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A LINK HOUSE
 PUBLICATION



MEMBER OF THE AUDIT
 BUREAU OF CIRCULATIONS

This month's cover photography of the London Symphony Orchestra and Calrec ambisonic equipment was by Suzie E Maeder and Norman Hodson

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Gerzon's Circulating Currents

Ambisonics, as most people will know, is a system developed by a group of British researchers in the early 1970's and now backed, at least theoretically (although there isn't much of a budget at present), by what used to be the National Research Development Corporation, now nominally a part of the British Technology Group. The system offers a technically effective solution to the problem of reproducing a complete 2- or 3-dimensional soundfield in the average living room, needing only three or four information channels respectively to do this. It is also compatible with stereo and mono, forming as it does a complete hierarchy of compatible methods for both horizontal or 'planar' surround sound and with-height 'periphony'. Unlike quad, it works. The three information channels which make up a planar surround signal may be encoded into two channels (UHF 2-channel encoding) and cut on a conventional stereo lathe, producing a disc which, if anything, sounds even better in stereo than ordinary stereo does. The system is highly regarded by many respected authorities in the hi-fi and pro audio worlds. Virtually a dozen companies are investigating or marketing ambisonic equipment, particularly decoders. Records are available in the shops. But the NRDC is not entirely happy with the commercial progress the system has made. It isn't going as well as one might expect, and this is reflected in the NRDC's reluctance to come up with a practical budget. What has gone wrong?

The problem is not a technical one. There is no fundamental flaw in the system. A typical ambisonic record/replay system may be summarised into three areas: soundfield creation, encoding and decoding. There must be a means of capturing sounds and localising them in the ambisonic soundfield. The signal must then be encoded into a 2-channel UHF format if it is to be released in regular disc format.

Finally, the listener must be able to take this 2-channel signal and decode it into four or more speaker feeds. Currently over half a dozen of the interested manufacturers are working on, or have produced, decoders for domestic or professional use. Two have produced encoders. This is all satisfactory. But at present there is only one means of creating or capturing a soundfield: the Calrec *Soundfield* mic (depicted on the cover with its control unit and the Calrec encoder). That is currently the only way. But only about 5 or 10% of records available today come from live performances which can be captured on one mic, however, ingenious. Multitrack is an important component of mainstream music. You can't record it all at once, with one mic.

What is needed is a method of taking a number of mono signals and localising them in an artificial soundfield, in much the same way as we create stereo. Luckily this is quite possible and the concepts are well known in the ambisonic fraternity. Unfortunately no manufacturer yet offers such a piece of equipment. NRDC money has not been offered for its development.

The music business needs something like ambisonics to give it a boost which could be bigger than digital. The consumers like it. But they will never buy it until they can buy their kind of music, in ambisonic form. 'Their kind of music' is recorded multitrack and needs a mixdown system to create the soundfield. This does not exist in commercial form (a device called a *Transcoder* is available, and is a good interim measure, but it has limited application). Such a mixer will never exist unless the NRDC funds its development, because manufacturers won't spend on research and development money unless it is an exclusive design, which is unlikely. NRDC is not happy with the way the system has (not) been selling. Therefore it will not finance such a project—Catch 22.

Richard Elen

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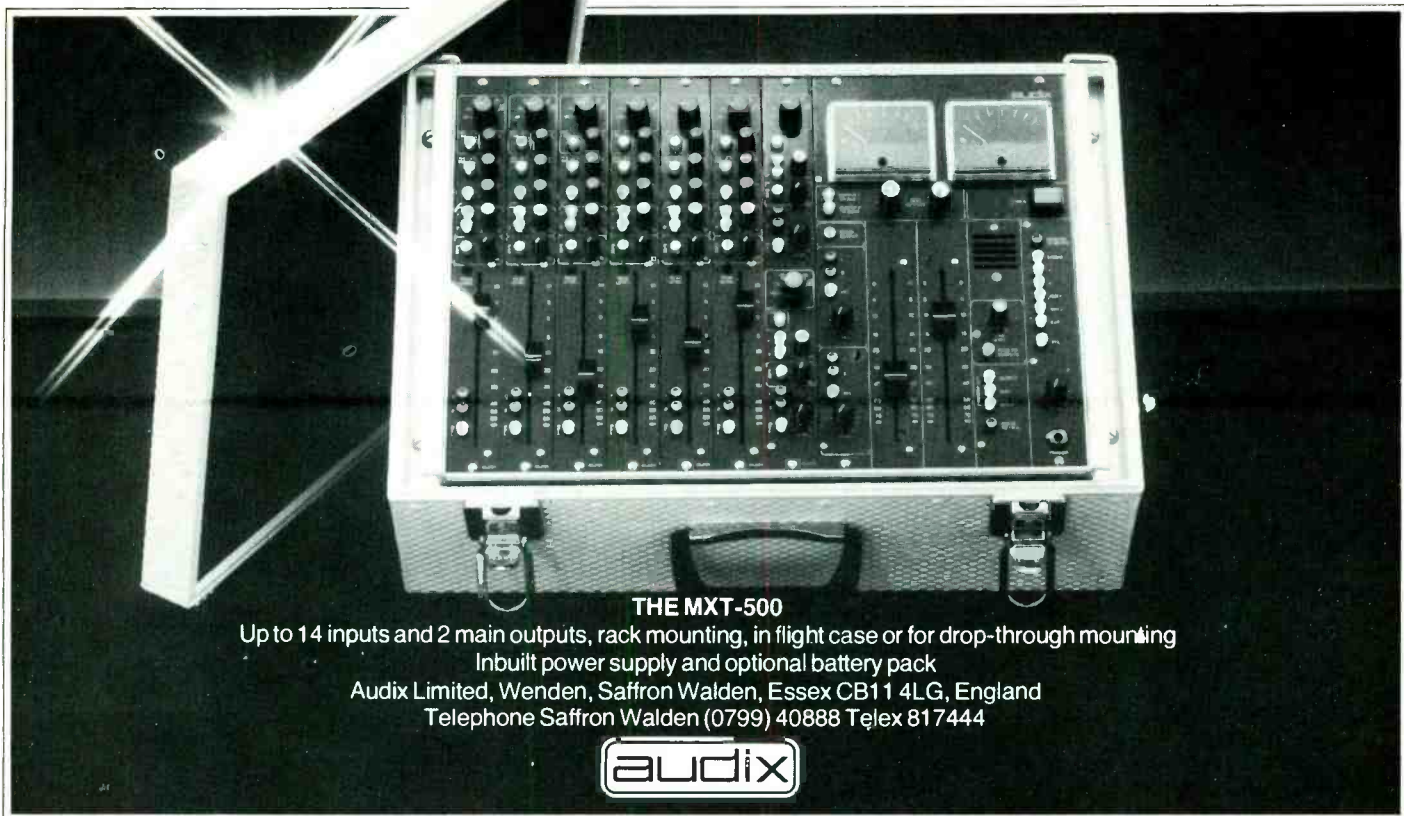
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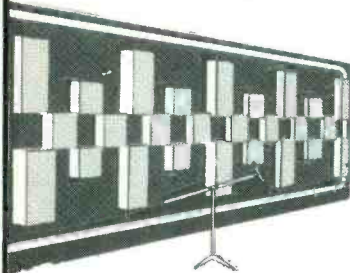


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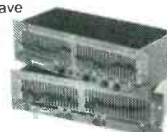
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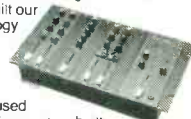
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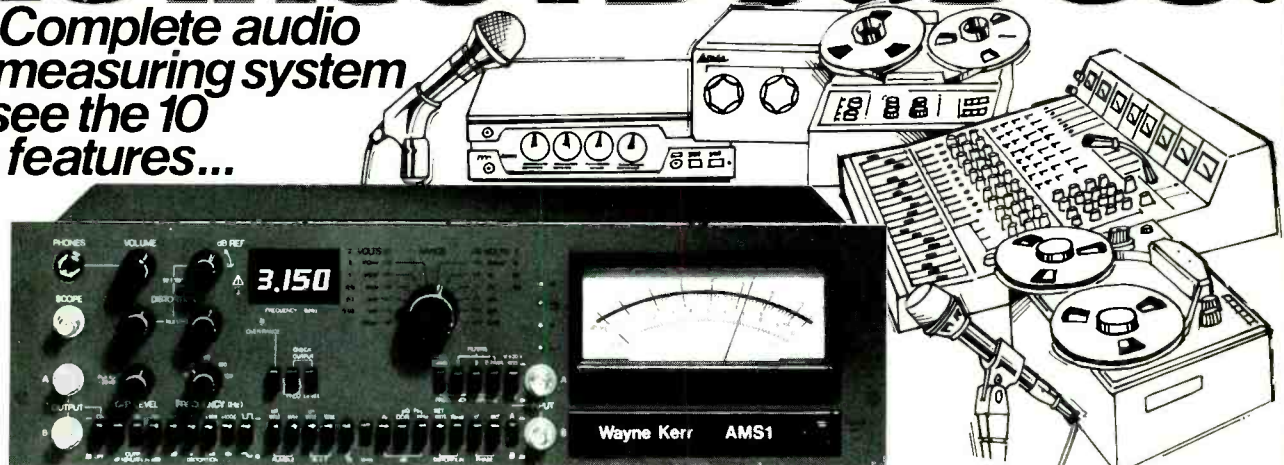
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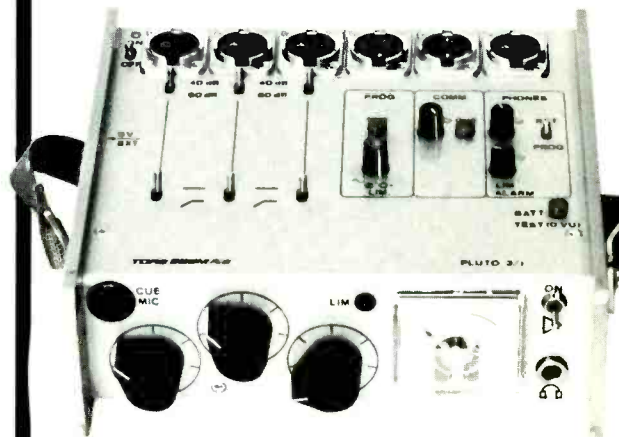
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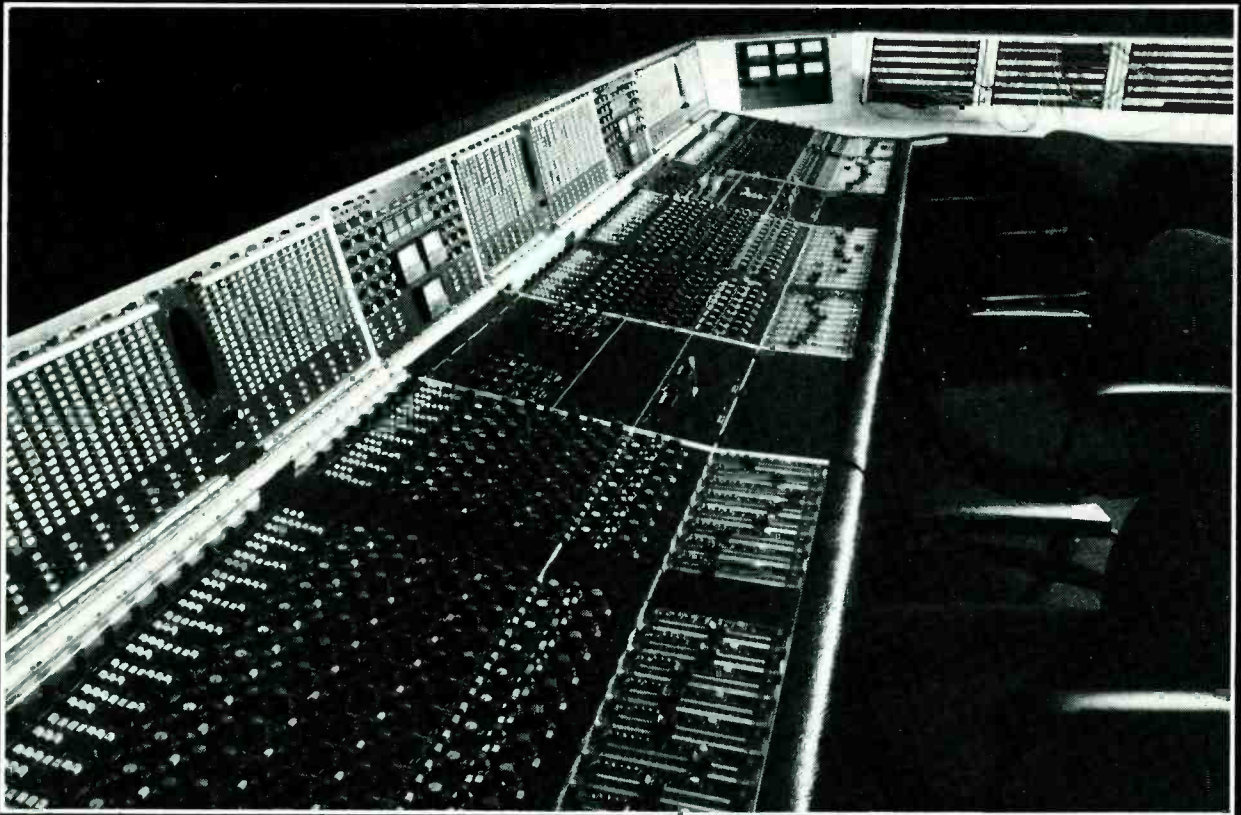
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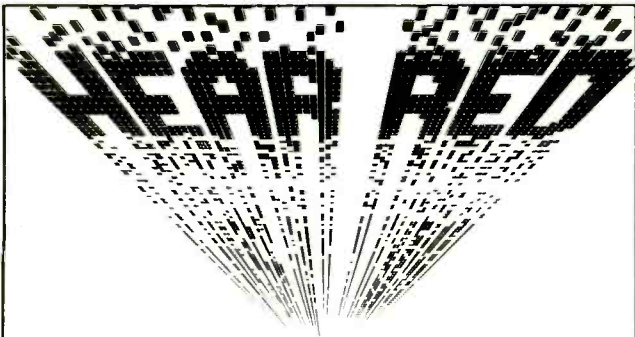
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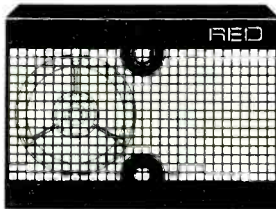
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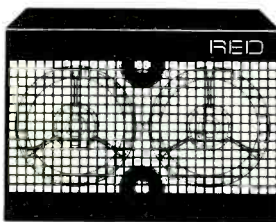
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RED A-3

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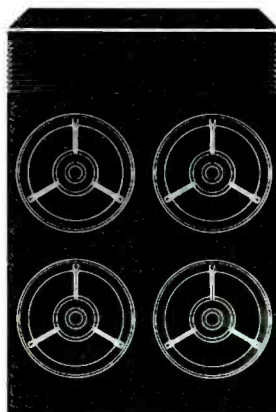
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RED A-4

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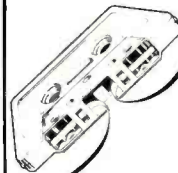
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Tape (INS)	Width (MM)	Tape (IN/S)	Speed (MM/S)	EQ NAB	Fluxivity (MWb/M)	EQ CCIR	Fluxivity (NWb/M)
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		15	380		200		200 or 320
½	12.5	7½	190		200		200 or 320
		15	380		200		200 or 320
1	25	7½	190		200		200 or 320
		15	380		200		200 or 320
		30	760	AES	200		
2	50	15	380	NAB	200		200 or 320
		30	760	AES	200		

Other tape configurations are available by request.

All Webber Test Tapes are recorded across the full width of the tape and each Test Tape is supplied with a Specification Chart and a line up procedure leaflet.

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Tel: 01-734 2812 Telex: 27939

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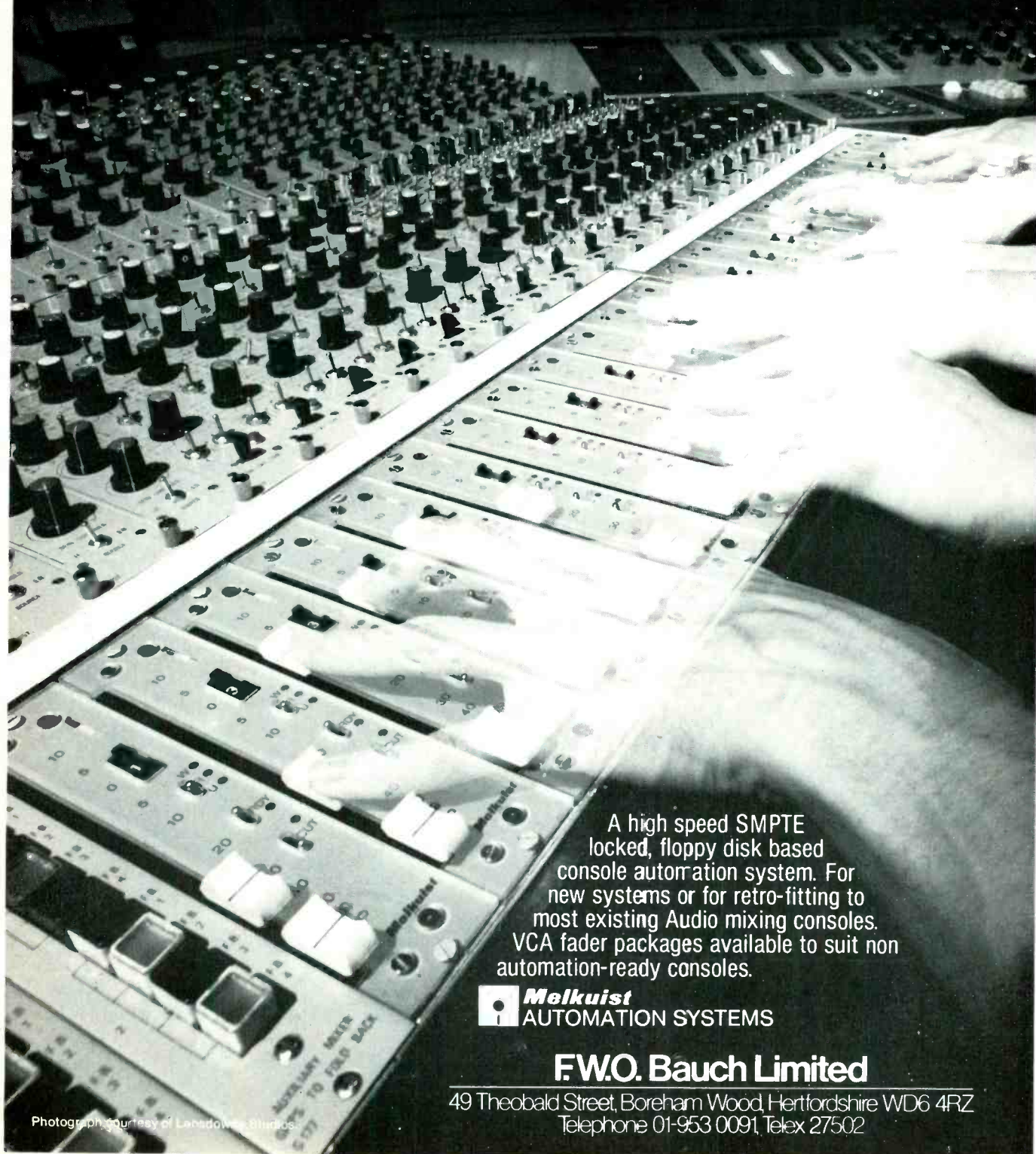


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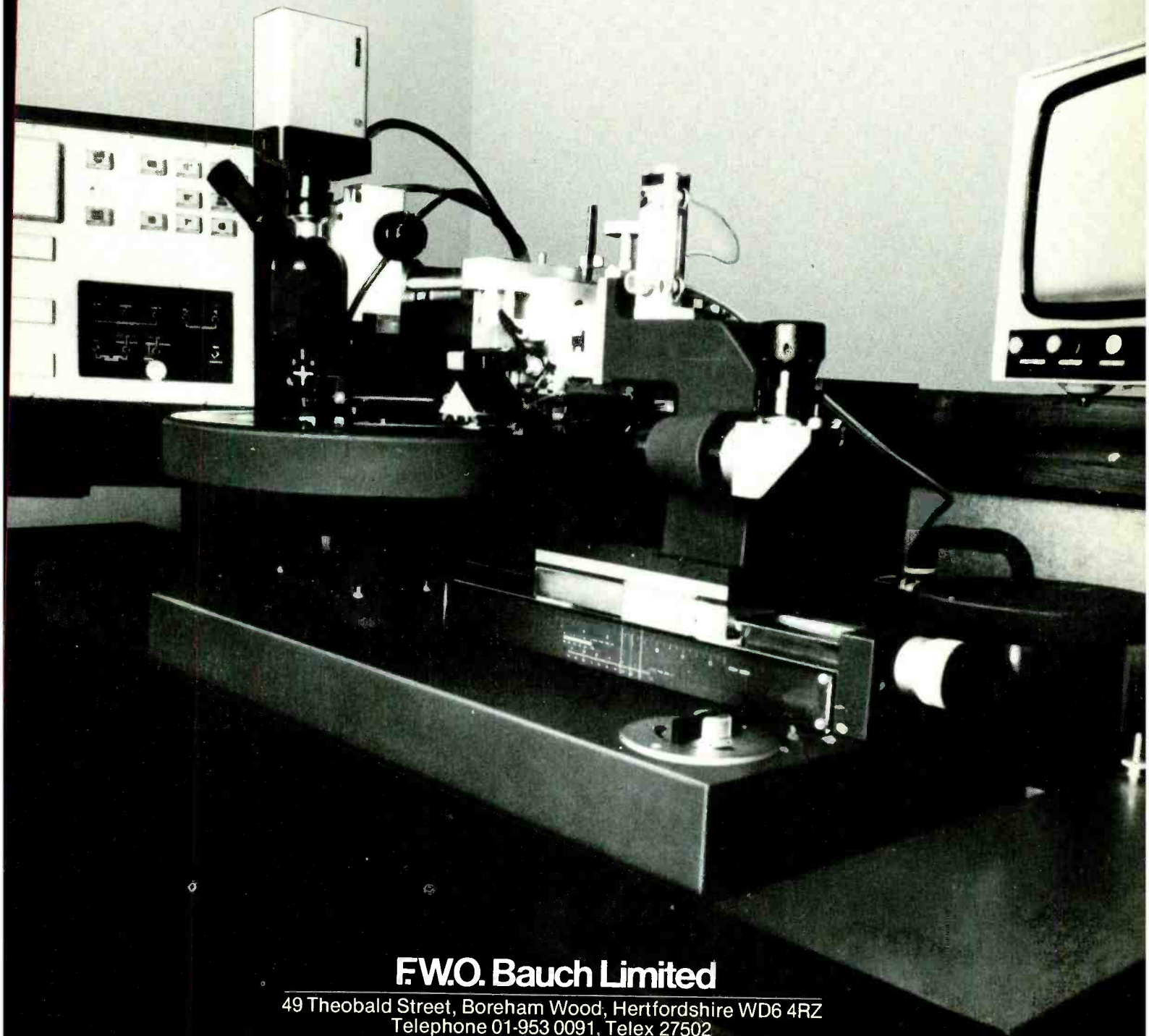
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Microelectronics in broadcast engineering

This is the title of the IBA's 15th issue of the *IBA Technical Review* and it details the growing importance of microelectronics in a wide range of broadcast applications. Seven papers are presented in this volume, with the main emphasis being on video and teletext applications. However, some of the papers deal with audio matters. An introductory article by George McKenzie takes an overview of the use of microprocessors in broadcasting; S Day details techniques for fault finding in microprocessor based systems; P A Crozier-Cole describes the use of microcomputers in the new IBA regional operations centres; while of particular interest, JB Watson details techniques used for digital audio processing by microcomputer. Copies of the *IBA Technical Review No 15* are available from: **IBA Engineering Information Service, Crawley Court, Winchester, Hants SO21 2QA, UK. Phone: 0862 822444.**

LDJ Electronics

American measuring instrument manufacturer, LDJ Electronics Inc, has opened a new European headquarters in the UK. The new office, which complements a new manufacturing plant at the company's Troy, Michigan headquarters, will be responsible for European sales and service back-up for the company's range of magnetic measurement instruments including instruments for the measurement and processing of the magnetic properties of recording tapes and loudspeaker magnets. The new UK office is: **LDJ Electronics, Unit 2 The Midlands, Holt, Nr Trowbridge, Wilts, UK. Phone: 0225 782860. Telex: 444337.**

Sound Broadcasting Equipment Show

We have been asked to point out that the 7th Sound Broadcasting Equipment Show, to be held in Birmingham on September 28, 1982, will in no way be affected by the recent problems of *Radio Month* magazine who helped to organise the show. Plans for this year's show are already well in hand and over half the available space has been allocated. Anyone wishing to exhibit or who would like to obtain invitations should contact Carol Pottinger at: **Audio & Design (Recording) Ltd, 16 North Street, Reading RG1 4DA, UK. Phone: 0734 53411.**

SPARS membership fees

The American SPARS studio association has announced a new membership and fees structure. Details of the new structure are as follows:

Regular membership—open to recording, mixing and mastering facilities with gross billings under \$1 million—\$365 per year.

Sustaining membership—facilities with gross billings over \$1 million—\$1,000 per year.

Advisory membership—open to any company providing services or supplies to the recording industry—\$2,500 per year.

Associate membership—open to any company or individual not qualifying for the above categories—\$250.

Linear IC catalogue

Precision Monolithics Inc has published a 920 page catalogue with complete technical data on its range of op-amps, sample and hold amps, buffers, D/A converters, voltage references, comparators, analogue switches, multiplexers and special products. Usefully a cross reference guide and a section with over 50 application notes are included to help designers find the most suitable product. The catalogue is available from: **Precision Monolithics Inc, 1500 Space Park Drive, Santa Clara, Cal 95050, USA. Phone: (408) 246-9222.**

UK: Bourns Electronics Ltd, Hodford House, 17-27 High Street, Hounslow, Middx TW3 1TE. Phone: 01-572 6531.

Hits from the Seventies

British readers wishing to wallow in nostalgia may be interested in obtaining the latest 10 album boxed set of records from the Reader's Digest Association. This set entitled *The Sensational Seventies* contains 160 top five singles from the UK charts and covers the years 1970 to 1979, with each of the 10 discs devoted to a particular year. Although not all the singles will suit individual tastes, as is the case with such mixed bag collections, the set forms a useful reference as to the fruits of the recording industry over the decade. The set, which is also available on cassettes, costs £29.95 including postage and packing, and is obtainable from: **Reader's Digest Association Ltd, 7-10 Old Bailey, London EC99 1AA, UK.**

ILR news

The IBA has announced the award of ILR franchises for three areas. The Newport (Gwent) service has been awarded to Gwent Area Broadcasting, which has been asked to make proposals for co-operation with the Cardiff Broadcasting Company, whose area overlaps that of the new station's; the Guildford area franchise is to be offered to County Sound; and the franchise for the Stoke-on-Trent area is to be

offered to North Staffordshire South Cheshire Broadcasting. This latter franchise is the first of the further 25 new ILR areas authorised by the Home Secretary last July.

Continuing its programme of introducing new transmitters for its ILR service, the IBA has announced the commissioning of a further two transmitters. These are a new station extending the coverage area of West Sound (Ayr) to Girvan, and another extending Essex Radio's coverage to

the Chelmsford area. At present this latter transmitter is being fed from the station's Southend studios although it is eventually intended that Essex Radio will also open a studio in Chelmsford.

The IBA has announced that the first ILR contract is to be re-advertised. This is currently held by LBC (London Broadcasting Company) for the provision of the ILR news and information service in London—including the national and international news service supplied to all ILR companies. It is being re-advertised a year earlier than scheduled under the Broadcasting Act 1981, in order to allow the IBA to plan ahead for its ILR services in the 1980s. The Authority aims to award the contract for an eight year period from October 1983 during the autumn of this year. This date ties in with the requirement under the terms of the Broadcasting Act 1981 to re-advertise other franchises from 1983 onwards.

Bournemouth ILR station Two Counties Radio, has broken new ground with its first digital session being recorded on March 6 for later transmission. The session which took place in the station's Studio 3, the largest in ILR, featured four vocalists and was mixed by chief engineer Stan Horobin, assisted by Chris Hollebhone from Sony Broadcast. The session was mixed live digitally and the existing studio equipment was used together with a Sony PCM 100 14-bit digital processor and Sony BVU 200B U-matic recorder. The tapes were subsequently edited using the Sony DAE 1100 digital audio editor, with extra effects being provided by a Sony DRE 2000 digital reverberator.



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*Dolby is a registered trade mark of Dolby Licensing Laboratories.

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New music stand

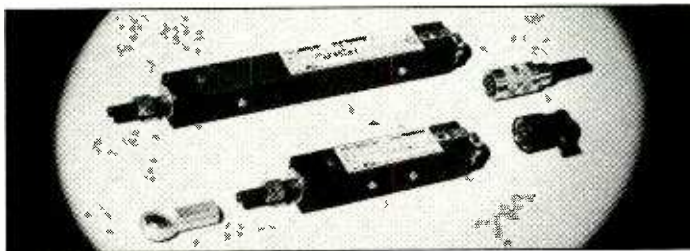
A new budget-priced music stand has been developed by RAT Manufacturing based on the company's popular existing model. The new stand is a lightweight model of tubular construction available in a range of colours, each in a tough coated finish. Features of the design include a friction joint that holds the music tray at any desired angle; easy height adjustment from 910 to 1,560mm; and optional extras including an accessories tray and a solid clip-on back for the music tray. Price of the stand is £24.

RAT Manufacturing Ltd, 17/18 Great Sutton Street, London EC1, UK. Phone: 01-251 2437.

Sierra/Eastlake SA

Sierra/Eastlake SA is the name of the new acoustic consultancy company set up in Fribourg, Switzerland to serve the audio/video and broadcast industries in Europe and Asia. President of the new company is Frederique Monmarche who was previously office manager of Eastlake Audio SA. The new company, which will employ Tom Hidley as its chief architect, will direct its operations in conjunction with Sierra/Eastlake in California and Hawaii.

Sierra/Eastlake SA, 3 Rue de L'Hopital, CH-1700 Fribourg, Switzerland. Phone: 021-622-268.



Waters position transducers

Variohm Components, the UK agent for Waters, has provided us with details of improved linearities being offered in the Waters range of position transducers. The smaller *Short Longfellow* series of position transducers are now offered with linearities of 1%, 0.5% or 0.1% in stroke lengths of 25mm, 50mm, 75mm, 100mm or 150mm. On the standard *Longfellow* series linearities of 1%, 0.5%, 0.1% or 0.05% are offered and the lengths available are

150mm, 225mm, 300mm, 450mm, 600mm, 750mm and 900mm. Waters has also provided a screen connection point for the plug and socket such that screened connecting cable can be used in difficult environments. In addition to the above, Variohm inform us that due to a change of marketing arrangements both the units will now be available ex-stock and at slightly lower prices. **Variohm Components, The Barn, Wood Burcote, Towcester, Northants NN12 7JR, UK. Phone: 0327 51004. Telex: 311754.**

Errata

In the *Diary* section of our June issue we stated that Midas had supplied five *TR System 24* into 8-8 modular consoles to the National Theatre, London. This was incorrect. The sale in fact comprised two *TR System 24* into 8-8 consoles and two *TR System 8* into 16 matrix consoles. Our apologies to Midas and the National Theatre for the confusion.

Contracts

- Scenic Sounds Equipment has received orders for btx SMPTE synchronising systems from Malcolm Bristow Studios, Kaye Laboratories and DW Television.

- Amek is to supply 19 *BC01* broadcast mixers on an OEM basis to BFE Germany. Amek has also supplied an *M2500* mastering console to Melodija Records, Moscow, with a second console to follow.

- The Broadcast Products division of Harris has announced that over 100 American AM radio stations are to purchase the company's AM stereo exciter.

- MCI is to supply a transformerless *JH-636* console with automation, plus a *JH-24* multitrack and *JH-110B* ½in stereo tape machine, for a new studio being constructed for Stargem Records, Nashville.

- Ampex is to supply an *ATR-104* 4-track tape machine, two *MM-1200* 24-tracks and an *EEOC MQS-103* synchroniser to Societe Francaise de Production (part of the French broadcasting authority) for a new OB vehicle.

- Apex Systems has received orders for its *Aphex II Aural Exciter* from Osterreich Rundfunk, Vienna; Radio Rumos, Caracas; Radio Luxembourg; Bavarian Radio & Television, Munich; Radio 702, Johannesburg; and Televisia, Mexico City.

- FWO Bauch Ltd has supplied a Harrison *MR3 36/32* console and Studer *A80* 24-track, plus ancillary equipment to Jeff Wayne Music (Productions) Ltd for its subsidiary Ollie Recording Studios. FWO Bauch has also supplied London Weekend Television and Thames Television

Microcircuit guide

General Instrument Microelectronics has published its 1982 product guide containing technical specifications on over 170 of the company's MOS microcircuits. The guide includes ROMs, EAROMs, single chip micro-computers, speech synthesis products, special circuits for radio and TV tuning, sound generator chips, telecommunications circuits, ULAs and control circuits. The new guide is available from: **General Instrument Microelectronics Ltd, Regency House, 1-4 Warwick Street, London W1R 5WB. Phone: 01-439 1891.**

Clark-Teknik design award

Clark-Teknik has recently received a Mobil Design Award for the design of its audio processing equipment range. In particular the company's *DN60* realtime spectrum analyser and *R760* reverberation analyser were commended for their design.

with the recently launched Melkuist SMPTE based Event Selector.

- Quad-Eight has supplied a *28/24 Pacifica* console to Musician's Recording Studio, Houston. Other additions to the studio include a Studer *A80* with autolocate, Lexicon *224* digital reverb, DeltaLab *DL-1* and *DL-2* DDLs and UREI *813* time-aligned monitors with White room EQ.

- The JVC Cutting Center, Hollywood has recently installed a *JVC CA-90/CH-90* cutting system.

People

- Steve Gunn, formerly with Trident Audio Developments, has joined Soundcraft Electronics as sales manager.

- Molinare has appointed Olav Wyper to the newly-created post of marketing and sales director.

Agency

- Red Acoustics has appointed Pro-Tek (UK) Ltd as sole trade distributors for its range of active loudspeakers in Great Britain. Trade enquiries should be directed to: Pro-Tek (UK) Ltd, 19 Cambridge Road, Madingley, Cambridge CB3 8AH. Phone: 0954 210766. General enquiries and demonstration arrangements to: 34 Lillie Road, Fulham, London SW6 1TN. Phone: 01-385 8586.

Address change

- Broadcast systems and equipment manufacturer, Brabury, has a new address: Brabury Broadcast Systems Ltd, Smitham Bridge, Hungerford, Berks RG17 0QU, UK. Phone: 04886 3511. Telex: 848760.



Digital co-operation

As the day of the complete digital recording studio moves steadily closer, 3M and Neve have announced that they are currently working on an interface system to enable the Neve *DSP* digital console system to be used in conjunction with the 3M digital mastering system. With over 60 3M digital recorders in operation around the world, this announcement makes sound commercial and technical sense and makes the likelihood of totally digital studios a much more immediate prospect than most industry observers would have thought six months ago.

It is worth noting that both Neve and 3M wish to see an internationally accepted standard for sampling frequencies. Thankfully moves in this direction are already underway with the adoption of 48kHz, 44.1kHz and 32kHz sampling frequencies seemingly now agreed within the industry. To fit in with these moves 3M has already decided to modify its recording system from the original 50kHz rate to operate at both 48kHz and 44.1kHz. Similarly, although Neve is willing to customise its *DSP* consoles to suit any digital or analogue recording system, it would naturally prefer to produce consoles to agreed international standards.

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.

We have been able to maintain a high level of sonic integrity in this most versatile signal processor. The frequency response of the processed signal is beyond 10 kHz, with a dynamic range exceeding 80 dB.

A micro computer based display option allows the user to read the created harmonic interval in terms of a pitch ratio, or as a musical interval (in half steps). This unique feature allows the pitch to be expressed in a language meaningful to both musicians and engineers.

We designed our Pitch Transposer as a practical musical tool for those actively involved in creative audio. It reflects our commitment to provide the highest quality signal processors with the features and performance that will satisfy the creative demands of today's musical artist. See your MXR dealer.

Atlantex Music, Ltd., 34 Bancroft Hitchin, Herts.
SG51LA, Eng., Phone 0462 31513, Tlx 826967



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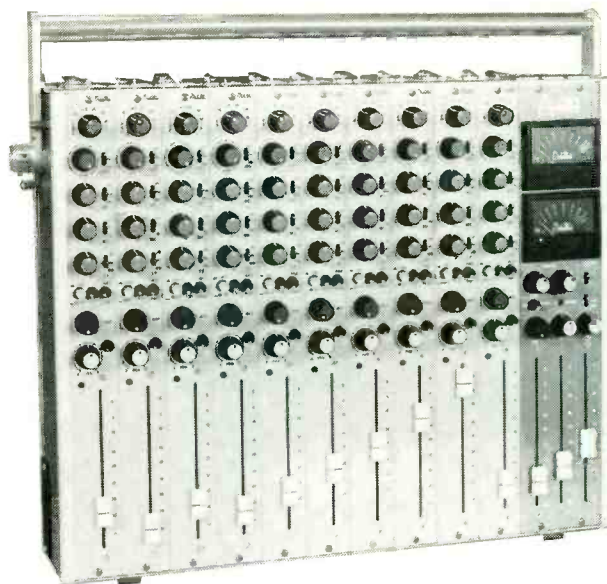
new products

Furman SG-10

Furman Sound has announced the introduction of a new sweep graphic equaliser, the *Model SG-10*. This new equaliser features 10 bands of ± 15 dB boost or cut EQ, with each band's centre frequency being continuously variable over a 4-octave range. Whilst the unit is effectively a mono 10-band unit, a unique stereo/split facility allows a user to instantaneously change from 10-band mono operation to 5-band stereo operation. This facility is available as the 10 bands are effectively five doubled up bands with variable centre frequency. Frequency ranges for each of the five doubled up bands are 16Hz to 250Hz; 32Hz to 500Hz; 125Hz to 2kHz; 500Hz to 8kHz; and 1kHz to 16kHz. Other features of the *SG-10* include LF 80Hz cut filters for both left and right channels; integral instrument preamps for low level sources and power amps; LED overload indicators; bypass switching with LED status indication; and low level outputs for driving instrument amplifiers. In addition balanced inputs and outputs are available as an option.

Furman Sound Inc, 616 Canal Street, San Rafael, Cal 94901, USA. Phone: (415) 456-6766.

UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Phone: 0462 31511. Telex: 826967.



Audio Developments ADO62

Mixer manufacturer, Audio Developments, has produced a new mixer in its range of portable mixers for location recording, the *ADO62*. The new mixer, which is a development of the successful *ADO31* mixer, has facilities for 10 inputs and stereo or mono outputs. Whilst most of the facilities remain unchanged from its predecessor, new features include improved EQ with three switchable turnover frequencies for HF (6kHz, 12kHz and 24kHz); two in the mid-range (1kHz

and 3kHz); and three for LF (30Hz, 60Hz and 120Hz). In addition improved PFL and monitoring facilities are provided. The mixer, which is battery powered, also incorporates power-saving circuitry to give extended battery life.

Audio Developments, Hall Lane, Walsall Wood, West Midlands WS9 9AU, UK. Phone: 05453 5351. Telex: 338212.

USA: Audio Developments, Suite 224, 1640 Fifth Street, Santa Monica, Cal 90401. 24 ▶

Complete control over your production crew with Telex Audiocom.

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Audiocom Intercom System

AVCOM

AUDIO VISUAL COMMUNICATION

For further information on Audiocom, Wireless Microphones and other Telex Inc. pro-audio equipment, contact the sole UK distributor: Avcom Systems Ltd., Stanlake Mews, London W12 7HS. Telephone: 01-740 0051 Telex: 892513.

Telex Wireless microphones—total mobility on stage.

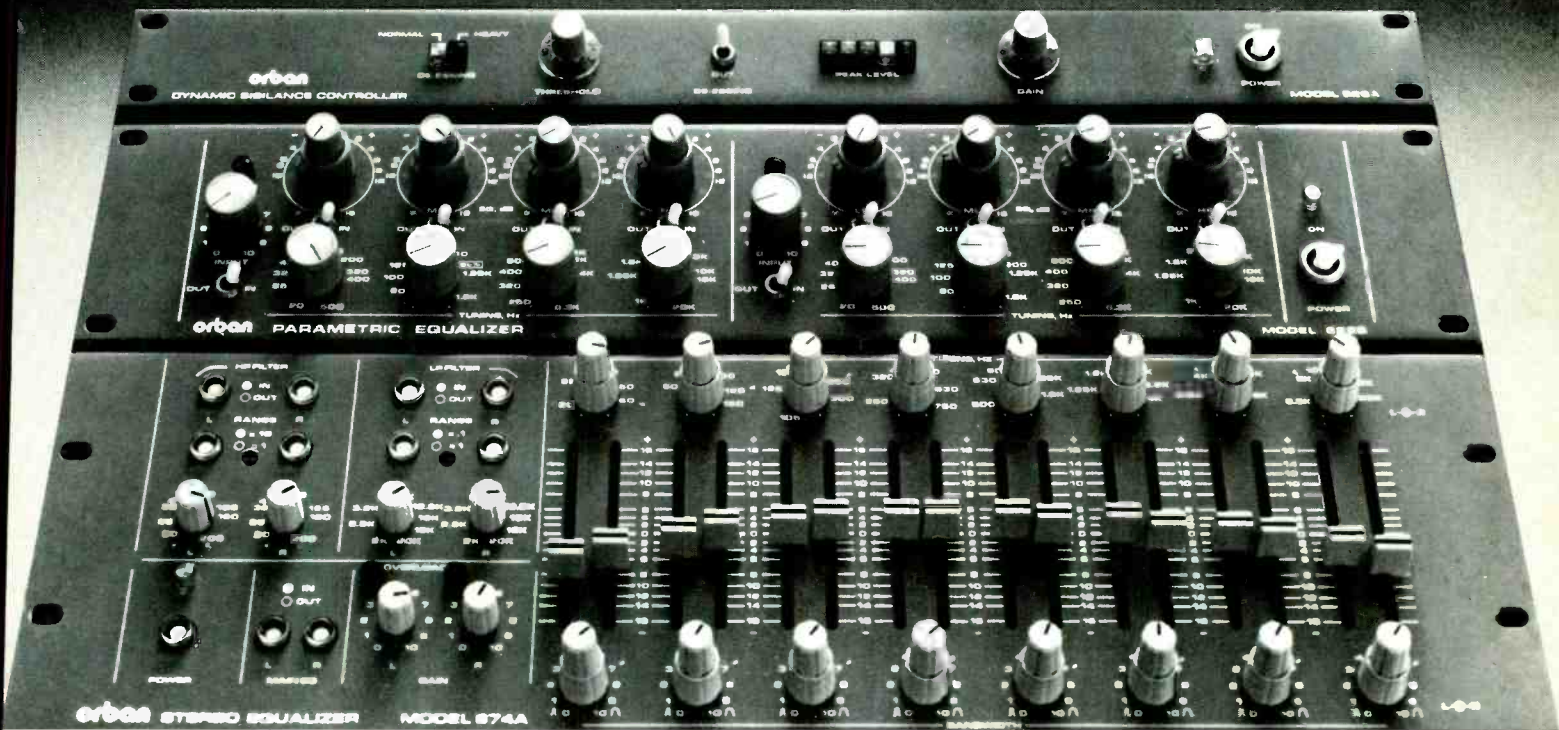
The Telex Wireless Microphone is an FM system which enables the performer to move freely and obtain a performance equal to or exceeding that of a wired system. For those who prefer a hand-held microphone with an integral transmitter, the Telex WHM 300 is ideal. This can be powered with a 24-hour alkaline battery or an 8-hour rechargeable NiCad. Alternatively, the WLM 100 Lavalier can be used in conjunction with the belt-pack transmitter. (Other quality low-impedance microphones can be used with the belt-pack transmitter).



WHM-300 WLM-100

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526A Dynamic Sibilance Controller

Clean, inaudible de-essing of vocals with consistent action regardless of levels

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 Norway LydRommet (Oslo) Spain M. Llewellyn-Jones (Madrid) Sweden Tal & Ton (Gothenburg) Switzerland Audio Bauer AG (Zurich)

new products

Phase Linear E51

New from Phase Linear is the *Model E51* 5-band parametric equaliser, a 1U high 19in rack mount unit for instrument and sound reinforcement applications. Part of the company's Professional Series range, the new unit features automatic balanced/unbalanced XLR and 1/4in phone inputs and outputs; +20dB system gain for low level sources; overall level control and bypass switch with LED indication; 'signal present', 'power ready' and system overload LEDs; output relay control; and line drivers. A special feature of the unit is the option of switchable peak or shelf response on bands one and five.

Phase Linear, 20121 48th Avenue, W. Lynnwood, Washington 98036, USA.



New Eventide broadcast DDLs

Making their debut at NAB were two new digital broadcast delay units from Eventide, the *BD931* mono DDL and the *BD932* stereo DDL. Designed as a low cost alternative to tape loop delay systems, the new units are available with either 3.2s or 6.4s of fixed delay, and use circuitry incorporating 64Kbyte RAM chips for memory. Both units offer >90dB of dynamic range with a bandwidth extending to 16kHz.

Further news from Eventide is that its *BD955*

range of broadcast delay units with auto catch-up feature has been reduced in price through the passing on by Eventide of price reductions to the RAM memory devices used in the units.

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA. Phone: (212) 581-9290. Telex: 710-581-2593.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

Instant songwriter's kit

Is it an electronic guitar? An autoharp? A synthesiser? No, it's the *Omnichord*, a remarkable device from Suzuki of Japan. It plays 27 chords, automatic bass and rhythm, and you can strum it . . . it's the ultimate instant songwriter's kit.

Surprisingly perhaps, the pro audio industry seems to lap up these marvels of Japanese technology—witness the immense business Turnkey have done with the Casio *VL-Tone*. I've already heard it on more than one record. The *Omnichord* is a worthy successor to such devices and, it would seem, it is far more useful in a number of ways.

The *Omnichord* is housed in a brown plastic case, not unlike a large autoharp or neckless guitar in shape. Towards the 'neck' end is a respectable speaker driven by an amplifier capable of quite remarkable fidelity. Next to this is a touch-sensitive panel which allows chords selected with pushbuttons to be strummed with the fingers or with a conductive-rubber plectrum. At the bottom end of the machine are three panels, the lower containing on/off and master volume controls, the centre section containing a rhythm unit offering six 'normal' rhythms (but 2-button combinations offer bizarre possibilities) plus rhythm level and tempo controls, while the upper section offers sustain and volume controls for the 'sonic strings' touch panel plus volume, 'chord mode' and 'memory' buttons for the chord section. The 'memory' button selects between chords only sounding when the appropriate chord button is pressed, or in 'memory mode', the chord plays until another button is pressed. The 'chord mode' button selects either manual playing of chords, or an 'auto-bass' function which plays the chord with bass line in tempo with the rhythm selection.

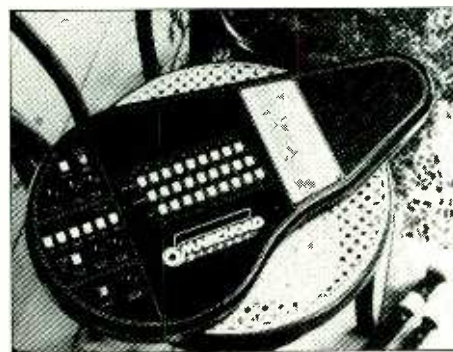
The centre section of the instrument offers nine common chords in major, minor or 7th variations. A small touch panel next to the 'sonic strings' cuts the audio output and resets the chord selection, so that no sound emerges until a new chord button is pressed.

The machine runs on 12V DC—supplied by no less than eight 'C' cells or an optional mains PSU; the presence of a good 12V rail is no doubt one reason why the audio sounds so good; a standard jack socket is also provided, although this doesn't mute the speaker. The socket is taken after the volume control but before the power amp; as a result, it is possible to mix an

external signal into the internal amp via this socket as well as taking audio out.

Who would want one? To my mind, virtually anyone. Everybody in the office has gone mad over it. Apart from obvious busking and quasi-musical 'leisure' applications, the *Omnichord* would be most useful to songwriters and composers who could use it to work out chord sequences and vocal/lead lines with a reasonable accompaniment without having to think too hard about actually playing the chords. In addition, the keyboard player who wishes to work pieces out at home and doesn't have access to a polyphonic instrument could find it almost indispensable. The presence of even a basic rhythm department can help a great deal in composition.

Obviously, the *Omnichord* is hardly designed for the studio. However, it could well find application there too. The 'harp' sound achieved by playing the 'sonic strings' is a good electronic sound, somewhat reminiscent of a cross between



an autoharp and a guitar. The chord section gives a good impression of a small reed organ, especially with some of the bass rolled off. Although no trigger outputs are provided, of course, it should be possible to wire them in; even so, useful effects can be achieved by driving the *Omnichord* into a synthesiser external input, driving the synth from a sequencer and using the synth's envelope generator.

The *Omnichord* almost certainly has a great market for professionals and amateurs alike, and no doubt we'll be hearing it on record in the near future. At £99 it won't break the bank.

Suzuki Musical Instrument Manufacturing Co Ltd, 443 Ryoke-cho, Hamamatsu, Japan.

UK: Craftmaster (UK) Ltd, Tower House, Lea Valley Trading Estate, Edmonton, London N18 3HR. Phone: 01-803 8941.

BSS Phase Check

New from Brooke Siren Systems is a 2-unit test system, the *AR130S* and *AR130D Phase Check* system, for checking the phase integrity of most 2-wire electrical equipment, such as connecting cables, microphones and loudspeakers. The two units in the system are the *AR130S*, a symmetrical encoded tone source for interconnection to the input of the equipment under test, and the *AR130D* detector and phase indicator which is connected to the output of the tested equipment. Features of the system include an encoded test signal allowing reliable and consistent testing of loudspeakers including HF compression drivers; four presettable tone frequencies; variable output level; battery 'low' indicator; large detector voltage input range accepting most mics, through to power amp outputs, without the need for range switching; no direct connection required between the source and detector other than the component under test; and performance unimpaired by crossovers, comp/limiters or loudspeaker protection devices. The system does not use a unidirectional pulse for its test tone. An additional facility is that mics can be directly connected to the detector input for mic and loudspeaker checking.

Brooke Siren Systems Ltd, 92 Colney Hatch Lane, Muswell Hill, London N10 1LR. Phone: 01-444 7892. Telex: 912881.

Gauss Model 7351

Cetec Gauss has added the *Model 7351* studio monitor to its recently introduced range of studio monitors. The new model, which needs to be bi-amplified (LF 400W RMS, HF 200W RMS), is a 3-way system and uses a 15in bass woofer and the new Gauss *2080* compression driver with a constant directivity horn. The monitor is designed for horizontal wall mounting and has both shelving and HF roll-off controls.

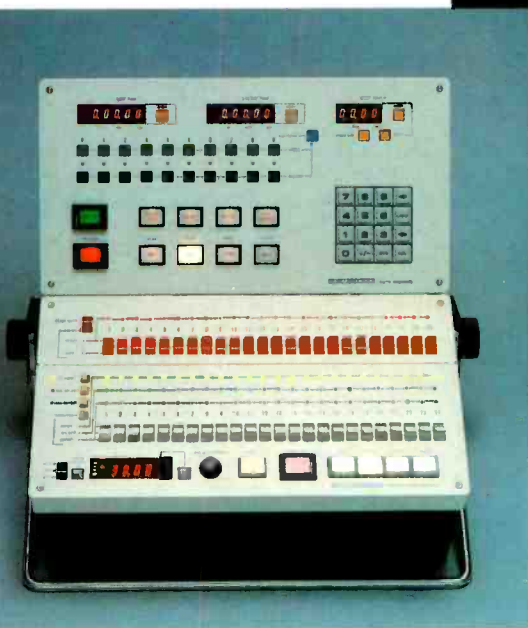
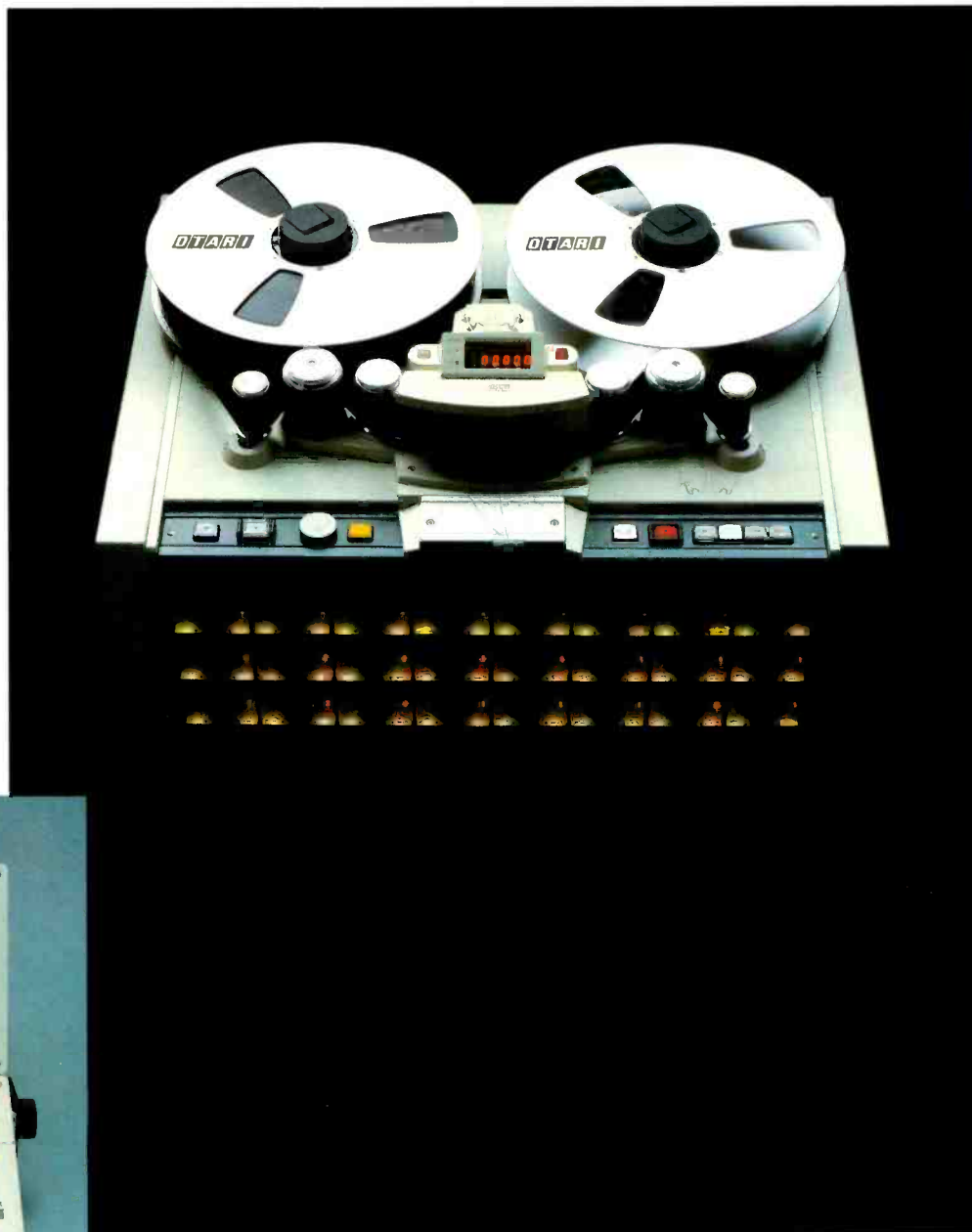
A feature of the monitor is the provision of a fourth order network crossover designed to minimise radiation pattern tilt off-axis. A further feature incorporated in the monitor is the use of unconventional crossover frequencies of 160Hz and 1.4kHz to give a smoother and more transparent acoustic response.

Cetec Gauss, 9130 Glenoaks Boulevard, Sun Valley, Cal 91352, USA. Phone (213) 875-1900. Telex: 194989.

UK: HHB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Phone: 01-961 3295. Telex: 923393.

True progress in multitrack engineering

OTARI
MTR-90

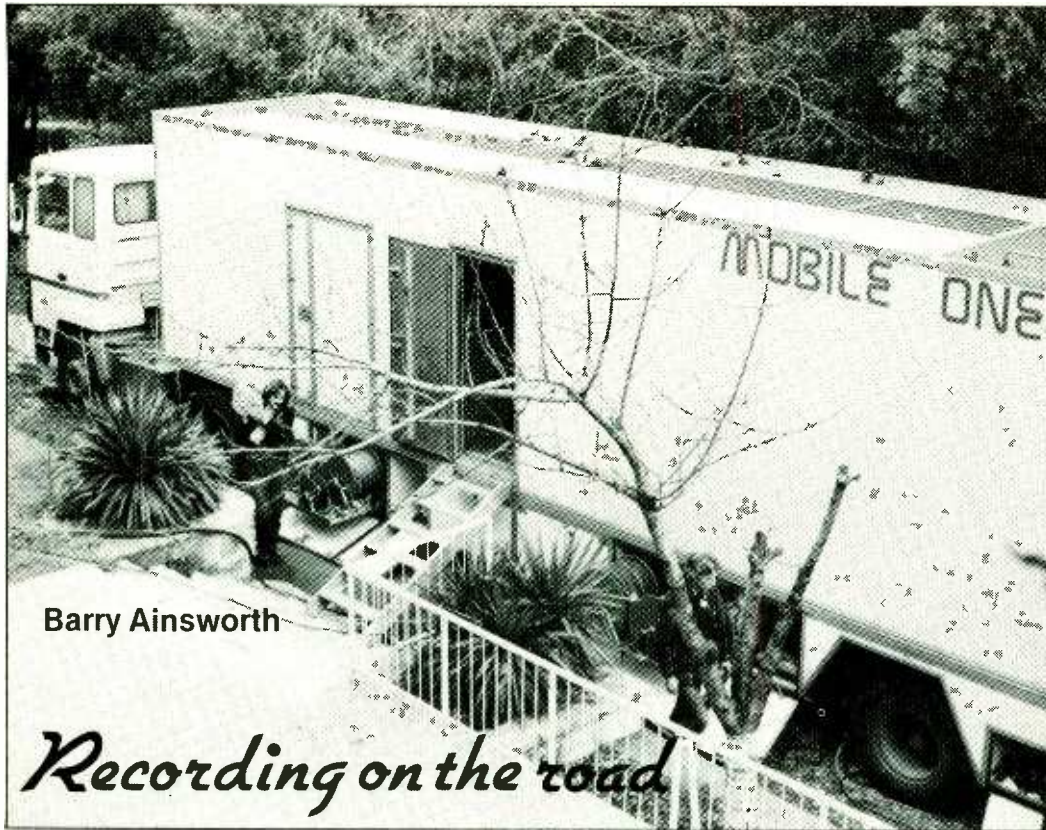


It's a reliable recorder with foresighted features. A new constant-tension transport has a full symmetric tape path, the most advanced electronic servo and a large diameter capstan without pinch roller. The latest electronics includes single-card-per-channel modules, full-fledged remote controller, auto-locator and

interface access for external synchronizers. Otari MTR-90 – the masterly multitrack with engineering expertise available in 16, 16 prewired for 24 and 24 track formats. Please contact us for further details of the new-generation machine.

OTARI

Otari Electric Co., Ltd.
4-29-18 Minami-Ogikubo, Suginami-ku, Tokyo 167
Phone: (03) 333-9631, Telex: J26604
Otari Corporation
2 Davis Drive, Belmont, California 94002.
Phone: (415) 592-8311, Telex: 910-376-4890
Otari Electric Deutschland GmbH
Gielenstrasse 9, 4040 Neuss 1
Phone: 02101-274011, Telex: 8517691 OTEL D



Barry Ainsworth

Recording on the road

IT'S been three years since the last *Studio Sound* mobile round up. In this time quite a few changes have taken place. First and most important, I've got more grey hairs – I assume this must be an occupational hazard. The number of times well intentioned people have said "What a wonderful life being a mobile engineer must be". I think they must mean getting the opportunity to travel, both in this country and Europe. One day in London, the next in Cannes, a drive through the south of France, a concert in Lyon, Paris, Brussels, and then back to London. The most important question people won't ask is "How long between concerts?" Even if they are told "seven days", it probably doesn't mean much. That sort of journey must be experienced, it is most certainly beyond description.

The mobile driver must have the patience of a saint, intimate knowledge of the route, and driving laws, etc, the stamina of a long distance runner and eyes in the back of his head, as well as a sixth sense to spot police radar traps at least a mile. An unsung saviour of mobile recording companies is the mechanical engineer, or the garage that will keep the mobile running through all kinds of problems, some of them purely mechanical, like very thorough servicing, and some of them natural, such as very low temperatures, which can freeze diesel fuel, brake valves, as well as other parts audio engineers cannot reach.

With a normal recording studio, the only worry is whether or not it needs redecorating, or there may be a

big disaster like water coming through the ceiling. A mobile can have quite a few problems along the same lines, but with subtle changes.

Picture if you will, the depth of winter, and an outside temperature of minus 20°, somewhere in Europe. The mobile has been parked and the time has come to connect up to the recording venue. Problem one, the locks won't unlock, now what? Quick panic, try every lock, saved, one works. More problems, the hinges have frozen solid, still can't open the door. Now what? In England it's easy just ask for some de-icer, not so easy when even 'thank you' in the local language sounds like someone being sick. It really is true when people say that only the English expect other nationalities to speak English. Now what? Let's find someone able to speak English and help. The first place to look is in the theatre, the band has started to set up their equipment, and surprise, surprise the first person approached is able to speak English, in fact he is English. Lesson one. Never expect good audio engineers to be only in England, they get everywhere! Okay, now at least we can start getting the mobile ready to record.

The next problem is the cables. Manufacturers do not exactly publicise the fact that multicore cables, in low temperatures can become like iron pipes. The only way here is to take the cables and the reels into a warm environment for a couple of hours. There's only one thing to do (the mobile is useless without its umbilical cords) and that is to discuss with the client's engineers what will be

required on the session. This is really where the audio problems start!

First it's necessary to find out whether or not 240V is available. Usually in Europe voltage is no problem, but there are places...

This problem usually occurs when the mobile is being used by a really famous artist, who at some stage decided that the idea of 'getting away from it all', is the only way to have a 'Meaningful' lifestyle. Then later he decides that a record has to be made, to help the tax man or to continue his idyllic life. Therefore, the end of a pretty poor mains electricity supply is the norm, complete with a poor road and various other unimaginable problems, that only become apparent when delicate electronic equipment has to be coaxed to work from power resembling something between a

happy?...Not quite. A playback of the ultimate take is made and – "What's that? Drop out? mmmmmmm." "Don't be silly! The manufacturers say tapes don't have drop out." Not true. Cold affects cables, freezes up doors, affects fuel, affects people, why not tape? Yes that's right, the oxide coating is coming off the tape like confetti. Low temperatures affect the bonding between the oxide coating and the backing, as well as the inbuilt tape lubrication. I must admit, some tapes are affected more than others, but how many different brands of tape can be carried to be available in these circumstances? The tape needs to be brought up to room temperature slowly. Problem solved, no more drop out.

The session continues, the language barrier has started to disappear as more people lose their initial shyness at trying to speak English. Also we try their language, the results can be quite funny. It's surprising how after a couple of days you find yourself talking naturally slower and more precise in the use of 'descriptive phrases' (usually applied when a musical part has gone wrong for the 21st time).

Eventually everything is complete, the session seems to have gone reasonably well, but due to the lack of knowledge of the local language, we're not really sure. Everybody is all smiles but even that can be confusing, they could be pleased to see you go! Anyway pack up time. Oh? temperature is still low. Cables that had solidified round a drum and were tenderly straightened are now refusing to recoil and as, an added bonus, have become frozen to the ground. Hot water might work.

NB do not try this. As the water temperature drops quickly the cables will become more solidly frozen to the ground. The only way which, although unconventional, works is to connect a reasonably high current through a couple of earth cores, thus warming the cables electrically.

Cables up and packed away, fuel pipes and brake lines thawed out, a blow lamp is useful here but usually

'Usually in Europe voltage is no problem but there are places . . .'

candle and a 100W bulb whose emission is going up and down like a fiddlers elbow.

Anyway I digress, back to the session problems. 240V, not available! Okay, how do we make the latest technological wonder work? Thank God there is a 3-phase supply available. Strap two phases together and, *Abracadabra*, 240V registers on the mains input, saved again! Right, the cables have thawed out, the connections are made. The lines have been tested, proved to work, and off we go into the recording session. Everybody

unavailable outside England (take one with you). Off to the next session on the other side of Europe.

What could be easier. A drive of maybe a couple of thousand kilometres, across maybe four countries. Winter! The Alps! and a time schedule to meet. Need I say more? Oh, yes, customs posts. There are some borders open 24 hours a day, there are others open early morning until late afternoon and others are open only in the summer. Reversing down the St. Bernard pass, even for a little way, is an experience not to be

missed. Always check these problems as early as you can on the journey, or before leaving England.

Usually it is necessary to arrange customs clearance here in England, which is then used throughout Europe, this entails a list of everything on the mobile, its description, including the serial number and its value. Unfortunately this means every reel of tape, even down to the smallest screwdriver. I will leave it to the reader's imagination to determine whether this is possible and practical, and the amount of time it takes at each customs post to check everything. The reason for this is to discourage the sale of the equipment abroad where there may be a higher value placed on each item than in this country, due to local taxes, etc.

The vital certificates stamped it's on to the next border, the day is Saturday, heavy trucks are not allowed to be driven across some countries on a Sunday, so yet another problem. Even if permission may be granted to drive the heavy trucks, the customs post will be closed, so once again the journey has to be planned in minute detail. Diesel fuel can be another problem, to fill the tank just before crossing a border can be an expensive mistake, as there may be a fuel surcharge levied. A full tank can cost as much in customs duty in the next country as it did in the first place. Eventually the truck arrives at the next venue. This is better, people who speak English, a theatre, ample parking, and a television crew. Now the fun starts. The theatre's a big one, the cable run as described is a short distance and enough power is available to light a small village, not the least a theatre.

The television trucks arrive, everybody meets the director and the show plans are finalised. There was a time when sound was the poor relation of pictures. In the minds of some directors this is still the case, but the majority of television companies are realising that there will be more mileage in a programme if the sound is acceptable for broadcast, cassette, or what could be described as 'The Philosopher Stone', video disc. Therefore good quality stereo sound is becoming the rule rather than the exception for musical television shows.

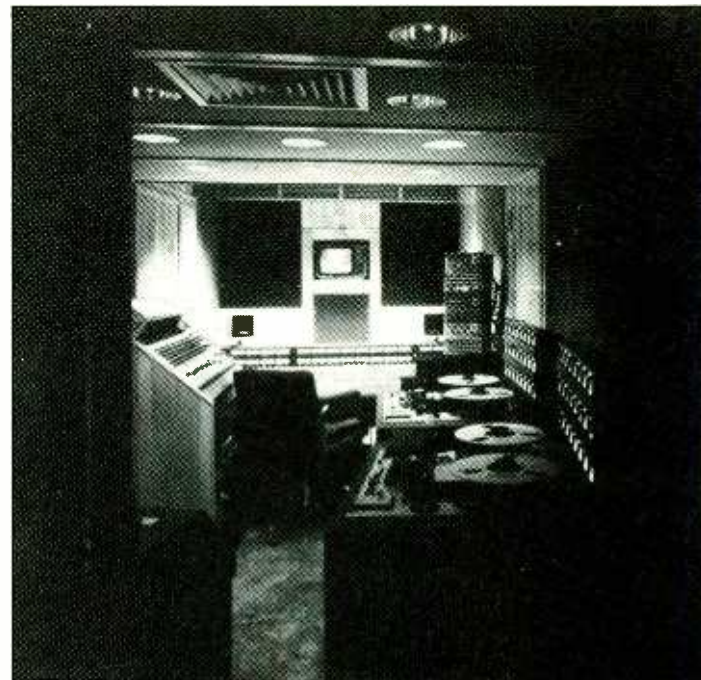
The director usually wants not only the sound from the musicians, but also the audience to be easily controlled both during a break between titles, but also during a piece as he may want to switch to an audience shot. Nothing sounds worse than an audio track that bears no relationship to the picture content.

Usually on a standard music show there can be up to eight cameras involved including a couple of roving ones. One thing that must be checked is the camera angles in relation to mic stands. Nothing looks worse than a continual shot of a musician cut in two

by a mic stand, from a fixed camera position. A little time carefully placing the mic stands without upsetting the actual sound of the mic will usually pay dividends.

Because of the high cost of video production there is usually not much time to rehearse, therefore it is vital to have everything working when the television company is ready to start camera rehearsals. This way perspectives can be judged, and there are no surprises when an instrument solo suddenly comes on the screen. The normal way is to record a multitrack tape of the performance. This can take the form of 23 music tracks plus one synchronisation track, which is usually SMPTE code generated by the television company and laid on to the video tape as well as the multitrack recording. This code gives a readout in hours, minutes, seconds and frames, and at a later date will lock the video recording to the audio multitrack. At the same time a monitor mix is recorded from the audio system, on to the audio tracks on the VTR machine, to be subsequently used during the video editing process.

A few years ago the standard method used in mobile recording was to put all the equipment, which was usually packed into flight cases, into a suitable room in a theatre, connect everything up, and trust to luck that the system would work, with maybe up to 20 audio channels. Things have changed. Now everything is perm-



Inside Mobile One

created is far higher and appears to be getting louder month by month.

Firstly, let's look at the audience. The theatre will probably be a large one, with what could loosely be described as an aircraft hanger acoustic. This really doesn't help the separation between audience and artist, but with a careful selection of mics and their positions the amount of

will probably be some reduction in the music level from the PA at this point. To make up for this reduction, there will be an increase in bass, this is fairly easy to lose by just filtering it out at the recording console.

Finally, to catch the real theatre sound I usually mic the balconies so that the nearest people are about 20ft from the mic positions.

In the control room this configuration will give the engineer an overall control of the amount of applause and the presence, as well as the individual sound of the theatre.

Looking at a modern band's equipment on stage an engineer could be forgiven if he thought technology had taken over from music. Most bands will have at least one synthesiser. These range from a simple drum machine, to the latest electronic orchestra. Unfortunately they have a wide variety of output levels and impedances. Some have microvolt outputs while others go up to a few volts, through volume or effects pedals. Usually the only time you hear the actual maximum level is during a concert, never during the rehearsal. Therefore, it is essential to have a variety of impedance matching devices, as well as different values of level attenuators. If a synthesiser starts to distort at high level it can be difficult to decide whether or not it is distortion or an effect added by the musician.

Another box of worms is phantom power. Most PA companies have phantom power available to power condenser mics. A mobile can also supply phantom power, but never both, therefore a discussion as to who will supply the phantom power, is best arranged earlier than later. The normal method is for the PA company to supply the power, so that the

'A full fuel tank can cost as much in customs duty in the next country as it did in the first place'

anently fixed into a vehicle and only the cables need to be taken into the theatre. If nothing else it takes less time to complete an installation which will probably have a greater number of channels than were used in the past.

There is a valid point for some discussion, as to the necessity for a multitrack rig, used to record a classical orchestra. There is the school of thought that a coincident pair is enough, after all the composer would have written the dynamics into the piece and the natural balance of the orchestra is the responsibility of the orchestra as well as the conductor. I consider that this does not take into account the individual ability of the musicians, or the presence that has become the standard required for today's hi-fi market.

The most important mic placing is a coincident pair somewhere near the conductor, after all, he should be hearing the full orchestra the way he has interpreted the composer's instructions. All that should be necessary is a few spot mics to help the overall presence rather than to drastically change the internal balance. A rock band is most certainly a different story. The volume level

unwanted breakthrough between the audience and artist can be kept to a minimum. A loud rock band against an audience can be the same as trying to mic a Rolls Royce next to a road drill.

There are many ways of miking an audience. Most engineers have their own theory. It varies from a single pair, to a number of mics round the auditorium. I have found that the most practical way is to treat the audience as three individual sections. First, the real fans of the artist, the ones that always get in shot on a TV special. These are the ones that arrive first and usually get down at the front, they are going to enjoy themselves come what may. They are also the loudest, they have to be, on a normal rock show have you noticed the volume level at the front? Anyway, a pair of mics on the PA speaker cabinets is a pretty safe bet. This will also take care of any time lags that may be present in the auditorium.

The next position is usually, if possible the rear stalls and under the first balcony. The type of audience sitting there are the keen fans of the artist, but the later arrivals. They are still enthusiastic applauders but there

Recording on the road

mobile can be completely isolated from the stage system. The usual effect of both supplying the power is a low buzz, which could be mistaken for an open circuit earth. If there is an unexplained buzz, it may well be worth checking that there are not two phantom power systems available at the mic head.

Drums are another problem area, usually a sound that is good for a recording session, may not be so good for a live show. Even though you are trying to produce a recording, the artist is trying to have a good live show. Compromise is the only way out here. Usually the kit has been tuned to give a loud sound on stage but to get this result it may have been necessary to lose some of the resonance that sounds so good in a studio. Using modern mics and PA systems this problem is not as common as it used to be, as the stage sound systems are now looking for sounds closer to recording techniques than in the past. Some of the new direct pickups are well worth trying, which allow almost total separation between individual drums.

Electric guitars and bass guitars usually have both direct injection into the recording system as well as the PA equipment. At the same time there is a mic used as an acoustic pickup. The only extra channel needed between PA and a recording system is for a feed pre- and post-effects pedal. By this time everything should be working, both into the mobile as well as the PA system. Earth loops have been heard, traced and removed, and so on to the sound check.

The best plan here is to allow the PA company to do their own sound check, and at the same time have somebody in direct contact with the mobile from the stage, to tell the recording engineer in the mobile what is happening on stage. A trap to fall into concerns the drums, where the first hanging tom can sound like the snare, the amount of level expected would vary enormously if the wrong mics were adjusted for a maximum level, and so on. Another area of confusion is the left and right cymbals. With somebody on stage at least problems like this shouldn't occur. The usual method of checking vocal mics is the age old custom of I-2, I-2, check, check, That's OK if all that interests the engineer is whether or not the mic is working, it could also give some idea as to the sibilant sound of the microphone. What it will not show is the bass response or the resonance characteristic of the mic. Say out loud 'I-2-check' how much bass end do you hear. As any engineer knows, it's usually the bass end of a signal that will give trouble from either unexpected high level, or the lack of separation. Coupled with the problem of bass floating around the stage, as well

as separation problems, a low frequency mic check is part of the overall mic set up. Most types of mic when damaged, can lose the bottom end. Even a broken lead can give you a healthy top, but be completely lacking in the bass end.

By now the stage is set, the PA company haven't complained and the local bye-laws have been satisfied, as to cable routes, security arrangements and fire precautions. The only thing left is for the artist to arrive and a run through to begin.

Wrong. There is the little matter of tape recorder alignment! Easy; no problem; quickly done; and other such like phrases. You must be joking! Most manufacturers will say, "power up the machine, allow to warm up for around ten minutes, and away you go." They also believe in fairies. A 24-track tape recorder's alignment can seem like one of the Labours of Hercules, that is unless it has been allowed to warm up properly. This may have something to do with the movement of the truck, a different tape bias level between tapes or even a different input voltage from the last session to the truck, somewhere there is the answer. It could be a mixture of all three. As soon as the mobile arrives at the venue it is a good idea to get power as quickly as possible so that during the initial stage set-up the equipment can be warming up slowly. It will be necessary to spend about an hour lining up the recorders, it really is time well spent.

Most tape manufacturers will say that their tapes have the most consistent bias level, from reel to reel. There was one manufacturer who produced a tape that varied a couple of dB from one end of a reel to the other, so what chance, reel to reel. It's well worth experimenting with different tapes, to find the most

suitable one on your machine. A 1dB change of bias could mean a 3dB change across the audio spectrum.

As I said before a recording engineer has the stamina of a long distance runner, the patience of a saint, the ability to eat infrequently, plus the hearing system of a bat. All these are useful in a standard recording day. Remember, by this time the day is only half over. You've managed to get the mobile to the venue, the equipment on stage, adjusted the recording system to peak performance, talked to the PA engineers and finally sat back to await the artist's arrival. Something's wrong, NO LUNCH, quick, look at the clock, no time, 15.45, the artist is supposed to arrive at 16.00. Oh well, eat later. Artist arrival imminent, 16.30 nothing happening, except

'An engineer has the stamina of a long distance runner and patience of a saint'

rumblings, check the monitors, engineer leaves truck, rumbling stops, draws conclusions.

Eventually the artist arrives and the rehearsal starts. Everything seems fine, the band sound comes together well, except for the Boeing 747 that appears to have landed in the theatre. A quick check reveals the audience mics wide open and a resonance from the PA getting into them. Roll off a little bass and everything cleans up. Maximum levels are checked, estimated to be about 60% of the level to be used on the performance, final sounds decided. For once everything goes like clockwork and the sound check is finished.

There are two schools of thought with regard to the actual recorded sound. One says that everything must be recorded 'flat' so that tapes can be re-equalised, and final decisions can

be made at the mix. "It'll be okay on the mix," attitude. The other says, "Produce a sound as near to the final sound of the record as is possible." Using this method any problems usually show themselves, such as phase error which can really be a killer. The law according to Lord Sod says that to have every cable, microphone, effect and even mic position in phase will not happen. At least with a fixed recording studio installation phase is within the control of the recording engineer, who will have the time to correct acoustic and electrical phase error over a period of maybe a few days. Once discovered, corrected, no further problem. On a mobile it is quite likely that you may be working in a different theatre, with a different PA system every day. It only takes one lead to be out of phase and a whole

new dimension could be added to the recording. Lord Sod also says it won't become apparent until the tape arrives in a cutting room, then the fun starts!

The most important rule is, *Leave Nothing To Chance*. Problems will descend on a mobile recording like flies round a jam pot, even the most carefully prepared sessions. Therefore, get at each problem as it arrives because there could be The Big One waiting around the corner to arrive when you least expect it.

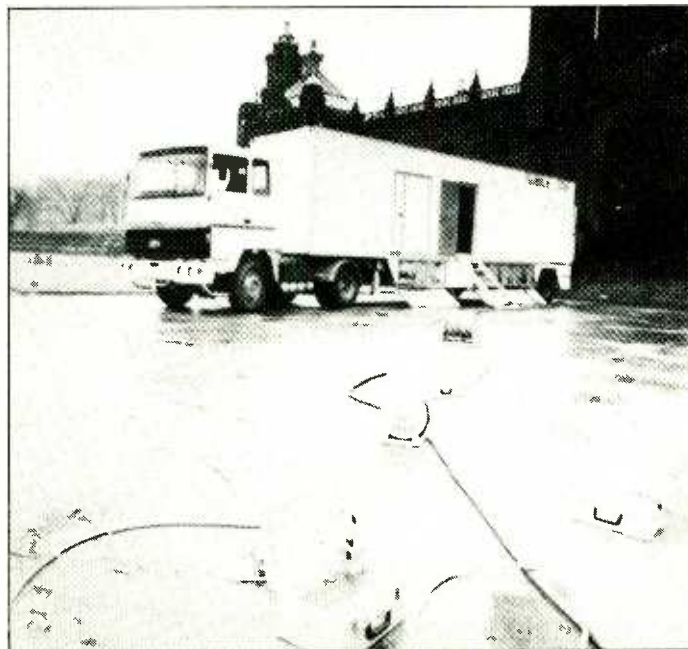
The rehearsal finishes and at last food. "Lead me to the nearest restaurant." The time is 19.00, the artist is on at 21.00 two whole hours to eat - magic!! I'm sorry sir we don't open till eight o'clock, the waiters don't arrive till then." This happens so often. Eventually a hamburger bar is found and for the fifth day hamburgers are the best thing since fillet steak. A mobile engineer's life for me! At least it's almost impossible to get fat.

Suddenly the hollow sound from the audience mics has been replaced by a couple of thousand cheering, shouting and clapping fans. The adrenalin is pumping, the encores come and another show is "In the can".

The equipment is switched off, tapes and cables packed away, lights in the theatre go off, and the truck is prepared to move away.

"Damn! Forgotten the mains connector". If I've heard that once, I've heard it a million times. Lesson to be learnt: always check the stage for equipment that seems to have a mind of its own and moves into dark corners.

Eventually all the gear is stowed away, and another day comes. We've been on this session since eight o'clock this morning, it's now 2 am, and still we have to be ready for the next session, and a new set of problems. What fun! (I wouldn't change it.) ■



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Martin Luddington,
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3M United Kingdom PLC.,
3M House, PO Box 1,

Bracknell, Berkshire RG12 1JU
Telephone: Bracknell (0344) 58398



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3M

Old tales never die

The only thing some publishers seem to understand is the word 'bandwagon'. Ten years ago, when the hi-fi boom took off, everyone started a hi-fi magazine. Most have survived, with the unhappy result that none has anywhere near as many readers as their foreign counterparts. So British magazine editors have a very difficult time trying to pay professional writers a reasonable rate. Hence some of the nonsense published about hi-fi.

Now the same thing is happening with video. I've lost count of the number of magazines that will supposedly tell you all you need to know about domestic, industrial and professional video. Once again there aren't enough serious writers to go round, so almost anyone with something to say about video can get into print. Meanwhile publishers have jumped off the bandwagon of jazz. Even the *Melody Maker*, which has been publishing news, views and features on jazz since the '20s, has now opted out. This has made room for yet more interminable articles on what the latest flavour of the month pop star has for breakfast and thinks about the real meaning of life.

Astonishingly the only way now to find out who has died and what's on in jazz is to read some of the free giveaways published by clubs like the Pizza Express, Ronnie Scott's and the 100 Club in Oxford Street.

I'm indebted to a piece by Digby Fairweather in a recent issue of Jim Godbolt's *100 Club News* giveaway for re-telling an apocryphal on the road story. Various attributed in the past to jazz musicians, concert pianists and travelling thespians, it goes just as well for travelling engineers. Herewith the bones; embellish at will.

Musician/actor/engineer checks in at cheap digs in far off town. Goes straight to the lavatory. Doesn't know that the landlady has just doused it with liberal quantities of inflammable chemical cleaner. Duly ignoring large notice 'Please do not drop cigarette ends in the toilet, and oblige', he drops fag end in behind him. Resultant explosion lifts him two feet off the pan and across the room. Landlady hears explosion and calls ambulance. Carrying him downstairs, the front ambulance man asks how it happened. On hearing the sad tale, ambulance man has hysterics, drops scalded passenger and thereby breaks both his legs.

Come to think of it, with stories like that in freebie music papers, who needs the jazz-free *Melody Maker* anyway.

All the tinsel and glitter of show business

In April Leonard Bernstein came to Britain to give a single concert, with the BBC Symphony Orchestra at the Festival Hall. On the bill, after Elgar's *Enigma Variations*, was Bernstein's own *Songfest*. This had originally been commissioned for the American Bicentennial Year (1976) but wasn't ready in time. It's a bitty work, with American poetry set to music. Some of the tunes are in a catchy *West Side Story* vein, but Bernstein the composer snatches them away again almost immediately, as if to ensure that the audience is never at risk of enjoying itself too

much. Nevertheless Bernstein the conductor certainly enjoyed himself, flailing around like an Italian traffic cop and leaping in the air like a disco dancer, only sometimes landing again in time with the music.

Some of the most difficult parts should have been sung by Jill Gomez but she was, in theatrical parlance, 'indisposed'. So on the Sunday before the Wednesday concert Clamma Dale was flown over from New York. She spent two days rehearsing with the BBC Symphony Orchestra and sang like a dream at the concert.

The next morning the *Guardian* reviewer reported: "The black singer, Clamma Dale, led a strong sextet with wonderful ease and freedom". But by then she was on a flight back to New York for another concert, so probably never read the review.

And anyone who didn't read the reviews wouldn't have known her name. For although Ms Dale had found time to learn her part in two days, the Festival Hall management hadn't found time to print the usual amendment slip for insertion in the programme. Instead there was an announcement over the Festival Hall PA just before the concert—that PA would do credit to a British Rail suburban station. The singer's name was completely inaudible. At the end of the concert there was a predictable standing ovation and the equally predictable bouquets of flowers for the girl singers. Upstairs there was a reception which ran on for an hour or so. Bernstein was supposed to show up but came so late most people had left before he arrived.

At the end of the reception Clamma Dale, the girl who had stepped in and saved the day, was now forgotten. No car, no cab, had been arranged. So in the wasteland of London's Southbank, Bernstein's star singer was left worrying about how to get a taxi or find a bus or tube train back to her hotel in Bond Street. Was it safe, she wondered, to walk outside alone?

Physically and mentally drained from two days of crash rehearsal and the concert, and weighed down with her stage clothes and a giant bouquet of flowers, she quietly and ever so politely also wondered whether the concert hall management had really intended her to find her own way back to the hotel by taxi, tube or bus. Somewhere, someone owes Ms Dale one heck of a grovelling apology.

Home tape fiasco

By the time you read this, the examination papers will have been handed in, and marking in progress. If you had something to say on the Government's Green Paper on copyright law reform, but haven't yet said it, you're too late. In fact, everyone and their cat now seems to have said something. Even the Performing Rights Society has had its say, although exactly what the PRS meant to say is rather hazy.

The PRS says it is "strongly critical" of the Green Paper which rejected a tape levy. But in a confused press statement the PRS urges "negotiation of a royalty as a more appropriate alternative". Quite what the difference is between a levy and a royalty on blank tape isn't clear. But as the PRS press release then goes on to refer to the US legal dispute "involving tape

and recording equipment company Betamax" (sic) it's also not clear how much the PRS knows about the audio and video business. We'll return to the PRS in a later column, with a look at its own long-running dispute with member Trevor Lyttleton.

If the British Government, and our EEC partners, do finally decide to follow the Green Paper and not put a tax, levy or royalty on blank tape, there's obviously going to be one mother and father of an inquest amongst the British record companies. In the beginning, before the BPI started its vastly expensive publicity campaign, there was without doubt a case to be made for some kind of low level tax on tape which licensed purchasers to use it how they liked. But that vastly expensive BPI campaign has been of such monumentally patronizing arrogance that in the final analysis it could well prove to have been disastrously counterproductive. Compare the BPI's campaign, if you will, with what's now happening in the USA. Over there the campaign for a levy on tape is following the obvious and logical route. Facts and figures are being presented first to prove the problem, with the lobby for remedies following later.

Warner Communications Inc has recently invested heavily in a 52-page report which analyses the whole business of home taping. The WCI survey is based on more than 2,300 face-to-face interviews and although it raises as many questions as it answers, there is no disputing that the survey was approached in a highly professional manner. The strength of the WCI report is that it isn't afraid to reveal facts that can be used against the campaign levy, as well as facts that could be used to support the industry's campaign.

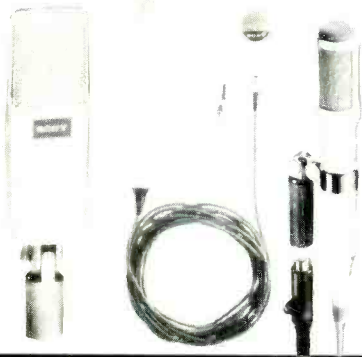
For instance WCI found that 45% of all the complete albums taped were from the taper's own records or tapes; and 33% of all the musical selections taped were from the taper's own records. Far fewer (34% and 21%) tapes were made from borrowed records. According to the report "tapers who are buyers are by far the most likely to perceive music as very important to them (56%) . . . buying and taping both reflect a more general commitment to music . . . the people who appear most interested in music are those who buy as well as tape . . . tapers spend more money on pre-recorded music than nontapers".

The report also found that "the vast majority of taping is done by those between 20 and 34 years of age, with at least a high school education and above average family income". All this suggests that it would not be too difficult a task to moralise against home taping as an alternative to buying. Well-educated people who are not short of spare cash and who like music could prove sympathetic and receptive to reasoned reminders that taping records instead of buying them is destroying their source of enjoyment.

So, perhaps if the British Government again rejects the idea of a tax on blank tape, the British record industry could start again. But this time with hard facts and figures in place of PR hysteria, and a reasoned campaign against the immorality of taping in place of the threat of a punitive tax to sanction it.

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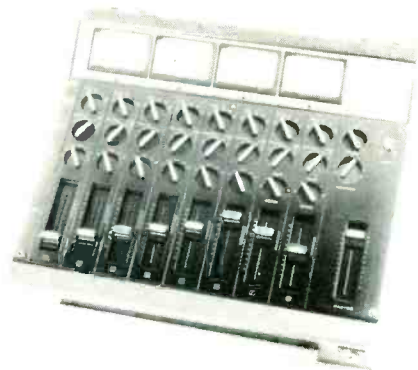
MX-P42 Mixer

Sony makes the difficult easy in field production with the ALC (automatic level control) equipped M x 542 4 x 2 portable mixer. Direct VTR interface. Ganging facility, Pan Pots, Phantom power facility for condenser mikes.



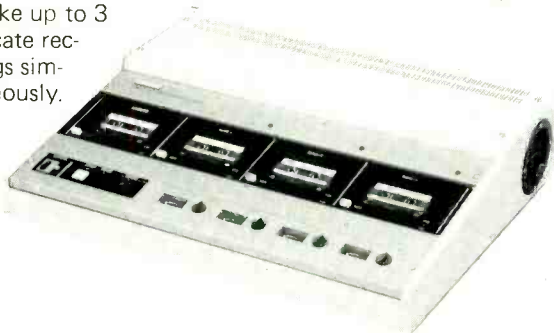
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A fully professional microphone mixer with 8 channel inputs and 4 channel outputs.



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High speed, high quality-sound duplication at eight times normal speed. The CCP-13A is a cassette to cassette duplicator designed to make up to 3 duplicate recordings simultaneously.

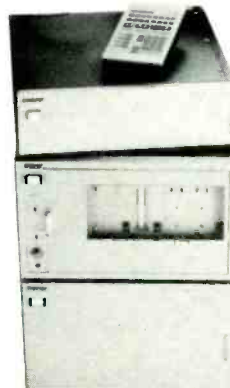


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PCM-1610, 16-Bit Digital audio recording system.

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**FELDON AUDIO**

126 Great Portland Street, London W1N 5PH Tel: 01-580 4314. Telex: London 28668

service Mobile recording guide

This is a listing of mobile recording trucks, offering multitrack remote facilities categorised by the country in which the facility is based.

CANADA

Filtrosn Mobile, 4 Careé des Bois, St. Thérèse, Quebec J7E 2R3. Phone: (514) 733-8166.

FRANCE

Le Voyageur, Société d'Enregistrement Laurent Thibault, Le Château, F-95300, Herouville. Phone: 446.54.59.

Publison Mobiles, 5-11 Rue Crespin du Gast, F-75011 Paris. Phone: 357.64.08.

NETHERLANDS

Mirasound, Langstrasse 51, NL-8131 BB Wijhe. Phone: 1826.

SWITZERLAND

Heubi Mobile, Audiocom AG, CH-3210 Kerzers. Phone: (31) 95.57.42.

UNITED KINGDOM

Abbey Road Studios (EMI), 3 Abbey Road, London NW8 9AY. Phone: 01-286 1161.

Buzz Mobile, 65 Widemarsh Street, Hereford. Phone: 0432 55961.

Island Mobile, Basing Street Studios, 8-10 Basing Street, London W11 1ET. Phone: 01-229 1229.

Manor Mobile, The Manor House, Shipton-on-Cherwell, Oxford. Phone: 08675 77551.

Mobile One, 29-30 Windmill Street, Tottenham Court Road, London W1P 1HS. Phone: 01-580 3744.

RAK Recording Studios, 42-48 Charlbert Street, London NW8. Phone: 01-586 2012.

Sabre Mobile, 55 Cliff Drive, Canford Cliffs, Poole, Dorset BH13 7JG. Phone: 0202 708303.

Soundbox Mobile, 18 Clifton Villas, London W9. Phone: 01-286 5490.

Sutton Sound, 80 Queensway, London W2 3RL. Phone: 01-262 9066.

The Mobile Studio, 2 Munro Terrace, London SW10 0DL. Phone: 01-352 0005.

The Truck Mobile, Comforts Place, Tandridge Lane, Lingfield, Surrey. Phone: 034285 2133.

Zipper Mobile, 15 Langland Gardens, London NW3 6QE. Phone: 01-435 3076.

USA

Artisan Recorders, 1421-A SW 12th Avenue, Pompano Beach, Florida 33060. Phone: (305) 786-0660.

Châton Recordings, 5625 Nauri Valley Drive, Scottsdale, Arizona 85253. Phone: (602) 991-2802.

Criteria Recording Studios, 1755NE 149th Street, Miami, Florida 33181. Phone: (305) 947-5611.

Fanta Professional Services, 1213 16th Avenue S, Nashville, Tennessee 37212. Phone: (615) 327-1731.

Record Plant, 8456 W Third Street, Los Angeles, Cal 90048. Phone: (213) 653-0240.

Record Plant NY, 321 W 44th Street, New York, NY 10036. Phone: (212) 581-6505.

Reelsound Mobiles, PO Box 280, Manchacha, Texas 78652. Phone: (512) 472-3325.

Roadway Recorders, 51 Glendale Avenue, Livingstone, New Jersey 07039. Phone: (201) 325-2056.

Sanborn Productions, PO Box 120, Route 3, Ashland City, Nashville, Tennessee 37015. Phone: (615) 254-6538.

Sound 80, 2709 E 25th Street, Minneapolis, Minnesota 55406. Phone: (612) 721-6341.

Wally Heider Recording, 1604 N Cahuenga Boulevard, Hollywood, Cal 90028. Phone: (213) 466-5474.

WEST GERMANY

Dierks Studios, Hauptstrasse 33, D-5024 Pulheim/Cologne 33. Phone: (02238) 3333.

service Contractors guide

This guide provides a listing of contractors for the construction of mobile broadcasting and recording units. Our service guide on studio designers and consultants (July 1982 issue) details companies capable of designing such vehicles.

AFA (USA)

AF Associates Inc, 100 Stonehurst Court, Northvale, New Jersey 07647. Phone: (201) 767-1000.

AMPEX (USA)

Ampex Corp, 401 Broadway, Redwood City, Cal 94063. Phone: (415) 367-2011. Telex: 348464.

UK: Ampex International, Acre Road, Reading, Berks RG2 0QR. Phone: 0734 85200. Telex: 847611.

AUDIX (UK)

Audix Ltd, Station Road, Wendon, Saffron Walden, Essex CB11 4LG. Phone: 0799 40888. Telex: 817444.

BOSCH (West Germany)

Robert Bosch GmbH, PO Box 429, Robert Bosch Strasse, D-1600 Darmstadt. Phone: 06151 808270. Telex: 419256.

UK: Robert Bosch Ltd, Rhodes Way, Watford WD2 4LB. Phone: 0923 44233. Telex: 935244.

BRABURY (UK)

Brabury Electronics Ltd, Smitham Bridge, Hungerford, Berkshire RG17 0QU. Phone: 048-86 3511. Telex: 848760.

CLYDE (UK)

Clyde Electronics Ltd, Ranken House, Blythwood Court, Anderston Cross Centre, Glasgow G2 7LB. Phone: 041-221 5906/248 3001.

DELL (UK)

Dell Technical Vehicles Ltd, Brokenford Lane, Totton, Southampton SO4 4DX. Phone: 0703 860044/5. Telex: 477426.

GERTENSLAGER (USA)

The Gertenslager Company, Wooster, Ohio 44691. Phone: (216) 262-2015.

GOWRINGS (UK)

Gowrings Engineering MVC Ltd, Darwin Close, Reading RG2 0RW. Phone: 0734 81654. Telex: 847572.

HARRIS (USA)

Harris Corp, PO Box 4290, Quincy, Illinois 62301. Phone: (217) 222-8200. Telex: 404347.

UK: Dynamic Technology Ltd, Zonal House, Alliance Road, Acton, London W3. Phone: 01-993 2401. Telex: 935650.

MARCONI (UK)

Marconi Communication Systems Ltd, Marconi House, New Street, Chelmsford CM1 1PL. Phone: 0245 353221. Telex: 99201.

USA: Marconi Electronics Inc, 100 Stonehurst Court, Northvale, New Jersey 07647. Phone: (201) 767-7250. Telex: 9919752.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU. Phone: 0763 60776. Telex: 81381.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801. Phone: (203) 744-6230. Telex: 969638.

RCA (USA/UK)

USA: RCA Broadcast Systems, Front and Cooper Streets, Camden, New Jersey 08102. Phone: (609) 338-3000. Telex: 834357.

UK: RCA Ltd, Lincoln Way, Windmill Road, Sunbury-on-Thames, Middlesex TW16 7HW. Phone: 09327 85511. Telex: 24246.

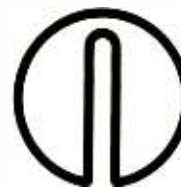
SIEMENS (West Germany)

Siemens Aktiengesellschaft, D-7500 Karlsruhe 21, West Germany. Phone: 0721 595 2428. Telex: 7826851.

THOMSON-CSF (France)

Thomson-CSF, Division Radiodiffusion-Television, 94 Rue Du Fosse Blan, F-92231 Gennevilliers. Phone: (1) 790.65.49. Telex: 620573.

UK: Thomson-CSF Equipment and Systems Ltd, Hunting House, Central Way, North Feltham Trading Estate, Feltham, Middlesex TW14 0UD. Phone: 01-751 6241. Telex: 934215.



DISKMIX™

representatives

European Continent
and South Africa

S. AFRICA

ELTRON PTY. LTD.

112 Polly St.

Box 23656, Joubert Park
Johannesburg 2044

S. Africa

Telephone (011) 293066

HOLLAND

SYNTECH ELECTRONICS

Zandpad 46/Postbus 83
3620AB Breukelen

Holland

Telephone: 03462-3499

ITALY

SCIENTEL AUDIO

Via C. Sigonio 50/2
41100 Modena

Italy

NORWAY

SIV ING BENUM AS

Boks 2493, Solli

Oslo 2

Norway

Telephone: (02) 442255

SPAIN

TELCO SOCIEDAD LIMITADA

Gravina, 27

Madrid

Spain

Telephone: 2317840 -
221 01 87

SWEDEN

INTERSONIC AB

Box 42133

S-126 12 Stockholm

Sweden

Telephone: 08/7445850

SWITZERLAND

AUDIO BAUER AG

CH 8064 Zurich

Bernerstrasse-Nord 182

Haus Atlant

Switzerland

Telephone: 01 64 32 30

Sound Workshop

Professional Audio Products, Inc.

1324 Motor Parkway

Hauppauge, New York 11788

(516) 582-6210 Telex 649230



Diskmix™

Expand the limits of your current tape-based automation system. After all, your multi-track was designed to record music, not data.

Diskmix not only stores more automation data (multiple mixes) on DSDD floppy discs, but also facilitates off-line editing and merging of mixes, and adds keyboard control of automated console parameters in a SMPTE time code-based system. And Diskmix can be interfaced with any console equipped with MCI, Valley People (Allison) or Sound Workshop automation.



What automation did for the recording console, Diskmix does for automation.

By Sound Workshop Professional Audio Products, Inc.
1324 Motor Parkway, Hauppauge, New York 11788 516-582-6210 Telex 649230

product Tape duplication guide

ACCURATE SOUND (USA)

Accurate Sound Corp, 3515 Edison Way, Menlo Park, Cal 94025. Phone: (415) 365-2843. Telex: 348327.

Model 2400: variety of formats for reel-to-reel, reel-to-cassette, etc. Tape width 0.15in, ¼in, ½in; duplicating ratios 4, 8, 16 or 32:1; speed 30/60 or 60/120in/s, optionally 15/30in/s.

System 100: reel-to-reel system with master accepting up to 10 slaves. Tape width 0.15in, ¼in, ½in; crystal controlled tape speeds 30, 60, 120in/s.

ALPHA (USA)

International Audio Inc, 2934 Malmo Drive, Arlington Height, Illinois 60005. Phone: (312) 956-6030.

Alpha 21/41: four models for mono or stereo cassettes, in either master/slave or slave/slave combinations. Originates and records on cassette, mono 2-track, stereo 4-track; duplicating ratio 16:1; speed 30in/s.

AMPEX (USA)

Ampeg Corp, 401 Broadway, Redwood City, Cal 94063. Phone: (415) 367-2011. Telex: 348464.
UK: Ampeg (Great Britain) Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 85200. Telex: 848346.

BLM-200A/3400 System: comprises *BLM-200A* loop-bin master for 25mm tape, and up to 10 *3400 series* slave units, 2- or 4-track on cassette pancakes, 8-track on cartridge tape; duplicating ratio up to 32:1; speed master loop 240/120 or 60in/s, slaves 120/60 or 30in/s.

RR-200/3400 System: comprises *RR-200* reel-to-reel master and up to 10 *3400 series* slave units. Master handles ¼in or ½in tape, slaves 3.8mm cassette pancakes or ¼in tape on 1-, 2- or 4-track formats; duplicating ratio up to 16:1; speed master 120/60in/s, slaves 60/30in/s.

APEX (USA)

Apex Machine Co, 3000 NE 12th Terrace, Fort Lauderdale, Florida 33334. Phone: (305) 566-1573.

Apex on-cassette printer: prints label copy directly on to cassette (both sides simultaneously in up to three colours), eliminating paper labels.

ASONA (West Germany)

Auvis-Asona KG, Stollbergstrasse 7, D-8000 Munchen 22. Phone: 089 22.50.57. Telex: 22084.

UK: (excluding cassette duplicators) Lennard Developments Ltd, 206 Chase Side, Enfield, Middx EN2 0QX. Phone: 01-363 8238.

HS16-M1: master unit with Revox A77 or A700, running at 7½ or 15in/s; pre-emphasis unit with a limiter and/or de-esser; and second tape machine (usually an A77) to produce submaster duplication tapes complete with pulses for the Asona 4-track time-shifting system. Built-in cassette machine for quality control.

HS16-L1 Loop-bin: handles ¼in tape recorded at

3¼in/s; duplicating ratio 16:1; accepts up to three slave units.

HS16-S1/2 Slave: single, twin or triple-transport unit running at 30in/s (16:1 duplicating ratio). Accepts up to 14in pancake reels.

HS16-W1/2 Loader: twin-transport unit for blank, pre-leadered or pre-recorded cassette or cartridge tape. Digital preselection counter allows any length of tape in steps of 10cm to be loaded.

2004: cassette loading system with built-in vacuum pump. Time or length preselection. Sorts randomly loaded cassettes to correct position. Automatic memory and rejection of any short cassettes. Two stop options. Preloaded magazine or automatic conveyor belt feeding modes.

Cassette Labeller: labeller using solvent to fix paper labels to cassettes. Capacity 300 cassettes/hour.

AUDICO (USA)

Audico Inc, 219 Crossen Avenue, Elk Grove Village, Illinois 60007. Phone: (312) 640-1030.

Model 751: cassette loader for loading blank tape in exact lengths by playing time. C-60 loaded in 25s. Other models available. *751-CT* for pre-recorded tapes. Cue tone sensor substituted for timer. *751-C + CT* loader fitted with timer and cue tone sensor. *751-CL* winds six preset sizes of cassette. Similar versions available for 8-track cartridges and NAB broadcast cartridges.

AUDIO/TEK (USA)

Audio/Tek Inc, 502-D Vandell Way, Campbell, Cal 95008. Phone: (408) 378-5586.

Model 1200B System: fully automatic loop-bin master and up to 10 pancake or reel slaves. 4-track ¼in master recorded at 3¼in/s to 4-track stereo cassette; duplicating ratio 32:1; speed master 120in/s, slave 60in/s.

Model 2000 System: loop-bin master, 2-speed, dual-capstan transport with bias supply, amps and control logic for up to 10 slaves. Slaves console mounted with plug-in head assemblies and automatic tape cleaners handling reel or pancake. 4-track ½in, 8-track ½in or 1in master to 4-track stereo cassette or ¼in 8-track; duplicating ratio 32:1 or 64:1; speed master 120 and 240in/s, slaves 60 and 120in/s.

Model 511 Duplicator Master: studio quality recorder for production of duplicator masters. Shifting head permits selection of any stereo programme by turning knob on head assembly. Constant tape tension. Produces 8-track and 4-track masters. ½in or 1in versions available.

Model 210 Cassette Loader: loader for small or medium runs. Digital blank tape counter. Loads up to C-120 in selectable 4s interval. Winding speed 120in/s; cue tone sensor; tape cut at end of cycle.

CROSS (Switzerland)

Cross Ltd, Lättichstrasse 8, Postbox 44, CH-6340 Baar. Phone: (042) 31.64.88. Telex: 65152.

CT1800: automatic cassette labelling machine with a capacity of 1,900 cassettes/hr. Cassettes loaded from a 50 cassette magazine.

CTI (UK)

Cassette Tape Improvements, 201 Bryn Fedw, Llanedeyrn, Cardiff, S Glamorgan CF37PW. Phone: 0222 732186.

Z79L Cassette Loader: high speed, semi-automatic cassette loader. Options include cue tone sensor for prerecorded bulk tape; drop out detector; and sensor for pre-leadered pancakes.

DENON (Japan)

Nippon Columbia Co Ltd, No 14-14 4-chome Akasaka, Minato-ku, Tokyo 107. Phone: 03544-8111. Telex: 22591.

DN-020-R-ESystem: comprises *DN-022-P-E* loop-bin master reproducer and *DN-322-R-E* pancake slave. Duplicating ratio 32:1; speed master 120in/s with 7½in/s master tape and slaves at 60in/s.

ELECTRO SOUND (USA)

Electro Sound Inc, 160 San Gabriel Drive, PO Box 60639, Sunnyvale, Cal 94088. Phone: (408) 245-6600. Telex: 910-339-9303.

Electro Sound produces a wide variety of tape duplication units including the *ES 8000* 64:1/32:1 microprocessor controlled tape duplicator which has a self diagnostic fault finding facility. The *ES 8000* additionally counts and displays the number of completed selections and tape pancakes. An optional accessory is the *ES 4300* automatic high speed quality control and assurance system with tone sensing and hard copy printout with pass/fail readout. Electro Sound also produces the *ES 5000* 32:1/16:1 tape duplication system with the same facilities as the *ES 8000* but with lower volume applications. Electro Sound additionally manufacture the *QCV* quality control reproducer which in conjunction with the *SQM* system quality monitor, measures, stores and prints out eight performance parameters and identifies those which are out of tolerance. A further unit is the *ES 1848* micro-processor controlled automatic cassette/loader.

GAUSS (USA)

Cetec Gauss, 13035 Saticoy Street, North Hollywood, Cal 91605. Phone: (213) 875-1900. Telex: 910-499 2669.

UK: Cetec International, Unit 15, Northfield Ind Estate, Beresford Avenue, Wembley HAO 1YB. Phone: 01-900 0355. Telex: 935847.

1200 Series System: basic system comprises *Model 1210* master reproducer, *Model 1260* tape loop-bin and *Model 1220* reel-to-reel or pancake slave. Up to 20 slaves can be used with one master. Master 2- or full-track on ¼in, 4-track on ½in or 8-track on 1in; slave, all standard formats on ¼in or ½in tape convertible. Duplicating ratios 32 or 64:1 with 7½ or 3¼in/s master tape; speed master 240, 120 or 60in/s, slave 120, 60 or 30in/s.

Model 1250B Quality Control Reproducer: features convertible tape transport and head assemblies for quick changes between cassette and cart formats. Both formats operate bidirectionally at 1⅞ or 3¼in/s.

GRAFF (UK)

Industrial Cassette Developments Ltd, 10 Sirhowy Estate, Tredegar, South Wales NP2. Phone: 049525 5035.

USA: Koperdak Enterprises, 1450 W Winona, Chicago, Illinois 60640. Phone: (312) 275-9748.

Graff HSCD: modular cassette duplication system for cassette-to-cassette copies. Accepts any number of slaves. Duplication ratio 16:1; speed 30in/s.

HEINO ILSEMANN (West Germany)

Heino Ilseman GmbH, Zum Panrepe 24, D-2800 Bremen 44. Phone: (0421) 48.30.83. Telex: 244055.

Heino Ilseman manufactures a variety of cassette orientated duplication aids including the *KZM3* automatic cassette loader and the *ETK-1* and *ETK-1S* automatic cassette labelling machines.

INFONICS (USA)

Infonics Inc, PO Box 1111, 238 Hwy 212, Michigan City, Indiana 43360. Phone: (219) 879-3381.

200 Series: range of cassette duplicators using either open reel or cassette masters. Slaves in banks of four, in 2- or 4-track for mono or stereo, slaves also available with either two or four motors, the latter providing fail stop, trouble lights and auto rewind. Masters are available using ¼in tape with two or four tracks (optional ½in tape transport), and in versions with auto stop, and cue, or a model for Dolby-B playback. Master cassettes have auto stop and track select. Duplicating ratio 10:1; speed 20in/s cassette, open reel 40, 80 or 160in/s.

ITI (USA)

David Lint Associates, 3350 Scott Boulevard Bldg, Santa Clara, Cal 95051.

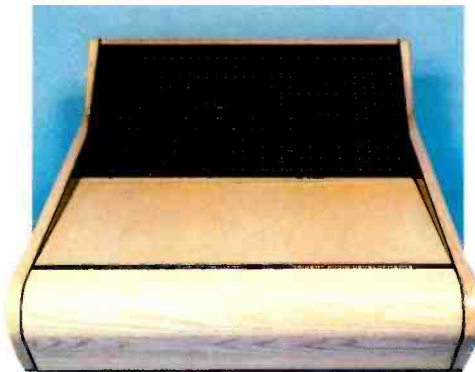
Graff HSCD





TRIMIX - not the way many people would build a mixer.

Trimix is a complete mixing system that has been carefully designed to grow with you from small beginnings (even a 6 into 2) to the most sophisticated of multi-track requirements, such as 32 inputs with full 24 track monitoring and integral patchfield. The Trimix system is modular in every sense: mainframes are produced in 16 or 24 way modules and the optional patchfield is a complete free standing unit that incorporates modular jack cards that can expand along with the rest of the facilities, when you are ready. Why settle for a mixer with limited facilities when Trimix makes the facilities LIMITLESS.



R & D always part of Trident

- U.S.A.** Studio Maintenance Services, Los Angeles.
Tel: 213-877-3311
Wilson Audio Sales, Nashville.
Tel: 615-794-0155
Trident (U.S.A.) Inc., 652 Glenbrook Road
Stamford, Connecticut 06906 U.S.A.
Tel: 203-348-4969
- Australia** John Barry Group, Sydney.
Tel: 2-439-6955
- Belgium** A.S.C. Professional Audio Consultants, Brussels.
Tel: 2-520-0827
- Canada** Heint Electronics Inc., Markham, Ontario.
Tel: 416-495-0688
- France** Lazare Electronics, Paris.
Tel: 1-878-62-10
- Holland** Dick Swaneveld, Hilversum.
Tel: 35-17722
- India** Kapco Sound Studio, New Delhi.
Tel: 43718
- New Zealand** Mandrill Recording Studios, Auckland.
Tel: 9-793222
- Norway** Protechnic A.S., Oslo.
Tel: 2-46-05-54
- S Africa** Leephy (Pty) Ltd., Blairgowrie 2194, Johannesburg.
Tel: 11-789 2424
- Sweden** Stage & Studio, Gothenburg.
Tel: 31-22-40-90
- Taiwan** Linfair Engineering & Trading Ltd., Taipei.
Tel: 3214454-7.

Trident Audio Developments Ltd.
Shepperton Studio Centre,
Shepperton, Middx. TW17 0QD, U.K.
Tel: Chertsey (09328) 60241.
Telex: 8813982 (TRIMIX G.)

product Tape duplication guide

ITL1: automatic cassette labeller capable of labelling up to 1,500 cassettes/hr. Labels both sides of cassette simultaneously.

KING (USA)

King Instrument Corp, 80 Turnpike Road, Westboro, Mass 01581. Phone: (617) 366-9141. Telex: 948485.

Model B-1 Cassette Loader: manual loader for pre-recorded and precise length blank cassettes. Cuts tape, aligns and splices.

Model 680 Cassette Loader: semi-automatic loader using a microprocessor to control automatic switching operations and eject the cassette.

Model 780 Self-Feed Loader: automatic loader, microprocessor controlled which loads cassettes continuously as long as tape is available.

LIBERTY/UA (USA)

Liberty Tape Duplication Co Inc, 2101 South 35th Street, Council Bluffs, Iowa 51501. Phone: (712) 328-8060.

Series LT-1600(B): duplication system with loop-bin master driving up to 10 slaves producing 8-track or cassettes on reels to be broken down later. Master unit includes slave electronics and bias controls. Master 8-track on 1 or 1/2 in; 4- or 2-track on 1/2 or 1/4 in. Slave 1/4 or 1/2 in on 14in reels. 8-track or cassette. Duplicating ratio 16:1; speed master 120in/s with real time speed of 7 1/2 in/s, slave 60 or 30in/s.

LYREC (Denmark)

Lyrec Manufacturing A/S, Hollandsvej 12, DK-2800 Lyngby. Phone: 02 87 63 22. Telex: 37568.

UK: Lyrec (UK) Ltd, 19 Erncroft Way, Twickenham TW1 1DA. Phone: 01-891 2022

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801. Phone: (203) 744-6230. Telex: 969638.

P-2000 System: 49PLM Loop-bin Master operable in a loop-bin or a reel-to-reel mode and can be connected to 20 twin-transport slaves. 4-track on 1/2 in tape (standard), or on 1/4 or 1 in to order. Duplicating ratio 16:1; speed 120in/s for 7 1/2 in/s master tape. 49P2S Slave is a twin-transport unit. 4-track on 3.81mm pancakes; two 1/4-track 2-channel heads, plus a reproduce head for off-tape monitoring or line-up.

MAGNEFAX (USA)

Magnetax International, Route 1, PO Box 764, Rogers, Arizona 72756. Phone: (501) 925-1818.

Magnetax produces a range of high speed common mandrel 1/4 in tape duplicators, automatic tape degaussers, and a master tape loop bin/7-slave cassette duplicator.

MTI (USA)

MTI Corp, 124 Montclair Avenue, Montclair, New Jersey 07042. Phone: (201) 744-2220. Telex: 642611.

System III: cassette duplication system comprising loop-bin master and up to 10 pancake slaves. Slaves utilise back-to-front tape path with 14in spool capacity, closed loop tape drive, constant tape tension, built-in tape cleaner and supply follower arm. Master 1in 4-track or four of 8-track, 1/2 in 4-track and 4- or 2-track 1/4 in on to 2- or 4-track cassette tape. Duplicating ratio 64:1 or 32:1; speed master 240in/s, slave 120 or 60in/s.

OTARI (Japan)

Otari Electric Co, Otari Bldg 4-29-18 Minami Ogikubo, Suginamiku, Tokyo. Phone: 03 333-9631. Telex: 26604.

UK: Industrial Tape Applications, 1-7 Harwood Avenue, Marylebone Road, London NW1. Phone: 01-724 2497/7368. Telex: 21879.

USA: Otari Corp, 1559 Industrial Road, San Carlos, Cal 94070. Phone: (415) 529-8311. Telex: 910-376 4890.

DP-1010 System: comprises DP-1310 master for 2- or 4-track 1/4 in, or 4-track 1/2 in tape; and DP-1510 slave for 2-track mono or 4-track stereo cassette or 1/4 in

tape. Duplication ratio 16:1. Tape speeds, master 120 and 60in/s, slave 60 and 30in/s. Optional BL-1310 loop-bin available.

DP-1610: bidirectional playback monitoring reproducer for 1/4 in tape or cassettes; 14in reel capacity; wide variety of track formats; tape speeds 3 3/4 or 1 7/8 in/s.

DP-1700: winding machine for automatic loading of cassette tape into housings.

DP-2700: automatic cassette leader tape loader with automatic leader cutting and splicing, and automatic tape tensioning.

DP-4050-OCF: self contained unit with a reel-to-reel master and six cassette slave transports. Master has two head stacks switchable as 4-track stereo or 2-track mono on 1/4 in tape; slaves have 4-track in-line heads. Duplicating ratio 8:1; speed master 60 and 30in/s (7 1/2 or 3 3/4 original).

DP-4050-CCF: cassette-to-cassette version of DP-4050-OCF, using same slave transports. 4-track in-line heads. Duplicating ratio 8:1; speed master and slave 15in/s (1 1/2 in/s original).

DP-4050-C2: professional 8:1 in-cassette duplicator comprising cassette master deck and two slave recorders in a desk-top type cabinet. Expandable up to 11 slaves using three additional units which contain three slaves in each. 4-track in-line heads.

DP-6755: tailoring machine which winds cassette pancake tape into empty cassette cases fitted with leaders. Machine automatically cuts leader and splices tape on to it, then winds the cassette at high speed and cuts at the appropriate point. Takes any length up to C-120. Audio sensing head enables the exact length to be cut for prerecorded tapes.

DP-7000 System: high speed duplicating system. Comprises DP-7300C loop-bin master reproducer for 4-track 1/2 in tape, tape speed 240/120in/s; and DP-7500C 4-track cassette slave (two 2-track staggered heads), tape speed 120/60in/s. Duplicating ratios 64:1 and 32:1. Master may be linked to up to 20 slaves.

PENTAGON (USA)

Pentagon Industries Inc, 4751 North Olcott, Chicago, Illinois 60656. Phone: (312) 867-9200. Telex: 253058.

UK: Visual Mar-Com Systems Ltd, 49a Thames Road, Strand-on-the-Green, Chiswick, London W4 3PP. Phone: 01-995 8345. Telex: 23678.

C100/C400: desk top unit comprising master and slave cassette decks providing copying with a 16x ratio and a duplication speed of 30in/s. Units include automatic rewind, adjustable bias, and a 'short copy' light which indicates insufficient tape to complete copy. C100 mono 2-track; C400 stereo 4-track.

C8: desk-top 8-track cartridge copier which copies all four stereo programmes in one pass, with master and slave decks in same unit. Duplicating ratio 8:1, duplication speed 30in/s. Single capstan drives both transports. 'Short copy' indicator and edit mode to chop programme material to fit cartridge.

Super C-1 and C-4: desk top cassette-to-cassette duplicator. C-1 2-track mono; C-4 2-track mono or stereo. Duplicating ratio 16:1; speed 30in/s.

C-10/C-20: desk top copier. Duplicating ratio 16:1; speed 30in/s. Features include automatic rewind master and copy, and faulty cassette sensing. C-10 2-track mono. C-20 stereo 2-track.

C-32TMS/C-34TMS: high speed 3-slave desk top cassette copier. Duplicating ratio 16:1; speed 30in/s. Unit includes automatic rewind of master faulty cassette sensing in slave positions. C-32TMS mono 2-track. C-34TMS stereo 4-track.

C322/C342: desk top cassette-to-cassette copiers with a master and three slaves. C322 mono. C342 stereo. Feature heavy duty construction and 'stabilign' head and guidance assembly. Duplicating ratio 16:1; speed 30in/s.

1100 Series: reel-to-reel, reel-to-cassette, cassette-to-cassette versions available. Modular systems with up to 11 slaves. Features include end of tape sensing, track select, automatic rewind of master, automatic cue on reel, motion indicators and individual channel controls (preset or manual). 1/2-track 2-channel or 1/4-track 4-channel on 1/4 in tape. Duplicating ratio 16:1; speed reel master and slaves 60 and 120in/s, cassette master and slaves 30in/s.

Pro-Series: reel-to-reel, reel-to-cassette, cassette-to-cassette systems available. Modular system with variety of master/slave configurations. Table-top console versions of reel-to-reel masters and slaves. Features include 'failsafe audio/bias monitoring', automatic rewind, cue and restart, and individual cassette audio/bias adjustment. 2-track mono. 4- or 8-track stereo, on 1/4, 1/2, and 1 in reel-to-reel or 0.15in cassettes or pancakes. Duplicating ratio 8 or 12:1; speed reel master and slaves 30 and

60in/s and 45 and 90in/s pancake slaves 15 and 60in/s, and 22 1/2 and 45in/s, cassette master and slaves 15 and 22in/s.

RECORTEC (USA)

Recortec Inc, 777 Palomar Avenue, Sunnyvale, Cal 94086. Phone: (408) 735-8821. Telex: 910-339 9367.

Automated Duplicator System: combines open-reel bidirectional master and high speed duplication and cassette loading in a single operation—blank tape from pancake reel is recorded while being loaded at constant speed. Slave/loaders can be equipped with an automatic cassette feeder. A simple cassette loader is also available. 4-track on 1/4 in; 4- or 8-track on 1/2 in; 4-, 8-, 12- and 16-track on 1 in tape. Duplicating ratio 32 and 64:1; speed master 240in/s, slave/loader 120 or 60in/s (for 7 1/2 or 3 3/4 in/s master tapes).

RTW (West Germany)

Radio-Technische Werkstätten GmbH, Neusser Strasse 297-399, D-5000 Koln 60. Phone: 0221 764035. Telex: 8885217.

CL1 Cassette Loader: loader consisting of supply reel, tape quillotine, cue-tone sensor, semi-automatic tape splicer and two winding stations. Winding speed of 5m/s. Winding stations operate on alternating basis. Built-in loudspeaker to detect cue tones if required. 4-digit counter and vacuum pump.

SONY (Japan)

USA: Sony Corp of America, 9 W 57th Street, New York, NY 10019. Phone: (212) 371-5800. Telex: 424595

UK: Sony UK Ltd, Pyrene House, Sunbury-on-Thames, Middx TW16 7AT. Phone: 09327 89581/876441. Telex: 266371

CCP/ORM Series: cassette duplication system using either open reel or cassette masters, with various combinations of master and slave units. Comprises ORM-10 open reel 1/4-track master machine taking 7in spools. CCP-13A master plus three slaves duplicator. CCP-11 master and one slave. CCP-04A four slave and CCP-02 two slave units switchable 2- or 4-channel, with automatic rewind and automatic stop. Normal master unit will drive two separate slave systems (with two or four decks) and for larger systems the AA-10 allows up to 10 slaves to be added. Duplicating ratio 8:1; speed open reel 30 or 60in/s, cassette 15in/s.

SUPERSCOPE (USA)

Superscope Tape Duplicating Products Inc, 455 Fox Street, San Fernando, Cal 91340. Phone: (213) 365-1191. Telex: 910-496 1481.

Automatic Cassette Loader: Series 1300 loaders fill empty cassettes from 10 1/2 in pancakes or reels at a winding speed of 240in/s. Length of tape is controlled by a cue tone. An 'automatic cassette feed mechanism' (ACFM) is available as an add-on.

TAPE AUTOMATION (UK)

Tape Automation, Unit 2, River Way, Harlow, Essex. Phone: 0279-442946.

Automatic Cassette Loader: loads cassette tape automatically into C-Zero preleadered cassettes. Will handle pre-recorded or blank C-60, C-90 or C-120 tape wound on hubs or spools. Winding speed 480in/s servo-controlled with deceleration to terminal speed of 160in/s for cueing. Vacuum transfer splicer; preselectable digital programme counter and length counter; comprehensive alarm system; adjustable winding tension.

In-Cassette Duplicating System: dual capstan master playback machine with Papst motors and master tape automatic rewind. Record slaves designed to minimise the effects of cassette mechanics. Cassette take-up and feed spools independently driven. Constant tape tension controlled by dual capstan and pinch roller assembly. Cassettes rewind if required. Bias and frequency response adjustable for each track. Adjustable for any make or grade of ferric tape. 16/32 times duplication.

Loop-bin Cassette Duplication System: master playback machine of dual capstan, loop-bin design. Loop-bin of gravity drop type with vacuum and air pressure control. Dual capstan design slaves mounted vertically allowing use of hubs or reels. Electronics adjustable for ferric or chrome tapes.

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Paris 75020.
Telephone: 3613101

MILAN –
Contact: Idea Recordings
C.G.D.,
Via MF. Quintiliano 40,
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Studio Hamburg,
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Galway – Genesis – GTO
Records – Marvin Hamlisch
– Island Records – London
Philharmonic Orch. –
Barry Manilow – Robert
Palmer – Phonogram
Records – Polydor Records
– RCA Records – Rush –
Bruce Springsteen – Stiff
Records – Supertramp –
Ultravox – United Artists
Records – Virgin Records –
Rick Wakeman – John
Williams – Stevie Wonder –
Yes.



MOBILE ONE

Equipment includes • Two MCI 24 track tape recorders (each with full remote control) • MCI 36 in 36 out mixing console • Triad 16 by 4 auxillary console • EMT Digital Echo • Eventide Harmoniser • Eastlake monitoring with JBL Loudspeaker and Amcron amplifiers • UREI limiter compressors • UREI Parametric Equalizers • SMPTE code generator/reader.

product Tape duplication guide

Master plays 1/4 in, 1/2 or 1 in tape with 2-, 4- or 8-track replay to cassette. Duplicating ratio 32:1 with 16 and 64 systems available; speed slave 60in/s.

TAPEMATIC (Italy)

Tapematic, Via Unione 13, 1-20050 Mezzago, Milano, Phone: 039 69.23.59.
UK: Tape Marketing, 13 Elm Road, Faringdon, Oxon SN7 1EJ. Phone: 0367 20262. Telex: 858623.

TMD 470/630: automatic winder. Cueing from tape counter or cue tones. Magazine capacity of 40. production speed three to four cassettes/min.
TMD470: semi-automatic winder.

TMD 530: labelling machine. 1,500 cassettes/hr labelled on both sides in one operation, uses compressed air. Labelling uses solvent.
TMD 670: Boxing machine operating at 1,800 cassettes/hr if in line with TMD 530 labelling machine.

TELEFUNKEN (West Germany)

AEG Telefunken, Casella Post 47, Viale Brianze 20, 1-20092 Cinisello Balsamo. Phone: 02 242.78.12. Telex: 312455.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Phone: 02813 88447. Telex: 849469.

Telefunken manufacture a variety of masters and slaves for operation with 1/4 and 1/2 in master tapes to pancake or Stereo-8 cartridge tape slaves. Accessories are available for making master tape recordings on all 6.35mm master consoles. Complete systems include: **BK12** comprising **BKM12** master and **M123A** slave; **BK5** comprising **BKM5** master and **M123A** or **BKT3** slave; **BK15** comprising **BKM15** master and **M123A** or **BKT3** slave; and **BK16** comprising **BKM16** master and **M123A** or **BKT3** slave.

BKM12 Master: master console with two **M12** tape reproducers running at 60 or 120in/s on 1/4 in tape. 4-track master tapes for pancake slaves recorded at 7 1/2 in/s (16:1 duplicating ratio). Accepts up to four slaves, others can be added with an extra amp set per slave.

BKM5 Master: master console with two **M15** tape reproducers running at 60 or 120in/s on 1/4 in tape. 4-track master tapes for pancake slaves recorded at 3 1/4 in/s (32:1 duplicating ratio), or Stereo-8 slaves recorded at 3 1/4 or 7 1/2 in/s (16 or 32:1 duplicating ratios). Up to four slaves can be accommodated, plus others (see **BKM12**).

BKM15 Master: master console with two **M-15** tape reproducers running at 120 or 240in/s on 1/4 in tape. 4-track master tapes for pancake or Stereo-8 cart slaves recorded at 7 1/2 in/s (16 and 32:1 duplicating ratios). Up to four slaves can be accommodated, plus extras (see **BKM12**).

BKM16 Master: master console with two **M15** tape reproducers running at 120/240in/s on 1/4 or 1/2 in tape. 4-track master tapes (for both widths) for pancake slaves recorded at 7 1/2 in/s (32:1 duplicating ratio), and 8-track master tapes (1/2 in only) for Stereo-8 slaves recorded at 7 1/2 in/s (16 and 32:1 duplicating ratios). Up to four slaves can be accommodated, plus extras (see **BKM12**).

M123A Slave: slave console with three **M12** recorders for continuous pancake or continuous/intermittent Stereo-8 cart tape running at 30 or 60in/s (16 or 32:1 duplicating ratios). Pancake version is capable of production 135 C-40 cassettes/hr; Stereo-8 version 135 T-40 carts/hr.

BKT3 Slave: slave console with two **M12** recorders for continuous pancake or continuous/intermittent Stereo-8 tape running at 60 or 120in/s (32:1 duplicating ratio). Pancake versions capable of producing 270 C-40 cassettes/hr Stereo-8 version 240 T-40 carts/hr.

Tachos 12 Tape Winder: automatic tape winder for cassettes preloaded with leader tape. Unit accepts a maximum of 50 cassettes via a reloadable hopper, and winds tape at approx 1,200cm/s.

AKV8 Tape Splicer: automatic machine for 8-track cart cores.

AKM1 Automatic Loader: automatic loading machine for prerecorded cassettes.

WS8 Winder: high speed bobbin winding machine for Stereo-8 cart cores. Two spooling shafts.

TELEX (USA)

Telex Communications Inc, 9600 Aldrich Avenue south, Minneapolis, Minnesota 55420. Phone: (612) 884-4051. Telex: 297053.
UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA. Phone: 01-749 2201. Telex: 897749.

Model 235CS-1 System: reel to cassette duplicator. Master and slaves have 2-speed operation with each slave module containing three transports. Slaves expandable up to nine without electronics. Available in 1/2-track, 1/4-track and 4-channel simultaneous configurations.

Model 300: modular console-mounted system available in reel-to-reel, reel-to-cassette and cassette-to-cassette configurations, or in any combination. Basic units comprise: open-reel master transport; open-reel slave transport; cassette master transport; slave module containing three cassette transports; plus record amp and bias oscillator modules. Each console accepts two transports and up to five modules. 1/2-track, 2-channel, or 1/4-track 2- and 4-channel. Duplicating speed reel master 15 and 30in/s, reel slave 7 1/2 and 15in/s, cassette master and slave 7 1/2 and 15in/s.

Copier I, II, IV, V and Copyette 1+1: desk top, cassette copying system. **Copier I** and **IV** are master/slave units. **Copier II** and **V** add-on slaves containing two transports. Two slaves can be added to one master, the slaves depend on the master for power and operating control. **Copier IV** and **V** feature additional track-select facilities, and a bias select switch for ferric oxide or chromium dioxide tape. **Copyette 1+1** is similar to **I**, but less auto erase and add-on capability. **I** and **II** 1/2-track 4-channel. Duplicating speeds **I** and **II** 30in/s, **IV** and **V** over 20in/s.

Copyette 1 & 3: portable mono cassette-to-cassette copier, master and 3 slaves. Duplication ratio 16:1; speed 30in/s.

WOLLENSAK (USA)

3M Mincom Division, 3M Centre, St Paul, Minnesota 55101. Phone: (612) 736-9567. Telex: 297434.
UK: 3M UK Ltd, PO Box 1, Bracknell, Berks RG12 1JU. Phone: 0344 26726. Telex: 849371.

2770 ES: desk top cassette copying system comprising one master and two slaves. One or both tracks can be duplicated in a single pass. Manual or automatic recording level, plus adjustable bias. 1/2-track 2-channel mono. Duplicating ratio 13.3:1; speed 25in/s.

2780 ES: Add-on unit for 2770 comprising three slaves.

2780 ES/S: similar to 2780 ES but stereo.

2772AV: Desk top cassette copying system comprising one master and two slaves. 1/4-track 2-channel stereo. Duplicating ratio 13.3:1; speed 25in/s.

2770AV System: desk top cassette copying system comprising one master and two slaves. One or both tracks can be duplicated in a single pass. Manual or automatic recording level, plus adjustable bias. 1/2-track 2-channel mono. Duplicating ratio 13.3:1; speed 25in/s.

1780AV System: Add-on unit for 2770AV comprising three slaves.

6030/2760 System: modular system comprising 6030AV reel-to-reel master and 2760AV cassette slave(s). 1/2-track 2-channel. Duplicating ratio 13.3:1; speed master can be copied at either 7 1/2, 3 1/4 or 1 1/2 in/s.

2790AV: portable cassette to cassette duplicator with master and one slave in a brief case.

front stage width 0 to 180°, rear stage width 0 to 150°. All inputs and outputs are unbalanced.

product Ambisonics guide

This Guide is in two parts: the first section describes commercially available equipment for the professional market, while the second lists manufacturers who offer domestic decoding equipment. The latter are included as sources of domestic-type equipment which may be useful for reference purposes.

Professional equipment

ABACOID (UK)

Abacoid Ltd, 110 St Margarets Road, Hanwell, London W7 2HF. Phone: 01-840 2076.

Professional Ambisonic Decoder PAD 9211: this unit is the first of a range of professional ambisonic equipment. B-format input on 5-pin XLR-type socket wired to NRDC standard (E,X,W,Y,Z), 33Ω input impedance. UHJ 2-channel input on 3-pin XLRs, 21kΩ impedance line outputs (LF,RF,LB,RB) on 3-pin XLRs, 33Ω impedance. All inputs and outputs unbalanced. Power input 240V 50/60Hz, 120V optional. Controls are power on/off, standard layout control calibrated 0.5 to 2.0, forward preference control calibrated 0 (neutral) to 6 (arbitrary calibrations for reference), main mode switch (B-format/UHJ/stereo bypass/remote). 1U high rack-mounting unit. Options include remote control unit; other options (eg screwdriver preset controls) available to customer requirements. Signal and chassis grounds separate and may be linked via rear panel terminations.

AUDIO & DESIGN (UK)

Audio & Design (Recording) Ltd, 16 North Street, Reading, Berks RG1 4DA. Phone: 0734 53411.
USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310. Phone: (206) 275-5009.

UHJ Transcoder: this unit is the first of the **Ambisonic Mastering System (AMS)** range of professional ambisonic signal processing equipment. The unit offers both encode (B-format to UHJ 2-channel) and transcode (4-channel 'quad' pairwise mix to UHJ 2-channel) functions in a 1U rack-mount package. B-format input on 5-pin XLR (NRDC standard). Pairwise mix inputs (LF,RF,LB,RB) on 3-pin XLRs. UHJ 2-channel encoded output on 3-pin XLRs. Power input 240V; 120V option available internally. Controls include

CALREC (UK)

Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorks HX7 7DD. Phone: 0422 842159.
USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310. Phone: (206) 275-5009.

Soundfield Microphone CM 4050 model 3B: supplied with **CS5014/3** control unit. Offers facilities for with-height periphonic recording to NRDC ambisonic specifications, supplying a 4-channel B-format output. Control unit offers monitor decode facilities, mic position compensation controls etc, which may be used during or after the recording to effectively vary the mic position in three dimensions. These facilities are also available in stereo applications. Post-session mobility also reduces criticality of mic positioning, thus reducing rigging time and complexity. The B-format output, being fully to NRDC ambisonic specifications, is compatible between periphony (with height), planar surround, stereo and mono.

UHJ Encoder 5020: encodes 3- or 4-channel B-format signal to 2- or 3-channel UHJ for disc cutting, broadcasting or other applications. Inputs and outputs on XLR connectors. Only control is on/off switch. Selection of models: **5020/7** takes 3-channel (planar surround) B-format in, produces 2-channel UHJ output; **5020/6** accepts full 4-channel (periphonic) B-format and produces 2-channel UHJ; model **5020/5** accepts 3-channel B-format in and generates a 3-channel UHJ signal suitable for broadcast applications (where the third channel is transmitted via phase-quadrature modulation), and other applications where a compatible 3-channel UHJ signal is required.

Domestic decoder manufacturers

Audiotech Industries, PO Box 8756, Auckland, New Zealand. Phone: Auckland 587 386.

Boothroyd Stuart Ltd, 13 Clifton Road, Huntingdon, Cambs PE18 7EJ, UK. Phone: 0480 57339.

IMF Electronics Ltd, Westbourne Street, High Wycombe, Bucks, UK. Phone: 0494 35576.

Integrex Ltd, Portwood Industrial Estate, Church Gresley, Burton-on-Trent, Staffs DE11 9PT, UK. Phone: (0283) 215432.

Minim Audio Ltd, Lent Rise Road, Burnham, Slough, Bucks SL1 7NY, UK. Phone: 06286 63724.

NAD, 683 High Road, North Finchley, London N12, UK. Phone: 01-446 3199.

Further information on ambisonics may be obtained from the NRDC Ambisonic Advisory Service, PO Box 98, High Wycombe, Bucks, UK. Phone: (0494) 445951, including data on how manufacturers may become ambisonic licensees.

It will discourage most eloquent music.

(William Shakespeare 1564-1616)

Our considerable experience in the field of equalisation coupled with a philosophy of continual research and development has enabled the realisation of a range of high quality Graphic Equalisers which have become standard tools for correcting room acoustics and offer the solution to tricky equalisation problems.

The latest Klark-Teknik equalisers incorporate scale switching which facilitates a fine resolution for small adjustments and yet retains full boost and cut when required. Construction is to the highest standard using selected components and all units are rigorously bench-tested and aligned before a burn-in period and final music test.

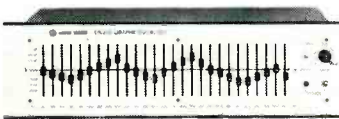
DN22 GRAPHIC EQUALISER



The DN22 is a dual-channel Graphic Equaliser, each channel having 11 filters providing up to 12dB boost or cut at 11 centre frequencies, covering the entire audio spectrum. Separate low and high pass filters are provided on each channel giving 12dB per octave attenuation above and below their respective turnover frequencies.

The DN22 offers an extremely wide dynamic range and negligible channel-to-channel crosstalk.

DN27A GRAPHIC EQUALISER



The DN27A is the successor to the widely acclaimed DN27. It is a 1/3rd Octave Graphic Equaliser, providing boost or cut of up to 12dB at 27 I.S.O. centre frequencies covering the entire audio spectrum.

The equaliser filters are of computer-aided design and consist of actively-coupled L.C. networks of the 'minimum phase' type. The inductors have precision-ground ferrite cores and coils wound to extremely tight tolerances.

DN30/30 GRAPHIC EQUALISER



The DN30/30 Stereo Graphic Equaliser represents a breakthrough in equaliser design, giving two channels of full 1/3rd octave equalisation in one compact unit. In addition to saving on rack space the DN30/30 also means a considerable financial saving for anyone requiring stereo system equalisation.

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



KLARK TEKNIK
sound science

product Disc cutting equipment guide

ALLIED RECORDING (USA)

Allied Recording Company, 3232 Green Point Avenue, Long Island City, NY 11101. Phone: (212) 784-2318.

UK: Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH. Phone: (22) 48666.

Range of disc recording blanks. 7in to 14in available.

AMPEX (USA)

Ampex Corp, 401 Broadway, Redwood City, Cal 94063. Phone: (415) 367-2011. Telex: 348464.

UK: Ampex Great Britain Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 85200. Telex: 848346.

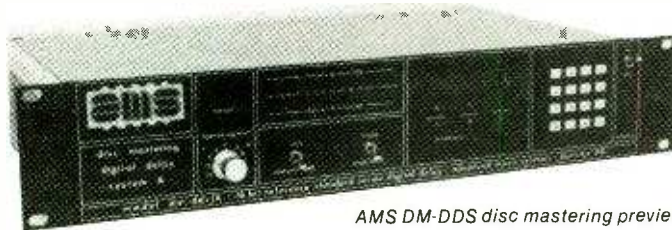
ADD-1: 2-channel digital delay unit allowing a standard tape recorder to be used as a mastering machine. Delay time can be preset up to 5.12s in 5ms increments, while the digital delay uses 16 bits for 90dB dynamic range with sampling frequencies of 25k, 50k or 100kHz. Unit compatible with half-speed cutting.

½ in ATR-100 Mastering Headblock: headblock to fit standard ATR-100 2-track recorder but operating on a ½ in head, 2-track standard. Intended for use with ADD-1.

AMS (UK)

Advanced Music Systems, 1-3 Wallstreams Lane, Worshtorne Village, Nr. Burnley, Lancs. Phone: 0282 36943. Telex: 63108.

USA: Quintek Distributors Inc, 4721 Laurel Canyon Blvd, Suite 209, North Hollywood, Cal 91607. Phone: (213) 980-5717. Telex: 194871.



AMS DM-DDS disc mastering preview delay line

DM-DDS: stereo disc mastering DDL, max delay 1-6s expandable to 10s. Two different bandwidth versions available. 10Hz to 24kHz, or 10Hz to 27kHz.

AUDIODISC (USA)

Capitol Magnetic Products, 1750 N Vine Street, Hollywood, Cal 90028. Phone: (213) 462-6252.

UK: Thorn-EMI Tape Ltd, Alma Road, Windsor, Berks SL4 3JA. Phone: Windsor (07535) 59171.

Master and reference lacquer discs.

CAPPS (USA)

Capps & Co Inc, 20 Addison Place, Valley Stream, NY 11580. Phone: (516) 825-4413.

UK: Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH. Phone: (22) 48666.

Vari-Depth Computer: offers 30dB vertical gain. 15dB lateral, 150ms attack time, 400ms decay. Modes include manual deepen and auto deepen (lateral/vertical).

Vari-Pitch Computer: offers 50 to 1,000 grooves/in (variable or fixed pitch) at 78, 45, 33½ and 16RPM. Also produce cutting styli.

COUNTY RECORDING (UK)

County Recording Service, London Road, Binfield, Bracknell, Berks. Phone: 0344 54935.

Produce disc cutting systems minus the lathe, incorporating the ME76UK cutterhead. Drive amp is the Quad 405, own control desk. Also produce cutting styli.



New JVC model CH-90 cutterhead

CYBERSONICS (USA)

Cybersonics, 11128 Weddington Street, North Hollywood, Cal 91601. Phone: (213) 766-7104.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 286668.

Disc Master 2002: compact electronically controlled cutting lathe. Features include direct drive turntable, digital display of speed, *CompuDrive* system with variable delay, updatable pitch and depth per revolution, and automatic control capability.

RIAA pre-emphasis, feedback and cutter protection systems — and a cutter amplifier.

JVC also produce a quartz locked DC lathe motor with speeds of 33½ and 45 RPM.

3M MINCOM (USA)

3M Mincom Division, 3M Centre, St Paul, Minnesota 55101. Phone: (612) 736-9567. Telex: 297434.

UK: 3M UK Ltd, PO Box 1, Bracknell, Berks RG12 1JU. Phone: 0344 26726. Telex: 849371.

Digital Mastering System: standard 3M 4-track digital recorder fitted with preview head for directly driving lathes.

MCI (USA)

MCI Inc, 1400 W Commercial Blvd, Fort Lauderdale, Florida 33309. Phone: (305) 491-0825. Telex: 514362.

UK: MCI (Professional Studio Equipment) Ltd, MCI House, 54-56 Stanhope Street, London NW1 3EX. Phone: 01-388 7867. Telex: 261116.

JH-110M: mastering recorder for disc cutting. Accepts 14in spools. 3-speeds (7½, 15, 30in/s). DIN or NAB head assemblies, variable delay time (0.5, 0.6 or 1 revolution), incorporates RTZIII-M return-to-zero, plus 24 memories.

MSR (UK)

MSR Electronics Ltd, Meeting House Lane, Balsall Common, Coventry, Warwicks. Phone: 0676 32468.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Conn 06801. Phone: (203) 744-6230. Telex: 969638.

MSR 2000: DC servo controlled lathe. Pitch drive range 50 to 1,000 grooves/in with optimised pitch and depth control. Microscope with video monitoring fitted. Complete systems available.

NEUMANN (West Germany)

Georg Neumann GmbH, Charlottenstrasse 3, D-1000 Berlin 61. Phone: 030 251-4091. Telex: 184595.

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

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

VMS80: computer controlled lathe with direct drive, crystal locked turntable on a neoprene cushioned lathe bed. Microscope may be optionally fitted with a video monitor system.

SAL74: drive system for the SX74 including PSU 2-channel amps, limiter, and tracing simulator.

SX74: stereo cutterhead for the SAL 74. Response 7Hz to 25kHz (±0.5dB 15Hz to 16kHz); 35dB channel separation.

DIGITAL SYSTEMS (UK)

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 286668.

PCM Preview Unit: 16-bit digital audio preview unit designed to interface with either the Sony 1600 or 1610 digital audio recording systems. Delay time presettable with automatic switching between 33½ and 45 RPM.

FAIRCHILD (USA)

Fairchild Sound Equipment Corp, 75 Austin Boulevard, Commack, Long Island, NY 11725. Phone: (516) 543-5200.

Range of cutter heads.

JVC/ADAMANT (USA)

JVC Cutting Center Inc, RCA Building, Suite 500, 6363 Sunset Boulevard, Hollywood, Cal 90028. Phone: (213) 467-1166.

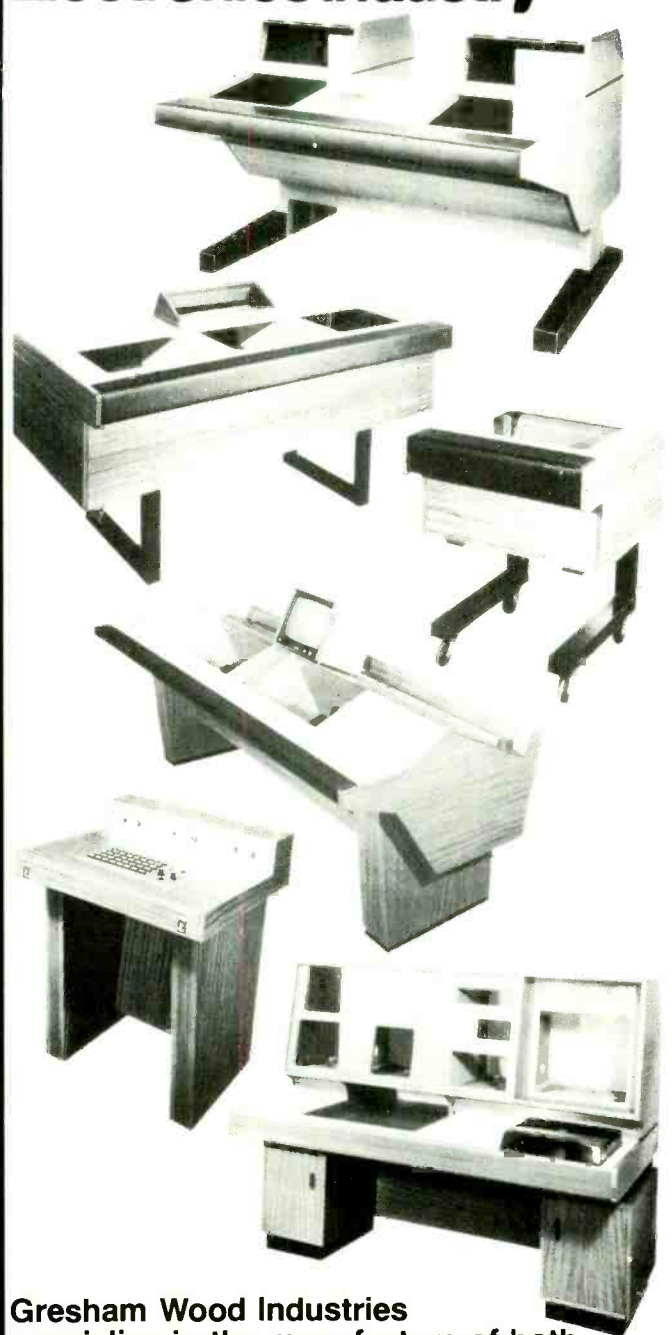
JVC/Adamant: recording styli for disc cutting. Diamond cutting styli only available on a lease basis.



JVC 355: 14 in diameter master lacquer discs.
JVC CH-90: 'isosceles T-bar' design stereo cutterhead with helium coding system. Response 5Hz to 25kHz (±0.5dB, 10Hz to 18kHz); 35dB channel separation.

JVC CA-90: cutter drive system for the CH-90. Comprises two sections—front-end section with

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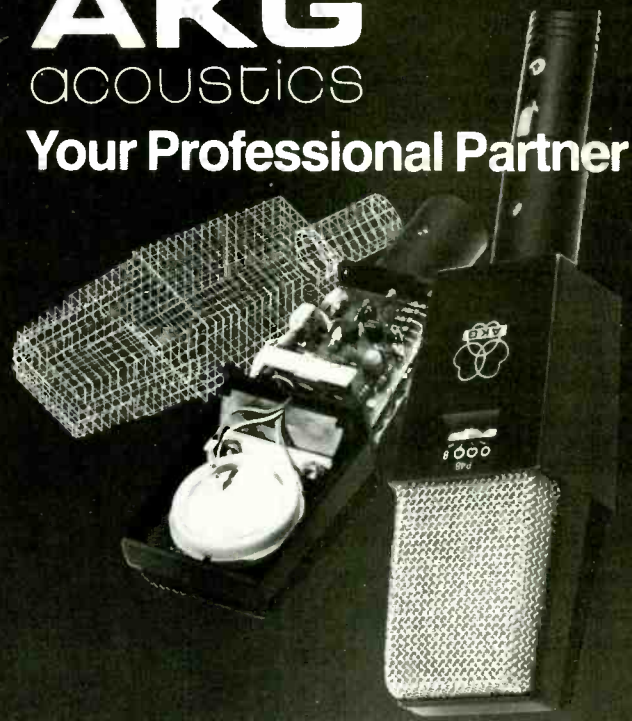
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ADV 297/16/E

product Disc cutting equipment guide

SX80CM: stereo cutterhead suitable for use with the Teldec *Direct Metal Mastering* system.

SP79 Cutting Console: console with adjustable EQ and level. Various configurations available including Dolby-A, Orban parametric EQ, Neumann U473 limiters, PPM, VU and phase metering.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts, SG8 6AU. Phone: 0763 60776. Telex: 81381.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801. Phone: (203) 744-6230. Telex: 969638.

9202 DDM: digital disc mastering console, accepting and providing digital or analogue inputs and outputs, allowing it to be used for conventional analogue disc cutting or as a tape-to-disc transfer console for digital discs. Features digital signal processing with integral delay facility and total memory capability. Full dynamic range control facilities and EQ can be incorporated in each signal path and these processors may be switched before or after the delay circuit. Delay is variable up to a maximum of 1.33s at 48kHz (1.45s at 44.1kHz) and can be extended to 2.66s max (48kHz) or 2.9s max (44.1kHz) if required. Other features include 4-band EQ with memorised control settings and automated motor driven faders; plus software implemented console self testing facilities. All signal processing circuits are housed in a 19in rack-mount cabinet, while the modular building block approach enables the control desk to be configured for ease of layout.

ORTOFON (Denmark)

Ortofon Manufacturing A/S, 11B Mosedalvej, DK-2500 Copenhagen-Valby. Phone: 01 46.24.22. Telex: 27587.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

USA: Cybersonics, 11128 Weddington Street, North Hollywood, Cal 91601. Phone: (213) 766-7104.

DSS731: cutterhead for the GO741 providing motional feedback to amp. Vertical cutting angle 15° (optional 20°), response 5Hz to 25kHz. DSS731 suitable for half-speed cutting of 4-channel discrete recordings.

new

DSS821: stereo cutterhead for the GO741. Replaces the DSS732. Offers 11mV cm/s output from feedback coil; max excursion 250µm peak-to-peak; frequency range 5Hz to 25kHz; vertical cutting angle 15° (optional 20°).

GO741/GE741: pair of amps plus PSU for DSS 731/821. Provide HF EQ, summing of motional feedback input, power output 500W at 20kHz into impedance matching circuit.

CPS741: 4-channel correction amplifier accepting two programme and two preview channels. Features phase reversal, EQ monitor controls, automatic control from cutting equipment.

STL732 Regulated Filter: 2-channel treble limiter, variable attack (0.3 to 100ms) and release (3ms to 1s), control threshold selectable.

SM721: stereoscopic microscope allowing cutting styli and fixture to be examined either from the tip or in its length direction.

PYRAL (France)

Pyral SA, 47 rue de L'Echat, F-94001 Creteil, France. Phone: (1) 207.48.90. Telex: 23742.

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

Disc recording blanks.

SCULLY (USA)

L J Scully Manufacturing Co, 128 Hurd Avenue, Bridgeport, Connecticut 06604. Phone: (203) 368-2332.

UK: Identification Ltd, Stratden House, 38 Heath Road, Helpstow, Peterborough PE6 7EG. Phone: 0733 253075. Telex: 32225.

Model LS76 'The Lathe': electronically controlled lathe with remote control of most functions. Features microscope, tone arm, pitch/depth controls, pitch drive range 95 to 600 grooves/in continuously variable.

Auto/Master: automated console using static and floppy disc memory to store level EQ, and corrective actions. Interfaces to both Neumann and Scully lathes.

SONTEC (USA)

Sontec Corp, 10120 Marble Court, Cockeysville, Maryland 21030. Phone: (301) 628-2283.

MES-430B: 4-channel, 3-band shelving parametric disc mastering equaliser with switchable Q, ±12dB range, 24 frequencies selectable per band.

DRC-400: disc mastering comp/limiter. Accessories include Allison 65K interface for automatic dynamic range control, an expander and variable frequency limiter.

CD-80 Compudisk: micro-processor based lathe control system retrofitable to Neumann and Scully lathes. Offers increased groove density and the capability to selectively over cut.

STUDER (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105, Regensdorf. Phone: 01 840.29.60. Telex: 58489.

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

USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tennessee 37203. Phone: (615) 329-9576. Telex: 554453.

A80/VU Preview: special model of A80 master tape recorder with preview head; accepts 12in spools.

TECHNICS (Japan)

UK: National Panasonic (UK) Ltd, 300-318 Bath Road, Slough SL1 6JB. Phone: 0753 34522. Telex: 847652.

USA: Panasonic Professional Audio Division, 1 Panasonic Way, Secaucus, New Jersey 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

SP-02: direct drive motor and drive electronics for a disc cutting turntable, plug-in compatible with Neumann lathes.

TELDEC (West Germany)

Teldec Schallplatten GmbH, D-2000 Hamburg 19, Heussweg 25.

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

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

new

Direct Metal Mastering: system using a copper recording blank on a stainless steel substrate, which is directly cut allowing the original to be used as the mother in the plating process. System uses the Neumann SX80CM stereo cutterhead with a diamond cutting stylus with no burnishing facets and a face angle >90°. Head is driven by Neumann SAL74B drive amps. System offers improved background noise; improved transient reproduction; elimination of lacquer springback; elimination of pre- and post-groove echo; and the possibility of longer playing times with lathes such as the Neumann VMS80 which incorporate computerised pitch control methods.

TRANSCO (USA)

Transco Products International, 875 Merrick Avenue, Westbury, NY 11590. Phone: (516) 333-2000.

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

Disc recording blanks.

WESTREX (USA)

Westrex, 2629 West Olive Avenue, Burbank, Cal 91505. Phone: (213) 846-3394. Telex: 698254.

UK: Westrex Co Ltd, Bilton Fairway Estate, Long Drive, Greenford, Middx. Phone: 01-578 0957. Telex: 923003.

RA1700 System: comprises RA1701 A/B equipment shelves and panels; two RA1703 input amps; two 98609 and 98610 EQ units; two RA1704 feedback/monitor amps; two RA1706 power amps; and RA1705 PSU. Other units in the series include RA1702A power drive amps and the RA1716 crystal controlled DC servo turntable drive for Scully lathes.

3D2AH: stereo cutterhead with phase and impedance correction networks.

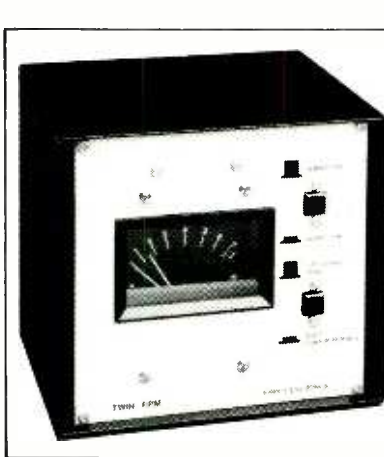
RA1706: HF limiter reduction amplifier with presettable level.

Diskmaster Systems: System I includes cutter system, Scully lathe, and console. System II includes cutter system, rack cabinet, and automated rebuilt Scully lathe with Westrex DC servo drive motor. System III as System II but with console.

ZUMA (USA)

Zuma Audio Inc, 4150 W Gelding Drive, Phoenix, Arizona 85023. Phone: (602) 938-8347.

Disc Mastering Computer System: microprocessor based digital system usable with Neumann VMS-70 and VMS-66 lathes. Features 'Constant Land' and 'Groove Nestling' programs. Optional colour VDU display incorporating floppy disk for data storage and retrieval.



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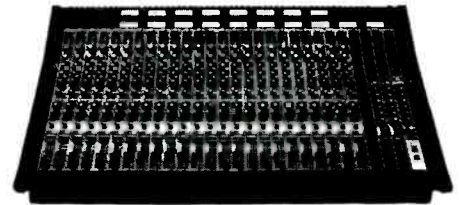
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Making tapes for disc

Ted Fletcher

DISC cutting is the transfer of sound waveforms from a master recording on to a plasticised acetate disc via a cutting stylus. Forgetting stereo for a moment, the signal is fed into a power amplifier which drives into a coil or series of coils in the cutterhead. The magnetic flux created within the coil causes lateral displacement of the stylus holder so that the device works precisely like a record player in reverse.

Stereo disc cutting is performed in exactly the same manner except that the stereo cutterhead has two sets of coils at 90° to each other. This allows the left-hand channel to be recorded on the outer wall of the groove and the right hand channel on the inner. When the same signal is applied to each coil, the movement of the cutting stylus is lateral. When the phase of one side is reversed the movement is vertical.

The cutting stylus itself is made of synthetic sapphire and is produced from a rod blank by precision grinding with diamond laps on wood formers.

During the cutting process, the stylus is heated by a tiny heater coil wound round it; this is to produce a better finish on the cut groove and so reduce random noise generated by the cutting process.

Limitations of disc cutting

Although the mass of the stylus assembly in the cutterhead is

John Martin of County Recording Services, has been involved in disc cutting and pressing for years. Originally a watch and clockmaker, he used his precision engineering knowledge to good advantage in the design and manufacture of stereo disc cutting heads. In an attempt to reduce the number of uncuttable master tapes that he receives he suggested that I might like to put together a few words on stereo phase and disc cutting.

designed to be as low as possible, because of this mass, considerable energy has to be fed to the coils to make it move precisely in proportion to the audio input to the amplifier. Recording tape can respond extremely quickly to transients, but the cutterhead has difficulty. Even if extreme

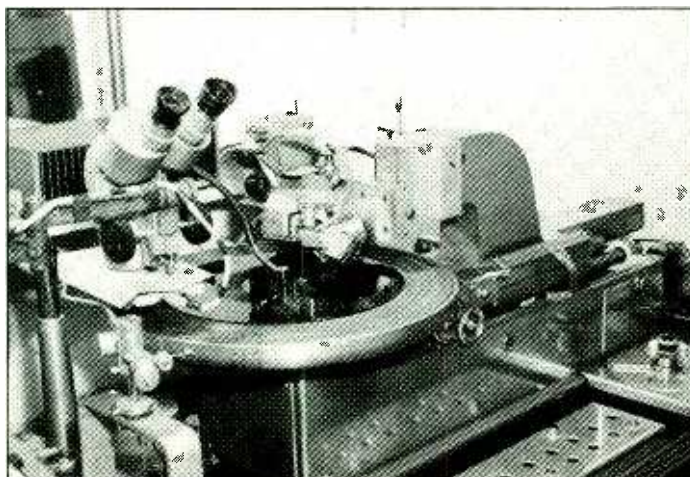
transients could be cut on to the record, the playback stylus could not follow grooves perpendicular to the line of travel! This means that there is a limit to the transient response on disc.

In order to ease the difficulty of cutterhead design, the standard equalisation curve used for disc

cutting and reproduction allows for constant acceleration of the cutting stylus regardless of frequency within the audio passband. The effect of this is that for higher frequencies, the stylus is moving quickly, therefore the amount of movement is small, at low frequencies the stylus is moving slowly and the grooves deviate much more from the centre line. This can be seen quite plainly when a record is viewed under a magnifying glass. Extreme bass frequency excursions on a record can cause the grooves to plough through into a previously recorded groove in spite of automatic groove spacing compensation; therefore, there is a limit to the dynamics and level of bass frequencies.

The most serious limitation (if one can call it that!) is difficulty with low frequency phase in stereo cutting. Out-of-phase signals cause vertical stylus movement—at high frequencies this is not particularly important as the groove deviation is small. However at low frequencies, severe out-of-phase components can cause the cutting stylus to either dig into the base aluminium of the master lacquer or leave the surface completely—no groove! Stylus tracking is also affected adversely by bass frequencies recorded at extremes of the stereo image.

These problems are most commonly overcome by the use of the 'Elliptical Equaliser'. This



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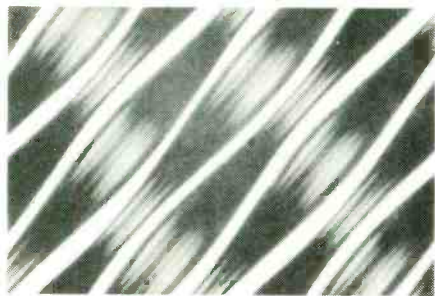


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Making tapes for disc

bunch of electronics is frequency sensitive and has the effect of mixing left channel and right channel in a progressively greater way with reducing frequency. In practice this is quite acceptable as very little directional information is contained at low frequencies.

Although not strictly a limitation, level control during disc cutting is more critical than in tape recording. A few decibels here and there on tape is hardly disastrous, while on disc, over-deviation of the cutter stylus leads to a rapid increase in distortion, the possibility of groove breakthrough, and a tendency for a less-than-perfect disc player to exhibit 'skating'.

Cutters are generally fitted with excellent limiters and compressors, but all good cutting engineers would rather capture the original recorded sound and not have the limiters blinking at them.

Dynamic range has not been mentioned as a limitation. Pop music by its very nature has low dynamic range in order to achieve easy listening on a wide range of reproduction equipment. The dynamic range of disc reproduction

is lower than the best noise-reduced tape, but not by a significant amount.

The last serious limitation is

time. Quite simply, the shorter the piece, the easier it is to cut. Budget albums can be very difficult.

outputs at all times and watch it. Occasional negative bursts are OK, but look out for rhythmic negatives, they could indicate an out-of-phase microphone and may cause the nightmare of all cutting engineers—LF phase difference. A more exact measure of phase can be gained by using a sum and difference meter (standard in the BBC and many ILR stations). This is a stereo PPM with one needle reading the mono combined signal and the other reading left minus right. If the difference needle stays above the sum needle for more than an instant you have real problems!

When you are sure that phase is OK, listen to the whole thing in mono—does it still sound all right?

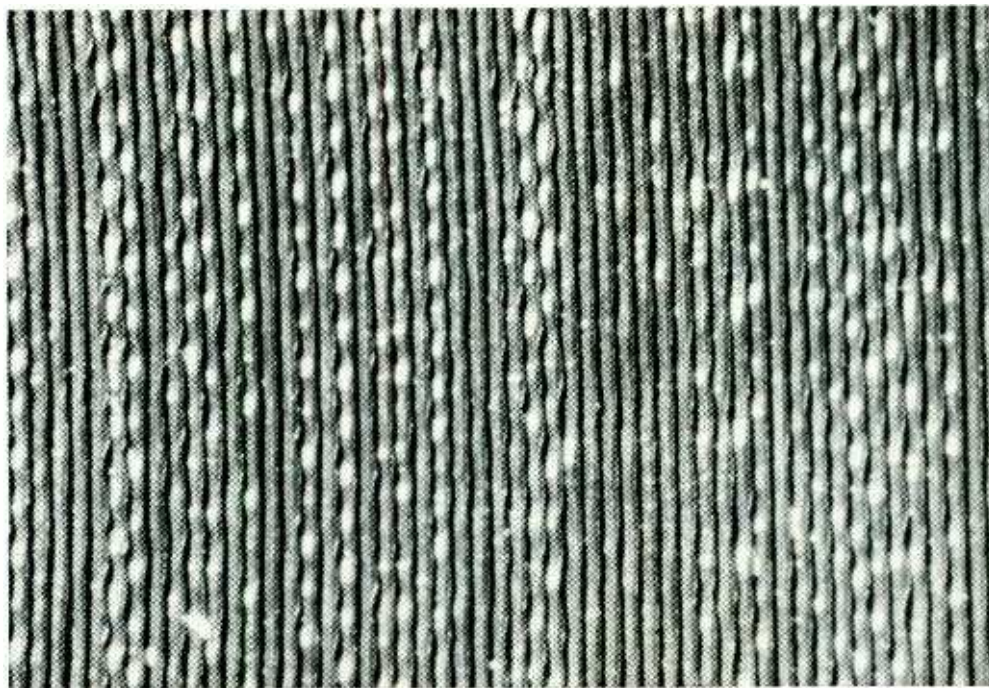
A further thought on phase; was the stereo master tape recorded on one machine? If not, it is advisable to listen carefully to the extreme high frequencies looking for any azimuth errors in the record heads. Once the tracks are committed to master lacquer, it is too late.

Editing

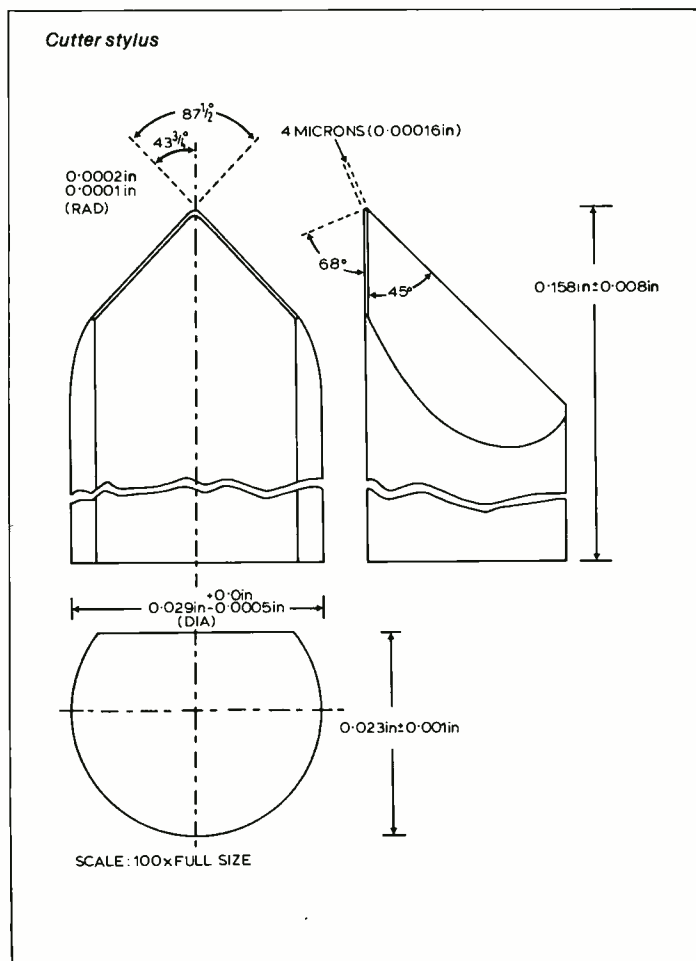
When 'topping and tailing' a master, make sure that the leader used is opaque and non-static. Occasionally crackles are induced in the cut from the leader.

Check the quality of the joins—a tape falling apart just before band 5 on an album can cause cardiac arrest in the cutting room.

Many thanks to John Martin for his prompt and detailed information on his latest cutterhead. May his bass stay in phase!



Out-of-phase bass



Preparation of a master tape

After the final recording or reduction session, when everyone has congratulated everyone else on the incredible sound, it is essential to look at the master tape and ask the question how is it going to cut?

Noise

Disc cutting does nothing to hide background noise—it can accentuate it by making tape hiss obvious after a leader. *[A common practice is to use blank—but recorded—tape instead of leader to minimise this effect—Ed.]*

Level

Did you check the levels through the reduction, on PPMs? For disc cutting they don't tell the whole story but they are still worth a careful of VUs. Peak levels should not deviate by more than a couple of decibels—any severe transients should be limited or clipped out. If you don't do it, the cutting engineer will and he might not be so sympathetic! Make notes for the engineer; if there are any heavy passages after long, quiet intros, you may find that they will come out severely squashed. Album tracks must be recorded at the same subjective level.

Phase

If you have a phase correlation meter, leave it connected across the

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Studiofile:1

Heubi's Mobile Recording Truck

With the increase of mobile recording studios over the past years it would be surprising if a country even as small as Switzerland did not possess one. At present the only 24-track mobile in the country, Heubi's (pronounced Hoybee) Mobile Recording Truck has been in service since the end of 1980, and already has a long list of diversified productions behind it, ranging from new wave and punk to jazz festivals and organ recitals in village churches.

The idea for the mobile arose in conjunction with the work of the parent company, Audiocom, in providing sound systems for various concerts and events where clients wanted recordings made, and the studio was launched towards the end of 1980. The philosophy behind mobile recording as preached by Audiocom is 1) the possibility of capturing live concerts on tape, 2) recording situations where a static studio is not possible – well, you can't really lug a 17th century pipe organ into a studio, can you! – and 3) to give clients the opportunity of recording where they like, when they like. The latter situation often gives rise to experimentation, and thus having to meet challenges not usually found in the studio. Examples include a group playing in the garden for that 'wide-open' sound (the sun was out, too), or a singer in the bathroom. The possibilities are endless. Though this sort of situation can appear rather comical and not very serious, the results obtained are often just what is required and that is what counts.

The mobile itself is based on a Toyota chassis, and with custom coachwork, total weight is just over the five tons. Interior dimensions of the truck are 18ft by 7ft 3in wide and 6ft 9in high. A bit small by studio standards but by no means cramped, as I found out when doing a rock festival for half the night. Perhaps the ergonomic chair helps. Proper ventilation has been installed. The acoustic treatment consists mainly of thick carpet over perforated hardboard, though a recent addition has been the installation of Sonex panels around the mixer and monitors. This has done a lot in cleaning up the early reflections from the desk and near walls, and allows the acoustics of the recording location to come through better. Originally a Soundcraft 1624, the mixer was changed at the beginning of the year for a Series 2400, though Soundcraft were obliged to make a 26 input custom version without the wood side panels in order to fit it into the truck! Audiocom boss Peter Heuberger (known as Heubi) is very pleased with the increased flexibility the 2400 gives over the 1624. Recorders in the mobile are

Otari MTR-90 24-track and Studer B67 and PR99 for mastering and copying. Cassettes are available from a rack mounted Sony and whatever else happens to be lying around. Monitors are JBL 4333s powered by a Harman Kardon Citation with desk mounted Auratones powered by a Quad 405. Though White third octave equalisers are used for final tweaking on the monitors, the natural frequency response has improved immensely with the latest modifications, with the 3dB down point being at 40Hz, not a bad response for a small space.

Ancillary equipment is also well in evidence and is mounted on a bridge over the console; simultaneously discreet and convenient. Since live recording is more prone to the unexpected than studio work, Audiocom have quite a selection of gain reduction equipment on hand, with 6 Scamp SO1 compressors, two UREI 1176 limiters as well as a Dual 1178 and an Audio and Design Express limiter. There are also thirteen channels of Scamp noise gates, these being a mixture of F300s and Dual gates. In order to facilitate faster working and avoid situations where one can be caught with one's 'trousers down' (or channels up?), the compressors are normalised through to the first 12 channels of the desk. Otherwise, they can be patched into channels in the normal way via the patchfield. Special effects apart from gain reduction are available in the form of two Eventide DDLs and Instant Flanger/Phaser, Lexicon Prime Time, various Scamp modules such as the S24, Ursa Major Space Station and reverberation courtesy of an Ecoplate 2 and two Master Room units. For those clients who require noise reduction 6 channels of A361 Dolby units are available and the studio is at present looking into the possibility of installing noise reduction for all 24 tracks. Other toys are available upon request, such as the EXR Exciter.

Connection to the outside world – apart from the power – is via Amphenol G multipins mounted in a



hood underneath the cabin roof, thus making it an 'all weather fighter', with feeds coming from 38 microphone lines and 19 tielines. The usual communications are also available – RTS Systems – plus a video link so that the engineer can see where the action is. Another useful little gadget is the Pioneer test set that is mounted over the console and that serves as a phase meter or oscilloscope readout, amongst other things.

A full selection of microphones are available – Schoeps, Neumann, Calrec, Electro-Voice, Sennheiser *et al* – including four U67s for the nostalgic. Audiocom have also been using PZM microphones and techniques from when they were first available and now have considerable experience in this field. Typical uses include ambience mics. at concerts or recordings where the acoustic of the *lieu* is equally important, such as organ music, chorales, etc. For those occasions where recording is done directly in stereo there is also the possibility of bringing in a JVC digital two track machine.

Because Audiocom can offer the combined services of PA and multi-track recording they are often in demand for events such as jazz festivals and are already regulars at Willisau and Zurich. For these situations it is common for the studio to do

a simultaneous monitor mix for radio broadcasting. The mobile is also prepared for interfacing with a video facility, such as a TV OB van, having a timecode generator for future synchronisation during post-production.

As well as recording, the mobile is often used for mixdowns. To this end a small overdub room has been installed in the Heuberger home at Kerzers where the mobile is based. In this way any modifications or additions that may be found necessary during mixdown can be quickly applied without having the agony of setting up a 'studio'.

Looking to the future, the big question is whether other mobiles now in preparation in Switzerland will saturate an already small market and make things difficult for everybody. The development of local radio is one area that could be to the common good as well as promoting a more active home music business. The signs are there but as always it is a question of wait and see. However, with 15 LPs in 1981 plus various 'live' productions behind it, Heubi's Mobile Recording Truck should still find itself well in the forefront.

Terry Nelson

Heubi's Mobile Recording Truck, Audiocom AG, CH-3210 Kerzers, Switzerland. Phone: (31) 95.57.42.

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Studiofile:2

Trident direct cut

Saturday April 17, 1982, saw history repeat itself after a gap of some 4½ years, when Trident Studios, London hosted a direct-to-disc recording session with UK band Nuclear Socketts. Readers with a lengthy memory may recall that in our February 1978 issue Mel Lambert reported on the first direct-to-disc recording made in the UK, when Trident cut the Warsaw Pakt 'Needletime' album on November 27, 1977. This album has achieved a certain repute amongst direct cut aficionados and its raunchy sound has received much acclaim.

Although Trident were involved in an abortive direct-to-disc recording of a jazz ensemble in the intervening period, the Nuclear Socketts session marked a welcome return to the direct-to-disc technique. Coincidentally, cutting engineer Ray Staff had assisted John Dent on the Warsaw Pakt session, hence maintaining historical continuity. Similarly, much of the equipment used on the latest session remained unchanged from the previous line-up.

Agenda for the latest session, which involved the production of both 7in and 12in singles of the same material, called for an early start with mic set-up and preliminary balancing and sound processing taking up the morning and early afternoon. By mid-afternoon, rough cuts of the B side were attempted with no difficulties being encountered, and after a quick playback everyone concerned including the band, producer Anthony Pringle, and sound engineer Colin Green was satisfied that they could get down to the nitty gritty task of cutting the four singles.

Actual disc cutting kicked off with the 7in version of the B side comprising two numbers *Trees and Flowers* and *I'm Alive*. The A side comprising a single number *Pretender's Zeal*. Both sides last about 3½ to 4min.

The actual mechanics of the session were relatively straightforward, with the tasks of engineer Colin Green and cutting engineer Ray Staff being considerably eased by the fact that producer Anthony Pringle had ensured that the band were extremely well rehearsed. Over the numerous run-throughs which the band did prior to cutting, remarkable continuity of timings, vocals and ensemble were achieved. Thus, the only potential problems were in the sound balance, miking and peak cutting levels. In the event none of these caused any major hang-ups with the result that the session went extremely smoothly.

Procedure for mixing down the session on Trident's Triad Series A 28-in 48-out console was unexcept-

ional. Colin Green providing Ray Staff with a straightforward stereo feed from the console. At the console itself Colin subgrouped the drums and bass, and basically gave Ray a direct feed with the minimum of EQ and ancillary processing. The results heard over the control room's JBL 4350 monitors being very clean, but retaining the band's somewhat 'rough and ready' rock sound, a good indication of the quality of the mix being given by the retention of the sound perspective even over the console mounted *Auratones*.

Turning to the line-up in the studio,

the Nuclear Socketts consist of a lead vocalist, drummer, bass guitarist and lead guitarist. Within the studio acoustic isolation was aided by the use of the popular Audio Kinetics acoustic screens. However, there were few problems in this respect. With regard to miking and the use of ancillary processing equipment, the configuration was as follows. The drum kit had an AKG D25 on bass, AKG C414 on snare, Shure SM57s on toms, Neumann U84 on hi-hat, plus a stereo Schoeps overhead, with a further two Schoeps mics for ambi-

ence. Turning to the bass guitar this was DI'd with in addition a Neumann U87 picking up the bass combo. Ancillary processing on the bass consisted of a Roland *Dimension D* chorus effect unit. Colin had no difficulty in picking up enough level from the lead guitar so in this instance he followed his usual practice of miking the combo, in this case using an AKG C12. Ancillary processing for the lead guitar consisted of an AMS DMX 15-80 digital delay line with pitch changer. Finally, Colin had a Neumann U47 on the lead vocalist with Electro-Voice RE20s for backing vocals. As I think is clear, Colin didn't use anything spectacular and worked to produce a relatively clean and simple mix with the minimum of sound tinkering.

Moving up several floors to Ray Staff's domain in the cutting room, this is equipped with a Neumann VM566 lathe with SX74 cutterhead and VG74 drive amps. The console is a custom desk of about seven year vintage. As might be expected a wide range of ancillary units are available here including an AMS DM-DDS disc mastering digital delay preview unit; Pultec EQP-1A3, 360 Systems and Court Acoustics EQ; modified Triad EQ units with mic/line switching; UREI 556 bandpass filters; and Audio & Design Express limiters and the company's *Transdynamic* processor. Despite this plethora of goodies the only unit actually used for the direct cut was the AMS giving a varigr groove facility. The straight feed Colin was sending Ray caused absolutely no problems at all — the maximum peak cutting level being about 14cm/s, approximating to about +12dB on the DM-DDS's speak LED display.

Whilst Ray was perfectly happy with the way the cuts were progressing, not surprisingly he was taking no chances. Accordingly, he also recorded stereo copy tapes as a reference and to cover for any unforeseen modifications which might need to be made to the cuts. For this purpose an Ampex ATR100 ¼in tape machine was used with BASF SPR50LHR tape running at 15in/s without Dolby.

Monitoring of the copy tape and playback of a couple of test cuts over the cutting room's JBL 4343 monitors confirmed that all was well. There upon the session rapidly proceeded with the actual task of getting through the four cuts. The end result can be judged on the Subversive label (catalogue number SUB 006/7 for the 7in version or SUB 006/12 for the 12in cut) which I'll leave to speak for itself, for those who fancy hearing the final product.

Noel Bell

Trident Recording Studios, 17 St Anne's Court, Wardour Street, London W1. Phone: 01-734 9901. ■



Reelsound mobile

Reelsound's mobile unit, operating from just outside Austin, Texas, is contained in a 1948 road bus. From inside this unprepossessing unit two golden albums, one of which went platinum, have emerged: Ted Nugent's *Double Live Gonzo* and Frankie Beverly and Maze *Live in New Orleans*.

Malcolm Harper, the owner, created Reelsound in 1969 after having worked with a small remote company during his college days. He has enjoyed the privilege of recording such artists as Earth, Wind and Fire, Christopher Cross, Quarterflash, Dottie West, Carol King, Tommy Tutone, Genesis, Taste of Honey, Journey, Joe Ely, Dwight Twilley, and Charlie Daniels Band to name a few.

The black metallic 6-wheeler road bus houses two MCI 24-track machines, MCI 428LM console, JBL monitors, dbx, UREI, White and Valley People processing units, Crown power amps, colour TV monitor system, RTS intercom, Ursa Major 8x32 digital reverb, MicMix XL-305 reverb and Delta-Lab DL-1 delay, Jensen transformer

splits and over 40 mics.

Recently Reelsound has seen an increase in projects which has prompted Harper to start work on a new mobile recording unit that is designed for better audio support. The new unit is scheduled to be finished in the summer of this year. Tom Hidley has designed the 42ft trailer-van unit for concert, TV SMPTE sync, film and long term album and mixing work. The unit will be equipped with an MCI 600 Series automated console, two JH24 24-track recorders and MCI ½in and ¼in 2-tracks. JBL 4430 monitors, Crown power amps. White ½-octave voicing, Ursa Major 8 x 32 digital reverb, dbx, UREI, Valley People and MicMix processing units will complete the equipment line-up. The mobile unit will also contain an overdub booth. With the completion of the new truck, Reelsound will be able to offer its clients the finest in equipment needs and over 13 years of experience.

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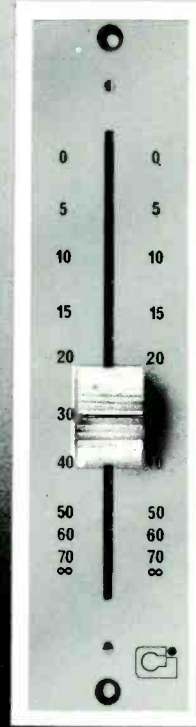
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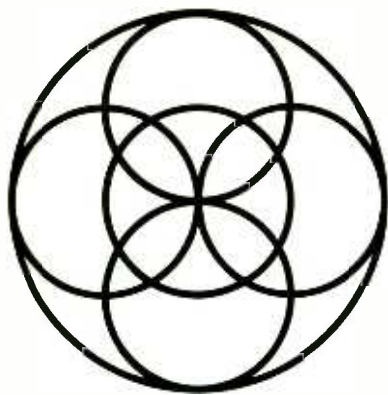
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Ambisonics~

An operational insight

Chris Daubney (IBA)

ABOUT three years ago, the IBA decided to undertake a review of the various proposals for quadraphony which were then current; it did this, not because quadraphony was an immediate and vital necessity for the infant ILR network, but because it wished to guard against international adoption of any standard which was less than optimal and which, if adopted, would be very difficult to change.

On a point of nomenclature, it soon became apparent that quadraphony was not the right word. There is no necessary connection between the achievement of reproduced sound coming from all around the listener and the use of four, and only four, channels of information to carry the sound or for only four loudspeakers to reproduce it. In the absence of a more evocative and accurate name, the IBA decided to style it 'surround sound'.

In essence, the IBA review was of two parts:

- a theoretical one, to determine how each system provided the clues for human ears and brains to perceive the surround effect, and how well the compatible stereophonic and monophonic signals were derived; and
- a practical one, to see how each system fared with all the different styles of programme material and production technique.

Early in the process of making the practical review it became obvious that, with the commercial material then available, the practical part was almost impossible because no programme material, recorded by the same artists in the same environment, but in the different systems, was obtainable. As this comparison was of fundamental importance, the IBA decided to undertake the necessary recordings. While a lot was achieved by using classical 'overall' mic techniques, only very superficial work was possible in the field of popular music. This was because the facilities of the mixing equipment were very limited due to the time available for completing the work. However, the investigation would not have been complete with-

Investigations made by the IBA into the various proposals for surround sound systems were in two parts, theoretical and practical. This article describes how it was necessary for the IBA to make recordings of suitable test material for the practical investigations. Two vehicles were equipped as a mobile surround sound recording control unit. Several constraints which affected the design of the equipment are explained, and a full description is given of the equipment used, including the comprehensive sound mixing desk. The associated microphone and monitoring techniques also are discussed.

out a detailed look at the problems of popular music recording, as well as a further look at drama, documentaries and 'classical' music. Therefore, the IBA decided to build a more extensive and permanent mobile recording facility.

This article reports on the design of the mobile unit and on subsequent experience from the operational viewpoint, also giving some details of the engineering designs involved.

Design philosophy

Several constraints affected the design of the equipment:

- surround sound is a developing subject, and changes in parts of the

Beneath a number of the multitrack PPMs are housed two of the special surround-sound facilities. To the left are shown some of the combined panning (through 360°) and spreading (diffusing) controls; each module contains two separate panpots and their associated panpot mixture selector. To the right of the panpots are two modules housing four Waltz controls. These allow for a previously balanced surround-sound field mic to be rotated about the listener by as much as 360°.

system were likely;

- the main involvement of the IBA was in conducting an investigation into systems;
- by the nature and structure of ILR, the IBA transmitters are supplied with programmes by programme contractors; transmissions of suitable programmes, made by use of different surround sound techniques, are possible only with the help and co-operation of the contractors;
- as the programme contractors are separate companies, each has its own philosophy and own experience of OB equipment design and layout;
- the time for design and construction and the availability of suitable

vehicles was limited.

The keynote of the design, therefore, was flexibility.

During the early theoretical considerations, it emerged that the system known as 'ambisonics' sponsored by the British National Research Development Corporation, covered the subject much more broadly than did most of its competitors; the various features were evolved from a theory of hearing, and the design covered the entire chain from mic to loud-speaker.

As the ambisonic design appeared to offer a system founded on a theory rather than on empirical guess work, the IBA decided to pursue the majority of its work along the ambisonic line.

In essence, ambisonic technology may be summarised as follows.

For precise central decoding of surround sound in one (horizontal) plane, three discrete channels of information are required. (One additional channel would allow such decoding to include height.) There is no constraint on the number of mics which can be used, nor on the number of speakers, provided that these are more than three. The system is divided into four sections, each with its own format:

A-format: microphones—covered later in this article;

B-format: studio equipment;

C-format: signal transmission;

D-format: decoding and loud-speaker signals.

The sound mixing desk operates primarily in B-format, though C-format signals are derived in it for transmission, and the monitoring decoding is in D-format.

In B-format, the signals are:

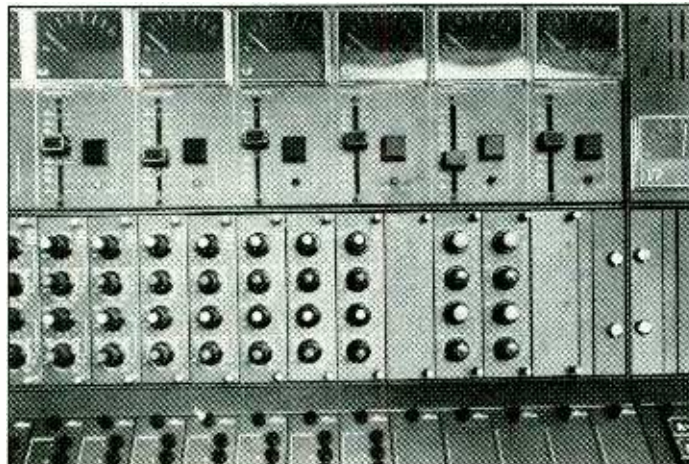
W—the pressure signals from the mics irrespective of direction;

X—the front-to-back 'figure-of-eight' velocity component signals from the mics;

Y—the left-to-right 'figure-of-eight' velocity component signals from the mics;

Z—the top-to-bottom 'figure-of-eight' velocity component signals from the mics.

The Z component is omitted for



one-plane (horizontal) surround sound. This arrangement of signals is chosen because it is rugged and any interchannel errors manifest themselves in the least unacceptable form as symmetrical image displacements.

C-format signals are a linear encoding of the final mixed B-format signals:

L—left signal for stereophonic compatibility;

R—right signal for stereophonic compatibility;

T—third channel to allow more accurate horizontal decoding;

Q—fourth channel to carry height information.

The Q component is omitted for one-plane (horizontal) surround sound.

In principle, D-format signals can be derived for any number of loudspeakers greater than three, from either B- or C-format inputs; the speakers are not constrained to being in a square layout. In the IBA mobile unit, four speakers are used, but decoding to six and eight speakers has been tried for certain other experiments.

With the above in mind, it was decided to use the modular 'black box' approach, ie, to provide as many different sorts of facilities in as large quantities as possible, preferably with each having individual inputs and outputs, so that the various styles of sound operation could be explored with the same equipment.

Design detail

Two vehicles were used; one housing the mixing and monitoring equipment and the other the multitrack recorders. The second van also acted as a cable tender.

Single channel sources

Ultimately, for horizontal surround sound, every source has to 'acquire' the three channels of information which characterise its volume and location. Unless, as in the case of the *Soundfield* mic, the output signal from the mic is already in the 3-channel form, all mic sources have to be processed to derive them. The same is true of synthesised sources.

Monophonic channels

There seems no reason to suppose that, with the advent of surround sound, the popular music world will suddenly change its technique of multiking, etc. Therefore, the desks for such will have to contain a large number of conventional mic channels which can amplify and control the individual sources. They must also feed multitrack tape recorders and artificial reverb devices, feed or insert other processing devices and provide controlled line level outputs of each source for panning and mixing. In the IBA mobile, there was room for

only 20 monophonic channels (and four monophonic groups) after space was allocated for all the other facilities. This provides sufficient channels to cope with small 'pop' sessions and is thought to be adequate to allow exploration of the majority of different styles of programming—albeit in a small way.

The line level outputs of the monophonic sources need to be panned so that the sound appears to come from the desired direction in the soundfield. This is effected by use of special panpots.

Panpots

Essentially, a mono signal is fed into a panpot and the three signals (W, X and Y) are derived therein. W is directly proportional to the amplitude; the relative gains and phases of X and Y provide the directional information. Specifically, if the mono input signal is M, then the B-format signals have levels as follows:

$$W = M$$

$$X = 2 M \cos \theta$$

$$Y = 2 M \sin \theta$$

where θ is the azimuth of the desired sound source direction measured anti-clockwise from centre front.

Thus, as the signal is panned around the circle, its position is determined by the relative values of W, X and Y.

In practical terms it would be ideal to provide 360° panning on one control. However, in the time available, the required sine/cosine pots to achieve this could not be obtained. So, in the IBA desk, it is necessary to select on a switch the quadrant required and then to pan on a separate control to the precise position within the quadrant. For flexibility, it would have been useful if the input and output of each panpot could have been available separately; however, with 20 inputs, there are 60 outputs and the jackfield bay was already 34 rows high.

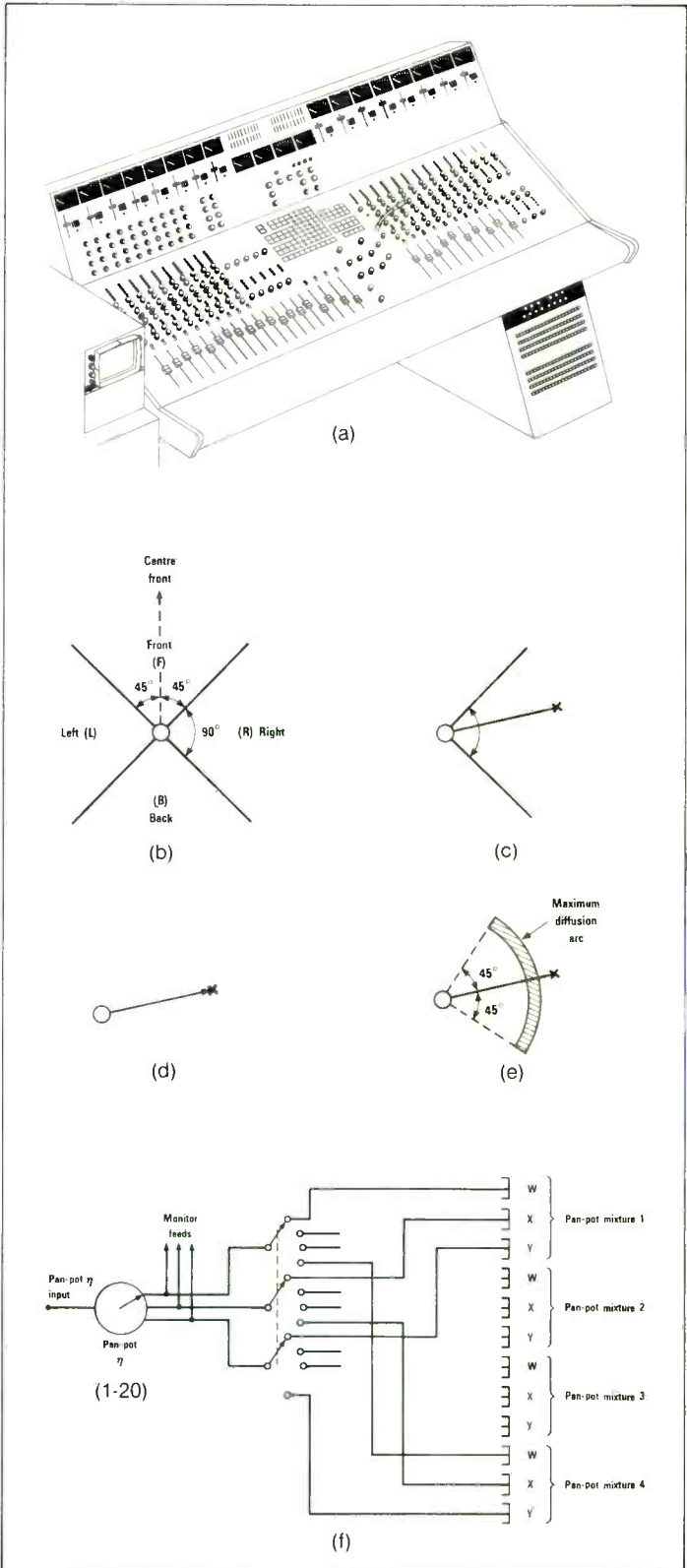
Thus, bearing in mind that at some stage in the proceedings the 20 sets of three outputs had to be combined as part of the final mix, it seemed prudent to achieve some of the mixing in the panpot modules. As a consequence, every panpot can be routed to one of four panpot mixtures and the outputs of the panpots are available only via these mixtures. However, it is possible to monitor the operation of each individual panpot.

When a surround sound panpot is working normally, the information contained in the three outputs W, X and Y, is sufficient to allow a proper decoding system to produce an accurately localised image. Later in this article will be found a brief discussion on the possible need for deliberately being able to delocalise an image in a controlled way—over a limited range. This facility is available on the panpots.

By use of appropriate networks, it

The main items of equipment are positioned as in (a). The layout was designed in modular form to provide the maximum variety of facilities, in as large quantities as possible, within the available space. The interconnections required for each different style of sound operation are effected on the jackfield.

In the IBA desk, because of a shortage in availability of the requisite components, the panpots are not continuously variable through 360°, but quadrant designation is used first (b), followed by the precise pan (c). Once the required position has been established (d) the sound can be diffused over an angle of and below $\pm 45^\circ$ on either side (e). Finally, the output of each panpot is available only via one of four panpot mixtures (f).



Operational insight

is possible to spread a panned image by a maximum of $\pm 45^\circ$ on either side of the precise position. In essence, the diffusion is obtained by panning different parts of the frequency domain to different positions within the chosen amount of spread. The positions are such that a frequency sweep over the usual broadcast audio frequency range (40Hz to 15kHz) would cause the image to swing back and forth six times.

Spreaders

Later in this article the need for delocalised sources is discussed. The achievement of such an effect is possible in the IBA desk by the use of spreaders; these are an extension of the concept of the spread on the panpots. In the current mono spreader design, there are no external controls, but simply one (mono) input and the three (surround) outputs. The signal swings, not merely over a maximum of $\pm 45^\circ$, but right through 360° six times during a sweep of the normal audio frequency range.

An extension of the mono spreader is the stereo version, in which each of the two inputs is rotated in its own network, but the two are then summed to one 3-channel output. At any frequency, the circuitry is arranged so that the two images corresponding to that frequency are 180° apart across the circle. This stereo version was conceived to cater for modern artificial reverb systems which have stereo outputs.

Consideration has been given to a further improvement in the illusion, by using a four input version, but this has not yet been tried.

Three channel sources

Once every source has 'acquired' its

On the right-hand side of the nearer set of monophonic channels are the special 3-channel groups. These groups have balance attenuators at the top of the modules which provide equal amounts of coarse attenuation in each of the three channels; the continuously variable control is achieved with the faders driving matched VCAs.



three channels of information, consideration can be given to generating the final mixed 3-channel output.

Waltz controls

Operationally, there are many occasions when, having generated a number of 3-channel sources or sub-mixtures, it is desired to rotate one or more of these sets of signals relative to another set to overlay or interleave the respective images. The surround sound extension of the stereo 'offset' facility is the waltz control.

One set of W, X and Y signals is fed into such controls, and from those controls is derived another set. In fact, the W signal, representing the amplitude of the signal irrespective of direction, is unaffected; the X and Y components contain the directional clues, and these are the ones which are changed as the source is rotated. In principle, this function would be provided on one control, such that one rotation of the control provided a complete rotation of the images through 360° . Because of the lack of suitable sine/cosine pots, this facility in the IBA desk is provided by choosing the number of quadrants through which it is required to rotate the images on one control, and then by 'fine tuning' the rotation on a continuously variable control. When the waltz control is set to centre front, there is no rotation of the images; all other shifts are derived relative to this.

Three channel surround groups

Surround group faders are essential to controlling the various 3-channel sources used in deriving the final mix. The desk contains five such group controls, each having a 3-channel input and output. A balance attenuator (in 6dB steps from +18dB gain to -12dB gain) is provided on each channel, but is

TABLE 1

Source	Signal	Destination	Signal
1. Panpot mix	1 W	1. Surround Group	A W
2. Panpot mix	1 X	2. Surround Group	A X
3. Panpot mix	1 Y	3. Surround Group	A Y
4. Panpot mix	2 W	4. Surround Group	B W
5. Panpot mix	2 X	5. Surround Group	B X
6. Panpot mix	2 Y	6. Surround Group	B Y
7. Panpot mix	3 W	7. Surround Group	C W
8. Panpot mix	3 X	8. Surround Group	C X
9. Panpot mix	3 Y	9. Surround Group	C Y
10. Panpot mix	4 W	10. Surround Group	D W
11. Panpot mix	4 X	11. Surround Group	D X
12. Panpot mix	4 Y	12. Surround Group	D Y
13. Echo (Stereo)	W	13. Surround Group	E W
14. Echo (Stereo)	X	14. Surround Group	E X
15. Echo (Stereo)	Y	15. Surround Group	E Y
16. Mono Spreader	1 W	16. Encoder	W
17. Mono Spreader	1 X	17. Encoder	X
18. Mono Spreader	1 Y	18. Encoder	Y
19. Mono Spreader	2 W		
20. Mono Spreader	2 X		
21. Mono Spreader	2 Y		
22. Mono Spreader	3 W		
23. Mono Spreader	3 X		
24. Mono Spreader	3 Y		
25. Surround Group	A W	32. Surround Group	C X
26. Surround Group	A X	33. Surround Group	C Y
27. Surround Group	A Y	34. Surround Group	D W
28. Surround Group	B W	35. Surround Group	D X
29. Surround Group	B X	36. Surround Group	D Y
30. Surround Group	B Y	37. Surround Group	E W
31. Surround Group	C W	38. Surround Group	E X
		39. Surround Group	E Y

ganged to one control on each group, and continuous level control is by similar means of accurately matched and ganged VCAs.

Since the *Soundfield* microphone (see below) has high level outputs and contains a Z component, it is convenient to route the outputs of this mic via one of these surround groups. In order to preserve the Z signal (when operationally convenient) at the same level as the W, X and Y signals, one of the surround groups (group A) has four accurately matched channels.

Jackfield and matrix

Because flexibility is the keynote, as many inputs and outputs as possible are made accessible. Apart from an insertion jackfield in the desk pedestal, the great majority of these

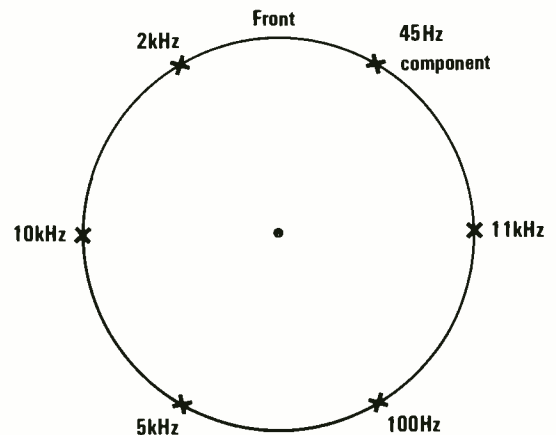
access points are provided on the main jackfield bay. Because of the need to feed tape recorders etc, as well as the main programme chains, virtually every facility has A and B outputs of every channel. Apart from the designated sources and destinations to and from the matrix, nothing is permanently connected, and the connections with the recording van also are on the jackfield.

The electrical mixing of the signals is effected partially in the panpot mixtures (as previously described) and then in a matrix which is housed in the jackfield bay. The designated sources and destinations of the matrix are shown in **Table 1**.

It is possible, therefore, to use the matrix to route signals through the

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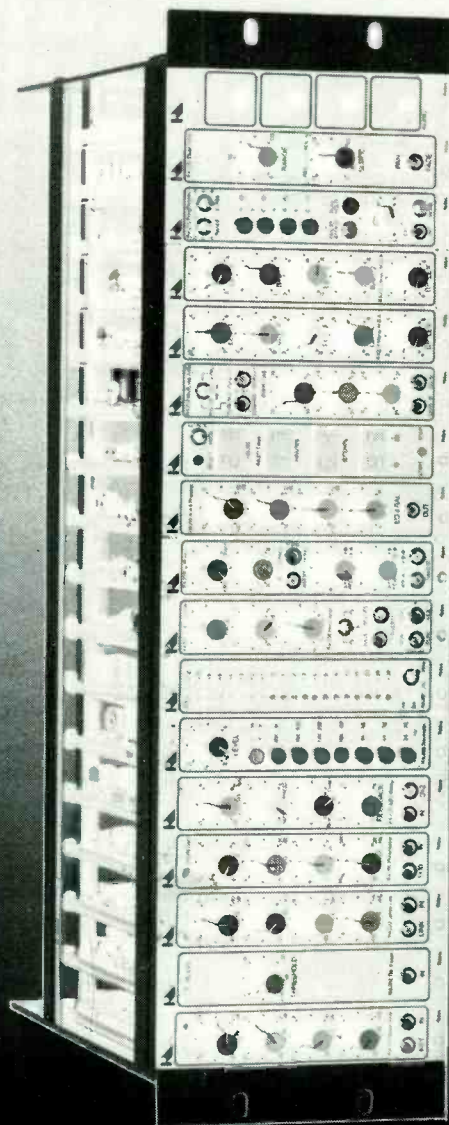
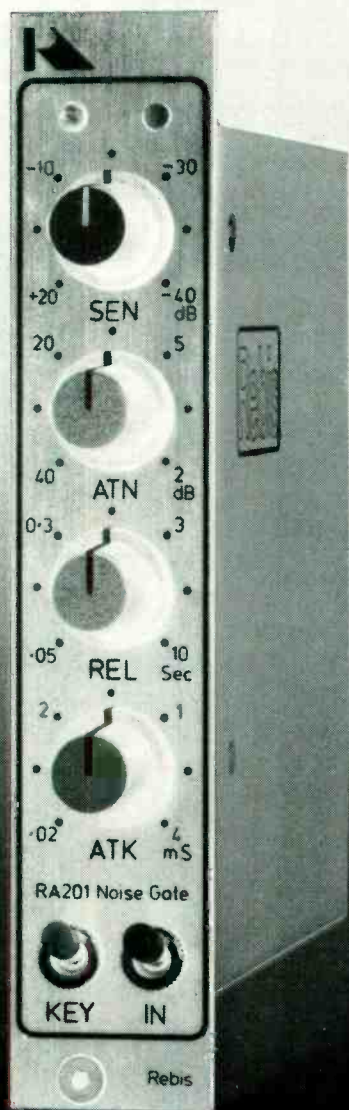
Operationally, there is often a need to delocalise a source of sound—eg, a sound effect such as that of falling rain. The diffusion of the sound is achieved by positioning different parts of the frequency spectrum at different points around the 'circle'; a frequency sweep between 40Hz and 15kHz would cause the image to rotate six times around the 'circle'.



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Operational insight

surround groups in a variety of ways to suit operational requirements, and the waltz controls can be inserted in many places.

One of the destinations from the matrix is the B-to-C format encoder.

Encoding, decoding and monitoring

Expressed briefly, the B-format final mix is encoded in the desk and is available on the jackfield bay for line sending in the transmission format.

It is absolutely vital in any sound control system, particularly in an experimental one such as this, that the monitoring is the most comprehensive possible. This makes necessary the monitoring panel on the desk and is an additional reason for the extensive jackfield facilities.

The visual monitoring facilities consist of 16 PPMs to measure either the record or replay signals from the 16-track tape recorders and PPMs 17 to 20, the feeds to which are described below. The subjective monitoring is from decoded signals fed to four high quality professional monitoring loudspeakers. PPMs 17 to 19 monitor either the B-format signals, C-format signals or, with PPM 20, the D-format signals which feed the loudspeakers. The selection of format for the PPM is made by means of the buttons in the bottom right hand corner of the panel. Unless otherwise latched, the overriding position is C-format because that contains the transmission signals. PPM 20, when not monitoring one of the loudspeaker feeds, can be made to indicate the level of any of the sources on the right hand side of monitoring panel.

Since most of the signals to be monitored are in B-format, there is a 'B-to-D' decoder to feed the loudspeakers. Any C-format signals (transmission output and radio check off-air input) are first converted from C-to-B (this can be done only if three or more transmission channels are in use). All monophonic signals are artificially encoded for monitoring as centre front signals.

One of the advantages of the ambisonic system is that the decoding arrangements are not related to either the mic technique or the number of channels of information. For central listening, all the information necessary for accurate 'horizontal' surround decoding is contained in the three channels; the decoding can be designed for any number of loudspeakers and can take account of where the speakers are positioned. Recognising that many listening rooms will not allow a completely symmetrical layout of loudspeakers, the decoder provides layout and distance controls which



The transcoding from the mixing format to the transmission format is effected in the module marked B-C. To the right of this is a set of decoders which allow vectorial display of the sound field on an oscilloscope and aural indication on two different sets of loudspeakers, one of which is set in the vehicle. The PPMs can be switched to either B-, C- or D-format signals.

In any sound control system, and particularly in an experimental one such as this, it is vital that the monitoring system shall be very comprehensive. The panel below allows monitoring access to all facilities for objective assessment on the PPMs and for subjective assessment on the loudspeakers.

respectively compensate for the speaker positioning and distance from the listener.

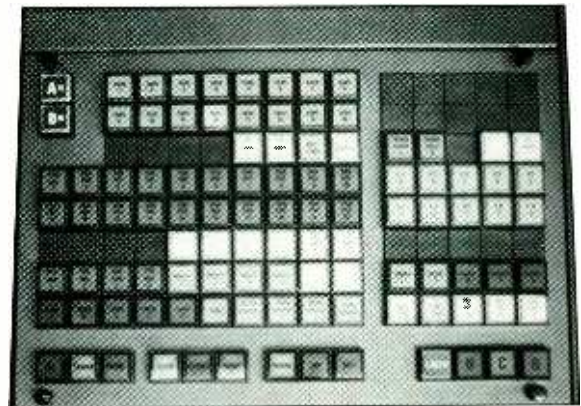
In the IBA desk, two decoders are provided, one for the vehicle itself and one for an external set of loudspeakers. The decoders are for four speakers, and the layout compensation allows for a 2:1 rectangle one way to a similar one the other way, with distance compensation (for the effect of different wavefronts) down to 1m.

Initial operational experience

General

After two decades of experience, engineers are still developing new techniques for stereo reproduction; hence, no-one could hope to do more than scratch the surface of the problem of surround sound production in a single year. What the IBA has been able to do is to tap the considerable and diverse talent available to it through the keenness and interest of the staff of ILR stations.

Engineers, sound balancers, music producers, musicians and hi-fi listeners have all contributed useful comments and expertise. Much of the musical world has been examined, though considerable areas of music, documentary material and drama remain unexplored. Many lessons have been learnt, not least of which was to concentrate on simple, non-prestigious programmes in controllable and repeatable environments. By far the most useful experience has been gained from small studio sessions over which a large measure of control could be exercised—mic positions could easily be changed, separation between sources could be controlled, and repeats were possible. The small size of the facilities put its own constraint on what was possible. However, as many 'big' sessions are



only extended versions of the sort which IBA facilities would handle, there was never any point in trying a 'big' session when just as much could be learnt from a smaller one.

The first hurdle to overcome was that of learning to accept reproduced sound coming from all directions. In everyday life one accepts it without question, but artificial reproduction seemed quite different. The IBA set out to find the system which offered perfect naturalness—the counterpart of real high fidelity—and not merely a novel effect which would quickly become tiresome. The developing of aural recognition, and of rightly critical judgement, have also been necessary. It has been obvious, on those few occasions when everything has worked satisfactorily, that a remarkable naturalness of sound is possible. Trying to discover why those few occasions were successful, and why many others were not so, requires working analytically through what has been heard. To this end, use of the multitrack recorders and small sessions has made possible the remixing, in

various ways, of the same simple material—sometimes with only very small variations—as a means of making such analyses.

It is a truism that one has to 'learn to listen' when dealing with surround sound. It appears that, although mono and stereo reproductions are quite different from normal everyday sounds, the human ear and brain have learned to accept them. In consequence, when presented with surround sound naturally reproduced, the brain registers surprise.

Perhaps the greatest apparent problem concerns the presentation of the material. One school of thought believes, presumably from an extension of what has been the norm in stereophony, that multimic techniques are, to a greater or lesser extent, essential in all audio material. The other school believes that, with the ability to create around the listener that naturalness of sound which is impossible in stereo, 'classical' mic techniques, use of a point cluster of mics to pick up the sound field at the wanted

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Operational insight

position, is all that is needed because the listener's brain will do the rest.

Soundfield microphones

'Classical' stereo mic techniques have involved the use of a 'stereo pair' to provide the fundamental sound stage; the counterpart in surround sound is the *Soundfield* mic.

This mic consists of a cluster of four sub-cardioid mics, on the faces of a tetrahedron, and so orientated that, when projected equally on to one plane, the four capsules point (approximately) in the conventional directions of LB, LF, RF and RB. The capsules have acquired these four designations and, in ambisonic terminology, this is the A-format. However, as the capsules are on the faces of a tetrahedron, three-dimensional sound pick-up is possible. The capsules are spaced as closely as possible; but, in order to attempt (at least to a first order) to produce a true representation of the soundfield at the centre of the tetrahedron, the amplified outputs of the capsules are equalised to take account of their physical spacing and characteristics. At the same time the A-to-B-format conversion is made.

The sound from the mic is critically dependent on the capsule matching, especially as regards the precision of image localisation. One of the acid tests of any surround sound system, and of this design of mic, is the 'walk around' [*in which a person walks round the mic (or uses a surround sound panpot) calling out cardinal directions at various points around the mic, referenced to centre-front—generally referred to as 'North'—Ed*]. The evenness and naturalness of the reproduced sound from a correctly aligned array is a most useful reference against which to make other judgments.

In the classical music use of the soundfield, with the orchestra, etc conventionally arranged, the temptation to be novel and to place the listener in the midst of the orchestra has been resisted and a conventional positioning adopted. The precise positioning of the mic relative to the orchestra depends on the style and period of the music, the size of the orchestra and the acoustics of the studio or hall—in the same way as it does in mono and stereo. Whether the derived stereo and mono is, acoustically, a less or more reverberant sound than that of normal stereo depends on the encoding system chosen for transmission.

The other matter for consideration is whether the mic should be mounted vertically so that the sound field presented to the listener is parallel with the ground, as in everyday experience, or whether the brain

is tolerant of a sloping soundfield as conventional slinging of the mic would produce. Because only horizontal surround sound is being decoded, in the horizontal plane of the mic, there is a danger, with the mic set upright near the source of sound, of the source being 'off-mic', and so therefore producing an imbalance in the direct sound in the X and Y components. As the information is not lost, but contained in the unused vertical component Z, it is possible to retrieve the situation by rotating the sound field in the vertical plane. This is easily achieved in a waltz control by overplugging the Y input with the Z component. The current version of the complete *Soundfield* mic which is commercially available has a steering box associated with the mic; this steering box will produce this electrical tilt as one of its facilities.

In most broadcasts or recordings which use a 'classical' overall coverage mic, it is frequently found necessary to supplement the output with spot mics close to certain instruments, etc. Matching the sounds from the spot mics to that of the soundfield leads to certain other possible techniques.

Other mic techniques

Because the spot mics are much closer to their sources (in terms of arrival of the sound at the mic and in terms of the sound perspective) than is the *Soundfield* mic, there is a danger 'lumps' arising in the overall sound. Consideration of the typical distances involved shows that the sound at the output of the spot mics may be as much as 30ms ahead of that at the soundfield. With the advent of purely electronic delays, it is possible to try the effect of delaying outputs of the spot mics as to be time-coincident with that from the soundfield.

Another technique which seems to provide a useful improvement (at least on initial trials) is that of using the spread facility on the surround panpots. When mixing outputs of the spot mics with that of the soundfield, each of them will be routed through a panpot in order to position its output electrically and to derive the necessary three channels of information. Using a very small amount of spread on each panpot (not more than 5° to 10°) seems to relieve the 'lumpiness' quite considerably. Whether combined spreading and delaying would effect worthwhile improvements is a matter for future investigation.

Panpots and spreaders

Apart from the use of the spread facility of the panpots as just described, the facility is a useful way of diffusing certain instruments or vocals, particularly when an ethereal effect is required, or for spot effects

in drama.

There is a likely desire to position, say, one instrument in front of another in a balance. Some initial experiments have been tried by changing the relative gains of W relative to X and Y. Certainly, when listened to at a point remote from the central position, the image can be heard to move towards the central listener's head, but the effect seems less positive when heard from that central position. The perspective of the original sound has a significant effect; and the use of spreading and delaying the sound, in addition to changing the relative gains of the three channels, would be worthy of research.

The overall spreaders have found occasional use with instruments, but are very useful in coping with artificial reverb return signals or dramatic effects such as rain and wind, all of which will probably need to be delocalised completely. The design of the spreaders is critical, especially in the way the mid-band frequencies are distributed. This ensures that the dominant pitch of the effects will not become lumpy. Any residual lumpiness can be steered to the best position by a waltz control.

Waltz controls

It seems quite possible that, in the world of popular music, a motorised version of a waltz control might soon be required, so that the sound field can be made to spin; but the manual control is most useful, not only for steering the output of spreaders or the 'tilting' of the *Soundfield* mic, but also for correcting any twist which the *Soundfield* mic might suffer from hanging on a cable. In addition, a *Soundfield* mic can be 'turned around' if, on any particular occasion it is found to sound better with an other than normal orientation. In multimic operations, the waltz control is a quick and convenient means of moving one group of pre-panned instruments (say, the brass section) around the sound stage relative to another group—say, the rhythm section.

Monitoring

The greatest problem encountered so far is with the small size of the vehicle and the consequently much too small listening area. The decoding is perfectly correct only in the middle of the area; and, in the context of the vehicle, this is very small. In addition, the speakers are too close and can produce too intimate an effect for some balances.

The reverb time is well-controlled and low (about 0.2s). When in the central listening position, the imaging seems good. Without losing too much room, this was about the highest RT which could be achieved economically. There is a school of

thought which claims that a higher than conventional RT in control and listening rooms leads to improved imaging; but, within the vehicle, testing of that claim was not possible.

Operational checking of facilities is helped by the use of a vector display; by using the Z input of an appropriate oscilloscope in addition to the X and Y inputs, a vector display of the soundfield can be obtained. Panpots, waltz controls etc, are easily checked, some of the patterns produced during programme being very revealing—particularly when the sources of sound are in a highly reverberant building such as a cathedral. Making the soundfield cohesive is much more difficult when working with artificially-generated soundfields. With practice, the vector display can be used as a guide; but care is necessary, firstly to retain concentration on analytical listening to the balance of sound, and secondly to avoid undue interest in the vector display.

Conclusions

Just as colour television might convey greater sense of reality than does black and white presentation, so may surround sound stand superior to stereo and mono audio reception. In what might be regarded as a presentation of sound more natural, and therefore more acceptable to the human ears and brain, may lie the paradox that the listener will be the more critical of it and the more displeased when it is imperfect. When the system is used to convey an existing, naturally-balanced soundfield, the producer and sound balancer might need to work much harder to ensure that the realism is not distorted by the system. For those areas of material for which no preconceived conventions exist, it will be a matter of experience as to what extent, if any, the listening public will accept the multitude of effects which the system is able to offer.

On the assumption that the usable listening area can be made worthwhile without involving unrealistic expenditure on numbers of loudspeakers, the most important underlying question for broadcasters and recording companies is whether consumer demand will be sufficient to render economical any method of surround sound provision.

Time and experience in operational use will undoubtedly bring greater reality as people master the techniques, but will it be worth all the trouble and expense if the listening public is not going to want it, or be prepared to bridge the gap between real life and reproduced sound? ■

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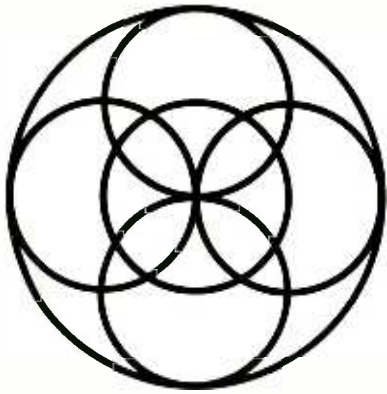
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Ambisonics ~

Circles of confusion

Peter Carbines

CIRCLES of confusion is a term borrowed from optics and photography which I feel appropriate to certain aspects of the ambisonic experience in both studio and sitting room. My hope is that this article will elicit contributions from other workers 'in the soundfield' and help set up a positive liaison between the NRDC/BTG team, equipment manufacturers and professional end users. Without such liaison, I fear that ambisonic technology is unlikely to be accepted in the mainstream professional studios and will remain a 'specialist' technique applied in limited recording applications which do not appeal to the mass market.

Such a fate would be undeserved, for not only are ambisonic production facilities quite stunning in terms of artistic manipulation, they would certainly have some applications also in conventional stereo technique. In that which follows, I have identified specific areas where there is clearly a need for the kind of liaison and exchange of ideas already indicated. My comments are drawn from five years' active experimentation in ambisonics and its application in multitrack recording technique, undertaken as a private unfunded project with two colleagues in time spare from that necessary to earn the daily crust.

Learning circle

Just as there is a 'trick' in our learning to perceive a stereo image, so there is a further trick in learning to perceive and make sense of an ambisonic soundfield.

To judge by the early years of 'ping pong', schizophrenic orchestras (who fortunately played from the same score), and hurtling express trains, it took the professional recording industry a little time to learn about stereo image.

Cynically, I shall note in passing that the ultimate end users, the con-

Peter Carbines explores the potential, and pitfalls to be encountered, in the development of ambisonic techniques and equipment for multitrack recording.

sumer public, have never learned the trick if my own observations of domestic set ups are representative. Separation, certainly: how could it be otherwise with one loudspeaker (usually fallen over unnoticed) behind the sofa, the other stuck up flat on the wall not far from the ceiling? But image, hardly. I shall refrain from commenting on tone control settings. Never mind, the important thing is that people like music in their homes and that writing, performing, recording and otherwise distributing that music is our bread and margarine.

Meanwhile, back in the studio, the chances are that the engineer at the mixing desk probably has some sort of stereo image to work by. If something is wrong, it is usually evident and the cause usually quickly established and rectified (Murphy's Law of course will ensure that serious session stopping faults always occur when studio maintenance have gone home to bed). The inevitable click which just happens along may require a retake or editing out, but it does not impair perception of stereo image or disturb psychoacoustic 'filters' in the brain.

That something is wrong in an ambisonic soundfield may not be so evident, especially if the soundfield is incorrectly realised through wrongly set up decoders or compromised speaker layouts. If it is evident, the cause may not be so easy to pinpoint. Worse still, the engineer's perception of the soundfield may have been temporarily disabled or distorted by phenomena in the field itself. Simply taking five may restore perception, but not if the time-pressure of the session causes a frantic check through all

possible variables with hurried tests giving no helpful results. Actual faults may now arise through errors in repatching, switches moved, and probably worst of all, attempts to restore or 'correct' the soundfield by fudging the decoder settings.

There is evidence that switching transients, if reproduced within a soundfield, can have just such a disabling experience on the perception of all individuals monitoring the soundfield and thereby mislead everyone into chasing phantoms through equipment and circuitry.

No doubt, given time and ambisonic experience, perception disturbing phenomena can be accepted and ignored. In the meantime, the psychoacoustic and psychomotor properties of ambisonic soundfields, especially those synthesised and manipulated dynamically, are worthy of further study. Equipment manufacturers and circuit designers should be aware of these properties and an objective method of checking studio soundfields researched.

Delete the variable

In the immediate future, ambisonic mastering facilities are likely to be hired into studios; therefore there may be some need for fairly elaborate decoder design to meet most environments. Certainly, such a decoder would only make sense if adjusted with the aid of an objective measuring instrument. Complex decoders would be costly and not cost effective if offering comprehensive adjustment facilities and used in a permanent set up, where the controls would be redundant after initial adjustment.

There seem to be several options,

none of which is being met with present 'state of the art' decoders.

Option 1: Portable package

A basic package of phase-matched speakers and power amplifiers together with a simple decoder could be offered on hire to provide ambisonic monitoring. Because of the properties of the soundfield, high apparent SPLs can be achieved at modest drive levels from small speakers, which are certainly easier to position in idealised settings than four normal studio monitors. Mic stand mounting might be useful for the soundfield monitors. Full bandwidth checks on equalisation could be made by switching in the existing studio big guns as required when setting up the mixing desk.

The decoder would need only a 'layout' control as a variable, 'dominance' and 'preference' not being useful in a monitoring situation, and the circuits fixed as neutral in both cases. Even without a practised ear, and without an objective soundfield qualifying instrument, a reasonably accurate monitoring soundfield could be quickly set up using the basic "walkround" and phasing test recorded on the *Hi-Fi Sound Stereo Test Record* HFS81.

Option 2: Studio dedication

In situations where a fixed ambisonic installation is required, the monitoring of the soundfield may be undertaken using studio monitors (four for planar ambisonics) which should be phase-matched. A survey of the layout should facilitate a studio-dedicated decoder at reasonable cost. This decoder would incorporate a perfectly standard PCB, but with the variable controls replaced by fixed resistors on the board. The PCB layout could be designed with solder pads for wiring-in or board-mounting pots (variable decoder) and mounting tags for the fixed resistors (dedicated decoder). Thus, circuit design and decoder

manufacture is made easier since one standard board covers two options. The problem of accidental misadjustment of controls or "twiddling" is overcome in a dedicated situation. Interchange of decoders between different control rooms in a studio complex could be met by providing studio maintenance with the necessary information or resistors to allow such interchange. Obviously, control room parameters would have to be known. The dedicated decoder then would be a simple box in the rack and could be relied upon to do its job without fear of variables being wrong.

Using the objective soundfield qualifying instrument at the time of installation would verify correct decoding in that particular studio.

Option 3: Optimising compromises
Professional recording studio control rooms are often far from ideal in shape or furnishings. Large fixed objects such as multitrack machines, equipment racks and of course, the mixing desk will cause reflections and shadows in the field. These can normally be ignored or lived with when working in stereo. Holes in, or dead spots around the periphery of a soundfield may seriously affect any work attempted, even allowing for 'mental corrections'.

There is certainly no guarantee that four (or more) phase-matched monitors could be set out in positions regular enough to be within adjustment range of basic decoder controls or fixed resistor arrangements. For example, the speakers should all be on the same plane, subtending the same angle of shoot to full centre and on a direct diagonal path to the opposite speaker.

Based on as yet limited experience in a working ambisonic studio situation, I can foresee the need for decoders to have provision to correct 'squints' and 'smudges' to overcome difficulties of this nature. It is certainly unreasonable to expect existing studios to make structural alterations in order to regularise speaker layouts, and this is another area where investigation is needed.

I would expect that it might be found possible to provide 'squint correction', 'refocus' and other delightfully-named control options by means of a retrofit daughter board on a standard PCB or by implementing an unpopulated area on such a standard board. Externally variable controls would be unnecessary since the decoder would very definitely be dedicated to one control room, yet costs would be kept down if the design of the 'standard' board made these options possible.

An overall approach along such a philosophy in decoder design would certainly assist the rapid penetration of this technology into existing

studios without the penalty of over-elaborate and costly monitoring requirements.

Ambisonic hearing aids

I have mentioned several times the need for an objective measuring device. Without it, there is no way to ensure 'soundfield compatibility' between studios, and subjective methods of using the traditional Golden Ear to distinguish a 'good east' from a 'bad south-east' when setting up a decoder using a recorded walkround test, are not really professionally admissible.

Some sort of 'soundfield vector-scope', set down in the monitoring position at the desk and used in conjunction with specific test signals would verify the accuracy of the soundfield and reassure engineers inexperienced in the ways and whiles of the same. Perhaps an array of LED's could be used to display the (hopefully) circular sound field and any significant deviations or irregularities. A fully periphonic sound field could probably be verified in much the same way.

Attaching test meters to loudspeaker terminals only verifies electrical conditions up to the speaker. A sound level meter may be used to verify the acoustic pressure produced by individual loudspeakers but may be ambiguous at the monitoring position (ideally full-centre) and cannot indicate irregularities in the soundfield.

In a commercial studio, rapid and accurate alignment of equipment is vital. The present experience of taking upwards of one hour to get a workable, but not wholly accurate soundfield could not be tolerated. A test instrument, perhaps along the line of the vectorscope suggested, together with the decoder options I have described, would certainly help ambisonic technology adapt to the existing real world of commercial recording, rather than expect it to come cap in hand to the ambisonic front door. It won't.

Filter blocks and royalties

The superior performance of the latest professional ambisonic decoder (Abacoid 9211) over existing designs, especially 'domestic' types, almost certainly results from closer matching of the phase shift and phase compensated shelf filters. The actual operating frequencies of such filters could probably vary over quite wide manufacturing tolerances between decoders without affecting the soundfield, but the matching of the filters within the same decoder, is critical. Ensuring accuracy will account for a goodly proportion of the production cost of a decoder and is open to compromise at the penalty of degraded performance.

One possible way to keep costs down, yet improve matching, would be to use thick and thin film hybrid

techniques, with laser trimmed resistive elements, to produce encapsulated filter blocks. Original development costs would be met by the NRDC/BTG operating a royalties system similar to that in use by Dolby Laboratories. Ambisonic hardware could be granted type-approval and allowed to carry a distinctive logo identifying it as ambisonic.

Only those recordings mastered on type-approved equipment and issued to the public would be allowed to carry the same identifying logo. Royalties would be due on every piece of software, but this should not be reflected in a distinct price differential to conventional stereo software in the High Street.

Advertising, perhaps on a co-operative basis by the NRDC/BTG and hardware and software manufacturers could be aimed at the public to fix the identifying logo of ambisonics firmly in the public mind, it being the guarantee of conformity to whatever international standards are agreed. Behind the control room glass, advertising and 'awareness' aimed at studio clientele will educate them in the benefits of ambisonics and cause them to distinguish type-approved studios from those operating more cheap-skate methods to produce some of the same kind of effects.

Approving hybrid chips and mastering hardware will not prevent manufacturers turning out equipment which evades the patents and thus any royalties, but it will be unable to carry the logo and ambisonic title, and thus avoid bringing the technology into disrepute due to poor or inconsistent results. An existing parallel is to be found in the domestic video cassette market, where inferior blank tape is manufactured in the two popular Japanese formats, *Beta* and *VHS*. To avoid prosecution and seizure of rogue non-approved cassettes, they do not carry the distinctive logos of either system, instead they are usually marked 'B system' and 'V system'. The inevitable problems which arise from these inferior products stand little chance of damaging public credibility of the actual systems they are aimed at.

The end-user

Professional acceptance of ambisonics depends very much on end-user demand. There is little point in going to the expense of equipping studios and developing soundfield controls if there is not public demand for the product.

So far, all recordings available to the public have been 2-channel UHJ, recorded in real time using the Calrec *Soundfield* microphone. Inevitably, these recordings cater for minority tastes, perhaps 90% of the mass music market being unexploited. It is clear that the

public ear is conditioned to music derived from multitrack and that money is where the energy is. The energy is with the various kinds of popular music, as it has been since the late '50s and seems set to continue for the foreseeable future.

Thus, the public must be convinced by multitrack-derived mass market oriented material, much of it incorporating the spectacular effects capable with ambisonic technology and which makes even the ultimate in stereo reproduction sound dull and lacklustre. The *Compact Disc* would enable 'with height' software to be available from the outset, albeit at reduced playing times.

I am concerned that the 'smudges', speaker dominance and other ear fatiguing effects noted by my colleagues and myself in using domestic decoders particularly with consumer format UHJ, will not convince the public that ambisonics is a working and realisable system whereas the various forms of quad were a set of compromises bounded by four loudspeakers. It may therefore be unwise for the public to be introduced to ambisonics by current state of the art domestic decoders, rather the early generations of such decoders should be built with few compromises and appear at a price as high as the market will bear. Because of the mass market implications, decoders should be integrated with audio preamplifiers as quickly as possible.

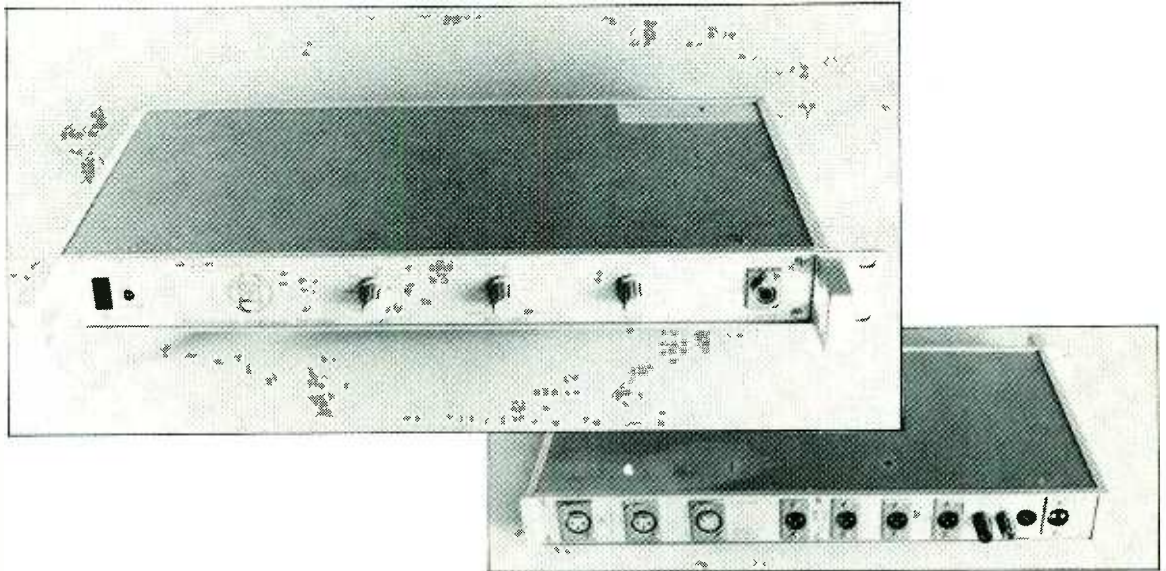
The fact that the public will certainly not put their speakers in optimum conditions and so probably never have a correctly reproduced soundfield in the sitting room need not concern us. But it is essential that in exhibitions, special presentations, hi-fi dealers with demonstration facilities and in the homes of their own audiophile friends, they do have the opportunity to hear at least planar horizontal soundfields correctly reproduced and socking it to them with music they understand. Technical arguments promoting ambisonics may persuade those lovers of the esoteric to indulge themselves, but it will take the *balls* of rock music and the *pzazz* of ambisonic production techniques to get the mass market dipping into its pocket, already under attack from video, personal stereo *Walkman*-type devices, home computers and the like.

Reflection

The amount of money required to investigate fully the problems I have outlined, and to advance most of the way along the path of applying ambisonics in multitrack recording, was spent last year by the UK division of a certain Japanese domestic hi-fi manufacturer in equipping a 'listening environment' for some of its more esoteric audio products. ■

Abacoid 9211

professional ambisonic decoder



THE decoder is a single standard rack-mount unit 1V high, and is designed for operation on 240V AC mains. It provides planar decoding of B-format and two channel UHJ signals into a four loudspeaker layout.

Signal input and output connections are made on the rear panel via XLRs. The mains lead is detachable and uses an XLM connector, 4 mm terminals are provided for separate chassis and signal earth connections if required. B-format signals are input via a single 5-pin XLR, female contacts, UHJ signals via 3-pin XLRs, one for each channel and wired in accordance with IEC 268/BS 5428. **Table 1** details the recommended standard for XLR connection of Ambisonic signals.

Outputs for connection to four power amplifiers and loudspeakers are via 3-pin XLR chassis-mounted plugs (male contact), wired to the IEC standard.

The decoder front panel is furnished with a mains power switch, LED power-on indicator, a rotary mode selector switch and two rotary potentiometers for adjustment of layout and preference. A socket is also provided on the front panel for remote operation of decode mode.

Functions are mechanically switched by substantial on-board relays; in the stereo mode and power-off conditions, the decoder defaults to a hard-wired bypass state. Thus, it may be left permanently connected in the monitor signal path.

The rotary potentiometers are specific to Ambisonic decoding. 'Layout' adjusts the decoder to the speaker placement, covering front to rear width ratios of 0.5 to 2.0, the central setting of 1.0 representing a layout with speakers at the corner of a perfect square.

'Preference' has arbitrary uncalibrated divisions between end positions neutral and forward. The

control subtly adjusts the pressures within the soundfield to give a more definite sense of front in the forward position.

Both these controls need adjustment only on installation of the decoder and should then be left alone. I strongly recommend that these controls are removed from the front panel and on-board presets substituted. This will avoid the ever present danger of the controls being altered, accidentally or in a well-meant 'twiddle'.

Subjective performance

This decoder proved to be a trouble-free transparent device providing a wholly realistic and fatigue-free soundfield in the horizontal plane from B-format and 2-channel UHJ test material.

Most interesting was the freedom from speaker dominance where images tend to localise in speaker positions. Even when images were deliberately panned into positions within a few degrees of speakers, there was no audible tendency to pull into the speaker. Panning an image through a speaker position produced no audible change in

level, coloration or vector.

Consumer-format 2-channel UHJ recordings were as stable and free of dominance effects as B-format recordings; after five years' experience of domestic decoders, I found this something of a revelation. Certainly, for the first time I have been able to enjoy musical performances recorded in real time using the Calrec *Soundfield* microphone, feeling relaxed and at ease in the reproduced soundfield.

Previously, I always found myself on edge and unconvinced that a full 360° soundfield was actually present.

A further interesting discovery made using the Abacoid decoder was the freedom from soundfield fragmentation and twisting which had always been noted when reproducing Ambisonic material through domestic loudspeakers of multiway design, where upper HF units may be as much as 0.5m above the bass driver. For my subjective tests of the Abacoid decoder, I used four identical phase matched two-way speakers of about 6.2 litres capacity, brought to a convenient monitoring height by placing them directly on top of the four Mission 730 Mk I speakers normally employed in my experiments. There was very little difference in terms of localisation produced when the sets of speakers were compared. I had always assumed that the distinctly monolithic shape of the Mission 730 was responsible for soundfield distortions previously experienced, but it would seem that inadequacy of domestic decoder design, probably in the matching of the phase shifter and phase compensated shelf filters is responsible.

In summary, this decoder can be highly recommended for accurate reproduction of Ambisonic soundfields derived from B-format or 2-channel UHJ sources.

Peter Carbines

TABLE 1

XLR CONNECTION STANDARD FOR AMBISONIC SIGNALS

Pin numbers	1	2	3	4	5
B-format	Earth	X	W	Y	Z
UHJ	Earth	Left	Right	T	Q

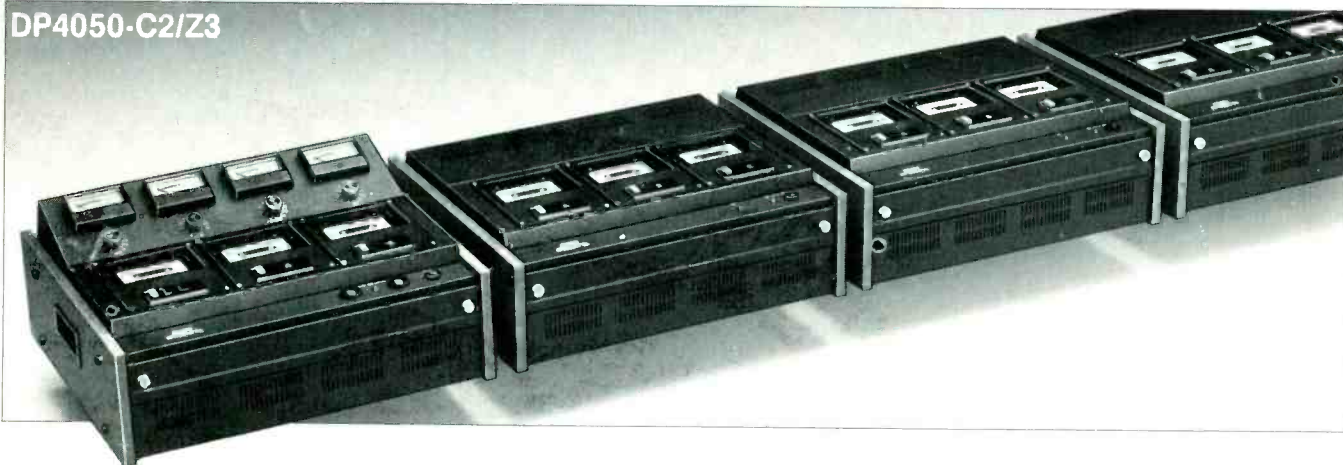
Notes: 1. UHJ connected via three-pin XLRs as a balanced line uses IEC 268 standard (Pin 2 "HOT"), one XLR per channel.

2. The order of the B-format signal is recommended for tape-track assignment, with W between X and Y to reduce intertrack skew effects.

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MicMix Dynafex



THE *Dynafex D-2B* is designed to offer a useful alternative to encode/decode noise reduction systems of the conventional type, and is unusual in that it is a decode-only unit, requiring only for the signal (with the noise you wish to remove) to be input at one end, a quieter signal emerging from the other.

As such a simplistic description suggests, it is one of the easiest units to operate you will ever come across in the studio. What's more, it works exceptionally well. It is, in essence, a specialised expander, consisting of a VCA and VCF, the

former being controlled by an amplitude detector and threshold control, the VCF being controlled by a frequency detector (Fig 1). The primary function of the unit is to provide a 'sliding' lowpass filter, whose upper roll-off frequency is determined so as to reduce the gain above the maximum frequency present in the desired signal. This thereby reduces the HF noise level, this being the most noticeable. At the same time, the expander section maintains the dynamic range characteristic above the threshold, introducing progressively greater gain reduction as the signal

level drops below the threshold (see Fig 2). The combination of these two functions within the system tends to reduce irregularities in the performance which would be obtained with one or the other alone.

Although there have been previous attempts to create this kind of noise reduction system, they have tended to be domestic units with several flaws and insufficient parameter variation to be successfully applicable to the studio or copy

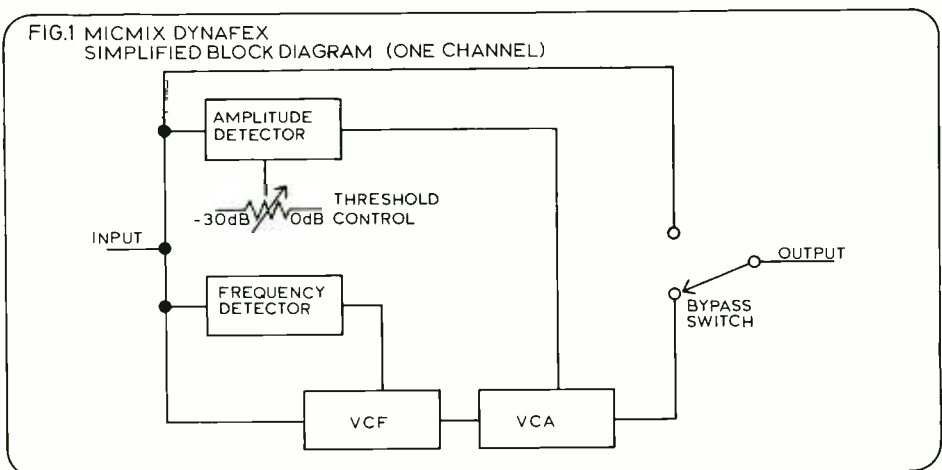
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MANUFACTURER'S SPECIFICATION (preliminary)
Input (ref 0dBV = 0.775VRMS)

Electronically balanced (transformers optional).
Impedance: 10kΩ unbalanced, 20kΩ balanced.
Nominal level: (internal switch) -10, 0, +4, +8dBV.
Maximum level: +20dBV.

Output
Source impedance: 15Ω unbalanced.
Maximum level: +20dBm into 600Ω.

General
Dynamic range: peak signal to background noise 110dBm.
THD: (20Hz to 20kHz) 0.1%.
Noise reduction: up to 30dB.
Dimensions: 19 x 1 1/4 x 8in (whd)
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Shipping weight: 7lb.
Manufacturer: MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220, USA.
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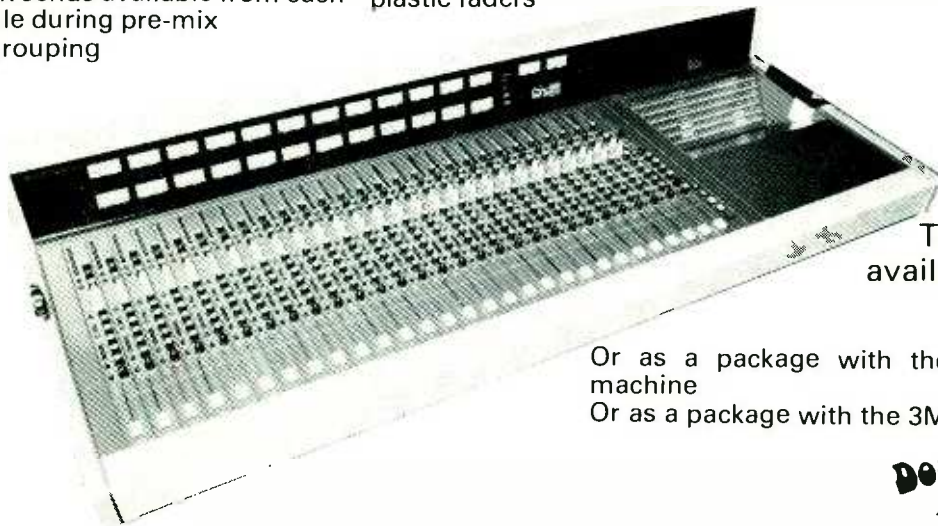
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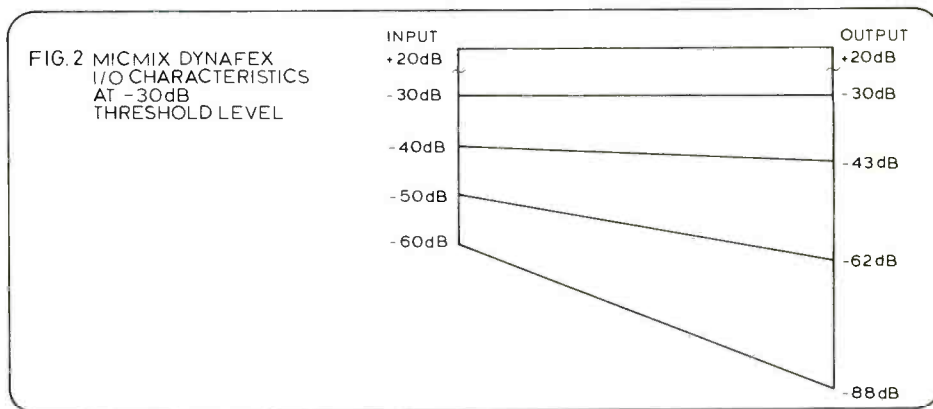
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room. The Philips *DNL (Dynamic Noise Limiter)*, at one time fitted to several of the company's cassette recorders and also available some years ago as an accessory unit with metering, performed solely the frequency-agile LPF function of the *Dynafex*, and suffered from an inability to adjust threshold levels. It was also prone to certain kinds of noise breathing on difficult signals. The addition of the dynamic range enhancing expander function on the *Dynafex*, and the presence of threshold controls, effectively limits these disadvantages to a virtually inaudible level.

Construction

The unit is built into a sturdy steel chassis, 19in wide and 1U high, with the normal rack-mounting ears. The main PCB, a thick fibreglass type, runs the width of the case (Fig 3). All ICs are socketed, and high-quality components are used throughout. However, the component reference numbers are not marked on the board. Certain ICs are somewhat anonymous, having their tops coated with black paint to obscure their type numbers. As the IC reference numbers are not given, it would be difficult to specify these chips if replacements were required! Indeed, no circuit diagram is provided (although this was a very early production model and included only a preliminary manual) which could make things difficult for the maintenance engineer.

The rear panel consists of a barrier strip I/O connector, which includes shorting links on the input side which may be removed if balanced operation is required. AC power is supplied via a standard IEC connector with correctly shrouded tags on both the socket and the adjacent 1/4in fuse holder, although the live connections are made direct to the PCB which has rather small physical separation from the chassis, such that shorting could occur if the PCB mounting bolts were to

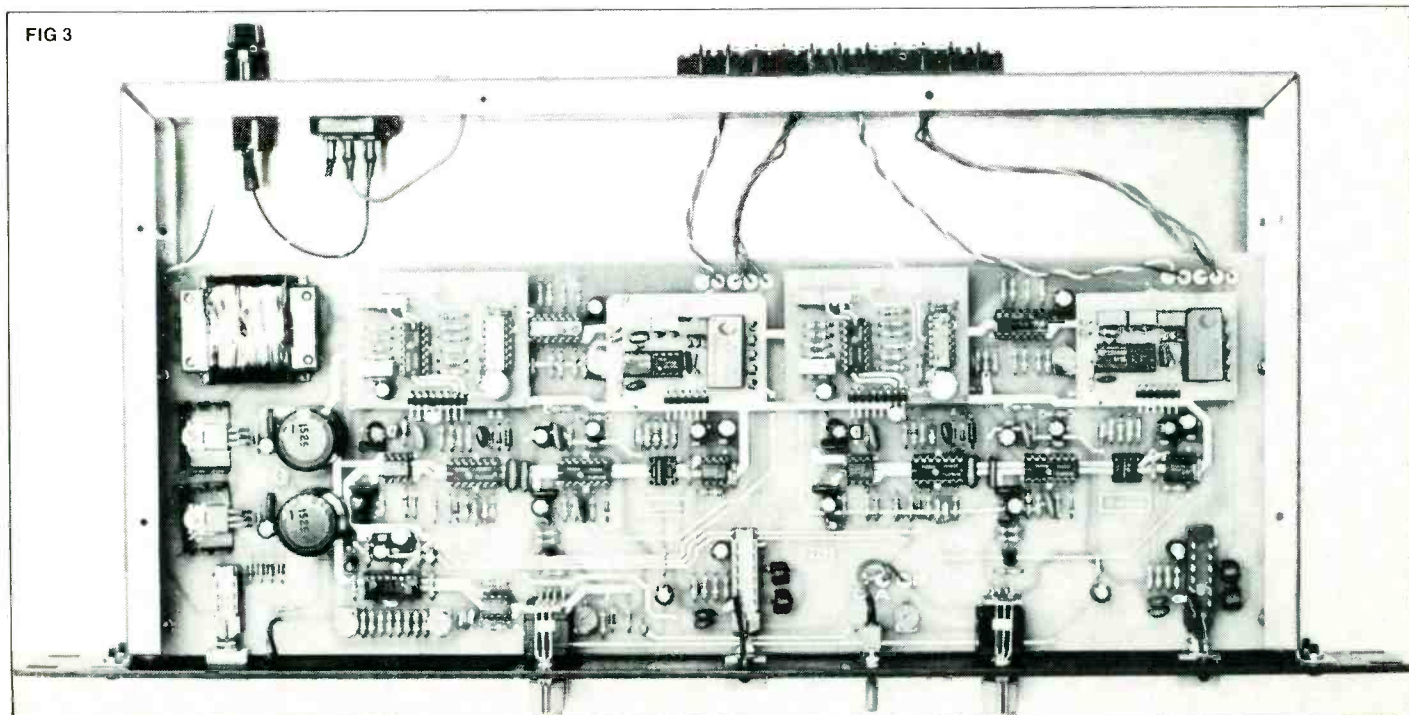


become loose. Some insulation between the PCB and chassis beneath the live parts would have been desirable. The ground line from the power socket is taken to a tag on the rear panel, and the PCB picks up its earth from the chassis via one of the mounting bolts. Solder pads at the Stenzyl-type miniature power transformer enable selection of 110 or 240V primary windings. It must be said that both the shrouding of the AC input terminals and the primary winding selection are unusual on US equipment, which is often both unsafe (as far as European standards are concerned) and difficult to modify for 240V operation. I hope this unit's features in this area represent a trend which will spread to other US manufacturers. Regrettably, this is somewhat marred by the supplying of a US-colour-coded mains cable (black/white/green); as it is a standard IEC lead, it might be better if this was supplied by the European importers. In addition, there is no mains power switch, so that the AC power is present all the time the unit is plugged into a live outlet, power switching being accomplished by a pushbutton on the front panel

operating in the low-voltage side of the transformer circuit. This is presumably to minimise the possibility of introducing hum due to mains cables crossing the PCB to a front panel mains switch, but it is a little worrying. However, copious warnings appear in the manual to this effect. Fully regulated $\pm 15V$ supply rails are generated by suitably 'heat-sunk' IC regulators. Apart from the power rails, the two channels are completely separate to minimise crosstalk, and two 'piggy-back' PCBs on each channel carry the VCAs (Valley People *EGC101s*) and related circuitry. These are connected to the main circuit board by ITT *GO-9* style connectors which, together with plastic prongs, securely support the boards. All the VCA adjustments are on these boards, allowing pre-adjusted 'gain-cells' to be fitted by the manufacturer. All presets are securely locked.

The unit may be adjusted for different levels of sensitivity via plug-in bridges across a pair of 8-pin DIL sockets, one for each channel. These offer -10, 0, +4 and +8dBV operation and allow the

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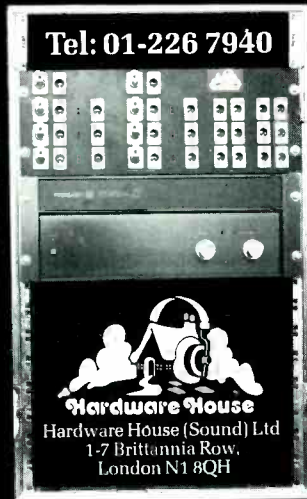
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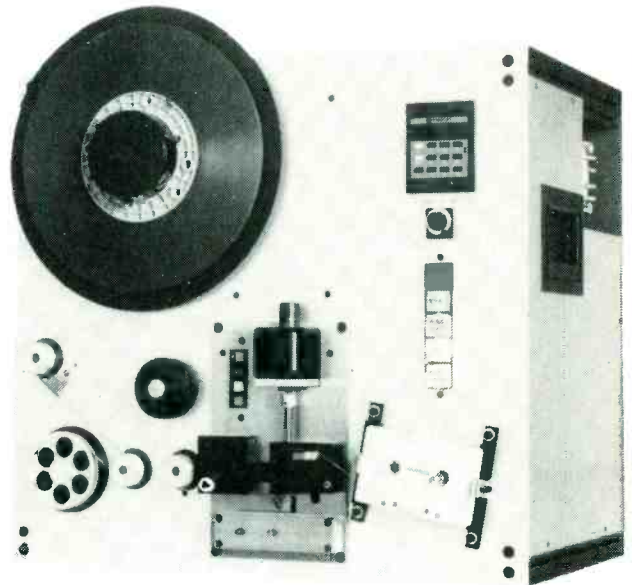
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unit to be set up for many operational environments, from domestic and semi-pro to studio and broadcast levels. The use of U-shaped metal bridges across DIL sockets is an ingenious and cost-effective solution to level adjustment, but the bridges are not very securely held, relying only on the friction connection with two locations on each DIL socket to hold them in place. I would have preferred the type of jumpers fitted to floppy-disk drives. Foam pads on the underside of the case lid would be useful here to ensure that the links don't drop out if the unit is knocked about in transit, especially when the socket springs have been loosened by constant readjustment. However, although the bridges *felt* loose, they resisted my attempts to shake them out.

Front panel

The panel controls are pure simplicity. Apart from the power switch, there is only one stereo/mono toggle switch, plus a threshold knob and bypass switch per channel. The bypass switch hard-wires input to output and disables everything.

Power on and bypass functions are indicated by red LEDs, and the only other indicator is a red/green LED per channel above the threshold controls. This LED changes from green to red when the threshold is exceeded, indicating that the *Dynafex* has stopped treating the signal in the latter condition. The stereo/mono switch couples the two channels' level and frequency sensing and places the threshold setting for both channels under control of the channel 1 knob. This ensures correct tracking and processing of a stereo image—an essential function. In stereo mode, both threshold LEDs still function. In mono mode, the two channels are entirely separate with no audible crosstalk.

Dynafex in use

Testing of the *Dynafex D-2B* was carried out at Marcus Music's London studios, where it was used in the production of cutting masters for two KPM library albums. One album consisted of solo blues guitar, and one track on the album—including a great deal of bottleneck work—was recorded at rather a low level. On increasing the level, unacceptable noise was present. This was thought to be a good test for the unit as the track included a good deal of transient HF signal in the most noticeable noise band. Running the *Dynafex* in stereo mode, the threshold was advanced until the average signal level just triggered the LED to red on both channels. Threshold tracking was found to be good—within 0.5dB. In operation, the unit effectively reduced the subjective noise to a totally acceptable level, and did not introduce any untoward effects. Even hard HF transients did not introduce a 'noise tail', and there was no apparent loss of HF response when the signal was below threshold (a subject we will return to later). The apparent dynamic range was increased somewhat, as would be expected, the effect being to marginally reduce the level of quieter passages: this was not undesirable.

The second test involved the copying of an entire album produced on an early Fairlight *CFI* and recorded originally on a 16-track machine at 15in/s with no noise reduction. In addition, the tape electronics on both the multitrack and the original stereo mastering machine were not

exactly quiet. The album included heavy transients at all frequencies plus large asymmetrical stereo effects, where the variation between left and right occasionally exceeded 20dB. The requirement was to clean up the noise, brighten the mix slightly and add a touch of plate echo. The primary noise sources which needed to be removed were quantisation effects from the synthesiser plus overall tape noise. Due to the method of sound generation, there was not a great deal of upper high frequencies, the majority of the signal being below 12 to 15kHz.

For this purpose, the *Dynafex* was initially patched into the console output, the original tape being brought up two channels of the Harrison *MR-3* console, equalised and sent to an EMT echo plate set to about 3.5s, the echo return and signal being mixed and sent to the second recorder via the *Dynafex*. Although, in the first test, the unit had required adjustment with the internal jumpers to run at -10 to trigger the threshold, for this application it was set to 0dBm, which gave a useful range of control, the threshold setting being adjusted so that the average level triggered the LEDs to red. At this setting, the threshold control—calibrated between 0 and -30dB—was adjusted to about -15 to -20dB. At this point an apparent left-right imbalance of about 3 to 5dB appeared between the *Dynafex* outputs but this was found to be an artefact not related to the unit.

With the unit patched into the system in this configuration it was immediately noticed that the *Dynafex* was greatly reducing the reverb time of the plate, such that to get a sound equivalent to that of a normal 3.5s decay it was necessary to at least double the plate setting. Effectively, the expander aspect of the unit was roughly doubling the dynamic range of the reverb, in the process completely removing extraneous noise in the echo return. Evidently a psychoacoustic effect was contributing to this, the noise of a plate normally being perceived as part of the decay. This indicated that the unit would be very useful for cleaning up reverb units, particularly spring types, assuming you could lengthen the decay suitably to lessen the apparent loss of decay time. In addition, equalisation before the *Dynafex* in the HF region appeared to be reduced, more HF boost being required with the unit than without.

It was apparent that this patching arrangement was unsatisfactory for the purpose, not because of any undesirable effects of the unit itself, but because of where it was inserted in the audio path. The *Dynafex* was therefore inserted pre-EQ, and the echo send derived after the equalisation. This did the trick, and indicates the best patching arrangement for this type of application.

With the *Dynafex* only inserted in the audio path, it was noticed that there was an apparent loss of HF response. Once again, however, this was found not to be a problem with the unit, it being a purely psychoacoustic effect whereby the upper noise band was being perceived as 'phantom top-end'. A note on this subject appears in the preliminary manual, and it is not a manufacturer's excuse—it really is true. This can be demonstrated by noting that the perceived HF loss was less on low-level material—where the *Dynafex* is doing the most work—than on high level signals. This effect will occur with any noise reduction system and no doubt with digital

recording media. The manual suggests the use of an *Aphex* or similar unit if the subjective top-loss is intolerable—this would no doubt produce stunning results. As one was not available, a slightly larger amount of HF boost was added after the *Dynafex* than originally expected necessary to brighten the mix. Echo was then added in the usual way and as a result, the overall noise on the final production master can be heard to be solely due to the echo returns! The unit successfully reduced the perceived noise on the master to an almost unnoticeable level, thereby fulfilling both our purpose and the manufacturer's claims. It should be noted, however, that the expansion aspect of the *Dynafex* will alter the time and rate of relatively short fades up or down. If a track fades in, it may appear to start at a low level and then 'rush up' to the final level as threshold is approached. Similarly, echo decays and fades-down may be reduced in time if the unit is inserted after level controls and echo returns. For the unit to do its job on continuous programme material, these minor disadvantages must occur. All that is required is to bear them in mind when they are likely to arise.

Conclusions

I was most impressed by this unit, and everybody I have shown it to has felt the same way. Of course, you *shouldn't* need one in a studio, but in reality it could turn out to be very useful for cleaning up tracks or sources where a conventional noise gate would be inappropriate. It also has potential for cleaning up reverb units (particularly of the low-cost or spring variety), delay units (and tape machines/echo units using tape designed for the purpose) and the output of certain types of synthesisers or synth sounds where heavy filtering results in high gain and system noise. Of course, it will be most at home in the copy room, and perhaps the cutting suite. In the copy room it will no doubt be useful for the making of production masters, especially from old tapes made in the days before noise reduction. In addition, it can be used to clean up tapes which originate on unusual media, for example cassettes. It could also find application for enhancing the dynamic range and noise performance of transcriptions from vintage discs. It would appear to have applications in the PA field, both for silencing effects units (plus the cassette recorder you play the music from during the interval?) and for the main system. In the broadcast field it may be useful for reducing land-line noise and for noise reduction on video machines' audio channels. For the consumer too, it also offers the possibility of rendering old and nasty cassettes playable again and might allow VCR owners to make some sense out of the generally ghastly quality of the sound on the majority of pre-recorded video tapes, although it can't touch the usual flutter and distortion.

Overall, I would have no hesitation whatever in recommending the *Dynafex D-2B* to anyone who performs a lot of copying or works with sound sources which have undesirably high levels of noise. Although certain applications may require careful thought about where to place the unit in the audio chain and there can be unfavourable effects on fades and reverb decays, these can all be circumvented with few problems. The *Dynafex* is a very effective and functional unit at a very reasonable price.

Richard Elen

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CADEY 16-TRACK 2 inch, £3,250. EMT 140 stereo plate, £2,200. Pace DM 32/16/2, £1,200. Ring Steve, Whitstable 263847 or Herne Bay 64785 after 6 p.m. (J)

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Our weekend sound studio courses are designed for everyone considering the profession or just plain interested.

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01-348-1339

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ALAN CHEETHAM AUDIO SERVICES

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 Audio & Design Compex Limiter, Vocal Stresser and Express Limiters. Scamp rack
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 Yamaha O1027 27 band graphic (pair) £695
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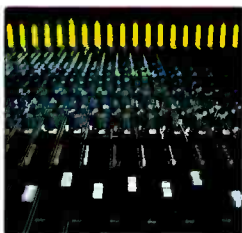


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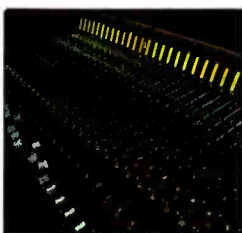
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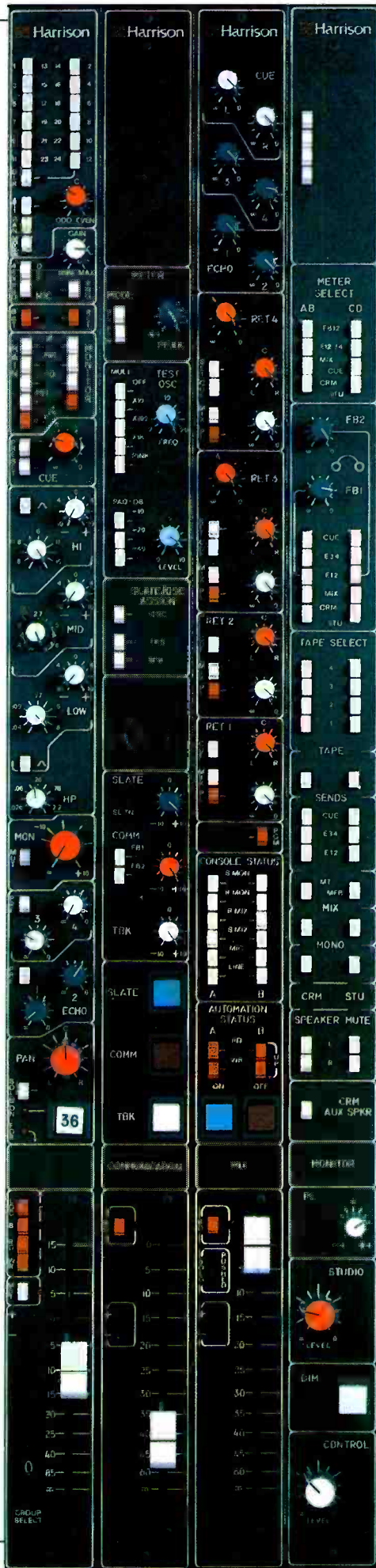


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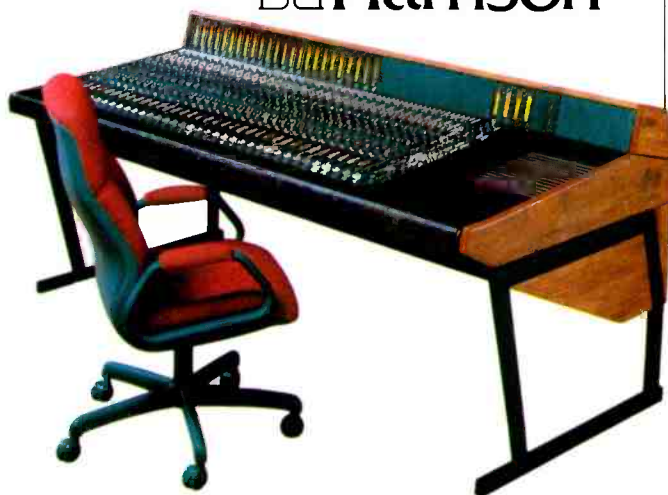
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