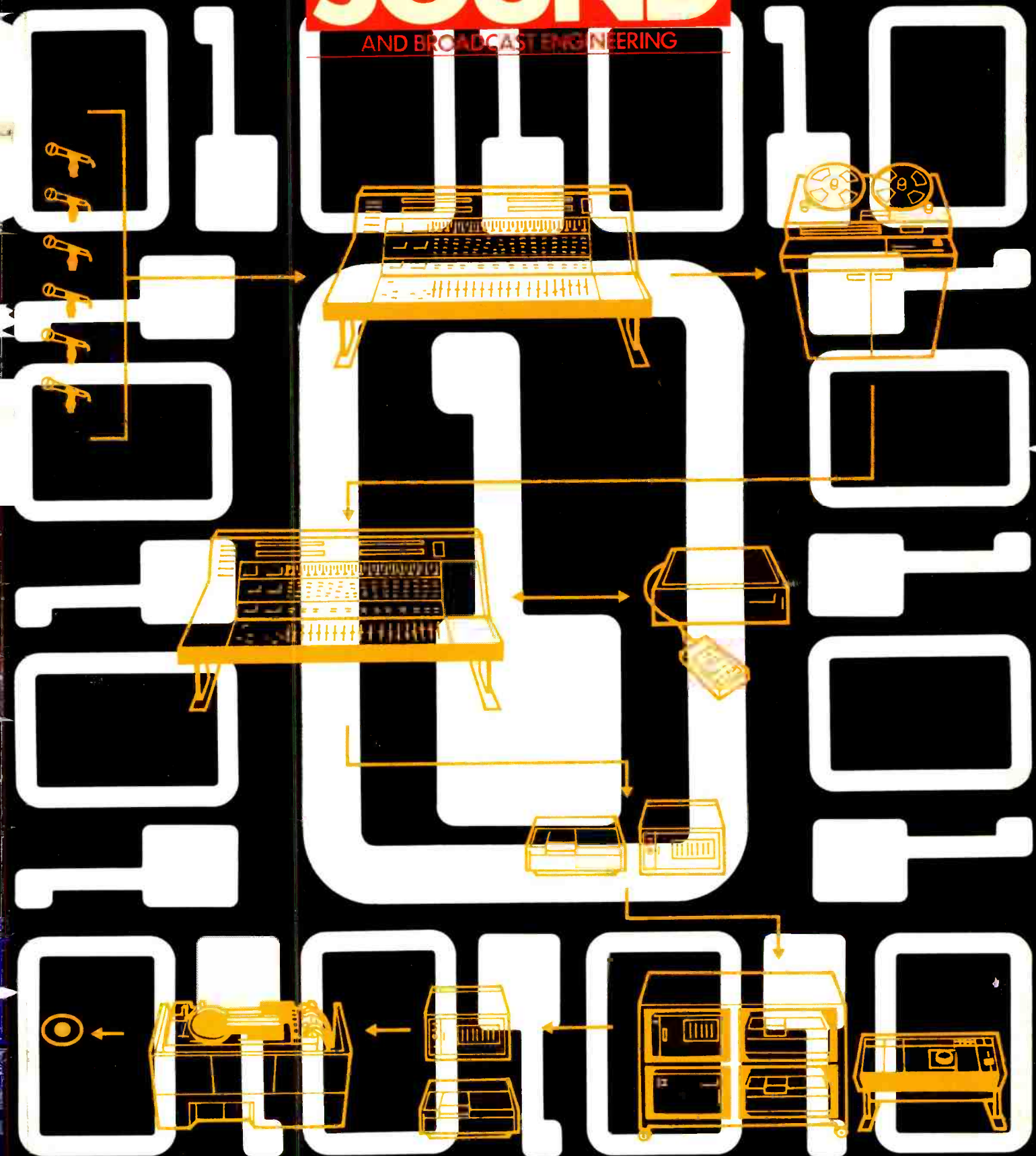


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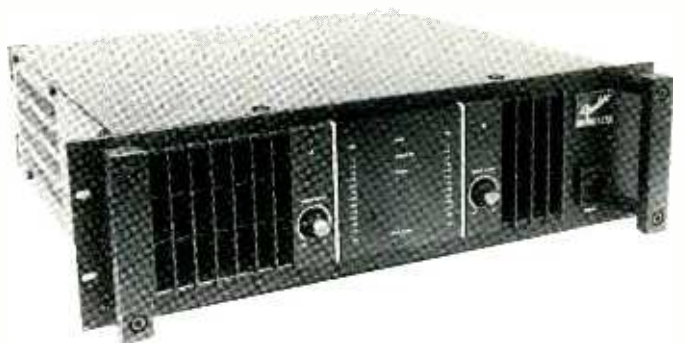
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EDITORIAL

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Cover: From concept to reality—our first digital cover overlaid with today's system



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A LINK HOUSE
PUBLICATION

Publisher and consultant to
APRS for Studio Sound's
Producer's Guide to APRS
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IMPORTANT ANNOUNCEMENT

Sony PCMF1/SLF1



Sony PCM701ES/SLC9



To clear any confusion or misunderstanding about the above Sony Digital recording products, please be advised:

1 The Sony PCMF1 is still in production in Japan, and is available from HHB. The Sony SLF1 video recorder has indeed ceased production, but HHB has managed to secure limited numbers of these desirable machines.

2 It should also be borne in mind that an alternative system exists for applications where portability is not essential. This system comprises the Sony PCM701ES processor – identical in function and compatibility to the PCMF1 – and SLC9 video recorder.

3 We would like to remind you that HHB are the foremost authority on Digital recording in the UK, and are happy to give you any 'clues' you need in this area.

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EDITORIAL

EDITORIAL

This month's comment from Keith Spencer-Allen

A decade of digital

To those of you with long memories, there may be something familiar about the background design of this month's cover. The graphic with '1's and '0's was used in a slightly different form on the first issue that we devoted to the general subject of digital audio electronics in all shapes and forms. That was nearly 10 years ago, in December 1974. By contrast the overlaid diagram is intended to show the point that we have now reached as a reality in the all-digital signal chain. The time seems to be ripe for a little comment and reflection.

Aside from a few fairly basic signal processing units, there was little in the way of commercially available digital equipment for coverage in that '74 issue. The principal article was a far-sighted piece by Steve Brown which at that time seemed only slightly more removed from a possible reality than it does now. Entitled 'An Alternative Approach to Mixing Console Design', it made suggestions about future directions that console design might take including digital control of audio, total assignability, a reduction in duplicated channel functions, the use of a keyboard to input instructions as well as hinting at a digital signal path. Ten years later, a console having many of these facilities and with a fully digital signal path is a near operational reality. A very much smaller unit using the same basic channel facilities is in regular operation in the CD mastering suite at London's Tape One studios. There is little doubt about the digital audio basics functioning and it only remains to tidy up the operational aspects of the system so that the awesome flexibility of the system can be brought under the control of a single engineer and require no more operational attention in session than does an 'equivalent' analogue console.

Within a few months there should be three DSP consoles in operation. With perhaps half a dozen or more companies also working on all-digital audio mixing systems, Neve will not be alone in their endeavours—well certainly not in a year or so's time. Cost will remain high though and until the advantages of an all digital system become clear, such systems will remain fairly exclusive beasts.

With digital multitracks the situation is slightly different. Although we have no precise figures on total numbers of machines in operation, there is little doubt that they are not quite such rare items. With their high capital cost, they do however still form a very minor part of the multitrack recording market. For studios, the decision to or not-to, followed closely by which? has to be a basic marketing choice. Can the studio afford to write off the cost of the digital multitrack over three years because at the present rate of development it will have little use as a marketing tool after that period; probably be incompatible with newer machines as well as having virtually no secondhand value. Because of these factors and the diversification of standards still present to a degree, very many influential studios are waiting to see. It does appear that the choice will actually

become even more confusing for the prospective purchaser if the machines using the dbx system, rumoured to be in development, actually reach the market.

When you turn to consider the mastering system, however, the situation is quite different. The benefits of digital mastering are fairly obvious: it is a necessity for CD mastering; it can be reasonably cost effective; and it gives the added advantages of electronic editing capability.

One area is of concern to me though—the making of purchasing decisions on digital equipment with inadequate information and experience of the different systems available. Brand loyalty is one strange phenomenon that has recently occurred in digital audio and this is particularly interesting in cases where the manufacturer has yet to go into production with a machine. Such loyalties are one way of purchasing and there are some arguments in its defence that are very difficult to counter, particularly when it is not that easy to gain practical experience of alternative systems for the average studio.

Asking other studios for their opinions will not really be of any help either. The strength of adverse reactions to various systems from a complete cross section of engineers would lead you to believe that none of the available systems are capable of working even to the slightest extent. I have heard remarks about the products of every digital manufacturer suggesting that they are useless for music or anything approaching it. What obviously contradicts these claims is that well known engineers are choosing to use a variety of such machines and in so doing would apparently be ruining any semblance of professional credibility they have had if some opinions are to be believed. There may be sonic differences between machines but I have yet to find someone who can discuss this with regard to *all* systems in matters of degree rather than these loaded extremes that are being thrown around.

Although the launch of CD has improved the market for digital audio equipment within the studio, it still represents a small proportion of the total audio recording market and has some way to go before it is anything other than that. A starting point has been established and we must hope for a period of all-round stability when we can fully evaluate where we are going, listen to the absolute quality we are or are not achieving and make decisions for the future.

For our part as a magazine, this will be the last issue that will be dedicated to digital topics. In future this coverage will be assimilated into the general contents of the magazine rather than as a separate topic that has to be considered as somehow remote from the basic rules that govern recording in general. We hope that this will help people to think of digital systems not as an end in themselves but a tool which can offer practical advantages audible in the end product. And if you have listened to the diverse quality of a cross section of current CD releases, that time cannot come too soon.

**STUDIO
SOUND**
AND BROADCAST ENGINEERING

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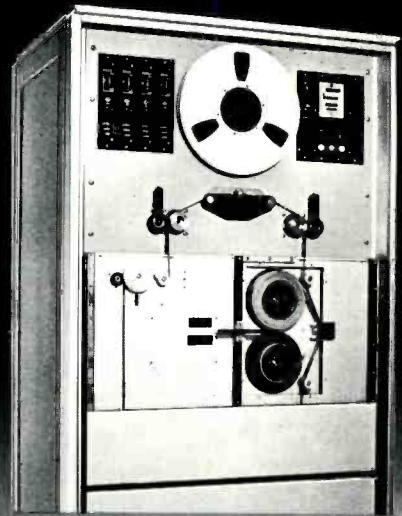
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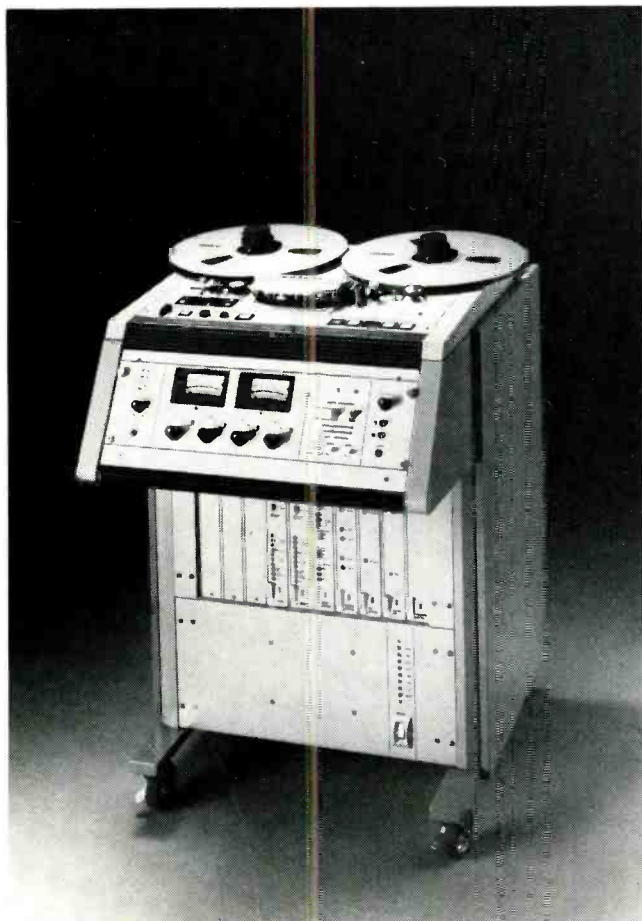
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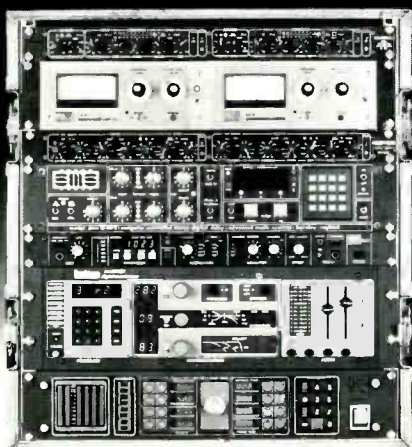
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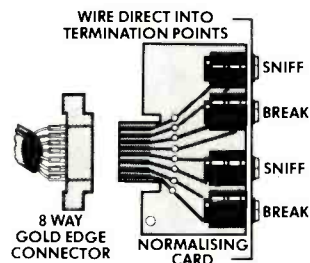
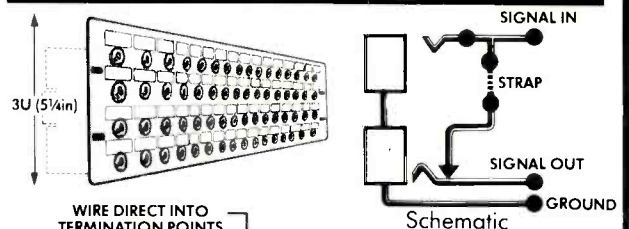
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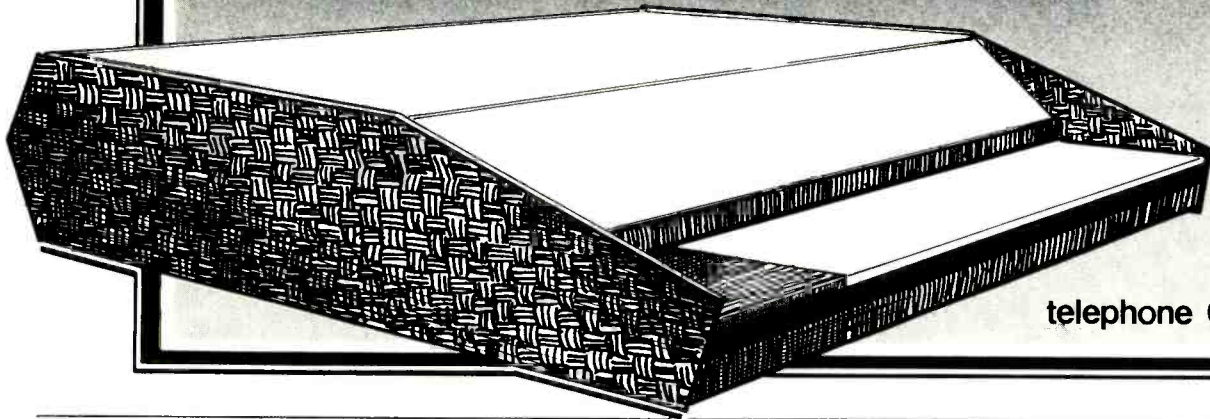
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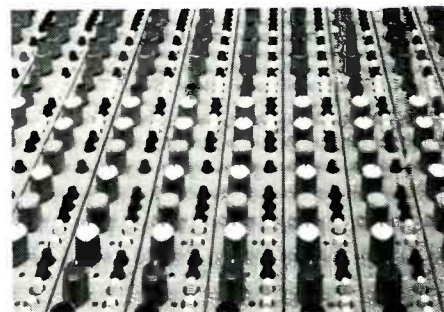
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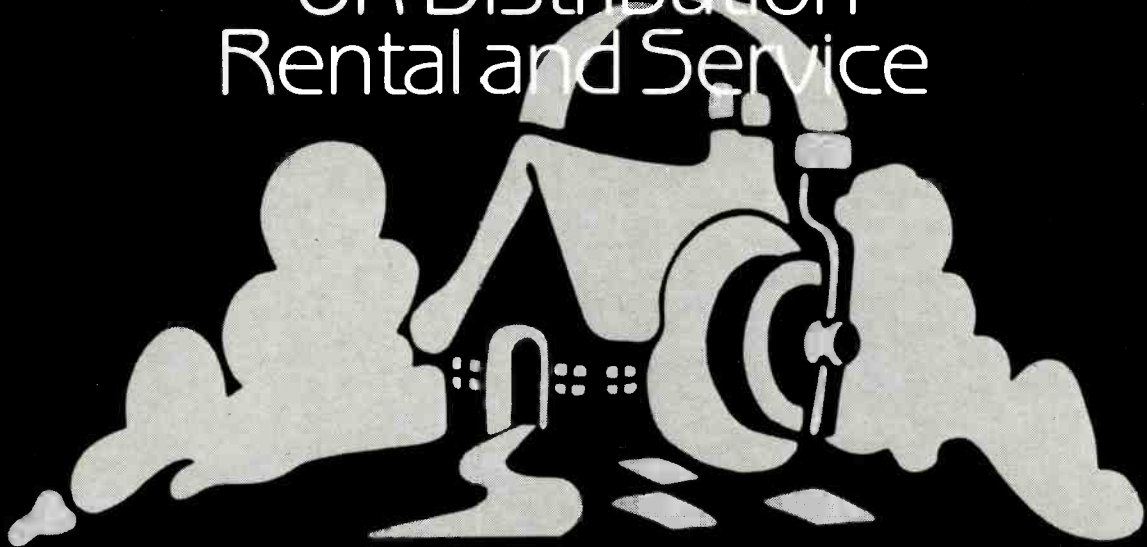
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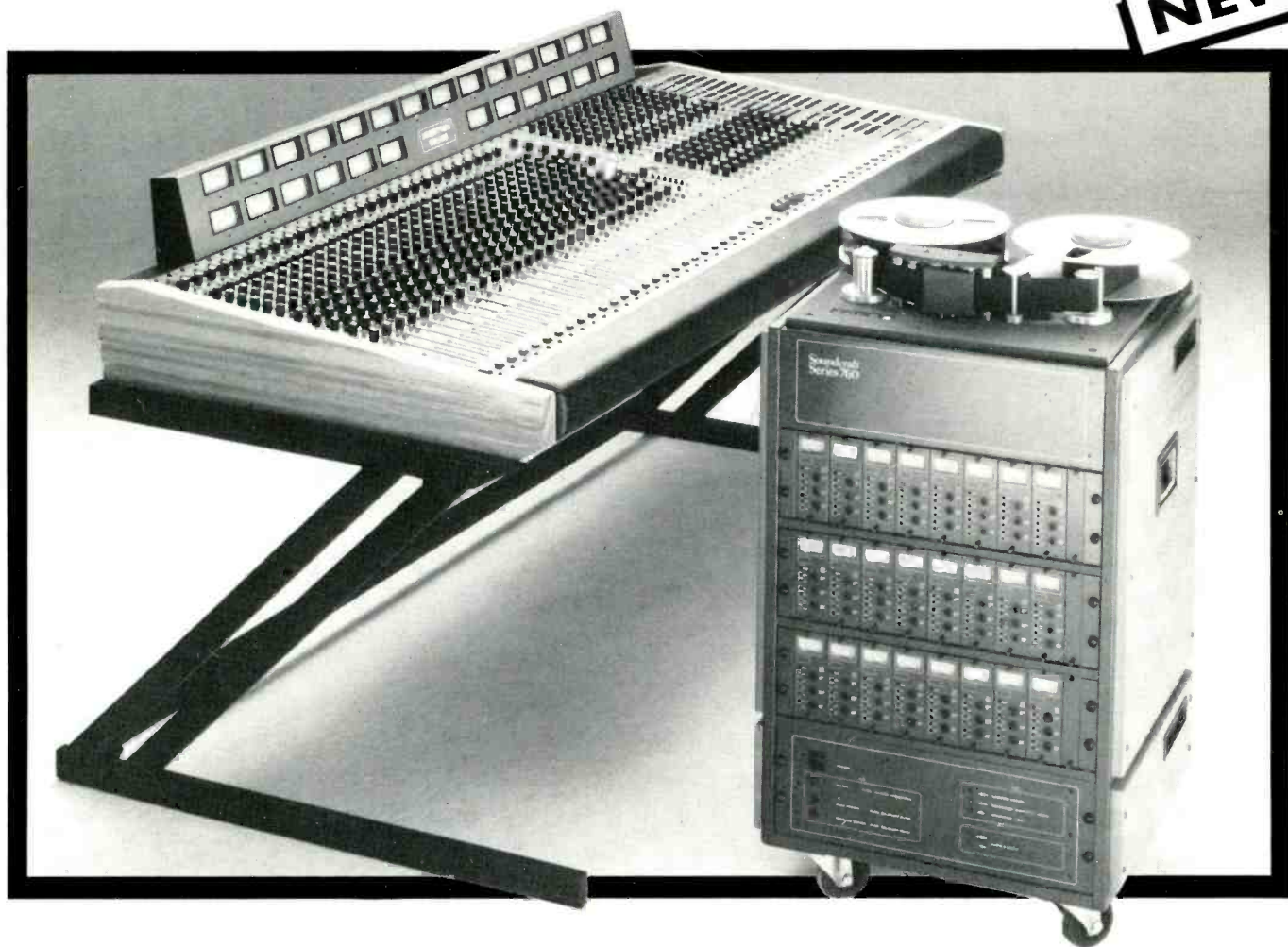
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A New Friend for the **SOUNDCRAFT MACHINE** *Soundcraft & Soundtracs 24 Track Package*

Continuing our philosophy of putting together high quality studio packages we are pleased to recommend the new SOUNDTRACS CM4400 console with digital routing partnered by SOUNDCRAFT Series 760 24 track machine.

NEW



The SOUNDTRACS CM4400 Console Features:

- * Fully modular and expandable to 32/24
- * Digital Routing Pre-programmable
- * Digital Muting Pre-programmable
- * Microprocessor controlled

- with non-volatile memory
- * RS232 Port allows CM4400 to communicate with most personal computers
- * Monitors can be used in remix
- * Upper Monitors have

- Digital routing/muting, EQ and Fader Reverse
- * 5 Band EQ
- * In Place solo
- * 6 Auxiliary Busses on channels and monitors

The SOUNDCRAFT Series 760 Features:

- * 24 track on 2"
- * 15/30 ips
- * Extra sync outputs
- * Remote control zero locate standard
- * Noise Reduction switching standard
- * Full service back-up

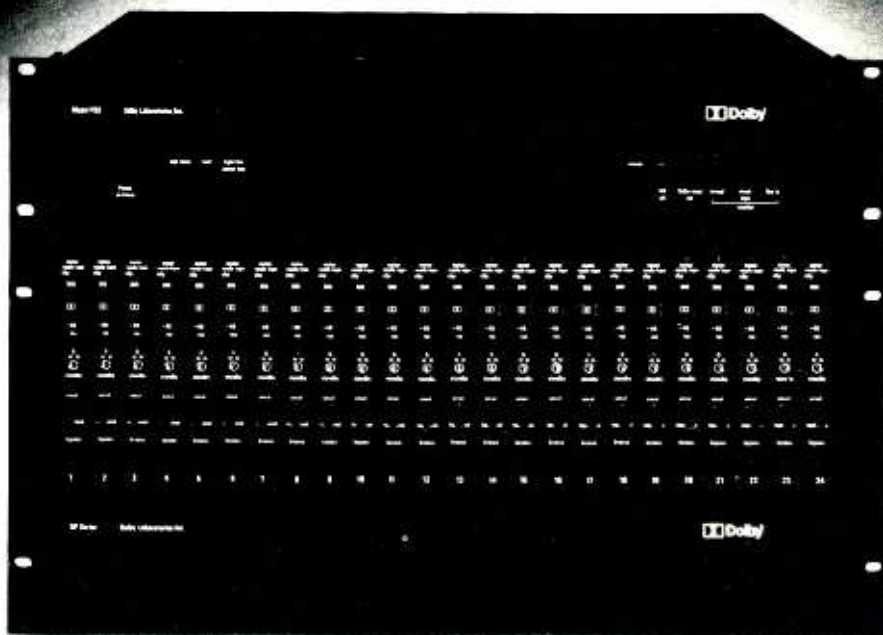
- * Interchangeable headblock standard
- * Can be supplied as 16 track and expanded at a later date
- * Drop-in can be operated by footswitch
- * Varispeed

This package is available only from

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 **Dolby**[®]



The Dolby SP Series Multi-track noise reduction unit

Dolby noise reduction is an integral part of professional multi-track recording practice in music, radio and TV broadcasting, and film studios throughout the world. A new noise reduction unit, the Dolby SP Series, has been developed for these and other applications, and provides up to 24 tracks of Dolby A-type noise reduction in only 12¼" of rack space. The SP Series' combination of compact size, ease of operation, and new features makes it ideal for equipping new recording facilities and upgrading existing ones.

For further information on the SP Series and other professional noise reduction equipment, contact Dolby Laboratories.

Highlights of the Dolby SP Series:

- Up to 24 tracks in only 12¼" of rack space, including power supply.
- Dolby A-type noise reduction characteristics utilizing standard Dolby Cat. No. 22 modules.
- Separate regulated power supply unit with electronically-controlled output protection.
- Low-noise fan cooling.
- LED display for each track permits accurate Dolby level calibration (within ±0.1 dB if desired) by matching intensity of LED pairs; further LEDs

indicate the presence of signals and clipping, and assist alignment with high-level reference tapes.

- Front-panel "UNCAL" control for each track permits rapid resetting of Dolby level for playback and punch-in on nonstandard-level tapes, then instant restoration of preferred preset studio Dolby level without recalibration.
- User-selectable option of "hard" or electronically-buffered bypass of individual tracks and of all tracks simultaneously.
- Snap-fit connectors on rear panel for rapid disconnection and reconnection.
- Balanced and floating input stages.
- Output stages drive either single-ended or balanced 600-ohm loads at levels up to +28 dB (19.5 V) before clipping.
- Ultra-low-distortion input and output amplifiers.
- Remote ground-sensing output configuration minimizes hum pickup when driving single-ended loads.
- Discrete FET switching for reliable, noise-free routing of audio signals.

Dolby Laboratories, 731 Sansome Street, San Francisco, California 94111, Telephone 415-392-0300, Telex 34409. 346 Clapham Road, London SW9, Telephone 01-720-1111, Telex 919109. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. 581/3621

SERIES 65

THE MIXER THAT DOESN'T LIVE UP TO EXPECTATIONS



If you're looking for a compact, economically priced mixer that will grow with your needs for 4, 8 or 16 track operation, you've probably been disappointed with the lack of 'Big Studio' facilities they have to offer.

Series 65 is a 'Big Studio' mixer in a compact frame at a very economical price. Fully modular, these are just some of the stunning features: Four band E.Q. (incorporating 2 swept mid ranges), eight auxiliary sends (balanced), separate mic and line inputs (balanced), stereo solo, auto-mute, monitor equalisation (three band incorporating a swept mid range and routable to group or monitor), four echo returns and unique 'Group assignment' which allows 8 or 16 track recording without the need for cross patching or paralleling outputs.

Technically the console offers the same sonic quality that has made **TRIDENT** a legend among world class recording studios around the world. Check out the **SERIES 65** today. In a world where you'd expect alternatives, there is only one : **TRIDENT**.

Trident Audio Developments Ltd.

Shepperton Studio Centre Shepperton Middx. TW17 0QD, U.K.

Tel: Chertsey (09328) 60241. Telex: 88139282 TRIMIX G

Trident U.S.A. Inc. 280 Mill Street, Ext, Lancaster, Mass 01523 U.S.A.

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GREENGATE

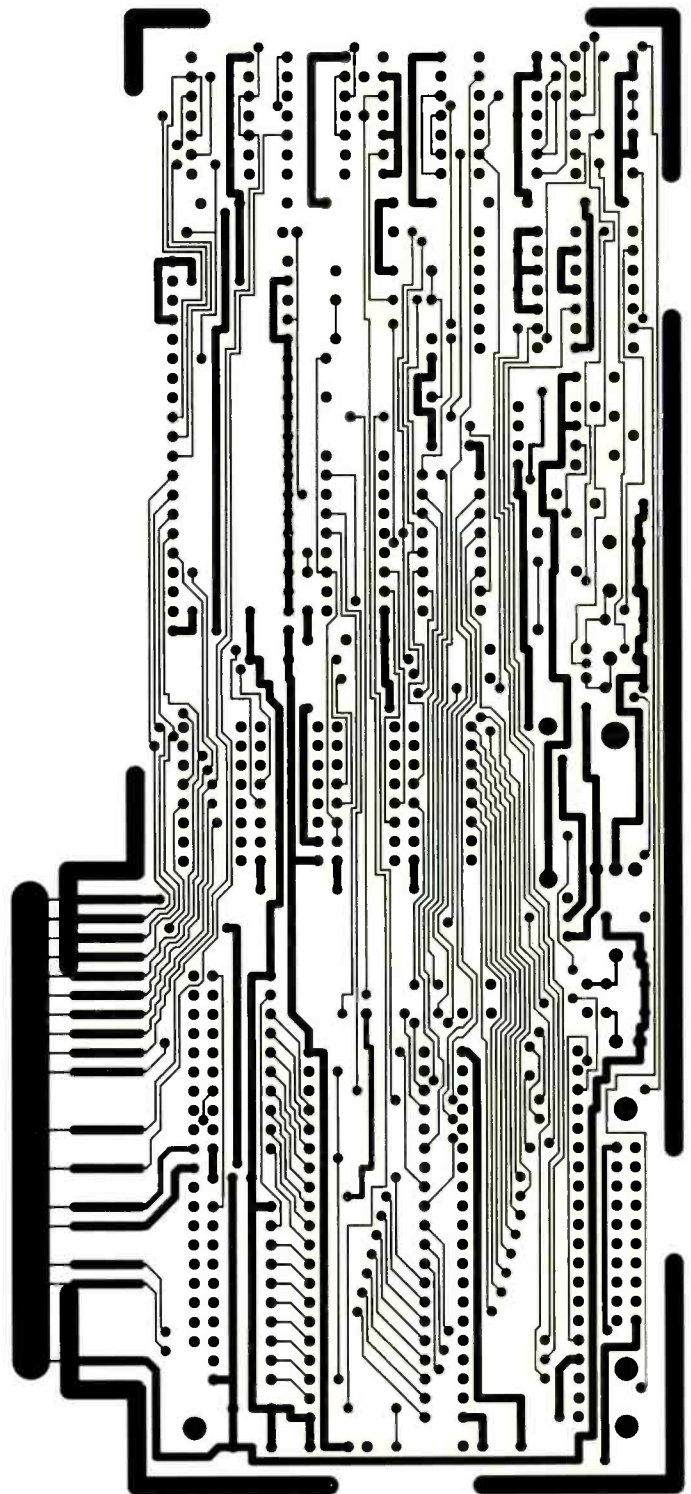
p r o d u c t i o n s

GREENGATE PRODUCTIONS and "MAINFRAME" announce their Digital Sound Sampling Sequencer, the DS:3. Starting at £250, this APPLE*-based 4-Voice polyphonic system brings high-quality digital sampling within reach of every musician and studio.

15kHz bandwidth and two-second-plus sampling periods ensure excellent sound quality. Powerful sequencing software together with 5-octave keyboard control of pitch gives a percussion/drum kit capability limited only by the user's imagination. There are no "PROMS", "Chips" or extras to buy!

- Four voice polyphonic output, forward or reverse sounds.
- External synch input from tape or synthesizer. Built-in 'click' metronome for synch output.
- Sampling rate 30kHz: 15kHz bandwidth.
- Record/Performance mode: sequences and entire concert if desired.
- 'Starter' kit of sounds supplied.
- Waveform editing at the monitor screen.
- Three FREE software updates included in system price.
- Complete sequencing programs: Real-time, Step, Full chaining, edit and storage on Floppy Disc.

DS:3



*APPLE is a trademark of Apple Computer Inc., Cupertino, CA, USA.

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SENNHEISER — THE PERFORMERS



DIARY DIARY

Developments, addresses, people

New Cluster for Olympia

Those who have experienced the acoustics of Olympia, London, will be all too familiar with the problem of speech intelligibility in the Grand Hall. Shuttlesound and Acoustic Management Systems have recently co-operated on the design of a 1 ton central cluster which is expected to produce a % Alcons of between 10% and 15% at the furthest listener.

The aim of the cluster design is to have a carefully

controlled and tight dispersion pattern and it is made up of the following Electro-Voice speakers: eight *TL606D*, two *606A*, eight *HR4020* and two *HR6040*. These are driven from six Crown/Amcron *PSA2* and one *DC300A* amps which are also flown as part of the cluster. The total power output of the system approaches 325 W and is capable of producing a sound pressure level of 110 dB re 2×10^{-5} Nm² at 20 metres.

Digital coding for CDs

Polygram have decided to include a letter coding on their CD inlays to signify the recording's digital or analogue history through recording, mixing/editing, and mastering/transcription. AAD will indicate an analogue session recording, analogue mixing and editing, and then final digital mastering, etc, and the coding will appear

under the track listing on the back cover with an explanation inside the booklet.

There has been much discussion over the way digital or analogue recordings have been identified, not least in *Studio Sound*, but Polygram's standard has been agreed with professional audio associations worldwide.

The politics of digits

Many people will recognise Sony's Dr Toshi Doi as one of the people at the leading edge of digital pro-audio research. Now we hear that he has been moved out to another department in the company and will no longer have the same responsibility for Sony's activities in this area.

Of course, every corporation has its internal politics and wranglings, but, if it is such internal politicking that has resulted in Dr Doi's 'transfer', it is sad news. During Dr Doi's 'reign', Sony has achieved great things. The 3324 24-track digital recorder has gained wide acceptance, initially perhaps in Europe, but now its sales are increasing rapidly in the USA. As the first DASH machine, it has probably ensured that the European market, at least, will be DASH-dominated, in both multitrack and stereo areas. Dr Doi, along with Studer's Dr Roger Lagadec, has been a vital contributor to the determination of the DASH format itself. Under Dr Doi's command, we have seen the gathering of Sony's digital pro-audio techniques to back

the launch of the Compact Disc and the *PCM-FI* into the consumer marketplace. The importance of Sony's digital stereo systems and the digital audio editor cannot be underestimated, and it is the virtual universality of Sony's equipment that has helped the software manufacturer's rise to the massive demand for maximum-quality digital stereo mixes and Compact Disc masters.

I for one wish Dr Doi every success in his new area of work with Sony. But Toshi will be sadly missed as Sony's spokesperson and innovator on the digital pro-audio front. If it was internal politics that led to the change, I sincerely hope that those who make the decisions will change their minds before it is too late, and that he will be offered his old job back. Otherwise, it will not only be his face at DASH forums that we will miss: it will be his originality, inventiveness, personality, and his ability to conceive world-beating digital audio products. Sony may find that they miss these qualities as much as we will.

Richard Elen

People

● Audix Ltd have recently made two new appointments. Alan Bond has joined the company as sales manager for all Audix products in the UK and overseas. He was previously marketing manager with Papworth Industries. Mike Joyce has been appointed sales engineer with responsibility for marketing and co-ordination of the sales of Altec Lansing products. He was previously with Rank Strand Sound.

● New head of BBC's Engineering Research Dept is Dr Bruce Moffat. Since joining the acoustics section as a research engineer in 1962, Dr Moffat has mainly been involved in techniques for digital applications in audio, video, broadcasting and television recording, he is also chairman of the UK CCIR working group on high definition television.

● Trackdown Technology Training Ltd, has appointed Bob Mercer to the position of technical director. He was previously electronics training specialist to the company which specialises in practical courses designed to develop skills in technical personnel for servicing of electronic equipment.

● Soundcraft Electronics has appointed Charlie Day to the position of international marketing manager. He has been working in the industry for many years, his most

recent post being international sales manager at Audio Kinetics.

● Philadelphia based A/V company Magnetik Productions Inc have announced the promotion of John J Etherington, formerly general manager, to vice-president and general manager. He will be directing the company's efforts to increase their nationally syndicated radio programmes. ● Trevor Pyke has joined World Wide Pictures Ltd as a dubbing mixer. He has previously worked for Associated British Pathé and EMI as a dubbing mixer on features, documentaries and newsreels. His work on *The Boat* resulted in an Oscar nomination.

World Wide are involved in recording and post-synchronisation projects internationally.

● Roy Acland has been appointed technical director of the Millbank Electronics Group with responsibility for engineering design and for Millbank's major product development programme. Roy was formerly chief engineer of ITT Consumer Products.

● Yoichi 'Sonny' Kawakami, long time marketing manager for Mitsubishi Electric's North American Digital Audio operation has returned to the Tokyo headquarters to co-ordinate worldwide marketing strategies.

Addresses

● Soundcraft Electronics Ltd, have announced the formation of Soundcraft Japan Ltd to market its products in that country. The new subsidiary is headed by President Takashi Saito, formerly marketing director of Hibino Electro Sound Inc who for many years have distributed Soundcraft products. Soundcraft Japan is the third overseas marketing subsidiary to be formed, following in the footsteps of Soundcraft Canada and Soundcraft USA. Soundcraft Japan, 4F Yoyogi Living, 12-21 Sendagaya 5, Shibuyaku, Tokyo 151, Japan. Tel: 03 341 6201.

● Digital Entertainment Corp

of Connecticut, New York and California, the Mitsubishi Electric subsidiary for digital audio recording equipment have opened up a regional office in Nashville, at 2200 Hillsboro Road, Nashville, TN 37212. Tel: (615) 298-6613.

● Maglink Audio Products have changed their name and will now be known as M.A.P. Ltd. The company, which supplies Maglink Timecode synchronising equipment and SMPTE/EBU timecode readers, have also moved to new premises and are now at Oakdene House, Alders Road, Tudeley, Tonbridge, Kent TN11 0PP. Tel: (0732) 353069 or (0622) 890737.

Graham Gouldman has recorded in the world's best studios.

(That's why he recorded his latest album at home)

Graham Gouldman, as a leading member of 10cc, has recorded in many world-famous studios, and certainly knows what makes a good recording, and also when he's achieved one. "But," he says, "I've always felt that the most creative recording environment is at home, in one's own space and in one's own time."

When he bought a Fostex B16 ½" 16-track recorder and an Allen & Heath System 8 16/16 mixer, he decided to put the system to the ultimate test and use it to record his current album. "Andrew Gold and I soon found that the sound quality far exceeded our wildest dreams," says Graham.

"The Allen & Heath mixer provided all the facilities I needed and produced quality to a standard beyond its price.

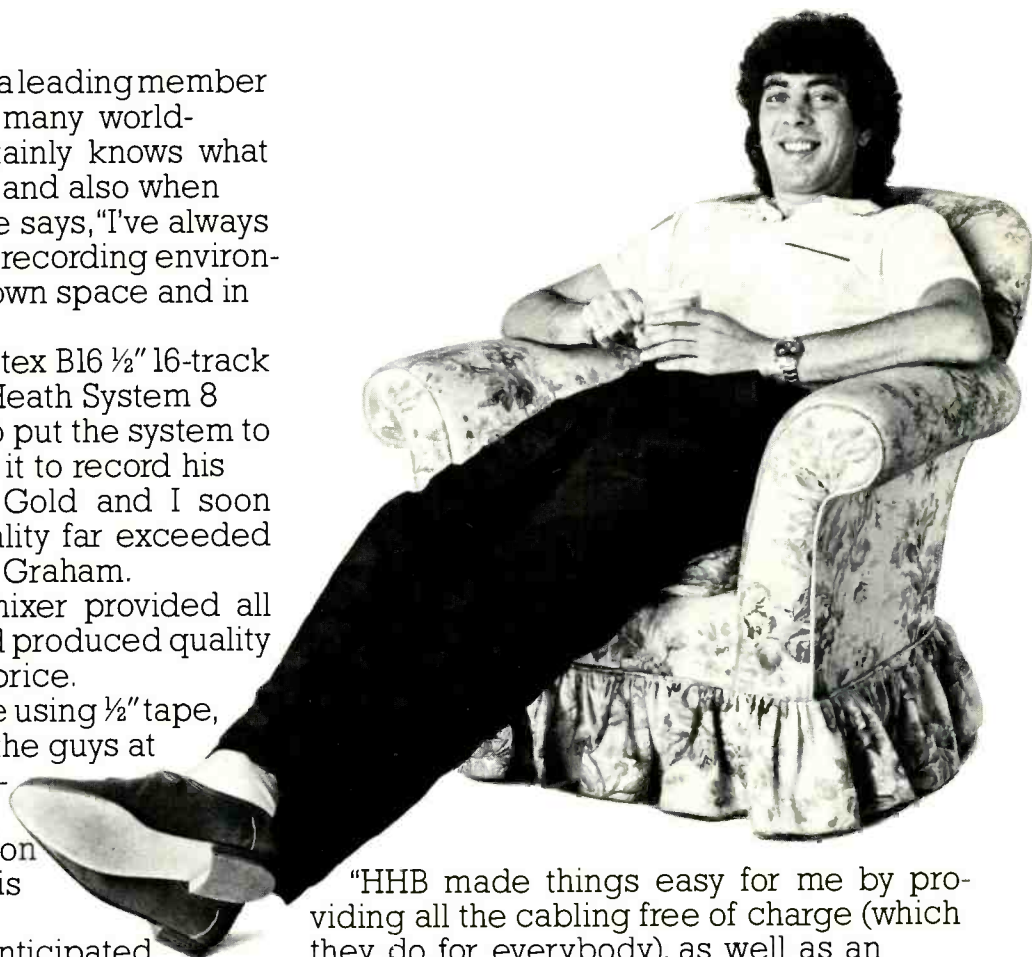
The Fostex B16, despite using ½" tape, was silent and accurate; the guys at Fostex really have mastered head technology, and the Dolby 'C' noise reduction really works a treat. All this for around £5000?!"

"For mixdown, we had anticipated having to transfer to 24-track - but when the time came, both Andrew and I agreed that the B16 sounded better.

You can hear the results for yourself on the new 'Common Knowledge' single 'Don't Break My Heart', on Phonogram Records."



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"HHB made things easy for me by providing all the cabling free of charge (which they do for everybody), as well as an informative demonstration, sound advice and a reliable back-up service to complete the package."

"I can thoroughly recommend this low-cost, high-performance multitrack system."

For further details about Fostex and Allen & Heath, and all other recording products, contact Martin Westwood by phoning 01-961 3295.

Fostex & HHB



HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Tel: 01-961 3295.

DIARY DIARY

Developments, training, events, agencies

BBC experiment with all-digital stereo TV sound

The BBC have begun experimenting with the all-digital transmission of television sound using the Crystal Palace transmitter after closedown. Their first efforts have made them confident that a digital system will best fulfil the requirement for stereo with television from terrestrial transmitters.

Initially a programme was put together incorporating a conventional analogue video recording of a rock concert which had previously been featured as a simultaneous stereo broadcast on BBC TV and radio. The associated digital recording of the sound signals was replayed into the digital stereo transmission system without conversion into analogue form.

The equipment included a

Studer sampling rate converter for converting from 44.1 to 32 kHz; and a BBC software-controlled processor for altering the pre-emphasis characteristic from that used in the recorder to the one required for transmission. The test confirmed the ruggedness of digital stereo TV sound in areas of difficult reception. Compatibility trials from Crystal Palace then confirmed that no significant interference would be caused to sound or vision reception on existing receivers.

In consultation with the Home Office, discussions with the IBA and industry are under way to establish an agreed UK specification. Now that compatibility is assured there will be further tests from time to time during normal programme hours.

CTS Studio 1 re-construction

Early in 1984 Eastlake Audio was commissioned by CTS Studios in Wembley, London, to re-design and substantially upgrade Studio 1. This has now been completed. The Studio 1 project forms part of CTS's re-building and improvements programme and follows enlargements and improvements made to Control Room 1 by Eastlake.

The Studio 1 floor area of 325 m² (3500 ft²) and ceiling height of 10 m (33 ft) makes it one of Europe's largest recording venues with capacity to accommodate more than 100 musicians. Many successful musical film soundtracks have been recorded at CTS.

CTS's brief to Eastlake required that the re-design should substantially extend the existing MF and HF reverberation times, provide an isolation booth capable of housing around 30 musicians and provide a smaller isolated booth for vocals, drums etc. Finally, the decor was to be upgraded.

Because of the uncommonly large cubic area of the studio, extensive use was made at the design stage of computer

models of large acoustical enclosures. Upon checking the performance at the end of construction the targeted reverberation figures were met within 10 ms.

The construction work included stripping out of all existing finishes except the ceiling, carrying out major structural changes to the area underneath the control room in order to form the two new isolation rooms, fitting new air-conditioning systems to serve the new isolation rooms and last but not least to install over 7 tonnes of French chestnut wall panelling and was completed within six weeks.

After finishing the re-construction of CTS Studio 1, Eastlake commenced work on a two studio project for Imagination Project Services within their newly erected Covent Garden headquarters building.

Design work is currently underway for Singapore Broadcasting's new multi-track studio, a large new studio for Sound Studio SA in Athens and other static and mobile recording facilities.

LEDE workshop

Synergetic Audio Concepts of California are to sponsor an *LEDE* control room design workshop. The workshop will be held during September 11th to 13th, 1984, at Acorn Recording Studios, Tennessee which were designed by Robert Todrank of Valley Audio.

A variety of subjects will be covered, from the initial delay gap to the latest in RPG Quadratic and Primitive Root Diffusors.

Synergetic Audio Concepts, PO Box 669, San Juan Capistrano, CA 92693, Tel: (714) 496-9599.

Forthcoming events

- September 21 to 25 International Broadcasting Convention, Brighton, UK
- September 25 to 27 AES Convention, Melbourne, Australia
- October 8 to 11 AES 77th Convention, New York, USA
- November 29 Sound Broadcast Equipment Show, Birmingham, UK
- January 28 to February 1 MIDEM '85, Cannes, France
- March 6 to 8 1985 AES Convention, Hamburg, West Germany

Agencies

- Allen & Heath Brenell has appointed HHB Hire & Sales as sole London dealers and distributors for their *System 8* range of mixers.
- Levell Electronics have expanded their instrument sales organisation and are now supplying ranges other than just Levell. Available now are Hameg oscilloscopes and Thurlby power supplies and instruments.
- Soundtracs have announced the appointment of nine new distributors. **Austria:** Hi-Fi Stereo Center (Kain), A-5020 Salzburg, Munchner Bundesstrasse 42. Tel: 0-662-37710. **Belgium:** SAIT Electronics SA, Chaussee de Ruisbroek 66, 1190 Brussels. Tel: (Monsieur D Regout) 02-376-2030. **Italy:** Linear Italiana SpA, 20125 Milano, Via Arbe 50. Tel: 02-6884741. **Korea:** Computech, Kwanghwamun, KPO Box 1706, Seoul. **Netherlands:** Professional Audio Center, Pieter Bollen Geluidstechniek BV, Hondsruglaan 83A, 5620DB Eindhoven. Tel: 040-424455. **Norway:** Siv Ing Benum AS, Boks 2493, Solli, Oslo 2. Tel: 02-442255. **South Africa:** Eltron (Pty) Ltd, 2nd Floor Elm Trust Building, 112 Polly Street, Johannesburg 2001. Tel: 11-29-3006. **Taiwan:** Linfair Engineering & Trading Ltd, 7th Floor, 7 Jen Ai Road, Sec 2, Taipei. Tel: 321-4454-6. **Spain:** Fading SA, Servando Batanero 8, Madrid 17. Tel: 408-67-00.
- The David Hafler Company

has announced the creation of a national sales organisation to cover the USA. The group is made up of qualified manufacturer's representatives and will promote the firm's new line of high powered professional electronics.

The David Hafler Company, 5910 Crescent Boulevard, Pennsauken NJ 01809. Tel: (609) 662-6355.

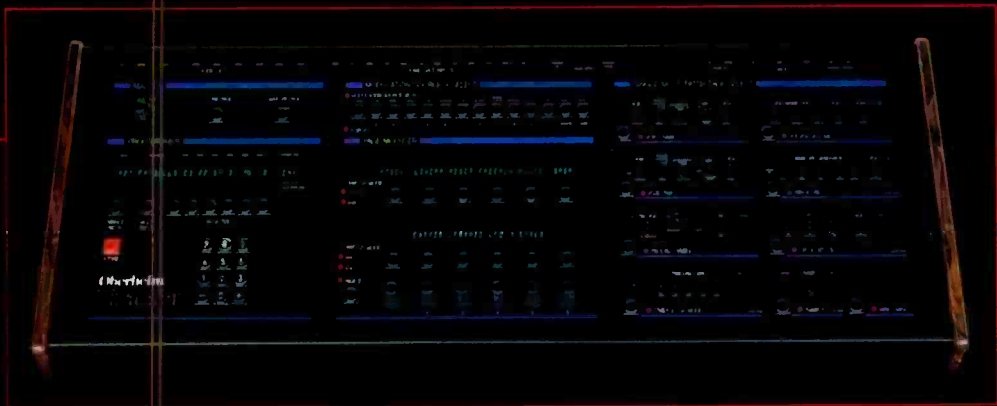
● FM Acoustics Ltd announce the formation of their US branch, headed by director Gene Michalsky. FM Acoustics USA, PO Box 311, Davis, CA 956170311. Tel: (916) 758-6300.

● Apex Systems Ltd have appointed six new distributors to sell their signal processing equipment. Atlantex Music Ltd will distribute to the UK AKG Acoustics (Canada) will distribute to Canada and Audio Systems PAS will cover Switzerland.

In the USA Peter M Schmidt & Co will cover Metro New York; Secom, Tennessee, Georgia, Mississippi and Alabama; and Mike Chafee Enterprises, Florida.

● Future Film Developments, the London based supplier of components and accessories to the audio industry, has been appointed by Audix as regional main dealer for Altec-Lansing's range of loudspeakers and power amplifiers. Future Film Developments, 114 Wardour Street, London W1V 3LP. Tel: 01-434 3344. □

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ers, MIDI and CVs simultaneously, and of course, the Oberheim System.

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NEW PRODUCTS

NEW PRODUCTS

Equipment, modifications, options, software

HBB's CLUE system

The APRS saw the introduction of the *CLUE* system by HBB. The Computer Logging Unit and Editor is a system designed primarily to meet the need for editing facilities on digital mastering systems using low cost PCM processors such as the Sony *F1* and *701 ES*. In addition the system gives sophisticated logging and automation facilities.

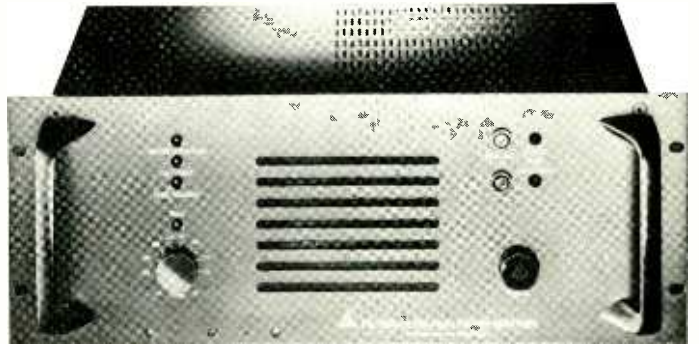
CLUE enables the performance of butt copy editing in both digital and analogue modes to frame accuracy. For compilation use and, suprisingly, most editing requirements, this is quite sufficient. Where greater accuracy is required the user will have to resort to full *DAE 1100* editing standard but should have saved himself some money. Insertion of auxiliary devices into the signal path during editing and provision for fades, level adjustments is allowed for. All components in the signal path are passive.

While recording or mixing, *CLUE* enables the user to log details of each take, such as title, start locations, length and up to 10 locations within

the take, there is also provision for comment. Information is stored on floppy disk. Autolocation of points is by absolute counter number, take number or logged position although the counter need not be zeroed. In playback a further 10 logging points may be 'marked'. *CLUE* can also provide calculation of times for takes, passages or lengths of sessions.

The hardware of the system comprises a 4U 19 in rack containing controlling computer, disk drives, switching circuitry and interface connections; a remote keyboard; for communication with *CLUE* and control of the recorders; and a VDU. The program is entirely menu driven and most commands are single key entries. Full access is provided to the audio and video inputs and outputs of both recorders in addition to the analogue inputs and outputs of the digital processor. Plans are in hand for development of further interfaces.

HBB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX, UK.



FM Acoustics high power amp

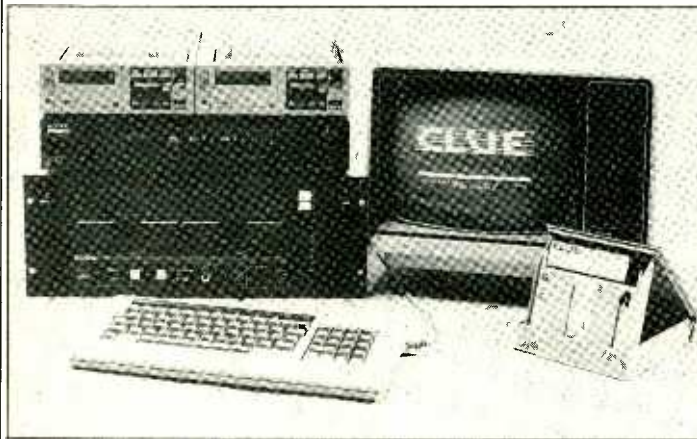
New from FM Acoustics is a high power mono amplifier, the *FM 1000*. Modestly claimed to be 'the world's first natural-sounding reliable non-bridged Ultra-High-powered amplifier', the *1000* is rated at 900 W peak into 8 Ω (3600 W peak into 1 Ω or 100 A peak!) for negligible distortion across the audio bandwidth.

Some of its many features are: a non-polarised, balanced input stage with CMR >75 dB; inverting or non-inverting use (through the balanced input); a passive 3 dB/octave lowpass filter at 60 kHz which, together with the power bandwidth of 120 kHz,

eliminates TIM or dynamic distortion; class-A operation throughout except for the class-AB output stage which has thermal tracking class-A bias; all-discrete circuitry; low feedback; a two-speed cooling fan; impedance compensated peak reading LED indicator; elaborate fail-safe and short circuit protection.

FM Acoustics Ltd, Tiefenhofster 17, CH-8820 Wadenswil, Switzerland. Tel: 01 780 64 44.

USA: FM Acoustics USA, PO Box 311, Davis, CA 956170311. Tel: (916) 758-6300.



Connectronics connectors

Connectronics have announced a new low cost *XLR*-type connector; 3-pin line and chassis connectors are available. They are made from a black, glass filled nylon material which according to Connectronics is 'virtually unbreakable under normal conditions'.

Connectronics Ltd, 20 Victoria Road, New Barnet, Herts EN4 9PF, UK. Tel: 01-449 3663. Telex: 8955127.

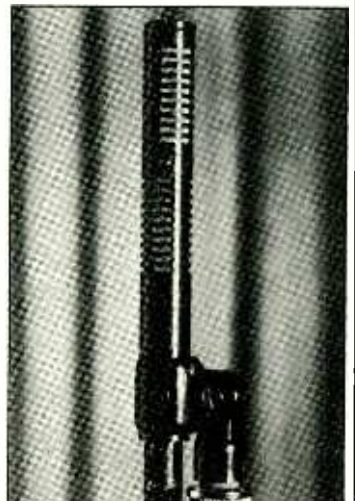
USA: Connectronics Corporation, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 324-2889. Telex: 642678.

Speiden ribbon microphone

Two years of R & D have led to a new coincident stereo ribbon microphone, the *SF-12*, from Speiden & Associates. Symmetrical figure-of-eight polar patterns positioned at right angles equals the classic Blumlein configuration, and accuracy is said to be excellent for either X-Y or M-S use. Features claimed are:

'unexcelled' stereo separation and imaging; wideband, peak-free response with negligible off-axis colouration; and superb transient response. Small physical size aids this accuracy, minimising disturbance of the soundfield via diffraction effects.

Two 1.5 micron ribbons of pure aluminium are employed, each weighing only 1/4 mg which is believed to be the lowest mass element ever provided in a commercial product. The *SF-12* is supplied with 18 ft of cable (four conductors plus shield) and an



adaptor terminating in two standard *XLR*-type connectors for direct use with professional 250 Ω front-ends. A standard adaptor is also supplied. **Speiden & Associates, 1216 Denmark Road, Plainfield, NJ 07062. Tel: (201) 756-5515.**

The Orban 424A Gated Compressor/Limiter/De-Esser.

Explained by us.

GAIN REDUCTION: Shows gain of the VCA (0 to -25db). Shows the effect of any control but OUTPUT TRIM and DE-ESSER.

INPUT ATTENUATOR: Adjusts drive to compressor/limiter, determining amount of G/R.

ATTACK TIME: Adjusts speed of response to input level increase. Fast: Peak limiter & compressor. Slow: Compressor only.

GATE THRESHOLD: Determines the input level that causes "gating"; VCA gain then moves slowly to IDLE GAIN setting.

OUTPUT TRIM: Adjusts VCA gain to control or prevent clipping as required. Effect is seen on VCA LEVEL meter. Not an Output Attenuator (Output Attenuator is located on rear of unit).

DE-ESSER OPERATE/DEFEAT: Activates or defeats de-esser control circuitry.

COUPLED/INDEPENDENT: Couples A and B gain and gating circuits for accurate stereo tracking.

COMPRESSION RATIO: Adjusts compressor from "looser" (2:1) to "tighter" (∞ :1).

RELEASE SHAPE: Linear: Compressor releases at constant rate. Exponential: Release starts slower, then accelerates.

VCA LEVEL: Shows peak operating level of VCA. Clipping occurs above approximately +2.

IDLE GAIN: Presets VCA gain when in gated condition or anytime unit is DEFEATED. Used for smoothing out transitions and for decreasing audible action of compressor.

OPERATE/DEFEAT: Activates or defeats gain control circuitry. Does not bypass any circuitry.

DE-ESSER SENSITIVITY: Adjusts threshold of de-essing. De-essing increases as control is turned clockwise.

Also available as a single-channel unit: Model 422A. Ask your dealer for a detailed brochure.

Reviewed by others.

"In addition to the measured performance being very good the subjective impressions of the unit were excellent. This product has many novel and highly practical features all of which are quite simple to use but need not be used if simplified operation is required. Overall a very good compressor/limiter, well made and easy to service."

Hugh Ford, *Studio Sound* November, 1983

"Overall, the 422A/424A should prove to be a system of diverse capabilities, able to tackle the widest variety of material—once the user masters its operation. In addition, its solid construction and excellent service documentation should insure years of reliable operation. Such qualities are typical of timeless designs that tend to retain their value long after the accountants have depreciated them away."

John Monforte, *db Magazine* July-August 1983

orban



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

Belgium Trans European Music (Bruxelles)
Finland Studiotec (Espoo)
France 3M France SA, Mincom Div (Paris)
Germany Estemac (Hamburg)
Germany Hausman Electronic (Berlin)
Greece Audiolab Hellas (Athens)
Holland Cadac Holland (Hilversum)

Italy Audio Products International (Milano)
Norway LydRommet (Oslo)
Portugal Amperel (Lisbon)
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Switzerland Audio Bauer (Zurich)

NEW PRODUCTS

NEW PRODUCTS

Equipment, modifications, options, software

Rogers studio monitors

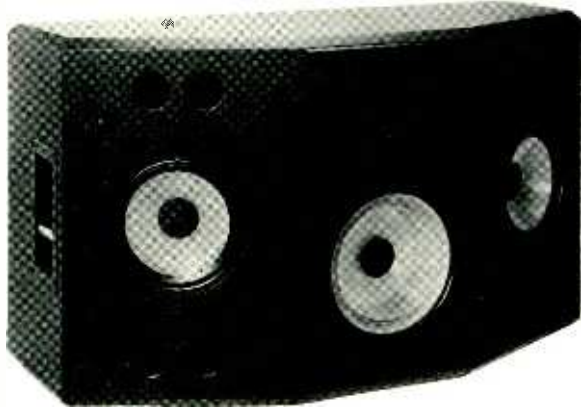
The British loudspeaker marque, Rogers, has a long history being particularly well known within professional circles for their versions of the BBC licensed designs *LS3/5A* and *LS5/8*. At the recent APRS exhibition they launched a new high powered studio monitor system that they have developed. Known quite simply as the *Studio Monitor* they have been designed for high power handling applications with a maximum recommended power per speaker of 1500 W. Details available at present are provisional although the specification is fairly precise. A frequency response of 30 Hz to 14 kHz ± 2 dB measured with an anechoic environment is claimed with a sensitivity of 92.5 dB at 1 m for 2.83 V input. Power requirements are 300 W for each LF unit; and 300 W for MF/HF units. Rogers can supply a suitable set of power amplifiers if required.

Maximum SPL measurements give figures of 120 dB at 1 m 30 Hz to 190 Hz and 117 dB at 1 m for 190 Hz to 14 kHz, both from a single monitor with peak levels exceeding 120 dB from a pair at 2 m. The LF units are Rogers 12 in polypropylene cones with Kapton coil formers; MF units are the same size polypropylene cone with Kapton voice coil former capable of withstanding over 400°C; while the HF unit is an Audax 34mm soft-dome tweeter.

An active crossover is used at 190 Hz using 24 dB/octave slopes with a passive MF/HF crossover at 2 kHz. A triamplification option will be available later in the year.

The cabinet is finished in black with dimensions of 48 x 28 x 22½ in (whd).

**Rogers Monitoring,
Swisstone Electronics Ltd,
310 Commonside East,
Mitcham, Surrey CR4 1HX.
Tel: 01-640 2172.**



Neutrik X Series

Neutrik have developed a new *X Series* 3-pin *XLR*-type connector. The new connector is more compact than the original, has no screws and acceptable cable diameters are increased from 2.8 mm to 8 mm.

**Neutrik AG, Oberglass 16,
FL-9494 Schaan,**

**Leichtenstein. Tel: 075
2.63.83. Telex: 77771.**
**UK: Eardley Electronics Ltd,
Eardley House, 182-184
Campden Hill, London W8
7AS. Tel: 01-221 0606. Telex:
299574.**
**USA: Philips Audio Video
Systems Corp, 91 McKee
Drive, Mahwah, NJ 07430.
Tel: (201) 529-3800.**

Allen & Heath System 8 improvements

Allen & Heath Brenell, have recently introduced a number of modifications and improvements to their *System 8* range of mixers. The new features include: 1) channel input, group output, and left/right faders fitted with the 100 mm travel type pots; all channel input sections now include an additional pushbutton for 'EQ cut'; connection of the multitrack recorder is now required only

at the tape input jacks, internal routing of the programme to the channel inputs is automatic; power supplies now include 48 V phantom power as standard. **Allen & Heath Brenell, 69 Ship Street, Brighton BN1 1AE. Tel: (0273) 24928. Telex: 878235.**

USA: Allen & Heath Brenell (USA) Ltd, Five Connair Road, Orange, CT 06477. Tel: (203) 795-3594. Telex: 643307.

Lexicon Rich Plate program

A new *Rich Plate* program is now available for Lexicon's *Model 200* digital reverb. The program and its 10 variations add a rich plate sound that produces 'a less metallic decay, similar to a gold-foil plate'. In this guise, the unit is expected to find wide use with percussion, especially on kick drums where the build-up of sound is less explosive.

This is the fourth package to be released in Lexicon's development program for the

200, the previous issues including *Halls*, *Plates* and *Chambers*. These upgrade programs are available to users at a minimal charge which covers the cost of materials.

Lexicon Inc, 60 Turner Street, Waltham, MA 02154. Tel: (617) 891-6790.

UK: Scenic Sounds Equipment Ltd, Unit 2, Comtech, William Road, London NW1. Tel: 01-387 1262.

Psionics range additions

Psionics have recently announced two new additions to their range of 4-channel signal processing units in single U rack mount form. The *EQ4* is a unit containing four bands of parametric equalisation with each band having a frequency range of 50 Hz to 1200 Hz or with the X10 switch, 500 Hz to 12 kHz. Over this range 15 dB of cut and boost is available with fully variable bandwidth. In addition there is a peak/shelving selector which disables the bandwidth control in the shelving mode. LF or HF shelving is possible. There is also provision for independent HF and LF 12 dB octave filters. A unique feature of the *EQ4* is that with an external switching system, it is possible to have any of the five EQ sections used for individual functions.

The second unit is the *ADI-4* Quad Direct Injection Network. This contains four

channels of semi-automatic DI with input sockets on the front panel. Each channel has an 8-LED ladder which will display the gain in the alignment mode and setting of the input amplifier for a nominal 0 dB output level for the loudest input signal while with the play mode selected the LED ladder displays standard input signal. All front panel sockets are duplicated on the rear panel with transformer isolated *XLR* outputs. An automatic ground lift compensation circuit is included plus an additional manual ground lift. The gain range is -40 dB to +30 dB with a selectable 20 dB pad.

Kelsey Acoustics Ltd, 28 Powis Terrace, London W11 1JH. Tel: 01-727 1046.

North America: Soundcraft Canada, 1444 Hymus Blvd, Dorval, Quebec, Canada H9P 1J6. Tel: (514) 685-1610. Telex: 05822582. □

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 **MITSUBISHI**
DIGITAL AUDIO SYSTEMS

DIGITAL EQUIPMENT

A brief appraisal of recent developments in digital hardware by Keith Spencer-Allen

One of the quirks of the current stage of development in digital audio is that due to the currently very high profile of the topic in discussion, development, papers presented and the selling of digital audio within the consumer field, you feel that there must be much happening. Well, quite simply, there is but very little that is at present translatable into product terms. Standards, techniques and the hardware needed to implement these ideas have to be developed and this takes time. What is also confusing is the manner in which the main digital manufacturers have taken to pre-emptive marketing on a grand scale often years before the product is likely to be available. If I had been writing this overview last year, the products I would have been able to discuss would not have been greatly different but long ago we

learn't that when discussing digital audio one has to talk about units that are often in 'production' only in prototype form. There is a further problem for us as a magazine in the shortage of equipment within the field to review. There are two items that we did hope to have reviewed for this issue but for a variety of reasons, the units were just not available in time. Such is the world of digits and audio at the moment although these reviews will be carried in due course.

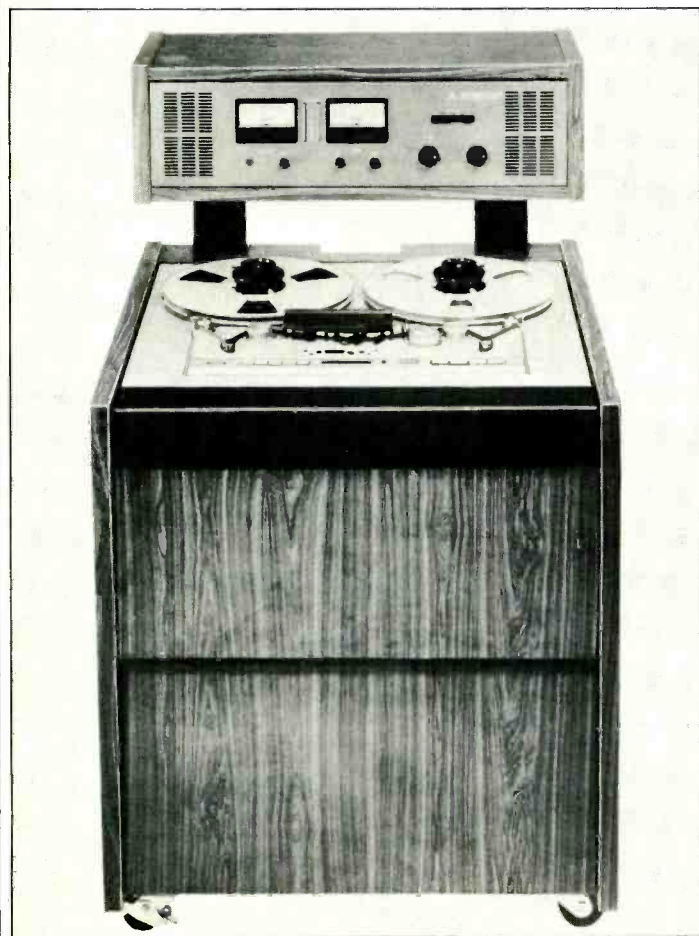
The current area of interest for those looking at second stage digital investment (post mastering systems) is the digital multitrack. If you had the money at this moment in time, there are only two systems in commercial production; Mitsubishi and Sony. Following the reorganisation of the US distribution system for Mitsubishi through the Digital Entertainments

Corporation, sales of the X800 multitrack and the X80 2-track appear to be going quite well within the States. The choice of 32-tracks for the multitrack seems to be considered commercially right. Sales of the system in Europe are rather low with an informed source putting an estimate of just two systems in operation—a guess made in the absence of any facts. Following the US lead, expect to see a higher profile on the system in Europe soon.

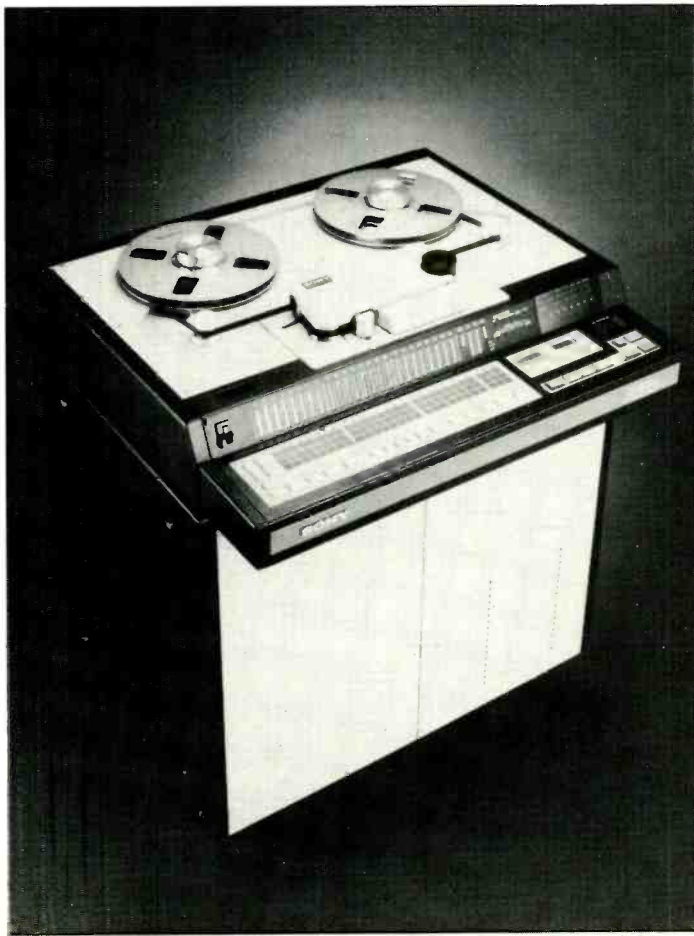
There are now a fair number, again no figures, of Sony 3324 machines in operation in Europe and the States. This machine now has the addition of a new remote unit and synchroniser, the RM-3310. The 3324 seems to sell to those who are happy to use the 1610 U-matic based mastering system rather than a digital 2-track tape machine such as the Mitsubishi. However Sony have a digital 2-track in development at present. An early prototype was first shown at the Paris AES in late March. Designated the PCM 3102, this is a DASH format machine with switchable sampling rates of 44.1/48 kHz using ¼ in tape at a speed of 7½ in/s. In addition to the digital tracks there are two analogue tracks. Sony claim that razor blade editing can be used as may electronic cross fade systems. The machine is equipped with a timecode track for synchronisation purposes and also slow rewind and slow 'fast forward' modes.

Studer, too, chose the Paris AES to preview their new 2-track digital machine (covered in new products July '84). This was a stationary head (DASH) format machine that should be available

Mitsubishi X80A



Sony PCM 3324



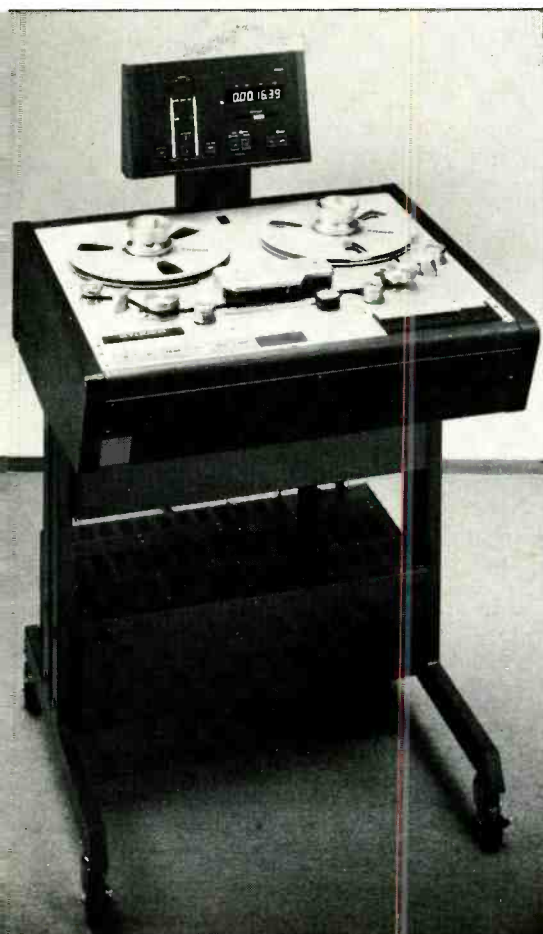
in about 6 months time.

Studer also chose the Paris show to announce their plans for the future on the multitrack front. They have decided that 32-track is more likely to be a popular standard for digital systems as the higher initial capital outlay becomes more attractive than a 24-track system. This does not mean abandoning the DASH format but using the double density 48-track format which requires the use of thin film heads. The breakdown of the 48-tracks will be 32 for digital audio and eight digital audio tracks, coded for error protection of the 32 audio tracks, and the final eight tracks will also be DASH encoded but will be used as spare channels, for the recording of labels, eg for such applications as extended dynamic range and advanced applications. The machine would still be capable of playing tapes from other DASH machines with 24, 32 and 48 tracks.

An ideal of the areas Studer are working in with regard to labels, editing systems, etc, may be obtained from AES reprints presented at the last three AES conventions. The Studer noise reduction system for processing analogue recordings in the digital domain is also progressing and may soon find real commercial applications.

Since this last time last year we appear to have lost two companies active in digital audio—Soundstream and 3M. Both were pioneers within their fields and as such suffered the fates of pioneering. I used the term 'appear to', as there are many

Studer PCM DASH 2-track



companies who are researching systems that are intended for future use once the studio market has accepted that digital recording systems *don't have to* use tape, and I would not be surprised to see some part of one of these companies again in the future.

While on the subject of other-than-tape-recording-systems, The EMT *Digiphon* hard disk based system has been further developed in conjunction with Gotham Audio to form *Systex*. This has applications in many fields but at present most of the marketing push is being directed at radio station usage for automated programming, etc. For pure music recording use, the playing time is a restricting factor as is the editing ability which is not accurate enough for critical music use.

There has been little happening in the mastering systems side of digital audio. The Sony *1610* is now almost completely standard for 'top-end' digital mastering. The fact that processing through a *1610* is necessary for CD mastering has of course helped. There has been a slight

degree of relaxation by the CD manufacturers themselves and they will now accept masters on other formats such as JVC *DAS* although they are still copied to *1610* at some stage.

JVC are still showing their digital mastering system at exhibitions although in a very low key manner. For instance there are no plans to market the *DAS* system in the UK although the situation is rather different in the US and there has been a positive marketing policy.

Denon has been experimenting with PCM since the early '70s and has a very wide catalogue of CD material recorded using their own mastering system, the *DN-035R MkII*. This is a U-matic based system using PCM 16-bit recording with a sampling rate of 47.25 kHz but with options on 44.1 and 48 kHz. It can be a 2 or 4-channel system and there are a number of available options. Denon also have a PCM editing system known as the *DN-036ED* random access system which is disc based and can operate with 4- or 2-tracks including mixdown from four to two tracks. The unit can

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DIGITAL EQUIPMENT

apparently operate with sampling rates of up to 54 kHz.

Although Denon have recently started to set up distribution systems for their professional audio products within the USA and Europe, information on the digital systems is limited and it is also not known if they are for sale as yet or purely for Denon in-house use.

At the lower end of the mastering spectrum (but only just) the Sony *PCM-F1* is everywhere. Sony unfortunately decided to discontinue producing the *SL-F1* portable Betamax recorder it was designed to match and be used with to make such a useful portable recording system. There are, however, still reasonable supplies of the unit available from some dealers. Similar to the *F1* in most electronic ways, the *701* is a rack mount PCM processor that looks a little more professional in its appearance. Sony have been fairly co-operative in encouraging manufacturers such as Audio & Design and RTW to

modify the unit so that it has a number of further functions. Audio and Design for example have three levels of professionalisation that include electronic balancing, attenuators, NTSC/PAL switching, CTC correction and 1610 input/output interface.

RTW have introduced the *Studio Processor Set 2* which consists of a *PCM-701* with extended functions and an interface unit, the *AD2* for digital copying and conversion between EIAJ code and full 1610 format.

The remaining digital topic is mixing consoles. The Neve *DSP* system is getting nearer full operation. There have been a number of test sessions so far that have given very encouraging sonic results. Apparently the cleanliness and transient preservation through the system is very impressive. Tape One studios have had a 'mini DSP' in operation for some months and they have been impressed with the digital EQ and compression facilities, again for their sonic capabilities. The only matters remaining to be sorted on the larger DSPs are apparently the operational procedures. It has been found necessary to limit some of the facilities available so that under session conditions with pressure on, the engineer was not able to make an error that would jeopardise the session due to vast flexibility available to him. These software problems are always an unknown factor and because

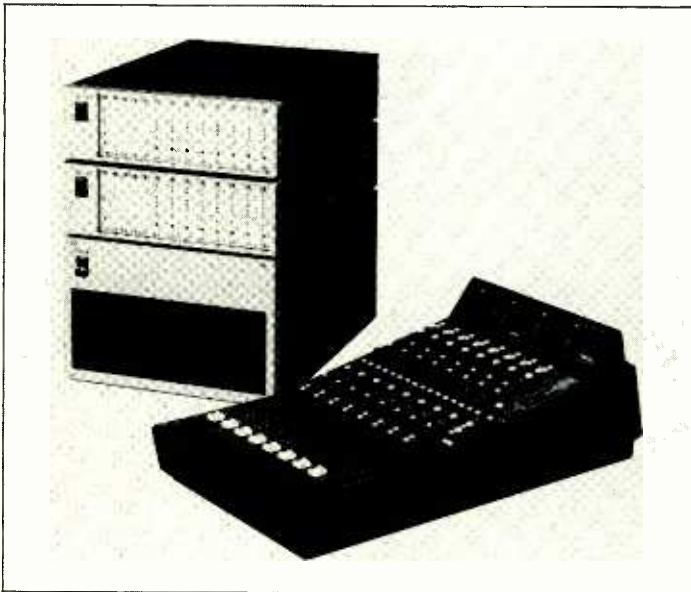
of this precise operating and installation dates have to remain open but not too far away.

The Paris AES saw the showing of a digital console system from Enertec although this is fairly much in the prototype stage. Further details will hopefully follow.

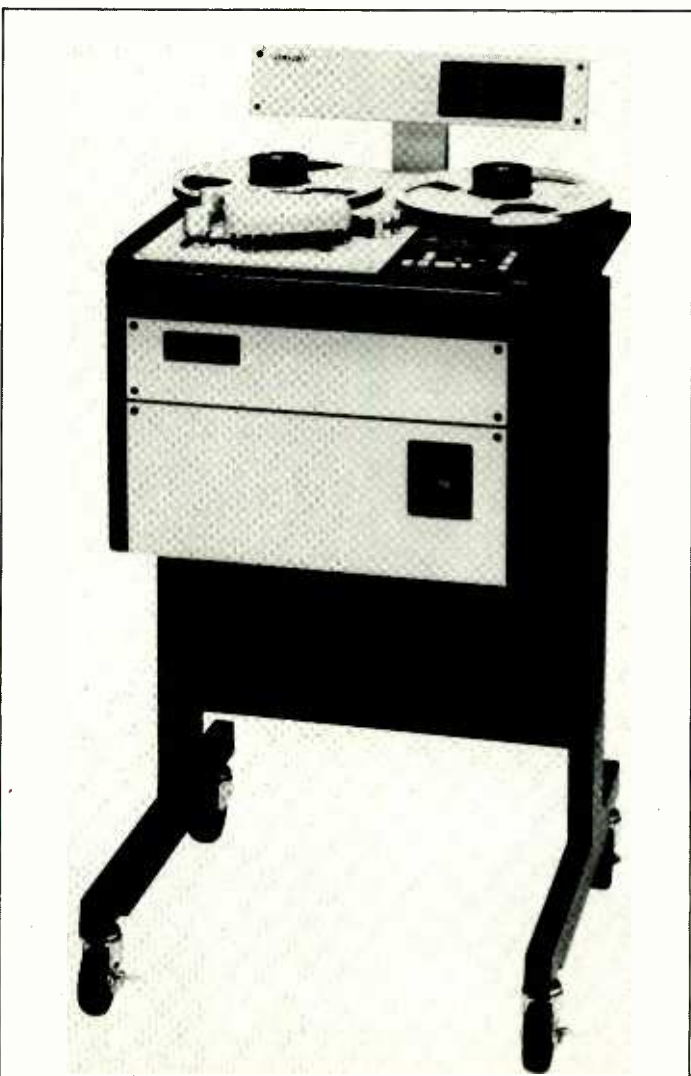
Also recently introduced by Sony was an 8-channel digital audio mixer. The system is modular and consists of a rack mount signal processor unit, desk top control unit and A/D and D/A units. The system is designed to connect directly to Sony digital equipment and will mix 16-bit linear digital signals. It provides a general mix facilities and 2-channel main output, a 2-channel sub-output and 8-channel direct outputs. The D/A and A/D units have variable headroom and sensitivity to allow input from many sources including analogue systems. In appearance and operation, the system is apparently similar to a standard console although solidly digital.

There are a number of other companies who are currently launching products into the digital market and these include HHB with the *CLUE* logging and editing system for the Sony *F1*, the intended multitrack system from Matsushita (Technics) and more recent developments from dbx with regard to the exploitation of the dbx *700* series. It is intended that all of these products will be receiving far more coverage in the very near future. □

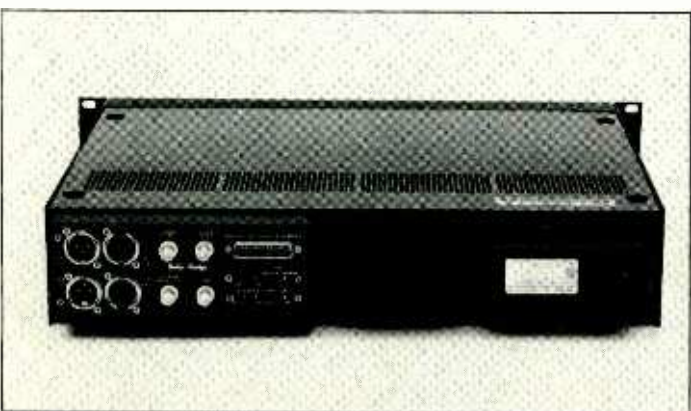
Sony 8-channel mixer



Sony PCM 3102



Audio & Design modified Sony 701



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MULTI CHANNEL AUDIO PRODUCTION FOR US TV

"The change to stereo television will either be a real boon, or an enormous pain in the rear." That statement came from Douglas Dickey of Solid State Logic, one of the principal speakers at the session on multichannel sound for television that opened the convention of the National Association of Broadcasters in Las Vegas, at the end of April.

One month before, the Federal Communications Commission issued its final Report and Order implementing multichannel TV, and equipment manufacturers, broadcasters, and engineers have since been scrambling to figure out what it all means to them. The various presentations and seminars at the convention showed that a lot of folks have been thinking seriously for some time about how multichannel TV sound will be implemented, and also that a lot of the problems the medium will produce have yet to be solved.

The FCC decision hewed close to the Reagan administration's official deregulatory stance: it opened up unused space on US television channels and at the same time avoided dictating how that space was to be used. Such an attitude is not without its drawbacks: two years ago the FCC made a similar move regarding AM stereo broadcasts (broadcasters were allowed to use any of four non-compatible formats), and the result has been utter chaos on the AM band, which may be solved only by some forward-thinking receiver makers.

Therefore, industry groups were determined not to let the Commission completely abrogate its regulatory responsibilities this time around. The Electronic Industries Association set up a group, known as the Broadcast Television Standards Committee (BTSC) to evaluate the various competing formats for stereo television, who eventually came up with very specific, well-documented recommendations for the FCC. The Commission did not exactly put the BTSC's findings into law—they believe that would invite antitrust lawsuits from manufacturers whose formats were not recommended—but instead sneaked them in sideways: broadcasters are free to use any format they wish, but if they use a stereo audio subcarrier with pilot tone at 15.734 kHz (a convenient place for a pilot, in that it coincides with the horizontal line frequency of US television broadcasts), then they must use the Zenith stereo system, and apply noise reduction to the subcarrier using a dbx system.

In absolute terms, this means that Zenith/dbx format broadcasts are protected from interference in that stations using other formats must put them in different parts of the TV channel. This means that the vast majority of broadcasters will implement the Zenith/dbx system simply to avoid confusion. (Exceptions will be allowed for subscription TV stations that already use a tone at that frequency as part of their scrambling systems.)

In a couple of respects, the BTSC system differs from the stereo TV systems already in use in Japan and Europe. The stereo subcarrier, which contains L-R information (the main audio is L+R, making the system compatible with existing mono

The only topic for conversation at the recent NAB Convention in Las Vegas was stereo sound for TV. To only a slightly less extent the situation was the same at the AES conference in Anaheim. Recent developments in the US have made stereo TV sound a near reality and when implemented in the near future, the effects will be far reaching in the audio industry. Paul D Lehrman reports on the discussions, seminars and feelings about the subject aired at NAB.

receivers), is amplitude modulated, like FM stereo broadcasts. Amplitude-modulated signals, of course, are susceptible to all sorts of noise—to avoid this, and to prevent any reduction in coverage area of the stereo signal (a problem familiar to FM broadcasters), noise reduction is employed. The dbx TV noise-reduction system is similar to, but not compatible with, the company's tape noise-reduction systems.

The L+R/L-R format does not allow for second-language broadcasts—to make bilingual programmes possible, a third, mono, 10 kHz audio channel, called the Secondary Audio Program (SAP) can be broadcast and decoded separately from both the main and stereo audio channels. (The new law does not require that the SAP carries audio, but does say that it must use the same type of modulation as the stereo subchannel, and if it is programme-related, it must use the dbx system.) Since the majority of sets will not be able to decode the main and stereo audio simultaneously with the SAP (and listeners wouldn't be able to deal with all that dialogue coming at them at the same time anyway), the SAP must be a complete soundtrack, with dialogue, music, voiceovers and effects, all in mono.

There will also be room for an additional subchannel, dubbed the 'professional' channel, which will eventually be used for internal station purposes, such as telemetering data back to the studio from a remote transmitter site, or as a talkback system for mobile units.

The NBC network has been experimenting with various kinds of stereo for television for the past couple of years, according to James Gibbings, the first speaker at the session. A listening room has been set up at network headquarters in New York to demonstrate the potential of the format to producers and advertisers. The *Tonight Show* has been recorded in stereo since October 1982.

Gibbings outlined some of the problems involved with converting to stereo. "The *Tonight Show* requires a 'bundled' mix," he explained. "Although it's pre-recorded, there's only 2 hrs between taping and airing, which is not long enough to do any post-production. There's also lots of leakage between the cast mics and the music mics. The console we're using is 20 years old. It's got a jack panel with a thousand holes. It is now configured into 53x20x6x2x1, so we can do stereo by taking signal off the submasters, but it has no panpots. When we have music groups on, we bring in an auxiliary Yamaha console to mix them. We are putting in a new console soon."

Gibbings pointed out that today's television productions use the 'Academy' roll-off on their audio tracks to accommodate the limitations of optical film tracks, which limits the bandwidth to about 200 to 8000 Hz. Using audio tracks on videotape, however, allows the sound to take on 'album quality', with the upper limit stretched to about 12 kHz. At the same time, he cautioned mixers not to apply music-recording techniques too strongly to TV sound: "The typical viewer position sees the TV picture covering 16° of an arc, while the

optimum stereo listening position covers 60°." Not only engineers, but set manufacturers have to be aware of the potential dangers. "Receiver makers have to inform buyers of the proper set-up procedures and options," he pointed out.

He also said that for the time being TV shows will use dialogue recorded in mono, with music and effects in stereo—panning dialogue tracks to follow actors' movements just doesn't work on the small screen. He suggested a technique for expanding the apparent stereo stage without generating a 'hole-in-the-middle' effect: while on-screen sound effects can be localised by panning them between the left and right channels, off-screen effects can be made to appear as if they are coming from outside the stereo image by recording them as minus-left and minus-right signals. "This widens the stereo image by as much as 25%, without pushing out the image location," he explained.

Another technique for keeping the centre image stable is to use 3-channel 'motion picture style' audio—a format which, Gibbings said, is feasible within the Zenith system, by broadcasting the third channel in quadrature with the stereo difference signal. With a little bit of cheating, 1 in C-format videotape can handle three audio tracks. Gibbings played two cuts from the *Tonight Show*, one mixed in 2-channel, the other in 3-channel. The use of stereo makes the stage much bigger and increases the live show feeling dramatically (even if the drums were too far off to the side and Ed McMahon kept moving from left to right), but from this reporter's vantage point in the centre of the room, the 2-channel mix actually sounded better—with three channels the centre speaker, used just for dialogue, seemed to remove Johnny Carson rather radically from the rest of the show. On the other hand, from the comments that came from those at the sides of the room, the 3-channel format works much better when the listener is far off-axis.

Kevin Dauphinee of ABC talked about the uses of the SAP: "Stereo itself will not increase audiences," he maintained. "The programming must do that." But SAP can represent a return on the investment in implementing stereo by attracting new segments of the viewing public—especially those for whom English is not a first language. "The US has 24 million Spanish-speaking people," he explained, "and the growth rate of that population is 6.5% higher than the general population, so that by 1990 there will be 30 million. Sixty percent of them are concentrated in six cities, and 86% live in 30 metropolitan areas."

Dauphinee pointed out that there are currently 18 Spanish-language television stations in the US, and five more on the Mexican border that have significant US audiences, and that \$93 million a year is being spent on reaching Spanish-speaking TV audiences. What he did not talk about, however, was the impact that major network affiliate station SAPs will have on established Spanish-speaking stations (most of which are independent and relatively small) and cable networks.

Who is going to watch a low-budget local talk show, at least one observer noted, when they can get *Three's Company* in Spanish?

SSL's Doug Dickey got down to the nitty-gritty of mixing and caring for multichannel sound on television. "It means a challenge," he said. "There must be an overall improvement in audio quality to compete with videodiscs, VCRs, and direct broadcast satellites."

The first requirement for producers, he said, is a good monitoring environment. "Most current control rooms are not set up well. The sound mixer is in the wrong place. But this doesn't mean rebuilding your control rooms: near-field monitoring, combined with judicious equalisation and some minor acoustic improvements will provide a workable solution. The point is not perfection, but your listening areas must provide a reference standard that results in excellent quality at the receiver.

"You may need equivalent sets of monitors for the mixer, the sound effects director, master control, and probably the technical director. Other areas can probably get by with good old mono. In some situations, you must be able to switch quickly between mono, stereo, and SAP. You might want to be able to switch in filters at times to accurately compare the main and SAP mixes."

Dickey explained that there will have to be modifications in equipment, as well: "C-format tape cannot handle stereo audio, timecode, and SAP at the same time," he said. "You can lock the VTR with a 4-track audio tape recorder, which is OK for occasional special programming, but in everyday use it becomes a horrible nightmare. It might make sense to put the timecode in the vertical interval instead, freeing up that track for SAP."

He maintained that it is unlikely that discrete 3-channel stereo will ever be used in television, as the format is much more important in large theatres, and there would be serious compatibility problems with existing mono and early stereo TV sets no matter how it was implemented. He did offer up one intriguing possibility, however, that a third audio channel could be used to broadcast a compatible surround-sound format, such as Ambisonics.

At the pre-production level, there will be more reliance on multitrack tape recorders—4-track to 32-track—as opposed to sprocketed mag film gear. "It's important to keep the dialogue, music and effects all separate, so that the SAP track can be done easily and quickly." For example on an 8-track machine, dialogue left/right could go on tracks 1 and 2, music on 3 and 4, and effects on 5 and 6, leaving track 7 for a mono-foreign language dialogue mix, and track 8 for timecode. This allows both the main stereo mix and the mono SAP mix to be laid back directly to the 1 in master with just one generation. He also noted that post-production computers will be very helpful for assembly and mixing, and "... will pay for themselves in short order".

"We just equipped one of Turner Broadcasting's trucks for stereo football coverage. The SAP going out of the truck will have everything on it but the English announcer—we'll use whatever

MULTI CHANNEL AUDIO PRODUCTION FOR US TV

we can, like duckers, extra microphones, and intercoms. The most important thing is that the mixing engineer will have to be bilingual. Sitcoms and dramatic shows will require even more care—but Hollywood learned how to deal with the problems of stereo, so TV will too. For one thing, the lighting director will now have two mic booms in each shot to contend with!"

The most interesting talk of the multichannel TV session was given by Mark Schubin, an independent consultant from New York. Schubin addressed himself to the problems of mono compatibility, and came up with some suggestions that should be taken seriously by everyone involved with multichannel sound, whether they are in broadcasting or not.

"If all the TV sets sold in the next 10 years are stereo, that means that half of the sets in use will still be mono," he began. "Therefore, there is a strong need for a good mono signal. Mono sets shouldn't sound worse when we start broadcasting in stereo. To do that, it is essential to mic properly and maintain phase integrity."

He then went into a discussion of miking techniques, which seemed to be news to most of the assembly. Spaced omnis, he explained, cause phasing problems at particular frequencies. Coincident pairs are hard to balance. M-S miking, on the other hand, gives the mixer both the greatest flexibility and the best mono compatibility. The trade-off is that to control an M-S pair properly requires three console faders—one for the mono mic, and two for the 'stereo' mic, wired out of phase to each other. Multimiking, of course, gives the greatest flexibility, but it is not always practical.

Other problems with phase are rampant in the audio world, he explained. There is no universal standard for XLR-type and tip-ring-sleeve connectors. Even within an individual console, some outputs might be out of phase with others, depending on how many op amps are in line. Microphones from different manufacturers, although wired the same for audio, might use different legs for phantom powering. The unwary field engineer, getting signal from his Sennheiser but not his Schoeps, would reverse the polarity on the latter. The microphone would come alive, but it would then be out of phase.

Tape azimuth delays, which are easily corrected on audio tape recorders, are harder to deal with on videotape recorders. Schubin noted that there exist no stereo alignment tapes for C-format machines. Video processing, through time-base correctors, frame synchronisers, and digital effects generators can also cause problems with the audio.

Processing often delays the picture, and if a pair of digital delays are used on the audio to match it to the picture, they often don't run at precisely the same clock rate, and high-frequency phase distortion can result. Limiters on the two stereo channels must be tied together, lest transients on one channel cause severe image shifts.

Schubin's solution to all of these

problems is simple, yet radical in the face of stereo's 25-year tradition. Instead of distributing left and right channels separately throughout a facility, he proposed, why not set them up as sum and difference channels. "Just change the labels on your patchbay," he said. When using separate left and right channels, he maintained, the mono signal needs a great deal of care, but with sum/difference distribution, problems on the difference channel are far less noticeable in the final analysis. "Distribution networks, wiring harnesses, and tape recorders don't care what the signals are," he said, "only the consoles and microphones do, and they can have encoding and decoding networks put in." Such networks, he said, use (for unbalanced lines) a grand total of four resistors each.

Schubin's proposal was met with a great deal of interest, and the next day he reported that the Public Broadcasting Network (which has had a stereo TV network in place for several years, the audio often being handled by stations of the National Public Radio network) had approached him after the seminar for more details.

Although just about everyone at the session was enthusiastic about the possibilities of stereo TV, there was some concern expressed about the 'chicken-and-egg' syndrome—which would come first, the broadcasts or the receivers that could pick them up? Many in the industry felt that ABC's previously-announced stereo and bilingual coverage of the summer Olympics would be the new medium's first great shot in the arm, but a few weeks before the convention, the network decided it was not to be, citing logistical complications and, ironically, the lack of available decoders.

One particularly sensitive issue that will have a significant impact on the future of stereo television in the US was not addressed by any of the speakers, but instead was brought up by someone in the audience during the panel discussion following the presentations: will cable systems carry stereo and SAP television audio? For the 30% or more of American households who are dependent on cable systems for their home entertainment, this is a crucial question.

It seems that many American cable operators are loath to add new services (unless, like premium-programme channels, they bring in immediate added revenues) claiming that their systems are already working up to capacity. For example, although MTV is distributed around the country with stereo audio, few cable systems deliver it that way to their subscribers, because it takes up space. Unless forced to handle stereo audio and SAP by 'must-carry' laws (which can be implemented either by the FCC or Congress), cable systems will likely stay away from them in droves, and that could put a damper on the acceptance of the format. Ralph Haller, of the FCC, fielded the question, but could say nothing definite: he said simply that it was "... not yet resolved". I guess we'll all just have to stay tuned. □



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STUDIO FILE

STUDIO FILE

If there is such a thing as the 'typical Nashville studio', then LSI must qualify as a pretty good example. Just a pistol shot away from Music Square, the musical heart of Nashville, the studio is built inside a converted house (very much Country style) that quietly blends into equally quiet surroundings. As is often the case with studios built in residential houses, there is nothing on the outside to betray its presence other than the studio nameplate.

Through the good offices of one Jeff West, a well-known (some might say notorious) figure in Nashville studio circles, I was able to visit LSI during a session. This is always more interesting as one is able to get a real idea of the atmosphere and sound of the studio.

The session in hand was for a new album by country singer Gary Stewart, together with an all-star session group consisting of David Briggs, piano/leader; Jerry Carrigan, drums; Mike Leech, bass; Jerry Shook, rhythm guitar; Dale Sellars, lead guitar; Pete Drake, steel guitar; and Roy Dea in the producer's chair.

Described as a typical Nashville session by engineer, Al McGuire, the interesting thing was that everything was going down on to 24-track 'live', vocals and all. I must say that it was quite a change to hear a group playing as a group and creating a sound together. Certainly, the sound coming out of the control room monitors was good and punchy with the monitor mix being well up to re-mix standards.

During pauses I asked Al how much would stay tracked and how much would be overdubbed. "I would say it's between 85% to 90% down. We may need some re-touching here and there but basically that's it." He went on to say that for the type of session and music this was the norm rather than the exception. "Country people don't like overdubbing, especially the singers. They would rather get it right with the band. Overdubbing tends to make them nervous." Though this tends to apply less to the newer generation of artists, the premise of getting it right as a group does mean that there is more swing and 'feel' to the music than there would be with overdub parts.

During the evening there were some of the 're-touches' that Al was talking about in the form of acoustic rhythm guitar overdubs together with some solo guitar

LSI Sound Studio, Nashville



Control room featuring distinctive wooden racks

work. However, the session had produced two or three songs ready for re-mixing.

The studio itself consists of control room and studio area, the latter being on a lower level, enhancing visibility from the control room. There is also an entrance lounge that serves as a rest area where there are the inevitable games machines and facilities for making drinks and snacks.

The control room acoustics are homegrown and effective. They were worked out according to the LSI people's ideas rather than by following set concepts. There is space to move around and the atmosphere is suitably low-key and relaxed. The roominess also means that you can get the whole band in to listen to playbacks without feeling you are trying to break the world record for people in a confined space.

The front half of the room is essentially absorbent, with hessian covered walls and ceiling. There is trapping between the monitors and in the ceiling, together with a certain amount of side wall half trapping, these latter being faced by drapes. The console is placed in the absorbent area together with the mix positions. The front half of the parquet floor is covered with a thick rug to complete the deadening effect. The rear half of the room consists of spaced rough wood panelling on the walls that acts as slat absorbers and a unified

wood ceiling. There is also a portion of rock wall that fills what once may have been a large fireplace as well as a section underneath the control room window. The rear wall also features a rather natty floral stained glass window which seem to be popular in American studios. The actual sound was clear and precise with good stereo imaging along the length of the console.

The tape machines are situated in an absorbent soffit that keeps them out of the way and retains their reflective properties. Someone has also had the bright idea of building two shelves, or niches, over the soffit to store the odds and bobs needed for the everyday running of a studio that otherwise seem to accumulate like fungus everywhere you least want them!

Recording at LSI centres around a Harrison 32C console with 32 input modules, and an MCI JH-24 multitrack recorder. Master recorders consist of a Studer A80/RC and Otari MTR-10, together with a Technics stereo recorder for general duties. dbx noise reduction is installed throughout should it be required.

Though one of the earlier Harrisons, the 32C is still very popular due to its great versatility and clean sound. The console at LSI has also been 'hot-rodged' by the unofficial Harrison hot rod service resulting in improved transient and high-end performance.

Automation is available with the Auto-Set system though it is not called upon very often. It does come in handy for saving those good monitor mixes, however!

Monitoring consists of UREI 813 speakers that have been modified for bi-amping*; a UREI 6500 amplifier handles the low end with a McIntosh for the treble. Bizarre as it may seem, there was not an Auratone in sight—unless they were hiding!

A feature common to US studios is the style of free standing rack cabinets and here LSI were no exception. Attractively made out of wood, the two identical racks present two sloping faces at different angles making them easy to see and get at, as well as having acoustically reflective properties preferable to conventional vertical racks.

As well as providing a flat surface on which to put the Auto-Set keyboard and tape machine remotes, the racks provide a home for various goodies helpful to the enhancement of sounds, such as Universal (UREI) 175 limiters, Pultec EQH-2 equaliser, UREI 550 filters and LA-3A and 1176 compressor/limiters, UREI 964 digital metronome (for when the drummer is late or in an advanced state of inebriation), EXR Exciter, Orban 3-channel de-esser, Eventide H910 Harmonizer, A&D Vocal Stressor and dbx 160 compressor/limiters. Time-related effects are taken care of by a Lexicon 224 reverb unit and a Prime Time, a Deltalab DDL with additional reverb effects provided by a Cooper Timecube and two fairly elderly Lawson plates.

Access to the control room and studio is from the entrance lounge, so that one does not have to tramp through one room to get to the other.

Taking up what was probably once the living room, the studio features a false ceiling of angled acoustic tiles together with a 'rough-hewn' décor of wood panelling, rock and acoustic foam. The area in front of the control room window has a semi-circular rough tile floor that makes it suitable for a bright, lively sound. In fact, this is where the acoustic rhythm guitar was placed. The rest of the floor surface is thick carpet.

The grand piano is placed in an open 'box' with a large ceiling trap. This provides a certain amount of separation without the pianist being shut away somewhere. Additional separation is provided by the



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STUDIO FILE

STUDIO FILE

various other keyboards grouped around the piano, these being a Wurlitzer electric piano, Rhodes suitcase piano plus a Hohner *Clavinet* and a white Hammond *B3* that used to belong to a certain Mr Isaac Hayes. The studio has a fairly small and dead-sounding drum booth with good visibility across the room, together with a good supply of separation screens for guitar amplifiers, etc.

Adjoining the studio is a largish isolation room that has lively characteristics. Good for vocals, the room also houses the matching white Leslie for the organ, with equally good results. Access to the room is via glass doors so communication with the rest of the studio is no problem. In order to enhance the live sound of the isolation room, LSI have built curved reflective screens that can be placed as required, thus throwing the sound around even more. The vocal sound obtained during the session I attended was certainly very present, no extra processing being used, and complemented the 'live' quality of the recording.

LSI have a good selection of microphones and I noticed AKG *D202s* on all the amplifiers with a Sennheiser *MD421* for acoustic guitar. AKG *452s* were used on the toms which probably contributed to the snappy drum sound that was obtained. As well as headphone foldback, the studio has Klipsch speakers mounted on the wall over the

control room window for studio replay.

The rather weary face of Al McGuire testified that LSI are not idle as a studio and confirmed that he and co-engineer Danny Dunkleberger were "kept pretty busy". In fact, over the 10 years that they have been open, LSI have never looked back. Studio work is

varied as well, dividing equally into records, jingles and song demos.

Though it is the music that is the important end product and there are many approaches to getting a good result, it did make a refreshing change to go into an automated multitrack studio where everything was going down together and sounding good enough to go straight to 2-track. Of course it does depend a lot on the style of music and the result required but it is still nice to find a studio where they get a group sound down.

Terry Nelson
LSI Sound Studio Inc, 1006, 17th Avenue South, Nashville, TN 37212. Tel: (615) 327-4565.

*A word of warning should you decide to modify UREI monitors: the *813* is a unit designed for powering by a single amplifier. Bi-amping would entail bypassing the internal crossover network which contains the UREI *Time Aligned* circuitry. The monitor could not therefore be considered as 'Time Aligned' and this would invalidate the *813* design principles.

Engineer Al McGuire with LSI's keyboards



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STUDIO FILE

STUDIO FILE

Sinus Musik, Berlin

Just five minutes from Berlin's most famous shopping street, the Kurfurstendamm, you will find the recording studios of Sinus Musik in a very pleasant, large, detached, house set away from the hustle and bustle of the city centre.

Occupying the whole of the basement, the studios cover an area of about 200 m², and although compact, the rooms have been designed to make maximum use of the space available. The acoustic design was carried out by Jensen of Hetlingen in Denmark who also designed the interior of the Sinus Musik mobile which is the only one of its type currently available in Berlin.

The shape of the studio is somewhat unusual but, despite this, very effective. It has two separate areas with the floor of one section set 0.5 m lower than the other. The main section of the studio measures about 4 x 7 m and has carpeted walls producing a fairly dead sound, while the second and lower section has stone and wooden walls for a more live sound suitable for vocals, etc.

The small 3 x 3 m drum booth provides excellent isolation from the rest of the studio and is extremely well damped to produce a tight, almost anechoic chamber type of sound. Direct visual contact is possible in the second section of the studio with four monochrome video cameras covering the remaining sections.

The control room was designed for a flat frequency response and has avoided the need for equalisation. The JBL 4333 monitors are driven by a Crown/Amcron DC300 power amplifier. The Soundcraft series IIIB mixing desk has 24 input channels, 24 group routes and 24 monitor channels.

MCI tape recorders are very much in the forefront at Sinus Musik with a 24-track machine, equipped with autolocator, varispeed and Dolby A and a 2-track master recorder which has similar facilities. In addition to these the studio has a Studer B67



Lower section of main studio looking towards drum booth



Soundcraft Series III console housed in the control room

plus various Revox recorders, and a triple head Hitachi D-850 cassette deck completes the recorder line up.

A recent acquisition is a new Giese Lock 3 synchronising system which can sync the audio recorders with either JVC U-matic or VHS video recorders. Thus enabling the studio to work on music scores for television and video companies.

Special effects units abound in plenty with Audio & Design Compex Limiter, Vocal Stressors, Barth Dynaset, Klark Teknik delay line, Ursa Major Space Station, Roland Modulator, Klark Teknik graphic equalisers, AKG BX20, EMT digital reverb and a sound effects library to name but a few.

Returning to the studio we find a wide range of keyboards from Yamaha—CP7 electronic grand piano, CS80 polyphonic synthesiser, YC45D electronic organ and U3 piano. But just to prove they are not a one brand studio you will also find a miniature version of the mighty Wurlitzer and others by Farfisa and Hohner.

The drum booth contains a full set of Sonor Sonic drums, Rototoms and electronic drums. In the string department the budding musician will find a selection of guitars, a zither, mandolin, banjo and an acoustic guitar. To complete the musical line up there are two accordions, one of which is a bass version, and several harmonicas.

Back to more technical matters Sinus use a wide selection of AKG, Beyer, Electro-Voice, Neumann and Sennheiser microphones.

After the recording session is

over there are plenty of facilities for relaxation including a quiet garden away from the hubbub of the studio where one can cool off or soak up the sun depending on the time of year. To one side of the garden the mobile studio and camper are parked. The camper is available for use at the studio or on location without charge with bookings of more than one day.

The mobile studio is based on a Ford 4.6ton truck chassis to which a large, air conditioned, sound proofed, control room has been added. The vehicle is equipped with a 28/24 in-line Concorde 2000 S mixer, a 24-track MCI recorder with varispeed and autolocator plus a 2-track Studer B67 for mastering. A high speed Revox B77 and Hitachi cassette deck are also available. A Giese Lock 3 sync unit is used to synchronise the audio recorders with video. Carrying a range of video equipment there are facilities for recording in U-matic and VHS formats.

The acoustics were designed by Jensen who tried for flat monitoring which enables the unit to be used for mixdown on location. JBL 4315s and a pair of Auratones are used for monitoring with the power being supplied by a Geuilec 530 power amps.

Effects units installed are similar to those available in the studio plus 300 W foldback to the stage using either headphones or Bose monitors. Finally the mobile is linked to the stage via a 200 m multicore cable and distribution box.

Although the majority of the mobile's work is in Berlin

recording concerts or radio programmes and providing extended sound facilities for the local TV network when on location, it can be hired for PA control and recording live concerts.

The man behind Sinus Musik is Ulli Weigel who has many other interests including Satellite Television which is already being tried out in Ludwigshafen featuring many British television shows and films. He is also heavily involved in producing programmes for German radio and television. Day-to-day management is handled by Alfous Hillebrand who greets his visitors in a warm and friendly manner which reflects the general atmosphere of the studio so you immediately feel at home.

On the whole freelance recording engineers are used although Reinhard Zwierlein and Rolf Krause do the majority of their work here. Many of the recording artistes who use the studio are local although more and more are of international repute like Joan Baez, the Berlin Philharmonic, Arakontis and Eric Burdon.

West Berlin is one of those cities that you should visit at least once in your lifetime, for it will uplift and revitalise you like a breath of spring air. On top of this the charm and friendliness of the Berliners will make you want to stay a lot longer than you originally intended and nowhere is this more apparent than at the studios of Sinus Musik. □

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DIGITAL SOUND SAMPLING

Mike Beecher describes a low-cost sound sampling system developed by Mainframe for use with a personal computer.

Recording sound samples for playback as musical input is not new—the Fairlight CMI, EMU Emulator, PPG Wave, Synclavier and 360 Systems have made these techniques available to major bands, composers and recording studios for several years. But the use of a personal home computer does represent a breakthrough in terms of cost, and even if you don't already have an Apple II these are available quite cheaply now. Movement Audio showed briefly a monophonic prototype instrument on the lines of an EDP *Wasp/Gnat* synth and the Böhm kit company have produced a sampling unit in one of their synths (as well as a reasonably priced digital drum machine that's currently getting a lot of attention). And apart from one Apple sampling card from the States (and programmed delay processors with memory hold and looping functions), the arrival of the *DS3* from British Mainframe's engineering team is an interesting development.

The system was initially created because their band couldn't afford an expensive drum machine. The band's engineer, David Green, set about producing a sequencer to run on their existing Apple II that could sample any sound for use (initially) as a percussion generator. The project was started just as they were recording their first main album *Tenants of the Lattice Work* last summer.

The *DS3* digital sound sampling sequencer comes as a plug-in card for the Apple II or IIe (48 or 64k, the latter preferable to get longer samples), plus 1 or 2 disk drives along with software on disk for sampling and sequencing applications, including complete sets of song sequencers. The card has four RCA phono assignable outputs and one RCA phono sample input.

Samples may be up to 2 s in duration over a bandwidth up to 15 kHz. Four-voice polyphonic playback of a single sample is then possible via a suitable digital keyboard, with various editing possibilities, such as forward/reverse playback, sync control from tape click track or synth TTL trigger pulse, looping of a sample to simulate sustain, and saving and loading of sequencers (including samples)

for performance use. Two standard joysticks are also used during editing of the sample and, of course, you need to input a sound via a microphone, tape, mixing desk, etc.

A self-contained system for the Apple II or IIe (using micro keys for playing) with operating software costs £250. The demonstration was actually rigged to a Casio keyboard and a complete installation service with user-

training for recording studios can be provided. For £450 you now get a suitable polyphonic music keyboard plus interface as well.

Operation

On booting the operating disk, you are able to load a set of samples previously saved on disk—a set of drum sounds is provided as a 'starter' kit.

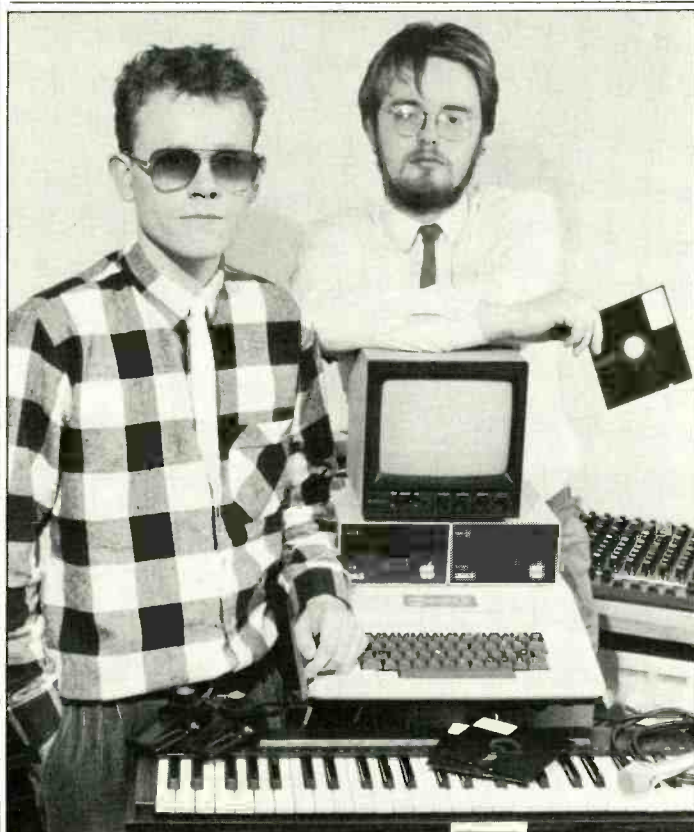
The system will allocate sufficient memory for a

sampled set and define the remaining area for the sequencer, making full use of the 24k memory available for storage after the main operating program. There's a size checking option that allows additional sounds to be allocated in some instances, but the biggest advantage is that a new set of sounds can be loaded in seconds from a disk store as compared to the hassle of physically changing ROMs in a drum machine like the LinnDrum.

For playing the sounds, a choice is given to do this via the Casio keyboard directly instead of through the sequencer, and there's also an external trigger input for live electronic drum pads. A graphics display can be shown of a waveform sample, a trace display for readout of an entered program sequence, and the size check mentioned ensures the required samples will fit into the computer's memory. For example, several instruments' sample times added together may exceed available memory space. If you need a set of similar sourced sounds, eg tom-toms, you could simply sample one mid-pitch tom and pitch them as you want by means of the 'kit-file' option. The latter also defines which key you hit on the micro to sound a particular sample.

Putting the assembled set of sounds into a sequence is done in real-time from the micro keyboard, following a specified metronome beat. Sequencers can be layered by merging together and joined in a chain. There's tempo setting over a wide range with the fastest note a semiquaver ($\frac{1}{16}$ note). Although this was suggested to be the basic pulse of a hi-hat, it's quite likely you'll need to double up tempo to get the extra quick flourishes that do occur in live playing.

An audible metronome from the Apple's built-in speaker sets the tempo, with fine adjustment from two micro keys. Entry commences from the first sound and a repeat marker for the bar being programmed is made using the space bar (correct to the nearest pulse). Each rhythm loop using one or more sounds in real-time entry can be re-assigned to another key to enable layering of these sounds at any point. The whole lot can then be saved as a bar with a file name that's recalled from a single defined micro key.

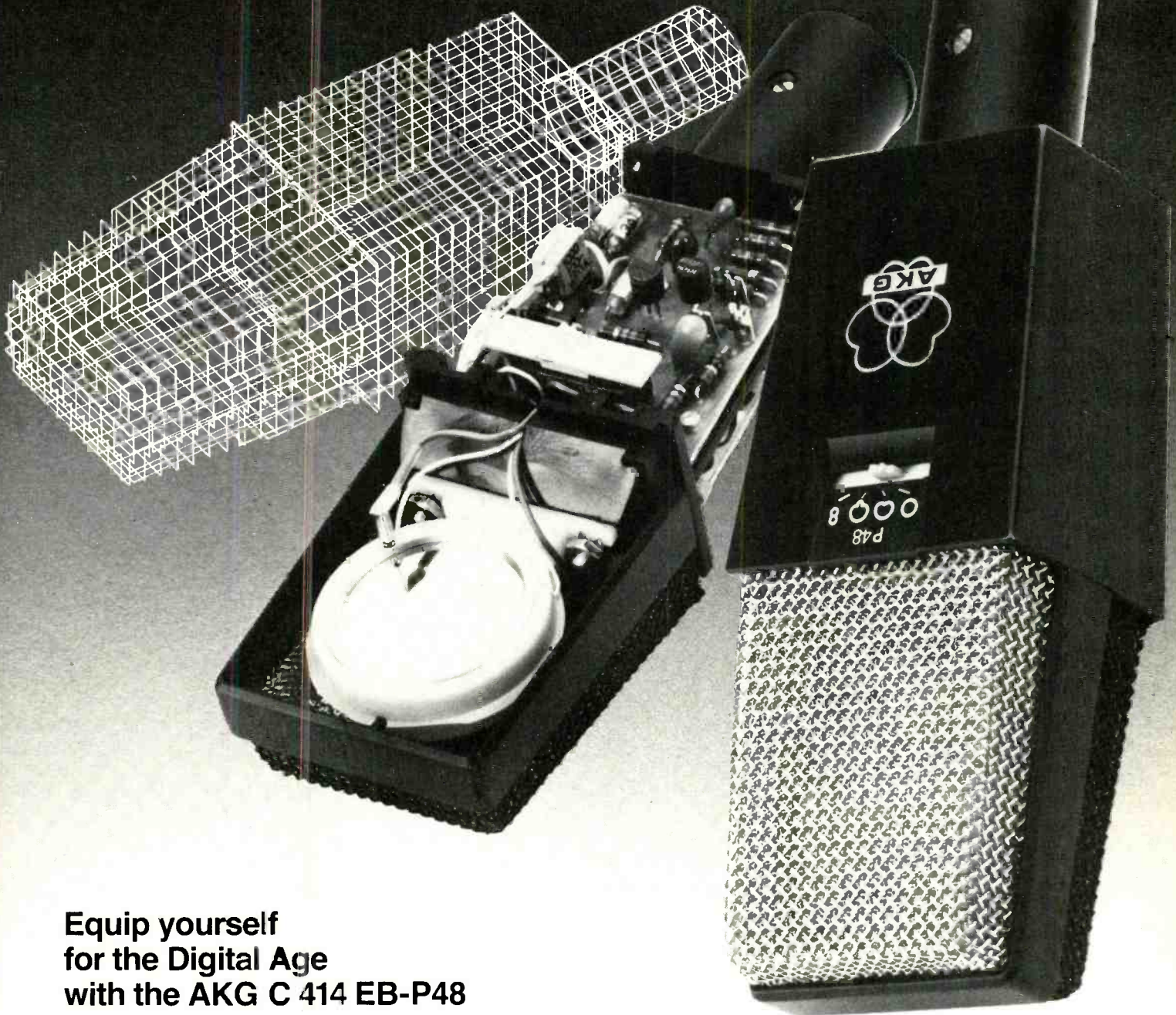


Mainframe's Murray Munro and John Molloy with the *DS3* system

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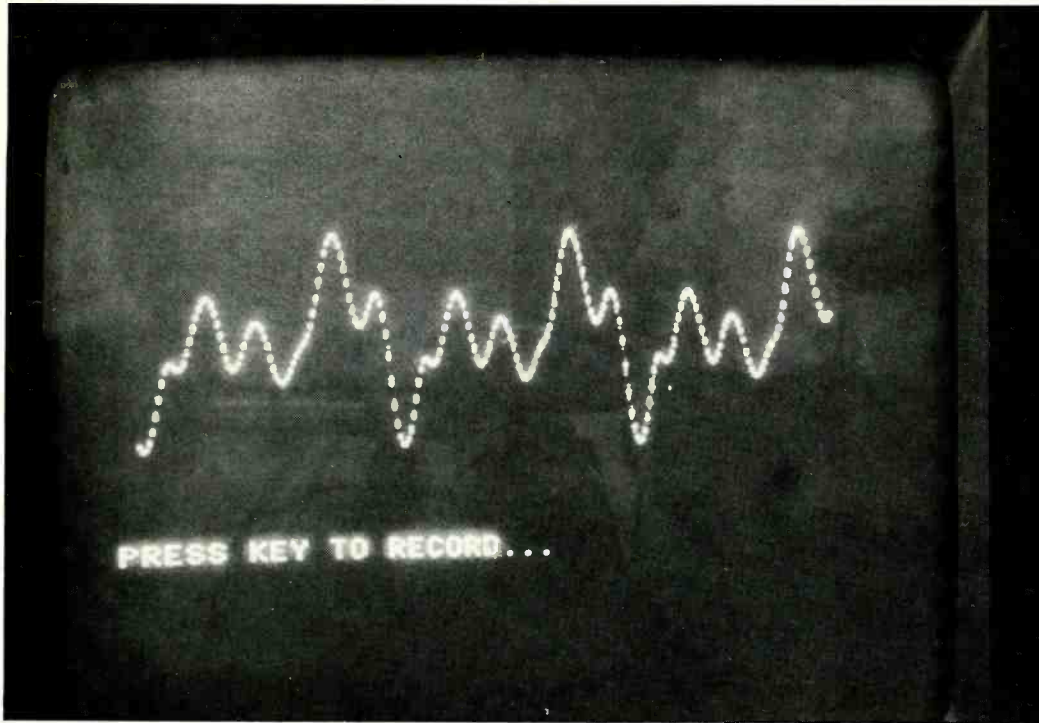
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ELECTRONIC INSTRUMENTS AND THE STUDIO



Graphic display of a sampled waveform

Drum machine system disk

Six options allow recording of a sound sample, editing of the sampled waveform in the computer's memory, and four setting up/play routines. These run the drum machine sequencer made by the sequence editor/compiler, or with 'Song Create' you select the samples for the 'drum machine' and 'performance compile' will let you prepare the correct order of your songs on disk file for a performance.

The 'Sequence Developer' provides seven options for examining the sequence catalogue, loading, saving, assembling, listing, joining or merging sequences, as well as being able to change sequence timing. In the sequence listing, up to 16 events can be shown with chosen samples' playing positions indicated for the four outputs available.

The creation of a complete sequence is straightforward and consists of first assembling rhythmic bars that can be played however many times you want before joining on new bars.

Merging of bar sequences to be played simultaneously is a useful utility enabling complex rhythms to be made through experimenting with one or two standard rhythm bars and adding 'fill' bars on top. A text editor helps with precise setting of events in a sequence.

Making a sample

An oscilloscope-style screen display shows the input sound being sampled as a waveform, with distortion appearing as clipping (from too high an input amplitude). Since it's quite likely that a sample time has some unwanted noise on entry or a delay, this is simply removed by some key tapping that drops out millisecond segments from the start of the wave. Since pitch changing of a sample means speeding up or slowing down the rate of the sample playback, any delay will be emphasised on lower pitches than the sample pitch.

Rough editing is done aurally by stepping through sections (or pages). More specific editing enables a particular part of the wave to be accessed on the screen with a first joystick rotary control moving the cursor pointer backwards and forwards and a second setting the speed of movement through the whole sample. Pressing the joystick button then puts rotary movement in a vertical direction to re-allocate a point of the wave on the screen—you could even draw a whole wave by this method, although it would take some time to do so.

A threshold level control is planned as a software update and will be essential for discriminating sampling, eg taking the required sound out of a background ambience, etc. A sample played back on the

keyboard will send each of the four notes played to the four individual outputs and looped playing of sounds can also be implemented.

Careful listening to a number of the supplied samples prompted the following observations: the side drum was effective with ambience decay built-in, bass drum was a little empty, the hi-hat had abrupt cut-off, woodblock/rim shot—a cross between both, low toms were fine, acoustic guitar did contain clicks at end release, but had a reasonable range of play and an authentic sound. The voice treatments in polyphony were the most interesting to use.

The system opens up the sound-creating performance of a band enormously and there's no reason why this kind of package shouldn't be of interest to a studio as an important tool for recording new instruments, sound effects and so on. To have a polyphonic system at low cost does increase its usefulness as an ensemble generator for voices and orchestral groups, although there are always certain limitations that have to be considered—different segments of samples cannot presently be linked, eg guitar attack to a piano sustain/release, the amount of time needed to collect suitable samples as opposed to 'library' files sold as accessories to the system. Provided the latter is catered for, a keyed sampling

system is likely to be quick and easy to use in the studio, with an acceptable output quality.

It is also standard practice on more advanced systems to take more than one sample over the required range. Most acoustic sounds require at least one good sample for each octave used and many require closer pitched samples—saxophone and grand piano are just two cases in point. Here we have to make do with one sample over whatever range we choose to play on the keyboard. Nevertheless, the highpass filtering appears to be adequate and in practice good selective results can be obtained.

Only short length sounds can be used in a group (2 s max available) and the built-in sequencer takes some of this memory as well. So hi-hat (open/closed), toms, bass drum, dry snare, rimshot, and claves are some that fall into the 'short' category, while cymbal crashes can only be used as a later overdub on to tape—that's a clumsy way of doing things, but Mainframe say it works.

It can take some time to get the right sample made and the user's skill, say, at playing a trumpet, may not be good enough either, so you'll have to hunt around for the right sound. But, as the Mainframe crew suggest, the most exciting samples often come from taking the unconventional rather than the conventional. Their latest recording projects have utilised some startling vocal samples that illustrate the potential of the system for 'electromusic'. Even though this may be old hat for CMI, *Emulator* and the other state of the art sampling instrument owners, if you've never been able to invest in those superb instruments, then the *DS3* offers a low cost alternative. It is also perhaps significant that the organ world has brought in PCM 'sampled' sounds, not just for percussion, but for acoustic instruments such as grand piano—take a listen to the new Technics organ, *SX-G7*, and you'll probably be very surprised at the realism you hear. And, of course, you now have an excuse to get away from Fender Rhodes, tubular bells and other acoustic instruments as well as familiar synthesised sounds, to a more dramatic soundscape embracing sampled vocal interjections, new timbres and effects! □

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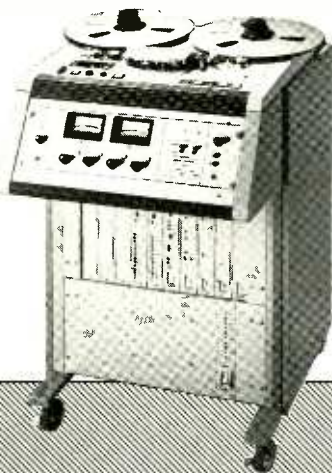
CASE HISTORY

BACKGROUND: Rooster is a long-established and unusually well-equipped small studio in West London, where owner Nick Sykes has recently invested in a complete control-room rebuild.

PROBLEM: Simply to get the best possible tape machines whilst keeping the bank manager happy.

SOLUTION: ITA installed a 24 track Otari MTR90 Mk. II and an MTR12 mastering machine at Rooster. The price difference between the MTR90 and its only serious rival made the decision easy. Another factor was the size of the control room and the access to it – a large European machine would have needed a crane and a demolition gang to install it!

RESULT: Nick is one of the growing army of experienced audio professionals now converted to Otari. He quickly realised that the MTR range's advanced technology combined with engineering excellence and ergonomic operation makes it by far the most cost-effective solution for the serious user.



OTARI DEVELOPMENTS

Otari MTR12 recorders are now available with a range of headblocks (which can also be retrofitted to existing machines) enabling the MTR12 to play and/or record either or both mono biphasic or FM pilot control tracks.

When used with the EC-402 plug-in resolver module, this means that the MTR12 becomes a self-resolving machine with tapes of these formats.

All the circuitry of the EC-402 is also available in the EC-401 Universal Resolver, which additionally provides the facilities of SMPTE/EBU timecode reader/display and universal capstan control of ANY machine. Thus the EC-401 enables virtually any type of machine to be phase-locked to any type of reference signal.

Also available shortly will be another headblock/module set for the MTR12, which will allow the record and replay of centre-track SMPTE/EBU timecode on 1/4" tape, compatible with Studer machines.

More details from Mick Boggis.

Mono Pilot and FM Pilot are compatible with NeoPilot and NagraSync respectively. NeoPilot and NagraSync are trademarks of Nagra-Kudelski Ltd.

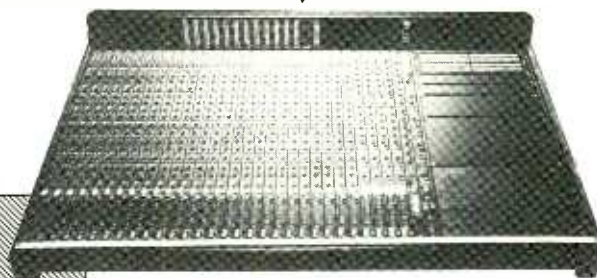
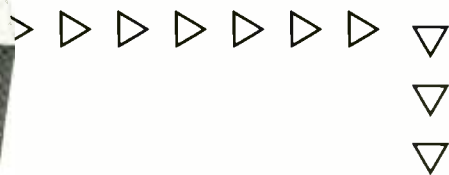
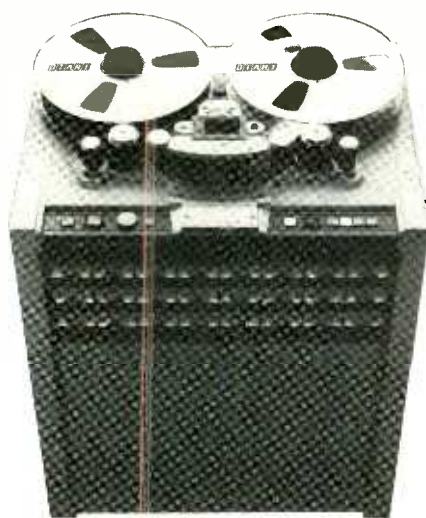


CASSETTE DUPLICATION

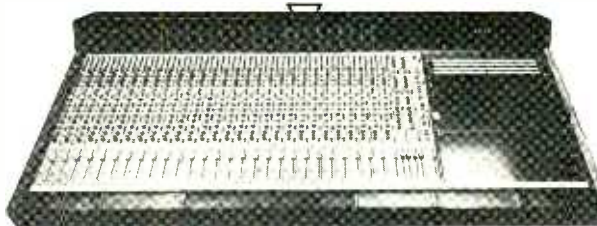
This new modular system from Otari gives a significant improvement in the quality that can be achieved with in-cassette duplication.

The new DP4050-OM reel-to-reel master is a separate unit which can accept 3 3/4" or 7 1/2" ips masters, and you can add to it up to 28 cassette slaves. A DP4050-C1 cassette master unit can easily be interfaced into the system.

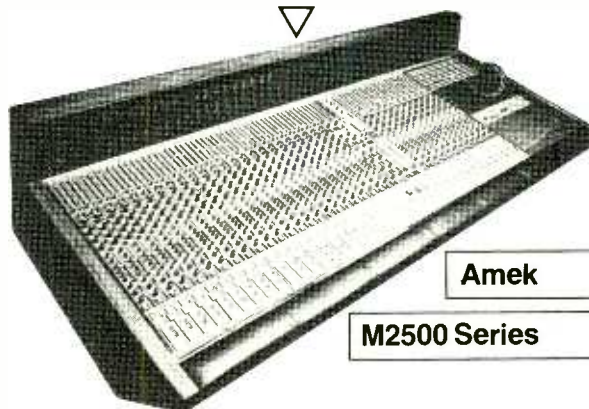
As it's Otari, the same consistent quality will be maintained long after other copiers have packed up, and serving requirements are minimal.



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M2500 Series

OTARI AND AMEK — TOGETHER FROM ITA

The Otari MTR90 Mk. II is being recognised by more and more studio owners as THE multitrack.

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We are also main London agents for the Amek/TAC range of consoles. These mixers have earned an enviable reputation for their highly "musical" eq, their flexibility and ease of operation and their extremely high standard of mechanical construction.

Again, ITA is THE ONE SOURCE.

We are currently supplying complete studio packages, centred around the MTR90 Mk. II and the Amek range, to studios of all types and sizes. Commercial studios, home-recording set-ups, video post-production, TV production . . . all are finding that the ITA solution of an Amek/Otari installation provides considerable advantages; technically, operationally and, not least, financially.

There are 3 Amek/TAC multitrack consoles to choose from. Between them, a wide range of budgets can be catered for. Each works beautifully with the MTR90, and each will provide levels of performance, operational ease and reliability unbeatable in its price range.

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The wear resistance of the magnetic layer ensures reliable operation even after hundreds of passes.

In spite of its considerable high MOL (+ 11.6 dB over reference level 320 n Wb/m), BASF Studio Master 910 has an unusually good print ratio of 57 dB and is therefore also suitable for long-term archiving. The BASF typical constancy of the electroacoustic properties and the excellent winding characteristics also ensure easy hub operation.

BASF Loop Master 920

The chromium dioxide master tape for high-speed duplication systems. At 64-times duplicating rate, the master is usually recorded at 9.53 cm/s. It is only the typical chromium dioxide properties featured by Loop Master 920 which offer that extra quality needed to allow exploitation of all the advantages of a high-class cassette tape (eg. BASF chromdioxid II). In spite of the mechanical stress to which it is subjected in the "loop bin", the durable magnetic layer means that the recording level remains extremely constant, particularly in the high frequencies, even after running thousands of times.

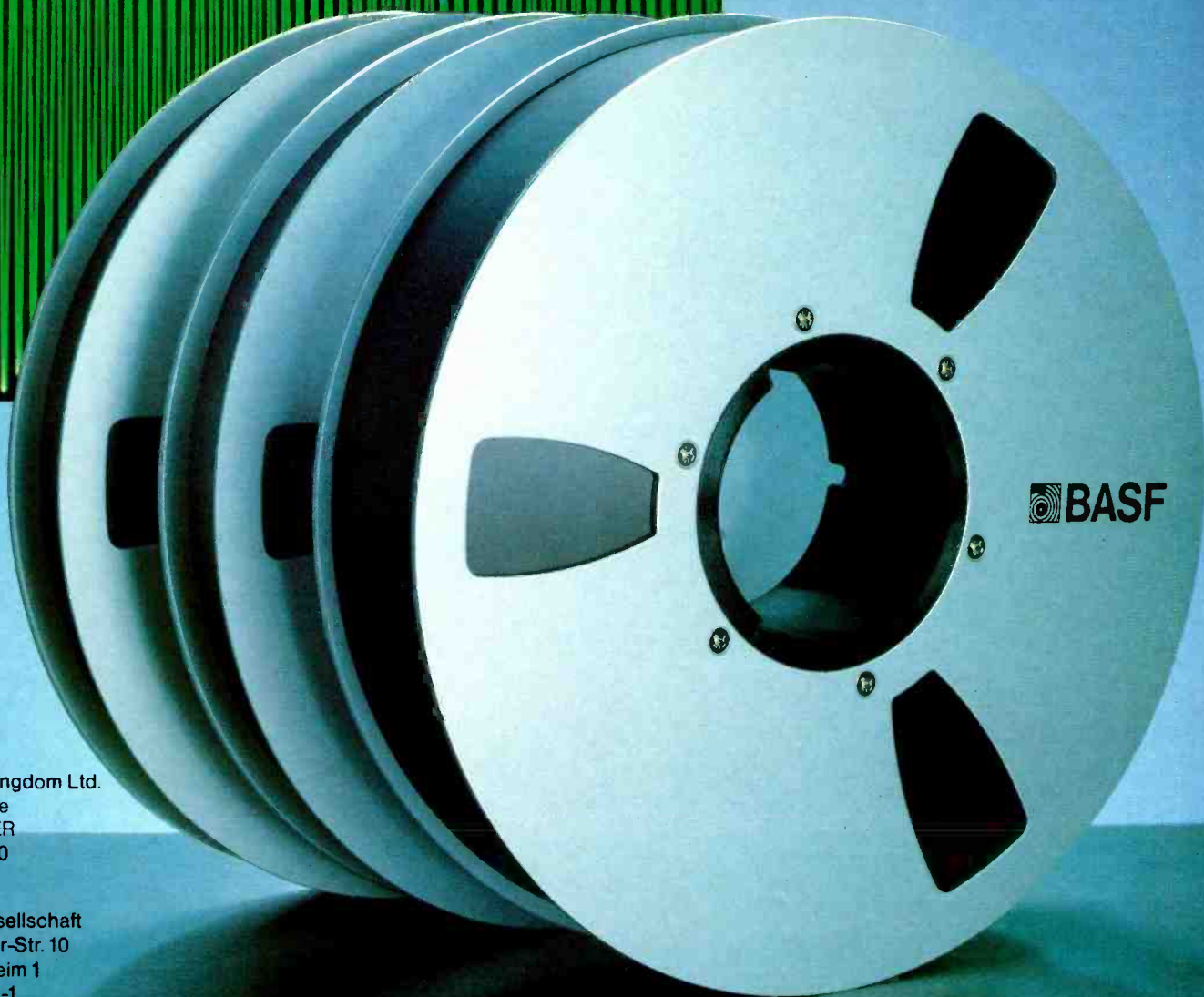
BASF Digital Master 930

This professional chromium dioxide tape is especially tailored to the requirements of digital sound recording (PCM), where the high storage density makes exceptionally high demands on the evenness of the coating. The typical chromium properties are brought out excellently in this latest form of sound storage. The antistatic magnetic layer and the black, conductive matt back protect the recording against dust-induced dropouts and ensure smooth, steady winding without damage to the tape edges.

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SAX ON CD

Doug Sax of LA's Mastering Lab and the man behind Sheffield Lab's direct-to-disc recordings, has been one of the most outspoken industry critics of digital recording. Then he appeared at the June '84 Chicago Consumer Electronic Show with no less than eleven Compact Disc titles on the Sheffield label.

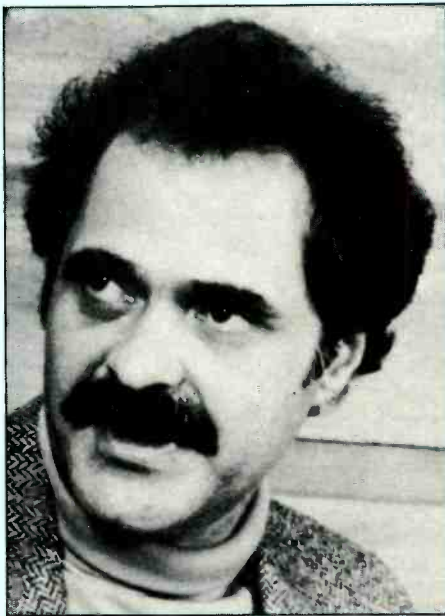
However, this is not quite the volte-face it appears to be. Sax remains resolutely critical of the current state of the digital art: "We were demonstrating CD and LP side by side at the CES show, and getting better results off the LP. This is an absolutely fair way to appraise the two: the same live feed was used; the digital was never returned to analogue—it was transferred straight to the CD, and the master lacquer was naturally cut directly."

The reasons behind the move into CD are essentially pragmatic. "Our research indicates that CD will eventually take 28% of Sheffield Lab's customers (in our US market) away from direct-disc purchase—though this is not going to happen overnight. The LP disc is on the way out in the States, but it's not the Compact Disc that's doing it, it's the Musicassette! 52% of the pre-recorded material sold last year in the United States was on cassette. A new commercial release sells more than 70% in LP format in its first year. Nevertheless the cassette sales figures overall indicate that over half the people consider this medium is good enough. (Another reason is that 80% of new cars now have a factory fitted cassette player.)

"There is no question that CD is going to become a lot better than it is currently. People who say that if the CD sounds bad it must be the poor recording, are essentially correct—much as I hate to admit it! But given a good recording, it still only gets so good. Now a lot of people are realising that you can get back a reliable 85 to 90% of what you put in if the signal is good, but that's it. However if the signal is exceptional, what you get back drops down to something in the order of 50%.

"But even under the best circumstances with CD, I still can't get emotionally involved with the music, and I don't know how you measure that as a percentage. The sound seems fine, but there must be other things going on

Doug Sax prefers the sound of direct cut analogue discs to that of CD. Paul Messenger asked him why he is now putting out CDs on his own label.



The LP is on the way out in the States, but it's not CD that's doing it

because I'm not getting off with it.

"I desperately hope the customers enjoy my CDs more than I do! I'm much happier with those I made from analogue tapes than with the pure digital recordings. That may seem to go against logic, but there are possible reasons: via

analogue you are asking for less storage, in terms of frequency response and peak transients.

"I've run four professional digital systems, and in some ways their abilities are superb, but the CDs I have done from analogue tapes, where the tape was particularly good, are the best sounding to my ears. I've done two projects recently where the multitrack had been mixed down to digital, but the clients had also brought in the analogue backup tapes. Both albums ended up being mastered from the analogue tape, after cutting digital and analogue versions of each.

"I did copious listening to the master tapes, down at the Mastering Lab, along with others including JVC engineers. These were the masters themselves, not a generation down or in CD format, and they were made on the same line as the direct disc with a \$30,000 recorder. The digital was a less complete restoration of what went on at the session than the production pressing of the direct disc, even using the JVC 900. The one thing I do know absolutely is that digital will get better, within the format. Somewhere along the way will come a bottom line, but we're miles from that yet.

"The JVC is the best machine I know, though mainly because of the absence of negative characteristics rather than a surfeit of positives. It seems to offer much better error correction than the Sony system.

"However, spinning head systems are very primitive. In order to assemble you have to go down a generation, which seems to be audible; it's not severe, but you lose some more low level. I record a whole side non-stop, and I have to go down a generation just to put the two sides together.

"The multitrack machines which have been offered by Sony and Mitsubishi have linear transport which allows razor-blade editing, and basically I do believe we should use a linear machine. It should also be in the CD format, so you don't have to go through rewriting. The tape doesn't have to get from one error correction code to another, from one timebase to another, and the channels should be staggered on the professional recorder as they are on CD. There should be no rewriting at all.

"There's only really the Mitsubishi in 2-track form at present, and I consider that is an unfortunate sounding

SAX ON CD

machine. I can stay in the room with the stuff that comes out of the JVC; I don't actually physically start throwing things at the loudspeakers! However, although the JVC runs at 44.1 kHz, it's not in the CD format, so it can't be transferred unaltered.

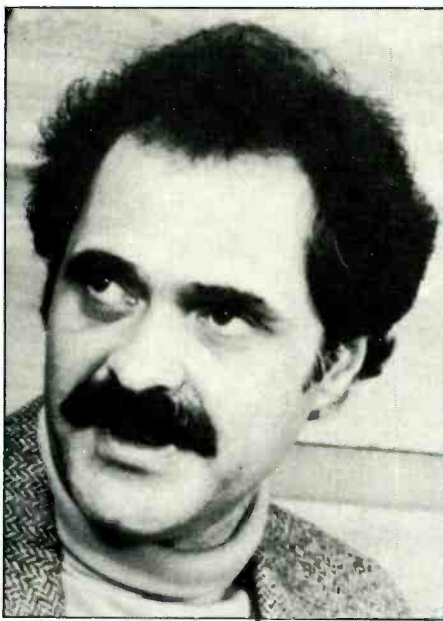
"I'll guarantee that there will be machinery available in three years time which will show up the present generation of models for what they really are. The engineers started by asking themselves how to store digital, and a video deck was an easy and cheap solution. Now the whole thing is happening, they can get serious and do something professional. And they can listen to the critics working with it, rather than the proponents, because that's the only way it will be improved.

"If digital is to improve, the input side of the professional recorder has to be improved. The A/D convertor is a dramatically more difficult device to make than the D/A, and that is the weakest link in the chain. I don't see anybody actively working in that area.

"Engineers are taking complacent attitudes, saying: 'This is good enough; if you hear anything you reckon is a characteristic of this, you're full of shit; we've done our testing and there's no difference.' But one of the companies will eventually say that it can be improved, because JVC are in competition with Mitsubishi and Sony. And even if improvement requires a very expensive device, we are talking about very expensive recorders costing \$30,000 to \$35,000, not CD players produced for a mass market.

"I had an article in *Billboard* which was answered by Peter Berkowitz of Polygram. He ended his reply with the implied facetious suggestion that I cut directly to Compact Disc. On reflection, that may not be such a dumb idea!

"I was talking about this recently with Martin Colloms, who said that to his knowledge that was the only way to get true 16-bit on to the CD: when you measure a CD player which gives 16-bit performance, it is on a computer generated signal. He didn't think it was possible to get 16-bit performance through the A/D convertors, let alone doing several generations of digital transfer without losing bits. Martin discussed using parallel 18-bit convertors, which Decca is currently using, because you need to start with



Whenever I do any purist recordings, it's an entire tube chain

more than 16 if you are going to finish up with 16, which sounds like good sense.

"Digital transfers are normally made through an editor, and that's a real rewrite function—you come in with apples and come out with oranges. At least with straight D/D transfer you start with a big red shiny apple, end with a slightly smaller less shiny apple, but it's still an apple."

Sheffield's purist approach is not restricted to direct cutting and a healthy suspicion of digital recording. Sax remains suspicious even of solid state electronics, preferring the custom-made valve (tube) which his brother designs for him: "I have never built a multichannel tube board; that would be a truly dramatic undertaking. But my mics are tube, and the output and summing section of our console are tube. All my research has shown me that the most audible part of the equipment is the

electronics, in recording and in playback. When I go in and record a symphony orchestra, which will probably be the next record we make, that's all tube. That's where it matters. Whenever I do any purist recordings, that's an entire tube chain.

"I wouldn't dream of going in front of an orchestra with more than one simple mic setup. There are a number of simple predictable microphone setups, from a Blumlein pair of ribbons, crossed figure-8 condensers, the middle-side matrix technique used on the first 20 Deccas (which are revelatory), an ORTF system of two mics pointed out about ear distance apart, and of course free-spaced omnis.

"The mic electronics are not only tube, they're also transformerless and operate at line level. There's nothing I've heard that does what they do if you put them over a set of drums. And the difference is in the electronics, not the capsules. I don't make my own transducers.

Essentially any condenser capsule is the same in terms of what it wants to feed, and what you need to handle it electronically. So I can plug in a Schoeps, a Neumann or an AKG or anything else that comes along. On my purist recording I control every element in the recording, including connectors, apart from the transducers at each end of the chain, the capsule and cutter.

"Although it wasn't my intent, I do have four CDs which are purely digital, and I guarantee I transferred them with the minimum meddling, along the lines of the LPs. I don't believe everyone is going to find the LP better, but if they've got a very good turntable and a good preamp, I think they'll hear things on the LP they'll not hear on the CD. One common link seems to be that you'll find a decent record player in the house of everybody who is critical of digital. Basically, I believe everybody buys at the level of their perceptions, and if some guy has a good system, he'll be interested in the direct-to-disc.

"In many ways recording direct-to-disc is really dumb, and I would prefer not to have to work that way. But if you're talking about the total abilities of the system, for sure it's the finest storage medium available today, even through all the processing and pressing. If we're talking about what the master lacquer sounds like, that's an order of magnitude ahead of everything." □



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THE
VIEW
FROM

NEW YORK

Twenty years after The Beatles first landed in the USA, the business of running a recording studio in New York City has settled into an increasingly stable mode of conservatism. As the generation which entered this business in the '60s and early '70s has taken over the decision-making processes at New York studios, a variety of factors have helped contribute to this sort of careful approach to fiscal management.

Chief among these were the economic realities of the 1970s, which caused seismic fluctuations in the availability of investment capital. A second factor was that, during the 1970s, rock became an accepted part of the mainstream of American popular music. Finally, in the City of New York, a series of Mayors have devoted considerable effort to bringing the various forms of entertainment industry business into the local economy. The revival of activity in the making of films and television commercials has paid dividends to a number of local recording studios, several of which have now gone over to the 'commercial jingles' business on a more or less full-time basis.

The result, according to those interviewed for this article, is an industry that takes great care in how it spends its money, values its respectability in the local financial community and puts its new employees through a

Earlier in the year we studied the London approach to studio management. Dan Abramson compares attitudes in New York City.

period of apprenticeship that usually lasts several years before anyone acquires the de facto status of journeyman. In addition, it is reported, advertising and public relations are frowned on within the industry, since they are considered too expensive and, in any case, unnecessary for any studio which has worked hard at maintaining its good name.

In effect, the prevailing emotional atmosphere seems to be closer to the work of Ivor Novello than that of John Lennon, although the clothing, conversation and decor of the studios make it clear that the top decision makers had their tastes formed sometime after the recording of *I Want To Hold Your Hand*.

Dollars and cents

The prime lending rate has been fluctuating in the United States, as any aficionado of Presidential races will already know. This is of special importance to the mostly capital-intensive recording industry.

Michael D Hektoen, president of Domino Media, which owns the Media Sound recording studios, reported

that capital had become somewhat tighter during the first half of 1984. Hektoen added, however, that the current state of affairs is quite preferable to what existed a few years ago, when the prime lending rates started at around 20%, instead of the recent 12 or 12½%. He said that this 8% gap is, for many recording studios, comparable to a considerable portion of their margin of profit.

Malcolm Addey, of Malcolm Addey Recorders, estimated that it is currently possible to equip a high-quality recording studio in New York City for anywhere between \$2 and \$3 m. He added, however, that those were not necessarily the numbers applicable to his operation.

In any case, Addey stated further, "I have never gone to a bank in my life and I don't believe in it. I finance myself entirely from earnings."

Estimates as to the cost of running such studios vary. Sal Ciampini, who is studio manager at Celebration Recording, stated that his operation has gross annual revenues of approximately \$750,000 and that the cost of running the studio was approximately 85% of that

total. In this instance, Ciampini pointed out, both the revenues and costs must be considered in light of Celebration's doing mostly commercial jingles and they are owned by Mamorsky, Zimmerman, Ham & Forrest, a company that produces and packages the jingles which account for 70 per cent of the recording done at the studio.

Michael Friese, who is the only full-time employee of Roxy Recorders, reported that Roxy has had annual revenues of anywhere from \$100,000 to \$200,000 during the last five years, with operating costs running from 60 to 70% of that total. The studio, he added, is located in Greenwich Village, which is decidedly off the beaten track as far as the New York media scene is concerned. Roxy, said Friese, relies on the services of musicians who, while good, have not yet made it into the higher echelons of studio musicianship. "Usually," he said, by way of explanation, "we're not going to get the average A-Team player."

The financial heads of these companies have been somewhat hampered by the simple fact that they are involved in the entertainment business, according to Hal Selby, studio manager for Electric Lady. "It's questionable," said Selby, in regard to the availability of loan money for sound studios. "Entertainment companies are always considered questionable by the major financial institutions." He further

stated that "When the interest rates go up and money gets tighter, we are considered even more questionable."

Cash management

Selby added that Electric Lady, which is a family-controlled public company with a full-time staff of about 20, has never gone to a bank for money, "... although we are constantly adding equipment". The cost of such equipment, he added, is either paid for out of revenues or the equipment is not acquired.

Addey, who is also a self-confessed bankphobe, contended that much of the money spent by recording studios on equipment is due to the hard-sell approaches of the equipment companies and is, in large part, wasted money.

"As far as I'm concerned," said Addey, "intense advertising by the equipment companies has hurt this industry by reaching the record producers and convincing them that they should feel guilty if they do not have in the studio every damned thing that's been advertised. It's a crazy situation in which the only people who are making any real money are the banks."

Aversion to banks was also expressed by Ciampini, although he placed greater value on the new developments in equipment than Addey did.

"If we can help it," said Ciampini, "we do not go to the banks, although we have done so in the past." He opts instead for lease arrangements and occasionally has been known to rebuild equipment on the premises.

In regard to tight money, however, Ciampini pointed out that this is a much easier situation to cope with if your studio is part of a larger conglomerate than if it is an independent operation. "Banks have become a bit more competitive in recent years," he said, "since the interest rates began coming down in the early 1980s. For an operation like ours, owned by a larger company such as Mamorsky, Zimmerman, Ham and Forrest, it is easier. This is because MZH&F has been in this business for 25 years and has an extremely good credit rating. For a company like that to go to the bank is no big deal."

Bob Walters, president and co-owner of The Power Station, reported that, while he runs a totally independent operation, he would happily accept subsidised status from a larger company if given the

opportunity. He also argued that the City of New York, which goes to great lengths each year to attract more motion picture and television production business, should consider greater efforts at keeping the recording studio business profitable.

"I don't see why the City doesn't come in and subsidise operations such as this," said Walters. "We bring in a tremendous amount of money from all over the country and all over the world. Record producers who come here do not do so in order to work in New York, they do so in order to work at a specific studio because they like the quality of the work done there. Our presence here is a benefit to the City's economy."

Walters conceded that his operation has benefited somewhat from music videos done for American TV, which are being done in New York in large part due to the Koch Administration's efforts to acquire new teleproduction business. He also concedes that the recording industry in general benefits from the

purchasing it outright. "I have leasing agents calling me all the time," he said, "which is an indication of how easy money is, at least recently. Of course, the availability of money depends on the nature of the facility and on how well it is run. If you are not getting too big for your breeches, or getting beyond the level at which the leasing people can see you are used to dealing with, this is not a difficult way to keep down costs."

Agreement on this point is offered by Debra Rebhun, general manager of the studio for Secret Sound. "There are a lot of items these days that are so expensive that it pays to go through a leasing company," she said. Included among these items she listed expensive digital reverb units and tape machines.

Her conclusion was: "Leasing depends on a lot of factors, but we find we are using it a great deal. A lot of the equipment that we acquire is paid for monthly out of profits. Some more equipment is acquired through leasing arrangements. But, as a rule,

'I have never gone to a bank in my life and I don't believe in it. I finance myself entirely from earnings.'

availability of work on TV and radio commercials, which also derive from the efforts of the city administration to bring business to New York.

"Unfortunately," he added, "the main problem is that the producers of commercials and music videos book too close, on very short notice. We are primarily an album-orientated studio, which means that we are usually booked up well in advance with rock and other album producing clients."

A somewhat different estimate of the situation is offered by Friese, who contended that "... credit for us has been loose lately, not tight". However, he added that this has had a lot to do with good cash management by the company. "We always maintain a healthy bank balance," he stated, "which of course makes credit a lot easier to get."

According to Friese, an equally effective means of acquiring money is via leasing new equipment, rather than

we don't borrow. In any case, we haven't had to go to a bank for money in quite some time—Thank God!"

Freelance engineers

Hektoen is of the opinion that the day of the freelance engineer has arrived, despite the fact that many studios still use exclusively full-time engineering employees.

"It just seems to be the direction in which the industry is going," Hektoen said. "A lot of clients have been bringing in their own engineers for reasons that cannot fully be explained. I think it's just that when certain clients or certain artists find an engineer that they work well with, they just don't want to experiment."

Hektoen added that Media Sound employs freelancers on either a flat rate or a percentage basis. He also added that, in a supply and demand sense, this has been a

very good year for those engineers who are in demand. "Once there is magic happening between an engineer and producer or a particular artist, then the engineer is in good shape. We consider it our job to make sure that we provide our clients with the right equipment and support systems so they can get the sounds that they want. That is what we are in business for."

Friese reported a similar situation, in which most of those engineers who come to Roxy Recorders do so with their own clients. "We have found that it's a lot more cost-effective to make the facility available to any freelance engineer who wants to come in," said Friese. He added, however, that "someone who is familiar with the studio is there to back them up."

According to Friese, a rate is charged for the room. If anyone brings in an engineer with them, the client is charged the regular rate, minus what Roxy usually pays its engineers. However, the cost of the back-up is included in the room rate, because, as Friese argued, this back-up is a necessity. "You have to have somebody here from the facility," he said, "just to show the freelancers what's normalled to the console on the patchbay, where do they find this or that and why is this set up that way. Nobody comes into a studio for the first time knowing how to handle that."

On the other hand, Debra Rebhun, general manager of the studio for Secret Sound, stated that, when her operation does use freelance engineers, it is usually on the specific request of a client and contrary to the way she prefers to have the studio run.

"We are real happy with our engineers," said Rebhun, "so if someone calls and asks us to recommend an engineer, we recommend one of ours. We do this because we have confidence in our people and the fact that we have confidence in them is the reason why we hired them in the first place."

Lorna Levine, studio manager for Automated Sound Studios, reported that she would only use freelance engineers on those rare occasions when her own staff of engineers are otherwise engaged. In the case of her operation, Levine said, the matter is complicated by the specific demands of the commercials jingle work that constitutes the bulk of her company's business.

"We do have freelancers in

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to do the engineering," she added, "but mostly when the ad agency or other client requests it. Then, depending on the situation, either we pay the engineer or the agency will."

The question of group loyalty is raised by Walters, who reported that his company employs 40 full-time employees and only a handful of part-time employees, such as those who answer the phone or those who work weekend sessions.

He believes that this sort of arrangement tends to work out better than the repeated hiring of freelancers, "because full-time employees care about the place when they're grown here. We believe strongly in promoting from within the organisation and in developing a sense of family within the studio."

However, as Hektoen pointed out, such matters as freelance and full-time employment, the financial bottom line frequently has to be the key decision-making variable. "I think what has happened to the business," said Hektoen, "is that there are a lot of fixed costs and margins are very tight. In order to remain competitive and at the same time to be able to afford all the new equipment that the clients demand, the studios have to be very fiscally responsive to the cost and effectiveness of freelance employees and decide on that basis."

The next generation

Apprenticeship is alive and well in the recording industry of the City of New York in the 'Age of Koch'. It is, according to several of those interviewed for this article, still the most efficient way of developing new in-house technical talent.

"You see people come to this place and we start them off in the shipping department," said Walters. "They make tape copies, they do deliveries, serve coffee, clean up, do all the menial things that young

people should do to get a feel of what the entire operation is all about." Walters only occasionally employs freelancers because he believes that full-time employees who "grew up with the company" simply care more about the organisation than freelancers do. "By the time our employees are prepared to go in and help in the studio they have already learned a lot about how things are done here and what is expected of an engineer," Walters added. "The result is that many times we have been able to take a gofer, for example and put him in as an assistant and find that he's pretty much qualified for the job."

Rebhun, who herself started in the business as an apprentice, believes that having begun there and climbed upwards gave her insights into the running of a studio and staff that she would not otherwise have had. "Usually," she said, "when you learn from the beginning, you really learn to get everything down pat, because you have learned it one step at a time."

She added that, among her current group of assistants, "I find that everyone who started from the bottom really knows a lot more than anyone you can hire from the outside."

Hektoen agrees with this attitude and contends that the process of apprenticeship is even more valuable in helping the new employees become familiar with Media Sound's clients. "We start people out on the switchboard, or in the shipping department," Hektoen said and added that messengering, cleaning and similar assignments are part of the breaking-in process.

"They get to know who our clients are in this manner," Hektoen explained, "and this way they get some kind of exposure to the way things are done, such as how to prepare the studios, what to put in there, what needs to be kept on hand for the various clients, that sort of thing."

Promotion, of course,

'I find that everyone who started from the bottom really knows a lot more than anyone you can hire'

depends on both the merit system and time lag. "It is," said Hektoen, "just a process of moving up—if things work out—when there is an opening."

Trade schooling

Rebhun attended a trade school herself before going to work as an apprentice. Speaking from the perspective of this experience, she commented: "They're not strict enough."

As she further explained, "From my own time there, I know that you can pass through those schools fairly easily without learning very much of what you are there for."

She does, however, see the trade schools as a good basis for the experience necessary to do good work in an entry-level job. When Secret Sound does hire entry level employees, Rebhun said, they have usually completed courses in trade school.

Malcolm Addey takes a more dim view of the trade schools. "They don't teach anybody anything," he said, "except how to spend money." Addey said that it is quite a few years since he has worked with people at the entry level of this industry, but argued that there never has been an acceptable substitute for on-the-job training.

"Most of the other knowledge you need to learn you will pick up as you go along like everyone else did," Addey said. "If you have any sense you will buy the right books and talk to people who are knowledgeable about the business and learn as you go."

He added that, in choosing

an entry level employee, he has always believed in the advisability of hiring musicians. "They do not necessarily have to be practising musicians," he said, "but it is extremely helpful to have some knowledge of the technicalities. You don't have to be an electronics genius to become a mixer," he added, "but it certainly helps to know music."

Levine, whose studio specialises in jingles for TV and radio commercials, pointed out that the very narrowness of that speciality dictates her hiring policies. Automated Sound Studios, she said, takes interns from local high schools, teaches them the business and does its entry-level hiring from that group. She said she usually does not hire aides just out of trade school, partly because of the high school interns and partly because "... it is more important to us that our employees have jingle experience".

By way of explanation, she pointed to the pace of jingle work, "... which is faster than record work. Someone can come in and within 3 hrs they put down a 60 s spot. That may easily include strings and horns and rhythm on it, along with the vocals."

Walters said he looks for other forms of education on an applicant's resumé. "As far as the technical aspects of the business are concerned," said Walters, "we like to train our employees ourselves. But we prefer to hire people who are well-educated." Those with higher education, he contends, are more adaptable to learning the ways and means of an industry as complicated as this one. "It's past the days when

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you can run this sort of studio by the seat of your pants," Walters added. "We have, in the recent past, hired individuals because they had impressive backgrounds in maths and physics, in addition to being musically inclined."

Several others, Hektoen and Selby in particular, report that, while they do not consider the completion of courses at trade schools to be grounds in itself for hiring an applicant, they do consider it a plus. Both added, however, that even trade school graduates have to go through an initial period of in-house training at their operations.

Ciampini, on the other hand, reported that his studio maintains an ongoing relationship with New York's Center for Media Arts. "If I need somebody I'll call their placement office," he said, "and ask the woman in charge to send me a couple of people she thinks would be good for me. I interview from among them and, hopefully, put one on my staff, to be promoted as the need arises."

Ciampini added that, on employing such individuals, the main thing he keeps an eye out for is "... the good sense to do things without being told to do them." He believes that this is a key personal quality for anyone who hopes to be a success in the recording business. Addey, on the other hand, offered with tongue in cheek a more universal criterion.

"If I were hiring a young person today," he said, "I would look for the same qualities that I had in my youth. Those," he said chuckling, "were incredible enthusiasm for the industry, sterling character and an extraordinary will to learn."

Motivating the workers

The awarding of bonuses varies by studio, according to individual criteria as to what constitutes superior efforts. "You work for it and you'll

see the money," was how Rebhun summed up her own philosophy of management and she added, "If anyone here works hard and does an outstanding job on a project there is *always* a bonus."

Ciampini, on the other hand, believes in paying people the salaries they are worth and encouraging morale through non-financial incentives. "It's like a family around here," he said. "We work hard at maintaining that kind of an atmosphere, but we don't have any real bonus or incentive-type plans."

Walters, who does give bonuses, also believes that the emotional climate of the studio can have a very positive effect on employee morale. "As far as incentives are concerned," he stated, employees are expected to find motivation in "... their growth and their increasing ability to do better work on their projects. That is where the incentives are because they translate into career advancement."

Walters contends that the structure of the business itself makes this sort of incentive feasible. "Basically," he said, "when you do something your name is on it. The assistants, the engineers, everyone, they all want to see their names on a well-made album. That is why they are motivated to make sure that the best possible product has been put on those albums."

Advertisements & PR

Walters added that his studio had never done any advertising, relying instead on the publicity generated by those album covers with his employees' names on them. In this regard, he appears to be among the majority in refusing to spend money on ads in order to make money.

Selby explains that business philosophy in this manner, "If you are a recording studio and you advertise it looks like you need the business. It's not like advertising Mercedes Benz

'If you are a recording studio and you advertise it looks like you need the business... We have always relied on word of mouth.'

cars. We have always relied on word of mouth. Our business comes to us because of our reputation."

Selby added that Electric Lady did try a few institutional-type ads a few years ago, to little positive result. The ads simply gave the name of the company and a very soft-sell approach.

Addey said that his own attempts at advertising have never proven to be worth the effort or expense. Certainly, he said, this has never produced the sort of business that word-of-mouth has produced.

"I had my operation listed in the trade journals a few times as a simple, free listing," said Addey. "But, as soon as the ads started to run," he recalled, "I started getting more and more resumés from people looking for jobs. And that is all I ever got."

Addey believes that there is an important lesson to be learned from this. "The only people who ever read the technical journals," he said, "are the technical people. And they don't book studios."

Hektoen reported that he believes in the value of advertising, but feels that the recording industry does not offer much in the way of efficient means of doing so. "We are a service business," according to Hektoen, "so the more people who are aware of us, the better it is, obviously. But we don't make a major point of it because very few people, in my opinion, respond to an advertisement."

He argued instead that quality of service and the resultant word-of-mouth are far more effective means of drumming up new business and are therefore far more worthy of the time, resources and efforts of a recording

studio. Media Sound has, however, published brochures and run ads in the trade papers, which Hektoen said was done more to create increased awareness of the name of the studio than for any other reason.

"We don't expect to get business off of those ads," he stated. "But what we can expect to do is very simply to let people know that we are here. In those ads we did not get into the technical aspects of our operations. We did not mention how long we have been in the business. We just ran a simple headline with a very simple picture of the studio and a message that said that if you want information, here's our phone number."

Hektoen's belief in a little of this sort of thing now and then to help the progress of word-of-mouth is shared by Rebhun. She said that, Secret Sound has occasionally advertised with limited success in the trades. She said, however, that somewhat better results have derived from the public relations concept of direct mailings to regular clients. Each time the studio gets a major new piece of equipment, cards are sent out to the list of regular clients.

Friese, on the other hand, believes that the best public relations efforts are those which involve the care and feeding of itinerant musicians. It is these individuals, said Friese, "... who are going to let people know that you exist, what sort of service you give, what sort of equipment you have, that sort of thing. I believe in treating the musicians real well and over the years I have taken in a considerable amount of work that way." □

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INSIGHTS

INSIGHTS

Views from Richard Elen

If someone came along, and told you they were going to play you a piece of impeccably recorded music but that they would be adding a number of pre- and post-echoes, about 30 dB down, up to several milliseconds away from the signal, plus a bit of ringing, and that you **WOULDN'T HEAR THEM**—you wouldn't believe them, would you? Of course not.

But, it turns out, this is exactly what you have been hearing on every PCM recording you've ever listened to.

Transients and aspects of the top end have been 'smeared' across several tens of samples in many cases, in a manner which is probably audible to a reasonable proportion of the population.

The problem is due to the design of filters used in A/D and D/A conversion in PCM systems. It should have been noticed before, and indeed, telephone engineers have known about it since the '30s (a major paper was published on the topic in 1938). Speaker manufacturers have known about it for some time, too, as it is important in crossover design. But nobody ever thought of applying it to digital audio before... a rather embarrassing pity!

The blame lies in two aspects of filter design in digital audio systems, and the effects were revealed at the recent Paris AES in a paper on the last day written by Dr Roger Lagadec of Studer's digital audio division and Dr Tom Stockham, founder of Soundstream, the original digital audio recording company responsible for a great many landmark recordings in the digital domain. Now we know the problem, there is no excuse!

The paper, innocuously labelled as a discussion of 'dispersion' in filter designs, breaks the filter problem down into two distinct areas, corresponding to the two parts of the filters used in digital audio systems.

The filtering around a digital audio converter consists of two main functional blocks: there is a nominally 'flat' section across the audible band up to the Nyquist/Shannon limit (half the sampling frequency), and a roll-off (usually pretty violent) at the top end to avoid aliasing and imaging effects. Lagadec dealt with the first area, while Stockham researched the second.

Roger Lagadec was working on a neat little box which I think Studer should market to the world: you take your nasty old analogue tape, stuff it into Roger's little box, and from the end comes a 16-bit digital signal with most of the noise removed. Basically, the box takes the signal and divides it into 512 bands, all neatly tailored into each other to produce a flat response when they are added together. A processor analyses the noise in each band digitally, and subtracts it from the signal, then you stuff it all back together again... the idea is as simple as that. Lagadec designed his filter bank to modern

Digital Audio... why you complained

specifications, but he and his team noticed that when the IRT test signal (an electronically-generated tone pulse) was passed through the box, it came out sounding noticeably mangled: so mangled, in fact, that the difference was quite audible on the Paris AES house PA during the paper. Everyone heard it, and oscilloscope photos proved it: there was a noticeable pre-echo on the signal. The effect in a single filter like that used in a PCM system is less, but still audible.

However 'flat' a filter of this type is supposed to be, it will always have a little variation of amplitude with frequency: this is called 'ripple', and it has been felt until now that a ripple of around 0.1% was quite acceptable. It turns out that it isn't, and filters need to be two orders of magnitude better than previously imagined. This is not a serious design problem, but nobody really looked at it because it didn't seem to be necessary. It is!

The effect is quite picturesque. The ripple in a filter can be Fourier-analysed into a series of sinewaves in the frequency domain: simply, the amplitude varies with frequency. What this means in real terms can best be described with an analogy. Imagine an RF carrier, with amplitude-modulation in the time domain (like an AM radio signal). The resultant effect is the creation of sidebands, either side of the carrier frequency. Now perform that modulation in the frequency domain instead, which is what our filter is doing with its ripple. We get 'sidebands', but this time in the time domain! Lagadec calls it 'dispersion'... I call it 'temporal sidebands'. You might well call it pre- and post-echoes, because that's what it is. In a digital audio system these temporal sidebands will produce a 'smearing' of one sample across up to 50 or 60 samples, at about 30 dB down on the main signal. Nasty. Putting music through a temporal mangler twice (eg recording on a digital system and then playing back on a CD player with the same problem) doesn't necessarily bring the level of the sidebands up, but it might well move them about in time and might make them more noticeable. The pre- and post-echoes will, of course, be more noticeable on transients, and will be more objectionable at the high end... and where have we heard that before?

Then we come to the 'brick-wall' roll-off at the top end of the audio band. This filter is put there to avoid aliasing, to get all the audio 'out of the way' before

it comes across the dreaded Nyquist limit where samples don't mean very much anymore. Dr Stockham looked at these filters in terms of the equivalent 'difference' filter required to return the response to flat. The resultant spiky response curve is horrifying to behold, and indicates that one thing the average brick-wall filter will suffer from is 'ringing'... it has such a sharp curve that any transient approaching it will 'ping' rather like a spring reverb unit in overload. Not a nice thing to put in the way of your nice, clean, audio signal.

Put these two effects together and one might have cause for believing that the signal has no chance of sounding right at all! Indeed, some would say that it doesn't, and they would probably be at least half right.

So, the research is all very well, but what does one do about it? Well, Lagadec and Stockham made some suggestions. First of all, you simply design the 'flat' bit of the filter to higher specs, with 0.01% ripple or better. This is not really a problem once you know you need to do it. The solution to the roll-off problem is rather different: you don't do it in the analogue domain at all, but digitally, where ringing can be avoided. So the best solution, they reckon, is to have a digital roll-off plus an analogue all-pass network with low ripple that goes flat right up to the end of the line.

Retrofitting existing recorders with this kind of filtering should be well possible, and of course the next generation of digital machines won't suffer from it anyway. And CPDM systems like the dbx 700 are less likely to suffer from it (the ringing at least) in the first place. So we can get the nasties out of the studio, anyway, and pretty sharpish. But what about the consumer's CD player?

Well, it turns out that a certain well-known European manufacturer of CD players took a rather novel approach to D/A conversion. Using a technique called oversampling, they were able to use a different kind of filter technique, including a digital roll-off. It turns out that they designed a filter system which is virtually identical to Lagadec and Stockham's proposals, and it is in all their models.

Of course, removing the problem from the replay system doesn't make the recording any better, but it helps. So if you've always wondered why one manufacturer's CD players consistently come out better in reviews and at home, that's at least part of the reason: for whatever reason, Philips had it right all the time.

The other effect of this rather important (to my mind) discovery is that the anti-digital camp now have a good excuse to embrace digital audio without losing face, mainly because they were at least half-right all along. Unless, of course, they can think of something else. □

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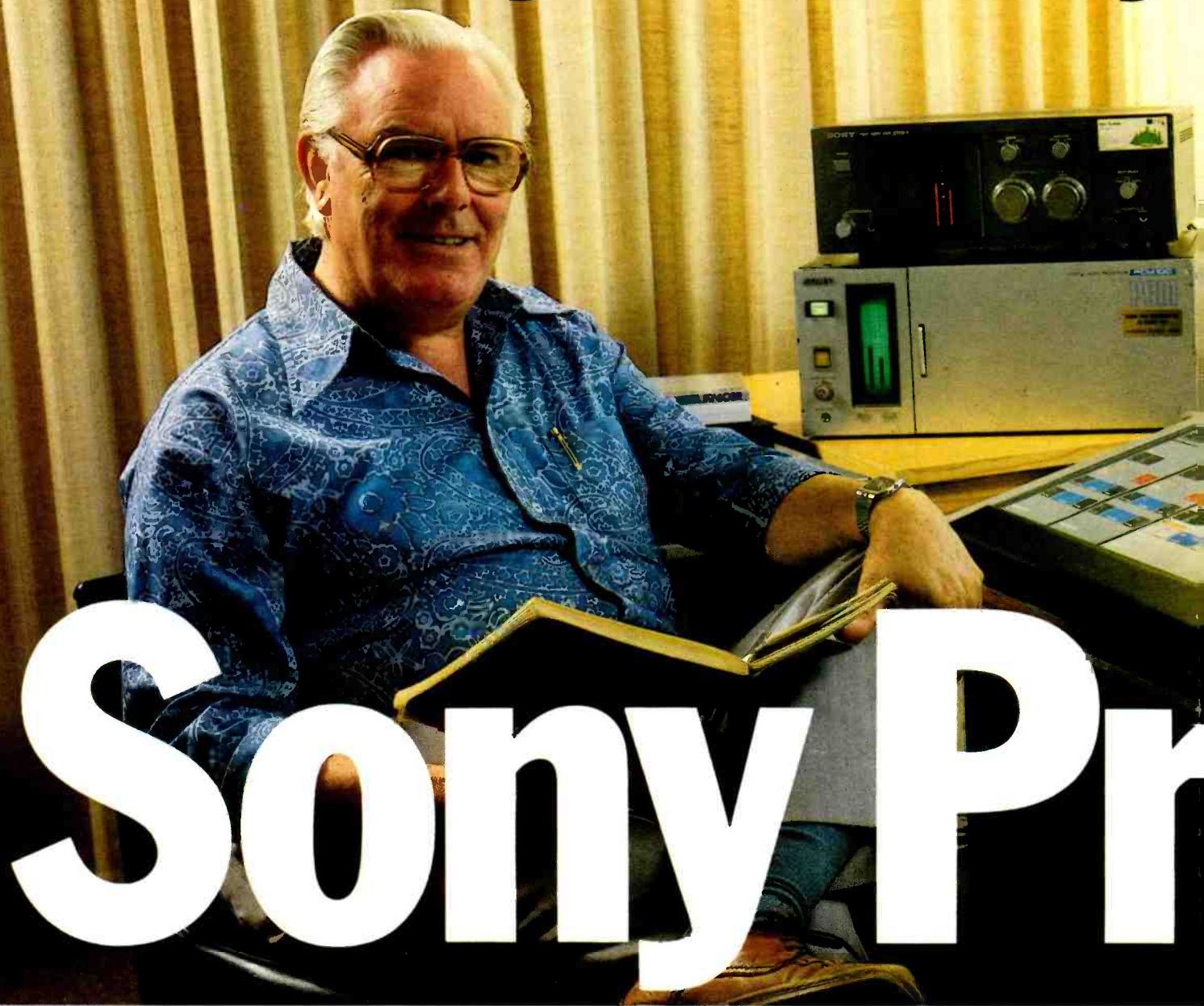
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Although Otari are better known at present for their reel-to-reel tape machines such as the *MX5050* and *MTR* Series, it is a less well known fact that the company started in 1965 with the manufacture of tape duplication systems. One of the first products was the *DP* Series of duplicators offering an 8:1 ratio and there are a number of such machines still in operation. Otari also developed tape loading systems for video tape and the expertise gained from these areas was applied to the tape machines. The tape duplicators went from the *DP 1000* series, the *DP 2000* for 8-track cartridge, the *DP 4000* and *5000*, to reach the *DP 6000* loop-bin duplicator which offered a maximum ratio of 32:1 and introduced the current tilted bin arrangement.

After the *DP 6000* was developed, Otari turned its attention to tape machines and it was only after establishing itself in that area that they have now returned to duplicators with the *DP-80*.

The basic system

The *DP-80* system comprises a *DP83C* master reproducer which features an enlarged version of the tilted bin used in the *6000* giving a tape capacity of 1,800 ft. This unit is available with ½ or 1 in transports. Within the *DP83C* there are power supplies for up to 10 *DP85C* slave machines and separate supplies for the record/reproduce and tape head amplifiers and a ±48 V supply for the capstan motor. Up to 20 *DP85C* slaves may be connected to one master unit when fitted with an additional mains audio distribution unit.

The master reproducer

The heart of a tape duplication system has to be the transport with the audio electronics playing a supportive role. In turn, the heart of the transport is the capstan which is a Hall-effect controlled DC brushless type with low mechanical and electromagnetic noise characteristics and combines high torque and efficiency with the reliability of AC motors. The main problem was to remove the noise generated by the motor with the main problems being things like flux leakage from the motor drive coil and noise from the

DESIGN OF THE DP-80

Three days after the publication of Mike Jones' epic *Advances in Tape Duplication* in the November 1983 issue, Otari announced a new generation of high speed duplication machines that immediately made possible some of his recommendations for duplication procedures. Within the article, fingers were pointed at the 3¾ in/s master as a limiting factor in the realisation of high quality high speed duplication. The benefits of 7½ in/s masters were clearly shown but economics dictated that 64:1 duplication ratios were preferred by record companies particularly as the complete duplication process was a lot slower than simple disc pressing. However, due to the obvious problems, 64:1 ratios were only possible with 3¾ in/s masters on existing machines and 7½ in/s masters were run at 32:1.

With the *DP-80*, Otari have achieved 7½ in/s duplication at 64:1 ratios with loop bin techniques. With sales figures already drawing close to those of discs, the pre-recorded cassette will get a further boost with 7½ in/s master quality and *Dolby HX Pro*. Perhaps it is the sheer figures involved that are the most impressive—480 in/s in reproduce mode which is faster than most tape machines in fast wind and looked at in larger units is just under 30 mph. John Wase of Otari UK gives basic details of the system and its design with relation to the use of very high tape speeds and associated requirements.

tacho generator and control functions such as drive current. These problems were overcome by completely shielding the drive coil, bringing the drive current squarewave shape closer to a sinewave, making the drive power source and control circuit electrically floating as well as a number of other modifications.

Within the capstan, the Hall elements are used to detect the position of the rotor and hence control the currents applied by three DC amplifiers to the stator coils. The tape speed is controlled by a crystal referenced phase locked loop circuit. The capstan system comprises one motor and shaft linked to a second shaft by a toothed belt giving a fixed tension across the heads. The capstans and pinch rollers themselves are designed to prevent tape wrapping around them at high speed. At 480 in/s proportionately more damage could occur and therefore more precautions are necessary. Both the capstan shafts and the pinch rollers have two parallel grooves cut into their circumference and these engage two pairs of 'fingers' or 'claws' which prevent tape adhering to the shaft or roller even if the splice should break.

The tilting loop bin has been modified to provide the improved handling needed from the high tape speeds. The aim is to keep the running of tape within the bin as smooth as possible and to this end the bin has been enlarged 30% so that the air flow within the bin is not a problem. The rear of the bin has a network of holes to enable air to prevent a pressure build-up in the tape coils. The front panel of the unit is glass.

Where the tape leaves the bin and heads towards the transport and heads, there is an adjustable guide arm that can be altered to allow for different tape capacities within the bin. At the bottom right of the bin there is a variable speed tape conveyer that can be adjusted to optimise smooth running of the tape and to ensure that the tape leaves from the top of the pack, not the bottom. All guides and areas touching the tape are made from aluminium nitride which is a very hard material and has been polished to a near mirror finish.

Tape leaving the bin passes over and between precision vacuum guides which stabilise the tape from the slightly erratic movements of the bin and then feed it to the closed loop system across the heads. The result of this design is a

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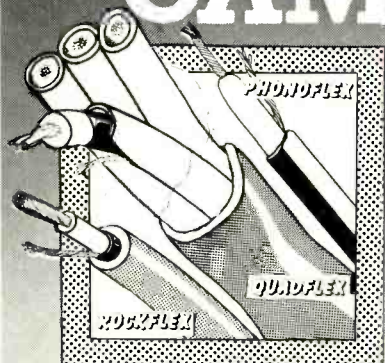
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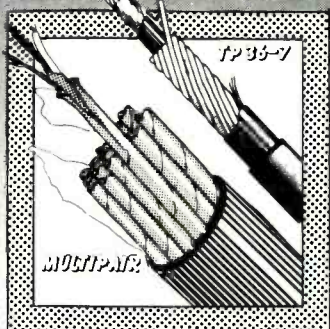
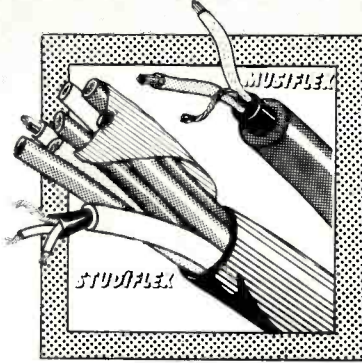
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DP-80

tape path that is controlled throughout its length with only very short sections of unsupported tape between the guides.

Operation of the bin can be manual or automatic with a photosensor to detect a small identification hole in the tape splice. Conventionally leader tape has been connected to the beginning and end of the master tape by splicing tape. The number of tape passes are recorded by a photosensor and this used to control prescribed functions. It has however been reported that this leader tape scratched the head. The single 2 mm hole in the splice removes the leader tape from the tape and reduces splices to one with the obvious gains in head wear and phase stability. The hole allows two things to happen: it actuates the slave timer which is programmable according to the slave start up time; and it enables the counting of cycles of the master so that when the preset number is reached a stop command can be sent to the slaves.

As well as 480 in/s, the DP-80 will run at 240 in/s with speed selection being at the touch of a button. There are also two separate, very flexible equalisers in each repro/record channel that can be selected by another switch to enable swift 480/240 in/s changeover or chrome/ferric EQ or a combination of all

four.

Audio electronics

In order to duplicate the dynamic range possible with a 7½ in/s master, a great deal of care has been taken. High quality IC amps with slew rates of 500 V/μs are used where necessary to ensure a flat frequency response up to 1.2 MHz while still retaining the dynamic range. Coupling capacitors with HF and LF characteristics are installed in parallel to prevent deterioration in sound quality.

The master reproduce heads are ferrite with an obvious design intention of making them resistant to wear. The outputs of the heads are taken to a head amplifier which is immediately adjacent to the headblock.

An optional extra for the master reproducer is the EMG System. This module monitors the reproduce signals of selected tracks and flashes a warning if any signal falls below the threshold for more than a given length of time as in the case of a twisted tape.

The cue tone oscillator has two separately adjustable settings, with a switch, and separate controls for length, frequency and level, for the 480/240 in/s operation, and to suit different types of cassette loading equipment. The tones can be switched to any combination of record channels and can be displayed, with a separate switch, on the VU meters. Cue tone is applied post output attenuator.

The slave recorder

The DP85C slave recorder also has a closed loop capstan system, but in this case drive is provided by two AC synchronous motors linked by a belt, giving excellent speed stability and constant tension across the record heads. The reel motors are also AC synchronous types, with rheostats to control their relative tensions. A switch selects the appropriate tensions for the pancake size used, by applying different AC voltages to the reel motors. All motor and solenoid power switching is done with TTL controlled solid-state relays. The capstan shafts and the pack arm head are unusual in that they are ceramic, which reduces wear and static induced noise. Pinch roller action is not simultaneous. The right-hand roller engages first, followed after a presettable time by the second pinch roller. This ensures the smooth take up necessary when operating at 120 in/s. Otherwise the transport is very simple with a straightforward cost-effective constant tension system rather than an over-complicated tape servo design. The transport is mounted on a rigid steel chassis to ensure stability over the life of the machine.

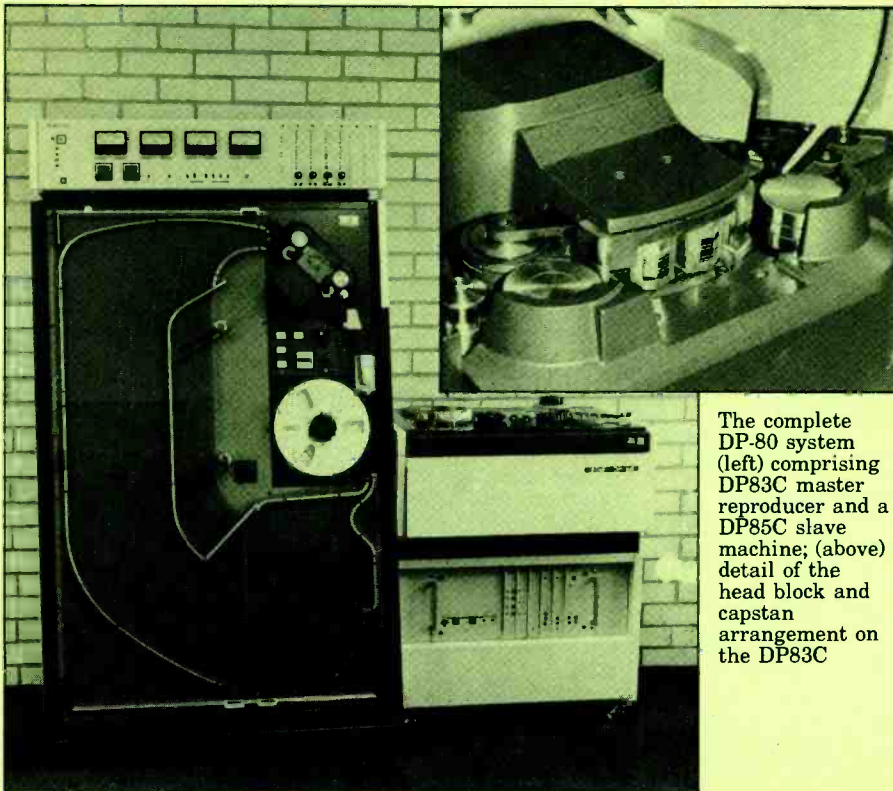
Each slave has its own oscillator and power supply. The 8 MHz bias oscillator is fully temperature compensated, crystal-controlled and highly stable, with ample headroom for chrome tape. The

slave recorder can be switched 'off-line' and completely removed from the duplication chain for servicing; all that must be supplied for free-standing operation is 100 VAC. The 'off-line' control can also be used to switch a slave out of the control line from the master when a pancake must be changed. The bias can also be switched off.

The control, power supply and record electronics are all modular and easily accessible. The bias and head amplifiers are mounted behind the head assembly, in the deck plate, with adjustment accessible behind a clip-on cover. The control and power supply cards are mounted below the transport and are easy to reach for servicing.

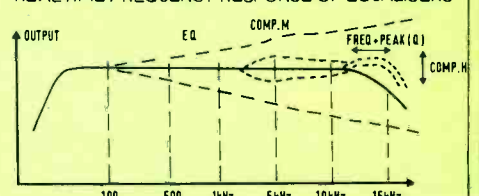
Single crystal ferrite record heads, in a staggered configuration, apply signal to the tape, which runs at 120 or 60 in/s, an additional head outside the capstan loop monitors signal level for EMG purposes. The response of the head as it stands at the moment is adequate for bias and level alignment. A motorised tape cleaner is fitted as standard, to reduce oxide deposits on the heads, which would otherwise cause HF loss and drop-outs as a result of poor head contact.

For those committed to 1 in mastering, a 1 in 480 in/s version will be available, as will a 1 in 4-track MTR90II towards the end of the year. Dolby HX Pro will be available for the slaves at around the same time. □

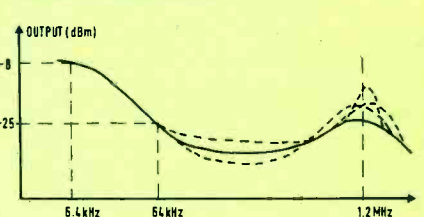


The complete DP-80 system (left) comprising DP83C master reproducer and a DP85C slave machine; (above) detail of the head block and capstan arrangement on the DP83C

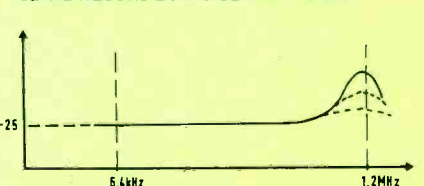
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BUSINESS BUSINESS

Barry Fox investigates the facts behind the industry news

Bleeping expensive

Even British Telecom, the good old British phone company, is getting into delta mod. BT has just launched a telephone answering service, called Voicebank. The rather curious idea is to let people who don't like answering machines use answering machines. Voicebank is a gang of eight 66 Mbyte Winchester hard computer discs, under control of a batch of Z 80 micros stashed 'somewhere in Paddington, London'. People who subscribe to Voicebank must ask callers to phone an allocated number and leave a message. It is converted by DM into a 32 kbit/s data stream and recorded on the Winchesters. The system then sends out a paging bleep to the subscriber who phones into Voicebank with a password to hear the message replayed. It all sounds very exciting, until you look at the fine print.

The eight Winchesters can hold 40 hours of speech. BT hopes for 5,000 subscribers and so to avoid overload, each message can only last 25 s and be stored for 12 hr. Also each subscriber is only allowed seven messages. After 12 hours, messages are automatically erased. Tough luck if you haven't called in. If you want to be bleeped you pay extra for each of the 40 sectors of Britain that are covered by paging. If you go abroad for the day the bleep can't reach you anyway.

I worked out the total cost for someone who wants to use Voicebank with full bleeping. It's well over £100 a quarter, plus VAT. Then there's £45+VAT to buy the all-essential key pad. A nice little answering machine costs less than a quarter's rental to buy outright. Somehow I think that Voicebank is one use of delta mod that won't catch on.

Tape whine

No wonder EMI and the record industry dream of another Beatles. The 'yesterhits' chart in *Billboard* magazine recently reminded us of what was going on 20 years ago in the US charts. The top five singles were all Beatles numbers. No 1, *Can't Buy Me Love*; no 2, *Twist and Shout*; no 3, *She Loves You*; no 4, *I Want To Hold Your Hand*; and no 5, *Please Please Me*.

The top two LPs were Beatles albums too (*Meet the Beatles* and *Introducing the Beatles*). Top that! Pity it coincided almost to the day with news that EMI has been fined £10,000 in Britain for breaching the chart code of conduct, by giving away freebies to try to hype the charts. Even more of a pity that the hype fine coincided with the record industry's last ditch attempt to persuade the British Government that there should be a levy on blank tape.

To simple minds like mine the whole debate is now academic anyway. If the Government puts a heavy levy on blank

tape, then inevitably sales will plummet. Dishonest pop pickers who snatch each week's hits off the air as they are broadcast will just re-use a few tapes. Sales of illegitimate, black market imports, and untaxed counterfeit tape, will boom. Both ways the Government will lose on VAT and income tax. The only people to make out of the deal will be the record companies. They would take the levy from however many legitimate tapes were still sold.

What Government in its right mind will sacrifice incoming tax money for the sake of injecting funds into an industry which has squandered its past fortunes and now resorts to trying to hype its own charts? The pity of all this is that the studio industry is stuck as pig in the middle, losing work as the record companies cut back.

Digital duplication

If we eventually get a new cassette format for digital audio then in the long term it will only take off commercially as a distribution medium when there is a fast-duplication process. At the present time only one method is used to make copies of digital audio tapes and video tapes. Slave machines copy in real-time while a master machine plays in real-time. Mass production is by using dozens, or hundreds, of slaves.

The video industry has long been looking for a way of duplicating tapes at high speed, like audio cassette tapes. The only successful way to do this is by transfer printing. Both Matsushita and Sony have had working transfer systems for at least 10 years now. Sony offered its system, called *Sprinter*, at the Berlin Radio Show two years ago. This year in Chicago, *Sprinter* was unveiled again. At \$200,000 there were only a few takers. Most video duplicators find it cheaper to buy several hundred slave machines and employ cheap labour to load and unload the cassettes after each real-time run.

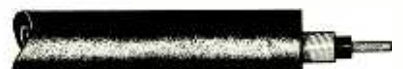
The *Sprinter* machine first makes a mirror image mother copy of the master tape on very high coercivity metal tape (1900 oersted compared to around 650 oersted for normal video tape). This mirror image mother is then wound on a spool with a blank tape and the sandwich wind briefly hit with a high frequency magnetic field. This instantly contact prints a replica of the mother image through on to the blank. The tapes are then unwound and the printed blank cut and loaded into a cassette. It takes around 1½ min to copy a 2 hr programme in this way.

Sony has problems with *Sprinter* because it will only work with hi-fi FM recordings on the Beta format as used in America and Japan. It won't work with VHS Hi-Fi or for Beta Hi-Fi in Europe. This is because the Beta Hi-Fi format in America slots the FM audio carriers into

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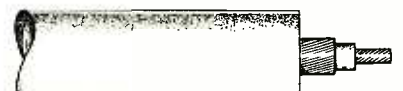
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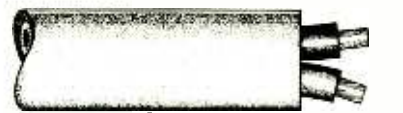
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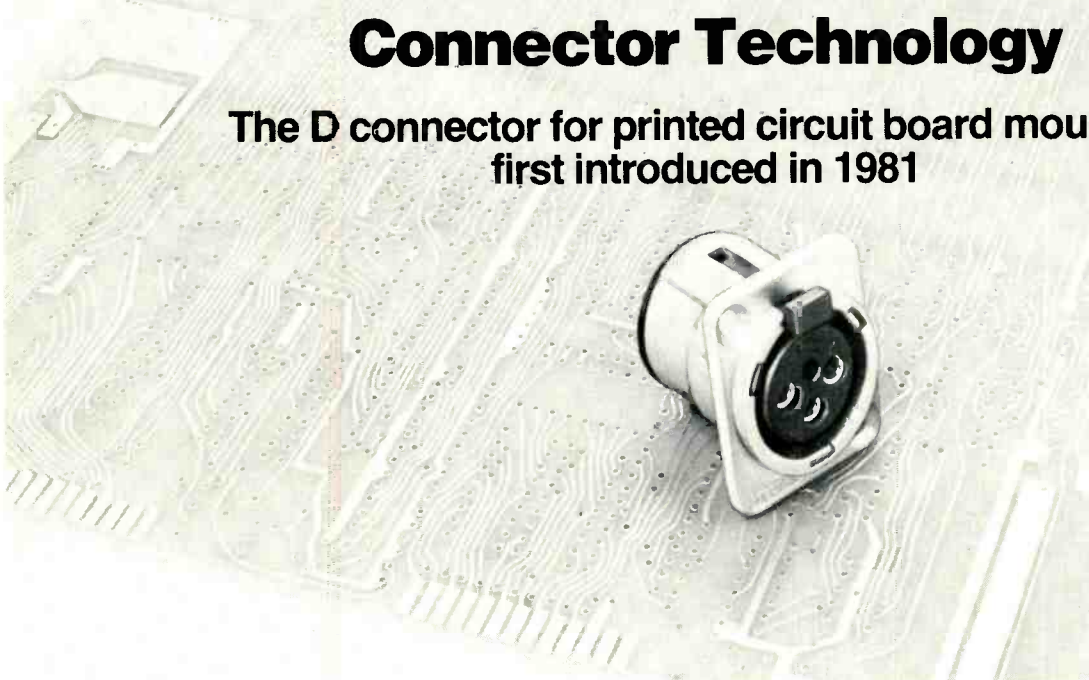
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BUSINESS BUSINESS

Barry Fox investigates the facts behind the industry news

notches in the standard video waveform. So FM audio and video can be contact printed together. But VHS Hi-Fi and Beta Hi-Fi in Europe use a different technique: depth multiplex recording. The FM audio is recorded deep down into the tape coating by one set of helical scan heads, and then a split second later the video heads skim the top magnetic layer off and replace it with video. The result is a two layer sandwich which can't be transferred by contact printing. "It's no accident that this technology was developed for the Beta format," says the Sony Corporation of America. What a clever way of saying the system won't work for other hi-fi formats!

But there seems no reason why contact printing should not work for rapid transfer of digital audio on 8 mm tape. It could also work for FM audio recorded, like a video signal, in a single layer.

Laser sound and vision

Now some news on laser technology. *Laservision* now has the American market all to itself. RCA wisely pulled the plug on the CED grooved capacitance system, after throwing half a billion dollars down the drain trying to sell a technology that was obviously out of date by the time it was ready for launch. Pioneer makes all the running on *Laservision*, with Philips and Magnavox showing only a token presence. This is pretty much the reverse of the situation in Europe. Pioneer is now selling *Laservision* videodisc players with a solid state diode laser, instead of the hefty gas unit. Pioneer is also now selling 8 in, as well as 12 in videodiscs. These are for short musical programmes and are used in the video juke box that Pioneer is launching.

Although not yet on sale, Pioneer in Japan has succeeded in putting digital audio on a videodisc along with the picture signals. The long term plan is obvious; a single player that will cope with either videodiscs, or digital audio discs, or videodiscs with digital audio soundtrack. This takes the development of CD full circle back to those days in the mid 70s when Philips in Eindhoven took a considered decision to split the standard between 12 in video and 5 in digital audio, with separate players needed for each.

There is one technical problem not yet solved. CD players have been able to use solid state lasers from the outset because the CD system can work with a relatively long wavelength light source (0.8 microns). It does not matter that this cannot be finely focused on to a single track of pits because digital crosstalk cancels out. *Laservision* signals are analogue so crosstalk degrades picture quality. The *Laservision* laser

wavelength is matched to the pit depth so that surface dirt is out of focus. This is set at 0.63 microns. It has proved much harder to make a solid state laser operate at this frequency, than at the lower CD frequency.

The Pioneer solid state laser player on show at CES Chicago was producing some very disappointing pictures, with poor S/N ratio and sometimes crosstalk interference from frame sync pulses. Privately the company has admitted to the trade that the player is a compromise. The laser wavelength is too long. The US market, familiar with poor quality TV pictures, may just put up with this compromise. But Europe will not. So don't expect a combined videodisc and digital audio disc player until solid state laser technology has improved. Also there's the purely commercial problem that in Europe Philips and Pioneer have a large stock of unsold gas laser videodisc players to dispose of before they can introduce a completely new machine.

A little too quiet

It is only a few years since 'a major new development' in the US cinema trade meant something new in popcorn dispensers. Few people over there, it seems, can enjoy a film without eating a jumbo bucket of popcorn while they watch. Now 'major developments' are more significant, like better sound. But the Hollywood dubbing studios still have to contend with popcorn.

Once there was a studio which was especially quiet and engineers could mix dialogue with a wide dynamic range. But when the films went out on general release there were complaints that paying customers could not hear what the actors were saying. Quiet passages were lost in the incessant background noise of popcorn munching. So the dubbing room installed a pink noise generator with speakers in the roof to raise the noise floor with just enough artificial popcorn noise to deter producers from mixing dialogue at too low a level.

Mistaken identity

Pioneer is using blind, black singer Ray Charles (as opposed to white, sighted musician Ray Charles) in its TV ads for videodiscs. The illogical choice is deliberate: RC says he doesn't 'see' the point, etc, etc.

But will the US public get the joke? In Chicago recently I was passing through the ritzy Knickerbocker Hotel when Ray Charles walked in with his minders. Outside on the pavement a suburban Chicago family were just letting auntie out of their car. "Oh look Wilma," said the man of the family, "there goes Little Stevie Wonder." □

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REVIEW REVIEW

Keith Spencer-Allen tries a new digital processor



BEL BD-80

For a company that was so closely associated with successful analogue delay line/flangers in their early years, it is slightly surprising that Bel have taken so long in developing digital units.

By watching the products of other manufacturers and the way that the industry has reacted to them, the manufacturer who is prepared to wait can learn a lot. The *BD-60* was the first digital delay unit from Bel and following hard on its heels comes the *BD-80* which might be referred to as a third generation delay system. It offers a single channel of digital delay with an expandable memory, a loop edit facility, and synchronised record and playback facilities.

The complete unit is a standard 19 in rack mount frame of 3½ in height. The front panel graphics divide the controls into the basic control functions of input and output levels, dry/delay mix and regeneration on one side, with the delay controls, oscillator and other effects type controls on the other.

There is little need to detail the basic control functions as they are generally self explanatory. The input control has a four-position LED indicator that I assume monitors the input level to the A/D convertor as it also responds to variations in the feedback level setting. Bel recommend a general operating level of -6 for normal programme material with occasional peaks of 0 dB. The bypass control simply switches out the delay circuit and the *BD-80* remains unity gain between input and output.

The dry/delay mix control has associated pushbuttons for phase reverse on the delay signal and a defeat button to remove the dry signal from the mix regardless of the control setting. This is a practice to be recommended as I find

mix controls a constant source of trouble when you generally only use the delayed output of a processor and mix it with the dry signal only at the console.

The feedback control also has two pushbuttons, one for phase reverse on the regenerated signal, with the other being an HF filter that removes top end every time the signal is recirculated.

In the delay and effects portion of the front panel, the delay controls are situated centrally. The selected delay time is displayed in ms on a large red LED display. When the *BD-80* is first turned on, this display will read the value of the maximum delay memory installed in the unit. After 10 s it will then revert to zero. The standard *BD-80* has 2,047 ms of memory and there are three memory expansion boards that give 4,095, 6,143, and 8,191 ms respectively. The review sample had the full 8,191 ms installed. Setting the delay time is by fast and slow buttons (black and white) for both up and down in time. The display also has a decimal point that flashes with a frequency equivalent to the set delay time.

On the lower half of the panel to the right of the delay display are a row of six pushbuttons. The first is a delay X2

MANUFACTURER'S SPECIFICATION

Frequency response: 20 to 15 kHz in ×1 mode; 20 to 7.5 kHz in ×2 mode.
Distortion: 0.2% max (0 dB @ 1 kHz).
Dynamic range: 90 dB typical.
Delay capacity: ×1=2 s, ×2=4 s; expandable via optional memory cards to: 8 @ 15 kHz; 16 @ 7.5 kHz.
Delay select: via up/down keypad counter (fast and slow) and LED display.
Modulation: (1) Oscillator (linear up/down ramp); depth 5:1 (×2 mode); speed 0.05 to 6 Hz.
Input impedance: 47 kΩ balance bridging.
Output impedance: 600 Ω drive capability.
Power requirement: 240 v 50/60 Hz (120 v internally adjustable).
Dimensions: (whd) 19×3½×12 in (rack mounting).

position. This multiplies the set delay time by two although the bandwidth decreases from 15 kHz to 7,500 Hz. This does not alter the displayed time though.

The next button is the oscillator in/out and this switches in the standard rotary controls for oscillator speed and depth to sweep the delay time for flanging effects, etc. The LED above the switch gives a flashing indication of the selected speed. Up to this point, the *BD-80* is fairly typical of a multitude of delay lines. The remaining buttons, apart from the power button on the extreme right, are best explained by an operational description.

The rear panel has sockets for input, direct output, delay out and mix out for the basic requirements. In addition there is a control voltage socket to give access to the CV circuits for the additional modulation of the signal or pitch change of memory signals. The start/stop function may also be controlled from the external sync socket which is an audio trigger input that may be used for external sync with drum machines, etc. All these sockets are ¼ in jack type while the mains connector for the detachable mains cord is an IEC type.

Operation

In operation the *BD-80* was quiet and presented no operational difficulties either in level, noise or distortion. There was a degree of leeway with regard to input levels and the occasional overload, provided it wasn't too great, gave few problems. The quality of the basic delay was good and very hard to distinguish from the original dry signal although with 15 kHz bandwidth, the unit is most suited to single instrument use rather than full programme where this would rarely be of any consequence.

The available memory within the

REVIEW REVIEW

BD-80 is the same figure as the displayed delay time. By pushing the right hand hold button, the contents of the memory are looped and continuously repeated. In this mode it is possible to process the stored signal with the oscillator, the X2 delay setting which halves the pitch of the stored signal as well naturally, and the repeat pitch control situated above the hold button. Releasing the hold button causes the memory to play through one time as it is emptied or replaced by new contents should there happen to be a signal present at the input to the unit.

Should you wish to use the memory facility for more specific functions, the sync button is essential. If the memory is cycling with the hold button selected as just described, pressing the sync button will halt the cycling and will only single shot cycle when the start button to its left is pushed. If the hold button is released, the sync control will dump the contents of the memory after playing them through.

To load into the memory, sync is selected and when the memory is ready to record under sync control, the decimal point on the delay display will remain illuminated rather than flash. Pushing the start/stop button will start the memory recording and when it is filled to the selected amount, the decimal point will illuminate again. Should the start/stop be pushed again the memory contents will be replayed as they are dumped. Therefore it is best to select hold as well.

Having obtained your stored memory, it is possible that you may wish to edit it. Unlike more expensive units, with the *BD-80* it is only possible to edit at one end of the memory. This is achieved by decreasing the set delay time displayed which removes from the loop the first parts of the signal to enter the memory. The replayed loop will then be shorter as will the single shot of the stored memory. Should the delay time be restored to the original setting used when the memory was filled, all the signal lost when the delay was reduced will be restored. Should you however attempt to erase sections of the memory by reducing the delay time and then releasing hold, it is in fact the last section of the memory that you will lose and as this is the opposite of what you might expect it requires a little thought.

You can use this facility to build up a composite stored memory as long as you bear in mind that you are always tacking on the end of the memory. For example if you record 5 s of memory and then wish to replace the last 2 s with something else the procedure is to set the delay time to 3 s, push start and record 2 s of signal. It is possible to build up as many of these composite sections as you wish provided there is room for them in the memory.

It is possible to remove (erase) sections

of the loop by releasing the hold button while the section to be removed is actually looping. This takes some practice though for accuracy. Should you wish to replace the erased section, just switch the hold button out at the required place in the loop while feeding in the replacement signal. After a few minutes practice it's possible to replace single numbers in a memory containing a swift count from 1 to 10.

It took a little experimentation to understand the memory features fully as the manual was not that clear about operation of these functions, although it was very good on all other aspects of the unit.

Summary

The *BD-80* is a unit that represents excellent value for money. There have been complaints from some people that it only edits from one end of the loop but this factor has to be set against the price of the unit which is far lower than systems of greater sophistication.

In operation the unit was quiet and presented no general operational problems. The basic delay was of good quality and when combined with the looping and synchronised replay facilities makes a unit that cannot be anything else but recommended, particularly at its price. □

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REVIEW REVIEW

A user report by Richard Elen

URSA MAJOR STARGATE 323



I have reviewed both the previous Ursa Major products and both have offered an excellent performance at a reasonable cost. The *StarGate* (or just *323* for short) is another such animal: like the other two units it is a digital reverberation unit, and this time it's even cheaper! The unit probably owes more to Ursa Major's first product, the *Space Station*, than to the later *8X32* but the *323* incorporates a number of highly impressive functions in a light (if not *that* small) package designed for the cost-conscious studio. Indeed, lightness is the first thing you notice on unpacking the unit, while the second thing is the fact that it is quite deep.

Controls

On slinging it into the rack, the noticeable factor is the clear, uncluttered front panel which makes the unit easy to appreciate and use in the most frantic circumstances. The controls and indicators are obvious: input level is adjusted until the signal just illuminates the red (0) LED occasionally, this latter being the top end of a neat 8-LED peak level display which includes peak hold characteristics to capture the shortest transient, and reads the signal level in the digital domain. The LF and HF Decay controls operate 6 dB/octave low- and highpass filters, the 3 dB-points being 14 to 480 Hz (LF) and 48 kHz to 3 kHz (HF). The HF control is particularly useful when using large room settings to reduce 'hang-on' of

sibilants to more natural levels, the unit having a good 15 kHz bandwidth; meanwhile the LF control has its uses for reducing muddiness introduced by unwanted bass information being sent to the reverb unit.

Further along we find the direct mix and reverb mix controls, which adjust the output signal levels accordingly. In the studio environment, of course, one usually sets the former to 'min' and the latter to 'max', but the inclusion of these controls is particularly thoughtful as they have obvious application in the smaller studio where channels may be at a premium.

Now we come to the central controls: those handling the room characteristics. A rotary switch selects one of eight

'rooms' which each have their own early reflection and decay characteristics. Interestingly, this control only glitches when there is a signal present (this is true of several of the time-related controls); if nothing is going on in the unit, you can 'change rooms' virtually silently—you may notice a *very* slight click on long decay times, generally because you have actually got some signal leaking into your echo send! Each room setting allows a different maximum length of decay, this maximum increasing as you go up the program numbers (which basically indicate larger and larger rooms). A 7-segment LED display indicates the room setting selected.

Next we come to the pre-delay control, another rotary switch offering 16 values. Each 'room' has its own pattern of early reflections inbuilt, but this control offers the same flexibility as patching a DDL into the send—not an unusual facility to find, but one which is very useful. You can adjust this control down to 0, which is useful, but occasionally, on *some* programme material or reverb program settings, you will get some phase-shift effects caused by interaction of the direct signal with the early reflections inherent in the program. In such cases, upping the pre-delay one or two steps will clear the problem without adding very obviously to the delay before the onset of reverberation. The pre-delay setting is displayed in ms.

The decay time control, another rotary, selects one of the eight reverb times available, its RT60 value being displayed

MANUFACTURER'S SPECIFICATION

Bandwidth: 15 kHz, all 'rooms', all decay times.

Sampling rate/bits: 32 kHz/15-bit linear.

Dynamic range: 80 dB.

Programs: eight 'room simulations'.

Pre-delay: 0-320 ms, 16 steps.

Decay times: 0-10 s in eight steps, room dependent.

HF and LF decay: adjustable controls.

Mixing: stereo direct and reverb mix controls.

Override functions: pushbutton controls (may be handled by foot pedals), input mute; dry only; reverb clear.

Inputs: electronically balanced differential, pin 3 high (21 k Ω), pin 2 low (11 k Ω), pin 1 ground; 7 V max input before overload. XLR-3 female connectors.

Outputs: stereo, active differential. Max output +10 dBV nominal, recommended load 600 Ω .

XLR-3 male connectors (pin 3 hot).

Dimensions: (hwd) 3.5 \times 19 \times 15.5 in.

Weight: approx 12 lb.

Power: 115/230 VAC (internal switch), 50/60 Hz, 30 W approx consumption. IEC power connector.



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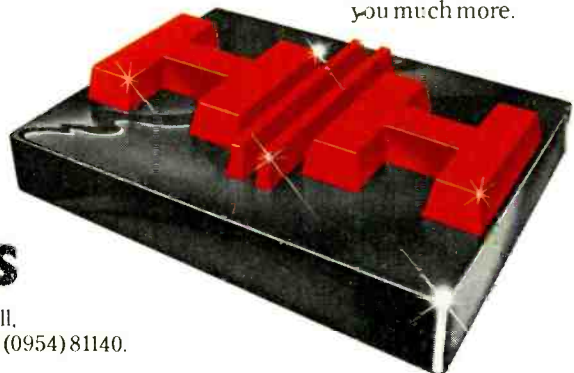
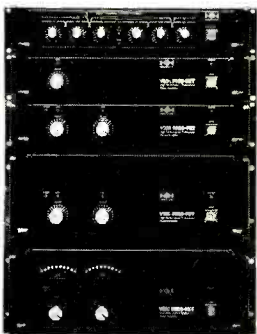
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REVIEW REVIEW

in ms. The possibilities range from 0 (early reflections only: good on drums) to a maximum of 2 to 10 s dependent on the program.

Then we come to the special functions available. These are actuated by pushbuttons or optionally by footswitch. Each of the three has an LED associated with it which flashes when the function is engaged. The first two, 'input mute' and 'dry only' are obvious; the third, 'reverb clear' actually forces a decay time of 0 s and gives early reflections only. Easier than resetting the decay time control, this button allows some very tasty effects.

The rooms

The eight rooms are fully described in the clear, comprehensive 30-page manual supplied with the unit (which also has a useful tutorial section on reverb and plenty of useful diagrams). The first two have plate-like characteristics; program 3 is a chamber; 4, 5 and 6 are small, medium and large halls respectively; while 7 is labelled 'cathedral' and 8, 'canyon'. As the program number increases, the diffusion is slowed, the colouration reduced, the spaciousness increased, and the intelligibility reduced (as you would expect!). The handling of percussion sounds is best in the lower program numbers, a fact also indicated in the manual in one of a number of comprehensive charts which also offer suggested settings for different types of program material.

The *StarGate* uses a single, highly flexible algorithm which was developed with an extensive utilisation of computer modelling and auditioning to achieve a remarkable degree of flexibility in the unit, without breaking the bank.

Using the StarGate

During the time I had the unit in the studio, I was able to use it on a fairly wide spread of musical material. The unit is also recommended for adding spaciousness to voiceovers and the like, but I was only able to try this briefly (and successfully) with shorter decay times on the first two programs.

A particularly useful effect is the 'reverb clear' function, which can be used for mono/stereo processing to great effect, especially on instruments like the mono Yamaha *DX-7*, with no direct signal present and minimal pre-delay. This setting (with some direct) also neatly 'fills out' many instruments, like a rather complex set of delays, much in the manner of the *Space Station*.

The unit is particularly effective for adding 'spaciousness' around drums and percussive instruments with smaller room settings. It is also useful for certain types of 'chorus' effects especially on the

larger hall settings with synth or similarly 'dry' input signals. 'Straight' reverb performance is generally exemplary (with one slight reservation covered later), and the larger 'rooms' are very impressive with church organ sounds and the like.

It should be noted that the *StarGate* is not really a stereo-input unit. The 'direct' signal path is indeed stereo, if you wish to use it, but the inputs to the reverb section of the device are summed, as previous *Ursa Major* products. This is no hardship, however, and true stereo-input reverb units tend to be pretty expensive.

Users of the *Space Station* will also be familiar with the 'tremolo' effect caused by the randomisation process in the reverb processor. Present to a lesser extent in the *StarGate*, this is sometimes useful, and sometimes a pain (eg on piano with the lower-numbered programs). It can be noticeable if you are asking for trouble. The purer and more steady the input signal, the more you notice this effect. Also, it is most noticeable when the reverb time is long (but the program number is low—odd) and the input level is low. It is pretty easy to get out of trouble by using large rooms on short decay times if you need a short reverb, and by driving the unit hard. The latter is neatly accomplished if you have a clever signal conditioning unit like a *Compellor* (which I recommend even if some people think it's really a broadcast unit!).

Conclusions

This device has managed to combine the ease of use of the *8X32* with a comparatively low price and a performance which, while based on that of the *Space Station*, goes way beyond it. I think this is *Ursa Major's* best unit so far. It does not pretend to be a *Quantec* or *Lexicon*, but it is a good step above virtually anything else in the marketplace at anywhere near this price. You may not want this device if you can afford one of the expensive reverb systems, but there are thousands of smaller studios to whom the *StarGate* will be a Godsend.

One modification I think could be cost-effectively included, would be internal jumpers to select which *XLR* pin is hot: it is reasonable for a US manufacturer to observe domestic practice in this respect, but it is painful to be forced to be non-standard in this day and age. *Audio & Design* did it neatly with the *Ambisonic* package, and I recommend their approach (mini PCB jumpers) to *Ursa Major*. Next time there's a board revision?

Overall, though, that's a minor niggle and I'm sure the *StarGate* will be *Ursa Major's* best-seller. □

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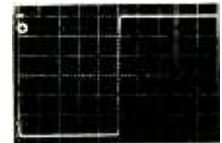
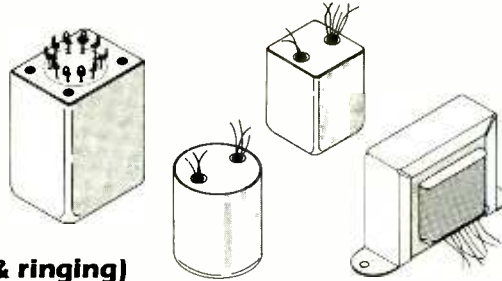
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JE-16A
2 kHz Square Wave

INPUT TRANSFORMERS AND SPECIAL TYPES

Model	Application	Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20 Hz Max Input Level ¹ (dBu)	Typical THD Below Saturation (%) 20Hz/1kHz	Frequency Response (dB ref. 1 kHz) 20Hz/20kHz	Band-Width ² -3dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot (%)	Noise Figure (dB)	Magnetic Shield ⁴ (dB)	Number of Faraday ⁴ Shields	Package ⁵	PRICES		
														1-19	100-249	1000

MICROPHONE INPUT

JE-16-A	Mic in for 990 opamp	150-600	1:2	+8	0.036/0.003	-0.08/-0.05	170	-10	<1.75	1.7	-30	1	A=1 B=2	63.61 68.25	42.49 45.60	29.32 31.46
JE-13K7-A	Mic in for 990 or I.C.	150-3750	1:5	+8	0.036/0.003	-0.10/-0.22	85	-20	<3	2.3	-30	1	A=1 B=2	63.61 68.25	42.49 45.60	29.32 31.46
JE-115K-E	Mic in for I.C. opamp	150-15K	1:10	-6	0.170/0.010	-0.50/+0.10	115	-5	<7	1.5	-30	1	3	41.48	27.72	21.65

LINE INPUT

JE-11P-9	Line in	15K-15K	1:1	+26	0.025/0.003	-0.03/-0.30	52	-28	<3		-30	1	1	102.86	68.72	47.42
JE-11P-1	Line in	15K-15K	1:1	+17	0.045/0.003	-0.03/-0.25	85	-23	<1		-30	1	3	39.53	26.41	20.62
JE-6110K-B	Line in bridging	30K-1800 (10K-600)	4:1	+24	0.005/0.002	-0.10/-0.30	75	-15	<1		-30	1	B=1 BB=2	62.31 70.95	41.63 47.38	30.56 32.70
JE-10KB-C	Line in bridging	30K-1800 (10K-600)	4:1	+19	0.033/0.003	-0.11/-0.08	160	-9	<2		-30	1	3	40.98	27.37	18.89
JE-11SSP-8M	Line in/ repeat coil	600/150-600/150	1:1 split	+22	0.035/0.003	-0.03/-0.00	120	-9	<3.5		-30	1	4	151.90	101.47	70.01
JE-11SSP-6M	Line in/ repeat coil	600/150-600/150	1:1 split	+17	0.035/0.003	-0.25/-0.00	160	-5	<3		-30	1	5	78.62	52.52	36.24

SPECIAL TYPES

JE-MB-C	2-way ³ mic split	150-150	1:1	-2	0.180/0.005	-0.25/-0.20	88	-15	<1		-30	2	3	34.08	22.78	17.78
JE-MB-D	3-way ³ mic split	150-150-150	1:1:1	-2	0.180/0.005	-0.25/-0.16	100	-12	<1		-30	3	3	59.57	39.80	31.08
JE-MB-E	4-way ³ mic split	150-150-150-150	1:1:1:1	+10	0.050/0.002	-0.10/-1.00	40	-18	<1		-30	4	1	96.29	64.32	44.38
JE-DB-E	Direct box for guitar	20K-150	12:1	+19	0.096/0.005	-0.20/-0.20	80	-18	<1		-30	2	6	43.04	28.76	22.46

1. Max input level = 1% THD; dBu = dBV ref. 0.775 V
2. With recommended secondary termination
3. Specifications shown are for max. number of secondaries terminated in 1000 ohm (typical mic preamp)
4. Separate lead supplied for case and for each faraday shield
5. Except as noted, above transformers are cased in 80% nickel mu-metal cans with wire leads.

PACKAGE DIMENSIONS:

W	L	H
1 = 1 ³ / ₁₆ " Diam.		× 1 ³ / ₁₆ "
2 = 1 ³ / ₁₆ " × 1 ³ / ₁₆ "		× 1 ³ / ₁₆ "
3 = 1 ³ / ₁₆ " Diam.		× 1 ³ / ₁₆ "
4 = 1 ¹ / ₂ " × 1 ³ / ₄ "		2 ¹ / ₂ " w/solder terminals
5 = 1 ⁵ / ₈ " Diam.		× 1 ³ / ₄ "
6 = 1 ¹ / ₈ " Diam.		× 1 ³ / ₁₆ "

NICKEL CORE OUTPUT TRANSFORMERS⁶

Model	Construction	Nominal Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20Hz Max Output Level ⁷ across (n) windings (dBu)	600Ω Termination Loss (dB)	DC Resistance per Winding (Ohm)	Typical THD Below Saturation (%) 20Hz/1kHz	Frequency Response (dB ref. 1kHz) 20Hz/20kHz	Band-Width -3dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot ⁸ (%)	Package ⁹	PRICES			
													1-19	100-249	1000	
JE-123-BMCF	Quadfilair 80% nickel	600-600 150-600	1:1 1:2	+28	2	-1.1	20	0.002/0.002	-0.02/-0.02	>450 158	-2.1 -4.1	<1	7	87.41	44.17	30.47
JE-123-DMCF	Quadfilair 80% nickel	600-600 150-600	1:1 1:2	+21	2	-1.0	19	0.004/0.002	-0.02/-0.00	>450 230	-1.2 -2.5	<1	8	50.71	33.88	23.38
JE-123-BLCF	Quadfilair	600-600 150-600	1:1 1:2	+32	2	-1.1	20	0.041/0.003	-0.02/-0.01	>450 168	-1.9 -4.0	<1	7	61.30	35.79	24.70
JE-123-DLCF	Quadfilair	600-600 150-600	1:1 1:2	+27	2	-1.0	19	0.065/0.003	-0.02/-0.01	>450 245	-1.2 -2.5	<1	8	39.61	26.45	19.42
JE-123-SLCF	Quadfilair	600-600 150-600	1:1 1:2	+23.5	2	-1.1	20	0.088/0.003	-0.03/-0.01	>450 245	-1.2 -2.8	<1	9	33.48	22.35	15.43
JE-112-LCF	Quadfilair	600-600 150-600	1:1 1:2	+20.4	2	-1.6	29	0.114/0.003	-0.03/-0.01	>450 205	-1.2 -3.2	<1	10	25.48	17.01	12.49
JE-123-ALCF	Quadfilair	66.7-600	1:3	+26.5	3	-1.3	8	0.125/0.003	-0.04/+0.06	190	-4.6	<6	8	42.14	28.15	19.42
JE-11S-LCF	Bifilar w/ split pri.	600-600 150-600	1:1 1:2	+30	1 (sec)	-1.7	63	0.058/0.002	-0.02/+0.01 -0.02/-0.05	>10MHz 155	+1.1 -4.1	<1	8	42.14	28.15	19.42

6. Multifilar construction has no faraday shield.
7. All specifications are for 0Ω source, 600Ω load.
8. Max output level = 1% THD; dBu = dBV ref. 0.775 V
9. Source amplifier -3dB @ 100kHz
9. Output transformers are horizontal channel frame type with wire leads, vertical channel frames available.

PACKAGE DIMENSIONS:

W	L	H	Mounting Centers
7 = 1 ¹ / ₂ " × 2 ⁵ / ₁₆ "		× 1 ¹⁵ / ₁₆ "	2 ¹³ / ₁₆ "
8 = 1 ⁵ / ₁₆ " × 1 ¹⁵ / ₁₆ "		× 1 ⁵ / ₈ "	2 ³ / ₈ "
9 = 1 ¹ / ₈ " × 1 ¹¹ / ₁₆ "		× 1 ³ / ₈ "	2"
10 = 1 ¹ / ₁₆ " × 1 ⁷ / ₁₆ "		× 1 ³ / ₁₆ "	1 ³ / ₄ "

These charts include the most popular types which are usually available from stock. Many other types are available from stock or custom designs for OEM orders of 100 pieces or more can be made to order. Certified computer testing is available for OEM orders. Call or write for applications assistance and/or detailed data sheets on individual models.

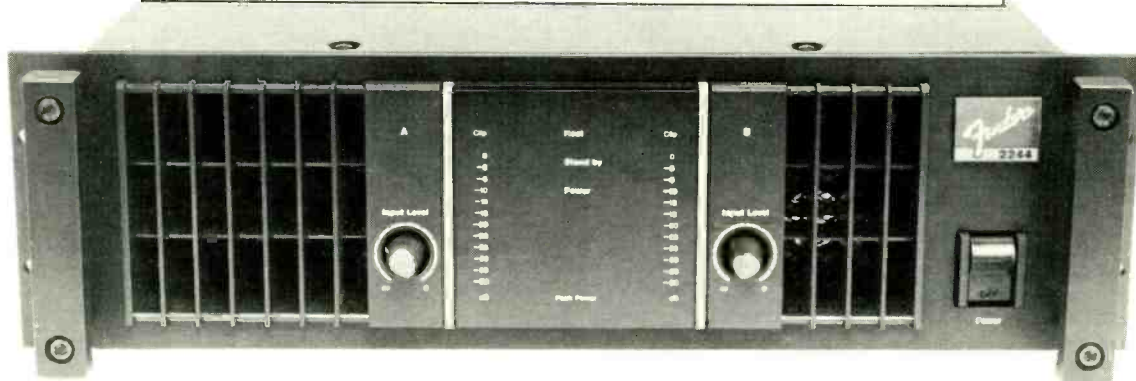
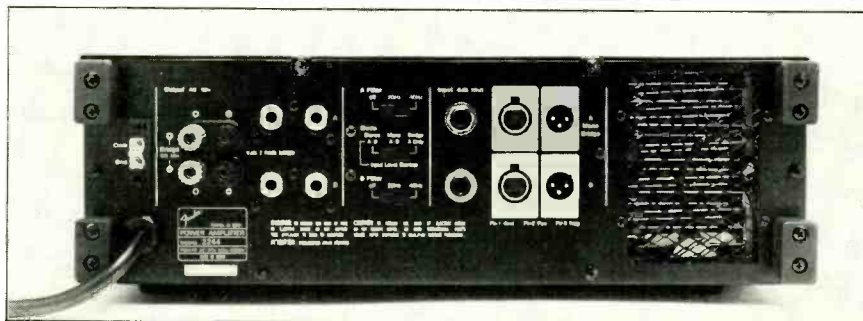
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REVIEW REVIEW

Hugh Ford reviews a power amplifier



FENDER 2244

The Fender models 2224 and 2244 are, with the exception of available power output, identical in specification, the smaller brother giving 120 W +120 W into 8 Ω or 240 W +240 W into 4 Ω . In both cases a single laminated power transformer is used to supply both channels via a common rectifier and smoothing components. However the AC section of the power supply is stabilised against input voltage variations by means of a 'backslope' power supply. At the time of writing only a 115 V 60 Hz version of the amplifier is available, but a European voltage version is expected to be available by the end of 1984.

The unit which is designed for rack mounting into standard 19 in racks occupies 3 U of rack height with the substantial alloy front panel having four slots for rack screws.

In order to make stacking in racks possible, forced air cooling is used. One rather noisy fan to the left of the unit draws air in through the front panel without filtering and passes it through a tunnel filled with interleaved heatsinks. These are attached to the inside of the thick alloy tunnel with

the output devices being attached to the outside. The second (and slightly quieter) fan draws unfiltered air into the right of the front panel and passes it over the power transformer from where the air mainly emerges at the right hand side of the amplifier

MANUFACTURER'S SPECIFICATION

Power output per channel: 880 W mono bridge (8 Ω); 440 W plus 440 W (4 Ω); 220 W plus 220 W (8 Ω).
Frequency response: 5 Hz to 50 kHz; +0/-1 dB 10 Hz to 50 kHz.
Distortion: less than 0.05% from 20 Hz to 20 kHz at full power.
Input sensitivity: 0 dB (0 dB = 0.775 V) for rated power.
Input impedance: 15 k Ω balanced.
Input control: 20-position detented rotary volume.
Highpass filter: 20 Hz/40 Hz/off, switch selectable per channel.
S/N ratio: >-100 dB; 20 Hz to 20 kHz at 8 Ω .
Damping factor: 200 at 1 kHz.
Slew rate: >42 V/ μ s into 4 Ω .
Rise time: 3 μ s.
Channel separation: >80 dB at 1 kHz.
Input connectors per channel: XLR-3 male and female ¼ in phone jack.
Output connectors per channel: 5-way binding posts on ¼ in centres and ¼ in phone jack.
AC requirements: 120 V \pm 10% 50/60 Hz.
Indicators: power LED, heat LED, level LED, standby LED (12 segment).
Manufacturer: Fender Musical Instruments, 1300 East Valencia Drive, Fullerton, CA 92631, USA.
UK: CBS Fender Ltd, Fender House, Jeffrey's Road, Enfield, Middlesex EN3 7HE.

through perforations in the case.

Two substantial carrying handles are fitted to the front of the amplifier giving mechanical protection to the input level controls and fascia. Just inside the right handle, the power on/off switch takes the form of a magnetic circuit breaker offering overall protection, no fuses being fitted.

Either side the air intakes are through plastic grilles with suitable finger guards in front of the fans. To the centre a dark translucent annunciator panel is in front of the indicators and level displays. Individual green, yellow and red LEDs at the centre indicate ready, standby and 'heat' overload with the level indicators at either side taking the form of an array of horizontal bars.

At the top of each level display a red bar indicates 'clip' with a space between this and the actual level indicator bars below. These comprise red bars for 0 dB and -3 dB indication followed by a series of green bars at -6, -10, -13, -16, -20, -23, -26, -30, -33 and -36 dB.

The level controls either side of the display take the form of potentiometers of the full range type

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REVIEW REVIEW

FIG 1
FENDER 2244
COMMON MODE REJECTION RATIO BOTH CHANNELS

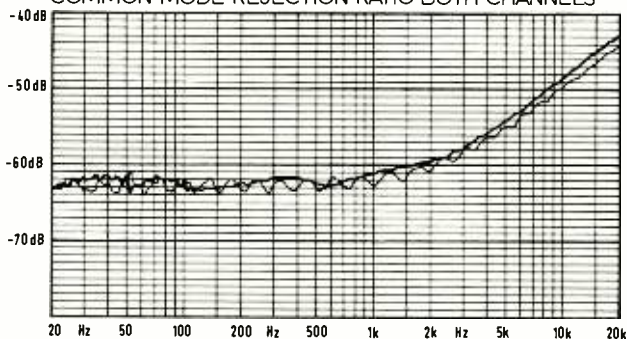
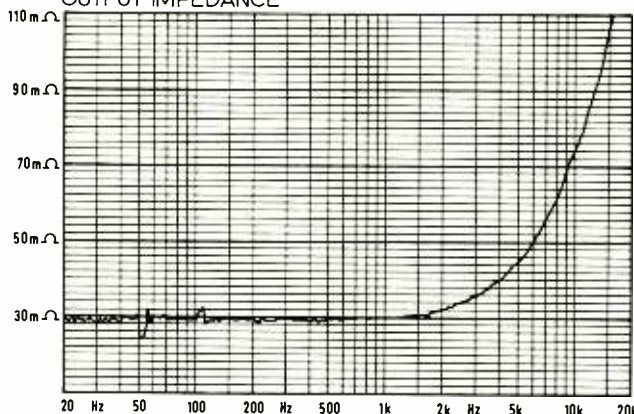


FIG 2
FENDER 2244
OUTPUT IMPEDANCE



detented with 21 steps at sensible intervals.

To the rear of the unit the incoming power is via a fixed cord with a removable link allowing ground isolation from the power line ground.

The electronically balanced inputs for the two channels are each paralleled at XLR plugs and sockets for 'daisy chaining' amplifiers, in addition to ¼ in jack sockets.

The audio power outputs feed twin sets of terminals/banana sockets on standard ¼ in centres with the terminal caps being captive and the wire holes vertical to ease the installation of terminal pins or wires. In addition the outputs are available at duplicated ¼ in jack sockets.

To the centre of the rear panel separate slide switches for each channel allow the insertion of 20 Hz or 40 Hz highpass filters with a third switch selecting stereophonic or bridge operation in addition to the option of paralleling the two amplifier's inputs for mono (non-bridged) operation.

All these rear panel features are mechanically protected by rubber 'bumpers' at each corner of the rear panel.

The sides are formed from sheet steel

and are screwed to the robust front panel. Similarly the base of the unit is pressed out of fairly heavy gauge sheet steel and supports the power transformer and smoothing capacitors plus further metal sub-assemblies which support printed circuit boards including a complex line input filter and the power supply control.

Behind the front panel another board is used for the level indication components etc, with the main audio boards being on the side of the force air cooled tunnel. Generally the boards

are of domestic quality, but good component identifications are provided with access to components being good and the wiring to a satisfactory standard. Furthermore the service manual contains board layouts, full circuit and components lists in addition to other useful information.

In addition to this a comprehensive user's manual is in preparation giving much valuable information for the less experienced user.

Inputs and outputs

The impedance at the balanced inputs remained approximately constant at 18.8 kΩ for both channels independent of the gain settings. Input sensitivity was 0.767 V for an output of 220 W into 8 Ω with the two channels being very closely matched at maximum gain to within 0.04 dB.

The common mode rejection for both channels is shown in Fig 1 to be virtually identical for the two channels at greater than 60 dB below 2 kHz.

At the outputs the DC offset was minimal at 0.1/1.3 mV with the modulus of the output impedance for the two channels being closely matched, typically as shown in Fig 2 which gives a damping factor of 285 reference 8 Ω.

Frequency response and noise

In the absence of the inbuilt highpass filters the frequency response for the two channels at 1 W into 8 Ω extended to a -3 dB point at 119 kHz as shown in Fig 3 where the low frequency response is very flat.

Inserting the 20 Hz and 40 Hz nominal highpass filters gave -3 dB points at 40.9 Hz and 20.7 Hz as shown in Fig 4 with the filters offering 12 dB/octave attenuation about well chosen frequencies.

Noise in the output was measured



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REVIEW REVIEW

using a 60 Hz, 220 V power supply with the level controls at maximum and minimum settings.

Unlike some amplifiers the worst noise condition was at maximum gain with the noise in the output reducing with the gain settings.

The noise performance shown in **Table 1** is consistently good with both channels being very close to each other and the gain setting making only a minor difference to the output noise with the inputs shorted.

Power output and distortion

Power output at the onset of clipping of a 1 kHz sinewave was measured with the input to the amplifier set to 120 V at both 50 Hz and 60 Hz, the frequency making little difference.

Using continuous sinewaves the outputs shown in **Table 2** were measured and all results were well above the manufacturer's specification.

With 10 ms tone bursts every 100 ms

the power output showed little difference, presumably due to the internally regulated output rails, with the power into 2 Ω being impressive with the amplifier delivering a burst current in excess of 20 A as shown in **Table 3**.

Total harmonic distortion and noise was measured at the full rated power output and 20 dB lower into both 4 Ω and 8 Ω at various frequencies and the good results are shown in **Table 4**.

As anticipated from these results

TABLE 1

Measurement Method	Noise in output ref 220 W into 8 Ω			
	Maximum gain		Minimum gain	
	Left	Right	Left	Right
22 Hz to 22 kHz RMS	103.9 dB	104.1 dB	106.5 dB	107.2 dB
A-weighted RMS	106.7 dB	106.7 dB	112.7 dB	112.2 dB
CCIR-weighted RMS	98.5 dB	98.2 dB	104.2 dB	103.7 dB
CCIR-weighted quasi-peak	93.2 dB	93.1 dB	100.7 dB	100.1 dB
CCIR-weighted ARM 2 kHz	104.9 dB	104.7 dB	110.9 dB	110.7 dB

TABLE 2

Power into load	Left	Right
8 Ω	270 W	267 W
4 Ω	463 W	445 W

TABLE 3

Burst power into	Left	Right
8 Ω	277 W	277 W
4 Ω	466 W	445 W
2 Ω	820 W	790 W

TABLE 4

	Total Harmonic distortion and noise			
	100 Hz	1 kHz	10 kHz	20 kHz
220 W into 8 Ω left	0.003%	0.0035%	0.0055%	0.0085%
220 W into 8 Ω right	0.007%	0.006%	0.009%	0.013%
22 W into 8 Ω left	0.006%	0.0055%	0.006%	0.007%
22 W into 8 Ω right	0.015%	0.015%	0.016%	0.018%
440 W into 4 Ω left	0.004%	0.005%	0.008%	0.013%
440 W into 4 Ω right	0.015%	0.015%	0.016%	0.018%
44 W into 4 Ω left	0.006%	0.006%	0.006%	0.006%
44 W into 4 Ω right	0.006%	0.005%	0.008%	0.013%

FIG. 3
FENDER 2244
FREQUENCY RESPONSE

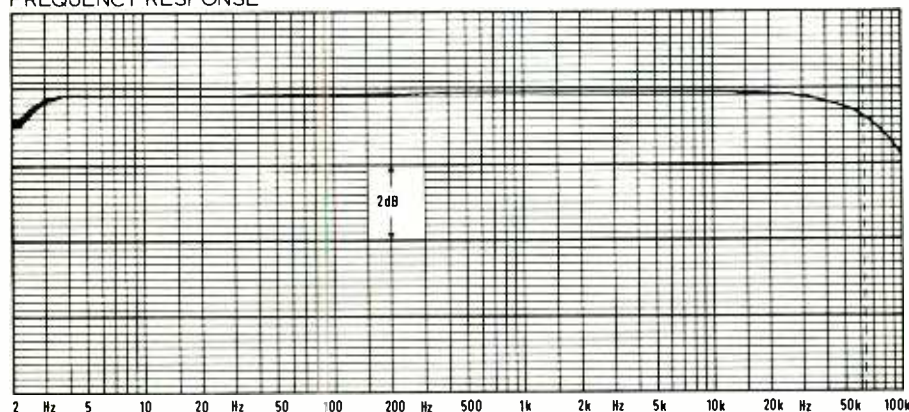


FIG. 4
FENDER 2244
FREQUENCY RESPONSE USING
HIGH-PASS FILTERS

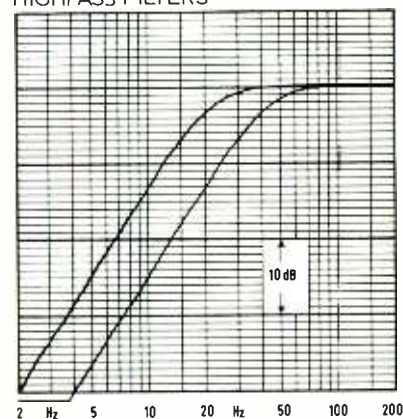
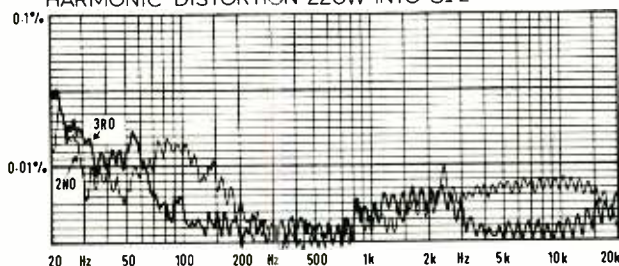
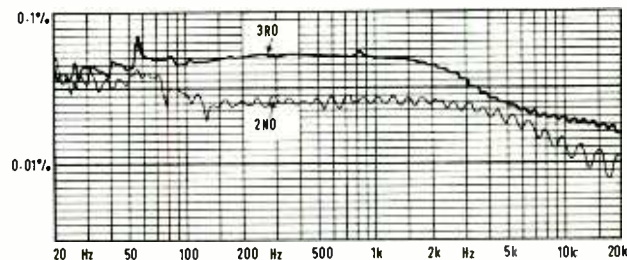


FIG. 5
FENDER 2244
HARMONIC DISTORTION 220W INTO 8Ω



(a) LEFT CHANNEL



(b) RIGHT CHANNEL

REVIEW REVIEW

FIG. 6
FENDER 2244
IM DISTORTION

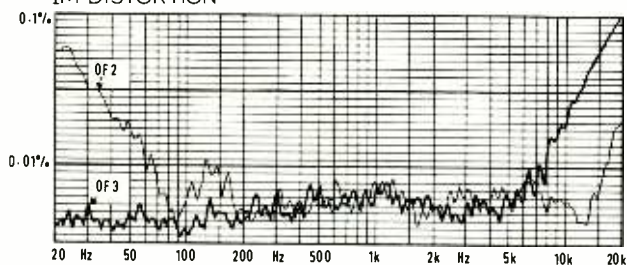


FIG. 8
FENDER 2244
CHANNEL SEPARATION

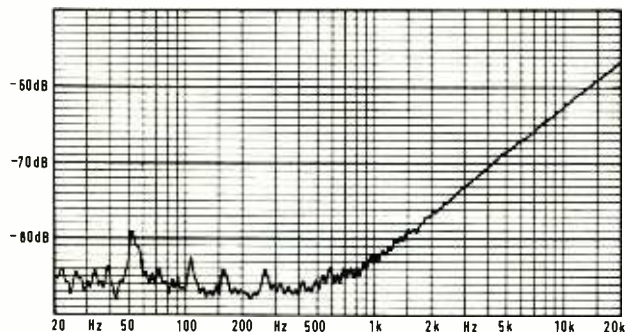


FIG. 7 FENDER 2244
SQUAREWAVE PERFORMANCE

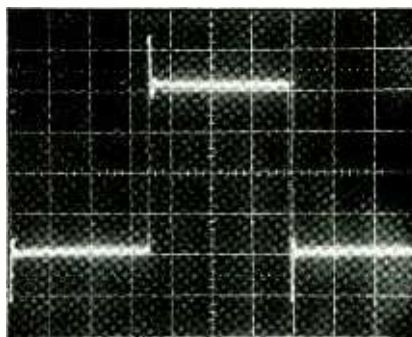
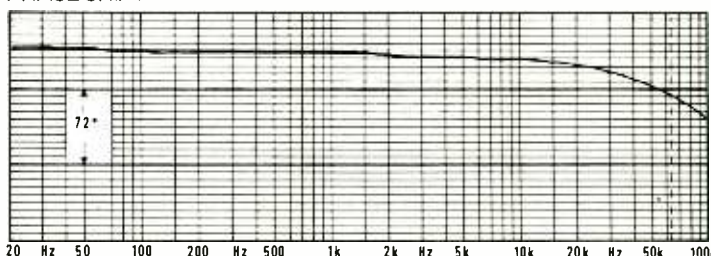


FIG. 9
FENDER 2244
PHASE SHIFT



the individual second and third harmonic contents of the two channels was different as shown in Fig 5a and Fig 5b for 220 W into 8 Ω. However at lower powers the distortion dropped to a very low level in both channels.

Intermodulation distortion to the CCIF twin tone method with tones separated by 70 Hz produced Fig 6 for 220 W peak equivalent output into 8 Ω. In this case both channels were similar with the intermodulation distortion dropping to even lower levels at lower output powers.

The squarewave performance of the two channels was virtually identical, with Fig 7 showing the overshoot present when working into 8 Ω in parallel with 2 μF, the removal of the overshoot. Rise and fall times were both 2.1 μs, with the maximum slew rate into 8 Ω 25 V/μs.

Other matters

Separation between the two channels was 82 dB at 1 kHz falling with frequency as shown in Fig 8. The phase shift within the audio band was minimal as shown in Fig 9.

Recovery from any form of normal overload was clean, although the output relays did not trip until very high amplitude and low frequency outputs occurred. Clipping at less than 1 Hz was possible, thus the use of the highpass filters is highly desirable for loudspeaker protection. Tripping and

recovery from low frequency overload was without problems.

The bar meters were found to have a peak rectifier characteristic as is desirable with the rise time being about 30 ms and the fall time 3.5 s. This is quite a sensible time constant with the meter showing 'clip' about 0.5 dB below serious clipping with the nominal 0 dB indication corresponding closely to the rated power output into 8 Ω or 4 Ω.

The indicated steps in the metering were accurate within the readability at all points.

Conclusions

This amplifier gives a very good all round performance to match many of

the best monitoring amplifiers.

Distortion of all forms was low, the noise performance excellent and the overall standard of construction quite good. In addition a comprehensive service manual was provided.

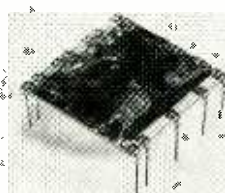
Whilst the amplifier itself ran very cool through the review, the snag for some applications is the cooling fans which are exceedingly noisy. □

Editor's comment

At the time of completing this review, Hugh was not aware that the 2244 was designed mainly for live sound applications although it does meet full studio monitoring requirements. Hugh's conclusions should be read with this in mind.

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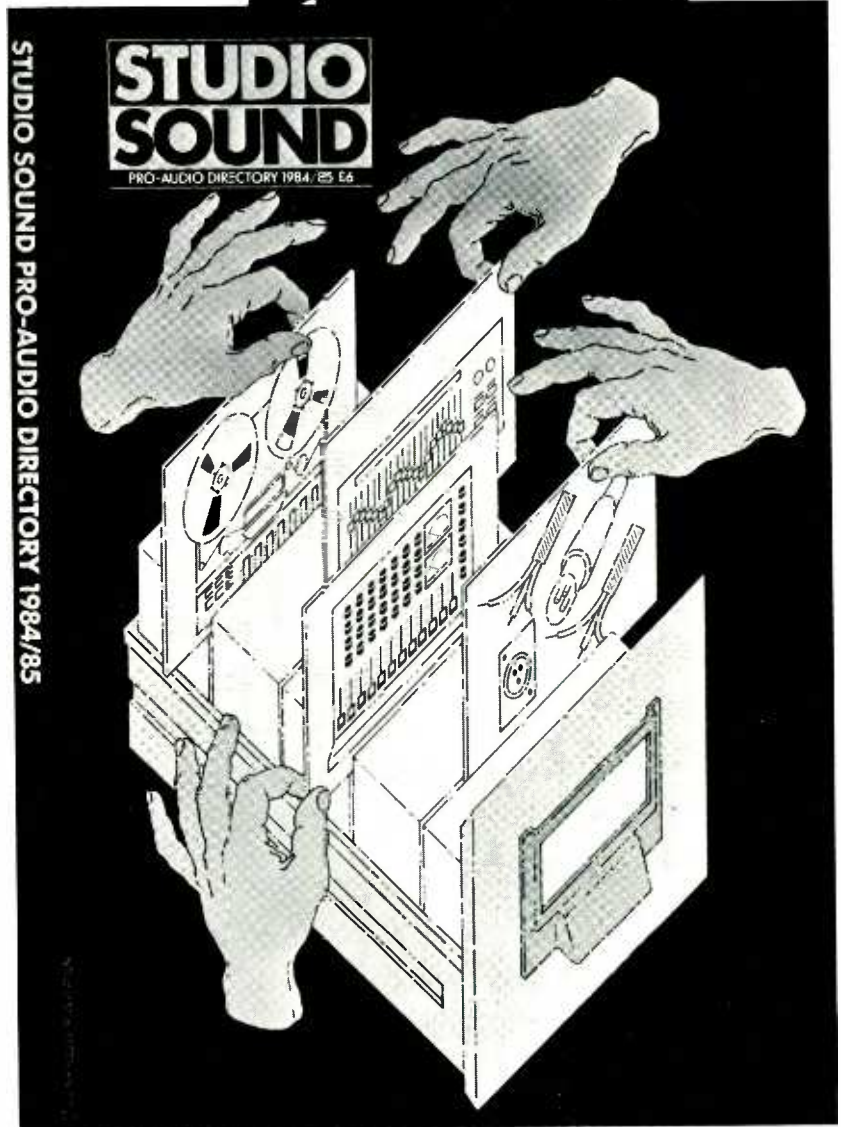
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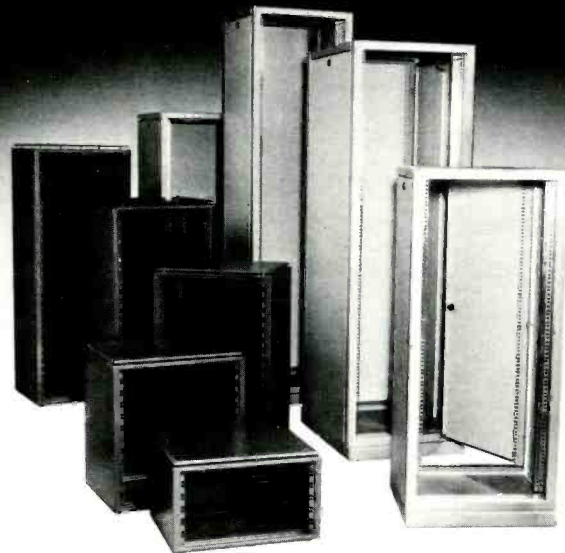


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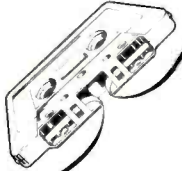
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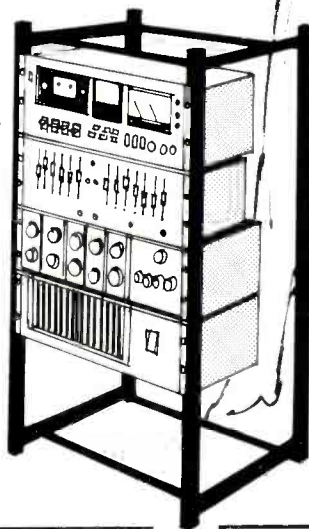
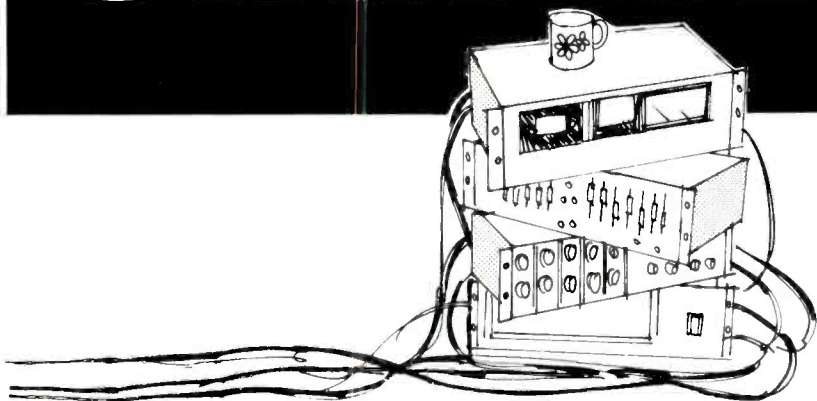
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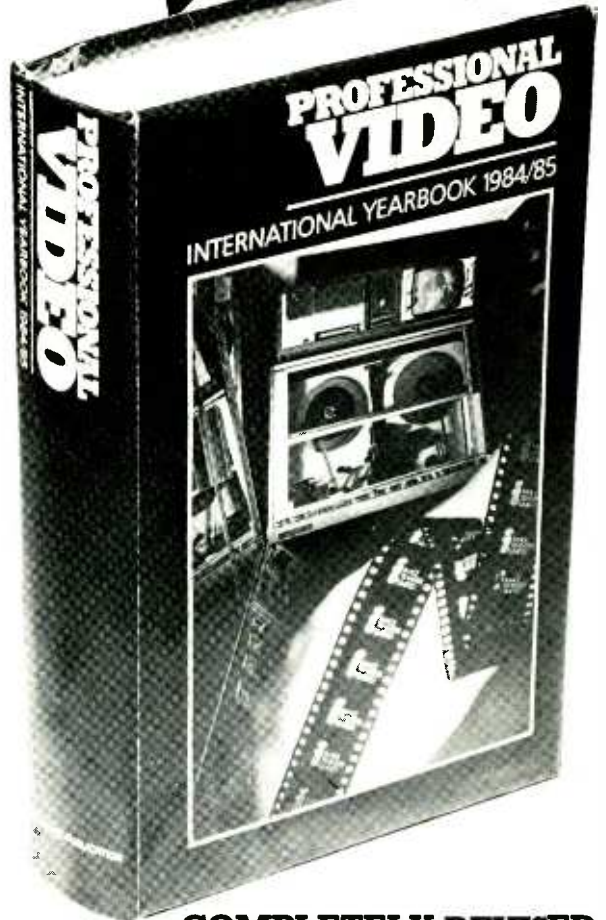
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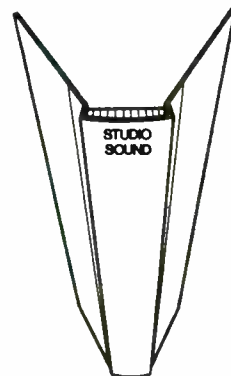
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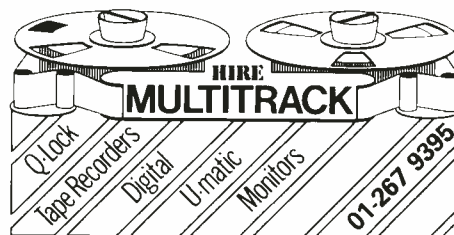


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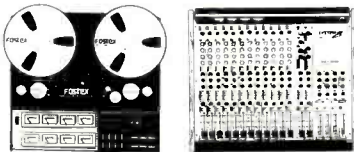
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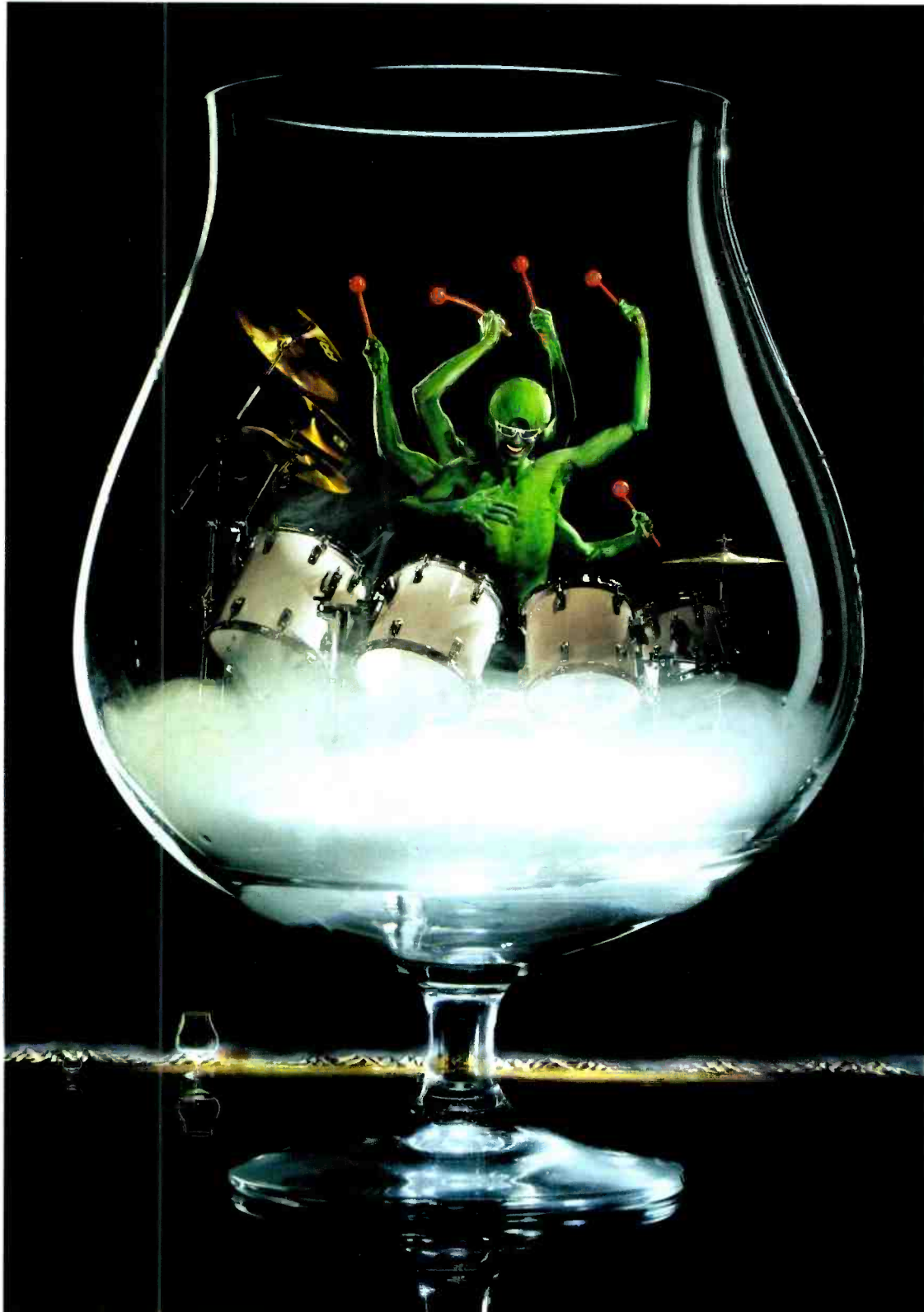
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