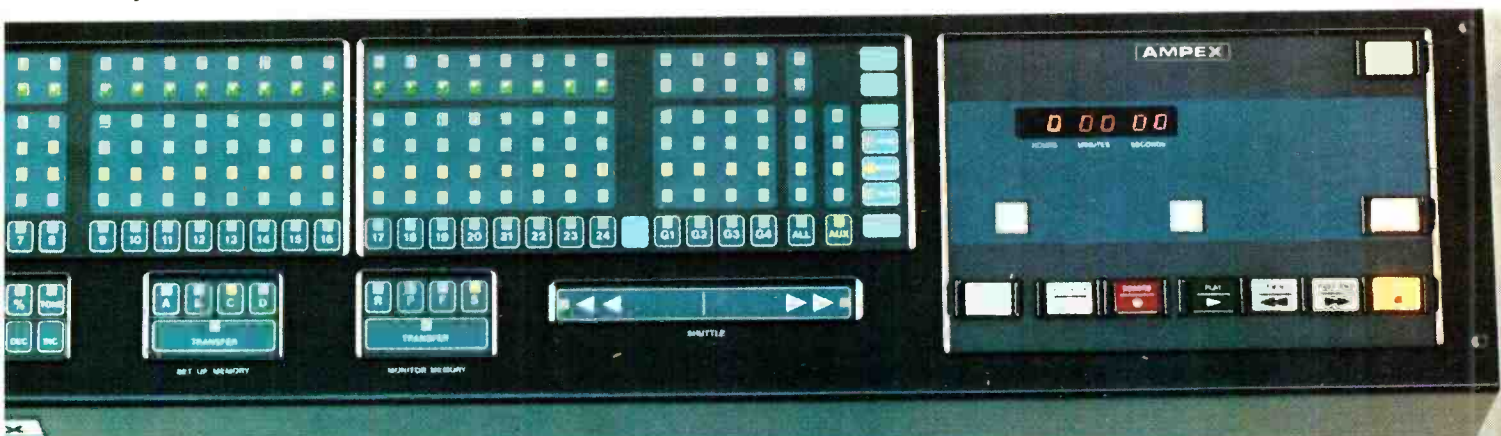




# from the future: ATR-124.

to the standard output, there is an optional auxiliary output with each channel that enhances flexibility. So don't think that ATR-124 is going to

Memory, and Record Mode diagnostics. The point is this: If you like the ATR-100, you're going to love working with the ATR-124.



ATR-124's Control Panel. Speed and accuracy at your fingertips.

replace anything that you do. On the contrary, it's going to improve the skills you have, if not help you develop some new ones.

**ATR-124 picks up where ATR-100 leaves off.** It's only natural that the people who brought you the ATR-100 should be the ones to bring you something better. ATR-124 offers you 24 channels instead of 4. You also get many new and exclusive features. The kind that have set Ampex apart from the crowd for the last 30 years. Features like balanced, transformerless inputs and outputs; a patented flux gate record head; 16" reel capability; input and output signal bus for setup alignment; membrane switch setup panel; fingertip-operated shuttle speed control; and microprocessor-based synthesized Varispeed -50% to +200% in .1% steps or in 1/4 tone steps. ATR-124 also features microprocessor-based control of Channel Grouping,

multiple 24-channel Setup Memory, Programmable Monitoring, Stay Alive

## ATR-124 options.

### As impressive as the ATR-124 itself.

With the addition of a built-in Multi-Point Search-To-Cue (MPSTC), you can rehearse edits and control five tape-time actuated events and be compatible with SMPTE time code. Separately controlled auxiliary output amplifiers with each channel provide simultaneous monitoring of normal and sync playback as well as all other monitoring modes. A roll-around remote control unit can also be added to the ATR-124 which contains all control features normally found on the main unit.

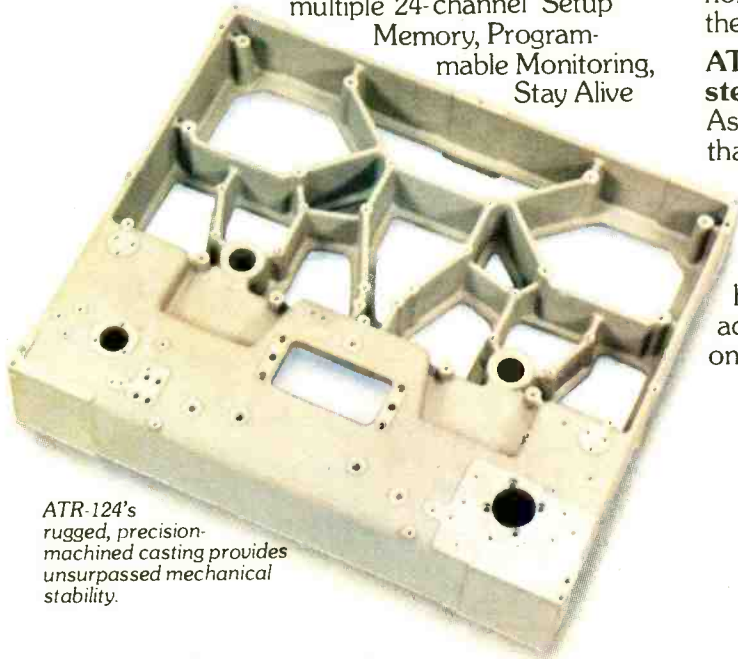


ATR-124's Multi-Point Search-To-Cue (MPSTC). Provides 100 cue locations.

## ATR-124. Your next step is to experience it firsthand.

As you scan the points we've covered, remember that you're scanning just a small portion of ATR-124's story. We haven't even begun to discuss the accessibility of key components for easy servicing and minimal downtime, or the features we've built in to give you greatly improved tape handling. To find out more, write to us at the address shown below. We'll send you a brochure on ATR-124, our latest audio effort.

ATR-124. Pure 24-Channel Gold From Ampex.



ATR-124's rugged, precision-machined casting provides unsurpassed mechanical stability.

# AMPEX

## Listen to the future

Ampex Canada Limited  
132 East Drive, Bramalea, Ont., Canada (416) 791-3100

# Survey: Noise reduction and gating

This survey is divided into two parts, the first covering two stage compressor/expander (compander) systems where the signal must be processed before and after recording, and the second part covering expander/noise gates which are single stage providing noise reduction upon replay only or when used with microphone inputs etc. We have not included compressor/limiters that include expansion since these were covered in the March 1979 survey.

## BEL (UK)

BEL Electronics, 48 Aylesbury Street, Bletchley, Milton Keynes.

Phone: 0908 641063.

UK: Don Larking Audio Sales, 50 Cheapside, Luton, Beds.

Phone: 0582 26693/27195. Telex: 825488.

## Noise Reduction Unit

Provides eight channels of simultaneous encode/decode enabling recorded signals to be monitored off-tape. Claimed to provide 30dB of noise reduction, no line-up, pre/de-emphasis (signal and level sense), uses 2:1 compression and expansion circuitry. Available with XLR, jacks or multipin connector.

Price: from £500, stereo unit only £130.

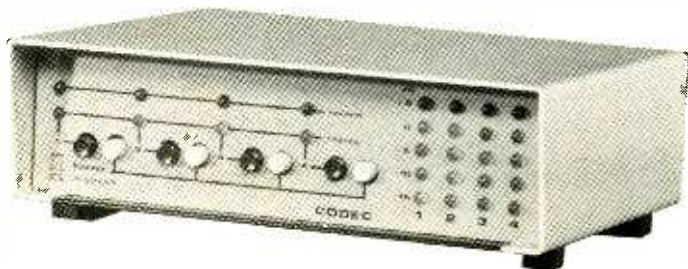
## DB Electronics (UK)

DB Electronics, 2 Ash Street, Buxton, Derbyshire SK17 6LL.

Phone: 0296 3756

## Codec

The Codec noise reduction system is an encoding/decoding linear dynamic filter system, that is a filter whose response is determined by the spectral content of the signal, independent of signal level. It offers companding of signals with dominant spectral content above 1.2kHz with hf noise reduction by pre/de-emphasis applied to signals prominent below 1.2kHz. Maximum claimed hf noise reduction is 25dB, max lf 8dB. Typical subjective improvement in S/N is 17-20dB. Bandwidth is 30Hz to 20kHz  $\pm$ 1dB. It is necessary to monitor the encoded recording level and most units (except the M41) have a 5-step LED level indicator.



DB Electronics  
Codec

The M41 is a 4-track switchable free standing unit with two buttons per channel, bypass and record/play, with LED indication of selection, no meters. M42 is similar but has LED level meters on each channel. M1 is a single channel simultaneous encode/decode unit available as a PCB or modular rack mounting unit. M1b is similar but restricted bandwidth (30Hz to 12kHz) for mobile broadcast use. M82 is an 8-track remote or machine switchable unit with separate 8-track LED level display.

Prices: M41 £125, M42 £160, others on application.

## dbx (USA)

dbx Inc, 71 Chapel Street, Newton, Mass 02195, USA.

Phone: (617) 964-3210. Telex: 922522.

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

Phone: 01-734 2812. Telex: 27939

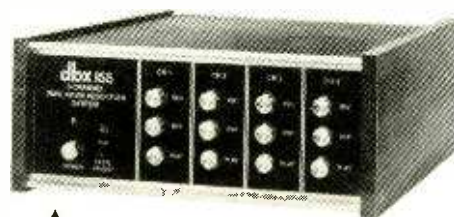
The by now well-known dbx noise-reduction system is available in a wide range of configurations for simultaneous encode and decode, switched encode or decode, and encode or decode-only.

All units feature the same 2-way compression/expansion system based on a 2:1 linear decibel slope applied to a 100dB range. Attack and release system provides 30dB of noise-reduction and a simultaneous 10dB increase in headroom. Frequency response is a quoted  $\pm$ 1dB 30Hz to 20kHz, total harmonic distortion typically 0.1% and equivalent input noise approximately -90dBm.

## Model 142

A 2-channel unit for broadcasters. The processing can be switched between encode or decode for recording or replaying such items as dbx-encoded NAB cartridges. The unit can also be used for 'normal' noise reduction on, for example, tape machines, or for improving the signal-to-noise ratio of land lines or microwave links.

Price: £480.



## Model 155

Provides four channels of either encode or decode, allowing simultaneous recording and monitoring of stereo recorders, built-in power supply, each channel individually selectable to rec, bypass or play. Phono connectors. May be rack mounted in pairs to provide eight channels, becoming the RM155.

Price: £335.

## Model 158

Provides eight channels of simultaneous encode and decode. The system is modular and contains its own power supply module plus a spare noise-reduction module for emergencies.

Price: £1640.



## Model 208

Similar to the 158 but having electronically balanced inputs and outputs and a prewired Cannon XLR interface.

Price: £2,050

## Model 216

A modular 16 or 24-channel system providing simultaneous encode or decode facilities. Each module contains the processing circuits for two channels of noise reduction, and can be remote-controlled from a tape machine or desk. A spare module is also provided for emergency backup.

Price: on application.

## K9-22

A plug-in replacement for the Dolby Cat 22 module. It is compatible in external dimension and interfaces directly with the main frame of Dolby 361, M16 and M24 systems, including power supply and switching functions.

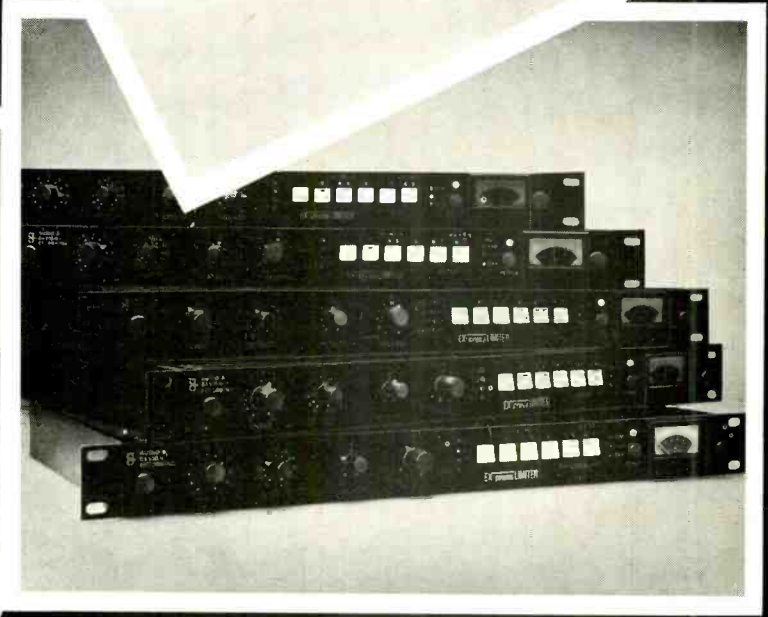
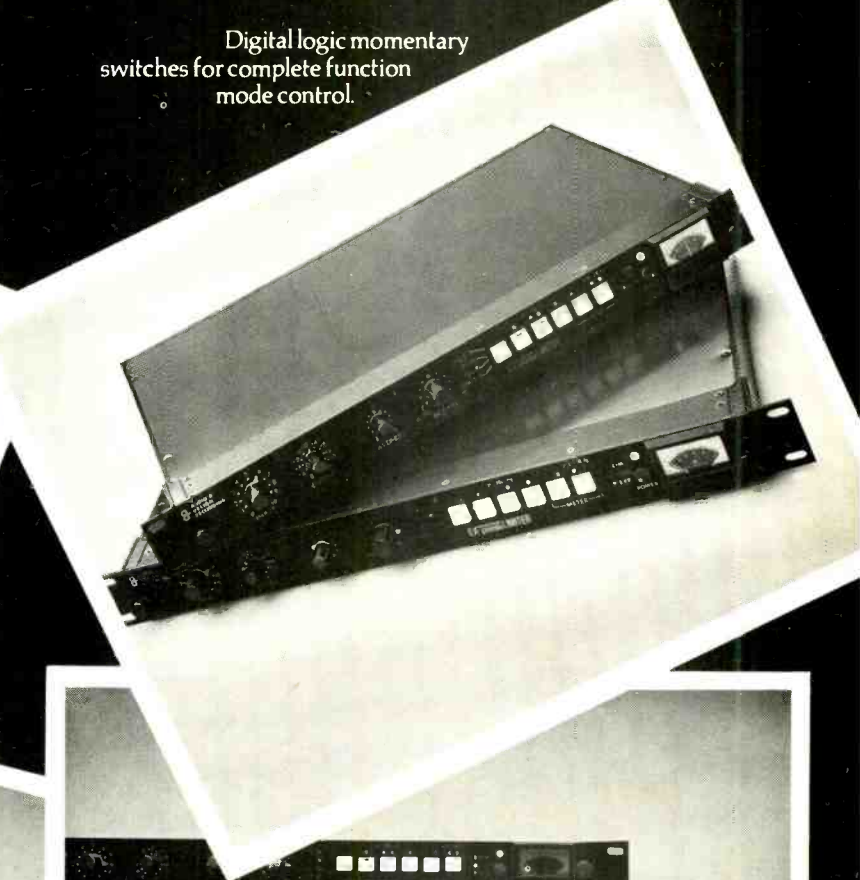
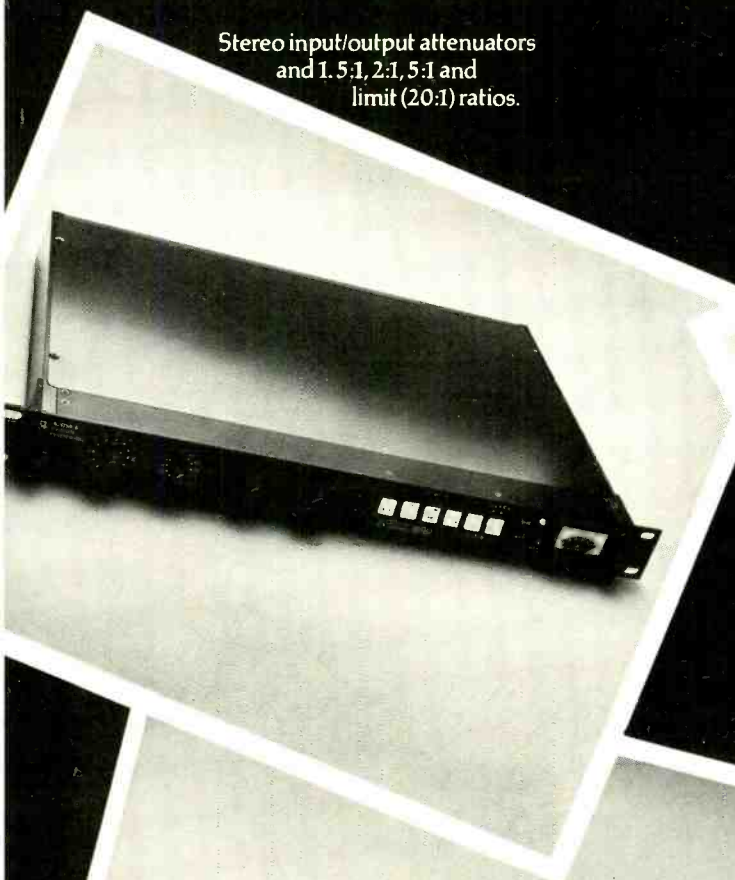
Price: £165.



# Glowing praise and flattering photos about the Ex-Press Limiter from ADR.

Stereo input/output attenuators and 1.5:1, 2:1, 5:1 and limit (20:1) ratios.

Digital logic momentary switches for complete function mode control.



The Ex-Press Limiter is a Compressor, Limiter and Expander designed and manufactured at ADR to our usual excellent technical specification.

Function Control is by digital logic switches and Led indicators show options in use as well as remembering 'last use' settings when the power is cut.

The Ex-Press also has stereo input/output attenuators, variable attack and release times and an auto release network for maximum in-studio versatility.

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84, Oxford Road, Reading, Berks. RG1 7LJ.  
Telephone: Reading (0734) 53411.  
Telex: 847605 a/b TILLEX G.

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PO Box 786, Bremerton WA98310 U.S.A. Telephone: (206) 275 5009.  
Telex: 152426 a/b NOTA B.



# Survey

## DOLBY (UK)

Dolby Laboratories Inc, 731 Sansome Street, San Francisco, Cal 94111, USA.

Phone: (415) 392-0300. Telex: 34409.

UK: Dolby Laboratories Inc, 346 Clapham Road, London SW9 9AP.

Phone: 01-720 1111. Telex: 919109.

There are two standard Dolby noise reduction systems: the 'professional' A system and the B system for consumer use. Both systems act as a constant gain amplifier over a wide range at low and high levels. Level dependent, variable gain action occurs only over a limited range and only in the side path of the system, while the main path always acts as a constant gain amplifier. In both systems the attack and release times depend on the signal conditions to minimise distortion products and modulation effects. The Dolby-A system uses four frequency bands in the side chain, which together cover the full audio bandwidth. The Dolby-B system, however, uses only one band in the side chain, whose cut-off frequency is controlled by the signal. This sliding action is claimed to be specific to Dolby noise reduction, like the dual-path, differential approach.

### Model 360/361

A rack-mounting, single-channel unit with Dolby-A characteristics, switchable between encode and decode.

**Frequency response:**  $\pm 1$ dB, 30Hz to 20kHz.

**Distortion:** less than 0.1% at 1kHz and +8dBm.

**Phase response:** less than 5° error, encode/decode.

**Noise reduction:** 10dB from 30Hz to 5kHz, rising to 15dB at 15kHz.

'Subjective noise reduction effect is independent of the signal level and is independent of the noise level over a wide range. Dynamic characteristics are maintained'. The Model 361 is identical to Model 360 except for built-in relay switching of operating mode. The change-over can be controlled automatically to follow the record/replay functions of a tape machine.

**Prices:** 360 £400, 361 £480.

### MH Series

A multichannel rack-mounting unit with built-in encode/decode changeover facilities. It is available in 8, 16, 24 and 32-track formats. Frequency response, distortion, phase response and noise reduction identical to Model 360. Crosstalk is 80dB between any two channels.

**Prices:** M8H (8) £3,250, M16H (16) £5,650, M8XH (+8) £3,100, M24H (24) £8,470, M32H (32) £10,900. Empty M24 rack £1,900.

### Model 330

A 2-channel unit incorporating Dolby-B encoder/decoder for use in tape duplication and quality monitoring. Distortion and phase response are identical to Model 360.



▲  
Dolby Model 334

**Frequency response:**  $\pm 1$ dB, 30Hz to 15kHz.

**Noise reduction:** 3dB at 500Hz, 6dB at 1kHz and 10dB at 4kHz and upwards.

**Price:** £800.

### Model 334

A 2-channel unit incorporating Dolby-B encoder/decoder for use in FM broadcasting. A change of pre-emphasis time constant to 25 $\mu$ s is achieved when the noise reduction is activated, reducing the need for hf limiting. Specifications virtually identical to Model 330.

**Price:** £800.

### CP50

Optical sound track cinema processor designed to replay Dolby encoded stereo optical or mono optical, or conventional mono optical. It also allows presentation of 4-track magnetic tracks, but without any processing. The stereo unit contains two Dolby-A cards, three 1/3-octave equalisers, centre channel and surround decoder, and an optical preamplifier for mono or stereo. Numerous options.

**Price:** stereo version basic £2,250, mono version £1,200.



Dolby CP50 cinema processor

### CP200

Rack mounting cinema processor for magnetic and optical sound tracks. In its basic form, it will handle up to four projectors in any sound format (including Dolby Stereo optical 35mm and Dolby Stereo magnetic 70mm) and also several non-sync sources. With options, it will also handle 70mm stereo surround and most future systems. Basically includes four channels of Dolby-A noise reduction, three channels of 1/3-octave loudspeaker eq, 70mm bass enhancement for tracks 2 and 4, preamplifiers for mono and stereo optical, and a matrix decoder for deriving centre and surround channels where applicable.

**Price:** £5,150 includes 70mm surround.

### Cat 55

Very compact module containing one channel of Dolby-A noise reduction designed for small size and low power consumption, switchable for record/play and signal selection for playback purposes. It is designed for incorporation in other equipment, and unlike the Cat 22, does not have high level interfacing.

**Price:** about £250.

### Cat 155/255

These incorporate the two channels of Cat 55 noise reduction mounted on a board designed to plug into specific video tape recorders, the Cat 155 for the Sony BVU1100/1000, and the Cat 255 for the Ampex VPR2/1 recorders.

**Prices:** around £550.

### Cat 22

Basic noise reduction module used in all Dolby-A equipment, includes a single channel of processing switchable for encode or decode, with line output, monitoring and line-up facilities.

**Price:** £240.

### Cat 40

Similar to Cat 22, but half speed version allowing noise reduction when replaying master tapes at half speed for mastering, with the four bands of processing lowered, by one octave.

**Price:** £290.

### Cat 35

NRM test set comprising a noise reduction module tester and test extender. Allows go/no go testing (there are no user serviceable parts on Cat No 22 modules) of Cat 22 modules either on the test bench or in-situ.

**Price:** £220.

## FUTURE FILM DEVELOPMENTS (UK)

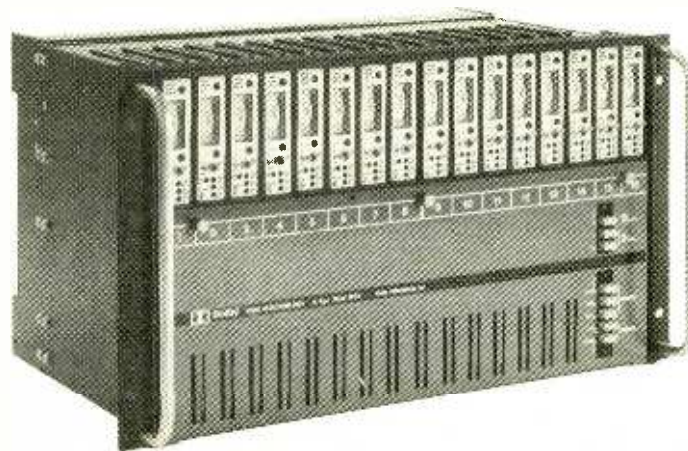
Future Film Developments, 36-38 Lexington Street, London W1R 3HR, UK.

Phone: 01-437 1892 Telex: 21624.

### DNR Series

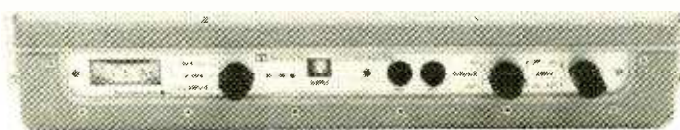
A portable unit containing two Dolby Cat 22 modules, plus the necessary buffer amplifiers, automatic record/replay switching etc for interfacing with Nagra IV single and 2-channel tape machines. Dimensions match that of the Nagra case and weight is under 4.5kg. Power is derived from internal batteries.

**Price:** about £1,150.

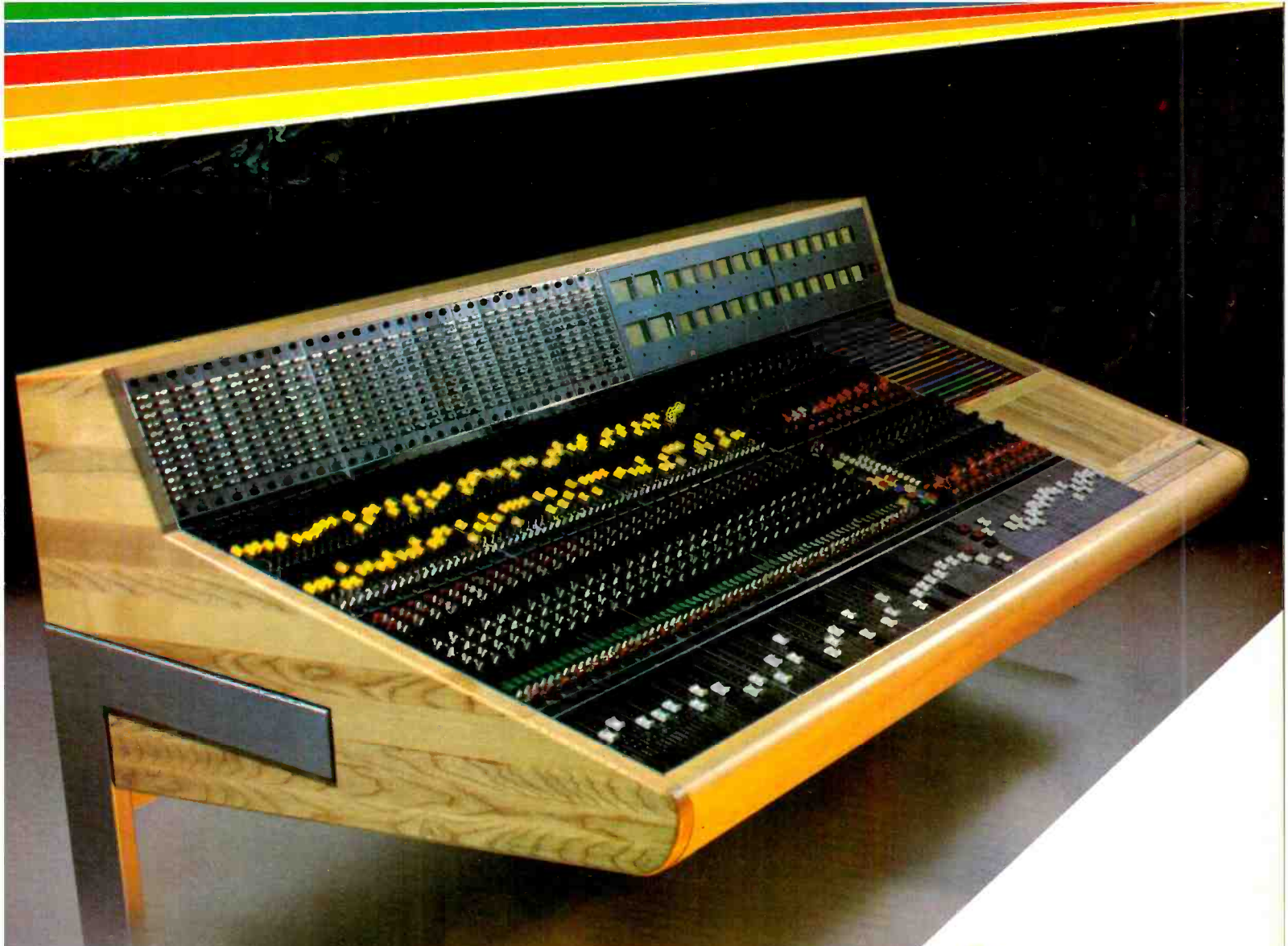


◀ Dolby M16H 16-track noise reduction unit

Future Film Developments' portable Dolby-A system







# TSM- Mixing with Style

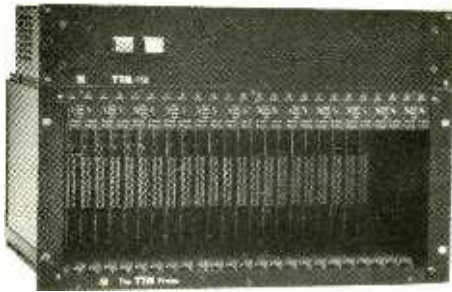
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 Post No 38, Studios Road, Shepperton, Middlesex, England.  
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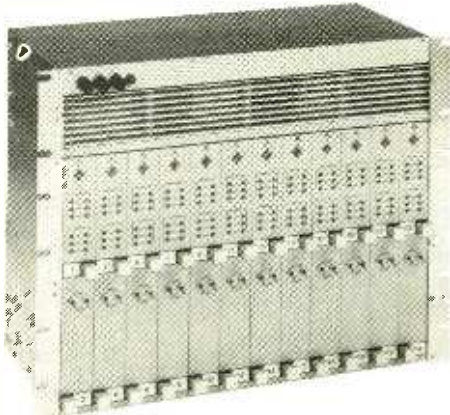
# Survey



▲ TTM Frame



▲ MXR stereo compander



◀ Telcom c4 rack

## GOTHAM/FABEC (Sweden)

Fant & Beckman AB, Eketrägatan 22, S-41712 Goteborg, Sweden.

Phone: 031 22.82.10. Telex: 27305.

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

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

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

Phone: 01-734 2812. Telex: 27939.

### The TTM Frame

Frame that will accept Dolby, dbx and Telefunken *telcom* noise reduction cards, 24 being accommodated across a 19in rack. Encode/decode and bypass remotely switchable, power failure bypass, electronically balanced inputs and outputs, front panel multiturn pots for level setting in record and playback, and pots for output line level and green/red LED threshold for level setting. The *Frame* is powered by a separate matching power supply. In addition to the 24-channel *Frame*, the *TTM202* accepts just two noise reduction modules with similar facilities.

Prices: on application.

## MXR (USA)

MXR Innovations Inc, 247 N Goodman Street, Rochester, NY 14607, USA.

Phone: (716) 442-5320. Telex: 978451.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA.

Phone: 0462 31511. Telex: 826967.

### Compander

Stereo noise reduction system using a 2:1 compress/expand ratio, with signals being compressed before recording and expanded upon replay, providing a claimed dynamic range of 100dB and equivalent input noise of -88dBV. Tracking accuracy is  $\pm 1$ dB per 20dB and IM 0.75% at 0dBV. Connectors are phono, and only control is bypass.

Price: £168.67.

## TELEFUNKEN (West Germany)

AEG-Telefunken, Postfach 2154, D-7750 Konstanz, West Germany.

Phone: 07531 862460. Telex: 733233.

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

Phone: 02813 88447. Telex: 849469.

USA: Gotham Audio Corporation, 741 Washington Street, New York, NY 10014.

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

### Telcom c4

The system is based on a 2-way compression/expansion principle using a 1:1.5 slope. The input is split into four bands—30 to 215Hz, 215Hz to 1.45kHz, 1.45 to 4.8kHz and 4.8 to 20kHz—before companding. Two modular units are currently available: the *c4* and the *c4D*. The *c4* is a 2-channel switched encode or decode unit for use with the Telefunken *M15A* multi-track, while the *c4D* is a direct replacement for the *Dolby Cat 22* module.

Frequency range: 30Hz to 20kHz.

Dynamic gain: greater than 30dB.

Signal-to-noise: greater than 94dB, weighted and unweighted.

Distortion: less than 0.2% THD.

Price: *c4* £938; *c4D* £367.

## EXPANDERS/NOISE GATES

### ADM (USA)

ADM Technology Inc, 16005 Sturgeon, Roseville, Michigan 48066, USA.

Phone: (313) 778-8400. Telex: 231114.

### Model 310

Type: modular noise suppressor with external power supply.

Attack time: 5 $\mu$ s.

Release time: 10 to 500ms/dB.

Attenuation: up to 85dB.

Threshold: adjustable from -40dBm.

Distortion: 0.15%.

Frequency response: 20Hz to 20kHz  $\pm 0.25$ dB.

Noise: -73dBm above threshold.

Power supply: external 20V required.

Price: \$325.

## ALLISON (USA)

Valley People Inc, 2821 Erica Place, Nashville, Tenn 37204, USA.

Phone: (615) 383-4737.

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

Phone: 01-953 0091. Telex: 27502.

### Kepex Model 500

Type: one-way gain expander.

Process: wide-band gain expander. Input signals greater than the threshold level will raise the gain of the unit to 0dB; signals below threshold are attenuated by the amount set on the range control (up to 60dB).

Threshold: -35 to +20dBm, adjustable.

Ratio: 2:1 from 0 to 15dB expansion, increasing to 4:1 at 60dB expansion.

Attack time: less than 20 $\mu$ s.

Release time: 50ms to 6s, adjustable.

Frequency response: (system alone)  $\pm 1$ dB, 20Hz to 40kHz.

Distortion: less than 0.5% THD, under normal operating conditions.

Noise: minimum 85dB below rated output.

Power: 24-28V DC, 70mA.

Price: £193.

### Kepex II

Type: one-way gain expander.

Process: wide-band gain expander. Input signals greater than the threshold level will raise the gain of the unit to 0dB; signals below threshold are attenuated by the amount set on the range control (up to 80dB).

Threshold: variable from -40dBV to +20dBV.

Expansion ratio: variable from 1:1.1 to 1:100.

Attack time: variable from 20 $\mu$ s to 20ms/20dB.

Release time: variable from 40ms to 10s/20dB.

Frequency response: (system alone)  $\pm 1/2$ dB, 15Hz to 22kHz.

Distortion: less than 0.1% IMD (SMPTE), under normal operating conditions.

Noise: at unity gain -80dBV, at 60dB attenuation -99dBV.

Power:  $\pm 15$ V DC, 50mA.

Price: £237.

## AUDIO & DESIGN (UK)

Audio & Design (Recording) Ltd, 84 Oxford Road, Reading RG1 7LJ.

Phone: 0734 53411. Telex: 848722.

USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310, USA.

Phone: (206) 275-5009. Telex: 152426.

### F300 Expander/Gate

A full frequency, low-level expander or gate from the *Scamp* range. The unit uses peak or rms-type sensing characteristics. Threshold is variable between -40 and +10dBm for source noise reduction or effects use. The unit is said to improve signal-to-noise ratio by up to 40dB where wanted signal is only 2dB above noise. Suitable for all types of programme material.

Attack time: 25 $\mu$ s, 1ms and 10ms/40dB range (max).

Release time: 25ms to 5s, continuously variable.

Distortion: 0.1% at line level; 0.3% worst case.

Frequency response:  $\pm 0.5$ dB, 20Hz to 20kHz.

Noise: in effects use less than -86dB ref +8dBm (weighted -3dB at 25kHz); for noise-reduction use less than -103dB ref +8dBm (same weighting).

Price: £230.



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Syntovox Vocoder 221



## Syntovox 221-The Intelligible Machine that set the standards in vocoder techniques. £2780.00\*

The Syntovox 221 is a 20-channel vocoder system already in wide use in sound recording studios, radio stations, scientific institutions, and by leading composers, for its outstanding quality and unexcelled intelligibility. Included are 54 dB/octave filters—a feature not to be found in any other vocoder on the market. It offers the versatility of a built-in pulse generator for direct speech synthesis, with several control units for pitch modulation.

Also available: the Syntovox 222 (Triple Two) — a simplified vocoder system specifically created for performing musicians who need a flexible, easy-to-use machine for on-stage and session work. Triple Two is the trend setter for budget recorders—with a price to prove it: £468.00.\*



\* Prices subject to variation, dependent on the rate of exchange.



UK Distributors

**Feldon Audio Ltd.,**

126 Great Portland Street, London W.1. Tel: 01-580 4314. Telex: London 28668.

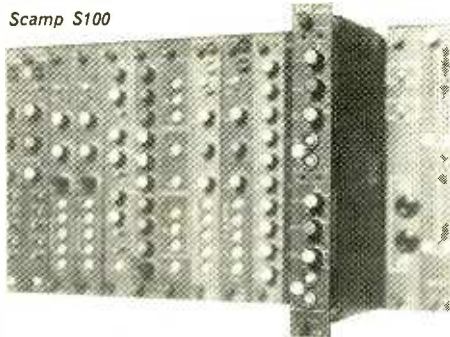
# Survey

## SO5 Dynamic Noise Filter

A low-frequency, single-ended processor from the *Scamp* range using frequency conscious, peak-sensing characteristic that imposes a variable slope roll-off to attenuate low-level If (rumble etc). Maximum slope is 18dB/octave; minimum 0dB/octave (flat) when above threshold. It is claimed that the unit will improve signal-to-noise ratios by up to 18dB/octave below 100, 200 and 400Hz turnover frequencies without modulating the high-frequency content. The filter is said to be ideal for reprocessing old masters or attenuating source noise. Optionally, it can be switched to full-frequency 20 or 40dB range noise gating. The model SO6 from the *Scamp* range is identical to the SO5 except for turnover frequencies of 2, 4 and 6 kHz—making it a high-frequency, single-ended processor.

**Price:** £205.

*Scamp S100*



## S100 Dual Gate

Provides two noise gates in a single *Scamp* module with a fixed 10µs attack time (the theoretical limit in the audio band), with variable release, range and trip level (threshold). Balanced inputs and outputs, bypass.

**Attack time:** optimised to around 10µs.

**Release time:** continually variable 0 to 40dB attenuation.

**Threshold:** -50dBm to infinity.

**Distortion:** 0.1%.

**Frequency response:** 20Hz to 25kHz -0.5dB.

**Noise:** -90dBm.

**Features:** LEDs for open and gate.

**Price:** £220.

## EMT (West Germany)

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

**Phone:** 07825 512. **Telex:** 754319.

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

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

**USA:** Gotham Audio Corporation, 741 Washington Street, New York, NY 10014.

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

## EMT 258

**Type:** one-way lowpass filter and expander.

**Process:** lowpass filter, whose turnover frequency is determined by the programme material being processed.

**Filter:** turnover frequency 1-20kHz, programme dependent; release time 0.05-2s, adjustable; threshold (signal) -25 to -65dB, adjustable.

**Expander:** total range (at 100Hz) 20dB; frequency range below 2kHz; release time less than 50ms for 10dB.

**Frequency response:** (system alone) ±0.5dB, 40-15kHz.

**Distortion:** less than 0.5% THD at internal zero level.

**Noise:** greater than 80dB rms at 0dB output level.

**Price:** £567.

## ROGER MAYER (USA)

Roger Mayer Electronics Inc, 225 East 57th Street, New York, NY 10022, USA.

**Phone:** (212) 486-1544

**UK:** Scenic Sounds Equipment, 97-99 Dean Street,

London W1V 5RA

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

## Model RM68

A single-channel noise gate.

**Attack time:** 150ns.

**Release time:** 30ms to 5s, continuously adjustable.

**Frequency response:** ±1dB, 20Hz to 50kHz.

**Output noise:** -96dBm.

**Distortion:** 0.05% under normal operating conditions.

**Features:** two LEDs — red for gating and green for non-gating; keying input; up to 16 units fit optional card rack.

**Price:** RM68 £69.

## MMT (West Germany)

Medical Measuring Technics GmbH, Im hohen Rain 25, D-7050 Waiblingen, West Germany.

**Phone:** 07151 55240.

## mmt 2011 Noise Gate

Modular noise gate with separate front panel, main panel and control module allowing remote operation. Has variable attack, release, attenuation and sensitivity.

**Attack time:** 5µs to 1s.

**Release time:** 5ms to 10s.

**Sensitivity:** 20mV to 10V.

**Attenuation:** 0dBm to 60dBm.

**Distortion:** 0.01%

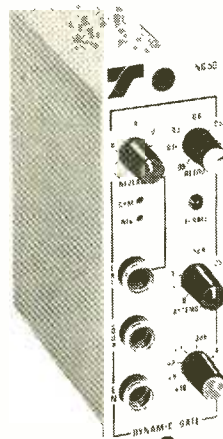
**Features:** LED indication of gate position.

**Power supply:** ±15V

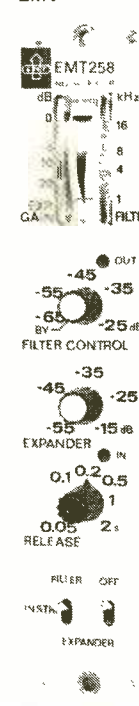
dc, 50mA.

**Price:** DM345.

NG50 Noise Gate



EMT 258



Rebis 201 Noise Gate



## ORANGE COUNTY (Canada)

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

**Phone:** (204) 775-8151.

**USA:** Parasound, 680 Beach Street, San Francisco, Cal 94109, USA.

**Phone:** (415) 673-4544.

## CLX Module

**Type:** single or dual-channel unit combining a compressor-limiter, expander and gate, with facility for external key. Expander slope 1:2; gate slope 1:20.

**Frequency response:** ±0.5dB, 5Hz to 100kHz.

**Distortion:** 0.05% THD with no gain reduction; better than 0.1% THD at 15dB gain reduction.

**Noise:** 89dB with expander/gate in; 100dB out (both at 30dB gain).

**Price:** on application.

## REBIS (UK)

Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 5AB.

**Phone:** 0384 71865.

## RA201 Noise Gate

Provides a noise gate in a module to fit the RA200 series rack, (optionally available as the RA201X to retrofit Kexpex racks). Variable controls for attack, release, sensitivity and attenuation. Key input allowing external operation of gate, bypass switch.

**Attack time:** variable 20µs to 4ms.

**Release time:** 50ms to 10s.

**Threshold:** -60dBm to +20dBm.

**Attenuation:** 2dB to 40dB.

**Distortion:** 0.01%.

**Frequency response:** 20Hz to 20kHz ±0.5dB.

**Features:** red LED for closed, green for open.

**Noise:** -92dBm.

**Powered:** externally powered by rack.

**Price:** £62.

## SYMETRIX (USA)

Symetrix, 109 Bell Street, Seattle, Washington 98121, USA.

**Phone:** (206) 682-3076.

## Signal Gate

19in rack mounting signal/noise gate with built-in power supply. Variable attack, release, range and threshold, bypass, external control input.

**Attack time:** 100µs to 1s.

**Release time:** 50ms to 3s.

**Threshold:** -40dBm to +10dBm.

**Attenuation:** 0dB to infinity.

**Distortion:** 0.2%.

**Noise:** -84dBm.

**Features:** LED threshold indicator.

**Price:** on application.

## TECHNICOBEL (France)

Technicobel, 8 rue de la Croix Martre, F-91122 Palaiseau Cedex, France.

**Phone:** (1) 920.80.39. **Telex:** 692543.

## NG50 Dynamic Noise Gate

Modular noise gate with coupling for stereo, and external input for other effects.

**Attack time:** 100µs.

**Release time:** 50ms to 3s.

**Threshold:** -40dB to +10dB.

**Attenuation:** variable 0 to 40dB.

**Distortion:** 0.5%

**Frequency response:** 20Hz to 20kHz ±0.5dB.

**Noise:** 0dB attenuation -86dB.

**Features:** gate LED.

**Power supply:** external ±18V required.

**Price:** on application.





The San Francisco String Quartet.

*Silence is an important part of music...*

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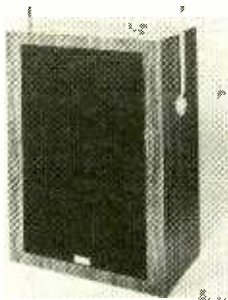
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# letters

## Recording subtleties

Dear Sir, In the December issue, Adrian Hope referred to some interesting experiences obtained at Reading, in my house in fact, by Mr Michael Gerzon and Mr Geoffrey Barton in which some of the subtleties in early Beatles' recordings were made explicit for the first time.

It should be pointed out that this was using the Variable Directional Preference (VDP) decoder, which is part of the Ambisonic technology, in its 'stereo decode' mode. The obvious point about a variable decoder, which surprisingly often seems to have been missed, is that it does need to be psychoacoustically compensated at all times. Its job is to produce feeds for loudspeakers which are to be listened to by human ear and brain, and their variation with frequency, in locating the direction of arrival of sounds. It is obviously absurd to suppose that the fact of being variable absolves it from this psychoacoustic responsibility. The VDP decoder also incorporates a number of other carefully contrived features.

A particularly interesting feature of the experiments was that things were heard explicitly for the first time in material with which the listeners had become extremely familiar during their teens. While it is worth a try, there can be no guarantee that old 'quadraphonic' decoders lacking psychoacoustic compensation will be able to locate these subtleties.

Yours faithfully, Peter Felgett, Department of Cybernetics, The University of Reading, 3 Earley Gate, Whiteknights, Reading RG6 2AL.

## Acoustic environments

Dear Sir, I have been following with interest two themes in recent issues of Studio Sound, namely the aim of the Tonmeister course in the education of record producers, and the importance of the correct sound environment in the performance and recording of music.

Both these themes are united in a practical sense in a recent record of nineteenth-century piano music played on instruments of the period by Alan Cuckston, and engineered by myself. The record, A Musical Evening With The Brontë Family (Swinsty Records FEW 01) was mastered using a new surround-matrix recording system.

As Christian Dreyer states in 'Letters', February '80, 'responsibility for recording is much too high for one pair of ears alone' and three of us were responsible for the entire production, Alan Cuckston, Alastair Lawrence (the piano restorer and tuner) and myself. There was sufficient understanding between us to afford complete co-operation without the need for a separate co-ordinator labelled 'a producer'. We felt it was particularly important to make the recording in a room with a similar acoustic to the Brontë's drawing room, and as it was impracticable to use the rectory at Howarth, we went to some lengths to assemble pianos and recording equipment in suitable rooms in Wharfedale. Editing of the final master was

the sole responsibility of Alan and myself.

A similar production schedule was followed in a previous recording, this time for RCA (The Sound of the Georgian Piano, LHLI 5101) which attracted praise from many reviewers.

It would be interesting to see whether a similar approach to recording would work with larger scale classical or rock productions.

Yours faithfully, Dr James Crabbe, Wolfson College, Oxford OX2 6UD.

## Square waves

Dear Sir, In response to Mr. Hall's letter in the March issue of Studio Sound concerning high frequency ringing, I would like to reply by saying that Ampex has been aware of the importance of square-wave performance in analogue audio recorders for some time.

'Respectable' sine-waves were first seen (to the best of my knowledge) on the ATR-100 some four to five years ago. This machine employs a linear phase record equaliser, thereby ensuring that no matter what machine is used for playback, the recording itself remains optimum. When this 'phase-linear' tape is reproduced on a machine equipped with an adjustable shelf equaliser operating in the region of 3kHz to 8kHz, very impressive square waves are demonstrated.

Yours faithfully, Tony Shields, Audio Product Manager, Europe, Africa & Middle East, Ampex Great Britain Limited, Acre Road, Reading RG2 0QR.

## Pressure mics

Dear Sir, I was very interested in an item in your May 1980 AES Report on pressure mics for classical music. In it you reported that Jurg Jecklin of Radiostudio Basel used such mics 16.5cm apart, separated by a 30cm disc acoustically treated.

Whitewall Records have in, the past year issued a number of records using a not dissimilar system. Our separating baffle is some 18cm in diameter, is acoustically treated and a variety of pressure mics have been employed. Following the BBC's use of a plain perspex disc in similar circumstances for dummy head binaural broadcasts, the records are intended also to give the improved headphone listening which dummy head recording produces.

With this similarity between Jurg Jecklin's interesting work, the BBC's and Whitewall's, could I ask if in his lecture Mr Jecklin mentioned the Binaural aspect or dummy head connection? Yours faithfully, M G Skeet, Whitewall Records, 2 Roche Gardens, Bletchley, Milton Keynes MK3 6HR.

Mr Jecklin referred solely to stereo loudspeaker reproduction in his paper. However, full details of Mr Jecklin's technique are available in AES preprint No. 1606 . . . Ed.



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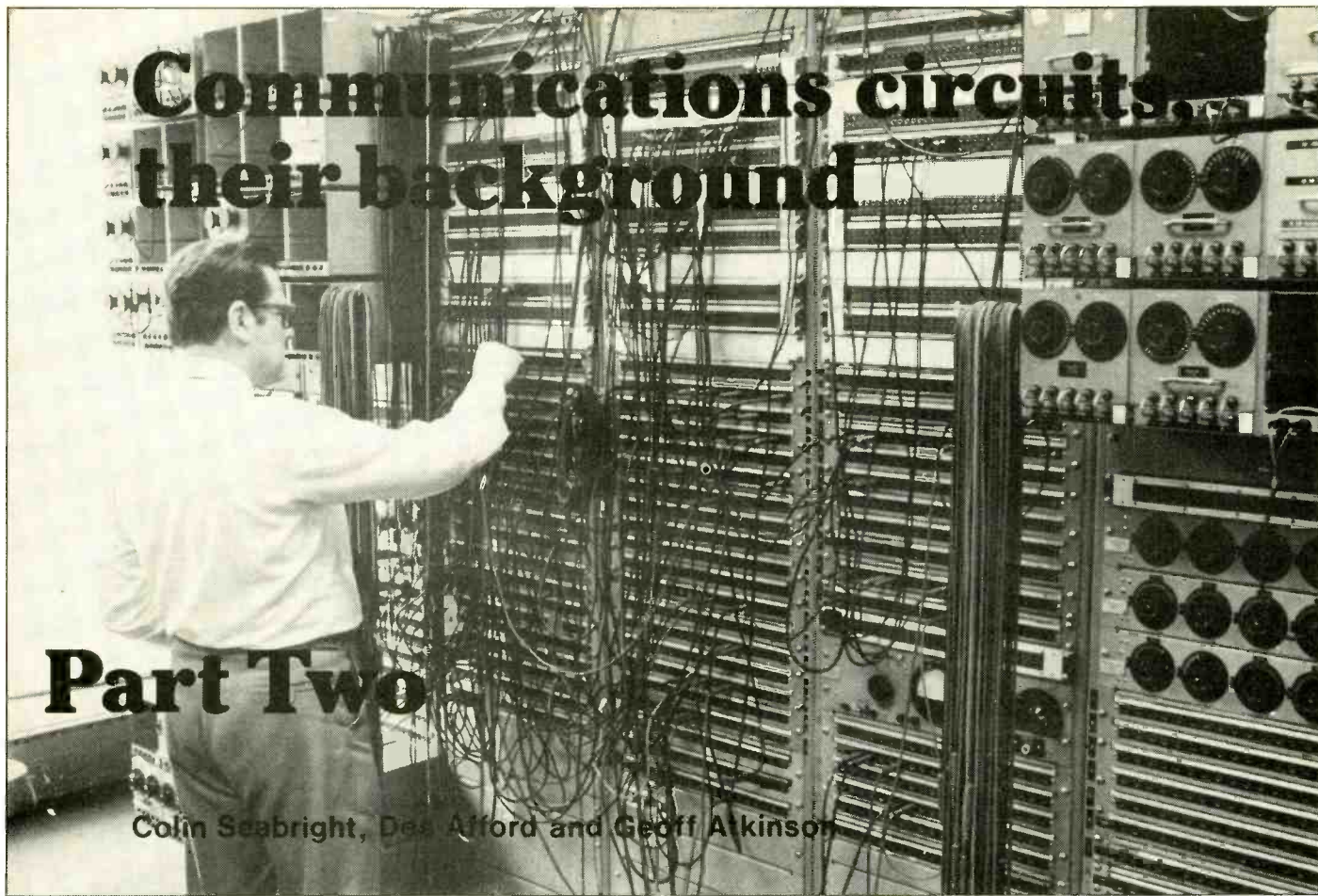
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# Communications circuits, their background

## Part Two

Colin Seabright, Des Afford and Geoff Akinson

### TEST PROCEDURES

#### General

Before any circuit is used to carry high quality programme material, the transmission parameters must be measured and any distortions reduced to acceptable levels. For all circuits it is necessary to measure the loss-frequency characteristic and to apply equalisation to bring the spread within the limits dictated by the intended programme content; to ascertain that there is an adequate separation between the signal and noise levels; and for amplified circuits further tests are necessary to verify that the active apparatus is not overloaded by peak signals, and the level received faithfully follows that transmitted throughout the dynamic range. A further distortion, but one which is not normally measured and the subjective effect of which is difficult to define or quantify, is phase distortion or the alteration of the

phase relationship between the component frequencies of a complex signal; but this is only noticeable on very long lengths of loaded physical circuits (see below) or where many filters are employed as part of the transmission system when the frequencies near the cut-off are delayed compared with the main part of the bandwidth.

Where two mono circuits are to be used together for the left and right hand channels of a stereo signal, it is very important to measure and correct the inter-channel phase difference throughout the frequency range since errors will impair both the image positioning for the stereo listener and, due to the cancellation caused by adding out-of-phase signals, the amplitude of the resultant sum signal for the mono listener. Similarly, if multiple circuits are required to carry the component parts of a composite signal (multitrack recording for subsequent mixing) the phase re-

**Last month we looked at the type of circuits supplied by PTTs, while in this second and concluding part the characteristics and test procedures for circuits are examined, followed by details on how circuits are realised in practice.**

lationship must be corrected between any and every pair of circuits, which in practice means retarding all other circuits to match that with the greatest inherent delays—a task which is probably not practical (or economical) over long distances, and is likely to be found necessary for short ones, where the circuits are normally co-routed.

Regardless of the transmission system used, unless that system is provided by the broadcaster and has the terminal equipment on his premises, a length of physical circuit, a 'pair of wires', will be used to extend the main circuit to the user, consequently all circuits require testing and equalisation to allow for this physical connection. Since the performance of all but the shortest circuits depends on the terminal impedances between which they are connected, the first consideration for any test apparatus is that it must present the same terminating impedance to the line as the programme equipment subsequently to be used on the line. Also,

as the circuit's performance depends on the signal amplitude, tests must be carried out with due regard to the range of levels, in particular the peak level to be transmitted. More importantly the peak programme level and therefore the tests must both be governed by the handling capacity of the circuit and, where relevant, the regulations of the organisation providing the facility. Balanced lines are normally used in order to minimise interference between them, and to ensure that this balance is properly maintained (and to meet the requirements of the Post Office where they provide the service) the terminal equipment, both for test and transmission, is connected via a repeating coil—an isolating transformer with an earthed electrostatic screen between the accurately balanced line-side windings and the less critical apparatus side.

**Amplitude equalisation**  
The first requirement is to determine and correct the loss-frequency

#### Correction

Due to a printer's error, a line was missing from Part One of this article, on page 48 last month. The sentence at the end of the third column should have read:

As an example, the rental for a standard, permanently rented, BPO music circuit (classified by the BPO as a tariff 'M' circuit) will be £75 per annum for a 1 to 1½ miles

circuit and £2,500 per annum for a circuit having a chargeable distance of 90 to 100 miles.

#### Acknowledgement

The authors wish to thank colleagues who have helped in the preparation of this article and the director of engineering of the BBC for permission to publish it.



response. For this initial test, a variable frequency oscillator is connected at the sending end, with an amplified detector at the receiving end—both units, as all other test apparatus, have to be of high standard. since measurements are usually made to a tolerance of 0.1dB, and chosen or switched to present the correct terminating impedances to line. The response is measured at some convenient level within the dynamic range of the programme, such that it is well above the noise, but sufficiently below the peak level to avoid overloading and consequent interference onto other circuits carried in the same cable or on the same system.

For inland circuits in Britain, the normal transmission procedure is to set up a circuit with a line-up tone (normally 1kHz) at 0dBm and to control programme levels to peak to 8dB above this. Tests have traditionally been carried out at line-up level, but for the many circuits incorporating pre-emphasis at high frequencies (as on most forms of carrier system), although line-up tone and programme are still transmitted at the same level (on the assumption that normal programme contains little power in the high frequencies) frequency response tests must be carried out 10dB below line-up. For International circuits in Europe, whilst no absolute levels can be chosen as standards since these may vary with local apparatus, test levels are defined by the EBU relative to the peak programme level permitted at any point in the chain, line-up (test level) being 9dB below peak, and frequency runs taken at 21dB below peak level.

Having measured the loss-frequency response, the next stage is to equalise it, if necessary, to the limits required for the subsequent programme. For OB purposes BBC Communications Engineers work to limits of 2dB overall from 40Hz to at least 10kHz, preferably 15kHz for music, but the upper frequency limit may be relaxed if the programme contains speech only, or is destined only for Long or Medium wave transmission; but much tighter limits are applied to individual permanent circuits, several of which may be connected in tandem to form a programme chain from studio to transmitter.

Equalisation is a major subject in itself, and can only be considered briefly here. The equipment used can vary from passive sections individually 'tailor-made' to suit particular circuit characteristics, through variable versions of the same type switchable for temporary requirements, to multisection graphic equalisers with active sections adjustable to cover the frequency band in many small por-

tions. The BBC mainly uses passive networks, designed to present a constant input impedance so that as many as may be necessary can be connected in tandem immediately after the receiving end repeating coil, all based on the bridged-T network shown in fig. 2. The selection of the components to give any particular frequency characteristic can involve complex calculations; the basic or maximum loss of any section is governed by the values of R1 and R2; the portion of the frequency spectrum over which it acts by the value of the reactive components for the non-resonant sections (fig. 3a or fig. 3b) which reach a maximum slope of 6dB per octave; the frequency spectrum and steepness of the resonant sections (fig 3c or fig 3d) by the resonant frequency and relative values of the tuned circuit components; and in all cases the component values must be chosen to maintain the required design impedance.

The whole process of equalisation is greatly simplified by plotting complete families of curves, similar to those outlined in fig 3, on transparent 'masks', with the attenuation increasing upwards, but on the same scale as the graph paper used to plot the measured loss-frequency characteristic of the circuit in the opposite direction. By positioning the mask over the circuit response curve, one can ascertain which equaliser section will give the best results; this process is repeated for each additional section until the required limits are met. Similar masks are used either

for the setting of variable equalisers, or, with tables of component values, for the design of tailor-made fixed sections when the almost infinite range of values available will allow more accurate equalisation than the limited range of switched settings on the variable equaliser. After equalisation, with as many sections as may prove necessary, a variable gain amplifier is used to restore the signal to the normal working level.

Graphic equalisers are commonly available now and although their design is beyond the scope of this article, their operation is much simpler, obviating the need for masks and calculations, by the directly calibrated adjustment of signal level at each of the many pre-determined frequencies. Whilst particularly suited to the correction of 'dips' and 'bumps' (minor aberrations which may occur at almost any point in the frequency characteristic) the equalisation range may not be sufficient to

equalise the steep curve of a long circuit without the additional use of one high basic loss passive section.

### Noise, harmonics, etc.

Only after equalisation can meaningful measurements be made of the other parameters of a circuit—of these it is usual to test first that which is most likely to be a problem, noise.

Noise commonly consists of crosstalk from other circuits in the same cable or carrier system (speech or inverted speech, voice-frequency data signals, dialling pulses or other switching clicks) and general background hum or hiss from active equipment en route. Whatever the source, for normal transmission paths noise is measured in the absence of signal, but in some of the modern transmission systems noise level is dependent on programme level, and where necessary for a complete

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FIG. 2 CONSTANT IMPEDANCE EQUALISER SECTIONS

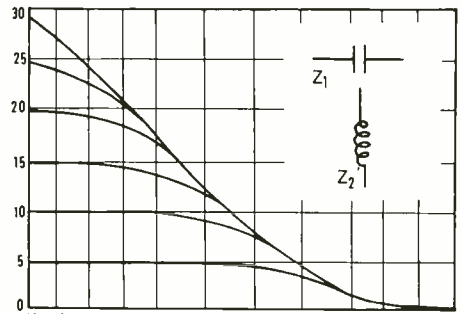
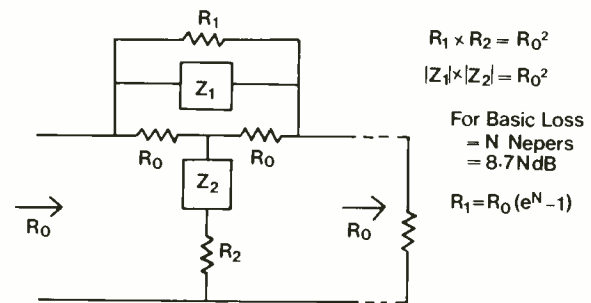


FIG.3a NON-RESONANT SECTION, LF LOSS

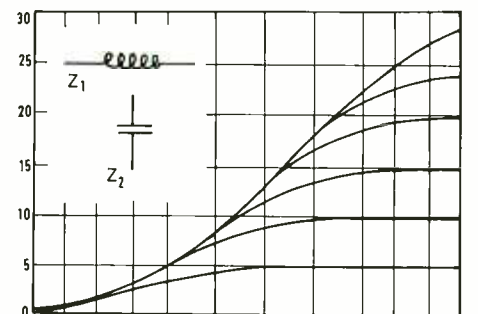


FIG.3b NON-RESONANT SECTION, HF LOSS

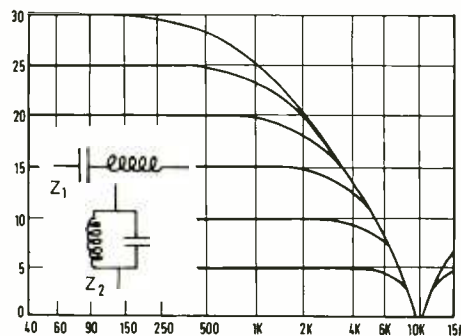


FIG.3c RESONANT SECTION OR 'DIP-FILLER'

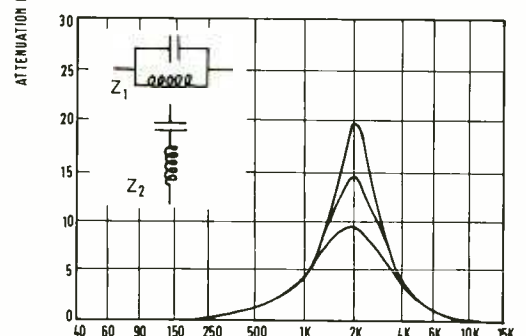
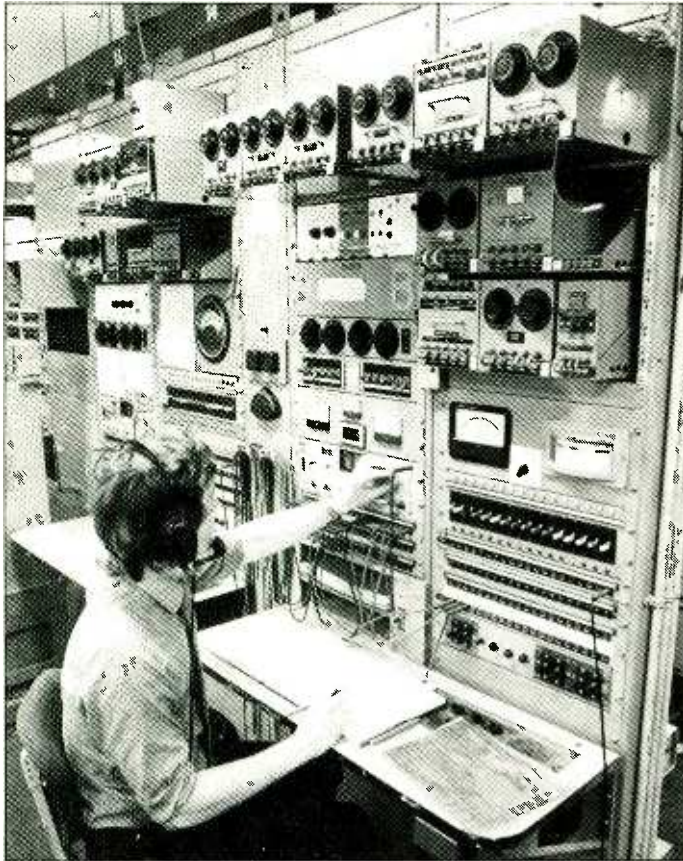


FIG.3d RESONANT SECTION OR 'BUMP-FILLER'

## Communications circuits



Stereo test position where the equalisation required is determined using equalisation sections (top of photo).

picture, measurements should be made in the presence of a tone which is filtered out before the measuring instrument. Where companders are included in the circuit, the 'pumping' effect of variations in noise level as the expander gain varies with signal amplitude can be annoying, but the effect can only be judged by a listening test in the presence of programme.

Noise is usually measured using a calibrated amplifier and Peak Programme Meter, fed with the equalised output of the circuit under test; the amplifier gain is first set to give a convenient reference reading on line-up tone, then re-adjusted to give readings of noise peaks after the oscillator has been removed from the sending end and replaced by an equivalent terminating resistor. Measurements are made both directly on the equalised circuit to indicate the absolute noise level, and again through a weighting network which emphasises some frequencies and attenuates others (to a characteristic defined by the CCIR) in accordance with the sensitivity of the human ear, to indicate the degree of annoyance caused to the listener when the circuit carries programme.

The level of noise is quoted as the separation between the noise peaks

and a convenient programme-related reference level, (either line-up or peak programme level) determined by the change in gain of the calibrated amplifier, and standard limits agreed for circuits provided by the BPO are 35dB below line-up level for unweighted noise and 43dB below line-up, weighted. It should be noted that the limits cover only the bandwidth specified by the BPO for each particular type of service, 6½kHz for OB and 10kHz for permanent circuits, and do not apply to any additional bandwidth achieved by the user by superior equalisation.

The next test determines the level of harmonic distortion introduced by the circuit, measurements being made at both line-up and peak levels at low and mid frequencies, usually 90Hz and 1kHz; no measurements are made in the upper part of the frequency spectrum, since harmonics would fall outside the bandwidth of the circuit, and in the case of carrier systems would cause interference into other channels. The test at line-up level will reveal any basic non-linearity in the circuit, and that at peak level will show up any overloading due either to a faulty amplifier or use of equipment at an incorrect working level.

Measurements can be made either with a wave analyser to

determine the level of each individual harmonic, or with a switched filter to remove the fundamental frequency, allowing measurement of the total harmonic content on the normal amplified detector. The working limits, quoted as the separation between the total harmonic content and the fundamental are 26dB at 90Hz and 37dB at 1kHz (at both test levels), corresponding to 5% and 1½% respectively.

At this stage a check should also be made of amplitude distortion, to ensure that any variation in sending level is faithfully reproduced at the receiving terminal. In its simplest form this test involves sending 1kHz tone at 20dB below line-up, a level which will reveal tracking errors in any companders included in the circuit, but if errors are suspected a full frequency run should be carried out at two or three test levels. No official limits are set down for this test, but discrepancies of more than 1dB would suggest some error in alignment of the circuit, except at extreme low frequencies where some compression is an inherent feature of the older types of BPO repeater amplifiers.

This completes the test procedures for mono circuits, apart from the clearance of any faults revealed, in which case the offending circuits may require re-alignment before retesting. Rejection of a BPO provided circuit will often result in the replacement of a large portion of the route, necessitating complete re-equalisation before verifying the other parameters. But in some cases no alternative routing is available and where peak harmonic separation is marginal, but the noise well within limits (or vice versa), a slight change in the programme sending level (subject to BPO approval) will suffice to achieve a satisfactory transmission path. An alternative solution to borderline noise problems, which are often the most difficult faults to clear (particularly if the fault is intermittent) but only applicable to circuits that do not already include integral companding, is to use companders over the whole circuit. The use of Dolby-A companders is approved by the BPO since, by only raising the amplitude of low-level signals, they produce no significant increase of the mean power to line, and leave the peaks unaltered which can give improvements of 10dB in the signal/noise ratio. In practice this is regarded as a last-resort solution, used only when testing time is at a premium, and not as a regular substitute for clearance of faults.

### Stereo

For stereo transmission it is desirable that the loss-frequency re-

sponses of the individual circuits required to carry the left and right channels should be matched to close limits, and unless the initial equalisation of the component mono circuits was adjusted with due consideration to this requirement as well as to the normal overall circuit limits, minor trimming of the equalisation may be necessary. The inter-channel difference should not exceed 1dB over the portion of the bandwidth which contains the bulk of the stereo positional information, 250Hz to 4kHz, or 2dB over the remainder of the band.

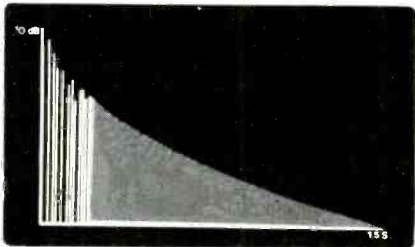
Having matched the amplitude response, the next step is to measure, and correct if necessary, the phase difference between the circuits throughout the bandwidth. It is important to note that amplitude equalisation must be completed before starting phase correction as all amplitude equaliser sections also affect the phase response, whereas properly designed phase sections will not alter the amplitude performance.

In order to measure the phase difference between two circuits, it is of course necessary to feed the output of the single variable oscillator to both circuits at once whilst maintaining the correct sending impedance to each. If line-sending amplifiers are available, two can be connected to the oscillator and their outputs adjusted to feed the correct level to line, otherwise the single output from the oscillator must be split by a hybrid transformer (giving 4dB loss to each output) or a resistive bridge splitting pad (6dB loss), and the oscillator output adjusted to maintain the line-sending level. At the receiving end the outputs of the two equaliser and amplifier chains are fed into the inputs of a phase difference meter and the phase angle between the two signals is recorded and plotted against frequency.

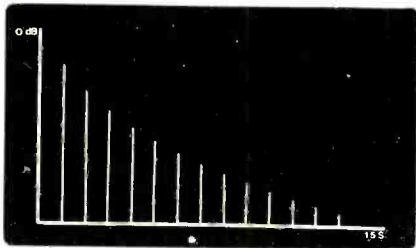
Whilst appreciating that delay and phase are inter-related, it has been found easier in practice to distinguish between the delay introduced by (and proportional to the length of) the transmission path, or (since we are concerned only with delay or phase difference) that caused by the difference in path lengths, and the phase errors introduced by inequalities in the amplifiers or other apparatus en route. In the same way, although they are all based on the all-pass lattice network (figs 4 and 5), 'phase' equalisers consist of a selection of non-resonant lattice sections with different component values operating over different portions of the frequency spectrum, each section giving a maximum



## This is reverb.



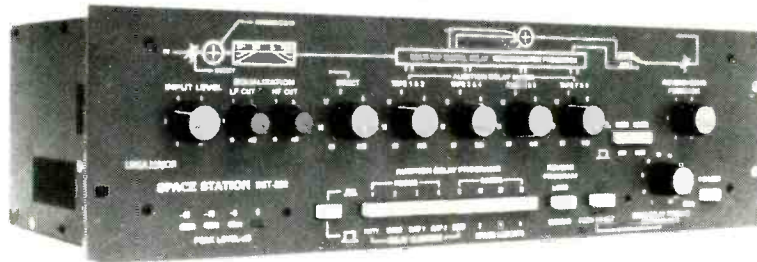
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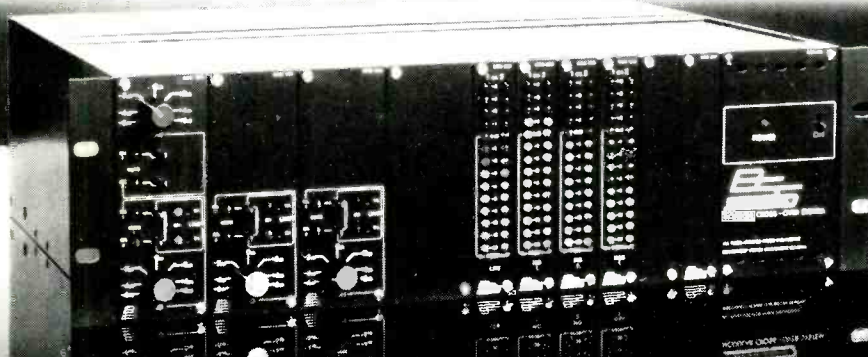
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# Communications circuits

phase change approaching 180°, whereas 'delay' equalisers contain many identical resonant lattice sections of a design carefully chosen to match the phase (or delay) curve of a length of cable up to the maximum usable cable frequency, above which the phase characteristic continues to a maximum of 360°.

Two standard types of delay unit are used in the BBC, one designed to match the virtually pure delay (with phase change proportional to frequency over the whole band) encountered on unloaded circuits at the rate of 10μs/mile, and the other with a delay that increases with frequency above about 5kHz to fit the characteristic of the commonest type of loaded music cables which introduce a delay of 45μs/mile at low and middle frequencies increasing to 75μs/mile at the highest usable frequency before cut-off. For convenience both types are calibrated in terms of the delay at 1kHz and masks have been plotted and are used in the same way as for amplitude equalisation, and further masks show the characteristics produced by various combinations of phase equaliser sections which can be set up either aiding or opposing (in the same, or in opposite circuits) to correct a wide variety of phase difference curves.

As the path lengths of the two circuits can be widely different, the delay introduced and therefore the inter-channel phase difference can be considerable; for example a difference of 40 miles of unloaded physical plant introduces a delay difference of 400μs, measured as about 130° at 1kHz and 1300° at 10kHz, and will, incidentally, need 16 resonant lattice sections to equalise. The plotted curve is therefore likely to cover several complete revolutions, but since the phase meter will only indicate angles within one revolution, any reading may need correction by a multiple of 360°, and the curve can

only be plotted correctly if sufficient discrete frequencies, or a continuous sweep, provide indication of the actual change from one point on the curve to the next.

There still remains uncertainty as to the true zero of the curve, for although it is possible to define the phase angle at one frequency relative to any other, there can still be absolute errors of complete revolutions. But the use of the delay equaliser mask to select a suitable setting will reveal the extent of the error since all delay curves (plotted as phase against frequency) are asymptotic to the true zero line at very low frequencies. This will also indicate, by a discrepancy of 180° (over the whole band), any reversal introduced in the transmission path, which can easily be corrected by a further reversal.

Having corrected the delay inequality between the two circuits by adding local delay sections to the shorter one, it only remains to equalise the overall phase difference characteristic by the addition of phase equaliser sections, again selected by using the appropriate mask on a curve plotted after delay correction, to achieve the required working limits which, within the BBC, are ±15° over the range 250Hz to 4kHz, relaxed to ±60° at the ends of the band. Due to the difficulty of maintaining tighter limits on permanent circuits, these

limits are applied to the overall chain from source to destination, including both OB and permanent links, and equalisation is normally set up for each combination of circuits as it occurs.

It is important to note that all the above phase correction is directed solely to matching one circuit to the other, no attempt is made to correct the phase distortion of either, and in practice, since we can only delay the signal on the faster transmission path to match that of the slower, equalisation often implies increasing the phase distortion of the better circuit.

Most music circuits are provided on physical plant, whether the simple pair of wires in a direct cable linking, say, a studio to a recording suite in the same building complex, a local circuit from one side of town to the other via the local telephone exchange, or the long distance circuit from one side of the country to the other, with many repeater stations at regular intervals throughout its length.

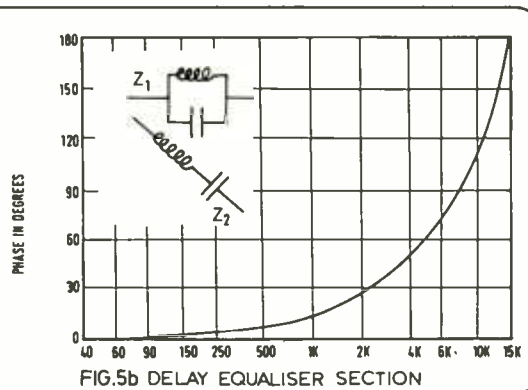
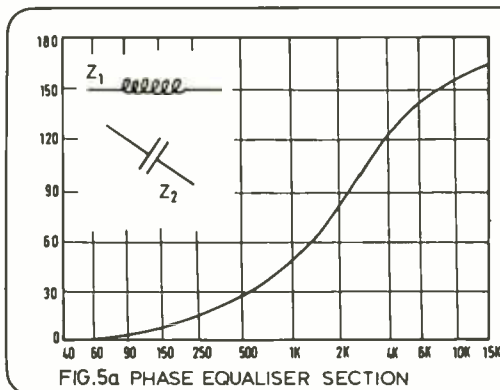
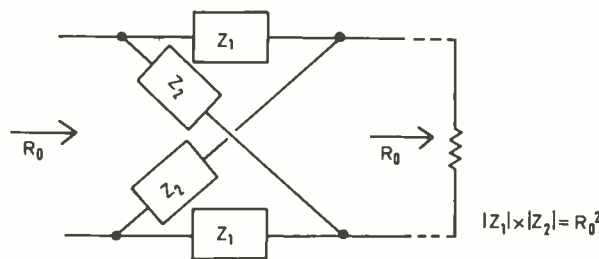
Whether provided on a permanent or a temporary (outside broadcast) basis, the construction, and therefore the transmission characteristics, will be similar, the longer circuits being provided as pairs of wires between the broadcaster's premises and the nearest telephone exchanges, and the two exchanges linked by further cable pairs with intermediate repeaters as necessary. For permanent circuits all the pairs, equalisers and amplifiers are dedicated to the specific

circuit and, once provided, barring accidents such as cable failure (and allowing for slight changes in loss at high frequencies due to seasonal temperature variations) the transmission characteristics should remain constant. For circuits provided on an OB basis, each local end, consisting of an existing pair from the exchange to a main distribution cabinet at a street corner, there connected to a selected pair along the street to a convenient distribution point, followed by a specially laid small cable into the required programme location, is set up specifically for a particular transmission, and because of the work involved is often the most expensive part of the provision. The two local ends of a temporary circuit are linked by one or more occasional programme circuits in tandem, drawn from a network of such circuits, permanently set up between main centres for the dual purpose of providing OB facilities and replacing faulty sections of permanent circuits.

Connecting a pair of wires between terminals will invariably introduce some loss, and in simpler terms this insertion loss consists of the length-dependent attenuation of the signal down the cable itself, together with the mismatch introduced at the ends since it is not feasible to match the terminal equipment to a line at more than one frequency. For normal twisted pairs, the attenuation increases with frequency, dependent mainly on the resistance of the conductors (commonly between 0.32 and 1.27mm diameter, the thinner the wire, the greater the loss) and the capacity between them (determined by the thickness of the insulation which may be dry paper in the old, lead-covered cables or plastic in modern cables—the closer the spacing, the greater the loss at high frequencies).

If inductance is added to the conductor (fig 6) the theoretical line characteristic can be improved so that loss is reduced to a constant amount at all frequencies, governed only by the resistance, but in practice, since this inductance can only be added in discrete lumps instead of distributed along the wires, this combines with the line capacitance to form a series of lowpass filter sections. The circuit performance is, however, significantly improved over the passband, fig 7 allowing greater spacing of repeaters, although severe phase distortion is introduced near the cut-off frequency. The bandwidth is determined by the size of the inductors and their spacing, and standard values give circuits suitable for either music or speech purposes.

FIG. 4 CONSTANT IMPEDANCE PHASE SECTIONS







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# Communications circuits

The terminal mismatch loss depends on the characteristic impedance of the cable, typically of the order of 1kΩ at low frequencies and 150Ω at the upper end of the band, and on the impedance of the terminal equipment which is normally a fixed value at all frequencies, traditionally 600Ω for permanent installations (the only value specified for customer termination of PO provided circuits). When sending from a 600Ω source, the loss into the comparatively low impedance of the circuit at high frequencies can be considerable, and for OB purposes (where potentially noisy temporary circuits are involved) the accepted standard impedance is 75Ω which gives a better power transfer to the line at the frequencies where the cable attenuation is greatest, thus giving a degree of pre-emphasis compared with a 600Ω source. The overall insertion loss for 1 mile and 3 mile lengths of typical local cable, showing the effects of the standard sending impedances, is shown in fig 8.

Long circuits consist of many such sections, usually of heavier gauge cable, with each section of perhaps 10 miles, equalised and amplified so that a normal level signal is fed onto the next. Equalisation of the insertion loss of one such section is a fairly simple proposition, but the result is seldom perfect, errors of the order of 0.5dB overall being fairly normal. Individually, these may be perfectly acceptable, but where a circuit contains many repeated sections, each equalised to this tolerance, the errors can be cumulative. The overall circuit response measured at the receiving terminal will then consist of the local end loss modified by this error, together with a low frequency loss introduced mainly by the many transformers en-route, and may look very different from the expected characteristic, consequently requiring many equaliser sections to achieve a flat response.

Short physical circuits such as local tie lines may not need any equalisation or amplification dependent on the cable gauge, the terminal impedances and the required bandwidth. The performance of various typical short cable lengths for three different terminal impedances is given in Table 4 which shows clearly that the lower the impedance the greater the overall loss for a given cable length, but also the less the spread.

## Carrier phantom

In practice many long distance circuits are provided, not on physi-

cal pairs, but on the phantoms of carrier circuits. Audio phantoms are derived using a complete working pair as each leg of the additional circuit, connection being made through the centre taps of the repeating coils on the side-circuits, so that the longitudinal current of the phantom signal can be carried together with the circulating signal of the side circuit without mutual interference, fig 9. Only where the side circuits are laid as a quad (the four wires of the two pairs interleaved and twisted together) is the balance of the phantom and therefore its noise performance good enough for music, but the carrier cables, where each pair carries a 24-channel frequency division multiplex system occupying the frequency band 12kHz to 108kHz, meets this requirement.

For the phantom circuit, the use of 2-wires as each leg and their close physical spacing halves the overall line resistance but greatly increases the capacitance so that it is necessary to equalise and amplify at every carrier repeater station (typically every 13 miles). Due to slight imperfections in balance, a small amount of the carrier signal may be found on the phantom circuit, but this is above 12kHz and can usually be filtered off at the receive terminal to give a music circuit with a bandwidth in excess of 10kHz.

## Carrier programme circuits

Carrier phantoms, the mainstay of the long distance music network in Britain for many years, are gradually being withdrawn as the 24-channel systems are superseded by

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FIG. 6 SIMPLIFIED EQUIVALENT CIRCUIT OF PHYSICAL LINES

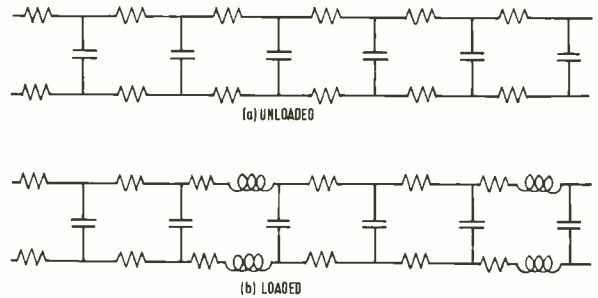


FIG. 7 ATTENUATION OF 10 MILES OF 0.9mm CONDUCTORS

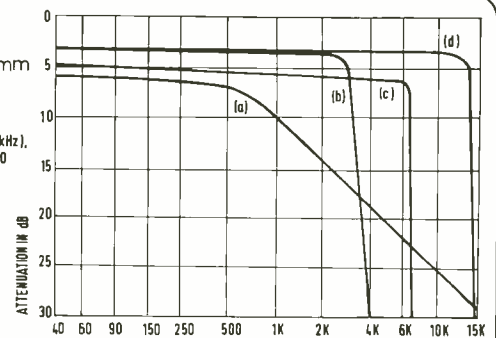


FIG. 8 PRACTICAL INSERTION LOSS OF TYPICAL LOCAL CIRCUITS

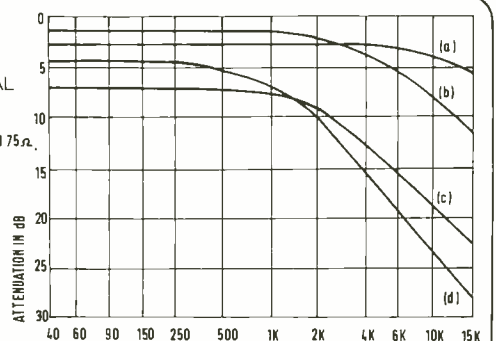


TABLE 4

Wire Gauge	Length miles	Resistance Ω	600Ω Terminals Loss	600Ω Terminals Spread	150Ω Terminals Loss	150Ω Terminals Spread	50Ω Terminals Loss	50Ω Terminals Spread
1.27mm (40lb/mile)	½	22	0.2	2	0.8	0	1.8	0
	1	44	0.4	5	1.4	0	3.2	0
	2	88	0.7	7.5	2.4	0.5	5.5	0
0.93mm (20lb/mile)	½	44	0.4	2.5	1.4	0	3.2	0
	1	88	0.7	5	2.4	0.5	5.5	0
	2	176	1.2	8	4.5	1	9.0	0.5
0.63mm	½	88	0.7	3	2.4	0.5	5.5	0
	1	176	1.2	6	4.5	1	9.0	0.5
	2	352	2.3	9	7.5	2	13.5	1
	3	528	3.2	12	10.0	3	16.5	2

Note: The above figures do not include Repeating coil losses. Loss (dB) is the attenuation at low audio frequencies. Spread (dB) is the range up to 10kHz.





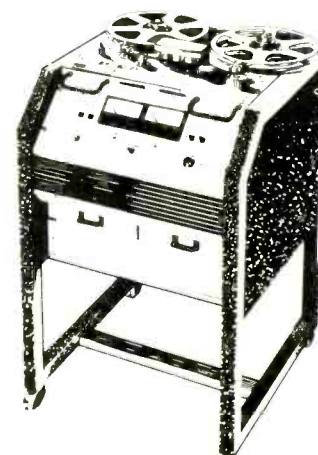
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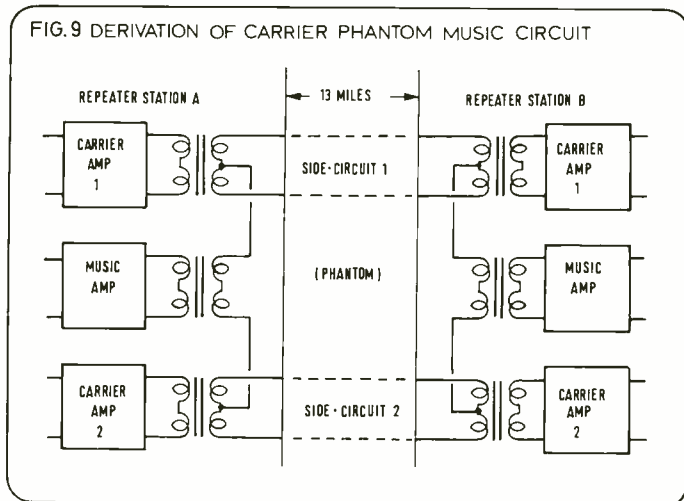


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# Communications circuits



others, many times larger, carrying the increased requirement of telephony circuits more economically either on coaxial cables or microwave radio links. Future music circuits are therefore more likely to be provided using carrier programme equipment, where the music signal replaces three adjacent 4kHz speech channels in the system, giving a usable bandwidth of about 10kHz after filtering. On these systems, intermodulation distortion can cause crosstalk from one channel to another, with the result that the noise performance is usually close to the limits, also normal harmonic tests at peak level are forbidden and these measurements must be made with short pulses of tone. Carrier programme circuits are satisfactory for normal mono transmission, but cannot be used for stereo as the signal may suffer from an overall frequency shift of up to about 1Hz (due to the use of unlocked modulation and demodulation carriers). Although this frequency change is not noticeable to the human ear, the signal can not be combined with another unshifted or differently shifted signal to form a stereo pair, so 48kHz groups are used instead, see later.

There is normally no amplitude/frequency distortion between the modulator and demodulator, but since there will still be physical local ends between this apparatus and the user's premises, the same parameters need to be measured and the overall response equalised as for any physical circuit.

## Radio Links

Audio channels can of course be provided on radio links although the availability of frequencies is limited. The allocation of frequencies in the UK is made by the Home Office and only broadcasting authorities are likely to acquire

them for this sort of quality service.

There are basically two sorts of audio radio link in service in the BBC, both using frequency modulation:

1) Point-to-point—working in the VHF or UHF bands. They tend to be 'custom built' BBC manufacture, although some commercial equipment is still used, and, with the addition of extra power amplifiers and using yagi aerials, can transmit up to 40 miles in a single hop. The equipment is housed and transported using 'commercial' vehicles.

2) Radio cars—again working in the VHF and UHF bands. With transmitter output power up to 40W and a 20ft telescopic mast most of London, for example, can be covered using only three base stations. The vehicles in which the equipment is installed vary from London taxis to estate cars, depending upon the facilities required.

Point-to-point links are normally used to relay complete OB programmes from the venue to the studio centre, whereas radio cars tend to be used for short notice on-the-spot interviews and inserts into programmes.

In addition, the microwave television OB radio links currently in use have an engineering audio FM sub-carrier channel above the vision (typically at 7.5MHz) which can be used for the audio component of the television programme.

## Use of 48kHz groups

Stereo over long distances (say more than 200 radial miles in the UK) is difficult on analogue line plant. On the other hand 48kHz groups exist widely in most countries including the UK. These groups are the standard PTT 12× nominal 4kHz telephony channels that are the basic 'building brick' of the telephony systems:

12 channels = 1 group (48kHz)

5 groups = 1 supergroup (240kHz)

15 supergroups = 1 hypergroup (3.6MHz)

Commercial equipment exists which takes two 15kHz audio channels and multiplexes them onto a standard 48kHz group (60kHz to 108kHz) using a multiple modulation system and employing companding to improve the noise performance. The frequency response, harmonics and phase differences are satisfactory for stereo transmissions.

As already noted, 48kHz groups are normally used for long distance telephony and are therefore available only from main exchanges. This means that when they are used for stereo OBs, physical pairs are still required to connect the OB site to the nearest access point for the 48kHz group and similarly at the receive end to the user's premises.

Multiplex equipment is available in many European countries including the UK, and also the USA. The continuing series of concerts under the auspices of the European Broadcasting Union, transmitted live in a number of European countries, are relayed using this system.

## The use of PCM systems

There are obvious advantages in using digital techniques for the transmission of audio signals over long distances. Once in coded form the signals are not degraded unless additional decoding/coding operations are performed or the bearer channel fails beyond a known threshold limit. On the other hand analogue signals will become progressively degraded when passed through equipment and transmission systems including lines.

Pulse code modulation is used for the high quality audio digital systems already in operation. Basically the 'quality' of the system depends on the rate at which the analogue signal is sampled (the highest frequency obtained being slightly less than half the sampling frequency) and the number of quantising levels (each of which is represented by a different coded word) and hence the number of bits on the PCM code. The effect of having a finite number of quantising levels is, over most of the dynamic range, equivalent to adding random noise at the output of the decoder. The more quantising levels used, the less the noise produced, but of course the higher the resulting bit rate. Additional techniques are used to minimise the effects of having a finite number of quantising levels and to conceal errors received at the decoder.

Using time division multiplex techniques, a number of audio channels can be sent together, at

the required bit rate, as a composite bitstream on a single bearer link.

To date, in the BBC, four audio PCM systems have been developed, two are in full operational use and the other two have been used experimentally. A short description of these systems follows.

### a) 6,336 kbits/s

This system has been in use in the BBC for a number of years to distribute stereo signals from London to the VHF Radio transmitters throughout most of the country. The system uses 13 bits per word with linear coding (no companding), a sampling frequency of 32kHz and provides 13 high quality audio channels by using a bit rate of 6,336 kbits/s. The bearer circuits used to carry the bitstream are 'monochrome standard' television links.

### b) 704 kbits/s

This 2-channel system accepts two high quality audio signals, samples them at 32kHz, converts them into 13 bits per sample digital form and processes them to reduce the transmitted bit rate. The bit reduction process, known as NICAM (near instantaneous companding audio multiplex), enables the number of bits per sample to be reduced to 10 for transmission with virtually no degradation in quality. The two channels are combined to produce a 704 kbits/s digital signal. In the receive terminal the 10-bit words are 'expanded' to 13 before decoding. In order to make the bitstream suitable for transmission on a television link, it is usually coded in HDB3 (high-density bi-polar) which ensures that no dc component exists in the signal.

An example of the use of this equipment was on the live transmission of the Elton John Moscow Concert in May 1979 using a communications satellite television channel as bearer.

The system is being further developed to produce equipment for operational use in conjunction with a mobile radio link.

### c) 2,048 kbits/s

This system also uses 32kHz sampling, a 13-bit word and the NICAM bit reducing technique. Six channels are multiplexed together and the resulting bit rate is 2,048 kbits/s. A number of these systems can be multiplexed together on a single bearer and it is likely that it will become the standard 'building brick' for future high density routes.

Bit reduction is, of course, economically attractive as it maximises the use of the communications medium. Later developments of the NICAM techni-





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## Communications circuits

ques (to be used in both the new 2-channel and 6-channel systems) use 14 bits per sample reduced to 10 for transmission.

### d) Sound in Syncs (SiS)

For many years BBC1 and 2 television networks have used the SiS PCM system to feed the audio component to the transmitter. SiS can also be used (and is, increasingly) for feeding the audio from television OB's and external studios to the broadcast centres. It is used extensively on the Eurovision network for the common 'international sound' component of multilateral relays.

As the system utilises the picture line synchronising pulses to 'carry' the digital audio, the constraints so imposed determine the sampling rate and the number of bits per sample. In order to produce a reasonable audio bandwidth, the audio is sampled at twice the television line frequency, ie 31.25kHz, resulting, after filtering, in a 14kHz audio channel. As only 21 PCM pulses can be 'packed' into a line synchronising pulse without extending the upper frequency limit of the vision channel (another constraint), only 10 bits can be allocated to each digital word.

A 10 bit word can describe only 1,024 ( $2^{10}$ ) quantising levels which is not sufficient to produce a high quality reproduction in the decoder, so an analogue compander is used to improve the performance.

Each alternate coded sample is stored for half a television line period and is interleaved with the adjacent sample and slotted into the TV line synchronising pulse 12µs long so that each synchronising pulse contains two samples and a marker pulse, fig 10.

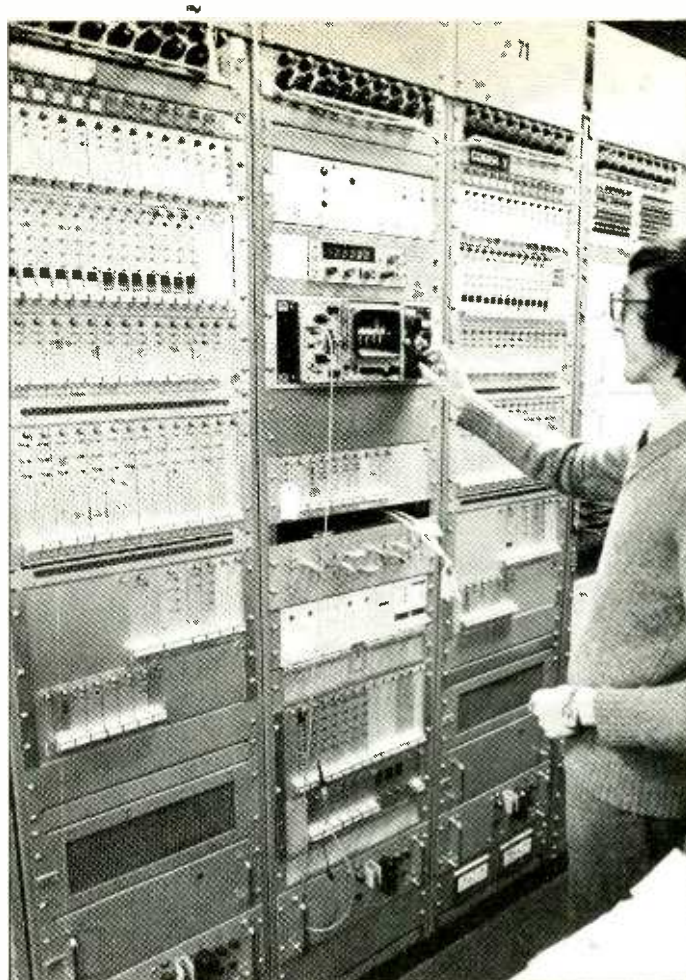
Vision and sound are therefore locked together—with advantages in switching and routing—until decoding at the transmitter or studio centre restores both signals to their analogue form.

### FDM systems

The PCM systems mentioned above all use TV circuits, in one form or another, as bearers. FDM (frequency division multiplex) can also be used to provide audio signals on TV circuits and one such system is used regularly in the BBC for stereo transmission in the UK where suitable analogue plant is not available. The equipment embodies a frequency modulation, frequency division system for the transmission of two high quality music circuits. The centre frequencies of the two channels are 2.67MHz and 3.33MHz and the deviation at full modulation is 75kHz. Whilst the utilisation of a 5MHz bandwidth circuit to provide two 15kHz audio channels may seem wasteful, if the TV circuits already exist and are not being used for TV, or there is no alternative available, then the picture changes. The equipment has also been used on BPO protection channels (the automatically switched reserve channels for the BPO's intercity telephony and television systems) which meet the specification for colour TV circuits and are available for temporary rental.

### Communications satellites

The International Telecommunications Satellite Organisation (Intelsat) series of geostationary satellites, parked about 23,000 miles above the equator, strategically placed over the Atlantic, Pacific and Indian Oceans, provides a worldwide service for telephony, television and to a lesser extent, audio. The satellites work through the large dish aerials—typically 100ft diameter in the 'standard A' stations—at earth stations sited in many countries throughout the world. The 'up-leg' frequencies are in the 6GHz band and the 'down-leg' ones are in the 4GHz band. Each satellite has 12 transponders (repeaters)



BBC 13-channel PCM equipment operating at 6,336K bits/s for stereo radio distribution.

each about 40MHz wide, one of which is usually reserved for television and is engineered for two channels in the 'half-transponder' mode.

Earth stations are currently being equipped to operate FM audio subcarrier systems with each vision channel to make more efficient utilisation of satellite capacity. At present audio channels are provided by combining telephony channels using carrier programme equipment and whilst they are provided basically for television, they can be hired on a temporary basis as individual wideband audio circuits when not otherwise required.

When stereo is required—and transmission from the East and West coasts of America and Japan have been successfully relayed—48kHz groups and the associated multiplex equipment (mentioned before) are used.

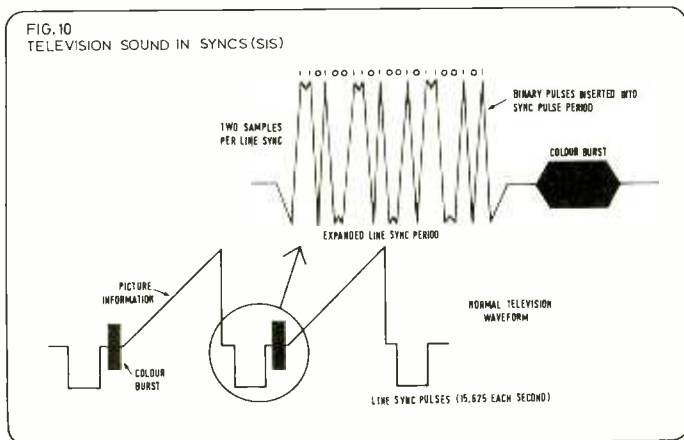
Long distance stereo circuits within the USA have been provided using two subcarrier channels multiplexed above the vision channel on a television link which are then demodulated and fed into the 48kHz group system in New York, the USA 'gateway' for the Intelsat network of satellites.

### Future trends

It is difficult at this time to speculate in detail about the future.

Digital audio communications is already with us (as is digital video) but at present the audio digital bitstreams are carried on conventional television circuits. Post Office digital bearers (high speed bitstreams up to 140M bits/s) may be available on certain routes by the mid eighties. It is difficult to say when the whole range of broadcast communications (video, audio, data and telephony) will be carried as packages in digital bitstreams but the indications are that it will happen sooner or later.

Communications satellites will make an increasing impact—currently the European Orbital Test Satellite (OTS), a fore-runner of the European Communications Satellite (ECS), is undergoing full operational testing and has been used experimentally for television OB's and other relays. ECS offers the possibility of carrying Eurovision and general telecommunications traffic, although no decisions have yet been made. In North America, extensive use is already made of 'national' communications satellites for a whole range of telecommunications facilities including distribution of broadcast networks and material for cable systems. Nevertheless, it is safe to say that physical lines, especially over short distance, will be with us for some considerable time.







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# APRS Exhibition - a preview

The 13th annual exhibition of the Association of Professional Recording Studios will be held from Wednesday June 18 to Friday June 20 at its traditional venue, the Connaught Rooms, Great Queen Street, Kingsway, London WC2. Over 90 companies will be exhibiting their products. Hours are 10am to 6pm, closing early at 5pm on Friday. Admission by trade card.

●**Agfa-Gevaert**: complete range of audio tapes for broadcasting and studio mastering applications including *PEM-368* mastering tape. Also the company's bulk cassettes and compact cassettes. ●**AKG**: new *C-567E* condenser lavalier mic; *C-414E* remote control condenser mic; *D-300* series of vocalists mics; full range of mics and accessories; reverb units including the portable *BX5*; and the *TDU 7000* modular time delay unit. ●**Allen & Heath Brenell**: launch of the *Syncon Series B* in-line modular console system. Also the *Syncon Series A* 16/24/28-track console; and the *AHB* 8-track package system; and the *SR Series* of sound reinforcement consoles. ●**Alice (Stancoil)**: *I2-48* semi-modular mixer; *STM-8* portable production/transmission mixer; *Custom Modular 20/8/16* console with matrix routing; and the *828* portable mixer. Also various ancillary units for broadcast use. ●**Amek**: *M3000* and *M2500* automated consoles; *Tape-pak* and *Auto-pak* computer systems; *M2000* and *M1000* consoles; and the *TAC 500* and *TAC 16/8/2 + 8* desks from the Total Audio Concepts series. ●**Ampex**: *ATR-116* and *ATR-124* multitrack recorders; *MM-1200* multitrack; *ATR-100* recorder including a recently intro-

duced 1/2in 2-channel version; *ATR-700* tape recorder; the *EECO MQS-100* synchroniser; the *ATR-102* and *ADD-1* disc mastering system; and Ampex tapes and cassettes. ●**AMS (Advanced Music Systems)**: new *DMX15-80S* stereo programmable DDL; *DMX15-80SB* broadcast version; new *DM-DDS* disc mastering DDL; plus the *DMX15-80* DDL and the *DM2-20* phaser/flanger.

●**Atlantex Music**: wide range of products from the *Ashly*, *Furman Sound*, *MXR* and *Sescom* ranges of audio signal processing equipment, plus cables and connectors from *Whirlwind Music*. ●**Audio & Design (Recording)**: comprehensive ranges of signal processing equipment. New items include the *Scamp* mini-rack; a new 19in rack mount *Scamp* power supply unit; the *Scamp S25* de-esser module; the *Gemini Easy Rider* rack-mount comp/limiter; and the first in a new range of rack-mount effects units, the *Panger* developed from the *Scamp S23* pan effects module. ●**Audio Developments**: *AD055* compressor/limiter; *AD070* prographic equaliser; *AD007* portable mixer; *AD045 Pico*, *AD049 Mixette*, and *AD031 Micro* mixer; plus a small mixer for ENG use and a new PPM. ●**Audio Kinetics**: *QLOCK 210* SMPTE time-code synchroniser; *XT-24 Intelocator*; and the company's range of modular acoustic screens. ●**Audix**: *ILR* console package; new 8-group version of the *B100* broadcast mixer; improved version of the *MXT-1000* broadcast mixer; and introduction of an extended range of broadcast modules. ●**Avcom Systems**: *Telex Communications 300 series* high speed in-cassette copiers; *SC Series* cartridge machines; plus special purpose headsets and intercoms. Also *Sonifex* portable PA mixer; new broadcast cartridge machines; and a budget priced range of cartridge machines.

●**Barth**: range of signal processing equipment.

●**BASF**: range of professional tapes, cassettes and magnetic film including calibration and test tapes. ●**FWO Bauch**: wide range of products from *Albrecht*, *Allison Research*, *CMX Systems*, *EMT*, *Harrison*, *ITC*, *Ivie*, *Klein & Hummel*, *Lexicon*, *MRL*, *Neumann*, *Revox*, *Studer*, *Switchcraft*, *Transco* and *UREI*. Highlighted will be the *Harrison MRI* digital/analogue hybrid console; the *EMT 251* digital reverb/effects unit; *EMT 948* direct drive turntable; *UREI 811* and *815* time-aligned monitor loudspeakers; *Switchcraft* miniature audio connectors; *Ivie 5000 Series* PA system rack units; and the *Allison Kepex II* keyable program expander. ●**Beyer**: new *M420N* unidirectional dynamic mic; new *M422N* special purpose unidirectional dynamic mic; reintroduction of the *M130N* bi-directional dynamic mic; *MCE5* miniature condenser mic; the *700 Series* modular condenser mic system; and several additions to the company's range of headphones and headsets. ●**B & K Laboratories**: new *Type 2033* high resolution signal analyser; new add-on unit allowing the *2010/1902* distortion measurement system and *Type 2971* phase meter to be used for time delay spectrometry; and the full range of *Bruel & Kjaer* audio measurement instruments. ●**Brodr Jorgensen**: *Roland RSS Series* of rack-mount signal processing units plus the *RE Series* of echo units. ●**CA Audio Systems**: demonstration of the *Cadac Digidac* digital fader system. Also the improved *P Series* version of the *Cadac 'In-Line'* series of consoles with full function flexibility and optional dc subgrouping, automation, and centralised routing. ●**Calrec**: new microprocessor controlled OB switching unit; plus the company's range of professional condenser mics including the *Soundfield* Ambisonic mic; and the company's sound control consoles. ●**Canford Audio**: an automatic cable tester; a low noise battery mic preamp; a telephone balance unit; studio ancillary equipment; and *EMO* DI boxes.

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◀ New 8-group version of the Audix B100 broadcast mixer ▶



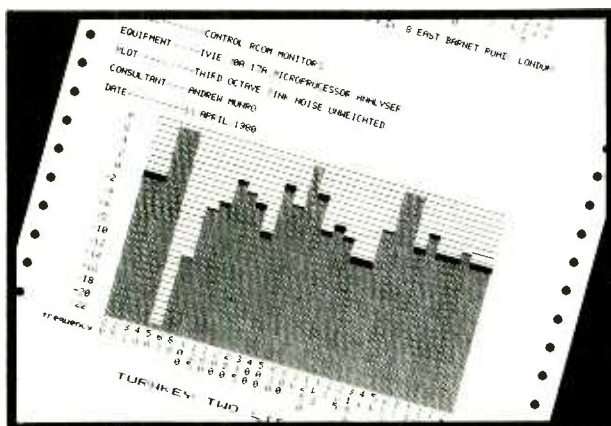
Beyer DT108 headset ▶



# SOUND EXPERIENCE IN DESIGN

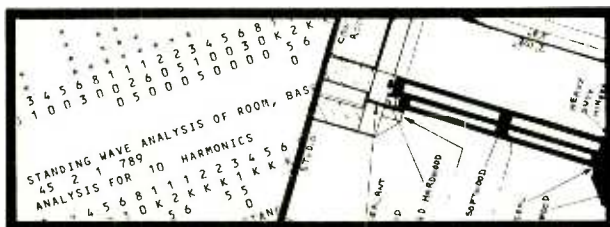
SEE US AT THE  
**APRS 80**  
EMPIRE ROOM

Accurate and neutral monitoring conditions are a vital link in the recording chain. Turnkey Two designs and updates studio acoustics using the most advanced technology available.



## The Acoustics Jungle

The studio is the most expensive element in the recording process. The complex reflections within its walls can distort an original sound more severely than any loudspeaker. Resonances and suck-outs of 20dB are not uncommon in poorly designed rooms.



## Cost Effective

Our knowledge of construction techniques and building materials enables us to produce rapid results. Whether it's a question of corrective measures or building from the ground up, we guarantee our efforts and time schedules.

Through Turnkey we can also supply complete equipment packages – getting it right at the outset solves many future problems.



## Systematic Analysis

The key to our operation. The use of computer analysis allows rapid meaningful data acquisition on site. Information is stored digitally and can be held for future reference. This also allows instant before and after comparisons when fine tuning.

Complete third octave analysis of both level and reverberation can be carried out in a few hours and time gated spectrometry even allows anechoic measurements to be made in a live room.

## Your move

Turnkey Two can get involved in a project at any stage – its never too late to put your acoustics right.

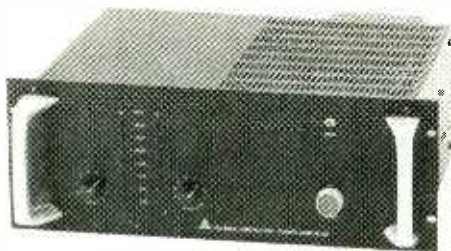
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## APRS preview



▲ High speed Sony cassette copier from FPA

◀ FM Acoustics FM800A power amp

●**Capital Components:** range of bargraph visual displays available with various scales and in VU and switchable VU-PPM styles. ●**Cassette Duplicating Supplies:** Crowmay loop-bin and in-cassette duplicating systems and an automatic cassette winder. ●**CB Electronics:** plug-in multi-track modular electronics available as a comprehensive system. ●**Cetec-Gauss:** 1200 Series high speed cassette duplication system which includes a microprocessor for constant system performance surveillance; range of fully automatic and semi-automatic cassette loaders from **King Instruments;** new higher power handling Gauss loudspeakers; range of stereo electronic crossovers including a new 5-way model; and a new instant start broadcast turntable. ●**Clive Green & Co:** multitrack in-line console for recording or broadcast use, developed in cooperation with **Enertec.** ●**Court Acoustics:** range of studio monitoring systems and associated equipment including full range of **BGW** power amps, plus equalisers and analysers from **Neptune Electronics.** Also the company's range of electronic crossovers and the **GE60** stereo 30-band 1/3-octave graphic equaliser. ●**Covmain:** **RCF AFSAI** 1/3-octave realtime spectrum analyser; range of professional loudspeakers and compression drivers; a new studio monitor enclosure; and a range of mics.

●**Design Electronics:** **Cuemix** studio foldback system. ●**Dolby Laboratories:** range of professional Dolby-A noise reduction units, including the **Cat 155/255** units for videotape recorders, and the **CP-200** for the reproduction of encoded stereo films. Also details of the Dolby FM system and the **HX** headroom extension system. ●**Don Larking:** details of the company's new and used equipment retail operation. Also **BEL** flangers and noise reduction units.

●**Eardley Electronics:** **Neutrik Audiotracer 3201** audio response analyser; **AD-4** analogue delay line; plus audio connectors and modular in-line components. ●**Electro-Voice:** full range of professional mic and loudspeaker systems, plus mixers and amplifiers from sister company **Tapco.** New products include the **Tapco C-12** mixer and the **XEQ-1** electronic crossover/equaliser from **Electro-Voice.** ●**EMI Tape:** range of professional and duplicating audio tapes; plus cassettes and accessories. ●**Enertec:** **UPS-4000** series 24-track automation ready console; **UPS-5000** and **UPS-5100** consoles; **F-462** series of tape recorders; **GCE-4000** series of solid state switching grids; and a cassette broadcasting system.

●**Feldon Audio:** wide range of products including **Syntovox** vocoders; **Pulse Designs Tempo-Check Studio 100** programmable metronome; **Inovonics Model 500** acoustic analyser; **Ursa Major SST-282 Space Station** digital reverb system; **Ortofon** disc cutting equipment; and

**Eventide Harmonizers,** delay lines, effects units, and realtime spectrum analyser for home computer interface. ●**Fitch Tape Mechanisms:** **T250** range of NAB 'A' cartridge record and playback machines; **T100** replay machine; **T101** record/replay machine; and **T70 Cartette** machines. Also **Audiopak** cartridges and the company's range of **BGM NAB 'C'** cartridge machines for background music installations. ●**FM Acoustics:** **FM 600A** and **FM 800A** power amplifiers. ●**Formula Sound:** **S19G** 2-channel, 1/2-octave, 19-band graphic equaliser and **SG19A** equaliser/analyser. ●**Fraser Peacock Associates:** new high speed cassette copier, plus details of the company's cassette duplication service. ●**Future Film Developments:** comprehensive range of cables, cords, connectors, jackfields, wiring aids and associated components, plus a wide range of audio accessories.

●**Harman Audio:** **JBL** range of monitor loudspeakers and **7510** automatic mic mixer; plus complete range of **Teac-Tascam** units including mixers, tape recorders, and the new **Portastudio** 4-channel mixer/cassette deck. ●**Hayden Laboratories:** **Nagra** portable tape recorders including the new **TRVR** logging recorder; **Sennheiser** mics and headphones including the new **Mikroport** radio mic system; **Sondor** film sound equipment; and **Telefunken** tape machines including a new autolocator for the **M15A.** ●**HHB Hire & Sales:** **Crown/Amcron** amplifiers including the **PSA-2** and **SA-2** self-analysing power amplifier; the **RTA-2** realtime analyser; and the **Badap 1** programmable audio measurement system from **Barclay Analytical.** ●**HH Electronics:** **TPA Series D** and **S500D** professional power amplifiers and the company's **MOSFET** power amps. Also electronic echo units and portable stereo sound control mixers. ●**Malcolm Hill Associates:** new **J Series** modular console, plus the company's **DX** range of amplifiers.

●**ITAM:** **Model 1610** 1in compact 16-track recorder with modular electronics and full function remote control; **Model 806** 1/2in 8-track recorder; and the **10-4** and **Model 882** mixers. Also the **Stocktronics** stereo echo plate; **Revox** mixdown recorders; **dbx** noise reduction; and **Otari** multitrack recorders and cassette copiers. ●**Jackson Recording:** details of the company's used equipment retail operation. ●**John Page:** **Stellavox** range of portable recorders and mixers including the **SP8** stereo/mono recorder.

●**Keith Monks (Audio):** professional and semi-professional record cleaning machines; **Model LS-19** monitor loudspeaker with built-in 10W amp; wide range of audio accessory equipment; and **EDC** radio mics. ●**Klark-Teknik:** new **DN60** 1/3-octave realtime spectrum analyser; plus the **DN27** and **DN22** graphic equalisers; **DN70** digital delay line and **DN71** controller; and the **DN34** analogue time processor.

●**Lee Engineering:** **Ampro** cartridge recorder/replay units; **Audi-Cord 100 Series** cartridge recorder/replay units; **McKay Dymek** communications receivers and broadcast equipment; **TFT AM** and **FM** modulation extenders; and the **Optimod-AM** and **Optimod-FM** units from **Orban.** ●**Leeholme Audio Services:** details of the company's cassette duplication services.

●**Leevers-Rich:** **Proline 1000** 1/4in professional recorders including the **Proline 1000L**, a new slow speed logging version; **Proline 2000TC** recorder now available with a microprocessor controlled programmable autolocation unit; and the company's demagnetisers, bulk erasers and magnetometers. ●**Lennard Developments:** complete range of **Woelke** professional record, playback and erase heads; plus wow and flutter meters, wave analysers, and bias/distortion meters. ●**Lockwood:** representative units from the company's loudspeaker enclosure ranges and from its monitor loudspeakers. ●**Lyrec:** new-look externally redesigned **TR532** 24-track tape recorder and **ATC** remote controller. Also the company's high speed cassette duplicating system and a new 1/4in recorder.

●**3M:** 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor. Also the **M79** multitrack recorder; **Wollensak** cassette duplicators; and **Scotch** audio tapes including **Scotch 265** digital mastering tape. ●**Maglink:** programmable synchronisation system using **Maglink** code; various accessory equipment including generators, readers, an **SMPTE/EBU** to **Maglink** interface, and a new **EBU** timecode reader with video character insertion and regeneration capability. ●**Magnetic Tapes:** **Chilton** portable mixing desks and the **QM2** range of consoles. ●**MBI Broadcast Systems:** **Series 24A** broadcast/production modular mixer and details of the company's turnkey design and installation service. ●**MCI:** **JH-600** console; **JH-500C** console; **JH-50** automation; **JH-45** synchroniser **JH-24** multitrack; and the **JH-110 Series** recorders in various configurations. Also the **Autolock III** and **RTZ III** locating devices.

●**Midax:** **PR System** mixing consoles in a variety of input/output configurations for sound reinforcement, on-stage monitoring, recording and production applications. Also the recently introduced **TR System** modular theatre consoles available in 24, 30 and 36 into 8-8 formats. ●**Mosses & Mitchell:** range of jacks and jackfields including the **440** range of miniature jack sockets and jackfields. ●**Music Laboratory:** **PSE** range including an echo-reverb plate, spring reverb, **D1** boxes, phantom power supplies, and equipment racks. Also range of amplifiers from **QMI.**

●**NEAL-Ferrograph:** new **Ferrograph Pent-house Studio 8** tape recorder designed for broadcast use; new **NEAL Model 312** stereo cassette recorder with **Dolby HX;** **SP74** 4-channel logging recorder; **Edit 7** replay only editing recorder; **SP7** 1/4in recorder available in a number of customised versions; plus the company's other tape equipment and its audio test units. ●**Neve:** **Model 8108** 56/48 console with microprocessor controlled assignment facility; **Model 5316** broadcast production console; **542** range of 8, 12 and 16-input consoles; the **Necam** fader system; and details of the company's custom and turnkey services.

●**Otari:** **MTR-90** 2in, 16/24-track multitrack recorder; **MX5050** and **MX7800** tape recorders; and the **DP4050** cassette duplication system.

●**Penny & Giles:** first UK showing of the company's digital fader with 8-bit digital output;

106 ▶



# ANOTHER **MCI** FIRST

## MCI—the first company to offer the totally transformerless system

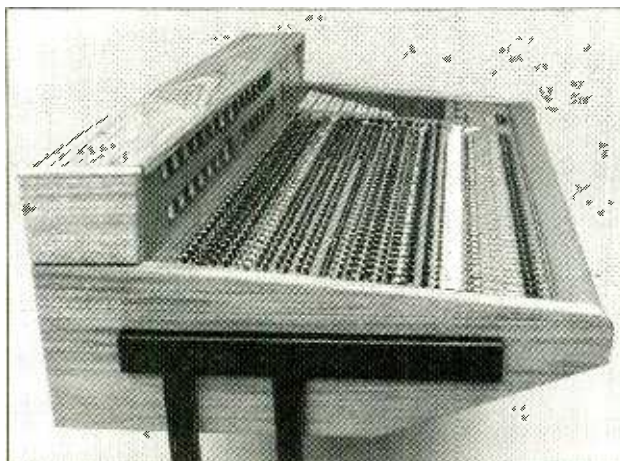
New integrated circuitry now make it possible for MCI  
to remove transformers throughout their product range

No head transformers in tape machines

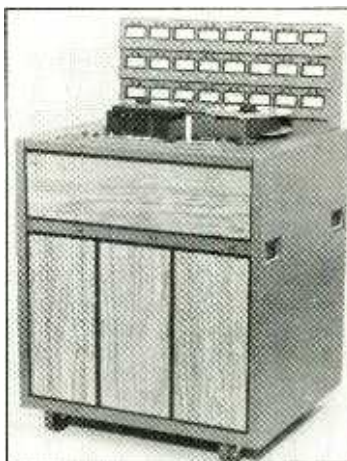
No mike transformers in consoles

Electronically balanced inputs and outputs throughout\*

JH-600



JH-24



JH-110B Series



\*Line transformers optionally available

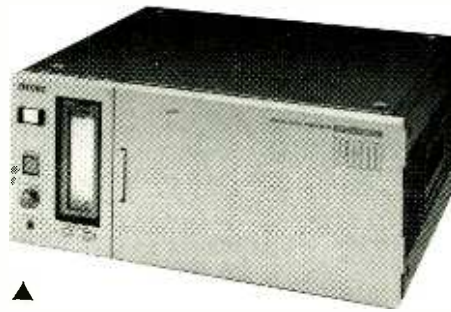
**MCI (PROFESSIONAL STUDIO EQUIPMENT) LTD.**

**MCI House, 54-56 Stanhope Street, London NW1 3EX. Tel: 01-388 7867/8. Telex: 261116**

## APRS preview

the company's complete range of analogue faders in various configurations including the new low cost *1000 Series*; plus the *QCPI* quadraphonic joystick controller. ●**Philip Drake Electronics**: *Commsbox* ring intercom system; *Mini Mobile* talkback system; *7000 Series* broadcast modular amplifying equipment; and modular OB commentator equipment. ●**Pyral**: wide range of open-reel and cassette tapes; plus magnetic soundtrack film; master lacquer discs; and a spectrum analyser.

●**Racal-Zonal**: range of audio tapes and cassettes including the low noise *888* mastering tapes; type *666* tapes; and super ferric oxide cassettes. ●**Raindirk**: new *Britannia* range of in-line consoles featuring 4-band parametric eq, modular mic amplifiers, digitally controlled status switching, and optional automation. Also new 250W MOSFET power amps and a stereo control unit. ●**Recording Studio Design**: wide range of equipment from RSD and Studiomaster including power amps, electronic crossovers, and a number of consoles designed for stage use. ●**Scenic Sounds Equipment**: wide range of products including *Amber* audio test sets; *Amek* recording consoles; *Allison Fadex* automated VCA fader module and *65K* programmer; *APSI* modular equalisers; *BTX* SMPTE code generators and tape synchronisers; *dbx* comp/limiters; *Deltalab DL-1* digital delay module, *DL-2 Acousticomputer*, *DL-3* digital delay line and *DL-4 Time Line*; *Editall* precision editing blocks; *Emilar* range of loudspeaker com-



▲ Sony PCM-100 digital audio processor

ponents; *Lexicon Model 224* digital reverb system; *Marshall Mini Modulator* and *5042* time modulator; *MicMix XL-305* reverb unit; *Orban* effects and equaliser units; *Rebis* parametric equaliser, comp/limiter and noise gates; *Schoeps* capacitor mics; *Valley People Trans Amp LZ* preamplifier; *White Instruments 200 Series* microprocessor controlled realtime analyser; and a new programmable parametric equaliser with 28 non-volatile memories from *360 Systems*. ●**Shure**: new *A27M* stereo mic adaptor mount; *SM81* cardioid condenser mic; *SC39 Series* phono cartridges; and *Pro Master* sound system; plus the company's range of dynamic mics. ●**Sifam**: wide range of VU and PPM meters, control knobs, switches and transformers. ●**Solid State Logic**: *SL-4000 E Series* automated console and *SSL* studio computer system, including several new hardware and software extensions, and a *Total Recall* option using a satellite computer to store and recall

each control setting of the console's I/O modules. ●**Sony**: *PCM-1600* 2-channel, 16-bit digital audio processor for use with *U-Matic* video cassette recorders; *DEC-1000* digital editing controller; *PCM-100* 14-bit digital audio processor; and the company's range of professional mics. ●**Soundcraft**: range of consoles and multitrack tape recorders. Tape recorders comprise the *SCM-381* available in 8/16-track 1in and 16/24-track 2in formats, while consoles include the *Series 400*, *Series 1S*, *Series 1624* and the *Series 3B* automated console in 16/24/32-track configurations. ●**Soundex**: range of small audio mixers, free standing PPM's and various power supplies. ●**Statik Acoustic**: range including the *SA30* electronic crossover; *SA20* dual reverberation system; *SA10* octave equaliser; and *SA100* dynamic delay/flanger. ●**Studio Equipment Services**: wide range of products with units from *Allen & Heath*, *Alice*, *NEAL-Ferroglyph*, *Teac-Tascam*, etc.

●**Tannoy**: *Buckingham* 3-way monitor loudspeaker system; *Classic Dual Monitor* and *Super Red* loudspeakers; new *Little Red Monitor*; and the company's hybrid passive/active crossover with time compensated circuitry and parametric equalisation for the low frequency section. ●**Toa**: comprehensive range of sound and communications equipment. New products include a range of horn loudspeakers and drivers; the *VMS 2000* modular PA system; and a new range of professional equipment comprising 6, 8 and 16-channel mixers, front loaded and bass reflex cabinets, powered column and monitor loudspeakers, plus a graphic equaliser and the *EMX 10* digital echo mixer. ●**Trad**: details and products from this company which specialises in buying and selling new and second-hand studio equipment. ●**Trident**: new *TSR Series* multitrack tape recorder with autolocate and compact remote control unit; *Series 80* modular console; *TSM Series* console available in 32/24 or 40/32 configurations; and *Fleximix* modular console system expandable to 24-track. Also the rack-mount parametric equaliser/filter and stereo limiter/compressor. ●**Turner**: range of stereo power amplifiers for studio and sound reinforcement use. ●**Turnkey**: *Ecoplate* reverb plate; *Advanced Audio Systems* digital delay; *Accessit* budget signal processing units; details of the company's retail and turnkey operations; plus launch of *Turnkey Two* an acoustics and studio design service. ●**Tweed Audio**: semi-standard broadcast console system in various frame sizes with comprehensive metering and monitoring facilities. Also the *B164* standard production console and the *BC82* battery/mains portable mixer.

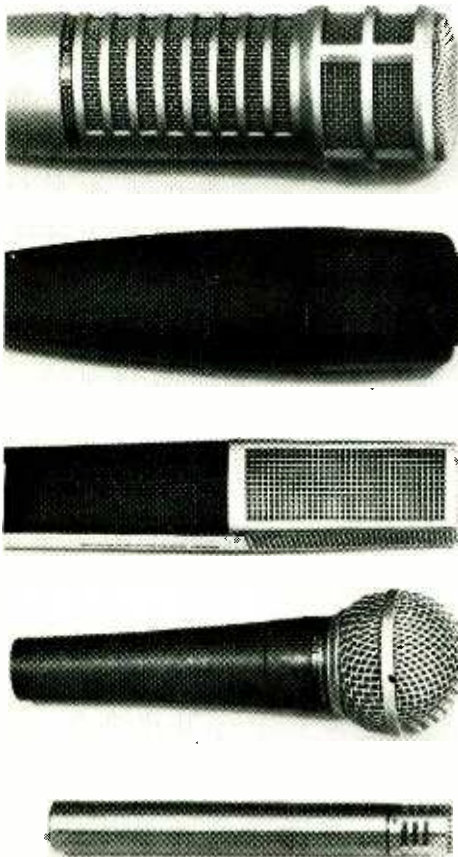
●**Vitavox**: range of multicellular high frequency horns, compression drivers, bass drivers, and passive dividing networks.

●**Walter Luther**: range of stands for mics, loudspeakers and studio lighting applications.

●**Wayne Kerr**: *Wayne-Kerr-Radford* ranges of high quality test instruments including the *RA200* analyser and *ADSI* digital store unit and the new *ALM1* line measurement adaptor.

●**James Yorke**: details of the company's cassette recording, production and packaging services. Also a new range of in-cassette copying machines from subsidiary company *Digitrax*.

●**Studio Sound**: editor Angus Robertson and assistant editor Noel Bell will be living up the proceedings together with Phil Guy who will be on hand to meet advertisers. *Studio Sound* T-shirts and sweat shirts will be available at the exhibition. Also in attendance will be staff from our sister magazine *Sound International* including editor Richard Elen. ■



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*and much more!*

Now, because you've asked us, we're offering mixers, reverbs, amps, sound reinforcement systems™, DDL's and much more, in addition to mikes and microphone accessories.

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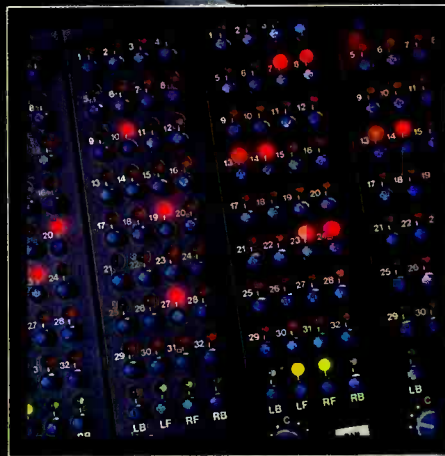


**How do you define a  
“fully programmable”  
mixing console?**

**(Hint: There is only one correct answer)**



# TOTAL RECALL™ from Solid State Logic







**Total Recall™**  
from Solid State Logic

# TOTAL RECALL™

The Solid State Logic Master Studio System is now available with TOTAL RECALL, an extraordinary system which monitors and stores the position of each and every control on the SL-4000 E Series Console.

With a single command, the engineer instructs the TOTAL RECALL computer to scan and remember the entire console status. Complete details of input selection, routing assignments, monitor and foldback levels, panning, equalization, echo sends, and dynamics modification are permanently recorded on floppy discs.

Another one-word command initiates recall of this information. The computer compares the positional data previously stored against the current physical position of each control, and generates a high-resolution colour display indicating which controls do not match the TOTAL RECALL memory store. By simply touching any switch or knob, the engineer activates a detailed display of its console subsection, which provides for a nulling accuracy of 1/4 dB. Once the entire console has been reset, a Full Scan Verification function provides further security, by searching for any controls which are not set within specified tolerance, and displaying them for adjustment.

TOTAL RECALL fulfills the major promise of studio computer technology. Using the entire console as an "input terminal," it preserves all of the progress made at each stage of the recording and overdubbing process, so that it may be directly applied to each subsequent session. TOTAL RECALL eliminates duplica-

tion of effort, and enhances creative continuity throughout the production. It gives each of your clients "lockout" security over the console, so that they may return to your studio at any time and pick up exactly where they left off. And, of course, TOTAL RECALL provides the ultimate in mixing memory.

Most importantly, TOTAL RECALL is accomplished without any sacrifice to the impeccable audio quality and creative flexibility which have become hallmarks of the Solid State Logic Master Studio System. Rather than use multiple VCAs or stepped digital switching, TOTAL RECALL employs a network of microprocessor-controlled data busses which carry only low-voltage analogue information addressed to each I/O module switch and potentiometer. The full use of all continuously variable controls is retained. No additional audio pass elements have been introduced to the signal path. Consequently, TOTAL RECALL adds absolutely no distortion and absolutely no noise.

The Solid State Logic E Series Master Studio System is one of the most exceptional products of recording technology ever offered. A limited number of the systems equipped with TOTAL RECALL are available for delivery during the balance of 1980. If you would like to join that select group of discerning studios and broadcast organizations who are dedicated to the highest order of engineering excellence, we invite you to contact us at your earliest convenience.

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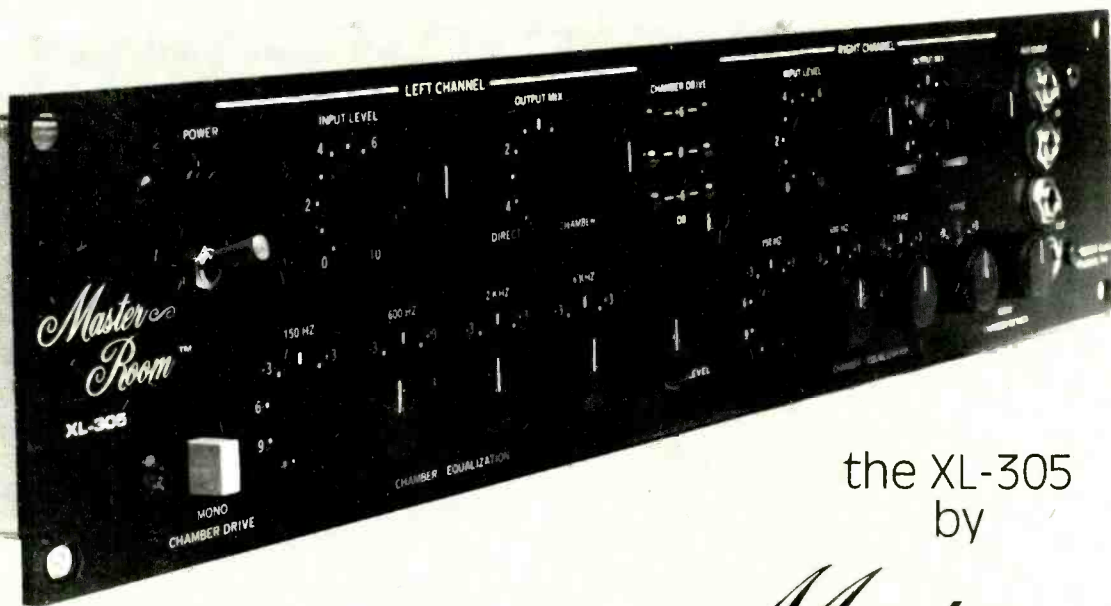
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**Master Studio Systems**

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# Incredible...

the "Acoustic Chamber Synthesizer"™



the XL-305  
by

*Master  
Room*™

- Totally new design approach
- The sound of a live acoustic chamber
- Natural sound, even on percussion
- Self-contained rack mount unit
- Full two-channel stereo

The Master Room XL-305 is a totally new design approach in reverberation technology. For the first time, the qualities and properties of a live acoustic chamber are available in a rack mount unit at an affordable price. There is a natural sound on percussion, as well as voices and all other musical instruments. This quality has not been obtainable from other compact reverberation devices. The XL-305 exhibits no unwanted side effects; it's as natural as a live chamber itself.

To hear this new advancement in reverberation, see your professional audio dealer and ask for a demonstration of this exciting new unit. Hear the XL-305 "Acoustic Chamber Synthesizer" for yourself, and you too will agree... It's INCREDIBLE.



**Scenic Sounds Equipment,**  
97-99 Dean Street,  
London W1V 5RA  
Telephone: 01-734 2812/3/4/5  
Telex: 27 939 SCENIC G

France **3M France SA, Mincom Div.** Boulevard de l'Oise. 95000 Cergy Tel: Paris 749 0275  
Germany **Audiolive** Kyffhauserstrasse 10A 5 Köln 1 Tel: Köln 230910  
Holland **Pieter Bollen Geluidstechnik** Hastelweg 6, Eindhoven Tel: Eindhoven 512 777  
Sweden **Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel: Gothenburg 130 216  
Norway **Siv Ing Benum AS** Skovvn 22, Oslo 2 Tel: Oslo 565 753

# Apex

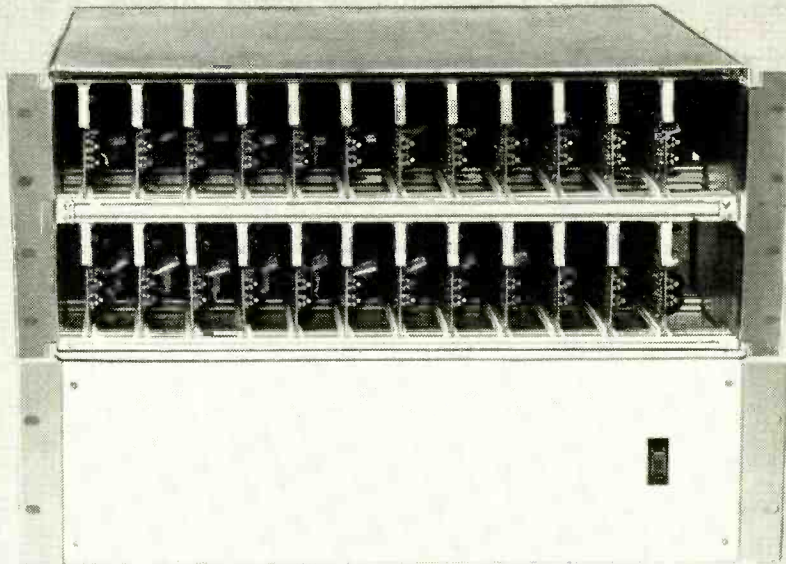
Apex Audio products are known and respected throughout the world for reliability and superb specifications. Here are five such products for the 1980's, each designed to give you a better sound.

## OAS-24 Grouping and Automation System

It provides up to 10 subgroups from 24 audio channels, using B&B voltage controlled attenuators.

The system comes in 3 parts; Control console, with 9 group modules each containing grouping switches, mute switch and fader, and one master module; VCA case with appropriate number of VCA cards; and power supply.

You can use it to extend the life of your console at a fraction of the cost of a new board, or move it from one studio to another any time you want, therefore taking extra capability only where you need it.



If you want full details on these products please contact any of the worldwide Apex companies.

**Apex Audio Systems UK Ltd**  
35 Britannia Row  
London N1 8QH England  
Telephone: 01-359 5275/0955  
Telex: 268279

**APHEX SYSTEMS LTD.**  
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TWX: 910-321-5762

**APHEX AUDIO SYSTEMS AUSTRALIA, PTY. LTD.**  
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TLX: (790) AA24035

**APHEX BENELUX**  
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TLX: (846) 26409 (TEMBEL B)

**APHEX BRAZIL**  
(Rio de Janeiro) Tel: 266-5117  
TLX: (391) 1121008 (XPSPC BR)

**APHEX AUDIO SYSTEMS CANADA, LTD.**  
(Toronto) Tel: (416) 363-8138  
TLX: 06225500 (OCTO TO1)

**APHEX CHICAGO LTD.**  
Tel: (312) 644-1666

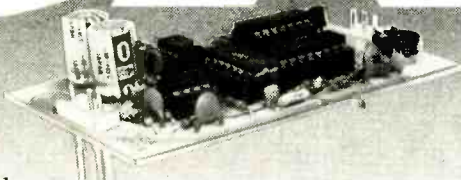
**APHEX COLORADO, LTD.**  
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**APHEX FRANCES S.A.R.L.**  
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# EX.



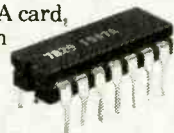
## B&B VCA 500A Card

This is a retrofit VCA for the MCI 500 Series and requires no additional circuitry.

THD, IMD and modulation noise are down to their theoretical limits as a result of patented "Class A" circuitry. Thus the 500A is free of colouration and distortion.

In addition, there is a B&B VCA 505 Universal Card which has a 15-pin edge mount, and buffered inputs. All the op-amps are on sockets so when even more sophisticated devices become available, they can be updated easily.

The 1537A VCA chips, which are the heart of the 500A card, are available separately for those who want to design their own applications.



## B&B EQF2 Parametric Equaliser/Filter

Equalisation is switchable peak or shelf, with reciprocal cut or boost.

Filtering is tunable high and low pass.

The B&B EQF2 covers the full audio band from 20Hz to 20kHz, and over each of its three frequency ranges it maintains a constant Q.

It is a high quality device well-known as a powerful and creative tool in the studio. Its response curves were chosen carefully to sound good and not just look good on paper.

It is illustrated in the new racking system which accommodates up to 10 devices, each of which plugs directly into the rear mother board.



## Model 712 Aural Exciter

The original Exciter launched in 1978 was greeted universally with tremendous enthusiasm by studios, producers and artists.

This new model provides even more control. As well as the previous facilities you can now adjust the phase slope and harmonic content of the processed signals to produce even greater clarity and presence.

It also features bargraph displays for easier monitoring, and all controls are now mounted on the front panel for easier operation.

## B&B CX1 Compressor - Expander

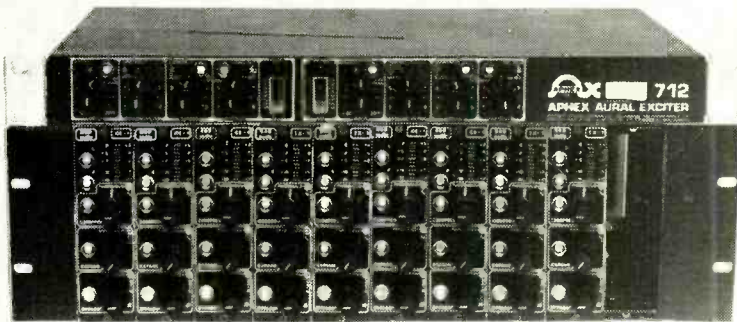
As a compressor, release time is variable from 50 msec to 2.5 sec, and threshold operates from -40dBv to +20dBv.

As an expander, release time is variable from 50 msec to 2.5 sec, and threshold operates from -75dBv to -10dBv.

Attack time for both the compressor and the expander is less than 1μsec.

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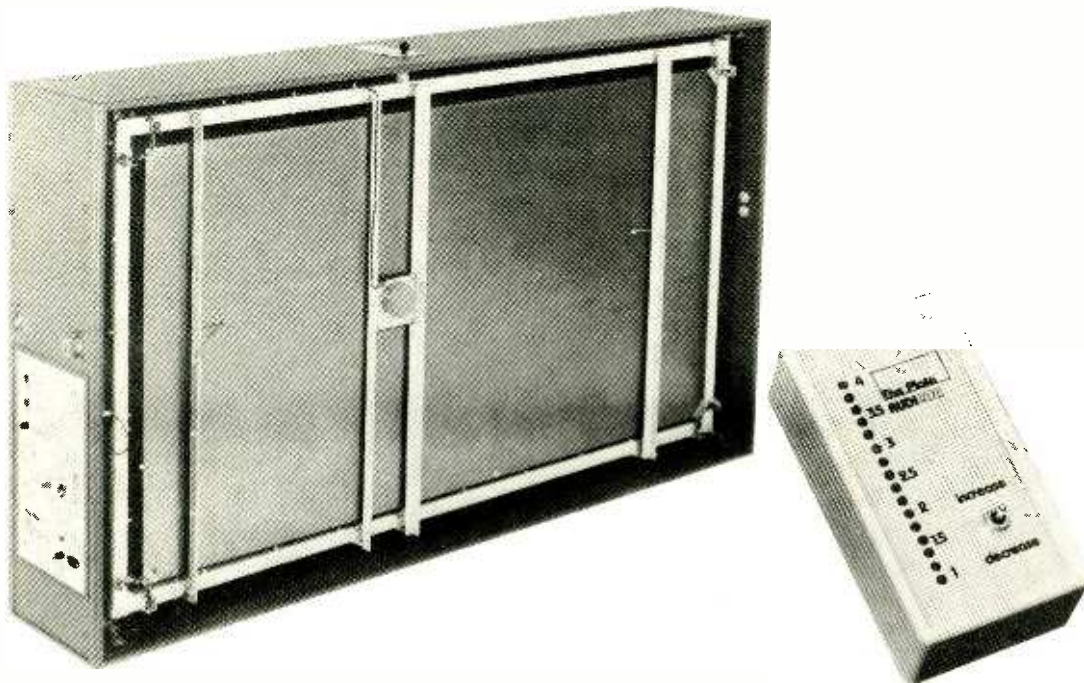
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## Audicon 'The Plate'



### MANUFACTURER'S SPECIFICATION

**Input impedance:** 1k $\Omega$  (nominal).  
**Input level:** -20 to +10dBm (+4dBm nominal).  
**Input circuit:** transformer balanced, floating.  
**Input connector:** Cannon XLR-3 (Switchcraft D-3-F).  
**Output impedance:** 600 $\Omega$  (DCR 64 $\Omega$ ).  
**Output level:** +4dBm (pink noise).  
**Output circuit:** (2) transformer balanced, floating.  
**Output connector:** Cannon XLR-3 (Switchcraft D-3-M).  
**Maximum output level:** +24dBm (into 600 $\Omega$ ).  
**Internal limiting:** none (full headroom through unit).  
**Reverberation time:** adjustable at unit, 1 to 4s nominal (at 500Hz), octave filtered pink noise).  
**Power requirements:** 120 or 240V ac.  
**Controls:** input level calibration (on panel). Return level calibration (2-internal).  
**Equalisation:** fixed, internal (maximum hf/lf reverberation ratio).  
**Size:** 49 $\frac{1}{2}$ in high  $\times$  18 $\frac{1}{2}$ in wide  $\times$  7ft 9in long.  
**Weight:** 350lbs.  
**Price:** £2,400.  
**Manufacturer:** Audicon Inc, 1200 Beechwood Avenue, Nashville, Tenn 37212, USA.  
**UK:** Trad Electronics Sales Ltd., 149B St. Albans Road, Watford, Herts.

THE AUDICON echo plate consists of a stainless steel fabricated frame. L section bars cross the frame to secure the loudspeaker type plate driver and the wires to the two piezoelectric transducers, the L sections supporting the latter having a length of rolled lead sheet strapped to them with cable ties, presumably to damp the resonance of the bars.

Each corner of the plate is tensioned by two

screw eyes which pass through spot welded reinforcements at the corners. The layout of the transducers is shown in fig 1 which shows that the arrangement is asymmetrical.

Damping of the plate is achieved by a sheet of damping material supported in an alloy frame. This frame is hinged along the bottom of the plate and is swung in or out at the top rather like a casement window, giving nominal reverberation times from 1s to 4s at 500Hz.

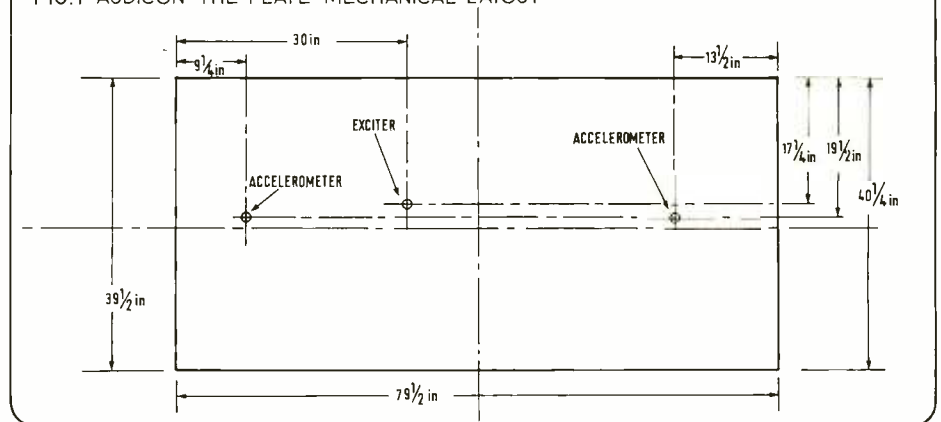
The complete reverberation plate is housed in a plywood case with rubber mountings at each corner of the box section frame and carrying

eyes at each end of the box. One end of the box is cut away to house the electronics package, and the remote control unit is mounted on the top.

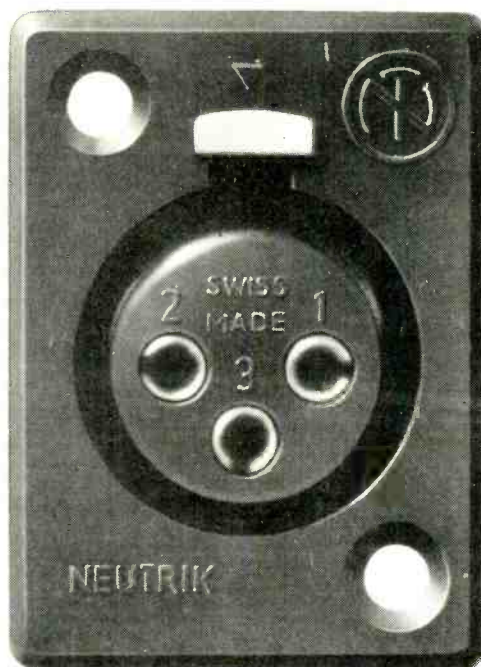
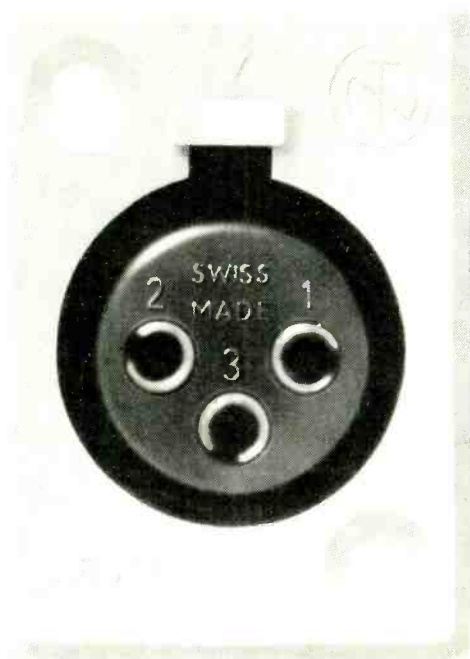
Remote control is effected by a geared down motor which drives a leadscrew which in turn moves the hinged damping plate. The remote control unit itself comprises a small box housing two pushbuttons, one to increase, the other to reduce the reverberation time. A vertical array of LED indicators shows the current reverberation time against a scale calibrated from 1 to 4s. The remote control box is quite tidily con-

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FIG.1 AUDICON 'THE PLATE' MECHANICAL LAYOUT







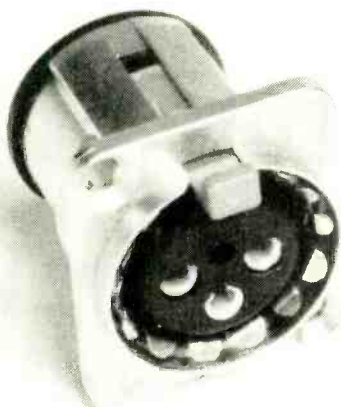
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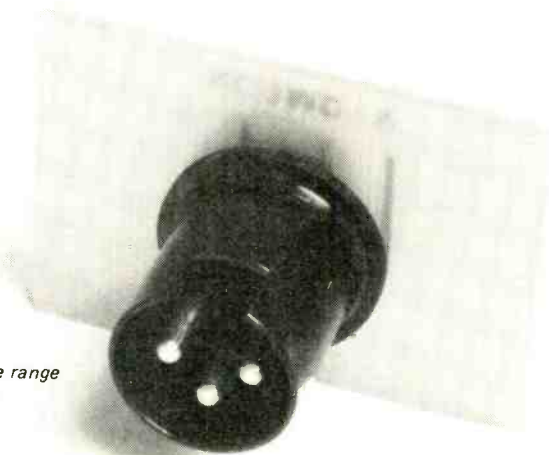


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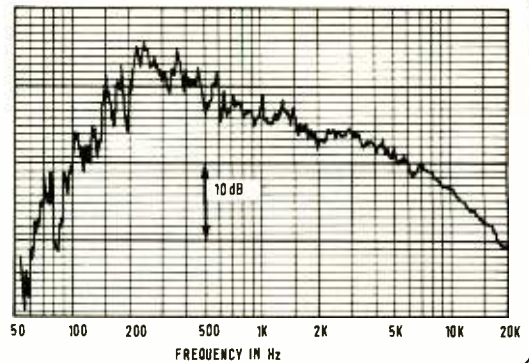
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## REVIEWS

FIG. 2  
AUDICON 'THE PLATE' RESPONSE  
AT 4s REVERB SETTING



structed and connects to the remote drive unit via a long lead with a 5-pin Tuchel connector at the remote end and a 5-pin Cannon at the other. Mechanically the remote drive is crude in construction with the reverberation time setting transmitted by a multiturn potentiometer mounted on the end of the leadscrew and body rotation restrained by mounting it in sheet rubber to take up the runout in the leadscrew.

Separate power leads are required for the remote control unit and for the audio electronics, both being fitted with IEC connectors. The signal connections to the audio electronics are by means of XLR connectors with an input drive level potentiometer. In addition there are two Imperial size fuses — one for the mains power, the other to protect the driver; earth terminal, power on/off switch and power indicator. The power on/off switch is of a type which would fail to reach British safety standards in view of the proximity of live parts to parts connected to the chassis.

The audio electronics are mounted on two circuit boards behind the connector panel, one for the power supply and the other the audio board containing the drive amplifier and the two transducer amplifiers which connect to the plate by means of quarter inch jack sockets. Neither board had any component identifications for servicing and no circuits or other servicing information was provided.

Other than the remote control, the standard of both mechanical and electrical construction was reasonable. Assembly was tidy but soldering not the best quality.

### Input and outputs

The input impedance measured as 1923Ω and specified as 1000Ω is uncomfortably low for many applications with the maximum input level being +13dBm (worst case) depending upon

frequency with the plate set to unity gain. It was found that the overall gain range was from +10dB to -40dB loaded into a high impedance.

The input and both the outputs are balanced connections with the maximum output level being fixed at +22dB reference 0.775V or +20dBm loaded into 600Ω from an output source impedance of 130Ω which is perhaps on the high side.

### Frequency response and noise

The overall frequency response as measured with random noise was found to vary with the reverberation time setting, the extreme cases being shown in **figs 2 and 3** which demonstrate a substantial change in the bass response and a not insignificant change in the treble response. Both outputs gave very similar results.

On the noise front, noise in the outputs was measured in a quiet room with the input shorted and the noise levels found in the outputs are shown in **Table 1**.

TABLE 1

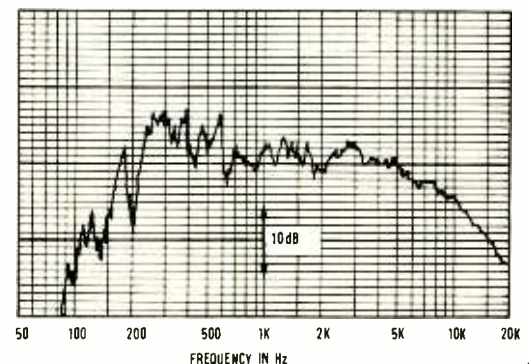
	Channel 1	Channel 2
A weighted rms	-75.5dBm	-72.5dBm
CCIR weighted rms ref 1kHz	-70.0dBm	-65.0dBm
CCIR weighted quasi-peak ref 1kHz	-66.5dBm	-61.0dBm
50Hz mains hum	-51.5dBm	-50.0dBm

I find the wild differences in the noise performance of the two channels worrying and whatever earthing arrangements were used, the 50Hz hum level was excessive but the mains harmonics were satisfactory at less than -70dBm.

So far as structural and airborne noise is concerned, the reverberation plate must be housed

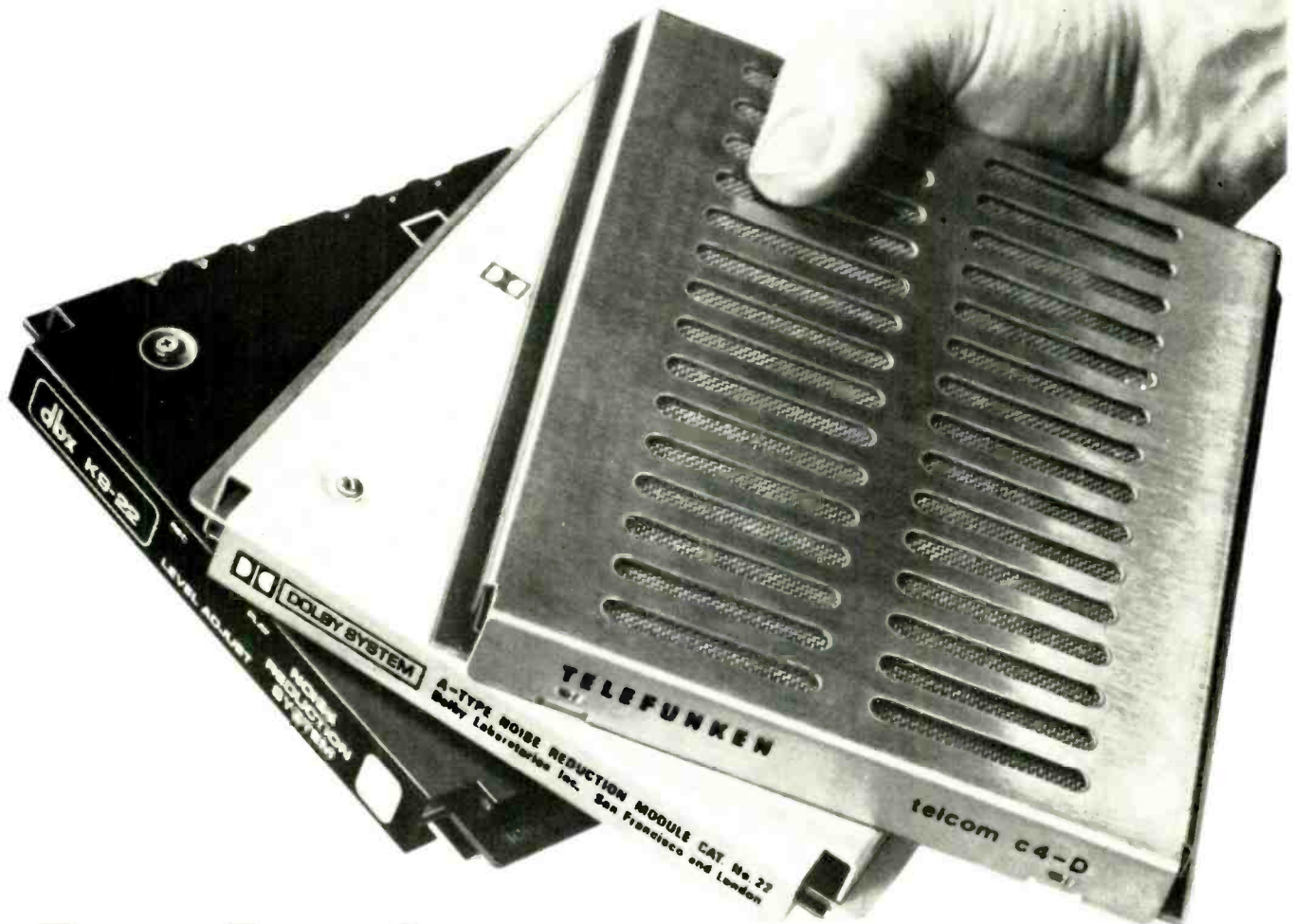
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FIG. 3  
AUDICON 'THE PLATE'  
RESPONSE AT 1s





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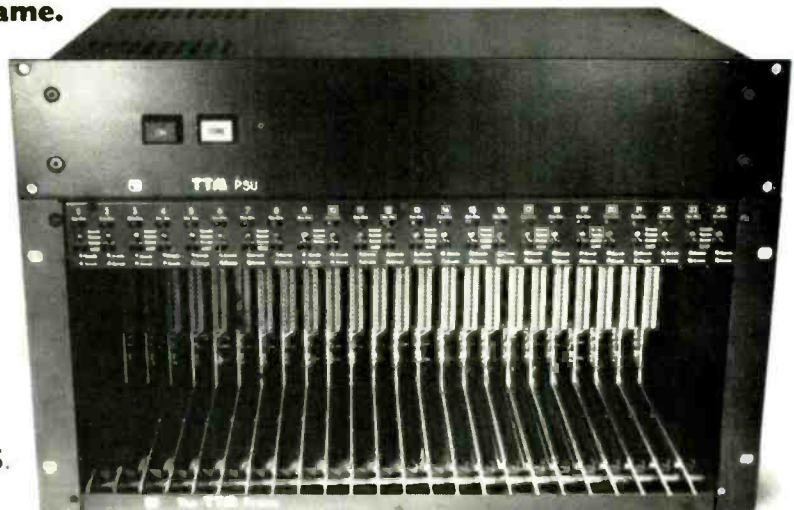
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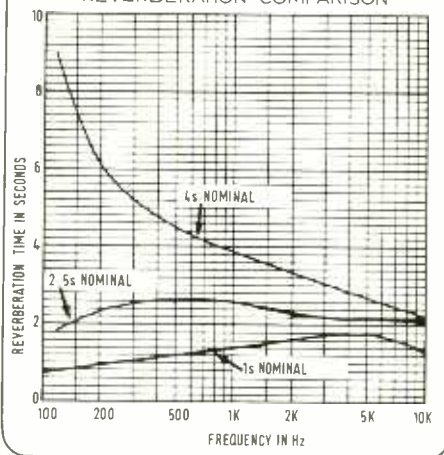
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FIG. 4 AUDICON 'THE PLATE' REVERBERATION COMPARISON



in a quiet and relatively vibration free environment and most certainly cannot be used in the studio or control room as can many mechanical reverberation units.

**Reverberation characteristics**

The relation between frequency and reverberation time for three time settings is shown in fig 4 which shows that at low reverberation time settings there is little variation with frequency, but at long reverberation times there is a dramatic increase in low frequency reverberation time with the time settings correct at around 500Hz as specified by the manufacturer.

Fig 5 shows the reverberation decay curves for 500Hz, 1kHz and 2kHz at a 2.5s reverberation

time setting demonstrating an exponential decay without any early decay. The same lack of early decay was found at all frequencies and settings of reverberation time.

The application of a 100ms burst of white noise to the plate produced fig 6 which shows a healthy buildup of reverberation and again shows the exponential decay with a reverberation time setting of 2.5s. At the same time setting the application of a single cycle burst of 1kHz tone produced fig 7 which lacks coloration normally found in a real room.

Subjectively the stereo imaging of the unit was pleasant but I always felt that there was the distinct sound of a plate. I also felt that at long reverberation time settings the unit was pleasant but became a little 'tinny' at short time settings.

**Summary**

Reverberation effects are very much a matter of personal preference but I found the characteristics of *The Plate* rather variable with reverberation time settings.

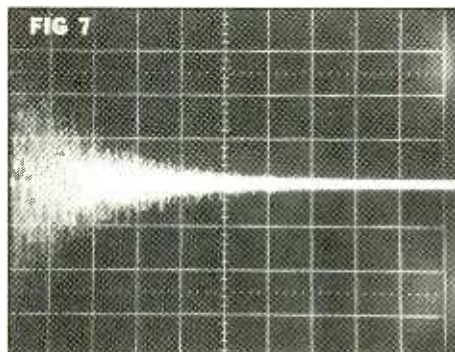
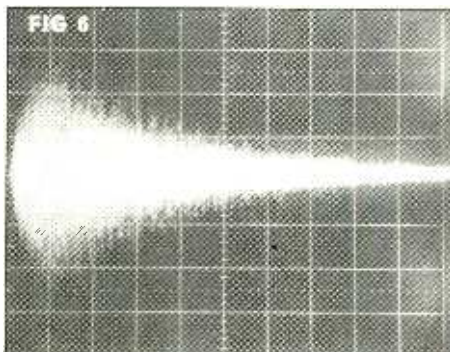
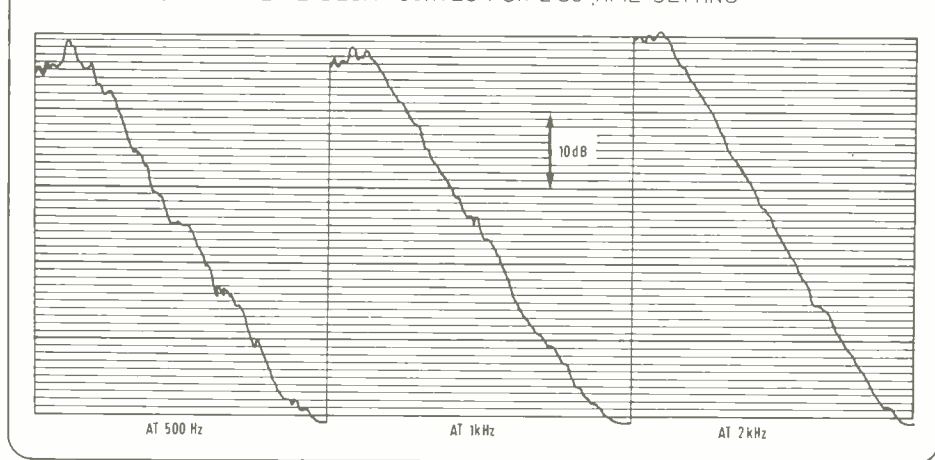
There could be no doubt that the sound was that of a mechanical plate as opposed to a digital system or a spring and it is this sound that some people prefer.

So far as the electronics are concerned the input and output impedances could be more convenient and I am not happy about the large difference in noise performance between the two channels. If the better channel is the norm the noise performance is excellent.

Overall the standard of construction was reasonable but I feel that complete servicing information should be provided.

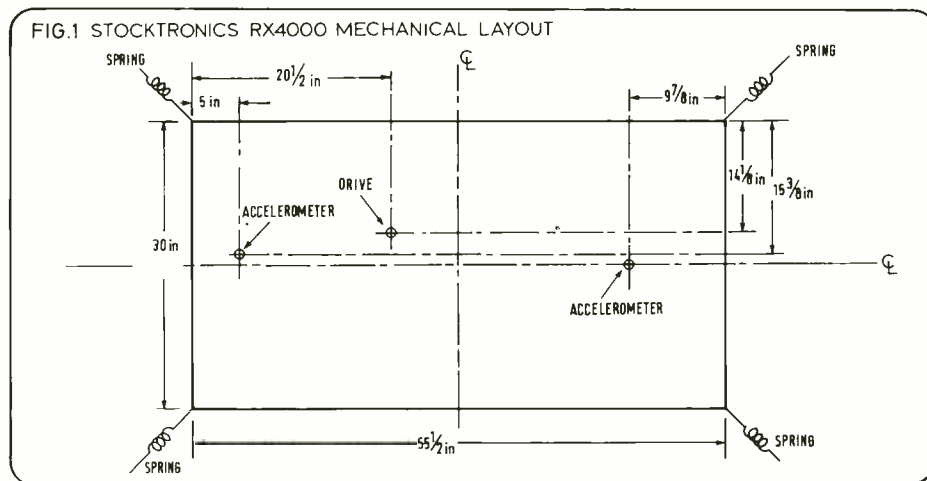
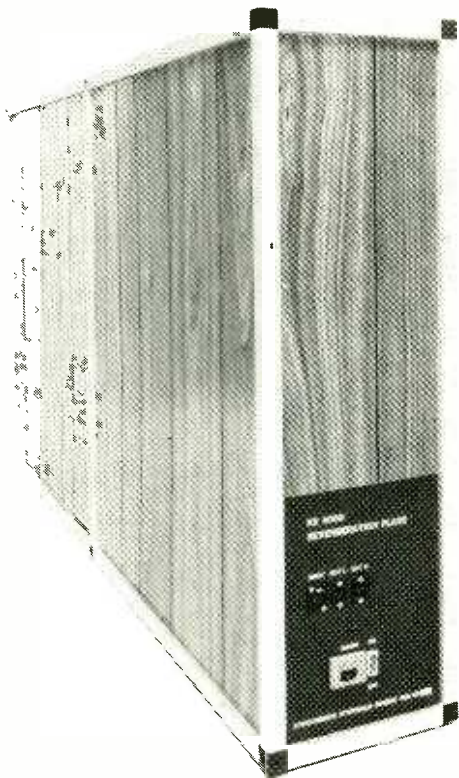
Hugh Ford

FIG. 5 AUDICON 'THE PLATE' DECAY CURVES FOR 2.5s TIME SETTING



# REVIEWS

## Stocktronics reverberation plate



### MANUFACTURER'S SPECIFICATION

**Frequency response:** curve supplied.

**Reverberation time:** 4s at 500Hz, (optional reverberation time down to 2s by special order).

**Noise level, better than:** -60dBV IEC linear, -80dBV IEC A-weighted.

**Inherent propagation delay:** approx. 5ms.

**Input level:** max +24dBm load 47k $\Omega$  balanced.

**Outputs:** max +26dBm into 10k $\Omega$  balanced, max +22dBm into 600 $\Omega$  balanced.

**Line power:** 110/220V strappable on printed circuit PC-board.

**Net weight:** 30kgs (66lbs).

**Dimensions:** 1555 x 900 x 275mm (61 x 35 x 11in).

**Options:** quad plates by special order.

**Price:** £1,290.

**Manufacturer:** dB Cassette, Katarinav. 20, S-116 45, Stockholm, Sweden.

**UK:** ITA, 1-7 Harewood Avenue, Marylebone Road, London NW1.

THE Stocktronics echo plate is constructed from a steel plate suspended in an alloy frame and is generally a lightweight unit which is readily portable. The unit covers have an imitation wood grain finish in the form of thin plywood screwed to the alloy frame, with the electronics unit recessed in one end of the cabinet. No adjustment of reverberation time is provided and, perhaps surprisingly, no damping is fitted to the reverberation plate.

As can be seen from fig 1 the drive unit is driven from the single input and two piezo-electric accelerometers which provide quasi-

stereo outputs. The drive unit takes the form of a typical loudspeaker moving coil driver which drives the plate via a short rod. Mounting of the plate within the alloy frame is by a spring at each corner and springs mid way along the upper and lower edges. No adjustment of tension is provided. This factor and the combination of an alloy frame with a steel plate makes me suspect that there may well be performance variations from sample to sample, and also with ambient temperature.

Two small eyebolts are provided at each end of the cabinet and these could be used for suspending the unit from the ceiling to avoid vibration pick-up from the floor. The thin covering of the unit makes it susceptible to the pick-up of environmental noise which makes it essential that this echo plate is located in a quiet place if unwanted outputs are to be avoided.

So far as the standard of construction is concerned, both mechanical and electrical aspects were good with all the electronics being mounted on a single good quality printed circuit board which had four preset controls. These consisted of two bass, a single treble and drive level controls. No servicing or set-up instructions were provided and the circuit board did not have any component identifications. It was also noted that the value of fuses was absent from the unit and the paperwork supplied.

On the electronics unit panel the input and two output connections took the form of balanced XLR connectors with input and output gains being fixed. The remaining features include an illuminated power on/off switch and

the IEC power connector with integral unidentified power fuses.

### Input and outputs

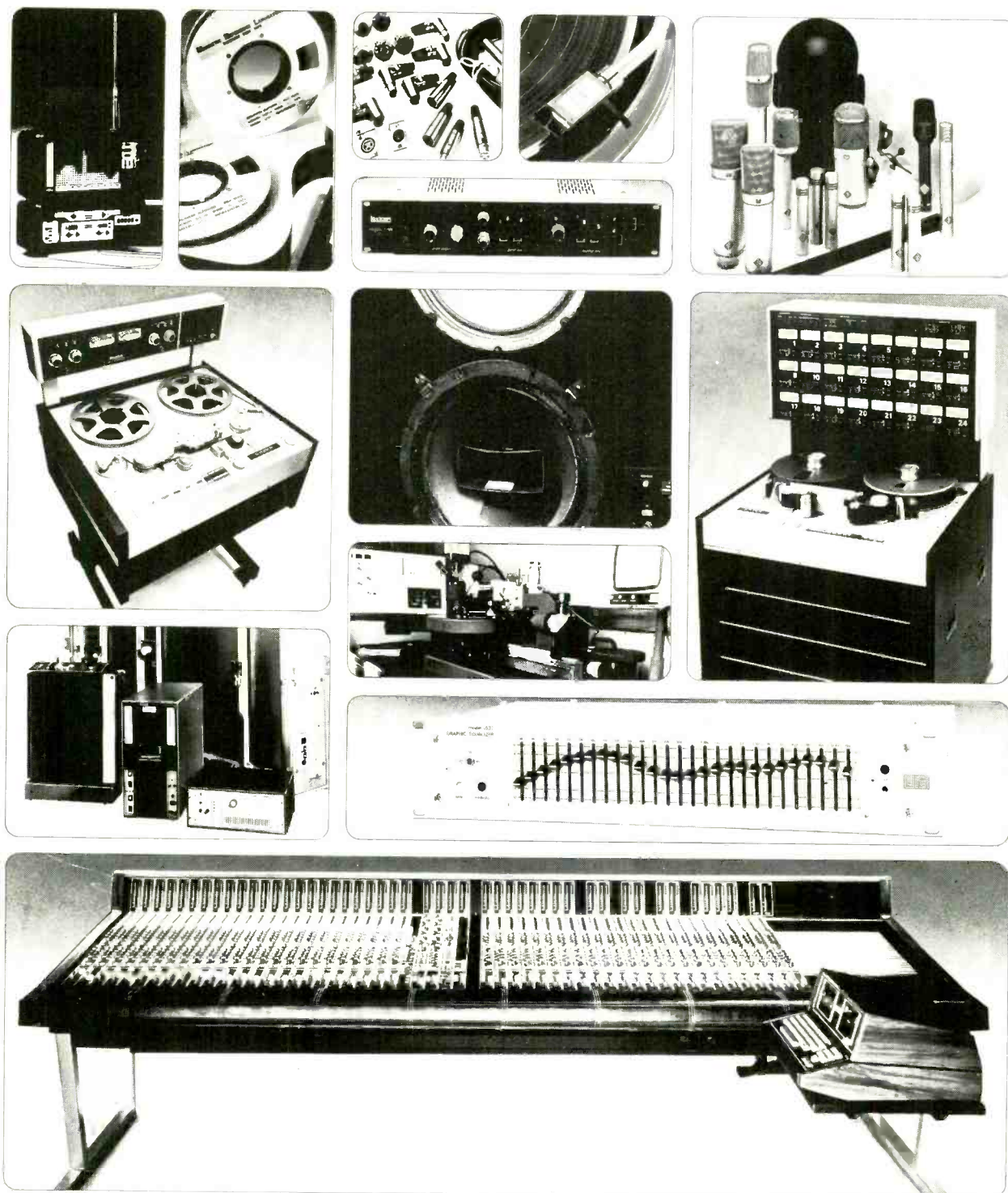
The impedance of the balanced input was found to be 45.7k $\Omega$  which is excellent for matching purposes together with the maximum input level of +20dBm before the onset of severe distortion. On the output end the impedance at 28.5 $\Omega$  was adequately low with a good drive capability of +25dB reference 0.775V with the overall gain of the echo plate being unity at 1kHz.

### Frequency response and noise

The overall frequency response as measured with random noise is shown in fig 2 which demonstrates a relatively flat response between 200Hz and 8kHz which would not be typical of common room types and it is felt that some benefit would be obtained if the bass response did not fall off so sharply. However, the fall off in bass response does have the advantage that the unit is less susceptible to the pick-up of extraneous noise and vibration at low frequencies.

On the noise front the two output channels had virtually identical performance with the exception of the mains hum levels at 100Hz, there being no significant hum in the outputs at other frequencies. Table 1 shows the noise performance in terms of output level to which must be added the output drive capability to arrive at the available dynamic range.





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FIG. 2 STOCKTRONICS RX4000 RESPONSE

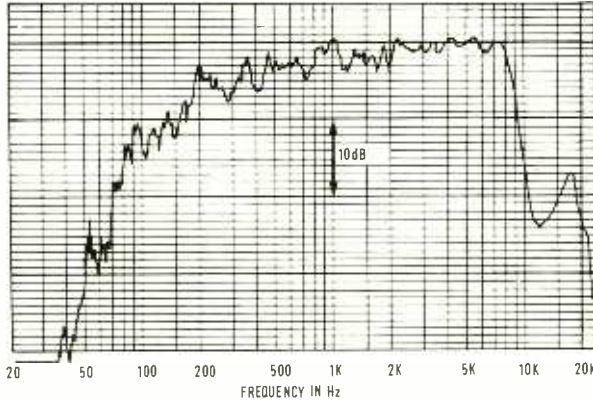


FIG. 3 STOCKTRONICS RX4000 REVERB TIME V FREQUENCY

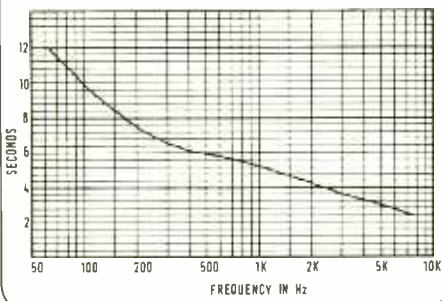


FIG 4

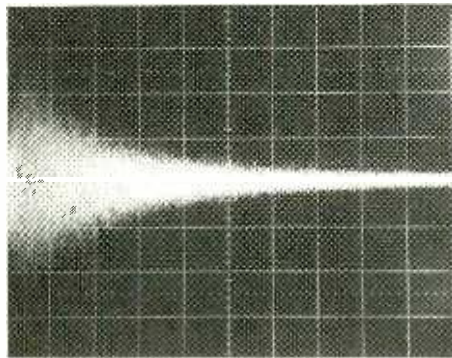


FIG. 5 STOCKTRONICS RX4000 DECAY CURVES

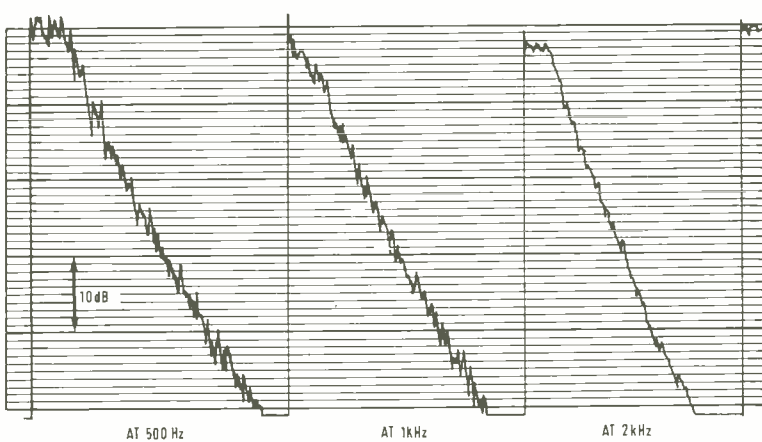


TABLE 1

Noise	Output 1	Output 2
20Hz to 22kHz rms un-weighted	-68dBm	-75dBm
A weighted rms	-78dBm	-78dBm
CCIR weighted rms ref 1kHz	-69dBm	-69dBm
CCIR weighted quasi-peak ref 1kHz	-65.5dBm	-65.5dBm
100Hz hum	-73dBm	-88dBm

**Reverberation characteristics**

As can be seen from fig 3 which is a graph of reverberation time versus frequency, there is a large variation with the reverberation time showing a substantial increase at low frequencies. The measured characteristics of the review sample differed significantly from the curve supplied in the manufacturer's specification in this respect and the measured reverberation time at 500Hz was 6s as opposed to the specified 4s.

The application of a 100ms burst of white noise produced the oscillogram fig 4 at the output, it being seen that a truly exponential decay occurs after the build-up of the initial reflections. This feature is confirmed by the third octave decay curves shown in fig 5 for 500Hz, 1kHz and 2kHz.

Applying a single cycle of 1kHz to the input produced the waveform shown in fig 6 at the outputs illustrating the presence of multiple reflections with random timing.

Subjectively I did not personally care for the sound of this reverberation plate which I found to sound rather 'tinny' but it is possible that the sound can be suitably modified by equalisation. However, the sound of an echo device is very much subjective and a matter of personal taste.

**Summary**

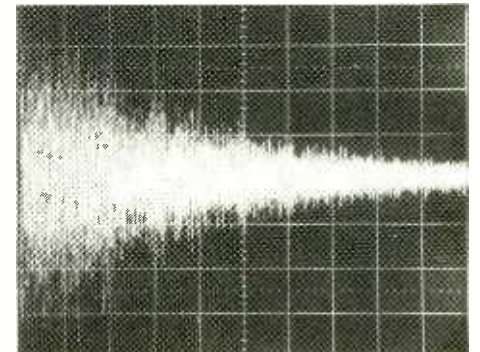
The Stocktronics *RX4000* reverberation plate is well constructed from both the mechanical and the electronic aspects. I do, however, find it surprising that there is no adjustment of the plate tension and no adjustable damping and this leads me to suspect that significant variations may exist between samples.

Electrically the input and outputs were well arranged and the drive levels and noise performance were good with the exception of the 100Hz hum level in one output.

Having a fixed reverberation time the applications of this plate are clearly limited, but, this of course reflects in the price which is modest by many standards.

Hugh Ford

FIG 6



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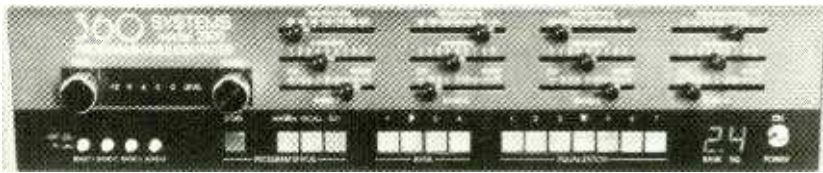
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# reviews

## 360 Systems Model 2800

### programmable equaliser



#### MANUFACTURER'S SPECIFICATION

**Frequency response:**  $\pm 0.2$ dB 10Hz to 20kHz  
**Harmonic distortion:** less than 0.1%, typically 0.05%. Residual is primarily second harmonic.  
**Noise:** 86dB below maximum output, 20kHz bandwidth, measured at unity gain, all bands in, no boost or cut. Residual is gaussian.  
**Output:** +21dBm, single ended,  $Z=47\Omega$ . Output transformer optional.  
**Output control:**  $\pm 12$ dB gain adjustment.  
**Input:** -4dBV or greater.  $Z=100k\Omega$  electronically balanced.  
**Headroom indicator:** 3dB steps from clipping to -12dB. Shows true headroom by sampling six locations in the equaliser and displaying the worst headroom condition.  
**Bypass switches:** perform mechanical disconnect of resonators.  
**Equaliser frequencies:** band 1 20Hz to 500Hz; band 2 68Hz to 1.7kHz; band 3 240Hz to 5kHz, band 4 800Hz to 20kHz.  
**Bandwidth:** adjustable from  $1/6$  octave to five octaves.  
**Boost/cut:** +12dB to minus infinity (typically 60dB below input). Equalisation contours are 'constant - Q', rather than reciprocal.  
**Connectors:** XLR-3, pin 1 ground, pin 2 low, pin 3 high.  
**Microcomputer system:** Z-80A; 5101 CMOS RAM; 2704 EPROM.  
**Front panel scan rate:** 7ms/frame.  
**Quantisation:** frequency 20 cents (0.2 semitone), bandwidth 24 cents (0.24 semitone), boost/cut 0.2dB above 0dB boost.  
**Power down:** power failure sensing circuit switches memory to low power battery support. Estimated 10 year support from internal lithium cell.  
**Display:** shows selected program number.  
**Dimensions (hwd):**  $3\frac{1}{2} \times 19 \times 12\frac{1}{2}$ in. Allow additional  $\frac{3}{4}$ in forward of mounting surface for panel controls.  
**Weight (net):** 12.5lbs.  
**Power requirements:** 25W at 117V, 60Hz, (240V version available).  
**Cooling:** natural convection, free air circulation required around unit.  
**Price:** £950 with 28 memories.  
**Manufacturer:** 360 Systems, 18730 Oxnard Street, Tarzana, Cal 91356, USA.  
**UK:** Scenic Sounds Equipment Limited, 97-99 Dean Street, London W1V 5RA.

**T**HE 360 Systems' programmable equaliser can be supplied as either a single or a 2-channel unit with both channels using the same controls which act as ganged controls for both equalisation and input and output levels.

The equaliser takes the form of four independent frequency bands with individual frequency, bandwidth and cut/boost controls, each with a nominal range from +12dB to minus infinity and bandwidth controls having arbitrary calibrations from one to nine.

Settings of these 12 equalisation controls and the output level for each band are digitally stored in the unit in a selection of 28 stores which are maintained even when the power is removed from the equaliser, there being an internal battery supply for this purpose.

Looking at the front panel of the unit the upper part, coloured blue, houses the analogue signal section with the lower black part looking after the digitised features. Starting with the analogue section, to the left there is an input level potentiometer of the conventional ganged audio type with an LED level display to the right. This display is calibrated in 3dB steps from 0dB to -12dB and indicates the headroom within the equaliser and not only the input and output levels, such that overload at intermediate points may be avoided. Next there is the output level potentiometer controlling voltage controlled amplifiers in each channel followed by the four vertical arrays of equalisation controls for the frequency bands 20Hz to 500Hz, 68Hz to 1.7kHz, 240Hz to 5kHz and 800Hz to 20kHz. As is clear, these frequency bands overlap so that the combined action of more than one band may be used if desired.

Turning now to the lower digital section, on the left there are four pushbutton switches which allow any of the four frequency bands of equalisation to be switched in or out of action for listening to the effect of each frequency band. Next come four program status pushbuttons followed by four 'bank' pushbuttons and seven

'equalisation' pushbuttons and finally a numeric display of 'bank' and 'equalisation'. The four 'bank' and seven 'equalisation' pushbuttons are used to select any one of the 28 (4x7) digital stores, with the current store being shown by the numeric display.

The four 'program status' pushbuttons select the mode of operation with the buttons being labelled 'store', 'manual', 'recall' and 'edit'. As its name implies, depressing the 'manual' pushbutton sets the equalisation to the manual front panel settings. The equalisation and output gain settings on the front panel may be placed into any of the 28 stores by selecting the desired store number and pressing the 'store' pushbutton. These stored equalisation patterns may then be retrieved by first selecting the desired store number and then pressing the 'recall' pushbutton. It follows that once a number of trial equalisations have been placed in stores, they may then be rapidly compared by first pressing 'recall' and then pressing the desired sequence of store locations. This operation does not introduce any clicks or other unwanted noises so that it is possible to change equalisations during live programme without troubles.

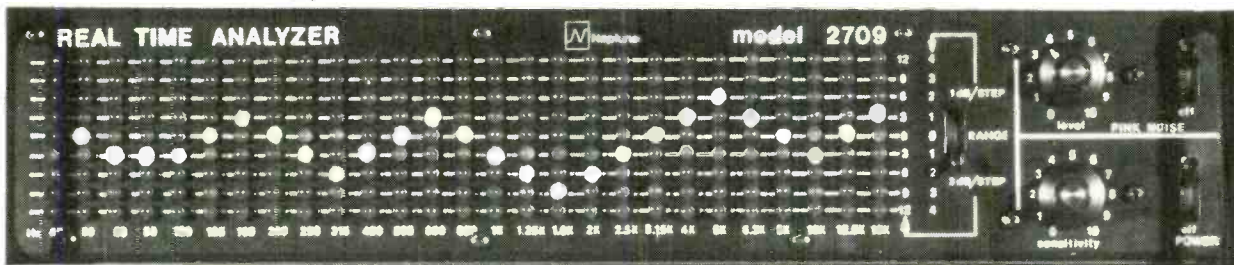
Two further useful features are provided by the 'edit' button. Firstly the contents of one store may be transferred to another so that equalisation patterns can be put into a desired order, and secondly the stored pattern in any store may be updated and either replaced in its original store or located in any other store location. Shifting locations is accomplished by first selecting the store to be moved and pressing 'edit'. The destination store is then selected and the numeric display blinks to warn you that you have an incomplete operation. You then press the 'store' button and the original pattern is now located in the original store and the new store.

The second use of the 'edit' button is updating stored patterns for either different equalisation or different gain within the frequency band. This

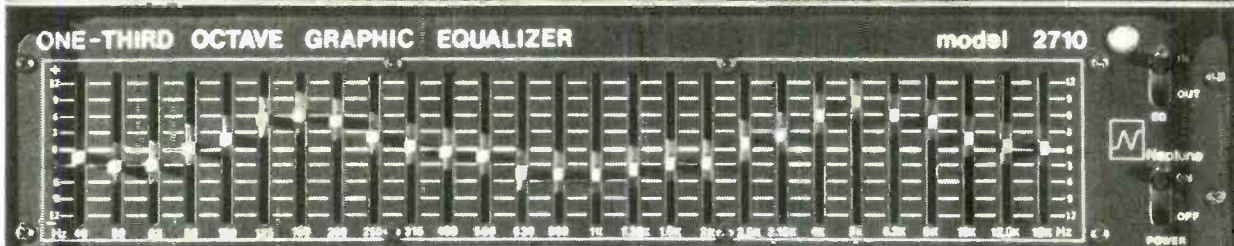
122 ►



# .... And some are more equal than others



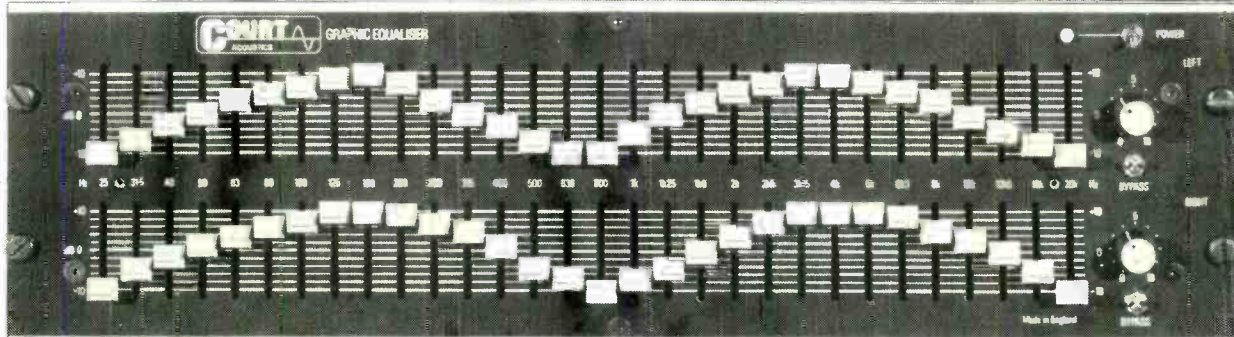
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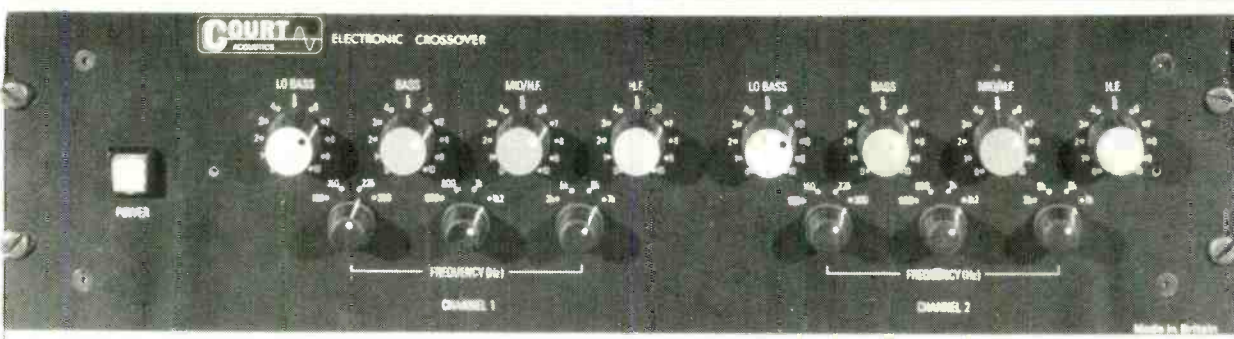
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342



GE60



EC2, 3, 4

- 2709 Neptune 27-band Spectrum Analyser**  
Giving 27-bands of display in 1db and 3db steps, with built-in microphone amplifier, and pink noise generator. Like all Neptune products, fully balanced at around half the cost of other analysers.
- 2710 Neptune Electronics 27-band Graphic Equaliser**  
All solid state giving 1/3 octave equalisation at a very low cost and giving considerably higher output and improved performance on any sound system. Also available in 10-band stereo and mono versions.
- 342 Neptune Stereo Parametric Equaliser**  
A new addition to the Neptune range for which we are sole UK agents. This superb equaliser gives 4 overlapping bands which can be separately switched in, and giving broadband equalisation covering the entire audio spectrum in one sweep, down to an extremely sharp notch filter. Balanced and unbalanced.

- GE60 30-band Stereo Graphic Equaliser**  
The ultimate equaliser with 60-bands on ISO centre frequencies from 25hz-20khz, up to 20db of gain, fully balanced with minimally flat filters allowing the unit to be used as a 'all cut' or 'all boost' equaliser.
- EC2, 3, 4 Constant Phase Electronic Crossover.**  
2, 3, and 4 way electronic crossovers switchable to standard frequencies.

  
**COURT ACOUSTICS LTD**  
35/39 Britannia Row London N1 8QH ☎ 01-359 0956  
Telex: 268279 BRITRO G



is accomplished by first selecting the desired store and then pressing 'edit'. Irrespective of the control positions the stored equalisation comes into action and moving the controls alters the equalisation pattern so a modified equalisation can be obtained. This may then either be returned to the original store by pressing 'store', or may be stored in another store by first selecting the store location and then pressing 'store'.

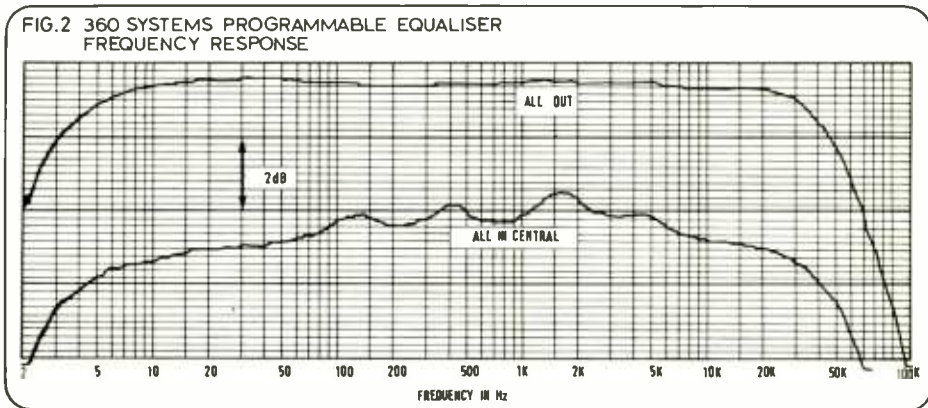
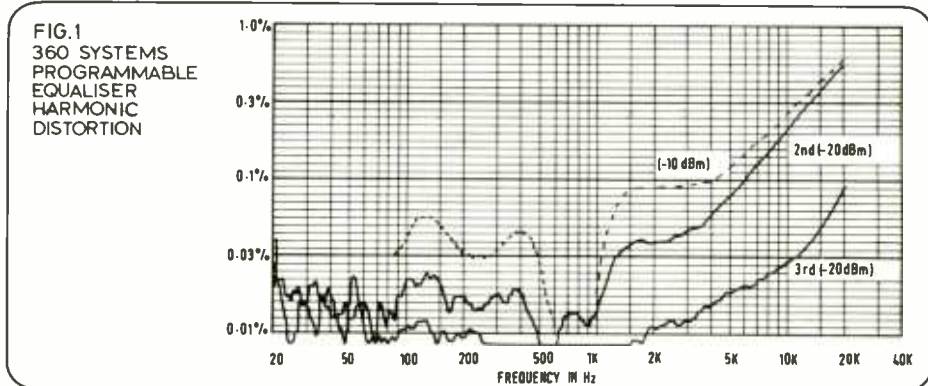
After a little use this overall system is very easy to understand and operate and the ability to switch instantaneously between different equalisations makes it simple to compare subtle differences between equalisations which are not always very apparent when twiddling the knobs on a conventional equaliser.

The final external features of this unit, which mounts into a standard 19in rack, are the front panel power on/off switch and the rear panel connections comprising a fixed power lead with an adjacent and properly identified power fuse plus the XLR type audio connections. These consist of two electronically balanced inputs and two outputs which are normally single ended but may be optionally transformer balanced. An additional future feature will be a remote control connection, but no details of this were available at the time of writing.

Within the unit the electronics are mounted onto four good quality printed circuit boards but no component identifications are provided for servicing and the instruction manual contained little information. One board behind the front panel supports the equalisation controls and front panel switches plus four preset controls, and this board feeds the digital section via ribbon cables and connectors, that digital section board covering the majority of the base of the unit. Two audio boards (one for each channel) are fed by the digital board again via ribbon cables and connectors. Rather alarmingly, each audio board has 22 preset controls but the manual does give the alignment procedure for these.

**Inputs and outputs**

The unit was found to have a constant and high input impedance at its electronically balanced inputs irrespective of the setting of the input level control. At maximum input gain the maximum input level for the onset of severe distortion was found to be 1.3V at 1kHz falling to 0.6V at 10kHz, both corresponding to just above the 0dB indication on the level display. At the 12



o'clock setting of the input level control (nominally unit overall gain), the maximum input level rose to a satisfactory +21dBm. The common mode rejection was found to be pathetic with only 10dB rejection in the audio frequency band.

On the output end, the output impedance of the unbalanced output was satisfactorily low at 48Ω with a drive capability of +20dBm loaded into 600Ω over the audio frequency band.

Whilst the input level control has an infinite range, the range of the output level control is intentionally restricted to a measured 22dB with the maximum overall gain of the unit being 15dB without any equalisation in use.

Checking the level indicator showed that the increments from 0dB indication to -3dB, -6dB and -9dB were within 0.1dB with the -12dB indication corresponding to -12.5dB, adequately accurate.

A source of potential confusion was that the level indication was found to be subject to pre-emphasis to the extent of +3dB at 4.5kHz rising to +10dB at 20kHz which reasonably follows the high frequency limitations of the unit. The reason for this performance restriction is unknown at the time of writing.

As stated by the manufacturer, the level indication senses level in various parts of the equaliser chain and not only indicates input or output overload. It was however found that the attack time of the indicator was rather long requiring about 35ms to indicate and also that it would have been helpful if the indication had a degree of peak hold.

**Noise and distortion**

Measurement of the output noise with the unit set for a flat frequency response and unity gain gave the results shown in Table 1 which having regard to the output drive capability are excellent.

TABLE 1

Band limited 22kHz to 22kHz rms	Noise	
	Left channel	Right channel
A weighted rms	-79dBm	-79.5dBm
CCIR weighted rms ref 1kHz	-81dBm	-80dBm
CCIR weighted quasi-peak ref 1kHz	-72dBm	-71dBm
	-68dBm	-67dBm

Plotting the harmonic distortion at operating levels of -10dBm and -20dBm produced similar patterns with the third harmonic remaining at a low level but the second harmonic rising sharply above 5kHz as shown in



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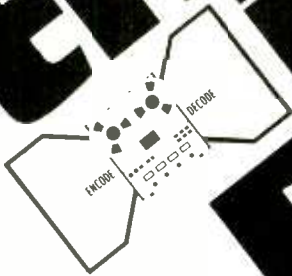
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# Breakthrough Through Noise Reduction

SEE US AT THE  
**APRS 80**  
EMPIRE ROOM



Compansion is professionally accepted as the most elegant and effective noise reduction system available. During recording, the audio signal is compressed and recorded above the inherent noise of tape. When played back, expansion takes place, restoring the original dynamic range, and pushing down the tape noise level.

Until recently, the cost of electronics to do this has been high, due to the high degree of design and component precision necessary to make the control circuitry track the constantly changing levels precisely, without altering the sound quality.

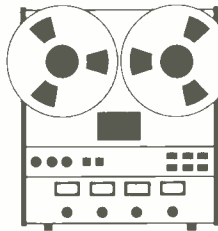


Now, a remarkable new integrated circuit, containing highly accurate gain control circuitry has been developed. We have incorporated this technology in the ACCESSIT Compandor.

Operating on the standard 2:1 Compression/expansion ratio, the unit provides up to 30dB of noise reduction. Used in conjunction with a quality tape recorder, noise is effectively reduced to inaudibility. Each unit contains a separate compressor and expander circuit so simultaneous recording and playback is possible. There is no need to switch the unit from rec/play.

A single, patent, self indicating push button, switches the unit in and out of circuit, assisting line up procedures and eliminating signal 'pumping' problems when overdubbing multitrack. For the sake of economy, the individual units have no internal power supply. They require 20V DC, available from the standard ACCESSIT power unit, which will supply up to four compandors.

● Since the units are packaged as individual mono channels, they can be used singly or in combination anywhere that there is a noise problem in the studio.



- Stereo masters, with a pair of compandors, are as quiet as the mixing desk.
- For multitrack recorders, one unit per channel is necessary. Many generations of overdubs with no noise build up are possible.
- Low cost echo and analog or digital delay units no longer need to contribute noise to the mixed signal.
- For video recorders, the sound quality can be improved to hi-fi standards.

There are four jacks, arranged in two pairs, on the rear panel of the unit. The compandor is simply connected in line with the input and output of the recorder. Various connection adaptors are available. The high input and low output impedances are compatible with any recording system. Lining up the units is simply a matter of switching the compandor in and out of circuit with the front panel push button, and adjusting the front panel preset to match the signal levels. All units come pre-aligned for most budget recorders. Installation is a matter of a few minutes.

To see how the compandor fits your requirements we give you the opportunity to try the units for thirty days. Interface them with your recorder and hear the advantages of no noise.



if, within 30 days you are not happy that ACCESSIT can fulfil your noise reduction needs, return the units to us for a prompt and courteous refund. To order your system, simply send your order and cheque or credit card number and we will send your order by return with full instructions and a 3 year guarantee. Service should never be required, but our prompt service by mail department is ready to deal with all problems. The Compandor is part of the ACCESSIT signal processing range. We have a compressor, parametric equaliser, booster amplifier and reverb unit, all at similar budget prices. Write now for full details.

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\_\_\_ Power Unit(s) @ £28.52 £ \_\_\_\_\_

Total enclosed £ \_\_\_\_\_  
Please enclose full payment with this order.  
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TABLE 2

	Band 1			Band 2			Band 3			Band 4		
Nominal frequency	20Hz	100Hz	500Hz	68Hz	340Hz	1.7kHz	240Hz	1.1kHz	5kHz	0.8kHz	4.2kHz	20kHz
Actual frequency	20.7Hz	104Hz	495Hz	68.1Hz	336Hz	1.7kHz	250Hz	1.35kHz	5.01kHz	834Hz	3.64kHz	19.9kHz
Maximum rejection (dB)	44/48	47/55	50/55	40/34	51/33	41/33	38/33	49/33	38/32	48/43	34/40	29/7

fig 1. Subjectively this increase in distortion is unlikely to be of concern as the measured intermodulation distortion to the CCIF twin tone method remained below -74dB at a -20dBm operating level up to 20kHz.

Operation of all controls including switches was found to be silent with no clicks in the output. However, a dc shift in the output was noted when operating the output gain control and this could produce undesirable effects.

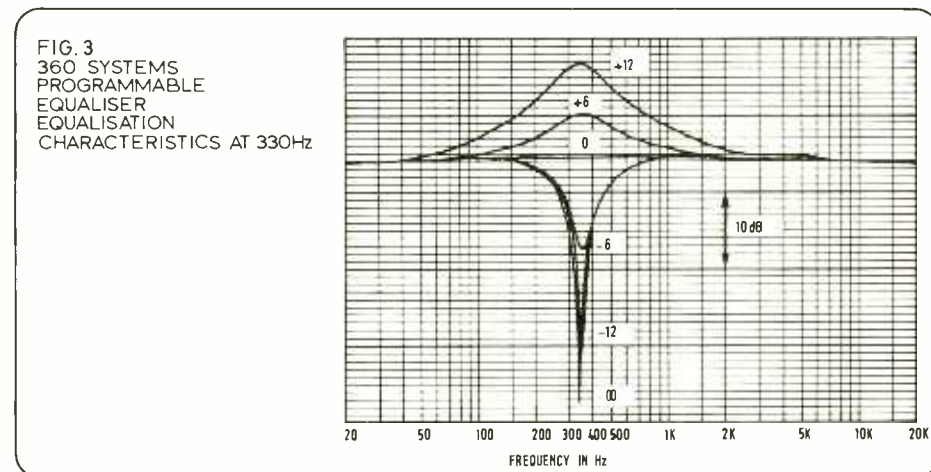
**Equalisers**

The overall frequency response of the unit with all the equalisers out of circuit and also with the equalisers in circuit with their gains set to zero is shown in fig 2 from which it can be seen that the overall frequency response is very flat within the audio band with the equalisers out. However, with the equalisers in circuit there is a generally acceptable degree of ripple with the controls in the mechanical 'flat' position.

As can be seen from Table 2 the extreme frequencies and the centre frequencies of all four bands are reasonably accurate, however, the maximum amount of rejection available varied widely. This depended significantly on the selected bandwidth and it was found that substantial improvements could be made by realigning the unit. As this sample of the equaliser had been used as a demonstration unit this is not perhaps surprising.

The typical equalisation characteristics with the bandwidth set to mid-point and the cut/boost control placed in its ±6dB, ±12dB and minus infinity positions is shown in fig 3. For a frequency of 330Hz it can be seen that a wide range is available with the boost calibrations being accurate, but the cut calibrations somewhat arbitrary. The effect of the bandwidth control is shown in fig 4 at maximum cut and boost for the extremes of the bandwidth control which provided a wide range of adjustment.

If the equaliser is to be used for such applications as removing hum from recordings, two equalisers may be tuned to the same frequency to obtain large narrow band cuts. This feature is



shown in fig 5 with two equalisers tuned to 100Hz. Clearly a good rejection is obtained with a relatively high 'Q', but patience is required to tune the frequency control to obtain such rejection.

**Other matters**

The tracking of the two channels was investigated and some comment is warranted on this aspect of the unit. So far as the gain controls are concerned the maximum error between channels was only 1dB for any gain setting, but the input gain control was not quite so good with error up to 1.5dB.

Similar degrees of error were found in the equaliser sections using a wide bandwidth. However, when a narrow bandwidth is used in the cut mode differences in tuning the frequency could lead to interchannel differences of up to 15dB which would be highly significant when attempting to reject hum, camera noise etc.

Overall, the digital storage system was a delight to use with the increments of control of all parameters being more than adequately small so that steps could not be heard. Initially some

trouble was experienced with the digital control going completely crazy and this was tracked down to power line surges. Increasing the input voltage from the nominal 240V to 270V completely solved this problem and the UK agent who modified the unit for 240V operation has been advised to investigate the mains transformers with which he modified the unit.

**Summary**

Purely as an equaliser, this is a versatile unit with a generally good performance, but with the digital programming facility it is a most powerful unit providing instant comparison between different equalisations.

The unit is well made and simple to operate after a short 'driving lesson', and I think engineers will be surprised how powerful a tool the instant comparison feature can be in hearing the subtle differences between minor changes in equalisation.

Hugh Ford

FIG. 4  
360 SYSTEMS PROGRAMMABLE EQUALISER BANDWIDTH EXTREMES

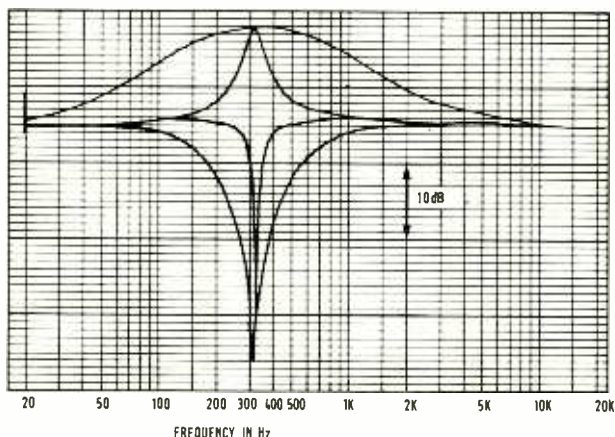
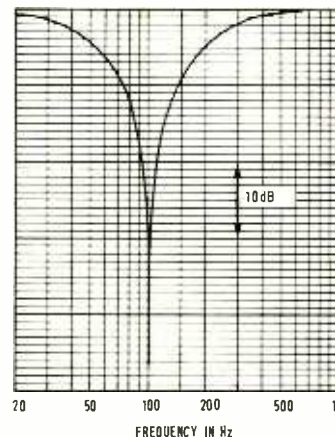


FIG. 5  
360 SYSTEMS PROGRAMMABLE EQUALISER MAXIMUM REJECTION AT 100Hz







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# Run your loving professional eye over this!

### Tonmeister history

Although everyone in the recording world must by now have heard of the Tonmeister course at the University of Surrey in Guildford, the story of the rather political background to the course creation — and the repercussions — isn't half so well known.

The industry clearly has mixed feelings over Tonmeister. Anyone who has been on the course is unlikely to regret the experience. But those who have been refused entry, for instance through lack of the necessary school leaving qualifications, will doubtless resent the stringent basic requirements and tough selection. The university has only around eight places a year to offer and for these there will be about eighty eligible applicants. The eligible eighty are first whittled down to a 'short' list of around 40 or 50 for interview. But there are hundreds, possibly thousands, of others who never get as far as the starting line because they don't have the necessary paper qualification combination of music, physics and maths at A level, plus some playing ability (preferably piano up to at least Grade 3). In some schools the timetable logistics make it very difficult, often downright impossible, for a pupil to study all these subjects together.

There is also suspicion of the course in some areas of the recording industry, especially amongst those who began their work in studio life as a teaboy or tape jockey. Then again there are studios (and the number is increasing) who have employed Surrey Tonmeister graduates and are more than happy to have been saved the need to spend expensive time on basic training.

Guildford is still the only British university offering a Tonmeister course. So love it or hate it, parents with children interested in music recording would be well advised to harass their school early on into streaming the child towards those three vital A levels and music practice. But how did the requirements originate?

Back in the mid '60's the Battersea Polytechnic had a music department which was operating on a shoestring. Its London and Durham B Mus course was tutored in some spare stage dressing rooms. A 1966 charter designated Guildford as a new technical university, but a larger music department was created to fill the gaps left by Battersea. Then came the idea of a joint technical and music course as the basis for a career in the then-booming record industry. Eyes turned to Germany (and Poland) where music and science have for many years been married in Tonmeister university degree courses. (Hence, by the way, the German title of the British course.)

A considerable amount of departmental politics surrounded the creation of the Guildford version. To cut a long and convoluted story short, the science faculty wanted more science in the proposed course than music, and the music faculty took the opposite view. In the end the course was housed under the music department roof with science lecturers brought in from other faculties. Subsequently a quite different PMA course (Physics with Musical Acoustics) was put together by the physics department. This is open

to students with no musical background and is obviously much more science-based than Tonmeister.

After a one year start-up period John Borwick, who 15 years earlier had taught BBC studio managers the practical side of their trade, was brought in to co-ordinate the Tonmeister course, organise the practical recording side and generally oil the wheels between the music and physics factions. This he achieved. But that one year gap had proved very significant.

It had originally been planned to keep the students on text book theory for at least one, preferably two years, before letting them loose on any actual studio equipment. Fortunately this draft academic structure was soon abandoned and an enlightened hands-on approach has been adopted ever since. But during that one year prior to Borwick's arrival the university had made several approaches to the recording industry. They were looking for encouragement, sponsorship and financial backing. An interesting parallel here is the catering course also run at Guildford University. This is totally supported by the hotel and catering trade and costs neither university nor taxpayer a penny.

To be euphemistic, the record industry was not enamoured of those original Tonmeister approaches. The Guildford plans came across as so much airy-fairy academic gobbledegook. The record companies and studios were not inclined to pour good money into a scheme which they thought likely only to produce elitist theorists. These people would then, so the industry supposed, expect to walk straight into high grade studio jobs. So, not to mince words, the opportunity of industry sponsorship was forfeited before the course got under steam.

For seven years Borwick ran the course successfully, despite a fair amount of behind the scenes dispute between the music and science people over the relative importance of music, science and practical recording experience. By the time Borwick had left in January 1979 the course was offering a fair balance between theory and practice. His job was then taken over by David Pickett, who had spent nine years with EMI Abbey Road Studios which is surely (along with the BBC) the best industry training anyone could ever hope to get. But — unusual in pre-Tonmeister days — Pickett was a practical musician and had graduated both in electronics and music. His B Mus was in fact done at evening classes while working at Abbey Road; no mean achievement. It's not surprising therefore that it was Pickett who got the Guildford job.

Of course a Guildford Tonmeister degree certainly does not guarantee the graduate a good job in the recording industry. But most years now those Tonmeister graduates who want a job in the industry will probably get one. Likewise those who are not accepted for the Tonmeister course, either through having the wrong qualifications or losing out on the ten-to-one selection ratio, are by no means doomed to live in a bank. Anyone who really wants to work in the recording business will go on knocking on doors until he succeeds. Tony Faulkner, ex Enigma, was for instance debarred from the

Tonmeister course by having the wrong A levels. So he studied on another, science-based, course at Guildford.

Attitudes in the recording industry do seem to be changing, albeit gradually. Tonmeister is no longer regarded with the suspicion of the early '70's and established studio engineers who have learned their trade through sweeping the floor, have been heard to remark: "I wish there'd been something like that when I started out". So perhaps, even despite the precarious state of the record industry and that first year false start, it's not too late for another university to create a Tonmeister course with at least partial backing from the record companies. After all, any industry which neglects its future has little future to look forward to. And paying someone to sweep floors and make tea is clearly a very uneconomical way of training them in recording science, technology and practice. The argument against the creation of any more Tonmeister courses is of course that already there aren't enough record industry jobs to go round. Fair comment. But there is more to a university course and degree than qualification for a job in that particular field of study. For instance the business world is thick on the ground with wealthy and successful men who under pressure, and after a couple of drinks, will admit that those impressive letters after their names signify only a degree in the mysteries of ancient Greek.

### To phone or not to phone

There used to be a TV programme which documented 'the space between words' i.e. the things that people meant but didn't say. There was a good example of the perils of word-spacing earlier this year when Jeremy Beadle, one of LBC's newest and most wayward phone-in presenters, was interviewed by the *London Evening Standard* newspaper. According to Beadle he wanted to do a phone-out programme but had found that 'it was against IBA rules to do one live'. This prompted a letter from Ron Onions, editorial director of LBC, which was, how-you-say, frank and to the point.

"Not so," wrote Onions, "maybe he should talk to me. After all I'm the one in the upper echelons of LBC who took him on. And I'm the one who's going to fire him one day. Maybe."

So what is the truth? Does the IBA, or does the IBA not, allow its commercial radio stations to do an American style phone-out? You know the kind of thing — the presenter phones up popular or unpopular public figures live on air and asks them awkward questions. In this way listeners hear their off-the-cuff response, rather than carefully prepared and politically expedient answers. Well, according to the IBA, Onions is correct in saying that there is nothing in the IBA rule book or code of practice to prevent a live phone-out. But it isn't as simple as that. The IBA does insist that the person being phoned must be **forewarned** before he or she goes live on air. This way no famous, infamous or public figure risks being heard on air refusing to talk or fumbling for an answer. ■



# The Total Package

If you are considering a multitrack system or updating an existing studio, Lake Audio offer a comprehensive range of studio equipment. We specialise in supplying the Total Package, which can be tailored to your exact requirements. We offer studio design, consultancy, installation, service and excellent prices.

If you would like to know how Lake Audio can help you, telephone us or use the coupon below.

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We specialise in supplying the Total Package whether your requirements are for an audio visual system, broadcast or production studio or a complete multitrack installation, no matter how small or large, Lake Audio will be able to assist you in selecting the correct components for your system.

## Mixers

Our range of mixers is vast, from a modest 12 into 2 to 24 track professional consoles, the list includes Alice, Allen & Heath, Fleximix, HH, MM, RSD, Studiomastrer and Soundcraft.

## Tape machines

The Revox 877 is probably the most popular studio mastering machine and we can supply all versions of this versatile machine. Multitrack machines include Teac 3440, Tascam 80/8 complete with DBX, Brenell Mini 8 Soundcraft SCM series and Lyrec.

## Microphones

We supply AKG, Beyer, Calrec, Neuman, shure and Pearl.

## Audio processing

The range available is vast, so we choose to stock only those products we believe are the best such as MXR, Flanger/Doubler, D.D.L., Graphics and Pitch Transposer, these are just some of the products making MXR a leader in the field. We also stock Audio and Design Recording, Scamp racks, etc.

## Monitoring

JBL and Tannoy supply most of the world's monitor speakers but no studio is complete without a pair of Auratones. Monitor amplifiers include Quad 405, 303, HH TPA and MOS FET, Turner and Amcron.

## Accessories

We have large stocks of many accessories, including Ampex 406/407 tape and Grand Master, all lengths of Ampex cassettes, EMI splicing blocks, leader tape, D.I. boxes, track sheets etc.

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Gauss systems are modularly engineered. That means you can start with a master and slave...then add up to 20 slaves as your business grows. And, Gauss' modular design means you'll never have to own a system that's out of date. As we improve the equipment, we improve it modularly. You add the improved modules (like 64:1 duplicating), when you need them.

Gauss engineering brings you a better product in sound. In speakers. In high speed tape duplicators. Listen. You'll hear the difference.



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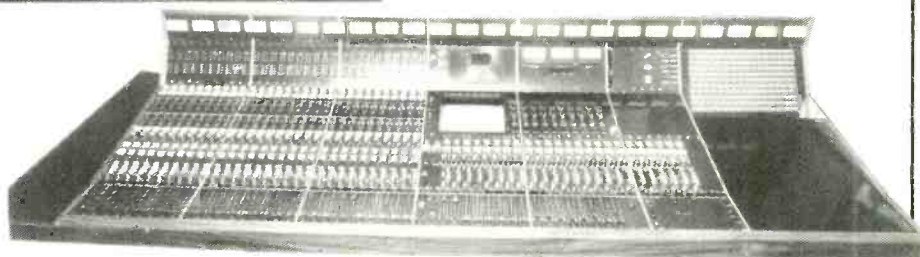
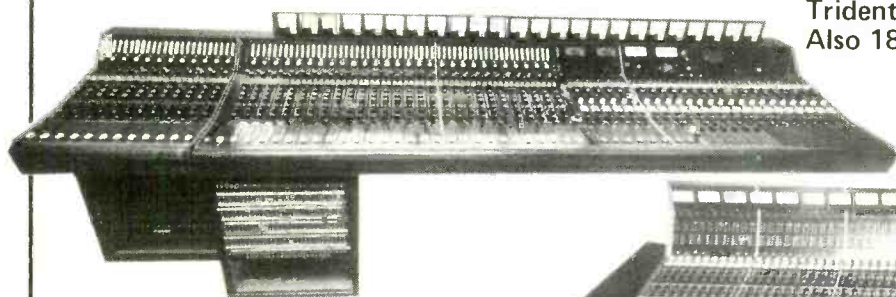
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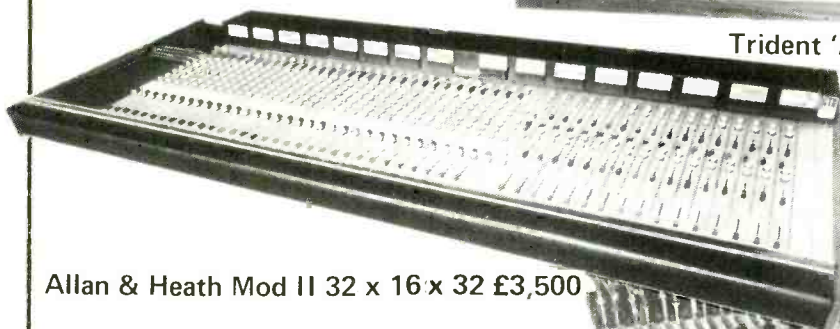


# USED CONSOLES EX-STOCK

Trident 'B' Series console 40 x 8 x 24 £12,000  
Also 18 x 8 x 24 available £6,000

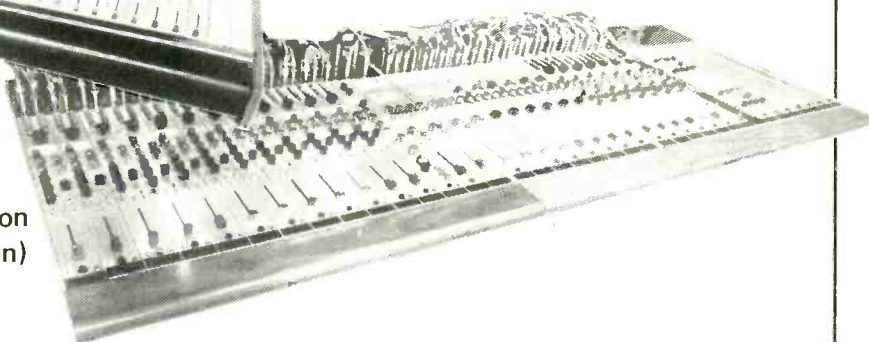


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Allan & Heath Mod II 32 x 16 x 32 £3,500

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These are just a few items from our comprehensive stock of professional recording equipment.

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or pick one up at the APRS Show on Stand Nos. 130/131



## The micro HS, broadcast cartridge machine

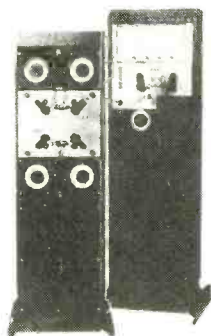
<b>COOL</b>	The new micro HS embodies the latest in circuitry and mechanics, designed and built in the U.K., with a total input power of only 10 VA when running.
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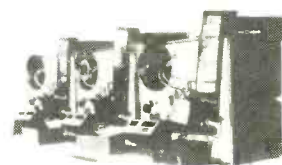
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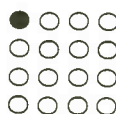
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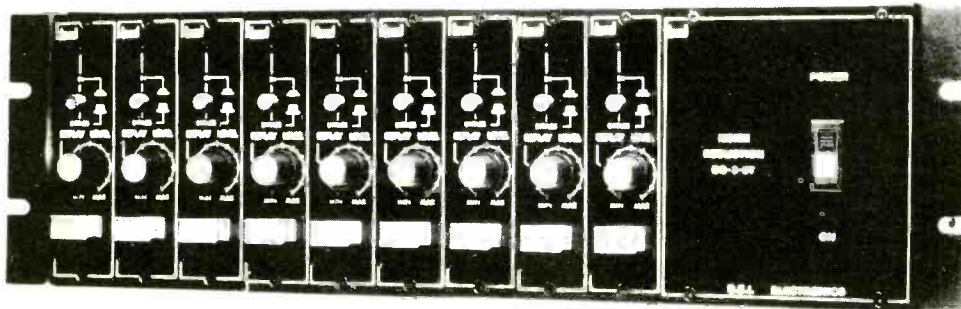
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- \* Simultaneous. En Code De Code (No Switching Record to Replay).
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8 Track unit illustrated also available in stereo form  
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Contact. Christos Lillis.

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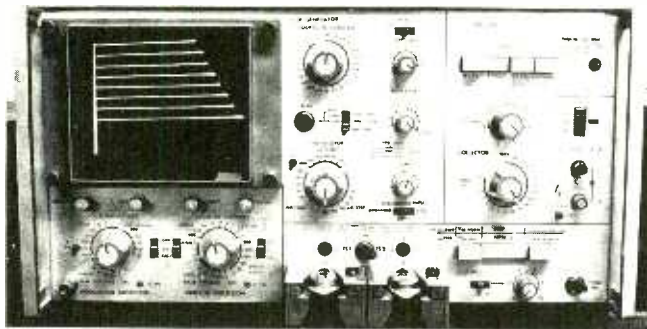
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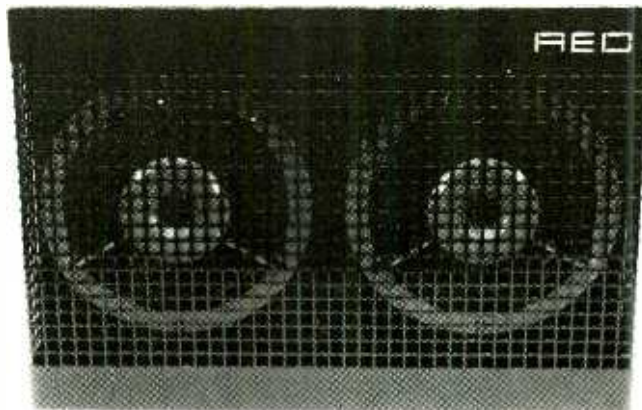
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You may think you have heard this one before - remember the M49?

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...And you can change your mind later by upgrading your configuration at your convenience for a minimum cost.

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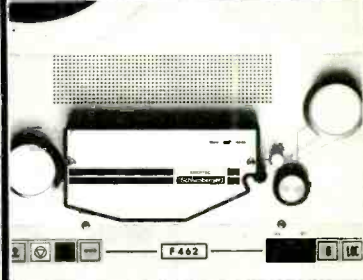
*Give us a call. We'll let you know how and where you can try this product (Why not in your own studio?).*

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Calrec design and manufacture microphones that provide the valuable 'ears' for your professional recordings.

We at Calrec have invested fifteen years in the research, development and perfection of the condenser principle.

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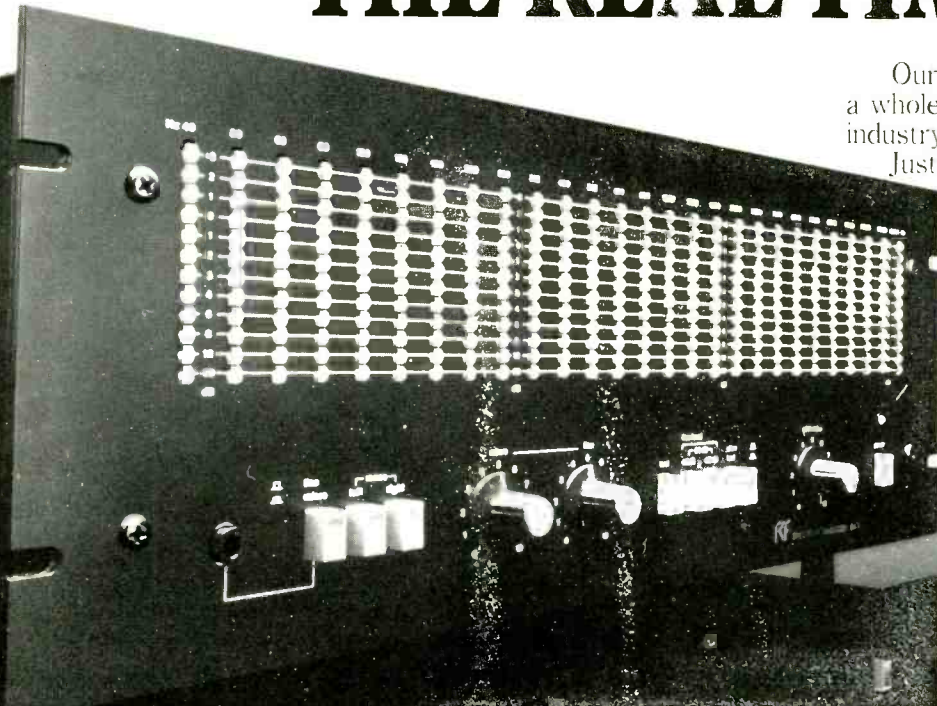
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Our real time spectrum analyser makes life a whole lot easier for everyone in the audio industry.

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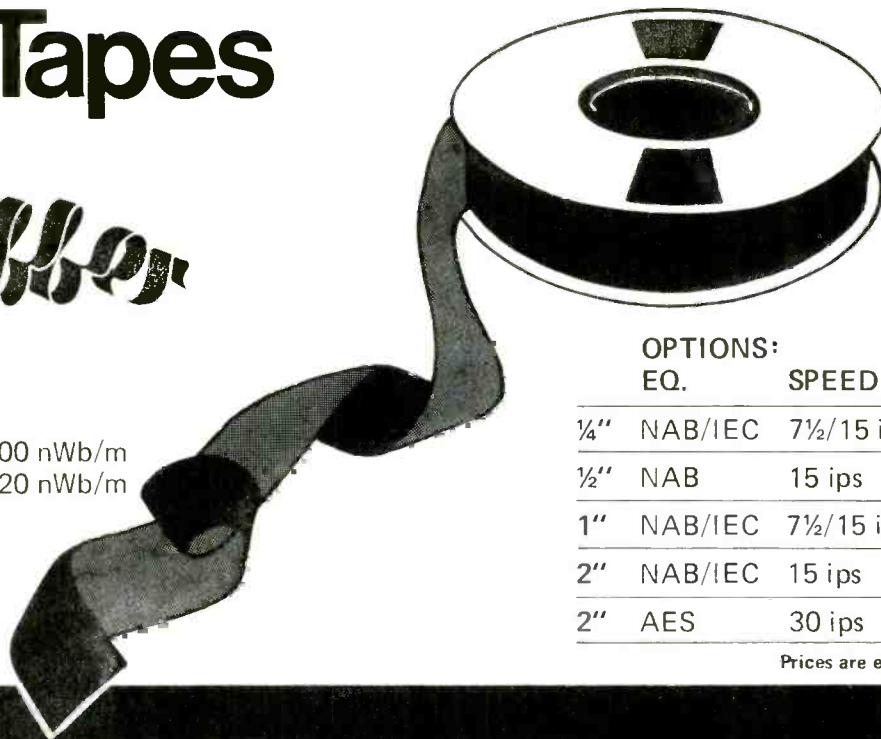
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320 Series — ref at 320 nWb/m



**OPTIONS:**  
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2"	AES	30 ips	£180.00

Prices are exclusive of VAT



Stereo Plate      £2400.00  
Remote Control   £ 350.00

Prices are exclusive of VAT

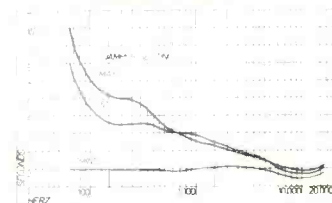
Input Impedance: 1000 ohms (nominal)  
Input Level: -20 to +10 dbm (+4 dbm nominal)  
Input Circuit: Transformer balanced, floating  
Input Connector: Cannon XLR-3 (Switchcraft D-3-F)  
Output Impedance: 600 ohms (nominal)  
Output Level: +4 dbm (nominal)  
Output Circuit: (2) Transformer balanced, floating  
Output Connector: Cannon XLR-3 (Switchcraft D-3-M)  
Maximum Output Level: +24 dbm (into 600 ohms)  
Internal Limiting: NONE (full headroom through unit)  
Reverberation Time: Adjustable at unit or via optional remote control, 1 to 4 seconds nominal (at 500 hz, octave filtered pink noise)

Driver System: Voice coil tape plate driver, low noise power amplifier  
Pick Up System: Ultra low mass (less than 1 gram) piezoelectric contact pick ups, FET preamplifiers  
Electrical Requirements: 120 VAC, 50-60 hz  
240 VAC, 50-60 hz  
Equalization: Fixed, internal (maximum hf/11 reverberation ratio)  
Size: 49½" High, 13½" Wide, 7" 9" Long  
Weight: 350lbs  
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DC-96



DC-63



VM40/41



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The '63, '96 and 40/41 are only 3 of a full line that includes electret lavaliers, advanced design XY-axis stereo mics, and complete accessories.

Please write us for full technical information and ask your pro-dealer for a demonstration.

We'll bet you dollars to marks you'll be surprised how much more you'll get with the Swedish Steal. Dealer inquiries invited.

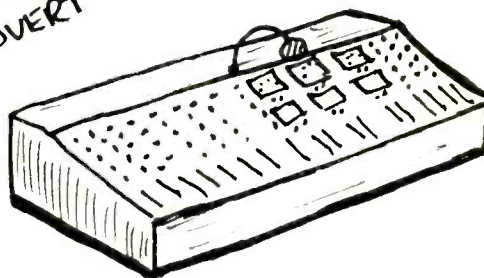
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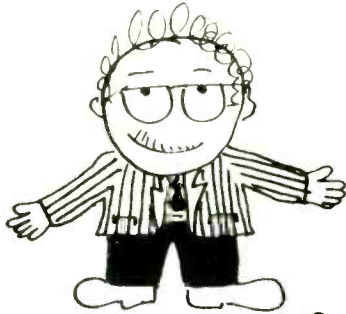
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PROGRESSIVE ELECTRONIC PRODUCTS

593 HIGH RD LEYTON E10-558-0678 LONDON ENGLAND







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BAX	—	1	Bass and Treble Tone Control	£7 40
MID	—	1	Mid Range Tone Control	£6 85
UGB	—	1	Unity Gain Buffer Amplifier	£4 40
VEM	—	1	Virtual Earth Amplifier	£4 95
LHD	—	1	Line Headphone Driver	£6 30
GPA	—	1	General Purpose Amplifier	£5 48
SFR	—	1	Scratch Filter	£7 55
GAP	—	1	General Purpose Amplifier	£5 48
SFR	—	1	Scratch Filter	£7 55
SUB	—	1	Subsonic Filter	£6 20
MAG	—	1	Disc Pre Amplifier (Moving Magnet)	£8 70
CM	—	1	Complete Channel Module	£70 26*
CM	—	1b	Complete Channel Module (with E.Q. defeat switch and additional facilities)	£80 24*
GM	—	1	Complete Group Module	£57 46*
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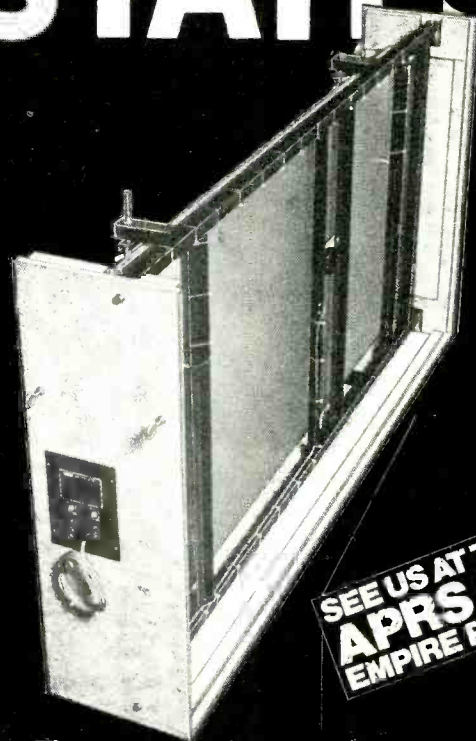


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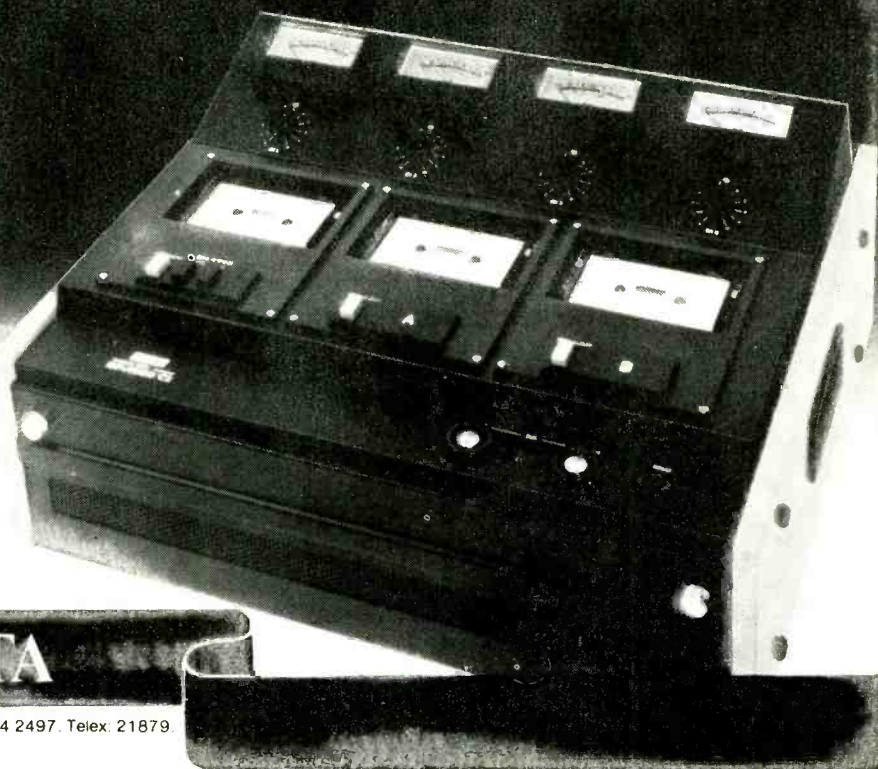


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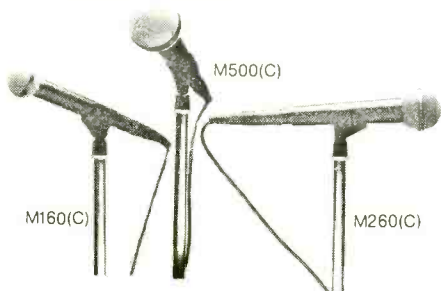
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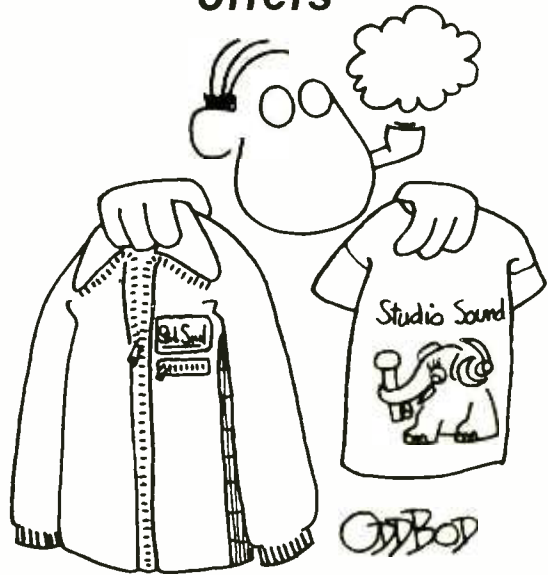
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**Note:** Advertisement copy must be clearly printed in block capitals or typewritten.

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

The attention of advertisers is drawn to "The Business Advertisements (Disclosure) Order 1977", which requires that, from 1st January 1978, all advertisements by persons who seek to sell goods in the course of business must make that fact clear. From the above date, consumers therefore should know whether an advertisement relates to a sale by a trader or a private seller.

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10-49	51p	53p	55p	59p	63p	67p	72p	80p	87p	97p	107p	117p
50-99	48p	50p	52p	55p	58p	61p	68p	76p	84p	94p	104p	114p
100-149	47p	49p	51p	52p	54p	56p	63p	72p	79p	89p	99p	109p
150-249	43p	45p	47p	48p	50p	52p	60p	69p	74p	84p	94p	104p
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All in first-class order £3,600.  
ALSO  
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Philips EL3503 Tape Deck minus head blocks	...	...	£45
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4 channel	...	...	£60
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mains or battery	...	...	£95
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or battery	...	...	£120
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Carriage and V.A.T. extra.

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★**Vinyl pressings** from your tapes. Labels. S.A.E. for list. Deroy Records, P.O. Box 2, Morecambe, Lancs. X

★**Disc Cutting** master and demos, pressings, cassettes, mobile recording studio. Free brochure. TAM Studio, 13a Hamilton Way, London N.3. Tel. 01-346 0033. X

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Point of entry to A.C.T.T.  
salary scale according to  
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