November 1981 £1

studio sound

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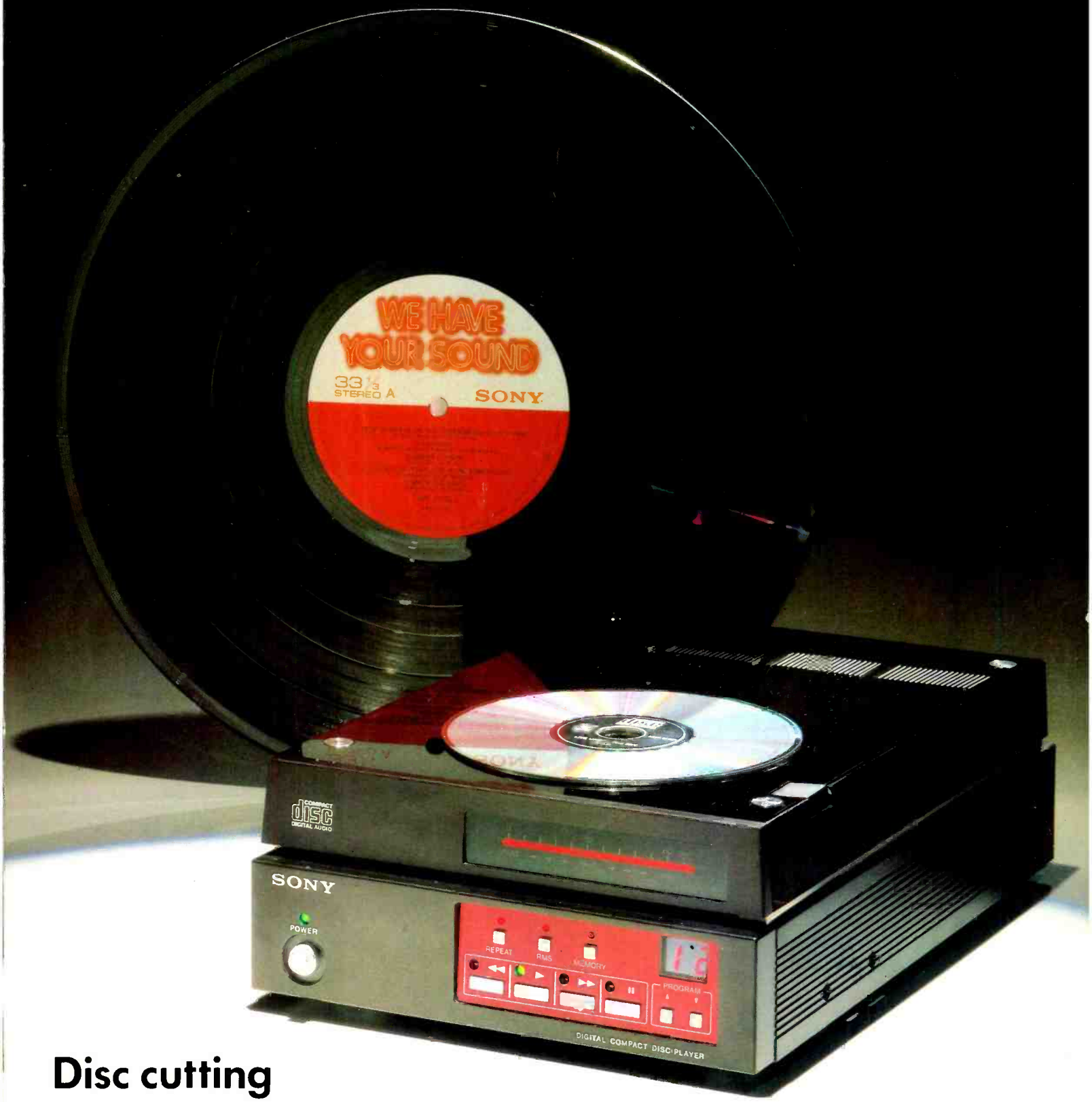

Disc cutting
Tape duplicating
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Soundcraft
THE CHALLENGER

Phil Dudderidge • Graham Blyth

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A LINK HOUSE PUBLICATION

ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

This month's cover photograph of the Compact Disc player, courtesy of Sony

Developing the disc

All of a sudden there seems to be a major effort to make disc reproduction better: and it's about time too. The record production process has advanced but a little since its inception, and virtually nothing has happened to it in the last quarter-century. Indeed, pressing quality has almost certainly dropped, and adding to this the fact that most listeners' equipment is better and more sensitive than it was a few years ago, it is hardly surprising that subjective impressions are that record quality is at an all-time low. Yet there are some technical improvements coming on line which appear to offer significantly better record reproduction.

One undoubted success is the Sony/Philips *Compact Disc*. It does sound very impressive, and although there may be problems with the increased dynamic range offered by digital (and compansion NR systems) as Mike Beville points out in this issue, it is certainly the system of the future, and shows that the generally nasty sound of current digitally recorded/analogue pressed records is not the fault of digital at all, but more likely due to such factors as cutter-head resonances (due to an unusual amount of hf information) and untidy compression of the digital signal to get it on to vinyl.

More questionable is the CBS *CX* system. While the idea—a compansion curve optimised to reduce disc noise by about 20dB—is fine, they really *shouldn't* have claimed it was 'compatible' (ie *CX* discs give acceptable results when played back without an expander) because it simply isn't true. When I heard the system at a recent London demo (at CBS studios) I was impressed by the noise reduction capability of the system when *CX* discs were played with a decoder but without, they sounded horrible: the degree of compression reminded me of the worst examples of US radio (probably why CBS think it's compatible—Americans are used to heavy compression). Quiet passages were unnaturally loud, and 'distant' sounds were brought forward and made larger than life, causing the stereo to lack depth. Even on rock music it would be disturbing, yet a number of US record companies have said that they are intending to release *all* their repertoire *CX*-encoded, with no choice for the purchaser. Record executives in the UK seemed to think it a good idea, too, and I would agree *if* they didn't insist that you didn't *need* a decoder. Even with one, what will happen when a radio station plays a *CX* disc, adding extra compression at the transmitter? What will the poor little *CX* decoder do with that?

Suggestions made to me that *CX* is just as compatible as stereo/mono, or Dolby-B played back without a decoder, are simply untrue. It is quite feasible to produce a mix which works well in both mono and stereo, as years of recording library music have long since taught me, and undecoded Dolby-B's extra hiss and top can be dealt with acceptably by a top-cut. *CX* undecoded is far worse than either of these. Yet *CX* does work fine *with* the decoder.

The answer is to release both ordinary and *CX* discs (cf dbx's market strategy) and let the public decide. When the sales of uncoded discs become uneconomically low, *then* drop them, but not before. Yet by that time, digital will no doubt be here. Besides, there already is a system of compansion for records: it's called dbx, and it works fine, even if *CX* is theoretically better suited to disc-noise reduction. Hardly surprising, then, that recording engineers in the US have already expressed displeasure at having alien compression curves imposed on their careful efforts, which the majority of listeners won't be able to remove. Even monitoring the mix direct and via an encoder won't solve the problem: they'll *never* sound the same. Of course, a professional quality *decoder* might make a marvellous effects unit, if used to process the mix, especially if you knew the album was going to be *CX* only . . .

One final point. If records I buy in the shops have the kind of noise and 'swish' that the *CX* demo records that I heard had, I take them back. Is *CX* going to be yet another excuse for even poorer pressings? **Richard Elen**

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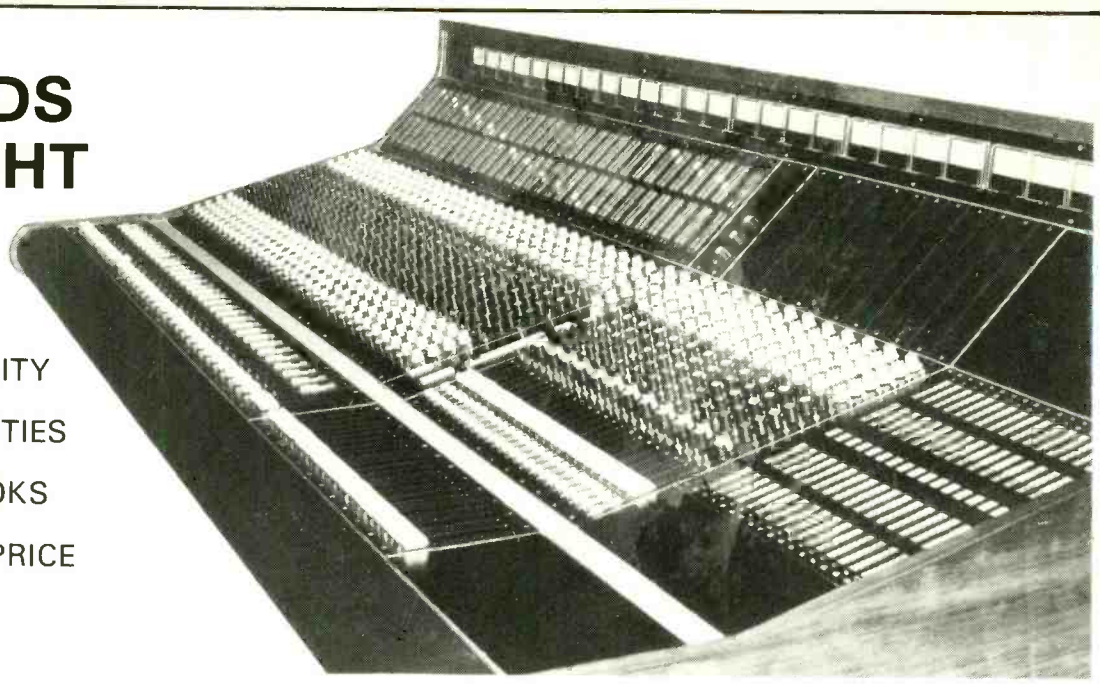

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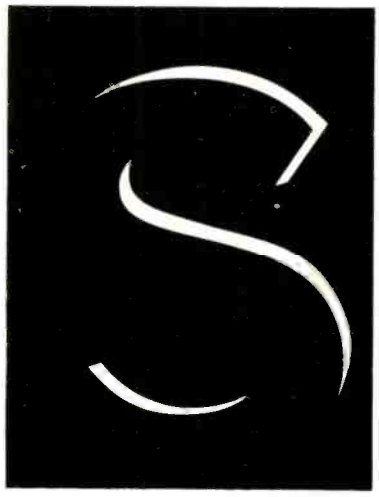

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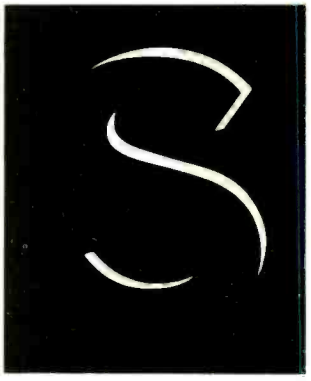

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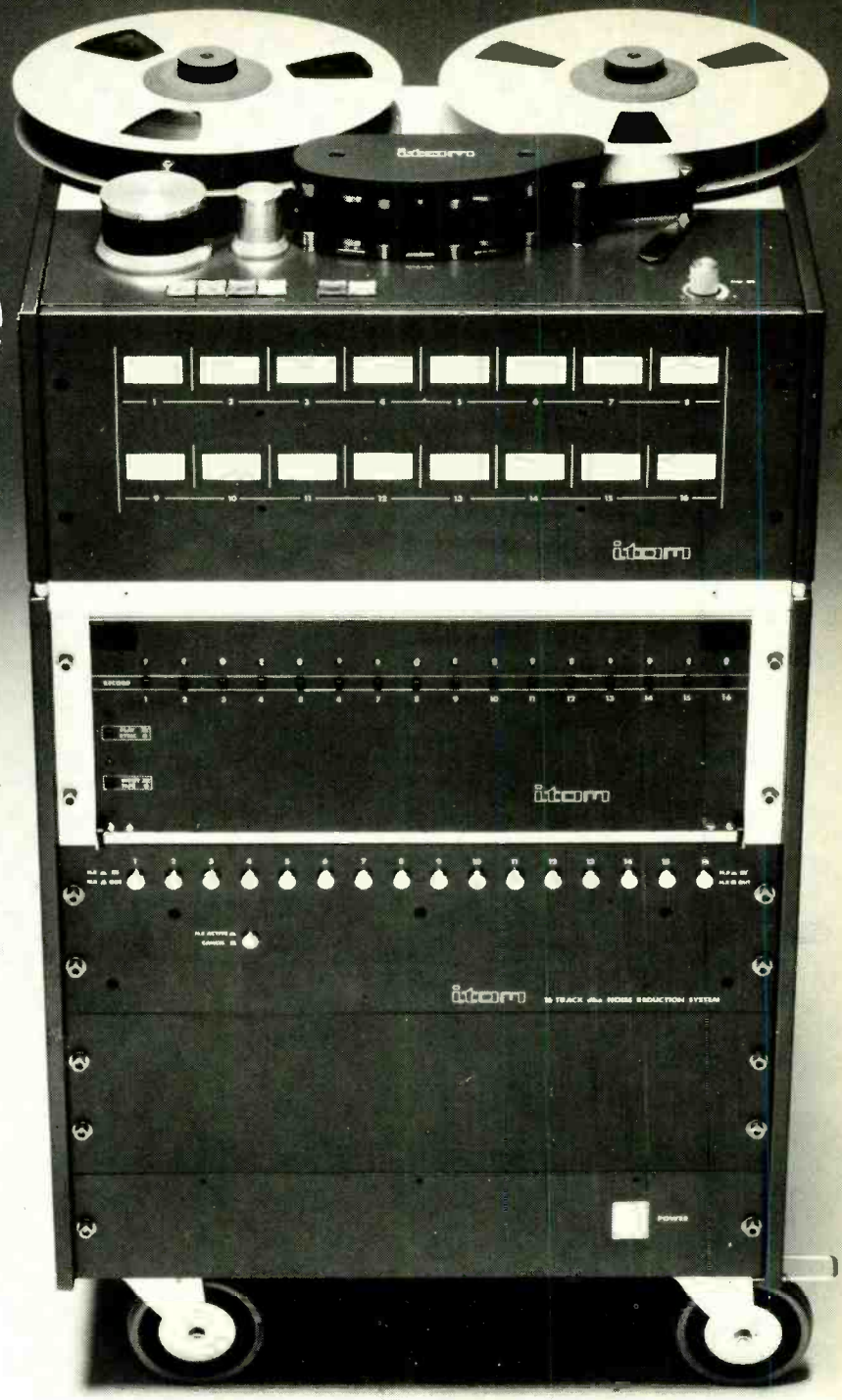

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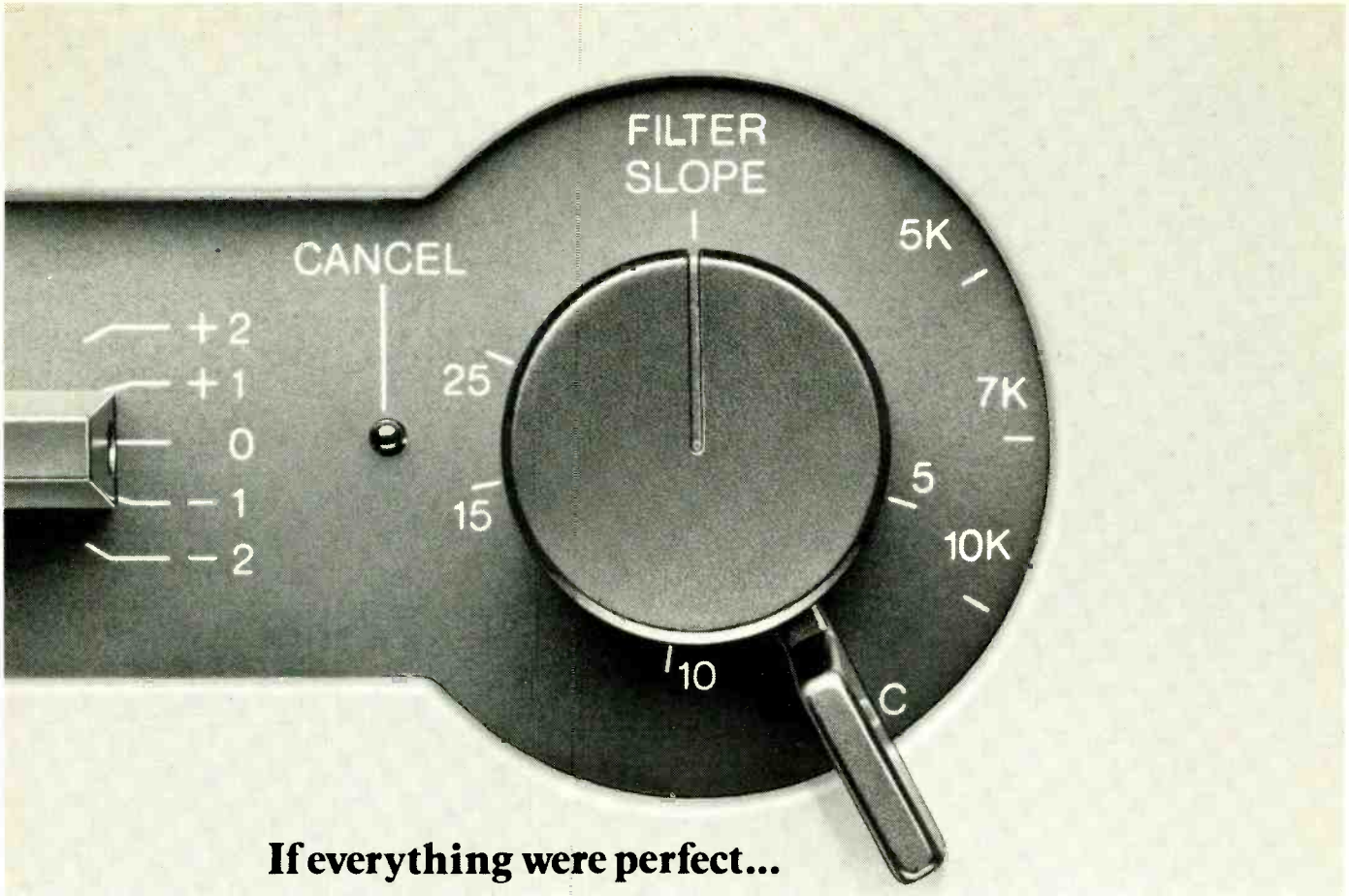

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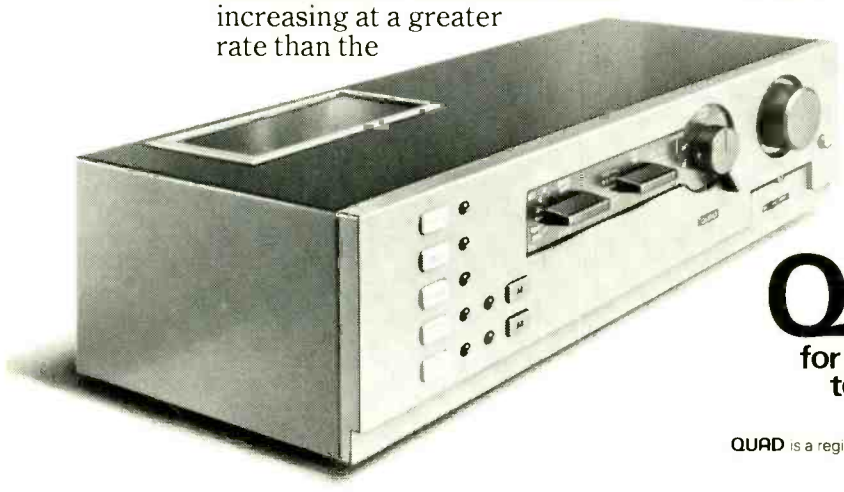

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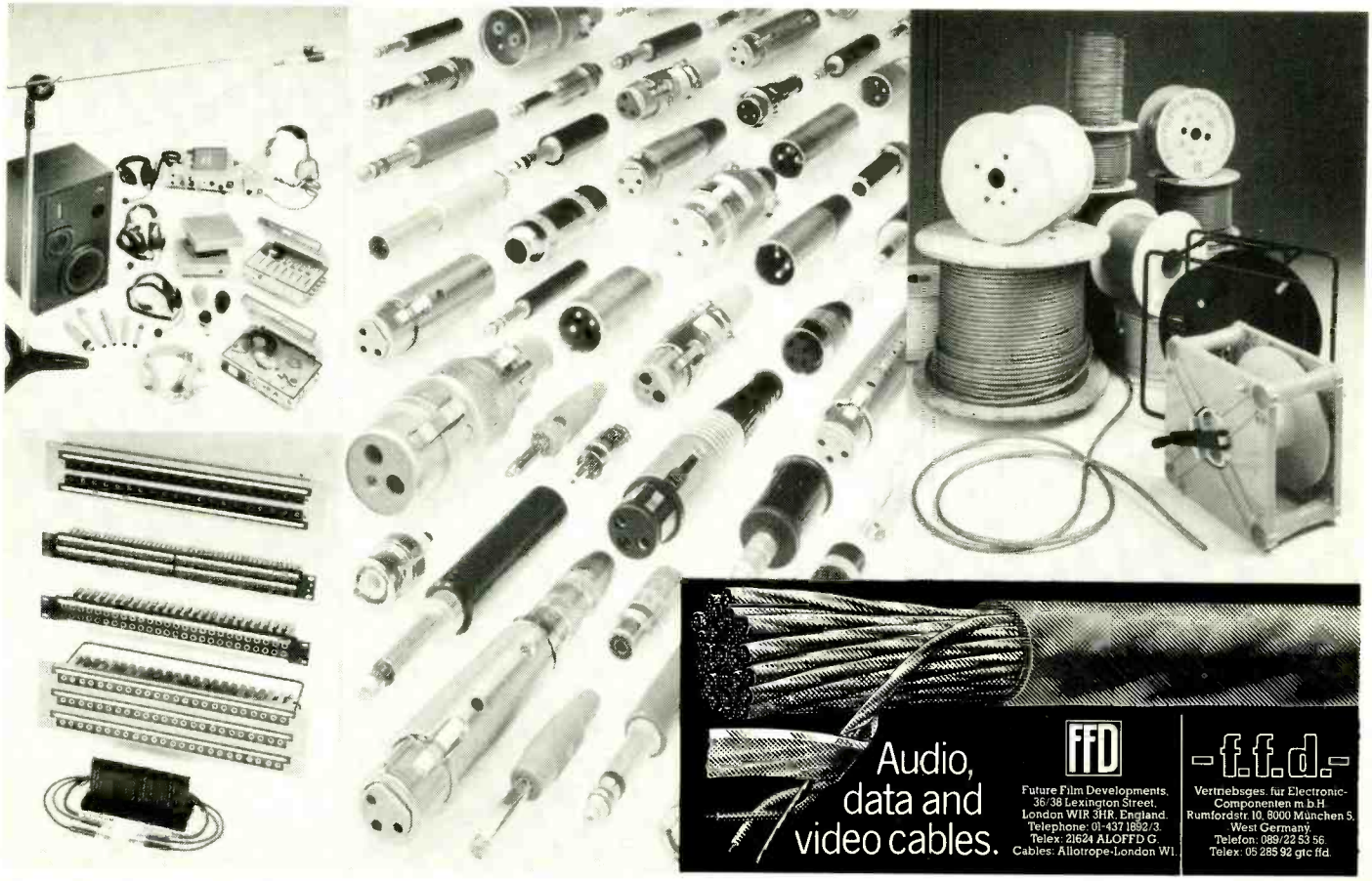

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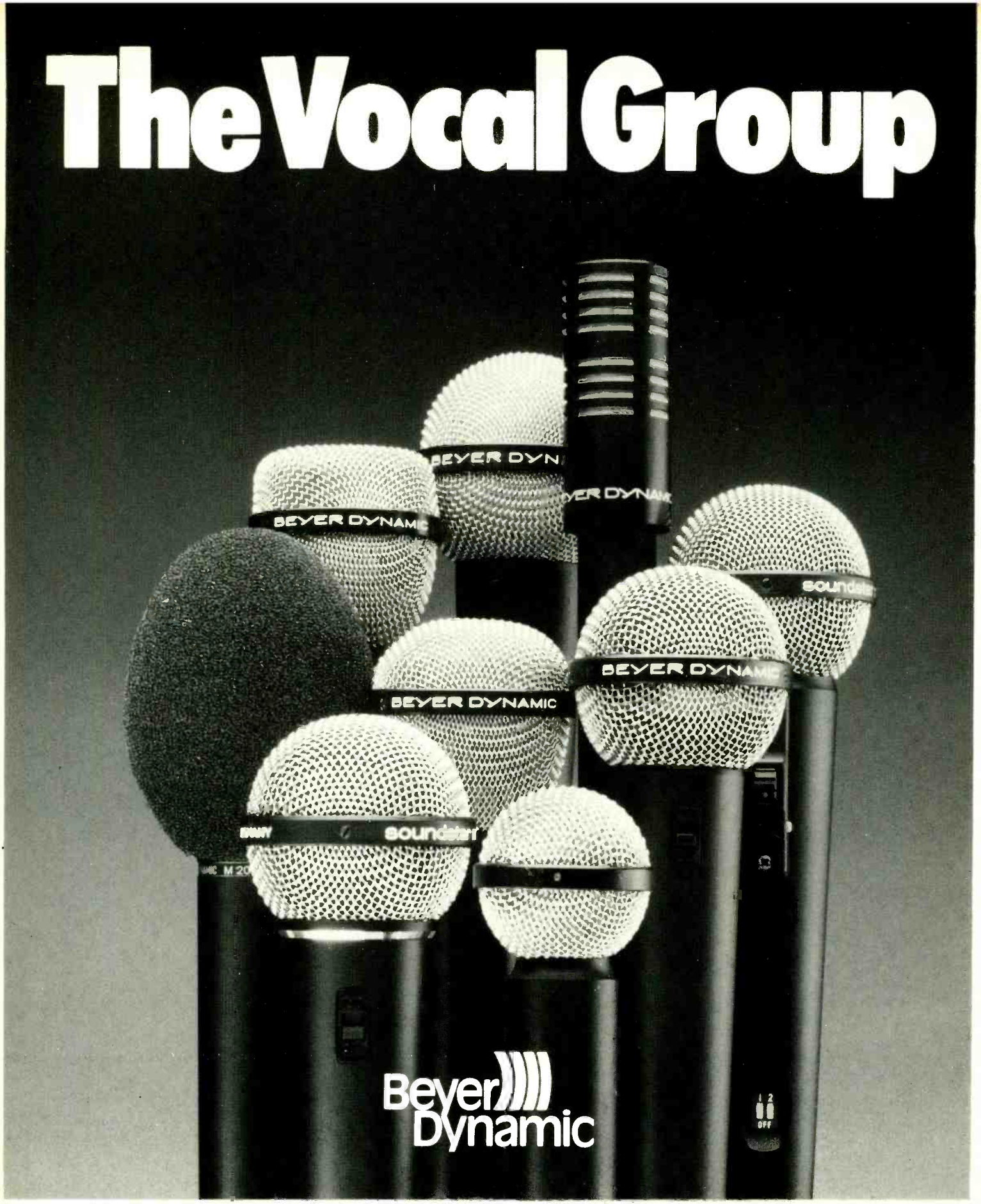

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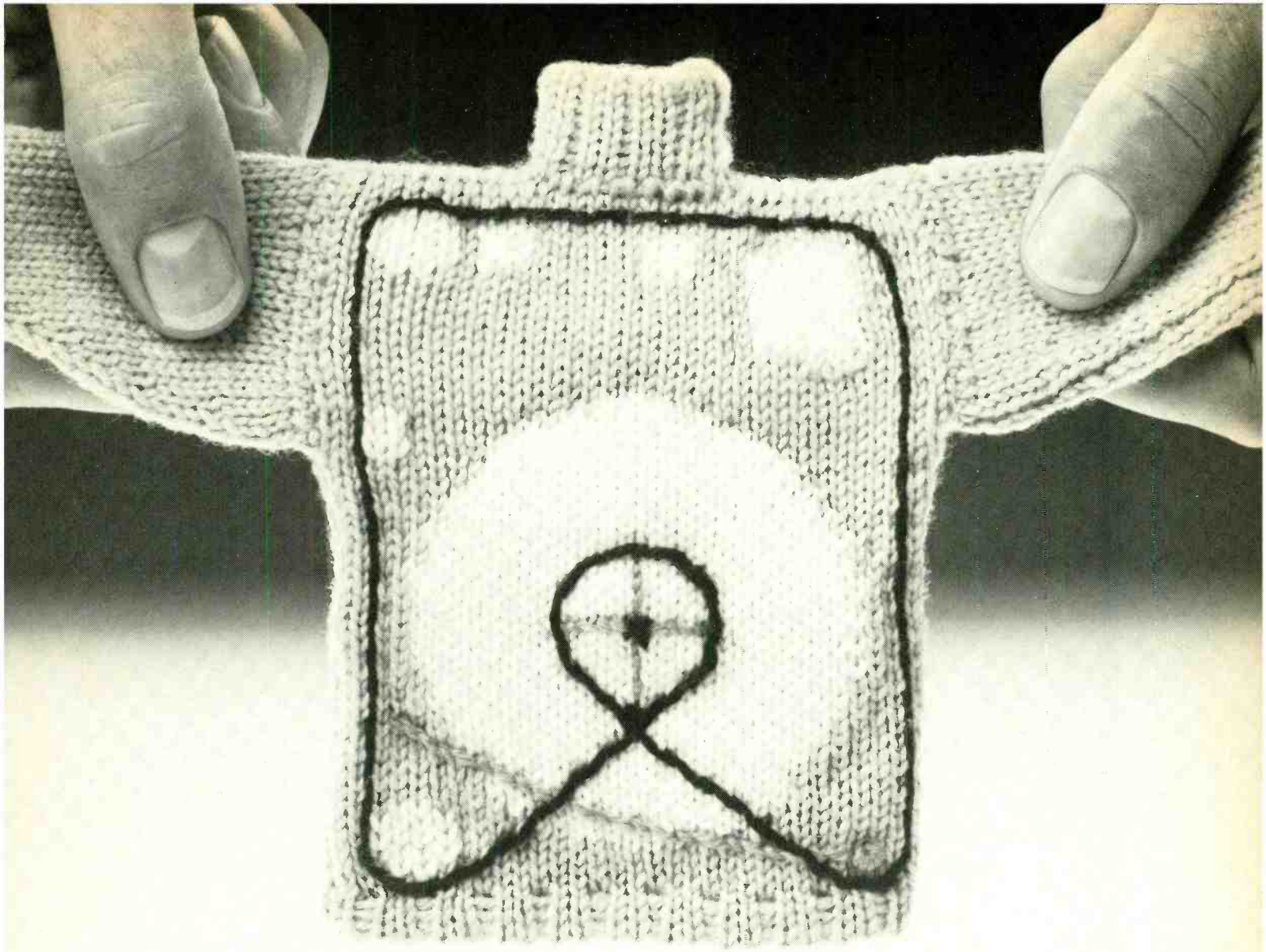

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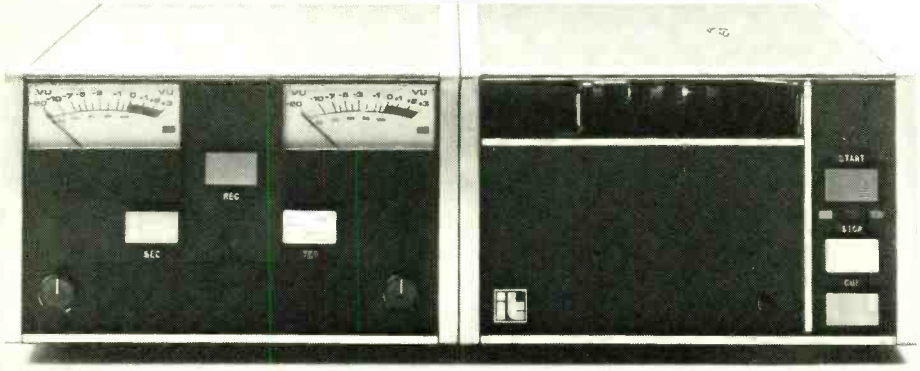

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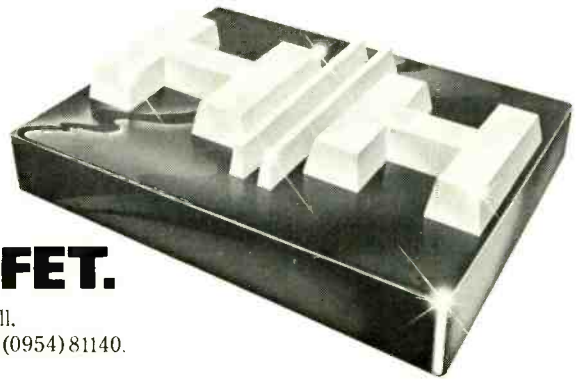

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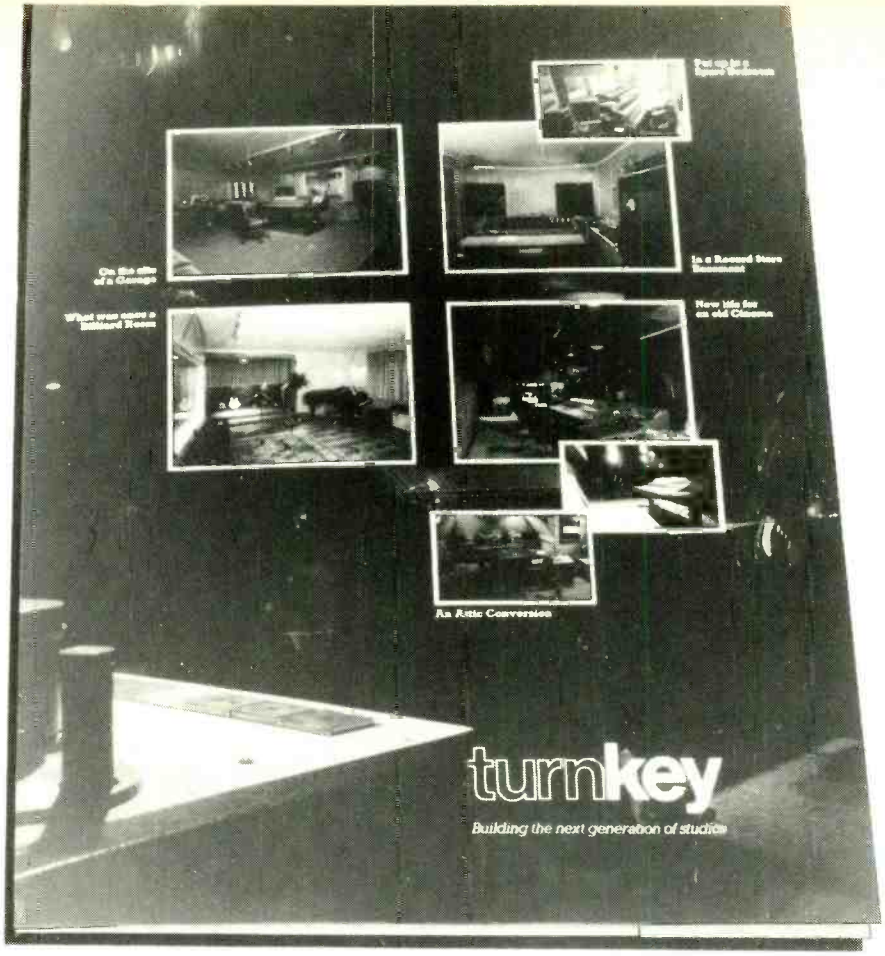
16 plus Fact File

Building 16 and 24 track studios is our business. In castles, cinemas, attics, and basements to name but a few. Some are in our hands from the time the first brick is laid, others we equip and commission.

Based on our involvement with these projects and their problems, we have prepared a unique file of information. It contains vital facts and figures, covering all aspects of establishing a successful studio.

The sixteen plus fact file is essential reading for anyone involved in establishing a professional multitrack studio. Write or call **Andrew Stirling** now for your copy.



In brief, this 40 page file covers;

What to look for in a building and what to ask the local authorities.

Building from the ground up, what it costs and how long it takes.

Studio Cashflow Planner and completed examples.

Finance and how to get it, what to tell your bank manager.

Package quotes for complete 16 & 24 track installations including wiring and installation.

How to avoid the signal processing trap.

The cost of running a studio and how much you can charge.

Advertise your studio for maximum response, where and how.

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Automation, the format fight and the future.

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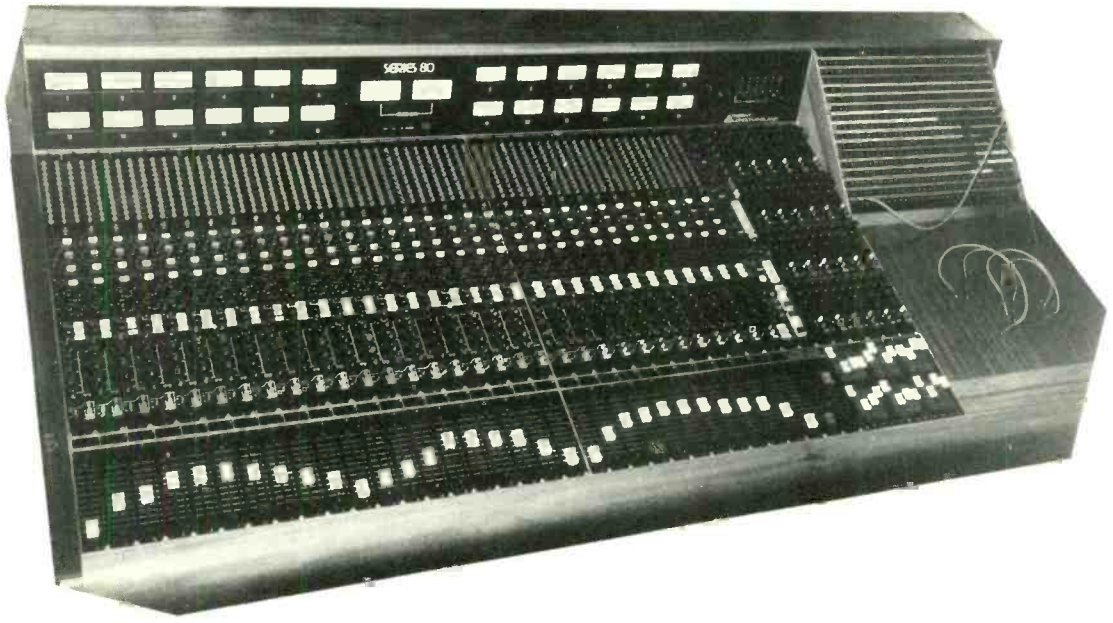

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Neve BCM 10 10 x 4-8 x 2 Modules ..... P.O.A.
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Triple Two allows vocal control over each played note or chord, featuring an unequaled dynamic response and clarity of sound. It is the interface between musician and his instrument, translating articulation into musical sounds.

■Syntovox Triple Two - trend setter for budget vocoders. Triple Two's the One.

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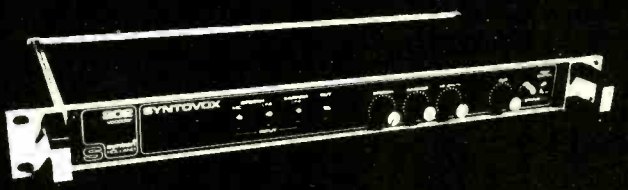
202

The Incredible Machine



Syntovox 202 is the latest development in vocoders by Synton. It was designed primarily to make a match between a polyphonic keyboard, a boosted bass or a fuzzed guitar and its player.

Syntovox 202 introduces the elegant way of moulding musical sounds into the shape of vocal articulation, enabling the user to impose his timbre upon cliché sounds - instantly!

We could have called Syntovox 202 "The Little Imposer". We didn't. We called it "The Incredible Machine". You'll find out why.

■Syntovox 202 - a thrilling effect at rock bottom price.

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221

The Intelligible Machine

Syntovox 221 is a 20 channel vocoder system which already has made its way to numerous sound recording studios, radio stations, composers and scientific institutions for its outstanding quality and its unexcelled intelligibility.

Syntovox 221 includes 54 dB/octave filters, a feature not found in any other vocoder on the market. It also offers the versatility of a built-in pulse generator for direct speech synthesis, and several control units for pitch modulation. Syntovox 221 features matrix patching for formant shifting, and a highly precise voiced/unvoiced detector system, and it offers extreme flexibility by the multiway connector which gives access to the analyzer and synthesizer sections and the control terminals of the voiced/unvoiced detector.

■Syntovox 221 - The Intelligible Machine - has set standards in vocoder techniques.

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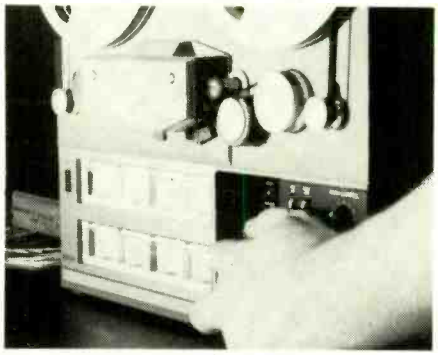
What to do with your hands on Friday the Thirteenth

Try out the latest in creative music recording at the 'Hands on Show', a unique two day event of live demos, new products, Workshops, in fact everything multitrack, right from the basics. You'll get hands on experience of equipment from leading manufacturers and a chance to talk to their experts.

Four to Twenty four

There's a new generation of Personal Multitrack equipment by **Fostex.** The ultimate suitcase studio and affordable eight tracks



on quarter inch. And of course **Tascam**, check out their full range, right up to sixteen track. Mix and compare the results with mastering studio equipment by **Soundcraft**. Hear their latest twenty four track system, and find out how they are cutting the cost of studio ownership. And don't miss the opportunity of doing your own balance of Sergeant Pepper on the original **Studer** four track,

which was used to record this classic Beatles album.

Computers Galore

It's not just where creative recording started, but also how microchips are invading music. There's the **Movement** real drum rhythm computer and **Roland's** latest Micro Composer. Even if you have never played, **Casio's** revolutionary VL-Tone won't fail to amaze you. And a few keystrokes on our **Pet** computer will assemble an equipment package at your command.

Ear Delights

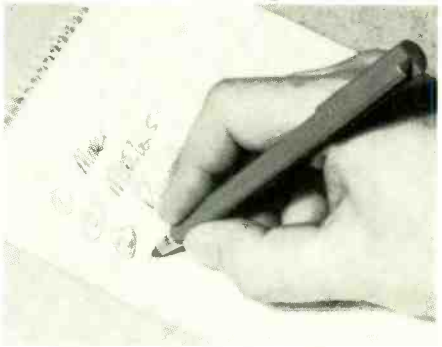
Don't expect silent demos. **JBL, Tannoy** and **Auratone** are there to let you hear why their systems are chosen for monitoring. All the way from budget compacts to multi driver monsters. **AKG**

cover the other end of sound with a wide range of microphones and accessories.

Effects Gallery

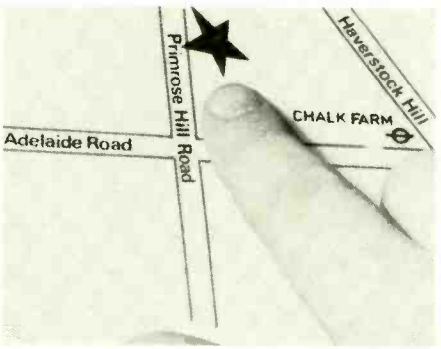
It's a unique opportunity for direct comparison of the latest studio effects, from harmonisers to aural exciters. Stretch and squeeze levels, frequencies and time with signal processing by **MXR, EXR, Ashly, Rebis, Accessit** and others. Bring along a tape or use the keyboards and guitars at hand for a personal demo. Product experts will answer every query.

Creative Workshop



If you make it through to Friday night, stay on and hear guest speakers talk multitrack. The basic equipment, effects and acoustics. Slides will be shown and problems discussed. Attendance is free, but **please** apply for tickets **now**, last time we ran out of chairs.

The 'Hands on Show' is being held at the Clive Hotel in Primrose Hill. On Friday November 13th



doors open at ten till the Workshop at seven. For the superstitious, same time Saturday, but open till eight. We look forward to seeing you there. Don't miss it.

For more information and Workshop tickets contact **turnkey**

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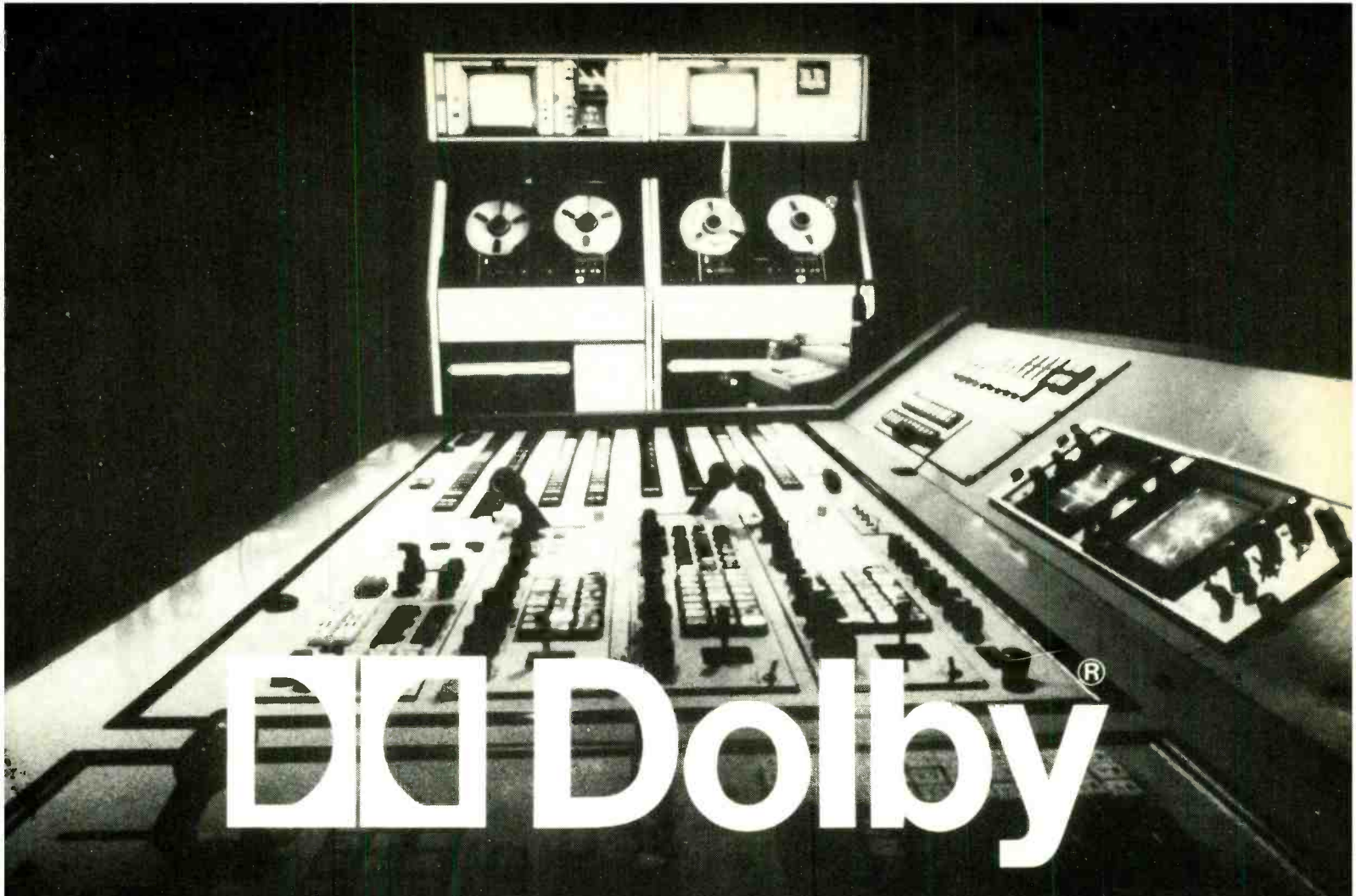
The HANDS ON Show



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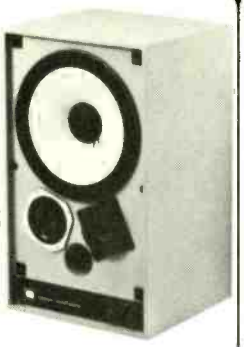

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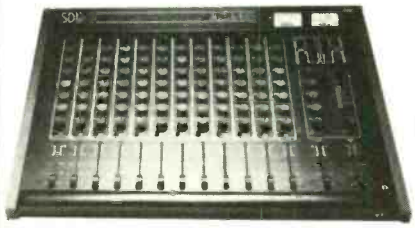

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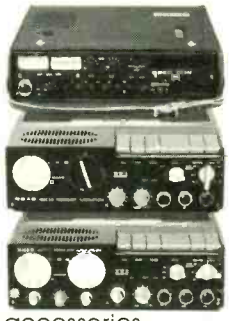

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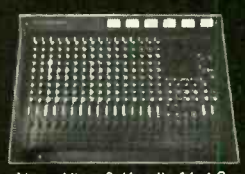

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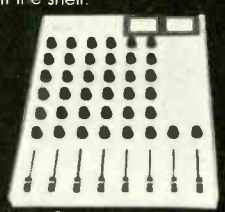

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diary

ATC loudspeakers

Acoustic Transducer Company, the London based manufacturer of professional loudspeakers, has been purchased by a new British company, Loudspeaker Technology Ltd. Managing director of the new company is Bill Woodman, designer of the original ATC range. The new company's first target is to maintain continuity of supply of ATC products; however, we are informed that once this is achieved the entire loudspeaker range will henceforward be manufactured incorporating newly designed symmetrical field ceramic magnet assemblies allowing prices to be reduced. Concurrent with the change of ownership, Loudspeaker Technology has taken over the ATC trademark and relocated the company's manufacturing operation to new premises. All enquiries concerning the ATC range should now be referred to Loudspeaker Technology Ltd, Westwood House, Great West Trading Estate, Brentford, Middlesex, UK. Phone: 01-568 8224.

Sale of The Next Century

Malcolm Jackson informs us that following the success of the first Sale of The Century at EMI Abbey Road, a second sale of professional audio equipment is to take place from October 14 to 16 at The Production Village, 100 Cricklewood Lane, London NW2. Further details are available from Jackson Music Ltd, The Studios, Rickmansworth, Herts, UK. Phone 09327 72351.

Proline accessories

Leevers-Rich has produced an illustrated leaflet giving details of the company's professional accessories for its *Proline* tape recorders. The leaflet gives details of the company's demagnetisers, extender cards for circuitry maintenance, a tape tension gauge and custom tool kits. Copies are obtainable from Tony Costello, Leevers-Rich Equipment Ltd, 319 Trinity Road, Wandsworth, London SW18 3SL, UK. Phone: 01-874 9054.

Instrument catalogue

Precision Instrument Laboratories has released the 4th edition of its test and measurement instrument catalogue. The 120 page catalogue covers a wide range of equipment and includes multimeters, oscilloscopes, plotters, recorders, signal sources and generators, component testers, etc. Copies are available from Les Rowe at Precision Instrument Laboratories, Instrument House, 727 Old Kent Road, London SE15. Phone: 01-639 4461.

CP Cases—France

CP Cases has recently opened a new sales office and warehouse in Paris. The new office which is headed by Eric Alvergnat will stock all CP Cases, CP Fittings and Mega products. CP Cases, 24 rue Carnot, F-93100 Montreuil, Paris, France. Phone: (01) 859.99.00. Telex: 8952532.

Cassette duplication

Ellie Jay Productions has informed us that they now offer a cassette duplication service with duplication being carried out in realtime (1:1). The service is offered on any quantity from one to 500 copies, longer runs continuing to be duplicated by the loop-bin method. A wide range of cassette tape can be specified for runs with brands available including TDK, Memorex, Agfa, etc. Customers can provide reel-to-reel, cassette or disc masters—and copying utilises graphic eq facilities, plus Dolby-A, Dolby-B, etc. Further details are available from Ellie Jay (Productions) Ltd, 97 Judd Street, London WC1, UK. Phone: 01-388 5771.

ILR news

Two new ILR stations have just gone on air, the 28th and 29th ILR stations to become operational. Radio Aire serving Leeds and West Yorkshire went on air on September 1, with Centre Radio which serves the Leicester area following on September 7.

The IBA has invited applications for ILR franchises for a further two areas. These are for the Guildford area and for the Stoke-on-Trent area. The Guildford franchise is one of the three remaining areas from the 15 stations authorised by the Home Secretary in November 1979, (those for East Kent and Barnsley still await invitation), while the Stoke-on-Trent franchise is the first of the new third phase of ILR stations approved by the Home Secretary in July of this year.

As part of its continuing programme of improving its transmitter network, the IBA has completed its new computer-based Regional Operations Centre (ROC) at St Hilary near Cardiff. The new ROC supervises all ITV and ILR transmitters in Wales, the West of England and South-West England. The opening of this new centre means that some 500 transmitting stations in England, Wales and the Channel Islands are now supervised from just three centres—Croydon (near London), Emley Moor (West Yorkshire) and St Hilary. Another ROC is currently under construction at Black Hill near Glasgow. This latter centre will supervise all transmitting stations in Scotland, Northern Ireland, the Isle of Man, and a number of stations on the England/Scotland border. In addition the original Croydon ROC is to be rebuilt next year to the same standards as the other ROCs.

40 ▶

BBC radio plans

The BBC has unveiled its proposed plans for its network, national, regional, and local radio services for the 1980s. At a Board of Governors' meeting on July 2 the following recommendations were approved: a) to improve portable and car radio reception and to reduce the number of VHF coverage gaps; b) to seek Government approval for a separate VHF outlet for Radio 1; c) to set up new local radio stations at the rate of three per year and to continue to develop a number of smaller opt-out stations in the national regions as resources permit; d) to encourage experimentation with the development of local services including shared programming until such time as a planned reduction in network output can be implemented; and e) that a decision on the possible restructuring of network radio for the 1990s be postponed until the present development plans are completed. The Board also decided that the question of whether to construct a new Broadcasting Centre in inner London should be considered separately.

The practical results of these recommendations will see all the existing BBC VHF transmitters being re-engineered to broadcast with slant polarisation, ie both horizontal and vertical polarisation; the building of approximately 100 new VHF transmitters to cover gaps in the existing VHF transmitter network; and the relocation of national regional radio so that Radio 4 programmes can be transmitted on VHF throughout the UK. Additionally, if these proposals were implemented Radio 1 would be given a separate VHF channel. These proposals will not, however, involve the BBC in any changes in its LW and MW transmissions.

The radio receiver of the future could include a display similar to the one shown in this simulated photograph.

While a number of the BBC's proposals are conditional upon the outcome of forthcoming International VHF Planning Conferences scheduled for 1982 and 1984, the BBC hopes that the VHF band will be replanned such that four BBC national UK services will be available in sub-bands 2.8MHz wide; there will be a BBC local and regional sub-band 3.0MHz wide; there will be an ILR sub-band 3.0MHz wide; and there will be an additional 2.8MHz sub-band available capable of carrying a further UK service possibly for educational usage.

A technical development which complements the above recommendations is a BBC designed system termed *Radio-Data*. This system, which utilises a data signal transmitted from a VHF transmitter, allows receivers equipped with the necessary microprocessor and ancillary electronic display to indicate in LED readout form which station a listener is tuned to. Other options available with the system include display of wavelength; display of programme or music titles, or even sports-scores; the capability of automatic station search or retuning when car users move from one frequency area to another; plus the ability to tune to preselected programmes when these are broadcast. Although the system is still experimental details of the system are available from the BBC in their Research Department Report *BBC RD 1981/4*.

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Holland	**Special Audio Products BV** Scheldeplein 18, Amsterdam Tel: Amsterdam 797055
Sweden	**Tal & Ton Musik & Electronic AB** Kaempegatan 16, S411-04 Gothenburg Tel 031 803620
Spain	**Mike Llewelyn-Jones** Francisco de Rojas 9, 2 DER, 9 Madrid 10 Tel: Madrid 445 1301
Germany	**Audio Vertrieb Peter Strüven GmbH** Hamburg Tel: Hamburg 5245151

diary

Rogers monitors

The British manufactured Rogers range of loudspeakers produced by Swisstone Electronics have slowly but relentlessly been making an increasing name for themselves in recording and broadcasting studios. To meet increasing demand Swisstone have therefore formed a separate marketing division titled Rogers Monitoring. Headed by Richard Ross and Steven Weller the new division will operate separately from the company's domestic marketing activities.

At present the company's range comprises four loudspeakers, the *LS3/5A* and *LS5/8* designed by and built under licence from the BBC, a passive crossover development of the latter loudspeaker the *PM510*, and the Rogers *Studio 1*. In addition Rogers also produce the *A100* and *A75 Series 3* stereo amplifiers and the *T75 Series 2* stereo FM tuner.
Rogers Monitoring, Swisstone Electronics Ltd, 4/14 Barmeston Road London SE6 3BN. Phone: 01-697 8511. Telex: 893980.

Trident (USA) Inc

Trident Audio Developments Ltd has announced that it has opened an American office in Stamford, Connecticut. The new American headquarters known as Trident (USA) Inc, is to be headed by Ken Bray as vice president. Ken was previously responsible for the company's European and worldwide sales and marketing. Other staff to be based in Stamford include Mark Terry, sales manager, and Jeff Hillier, chief engineer. The new office in addition to marketing the company's products will provide service support on a direct basis to the North Eastern USA. Trident's existing dealer network will be retained with Empirical Audio acting as consultant dealers on behalf of Trident (USA); while Wilson Audio Sales in Nashville and Studio Maintenance Services in Los Angeles will continue to distribute the company's products in the South and West. Trident (USA) Inc is located at: 652 Glenbrook Road, Stamford, Connecticut 06906, USA. Phone: (203) 357-8337.

Agencies

● Clyde Electronics has been appointed agent for the Marti range of communication equipment. Clyde Electronics Ltd, Ranken House, Blythswood Court, Anderston Cross Centre, Glasgow G2 7LB, UK. Phone: 041-221 5906 or 041-248 3001.

● The *Status* range of power and pre-amplifiers is now available to professional users from Jim Dowler, 117 St Margarets Road, Twickenham, Middx, UK. Phone: 01-891 3862 or 01-892 3469. Jim is also offering a 24hr service facility to users in the London area.

● Audio Kinetics has appointed Telco SL as its sole Spanish agent. Telco SL, Gravina 27, Madrid 4, Spain. Phone: 231 7840. Telex: 27348.

● Solid State Logic has appointed Iain Everington of Audio Mix Systems as its agent in Australia. Audio Mix Systems (Int) Pty Ltd, 3/79 O'Sullivan Road, Rose Bay, Sydney, New South Wales 2029, Australia. Phone: (02) 371 9009. Telex: 23976.

● Clyde Electronics has appointed a number of overseas agents for its range of broadcast products. *Australia:* Klarion Enterprises Pty Ltd, Regent House, 63 Kingsway, South Melbourne, Victoria 3205, Australia. Phone: (03) 61 3801. Telex: 34732. *USA:* Audio Techniques Inc, 1619 Broadway, New York, NY 10019. Phone: (212) 586-5989; Audio Techniques Inc, 652 Glenbrook Road, Stamford, Connecticut 06902. Phone: (203) 359-2312. Telex: 996519; Pro Audio General Store Inc, 1378 NW 100th Avenue, Coral Springs, Florida 33065; and Marcom, PO Box 66507, Scotts Valley, Cal 95066. Phone: (408) 438-4273. Telex: 910-598-4417. *Western Canada:* Commercial Electronics Ltd, 1335 Burrard Street, Vancouver, British Columbia V6Z, Canada. Phone (604) 669-5525. Telex: 04 54470.

● Audio & Design Recording Ltd have recently signed on a new distributor in Peru, Estemac Peruana SA, Casilla 224, Lima 18 (Miraflores), Peru. Phone: 455530/456597. Telex: 25385.

Address changes

● Marantz Audio UK Ltd has moved to 15/16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middx UB7 0LW, UK. phone: 01-897 6633/9.

● Tentel has moved to larger premises at 1506 Dell Avenue, Campbell, Cal 95008, USA. Phone: (408) 379-1881.

● American manufacturer Accurate Sound Corp has moved to larger premises at 3515 Edison Way, Menlo Park, Cal 94025, USA. Phone: (415) 365-2843. Telex: 348327.

People

● Accurate Sound has appointed Irwin Diehl to the newly created position of general manager and promoted Don O'Bella to sales manager. In addition Paul Hulse has joined the manufacturing division of the company.

● The Otari Corp has added Tom Defiglio and Barry Ross to its technical staff, while Clifford Pong joins its sales staff.

● The IBA has appointed Edwin Riddel to the new post of chief radio programming officer, while Sheila Porritt has been appointed principal radio programming officer.

● Robert Weirather who left the broadcast products division of Harris to join Broadcast Electronics, has rejoined Harris as a consultant on its new product develoment programme.

● Rick Plushner has been appointed national sales manager (USA) for Sony's Digital Audio Division.

● Garry Margolis, formerly of JBL has moved to United Recording Electronics Industries (UREI) to take up the position of Director of Sales.

Contracts

● Audio Kinetics has supplied London Weekend Television with a further *Q-Lock 310* synchroniser system. Other recent sales include a *310* to Television Automation Ltd for its new multitrack audio facility, while Trilion Video and Video London have both ordered *Q-Lock* systems for use with their Trident *TSR* multitrack recorders.

● M-Jay Electronics has supplied the Fashion Recording Studio, Faversham, Kent with an *Airedale* 32/24/24 console. A similar console with custom extras has been supplied to Look Records Ltd, Huddersfield.

● The broadcast products division of Harris is to supply the Bahrain Ministry of Information with 100kW and 50kW MW transmitters for a new radio facility. In addition WVOX, New Rochelle, New York has taken delivery of a 1kW MW transmitter.

● Soundcraft Electronics recently supplied five *Series 1S* 12/2 consoles, customised with Penny and Giles faders and PPMs, to BBC Radio for use on the BBC's coverage of the Royal Wedding. Subsequent to this the consoles will be used for the provision of stereo sub-mixes for programmes such as 'In-Concert'.

● Clyde Electronics has supplied two *Delta Series* consoles and a *Alpha Series* console to North Sound, the ILR Aberdeen station, while Cardiff University's School of Broadcast Journalism has received an *Alpha* console and *BTU1* broadcast turntable units. Clyde also loaned LBC a customised *Alpha* mixer (housed in the Radio Clyde Mobile 3 unit) for LBC's Royal Wedding coverage.

● Solid State Logic are to supply Warner/Pioneer Japan with a SSL console. In addition Onkio House has ordered a second console for its mixdown room. Other Japanese contracts gained this year include consoles for JVC and Yamaha.

● Elliott Brothers has supplied eight *15XB* Tannoy Monitor speakers and stands with built-in H/H amplifiers to London Weekend Television; in addition, both Radio West (Bristol ILR) and Essex Radio (Southend-Chelmsford ILR) have acquired Tannoy systems from Elliott Brothers for use throughout the station and for on-air use respectively. The company is also to install Chiltern Radio at Bedford.

● Scenic Sounds Equipment Ltd, the UK distributor for Amek, has supplied a 28/24 *M2000A* console to the recently refurbished Gooseberry Studios in London.

● The South African Broadcasting Corporation has ordered 11 Audio Kinetics *310* SMPTE/EBU timecode synchronisers for audio/video interlock purposes. Other recent Audio Kinetics contracts include a *Q-Lock* system for the ITN TV news service, and a *310* synchroniser for Pete Townshend's rebuilt 46-track Eel Pie Studio.

● AMS has supplied Townhouse Studios and Peter Gabriel with further *DMX 15-80S* DDLs complete with stereo harmonisers and the new Loop Editing System software. In addition AMS has also supplied Polygram Studios, R G Jones Studios, Playground Studio, Jean Michel Jarre, John Paul Jones, Fleetwood Mac, Pete Townshend and Glyn Johns with *DMX 15-80S* stereo DDLs and pitch changers. Other recent orders include a *DMX 15-80S* DDL to Wessex Studios; broadcasting units to both HTV and Capital Radio; a further six *DMX* systems to the BBC; and a *DM 2-20* to Capital Radio.

● The Broadcast Products Division of Harris is to supply Radio-programas Del Peru with four 10kW AM transmitters. Other orders for Harris include a new FM transmitter station with a CP (circularly polarised) signal for WBBQ-FM, Augusta, Georgia. Harris has also completed delivery of 21 dual 300W FM transmitters to the IBA for its FM expansion programme. ■

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Lexicon's new Model 93 "Prime Time" digital delay processor gives recording studios and entertainers an easy-to-use professional quality time delay with special effects and convenient mixing all at a price you can afford. It combines a degree of flexibility and versatility never before offered in equipment of full professional quality.

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- All dynamic functions can be footswitch controlled
- 90 dB dynamic range, total distortion below 0.08% at all delay settings

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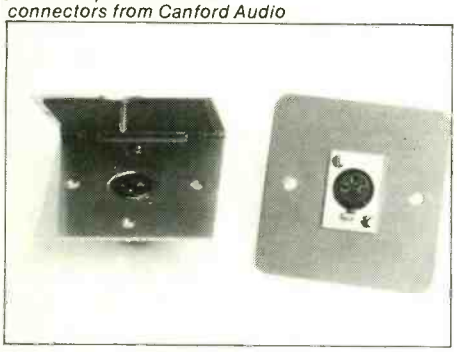
Lexicon, Inc., Waltham, Massachusetts 02154, USA

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

new products

Floor and plate-mounted connectors from Canford Audio



XLR-type connectors

Canford Audio are now manufacturing floor and plate mounted *XLR*-type connectors for studio construction and decor finish purposes. The floor mounted units consist of a 3 pin *XLR*-type female connector fitted in a satin-nickel finished steel plate, with sprung hinged flap, sealing rings and closure screw (for optional usage). Mounting holes fit standard BS electrical flush boxes. Canford can also supply an *XLR*-type 3 pin male unit to special order. The plate mounted unit is to the same type and finish as the floor mount units but with a slightly different mounting and without the hinged flap. As with the floor mount types other connectors are available to special order. Whilst the new units offer a variety of flush fitting applications, Canford inform us that the low cost ABS wallmount connector boxes will remain in production.

Canford Audio, Stargate Works, Ryton, Tyne & Wear NE40 3EX, UK. Phone: 089422 4515. Telex: 537792.

USA: Canford Audio (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 348-4969. Telex: 643678.

MicMix XL-121

The *XL-121* is the latest addition to the MicMix *Master Room* series of reverb units. This new mono unit incorporates the same technology as its predecessors, the *XL-305* and *XL-210,* and is designed to eliminate the boing, twang and flutter common with spring-based reverb. This performance is achieved without the use of internal limiting or other signal processing, and it is claimed that the unit will perform well even on harsh transient signals such as drums. A preamp gain control is fitted to allow instrument or line level inputs, and an output level control facilitates interfacing at the output end. Output mix controls and equalisation are also fitted, the latter including three bands (150Hz low, 1.2kHz mid and 6kHz high) with ±12dB adjustment. A dual-colour LED indicates power on (green) or overload (red) and ¼in jacks are provided for input and output. Additionally, a patch-point is fitted for external processing. A footswitch may be plugged into the rear panel for reverb switching.

Specifications: max input level +18dBV; input impedance 47kΩ unbalanced; max output level +18dBm; output impedance 47Ω unbalanced; frequency response direct channel 20Hz to 20kHz, +0, –2dB; decay time 2.5s; harmonic distortion <0.1% direct channel; output noise –75dBm direct channel, –68dBm reverb channel A weighted.

MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220, USA. Phone: (214) 352-3811.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

New Status units

The Status *500X* is an upgraded version of the existing Status *500* power amplifier. Superficially unchanged, with a power output of 250W per channel into 8Ω the new unit includes a number of advanced features including 4-terminal output connections which place the speakers and leads plus the connectors themselves and the protection relay inside the feedback loop. This offers a large increase in the lf damping factor, and thus improves the bass response. Back EMF effects from the speakers are reduced, as is the need for special speaker cable.

Other internal modifications include the addition of a current mirror to the first stage and emitter-followers to drive the MOSFET output stage. Servo-loop feedback is used to eliminate offset drifts, and an input/output comparator is employed to indicate clipping. The slew rate has been increased and both IMD and THD are reduced to under 0.01% over the audio range. A new dual-phase PSU improves the lf power bandwidth which, with the 4-terminal output system, brings impressive reproduction improvement over the lower two octaves. In true bridged mono mode, the amp uses phase inversion to give up to 800W into 8Ω. Electronically-balanced input amps have also been fitted to the new unit.

Also available in the Status range is a new preamp, the Status *10.* The unit is identical to the current Status *20,* but has no tone controls. A new moving coil RIAA preamp for the Status *20* is also available, the *Type C,* offering improved S/N ratio by way of better input impedance matching. Typical performance is within 0.1dB of the RIAA curve from 20Hz to 100kHz. Plug-in components are supplied with the unit which facilitate impedance and sensitivity matching.

Raindirk Ltd, 33A Bridge Street, Downham Market, Norfolk, UK. Phone: 03663 2165/3617. Telex: 817737.

USA: Audicon Marketing Group, 1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (615) 256-6900. Telex: 554494.

Rycote windshield

Rycote who were the originators some 11 years ago of the lightweight, unbreakable plastic windshield for directional (gun) mics, have produced a new windshield which can be removed and replaced on a gun mic in seconds without any requirement for careful alignment of parts or the need for fiddly unscrewing. Utilising a simple—so simple that it's amazing no one has thought of it before—technique, Rycote have cut a slot along the length of the windshield which matches an H-shaped section fitted to the shockmount/handle which carries the mic. The result, the windshield can now slide over the mic without disturbing the shockmount or the handle bracket. On and off as easily as that! The accompanying photograph illustrates just how simple the technique is.

Rycote Microphone Windshields Ltd, Unit 6, New Mills, Slad Road, Stroud, Glouces GL5 1RN, UK. Phone: 04536 79338.

Dot matrix LCD module

As microprocessor controlled audio systems and alphanumeric displays are becomingly more prevalent within the recording industry, manufacturers with thoughts of producing units requiring LCD message displays might care to investigate a new liquid crystal dot matrix display module, the *AND1861,* from Semiconductor Supplies (UK) Ltd. The *AND1861* features 40 alphanumeric characters in a two row, 20 character per row format. Each 5 × 7 dot matrix character is 0.21in high and is capable of displaying the full ASCII character set. Below each dot matrix character an additional row of dots has been provided for a cursor. Display drivers which store and update the dot information are included in the dual pcb design. Mounting of the display is accomplished with elastomer connectors and a metallic bezel. The display operates from a 5V dc supply and the entire unit excluding the attached ribbon cable leads, measures a compact 5.59 × 1.85 × 0.57in (whd). The *AND1861* is available with red, green or blue displays in addition to the standard black.

Semiconductor Specialists (UK) Ltd, Carroll House, 159 High Street, Yiewsley, West Drayton, Middx UB7 7XB, UK. Phone: 08954 45522/46415. Telex: 21958.

44 ▶

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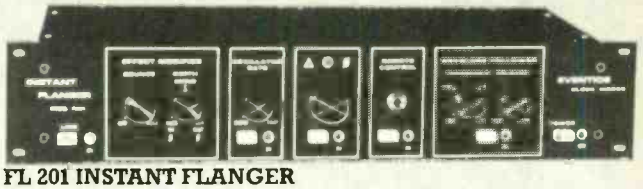
H 949 HARMONIZER
Pitch change: one octave up, two down. Delay: two outputs each 393.75 ms. Micro pitch change. Time reversal. Repeat. Randomized delay. Flanging. High and low feedback E/Q. Two selectable algorithms. Frequency response: 15 khz. Dynamic range 96 dB.

H 910 HARMONIZER
Pitch change: one octave up, one down. Delay: output one, 112.5 ms output two, 82.5 ms. Frequency response 12 kHz. Dynamic range: 90 dB. Feedback control.

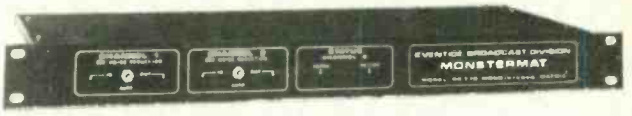


FL 201 INSTANT FLANGER
Simulates true tape flanging, initiated by an internal oscillator, manual control, remote control or envelope triggering. Now available with the interchangeable B.P.C. 101 card which turns the unit into an instant phaser.

BD 955 BROADCAST DELAY LINE
Designed specifically for the broadcast industry and is primarily intended for the policing of live transmissions. There are three maximum delay times available 1.6, 3.2 or 6.4 seconds plus a unique program dump and catch up facility.

2830 OMNIPRESSOR
The Omnipressor combines the characteristics of a compressor, expander, noise gate and limiter in one package.

JJ 193 DELAY LINE
Four outputs, each with up to 510 ms of delay, independently switchable in 2 ms steps. Extra delay is optional to a maximum of 1.022 or 2.046 secs. Frequency response: 12 kHz. Dynamic range: 90 dB.



R.D. 770 MONSTERMAT
Mono/Stereo Matrix unit. The Monstermat solves the problem of tape phasing and noise on cartridge machines.

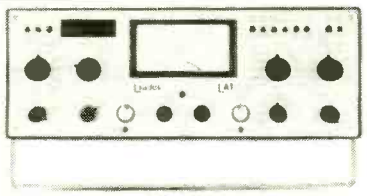
1745M DELAY LINE
Up to five outputs, each with a maximum of 320 ms of delay (640 ms in the double mode) selectable in 20 μ steps. Optional modules available include a pitch changer, and a remote control module which controls the delay line with a micro-computer. Frequency response: 16 kHz (8 kHz in 'double' mode). Dynamic range: 90 dB.

U.K. Distributors

Feldon Audio Ltd.,

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

new products



Lindos LA1 Mk2 audio analyser

Lindos Electronics has introduced a Mk2 version of its *LA1* audio analyser which incorporated a low distortion oscillator, a digital frequency meter and a comprehensive measuring section that can check signal levels, frequency response, weighted or unweighted noise, rumble, wow and flutter and distortion. Improvements from the original analyser include the adoption of BNC sockets as standard, a larger meter scale with 0.1dB markings, an audio band filter meeting CCIR 468-2 requirements for unweighted noise measurement, and the incorporation of both CCIR and IEC A weighting noise curves as standard. While the basic *LA1* meets most requirements, Lindos are also offering two other versions for specific professional applications. These are the *LA1-P* which includes two extra meter characteristics, true rms and CCIR 468-2 quasi peak (for noise measurement); and the *LA1PI* which adds PPM characteristics to the list of functions making the unit particularly suited to the needs of local radio stations having to meet the IBA and BBC codes of practice. All the units operate from a signal *PP9* battery with a choice of three optional add on units as follows: the *MA1* which is a simple mains adaptor; the *MA2* which provides mains or rechargeable operation, audible monitoring, and DIN connectors with channel switching; and the *ST1* studio interface which provides mains operation, audible monitoring, and balanced inputs/outputs with channel switching via four PO jacks (*XLR*s optional), and drives up to +26dBm into 600Ω. Prices for the above units are: *LA1* £450; *LA1-P* £540; *LA1-PI* £590; *MA1* £35; *MA2* £60; and *ST1* £150.

Lindos Electronics, Sandy Lane, Bromeswell, Woodbridge, Suffolk IP12 2PR, UK. Phone: 03847 432.

Soundex studio accessories

Soundex, best known for its PPMs, has introduced a metal cased studio illuminated sign available with a variety of legends. Termed the *D882* the unit is available with 'on air', 'quiet please recording' and 'rehearsal' legends as standard with others to order. Housed in a 6 $\frac{3}{16}$ in x 3¼ x 3 $\frac{5}{32}$ in casing finished in grey stove enamel, with surface mounted indicators, the sign is lit by twin *SBC* lampholders accepting twin bayonet cap *B15d* type lamps. Lamp replacement is from the front and various legend panel colours are available.

A similar metal cased unit is also available which accepts twin domed glass lens held in place by moulded bezels. This unit, termed the *D883* accepts a variety of coloured lens units with two-colour variants being to customer specifications. In addition Soundex also produce the *D650/G* signal lamp, lens and bezel (as for the *D883)* to allow the fittings to be flush mounted in studios at their construction stage. Prices are £22.85 *D882*, £37.80 *D883*, and £7.86 *D650/G*.

Soundex Ltd, Park Lane, Broxbourne, Herts EN10 7NQ, UK. Phone: 09924 64455. Telex: 897255.

Simple continuity tester

Highland Electronics has introduced a new simple continuity tester with an integral audible warning buzzer and a top mounted red LED indicator. The tester, *Model RPX 51-HL*, is housed in a red impact-resistant plastic case measuring 85 × 30 × 15mm, which has a pocket clip moulded into the casing. The tester is provided with two test leads 1m long, colour coded red and black to indicate polarity, and terminated with an insulated probe (red) and a stub clip (black). Voltage at the test terminals is 5V, current 75μA. The resistance test range is 0 to 600kΩ and the tester is protected against accidental inputs up to 500V ac. Power supply is from an internally mounted 9V *PP3* dry battery and battery consumption is 20mA.

Highland Electronics Ltd, Highland House, 8 Old Steine, Brighton BN1 1EJ, UK. Phone: 0273 693688. Telex: 87616.

Lemo connector

Lemo has introduced a pcb mounted angle socket in its *Series B* range of connectors. The socket has four stepped fixing posts arranged such that a 0.5mm gap is available between the socket and the pcb, and variants available include 2, 3, and 4-female contacts, although a 5-contact receptacle is not available.

Lemo UK Ltd, 12 North Street, Worthing, West Sussex BN11 1DU, UK. Phone 0903 34543. Telex: 877543.

New Wireworks cables

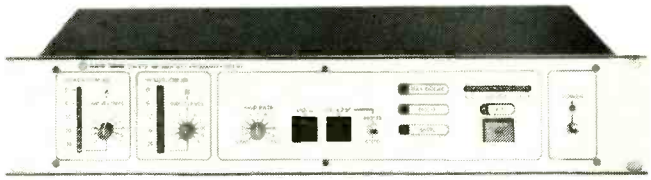
Wireworks has announced the introduction of several new cable types. First off is the *HVT Multicable Series* which combine one or more coaxial cables (for video use) with professional audio pairs, in one outer jacket. The series features BNC connectors on the video cables and *XLR*-type connectors on the audio lines, with all lines terminated on each end in tails (connector fan-outs). Standard cable lengths range from 25 to 250ft and the series are available in single video/single audio, single video/three audio, two video/five audio, and two video/five audio/two control wire variants.

The second new cable series is the *BC Series* featuring BNC-type connectors and available in three coaxial cable types—50, 75, and 93Ω—*RG58/U* for rf applications, *RG59/U* for video applications, and *RG62/U* for use with computer systems. These are available in seven standard lengths with both male/male and male/female cable styles.

Finally, Wireworks has introduced the *UC Series* cables featuring UHF-type connectors and available in three coaxial cable types—52, 50 and 75Ω—*RG8/U* where low loss rf cables are required, *RG58/U* for conventional rf applications, and *RG59/U* for video interconnect. As with the *BC Series* these are available in seven standard lengths and in male/male and male/female configurations.

All the above cables are available in the Wireworks *Bandits* cable marking system which indicates cable length by colour coding, with the additional facility for customer name imprinting.

Wireworks Corp, 380 Hillside Avenue, Hillside, New Jersey 07205, USA. Phone: (201) 686-7400. Telex: 710-985 4675.



Stereo profanity delay

New from Klark-Teknik is the *DN772* stereo digital profanity delay unit. Designed primarily for use as an obscenity filter for radio phone-in programmes, the unit meets in full the IBA code of practice requirements. Features include 7.15s delay, with noiseless edit and skip functions, a dynamic range in excess of 80dB, and compact 2U rack-mount cabinet. The skip function automatically calculates the optimum time to increase the delay and does so without pitch alteration or signal degradation.

Klark-Teknik Research Ltd, Walter Nash Road West, Coppice Trading Estate, Kidderminster, Worcs DY11 7HJ, UK. Phone : 0562 741515. Telex: 339821.

USA: Klark-Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

46 ▶

ACCURATE SOUND CORPORATION

SYSTEM 100

High Speed Audio Duplicator

WITH PERFORMANCE "UNDUPLICATED" BY OTHERS

The System 100 . . . a compact and efficient "workhorse", that will perform today and for many years to come. Developed around a rugged, precision machined, tool-aluminum transport (unique in today's marketplace) and built to outlast the rest. The AS-100 transport eliminates mechanical brakes, consolidates the entire logic/control electronics on one circuit board, and reduces parts count to just those needed to do the job.

If your business involves high-speed tape duplicating . . . day-after-day-after-day, the System 100 will make your job easy . . . even routine!

APPLICATIONS

- Broadcast Syndication
- Government/Military
- Commercial music production
- Recording Studio
- Educational/Religious
- Advertising

FEATURES

- Elimination of Capstan-idler (pressure roller)
- Crystal-referenced DC Servo Capstan
- DC Servo Supply & Take-up Motors
- No Mechanical Brakes or Adjustments
- 16:1 Duplicating Ratio
- High Performance Ferrite Heads

WRITE OR CALL: **ACCURATE SOUND CORPORATION**
3515 EDISON WAY, MENLO PARK, CA 94025
(415) 365-2843 Tlx: ASCO 34-8327

At last, a machine that really gets to grips with the cassette.

The **GRAFF** cassette machine is a completely new departure in cassette handling. Because it is built to uncompromisingly high standards, several variants can fulfil a number of different highly demanding roles with equal success.

It can record the Minute Waltz in 3.75 seconds.

GRAFF HSCD High Speed Cassette Duplicator

The most highly developed precision machine on the market. Copies cassettes at **16** times normal speed – both sides at the same time. (It takes under 2 minutes to copy a C60). Extra slave modules can be added one at a time.

For Jingles that don't Jangle.

GRAFF JM Cassette Jingle machine

Now a viable low cost alternative to the cartridge jingle machine. Runs at double the normal speed (**3¾ ips**), with a double-sided head for superior reproduction. Auto cue at **500 ips**, and optional auto link system for slave machines.

Modular construction, no belts, no pullies: 4 motor drive per cassette. Precision electronic motion control. All parts are machine engineered for reliability.

ICD Industrial Cassette Developments Limited
10 Sirhowy Estate, Tredegar, South Wales NP2 4XY Tel: (049 525) 5035

GRAFF™

new products

Nady MC 610

Nady Systems has added the *MC 610* compact 4-way multi-coupler system to its range of radio mic systems. Portable, yet rugged, the *MC 610* is housed in a 14 × 9 × 10in flight case, weighing 18lb, and has been designed for audio engineers who require a durable, light weight multi-channel radio mic system for either OB or studio usage. The *MC 610* links four dc-powered Nady *610B* mini-receivers via a single antenna with an rf pre-amp providing 12dB of gain to ensure no signal loss in the coupling process. Storage for four transmitters, 12 D-size batteries and accessories is provided in the door of the carrying case. To aid versatility the four receivers can be easily removed for independent operation. Price of the *MC 610* is $600.

Nady Systems Inc, 1145 65th Street, Oakland, Cal 94608, USA. Phone: (415) 652-2411.

UK: Hardware House (Sound) Ltd, 34 St Philip's Road, Dalston, London E8. Phone: 01-249 0916.

New Neve broadcast console

Due to be introduced at the 6th Sound Broadcasting Equipment Show in Birmingham is an all-new radio console from Neve, featuring 16 inputs for stereo operation, and utilising solid state switching elements. The console may be user-programmed for many different modes of operation. Channels are available for mic, stereo line or outside sources, the latter being fitted with selectors automatically switching talkback to the source. Full provision is made for switching 'phone-in' operation, and a script panel is fitted along with ample room for peripherals such as cart machines immediately in front of the operator. No rear access is required, so the unit is ideal for OB use and in small control rooms.

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

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

AEG-Telefunken digital recorders

As a result of co-operation between AEG-Telefunken and Mitsubishi, AEG-Telefunken has added three new digital units, to its range—the *MX-80* transportable 2-channel recorder, the *MX-80A* console format 2-channel recorder, and the *DDL-1* digital delay line for disc cutting purposes. These units are the counterparts to the Mitsubishi *X-80, X-80A* and *DDL-1* units previously described in *Studio Sound*. Although not yet available AEG-Telefunken also inform us that they will be marketing the Mitsubishi 32-channel digital recorder as the *MX-800* multi-track, while the Mitsubishi electronic editing system will be marketed as the *MXE-1*.

AEG-Telefunken, Postfach 2154, D-7750 Konstanz, West Germany. Phone: 07531 86.24.60. Telex: 733233.

UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 9UG. Phone: 02813 88447/89221. Telex: 849469. ■

new Disc cutting equipment products

For address details see product guide

PCM preview unit

Feldon Audio are marketing a new digital audio preview unit manufactured by Digital Systems. The unit is specifically designed to interface with the Sony *1600* digital audio recording system and is designed to derive the advance (preview) signal information required for disc cutting. The preview unit utilises the D/A and A/D converters in the Sony *1600*, thereby eliminating the possibility of signal degradation which would be associated with delay units based around separate converters. A version of the system will shortly be available for use with the Sony *1610* processor and we understand units have already been supplied to Stevie Wonder and Teldec in West Germany.

Specifications: 16-bit main delay path; analogue preview output derived from a 12-bit D/A system. Max delay time 2·229s (44.1kHz) or 2·231s (44.056kHz). Delay time presettable in increments of 1·45s approx, with automatic switching between 33⅓ and 45 rpm. For disc cutting applications the unit contains PROMs with preset delay times for all known cutting lathes. Internal presets determine the analogue output level, and the output is electronically balanced. The preview output has a dynamic range of >55dB and a frequency response of 20Hz to 15kHz, +1, −3dB. In conjunction with the Sony *PCM 1600* the unit may also be used as a high quality analogue I/O delay line. ■

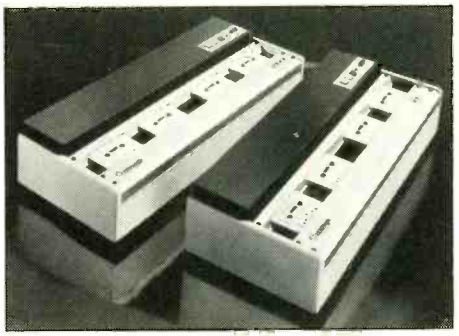
new Tape duplication products

For address details see product guide

Graff HSCD

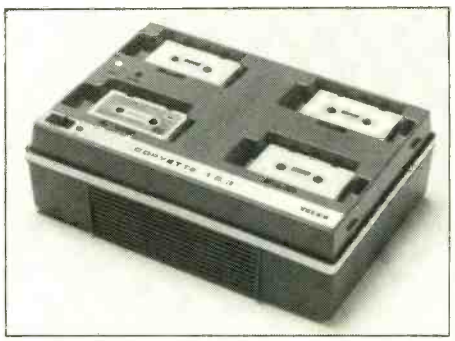
Further to the new product item in our October issue concerning Graff cassette machines, we have now received full details of the company's *HSCD* high speed cassette duplicator. This uses a dual-capstan four motor direct drive transport featuring no belts or pulleys, and is servo controlled. Totally modular the system has power, master and slave modules with plug-in electronics, and is unusual in as much that slave modules can be added either one at a time or as many as one wishes with no upper limit to the number which can be accommodated. The system features audible and visual alarms for short or jammed tapes; dynamic constant back tension to ensure excellent tape to head contact and careful tape handling; minimal tape stretch due to the servo control of tension; optical sensor control to govern tape stop on fast rewind (500in/s) in automatic or manual modes (less than 10s for a C-60); ferrite tape heads; mono or stereo copy in a single pass; and a special 'enhancer' switch for use when copying medium or low quality masters. The manufacturers also claim that the system's constant servo tape speed control ensures accurate tape speed such that cassettes are guaranteed to run within 0·25s of each other (C-60 cassette). Prices of the units are *HSCD* £890 stereo; £790 mono; *HSCD Slave* £490 stereo; £450 mono.

Specification: tape speed 30in/s (76cm/s); speed variation <0.1%; wow and flutter <0.1% Wrms; frequency response using Maxell *UDXLI* cassette tape 50Hz to 10kHz ±2dB, 40Hz to 14kHz ±3dB; S/N ratio within 3dB of master over the range 50Hz to 10kHz; crosstalk >55dB between channels 2 and 3, >40dB between other channels at 1kHz; THD <2.0%; bias 1MHz crystal referenced. Head configuration stereo 4-track ferrite; monitoring discrete LED display with PPM characteristic; rewind time <12s (C-60).



Pentagon C322 and C342

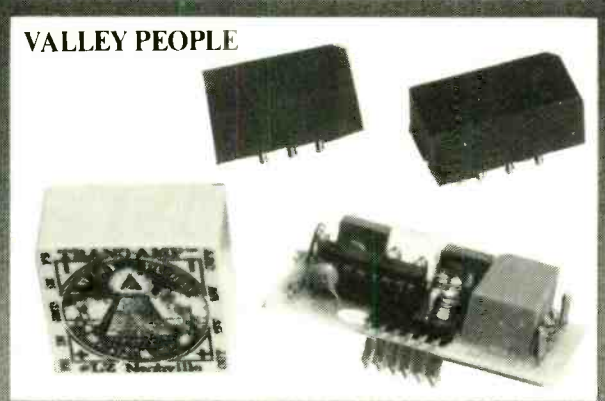
Pentagon has introduced two new high speed 3-slave desk top cassette-to-cassette copiers, the *C322* and *C342*. The new models are improved versions of previous Pentagon models and feature heavy duty rugged metal mainframes, new 'stabilign' head and guidance assembly, new cassette protection circuitry, and new precision supply motors. The 'stabilign' assembly incorporates a new die-cast head mount, and a newly designed pressure roller and head guiding assembly to overcome the problems of head misalignment and poor cassette tape guiding. Although the new assembly is introduced on these new models, Pentagon inform us that 'stabilign' head mount kits are available for retro-fitting to older versions of Pentagon cassette duplicators. The *C322* is a mono copier while the *C342* is a stereo copier. Production capacity of the copiers is 75 C-60 cassettes/hr; duplication ratio 16:1; speed 30in/s.

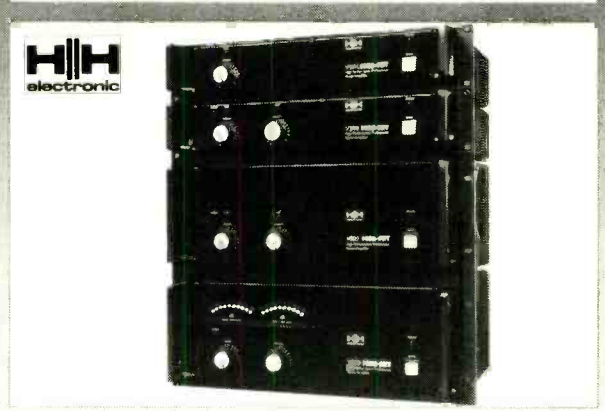


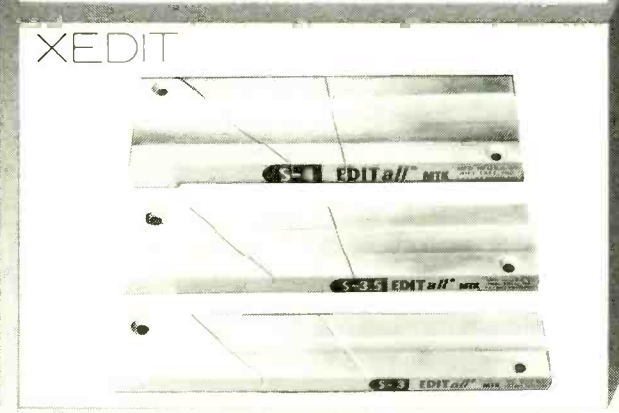
Telex Copyette 1 & 3

New from Telex is the *Copyette 1 & 3* portable, master and 3 slave cassette-to-cassette copier. A 2-channel half track mono cassette copier, the new unit is simply operated by a single copy pushbutton switch which governs both the copy and rewind functions. Duplication ratio is 16:1 with a copying speed of 30in/s, automatic rewind 80in/s approx. ■

Scenic Sound's small ads







Scenic Sounds Equipment, your first stop for clever audio products–large or small

SSE

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

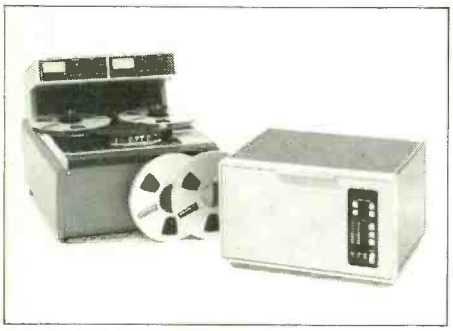
product Disc cutting equipment guide

ADAMANT/JVC (USA)
Master Recording Supply Inc, 4000 West Magnolia Blvd, Suite J, Burbank, Cal 91506.

Recording styli for disc cutting.

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 the 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 and frequency response is 5Hz to 18kHz +0.5dB, or to 20kHz −1.5dB.

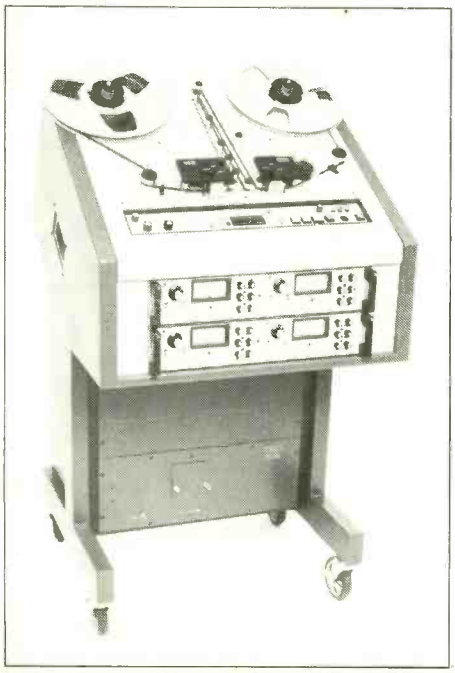


Ampex disc mastering system

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

AMS (UK)
Advanced Music Systems, 1-3 Wallstreams Lane, Worsthorne Village, Nr. Burnley, Lancs. Phone: 0282 36943. Telex: 63108.

MCI 110M-VP tape recorder/reproducer



AMS DM-DDS

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

DM-DDS: stereo disc mastering DDL, max delay 1·6s expandable to 10s. Two different bandwidth versions available. *(See page 30, September 1981).*

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

Master and reference lacquer discs.

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

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-per-inch (variable or fixed pitch) at 78, 45, 33⅓ 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* cutter head. Drive amp is the Quad *405*, own control desk.
Also produce cutting styli.

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: 28668.

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

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

PCM Preview Unit: 16-bit digital audio preview unit designed to interface with the Sony *1600* digital audio recording system. Delay time presettable with automatic switching between 33⅓ and 45rpm.

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 *RTZ III-M* return-to-zero, plus 24 memories.

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.

50 ▶

A New Leader

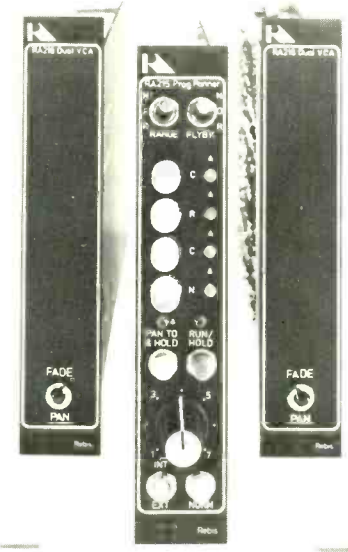
The Rebis Programmable Panner

Pan Range Switch
selects full, normal or reverse pan field.

Pan Hold Selectors
programme image hold to any combination of quarter, half, threequarters and full cycle positions to define one-shot pattern or final image after free run.

Rate Control
sets panning speed from 30 seconds per sweep to 10 cycles per second.

Rate Int/Ext Switch
allows pan speed to be controlled externally by a D.C. source for modulated or programme related pan speed.



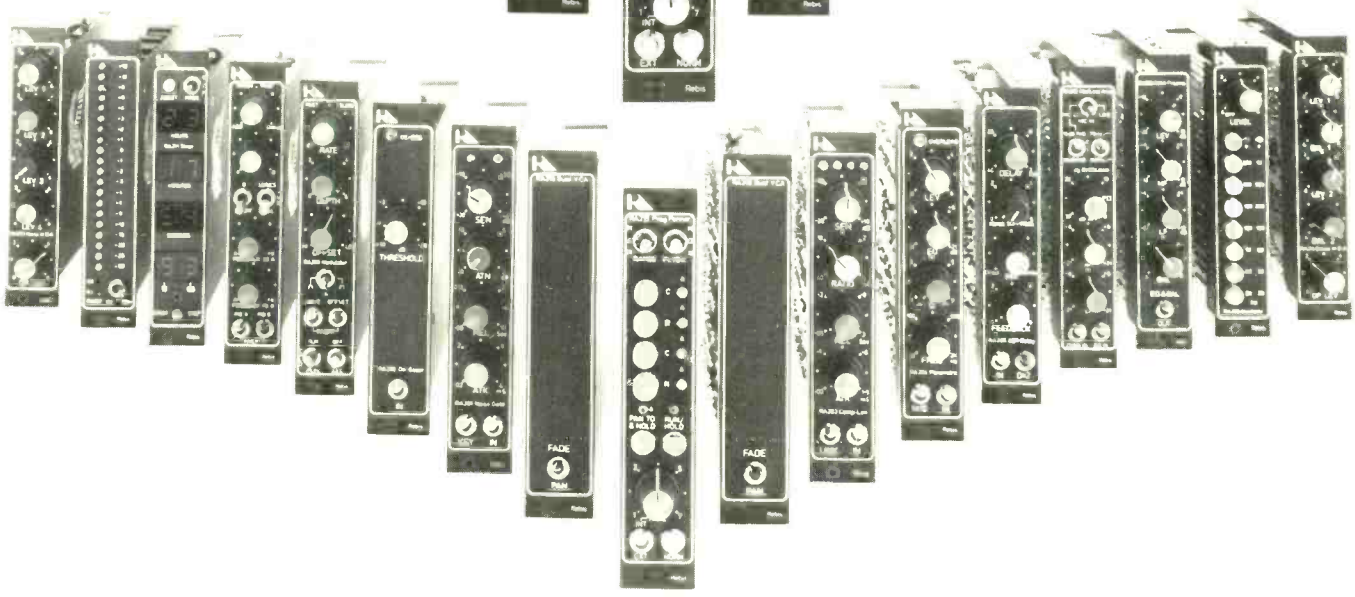
Flyback Switch
selects symmetrical panning or flyback from either normal to reverse, or reverse to normal.

LED's
indicate status of image throughout pan.

Pan Mode LED's
indicate programmed or free run panning action.

Trigger Buttons
for programmed one-shot, run, random hold, programmed hold, all functions can be externally controlled by D.C. or programme.

Normal Image Button
returns signals to normal positions.

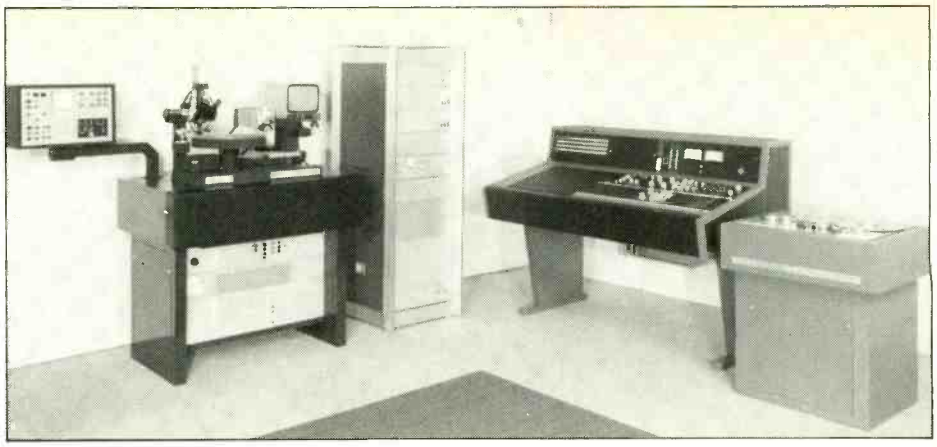


The new RA215 Programmable Pan Control module uses the latest in digital technology to put you in creative control of a unique range of stereo effects.

For further information contact: Rebis Audio Ltd., Kinver Street, Stourbridge, West Midlands, DY8 5AB, England. Tel: 0384 71865. Telex: 335494.

Germany; Thum & Mahr Audio, Leverkusen 41600. Studitechnik Jürgen Klever, Hamburg 6901044. Hausmann Concert Electronic, Berlin 4336097. **Belgium;** SED, Brussels 5227064. **U.S.A.;** Klark-Teknik Electronics Inc., Farmingdale, N.Y. 2493660. **Sweden;** Tal & Ton, Gothenberg 803620. **Netherlands;** SAP, Amsterdam 797055. **Finland;** Studiotec, Espoo 520604. **France;** Lazare Electronic, Paris 8786210. **Spain;** Mike Llewellyn Jones, Madrid 4451301. **Japan;** Continental Far East, Tokyo 5838451. **Australia;** Audio Mix Systems, Sydney 9009.

product Disc cutting equipment guide



Neumann disc mastering system

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-per-inch with optimised pitch and depth control. Microscope with video monitoring fitted. Complete systems available include Ortofon equipment and Neve mastering consoles.

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.

VMS70 Lathe: incorporates *AM66* lathe, *VA66* lead-screw drive unit, *AS66* drive control, *SV66* pitch/depth control amp, *NG70* psu and *ZT70* console.
VMS80 Lathe: 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 Cutter Amplifier: drive system for the *SX74* including psu, 2-channel amps, limiter, and tracing simulator.

Neumann SX74 cutter head

SX74 Cutterhead: stereo head for the *SAL74*. Response 7Hz to 25kHz (±0.5dB 15Hz to 16kHz); 35dB channel separation.
SP79 Cutting Console: console with adjustable eq and level. Various configurations available including Dolby A, Orban parametric eq, Neumannn *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, Conn 06801. Phone: (203) 744-6230. Telex: 969638.

System 9022: disc mastering console to various configurations. Features include monitoring facilities, remote controls, eq, noise reduction, etc.

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.

DSS731/732 Dynamic Cutterheads: stereo heads for the *GO741* providing motional feedback to amp. Vertical cutting angle 15° (optional 20°), response 10Hz to 20kHz (*DSS 732*), 5Hz to 25kHz (*DSS 731*). *DSS732* for stereo recording, *DSS731* for half-speed cutting of 4-channel discrete recordings.
GO741/GE741 Cutting Amplifier Set: pair of amps plus psu for *DSS 731/732*. Provides hf eq, summing of motional feedback input, power output 500W at 20kHz into impedance matching circuit.
CPS741 Correction Amplifier: 4-channel correction amplifier accepting two programme and two preview channels. Features phase reverseal, 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: allows 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.
UK: Pyral Magnetics Ltd, Courtlands Road, Eastbourne, Sussex. Phone: 0323 638965.
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, Conn 06604. Phone: (203) 368-2332.
UK: Identimation 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-per-inch 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 Disc Mastering Equaliser: 4-channel, 3-band shelving parametric 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 Lathe Control System: microprocessor based 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, Tenn 37203. Phone: (615) 329-9576. Telex: 554453.

A80/VU Preview: special model of *A80* master tape recorder with preview head; takes 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.

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.

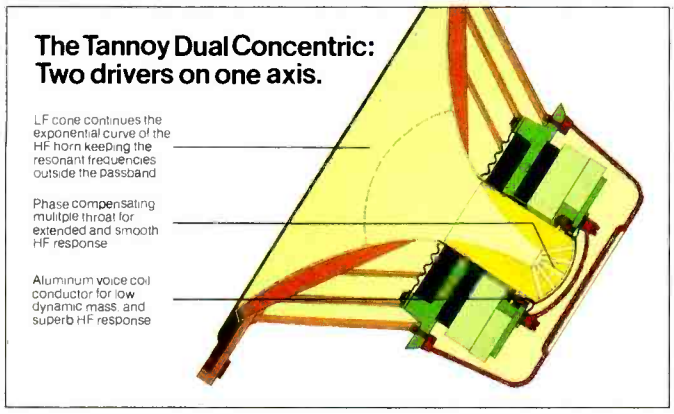
RA1700 System: comprises *RA1701A/B* equipment shelves and panels; two *RA1703* input amps; two *98609* and *98610* eq units; two *RA1704* feedback/monitor amps; two *RA1706* power amps; and *RA1705* psu. Other units in the series include *RA1702A* power drive amps and the *RA1716* crystal controlled dc servo turntable drive for Scully lathes.
3D2AH Recorder: stereo cutterhead with phase and impedance correction networks.
RA1706 HF Reduction Amplifier: hf limiter 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. ■

Tannoy: A single source for the single-point sound source.



Behind the grill of most Tannoy Loudspeakers is not the usual collection of separate tweeters and bass units. Instead, you'll see what appears to be one speaker only, but which, in fact is two speakers in one.

Therein lies the Tannoy Dual Concentric principle. Single point sound. This unique method of placing a high frequency compression driver within and behind a direct radiator bass unit provides superb natural sound, low coloration and phase coherence for proper stereo imaging and high sensitivity.

A bass that's deep but not "thick." Individual bass notes should be deep and rich, but not "thick." They should be easily separated by the ear. With classical music the bass should be a fine reproduction of the natural sound of the instruments.

With contemporary rock, a loudspeaker should easily handle the accentuated bass without distortion. In Tannoy Loudspeakers, these capabilities are apparent. You can separate the drummer from the bass player and the tubas from the cellos.

Midrange: The "live" factor. This is more difficult for comparative evaluation as most loudspeakers offer acceptable qualities in this tonal range.

Choose a solo instrumental record and try not to listen to the melody which may distract, concentrate on purity of sound, a closeness to the actual instrument.

Close your eyes. Vocals should not sound "wooden" or "telephone like." Tannoy Loudspeakers provide the closeness to reality which gives that very satisfying illusion of the original "live" performance.

Clarity and response on the high end. The snap of a snare drum, the sound of an acoustic guitar, string sections, an operatic soprano, or the crash of a cymbal, these will tell you if the high frequency response is providing the absolute clarity essential for good treble quality.

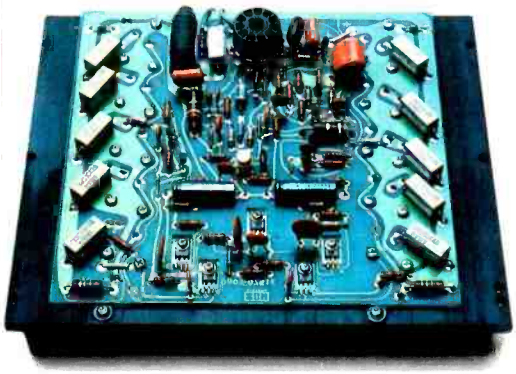
Voice sibilant should be clear but not over emphasized, the infinite flexibility of the female voice is a revealing test for any loudspeaker, and Tannoy Loudspeakers pass this test faultlessly.

The English know. Some of the best recording studios in the world are in England, and in the U.K., Tannoy is one of the most popular, if not the most professional loudspeaker.

Call 800-421-1274. We'll tell you where you can listen to a full line of Tannoy studio monitors. And discover what the English have known for over fifty years.

Model X05000 Time Compensated Electronic Crossover

BGW: Technology and engineering in a world of whistles and bells.



How do you become the world leader in power amps in five years or less? That's easy:

Make it first. Imagine. Invent. Create. You end up with things like fully modular construction, fool-proof speaker protection, and one-piece construction.

Give it more. More features. Like precision stepped thick film input attenuators, front panel mounted magnetic circuit breaker/power switch, and multi-colored, state-of-the-art LED display circuitry.

Make it last. Use welded steel instead of screws. (They unscrew.) Don't overstress the product. It'll live longer. And keep it simple. We make it modular. So servicing is that much easier.

If you like what we're saying, you'll love what you see. Test a BGW for yourself. Or, read on.

The DC Arc Interrupter: Still the best speaker protection you can buy. When harmful d.c. voltage is present at the amplifier's output, a sensing circuit triggers a fast-acting, heavy-duty relay to open and disconnect the amplifier from the loudspeaker load.

Due to the high energy associated with this type of potentially disastrous failure, conventional relay circuitry was found unacceptable and this new system, based on magnetic arc-interrupting physics was developed.

The largest SOA in the industry. Our BGW 250 series uses three times as many output devices as the competition. And since output devices are the single most important factor in determining the lifespan of an amplifier, expect ours to last three times as long.

In our 750 series, we use a heavy-duty rear-mounted two-speed industrial fan to move large volumes of air in from the back, over the internal circuitry and up through exhaust ports.

This unique thermostatic cooling system, combined with 24 large-geometry output devices, give BGW the largest SOA, or Safe Operating Area, in the industry today.

Two handles and one piece of steel. Instead of aluminum or plastic, the chassis of all BGW amps are constructed of welded steel for maximum strength, rigidity and RFI immunity.

Two, large, convenient front panel mounted handles make moving easy. (By the way, because of our unusually strict standards, we are forced to make most of our metal parts ourselves. And that's fine with us.)

Circuitry: Sophistication at the heart of the system. We use large-geometry, full-complementary circuitry. Full. Not "quasi" like a lot of our competitors still use. Full costs a little more. But the result is much better high frequency response with much less distortion.

It's a tradeoff we'll gladly make.

Thanks, Billboard. Thanks, America. According to the Billboard magazine U.S. Equipment Brand Usage Survey, between 1977 and 1980, of the top three amplifier manufacturers, only BGW showed an increase in market share. Specifically, a 25% gain in studio usage, making BGW the fastest growing power amplifier source in the United States today.

That's what happens when you make it right.

Look at the Numbers:

TANNOY

MODEL	DRIVE UNIT	MAXIMUM OUTPUT LEVEL (PEAK)	SENSITIVITY 1 WATT 1 METER ANECHORC 4TT STERADIANS	FREQUENCY (1) RESPONSE	DISPERSION INCLUDED ANGLE @ −6dB POINT @ 10 KHZ	RECOMMENDED AMPLIFIER POWER @ 8 OHMS	CROSSOVER FREQUENCY	ENCLOSURE DIMENSIONS H X W X D	ENCLOSURE INTERNAL VOLUME
SRM 10B	10" Dual Concentric	109dB SPL (115dB)	90dB	55Hz-20kHz	90 degrees conical	50 Watts	1 2 kHz	20 6 X 13 8 X 10 4"	35 Liters. 1 2 Cubic Feet
SRM 12B	12" Dual Concentric	112dB SPL (117dB)	92dB	55Hz-20kHz	90 degrees conical	100 Watts	1 2kHz	23 X 15 7 X 10 8"	46 5 Liters. 1 6 Cubic Feet
M 1000	15" High Sensitivity Dual Concentric	114dB	94dB	50Hz-20kHz	90 degrees conical	200 Watts	1 0kHz	40 5 X 28 4 X 17"	230 Liters. 8 Cubic Feet
M 3000	15" Wide Bandwidth Dual Concentric	112dB SPL (119dB)	92dB	40Hz-20kHz	90 degrees conical	150-200 Watts	1kHz	40 5 X 28 4 X 17"	230 Liters. 8 Cubic Feet
DREAD NOUGHT	1 15" Special Dual Concentric 2-15" Woofers	121dB SPL (126)	96dB	30Hz-20kHz ±3dB	90 degrees conical	750 Watts Low Frequency 500 Watts Mid Frequency 250 Watts High Frequency	250Hz 2 0kHz	35 X 52 4 X 23.2. 14 2 15° Baffle Slope	400 Liters (15 Cubic Feet) 40 Liters (1 5 Cubic Feet) Sealed Cavity

(1) Frequency Response measured in 1/3 octave bands at any power up to Rated Continuous Power with response within ± 4dB

BGW

MODEL	DESCRIPTION	TOTAL POWER* OUTPUT	8Ω POWER OUTPUT EACH CHANNEL	FEATURES MODULAR CONSTRUCTION	MAGNETIC CIRCUIT BREAKER	FULL COMPLEMENTARY CIRCUITRY	DC ARC INTERRUPTOR SPEAKER PROTECTION	FAN COOLED	CALIBRATED PRECISION STEPPED ATTENUATOR	LOSS OF FEEDBACK CLIP INDICATOR	TRI COLORED LED VU METER WITH CLIP LIGHT
75	Professional Power Amplifier	75	25 Watts	Yes	No	Yes	No	No	No	No	No
150	Professional Power Amplifier	150	50 Watts	Yes	Yes	Yes	No	No	Yes	Yes	.5% & 50% LED's
250D/E	Professional Power Amplifier	400	100 Watts	Yes	Yes	Yes	Yes	No	Yes	Yes (250D)	Yes (250E)
600	Professional Power Amplifier	800	175 Watts	Yes	No	Yes	No	No	No	Yes	No
750B/C	Professional Power Amplifier	900	225 Watts	Yes	Yes	Yes	Yes	Yes	Yes	Yes (750C)	Yes (750B)
1250	Professional Power Amplifier	1200	400 Watts	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
320B	Commercial Power Amplifier	100 Watts/Ch @ 70 volts		Yes	Yes	Yes	No	No	Yes	Yes	No
620	Commercial Power Amplifier	200 Watts/Ch @ 70 volts		Yes	Yes	Yes	No	No	Yes	Yes	No

*TOTAL POWER OUTPUT
The total power output is the actual power output as measured during our final test at the factory
Test conditions mono operation 8 ohm load 1kHz @ 0 1% Total Harmonic Distortion Line voltage maintained at 120 volts RMS 60Hz This power is equivalent to the sum of both channels when driving 4 ohm loads in the stereo mode

BGW The exclusive importer/distributor for Tannoy products in the United States.

BGW/TANNOY

13130 S. Yukon Ave., Hawthorne, CA 90250; Telex: 66-4494, Phone: (213) 973-8090

product guide Tape duplication

ACCURATE SOUND (USA)

Accurate Sound Corp, 114 5th Avenue, Redwood City, Cal 94063. 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.

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)

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.

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 onto cassette (both sides simultaneously in up to three colours), eliminating paper labels.

ASONA (West Germany)

Auvis-Asona KG, Stollberstrasse 7, D-8000 Munchen 22. Phone: 089 22.50.57. Telex: 22084.
UK: Lennard Developments Ltd, 206 Chase Side, Enfield, Middx EN2 0QX. Phone: 01-363 8238.

HS16-M-1: 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 3¾in/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. Full stop from winding speed of approx 240in/s within 30ms.
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.

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 3¾in/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. Reel capacity 10½ NAB max.

56 ▶

Ampex BLM-200A/3400

product Tape duplication guide

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 with cassettes transported in multiple steps to the precision labelling device.

CROWMAY (UK)

Cassette Duplicating Supplies, Blaylynn Ltd, 2nd Floor, Broadway House, The Broadway, London SW19 1RH. Phone: 01-540 0707. Telex: 826715.

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: duel 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 rewound 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. Master plays ¼, ½ or 1in tape with 2-, 4- or 8-track replay to cassette. Duplicating ratio 32:1 with 16 and 64 systems available; speed slave 60in/s.

CTI (UK)

Cassette Tape Improvements, 201 Bryn Fedw, Llanedeyrn, Cardiff, S Glamorgan CF3 7PW. 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)

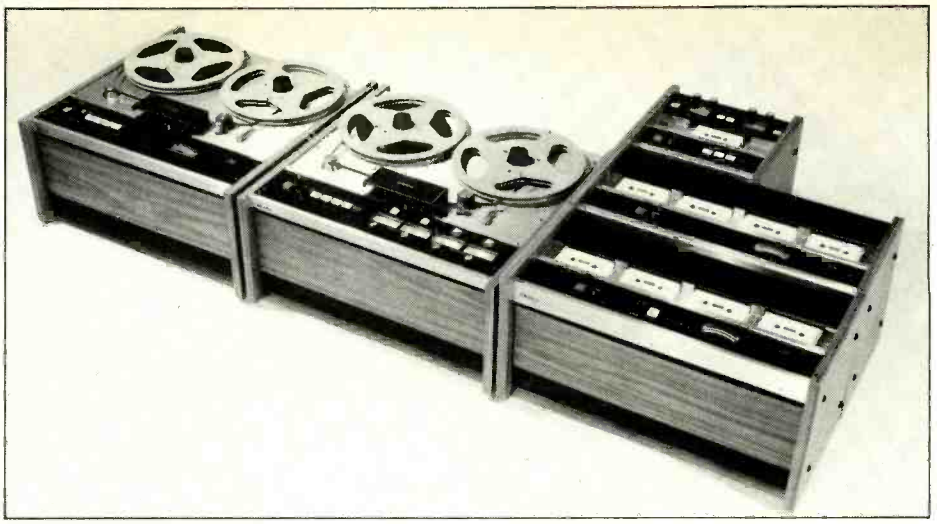
Nippon Columbia Co Ltd, No 14-14 4-chome Akasaka, Minato-ku, Tokyo 107. Phone: 03 544-8111. Telex: 22591.

DN-020-R-E System: 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 produce 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 produce 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



Infonics 200 series

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* microprocessor 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 ⅛in tape convertible. Duplicating ratios 32 or 64:1 with 7½ or 3¾in/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 3¾in/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 Ilsemann GmbH, Zum Panrepel 24, D-2800 Bremen 44. Phone: (0421) 48.30.83. Telex: 244055.

Heino Ilsemann manufacture 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.

ITI L1: 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 ½in, 4- or 2-track on ½ or ¼in; slave ¼ or ⅛in on 14in reels, 8-track or cassette. Duplicating ratio 16:1; speed master 120in/s with real time speed of 7½in/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, Conn 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 ½in tape (standard), or on ¼ or 1in to order. Duplicating ratio 16:1; speed 120in/s for 7½in/s master tape. *49P2S Slave* is a twin-transport unit, 4-track on 3.81mm pancakes; two ¼-track 2-channel heads, plus a reproduce head for off-tape monitoring or line-up.

MAGNEFAX (USA)

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

Magnefax produce a range of high speed common mandrel ¼in tape duplicators, automatic tape degaussers, and a master tape loop bin/7-slave cassette duplicator.

MTI (USA)

MTI Corp, 124 Montclaire Avenue, Montclaire, 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, ½in 4-track

58 ▶

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

MXR Professional Products Group

product Tape duplication guide

Otari DP-7000

and 4- or 2-track ¼in 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)

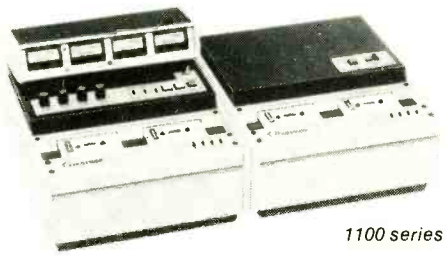
Otari Electric Co, Otari Bldg 4-29-18 Minami Ogikubo, Suginamiku, Tokyo. Phone: 03 333-9631. Telex: 26604.
UK: Industrial Tape Applications, 1-7 Harwood Avenue, Marylebone Road, London NW1. Phone: 01-724 2497/7368. Telex: 21879.
USA: Otari Corp, 1559 Industrial Road, San Carlos, Cal 94070. Phone: (415) 529-8311. Telex: 910-376 4890.

DP-1010 System: 'low-cost' duplicating system comprising: *DP-1310* master for 2- or 4-track on ¼in or 4-track on ½in tape; *DP-1510* slave for 2- or 4-track cassette pancakes, or 2- or 4-track on open reel; and *DP-1610* bidirectional playback monitoring unit. Master is available as a reel-to-reel machine, or modular ¼in loop-bin.
DP-1310 Master: 2- or 4-track on ¼in or 4-track on ½in tape (convertible). Duplicating ratio 16:1; 120 and 60in/s.
DP-1510 Slave: 2-track mono or 4-track stereo on cassette or ¼in open reel tape. Duplicating ratio 60 and 30in/s.
DP-1610 Monitoring Reproducer: bidirectional reproducer for ¼in open reel or cassette tape.
DP-2700 Automatic Cassette Tape Loader: loads C-30, C-60, C-90 and C-120 cassettes automatically with leader tape. Automatic leader cutting and splicing with automatic tape tensioning. Incorporates a digital counter; an audio signal sensing device for either prerecorded or blank tapes; plus vacuum pump. Reel capacity 12in NAB hub. Monitor loudspeaker optionally available.
DP-4050-OC System: 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 ¼in tape, slaves have 4-track in-line heads. Duplicating ratio 8:1; speed master 60 and 30in/s (7½ or 3¾ original).
DP-4050-CC System: cassette to cassette version of *DP-4050-OC*, using same slave transports, 4-track in-line heads. Duplicating ratio 8:1; speed master and slave 15in/s (1⅞in/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-6000 System: comprises *DP-6300E-240* bin master for ½in tape or *DP-6300C-240* bin master for cassette tape, and up to 10 *DP-6500C-32* cassette pancake slaves, or *DP-6500E-32* ¼in 8-track cart tape slaves.
DP-6300E-240/C-240 Master: dual capstan loop-bin unit, *E-240* 8-track (two staggered heads) on 1in tape; *C-240* 4-track (two staggered heads) on ½in tape. Speed 240in/s.
DP-6500E-32/C-32 Slave: *C-32* 4-track (two staggered heads) on ⅛in tape; *E-32* 8-track (two or four staggered heads) on ¼in tape. Speed *E-32* 60in/s, *C-32* 120in/s.
DP-6750 Tailoring Machine: 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 cassette duplication system. Loop-bin master reproducer, 4-track on ½in master on to 4-track cassette tape (two 2-track staggered heads). Duplicating ratios 64:1 and 32:1; speed master 240in/s, slaves 120in/s or 60in/s.

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. Duplication 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 producing a C-30 in under 60s. Track select allows any combination of programmes to be copied in one pass. *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 — duplicates a C-60 in less than 2 min. 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 3 slaves. *C322* mono, *C342* stereo. Feature heavy duty construction and 'stabilign' head and guidance assembly. Duplication ratio 16:1; speed 30in/s.



1100 series

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). ½-track 2-channel or ¼-track 4-channel on ¼in 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 ¼, ½, and 1in reel-to-reel or 0.15in cassettes or pancakes. Duplicating ratio 8 or 12: 1; speed reel master and slaves 30 and 60 in/s and 45 and 90 in/s pancake slaves 15 and 60in/s, and 22½ and 45in/s, cassette master and slaves 15 and 22in/s.

60 ▶

Sound Technology products are available from the following European Distributors:

U.K.	Precision Audio Marketing Bimini House Christchurch Road Virginiawater, Surrey Tel 09904 4416
W. Germany	M.V. Messgeraete Vertrieb Munich Tel 089/141 6085
France	Spektrix Herblay Tel 03/997 17 48
Italy	A.E.S.S.E. S.P.A. Milan Tel 02/54 64 741
Switzerland	Peerless Elektroakustic Ruemlang Tel 01/8177772
Spain	Anadig Ingenieros, S.A. Madrid Tel 01/433 2412
Austria*	Peerless Handels, G.M.B.H. Vienna Tel 0222/83 22 24
Netherlands/ Belgium	Audin Bv Nieuwegein Tel 03402/41345
Denmark	ITT Instruments Glostrup Tel 02/45 1822
Finland	Into Oy Helsinki Tel 090/742-133
Sweden	Teleinstruments AB Vällingby Tel 08/38 03 70
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SOUND TECHNOLOGY
1400 Dell Avenue, Campbell, CA 95008
(408) 378-6540 Telex: 357445

1710A

1700B 1701A

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Every system in the 1700 Series combines a flexible, ultra-low distortion sine-wave signal generator, a high resolution automatic-measuring THD analyzer, optional IMD analyzer and an accurate A.C. level meter in one instrument. Not only will a 1700 analyzer clean up your act, it'll clean up your bench too.

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- Fully automatic nulling circuitry that measures distortion as low as .0009%. In less than five seconds.
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product Tape duplication guide

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 ¼in; 4- or 8-track on ½in; 4-, 8-, 12- and 16-track on 1in tape. Duplicating ratio 32 and 64:1; speed master 240in/s, slave/loader 120 or 60in/s (for 7½ or 3¾in/s master tapes).

RTW (West Germany)

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

CL1 Cassette Loader: loader consisting of supply reel, tape guillotine, 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 ¼-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 10½in pancakes or reels at a winding speed of 240in/s. Length of tape is controlled by a cue tone, 1s in duration 5 to 20Hz (at 1⅞in/s real time), giving a splicing accuracy of ±5cm. An 'automatic cassette feed mechanism' (*ACFM*) is available as an add-on.

TAPEMATIC (Italy)

Tapematic, Via Unione 13, I-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.
TMD 470: 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)

Manufacturer: AEG Telefunken, Casella Post 47, Viale Brianze 20, I-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 ¼ and ½in 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 ¼in tape. 4-track master tapes for pancake slaves recorded at 7½in/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 ¼in tape. 4-track master tapes for pancake slaves recorded at 3¾in/s (32:1 duplicating ratio), or *Stereo-8* slaves recorded at 3¾ or 7½in/s (16 or 32:1 duplicating ratios). Up to four slaves can be accommodated, plus others (see *BKM12*).
BKM15 Master: master console with two *M15* tape reproducers running at 120 or 240in/s on ¼in tape. 4-track master tapes for pancake or *Stereo-8* cart slaves recorded at 7½in/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 ¼ or ½in tape. 4-track master tapes (for both widths) for pancake slaves recorded at 7½ (32:1 duplicating ratio), and 8-track master tapes (½in only) for *Stereo-8* slaves recorded at 7½in/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 producing 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. Minimum

62 ▶

Recortec duplication system

OTARI

Otari Electric Co., Ltd.
4-29-18 Minami-Ogikubo, Suginami-ku
Tokyo 167, Japan
Phone: (03) 333-9631, Telex: J26604

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- DIN-head version is available.
- Comprehensive servicing and support. Fully modular power supply, audio and transport electronics card frame. A highly dedicated distributor service network with factory trained and supported technicians.

For full details of the heavy-duty machine, please contact us.

product Tape duplication guide

length of 60cm of tape can be handled; stop time approx 40ms, accuracy ±5cm. Production rate 3 to 4 cassettes/min according to tape length.
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)

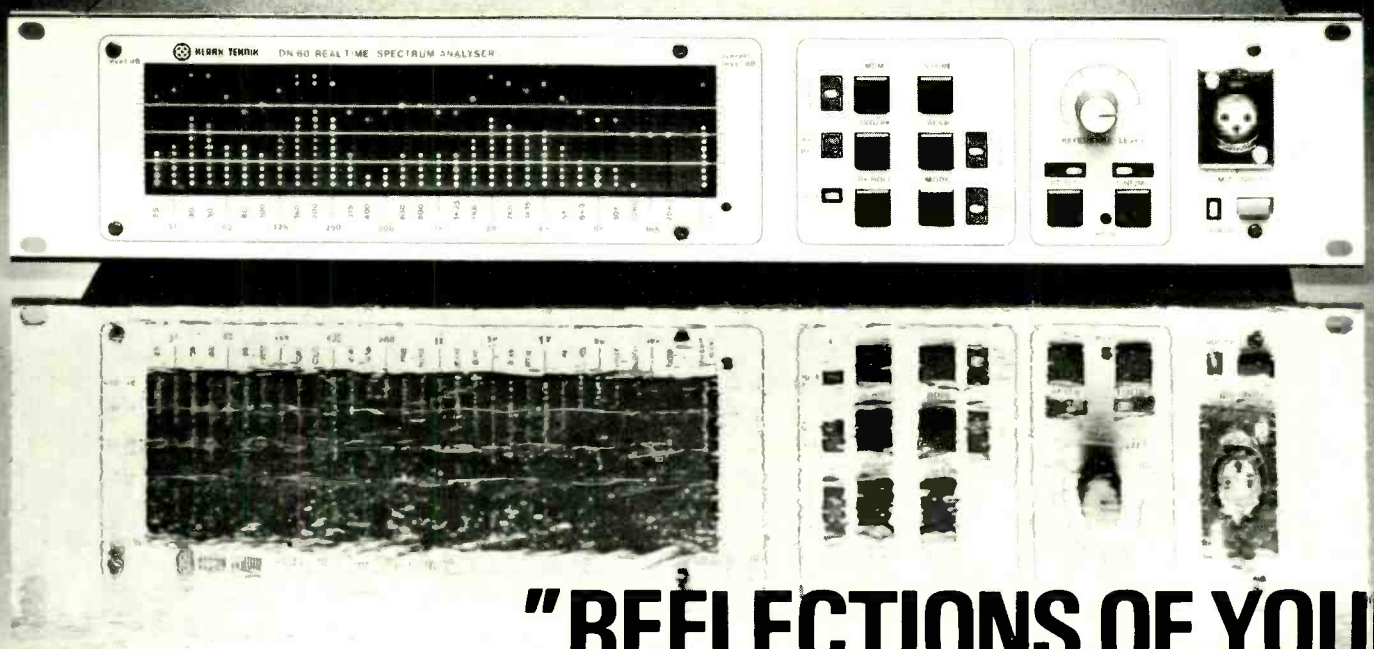
Telex Communications Inc, 9600 Aldrich Avenue south, Minneapolis, Minnesota 55420. Phone: (612) 884-4051. Telex: 297053.
UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA. Phone: 01-749 2201. Telex: 897749.

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 ½-track, ¼-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. ½-track, 2-channel, or ¼-track 2- and 4-channel. Duplicating speed reel master 15 and 30in/s, reel slave 7½ and 15in/s, cassette master and slave 7½ 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* ½-track 2-channel, *IV* and *V* ¼-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.

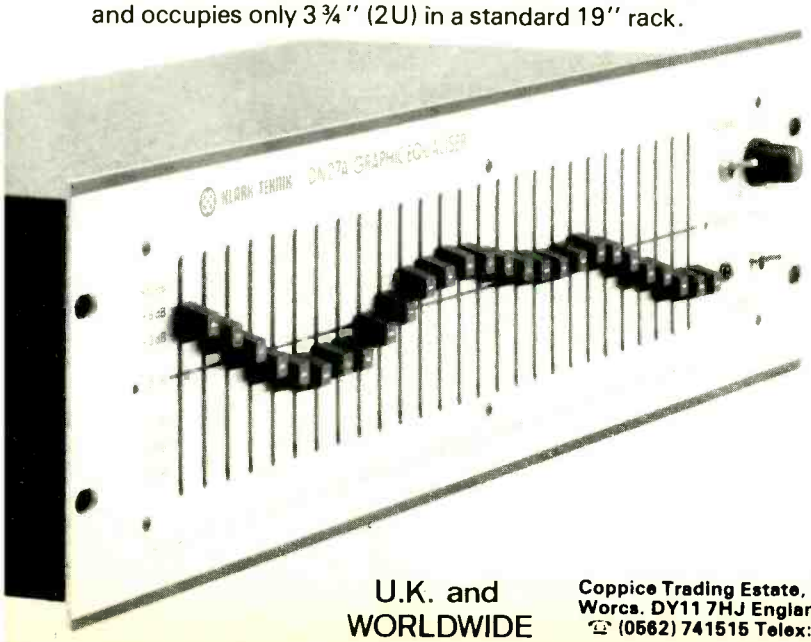
2770 ES: desk top cassette copying system comprising one master and two slaves. One or both tracks can be duplicated in a single pass; C-30 copy and rewind in 100s, C-60 in 200s. Manual or automatic recording level, plus adjustable bias. ½-track 2-channel mono. Duplicating ratio 13.3:1; speed 25in/s.
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. ¼-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; C-30 copy and rewind in 100s, C-60 in 200s. Manual or automatic recording level, plus adjustable bias. ½-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). ½-track 2-channel. Duplicating ratio 13.3:1; speed 'master can be copied at either 7½, 3¾ or ⅞ in/s'.
2790AV: portable cassette to cassette duplicator with master and one slave in a brief case. ■



"REFLECTIONS OF YOUR SOUND JUDGEMENT"

The "DN60 REAL TIME ANALYSER" is the heart of a new audio measurement system from the engineers at KLARK-TEKNIK and is the perfect compliment to the new DN27A Equaliser shown below. Using Micro-Processor based circuitry, the DN60 is capable of performance checks on virtually any audio equipment, and is especially well suited for aligning audio tape recorders. On-site performance verification, whether of a 10,000 seat arena, or a studio control room, is easily facilitated with the DN60; and is an excellent method of building your customer's confidence.

If you're a recording or broadcast studio, include the RT60 Option and provide quick and accurate alignment for your reverberation systems (plates, springs, digital). The DN60 incorporates a pink noise source internally, and occupies only 3¾" (2U) in a standard 19" rack.



If you take your sound on the road, the DN60 can help make that 5 p.m. sound check go easy, leaving enough time for a quick dinner before showtime. With the inclusion of Three Memories, and a Peak-Hold function, you can expand the scope of your sound check, and provide that extra edge of excellence.

The DN60 is Micro-Processor technology at a price you will like.

Other useful features include:- "A" Weighting , Average or Peak Reading and Selectable Response Time.

DN60 Options:- • Calibrated microphone • RT60 (Reverberation time) package • X/Y Plotter and oscilloscope interface • Dot matrix printer interface.

Now complete your system with the new DN27A ⅓rd OCTAVE EQUALISER and quickly adjust your sound to perfection.

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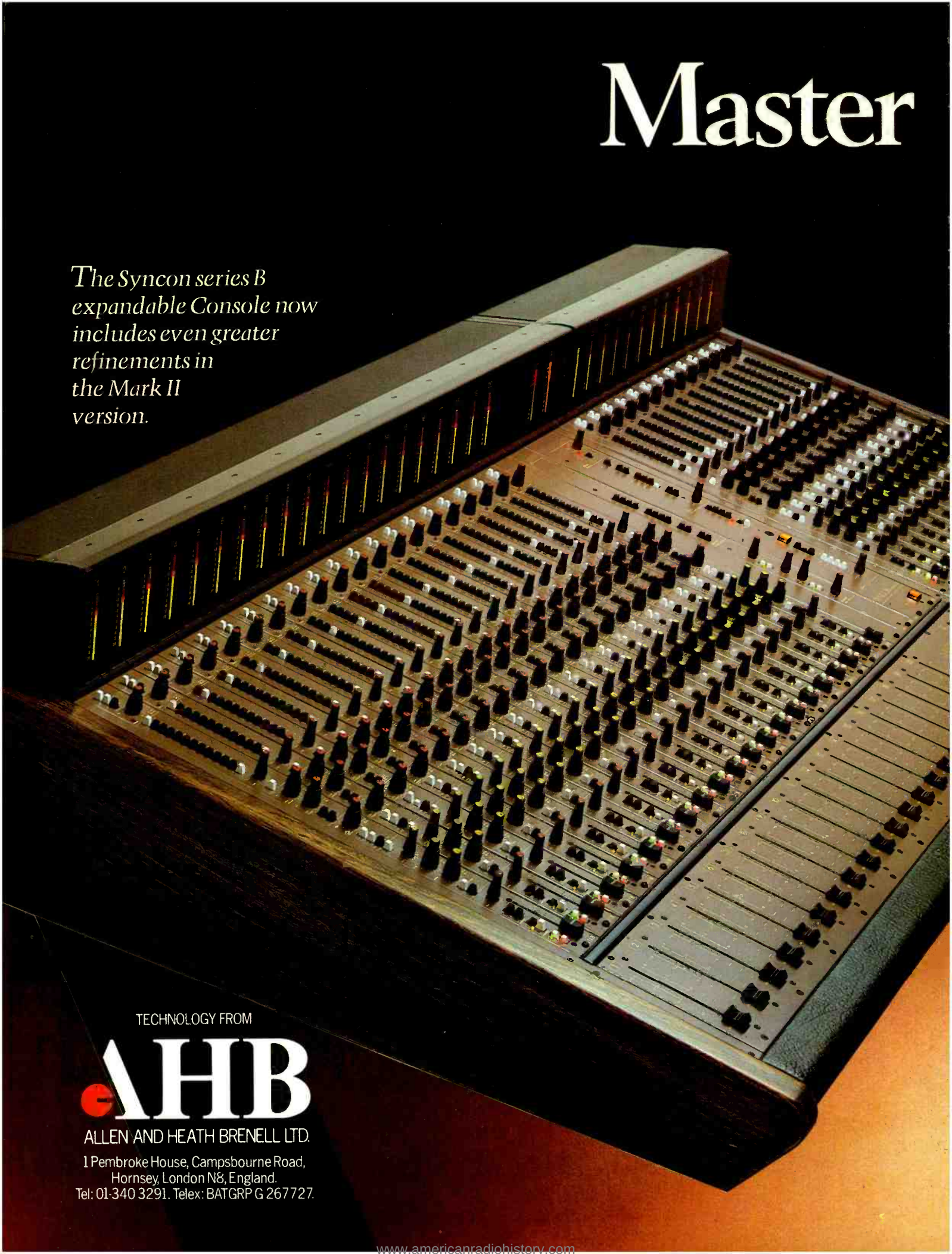
Master

The Syncon series B expandable Console now includes even greater refinements in the Mark II version.



TECHNOLOGY FROM

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The Compact Disc

Alan Kilkenny

The forthcoming arrival of the Compact Digital Audio Disc is set to revolutionise the recording industry over the coming decade. In this article Alan Kilkenny of Sony describes the system and outlines how it will change the way engineers work.

AROUND this time next year will see the United Kingdom release of the joint Sony-Philips development, the Compact Digital Audio Disc. With specifications such as those listed below in conjunction with the system's resilience to mechanical damage, it is self-evident that the introduction of such a revolutionary concept must have many implications for the established record industry and for recording studios.

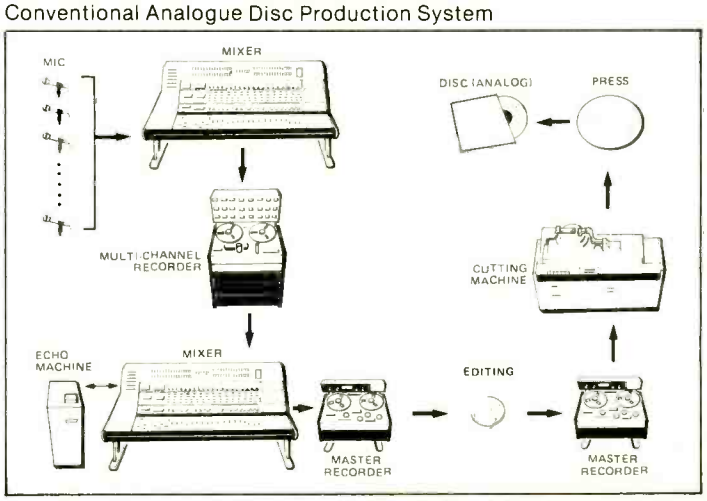
Naturally the electrical specifications relate not only to the quality of the disc and laser-player, but also include the master-tape if this was made using Sony PCM *1600, 1610,* or *3324* 16-bit recorders. If the DAD (Digital Audio Disc) is manufactured from an analogue master-tape, then the signal-to-noise ratio, channel separation, peak distortion and wow & flutter will naturally degrade to the quality of the master-tape.

There is widespread dissatisfaction among consumers and industry alike as far as the pressing quality of conventional analogue discs is concerned. High quality domestic sound reproduction equipment is readily available at low cost, and the ability to detect surface imperfections becomes daily more frequent. Conventional LP's are easy to damage through mishandling, and are often faulty at time of purchase through inadequate factory quality-control or extended storage in an unsuitable environment. It is clear to see that the marketplace is ready for a new, more up-to-date home-replay format, set to take full advantage of the data-processing age, and built for the future. The analogue LP Disc finds its origin in the latter half of the 19th century, and the time is right to put it to rest in the light of so many technological developments and requirements which have arisen over recent years. Target price for DAD software is very close to that of a conventional equivalent LP, and the player will be priced initially to be competitive in the hi-fi middle market, offering a much improved sound quality totally independent of matching problems like lead-capacitance, effective mass, feedback, etc. characteristics of analogue players. After the firm establishment of the DAD in the hi-fi market-place it will soon filter down into the general mass market through car-players, personal 'Walkman'-type players, and combined DAD/portable radios. The non-vulnerability of DAD to mechanical mistreatment will inevitably be a very great selling-point for non-expert domestic users.

Sampling rate for the DAD has been established at 44.1kHz, and quantisation is 16 bits linear/channel. The contactless solid state laser pickup operates at a wavelength of 780nm and is made from ALGaAs; focal length is approximately 2μm and the beam diameter approximately 1mm (measured at the surface of the disc). Error-correction using CIRC (Cross Interleave Reed Solomon Code) is capable of correcting a burst-error as large as 3,548 bits (or 2.38mm on the disc); errors greater than this can be compensated for by linear interpolation so long as they do not exceed 14,000 bits (9.4mm on the disc). In theory it is possible to drill a hole in a DAD up to 2mm or so diameter, and still this disc will play perfectly. The handling advantages of DAD are therefore obvious in comparison with the existing LP, and also in comparison with other proposed formats of digital audio discs requiring protective caddy packaging to avoid dust and mechanical damage. With DAD there is now a single world standard independent of any video standards (NTSC 60 fields, PAL 50 fields, etc.) which is not the case with any hybrid pseudo-videodisc system, and international standardisation is essential for both software and hardware licensees of the digital format.

Before passing on to the manufacturing process for DAD laser-

Conventional Analogue Disc Production System



SPECIFICATIONS

Frequency response: 20Hz to 20kHz.
S/N ratio: >90dB.
Dynamic range: >90dB.
Channel separation: >90dB.
Harmonic distortion: <0.05% at peak modulation.
Wow & flutter: immeasurable.
Channels: nominally 2, can be extended to 4 channels with halved playing time.
Playing time: nominally single-sided disc with 60 minutes. Maximum side-length 75 minutes. Double-sided disc can be manufactured.
Pick-up system: Laser/Optical contactless pickup.
Disc diameter: 120mm (4.7in).
Disc thickness: 1.2mm.
Track pitch: 1.6μm.
Rotating speed: 1.25m/s, constant.
Rumble: zero.

discs I should like to mention the 'User Bits' facility, whereby it is possible to record additional information on the disc, such as a score, script or text, and programming data in encoded form for visual display, track selection and pre-programming of the player, whereby it will be possible to play tracks, jump tracks or repeat others at will.

The manufacturing process for Compact Digital Audio Discs is obviously different in some significant respects from pressing conventional LP's. The differences start with the cutting process, which is no longer a creative artistic process as it is in many countries. Any compression of dynamic range, gain-riding, equalisation and fades, etc. will have been done to the master-recording before its arrival at the disc-cutter, since there is no quality loss in producing a production master-tape if it is a digital transfer from a digital master-tape. Monitoring facilities in conventional cutting-rooms are often less than ideal, with high ambient noise-levels and poor acoustical qualities, and it will be an advantage to prepare the final master-tape's sound quality in optimised surroundings. Since the manufacturing process for DAD imposes no modification at all to the digitised sound-quality, monitoring the deprocessed output of a 16-bit converter at all times will indicate the sound-quality of the finished product, without the expense of recutting on artistic or musical grounds to compensate for analogue manufacturing limitations. Mechanical cutting lathes are impractical for digital disc production because the pits to be carved are too small to be handled mechanically. Instead, to produce digital discs, a glass plate coated with photo-resistive material is first exposed to a laser beam, to be developed in the next step to form pits corresponding to the presence or absence of digital signals. After undergoing the silvering process, this becomes the glass master, which is next pressed against a metal plate to make a reverse copy of the photo-etched depressions on the nickel plate. In this way a digital metal master can be produced, which in turn is used as the mother for the production stamper. Pressing is the final stage of disc production: using the stamper, Compact Discs are produced in large numbers in similar fashion to conventional analogue albums. The signal surface of each stamped disc is then coated with reflective material, followed by a coating of protective transparent plastic on top of that. This ends the production of a single-sided disc; with two-sided discs, the additional process of combining two single-sided discs together is necessary. The small size of disc naturally results in reduced material costs, with greater profits possible for the manufacturer; packaging can also be simplified. The Compact Disc is only one seventh of the area of present LP records, and weighs as little as approximately 35gm including a deluxe gate-fold sleeve, thereby facilitating mailing or shipping.

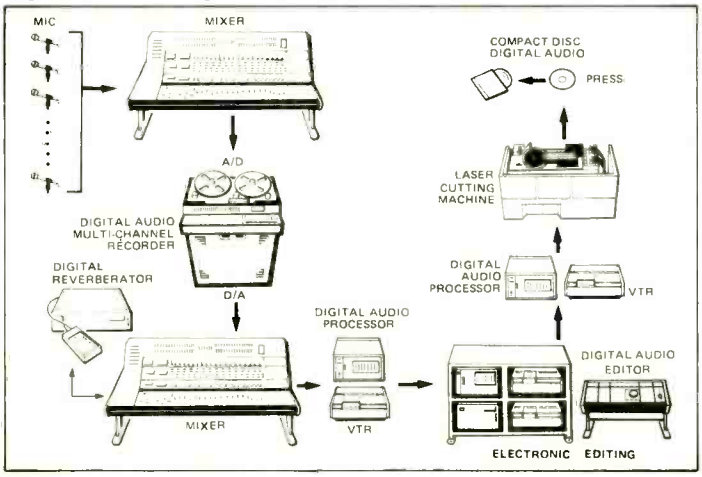
The development of a very powerful error-correction system in the Compact Digital Audio Disc Player was not simply to overcome dust, dirt and finger-marks on the disc's protective layer, it was also conceived to minimise problems with slightly less than perfectly manufactured discs. With conventional analogue pressings, it is possible for a poor-quality disc to be marginally acceptable to a non-discerning purchaser; top-loss, rumbling-noises pre-echoes, off-centre pressing, non-fill, stitching, dimples, lacquer-blinds, etc. all degrade the audio quality but still some musical information is discernible. With DAD if the disc manufacturing standard of quality falls below an acceptable level then the disc will not reproduce the digital information required by the player and the electronics may mute producing no music at all for the duration of any huge fault in manufacture, that is if it exceeds 14,000 bits.

Many hardware and software manufacturers are committed to DAD and the UK launch is planned for Autumn 1982, so there will be a lot of work for the disc-pressing plants to make sure there is an adequate supply of discs ready for simultaneous marketing with the players. Without software of reasonable quantity and musical variety, the market could well initially show resistance to the new format. In Europe, the main source of supply of programme material will probably be the Polygram record group (including Philips, Phonogram, Polydor, Deutsche Grammophon, Decca, and licensed labels), and in Japan CBS/Sony, Warner/Pioneer and Nippon Columbia are all heavily committed. The manufacturing prospects for the rest of the world will finally take shape over the coming weeks and months, and it is most probable that serious interest will snowball rapidly as the launch date for the players gets nearer.

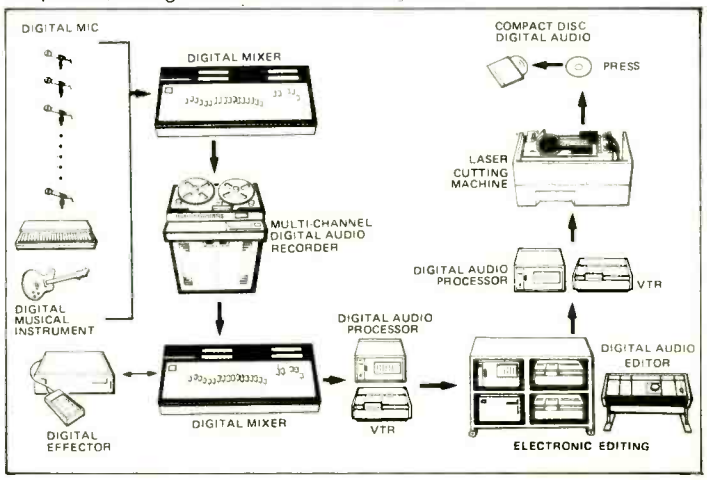
From the recording studio's point of view, the Compact Digital Audio Disc format will make some differences. The dramatically reduced background noise level of the disc renders any slight technical imperfections in the recording chain far more noticeable to the record-buyer, for example hiss or hum from old microphones, mixers, compressors and echo-plates are as obvious on the finished DAD album as they are when monitoring the master-tape! The main change will be one of the education of consumers to recognise what is good, and conversely what is bad, so it is likely that market expectations as far as sound quality is concerned will increase steadily over the coming years. There will certainly be increased pressure upon studios to equip with digital recording equipment, since with a DAD laser-disc player in the front-room with possibly a 14-bit record/replay machine as well, consumers will be less than completely satisfied with the deficiencies inherent in analogue recording, particularly exaggerated by the low background noise of the rest of the hi-fi system. Since all material marketed on DAD will have to be converted to 16-bit quantisation 44.1kHz sampled pcm it makes sense to do this conversion as early as possible in the chain to minimise any possible losses or additions, and producers convinced of the advantages of the final marketing medium will inevitably seek out the studios most able to satisfy their requirements, i.e. those equipped with digital recording equipment.

The Compact Digital Audio Disc is another step in an exciting new age of digitised sound, and eventually one can envisage satellite broadcasting of the digital audio bitstream for ultimate conversion in the home. In Great Britain the BBC have been using digital audio microwave links for some years to avoid land-lines to transmitters, and sooner or later we can expect the link to the home to be digital as well, bringing live concerts into the home with alarming realism. It is fascinating to look back to publications from around 1947 when the LP was first being introduced and was showing definite signs of superseding the 78rpm disc. The move from LP to Compact Disc is as significant and will be as total in the fullness of time, and it is most interesting to compare commentary from that period to commentary today. The change from 78rpm to LP was nearly as important to the growth and survival of the home entertainment industry then, as the move from analogue LP to Compact Disc is for us all now (studios, record-companies, consumer electronics manufacturers, and dealers alike). If we want to ensure a future where the record companies can sell a product up to the standard at least of the domestic equipment which is going to play it back in the home DAD points the way forward. ■

Digital Audio Editing and Disc Production System



Proposed All-Digital Disc Production System



AES 70th Convention, New York - a preview

The 70th Convention of the Audio Engineering Society will be held from Friday, October 30 to Monday, November 2 at its usual venue, the Waldorf-Astoria, New York. Products will be shown by over 185 exhibitors covering all aspects of the audio industry.

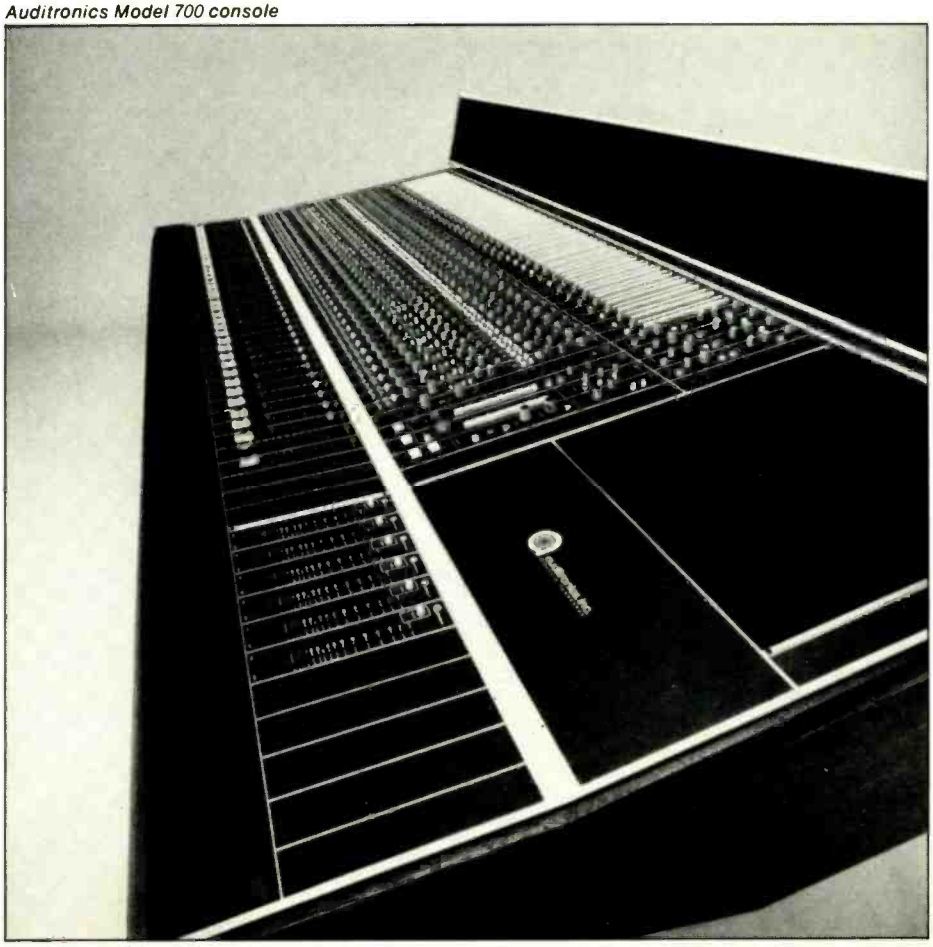
A

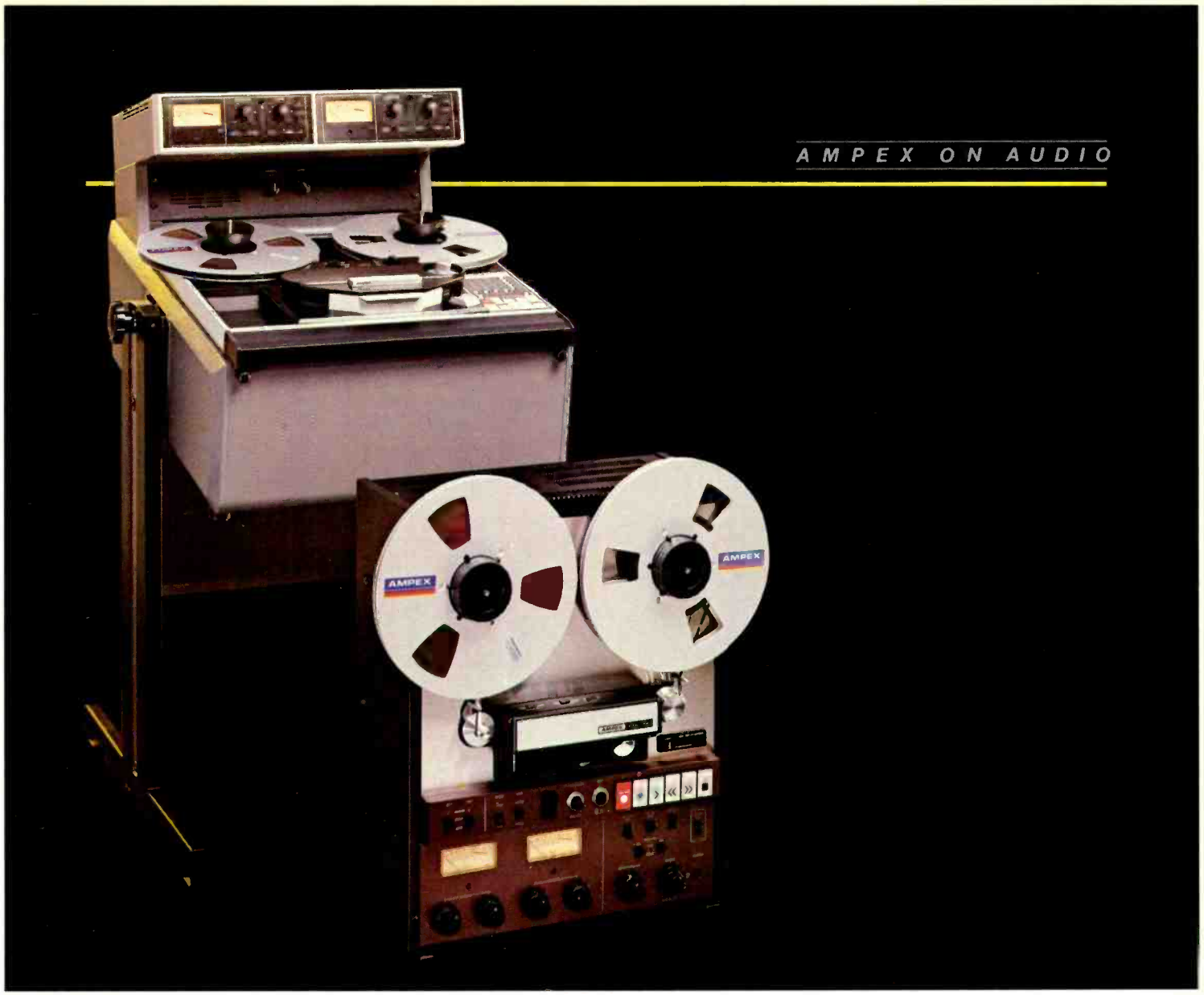
● **AB Systems Design:** *Model 1200A* power amplifier, *Model 2400* electronic frequency divider, *Model 912* pre-amp/mixer, and *Model 730* tri-amp system. ● **Acoustic Design by Jeff Cooper:** display of professional recording studio, control room, and film studio designs including details of recent design projects. ● **Acoustilog:** *Model 232A* reverberation timer and the *Impulser* impulse excitation option which allows checking of loudspeaker polarity, phase and alignment in multi-speaker systems. Also the company's time delay spectrometry equipment used in conjunction with its acoustic consultation service. ● **Adams-Smith:** *Model 605* synchroniser and *TC-600* timecode generator/reader. ● **Agfa-Gevaert:** range of tapes including *PEM 526*, *PEM 468* and *PEM 428* mastering tapes; plus cassette tapes and cassette pancakes. Agfa-Gevaert are to introduce a new ¼in, high output, low noise, low print mastering tape, type *PEM 369*. ● **AKG:** wide range of condenser and dynamic mics and accessories; the full range of reverb units including the *TDU 7000* modular time delay unit; and the recently introduced *Micro-Mass Technology* range of phono cartridges. Highlighted will be the *C414EB-P48* and *C535EB* mics. ● **Allen and Heath Brenell:** first US showing of the *Syncon 24* 24-track recorder with full autolocate and remote functions. Also the *Syncon Series B* modular in-line console expandable up to 44/24; the *16:4:2* and *8:4:2* budget mixers; plus a new additon to the latter range, the *24:4:2*. ● **Alpha Audio:** *Sonex* acoustical foam. ● **Altec Lansing:** wide range of equipment including monitor loudspeakers, small mixers and intercoms. ● **Amber:** *Model 3500* miniature distortion analyser with built-in oscillator, automatic operation, battery powering, and performance to 0.002% residual. Also the *Model 4400A* multi-purpose audio test set. ● **Ampex:** *ATR-116* and *ATR-124* 16-track and 24-track recorders. Also the *MM-1200*, *ATR-100* and *ATR-700* tape recorders; the **ECCO** *MQS-100* synchroniser; the *ATR-102* and *ADD-1* disc mastering system; and Ampex tapes and cassettes. ● **Ampro/Scully:** broadcast equipment plus the Scully *LS76* disc cutting lathe; *Auto/Master* automated disc master console; *284B* 8-track recorder with varispeed; and *280B Series* 2 and 4-track recorders. ● **AMS (Advanced Music Systems):** *DMX 15R* digital reverb system for use with the *DMX 15-80* programmable DDL; *DMX 15-80SB* stereo broadcast delay line; *Digital Loop Editing System* for the *DMX15-80 Series;* a new digital audio store for film overdubbing of sound effects; the *DM-DDS* digital disc mastering delay line; and the *DM2-20* phaser/flanger. ● **Anvil Cases:** range of equipment cases including the *Amp Rack* series.

● **Aphex Systems:** recently introduced *Aphex II Aural Exciter* available as two models, one for studio usage and one for broadcast purposes. Also the *OAS-24* grouping and automation system; *CX-1* compressor/expander; and *EQF-2* parametric equaliser. ● **APSI (Audio Processing Systems):** range of units including the *Model 559*, *561* and 562 equalisers. ● **Ashford Audio:** range of exponential-flare radial horns. ● **Ashly:** *SC-44* keyboard input processor; 2-, 3- and 4-way electronic crossovers; *SC-66A* 4-band parametric equaliser and the *SC-63* (mono) 3 band parametric; plus updated versions of the *SC-50* (mono) and *SC-55* (stereo) peak limiter/compressors. ● **Association of Sound & Communications**

70 ▶

Auditronics Model 700 console





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AES preview

Engineers: details of the Associations activities plus those of its members and exhibition attendees. ● **Audico:** *Model 751* cassette tape loader, plus a range of cassette rewinder/exerciser/timer units for duplication operations including the *Model 200-9* tape timer. Also *Hockey-Puck* splicers for ½in audio or ¾in video tape and the *MF-6* 50Hz pulsing system. ● **Audicon:** *The Plate* reverb systems; *Alpha One* and *Alpha Two* monitors; multipair audio cable; and studio accessory items. Additionally, **Barth** signal processing equipment; **EELA Audio** mixers; **Raindirk** mixing consoles; and the **Redwood Research** *Param* equalisation system. ● **Audio Arts:** *Model 400* and *Monitor 10* mixing systems; *5200A* stereo mixer/preamp; *1500* tunable notch filter and feedback suppressor; *4200A* parametric equaliser; *4100* parametric equaliser/ preamp; *1400* parametric electronic crossover; and the *2100A* tunable electronic crossover. ● **Audio & Design (Recording):** first US showing of the *Panscan* pan effects unit. Also the *Transdynamic* processor; plus the full range of *Scamp* modules and racks; and the company's range of rack mount signal processing equipment. ● **Audio Developments:** *AD055* compressor/ limiter; *AD070* prographic equaliser; *AD007* portable mixer; *AD045 Pico*, *AD049 Mixette*, and *AD031 Micro* mixer; plus a small mixer for ENG use and a new PPM. ● **Audio Kinetics:** *QLOCK 310* synchroniser; the *QLOCK 210* synchroniser; and the *XT-24 Intelocator*. Also details of the range of *Q-Soft* dedicated software machine interfaces. ● **Audio Technica:** the *AT803R* tie-clip electret condenser phantom powered mic; the *ATM11R* and *ATM91R* phantom powered mics; and the *AT8501* remote 9V battery supply unit. ● **Audio Video Automation:** audio/video tape loading equipment. ● **Audiotechniques:** details of the company's sales, rental and service operations, and a selection of professional recording equipment. ● **Auditronics:** *Model 700* console with the company's recently developed *Model 1200* automation system; plus a new compact submixer. Also *Model 1000* audio distribution amp system.

B

● **BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes. ● **Beyer:** range of dynamic and condenser mics plus headphones. ● **BGW:** range of amplifiers including the recently introduced *320*, *620*, and *1250* power amps. ● **B & K Instruments:** comprehensive range of audio measurement instruments. ● **Bose:** *Model 802* loudspeaker plus the *802-E* active equaliser and other units. ● **Bryston:** range of amplifiers. ● **btx:** *Model 4600* SMPTE tape controller—an audio controller and editing system for two, three or four audio or video recorders, plus the *5000 Series* of SMPTE time code generator/display units. Also the *Shadow System*, a computer interfacable audio/video synchronising system.

C

● **Calzone:** range of flight cases for amplifier rack units, mixers, effects units, etc. ● **Canary:** range of consoles up to 16-track. ● **Casheab:** no information received. ● **Cerwin-Vega:** range of monitor loudspeakers and amplifiers. ● **Cetec Gauss:** tape duplication system for a master and up to 20 slaves, plus Gauss loudspeaker drive units. ● **Cetec-Vega:** *Model 80* and *81* handheld radio mics, plus the company's established range of communication equipment. ● **Clear-Com:** *RS202* intercom system plus the *System II* remote stations and *KB-124* duplex remote station. ● **Community Light & Sound:** range of high-level sound reinforcement equipment including the *PBL-90* cabinet. Also the *Z10D* range of radial horns. ● **Con Brio:** *ADS 100* and *ADS 200* digital music synthesisers. ● **Consilium:** *SPA 11* narrow band spectrum analyser and *GNA 11M* network analyser; plus the *RTA 11* and *RTA 12P* realtime analysers, and *PNG 11* pseudo noise generator unit. ● **Crest:** range of power amplifiers. ● **Cross:** *CT-1800* automatic cassette labelling machine. ● **Crown International:** recently introduced *PS200* and *PS400* amps; *MX4* active crossover; and *SL-2* pre amp. Also the *PSA-2* and *SA-2* self-analysing power amps; the *PZM* range of pressure zone mics; and the *Badap 1* programmable audio measurement system.

D

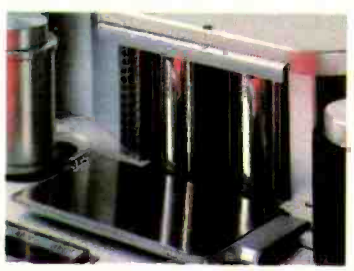
● **Dallas Music Works:** no information received. ● **David Lint Associates:** ITI *L-1* automatic cassette labeller; Teccon sendust heads for duplication purposes; plus **Electro Sound** tape duplicating equipment. ● **Datatronix:** broadcast and multitrack consoles plus a range of amplifiers. ● **dB Cassette: Stocktronics** *RX 4000* stereo reverb plate. ● **dbx:** *900 Series* modular signal processing system, plus variety of noise reduction units and comp/limiters including the *Model 164*, a stereo version of the *Model 163*. ● **D & D Engineering:** *MK-2000* cassette tape loader. ● **DeltaLab:** *Memory Module* delay extender; *DL-1* digital delay module; *DL-2 Acousticomputer; DL-3* digital delay line; and *DL-4 Time Line*, a multi-

72 ▶

As usual the AES 70th Convention will feature four days of specialised technical sessions, with a total of 75 technical papers being presented in 12 sessions. In addition, parallel to the technical sessions, the AES is offering 10 special workshops directed toward examining the practical aspects of audio engineering. Further to these, there will also be a special Tape Machine Clinic, where participating manufacturers will present updated technical information on the proper tape machine maintenance of their respective products. Details of the technical sessions and workshops (workshops are indicated in italics) are as follows:

	MORNING	AFTERNOON	EVENING
FRIDAY, OCTOBER 30	A – Signal Processing	B – Microphones, Loudspeakers, Listeners and Rooms	C – Transducers
	◀ *Basics of Mixing Consoles and Applications* ▶		*Audio/Video Interfacing*
SATURDAY, OCTOBER 31	D – Sound Reinforcement and Room Acoustics	E – Studio Technology F – The Standardisation Activity of the AES	G – Electronic Music H – Open Meeting of ANSC S4 on Audio Engineering
	Tape Machine Clinic	*Sound Reinforcement*	*Tape Duplication*
SUNDAY, NOVEMBER 1	I – Digital Recording, Editing, Reproduction and Signal Processing	J – Analogue Recording and Reproduction	
	Sound Reinforcement Devices	*Synthesisers and Electronic Music*	
MONDAY, NOVEMBER 2	K – Circuit Design and Measurement	L – Disc Reproduction and Broadcast	
	Physical Effect of High Sound Pressure Levels	*Digital Editing*	

SPOILT FOR CHOICE.



When you come to choose your new multitrack, deciding on a Studer will probably be easy. What will be a little more difficult will be *which* Studer to take - the new A80/VU Mk III or the new A800.

Both machines are superb examples of Studer precision. Both come with the new narrow head block that cuts the travel distance between the erase and record heads to 88 millisecs at 30 ips (now available as a conversion for existing A80/VU models). And both are available in several tape width/channel number configurations.

Whatever your criteria, choosing between the A80/VU Mk III and the A800 won't be easy. But then Studer never have been in the habit of taking the easy way out when it comes to performance.

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function special effects delay line. ● **Dolby Laboratories:** range of professional Dolby A noise reduction units, including new modules for videotape recorders. Also Dolby Stereo cinema sound processing equipment, plus details of the Dolby-C system. ● **Duncan Electronics:** no information received.

E

● **East Coast Sound:** range of sound systems including own product range of loudspeaker cabinets, wiring harnesses, patch bays and other accessories. ● **Eastern Acoustic Works:** *FR-350* horn-loaded loudspeaker system and *MR-102* horn-loaded upper-bass reproducer. Also the *State Performance* range of stage monitor loudspeakers. ● **Electro-Voice/Tapco:** *Sentry 100* monitor loudspeaker and recently introduced *Panjo* mini-mixers. Also full range of Electro-Voice mics and loudspeakers, plus the Tapco range of mixers and amplifiers. ● **Eventide:** recently introduced *SP2016* programmable effects processor; plus *Model H949 Harmonizer;* range of plug-in realtime spectrum analysers for use with home computers; the *BD955* broadcast delay line; and the *RD770 Monstermat* mono/stereo broadcast matrix unit. Additionally, the *Instant Flanger* and *Omnipressor;* the *BPC-101* plug-in card which converts the *Instant Flanger* to an *Instant Phaser;* and the *JJ193* and *CD254* DDLs. ● **EXR:** *Model EXIII* signal clarification and boosting unit and *Model SP-1* studio unit.

F

● **Fostex:** *Model 350* 8/4/2 mixer; *Model 250 Multitracker* 4-track high speed cassette unit; and the *A-2* 2-track, *A-4* 4-track, and *A-8* 8-track recorders all using ¼in tape. ● **Furman Sound:** *RV-1* spring reverb system, plus the *TX-2* tunable crossover/bandpass filter; *PQ-3* parametric equaliser/preamp; and *PQ-6* stereo parametric eq/preamp.

G

● **Gotham Audio:** *EMT 251* digital reverb system; **EMT** reverb units; **Telefunken** tape machines and *Telcom* noise reduction system, **TTM** noise reduction frames; and **Neumann** condenser mics. ● **Grandy:** *Promix 1* adjustable multitrack head assembly with independent control of azimuth, zenith, tape height and wrap. Also replacement tape heads and a range of single crystal ferrite record heads for high speed duplicating.

H

● **Harrison:** *MR Series* recording consoles *(MR-1, MR-2, MR-3),* plus the *PP1* post production console; an *Alive* console; and the *Autoset II* automation programmer. ● **Harvey Sound:** no information received. ● **Hazelcom:** no information received. ● **Heino Ilsemann:** *Type KZM3* automatic cassette loader and the *Type ETK-1* and *ETK-IS* cassette labelling machines. ● **Hewlett-Packard:** range of audio test instruments. ● **HH Electronics:** *TPA Series D* and *S500D* professional power amplifiers and the company's *MOSFET* power amps. Also electronic echo units and portable stereo sound control mixers. ● **HM Electronics:** wide range of radio mics and receivers including road-cases and accessories. ● **Hill:** range of consoles and power amplifiers. ● **Hitachi:** no information received.

I

● **ITAM:** *Model 1610* 1in compact 16-track recorder with modular electronic and full function remote control; *Model 806* ½in 8-track recorder; and the *10-4* and *Model 882* mixers. ● **Infonics:** *200 Series* of tape duplicators including a high speed metal tape cassette duplicator. ● **Inovonics:** range of audio processing, recording and instrumentation equipment including the *Model 500* audio analyser; *Model 201* average/peak limiter; *Model 231* octave-band compressor; and the *Map-II* broadcast audio processor. Also the 'Gordon Headroom Meter' a UK/EBU-responding level meter. ● **Institute of Audio Research:** president Al Grundy and executive director Phil Stein will be available to give details of the Institute's training programmes. ● **Integrated Sound Systems:** no information received. ● **Interface Electronics:** range of mixers designed for recording, sound systems, theatres, stage monitoring and other applications. Available configurations range from 8/2 to 48/16 and features include wide range parametric equalisers. ● **International Audio: Alpha** high speed in-cassette copiers. ● **International Consoles:** new audio control console system. ● **Ivie Electronics:** *Gold Standard* range of calibration mic capsules, preamps and power supplies. Also the *IE-17A* microprocessor controlled acoustics analyser and *IE-30A* spectrum analyser.

J

● **Jackson Music:** no information received. ● **JBL:** recently introduced loudspeaker drive units for PA and studio monitoring applications, plus the new *4430* and *4435* studio monitors. Also the complete range of monitors and the *7510* automatic mic mixer. ● **JRF Co:** no information received. ● **JVC:** *Series 90* digital recording system.

K

● **Keith Monks:** new studio turntable unit; producers playback turntable; wide range of mic stands; *LS-19* monitor with in-built power amp, plus record cleaning machines. Also **EDC** radio mics. ● **Kelsey:** range of PA consoles and ancillary equipment. ● **Kimball:** Bösendorfer and Kimball grand pianos. ● **Kinetic Systems:** no information received. ● **King Instruments:** self-feed cassette loaders and various video tape loaders. ● **Klark-Teknik:** *DN72* memory bank for the *DN70* digital time processor; new *DN772* stereo digital profanity delay unit; *DN30/30* dual 30-band graphic equaliser; *DN80* 16-bit realtime audio computer; plus the company's established range of graphic equalisers and effects units.

L

● **Lake Systems:** no information received. ● **Lakeside Associates:** no information received. ● **Lexicon:** *Model 1200* audio time compressor; *PCM41* DDL; and *122* series of stereo delays. Also the *Model 224* digital reverb system; *Model 92* and *Model 91* digital delay units; and the *Model 93 Prime Time* digital delay/processor/mixer. ● **Linn Electronics:** range of music synthesisers.

M

● **3M:** 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor including the new crossfade facility. Also the *M79* 24-track recorder; **Wollensak** cassette duplicators; and *Scotch* audio tapes including *Scotch 265* digital mastering tape.

74 ▶

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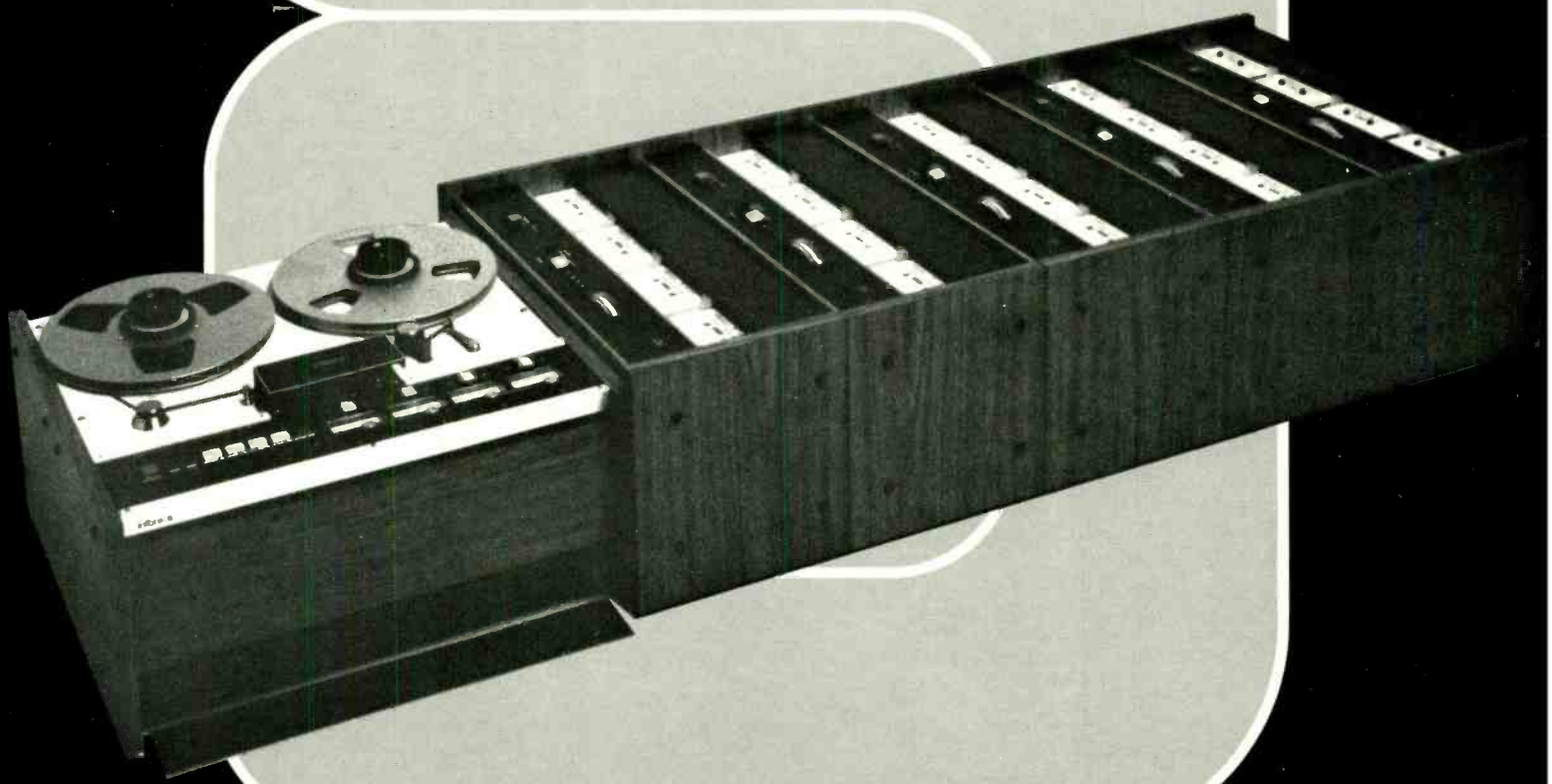
TAPE DUPLICATORS



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● **Marshall:** *Model 5402* time modulator, plus the *Mini-Modulator* digitally programmed analogue delay unit. ● **Martin Audio/Video:** a 14Hz film sync generator, and ranges of toroidal power transformers, metal rack cases and other components and hardware. ● **Matsushista:** *Technics* range including *SP-02* direct drive motor and drive electronics for a disc cutting turntable, plug-in compatible with Neumann lathes. Also turntable console for recording and broadcast use; professional PCM recording system; digital audio disc system; and *SP-15* and *SP-25* studio turntables. ● **MCI;** *JH-556D* and *JH-652* consoles, plus *JH-24* and *JH-110* tape machines. Also a variety of other equipment. ● **Meyer Sound Lab:** range of studio monitor loudspeakers including the Swiss-produced *ACD/Meyer* reference monitor system. Also the *UM-1 UltraMonitor*. ● **MicMix:** new *XL-121* reverb system, plus the *XL-305, XL-500* and *XL-210* reverb units. ● **Midas:** *PR System* consoles in a variety of input/output configurations for sound reinforcement, on-stage monitoring, recording and production applications. Also the *TR System* modular theatre consoles available in 24, 30 and 36 into 8-8 formats. ● **The Mike Shop:** *Accessit* range of ancillary processing units; *Great British Spring* spring reverb; and *Seck* mini-mixers. ● **Mission:** range of monitor loudspeakers. ● **Mitsubishi:** *X-80* and *X-80A* 2-channel digital recorders; *XE-1* electronic editor; and *X-800* 32-channel digital recorder. ● **Modular Sound Systems:** range of modular loudspeaker enclosures and rack-mount cabinets. ● **MTI:** *System III* 64:1 cassette duplicating system, plus various ancillary products. ● **Musico:** *Resynator* instrument controlled synthesiser. ● **Music Technology:** *Crumar GDS* computer controlled digital synthesiser. ● **MXR:** wide range of ancillary equipment including the recently introduced *Model 151* digital delay line. Units include graphic equalisers, flanger/doubler; digital delay; dual limiter; pitch transposer; and linear preamp.

N

● **Nady Systems:** range of 'Nady Cordless' and 'Nasty Cordless' radio transmission systems. Also the recently introduced Nady *VHF600* and *VHF700* transmitter/receiver systems. ● **Neutrik:** comprehensive range of *XLR*-type connectors; *K-Check* cable tester; and new additions to the company's audio instrumentation range comprising the *3204* constant sound pressure source with integrated compressor amplifier and the *3282* artificial ear. ● **Neve:** *Model 8108* 56-channel console; *Necam II* post-production mixdown system; plus a *5316* console and portable *5422* suitcase mixer. ● **New England Digital:** digital signal processing equipment, plus the *Synclavier II* digital synthesiser. ● **Noise Ltd:** custom-built portable console cabinets designed to accommodate various manufacturers modules.

O

● **Omni Q:** *TL Series* synchroniser/effects modules. ● **Orban:** new *Model 674A* stereo quasi-parametric equaliser; *Model 672A* quasi-parametric equaliser; *526A* single-channel de-esser; and an improved version of the *111B* dual spring reverberation unit. Also the *245E* stereo synthesiser; *418A* stereo comp/limiter; and *622B* parametric equaliser. ● **Otari:** *MTR-90* 2in, 16/24-track multitrack recorder; *MX5050* and *MX7800* tape recorders; and the *DP4050* cassette duplication system.

P

● **Panasonic:** Ramsa range of mixers, amps, mixer/amps and column loudspeakers. ● **Peavey:** new PA consoles; *EQ-27* graphic equaliser; *SP-2* loudspeaker system; *CS-800* power amp; plus a wide range of loudspeakers, amplifiers and ancillary units. ● **Penny & Giles:** new *3000 Series* faders plus the established range of faders and quadraphonic panpots. ● **Pentagon:** range of cassette copiers and open reel tape duplicators, including the *C-10, Pro-Series* and *1100 Series* cassette copiers and *SRCC 4250-12* tape duplication system. ● **Phase Linear:** wide range of amplifiers, equalisers and crossovers. ● **Phoenix Audio:** no information received. ● **Pioneer:** digital audio laser-read disc system, compact PCM disc system, and ribbon sendust tape heads. ● **Publison:** range of audio processing equipment.

Q

● **QSC Audio Products:** no information received. ● **Quad-Eight:** new *Ventura* disk-automated post-production console featuring a more powerful version of the *Compumix* automation system. Also the *System-5* digital reverb system and the *248* expandable modular console. ● **Quantum Audio:** *QM-8, QM-12, QM-128, QA-1010* and *Gamma A* consoles.

R

● **Raindirk:** *400 Series* range of broadcast consoles, plus the *Status 500* MOSFET power amp and *Status 20* modular stereo control unit. ● **Red Acoustics:** professional monitor loudspeaker. ● **Renkus-Heinz:** range of loudspeaker drivers, horns and passive crossover networks. ● **Roland:** *RSS Series* of rack-mount signal processing units plus the *RE Series* of units, and the *TR808* drum machine. ● **RWO/Fostex:** wide range of studio monitor loudspeakers and drive units. ● **RTW:** acoustic measurement equipment, plus tape duplication systems.

S

● **Saki Magnetics:** range of hot pressed glass bonded ferrite heads including heads for in-cassette duplicators and high speed metal tape duplicators. ● **Sansui:** wide range of audio units including power amplifiers. ● **Sequential Circuits:** *Prophet* synthesisers and sequencers. ● **Sescom:** introduction of a portable audio generator, harmonic distortion analyser, audio voltmeter, millivoltmeter and an audio frequency meter. Also wide range of audio modules, transformers, splitter boxes, direct boxes, 3-band parametric equaliser, 10-band graphic equaliser, and 4-channel mic-mixer. ● **Shure:** new *Model 711* loudspeaker system and *Model M267* 4-way mic mixer. Also the company's ranges of condenser and dynamic mics; *Pro Master* sound system; and range of phono cartridges. ● **Solid State Logic:** *SL-4000E Series* automated console; *SSL* studio computer system; and *Total Recall* studio automation system. ● **Sontec:** *Compudisc* digital control system for Neumann and Scully lathes; plus the *DTC-400* disc transfer console: *DRC-400* dynamic range controllers; and a range of

76 ▶

Shure M267 mic mixer

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AES preview

equalisers. ● **Sony:** *DAE-1100* digital editor for the *PCM-1600* and *PCM-1610* digital processors and *U-matic* based digital recording systems; a digital compact disc system; and a wide range of mics and radio mics. Also the company's digital multitrack studio system. ● **Soundcraft:** *Series 2400* 24/16 or 28/24 console, plus the *Series 800, Series 400* and *Series 1S* consoles. Also the *SCM381-8* 8-track, 1in tape recorder and *SCM762* 16 or 24-track, 2in multitrack recorder. ● **Sounder Electronics:** no information received. ● **Soundstream:** digital audio recording system. ● **Sound Technology:** *Model 1500A* microprocessor based automatic tape recorder test instrument. Also *Model 1710A, Model 1700B* and *Model 1701A* distortion measurement systems. ● **Sound Workshop:** *Series 20, Series 30* and *Series 40* modular consoles, plus *242* and *262* stereo reverb systems, *Super-Group* grouping system, and *ARMS* automation system. ● **Spectra Sonics:** *Model 1500* ⅓-octave graphic equaliser; *Model 510* bandpass filter; and *Model 802* signal generator. Also a wide range of ancillary units. ● **Sphere:** *C-Series* consoles and *1604* satellite mixer, plus the company's new continuous band digital fader and attenuator. ● **Stanton:** *Model 310* phono preamplifier/equaliser and *Dynaphase 55* headphones. Also the *500 Series, 680 Series, 681 Series* and *881S Series* phono cartridges. ● **Statik Acoustic:** range of ancillary equipment comprising *SA30* electronic crossover; *SA10* single-octave graphic equaliser; *SA100* dynamic delay/flanger; and *SA20* dual reverb system. ● **Stephens Electronics:** *821B* range of tape recorders featuring capstan-less and pinch roller-free drive. Models on show will include a 40-track, 2in machine, and a 24-track portable machine. Also the *Q-II* autolocator and other accessories. ● **Studer/Revox:** variety of equipment including *A800* and *A80* multitrack recorders; *TLS 2000* sync/edit system; Studer *169* portable console; and Revox *B77* and *PR99* tape recorders. ● **Studiomaster:** range of mixers and ancillary equipment for PA and studio applications. ● **Studio Technologies:** *Ecoplate II* reverb plate and matching amplifier. ● **Swintek:** *Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand-held lavalier cordless mics with multiple diversity antennae; and *MK200* communicator. ● **Symetrix:** no information received. ● **Synton:** *Syntovox 222* vocoder, a simplified version of the *Syntovox 221* effects vocoder; *Syntovox 202* vocoder designed for guitar players; and *Syntovox 232* 16-channel vocoder with a voltage controlled filter bank.

T

● **TAD (Technical Audio Devices):** range of loudspeaker drive units including beryllium diaphragm compression drivers. ● **Tangent:** *Model 3216* console available in 16/24/32-channel formats, plus the *Series 4* sound reinforcement consoles. ● **Tannoy:** *Buckingham* 3-way monitor loudspeaker system; *Classic Dual Monitor* and *Super Red* loudspeakers; *Little Red* and *SRM Series* monitors; *Dreadnought* monitor, and the company's hybrid passive/active crossover unit. ● **T D Audio:** no information received. ● **Teac:** comprehensive range of mixers and tape machines from the *Tascam* range. Introduced will be the *Model 44* 4-channel, ¼in tape recorder. ● **Tektronix:** *TM500* range of audio test equipment. ● **Telex Communications:** range of headsets, intercoms, and cassette duplicators,

Teac Tascam 44

including the recently introduced *3000 Series* tape transport, *Audicom* headset intercom system, and *FMR-1* radio mic system. ● **Toa Electronics:** new *RX-7 Series* modular consoles. ● **Trident:** *TSR Series* multitrack recorder with autolocate and remote; *TSM Series* multitrack console; and the recently introduced 8 group *Trimix* console.

U

● **UREI:** wide range of products including consoles, limiters, equalisers, filters, power amps, and time aligned loudspeaker systems. ● **Ursa Major:** *8X32* digital reverb system and the *SST-282 Space Station* digital delay line and digital reverberation system synthesiser.

V

● **Valley People: Allison** *Kepex II* and *Gain Brain II* units; *Fadex* programmable fader system; the *65K* automation system; plus the various Allison VCA modules. Also the *Trans Amp LZ* transformerless mic-pre-amp, and recently introduced *Dyna-mite* compressor/limiter/expander/gate effects unit.

W

● **Westlake Audio:** *HR-1* phase coherent studio monitors; *TM-1* monitor system; plus various DI boxes, and multiboxes. ● **Wireworks:** range of hard-wired mic cables and multicables together with a number of audio accessories. ● **Woelke:** range of professional record, playback and erase heads for 16/24-channel multitracks, plus the company's other ranges of multitrack heads. Also wow and flutter meters; wave analysers; and bias/distortion meters. In addition new cue-track heads for ¼in tape usage.

X

● **Xedit:** drift and flutter meter plus splicing blocks and a film strip pulser/converter.

Y

● **Yamaha:** wide range of audio products including the *PM-2000* console available in 24 or 32-input channel configurations.

●

● **Studio Sound:** editor Richard Elen and assistant editor Noel Bell will be attending the Convention together with advertisement manager Phil Guy. Copies of Studio Sound will be available from our room number 785. ■

1

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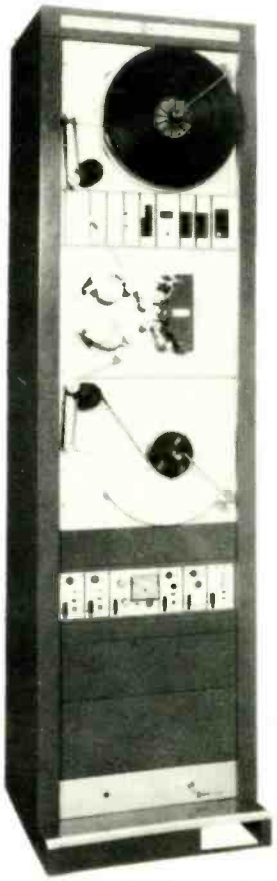

ST-6000 Series reproducers and recorder/reproducers

All the range of ST-6000 Series of machines for use with magnetic film incorporate the new Westrex ST-6200 DC Servo Motor System, and are housed in a cabinet rack.

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- Fast Forward and Reverse operation when laced through the film sprocket at up to 15 times standard speed for the 16mm machines and up to 6 times for the 35mm machines.
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Available on single and multiple channel recorders 16mm or 35/17.5mm. This facility makes it possible to switch into the record/erase mode and back out at any time during the recording process without discernible clicks, noises or changes in recorded level. It is possible to insert corrections, delete errors, add extensions and post-sync dialogue. Selective record/erase is provided on multi-channel machines.

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- Flutter and Wow: Less than 0.1% rms.
- Sound Stability: 150 milliseconds.
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- Film Capacity: 35mm-600 metres (2000ft). 16mm-725 metres (2400ft).

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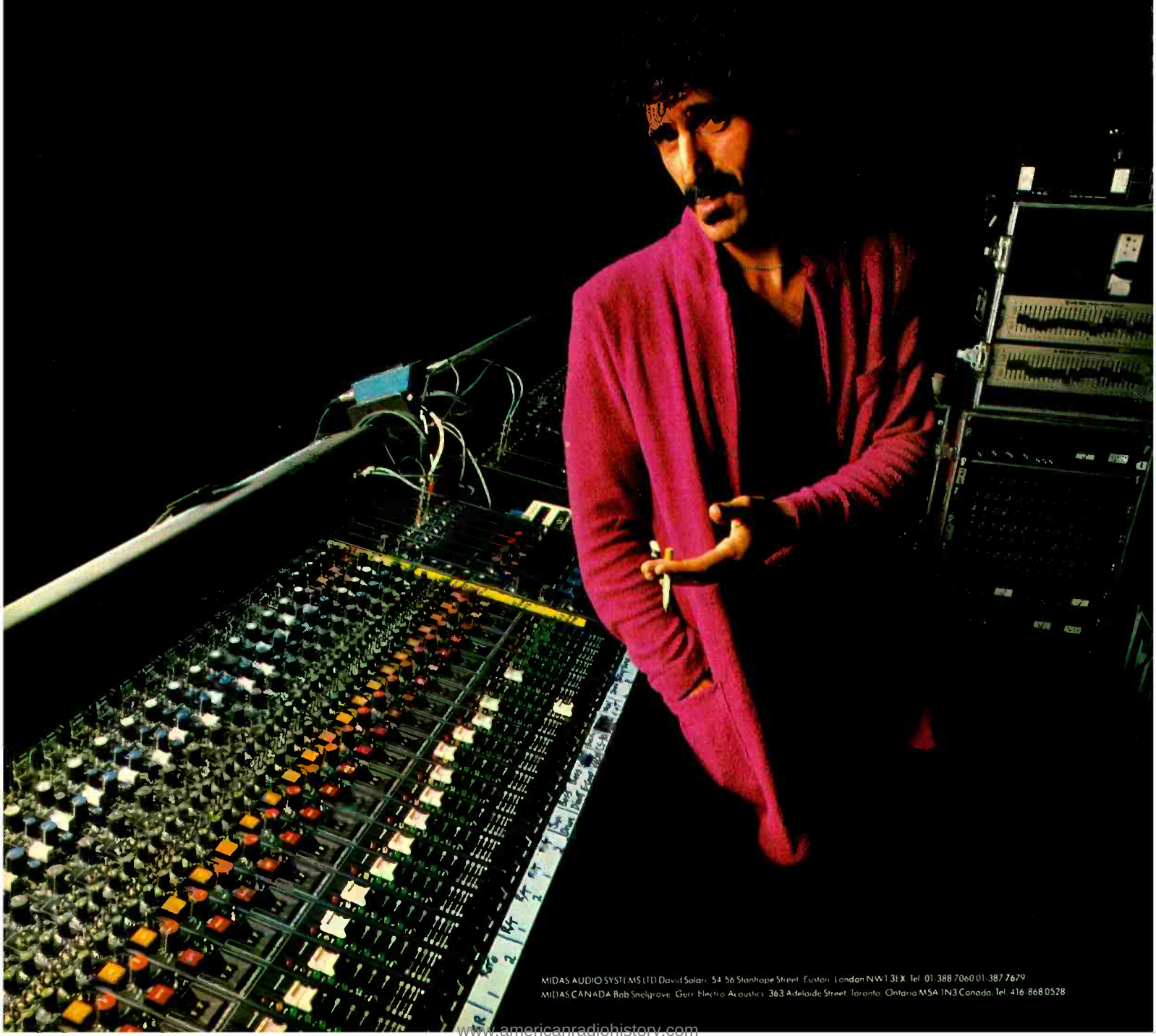

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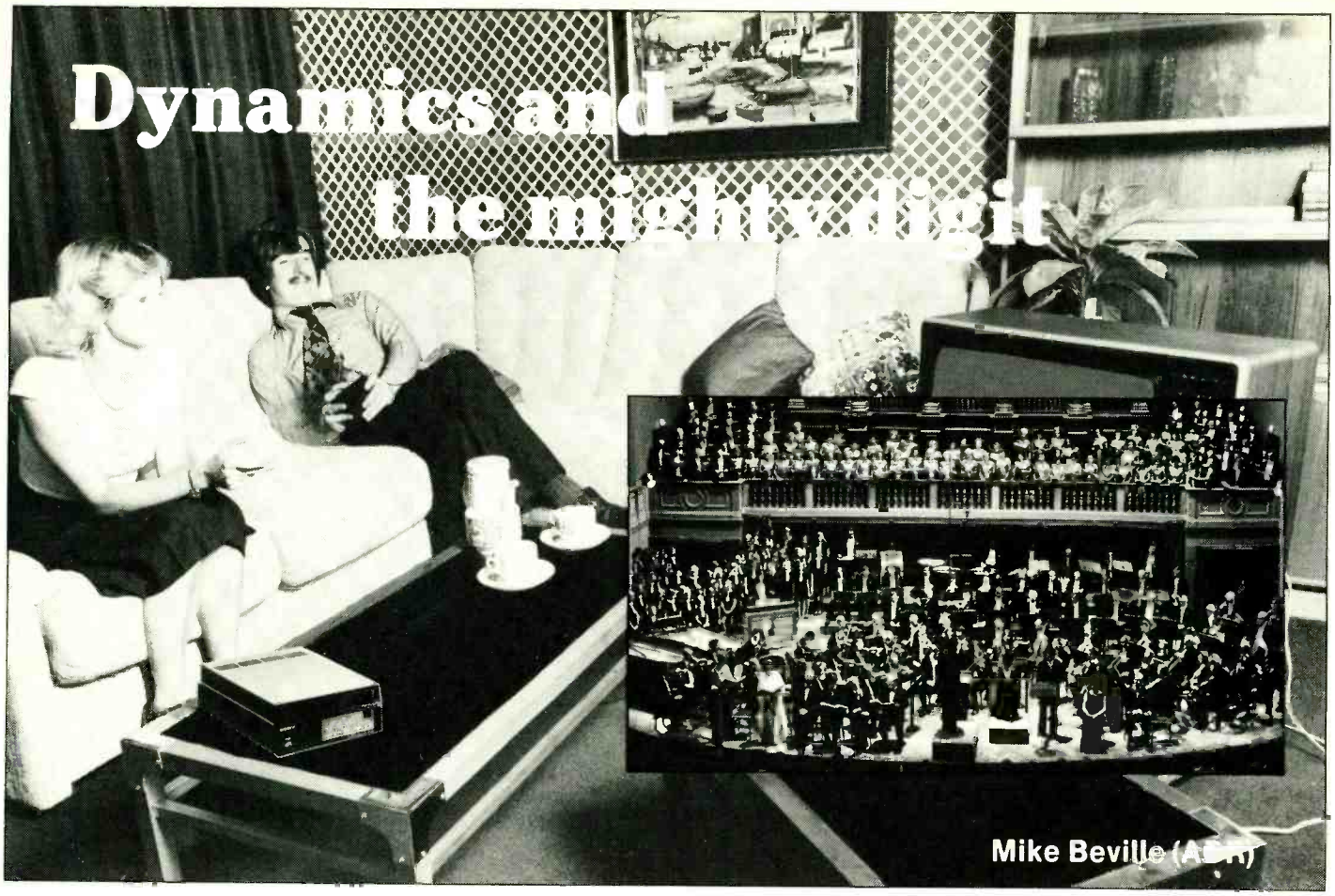
Dynamics and the mid/hi-fi



Mike Beville (ACR)

This two-part article explores dynamic range from concert hall to living room; considers the implications of microphone technique and monitoring level on balance and subsequent listening level; and reviews the dynamic capabilities of current media, the proposed CBS *CX* noise reduction system and the Sony/Philips digital *Compact Disc.* It discusses various forms of compression used in classical recording and why they will continue to be necessary.

THE audio system has had a relatively short history with particularly dramatic progress having been made in the last 25 years. Throughout this time, the component blocks that go to make up a system have vied with each other for technological advance. The sixties saw substantial improvements in pick-up and cartridge development; whilst on the professional side noise reduction was introduced along with better cutter heads. In the seventies, new materials revolutionised the loudspeaker industry and the compact cassette was refined into a respectable record/replay system. In the early eighties all is now set to revolutionise what might be described as the dinosaur of the audio system. Already 2-track digital master recording is well established on the classical front and is battling to be heard through—the vinyl record!

Dynamic range is an essential part of most musical form; much of the past technological effort has been devoted to ways of engineering sufficient range into recording and transmission systems. To date, limitations in this respect have been of a technical nature; the advent of digital recording, the digital record and noise reduction applied to the vinyl disc, open up exciting possibilities. There are also dangers that could alienate an important section of the record buying public.

Most of the measurements referred to are based upon figures taken using a B & K sound level meter (Model *2218*). The A-weighting characteristic was used throughout (A-weighting rolls off the lf response in an attempt to relate level to subjective perception). Maximum sound pressure levels were taken using the PEAK HOLD mode (peak level being the significant factor in an electronic system). Low level signal and ambience (residual background noise) was measured in the FAST AVERAGE mode (this relates to the interference level through which other signals would no longer be audible). *Dynamic ranges quoted are therefore the difference between an average measurement at low level and a peak value at high level.* To relate these to a peak-to-peak reading, some 7dB should be added to the low level average (ie reducing range by 7dB). It was found that using the average mode to measure high level signal reduced the peak readings by 12dB on orchestral music and 10dB on 'MOR' pop material.

Dynamic range

There are a number of definitions for dynamic range that should be considered. Musically it is the relationship between the loudest and quietest sounds of which an instrument, or group of instruments, is capable. In the auditorium, dynamic range (as heard by the audience), will lie between the loudest crescendo and the decaying signal until lost in the ambience of the hall. For the control room and when listening at home, it will be the difference between the established peak monitoring level and the ambience of the room. In an electronic system, the noise level will set the lower limit, whilst a point just below that at which distortion becomes unacceptable, will determine the upper maximum level.

Electronic system noise is more objectionable than natural ambience; it is difficult to discriminate against, due to its directional nature and wideband content. To some extent random noise (in the listening environment—but less so on the recording) can be rejected by concentrating attention through it. Natural ambience adds to the reality of the sound by conveying the acoustic properties of the concert hall, along with audience presence, if any. This important part of the recording is progressively lost to many listeners as dynamic range in the recording is increased.

Typical peak levels of an orchestra in the studio or auditorium (as heard from a seat in the front stalls) are likely to be of the order of 110 to 115dBA, dependent on the forces involved. Ambient levels are likely to be as low as 30 to 35dBA during a musical pause, rising to 45 to 55dBA (average) between movements (especially with an audience). Thus it would seem that the concert hall offers a dynamic range of some 80dB.

Recording media

The vinyl pressing has served the industry for several decades; to

many it has never ceased to be a wonder that such complex waveforms could be contained within the walls of a groove cut with a sapphire chisel! Until the mid sixties (when Dolby A substantially cut tape noise) the noise of a good pressing was likely to be better than the master tape. Balance engineers and conductors had until that time been constrained by the capabilities of the master tape. With continual improvements being made in analogue tape, a dynamic range of 80dB on first generation is possible. The advent of digital recording has substantially improved on this, to a figure of around 95dB. The added bonus is that distortions associated with analogue recording have largely been cleaned up in the process, whilst duplicate copies can be made without further degradation.

Undoubtedly one of the greatest disappointments for the record-buying public has been the somewhat variable and often indifferent quality of the vinyl pressing. In addition, it can easily be damaged and is very susceptible to airborne pollutants. CBS is just about to promote and market its own noise reduction system called *CX*, which it is claimed will improve disc noise by 20dB. It is stated that the system is compatible, giving acceptable results when replayed without the decoder. Those who have heard the system seem enthusiastic about its performance and expect it to give a new lease of life to the record as we know it. *(Except that it isn't really "compatible"—Ed.)*

The digital audio disc promises to be a really dramatic step forward. In a manner never previously possible, the listener will have direct access to the original master recording. Some idea of that quality is currently to be heard on BBC direct broadcast concerts, now routed to many areas via pcm and uhf links. Those who heard the recent historic broadcast from Shanghai and the subsequent digitised transmissions (via satellite) of the BBC Symphony Orchestra's Far East tour, will have been impressed by the technological achievement as well as the quality of the sound. The modern transmitter is likely to have a dynamic range of some 75dB and, given a good tuner in an adequate reception area, a dynamic range of at least 70dB should be possible.

The compact cassette has gained remarkable popularity and a respectable performance that few would have anticipated when it was initially introduced. The fact that there are no clicks or pops is a great attraction; on record these common occurrences detract from the programme out of all proportion to their duration in time. With noise reduction and the latest in tape technology, the cassette can be expected to produce a noise performance quite equal to the best pressing. It is not without its problems, but in the main these relate to production and are not so obvious to the listener.

The dynamic range of a pressing is of the order of 65dBA, though this is rarely maintained throughout the processing and pressing cycle. The CBS *CX* system promises to improve this significantly; it is likely to eliminate the basic disc noise and rumble including patchy areas that are not quite up to standard; ticks may be reduced and so may scratches to a lesser extent. It is too early to establish how good the companding system is, or what side-effects might result from that. It will not get rid of other distortions associated with disc —but it is likely to be a useful improvement for those who cannot be persuaded to go digital.

For most listeners the benefit of the digital disc will be the complete absence of surface noise and those spurious clicks and pops. With the Sony/Philips *Compact Disc*, there will also be a far greater tolerance to poor handling and much better durability. There will be no rumble, no wow from eccentric centre holes and no tracing or tracking distortions. With digital mastering there will be a reduction in analogue tape distortion; however there will be many high quality (especially first generation) analogue masters which would profit from being released on digital disc.

It may not be widely appreciated that the dynamic range on most classical records has been of the order of 55 to 60dBA for many years. Not only is 60dB pushing it in respect of the record but it is getting towards the high side for the average listener. The danger is that dynamic range is already being further extended now that digital masters are being recorded and a medium is on hand that will be capable of bringing the full dynamics of the orchestra into the living room! Information on some discs cut from digital masters is being lost in the pressing noise (–65dBA down). Even when on digital disc or a *CX* processed pressing, it will be found that to make the recording really sound convincing and come alive, a very high reproduction level will be necessary!

Listening levels

Ambient noise in the home is typically 30 to 45dBA. On a Sunday morning before the rest of the household starts to move, it could be as low as 25dBA (even towards 20, if one keeps really still), but this is exceptional. The domestic environment is likely to be anything up to 25dB worse than the studio control room! Not only would many domestic systems be unable to maintain professional levels cleanly, but there is another phenomenon which might be termed 'preferred listening level'. It is now many years since the BBC did its research into listening levels, but to the best of my recollection peak SPL levels for classical music were found to be 80dB for women, 85dB for men,with hi-fi enthusiasts and those professionally connected with audio, listening at peak levels of 90-95dB. In my own more limited, but more recent, experiments I found that women would tolerate 90dBA, but that 95dBA was pushing it. Having a large room is helpful since people can sit at varying SPL positions, according to degree of interest. These figures would seem to indicate a dynamic range at the low end of 35dB, ranging to a maximum of 65dB under optimum conditions.

It is interesting to note that the range of sound levels with which we are familiar and comfortable tend to lie in the 70 to 90dBA span. Speech is of the order of 80 to 85dBA; traffic and interior car noise some 70 to 90dBA, whilst television listening levels seem to check out at 80 to 85dBA.

Because of numerous distractions and competing activities, it is rarely possible to listen to music with the same degree of involvement as in the concert hall. It is often necessary to concentrate harder to hear the low level programme detail. As dynamic range increases this becomes more difficult; couple this kind of effort with signal dropping into noise on record and it is quite easy to find oneself listening less and less to wide dynamic programme—which in turn could mean buying fewer records! Of course it is possible to listen on headphones, though I've never found this way of listening to be entirely satisfactory. For one thing the orchestra insists on crowding into one's skull and then following your every movement! Then there is that umbilical cord; it may be something to do with the trauma of birth, but I don't like being tied to a machine. Wearing headphones tends to cut one off from others, with consequent loss of shared experience and companionship. No, putting on headphones has almost the connotations of a social disease; it's like being sent to the woodshed for a smoke!

There is a real problem in many households where wide dynamic range recording will tend to push up listening levels and cause disharmony. Although dynamic range is certainly a factor in this equation, perhaps more significant is the level at which programme was originally balanced! When setting listening levels, judgement seems to relate to low and mid-amplitude signal in order to establish the correct size and perspective of the instruments. I have found that, particularly on some digitally-mastered discs, when this level seems right, peak level is frequently between 100 and 105dBA!

Monitoring and balance

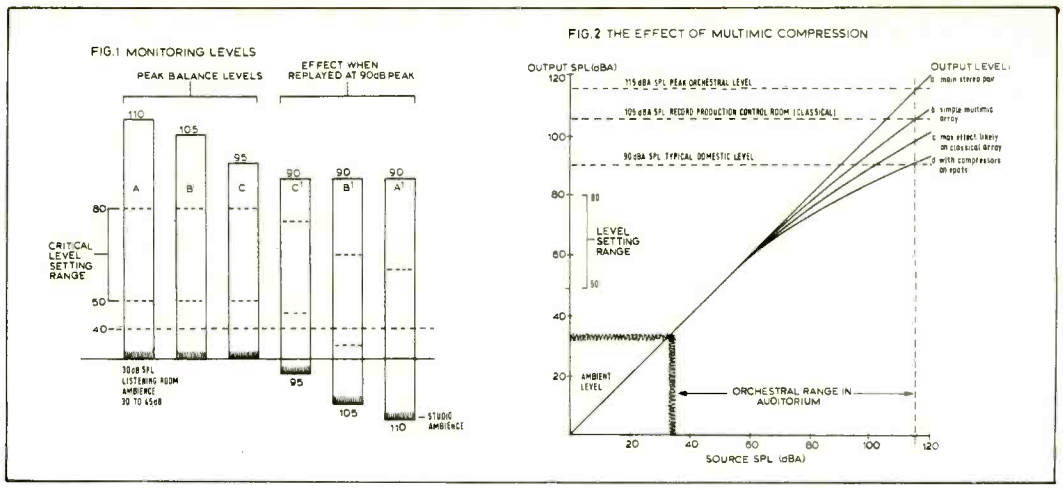
Monitoring conditions are clearly a vital aspect of getting the right balance; in a record production session, conductor and balance engineer will invariably work closely together and must have complete confidence in the accuracy of what they are hearing. The monitoring environment sets the framework within which the balance is achieved and the seal of approval given.

In a well-designed control room, the monitor system will deliver a sensibly flat response over the critical monitoring area. It is often capable of reproducing levels in excess of those heard in the studio. The basic ambient noise of the control room is likely to be better than 20dBA, with any noise generated coming from tape machines or the presence of people. It is a unique listening environment and in this respect can be misleading in terms of what the customer will hear. It would be quite possible to reproduce the full dynamics of the concert hall or studio at a listening level 10dB lower and still hear the ambience of the studio!

Particularly when balancing wide-dynamic programme, high monitoring levels are likely to lead to less than optimum results when replayed 10 to 15dB lower. Whilst higher levels no doubt make for easier concentration and detection of technical problems, it will inevitably lead to wider dynamics than if balanced at a lower level. It is probably normal practice periodically to check an established balance at lower level; better results might be obtained (in the opinion of the listener) if this procedure was reversed, with periodic checking at higher level for hidden troubles. **Fig 1** illustrates three monitoring levels (A, B and C) representing peak SPLs of 110, 105 and 95dB. When establishing a balance, there are critical levels that will always be 'correctly' set almost irrespective of monitoring level. These levels probably relate to an SPL range of 50 to 80dB and give information concerning size and distance of an instrument and cannot deviate too far without sounding unconvincing (too low), or larger than life (too high). The chosen peak monitoring level sets the limit of a dynamic framework within which the engineer has to accommodate the upper range of dynamics (ie over an SPL of 80dB). If a level of 105dB is used, then the upper 30 or 35dB will go into 25dB (105–80); if a monitoring level of 95dB is established then it will be 30 into 15dB (95–80): not as awesome as it might seem on the face of it, as will be apparent when looking at mic balance. The significant factor is that a lower monitoring level puts pressure on the engineer to make it work at sensible listening levels, which is surely his major

82 ▶

Mighty digit



purpose.

The critical 50 to 80dB SPL also forms a key to the optimum replay level and subsequent re-creation of what the balance engineer heard, and so presumably what he intended others to hear. When reproduced at 90dB, C^1 is not going to be quite optimum, but is likely to pass unnoticed, with minimal information lost in the low signal area and 5dB difference on the 'level setting area' which could be down to a variation of distance. However on B^1 the difference is more serious and clearly audible as being unconvincing, plus the fact that there is a considerable loss of important low level information. This is in fact a specific example of a digitally mastered record. In order to obtain what I felt was a convincing 50 to 80 region, the peak level measured was 105dB! (Subsequent measurement of monitoring levels in the same studio seems to confirm this phenomenon; the level was 106dBA with the orchestra producing 112dBA in the studio.) At this level the pressing noise was reproduced at a 40dB SPL and there was clearly another 10dB of information which was being masked by that noise. On a digital record this would be available and audible in my listening room where the ambient noise is around 30dBA. Unfortunately that listening level is quite unacceptable and when reproduced at more modest levels the record just does not work as well as it could, had it been monitored differently. When using the processing system that will be described later, the disc could be replayed convincingly at peak levels of 95dBA with a realistic 50 to 80 region. **Fig 1**, A^1 hopefully does not happen-but it could!

Listening to BBC concert broadcasts recently, my impression is that when involving moderate sized orchestras, the 50 to 80 region is reproduced reasonably convincingly at SPL of 95 to 98dBA. Indeed, on the Prom broadcast series, if level is set on the announcer's voice (about conversational level) music is likely to peak at 98dBA. However, broadcasts of exceptionally large orchestral/choral forces seem to require reproduction levels of about 103dBA for a convincing 50 to 80 level. This suggests the need for a further dynamic reduction of about 5 to 8dB to optimise listening levels of 95 to 98dBA for this type of programme.

I attended the performance of Mahler's Third Symphony which was also broadcast from the Royal Albert Hall. Armed with a sound level meter and positioned in a second tier box to the right of the orchestra, some 80 to 90ft from the rostrum and 25ft above it, peak levels were typically 104dBA with two exceptional orchestral crescendos of 110dBA. Bearing in mind that 3dB as a power ratio will be equivalent to doubling/halving the distance, the signal at the stereo pairs would probably have been around 118dBA. For those not familiar with the forces involved, an already large orchestra was augmented by eight percussion players and two choirs! The solo soprano peaked at 95dBA, whilst a soft tap of the bass drum read as low as 35 to 40dBA. Perhaps the most surprising reading (although not typical throughout the performance) was 28dBA in a musical pause, in spite of such a large audience!

One of the major differences between the operation of record production and broadcasting is in connection with the influence of the conductor. In broadcasting the relationship between balance engineer and the conductor is likely to be negligible, the engineer doing the job of conveying the performance according to his best judgement. In the recording studio the relationship may well be very different, with some conductors taking a very close interest in the balance obtained. The pressure for increased dynamics at this time seems to be originating from the conductor. The balance engineer has always had the responsibility for transposing the sound created in the studio to the sound as heard in the home; with technical restraints lifted his job could be made more difficult as he tries to control the natural enthusiasm of the conductor who, unrestrained, may foist the full dynamics of the concert hall on to the record buyer.

Microphone balance

What has happened to the 80dB dynamic range that apparently exists in the auditorium and what are the original dynamics anyway? Are they as heard by the conductor or from some position in the audience—perhaps as heard at the position of an optimally-placed stereo pair? What is heard will depend upon position; the closer the more dramatic the range compared with a point farther away in which the acoustics of the hall increasingly modify the sound. Recording from a stereo pair will give a faithful representation of the dynamic range from that position; as soon as additional mics are added, it's another ball game!

There has always been a school of thought that has maintained what might be described as a purist approach; arguing that additional mics will introduce random phase differences that degrade the stereo image, alter the perspective and produce larger than life effects. In general few would disagree. The problem is that the single stereo pair will only work on smaller orchestral groups. How much of the 'workability' is limited due to coverage is debatable. My own view would emphasise the dynamic aspect and draw attention to **Fig 1**, A which might be typical of the output of a single stereo pair. If it were reproduced at essentially the same level as heard at the microphone, it might well be considered workable. In fact with the smaller group this is exactly what happens and the realism of the 50 to 80 region is achieved at moderate peak reproduction levels.

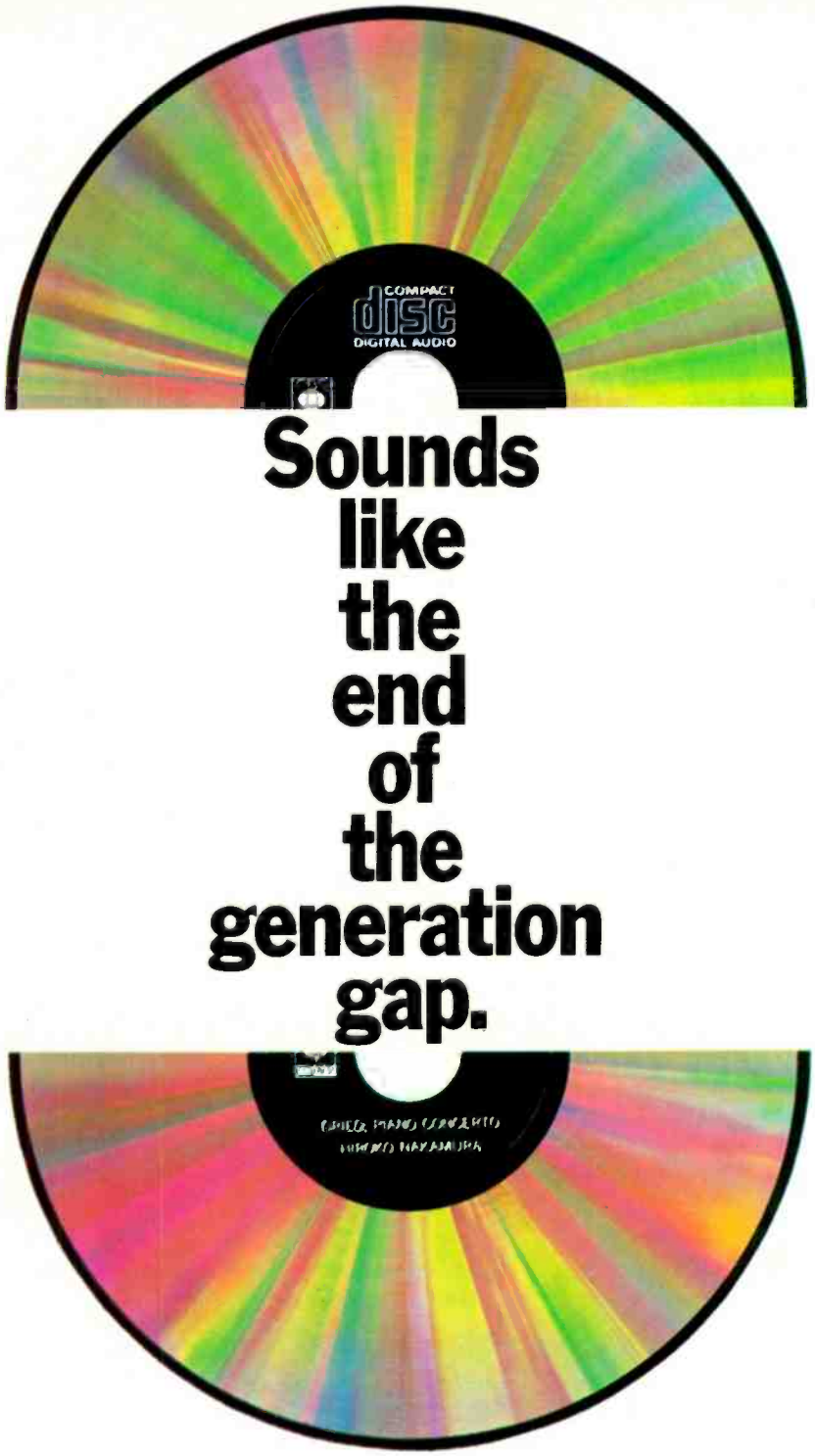
Reinforcement by spots and ancillary stereo pairs gives greater control over instrumental balance and more significantly will improve low level definition by compressing high level signal. When two identical voltages are added, the peak value is doubled (increased by 6dB). When mixing audio signals from different mics, the peak signals are rarely identical so that the effect is to increase average level without apparently adding significantly to the peak level. Obviously there comes a point where (hopefully) being in-phase they will do so; but before this point is reached there can be a considerable compression effect.

Some years ago, whilst exploring this phenomena, I used a 4-track recording of *Carmina Burana*, made by students of Surrey University. Two tracks contained the output from a main stereo pair, covering the orchestra with the choir to the back. Taking the output of the main pair, peak level was established and a section recorded on to 2-track. A subsequent run over the same section was made, this time adding in the spots to the stereo pair. At the point where there was an increase in level, the two spots were marginally backed off, to retain the peak level previously recorded. The two takes were compared and the increase in low level gain was found to be 12dB —a significant dynamic reduction. Of course there was no account taken for artistic balance, and one would not necessarily seek to get the maximum level out of each mic in that way. It is indicative, however, of what happens as soon as a multimic array is used.

Fig 2 attempts to represent the effect of multimic compression; it is at best an *idea* of what is happening and the curves are essentially speculative. The line 2a would represent the output from a main stereo pair and will exactly convey the dynamics from its position, 2b is the effect to be expected from a fairly simple array, whilst 2c is probably the maximum compression likely on a classical balance. This could be in the region of 15 to 18dB. 2d illustrates how the effect can be extended by subtle compression of spot mics (referred to in part two).

Multimic compression will effectively enhance the low level detail and increase the low level ambience contributed by the auditorium. Because peak levels are compressed, the 50 to 80 signal is heard close to its proper perspective when replayed at domestic levels. The term 'digital dryness' has already been coined and a certain lack of warmth noted in some digital recordings. In seeking to extend the dynamic range, the low level information and acoustic coloration is being pushed farther down when replayed at normal listening levels. The compression technique to be described (also in part two) can recover that information whilst at the same time giving convincing reproduction at modest listening levels. ■

To be continued



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Théâtre Musical de Paris

By a happy coincidence, an invitation to visit the recently refurbished Théâtre Musical de Paris arrived in our editorial offices, just as we were commissioning our in depth article into the stereo telephone relay exploits of one Clément Ader. Quick to seize on the opportunity to take a look at Paris theatreland and to see how far the art of sound engineering had progressed in gay Paris in the intervening century since Ader's exploits, I brushed up my schoolboy French and set out on a fact finding mission.

Situated in the heart of Paris, the Théâtre Musical de Paris, or Le Châtelet as it is known colloquially, occupies a complete rectangular block adjacent to the river Seine. An imposing yet ornate building, the theatre was designed by Gabriel Davioud in the Italian Renaissance style with construction being completed in 1862. Originally known as the Théâtre du Châtelet, the theatre has hosted a variety of musical events with highlights from its history including Edouard Colonne's orchestral concert series, Diaghilev's famous opera and ballet performances with Chaliapin, Pavlova, Nijinsky and Fokine, and Toscanini's Italian opera performances with Caruso and the Metropolitan Opera of New York. These particular milestones in the theatre's history all date from before the First World War and although traditional concert, opera and ballet performances continued after the war, the last 50 years have been notable for a diversification into operetta, Broadway shows and plays. This latter aspect originated in 1930 and continued up to 1966 under the control of the then theatre director, Maurice Lehmann. The diverse nature of the theatre's presentations is still reflected today with a wide variety of material including opera, operetta, ballet, orchestral and chamber concerts, and a variegated selection of recitals being mounted.

A watershed for the theatre, which had basically remained unchanged since its early days, occurred in 1979 when the City of Paris which owns the theatre decided to completely renovate the building at a projected cost of 35 million francs. This renovation—which included the provision of a new sound control and reinforcement system—entailed refurbishment of the decor, installation of a new air conditioning system, installation of a CCTV system with 10 colour monitors, refurbishment of the back stage areas of the theatre, and alterations to the stage and orchestral pit. The latter alterations now allow the theatre to cater easily for the differing demands on space created by the needs of symphony and opera/ballet orchestras, simply by moving detachable parts of the front staging.

The building occupied by the theatre, as mentioned above, is Italianate in style and takes up a complete rectangular block. This block is virtually split down the middle with the entrance salon, stairwells and seating (plus a cinema situated below the theatre) being accommodated in one half of the building, while the other half is taken up by the stage and back stage areas which include two rehearsal rooms, storage areas and one of the largest goods lifts I've ever seen, capable of lifting an articulated lorry from the fourth basement floor to stage level. The stage itself is some 78ft wide and 115ft deep and with this ample size can encompass a healthy array of scenic effects including, of course, the statutory stage trap doors. Some idea of what can be accomplished is gained from the knowledge that the Châtelet stage has hosted volcanic eruptions, naval battles and a train crash in its time. In the latter case apparently a complete period train including railway track was accommodated!

The auditorium of the theatre, which has a seating capacity of 2,500 (100 less than when originally built), comprises a stalls area set slightly lower than the stage, a capacious circle slightly above stage level, and three balcony tiers curving round the three sides opposite the stage. Centrally positioned in the second balcony tier are the sound and lighting control rooms, with the sound control room to the left when viewed from the stage. Either side and facing the stage at an angle are decorative gilt fretted panels, behind which are mounted the sound reinforcement loudspeakers. Other loudspeakers for on-stage monitor purposes are provided to the sides of the stage.

Sound system

Although work on the renovation of the theatre commenced in 1979, the design and installation of a new sound control and reinforcement

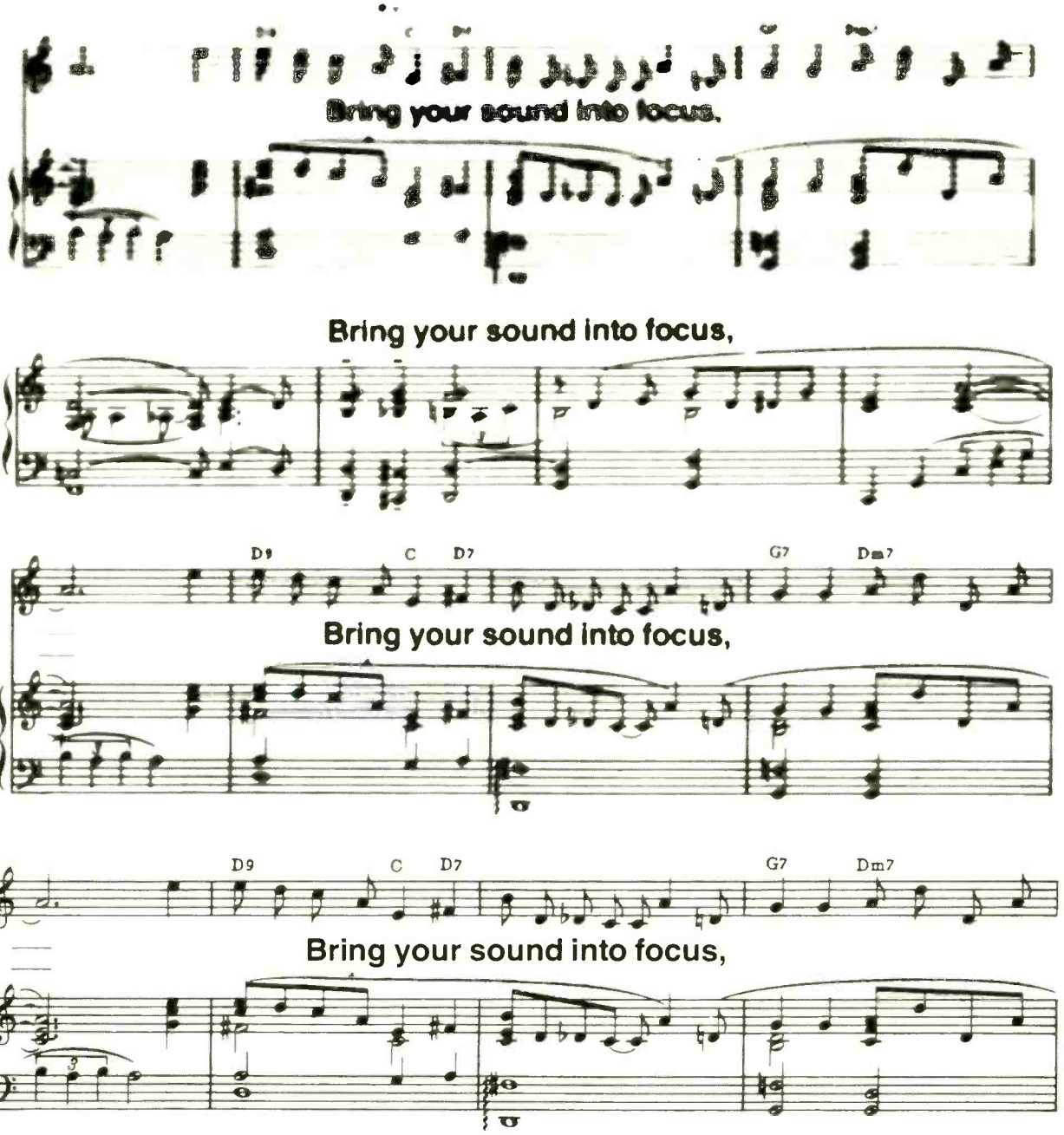
86 ▶

Stage and orchestra pit

Photo: Mesnildrey

Refurbished auditorium

Photo: Mesnildrey



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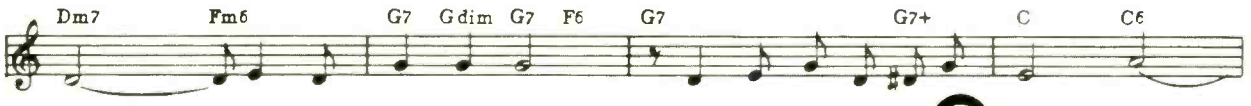

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Théâtre Musical de Paris cont'd

system did not begin until 1980. Design of the system is by Yoël Schwarcz of the French company Régiscène who also supervised the installation. Régiscène are a comparatively new company in this field, only having been formed in 1977, but in the short time they have been in existence they have built up an excellent reputation in the PA business. From relatively small beginnings the company has constantly expanded, and the company, in addition to its sound control and reinforcement theatre installation service, also offers a consultancy service, a lighting and PA hire service, a PA custom building service, manufactures a variety of PA and lighting units, and acts as French agents for Brooke Siren Systems, Midas, Martin Audio, Mantec, Topaz, Fortress flight cases and various other ancillary ranges. Such is the name the company has built up that it currently provides equipment for some 150 concerts a month, often providing complete PA systems including lighting, consoles, ancillary equipment and engineers for tours ranging as far as Germany, Belgium, Holland, Switzerland, Eastern Europe and Africa. Recently PA systems have been supplied for the Papal tour of France, the *L'Humanité* festival, the Midem festival, the Antibes jazz festival, the London symphony Orchestra, the Leipzig Gewandhaus Orchestra, and for concerts by James Brown, Elvis Costello, The Clash, John McLaughlin, and Gilbert Becaud.

The design and installation of the new sound reinforcement system was conditioned by two particular requirements. Firstly all mic, amp and loudspeaker lines had to be routed 'behind the scenes' to avoid marring the renovated decor. Secondly, as installation was to take place whilst the theatre was in use with both rehearsals and performances taking place during the course of a working day (and with the basement cinema constantly in use) installation had to be carried out without disrupting the theatre's and cinema's normal schedule. The first requirement entailed amp and loudspeaker lines running up to 500ft in length, while the mic lines had to be fed up over the top of the auditorium with the longest mic lines being some 380yds long. Installation of these lines entailed drilling through foot-thick concrete floors to gain access upward and downward at each floor level from the control room to the various mic, amp and loudspeaker positions, all this work having to take place in the intervening gap between rehearsals and performances. Despite the difficult requirements installation of the system was carried out in two months with completion in February 1981.

In the company of designer Yoël Schwarcz and Le Châtelet's chief sound engineer Pierre-Yves Ganne, I was given a guided tour of the completed installation beginning with the control room. This is approximately 15 x 10ft, with a sloping glass window at the front giving a downward view to the stage, and houses a Midas *TR System* console. This console is a 24-input desk (commutable to 48 inputs) with eight main groups and eight subgroups. This main console is linked to a Midas sub-console situated to the right of the main console which takes a stereo feed from the main console and then feeds the four layers of left and right sound reinforcement loudspeakers situated behind the decorative panels facing the stage. In addition to the above the main console also has 24 direct outputs available for feeding the ORTF (French Radio) control room or for feeding mobiles. Due to the limited amount of space available in the control room all ancillary equipment is housed in 19in racking to the rear. Units available include two Studer *B67 MkII* and three Revox *B77* tape recorders, a Revox *B790* linear tracking turntable, and a Teac *C3* cassette deck. Other ancillary units are supplied as required by Régiscène. Monitoring is via a pair of *Auratones* driven by a BGW *250*.

Midas TR System console, sub-console to the right

From the control room all mic, amp and loudspeaker lines are balanced due to the length of runs required. The amp and loudspeaker lines run to positions left and right of the stage with the amps housed in 19in racks and feeding four levels of loudspeakers on each side of the stage, the four levels being situated at the three balcony levels plus the circle level. Each side of the stage has 14 BGW power amps utilising BGW *750*'s for lf and BGW *250*'s for the top end. Frequency dividing being accomplished via the Brooke Siren Systems *FDS 320* 2-channel, 2-way frequency dividing system. Each level of sound reinforcement loudspeakers comprises five Régiscène *Dimension 2* 2-way units (40 of these being required in total), these being installed on anti-vibration mounts. In addition to these four Martin Audio *FR3* units are also provided, while for stage monitoring purposes four Martin Audio *H350* units are available as stage side fill monitors.

Pierre-Yves Ganne at the Midas console

Mics

Moving on to the mic lines, which you will recall had to be routed over the top of the auditorium, these have to rise the equivalent of four floor levels and drop seven floor levels simply to reach stage level, this explaining why the farthest mic positions required lines no less than 380yds in length. As befits a theatre hosting a wide variety of musical events a large number of mic positions have been catered for, a total of 67 being the maximum available. This large number also entailed the provision of a healthy number of stage boxes and Régiscène has installed custom-built units at various points adjacent to the stage. Microphones used at Le Châtelet incidentally are the usual variegated selection with a preponderance of types from AKG, Beyer, Electro-Voice and Neumann.

Although many of the theatre's productions are rehearsed on stage particularly in the final stages of preparation, Le Châtelet also has two rehearsal rooms which required fitting out with basic sound facilities. However, because these facilities are not always needed the equipment provided is housed in custom built flight cases mounted on castors, such that it can be wheeled out for use at short notice. The equipment available comprises Revox *B77* tape recorders, Régiscène *Dimension 2* loudspeakers and BGW power amps, these replicating the main installation.

From our conversations chief sound engineer Pierre-Yves Ganne and his assistant Rui Leitao seemed more than pleased with the new installation. Particular aspects which they appreciated being the flexibility of the Midas desk, and the expertise and helpfulness of the Régiscène installation team, who had had to work under difficult strictures at times but who had suceeded in installing the system with the minimum disruption and without causing the delay or cancellation of a single performance. Pierre-Yves who has been at Le Châtelet since 1976, having been a freelance engineer with touring bands, then a resident engineer at the Casino de Paris, was particularly pleased that the new sound facilities are a fitting foil to the renovation of this beautiful building and he is looking forward to a stimulating future at this freshly rejuvenated venue. **Noel Bell**

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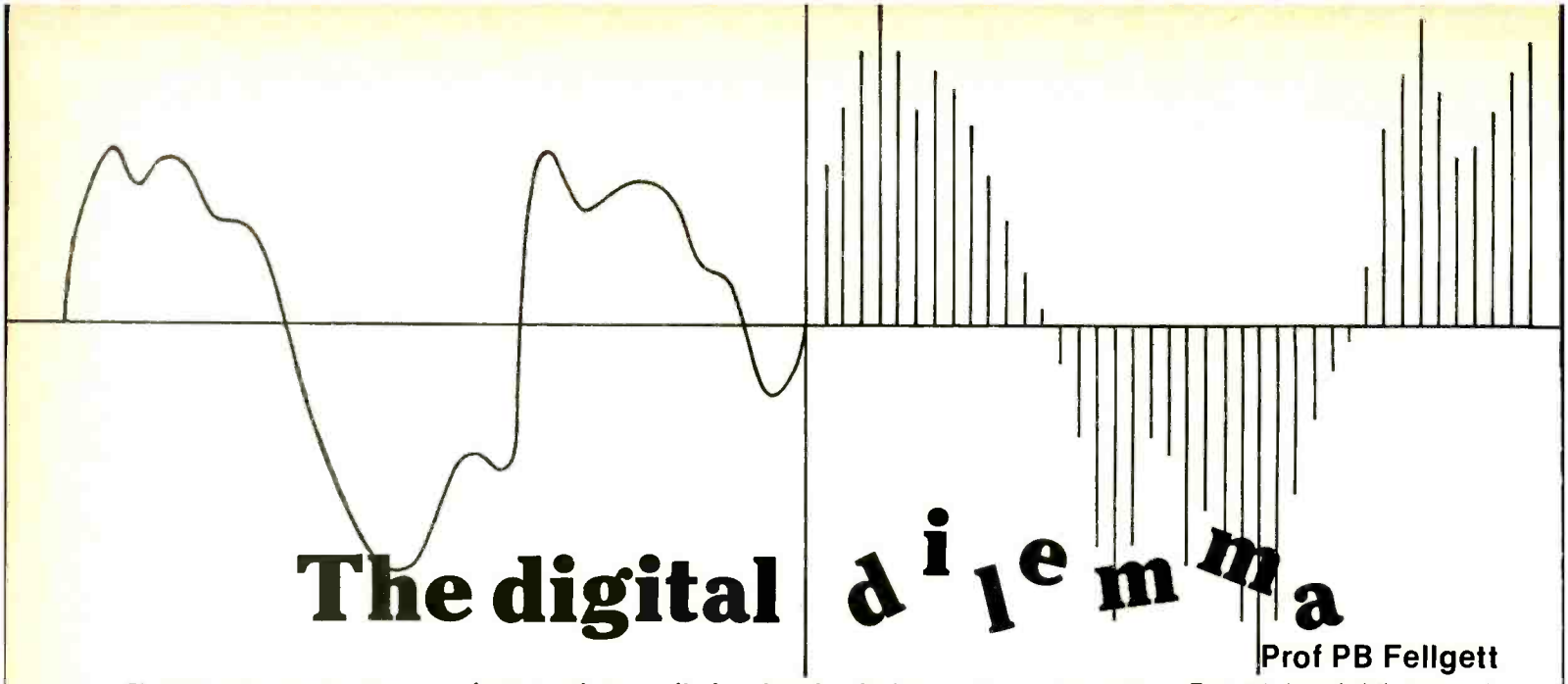


The digital dilemma

Prof PB Fellgett

Inasmuch as audio is a fashion industry, it may be said that skirts are being worn digital this season. Many members of the industry consequently face a dilemma: to digitise, or not to digitise, that is the question. Moreover it is a question where the wrong answer may lead to expensive outlay or disastrous business losses.

SOME quite amazing things are being said about digital recording of sound, such as that it overcomes all the limitations of analogue methods! The BBC has broadcast digital recordings, drop-outs and all, with announcements which almost seem to imply that they are superior to a live concert. One rightly-respected and usually reliable audio journalist has described digital recordings as 'free from noise' without any qualification. Perhaps strangest of all, consumer equipment using digital formats has been used to demonstrate and extol the virtues of digital methods using programme material dubbed from analogue masters. Clearly a more sober appraisal is needed of the real merits and drawbacks of digital recording.

There can be little doubt that in the long run the future of audio lies with digital methods. This prediction is not necessarily based on the inherent virtues of digital techniques so much as on the fact that the digital-computer industry has made it progressively easier and cheaper to implement digital methods of processing, recording and distribution. Digital methods do indeed have important advantages, but the road to the full realisation of these may be longer and thornier than is at present commonly thought.

Backlash

The trouble is that 'digital' is being sold to the public not for what it is but for the name, like hot pants or shocking pink. If the actual merit matches the name, no harm is done, but otherwise the industry is setting a snare for its own foot. You cannot fool all the people for very long, and sooner or later there will be a backlash against any fashion which claims more than it can deliver. A lesson ought to have been learnt from the fate of 'transistor sound' following the premature introduction of solid-state power amplifiers, before there was sufficient knowledge of how to design them properly. Indeed there are already signs of a backlash against the supposed 'unmusicality' of digital sound.

The pit is dug still deeper by naive interpretations of a few selected properties in which digital seems to be superior to analogue. For example, a modern digital system might be quoted as having a dynamic range of 90dB and less than 0.1% total harmonic distortion (THD), and at first sight this seems a great improvement on anything analogue has to offer. In fact, of course, digital recording does not overcome the limitations of analogue, but by-passes them by taking a different route, so that one set of problems is replaced by a different set. Some things get better, others worse, and it is very necessary to assess critically the overall balance of advantages in the two methods.

Signal-to-Noise

In comparing recording methods having characteristics as different as analogue and digital, great care is needed to avoid comparisons that are misleading or even completely spurious. As an illustration, consider a 12-bit digital system. The largest signal that can be accommodated is $2^{12} - 1 = 72.2$ dB greater than the step corresponding to the least significant digit (lsd). The output of a perfectly-adjusted digitiser would be correct to the nearest lsd. The maximum error would therefore be ½ lsd and (if random) the average error ¼ lsd, which is 20 log 4 = 12dB below the lsd (dB lsd). Allowing for the usual rms weighting reduces this to 10 log $12 \simeq -10.8$dB lsd. The ratio of largest signal to rms noise is therefore $72.2 + 10.8 = 83$dB, which sounds much better than 8 tracks/in analogue tape (eg 2-track ¼in or 4-track ½in) for which the unweighted S/N ratio may be 70dB at 15in/s or 72dB at 30in/s.

In fact of course the comparison is false, as well as being based on an incorrect calculation which in addition uses questionable assumptions.

In the first place, the quoted S/N ratio of analogue recording compares the rms noise with the rms value of the largest *sinusoidal* signal that can be accommodated, whereas for the digital system the largest *total* signal excursion was taken. This peak-to-peak excursion is 9dB greater than the rms value of the sinusoid with which it is compared.

Secondly, the assumption of random error is incorrect at low levels of signal. The idle-channel noise depends critically on just where the dc level happens to be in relation to a bit-transition, and may be as large as −6dB lsd. This maximum may be reduced, and the unpleasant variation of the noise evened out, by addition of a 'dither signal' which can be chosen so as to reduce the worst-case rms noise to about −8.3dB lsd[1], 2.5dB worse than the elementary calculation assumed. Added to the 9dB previously discussed, this shows that the original comparison was optimistic in favour of digital by 11.5dB. To compensate for this needs another two bits so that a 14-bit system is needed even to match the analogue S/N ratio.

Even this is optimistic because it assumes perfect adjustment. If the error is not to exceed ¼ lsd in a 14-bit digitiser, the digit-weighting components and switches need to be accurate to about 0.0015%. This is difficult to achieve and to maintain in use, and most digitisers are claimed only to be monotonic. This implies a worst-case error of nearly a whole lsd, so the noise estimate needs to be scaled up by about 6dB. The eventual D/A converter contributes errors of its own, which are likely to be of similar magnitude, particularly if it forms part of the consumer equipment. Assuming random addition, this may increase the noise by a further 3dB.

Moreover, in setting levels for a digital recording some allowance needs to be made for the sharp overload of a digital system, unlike analogue tape which self-limits on instantaneous peaks in a fairly graceful manner. The opinion has been expressed[1] that at least another 3dB of headroom needs to be allowed.

Adding the factors resulting from these practical (or, if you prefer, Murphy's Law) considerations gives $6 + 3 + 3 = 12$dB, requiring a further 2 bits. So it now appears that a 16-bit system, or at least a 14-bit system working to 16-bit accuracy, is needed just to match the S/N ratio of analogue tape.

Distortion

Naive comparisons of conventionally-quoted distortion figures may also be highly misleading. The nominal overload point of analogue tape is usually identified with the signal level giving $3\% \simeq -30$dB THD, and it is this nominal distortion value that is normally quoted. This distortion is predominantly of 3rd harmonic type which falls by 2dB, relative to fundamental, for each dB drop in signal level below the nominal

maximum. Distortion is therefore low over most of the working range, falling to 0.1% = −60dB for a signal only 15dB below maximum level. Moreover the recording bias, by smoothing out any crossover effects that might otherwise occur, ensures that the distortion continues to fall monotonically towards zero at the lowest signal levels. Even as the limit of audibility is approached, a pure tone continues to be heard as such, distinguishable from a squarewave.

The lowest distortion in digital recording occurs, on the contrary, at nearly maximum signal level. It increases as the signal falls, obviously becoming the equivalent of hard-limiting when the signal level approaches 1 lsd. Any resemblance to crossover distortion in class-B amps is not entirely coincidental. The 'transistor sound' episode should have alerted us to the dangers of measuring sinewave distortion at comparatively high signal levels while ignoring transient and low-level effects. Quite simply, a figure of say 0.1% THD for a digital system will refer to the *lowest* value attained in the working range, while for an analogue recorder 3% THD refers to the *highest* value occurring at the nominal overload limit; hardly an equitable comparison.

Moreover, as is well known, THD correlates poorly with subjective impressions of distortion, and considerable efforts have been made to find better objective indicators of distortion [2], [3]. Some kinds of distortion are comparatively harmless at levels as high as a few percent, whereas others are certainly harmful below levels of −60dB, and may be significant down as far as −120dB. At present, theoretical understanding of these differences is rudimentary, but from a practical point of view distortions are often characterised (by association) as of 'Class-A' or of 'Class-B' type. This expresses, in a rough way, the observation that the ear is comparatively tolerant towards smooth non-linearities, but intensely sensitive to any kind of jump or discontinuity. The distortions of analogue tape are of the smooth Class-A type, while digital recording imposes at every bit-transition just the kind of step-discontinuity to which the ear is so sensitive. It is likely, therefore, that a digital system will need to have a lower THD (even at the same signal level) than analogue if it is to sound as good.

Dynamic range

Both distortion and noise are implicit in the concept of dynamic range. It is often identified with the ratio of maximum signal to system noise, but of course this is not the dynamic range itself but a convenient conventional measure of it which is perfectly valid for the purpose of comparing one analogue system with another. When systems having characteristics as different as those of analogue and digital recording are compared, however, it is necessary to look carefully at the basic meaning. Dynamic range properly refers to the ratio of the largest to the smallest significant signal the system can accommodate. An analogue signal does not disappear when its level falls to that of the *wideband* noise, since the ear is able to act as a wave-analyser discriminating against noise components at frequencies different from those of the signal; this is why the erase depth of a recorder needs to be greater than the nominal wideband measure of S/N ratio, especially when recorded tones are to be erased. It has been observed[4] that simulated programme of bandwidth about 200Hz centered at 500Hz remained audible at levels as low as 16dB below wideband noise, giving a true dynamic range for this recorded material of about 72 + 16 = 88dB. This limit of audibility agrees almost exactly with what would be expected from the theory of Critical Bands. This theory predicts also that the audibility of a 1.4kHz tone would depend on whether its amplitude exceeded the noise in the surrounding 1/20-octave, which is about 25dB below the unweighted wideband noise level, or 21dB below the A-weighted noise, giving the possibility of up to 72 + 25 = 97dB true dynamic range for pure tone in analogue recording.

By contrast, a digital system no longer responds to a signal once it falls below the level of 1 lsd. At this level pure tones and squarewaves have become indistinguishable, and severe granular distortion is perceptible even in signals several times as large[5]. This is almost certainly the reason for digital recordings, if they use insufficient digits, suddenly going 'deaf' as reverberant sound decays, and for a peculiar distortion of initial transients also noticeable on such recordings. To match the pure-tone dynamic range of analogue tape requires at least 16 bits, giving 65,535 discrete levels so that the lsd is some 96.3dB below the maximum signal that can be accommodated, irrespective of noise in the digital system.

Even this number of steps is not really as good as covering the signal-range smoothly and continuously, as analogue recording does. The use of dither, as well as improving the noise properties, also helps to blurr-out the discrete steps, at least in a probabilistic sense. It may indeed be advantageous to add more dither than would be optimum for noise performance, thus trading some S/N ratio for improved signal characteristics at low levels[5]. Although this is certainly subjectively helpful in concealing granular distortion, it cannot actually remove the stepwise character inherent in digitisation. Essentially, the step non-linearity causes intermodulation between the signal and the dither, thus spreading the distortion products all over the audio band so that the ear does not so readily associate them with their origin in distorted signal; despite the improvement that results, it has to be admitted that intermodulating signal with noise is not usually a recipe for high-quality sound.

The foregoing discussion is over-simplified, for example in making no mention of the important topic of equalisation and pre-emphasis both in analogue and digital recording. It also omits many other important aspects, such as the facility of copying digital recordings without significant loss, and the consequent ease of editing, and of rehearsing edits without commitment; against which, of course, the necessary equipment is considerably more elaborate and costly than a block and razor blade. It is all too easy to become bogged down in details, argument about the details, counter argument, and argument about the counter argument. No attempt has therefore been made at a systematic and comprehensive comparison between analogue and digital recording methods. The aim has been no more than to try to correct an over-rosy view of the newcomer among recording media, and to stimulate some critical thought.

How does it sound?

In the end what matters is how it sounds. There is some measure of agreement that, in comparison with analogue, digital recording tends to display the following characteristics, listed in random order:

- a solid and smooth-sounding bass. This may be associated with the ability of digital recording to go down to dc if required, whereas analogue suffers from lf 'woodles' and cut-off due to 'secondary-gap' effects;
- a tendency to 'go deaf' at low levels, particularly noticeable in the way ambient sound dies away; but, in compensation, freedom from analogue 'squash', particularly of hf components, at high signal levels. These effects are very much what would be expected from the quite different distortion characteristics of the two media, as already discussed;
- a sense of clarity and resolution or discrimination. This may be associated with the relative freedom of digital from the modulation noise of analogue recording, as discussed in more detail below. One result may be to show up glaringly any clumsiness in mic technique;
- a feeling of 'glassiness' or 'skidding' associated with high frequencies. Probably several phenomena contribute to this, including the behaviour of the sampling filter and the sample-and-hold circuits, as discussed in more detail later, and the increasing distortion at low signal levels. The effect is sometimes particularly noticeable in string tone.

Even this short list is enough to illustrate that the advantages are not all one way. On balance, my present judgement is that digital recording can perhaps give an overall advantage over typical 15in/s analogue using noise reduction. The balance is more even when the best current digital is compared with state-of-art analogue. The advantages of digital tend to be those which make an initial impact, but on more prolonged listening analogue seems to be more musical and less tiring: the differences between bipolar and valve power amps are to some extent analogous. Everyone is entitled to their own opinion, but nothing of what my ears tell me really explains the present fashionable preference for digital recordings in terms of how they actually sound. At best they can be very good, although characteristic faults always seem to be present. There is however, no way of knowing if the results might not have been even better had the same care and skill been lavished on an analogue version, and certainly reviewers tend to assume that any good qualities found are due to the use of digital techniques even when other causes readily suggest themselves. On the other hand, some of the less good digitally recorded records that have been issued fall short of the standard normally expected.

Determination of standards

In order to make a decisive advance on current standards, it will be necessary to make improvements in at least three aspects of digital recording:

- two separate reasons have been put forward in the foregoing discussion for believing that a 16-bit digitiser is needed to match, so far as unlike can be compared with unlike, the subjective performance of the best analogue tape recordings. We simply do not have the knowledge to decide how many bits are *really* needed, but such estimates as can be made suggest at least 18 and probably 20, several lines of argument converging about this figure[6]. Even this is likely to prove conservative, since the history of audio is a story of each generation underestimating the powers of the human ear and the standard of quality it demands before it is really satisfied. However there is at present no practicable way of fulfilling this requirement for an accuracy of one part in a million in a digitiser working at audio speeds under studio conditions;
- as essential as the quantisation of

90 ▶

Digital dilemma

signal amplitude is its sampling in time. The possibility of representing a continuous waveform by a discrete set of values is expressed by what is sometimes called the Nyquist theorem which, loosely speaking, requires two samples to be taken for every cycle of the highest frequency present. Thus, for audio, at least 40,000 samples per second are required, and in practice it is necessary to have a small 'guard-band' so that a sampling rate of around 50,000 per second is needed. A so-called 'sampling filter' is needed which will pass the whole audio band but cut-off sharply, within the guard-band, to give high attenuation at and beyond half the sampling frequency. Thus there are severe requirements on the sharpness of cut-off, and on the uniformity of amplitude and phase-linearity within the audio band, together with stringent noise criteria. At present we do not know how to specify these requirements in the best way. It is well known that a sharp cut-off within the audio band tends to give a subjectively unpleasant ringing effect, but research is still needed to determine how high the cut-off frequency must be placed in order to avoid this, and what are the subjectively optimal phase and amplitude characteristics;

- the task of sampling the signal at the required rate, and then holding its value accurately while the digitiser operates on it, is far from trivial. The sample-and-hold circuit is essentially a switch, with all the opportunities for non-linear behaviour that this opens up. Settling to an accuracy of one part in a million requires an interval of time some 14 times as long as the time-constant. In addition, the held signal must remain constant, to the high accuracy required, during the time the digitiser is at work, despite leakage, dielectric absorption or other cause. A satisfactory design is probably within the capabilities of present state-of-art, but it is not obvious that the devices in current use are good enough.

Thus the three essential steps of filtering, sampling and the digitising itself all need to be done better than at present, and at least two of them better than we know how to do at present. There is still a long hard path ahead, and as always in audio the final result will depend not only on the engineering specification achieved but also on the audio perceptions and musical sensitivity of the designer.

Possibilities of analogue

Meanwhile, there are important possibilities remaining in analogue recording. Even if in the end it proves to be a rear-guard action, realising these possibilities would follow the historical precedent of clipper sailing ships reaching the climax of their development in response to the challenge of steam.

The assumption seems to be current that the way for analogue recording to meet the challenge of digital is by developing and using more and more powerful noise reduction systems, but this view seems to be based on a misapprehension so basic that it is hard to understand how it has come about. Noise reduction systems have served the industry well for many years, and are likely to do so for years to come. They do not however act as a universal panacea, but like all technological devices have particular functions which serve particular purposes, and none of these seems central to matching the actual advantages that can be claimed for digital. It almost seems as if the false notion that digital recordings are 'free from noise' has given rise to the supposition that if analogue recordings can be made 'noiseless' too, then they will sound as good as digital!

What are called 'noise reduction systems' are in fact companders with various refinements[7]; they compress the dynamic range of the programme material before recording, and expand it again on playback. The degree and law of compression, its frequency dependence, equalisation, etc differ from one system to another, according to the aims and priorities of the designer, trading one advantage for another. Nevertheless the basic benefit is the same for all, namely that quiet passages are recorded at a higher level than they otherwise would be, and are therefore better able to override the noise on playback. The result cannot sound better than if the same passages had been recorded (in isolation from the louder ones) at this same level without companding. There is no magic about this; companding can do nothing to ameliorate such things as woodles or noise modulation.

Indeed, there is a price to pay. Every extra stage of filtering, amplification, or other processing is likely to involve some loss of signal quality, however slight, and companders pose special problems. For example it is hard enough to design a straight amplifier that is truly signal transparent to the best modern standards, and an amplifier with voltage-controlled gain is that much more difficult, being in effect a device for intermodulating the signal and control voltages and therefore inherently non-linear. Nor is it easy to keep the expander accurately tracking the compressor. The classical noise reduction systems solved these problems so well as to confer great benefit on recording. Nevertheless if the compressor and expander are connected directly together (without intervening tape) a change in signal quality can be discerned which has become more significant as state-of-art quality in audio has gradually increased during recent years. With the tape recording stage intervening, the errors become greater because the expander no longer acts on exactly the same signal as delivered by the compressor. This is because of imperfections in recording which include phase distortion (the better systems allow for this to some extent), squash, noise and instability of amplitude at both record and playback; these instabilities are indeed actually increased by the expander, the more so the more 'powerful' the system.

So far only brief reference has been made to noise modulation, by which is meant noise-like fluctuations in the amplitude of analogue recorded signals. Since a cause of this effect is variation in head-tape contact during recording, due to mechanical roughness of the surface of the tape, it is sometimes called 'asperity noise'[8]. The effect can be seen directly on an oscilloscope, and indeed this has been proposed as a means of setting the bias level. The intermodulation products generated in this way can be at a level as high as −40dB relative to signal. This is so great compared with other spurious components of the tape output as to suggest that the major audible imperfections of analogue are predominantly due to this cause, which of course noise reduction systems can do nothing to overcome.

The main imperfections of analogue recording which can and should be tackled in meeting the digital challenge are:

- modulation noise, as discussed above;
- bass cut-off and woodles, due to secondary gap effects;
- squash, especially at high frequencies, and associated inter-modulation effects.

For the user of existing analogue equipment who does not wish, or cannot afford, to convert to digital recording, the main options are:

- convert to 30in/s tape speed. Although this makes secondary gap effects worse, it reduces squash and gives a much 'cleaner' sound. The subjective improvement on going from 15 to 30in/s is generally judged to be greater than that from 7½ to 15in/s;
- use the widest track-widths available, and the fewest tracks. This reduces modulation noise;
- maintain the equipment meticulously, and set it up as accurately as can be measured. Use a good wave-analyser to check for intermodulation products;
- in any new purchases, choose the best possible circuitry, heads and other components.

These precautions will, as a by-product, increase the S/N ratio so that little, if any, noise-reduction is needed. Tape costs may be increased, but it takes a lot of tape to pay for a complete digital system including editing.

The options available to the manufacturer of analogue recorders are rather wider. They include:

- provision of 30in/s as standard, or as conversion kits;
- provision of heads using the widest practicable track widths; the Ampex ½in stereo head is an example of this. By contrast, the standard 4-track ½in head uses only just over 50% of the actual tape width. More efficient use of the magnetic material requires acceptance of smaller inter-track spacing and therefore greater crosstalk between tracks, but in many applications (including stereo) this is no real disadvantage; 'separation' has become a preoccupation not wholly explained by actual practical need;
- reduce secondary-gap effects by extending the replay pole-pieces or in some other way. Accept and overcome any hum problems which result;
- upgrade all associated circuitry to be as signal-transparent as possible. Improve the flatness of equalisation.

Finally, tape manufacturers can:

- devote as much attention to modulation noise as they do at present to other parameters which are commonly given greater prominence;
- try to optimise the relationship of tape characteristics to those of state-of-art professional recorders as well as has been done in the historic progress of the audio cassette from speech-quality-only to acceptable musical standards.

With such initiatives, in which existing manufacturers and users have a common interest, there is no reason why analogue and digital recording should not co-exist in healthy competition for some time to come. ■

References

1 Eley, S R, *Idle-channel noise in pcm sound-signal systems*, BBC Report RD 1978/4.

2 Belcher, R A, *An experimental investigation of test-noise signals for the measurement of non-linear distortion of sound-signals*, BBC Report RD 1974/2.

3 Belcher, R A, *Audio non-linearity: a comb filter method for measuring distortion*, BBC Report 1976/12.

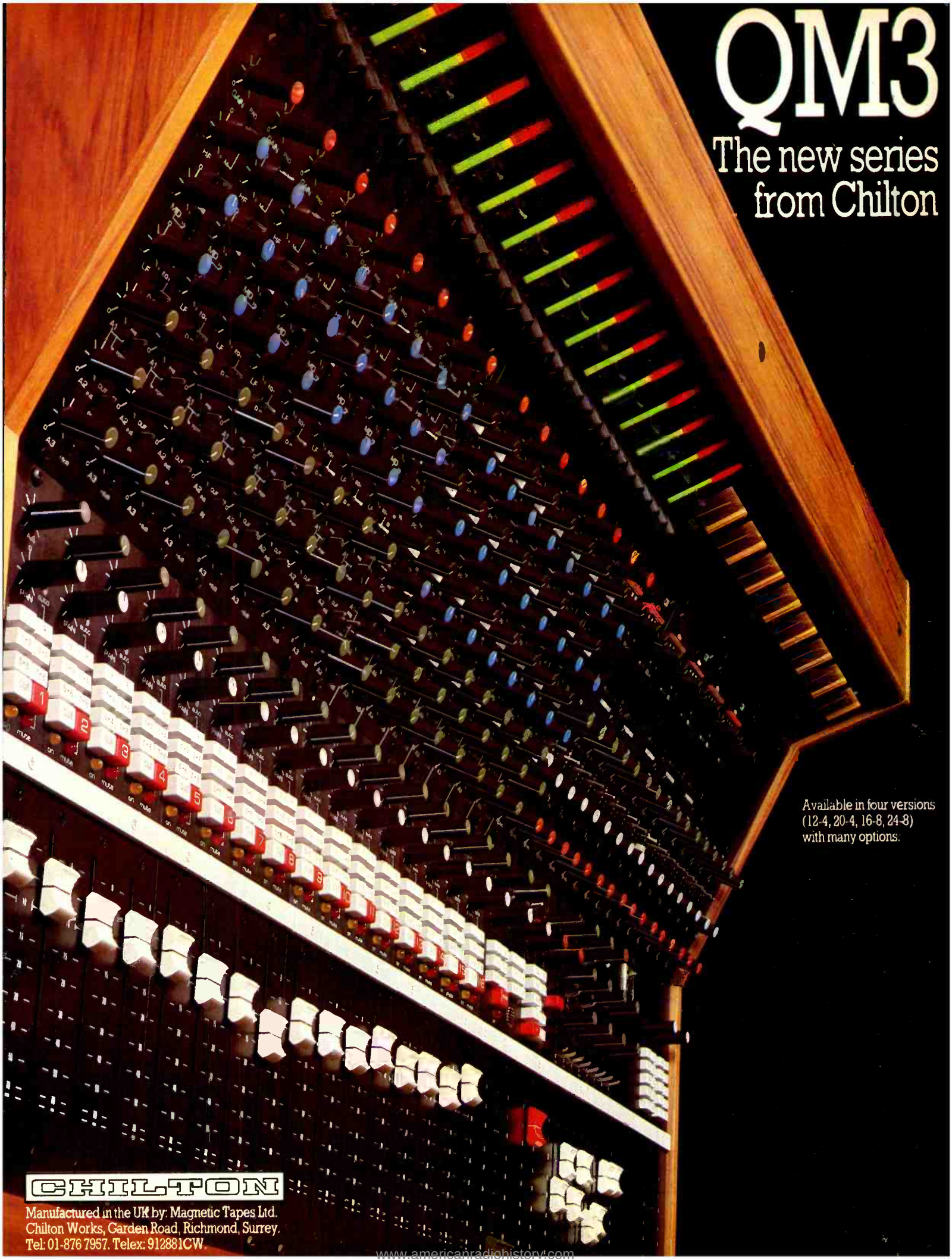
4 Barton, G J, *On perception and technology in the reproduction of sound*, Doctoral Thesis, University of Reading, 1979.

5 Cross, M G, *Pcm for high quality sound distribution, quantising distortion at very low signal levels*, BBC Report RD 1970/18.

6 Manson, W I, *Digital sound: studio signal coding resolution for broadcasting*, BBC Report RD 1980/15.

7 *Studio Sound* Noise reduction issue, September 1976.

8 Trendell, E G, The measurement and subjective assessment of modulation noise in magnetic recording, *JAES 17*, 644-653, 1969.



Designing a professional mixing console

Steve Dove

Part Thirteen-The Back-end 1

A little of something for everybody—this part concludes the channel module description with details of the auxiliary feeds, the audio path summing and output stages—whilst not for the weak of heart there is a treatment of how to make virtual-earth mixing actually work.

MUCH of what follows refers back to Parts Three (November, 1980) and Six (March, 1981) of this epic series. So for inveterate *Studio Sound* hoarders I suggest you dig the copies out before we continue.

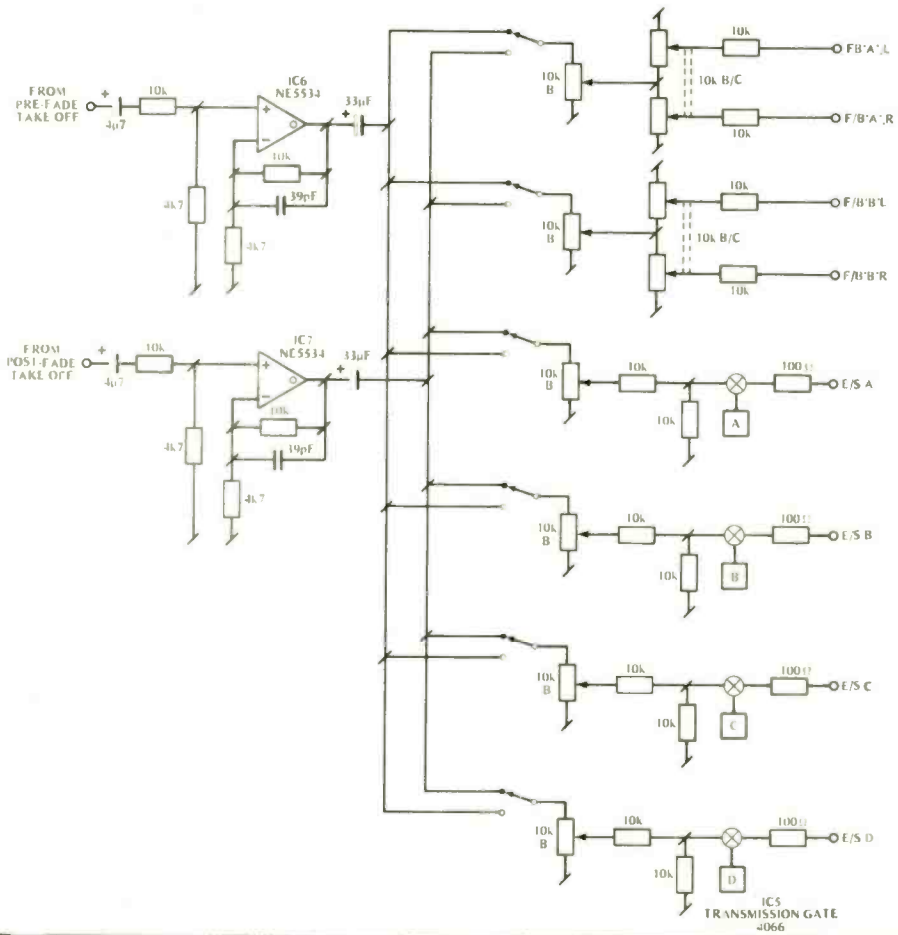
Auxiliary channel feeds

Two prefade (pre-mute) feeds are provided on each channel, each with level control and pannable across a stereo pair of mix busses. This provides a versatile facility enabling separate stereo submixing, two rather flash stereo foldbacks or four separate feeds. Each of the pairs is selectable to post fade should extra effect feeds be needed during a heavy mixdown, whereupon they will be subject to channel mutes also.

Four individual post-fade effect feeds are individually mutable, locally or remote, individually level controlled and selectable to pre-fade (should foldback requirements get a bit silly).

Pre/Post switching is done via 'real' switches—in fact push-pull switches operating concentrically within the level control potentiometers, saving hassle and panel space (in normal, out reverse). There is no conceivable time the function needs to be remoted so there is no drawback there to mechanical switching. Effects feeds, though, are quite often twitched during mixes; consequentially, remotes are brought out to a rear multiway socket to facilitate linking to automation should the need be. Local activation is achieved through the debounce/latch arrangement used extensively in the channel mode switching **(Figs 65a and 65b)**, the latch output driving a very simple single element transmission gate per feed to buss—isolation, crosstalk and noise criteria are not particularly critical on these feeds, but still come out quite creditably. The console switch-on reset master reset buss (MRB) cancels all these feeds leaving a clean slate rather than the alternative unpredictable hordes of 'ons' and 'offs' in the event of a power interruption or control 'zeroing'.

FIG. 65a AUXILIARY SEND CHANNEL AUDIO PATH



Summing modules

Much of the actual mixing within the system so far described is self-contained—multitrack routing, when achieved via a matrix, allows multiple sourcing to any chosen 'group' or machine track. A stereo mixdown of all the channels is possible by this method by selecting them to an arbitrary pair of tracks

FIG. 65b EFFECT SEND LOGIC CONTROL

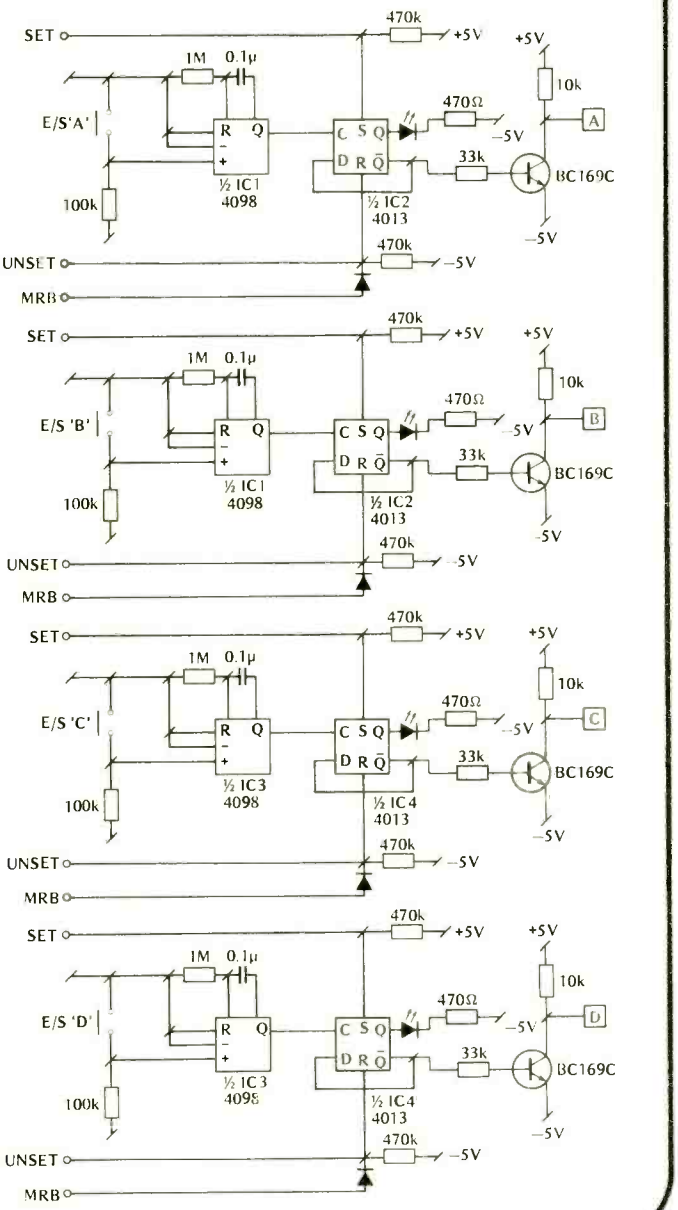
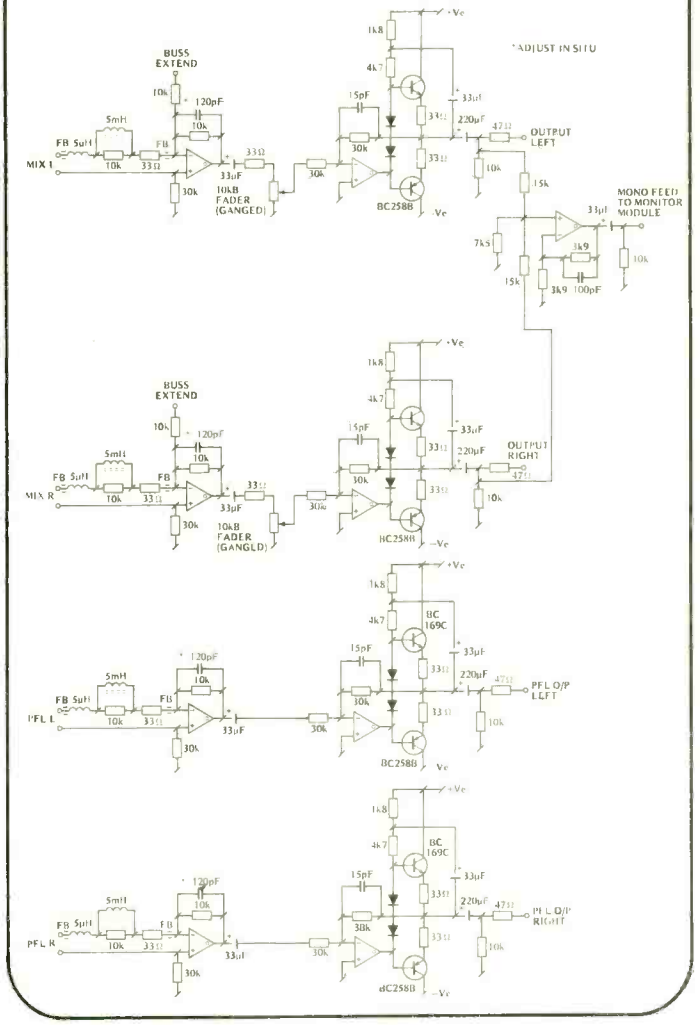


FIG. 66 MASTER GROUP MODULE



across which the mastering machine is hung. This is in fact the mixdown technique used in many console systems whether in-line or discrete monitoring; although entirely feasible it is not the manner in which this particular system is intended to be used, unless your really out to make life hard for yourself.

Stereo mixdown is achieved in the same busses as the multitrack monitor mix, the 'solo' monitor function making its happy home here too.

A master group module contains the mix-amps, fader and line-amps pertaining to the stereo buss together with sundry other related things, like mono summing (Required for a monitor feed) and clean auxiliary buss access for extending the monitor mix (for effect returns or temporary extra channels).

The circuit diagram of **Fig 66** in its simplicity belies the hidden design which is in the relationship of the circuitry to its mechanical and electrical environment.

This is where the care and feeding of op-amps (Part Three, November 1980) and grounding paths (Part Six, March 1981) really pay dividends —or not if you aren't careful. Mix-amp stages—with large numbers of permanently assigned sources such as in the main mix busses —are as crucial to the overall well-being of a console as any front-end stage. In a typical situation, as a unity gain virtual earth mixing stage with 33 sources (channels plus access) the amplifier is being asked for 30dB-ish broad band gain—as much as any other stage in the chain including both the mic pre-amp or secondary input stage.

That this mix-amp gain is sometimes referred to as 'noise gain' is not accidental. Unless care is taken to balance fader-back channel noise contributions against this self-generated mix-amp noise, the latter could well predominate and arbitrarily determine the noise-floor for the entire console. Similarly, channel noise contribution due to gainy buffer-amps should equal or outstrip mix-amp noise. Other compromises start waving flags to delight and amuse. Self-noise generation in the mix-amp is predominantly the amplified thermal noise of the source and feedback resistances, device input current noise and surface generation/recombination noise. The last two can be minimised by device choice—minor quirks simply solved. Thermal noise is physics and here to stay until the universe cools off a bit (who said entropy?). Common sense on first glance says make the mix resistors as low in value as possible, but too low a value would cause quite large signal—hence ground—currents to be thundering about, and on a less technical level necessitate yet another tier of buffer amplifiers to feed the busses after the pan controls. The buss feed resistors are also deliberately used to modify the law of the log/reverse-log pots used for the pan. Whilst not materially affecting the centre-pan attenuation, this trick can help the subjective linearity of an image sweep across stereo versus control rotation, which can otherwise be a little too concentrated at the ends of the control. A law unto itself.

Ordinarily though, the mix resistors are of such a value that in the context of a complete mixer the combined effectively paralleled resistance is well below the optimum source impedance of the mix-amp device used, so the primary noise modes are those previously mentioned. This isn't too difficult with FET front end devices such as

94 ▶

the *TLO71* with their ludicrously high OSI. These devices have a couple of other major benefits in this application by virtue of their FET inputs. Input current, hence input current noise, is extremely low and being FETs they don't have many low-frequency junction and surface noises inherent to bipolar devices. It seems a paradoxic absurdity to use an ultra-high input impedance device for 'zero' impedance mixing.

Things can get a bit startling if the resistance/OSI relationship is awry. Above the OSI, device input noise voltage becomes an increasingly important noise contribution. Many years ago in a mixer design with bipolar device mix amps and quite high mix resistors, the measured buss noise was actually *lower* on a 20-channel version than on the 10-channel original. It wasn't until many visions had passed of Nobel Prizes and Rolls-Royces that we sussed what was happening. Increasing the number of source resistors reduced the buss impedance above the amplifier's OSI, through it and eventually below it where input noise voltage was no longer contributing.

Theoretical source impedance and device contributions tell less than half the story in a practical design, they may be quantifiable in the isolation of a test bench but thrown into a system they can all seem a bit meaningless. Part Six (March 1981) gave an insight—it's largely down to grounding and out-of-band considerations.

Curly things

The funny curly things between the buss and the amplifier input in **Figs 66 and 67** are inductors—remember them? These are only small ones though; don't panic. A simplistic view is that they are there to stop any rf on the mix buss finding its way into the electronics, but this is only part of their purpose. The ferrite beads and small chokes (about 5μH) are there to increase the input impedance and hopefully help decouple the buss from the amp at vhf and mid-vhf respectively, whilst the larger inductance creates a rising reactance in one phase sense to mitigate the falling reactance of the buss capacitance. If left unchecked this capacitance would cause the mix-amp extreme hf loop gain to scream off into the ionosphere turning it in to a lovely rf oscillator on the way. Feedback phase-leading around the amp stops the gain *rising* but if it weren't for some series loss, accidental or deliberate, in the input leg it would be insufficient to hold the amps' phase margin within the limits of stability at the bandwidth extreme where device propagation delay becomes significant in the loop. A small series resistance can provide this loss whilst also defining the maximum gain to which the circuit can rise, whilst the parallel inductor/resistor combination improves on this in a few important respects.

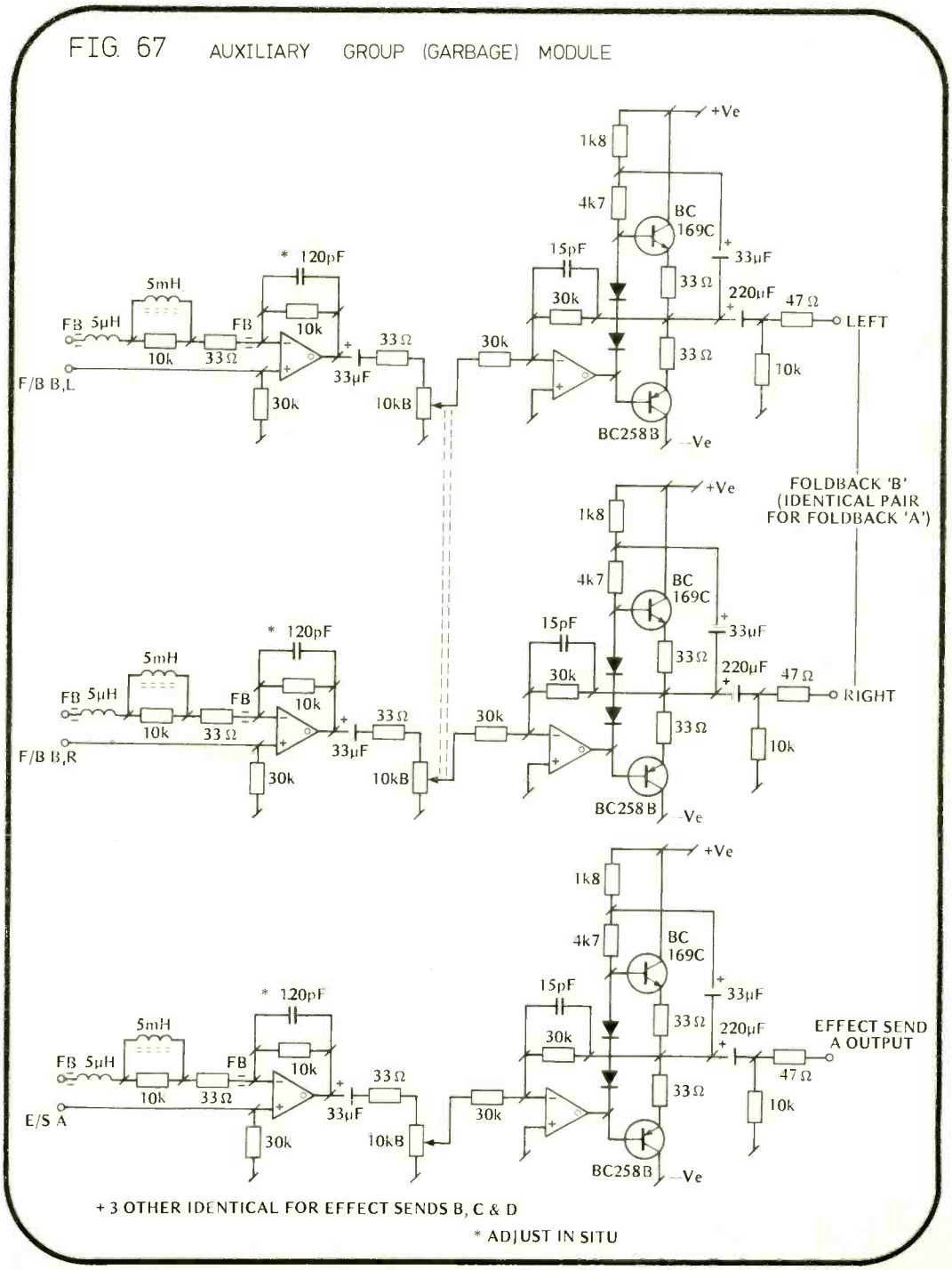
The inductor is calculated to present low in-band (<20kHZ) reactance, allowing the mix-amp to operate on the buss in a virtual earth (zero impedance) configuration. The reactance rises gently at the audio hf end, imparting little frequency response anomaly but a definitely beneficial partial phase-straightening against the inevitable effect of heavy feedback phase-lead compensation.

At even higher frequencies, the inductive reactance continues to rise until the combined network impedance is limited by the resistor, itself a high enough value to afford a sizeable choke to buss nasties and to define amplifier out-of-band gain to a reasonably low value. It is low enough, however, to stop the inevitable inductor/buss capacitance resonance getting completely out of hand. Making an L/C oscillator is one way of preventing spurious instability, one supposes.

Whilst FET inputs are far less prone than are bipolar inputs to the intermodulation and direct demodulation effects that cause rf interference to appear out of nowhere, this fairly healthy brace of filtering may be helpful to those unfortunates living within spat-upon distance of Crystal Palace/Empire State Building/Mount Wilson or

96 ▶

FIG. 67 AUXILIARY GROUP (GARBAGE) MODULE



some other unsociable source of vhf, megawatts.

Alternative mixing

There are of course alternatives to single-buss virtual-earth mixing. Passive resistor mixing **(Fig 68)** is quite viable for fixed-assignation systems that aren't going to be chopped, changed or switched in and out of. A major advantage is that buss capacitance is merely something to be taken into account of in terms of response and phase, rather than directly imperiling the stability of the mix-amp. For passive mixing, the mix-amp is just a buffer amp to make up the loss in the resistor tree and rf filtering becomes simple with known filter source and load impedances together with the ability to refer against ground. Primary hang-up is that the buss is unbalanced, has an impedance at audio (albeit fairly low), and hence lays itself wide open to induced garbage and capacitatively coupled crosstalk. Despite this, it is a method used with considerable success for many years in quite a few production mixers.

Distributed or devolved mixing **(Fig 69)** uses local mix-amps to sum blocks of, say, eight channels, the outputs of these local amps then being taken to a common summing point. This quite neatly obviates having to deal with a long buss but does create a practical problem of locating the distributed summers, preferably where it doesn't mean having to dismantle the mixer to get at them!

Both passive and devolved systems have the advantage that large amounts of the 'buss' can be run in screened single cable, the extra capacitance not having the awful consequences it would with virtual earth.

For consistency all busses would be run devolved meaning sub-mix facilities for the PFL busses, four effect sends, four foldbacks, the main stereo/monitor mix and the eight subgroups (if used) together with having to arrange the master mix for each of those at the grouping end. Aarrghh! life's too short, really!

Virtues of earthing

The console's virtual-earth mixing busses all end up in identical mix amp/attenuator/line amp configurations. Exceptions are the mono sources (effect sends) which have individual master level controls rather than ganged stereo attenuators and the PFL (which does not need a level control anyway, being a purely monitoring function). These back-end stages are homed in two of the very few one-off modules in the design: stereo monitor/mix (with the master fader) and the PFL summing occupy the Master Module whilst the remaining auxiliary functions are summed in the Auxiliary Master (or Garbage) Module. **(Figs 66 and 67).**

The outputs, each low impedance unbalanced, are taken to the jackfield, where they are normalled to their appropriate destinations and directly bridged by the differential inputs of the monitor selector switching matrix (adjacent to the field). It is assumed that the studio system will operate on the unbalanced out/differential or balanced input principle—output transformers need to be added if not.

Grounding paths for virtual-earth mixing—especially in long mixers—are always the final arbiter on how far down the system noise floor will go and how susceptible the mix stage is to extraneous fields and earth currents. In this age of digits ground paths are especially crucial. Remember (Part Six) how the 'ground' on the non-inverting input of an op-amp mix-stage gets amplified up by the 'noise gain' of the stage? This implies that a ground noise of −100dBu will end up at about −70dBu for a 32 source mixer—barely adequate. A simple but so, often ignored rule with virtual earth stages is to make sure that the ground reference has got the same 'dirt' on it as the signal and vice versa—Yes Ground Follows Signal. If both ground and signal have the same garbage in the same phase, there's a fighting chance that it'll get ignored as common-mode and not amplified in the mix-amp. Thus for each mix-buss, there is a parallel ground buss being fed by the last relevant ground reference from each channel. Avoiding a major buss length ground loop (otherwise known as a single-turn transformer), this means that all the heavyweight signal current in the fader/mute/mode switchery has a direct wire to central ground whilst the mix-amp has a respectable output referenced ground to work against, clean of channel signal currents but representative of the say buffer-amps' reference in the case of stereo mix. The mix amp does *not* take a direct system central ground of it's own.

As a quick aside, signal path grounding in the channel is greatly simplified by the 'ground decoupling' afforded by the differential return amplifiers at the eq input and post-eq break-point return. With such a complex system it would be rather trying without them.

FIG. 68 PASSIVE MIX AMP ARRANGEMENT

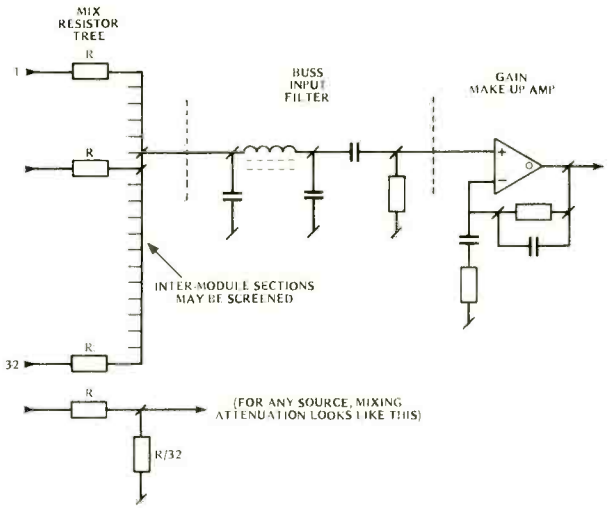
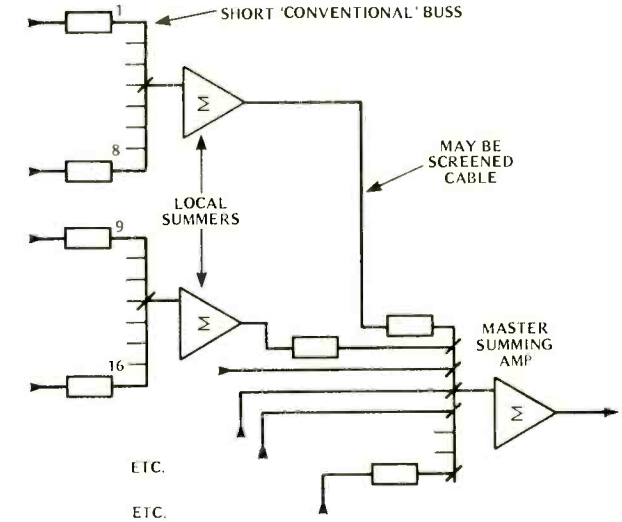


FIG. 69 DISTRIBUTED OR DEVOLVED MIXING



Automation asides

Thankfully automation system fader modules now have separate ground terminations for at least audio, control voltage manipulation and logic. This is a welcome change from some earlier generation systems where the voltage control line shared the audio ground as a reference, occasionally with some less than healthy results. The favourite must be ground currents from heavily modulated channels—eg kick drum—twitching the ground potential against which the VCA's were referenced hence cross modulating into all the other channels. That one's fun. So is trying to lose logic chatter and wheezes—a reverse effect of the same mechanism.

Nowadays, installing or building-in a fader-and-mute automation system to a console design such as this is little more complex than putting in standard Penny & Giles faders, reading the handbook and making sure you plug into the big box the right way up. As for audio interfacing, it 'looks' just like a conventional fader—a top, a bottom (ground) and a wiper. In fact with the Melkuist in bypass that is *exactly* what you've got—a standard log fader.

Valley People's *Fadex* is a little different in that the control element is always a voltage controlled *amplifier* that can be arranged to give gain obviating the need for a post fader buffer amp to allow for fader back-off. In practice though, and especially in this design, that amplifier performs other functions also such as output drive and (specifically here) bandpass filtering. It's worthwhile considering however, if it is to be designed in from the outset. ■

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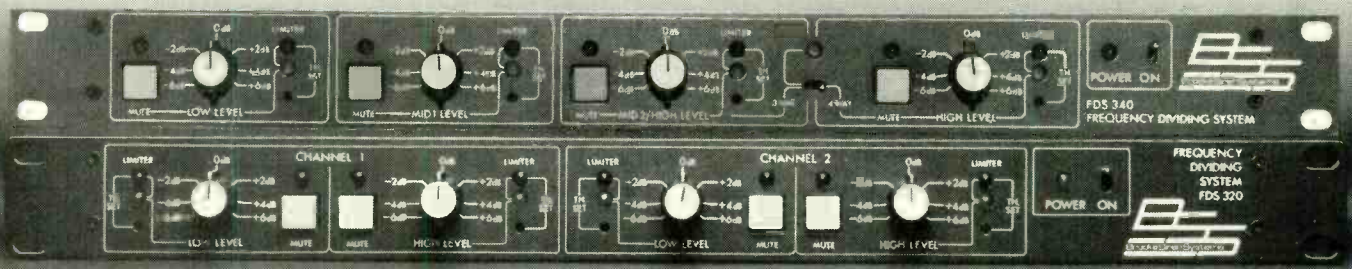

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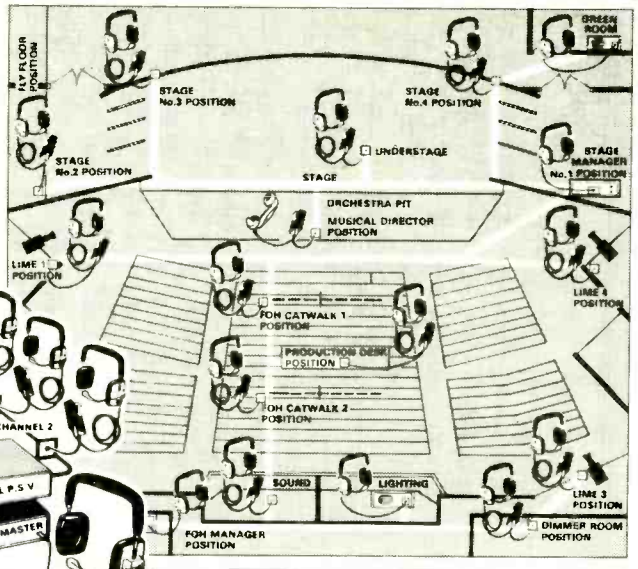

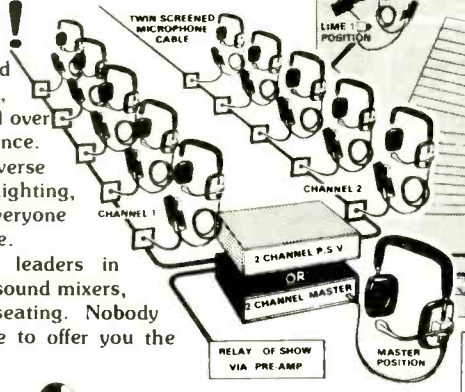

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CX

CBS could well be in for a very uncomfortable time with *CX*, the new disc noise reduction system.

CX is being touted by CBS as a cure-all for conventional, analogue pressings. To quote CBS, it is "a major audio process which virtually eliminates surface noise" and "increases the dynamic range of discs by 20dB to nearly 85dB, comparable to that of an actual concert hall environment". In many respects *CX* parallels dbx because in addition to the established dbx tape systems for professional and domestic use, dbx offers a decoder for replaying dbx-encoded discs. There are now nearly 200 of these discs on sale around the world. So why should CBS now push *CX* in the face of dbx? It's rather like Kinitek pushing a new cinema sound system in the face of Dolby.

The answer is to be found in the name *CX*, which is short for Compatible Expansion, and another of the *CX* claims: "The unique compatibility feature of the *CX* process allows *CX* records to be played today on any stereo system with the sound quality of conventional stereo releases". Brave words indeed, especially as dbx are the first to admit that a dbx-encoded disc is *not* compatible. It sounds horribly compressed when played on conventional equipment, without decoding. So dbx discs can only be issued in double inventory, ie one version in conventional non-encoded form and the other version in dbx-encoded form. So how on earth can *CX* expand the dynamic range by 20dB and remain "*completely* compatible"? (CBS's italics, not mine.)

Like dbx, the *CX* system compresses the original programme when it is transferred to disc and then expands it again on replay. CBS chose a 20dB compression value, which is more than Dolby-B (10dB at higher frequencies) and less than dbx (at over 30dB). It is of course by offering just 10dB of noise reduction and only at high frequencies that Dolby achieves compatibility for domestic use; B format Dolby encoded tapes can be replayed on non-Dolby equipment quite satisfactorily. But the Dolby-B system is not directly applicable to discs. It is tailor-made for low-speed, narrow-track tape and this is why it only reduces high frequency noise. Noise on disc is of much broader spectrum. Dbx reduces noise right across the audio range, with a compression ratio of 2:1, and fixed equalisation. This is what makes dbx encoded material non-compatible with conventional reproduction systems, but very effective with the correct decoders.

CBS claim to have achieved the impossible, namely a high degree of compansion *and* compatibility, by using a 2:1 curve which is not fixed. Compression is at 2:1 for signals down to −40dB. The slope then converts rapidly to 1:1 for signals below −40dB. The expansion curve is of course complementary to this.

The ever-present problem for any compansion system is pumping. The signal level must be continually monitored and used to control the compander circuits. To minimise pumping with *CX*, the programme signal is first passed to a fast-acting main filter circuit, with a 1ms attack time constant and a 10ms release time constant. The signal is then split four ways, and routed through four separate filters with different time and frequency characteristics. These filters separately analyse low level steady signals, peak transients and transient dips. The output at the four filters is then combined to produce a single, main gain control signal for the compander.

CBS in America is so enthusiastic about *CX*, that the company says that its "ultimate objective is to encode all new CBS releases . . . this will encompass all musical categories". Several hardware companies are now making *CX* decoders and the WEA group (Atlantic, Warner, Elektra, etc) is reported to have backed the system. Clearly some sectors of the US press and trade are seeing *CX* as the answer to the record industry's quality control problems.

So how compatible *is CX*? Is it truly "Compatible Expansion"? What will happen if CBS adopt a single inventory approach and issue everything in *CX* format? Of course rock music won't suffer, and may even benefit, from the compression which will result from playing back a *CX* disc without a decoder. The music will sound even more tight and punchy than the producer intended. But classical music will surely sound squashed. So why haven't American audio critics yet been too openly critical about *CX*? Here you have to remember that in America much FM radio is severely compressed, to levels which would be regarded as quite unacceptable in Europe. So ears over there are attuned to the sound of compression. Most European ears won't be so easily satisfied.

Meanwhile a recent press conference held by dbx in London, and demonstrations of dbx mounted by Matsushita-Technics in Japan, have put further nails in the *CBS CX* coffin. Both Matsushita-Technics and dbx have clearly improved the performance of dbx and Jerry Ruzicka made the company strategy abundantly clear. "We intend to dislodge Dolby and become the standard noise reduction system for the '80s". Whether or not dbx dislodges Dolby is a moot point, but certainly dbx will give Dolby a run for their money.

It's clear that the market, both domestic and professional, is likely to shake down into a stand-up confrontation between Dolby and dbx. Here Dolby Labs will suffer from the disadvantage that they haven't taken press relations seriously for years now—since Bob Berkowitz left for Acoustic Research in fact. Dolby just aren't geared to the kind of press and public relations offensive which will be necessary to counter the dbx thrust. But for poor press relations, CBS in Britain surely takes the prize. The company has built up an enviable track record of complete disinterest in any question more technical than what their flavour-of-the-month pop star had for breakfast. The future does not look good for *CX* in Europe.

In the US, studio engineers are already banding together to fight *CX*. If they reject *CX*, then so will the musicians and artists, and it won't matter a hang what the cloth-eared bosses of the record companies think or say. With grass roots rejection of *CX* it is bound to be still-born. CBS has made a tactical error in trying to sell the system at management level before first giving the industry's engineers a say.

CBS has a history of extravagant claims. Even before *SQ*, in the mid '50s there was "360 hemispheric sound—another Columbia first—guaranteed high fidelity". To the company's potential embarrassment some of these discs are now being re-issued in Japan; for instance *Suddenly it's the Hi-Lo's*. According to the sleeve, "360 sound . . . represents the *summa cum laude* of high fidelity". This explanation is followed by the extraordinary promise that "It is your *guarantee* that each record so designated has been engineered and individually tested under the supervision of the Columbia Sound Laboratory . . . including an actual laboratory-calibrated playback of *each* disc before it is released". CBS might be better advised to spend their time and money on implementing checks like these again to improve disc production quality instead of trying to foist a noise reduction system of arguable compatibility on the recording industry and record buying public.

All right, OK, you win

Over the years I've written critical pieces about the BBC in a few magazines. Perhaps this helps explain a couple of recent events.

Every now and then I broadcast on BBC regional radio, but by telephone link from a London studio. The topic is usually inventions or consumer electronics, and the broadcasts are live. A few months ago I turned up at Broadcasting House at the appointed hour to find the appointed studio tied up with a link to Australia. "Hadn't we better try getting through" I kept nudging as the minutes ticked away to the time set for my live contribution. "We have first call on this studio" I was firmly reminded by the Broadcasting House news team. With literally less than 2min to go the leisurely tie-up with Australia was terminated with leisurely goodbyes. "Do you happen to have the number for the regional studio?" I was asked casually. Of course I didn't. Broadcasting House switchboard found the number and the line was finally dialled through as the seconds hand of the studio clock ticked up to time. I was handed a pair of headphones and sat down in front of a microphone. Over the headphones I heard someone, apparently an inventor, say something about a caravan. Then the regional link man broke in. "Now we have been joined by Barry Fox in London—what does he think?" Not knowing what had been said, or who had been saying it, the best I could come up with was "Well of course caravanning is a limited market". The engineers at BH seemed to enjoy the next, awful, ten minutes hugely.

Not long afterwards a similar tie line was put through from the Radio London studios in Marylebone High Street. Again the studio was unavailable at the appointed hour and again I was patched through at the last possible moment. This didn't matter, because it was a straight 2-way chat with the regional link man. What did matter is that someone at Radio London, accidentally or otherwise, was feeding two quite different signals into my headphones, one live from the region and the other live from Radio London. If it was deliberate, then I congratulate them on their ploy. To make someone do a 10min live interview on air, with weather forecasts, traffic news and disc jockey chat mixed into the cue feed at the same level as the unseen interviewer's questions is enough to make any journalist write only nice things about the BBC for ever afterwards. ■

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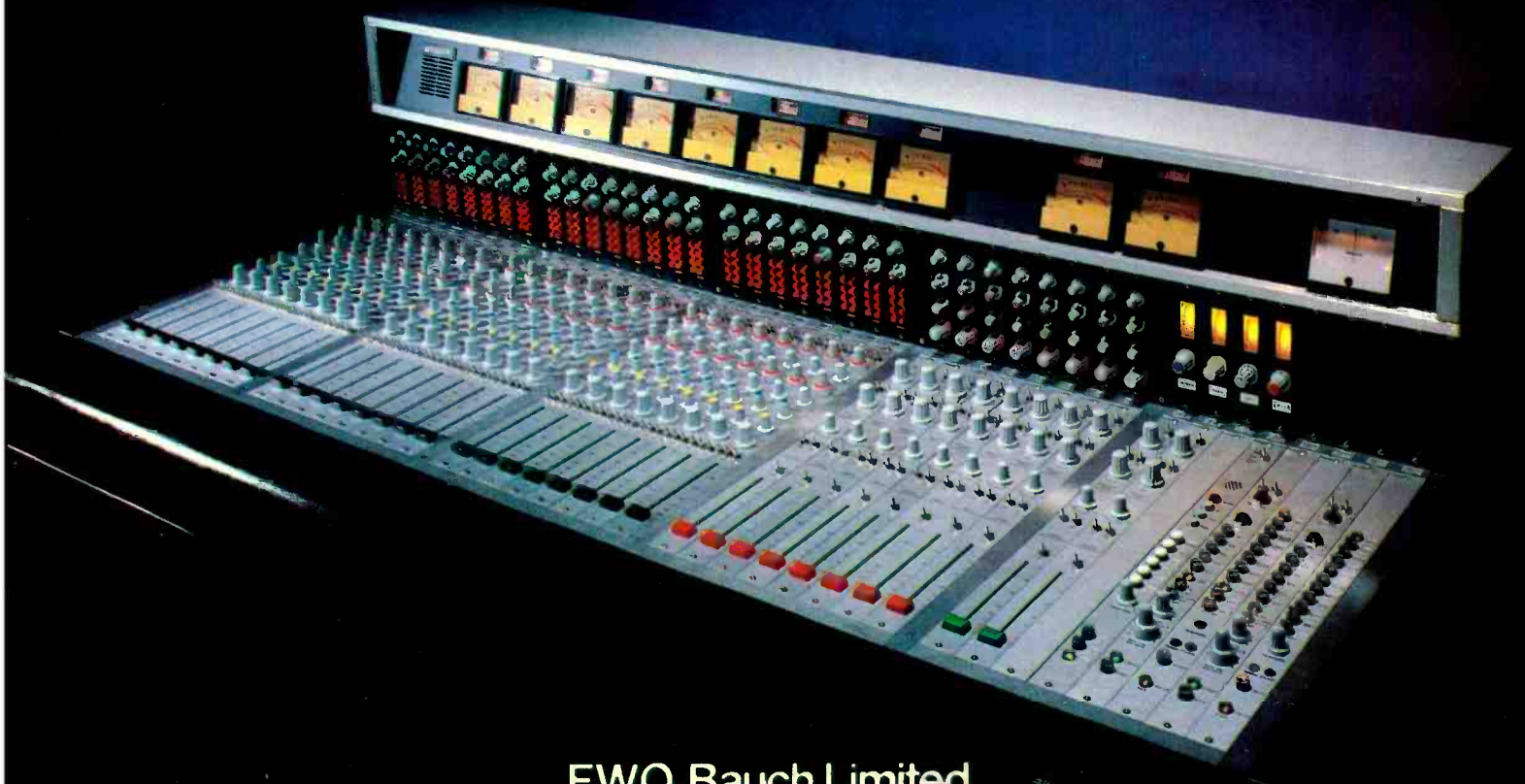

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Clément Ader aged 81

The Amazing Clément Ader

Antony Askew ARCM, MIBS

One hundred years ago this month, the first demonstrations of stereophony, the relaying of opera performances via telephone wires to the Paris Exhibition of Electricity, were coming to a close. In the final part of this article, we hear the critics' reactions to the hearings, and uncover the makings of a scandal.

SO FAR we have seen comments from technical writers. How did musicians react? One music critic, M. Weber, was reported to have stayed away rather than make too rapid a judgement on such a brief listening period. But the critic of the *Political and Literary Review*, Leon Pillaut, did go:

"What is really extraordinary is that the music is perceived, not only with all the pitches and rhythms which make up musical phrases, but also the timbres of the voices and instruments that go with them. If one could eliminate the rumbling of machinery which fills the Exhibition Palace and which pervades the listening room and, if one were allowed to listen long enough, one would end up by having a complete impression of the performance. The cause of this fidelity of musical reproduction is that none of the multiple relationships of the sounds of a large orchestra and numerous voices is altered by telephonic transmissions and the ear soon re-establishes aural sensations into their true perspectives.

"In the five or six minutes during which we were allowed to listen . . . we heard two fragments of the second act of *Le Prophète*. The first of these fragments contained Fides' Aria "O mon fils! sois beni . . .", which was unfortunately cut short by the ringing of the bell which times the listening period . . ."

These demonstrations were, being heard on earpieces, a kind of 'binaural' stereophony, and the major problem encountered today was perhaps noted by him even during the brief time he listened:

". . . During the whole of the first section of this Aria, the singer's voice could be heard as clearly as in the hall itself, and the words as distinctly *as if one's back were turned to her* (my italics). The timbres of the accompanying instruments were perfectly recognisable, especially those of the wind instruments; in particular, a chord played by the oboe, clarinet and bassoon linking the Aria to the preceeding Recitative, stood out above the others. Possibly there are certain harmonies and timbres whose sound make-up is better than others for the little metal plate which acts as a diaphagm for the telephone. As for the clarity of the words and the singing, it was complete . . . one can work out exactly the location of the people singing on the stage by the greater or lesser intensity of their voices. This sonic perspective is even more pronounced than in the Opera House itself and must be more or less that which exists near the prompter, that is the voices of the singers approaching the footlights . . . ring out proportionately far too loudly in comparison with the voices which are further away.

"In such instances one hears not only the singing very loudly, but also all the involuntary movements of the larynx, such as vibrato and even the sudden intake of air . . ."

He also established another of the 'truths' of reproduced music:

". . .The telephone lacks indulgence; out-of-tune intervals, so frequent in ensembles, can be heard more cruelly still than in real life."

It is also apparent, as we saw in Ader's Patent, that no importance was placed on the left/right aspect:

". . . a trombone chord exploding in the left ear-piece, which is a little disquieting since these instruments, placed to the right of

the conductor, normally affect the right ear . . ."

Pillaut also, in his closing comments, anticipated the need for 'Balance and Control':

". . . and finally the noise of the applause, which rose at the end of a soprano aria, signifying an enthusiastic admiration was mixed with an increase of sharp sounds and appeared more than a little strange."

But, having seen that the transmissions were not only very successful, but captured the imagination of the majority who experienced them and became the principal attraction in a very significant international exhibition, why did not stereophony 'take off' from that moment? Why did about 50 years go by before any significant work became undertaken? For had not the demonstration with all this favourable reaction taken place at such an early stage in the development of telephony as to make the stereophonic ingredient almost indispensible, particularly in the wired broadcasts that were established and which continued for nearly 50 years until being killed by radio.

The investment of double lines to many subscribers would have been a major stumbling block and it has also been suggested that the 'quest for quality' could have been resolved in other ways, but there was another possible influencing factor.

The Paris network was, as we have said, set up and monopolised by the General Telephone Company under a concession granted by the Minister of Posts and Telegraphs, M. Cochery, and the monopoly had been under some criticism from some of the journals of the day, indeed one, *L'Électricité*, had been sniping at the entire Posts and Telegraphs administration — which also was involved in the running of the Exhibition — so much so that the sale of it was banned within the confines of the Palace of Industry. It proclaimed however:

. . . we are convinced that our voice will be heard there because no means has been found of applying the puerile ostracism to our readers to which our journal has been subjected, and against which we are protesting simply for the dignity of the Press.

L'Électricité

Despite their hostility towards the administration the paper wrote a glowing account of the hearings. Incidentally, I had been puzzled by a discrepancy in several accounts about the actual duration of the listening periods allotted to visitors — some say five minutes, others two. *L'Électricité* clarified this point by hinting at VIP treatment received by people with special passes. The poloi, who had to pay some 5 francs to get into the telephone rooms, were also rather unfamiliar with the way of handling a telephone:

. . . not everyone puts their ears to the correct end of it and the superintendent frequently has to show beginners how to hold it in a way as to be able to hear.

L'Électricité

L'Électricité's account makes entertaining reading — they don't write like this nowadays!:

"Those who had bought admission tickets at the turnstiles had to endure a very considerable wait and, even then were not admitted until those with special passes had been catered for. The crowd persisted throughout the evening and, as a result, the 'real' public did not get into the telephone rooms without having endured a wait which was as lengthy as it was disagreeable. But, despite the discomfort of this wait, we entreat our readers to endure the weariness so that they might enter the Holy of Holies of airy Harmony.

"For, those people who have not taken part in this marvellous experience, which lasts barely two minutes, cannot boast of having known the Exhibition . . .

"During the two minutes, a great silence reigns, interrupted nevertheless by cries of surprise from Opéra habitués when they recognise their favourite performers. The applause especially, is easy to hear, even without having one's ear to the telephone. Nothing is stranger than the sight of 24 people ranged around a table to which they turn their backs and face the wall like the Israelites who, during one of their religious festivals, bemoan the fate of the Temple of Jerusalem. When the two minutes have elapsed, the superintendent throws a switch which brings the miracle to an end with the same swiftness displayed in *The Tempest* when Ariel cuts off his airy music.

"The disappointment of the listeners is no less acute than that of the castaways whose disenchantment Shakespeare describes so poetically in his admirable comedy.

"The earpieces fall from disappointed hands and everyone turns away in silence as if they were trying to preserve the memory of the impressions they had just experienced. It is only after leaving that they give free rein to their expressions of admiration."

The article continues with gradually increasing criticism of the administration of the Exhibition together with insinuations that the Ader telephone system might not be all that it was thought:

"We feel that it is a mistake to stop the hearings during the (opera) intervals. By thus increasing the duration of the hearings, not only would one augment the number of persons who would enjoy the benefit, but those who were admitted during intervals would have no right to complain. Because, during presentations, it is often the (opera) audience that gives the greater entertainment; even more so being overheard more than a kilometre away. Paradoxically, and M. Cochery's Exhibition administration gives us more than one example, it is precisely at the moment when the experience would be most interesting that one is prevented from having it. Since there is a reason for everything, it must be that this apparent lack of intelligence is possibly hiding an imperfection in the apparatus of the General Telephone Company. Are the intervals, perhaps, serving as moments of rest for the batteries which have to work extremely hard and cannot carry on without some time to catch their breath? On the other hand, perhaps maintaining respect for intervals is *de rigeur* for any apparatus of the General Telephone Company."

Rivals

Were other systems superior? The hearings had become so successful that the two original rooms became inadequate to satisfy the demand. More rooms were put aside and *L'Électricité* took this opportunity:

"Some studies on this subject could be undertaken if one of the new opera rooms proposed were to be set aside for this . . . In fact, several telephonic instruments, which deserve a hearing, form part of the foreign exhibits. In taking advantage of the protection of our hospitality and our egalitarian laws, the inventors of these ingenious systems must be treated in a fashion conforming to our national traditions.

"We have in the French section, the Maiche telephone; in the Belgian section, Locht's pantelephone; in the Italian, the Gugliemini; and in the American, the Dobledear telephone, all of these have a right to be experienced."

Reasons, already quoted, had been put forward for the lack of success in relaying plays. *L'Électricité* had its own view:

". . . it is easy to understand without having recourse to the tortuous explanations by certain of our colleagues. Not only do the virtuosi (singers) have an inestimable advantage in launching upon the air rolling runs, which carry more easily than do tiresome tirades, but their acting is not overdone and, when a tenor cries to his companions to fly to the salvation of their country, he takes care not to leave the prompter's box. Which is more than can be said of a juvenile lead (in a play) who really throws himself in front of his enemies, or the villain in a comedy who lurks in the wings before throwing his dagger.

"May we be permitted to sum up our thoughts with a single axiom: an actor on stage cannot at one and the same time concern himself with the audience from whom only the footlights separate him and with the invisible listeners weakly clutching to their ears the telephonic earpieces; one must be sacrificed to the other, for one cannot serve two masters at once."

Plot thickens

The writer ends his piece with this paragraph:

"The General Telephone Company having demonstrated its impotence, then fairness, justice and national honour require us to give its rivals an opportunity to do better. The persistent exclusion of its contemporaries would constitute a gross abuse of power. We doubt that the commission would dare to commit such a strange injustice. In any case this will not happen without our informing the independent Press of the proceedings which we intend to take to further this cause once the new Chamber is assembled. At least one Member will be found to ask M. Cochery to give reasons for his preference in the matter of telephonic apparatus."

The plot thickens — and more is hinted at in the issue dated November 12th.

"The Minister of Posts and Telegraphs has given Deputies the right to attend some telephone hearings free. Monsieur Cochery has evidently yielded to the very legitimate desire to secure the sympathies of those political people on whom he depends, but he has not given a thought to the other side of the coin.

"In the eyes of the Chamber, the telephone does not exist, for in the

102 ▶

Ader

Budget for 1882 there is no specific chapter relating to it."

What is *L'Électricité* hinting at? Was Cochery allowing a company to exploit the new communication without real accountability?

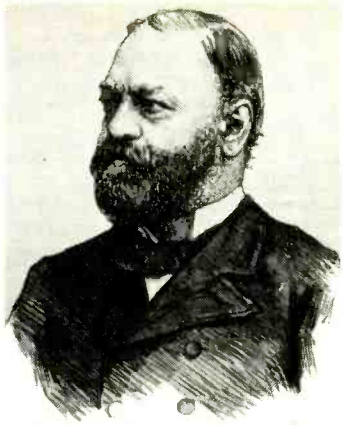
"The receipts accruing to the General Telephone Company are amalgamated —" and here he alludes to another journal apparently equally unhappy about the situation — "the *Intransigent* would say disguised *(dissimulées)* — within the heading of various receipts."

Was the Minister of Posts and Telegraphs attempting some sort of cover-up?

"Despite the promise to enact a special law, the Minister continues strictly to apply our telegraphic laws to telephones.

"Among all those worthies pressing around the rooms where the wonders of M. Ader can be heard, is there not one who, leafing through the Budget on which he must vote, seeks to discover therein the apparatus which M. Cochery demonstrated with such ostentation?

"Must we conclude that M. Cochery finds the pear ripe and ready for picking? Will he finally



M. Cochery, Minister of Posts and Telegraphs

place our Assemblies in a position to choose between two equally unpleasant attitudes, either to confirm by law the "de facto" monopoly granted to the General Telephone Company, or to increase the budget by an honest sum of a few millions which will have to be paid by the subscribers?

"Was not the real practical goal of the Exhibition simply to turn people's minds against the whole area of telegraphy and in favour of new, more generalised developments?"

Was the Minister, with the best intentions, organising a PR campaign to promote what was, after all, a better means of communication but at the same time allowing a monopoly to a Company which used (if *L'Électricité* is to be believed) inferior techniques without confirming their position democratically?

"We therefore entreat the Honourable Deputies and Senators not to let themselves be carried away by demonstrations which would have been more interesting if the administration of the Exhibition (headed by Cochery) had not contrived, *by default*, to ensure a monopoly for an instrument which, despite its qualities, we have no doubts in considering totally inferior."

Strong stuff — but it still continued to report the enthusiasm of the public at the hearings. When the Exhibition was in its last few days it wrote:

". . . . the rooms were thrown open to all-comers for 1.50 francs. Despite the fact that it proved impossible to satisfy all the visitors, there were no noisy scenes" (apparently four days before, one of the rooms had been invaded and had only been evacuated with difficulty) "of people asking for their money back. Nearly three thousand people who had queued for two hours were unable to obtain a place in any of the four rooms. They went away without showing their discontent at having vainly submitted to the tortures of a prolonged wait."

Finalé

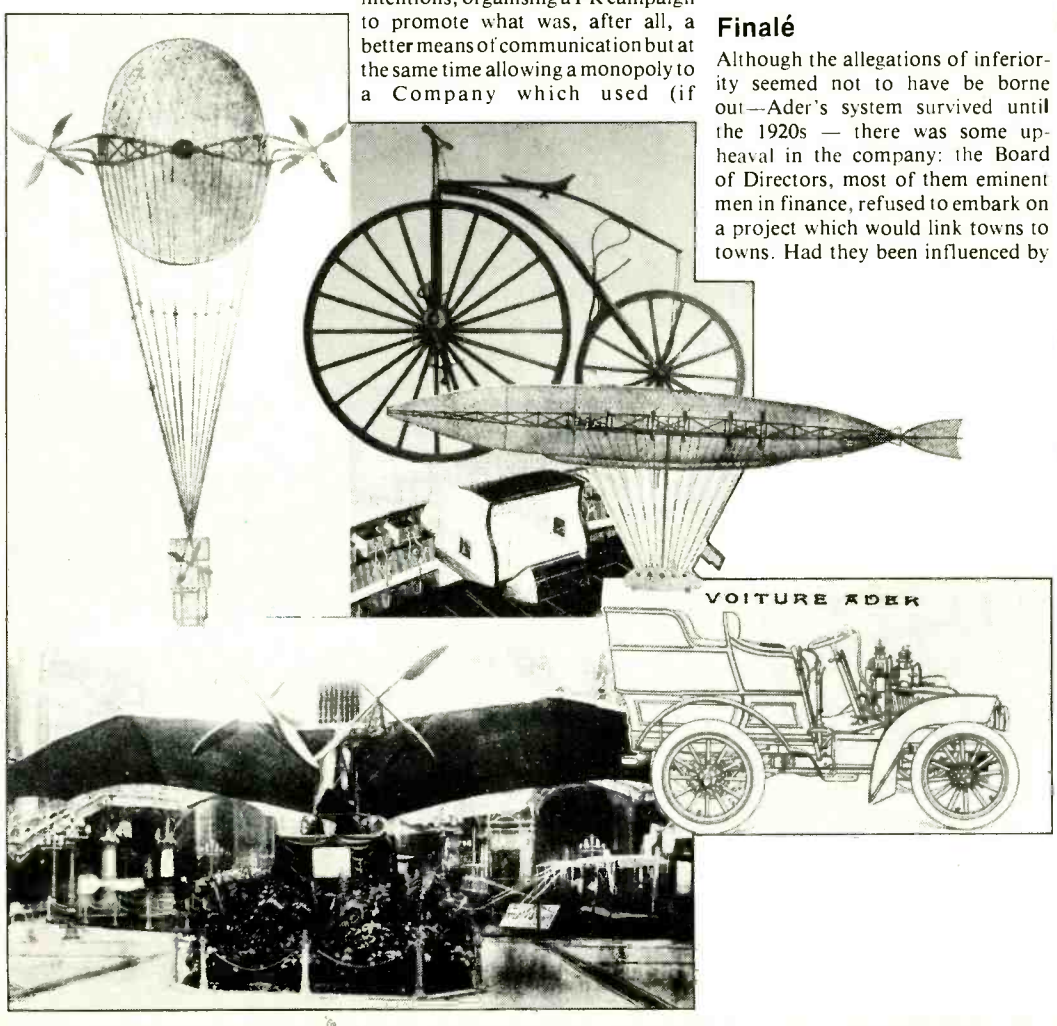
Although the allegations of inferiority seemed not to have be borne out—Ader's system survived until the 1920s — there was some upheaval in the company: the Board of Directors, most of them eminent men in finance, refused to embark on a project which would link towns to towns. Had they been influenced by the remarks made in *L'Électricité* and thus become concerned about the long-term viability of the Company?

The *théâtrophone* idea did catch on, but seemingly in mono only. Ader had left the Company to dedicate himself to aviation. He had been the innovator and as mentioned, the laying of double lines to all subscribers was probably too much to contemplate. A distinguished musician who recently retired from the BBC told me that he remembered hearing the *théâtrophone* in Paris in the 20s at a private house and, although there *were* two earpieces there was no indication of any stereophonic quality.

But, Stereophony *did* first happen in the summer and autumn of 1881 *and* caught the minds and imaginations of ordinary people, music critics, engineers and journalists — as we have seen. Let the last word come from *The Times:*

But here comes the most marvellous thing of all. Behind dark hangings, intended to deaden the sounds outside, Rooms 7 and 8 contain telephones in contact with the Opéra and Théâtre Français. Thus the visitor will be able from the Palace of Industry, to hear Mddle. Krauss or Mddle. Bardet, unless, indeed, they prefer to hear *Hermoza* with one ear and *Phèdre* with the other. I will not say that the voice does not lose some of its qualities in passing through the telephonic wires. Still, it remains distinct and quite recognisable. In such cases, however, all kinds of progress may be expected in the future, and who knows but a few years hence all comfortable houses may not be provided with the means of hearing at the fireside the finest operas, concerts and tragedies, with the additional advantage of being able to exclude the second-rate pieces with a kind of turncock for music and acting, just as they now have a turncock for water and gas!

Times



Acknowledgements

I must record my gratitude to several people who have given help and advice: Keith Geddes of the Science Museum who provided the first French documents and illustrations that hinted that the 1881 demonstrations were rather more than just a curiosity; Charles Gibbs-Smith, whose book on Ader's flying claims is definitive, for his courtesy and interest in my own research; and to two of my colleagues, Paul Hamburger and Peter Sidhom, for their help in translating some of the German and French documents.

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The Param - technical report

MANUFACTURER'S SPECIFICATION
Number of channels: maximum 128 internal memories.
Number of standard equaliser setting memories: maximum 32 internal memories.
Number of total console setting memories: maximum 64 internal memories.
Data crosstalk: – 100dBm computer data to audio.
Computer graphic resolution: 272 x 164 dot matrix.
Video outputs: 75Ω NTSC composite video (BNC)
Set-up time: 300μs one channel; 1.2ms entire console.
Number of filters: six per equaliser channel.
Low filter: shelving ±16dB in 2dB steps, four frequencies.
High filter: shelving ±16dB in 2dB steps, four frequencies.
Mid 1: ±16dB in 4dB steps, 16 frequencies.
Mid 2: ±16dB in 4dB steps, 16 frequencies.
Low cut: 12dB/octave.
High cut: 6dB/octave.
Noise level (20Hz-20kHz) filters flat: < – 96dBm rms; < – 90dB, ±4dB gain in all filters together.
Digital crosstalk: < – 88dBm only during switching, ±4dB gain in all filters together.
Distortion (THD): <0.1% at +24dBm into 600Ω; <0.05% at +20dBm into 600Ω.
Accuracy: boost and cut ±0.5dB; frequencies ±2%; gain ±0.5dB.
Frequency response: ±0.5dB from 20Hz to 20kHz.
Maximum input level: +24dBm.
Maximum output level: +24dBm into 600Ω.
Input impedance: 10kΩ.
Output impedance: unbalanced 5Ω.
Slew rate: 10V/μs.
Central control panel: 230 x 150 x 80mm with soft leather back.
Computer system: 19in rack, 3 units high.
Equaliser: 19in rack 3 units high with up to 16 channels each. Audio cabling via 30-pole connectors.
Power supply: 19in rack, 3 units high.
Monitor: any video monitor with standard video input.

OPTIONS
Long-term storage: (1) Audio tape — 20s for complete internal memories. (2) Floppy disk — 500 console settings.
Spectrum analyser: 10 band octave plus level indication.
Balanced output: 50Ω.
Programmable gain: +2dB, 0dB, – 2dB, – 4dB.
Equaliser grouping: eight groups.
Other: provisions are made for additional automation of send level and panorama in quadraphony.

Manufacturer: Leunig GmbH, Pinner Strasse 7, D-5206 Neunkirchen-Seelscheid 1, West Germany.
Europe: R Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76, West Germany.
UK: EELA Audio Industries Ltd, 13 Molesworth, Hoddesdon, Herts EN11 9PT.
USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, Tenn 37212.

AS THE functions and features of the *Param* equaliser have been described in George Chkiantz's user report (*Studio Sound*, October 1981) my comments in this technical review are restricted to reporting upon measurements. I would, however, remark that I too was very impressed with the standard of construction in both an electronic and a mechanical sense. Throughout the measurements the *Param* was only affected by serious mains power 'splats' and when it was affected no stored information was lost, but the cursor might jump position or the display change. In practice the mains voltage could be dropped from 240V down to 170V before any troubles started.

Inputs and outputs
So far as the audio signals are concerned three multipole connectors each handle four sets of balanced inputs and unbalanced outputs, the gain with the equalisers 'flat' and the outputs unloaded being unity within 0.2dB at 1kHz.

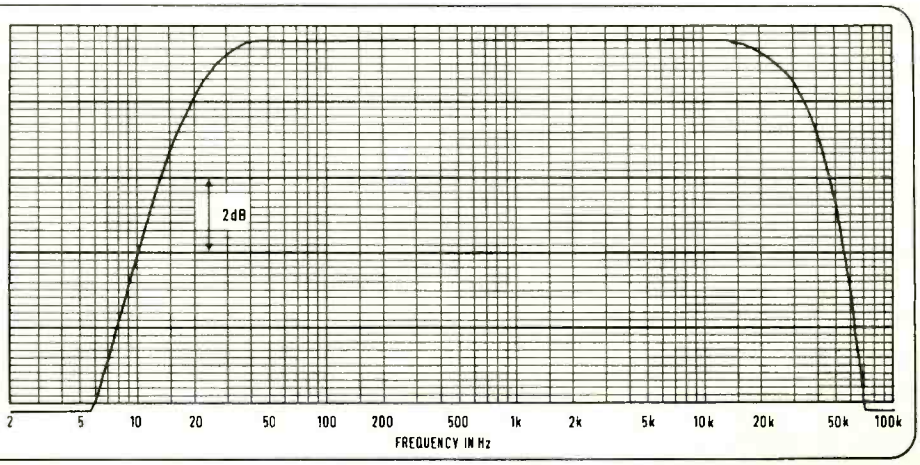
Measurement of the input impedance showed this to be very close to the nominal 10kΩ with the common mode rejection being 60dB up to 5kHz and then falling to 52.5dB at 20kHz. Input overload occured at +23.7dBm at all audio frequencies, however, no indication of input overload was provided, the '?' on the display only relating to post equalisation overload.

On the output end the maximum output at the onset of severe distortion was +23.1dBm loaded into 600Ω or 0.6dB higher into an open circuit with the output impedance being only 5Ω.

The displayed '?' for overload indication was found to occur 1dB below the onset of severe distortion. Operation of the overload detection was very fast, however, if the unit was displaying

106 ▶

FIG.1
PARAM OVERALL FREQUENCY RESPONSE



the channels the overload indication was found to be inoperative.

Examination of the video output showed this to provide a standard 1V video signal plus synchs into 75Ω from a 75Ω source.

The data output to tape provided a 1.5V rectangular peak to peak signal with a maximum frequency of 220Hz with the *Param* transmitting its full content of data in 24s.

Frequency response

The overall frequency response with the equalisers switched out or with them switched in 'flat' is shown in **Fig 1** it being seen that out of band signals are rapidly attenuated.

Fig 2 shows the effect of the fixed low cut and high cut filters, the low cut filter having a 12dB/octave rate of attenuation below 70Hz with the high cut filter operating at 6dB/octave above about 13kHz.

The low and high filters each had eight cut or boost settings shelving in 2dB steps as shown for the high filter in **Fig 3.** In addition the two filters have four selectable frequencies as is also shown for the high filter in **Fig 3.**

Finally the two 'mid' filters are identical providing a range of ±16dB in 2dB steps **(Fig 4)** and not 4dB steps as indicated in the manufacturer's specification. Each filter had 16 selectable frequencies as shown in **Fig 5.**

In operation the changing of filter characteristics was nearly always noise and click free and even if clicks did occur they were at a very low level and would nearly always be inaudible in programme.

Distortion

Both harmonic distortion and intermodulation distortion to the CCIF twin tone method were measured under various combinations of filter and equaliser settings and found to behave as should be expected in relation to equalisation.

Both the second order and third order intermodulation distortion products were below 0.03% with audio frequency signals up to 20kHz.

On the other hand the harmonic distortion (as measured on more than one channel) behaved as shown in **Fig 6** for 10dBm output and did not vary substantially at other output levels. However, as the distortion at high frequencies is only harmonic and not intermodulation distortion, the harmonic distortion situation at high frequencies is not as bad as it would appear at first sight.

Noise

The noise measured at the output with the equalisers 'flat' and in or out of circuit was constant at the levels indicated in **Table 1.**

TABLE 1

Measurement method	Noise
Band limited 22Hz to 22kHz rms	−91.5dBm
A weighted rms	−93.5dBm
CCIR weighted rms ref 1kHz	−88.0dBm
CCIR weighted quasi-peak ref 1kHz	−84.0dBm

108 ▶

FIG. 2
PARAM FIXED HIGH AND LOW CUT FILTERS

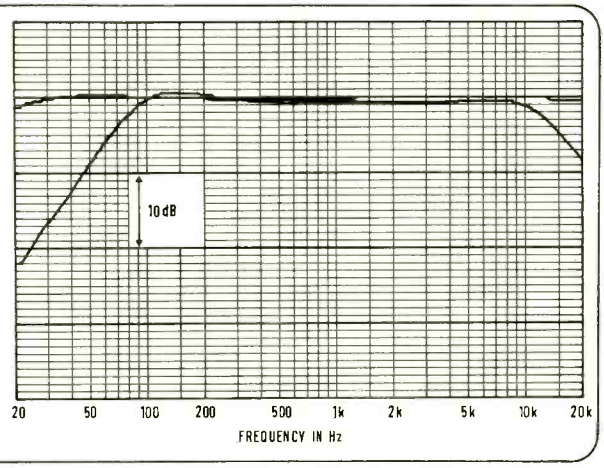
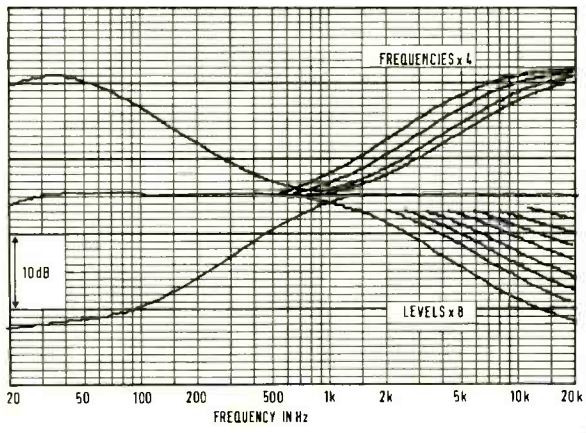


FIG. 3
PARAM HIGH AND LOW EQUALISERS



TRIMIX

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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 La Salle Audio Products Ltd., Montreal. Tel: 514-342-4503

France Lazare Electronics, Paris. Tel: 1-878-62-10

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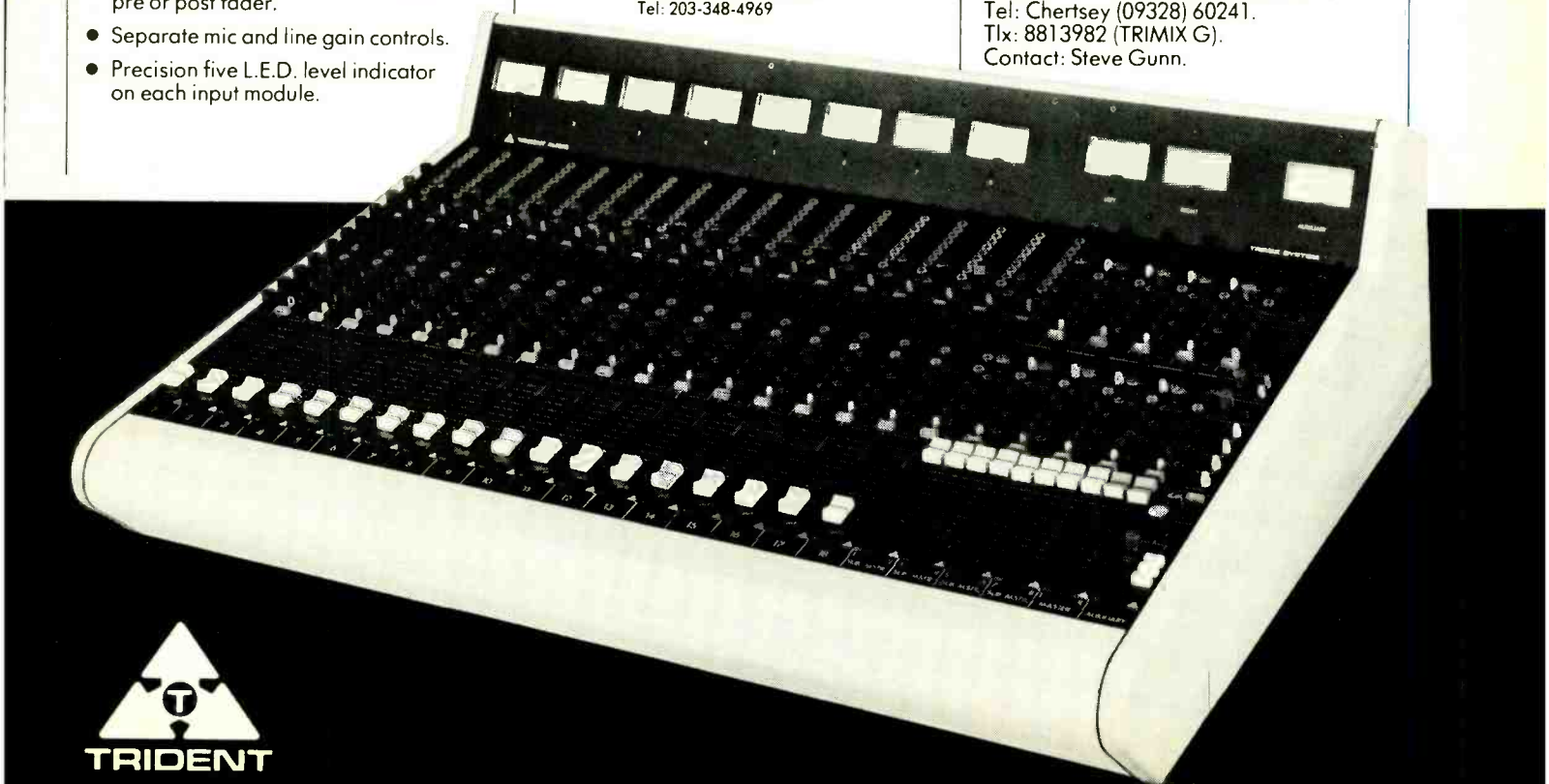
Sweden Stage & Studio, Gothenburg. Tel: 31-22-40-90

Taiwan Linfair Engineering & Trading Ltd., Taipei. Tel: 3214454-7

Trident Audio Developments Ltd.
Shepperton Studio Centre,
Post No. 38, Studios Road,
Shepperton, Middx. TW17 0QD, U.K.
Tel: Chertsey (09328) 60241.
Tlx: 8813982 (TRIMIX G).
Contact: Steve Gunn.



TRIDENT

Excellent earthing arrangements, comprising separate power, chassis and signal grounds, made the unit entirely free from hum problems and the audio outputs were completely free from audible digital crosstalk or any beating of the audio signals with internal digital information.

As is expected in an equaliser the noise levels increased if any equaliser was boosted, but a peculiarity of the *Param* was that noise also increased if equalisers were cut by about the equivalent increase for the same amount of boost.

Summary

With the exception of the high frequency harmonic distortion levels the performance of the *Param* was excellent. As with many microprocessor driven devices there was some leakage of rf interference, but this was at a low level.

Hugh Ford

Postscript

The manufacturer informs us that in current production the overload indication is also operative on input overload. In addition the high frequency distortion performance will be improved in future production, the cause of distortion being the type of diode used in the overload protection circuit.

FIG.4
PARAM MID EQUALISERS – LEVEL SELECTION

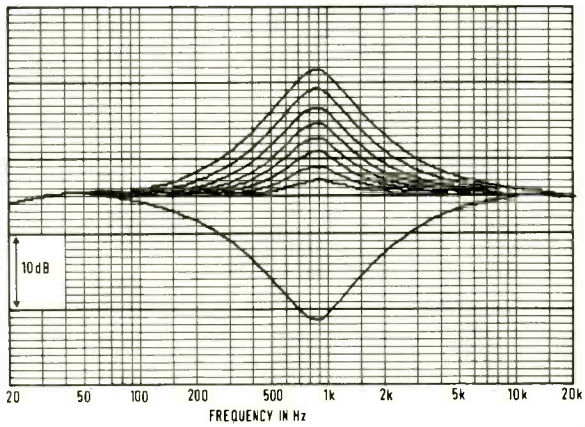


FIG.5
PARAM MID EQUALISERS FREQUENCY SELECTION AT MAX BOOST

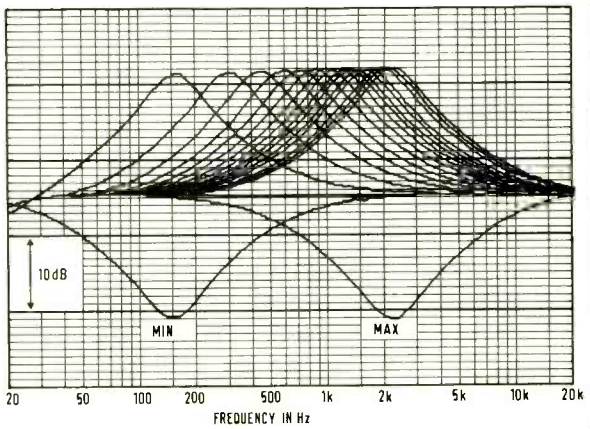
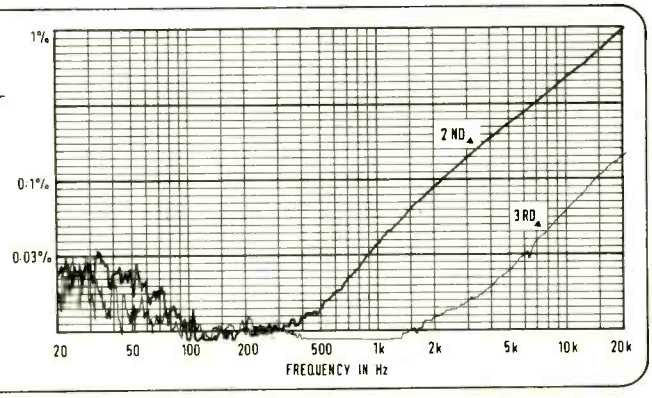


FIG.6
PARAM HARMONIC DISTORTION AT +10dBm OUTPUT EQ IN AND FLAT



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Amcron

Lexicon PCM 41

MANUFACTURER'S SPECIFICATION
Total distortion and noise: 0.04% typical; 0.7% max at 1kHz, 'Delay/Delay Multiply' x 1; 0.1% typical over bandpass of 20Hz to 15kHz.
Frequency response: 20Hz to 15kHz, +0, −1dB in x1 mode; 10Hz to 16kHz, +0, −3dB in x1 mode; 20Hz to 6kHz, +0, −3dB in x2 mode.
Dynamic range: >90dB, 20Hz to 20kHz bandwidth.
Delay capacity: x1 mode, 200ms at full bandwidth, 400ms at 6kHz bandwidth; x2 mode, 400ms at full bandwidth, 800ms at 6kHz bandwidth.
Delay selection: 11 pushbutton selected taps, each tap continuously variable over a 4:1 range via the 'Delay Multiply' control. Taps are at 0, 0.8, 1.6, 2.4, 4, 7, 12, 26, 50, 100 and 200ms in x1 mode (double these in x2 mode).
VCO modulation: depth adjustable from 0 to a 4:1 sweep of delay time; rate adjustable from 0.1 to 10Hz. An LED flashes to indicate the VCO modulation rate.
VCO shape: continuously adjustable between sine-wave and envelope, or squarewave and envelope functions.
Power requirements: 115 or 230Vac (selectable), 50 or 60Hz, 20W max. Standard IEC power connector on rear of unit; 3-prong cord provided.
Dimensions: standard 19in relay rack-mount (483mm), 1¾in high (44mm), 11in deep (280mm).
Weight: 5.5lb (2.5kg).
Manufacturer: Lexicon Inc, 60 Turner Street, Waltham, Massachusetts 02154, USA.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.

THE *PCM-41* comes ready for mounting in a standard rack, or may be used free-standing. It offers up to 400ms digital delay at full bandwidth (−3dB at 16kHz) or a maximum of 800ms with reduced bandwidth (−3dB at 6kHz). Mains operating voltage is selected (115/240Vac) by means of an internal switch, the mains lead being detachable and connecting via IEC 3-pin plug and socket.

All external connections are made on the rear panel, the majority of controls set in functional groups on the front panel. Installation and use presented no problems, and the user instructions were well-written and informative. The *PCM-41* was very easy to use, and once patched into the test situation required minimal familiarisation before creative use of its facilities was explored.

Construction
The unit is ruggedly constructed, the entire internal area taken up with a single pcb. LED displays on the front panel are set on vertically-mounted small pcbs. All but one of the integrated circuits used are mounted in sockets, including the regulator devices, but the few discrete transistors are directly soldered in position. Each component is clearly identified on the board, and even the fuse data is screened onto the board — fuses are 5 × 20mm pcb-mounted types. In general, the components had been well dressed, although some had risen from position prior to wave-soldering. A number of assembly defects were noted, some of them considered to be serious. It is felt that the unit is worthy of better on-line inspection and more rigorous final inspection. Among the major defects noted:

- one small electrolytic capacitor (C160) dry-jointed;
- pellets of solder and pieces of cropped component leads loose in the cabinet or adhering to the pcb, with consequent danger of shorting;
- IC U61 had pins visibly shorted by incomplete and faulty cropping and there were other instances where incomplete removal of cropped leads and pins had caused them to bend, perilously close to each other or adjacent tracks;
- some leads appeared to have been cropped after soldering; this practice leads to the formation of crystallised joints and eventual mechanical failure and should be avoided unless the solder joint is reflowed.

The unit was noted not to comply to European or UK standards of electrical safety (IEC 65; BS 415: 1979) but this was principally a matter of lacking the necessary external markings and warnings to the user. An interwound mains transformer is fitted, its screen directly connected to mains earth. User-safety relies on the mains earth connection being made, and the appropriate warnings were absent on the cabinet or instructions.

All on-board presets had been mechanically locked, and the IEC mains input socket incorporated a delta-type filter.

Ins and outs
Audio signals are input via a standard jack socket to a balanced differential circuit; a nice feature is that balanced lines are accommodated with a tip-ring-sleeve plug and unbalanced lines if a tip-sleeve plug is inserted. The nominal 0dBM sensitivity of the input may be increased by 20dB using an adjacent latching pushbutton, and this would suit most low-level outputs from electrical musical instruments or domestic audio equipment.

Two audio outputs are provided, both unbalanced jack sockets; the main output has a level

112 ▶

ASHLY

From the Ashly range of rack-mounting studio effects units, the SC-50 (mono) and SC-55 (stereo) Peak Limiter/Compressors give you positive control of all limiting characteristics. The extra low noise and distortion spec is compatible with your best mixing console. The Ashly SC series units are designed and constructed for efficiency and reliability.

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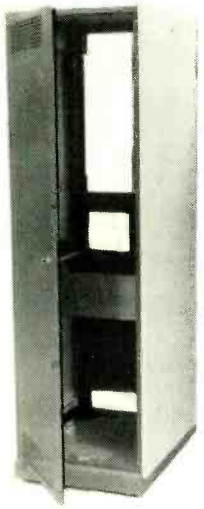

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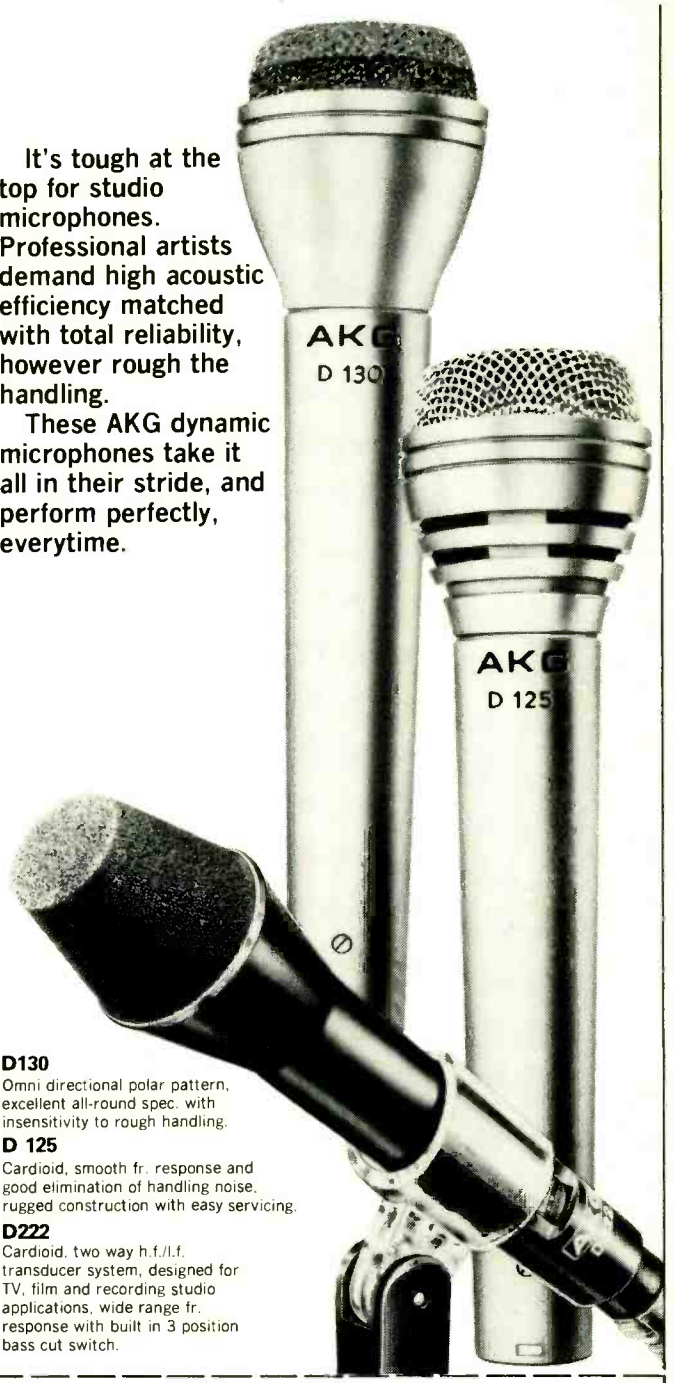

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noise from a track, or to increase dynamic range. The front panel has five continuously variable pots, two switches and a 'thermometer-type' display of 13 red LEDs to indicate the amount of attenuation. A 3-position switch selects the control source for the unit; this may be derived from the 'key' input or the main signal. The third position of this 'mode' switch disables the control circuits, effectively bypassing the unit. The release time is adjustable from 0.4 to 10s, and the attack time from 0.02 to 20ms. The expansion ratio is variable from 1:1 to 100:1 and the threshold of operation from +20dBV to −40dBV. A range control sets the amount of gain reduction applied in the absence of a control signal, thus limiting the range over which the expander can work. This is due to the fact that expansion is limited to unity gain. An extremely good feature is that the release time of the machine can be switched to follow a linear or a logarithmic curve. The latter is an unusual option and turns out to be very useful in many applications.

The usefulness of a noise gate is ultimately determined by the minimum attack time: if it is too slow, the starting transient of the wanted signal may be distorted or lost. I found the *Kepex II* fast enough for many applications, and found that several interesting sounds could be created on drums and vocals, especially if accompanied by judicious juggling of the ratio and range controls. By using slower attack times, unwanted sounds such as breath noises on vocals could be removed. This worked well, although the resulting sound can feel unnatural. Using the external control 'key' mode, and keying from a lead track, very effectively tidied up some rather scrappy double tracking. This technique could also be used to some extent to tighten up other aspects of a recording.

I must admit that I have never found expanders very useful devices as I usually find it very difficult to relate the action of the controls to what I am trying to achieve. I did find, however, that the *Kepex II* controls were easier to use than the average, but unfortunately I could hear clicks occurring during expansion. This effect, though much less offensive than with the earlier model, appears to relate to the operation of the LED display. This was such a well-known effect on the original *Kepex* that I am rather surprised that Valley People have not yet got round to fully resolving it. The noise could sometimes be diminished by increasing the release time, but this also disposed of the intended effect. I found that, in the expansion mode, this unit could only be used really successfully over a restricted range and with low ratios.

Gain Brain II

The *Gain Brain II* is similar to the *Kepex II* in style and has a very similar front panel layout. Five rotary controls and two toggle switches control the device, and another LED bargraph monitors what is going on. The *Gain Brain II* is a limiter/compressor which is complementary to the *Kepex II*. Release times are variable from 0.5 to 5s; attack from 0.2 to 200ms. The threshold is adjustable from +20 to −40dBV, as with the *Kepex II*. Compression ratios are variable from 1.3:1 to better than 20:1, with a 50:1 fixed ratio in the 'ducking' mode. A range control is provided to make up the gain lost by the compression process; this control is also used to adjust the amount of gain reduction applied when used in the ducking mode. As with the *Kepex II*, the release time can be made to follow a linear or logarithmic curve and control can be derived internally or from an external input, or switched off to bypass the unit. This last is not as useful as it could be, because make-up gain is still retained. This is required because the device essentially reduces gain from unity. Now, if the input signal is limited at, say, a 10:1 ratio, at a threshold of −10dB, the overall level returned to the desk must be made up with the use of the unit's gain control; this added gain is still present when the mode switch is set to 'out'. A direct comparison of the quality of the sound with and without compression is thus difficult, as a large gain difference exists between the two. This is all the more a pity as, when the mode switch is set to 'out', the gain returns to maximum, following the release envelope. This would have been a very useful feature.

In use the *Gain Brain II* proved to be an excellent device, and I spent many happy hours using it on all kinds of source material. I found that the compression ratio that was required was often less than I would normally use (calibration?) —otherwise the device appeared to over-limit. However, this was never difficult to get out of, and could indeed be used to good effect on certain sounds. Another slight problem was that the attack and release controls interacted at the extreme ends of their range, so that if a very fast release was used, lengthening the attack would also lengthen the release. However, apart from these minor grumbles, I enjoyed using this device very much, finding it particularly useful on vocals and percussive sources. The range of the controls is well chosen: they are not too critical to adjust, but there are no large areas where nothing much happens. The fact that the device may be used beyond the 'safe areas' makes it interesting to experiment with. Once again the provision of logarithmic release proved a very interesting option, which was often very useful.

Comments

Both the above devices use the Valley People *EGC 101* voltage controlled amplifier as a control device. This VCA is well known in the console automation field where it has shown high quality and reliability. It works faultlessly in these modules and both units have a very 'transparent' quality; indeed, no degradation of signal was at all apparent. Control of the VCA seemed very well achieved, and it appeared that rejection of the control waveforms in the VCA was excellent, so that the texture of the sound was not substantially altered during compression. It is not so easy to judge this in the case of the *Kepex II*, due to the clicks mentioned above.

A feature that was notable by its absence, in both devices, was the lack of a front panel stereo coupling switch. Although coupling via the rack backplane may be possible, it should surely be more accessible. While on the subject of controls, however, it is notable that all of them may be remotely controlled, as they handle dc only. Indeed, this may be a good idea, as the screen-printing on the front panels shows a tendency to rub off!

George Chkiantz

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Valley People Kepex II

Valley People Gain Brain II

MANUFACTURER'S SPECIFICATIONS
KEPEX II
Max input level: + 21dBV, electronically balanced 50kΩ.
Max Key input level: + 21dBV, electronically balanced 50kΩ.
Max output level: + 21dBV into 2kΩ or higher, unbalanced.
Frequency range: 5Hz to 100kHz, – 3dB.
Slew rate: 13V/μs (150kHz full power bandwidth).
Distortion (static, + 10dBV input): 0.05% max IMD or THD.
S/N ratio (20Hz to 20kHz): 105dB, ref + 21dBV, signal full on.
Gain reduction range: variable 0 to 80dB.
Threshold: variable —40dBV to + 20dBV.
Expansion ratio: variable 1:1.1 to 1:100.
Attack time (for 20dB gain increase): variable 0.02 to 20ms.
Release time (for 20dB gain decrease): variable 0.04 to 10s.
Release shape: switchable linear or logarithmic.
Input mode: switchable, In/Out/Key.
Gain reduction indication: 0 to 50dB on 13 element LED display.
Stereo intercouple: via rear connector.
External VCA control inputs: two, – 20dB/V, at 4.99kΩ.
Power requirements: bipolar 15V, 85mA.
Dimensions: 1½ × 5¼ in, fits *TR 804* rack.
Additional features: drive for external VCA or meter; master 'Out' buss; unbalanced input monitor output; full remote voltage control of all parameters; monitor output of all parameter control voltages; and electronic switching of internal/external parameter control.

GAIN BRAIN II
Max input level: + 27dBV, electronically balanced 50kΩ.
Max output level: + 21dBV into 2kΩ or higher, 47Ω output impedance.
Frequency range: 5Hz to 100kHz, – 3dB.
Slew rate: 13V/μs (150kHz full power bandwidth).
Distortion (static, + 10dBV input): 0.01% max IMD or 1kHz THD.
S/N ratio (rms signal to rms noise, 20Hz to 20kHz): 112dB (+ 21dBV in/out); 95dB (+ 4dBV in/out); 85dB (– 16dBV in, + 4dBV out).
Gain reduction range: >50dB.
Threshold: variable – 40dBV to + 20dBV.
Ratio: variable 1.3:1 to ∞ :1.
Ducking ratio: 1: – 50.
Ducking range: active attenuation variable 0 to – 48dB.
Attack time: variable 200μs to 200ms/20dB.
Release time: variable 50ms to 5s/20dB.
Release shape: selectable linear or logarithmic.
Output gain: variable 0 to + 48dB; 0dB in Ducking mode.
Gain reduction indication: 0 to 50dB on 13 element LED display.
Input mode switch: in (normal)/Key (sidechain)/Out.
Stereo intercouple: via rear connector.
External VCA control inputs: two, – 20dB/V, at 4.99kΩ.
Power requirements: bipolar 15V, 100mA.
Dimensions: 1½ × 5¼ in, fits *TR 804* rack.
Additional features: drive for external VCA or meter; master 'Out' buss; unbalanced input monitor output; and balanced, + 27dBV, 50kΩ, sidechain input.

TR 804
Free-standing portable rack mount unit designed to house and power up to four *Kepex II* or *Gain Brain II* units. The *TR 804 PR* includes a power supply, while the *TR804 UR* is unpowered. The latter is for applications where eight units are housed in a standard 19in rack, this second mini-rack receiving its power from the first powered mini-rack. The *TR 804* is convertible for standard 19in rack mounting with a rack mounting kit. Audio connection is via back panel mounted barrier strips. Back panel hinges down to access card accessory connections.
Power supply: ac power, 95 to 125Vac or 190 to 250Vac, 50/60Hz; dc power, bipolar 15V (±3% line, + 1% load); current capacity 0.8A.
Operating temperature: 0 to 70°C.
Dimensions: 8½ × 5¼ × 11½ in.
Weight: 6lb.
Manufacturer: Valley People Inc, PO Box 40306, 2820 Erica Place, Nashville, Tennessee 37204, USA.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.

EARLIER versions of these two devices are already quite well known in recording studios, indeed the trade-name *Kepex* has almost become synonymous with the term noise gate. The new versions are manufactured by Valley People, a company formed by a merger of the original manufacturers, Allison, with Valley Audio. The devices submitted for review were mounted in a 'mini-rack' some 8½ x 5¼ x 11½in (whd) in size, with an integral power supply and barrier strip connectors on the back: these *TR804* racks may be mounted singly, or in pairs side by side, in a standard 19in frame, with the addition of rack-mounting 'ears' (supplied). The unit was supplied with a 3-pin American mains plug, US colour-coded lead (what is the 'color' of death?) and no obvious statement as to the required supply voltage, although a sticker was eventually found behind the back panel indicating that the device was intended for 240V. Two *Kepex II* units and two *Gain Brain IIs* were mounted in this rack.

Kepex II
The *Kepex II* is a noise gate/expander which may be used either to gate out unwanted sounds or

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control potentiometer adjacent, the direct output has a fixed level and provides only delayed signal.

Three remaining jack sockets allow remote operation of some facilities. The 'bypass' socket does just that; 'repeat' allows segments stored in the digital memory to be continuously output; and 'VCO' allows remote sweeping of the VCO over a 4:1 range to vary the actual delay. It should be noted that the 'repeat' facility, with the possibilities of 'overdubbing repeats' using front-panel controlled regeneration is only accessible via this remote jack, there being no front-panel switch.

Controls, functions, delays

Audio input levels are indicated by a vertical array of five LEDs, scaled in 6dB steps below 0dB, the clipping point of the A/D converter. In use, optimum results were achieved allowing the red 0dB LED to flash on occasional peaks, the average indication being −12 to −6dB. Gain is adjusted using a rotary level control, once the range has been set using the sensitivity switch by the input socket at the rear. It was not found possible to deliberately overload the analogue/audio input circuit so as to induce distortion for certain special effects without causing the A/D converter to clip and produce aliasing distortion.

Fixed delay taps are selected in an 'up-down' fashion using two momentary-action push-buttons, and indicated on an array of 11 LEDs. The fixed delays may be varied over a 4:1 range by a rotary 'Delay Multiply' control, scaled 0.5x to 2x the indicated delay, or the delay may be swept using the VCO remote facility. A latching pushbutton selects the longer range of delays (0 to 800ms), its use indicated by a 'x2' reminder LED close to the delay array.

A group of three rotary controls are used to operate the VCO. 'Rate' from 0.1 to 10Hz and visually indicated by a flashing LED; 'Waveform' continuously variable from sine to squarewave with an envelope-following function located by a detent at the midpoint; and 'Depth' allowing manual sweeping over a 4:1 range and disabling the VCO function when fully retarded to the '0' position.

The output mix rotary control adjusts the levels of direct source and delayed signals fed to the main output. A central setting mixes the two equally, extreme settings giving wholly source or wholly delayed signals. A phase inversion switch is provided on the delayed signal prior to output mixing.

Signals from the D/A converter may be regenerated and mixed back with the input signals in analogue form using a feedback control. Low and highpass filters may be used to modify the feedback signal, selected by latching pushbuttons, and a further button phase-inverts the feedback signal, adding to the range of effects.

A nice feature of the unit is that at power-on, it sets itself up in the zero-delay state, the '0ms' LED in the delay array being illuminated.

Using the effects

All the usual effects, echo, reverb, flanging, negative flanging, slapback, ADT, Aliens and Drainpipes were easy to set up and the majority of effects were easy to relocate on subsequent occasions.

Use of the envelope-following facility of the VCO produced some weird instrumental effects and tragi-comic depressed-sounding entities when voice was processed. It was noticed that very small adjustments of the VCO 'Rate' control (especially between the one o'clock and three o'clock positions could have startling changes on many types of effect, so that some patience was needed to get the correct settings to return to a particular effect.

The *PCM-41* is certainly a versatile unit, but appears to suffer from two unpleasant vices. Firstly, anti-aliasing of the input A/D converter leaves a lot to be desired, and this becomes painfully obvious if the 'Delay Multiply' control is advanced much beyond the x1 position. Aliasing distortion is really most unpleasant, and quite horrendous levels become evident in the output audio signal.

Secondly, the audio bandwidth is perceptibly restricted, even on the shorter range of delays. Attempts to effect some remedy by touches of eq to the signal prior to the *PCM-41* had little effect or brought on aliasing distortion, even when input levels were reduced to allow more headroom. In the 'x2' range of longer delays, bandwidth is obviously restricted, as is to be expected in this type of equipment and current techniques, but this restriction was felt to be reasonable in view of the fact that longer delays tend to be used for echo and reverb effects, and the restricted hf assists the effect to sound more natural. On the shorter delays, the hf restriction is characterised by a 'dullness', a rather 'wooden' effect like that produced by misaligned Dolby-B circuits or level mismatches in domestic cassette recording equipment.

Unexpectedly, this 'dulling' of the audio proved very useful in Haas-effect processing of mono material into pseudo-stereo, where the change in frequency response of the delayed signal assisted the processing and even allowed reasonable separation of drum kit components, as well as making a convincing wide spread of voices in chorus. Thanks to the *PCM-41*, I can now enjoy quite stunning pseudo-stereo from several 'old favourites' in my collection of 45 rpm mono singles (I am now convinced that Phil Spector was misled; the Ronettes and Crystals never sounded better to me).

It is possible to interconnect two *PCM-41* units to produce additional effects, longer delays, 'tape-phasing' (with actual null-points to get that stomach-churning 'inside-out' effect) and control of unwanted reverb in the live performance situation.

Summary

The Lexicon *PCM-41* Digital Delay Processor should prove to be a useful tool in generating a range of effects in any studio or in live performance. Intending purchasers are recommended to audition the unit carefully, to see if its range of facilities outweighs the problems of bandwidth restriction and aliasing distortion which were identified as areas of doubtful performance.

The manufacturers should certainly improve their quality assurance procedures to reduce the number of assembly defects to more acceptable levels.

Peter Carbines

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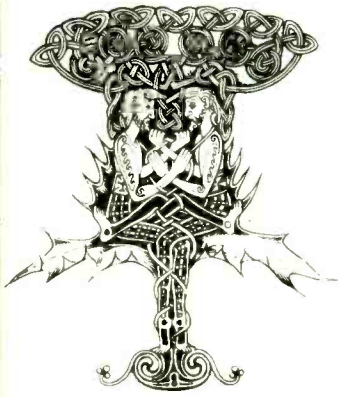

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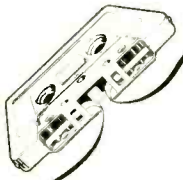

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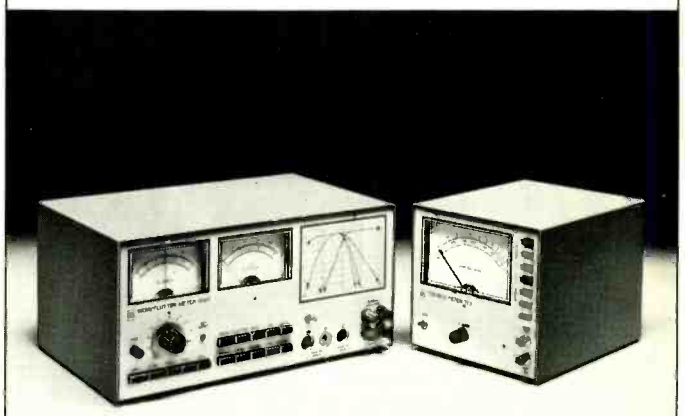

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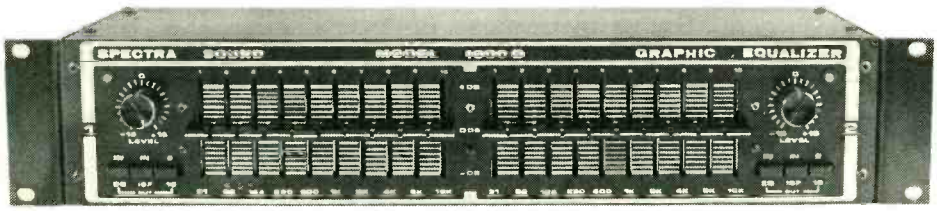
Spectra Sound 1000B equaliser



MANUFACTURER'S SPECIFICATION
Circuitry: low noise, wide bandwidth, high slew rate technology using gyrator synthesised inductors.
Frequency response: 20Hz to 20kHz ±0.5dB at +18dBm (controls flat).
Control range: ±8dB or ±16dB (cut/boost) each band.
Level control: – 15dB through unity to + 15dB.
Overload indication: dual colour LED indicates red 2dB before clipping.
Distortion: unmeasurable THD <0.0018%, IM <0.0018% 20Hz to 20kHz + 18dBm.
Crosstalk: 116dB at + 18dB, 1kHz, unity gain, either channel driven. 93dB at + 18dB, 20kHz, unity gain, either channel driven.
Input impedance: unbalanced 100kΩ, balanced 10kΩ bridging.
Output impedance: less than 1Ω, typically 0.3Ω.
Output level: +18dBm continuous sinewave output power.
S/N ratio: 104dB below +4dBV, 118dB below +18dBV unweighted, 20kHz bandwidth.
Connections: unbalanced input and output, ¼in phone jack. Balanced input and output *XLR* connector.
Power requirement: 100/125Vac 50 to 60Hz 10W maximum, 220/240Vac version available.
Dimensions: (whd) 19 × 3½ × 8¼in (482 × 8.9 × 208.2mm).
Net weight: 6¼lb (2.83 kg).
Shipping weight: 7¾lb (3.5 kg).
Manufacturer: Spectra Sound, 3750 Airport Road, Ogden, Utah 84403, USA.

THE Spectra Sound *Model 1000B* equaliser consists of effectively two separate 10-band equalisers in a chassis designed for mounting into a 19in rack occupying two units of rack height.

One set of equaliser controls is situated on the left half of the front panel and the second equaliser's control on the right half with the extremities of the panel having the level potentiometers, three pushbutton switches and a dual colour LED indicator. The latter is normally green until the clipping level of the equaliser sections is approached when it turns to red, however the overload indication does not appear if the input stages are overloaded in either the normal or the bypass mode.

One of the three pushbutton switches selects the normal or bypass modes with the latter connecting directly the unbalanced input and output but leaving the balanced input buffer when the balanced input is used and the balanced output amp when the balanced output is used. A second switch puts a 20Hz highpass filter in circuit within the equaliser section with the third switch controlling the boost/cut range of the equalisers which can be either ±8dB or ±16dB—a most sensible idea.

To the rear of the unit the unbalanced connections take the form of ¼in, 2-pole jack sockets with the input socket automatically disconnecting the balanced input when the jack connector is inserted. The balanced input and the balanced output (which is permanently available) are wired to *XLR-3* connectors the ground pin of which is connected to the chassis.

Remaining at the rear are the fixed power lead with its properly identified Imperial size fuse, and the power on/off switch in the form of a miniature toggle switch. The latter is unsatisfactory as the clearance between parts connected to the mains and those connected to the chassis is inadequate to meet British safety standards.

Within the unit the base is covered with a mother board which includes the single power transformer feeding two separate rectifiers and stabilised supplies, one for each equaliser, thus reducing crosstalk. Two separate boards for each equaliser support the electronics with a further board being used for mounting the equaliser sliders. The standard of wiring and soldering was found to be excellent and the board layouts uncluttered and tidy. However, no component identifications are provided and the review sample was not accompanied by any servicing information.

Inputs and outputs

Measurements on the balanced input showed this to have an input impedance of 39.6kΩ which remained constant with the gain setting, the maximum input level being 9.2V (+21.5dBm) at the onset of input clipping with the common mode rejection ratio remaining at −75dB throughout the audio frequency band.

The unbalanced input was found to have an input impedance of 49.7kΩ with the same level handling capability as the balanced input. The overall gain from the balanced input to the output was found to be +6.5dB at the mid point of the gain controls which had a range of ±13dB about this point, the unbalanced input having 6.5dB less gain than the balanced input.

The balanced output had a very low impedance of only 0.3Ω capable of driving +25dBm into 600Ω at the onset of clipping with the unbalanced output having an impedance of 2.2Ω and being capable of providing +21dBm.

Whilst the overload indicators do not work in the case of input overload they became illuminated at 1.5dB below the onset of output clipping and gave an adequate visual warning of

120 ▶

FIG.1
SPECTRA SOUND 1000B
OVERALL FREQUENCY RESPONSE

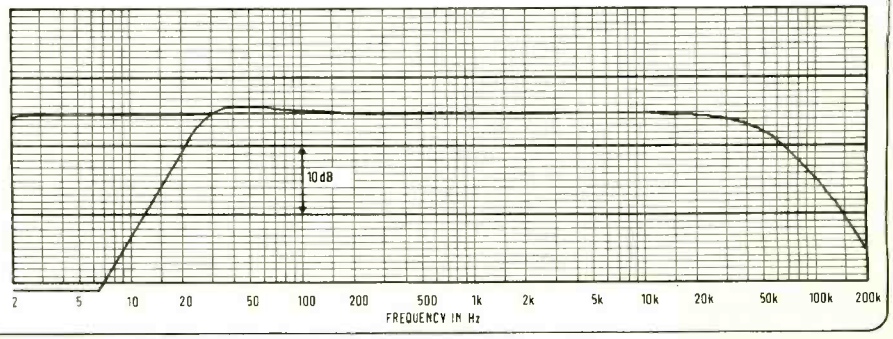


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TABLE 1	
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A-weighted rms	– 94dBm(A)
CCIR-weighted rms ref 1kHz	– 85dBm
CCIR-weighted quasi-peak ref 1kHz	– 81dBm

clipping exceeding 5ms duration. They would, however, be more useful if there was a hold time to improve visibility.

Frequency response and noise

The overall frequency response from the balanced input to the balanced output with the equalisers at their detented mid position is shown in **Fig 1** as is the response of the switched highpass filter. In the flat position the response was extremely flat with the highpass filter offering a 12dB/octave attenuation below the – 3dB point at just over 20Hz.

A typical frequency response curve for the 1kHz equaliser is shown in **Fig 2** for the extreme cut and boost at the ±16dB setting with the actual ranges being slightly in excess of the nominal figures.

All 10 equalisers from 31Hz to 16kHz exhibited similar curves, with **Fig 3** showing the cumulative effect of the equalisers and a curve for a typical practical setting. In practice the individual equalisers were silent and smooth in action as were the gain controls.

Noise at the outputs behaved as it should in relation to the equaliser settings and gain settings, however, the hum level in the outputs varied substantially with the ±8dB or ±16dB range settings.

With the range set to ±8dB and the gain set to the zero calibration (6.5dB gain using the balanced connections) noise at the output was good as shown in **Table 1.**

Setting the equaliser ranges to ±16dB produced hum at an objectionable level in both channels, being —61 to —63dBm at 150Hz and —67 to —70dBm at 250Hz.

Distortion

Measuring the second and third harmonic distortion at +18dBm output produced **Fig 4** which shows a very low level of distortion which is mainly the residual of the instrumentation at below 0.01%.

Similarly measurement of the twin tone IM distortion to the CCIF method showed this to be excellent at less than 0.01% from 20Hz to 40kHz at any output level below clipping.

Other matters

Crosstalk between the two channels with one channel driving +18dBm was excellent as shown in **Fig 5.** Tone burst testing showed the equalisers to completely lack any unwarranted ringing and provided care was taken with the input and output connections the unit was completely stable.

Summary

This Spectra Sound equaliser is a unit compatible with both professional and semi-professional signal levels and offers a very good distortion performance.

Overall the performance was good, with the sole exception of the hum problem: this is probably a simple matter for the manufacturer to rectify, as is changing the type of power on/off switch.

Hugh Ford

FIG. 2
SPECTRA SOUND 1000B
FREQUENCY RESPONSE
FOR 1kHz EQ

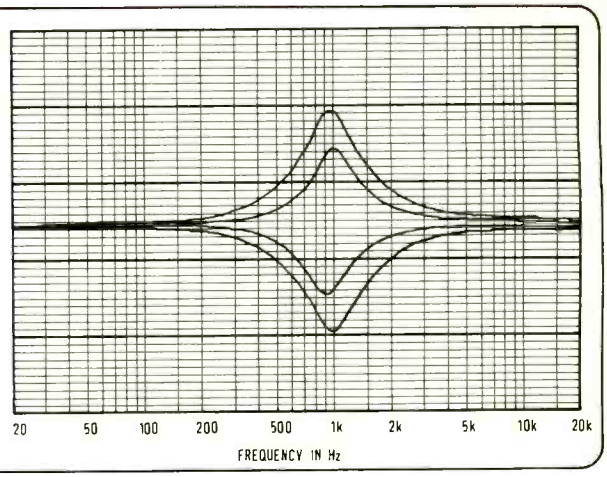


FIG. 3
SPECTRA SOUND 1000B
CUMULATIVE EFFECT OF
EQs AND TYPICAL
PRACTICAL SETTING

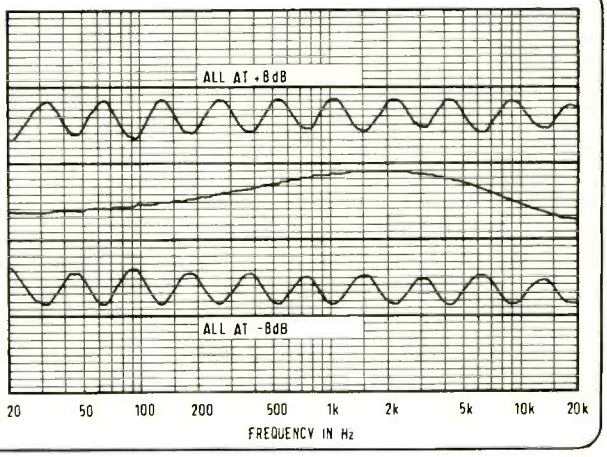


FIG. 4
SPECTRA SOUND 1000B
HARMONIC DISTORTION
AT +18dBm OUTPUT

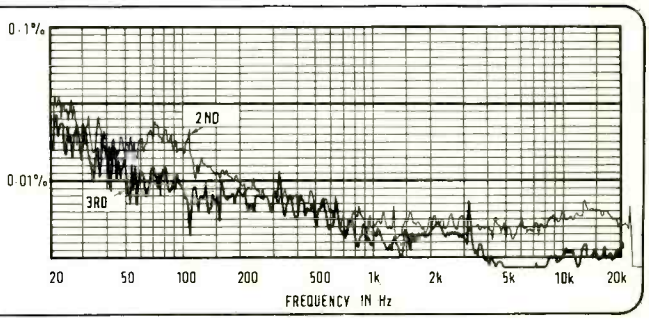
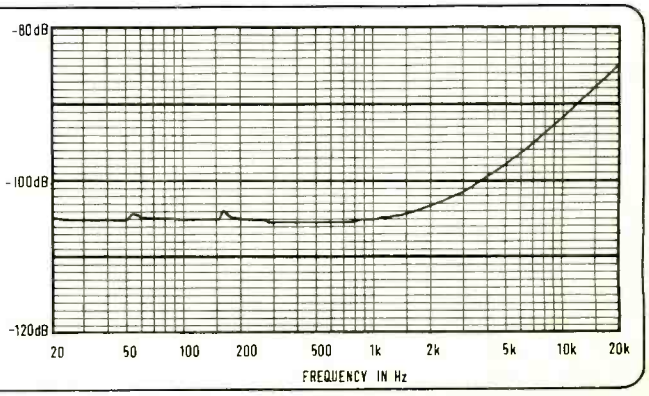


FIG. 5
SPECTRA SOUND 1000B
CROSSTALK WITH ONE
CHANNEL DRIVING +18dBm



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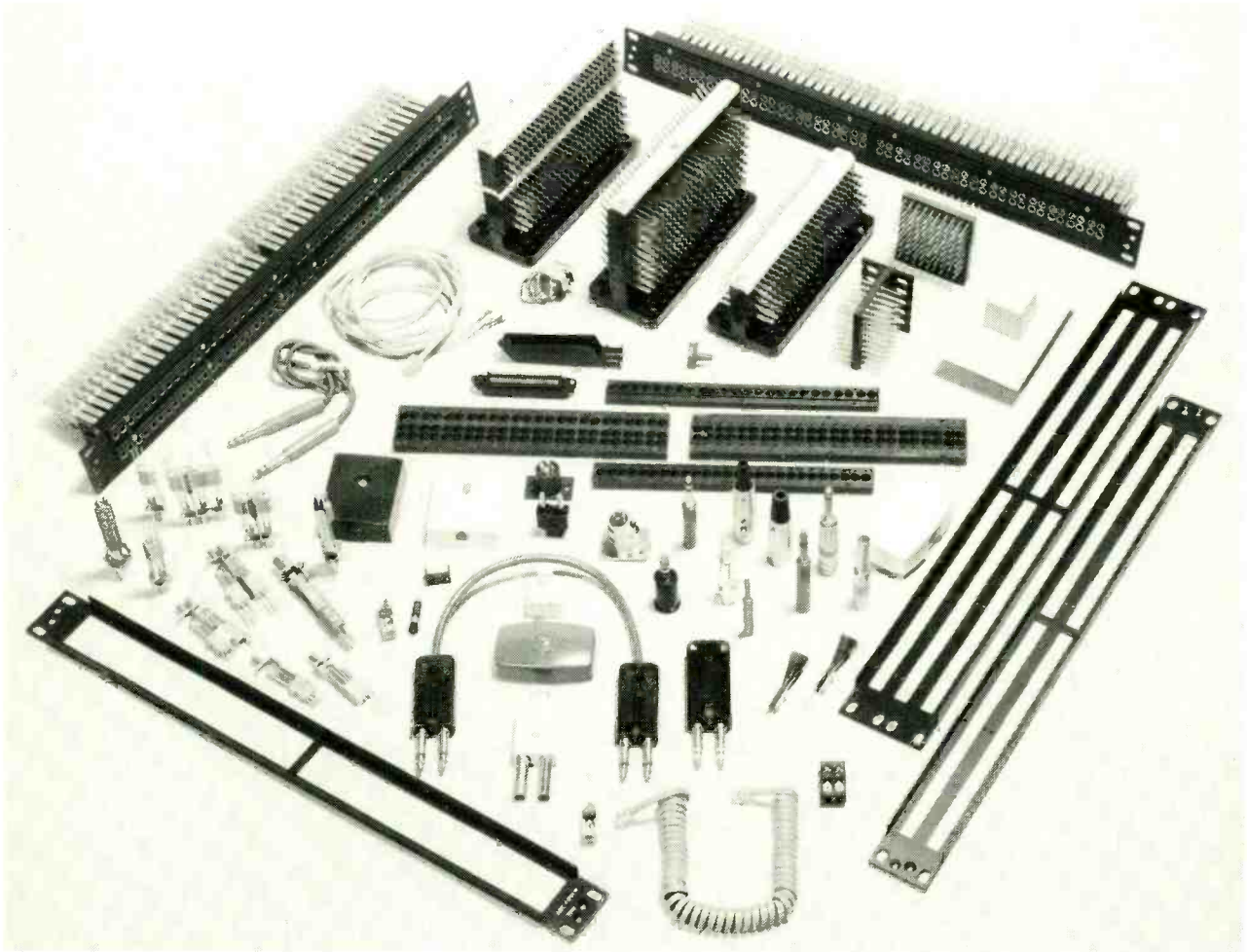

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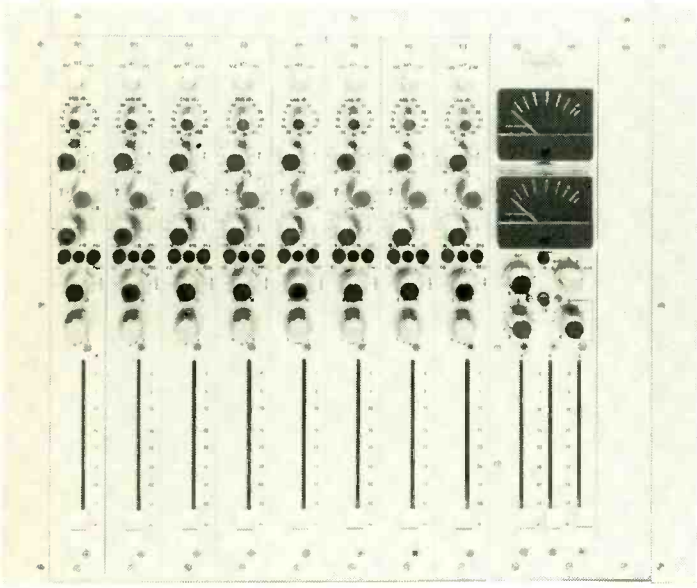

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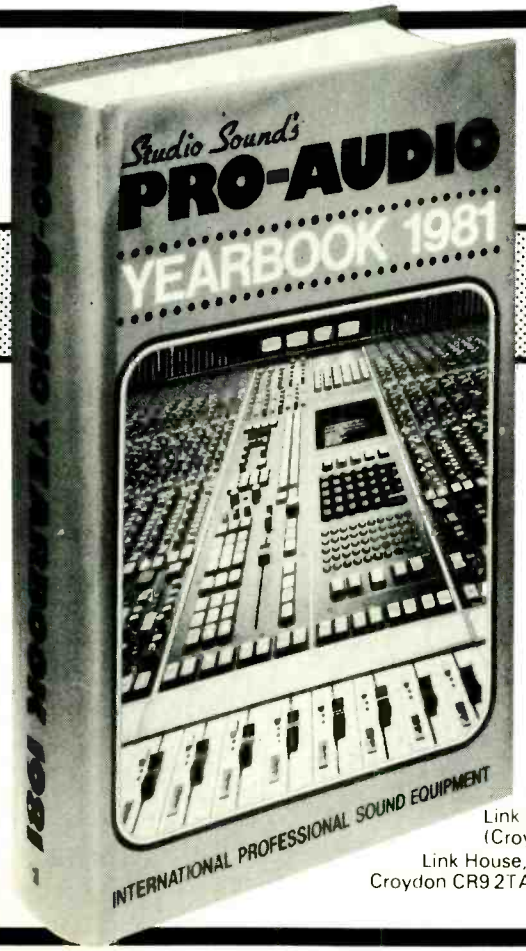

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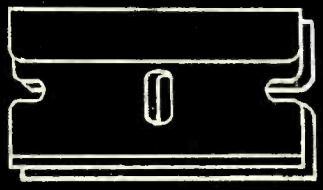

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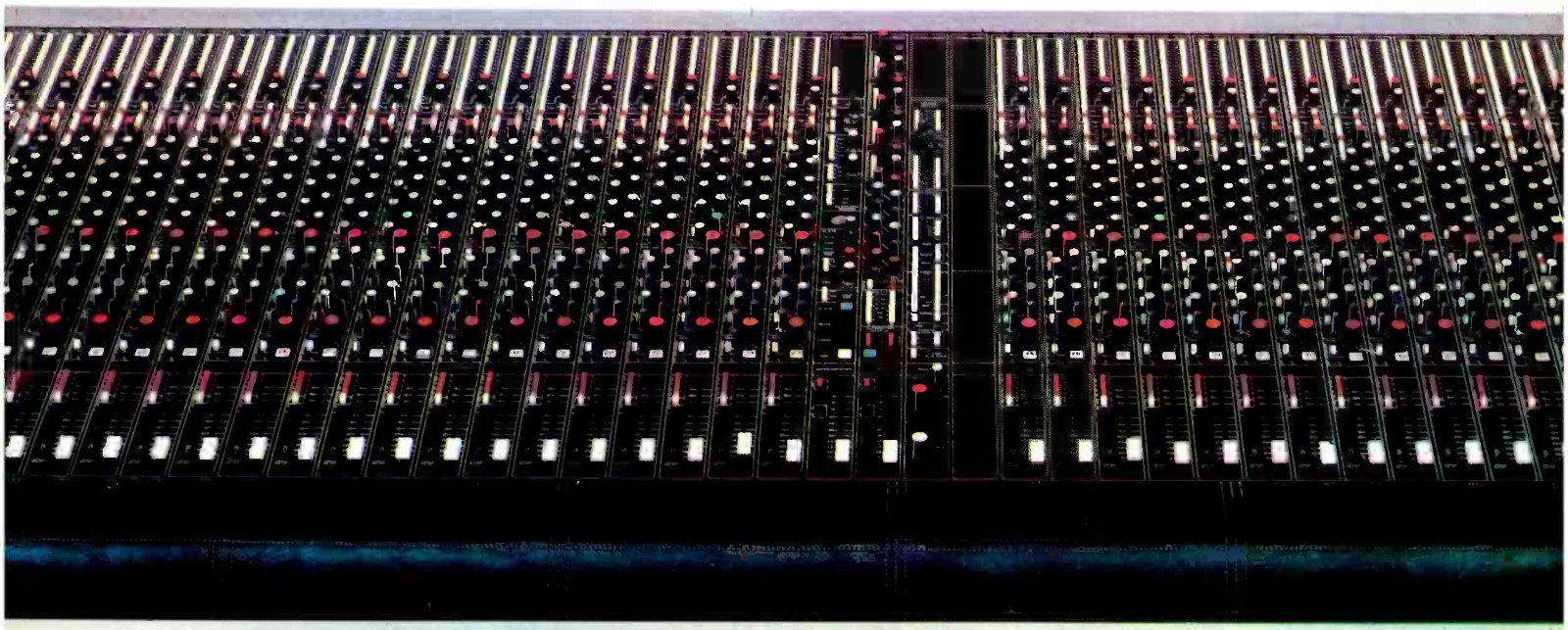

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