MARCH 1994 $5.00 £2.00

STUDIO SOUND

AND BROADCAST ENGINEERING

THE INTERNATIONAL PRO AUDIO MAGAZINE

MONITORING

The in-ear revolution; horn driver analysis

MIDI

P&G MIDI Manager

MIDI and remote control

Focusrite In-line

New console exclusive

9 770144 594017 03

"G Plus Sounds Excellent By Any Standards"

Allen Sides, Ocean Way

The world's largest music console – a 100-channel SL 8000 G Plus – is installed at Ocean Way's 'Record One' facility in Sherman Oaks, California.

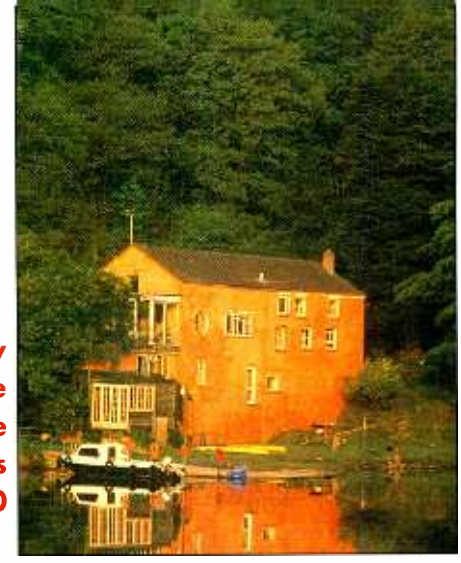
"Record One and Ocean Way share a common ethic – to provide the best possible equipment, classic and modern, to meet the needs of both artist and producer. I have always respected the ergonomics and automation of SSL desks. The addition of Ultimation™, bypassing the fader VCAs, and new audio enhancements mean that G Plus sounds excellent by any standards."

Allen Sides, Owner
Ocean Way, Los Angeles

Solid State Logic

International Headquarters:- Begbroke, Oxford, England, OX5 1RU. Tel: (0865) 842300
Paris (1) 34 60 46 66 · Milan (2) 262 24956 · Darmstadt (6151) 93 86 40 · Tokyo (3) 54 74 11 44
New York (212) 315 1111 · Los Angeles (213) 463 4444 In USA call Toll Free 1-800 343 0101

STUDIO SOUND
AND BROADCAST ENGINEERING

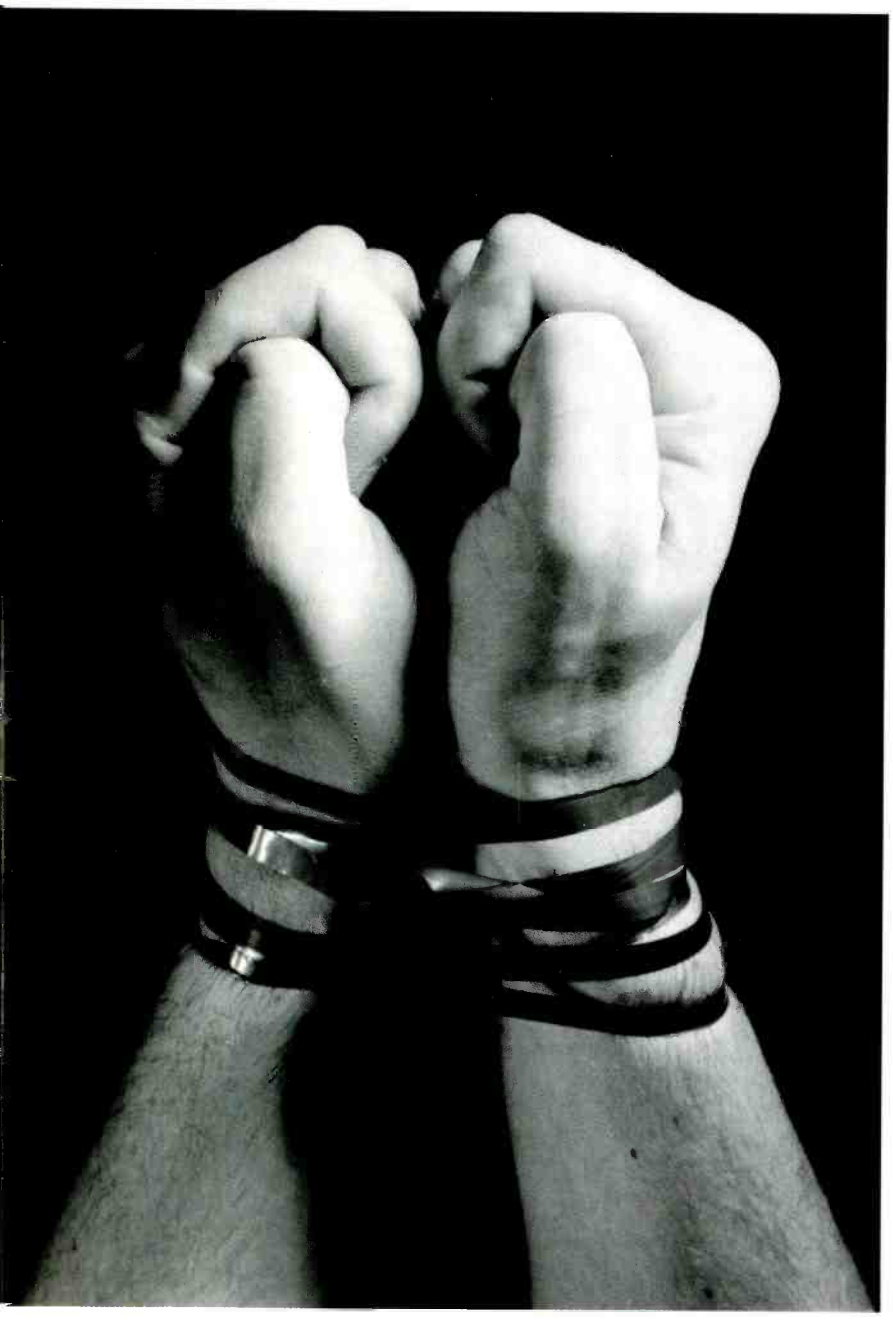


England's West Country houses one of the most picturesque studios Sawmills
See page 20

CONTENTS

MIDI control for the discerning professional. See page 44

TIED TO THE JOB?



But have you ever thought about professional digital audio editing? Too slow? Too expensive? Difficult to understand? SADiE™ Disk Editors have changed all that. For a start SADiE™ runs on a PC, so you get much more computer for far less money. It has a fully functional Windows 3* user interface, non - destructive sample accurate editing, real time cross fades and up to 8 track playback with real time digital mixing, bounce down, overdub, EQ and dynamics control. And real time saving.

SADiE™ Disk Editors have sold world-wide into broadcast, post-production, studios and mastering organisations, so its already been well and truly put to the test out in the field. SADiE™ Version 2 incorporates many of our customers suggestions. Talk to them about our commitment and service, if you don't know a SADiE™ user in your area, we can easily put you in touch.

Tied to the job or just tired of the job - why not free up a couple of minutes today and phone or fax for some more information.

- *Windows 3.1 * on 486 host computer*
- *Rapid graphical editing*
- *Clear user interface*
- *Local SCSI drive fast audio access*
- *All crossfades calculated in real-time*
- *Fully non-destructive, sample accurate editing*
- *Up to 8 track playback with real-time mixing*
- *Unique Trim Window allowing real-time adjustment of audio*
- *Jog and shuttle scrub modes*
- *AES/EBU, SPDIF and analog I/O*
- *All standard sample rates*
- *Full SMPTE timecode support with chase and trigger lock*
- *16, 20 and 24 bit digital audio editing*
- *Bounce down*
- *Overdub*
- *Reverse playback*
- *Real-time dynamics control*
- *Real-time EQ*
- *Real-time digital resampling*
- *Real-time duration change*
- *Real-time noise reduction*

BRITISH INNOVATION

MANUFACTURED IN THE EUROPEAN COMMUNITY BY STUDIO AUDIO & VIDEO LTD

Studio Audio & Video Ltd
The Old School, Stretham
Ely, Cambridge
CB6 3LD. UK
TEL: +44 (0)353 648888
FAX: +44 (0)353 648867

USA

Studio Audio Digital Equipment Inc
1808 West End Avenue
Suite 1119
Nashville, Tennessee 37203
USA
TEL: +1 615 327 1140
FAX: +1 615 327 1699

SADiE DISK EDITOR

SADiE™ DISTRIBUTORS WORLDWIDE

Argentina Kappa T 081 31 0818 F 081 31 1493 • **Asia Pacific** VW Marketing T +44 372 728481 F +44 372 724009 • **Australia** Audio & Recording T 02 316 9935 F 02 666 3752 • **Canada** JSGS Ltd. T 416 751 7907 F 416 751 7975 • **China** Wo Kee Eng. Ltd T +852 774 2628 F +852 363 7808 • **Denmark** SC Sound T 43 99 88 77 F 43 99 80 77 • **Finland** oy HedCom AB T 90 682 866 F 90 682 8489 • **France** Coach Audio T 87 77 00 00 F 87 77 01 21 • **Germany** Stefan Mayer Audio Engineering T 0 6851 6519 F 0 6851 6519 • **Hong Kong** Digital Professions Ltd T 318 0588 F 305 1455 • **Israel** Sontronics Electronic Equipment T 03 5705223 F 03 6199297 • **Korea** Avix Trading Co. Ltd. T 02 565 3565 F 02 565 3561 • **Philippines** Tracks T 2 631 3277 F 2 631 3267 • **Poland** Unico T +44 223 63025 F +44 223 301488 • **Singapore, Malaysia, Indonesia** Team 108 Technical Services T +65 748 9333 F +65 747 7273 • **South Africa** Tru-fi Electronics SA (Pty) Ltd T 011 462 4256 F 011 462 3303 • **Spain** Lexon T 93 203 48 04 F 93 280 40 29 • **Sweden** Tranzicom T 08 730 3710 F 08 730 5125 • **Taiwan** Acesonic T 2 716 8896 F 2 719 2065 • **Thailand** KDM Trading T 2 318 2724 F 2 318 6186 • **USA** SADiE Inc T 615 327 1140 F 615 327 1699 •

STUDIO SOUND
AND BROADCAST ENGINEERING

March 1994
Volume 36 Number 3
ISSN 0144 5944

EDITORIAL
Editor: Tim Goodyer
Assistant Editor: Julian Mitchell
Production Editor: Peter Stanbury
Secretary: Mary Walsh
Consultant: Sam Wise
Columnists: Barry Fox; Kevin Hilton; Martin Polon
Regular Contributors: James Betteridge; Simon Croft; James Douglas; Ben Duncan; Tim Frost; Philip Newell; Terry Nelson; Dave Foister; Francis Rumsey; Yasmin Hashmi; Zenon Schoepe; Patrick Stapley; John Watkinson

ADVERTISEMENTS
Executive Ad Manager: Steve Grice
Deputy Ad Manager: Phil Bourne
Business Development Manager: Georgie Lee
Advertisement Production: Carmen Herbert
Secretary: Lianne Davey

CIRCULATION
Controlled Circulation Manager: Maria Udy

Director: Doug Shuard
Publisher: Steve Haysom

EDITORIAL AND ADVERTISEMENT OFFICES
Spotlight Publications Ltd, 8th Floor, Ludgate House, 245 Blackfriars Road, London SE1 9UR, UK. Tel: 071 620 3636. Fax: 071 401 8036.

NEWSTRADE DISTRIBUTION (UK)
UMD, 1 Benwell Road, London N7 7AX, UK. Tel: 071 700 4600. Fax: 071 607 3352.

Origination by Craftsmen Colour Reproductions Ltd, Unit 1, James Street, Maidstone, Kent ME14 2UR.

Printed in England by Riverside Press, St Ives plc, 2 Grant Close, Gillingham Business Park, Gillingham, Kent ME8 0QB, UK.

Studio Sound and Broadcast Engineering incorporates Sound International and Beat Instrumental.

Studio Sound is published monthly. The magazine is available on a rigidly controlled requested basis, only to qualified personnel.

Subscription Rates:
UK annual subscription: £24.00
Overseas surface mail: £30.50/US:$89
USA airspeeded delivery: $70

Subscription Enquiries
UK: Subscription Dept, Studio Sound Magazine, Spotlight Publications Ltd, 8th Floor, Ludgate House, 245 Blackfriars Road, London SE1 9UR.
USA: Studio Sound Magazine, 2 Park Avenue, 18th Floor, New York, NY 10016.
US Postmaster
Please send address corrections to: Studio Sound Magazine, c/o Mercury Airfreight International Ltd Inc, 2323 Randolph Avenue, Avenel, New Jersey NJ 07001.
US second class postage paid at Rahway, NJ.

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

PPA PERIODICAL PUBLISHERS ASSOCIATION

Total average net circulation of 19,120 issues during 1992. UK:8,194. Overseas: 10,926. (ABC audited)

un A United Newspapers publication

Logical alternative

Apart from a small number of die-hards, we are currently busy building an increasingly 'digital' present on the ashes of our analogue past. Where once ever-improving analogue recording equipment looked indefinitely able to provide for all our needs, digital technology has offered us an irresistible alternative—one free from many of the intrinsic limitations of analogue. Currently, we are all too engrossed in the advantages of digital to look at *its* intrinsic limitations. Or are we?

There is an alternative to the accepted logical foundation of digital technology and it is gaining ground alarmingly quickly. While the West in general—and Western Europe in particular—has ignored it, the Far East has begun to embrace it and already incorporated it into hi-tech systems ranging from rice cookers to helicopters.

This alternative is grounded in 'fuzzy logic' as opposed to our Aristotelian logic. It is born of a 'fuzzy' school of scientific and mathematical thought where the 'black and white' logic of conventional mathematics have been replaced by a 'grey' logic—where zeros and ones give way to the values between, where bits defer to fits (Fuzzy unITs) and MIPS to FLIPS (fuzzy logical inferences per second). Fuzzy logic, argue its protagonists, give us back the real world vagaries missing from present mathematical systems and in doing so, give us a convention that more closely represents the day-to-day mechanisms of life. Illustrating the practical shortcomings of Aristotelian mathematics is easy—take a look at quantisation error, for example. Offering an attractive alternative to it is less so.

But only in mathematics are matters perfectly precise, everything we, and our equipment, set out to achieve involves degrees of a situation rather than all-or-nothing situations. By adopting imprecise methods of assessing a situation and directing resources, fuzzy logic addresses the real world on common ground. Fuzzy logic is claimed to go so far as to allow machines to 'reason' in a way analogous to the human brain (significantly, it is now an important part of AI research in the form of neural nets). Certainly, fuzzy systems demonstrably offer smoother control and processing than traditional digital systems.

It is no surprise that fuzzy logic (or vague logic, as it was originally called) and fuzzy maths are having a hard time in academia; after all, they challenge the very heart of logical thinking—in the West. In the Far East, however, the vagaries of fuzzy logic strike a harmonious chord with many traditional philosophies, a fact which appears to have further hindered Western acceptance. A number of Eastern nations have, however, taken to fuzzy thinking, and a significant part of their hi-tech industries now makes use of it. An indication of the Japanese commitment to fuzzy technology can be judged to some extent by the fact that they now operate two research centres dedicated to it—the Laboratory for International Fuzzy Engineering Research (LIFE) in Yokohama and the Fuzzy Logic Systems Institute (FLSI) near Tokyo. Both were established with the assistance of MITI (the Ministry of International Trade and Industry). The companies represented by the Board of Directors of LIFE include high-ranking executives from the likes of Matsushita, Toshiba and Hitachi; its inaugural membership stood at around 50 companies including the likes of Sony, KAO and Mitsubishi.

In the Far East, fuzzy logic has already made a positive contribution to a wide variety of products—some industrially pitched, others intended for the domestic market. A palm-top computer from Sony, for example, and video camcorders from Panasonic, Canon and Sanyo join an assembly-line scheduling from Omron give some idea of the scope and scale of fuzzy applications. Make no mistake: the Far East is serious about fuzz. Fuzzy thinking is slowly being accepted in to US too. And unless the whole concept of scientific fuzz is soon proven to be invalid, we can expect to see it making its presence felt in audio and video equipment imminently. ■

Tim Goodyer

Cover: Garwood in-ear monitoring

Photography: Phil Dent

International News

In-brief

● Dorrough Audio win award
The Academy of Motion Picture Arts and Sciences has awarded Dorrough Electronics a Technical Achievement Award for its Audio Level Meter, now in wide use in motion picture production, posting, music mixing and dubbing.
Dorrough Audio. Tel: +1 818 998 2824

● Digital Audio courses in Paris
Les Ateliers UPIC Institute in Paris, have inaugurated an educational programmme designed to complement the music production in their three studios. The nine-month programme, open to students from around the world, goes from October 1994 to May 1995. Courses include Computer Music Techniques; Compostion Seminar; Electroacoustics and Studio Technology.
Les Ateliers. Tel: +33 1 60 13 93 39

● Changes for Sennheiser
Paul Whiting has been appointed General Manager of Sennheiser UK, following the departure of Ralph Martinke to take up a new position with a German technology firm.
Sennheiser UK. Tel: 0628 850811

● Young Woman Engineer of 1993
Helen Marshman, Cable Engineer with Cable and Wireless (Marine) Ltd, Essex, has been awarded the title 1993 Young Woman Engineer of the Year. The aim of the award is to encourage more young women to pursue a worthwhile career in the electronic, electrical or allied engineering fields.
IEEIE. Tel: 071 836 3357

▼ HHB appointments to the board
Pro-audio supplier HHB Communications have recently appointed Steve Angel and Mike Bradley to the board as Sales Director and Technical Director respectively.
HHB. Tel: 081 960 2144

HHB Communications appoint Steve Angel (left) and David Bradley to the board

● Emmy award for Nexus team
Members of NTL's Nexus division have received an EMMY from the National Academy of Television Arts and Sciences. Nexus built NBC's technical facilities for the Barcelona Olympics.
NTL. Tel: 0962 822582

RIAA: 'Piracy in decline after six years of increase'

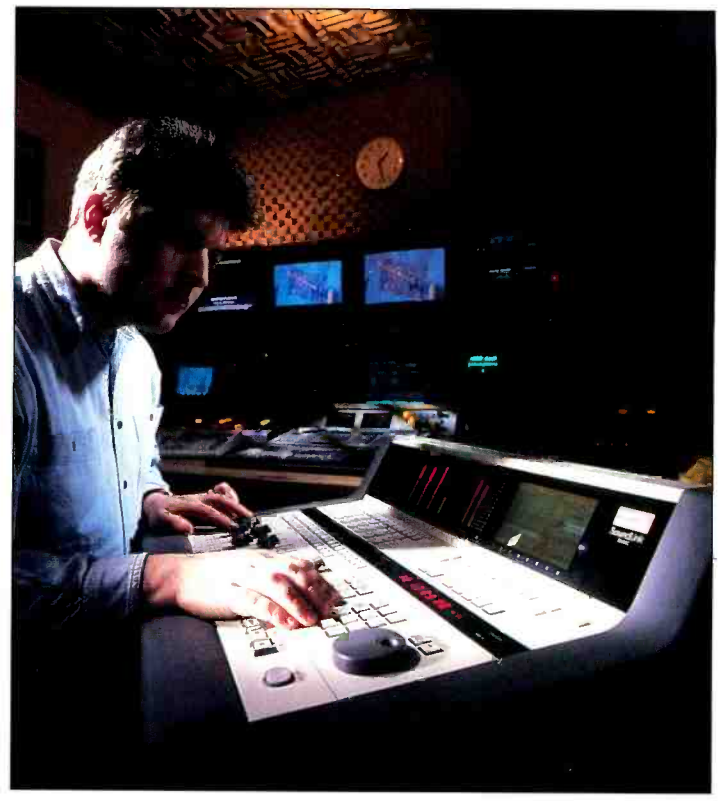
The Recording Industry Association of America have released their 1993 antipiracy statistics reflecting the first annual decline in counterfeit cassette seizures in six years.

The RIAA indicates approximately 2 million counterfeit cassettes were seized in 1993—down from 2.5 million in 1992.

The association have explained the decrease in street sales of counterfeit cassettes is directly linked to a decrease in the number of manufacturers, distributors, street vendors and other individuals producing and selling counterfeit cassettes. This fact, they say, is due to the maturation of a number of RIAA programmes introduced over the last few years, targeted at illegal street vendors as well as manufacturers and distributors.

They also credit the increased involvement of the legitimate recording industry at the retail level, mainly in building regional coalitions.

Notable statistics and activities include 144 criminal convictions of sound recording pirates, a 140% increase over the past five years. The report also mentions a small growth in pirate vinyls and CDs. In New York the first alleged counterfeit CD operation in the US was uncovered with 3,000 CDs seized.
RIAA Inc. Tel: +1 202 775 0101.



Ralph Tittley, Senior Editor at Optical Image with the Korg *SoundLink*. This West Midlands postproduction house have bought an eight-hour *SoundLink* digital audio editor for its studios in Stourbridge, UK. Presently being used in the three Edit Suites and shortly to be installed in the new Sound Dubbing Suite. The system comes complete with v. 4.0 software and Exabyte *8500* tape backup system which is five times faster than real time

Multimedia broadcast first for NAB

Sveriges Television (SVT), the Swedish national public service broadcaster, will demonstrate a prototype of a Multimedia Broadcast Service at the NAB '94 in Las Vegas, between March 20–24th. It will be the first North American demonstration of this technology.

The system will exhibit several potential applications of a multimedia broadcasting service; interactive multimedia programs such as games or educational programs downloaded to receivers; a current summary of TV programmes, updates during the course of the programme; an electronic newspaper; and an electronic programme guide.

In operating the multimedia system, the video, audio and other data stored in the receiving station are continuously updated via a digital transmission link.

Multimedia broadcasting will become possible as high capacity digital services are made available to consumers. Within the NTSC environment, the National Data Broadcasting Committee is working on standards for delivery of high speed data using the NTSC television service as a delivery medium. For the all-digital advanced television service under consideration by the FCC, multimedia broadcasting is being discussed as potential ancillary use of the digital channel capacity.

The Sveriges Television demonstration of multimedia broadcasting shows that there are few technical barriers preventing television broadcasters from becoming multimedia providers and offering new, improved and unique broadcasting services to the public.
NAB. Tel: +1 202 429 5350.

CTS Studio One widens for 1994

Studio One at CTS in North London, has been given a comprehensive acoustical face-lift which has resulted in an increase in floor space as well as a warmer more reverberant acoustic.

The new-look Studio One is now wider, after the selective removal of elements of acoustic treatment following computer analysis by designers Recording Architecture. This provides a more comfortable environment for the orchestras which routinely use the studio for classical and soundtrack recording, as well as allowing house and visiting engineers more versatility in the way they set up those orchestras.

This fine-tuning of Studio One's acoustic is the latest project in a long-standing relationship between the Lansdowne Group's studios and Recording Architecture, which has included the attunement of Studios Two and Three.
CTS. Tel: 081 903 4611.

Harman acquire Studer Revox

Studer Revox AG have announced that an agreement for the sale of the company has been met between Motor-Columbus Ltd and Harman International.

The consumer electronics division (hi-fi), which accounts for about 20% of Studer Revox's turnover, is excluded from this agreement and negotiations with interested buyers are still in progress.

With the takeover of Studer Revox AG the Harman Group will have an unmatched range of products in the professional audio sector. At the same time the worldwide market penetration will be significantly improved. In addition, future system solutions can be offered with leading-edge products of renowned brands.

Studer Revox will continue to be managed as an independent group. The Studer Professional product range includes analogue and digital mixing consoles and tape recorders, digital audio workstations, compact disc players and recorders, broadcast automation systems and complete systems.

Studio Revox AG, who are headquartered in Regensdorf-Zurich (Switzerland) operate wholly-owned subsidiaries in France, USA, Canada, Germany, Great Britain, Japan, Singapore amd Austria.

Studer Revox AG.
Tel: +41 1 870 71 11.
Fax: +41 1 840 47 37.

Engineer Jackson Schwartz stands next to the Euphonix *CS2000* recently installed at Pacific Ocean Post in Santa Monica. The console, marks Euphonix's hundredth sale

Audix make list

Audix Communications have achieved the status of Sound and Communication Industries Federation (SCIF) approved installer, as part of their committment to promoting the quality of sound system installations.

In order to achieve the status of Approved Installer, Audix were asked to supply the names of six customers who have systems installed in the past two years. SCIF officials then approached those customers with a view to discovering how satisfied they were with the work carried out and the completed installation. SCIF then visited the company to inspect its operation, looking at the actual site, the company's documentation and the British Standards they operate.

SCIF see this as a logical extension to BS5750 which, at the end of the day, can only really guarantee quality of administration rather than quality of customer service.

SCIF. Tel: 0628 667 633.

The professional audio-video group of 3M have presented their Visionary award to Chipping Norton recording studio and Oxford-based band Radiohead. Pictured above are Chipping Norton's Richard Vernon (third from right), together with members of Radiohead and Richard Wilson of 3M (third from left)

AES STOP PRESS!

● Studer revealed true 24-bit capability for their D827-48 DASH recorder... ● The AES are looking to increase the European membership by as much as 20% according to Vice President in Europe Dan Popescu speaking at the show... ● A strategic alliance between AT&T Digital Studio Systems and Harrison by GLW will result in a complete digital mixing console before the end of the year, the two manufacturers have revealed... ● Studio design and acoustic consultancy Munro Associates have announced they have gained the contract for a £3 million studio for UK Producer Mike Stock of Stock, Aitken Waterman fame... ● Ex-Marillion vocalist Fish previewed his latest single *Lady Let it Lie* as part of a paper on ISDN in broadcasting and postproduction applications. The single, to be released on the 4th April, was played back from Fish's studio, The Funny Farm, in Scotland... ● MITS International reported that demand for Mitubishi machines was still great 14 months after Mitsubishi closed their pro-audio operation... ● Harman International confirmed their agreement to acquire Studer Revox from Motor Columbus for an undisclosed sum. ■

Contracts

● **FX Rentals link-up to the world**
FX Rentals are now offering for hire ISDN hardware that allows studios to use the international telephone network to set up real-time high-quality audio links. FX Rentals now can offer a choice of codecs from CCS and Dolby.
FX Rentals. Tel: 081 964 2288

FX Rentals add ISDN hardware. Left to right Neil White and Nick Dimes of FX Rentals, with Bill Foster of the Audio Exchange

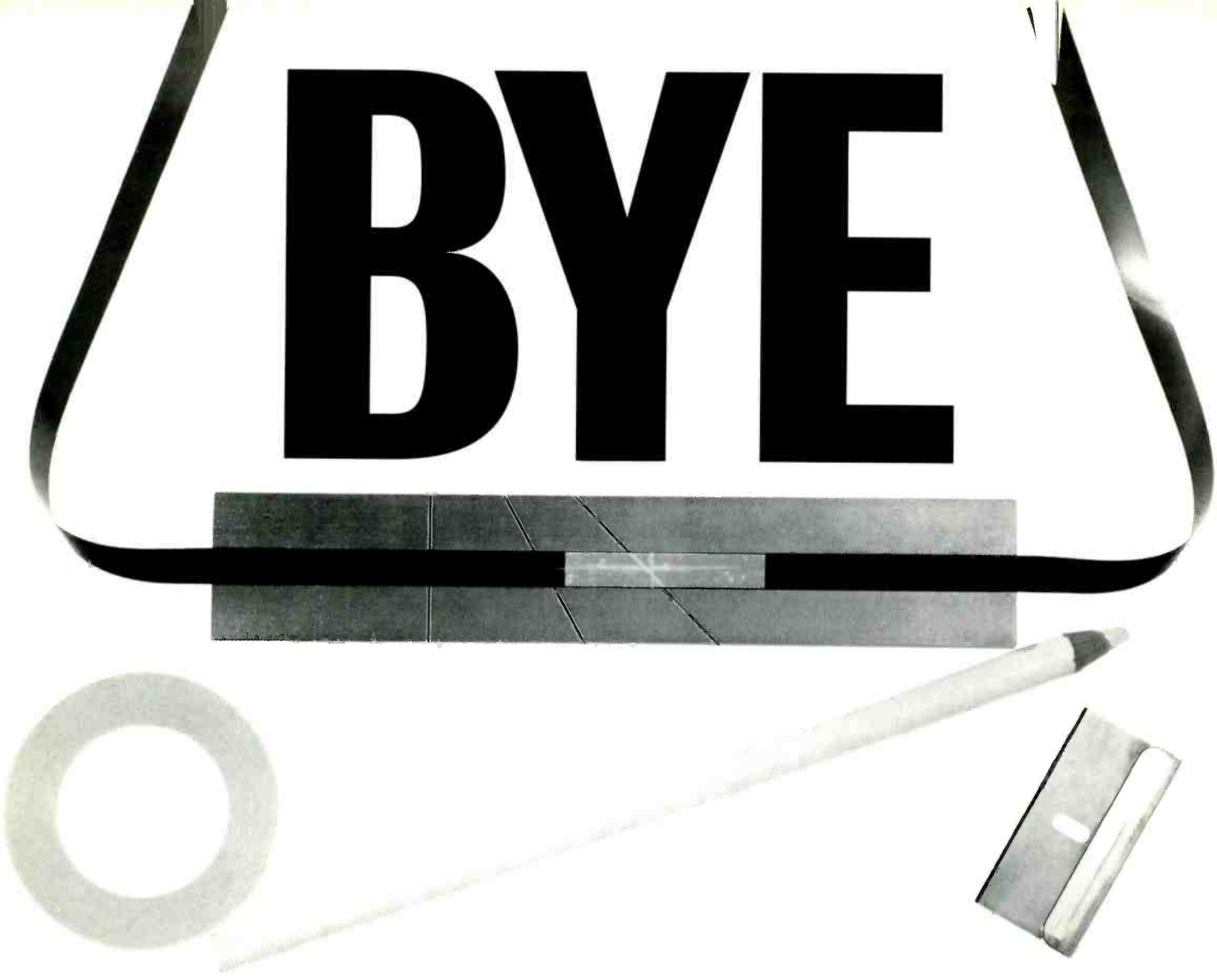
● ***Logic 1* used on Korean song**
The *Logic 1* at Korean broadcaster, MBC has been used to postproduce an award-winning radio programme. The 30-minute adaptation of a traditional Korean song was edited and mixed on the *Logic 1* by operator Suh Gi-Bong.
AMS Neve. Tel: 0282 457011

Operator Suh Gi-Bong with MBC's *Logic 1*

● **Ollie J rolls over a *Jade***
The Soundtracs *Jade 48* patchbay production console in Studio One at Roll Over Studios is being used by 19-year-old Producer Ollie J who is attracting such artists as Rozalla, East 17, 2/3rds and Leftfield. A second *Jade* is due to be installed in place of a Soundtracs in-line soon.
Soundtracs. Tel: 081 399 3392

Producer Ollie J and Soundtracs *Jade*

BYE



THE edit block. The razor blade. And the splicing tape.

All you need really. Cut, splice, listen, cut, splice, listen, boom, finished.

No waiting to get what you've done dumped from a hard disk. No tying up an entire facility to do a simple transfer. You walk out with your work under your arm.

Well, now you can have all that along with digital quality and the program length offered by DAT.

Two Fostex D-10 DAT recorders will lock together and give you sample accurate splices. You can scrub back and forward, find your mark, hit the button and there's another edit.

You want a bit of a gap? DAT with silence on it as quiet as leader tape.

You want it to happen... now? The D-10 offers instant start at up to 799 individual programme points with a search speed up to 250 times normal.

Put simply working with two D-10s is simple and intuitive, just like using your ears and a chinagraph.

Digital doesn't have to be complicated. The Fostex D-10 is proof of that.

Editing blocks, who needs 'em? Please send me more information about the D-10 or call 081 893 5111

Fostex

NOW EVERYTHING CONNECTS

FOSTEX (UK) Ltd. Jackson Way. Great Western Industrial Park. Southall, Middlesex UB2 4SA

OCEANE II

Oceane II is a stand-alone optical disk recorder-editor launched by French manufacturer Publison at the AES.

The machine comes in a 3U 19-inch rack with a sophisticated remote control. Audio is recorded simultaneously onto four optical tracks. The recording capacity for each optical track is four hours on two sides using a 1.3Gb optical media.

There is full compatibility with Publison's *Infernal Workstation* when more tracks are needed. A 3.5-inch floppy disk drive is also included to read EDL information.

Oceane II features a remote with comprehensive editing facilities. A colour graphic screen enables the usual functions; cut, cut and splice, copy, move, insert, etc. Also featured are special effects like time compression-expansion or harmoniser on each track.

Publison, 18, Avenue de la République, 93170 Bagnolet, France. Tel: +31 1 43 60 84 64. Fax: +31 1 43 60 84 64.

Publison's *Oceane II*

SPL *Optimizer*

The *Optimizer* is a new parametric equaliser from SPL, the makers of the *Vitalizer*. The unit's proportionate Q allows pinpoint adjustment of frequencies and care has been taken over the filter design to create smooth bell characteristics.

The unit can be used in Stereo or 2-channel mono and has independent output level control of each band. Each band has a LP/HP/BP and notch filter with a range of 10Hz—24kHz.

A roll-off is provided with adjustment from gentle to steep. This feature allows you to change the character of the sound just by rotating the the control.

Europe: The Home Service, 178 High Street, Teddington, Middlx. TW11 8HU, UK. Tel: 081 943 4949. Fax: 081 943 5155.

Solid *Gold* from DAR

Launched at AES Amsterdam by Digital Audio Research was the *SoundStation Gold*—a new approach to digital audio workstations. *SoundStation Gold* is a complete, integrated production centre, comprising an assignable, dynamic automated Mix Controller, a dedicated edit Control Console and an enhanced processing unit, which contains both hard and optical disk storage facilities.

The Mix Controller incorporates eight assignable channel strips, with four control layers, and a stereo master. Each strip contains a touch-sensitive motorised fader, a display section and channel function control keys. The Mix Controller provides total control of digital mixing, system monitoring and DAR's segment-based Processing.

The Control Console uses simple, tape-like operations for record, playback and editing—all shown on a single page. It is available in two options; a compact console, high resolution monitor and pointing device, or the renowned *Classic SoundStation Console* with integrated touchscreen.

Other key features include dual machine control, instant spotting to remote time code, feet and frame displays, and single key access to editing functions. DAR's *WordFit* dialogue synchronisation is available as an option, and an Autoconform package can also be specified.

Currently available in 8 and 16-channel versions, *SoundStation Gold* provides a recording capacity of up to 22 track-hours on hard disk, in addition to removable, dual-density optical disks. Studio integration is achieved as standard by analogue and digital AES-EBU inputs and outputs, together with dual *RS-422* serial machine control and the ability to lock to any external sync source.

Digital Audio Research, 2 Silverglade Business Park, Leatherhead Road, Chessington, Surrey. KT9 2QL, UK. Tel: 0372 742848. Fax: 0372 743532.

Fostex *D30*

At the AES Amsterdam Fostex launched the *D30* DAT recorder. The *D30* is a four-head time-code machine with extensive editing and synchronisation capabilities.

Key features include RAM scrubbing and instant start, independent channel record capability, plus built-in chase sync facilities including a high-speed LTC reader and VITC reader as standard. A large menu-driven LCD is provided for easy access to all control, setup and user information.

UK: Fostex UK, Unit 1, Jackson Way, Great Industrial Park, Southall, Middlx, UB2 4SA. Tel: 081 893 5111. Fax: 081 893 5237. ▶

Fostex *D30*—launched at the AES in Amsterdam

In-brief

● **Fatigue-free Yorkville monitors**
Yorkville have designed a three-way studio monitor for long-term listening. Yorkville designers have incorporated high-grade components and many hours of crossover optimisation routines to give the *YSM-3* a smooth frequency response
Yorkville. Tel: +1 905 837 8481

▼ ***Tukan* play music with Linn**
Linn, makers of discerning hi-fi products have launched the *Tukan* nearfield monitor which they claim will be ideal for use in video applications or multi room installations.
Linn Hi-Fi. Tel: 041 644 5111


The *Tukan* from hi-fi's Linn Products

● **DigiDesign demo *MasterList CD***
MasterList allows the user to create CD or album masters on a number of affordable CD recorders, as well as DAT recorders or 8mm SCSI tape drives. When used with a compatible CD recorder, *MasterList CD* creates fully Red Book-compatible glass-master ready CDs, encoded with PQ subcodes.
DigiDesign. Tel: +1 415 688 0600

● **Studer & Motionworks develop**
Motionworks & Studer have joined forces to develop an integrated machine-control system for all Studer mixing consoles by installing a custom machine-control panel containing full tape transport remotes, individual machine status for up to five machines, a control wheel and many control functions.
Motionworks. Tel: 0865 790577

● **Biamp Advantage *DEQ 282/M***
The Advantage *DEQ282* offers two channels of 1/3-octave, digitally controlled EQ in a 1U space.
Sound Dept. Tel: 0865 514461

Bryston's *NPB* series

Bryston *NPB* amplifier series

The *3B NPB, 4B NPB* and *7B NPB*, 'involve an approach radically different from other amplifiers,' claim manufacturers Bryston.

Bryston use two completely independent power-supplies for the utmost separation and image clarity. Discrete and symmetrical circuitry is used throughout for inherent wide-band linearity.

Other standard features of the new range include overload indicators which sense any form of distortion; front-panel gain controls; GROUND LIFT and BRIDGE-MONO switches on the back; and balanced (or unbalanced) operation.

All models are backed by Bryston's 20-year parts and labour warranty.
Bryston, 57 Westmore Drive, Rexdale, Ontario, Canada M9V 3Y6. Tel: +1 416 746 1800. Fax: +1 416 746 0308.
UK: The Professional Monitor Company, 27 The Avenue, Highams Park, London. E4 9LB. Tel: 081 531 5308. Fax: 0582 579278.

Soundcraft Series *10S* on-air desk

The Series *10S* from Soundcraft is a variant of the Series *10S* on-air modular self-op console designed for the particular demands of the North American and Asian broadcast markets. This version is intended to be particularly suitable for local radio stations and smaller studios of national broadcasters.

A choice of mono mic-line, stereo line-line and Telco inputs allow customers to specify a console configuration to suit their individual requirements, and the desk is available in 12, 20 or 28-input frame sizes. Among the standard features are twin stereo buses for programme and audition, and an interlocking remote control system that prevents channels being opened when machines are in record or wind.
Soundcraft Electronics, Cranbourne House, Cranbourne Industrial Estate, Cranbourne Road, Potters Bar, Herts. EN6 3JN, UK. Tel: 0707 665 000. Fax: 0707 660 482.

Soundcraft Series *10S*

H I G H - T E C H

MUSCLE

BECAUSE PERFORMERS "LIVE OR DIE" BY THEIR SOUND SYSTEMS, WE'RE PROUD TO ANNOUNCE THREE NEW TOUGH GUYS TO THE PEAVEY POWER AMPLIFIER LINE...THE PV SERIES. THIS NEW LINE COMBINES THE LATEST SEMICONDUCTOR TECHNOLOGY ALONG WITH THE MOST CONTEMPORARY APPROACH TO TRANSFORMER DESIGN FOR HIGH PERFORMANCE, BRUTE POWER AND UNMATCHED RELIABILITY WITH SPECIFICATIONS, SOUND, AND PRICES THAT CAN'T BE BEAT.

PEAVEY ELECTRONICS (U.K.) LTD.
HATTON HOUSE HUNTERS ROAD
CORBY NORTHANTS NN17 5JE ENGLAND
TEL 0536 205520 FAX 0536 69029

Mistaken ID

The last couple of years have seen much discussion over 'consumer' technology in professional service. One medium not yet caught up in the debate is CD-R, but this too was originally a domestic format. I was reminded of CD-R's domestic origins, however, by a recent experience, which I offer here for open comment.

I had finished mastering a CD project—apart from the PQing, which was more complex than usual. The content was a live recording of the Guildhall School of Music and Drama's production of *Curlew River*, a piece by Benjamin Britten, which runs for 73 minutes without any clear movement breaks in which it is not at all obvious where the 'tracks' should appear. Immediately the question becomes an artistic rather than a straightforward technical one. Having established points in the score where an ID would make some musical sense, it still remains to ensure that, where possible, the CD can be started with a little initial ambience. One possible set of track positions suggested itself, and I decided to have a CD-R made with these in place.

It struck me that the simplest way to do this would be to make use of one of the systems which can convert DAT Start IDs to CD track numbers during transfer. These systems exploit the fact that Start ID data appears in the SPDIF datastream (not in AES-EBU) and can be used to trigger the CD-R machine to write a track ID. A problem with early equipment was the fact that it takes a finite time for the unit to recognise the Start ID and to carry out the conversion, often resulting in the CD index appearing late. This is further compounded by the fact that many source DATs are idented using an automatic ID facility, which writes a Start ID when audio rises above a certain threshold after a period of silence; this, usually places the ID 'late'.

There are currently two units available to carry out ID transfer (with other manipulation of the data): Audio Design's *SmartBox 2* and HHB's *CDR Indexer*. Both manufacturers are aware of the aforementioned problems, and both have attempted to address them by delaying the audio data. Both incorporate variable delays, the HHB defaulting to a maximum of 185ms and the *SmartBox* using a 'zero' reference value of around 400ms which can be varied upwards or downwards in increments of about 70ms (dependent on sampling rates) to a maximum of almost 1.5s. It seemed reasonable to assume that if the DAT IDs were in the right places, the interface's delay could be set so that the CD-R machine would replicate those ID positions on the CD.

With this in mind, I took a DAT clone of the Sony *1630* master where the relationship between the DAT A-Time and the *1630*'s time code was known to within a frame. I placed Start IDs on the DAT using the ID Rehearsal function on the Fostex *D20*. This allows an ID to be slid backwards and forwards a frame at a time until it is in exactly the required position before finally writing it. I noted the resulting time position for each one in order to make up a PQ listing for the *1630* and sent the DAT to one of London's most reputable copying houses—one which had specifically been recommended as having considerable experience with CD-R and the *SmartBox*. It therefore came as a surprise to find the IDs had been effectively remastered on hard disk (with PQ worked out by listening to my DAT) for the CD. It seemed I was expecting rather more from the system than it was designed to deliver. Precise transfer of DAT IDs —so that they end up on the CD in exactly the same place relative to the music—is fraught with unexpected difficulties.

In the first place, a DAT with precisely-positioned IDs is a rarity in itself. Few machines allow the kind of frame-accurate placement that the *D20* provides; even those that have a rehearse function often work in increments of a few frames. Auto identing is just about the only way most people have of placing them hard on the start of a track—the resulting position varying according to the nature of the initial sound and the way in which the individual DAT machine operates.

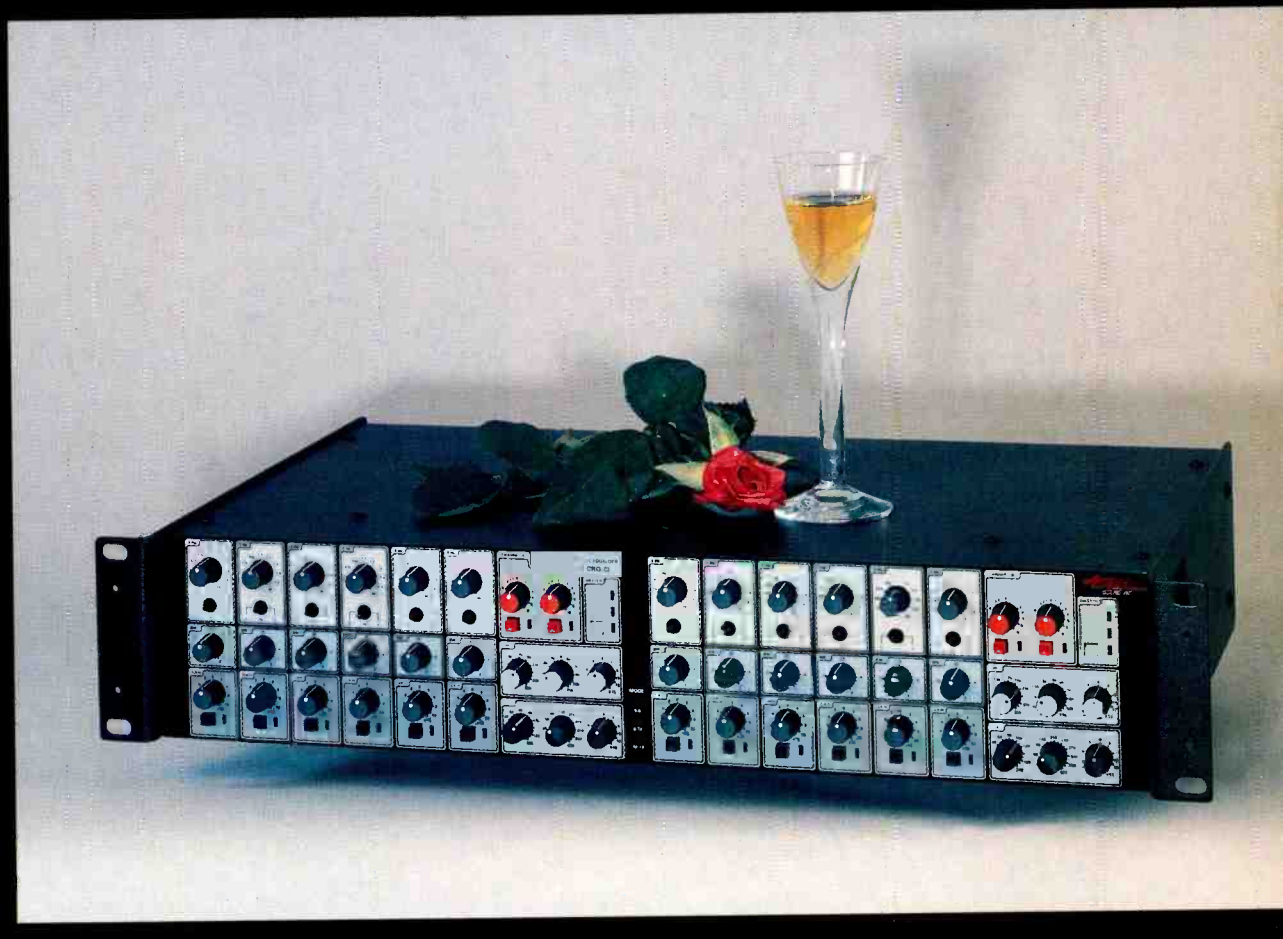
Then there is the time taken for an interface box to recognise the ID in the datastream. Ideally this is predictable, but if an error should occur on the tape at the critical moment, it may take longer for the ID to be distinguished from the audio. Finally, there is the time taken for the CD-R transport itself to write its ID, which apparently varies from machine to machine. The only way to allow for this with confidence would be to find out each model's inherent delay by trial and error, and hope it does not change next time the software is upgraded.

All these problems can be overcome given the will. The first is not really a problem; IDs can be written onto a DAT in precise positions. The second is a small consideration, and probably makes little practical difference. This leaves the last, with the time-consuming and CD-R blank-wasting task of tinkering with delay times until the right offset is found for the particular combination of equipment, and this is the bit nobody seems to have done. It seems—judging from from the various people I have spoken to—that nobody has ever asked for this kind of precision in such a transfer.

I ought to say at this point that none of this is intended as undue criticism of any of the systems currently available. They clearly meet a need, carry out their intended tasks well, and are already pushing the technology further than it was originally designed to go. It seems to me, however, that it could be pushed even further, and that some work still needs to be done if its full potential is to be realised. Am I asking too much? Am I asking for something that nobody else wants? If there is anybody out there who would find the kind of facility I am talking about as useful as I perceive it to be, then take this as a call to arms. If not then please beware: DAT-to-CD-R transfer is not yet an exact science. ■

Dave Foister

Thanks to: Tim Channon, Designer of the *SmartBox*; Phil Beville at Audio Design; Steve Angel at HHB; Tony Batchelor at TAM Studio; and Tim MacNamara at Fostex UK.



INTRODUCING APOGEE'S LATEST MASTERPIECE IN ENGINEERING:

THE CRQ-12 MULTI-MODE PARAMETRIC EQUALIZER.

Featuring unprecedented sonic quality with dynamic range greater than 115dB and distortion less than 0.003% at +21dBu.

The CRQ-12 is rich with features. *Twelve fully parametric filters* (each adjustable from 20Hz to 20kHz), *four shelving filters* and *four band-pass filters*. All assignable through "Multi-Mode" operation into three distinct configurations. *Fan cooled* for ultra-stable filter settings. *Four outputs* (two per channel) each with level control and mute switch. *Bypass level controls* on all outputs prevent feedback in the event of power loss.

Finally, a sophisticated tool for absolute control that brings out the best in touring systems, control rooms and everything in between. Call or write for detailed information.

1150 Industrial Avenue
Petaluma, CA 94952
Ph.: (707) 778-8887
Fax: (707) 778-6923

APOGEE SOUND INC.

See us at MUSIK MESSE, Stand 9.2 B88

L'ACOUSTICS V-DOSC

It would probably be true to say that the beginnings of sound reinforcement lie in the first cinema sound systems—where it first became essential to project amplified sound to an audience in a large acoustic space. From this point on, there have been continual developments which have marked recognisable steps forward in the quest for improved live sound.

The first major revolution was the Altec *Voice of the Theatre* system which was employed into the 1960s in various forms, where large multiples of units were required for the emerging requirement of high-power requirements for rock concerts.

Good as these systems often were, they were difficult and time-consuming to set up, as well as being physically bulky and difficult to move around. In the search for a better system, the research work done by Meyer Sound Labs' John Meyer, resulted in smaller, processor-controlled systems. This, in turn, led to a variety of one or two-box systems intended to be installed in arrays.

However, large arrays have their own associated problems—these can be generally summarised as interference and phasing products due to the use of multiple sound sources. Other shortcomings include limitations on the maximum acoustic power output in any one direction, coupled with the 'law of diminishing returns'. In order to achieve correct coupling characteristics for multiple enclosures, the cabinets are often presented in trapezoidal form, and should ideally incorporate the angles defined by the horizontal directivity characteristics of the system. Attempting to make these considerations can often give rise to ergonomic and manufacturing problems and, consequently, is not always a feasible option.

Where modern systems (in the right hands) are capable of excellent results, there is a growing feeling among engineers that the control end of sound reinforcement system has far outstripped available speaker systems in terms of performance —and that it is once again time to move forward.

The challenge has been taken up by L'Acoustics in France, led by acoustician Dr Christian Heil. The result is the *V-DOSC* (Diffuseur d'Onde Sonore Cylindrique) sound reinforcement system (it is worth noting in passing that France is well to the fore in bringing innovations to the live sound industry).

V-DOSC has been designed for medium to large events, and addresses several basic criteria, namely: a horizontal coverage angle of 90° (-6dB down points) with a vertical angle of 5° per enclosure. It has been found that the vertical coverage requirements are normally found between 10°–40°.

The vertical coverage corresponds to the diffraction of a flat isophasis radiating ribbon, the angle of which varies according to frequency. In the case of a single enclosure, this angle is 5° at 12kHz and correspondingly wider for lower frequencies.

This results in a major improvement in stacked arrays: the coupling of *V-DOSC* enclosures is correct for all angles between 0°–5° and is defined by the high-frequency content required. At 0° the coupling is claimed to be perfect at any frequency, at 5° the upper limit is around 12kHz.

In the case of enclosures being stacked at 0° (one on top of the other!), the HF limit will be that of the HF driver, with the vertical coverage being determined by the height of the stack. Should a wider horizontal coverage being required, separate systems should be used and spaced at a sufficient distance to avoid interference problems.

***V-DOSC* stack**

The coupling characteristics of *V-DOSC* can be summarised as follows: a plane and even array of η identical sound sources is equivalent to a single sound source having the same shape, providing that the wavelength is larger than the step of the array[1] (Step<f/3000), and-or that the filling coefficient of the array is more than 80% (that is, the total areas of the radiating sources is at least equal to 80% of the total area of the array).

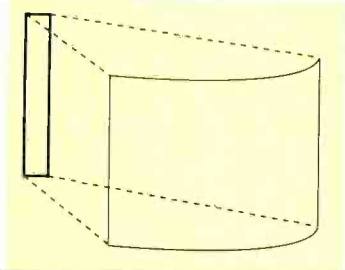
The *V-DOSC* enclosure is equipped with two 15-inch (38cm) drivers in separate reflex-loaded chambers, four 7-inch midrange drivers mounted in a v-shaped waveguide, and two 2-inch compression drivers loaded by the special *DOSC* waveguide exiting into the centre of the v-waveguide.

The distance between the acoustic centres of two *V-DOSC* enclosures is 0.45m for the low-frequency range and 0.22m for the mid-frequency range. This means that the coupling is excellent for frequencies below 730Hz for the LF, and below 1460Hz for the MF. The crossover frequencies of the system have been set at 200Hz and 1300Hz, using the Yamaha *D2040* digital crossover unit programmed with extensively-researched parameters for enclosures alignment.

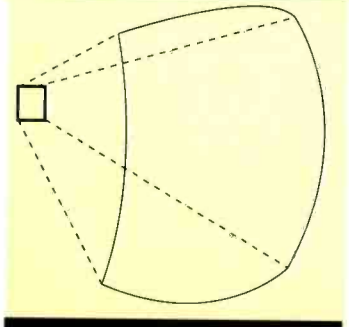
The coupling of the HF is produced by the *DOSC* waveguide, which provides a ribbon-shaped flat, isophasis wavefront at the two vertically-aligned exit ports.

A *V-DOSC* enclosure can be considered as part of a modular system where each module is identical, and when four (the minimum recommended number) or more units are stacked, the results are coplanar symmetry.

Other sound reinforcement speakers act as spherical wave ▶



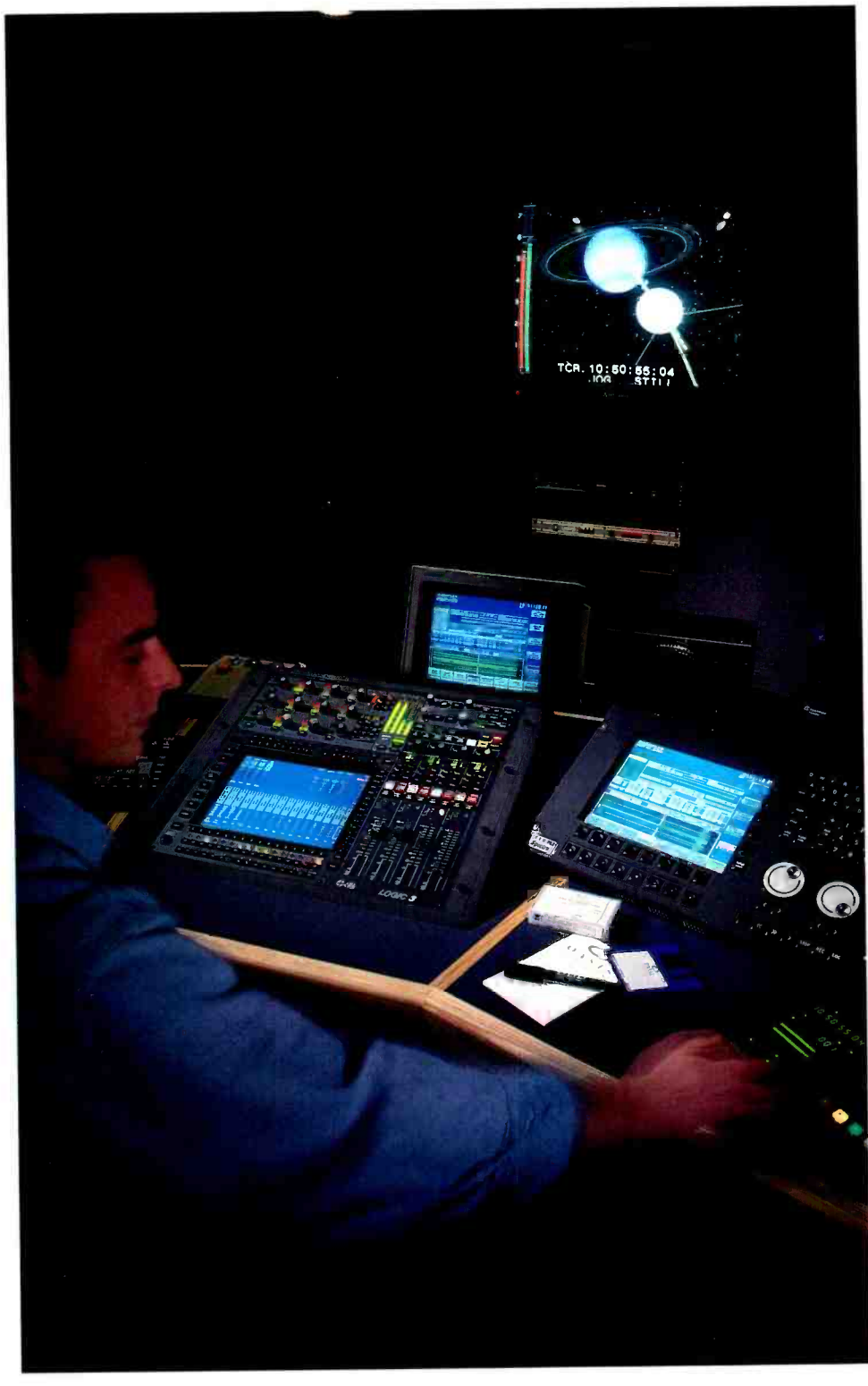
Cylindrical propagation



Spherical propagation

Detail of the *V-DOSC* enclosure

THE CALM OASIS.



HUGH MITCHELL-DAWSON AT OASIS TELEVISION, LONDON.

"The first thing I liked about the new Logic 3 was its size. For all the things it can do, it's very compact, so it doesn't take up the whole studio. It makes the place more relaxed, so you can plan around it.

"Conceptually it's very different, but it feels like a normal desk. I got into it very quickly, there are no complicated manuals to learn.

"But it's still very powerful. You don't need to buy extra stuff like EQ and compressors, because they're already in there. And you don't have to touch the patch bay, because the Logic 3 has assignable routing.

"Yes, feel is very important, the ergonomics are very good. The physical contact you have with a desk is integral to mixing and even though there's a lot of automation with the Logic 3, you still get physical things to do. I really like its character.

"And its speed is a great asset. You never need to compromise, even if time is short. You always get exactly what you want.

"That's why a lot of people call it the 'What-if?' machine. Because there's so much it can do, you don't reach technical limitations.

"I did look at other systems, but you can't touch the heritage of AMS Neve. The Logic 3 and AudioFile really is a well integrated digital audio workstation. It's like having a thousand hands."

AMS NEVE

A SIEMENS COMPANY

For more information contact:
AMS Neve plc, Billington Road, Burnley, Lancs BB11 5ES, England. Telephone: (44) 282 457011. Fax: (44) 282 39542.

THE LOGIC 3

Before You Jump Into Digital Nonlinear Post-Production, Make Sure You've Got The Right Equipment.

Moving into digital post-production is a big step. But it doesn't have to be a leap of faith.

Just do what more professionals have done, from commercial TV to Hollywood: choose Avid.

At Avid, you'll find the first high-quality nonlinear online video systems. The world's first true 24-frame digital film editing system. And the first affordable digital audio workstation to integrate multitrack audio with sync-locked digital motion picture.

The fact is, no other company offers you so many choices for digital editing. From online to offline, from audio to film. And we're proven in more than 2,000 professional installations, backed by an outstanding customer support staff.

Avid knows how to make editing systems that unleash your imagination. That work intuitively, the way you work. That give you the power to explore your ideas more easily, more quickly, and more effectively than ever before.

Before you jump into digital nonlinear post-production, call the company that's already been there:

+44 753 65 59 99 (Pat).

We'll make sure your next digital system is a step in the right direction.

From video to film to audio, only Avid's Emmy Award-winning systems cover you every step of the way.

A · V · I · D ®

When You're Ready For The Best.

Avid Technology Europe: Pinewood Studios, Pinewood Road, Iver, Bucks SLO ONH - England

generators and should, ideally, behave like point-sources. The *V-DOSC* system differs in that it produces a cylindrical wavefront, with three vertical sound-radiating 'strips'. This provides a very defined and even coverage angle as well as giving greater projection.

The soundfield generated by a *V-DOSC* system behaves according to two modes, the Fraunhofer Zone (or far field) and the Fresnel Zone (or so-called close field[nearfield]) and a particularity of the *DOSC* system is that the Fresnel Zone extends to a large portion of the audience area. At this stage, the reader interested in delving more deeply into the physics of the system is referred to the AES Preprint; here we will examine the real-world implications of *V-DOSC*.

I have had the opportunity to evaluate the system in local free-air conditions, a large open-air festival and very recent tests in a large concert hall designed to accomodate symphony orchestras rather than amplified instruments.

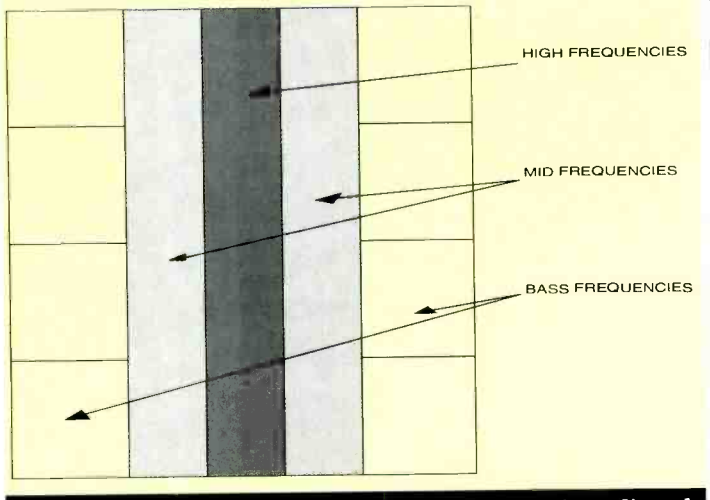
The cylindrical wavefront—best visualised as wedge of cheese—provides an even coverage over the audience areas with minimal variation of SPL from front to back. High-frequency propagation is exceptional, with a level of clarity which—in less elegant terminology—puts the signal 'right in your face'. Open-air events using *V-DOSC* have been covered elsewhere so we will come right up to date with the results obtained very recently in the above-mentioned hall.

The effect of the system is to push back the barriers of the Critical Distance and almost eliminate the acoustics of the hall—a highly desirable trait in particularly reverberant spaces. This in turn provides greater intelligibility and control of the signal over the entire frequency range—including the low frequencies down to about 50–60Hz. The presence-quality of the signal (especially with vocals) is very noticeable, and the stereo field was far wider than is normal with most systems (once off the centre line, they tend to collapse hard-left or hard-right). In fact, the right channel signal is easily discernible even when standing near the left wall of the above venue, and vice versa.

The 'worst seat in the house'—or the areas notoriously difficult to get any decent sound into—are virtually always under balconies, where the combined effects or resonances, reflections and so on. render poor sound quality. The *V-DOSC* system was able to provide sound so consistent that it was almost indistinguishable at the rear of the hall (under the balcony) from that in the centre—a remarkable achievement.

I should not suggest that L'Acoustics system is a panacea for all ills, but it is aimed at fulfilling specific requirements in a specific manner. The results obtained thus far show the *V-DOSC* system to be a further step forward in the evolution of sound reinforcement systems—and to dispelling one of the greatest rock 'n' roll lies: that it sounded great 'out front'. ■

Terry Nelson



A DOSC stack behaves like an ensemble of three time-aligned drivers, each specialised in the radiation of a specific frequency spectrum. The ensemble is coherent, producing an interference-free wave across the audio spectrum

IN THE ARMS OF MORPHEUS

Is there no end to the impressive use E-mu Systems can make of 1U of rack space? It seems not, as the company's new synth module, *Morpheus*, is by far the most dramatic departure in synth development for the company to date. The complexity of its 'Z-Plane technology' (which E-mu claim offers an amount of filtering 'unprecedented in all of electronic music history') make it impossible to go into great depth here, but as it is an important device for E-mu and synthesis in general, let us look at its potential.

Morpheus has 8Mb of 16-bit samples (which can be expanded to 16Mb) which form the basis for its synthesis. It has 128 factory presets and 128 user-programmable memory locations. An actual memory-card slot (as opposed to something that looked like a memory-card slot on previous models) permits additional storage, and 128 Hyperpresets can be created. A Hyperpreset is a type of performance configuration that includes keyboard zones, mappings and layers. The 16-channel multitimbral unit allows for up to 32 different sounds to be present on a keyboard simultaneously.

Audio connections are via three assignable stereo outputs using the usual tip-ring-sleeve arrangement for adding external processing, and there are two internal effects units capable of 28 different effects types. These include delay, chorus, flanger, reverb, early reflections, phase shifter, chorus, distortion and ring modulator and are essentially separate from the presets—which means you can treat them like independent units that can switched in or out. The degree of programmability varies between effect types but all are well suited to the *Morpheus* sound, particularly the fuzz tones.

Front panel controls are yet another refinement of the tried and tested *Proteus*-style presentation of cursor keys, dial and small LCD which now has LEDs beside the buttons labelled MASTER, PRESET (EDIT), MIDIMAP, HYPER (Hyperpreset setup), COPY and HOME-ENTER. There are 16 MIDIMaps (16 more on a memory card) each of which contains such things as effects configuration, patch, and mix data for all 16 channels that you could use as a prerun to a sequence, for example, so that someone acquainted with a *Proteus* will be able to get around the *Morpheus* fairly comfortably.

Editing of Z-Plane synthesis is considerably more involved than previous synthesis systems, but their are certain similarities. Presets are composed of primary and secondary instruments which can be further layered in the aforementioned Hyperpreset mode. *Morpheus* uses two multiwave LFOs, three envelope generators, two multisegment function generators and it will respond to four MIDI continuous controllers at once.

The function generators have eight segments each, adjustable for level, time and one of 63 shapes. Add to this conditional jumps—which are criteria that can be entered to effectively jump around the envelope depending on how you are playing—and it becomes complex stuff. One of the natty up-shots of this is an additional function generator, called a free-running FG, that operates only in Hyperpreset and enables a collection of assembled sounds to be modulated as one—and because the generator is free running, it can be programmed to work independently of note triggers.

The Z-Plane aspect of *Morpheus* concerns itself with filtering and is really rather special. In very—and I mean very—simplistic terms this allows you to impose the filter characteristics of one sound onto another. There are 197 Z-Plane filter templates in the box; these include pianos, guitars, percussion, voices and plenty of non-real-world examples. By now any suspicion you may have had that that this is a pleasantly simple unit should have been totally eradicated—the device is positively frightening. It is not just a case of getting your head around the dialect *Morpheus* is talking, it is getting into the unit and tweaking it while remembering what you have done and trying to keep a clear picture of what you are attempting to achieve that is the problem. It needs a computer editor to do it justice because the options are just too wide and varied. I found myself drifting around the filter and envelope pages and fiddling with no set plan, occasionally developing something good, occasionally making a right old din but strangely enough I found myself still liking it.

The sound

Hopes that *Morpheus* might offer any definitive 'real-world sounds' are largely unfounded. Instead the sounds are strange and different, and one of the biggest tasks you are faced with is trying to imagine what a filter of one type will do to a sound of another. I could not, and find it hard to describe even now but it sounds quite unlike anything I have ever heard before.

A high proportion of the presets are aimed at techno music with super-deep basses and kick drums, loads of analogue synth blips and blobs, filter sweeps and rhythmically orientated textures—very 'now' sounding. It is easier to get *sweepy* analogue results out of a *Morpheus* than the originals simply because the sounds are conveniently tailor-made to rave.

All the presets including the pads and polyphonic stuff have a superb amount of movement, animation and development and all are heavily mapped for controller data that drastically evolves the sound. If you work these, you have a synth that evades recognition through radio and TV commercial play better than most. Only the variability of the sound is likely to help you identify a *Morpheus* at play.

Standard piano, string and lead timbres are strong and rich. If you are taken by the prospect of programming then you will be arriving at sounds that are different. The sound libraries and programmers that will inevitably appear are going to take it yet further.

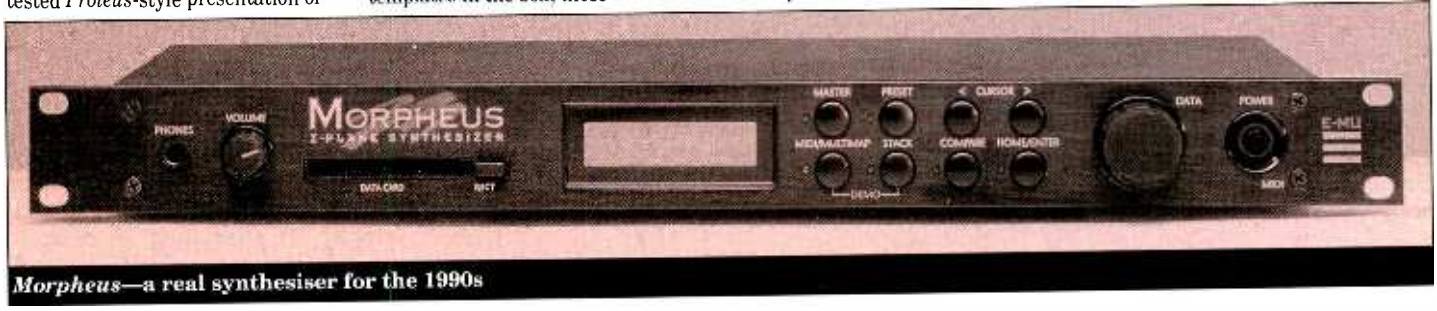
Conclusion

E-mu have achieved something extraordinary on two distinct levels. They have presented *Morpheus* with presets and in a way that will appeal to those who are into current sounds. On a more intellectual level, there is a degree of control and movement within *Morpheus* that will make it a real programmer's synth.
It encourages interaction when played and is very expressive. If manufacturers continue to fail to come up with genuinely new synthesis methods then this is the direction that synthesis is likely to take—adopting an altogether higher plane of manipulation of a set of core sound sources.

Morpheus is a real synth for the 1990s; approachable and impressive on one level and stupendously powerful and complex on another. Hear it. ■

E-mu Systems, PO Box 660015, Scotts Valley CA 95067, USA. Tel: +1 408 438 1921.
Europe: E-mu Systems UK, Suite 6, Adam Ferguson House, Eskmills Industrial Park, Musselburgh EH21 7PQ, UK. Tel: 031 653 6556.

Music News is compiled by Zenon Schoepe



***Morpheus*—a real synthesiser for the 1990s**

THE MILLER'S TALE

Andrew Sutcliffe visits Sawmills—a remote residential studio with a unique approach to reverberation

The decision to record in a residential studio, far from the noise and hubbub of large cities, is based primarily on the desire to be close to the work in hand for the duration of a project and free of unnecessary distractions. There are a number of good residentials available, capable of achieving top-class recordings in pleasant surroundings, so on what basis does one make a selection? The skills of the house engineer, the recording technology available and the recreational facilities all contribute to the choice, further qualified by one's subjective views of a studio's location and its perceived ambience. And if levels of physical ambience could be monitored on a mixing console, the degree of atmosphere exuded by Sawmills Studio in southern Cornwall would peak reassuringly. The meters for privacy, individuality and quality of life would also be at 0dBFS.

The aspects that make Sawmills different from other residential studios become apparent even when making one's initial enquiry regarding a booking. Any studio might respond with, 'Hold on while I check the diary', but a call to Sawmills also results in an immediate check of the local tide tables. Access to the studio is via a four-minute voyage down a tidal river and is therefore very dependent on tide times. The studio runs its own capacious launch, which is capable of taking a transit-van's worth of gear in a single trip. Visitors are collected from the quayside in the nearby village of Golant. Those who try to cheat the moon and arrive at an unscheduled time either have a long wait watching the river fill up, or an eight-minute walk along the river's edge.

During the studio's 18-year history, not a single item of equipment has ever been lost overboard, making an aqualung exploration of the river bed, in search of valuable musical salvage, doomed to a very damp failure. Apparently there were a few heart-stopping moments, while shipping in the studio's grand piano a few years ago, but the river has consistently remained free of submarine Steinways.

As the launch turns into the studio's private creek, which is virtually a tidal lake, the magic of Sawmills begins to work its spell. The lack of road access means that the 19th century mill is about as private and as isolated as it could be—there are no neighbours to complain about noise and the only unscheduled visitors are likely to be a pair of swans swimming in the creek. It offers pure tranquillity in terms of location, atmosphere and outlook. Although customers occasionally come for a day or two, the minimum practical stay tends to be around a week, with many projects remaining at Sawmills for a month or more.

Sawmills can accommodate up to eight residents in the comfortable main building, (which includes a separate producer's suite) and provides an excellent standard of catering from its large kitchen. There is a games room in a different building and the studio's library features a vast choice of books and videos. Between sessions, the picture-postcard surroundings invite exploration, further adding to the quality of the available recreation. The studio also has its own canoes, while sailing and fishing can all be arranged locally.

Facilities and support

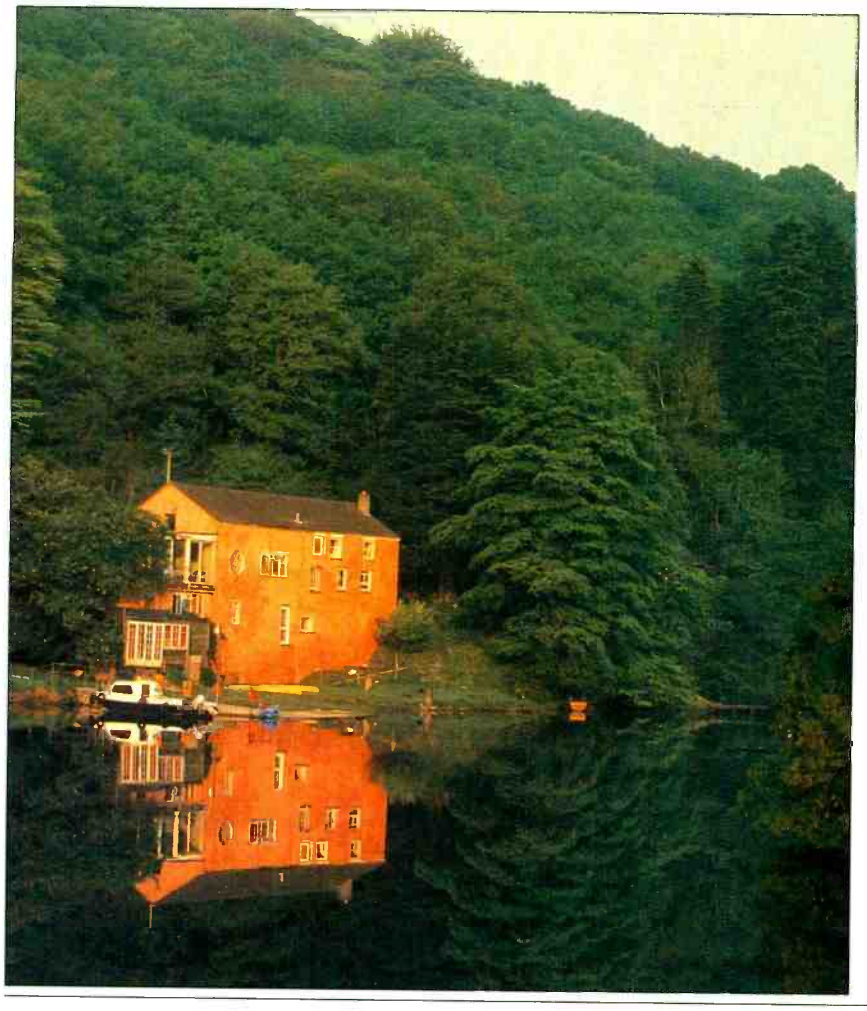
In addition to the attractions of its unique location, Sawmills is also a well equipped and superbly maintained 24-track studio. The acoustics of the control room were designed in-house by John Cornfield & Simon Frazer. It is equipped with a 54-input Trident *Series 80* console, which both staff and customers appreciate for its almost legendary sound quality. Cornfield, Sawmills' resident engineer since 1985, comments that, 'the desk was originally installed soon after I started working here, and it has performed admirably ever since. It offers excellent flexibility, the quality of its EQ is very popular and we would be loathe to change it. However, it's reassuring to see that Malcolm Toft is now back into designing consoles and we await the developments with interest. We designed and installed our own mute automation system into the Trident and recently added 32 channels of fader automation. Many clients return to the studio partly because of the Trident's sound. We would be foolish to change the console, unless we and our customers felt that the replacement would enable us to increase either our appeal or the quality of the end result.'

The control room's Quested monitors have been well integrated into the space and the room also features extensive outboard gear, comprehensive sequencing and sampling facilities, in addition to a large mic wardrobe. Good microphone technique is something that Sawmills holds especially important and the studio also has access to a private collection of valve microphones, which are available for hire. The main studio room leads to a separate isolation booth, and also has a resident grand piano, together with a drum kit and a selection of backline gear. Tie lines are connected to several other buildings on the site, providing a very large and flexible total studio area with a choice of room acoustics.

Recorders at the studio comprise an Otari *MTR90* 24-track, supported by an Ampex *ATR 102*, a Technics DAT machine and hard-disk mastering facilities. The studio's preferred tape for the analogue machines is the very high level 3M *996*, which has been specified increasingly frequently. It is used without noise reduction on both the multitrack and the stereo Ampex—the latter normally being run at 30 ips with a half-inch head block.

Cornfield again: 'One of our more recent converts to *996* has been Producer John Leckie. He was first introduced to it earlier this year while mixing the first Verve album onto half-inch and couldn't believe the lack of hiss, commenting that it sounded "better than digital". It seems that John has continued to use it on many different projects and the tape has certainly delayed any thoughts we may have had about making a move towards digital multitrack. Other bands which have enjoyed the high level benefits of 3M *996* include The Mystics and The Julie Dolphin.'

In spite of the isolation of the studio, Sawmills has good relationships with the major London-based equipment hire companies, and most items can be at the studio within six ▶



hours of a request being made. If a client particularly wants a digital multitrack, that can be arranged and the studio's launch is entirely capable of handling the final part of the journey.

Cornfield and his assistant Dylan Spalding are both experienced electronics engineers. This fact contributes to the high degree of studio maintenance at Sawmills and also minimises the impact of breakdowns, ensuring that urgent repairs can be carried out on site—an absolute necessity in view of the location. The studio keeps a large stock of spares in its well-equipped workshop, together with a good selection of test equipment, and so far has never had to delay a session due to lack of either parts or in-house skills.

The engineering staff's recording skills are complemented by those of Sawmills' Ruth Taylor, who manages the studio bookings. She describes her role as being a combination of health visitor, social worker, hotel manager, caterer, psychologist, backing vocalist and occasional audience.

Taylor highlights some aspects of life at Sawmills: 'Largely due to our location—which tends to mean a relatively long stay for many clients—the whole structure of a project can be quite different. The atmosphere is unhurried and even the most stressed-up individuals manage to unwind here and become extremely relaxed. You get to know people very well during their stay, and indeed you have to, in order to be aware of their individual needs, likes and dislikes, which might encompass diet, health, privacy and working routine. It can be like losing an old friend when they leave but ▶

The Most Widely Used Studio Microphones.

Take a look around the next time you're in the studio. Ask the most demanding musicians and recording engineers what microphone they use to produce the brightest and clearest sound. You'll find that most of them prefer AKG 414's for recording their music's incredible dynamic range, subtle nuance and emotion.

It's no wonder that the 1992 and 1993 *Billboard* surveys found that AKG microphones are the "#1 Most Widely Used Studio Microphones."

For years the 414 series and its AKG signature sound have been a part of recording the best music in the business. That's why the 414 is a studio classic.

AKG

H A Harman International Company

Harman UK, Unit 2
Borehamwood Industrial Park
Rowley Lane, Borehamwood
Herts, WD6 5PZ
Telephone 081-207 5050
Fax: 081-207 4572

Classic.

The 414 is available in two models, the C414 B ULS and the C414 B-TL.II.

Whatever your situation the MKH family ensure accuracy and intelligibility in all aspects of recording.

Sennheiser MKH 80 studio condenser microphone

Superb studio performance and the ultimate in flexibility: the MKH 80 variable pattern studio condenser microphone extends the outstanding quality of the Sennheiser MKH range. The MKH 80 features exceptionally low noise, a wide range of audio control and a high dynamic range plus switchable pre-attenuation, HF lift and LF cut to compensate for proximity effects, and LED indicator for exact orientation. The most versatile microphone designed for any recording situation.

ALL THE MICROPHONES YOU'LL EVER NEED.

SENNHEISER

Sennheiser UK Ltd. Freepost. Loudwater, High Wycombe, Buckinghamshire, HP10 8BR. Telephone 0628 850811. Fax 0628 850958

fortunately, a large percentage of our clients keep returning year after year.'

Echo creek

In addition to the privacy and sheer natural beauty of Sawmills, the studio's unique location can play an integral part in the recording process. The immediate surroundings prove that you do not necessarily need the latest digital gizmo to create an interesting reverberation effect. You can do it with a lake, a generous supply of microphone cable and a boat. Which is the simpler method depends on your attitude to life, and which is a more satisfactory recording technique depends on the style of effect being sought. The simplest type of 'creek ambience' effect is often used on drums and is obtained by opening a door on the side of the studio overlooking the water, allowing the sound of the kit to reverberate around the creek and bounce back from the hillside opposite. Microphones are placed on a balcony above the studio and feed the returned ambience back to the console.

The 54-input Trident *Series 80* console in the control room at Sawmills

Variations on this theme involve placing microphones either around the banks or even on a boat in the middle of the creek, and arranging loudspeakers outside the studio building to fire out across the water. The delay patterns are as affected by the state of the tide and the season as they are by the relative mic and speaker placements. A smooth expanse of water will reflect sound differently to damp mud and trees in leaf will behave differently to bare branches. Some 'creek ambience' effects were utilised while recording tracks for ▶

STUDER Mixing Consoles

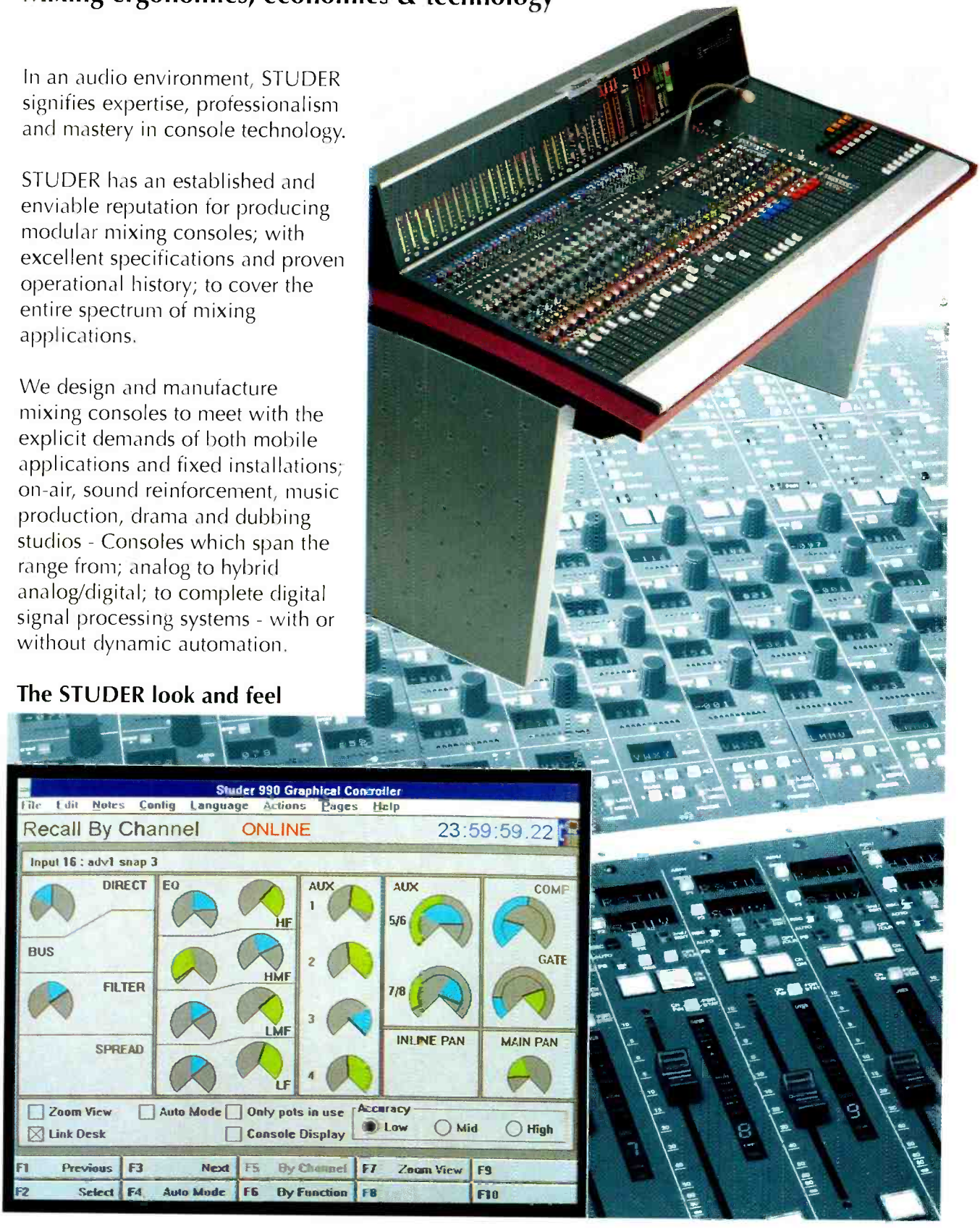
Mixing ergonomics, economics & technology

In an audio environment, STUDER signifies expertise, professionalism and mastery in console technology.

STUDER has an established and enviable reputation for producing modular mixing consoles; with excellent specifications and proven operational history; to cover the entire spectrum of mixing applications.

We design and manufacture mixing consoles to meet with the explicit demands of both mobile applications and fixed installations; on-air, sound reinforcement, music production, drama and dubbing studios - Consoles which span the range from; analog to hybrid analog/digital; to complete digital signal processing systems - with or without dynamic automation.

The STUDER look and feel



STUDER
PROFESSIONAL AUDIO EQUIPMENT

STUDER, a Division of STUDER REVOX AG, Althardstrasse 30, CH-8105 Regensdorf, Switzerland
Telephone +41 1 870 75 11, Telefax +41 1 840 47 37

Subsidiaries:
Austria: +43 1 470 76 09/10
U.K.: +44 81 953 35 33
France: +33 1 34 80 87 00
Germany: Berlin +49 30 72 40 88
Japan: +81 3 3465 2211
Singapore: +65 481 56 88
Canada: +1 416 510 1347
USA: Nashville +1 615 391 3399
San Francisco +1 415 326 7030

Robert Plant's album *Fate of Nations* and the technique has been put to good use on many other projects, including the Julie Dolphin album *Lit*, due for release in early 1994.

In addition to the creek itself, Sawmills also has an excellent selection of reverb and delay electronics, ranging from AMS and Lexicon to Yamaha and an EMT stereo plate. The creek's acoustics have also been exploited for quayside backing vocals and the occasional floating lead vocal, although the studio gets a little nervous about mounting expensive microphones in a rowing boat. On one occasion, a band's entire PA system was erected on the grass beside the studio and microphone tie lines were laid to the other end of the creek. The studio staff maintain a commendably flexible attitude to unorthodox recording techniques, which complement their more conventional skills and expertise.

Sawmills' co-owner Dennis Smith comments on the staffing structure at the studio: 'We have endeavoured to create a very strong team at the studio. One needs a careful mix of technical skill, musical awareness and excellent people-handling abilities, which we would appear to have achieved. We enjoy total commitment from the whole crew, some of whom live on site, and our clients certainly seem to appreciate the friendly and professional atmosphere.'

Hum and nectar

Hum is usually the one thing that you can do without in a recording studio. It is bad enough if the source is electronic but it is especially unwelcome if a swarm of bees is to blame. However, a recent project at Sawmills benefited from a swarm which had been overflowing from a hive on the other side of the creek. Ingrid Schroeder had just arrived at the studio to work on a solo project, which included a song called 'Bee-charmer', and immediately took advantage of the situation. Co-writer Barry Flynn rowed a tie line across the water in a canoe and, armed with a Neumann *U89*, recorded nearly two hours of bees onto DAT. This was harder than it sounds as the bees mistook the wind-shielded *U89* for another swarm. However, the recording was successful, extracts were sampled into the final piece and no stings were suffered. A local beekeeper then re-united the swarm in his own hives.

Producer's paradise

Sawmills Studio demonstrates the fact that it is possible to find a very well-equipped studio, noted for good sound and quality results, which also offers some significant benefits over other residentials. Its unique style of privacy encourages a single-minded attitude to getting the music down correctly, whilst also minimising unwelcome interruptions. Its isolation can obviously inspire a high degree of creativity, by maintaining a thoroughly relaxed atmosphere. From the technological point of view it would be a good studio anywhere, but its location can contribute as much to peace of mind as it can to recording technique. ■

Sawmills Studio, Golant, Fowey, Cornwall PL23 1LP, UK. Tel: 072 683 3338/3752. Fax: 072 683 2015.

GENELEC IS A REGISTERED TRADEMARK OF GENELEC OY FINLAND

ACTIVE MONITORING
WITH THE NEW GENELEC 1030A.
THE SMALL WAY
TO MAKE A BIG IMPROVEMENT.

GENELEC®
OLVITIE 5
FIN -74100 IISALMI, FINLAND
TEL +358-77-13311
FAX +358-77-12267

Gefell Microphones – The New Industry Standard for less than 1/3 the price of the old industry standard

Since their re-discovery, Microtech Gefell microphones are rapidly becoming the new industry standard. The reason? Because their fantastic audio quality – thanks to the original George Neumann M7 capsule design – is available for less than a third of the price of other leading microphones that used to set the standard.

At Microtech Gefell's factory in Germany, craftsman-like attention to detail is combined with the latest in R&D and production techniques to enable you to enjoy today's finest microphones – at yesterday's prices

These are just two of the enormous range of Gefell microphones, call Stirling Audio Systems for information on the rest:

UM 70 – A switchable Omni-directional/bi-directional/cardioid microphone. Superb sound. Available in a low-noise version (UM 70S) and as a cardioid-only mic (M 71 or low-noise version M 71S).

UM 92S – A valve mic which also uses the M7 capsule. Complete with flight case, power supply, Mogami cable, suspension mount and windshield.

Don't just take our word for it:

"This is a top-notch microphone, clean, smooth, accurate, and detailed...Everything I heard through it sounded natural and convincing...this is an awful lot of microphone for the money, outshining more expensive competition...it's probably the bargain of the year." Dave Foister, Studio Sound (review of the UM70)

"With the UM92S, vocals take on an air of increased confidence and life, yet at the same time, they retain the impression of being true to the performer...I've tried several good valve mics over the past several years and few have impressed me as much as this one"
Paul White, Sound on Sound

Stirling

071 624 6000

Stirling Audio Systems Ltd., Kimberley Road, London NW6 7SF
Tel: 071 624 6000 • Fax: 071 372 6370

AKAI DR4d

Akai's *DR4d* hard-disk recorder— the most accessible machine on the market

In these days of software-driven development, there is a genuine danger of passing judgment on a product before it has approached its full intended potential. While this state of affairs can be seen as a mitigation of the cavalier attitude of those manufacturers who regularly release equipment before it is fully grown, we must accept that ongoing development is now part and parcel of software-based technology. Indeed, few digital products would presently be attractive if it were known that their facilities were fully developed the purchase date without the possibility of future upgrades and enhancements. These qualities have become our assurance of longevity and ongoing manufacturer support.

Thus we come to the Akai *DR4d*. This hard-disk recorder been out and about for some time now, but its sync capabilities have only been realised recently. This simple addition takes the device beyond the realms of the rather plain stand-alone machine that first appeared on the market.

There is also the introduction of the *DL4d* remote control unit to consider—a must for multiple *DR4d* use which also adds significant speed and convenience advantages over the front panel controls of the stand-alone unit (the *DR4d* when rackmounted vertically is harder to operate than the horizontal and movable surface of the remote). The *DL4d* also offers an LCD which presents information more clearly and less cryptically than the LED hieroglyphics display on the host unit.

The *DR4d* was initially greeted with surprise in some quarters. Considering Akai's skill with samplers and excellent *DD1000* magneto-optical recorder-editor, some observers were disappointed by the seemingly uncomplicated nature of the *DR4d*. A more than passing resemblance to a tape machine is reinforced the more you look into the *DR4d*, prompting criticisms that the advantages of hard disk recording were not being maximised.

The *DR4d* does employ hard disk features like instant access and mobility of data, but it does not use some of the fancier things like extended crossfades and infinite layers of Undo. Consequently, the *DR4d*'s four tracks can be stacked to a maximum of four for 16-track stand-alone or remote operation, has a fixed, fast-crossfade time close to a butt edit and there is only one layer of Undo available. Storage is handled by up to 545Mb of internal drive plus external drives to suit your requirement and pocket. Indeed it is possible to buy an empty *DR4d* to front your own hard drives although a loaded unit does make a very attractive stand-alone editing package.

Operation

What you have on the host unit is a set of chunky traditional transport controls, four meters reading to or from the four tracks, an AUTO MONITOR button, individual illuminated track-arming buttons and paired source selectors for digital or analogue inputs.

It really is a matter of plugging something in, hitting PLAY and RECORD, and away you go. No matter what computer-fronted system manufacturers say, it cannot be any simpler than this. Analogies to tape recorder control become obvious.

Everything is referenced to the *DR4d*'s own absolute time with Forward and Rewind controls having two modes—fast with one press and very fast with a second. They also function as cue and review when in Play mode,and there are even a Return-to-Zero and 'counter' Reset functions.

Jog and Shuttle wheels are active in all transport modes except Record, and on the *DR4d* these are also used to enter parameter values. On the remote the same wheels serve to select and adjust parameters in the submenu and Edit modes.

The fact that merely touching one of the wheels brings any audio movement to a standstill can be disconcerting if you are used to wheels that have to be switched in. However, you learn to exploit this quickly and develop a skill for switching between Scrub modes and normal transport functions for fast cueing and locating. It is a superb combination of control mechanisms.

Record is entered, after arming the track-record buttons—by holding PLAY and tapping the RECORD button or holding RECORD and pressing PLAY. The former permutation is instantaneous, the latter takes slightly longer to react and seems fairly redundant to me. Unfortunately, you can not go into record on the track-arming buttons from a record-ready status which is a shame.

A numeric keypad permits access to eight, single button-push, locate points and a further 100 so-called stack-locate points (which require a press of the STACK button followed by a two-digit entry). Most of the keypad buttons also serve a different purpose in the Submenu mode which concerns itself with general setup and backup functions. Other locate related features include a LAST button, which toggles between the last two positions at which the STOP button was pressed, and programmable preroll time.

Central to the heart of the *DR4d* is the programming of IN and OUT buttons. These are set by striking the STORE-ENTER button in any transport mode which captures an absolute-time point and allocating to the IN or OUT button with a single press. The same simple process is used to program locate points. The In or Out points can thus represent the section markers for a delete edit, for example, or the segment of audio earmarked for an automated punch-in after practising in a rehearse mode. The precise adjustment of these In and Out points is, of course, what the Jog and shuttle wheels are really about.

Editing

For a machine accused of being limited in the cutting and splicing department, the *DR4d* offer a lot of tricks through its seven edit modes. Copy copies an In-Out marked segment to anywhere else overwriting as it does so while Copy and Insert takes the same segment and moves the audio along at the destination to make room for it. Move takes a segment and overwrites with it at its new destination and Move and Insert shifts the audio along at the destination. Copy and Move modes permit the earmarked segment to be copied up to 99 times at the destination. Erase removes a segment leaving a gap, Delete removes the segment and rebuts, while Insert simply slots in a gap of specified duration at the current location. ▶

Zenon Schoepe gets to grips with Akai's hard disk recorder-editor armed with MIDI and SMPTE cards and the new DL4d remote

CONNECTIONS

Recording is 16-bit linear PCM using 16-bit, 64x oversampling, fifth Delta-Sigma modulation, A–D conversion and 18-bit, 8x oversampled, D–A conversion.

The *DR4d* operates on balanced-jack, analogue inputs and outputs each pair being switchable for -10dB/+4dB operation. The standard digital I-O supplied has XLR AES-EBUs and phono SPDIF connectors which are selected from the sub-up menu and can be allocated to tracks for recording from the front panel. An optional and identical digital I-O can be added for dedicated access to and from the unit's four tracks. A SCSI-A port is standard for daisy chaining a maximum of six external hard drives in addition to a DR4d internal drive. The optional SMPTE, MIDI and SCSI-B interfaces have empty slots ready for installation. ■

Activation and selection of the desired Edit procedure is performed by scrolling down the edit modes on the EDIT button and confirming with the ENTER key. On the remote you hit EDIT, scroll to the required mode with the wheels and confirm with ENTER. An annoying facet on both, which I would like to see improved on the next software version, is that the last used mode is not held in the Edit menu so you have to scroll though the different options each time.

When Copying or Moving a segment the source tracks are identified on the input source selector buttons and destination tracks on the track-arming keys. The track-arming buttons are also used to identify the tracks on which you wish to perform the other edit procedures.

In all instances you get one crack at an Undo which is lost once another edit or recording is made. The jog wheel is surprisingly good and while it does not sound terribly analogue it has a predictable nature that can be adapted to. Alternatively you can whizz around the audio with the shuttle wheel, which graduates from 0.25, 0.5, twice and 4x play speed. Add to this a Play between In and Out points function, a continuous Repeat function of the same segment and a Play to Out function, which plays up to the currently displayed position prerolled by a programmable amount, and you have got some useful tools to help you make sure you won't need the UNDO button. For the sort of material that can be butt edited it is about all you need and if you do get it wrong you just undo and re-edit.

You can work quickly; I managed to compact a mix severely in hardly any time just by tapping In and Out points in on-the-fly and deleting with good results (even if I say so myself). It's the way you would want to be able to work with tape if only you could. Dialogue is easy too and in general cutting things down is far faster than building things up because you have to wait for the *DR4d* to jumble data around on a Move or Copy function and, of course, you have to think a little more yourself.

MIDI and SMPTE

Loaded with the optional cards, the *DR4d* will chase any time-code rate and varispeed accordingly with no problem at all. You basically plug in the code feed on a standard jack—it will tell you if the code rate is different to what it is expecting to receive—and then it will chase around on its 24-hour absolute-time clock and you can forget about it. Offsets are set within the Submenu section and are relative to absolute time.

It will also function as a MIDI master for driving a sequencer, although curiously—given the ease with which it can chase time code—the *DR4d* is not able to lock to MIDI. This would open up great possibilities for a tapeless MIDI environment as it can deal in bars, beats and clocks for a more musical interpretation of the hardware. As a MIDI clock source complicated beat maps can be created.

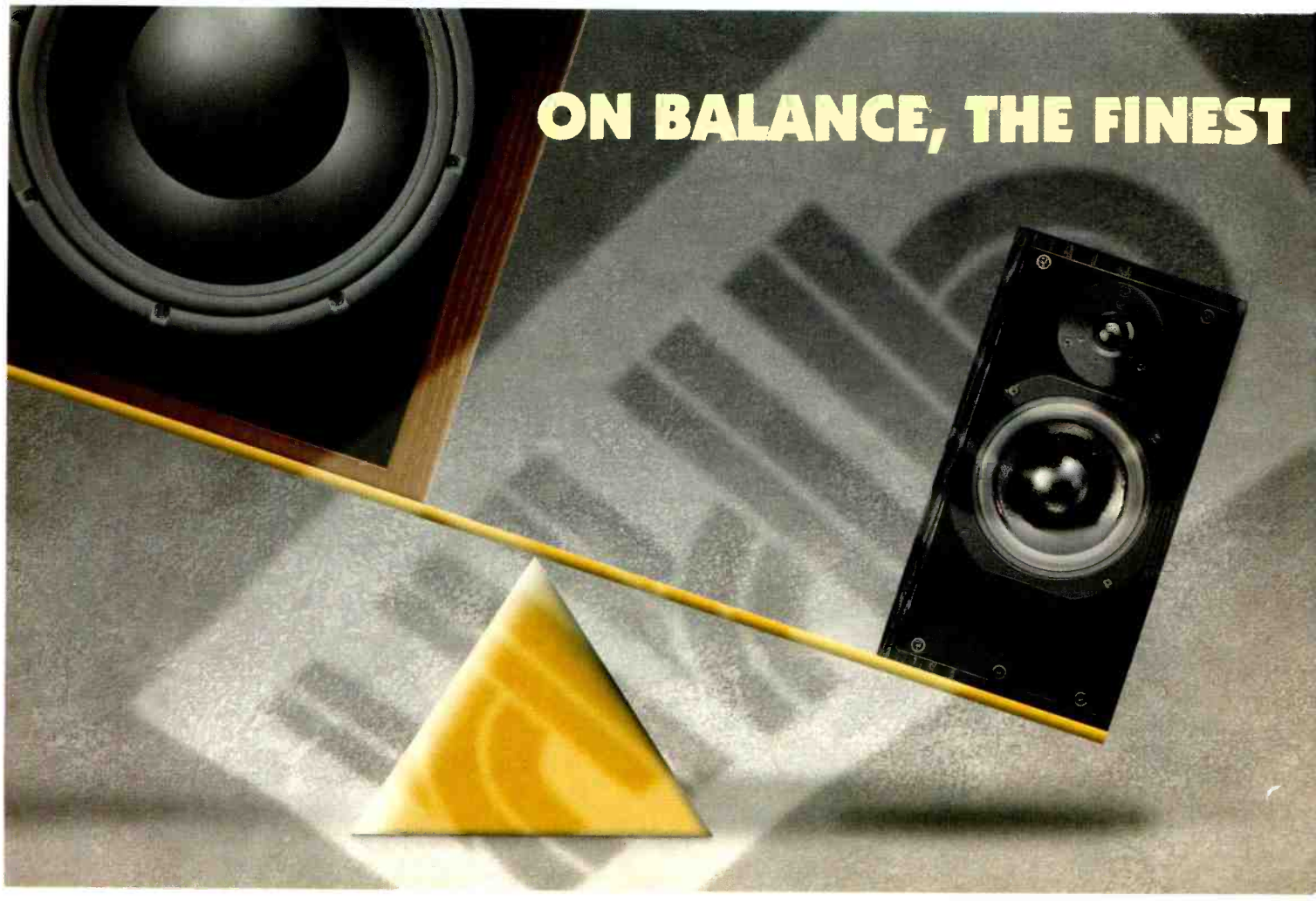
Future enhancements that will arrive with v3 software will support MIDI Machine Control, MTC and time-code generation plus SCSI-B protocol promises to allow direct and faster computer access to the machine and its data. Sequencer manufacturers are also busy incorporating the *DR4d* into their systems.

The remote

Aside from duplicating all the controls available on the *DR4d* main panel, many as scrollable menus on the LCD, the *DL4d* remote gains some useful features of its own. An ALL PLAYBACK button clears all record-ready tracks while SOLO previews any tracks selected on their track-arming buttons and these are then auditioned each time SOLO is pressed. Finally a machine selector assigns the remote panel to the control of one of four connected *DR4d*s. These can be daisy-chained by multipin connector through their front panel Remote in and Thru sockets; the master machine being additionally attached to the remote control.

Impressions

The headphones output and level pot make the *DR4d* a potent stand-alone editing machine providing you are not dealing too much with mono material as the odd-even track assignment in the



stereo can get you cross-eyed. The remote enhances the operation considerably simply because it is easier to understand, but it is worth keeping the host unit in sight just to remind yourself of which tracks are active from the meters.

Although you can capture an absolute-time point in any transport mode, if you capture one on the fly and then press STOP before allocating it to a locate memory or In or Out point then it is cancelled. This irritated me because I was grabbing a location and knowing that I wanted to do something with it I was scrubbing or stopping the audio before I had decided precisely what that would be. The system is basically rushing you to make a decision.

Analogies to tape run out when you discover that you can only go to the generous 108 locate points from Stop. That is pretty daft in my opinion.

Finally, for the amount of use and abuse it gets, a larger and more substantial STORE-ENTER button would have been a good idea particularly when you compare it to the size and usefulness of the ZERO RETURN button.

However, the machine has a high degree of logic which means you can get out of a specified routine, like an edit function, simply by pressing any other button but the one you are supposed to. I have also got to say that, despite my best efforts, it did not crash once—pretty damn good for a brand new remote and sync card particularly as I was working it consistently at the limits of the meagre 18.25 track-minutes-48kHz hard disk that was supplied with it. In such circumstances it can get a tad sluggish but a larger drive would sort it. However, you can align the data to rearrange it more efficiently and for the aforementioned amount of audio this took around five minutes to perform. The answer has to be to use less of a larger drive.

About the only thing I really missed was the ability to slide tracks around easily relative to each other. You can approximate the effect by sequential deletion or insertion of minute segments (21ms minimum deletion, 1 frame minimum insertion) but it is tedious.

Conclusion

When the *DR4d* was announced many questioned the point of having hard disk on tap and presenting it like a a tape machine. But Akai have got it right.

If we look at the success of the *ADAT* and *DA88*—I am talking about their use across the professional spectrum—it has proved that people are not entirely convinced that the hard disk systems out there at the moment serve as an adequate and widespread replacement for traditionally implemented and presented operational concepts. This is brought in to sharper focus by cost. The *DR4d* has got to be the most accessible hard-disk machine on the market. It is also the cheapest stand-alone and a 213Mb internal-drive version with SMPTE, and MIDI will cost in the region of £2,400 inclusive of VAT in the UK. You can expand with slave *DR4d*s for more tracks, extra external storage and a remote. This modularity will appeal to many.

The *DR4d* does not have really sophisticated editing capabilities but it is still very clever and a lot more than adequate. It has destructive editing and one level of Undo—by my reckoning that's a whole one better than you get on tape, some of which can not be cut anyway.

The fact that the *DR4d* now locks reliably and transparently to SMPTE and generates MIDI as an output makes it a significant piece of kit. It is a perfect and natural companion to any tape-based system not just by expanding the system's tracks but by releasing the potential of the machine(s) you already have. It remains a fast stand-alone recorder-editor.

Here is a machine you can master to, comp on, assemble on and rearrange on that is cheap, accessible, immediate and it sounds good too. For a lot of applications this is all that is required. ■

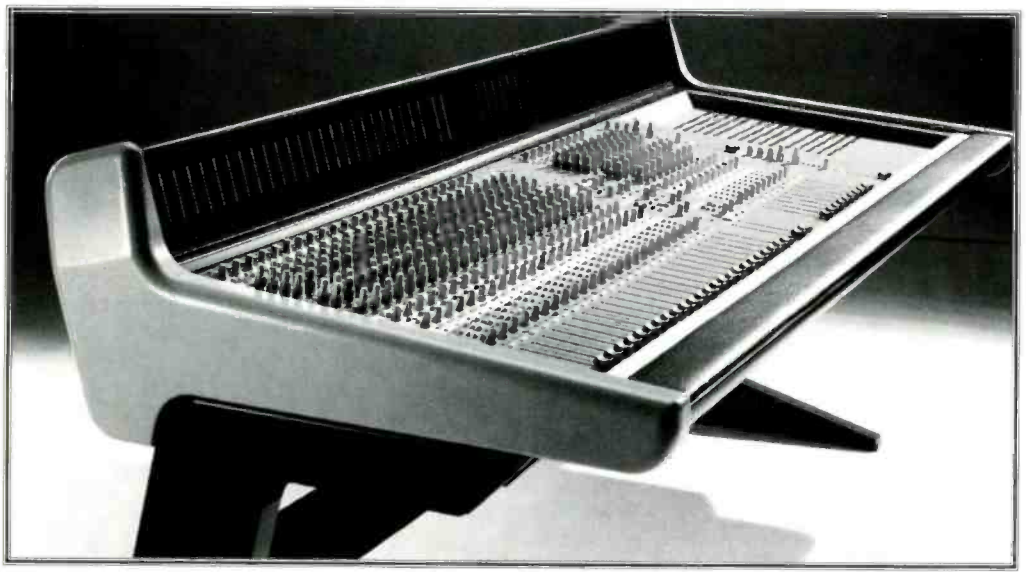
THE SUBMENU

The submenu can only be accessed while in Stop. From here you can set the phono, XLR, SPDIF or AES-EBU nature of the paired input and output digital connectors, and the SMPTE rate and offset. You can also preset Preroll and Play To Out times in seconds, format and erase your hard disks, align them, set the sampling frequency (32kHz, 44.1kHz and 48kHz) and set emphasis. You also select time-code chase or MIDI master status from here and create your beat map.

Varispeed is activated on a dedicated button and offers -33.33% at 48kHz, -27.44% to +8.84% at 44.1kHz and +50% at 32kHz. The downside to this is that varispeed values have to be selected while the machine is in Stop, which makes fine tuning for pitch a bit of a pig [Let's say a trotter], and varispeed itself can also only be activated while the machine is stationary. ■

UK: Akai (UK) Ltd, Haslemere Heathrow Estate, Silver Jubilee Way, Parkway, Hounslow, Middlesex TW4 6NQ. Tel: 081 897 6388. Fax: 081 759 8268.
US: Akai-AMC, 1316 East Lancaster, Fort Worth, TX 76102. Tel: +1 817 336 5114.
Fax: +1 817 870 1271.

IF SILENCE IS GOLDEN, THIS CONSOLE SHOULD COST 7486% MORE



The D&R Orion. From its Hi-Def™ EQs to its fully modular design, from its custom-welded RFI-killing steel frame to its incredibly flexible floating subgroups, the handcrafted Orion is every bit a D&R.

Next time you audition a console, from anyone at any price, ask to hear a test for which we're well-known. It goes like this: We select 'mic' across the board, and assign every channel to the mix bus. We crank up the studio monitor amp, all the way. We push up all the channel and master faders, all the way. We turn the console's monitor level up. All the way. Next, we invite each customer to place his or her ear right next to one of the monitor's tweeters.

Gingerly, they listen, to not much at all.

Then, we bring the monitor pot down from what would be a speaker-destroying level to a merely deafening level. Before ears are plugged and music blasts forth, we invite one last, close listen, to confirm the remarkable: Even with everything assigned and cranked up, a D&R console remains effectively — and astonishingly — silent.

Of course, a D&R is much more than the quietest analog board you can buy. So we equip each handcrafted D&R with dozens of unique, high-sonic-performance features. And we back each board with our renowned factory-direct technical support.

How much is all of this worth? Well, if silence is golden, then every D&R is worth its weight in gold.

In which case, until we raise its price about 75 times, the D&R console pictured at left is one truly impressive investment opportunity.

D&R

D&R ELECTRONICA B.V.
Rijnkade 15B, 1382 GS Weesp, The Netherlands
tel (–) 31 2940-18014 • fax (–) 31 2940-16087
D&R WEST: (818) 291-5855 • D&R NASHVILLE: (615) 661-4892
D&R SOUTHWEST: (409) 756-3737 • D&R USA: (409) 588-3411

D&R handcrafts consoles for recording, live sound, theatre, post-production and broadcast, for world-class to project facilities. "Weight in gold" comparisons based upon 11/93 market prices.

IN YOUR EAR

Kevin Hilton listens to the practical and technical considerations surrounding the use of wireless mic and monitoring systems

If new technology has given people the freedom to be more creative or more adventurous in their work, then one of the great liberators in live performance has been the wireless pack. Radio microphones—and, latterly, in-ear monitors—have enabled designers of both stage sets and sound systems to be more daring and release bands and theatre productions from the constraints of traditional equipment and staging.

Last year's gigantic *Zooropa* tour by U2 was a study in excess. Although its status as the biggest stadium tour ever could be argued, it was without a doubt the most equipment-heavy and, consequently, costliest tour ever seen. U2 wanted to take the live concert as far as it would go—and they did. But it would not have worked without wireless technology.

The shows used 22 dedicated frequencies for the wireless microphones and in-ear monitors, allowing the band members to not only move around the main stage but to walk out along a gangway to a secondary stage some 100 feet away in the middle of the audience. This brought problems in the shape of time-alignment and howl-round, with the musicians being right in front of the main rig. The band's front-of-house Engineer, Joe O'Herlihy, said at the time, 'The reason the whole thing works is because of the in-ear monitoring.'

Zooropa was an extreme; wireless technology (radio mics, instrument transmitters and in-ear monitors) is now being used by a whole range of groups and musicians, for varying reasons. UB40 have a large number of players on stage (see sidebar) and the use of radio systems has reduced the amount of wedges and backline; some use them as an essential element of a 'mobile' stage show, while others use them simply because they are there.

Musical theatre has now progressed to the point where a great many shows could not be performed without some form of wireless system. Productions on both Broadway and in London's West End now regularly feature anything up to 20 radio mics and the increasing use of in-ear monitoring is set to boost the need for frequencies. An example of this is a new production of *Jesus Christ Superstar*, which is touring Australia and New Zealand with 28 radio mic channels and ten in-ear systems.

When the revival of *Joseph and the Amazing Technicolored Dreamcoat* was being planned back in 1991, sound designer, Martin Levan, toyed with the idea of using cabled mics (the norm when the show was first performed in the 1970s), but soon abandoned it. *Joseph* opened using a total of 24 radio-mic channels for the 25-strong cast, allowing greater freedom of movement on stage.

This has led to increasingly startling productions, but it does tie the shows to the technology, as Martin Noar—a director of Garwood Communications, which designs and manufactures the *Radio Station* in-ear monitor—observes: 'Because of current technologies, like radio mics and foldback, set designers are taking advantage to create more and more spectacular shows. They would find it virtually impossible to perform using conventional equipment like cabled mics.'

As the use of wireless systems has increased around the world, so has the level of regulation. While the control of air-wave use is completely understandable, many manufacturers, designers and users are concerned at the number of regulations between different territories, particularly within the European Community. 'We're still getting to grips with the various countries' attitudes,' comments Andrew Bruce, leading Theatre-Sound Designer and a Director of Autograph Sound Recording. 'No other countries have the same attitude as here but that's mainly because we did a lot of work a few years ago talking to the relevant authorities.'

The regulations for radio equipment divide type approval, frequency allocation and licensing. Type approval ensures that equipment reaches a minimum performance standard and does not cause interference to other radio users, while also determining which part of the frequency spectrum it will use. Frequency allocation relates to the operation of systems in different countries while licensing permits the user to operate them. With the creation of the Single European Market, manufacturers, designers and operators have been hoping for unification of another kind, that of uniform type approval and frequencies across the proposed United States of Europe.

In the area of type approval standards, work has been going on under the auspices of the European Telecommunications Standards Institute (ETSI) for the past few years to achieve harmonised standards for radio and telecommunication systems. The proposal for a European type approval standard was due to be sent out for public consideration during March. In the past, the mainstay of type approval has been frequency modulation with a 200kHz bandwidth but this new document proposes a 'mask' approach, which ▶

PHOTO: PHIL DENT

will work on 200kHz, 150kHz and 100kHz-wide bands. If equipment fits into one of those slots, and meets the necessary type-approval standards as regards transmission power and unwanted emissions, then it will be type approved.

'This should create a significant increase in the number of channels within the allocated bands,' says Brian Copsey, Secretary of the UK licensing agency ASP Frequency Management. 'We're encouraging manufacturers to be spectrum efficient.' The proposed document includes radio microphones using any form of modulation: FM, linear and even digital. 'Providing they sit within the mask, it won't be a problem,' says Copsey.

Creative types generally complain that regulators are just administrators who do not have an understanding of what designers are trying to do. Consequently, they say, certain pieces of equipment are often not taken into consideration. A leading example is the *Radio Station*, which uses some of the same technology as a radio microphone but is used for a totally different application. 'We were told that it would probably fall into the same category as radio mics,' explains its designer, Martin Noar, 'but because it's a unique product, there was no specific classification as far as type approval was concerned.'

However, as far as the ETSI standard is concerned, the attitude of the Association of Service Providers, (ASP Frequency Management grew out of the original industry body), appears relatively laid back. 'The *Radio Station* is a fixed radio microphone that just reverses the process,' comments Copsey. 'It's also a very low-power unit and it conforms to the basic requirements.' In a strange way, the *Radio Station* would appear to open up the way for further work in the field of radio microphones, as Copsey intimates. 'It's a stereo unit and it sits within the mask with no problem. Stereo microphones would be feasible under the mask.'

John Wykes is Senior Engineer at Audio Engineering, maker of the Micron range of radio microphones, and is also a contributor to the ETSI subcommittee RES (Radio and Electronics Systems) 8, which deals with technical standards. He says of the type-approval proposal, 'In principle, it's very similar to the current UK type-approval. As far as the UK will be concerned, there's not going to be any obvious difference.'

Having now been released into the public domain for discussion, the bureaucratic timetable would look this : the document will be up for public appraisal for about six months, after which it will return to the committee stage for any modifications. This would mean that it will be at least a year before it is finally published.

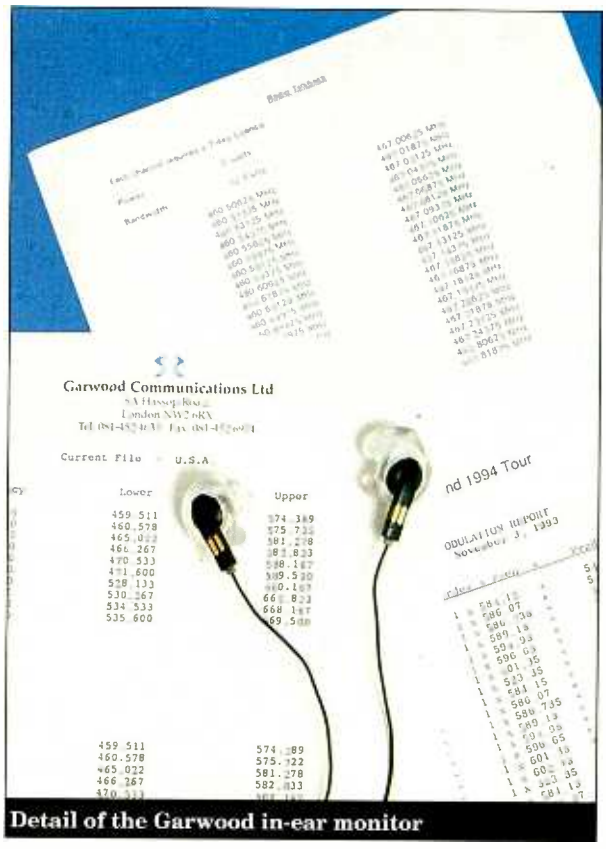
However, type approval is only the beginning as far as radio microphone regulations are concerned, and things certainly get more complicated for the end user after this point. As John Wykes says, 'If type approval is accepted on a Europe-wide basis, that will be statutory but frequencies and power are still down to each individual country to decide.'

It is this situation which has caused frustration among manufacturers of radio equipment and the designers of the productions that use it. 'There should be one specification, absolutely,' asserts Noar. 'It's difficult enough for me to deal with the companies who ask my advice regarding suitable frequencies. It's even worse if you think about the problems faced by the US hire companies. They're confronted by a region half the size of America which has 16 different standards and 16 different frequencies.'

Andrew Bruce observes, 'We have to throw ourselves on the mercy of the local PTT [Postal, Telegraph and Telephone Administration, the agency that provinces communication services in many countries and also often acts as the regulator]. Before we took *Les Miserables* to Madrid, we had a year of to-ing and fro-ing with the PTT out there. The problem is, in asking for frequencies you're alerting them to the fact that you need them. If they say no, they're likely to come looking if you go ahead.'

Body language

Although the nature of radio microphones and their importance to productions of every kind is fully understood by the professional audio industry, the licensing and regulatory bodies that they have to deal with, which are generally concerned with telecommunications, are less aware of their needs. 'When you look at the area of GSM [which covers such equipment as cellular telephones and mobile radio] it numbers millions of people. Radio mics don't have the same clout when you're talking on a European basis,' says Copsey. 'It's easier to justify the use of the spectrum if you've got hundreds of thousands of users as opposed to a few.'



Detail of the Garwood in-ear monitor

From the manufacturer's perspective, Wykes says: 'Some countries have basically got no licensing systems for people other than broadcasters using a radio microphone. They get used but it's without official backing.' On the subject of lack of understanding, he adds, 'Radio microphone users come off badly. There are commercial pressures, what with the weight of cellular manufacturers, who have go a very loud voice.'

However, people are taking advantage of the upcoming European spectrum review to stake their claim to at least some parts of the spectrum. The UK-based ASP is encouraging its members to take part in the process. 'The European Radio Organisation (ERO) are looking at the frequencies in the band sweep 29.6 to 900MHz,' he explains, 'and we are looking for a much higher profile for radio microphones. The ASP have encouraged people to reply to the relevant bodies so that radio microphones can have a position within the band.'

When the latest UK Broadcasting Act came into force in 1990, it proposed that a new national TV station, *Channel 5*, would use the frequencies on Channel 35 (582–590MHz), which was already being used for licensed radio microphones. Pressure was put on the Department of Trade and Industry (DTI) and consequently Channel 69 was offered as a replacement, albeit with some restrictions. Channel 35 is still available for radio mic use in some areas of the UK, specifically London, Birmingham and Bristol.

In December 1993, the new 14-channel bandplan was added to Channel 69 for UHF use. This was followed at the beginning of February this year by a new category of licence for nonrental operations. Single-channel licences currently cost £100 each and (through a SAP3 form) allow a hire company to extend that licence to cover the end user as well. The new licence, costing £130, is for single or multiple nonhire units, and is targeting such organisations as small drama groups. The £130 fee pays for all five VHF frequencies or for either of the two groups of seven frequencies on channel 69. Copsey feels it is unlikely that end users would require all three licences.

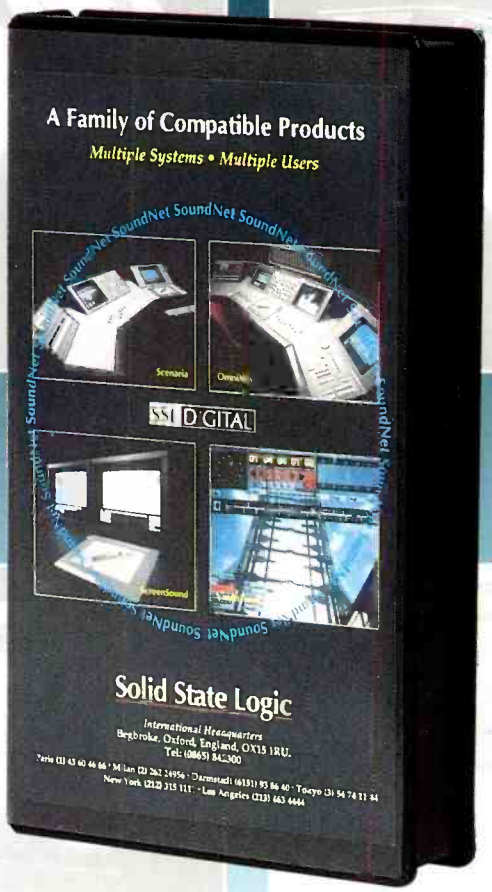
Another change, which was implemented 18 months ago, was to implement band-edge licensing, with specific regard to fixed-site systems. 'Where possible, we give the top or bottom of the spectrum as a licence block,' explains Copsey. 'This is in general line with the ETSI standard to improve spectrum efficiency. We are trying to give more freedom to the end user and allows for physically adjacent sites.'

As far as a Europe-wide agreement on frequencies is concerned, Copsey says, 'Through our ETSI work, a request for harmonisation of some radio microphone frequencies has been sent to CEPT (Central European Post and Telegraph organisation). The Association has also been talking to other national bodies. Within other countries, the allocations often work on spot frequencies, which is often a mathematical progression.'

It seems that this lack of understanding, coupled with the influence of the powerful cellular phone and other mobile systems operators, could work against a single European frequency. However, manufacturers and end users are aware that they have to slot in alongside these other users. 'Realistically I can't see any Europe-wide common frequency bands,' says John Wykes. 'I hope that there will be some on VHF but at UHF I would imagine that it would be 800–808MHz and above 850MHz. The only way we could cover the whole of Europe would be if there were a couple of TV bands which could be used with synthesised equipment.'

Andrew Bruce says of the attempts to unify the situation, 'It's good to hear that organisations are doing this. It's a welcome step in the right direction, they're interested enough to know what we want. The UK is probably in the best position to lead the way because we persuaded the various agencies to give away as many frequencies as possible. Perhaps we can do the same with the PTTs.' However, Bruce adds that in many cases ▶

A FAMILY OF COMPATIBLE PRODUCTS
THE VIDEO



SSL DIGITAL

Please send me a VHS copy of the Family of Compatible Products Video ❒ – in PAL ❒ in NTSC ❒

Please call to arrange a demonstration of ScreenSound ❒ VisionTrack ❒ Scenaria ❒ OmniMix ❒ SoundNet ❒

Please send more information on ScreenSound ❒ VisionTrack ❒ Scenaria ❒ OmniMix ❒ SoundNet ❒

Name: _____ Position: _____

Company: _____

Address: _____

_____

_____

_____

Postcode: _____ Telephone No.: _____

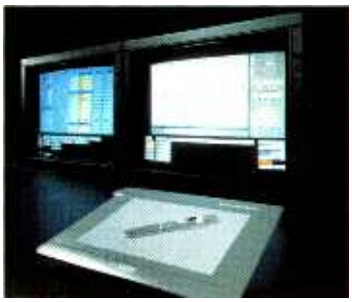
1993
The Queen's Award for Technological Achievement

SSL DIGITAL
Solid State Logic

With SSL's unique family of digital products, audio post-production for video and film moves to new heights of speed, accuracy and creative potential.

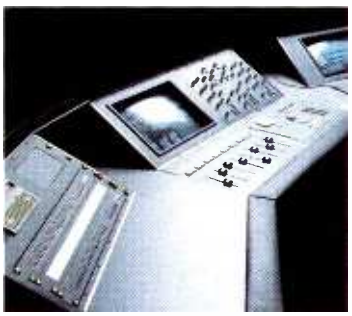
SoundNet

The world's only multi-user digital audio network system. ScreenSound, Scenaria and OmniMix users can work on the same, or diverse projects without having to waste time up- or down-loading. SoundNet also provides a central database of all audio held on hard disk or optical discs, removing the need to duplicate sound libraries.



ScreenSound

An integrated digital audio-for-video editing suite. Hard disk recording, editing and mixing, combined with multiple machine control.



Scenaria

24-track random access recorder, multi-channel editor, 38-channel digital mixing system, and random access video are just some of the features which enable Scenaria to set new standards in audio post-production.

OmniMix

All the features of Scenaria, plus a configurable output bus structure, suitable for 4, 5 or 6-channel surround sound and a variety of stem mixes. MotionTracking™ dynamically automates panning to an exact position within the surround sound field. Spatial Processing™ provides advanced digital audio effects to emulate the characteristics of objects moving in space and time.

VisionTrack

A random-access video system, providing a digital picture source which maximises the speed and the performance of SSL's digital audio systems

Now available from Solid State Logic is a 20 minute video on SSL Digital systems. Shot at SSL's headquarters and at SSL Digital equipped facilities in France, Austria, America and Japan, the video features interviews with owners and users discussing their applications for, and benefits of, these digital products.

To request a copy, complete and return the card below.

By air mail
Par avion

IBRS/CCRI NUMBER:
PHQ-D-2652-OX

NE PAS AFFRANCHIR

NO STAMP REQUIRED

REPONSE PAYEE
GRANDE-BRETAGNE

Solid State Logic
Begbroke
OXFORD
GREAT BRITAIN
OX5 1YZ

GO OPTICAL WITH AUGAN

AUDIO EXPERTS DECLARE: "THE FUTURE IS NOW"

REWRITABLE OPTICAL DISCS

"First Question":
Who supplies optical player/recorders and editors from 2 tracks to 24 tracks or beyond?

"Answer from the audio expert":
AUGAN. Take for example their 202 -, 204 - or their 408 - OMX, an 8 track machine which you can combine to 24 tracks usable for music, broadcast or synchronized to video and film.

"Last question"
What about compatibility?

"Answer"
With a DIN norm for lineair recorded audio on ISO standard optical disks your audio is retrievable now and in the future.

WE CONVINCED MANY PROFESSIONAL USERS

WHY NOT LET US CONVINCE YOU!

AUGAN Instruments BV - Wilhelminastr 31
6881LH VELP (31)85.648966 The Netherlands
DISTRIBUTORS:
*The Netherlands - Ampco 030.414500
*Belgium - Asc 02.5200827
*France - TBC Communications 1.47457880
*Germany - Dasa 4103 605468
*Sweden - Zima Productions 08.6535710
*Italy - Audio International 02.27304401
*Switserland - Mase - 22.3212345
*United Kingdom - Studer Revox 081.9533533
*Spain - Fading - 01.3772400
*U.S.A. - A/Z Associates 617.4440191
*Korea - Hi Tone 82.2.5765571/2
*Singapore - Auvi 65.2832544
*Hong Kong - PL Development 08891009

UB40: PLAYING BY EAR

The current tour by Birmingham's finest, UB40, moved off to the American theatre circuit at the end of January after a successful European trip. It is a largely wireless affair; when they started the European leg in October, the 11-piece group was using a total of 18 radio systems, including four Radio Station units.

As there is a large number of people on stage and a high degree of technical sophistication, the band's monitor setup is consequently quite elaborate, using a mixture of cabled and wireless in-ear monitors, mixed with conventional wedges.

The monitor engineer is Jon Ormesher, who has been working with the band for the past five to six years, mixing monitors on the last three tours. 'UB40 can be a difficult one to do,' he says, 'because with most bands you have just one lead singer, but here it's an 8-piece co-operative where all are equally important. It's also difficult keeping track of the people on stage—there are 11 in the band and eight of them are constantly moving.'

Ormesher first came across the Radio Station five years ago when he was working with Everything But The Girl and has used them several times since. UB40's involvement with the system goes back to a demo given four years ago by Chrys Lindop of Personal Radio Systems, the UK distributor of the unit.

Although this demo did not result in a sale at the time, the trombone player-vocalist, who has very specific monitoring needs because of a soft singing voice, remembered the Radio Station and pushed for it on this tour.

Four members of the band are now using the Radio Station: percussionist, singer, vocalist-optigon player, saxophonist and trombonist. The keyboard player uses the unit's ear moulds, but wired on a cable, while the drummer monitors on a specially-designed rig using both stage speakers and enclosed headphones. This arrangement is fed with four subgroups from Ormesher's monitor console, which are then specially mixed by the drum technician between the wedges and the cans.

The total number of stage monitors used by UB40 has been reduced due to the wireless systems, although the current show is still using 16 wedges. 'It's difficult with a lot of wedges on stage,' reports Ormesher, 'because you're constantly changing where things are. Before desks had VCAs, you had to be rerouting mixes continually, while keeping an eye on where the band was going.'

On this tour Ormesher is using a 40:18 TAC *6500* console with VCAs and eight mute groups. Although this sounds more than adequate, Ormesher observes that this board is completely full. 'You don't get separate outputs for everyone on these things,' he says, 'so desks will have to get bigger in the future.'

Ormesher comments that as well as making for a less cluttered stage, the Radio Station has helped improve the overall sound of the band. 'It makes for a cleaner and quieter stage,' says Ormesher. 'As a monitor engineer, I want almost silence. I think that monitoring in general is going to become more headphones oriented because it's more precise.'

While saying that the in-ear systems haven't fundamentally changed the way he works, Ormesher adds, 'It gives me a lot more freedom to mix. A lot of monitor mixing is guess-work because I'm not on stage—the backline colours the result as well. But now I've got my own ear piece and I know exactly what is going on—it cuts out the guesswork.'

Over the past five years, Ormesher has used the Radio Station with a variety of different bands and types of music but he says that this is a less of a factor. 'It works perfectly well for any style of music. Live, it's the environment that you're playing in that matters, not the type of music. If you can control the environment, it will work.' ■

PHOTO: DAVID SCHIENMANN

the regulators could be accused of over-reacting: 'Theatre is not going to cause any interference because the units are so low powered. Devices of 50mW or 20mW are not going to harm anyone.'

While discussion and debate continues on the subject of type approval and frequency allocation, there is another, perhaps greater matter to be taken into consideration: electromagnetic compatibility. Work towards agreement on this issue is going on in parallel with the other aspects; in the work being carried out by the EC, RES 9 is the committee responsible. Brian Copsey observes that it is likely that EMC conformity will consist of EMC tests and some tests taken from the ETSI standard.

The EMC directive becomes law on 1st January 1996, after which all electrical equipment will be expected to carry the CE mark. If a CE tag is not obtained, then type approval and frequency allocation both become rather academic issues. ■

“The engineers love it, the A&R men love it, and my accountant almost broke into a smile”

The DC2000 breaks new ground for in-line recording by offering moving fader technology at a price that you can afford.

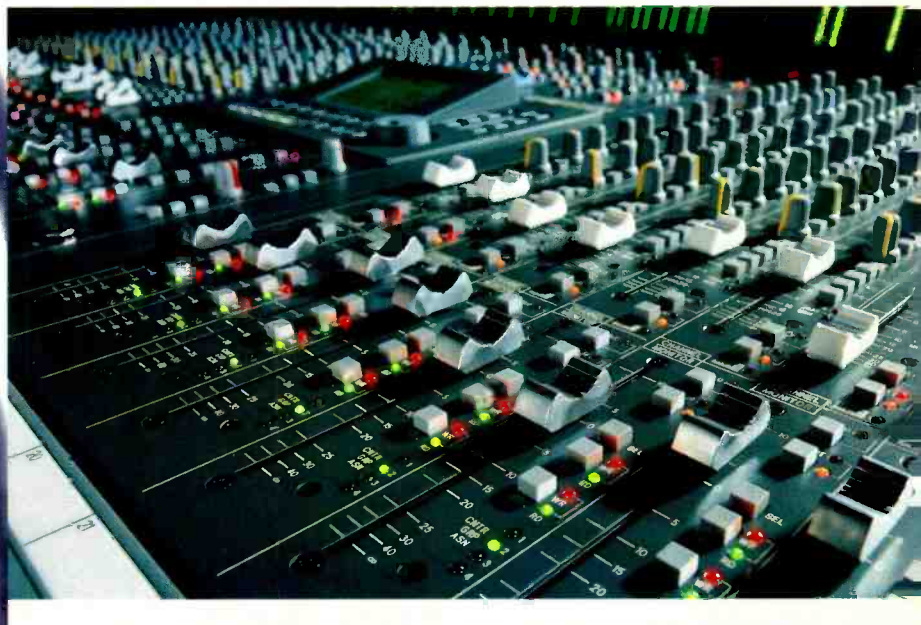
As a complete integrated workstation, the DC2000 has in-built computer control and requires no additional PC. Through its moving fader technology, the DC2000 provides an accurate and intuitive approach to sound recording, that would be almost impossible to achieve manually.

With advanced project management capabilities, mixes can now be created faster and more effectively by utilising the DC2000's advanced on-board touch screen computer, dedicated software package and hard disk storage...

and as the DC2000 comes from Soundcraft, you can trust them to deliver a product that is produced to the highest standards of manufacture and service.

So why not make the next move and call your nearest Soundcraft dealer. It could make you, and your accountant, extremely happy.

MOVING FADER



Harman International Industries Ltd., Cranborne House, Cranborne Industrial Estate, Cranborne Rd., Potters Bar, Herts EN6 3JN, England. Tel: +44 (0) 707 665000. Fax: +44 (0) 707 660482

A Harman International Company

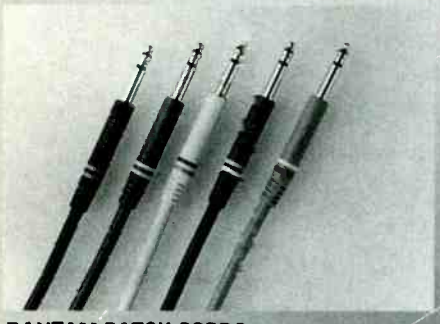
Soundcraft

DC 2000

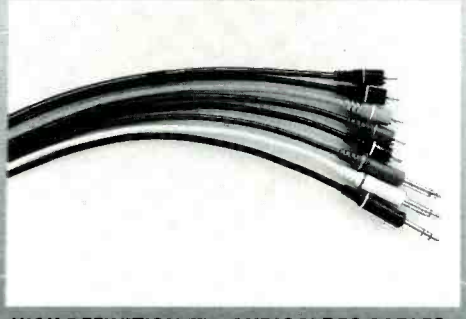
THE LONG-LIFE, ECO FRIENDLY CABLE

MOGAMI

Any cable failure often results in problems where the original cause is extreme y difficult to detect. The reliability and quality of Mogami cable ensures those problems do not arise. Long-life, safety, efficiency and economy make Mogami the No. 1 choice for cable.

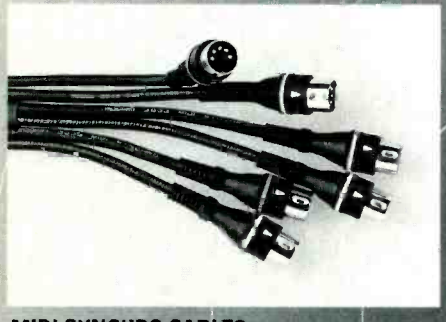


BANTAM PATCH CORDS

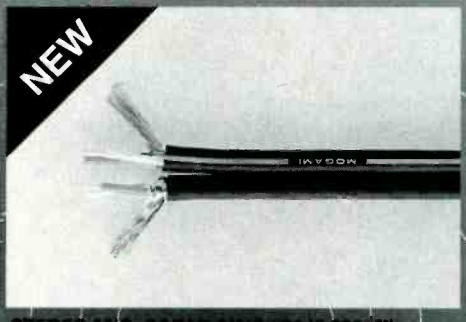


HIGH DEFINITION 75Ω AUDIO/VIDEO CABLES

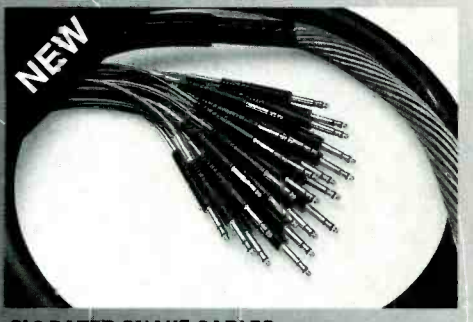
LONGFRAME PATCH CORDS



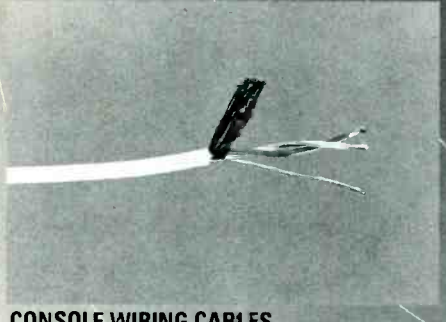
MIDI SYNCHRO CABLES



STEREO M.I.C. CABLE AWG #24 (0.226M²)



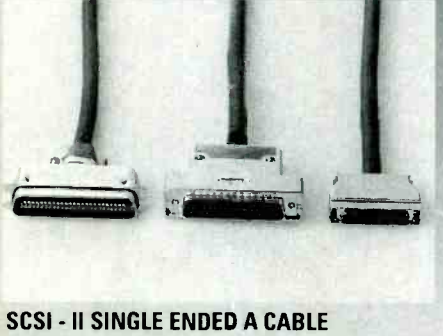
CL2 RATED SNAKE CABLES



CONSOLE WIRING CABLES

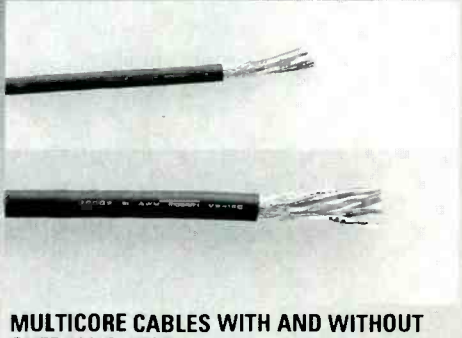
CL2 RATED SUPER-FLEXIBLE STUDIO SPEAKER CABLES

AES / EBU 110Ω DIGITAL AUDIO CABLE



SCSI - II SINGLE ENDED A CABLE

PARALLEL DIGITAL VIDEO CABLE



MULTICORE CABLES WITH AND WITHOUT OVERALL SHIELD

CALL OUR DISTRIBUTORS FOR A FREE CATALOGUE AND/OR FOR MORE INFORMATION:

AUSTRALIA: *GREATER UNION VILLAGE TECHNOLOGY (02) 550 5488* • **AUSTRIA:** *DIETMAR KOLLER RECORDING EQUIPMENT (0222) 450 43 43* •
CANADA: *CABLETEK ELECTRONICS LIMITED (604) 942-1001* • **CROATIA:** *AUDIO VIDEO CONSULTING (38) 41 624 622* • **DENMARK:** *D A DISTRIBUTION APS (31) 61 07 55* •
FRANCE: *D.M.2.J. SARL (1, 39 57 90 44* • **GERMANY:** *AUDIO-VERTRIEB PETER STRUVEN GMBH (04106) 6 99 99* • **HONG KONG:** *ODYSSEY ENGINEERING CO.LTD.5-8988111* •
ITALY: *AUDIO LINK (02) 2940 6796* • **JAPAN:** *MIT INC. (03) 3439-3755* • **KOREA:** *AVIX TRADING COMPANY (02) 565 3565* • **NEW ZEALAND:** *DENCO AUDIO LTD (3) 3790743* •
NORTH AMERICA: *MARSHALL ELECTRONICS INC. (310) 390-6608* • **SINGAPORE:** *TEAM 108 TECHNICAL SERVICES PTD. LTD. (065) 748 9333* •
SOUTH AFRICA: *EMINENTLY MORE SUITABLE S.A. (011) 886 9662* • **SPAIN:** *MEDIA-SYS S.L. (93) 485 09 11* • **SWEDEN:** *TAL & TON ELEKTRONIK AB (031) 80 36 20* •
SWITZERLAND: ZAP SONO (022) 756 32 27 • **TAIWAN:** *SEA POWER CO. LTD. (02) 298 2688* • **THAILAND:** *VIDHYA SUVANICH (2) 321 4426* •
THE NETHERLANDS: *MAARTEN'S SOUNT & VISION (0) 5130 29120* • **U.K.:** *STIRLING AUDIO SYSTEMS LTD. (071) 624-6000* •

AUDIO REMOTE CONTROL
WHERE TO NEXT?

Frances Rumsey looks at the present options for remote equipment control and discusses the role of MIDI as a blueprint for the future

The Holy Grail of a 'universal' remote control interface for audio and video equipment has been sought after for many years. In many instances the vested interests of manufacturers in sticking to their own unique remote protocols have prevented the widespread adoption of universal machine control standards such as the ESbus (EBU-SMPTE remote control bus). Even so, there is a light on the horizon for the audio systems engineer wanting to integrate the control of different items of equipment using a common bus. The relatively recent introduction of a MIDI Machine Control protocol allows MIDI to be used in the remote control of tape machines and other studio equipment, whilst MIDI Show Control is a protocol designed for the control of A-V equipment and other effects used in live productions. The recently issued Draft AES-24ID protocol is intended as a means of controlling and monitoring audio systems using a high-speed computer network as the common interface.

This article investigates the capabilities of these protocols and looks to a future in which multiple audio devices from a range of manufacturers may be controlled by a single computer. The benefits of such automation in live sound, theatres, theme parks, and also in the recording studio, will be considerable. Audio systems will be concentrated upon, although there is crossover into video and related media.

There are two main fields in which remote control is required in audio systems—one is machine control and synchronisation, the other is the control of signal processing. In the first category come applications such as tape (or disk) recorder control for editing and postproduction; in the second category are included such operations as adjusting the output level of an amplifier or the setting of the equaliser on a mixer.

The ESbus

The ESbus—properly described as the EBU-SMPTE remote control bus—was an attempt to standardise a remote control protocol mainly for audio and video recorders. It has been around since the mid-1980s and is based on a serial 9-pin RS422 remote interface running at 38.4kbaud (similar to Sony's 9-pin interface used on its audio and video equipment). It was particularly welcomed by synchroniser manufacturers, such as Audio Kinetics. As such synchroniser manufacturers know, virtually every tape machine on the market has a slightly different remote interface: some are parallel, some are serial, and each tends to use different connectors, voltages and pin configurations. Furthermore there is no common agreement over the frequency or DC voltage used to control capstan speed, there is a range of different tachometer signals, and so forth. It is rather like the days of synthesisers before MIDI came along.

The ESbus protocol defines a common electrical interface and also a common set of commands for controlling machines, with the benefit that a 'Stop' command will be interpreted as Stop by any machine receiving it. Without ESbus capability a synchroniser would have had an interface dedicated to each tape machine, but the beauty of ESbus is the possibility for a single serial interface from a controller to be looped through all the controlled devices in the system, each device having a unique address. The controller could address groups of devices together, or single devices, and information from the tape machines about their status would be returned over the same serial bus. In synchronised systems a time-code connection is daisy-chained from the master device to all the slaves, and it is expected that slaves will be self-synchronising to the master time code (that is, they need a built-in synchroniser). **Fig.1** shows an example.

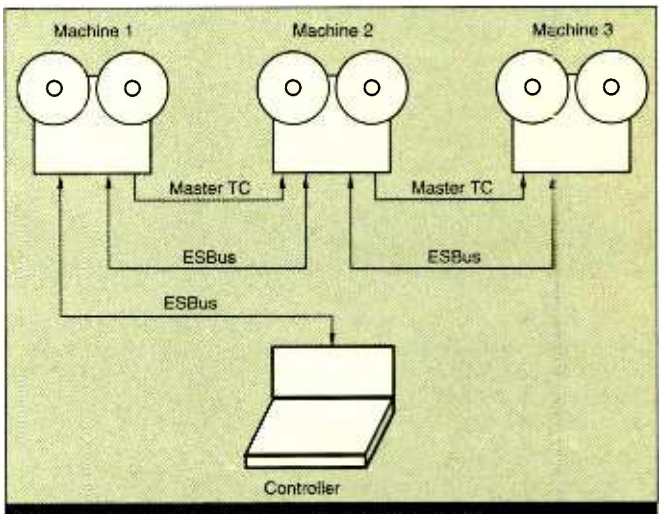


Fig.1: Internal synchronisation using ESbus

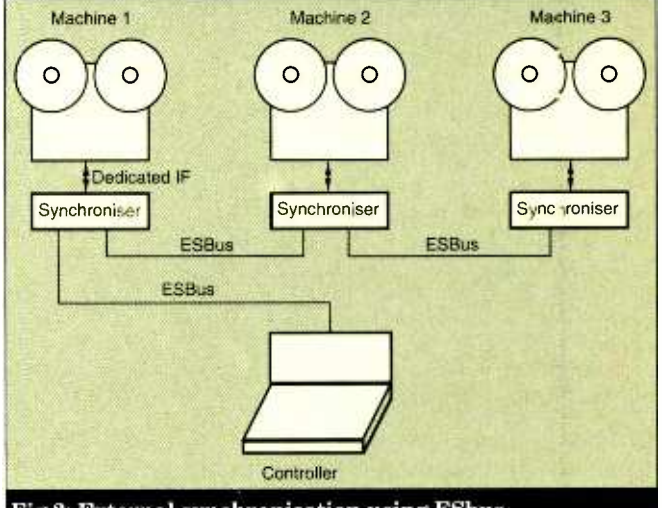


Fig.2: External synchronisation using ESbus

Since only a small number of tape machines have been equipped with built-in synchronisers and ESbus interfaces, a halfway-house solution has been adopted in some cases. Audio Kinetics ESbus range of equipment uses a modular synchroniser for each controlled tape machine which communicates with the tape machine over whatever dedicated remote interface is required, and this synchroniser in turn communicates with the AK controller over an ESbus link. Thus the ESbus interface and synchroniser is effectively external to the tape machine (see **Fig.2**).

It is no surprise that those most keen on ESbus are the independent edit ▶

controller and synchroniser manufacturers (because it would make their job easier if every tape machine talked the same language), whereas many tape machine manufacturers have been less enthusiastic. If you are a manufacturer of videotape recorders, for example, you can force your customers to buy your edit controller by having a unique remote control interface. With a universal remote interface, the customer is able to mix and match machines from different manufacturers in a large system. There are a few ESbus-equipped audio tape recorders: Panasonic's DAT machines are one example.

MIDI time code and cueing

MIDI is an example of a universal remote control interface (originally designed for musical instruments) which has now found its way into all sorts of applications never originally envisaged. Its universality in studios and live setups has encouraged designers to use MIDI for automation applications such as machine control, synchronisation, lighting control and complete multimedia extravaganzas such as those mounted in theme parks or museums. It is remarkable that the MIDI standard, which in many parts is so loose and non-proscriptive, works as well as it does, but this is largely because it is governed by the principle that it should be cheap to implement and equally open to simple implementations as to complex ones. The issues raised here are expanded considerably in the newly published book *MIDI Systems and Control* (2nd Edition), as detailed in the Further Reading at the end of this article.

MIDI Time Code (MTC) was introduced back in 1987 as a means of translating SMPTE-EBU time code into a form that could be carried as standard MIDI messages, and this opened up the world of MIDI to integration with professional audio and video. MIDI sequencers were able then to control events with relation to hours, minutes and seconds, rather than to musical bars and beats, which is vital for operations such as sound effects dubbing and film music composition. A lesser-known part of the MTC standard is the provision for setting up cue points and events within intelligent MTC peripherals, such that they can be programmed to execute the programmed events when a particular time code value is received. The intention was that all sorts of studio devices, such as CD players, tape machines and samplers, could be equipped with cheap MTC interfaces and programmed to trigger replay, recording or any other event type at a particular time, under control of a computer running Cue List Manager software.

Although the time code part of MTC has been adopted widely, the cueing part of it is rarely used, and has really been superseded to some extent by the more recent MIDI Machine Control.

MIDI Machine Control

The MIDI Machine Control (MMC) protocol was introduced in 1992, and has a lot in common with ESbus (see above). It is another attempt at a universal remote interface for studio machines, but based on MIDI rather than the RS422 electrical interface. It is possible that it may stand a better chance than ESbus in the audio world, for the simple reason that nearly every studio already uses MIDI, and this protocol makes it possible for existing MIDI sequencers and other MIDI software to control studio machines as well as existing MIDI equipment. It is also very cheap to implement, and is not so rigid a standard as ESbus. It can be implemented in a very simple fashion, but there are possibilities for more complex operations.

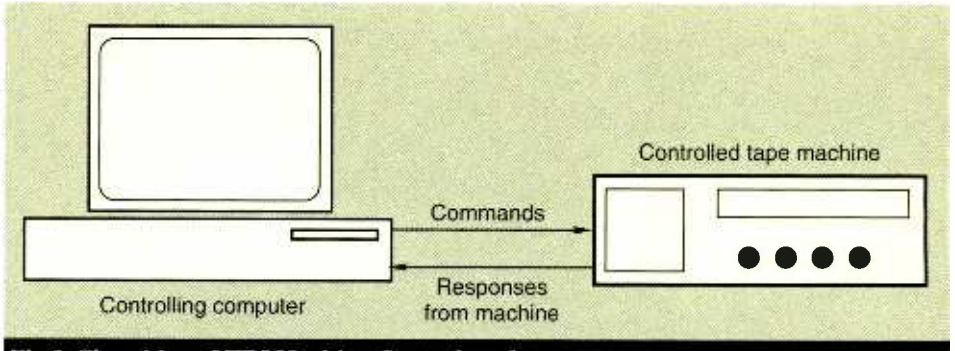


Fig.3: Closed-loop MIDI Machine Control mode

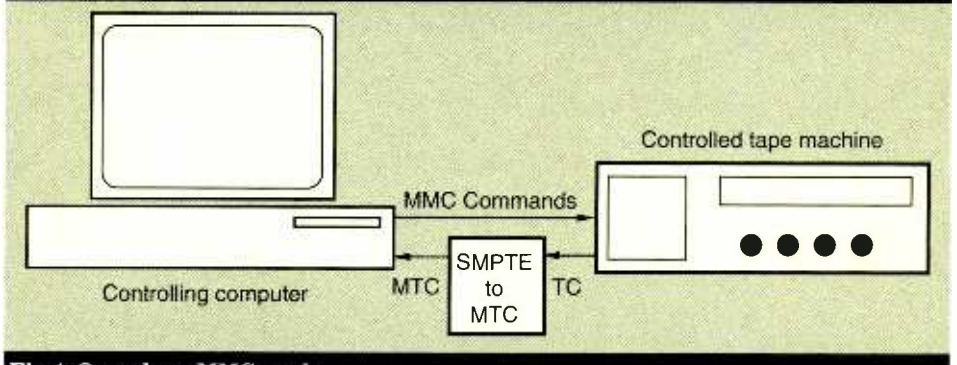


Fig.4: Open-loop MMC mode

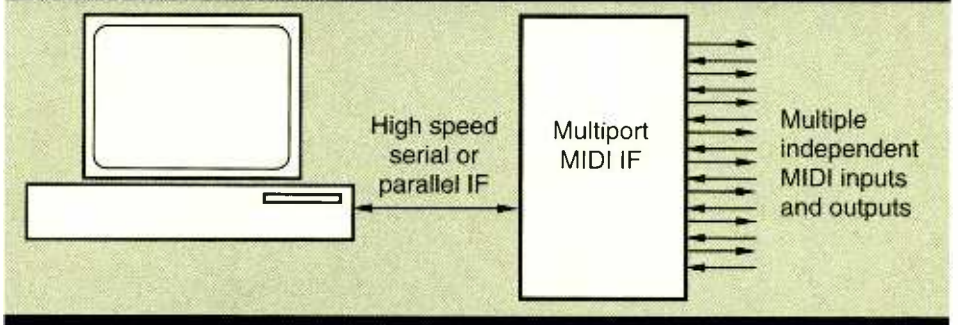


Fig.5: Multiport MIDI interface

In the way that commands are issued and responses expected from machines, MMC resembles ESbus, and the command set of MMC is modelled on the Audio Tape Recorder part of the ESbus standard. Because of this, any machine on which ESbus has been implemented should also be able to include MMC functionality with relative ease. In its simplest form, a computer running software with MMC capability will issue basic transport commands such as Play, Stop, Rewind, to a tape machine equipped with a MIDI interface. The software will often be the same software that controls the musical MIDI equipment, in other words a sequencer package. For example, Opcode sell a version of *StudioVision* for the *Macintosh* with MMC implemented, so that external tape machines can be made to follow the same transport commands as control the music sequencer.

It is possible to run MMC in open or closed-loop modes. In the closed-loop mode, as shown in **Fig.3**, commands from the controller may result in responses from the controlled machine. For example, the controller may ask for a tape machine's current status, or ask it its current time code location. Such an arrangement would be used in more advanced setups, whereas a simple open loop could be used where only basic transport functions were needed. In the open loop there is no response path from the controlled machine back to the controller. The controller distinguishes between open and closed loops by sending out a command and waiting to see if a response comes back. If no response is received within two seconds it may assume an open loop.

In an open loop situation, such as that shown in **Fig.4**, the controller issues basic commands to a tape machine using MMC. There are a number of ways in which time code can be fed back from the controlled machine to the controller. MMC devices (such as tape machines) are intended to be able to store their current time-code location in an internal register, which either means that they must have an internal time-code reader which reads time code off tape, or in simpler devices requires that tachometer or control track pulses are used to update the time-code register. In **Fig.4**, conventional SMPTE-EBU time code is taken from the machine's time-code output and converted into MTC using one of the many time-code-to-MTC convertors on the market. The MTC data is then read by the controller to determine the position of the tape machine. It may be necessary for the controller to send the current time code location back to tape machine in order to set its internal time-code register if it does not have an internal time-code reader of its own.

If the tape machine had its own internal time-code reader, it would be possible to do away with the SMPTE-EBU time code output altogether, as well as the SMPTE-MTC convertor. The MIDI Out of the tape machine could then send time code to the controller in the form of MTC data, possibly ▶

NOW WE'RE MOVING THEM.

SEE THEM MOVING ON STAND No. 9.2 D23 FRANKFURT MUSIK MESSE

Soundtracs have earned a reputation for introducing mixing consoles which continually set new industry standards for quality, innovation and value.

A reputation our competitors would die for.

Last year we sent them reeling with the stunning, high-end Jade Production console.

And if Jade turned them green with envy the new mid-range Solitaire is set to give them the blues.

Awash with features and function, the Solitaire Production Console combines the finest audio quality with DSP multi-processor control including the option of motorised faders.

Like someone once said - "Innovative in design, dynamic in operation".

Present on every channel the unique FdB Parametric Equaliser™ overcomes the problems of non-linearity in music and the ear providing precise control of all frequencies in the audio spectrum.

In addition, all monitors have a 2-band equaliser plus access to the FdB Parametric Equaliser™.

The on-board ADP, (Assignable Dynamics Processor), provides a comprehensive range of gating, compression, expansion, limiting, modulation and auto-par functions on each channel.

Plus there's the precision automation, in motorised fader or VCA flavours.

Quite a specification. - Quite a console.

Solitaire - much more than moving faders.

SOUNDTRACS

SOLITAIRE

Soundtracs PLC. 91 Ewell Road. Surbiton. Surrey KT6 6AH. England. Tel: 081 399 3392. Fax: 081 399 6821.

combined with MMC responses, to form a closed-loop arrangement.

A number of audio recorders now have MMC as standard, particularly those likely to be incorporated within the 'project studio' type of environment, such as the modular digital multitrack cassette machines which are taking the industry by storm.

Can MIDI cope?

Users of MIDI tend to worry about the inadequacy of the interface to carry much time-critical information, and may be concerned that one interface is carrying musical information for a studio full of sound generators and effects, as well as console automation data, machine control and time code. Whether or not this is a real problem in practice depends on the musical content and how the system is configured. Anyone running a serious MIDI-controlled studio or live rig needs to be using a good multiport MIDI interface with their computer, such as Opcode's *Studio 5* or Mark of the Unicorn's *MIDI TimePiece*. These interfaces can communicate at high speed with the computer, largely eliminating the data rate bottleneck which otherwise occurs at this point, and allow each controlled device in the studio to have its own dedicated MIDI interface (**Fig.5**). Each MIDI device is then only sent the data it needs, which drastically reduces the amount of data on each cable, and increases the effective number of MIDI channels in the system (since each MIDI port on the interface is capable of carrying data for all 16 MIDI channels).

It is then up to the sequencer software running on the computer to optimise the handling of MIDI events, including timing information. The various MIDI operating system extensions available from the top-end sequencer manufacturers deal with the optimal routing and timing of MIDI data in conjunction with multiport interfaces. Of course there are limitations in responsiveness and speed owing to the nature of MIDI as a relatively low-speed serial interface, and it is not designed as a real-time control network with guaranteed limits on the delay of messages, but the fact is that it works 95% of the time, it's everywhere and it's cheap! Users will have to weigh improvements in reliability and speed which might result from an alternative means of control against the increased cost and lack of universality.

PA422

PA422 is a remote control bus and protocol designed mainly for PA equipment, and is based on an RS422 serial bus running at 19.2kbaud. It will run distances over 1000m and can be used to connect up to 255 devices in a daisy-chained fashion to a controller. It became an AES standard in 1991. Controlled devices cannot initiate any sort of communication with the controller, requiring that the controller polls them if it needs to find out their status. It may be superseded by AES24, described below.

MIDI Show Control

MIDI Show Control (MSC) was introduced in 1991 as a means of allowing MIDI systems to control things like lighting rigs, theatrical equipment, live shows and A-V equipment. It is based on the sorts of commands used in computer-based lighting controllers and other show-control approaches such as those used in theme parks and museums.

MSC messages are carried as universal system exclusive MIDI messages, and fall into a number of categories such as 'lighting', 'sound', 'machinery', 'video', 'projection', 'process control' (dry ice, smoke and so on) and 'pyro' (flames, explosions and so on). Many of the MSC messages are basic commands like 'go' or 'fire' with a cue number to indicate which of a stored list of cues is to be executed.

AES24

Work has been going on in the AES over the past few years to standardise a means for controlling and monitoring audio systems using a computer network. Networked approaches are gradually superseding the concept of the point-to-point remote control interface that has been used over that last 20 or so years, and this acknowledges the increasing use of computer control in all areas of audio. Network technology is now getting to the point where the cost per node is reasonable (although still not as low as MIDI).

The Draft AES24ID document, which was published in December by the AES, is intended as a discussion document and introduces an object-based protocol for controlling and monitoring a wide range of audio equipment such as amplifiers, mixers, equalisers, and other devices. It does not appear to preclude the control and synchronisation of tape machines or other such equipment, although it is not specific on the matter, being a relatively open protocol with many of its applications currently undefined. Those working on the AES24 standard are conscious of the need to maintain as much compatibility in appropriate areas with MIDI remote protocols such as MSC and MMC.

Work on the AES24 standard (conducted by the SC-10 subcommittee) has been intentionally split into two parts: one being the application protocol dealing with the structure of messages and the object-based approach to control, and the other looking at the transport mechanism for the data. What has been published for discussion is the application protocol, whereas the transport network is still to be defined. The SC-10 group put out a 'call for technology' last October, as a means of inviting proprietary network technology manufacturers to submit their approach for consideration as the (or one of the) recommended transport mechanism(s).

It is likely that the chosen transport technology will perform in a deterministic fashion, that is it will be able to deliver packets of data from controller to destination in a specified time-frame, with a known maximum delay. This is a requirement of many real-time control systems, and is important for audio control since many applications may be time-critical. SC-10 is also looking for technology which can be implemented at a low cost per node (around $5), since this will be the deciding factor in determining whether a manufacturer will implement it or not. There is a difficult decision to be made here between settling on a high-performance, high-cost network which will be relatively 'future-proof', and a lower speed, low-cost solution which could be implemented today. The evidence from MIDI is that a widely-adopted, low-cost solution with adequate performance for the majority of situations is the correct choice. There is no point in a standard which cannot be implemented widely.

One of the problems in settling on a network system is the dilemma over whether or not to allow for the possibility of the network carrying digital audio in the future. The data rate required for digital audio is vastly in excess of that required for control data, and this puts a completely different face on the problem. Clearly there are benefits in what might loosely be called a multimedia network, carrying audio, video and control data, but there is a distinct need for a network with the single clearly-defined purpose of control. The cost of implementing a network designed to carry digital audio on a low-cost amplifier would probably be prohibitive.

MediaLink

The MediaLink protocol was introduced in 1989 and is still under further development. It is principally a fibre-based network protocol, but it is possible to run it over other media, and currently there is a version running at 125kbit/s which carries MIDI, RS232 and PA422 data for control and monitoring purposes (MediaLink 1). Current development centres on the manufacture of a custom chip for high speed networking which could be installed in virtually any product intended for multimedia applications, so as to allow the network to carry audio, video and control data, as well as other types.

MediaLink's manufacturers, Lone Wolf, have demonstrated multiple audio devices from different manufacturers being controlled over a significant distance, and the company already sells devices which allow a large number of MIDI channels to be multiplexed on a single optical fibre and routed over distances much greater than those possible with ordinary MIDI. The company appears to see itself as a strong contender for the AES24 transport prize, although the costs of MediaLink 1 implementation currently seem considerably higher than the AES24 goal of $5 per node.

The future

It is my prediction that MIDI Machine Control will be used increasingly in audio equipment, and will succeed where MTC cueing did not. One computer with a multiport MIDI interface could then be used to control nearly all automated studio operations. MMC may also be more popular as a means of implementing ESbus-like control than ESbus itself, which would be ironic.

It would be reasonable to suggest that computer-controlled data networks will begin to take over from dedicated remote interfaces in the near future, particularly in the field of audio system control. The universality and cheapness of MIDI as a remote interface will ensure its continued existence for many years to come, especially in the music industry, and we may well see a long crossover period between MIDI and a higher speed network carrying MIDI-like data as part of its protocol, with intermediate gateways to convert between the network protocol and a number of individual MIDI interfaces. ■

Further reading

1. 'Application Protocol for Controlling and Monitoring Audio Systems.' *Journal of the Audio Engineering Society*. Vol.41 (12). December 1993.
2. M Karagosian, 'Report of the SC-10-1 Working Group on Data Communications.' *Journal of the Audio Engineering Society* Vol.41 (11), November 1993.
3. M Lacas and D Warman. *The MediaLink Real-Time Multimedia Network*. Presented at the 95th AES Convention, New York, 7–10th October 1993. Preprint 3736.
4. *MIDI Show Control 1.0*. International MIDI Association. 1993.
6. *MIDI Machine Control 1.0*. International MIDI Association. 1992.
7. *MIDI Time Code and Cueing*. International MIDI Association. 1987.
8. F Rumsey, *MIDI Systems and Control*, 2nd Edition. Focal Press, Oxford and Boston. 1994.

"THE BEST"

Just Keeps Getting Better...

FRANKFURT Musik Messe Stand 9·2·B27

"The M5000 is part of my standard rack."

George Massenburg

Grammy™ Award winner and TEC "Hall of Fame" Engineer

"A cleanliness that makes me wish I could remix every record I've ever done."

Roger Nichols

Grammy and TEC Award winning Engineer

"The depth of field and remarkable quality puts this unit at the top of my list of reverbs I will use on every project."

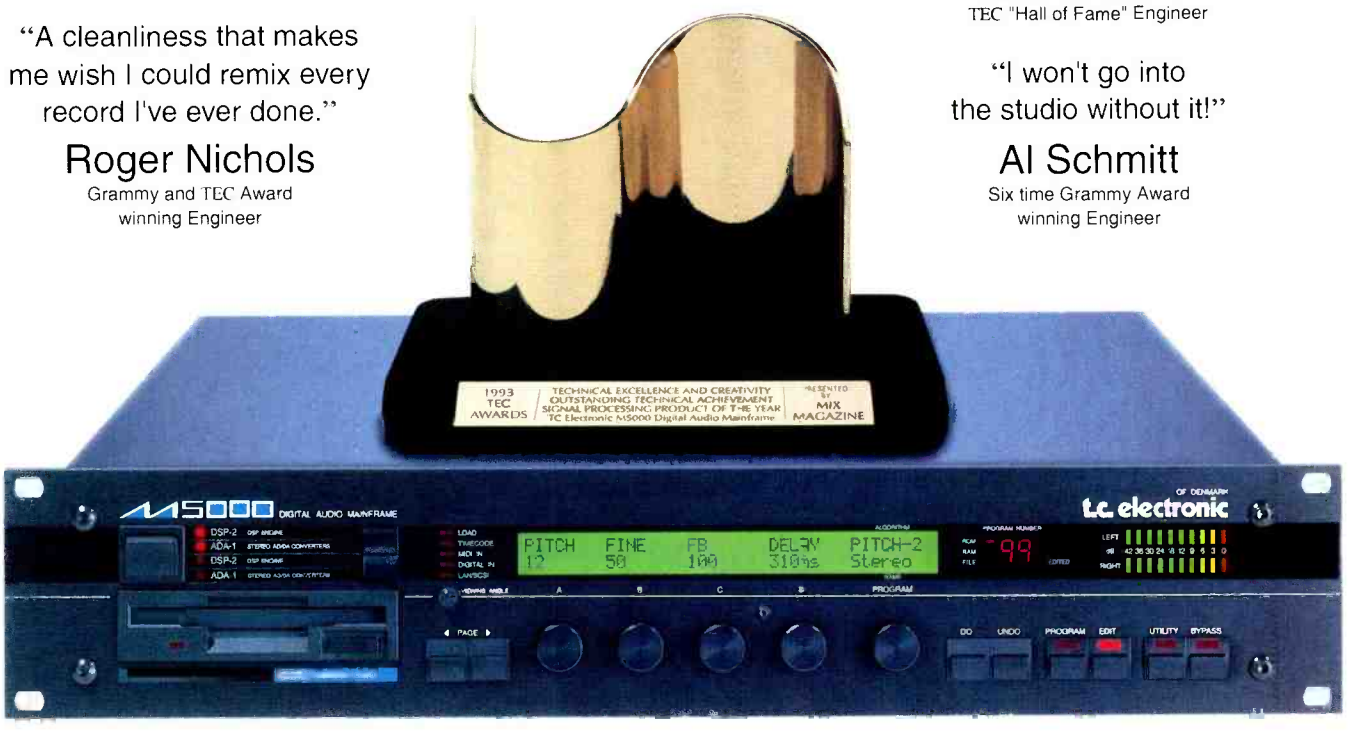
Bruce Swedien

Grammy Award winner and TEC "Hall of Fame" Engineer

"I won't go into the studio without it!"

Al Schmitt

Six time Grammy Award winning Engineer



...and better and better. The M5000 is the only software *and* hardware upgradable digital signal processor in the world. No need to purchase a new unit every few years. Under continuous refinement, the M5000 will serve you for years to come.

Unlimited User Presets
Talk about storage capacity...22,077 user presets will fit on a standard 1.44Meg floppy disk. PCMCIA memory card too.

The 60 sec. Upgrade
A "NEW" M5000 is as near as your mailbox or modem, since the latest software is always on our exclusive 24 hour BBS.

Sampling Here NOW!
Short sampling is standard and very easy to use. Trigger from analog, digital, MIDI or pedal inputs.

VER. 1.12

Minutes of Sampling
Our Extended Sampling Option permits fast triggered samples up to 3 minutes in phase locked Stereo or 6 minutes in Mono.

The 100+ Presets
include Reverb, Nonlinear, Ambience, Pitch, Chorus and Delay like no others. Third party software to be available soon.

FREE UPGRADES
Upgrading your M5000 to the latest standard software is fast, easy and best of all FREE of charge!

VER. 1.12

Expandable Hardware
Want a second "machine" in your M5000? Simply install expansion modules. It's cost effective and no additional rack space is required!

8 Channels I/O
In the digital domain you can expand the M5000 to four independent stereo "machines" using the AES/EBU, SPDIF or Optical I/Os.

VER. 1.12

TEC
TECHNICAL EXCELLENCE & CREATIVITY
1993 WINNER

OF DENMARK
t.c. electronic

International Head Office - Grimhøjvej 3, DK-8220 Brabrand, **DENMARK** - Phone:(+45) 86 26 28 00 Fax:(+45) 86 26 29 28
AUSTRALIA (02) 975 1211 • **AUSTRIA** (222) 601 17 • **BELGIUM** 011 28 1458 • **BRASIL** 21 325 9221 • **CANADA** (514) 738 3000 • **CHILE** 2 231 2356 • **CHINA** 1 8515533
ENGLAND 0691-658 550 • **FINLAND** (9) 0592055 • **FRANCE** (1) 48 47 45 26 • **GERMANY** 05231-3297 • **GREECE** (01) 8837 629 • **HOLLAND** 030-414500 • **HONG KONG** 3 620202-5
INDIA (22) 615-0397 • **ISRAEL** 03-5441113 • **ITALY** (02) 50841 • **JAPAN** (03) 3332-3211 • **KOREA** (822) 741-7385 • **NORWAY** (22) 710710 • **PORTUGAL** 1 4754348
SINGAPORE 7489333 • **SPAIN** (93) 340 55 12 • **SWITZERLAND** 56 32 18 50 • **TAIWAN** 2 719 2388 • **THAILAND** 480-6923 • **U.S.A.** (805) 373-1828

MIDI MANAGEMENT

Premier fader manufacturer Penny & Giles have produced a professional real-time MIDI controller. Vic Lennard lets his fingers do the talking in this exclusive review

For many of us, real-time MIDI control is an essential aspect of modern musical life. From lighting rigs and general MIDI equipment in the live arena, down to activating a synth's filters in the studio—a central MIDI control unit can be worth its weight in gold.

Previous attempts to build such a unit have only met with partial success—perhaps due to the religious use of 'standard' faders. While to many this is infinitely better than moving an on-screen fader with a mouse, the problem of movement from one setting to another, and the resulting lack of fader position update, has never been solved. The best results have probably been achieved with a pair of arrow-shaped LEDs next to the fader (where a button is held down to disable the fader which is then moved until both LEDs are alight, so establishing the current fader, or 'null', position).

Penny & Giles believe they have the answer and have implemented it in their brand new *MM16 MIDI Management System*. Instead of using a normal fader, a clear, ridged nylon caterpillar track has been placed over a static 20-segment LED bar display—the LEDs always show the current fader status so removing the need to find the null position. P&G call this an 'Endless Belt' and the fact that no-one has previously developed a similar 'fader' is quite incredible; such innovation represents a significant step forward over many aspects of fader design.

Layout

The *MM16* is aimed firmly at the professional market and so is substantial in build, weighing some 6.5kg and measuring 43cm by 24cm by 14cm in a gentle wedge shape. While there are holes to facilitate rackmounting, it is unlikely that anyone would want to use the *MM16* vertically; access to the rear sockets is made awkward as is removal of the locking external PSU lead.

The main part of the *MM16* has 16 channels of belts, each with an associated switch, or 'key' as P&G refer to it, above. The program-select buttons to the left allow access to the 64 different programmable patches, in eight banks of eight, while directly above this are the eight control buttons. Above this arrangement is a 2-line by 20-character backlit display, a pair of buttons with which to move the on-screen cursor and a large easy-to-use rotary wheel for parameter changing. The latter function can also be carried out with a pair of dedicated increment-decrement buttons. Finally, the *MM16* offers three buttons for sequencer control (transmitting MIDI Start, Stop and Continue commands) and a further five buttons to handle MIDI Machine Control commands.

A fair degree of thought has gone into the design of the rear of the unit; P&G appreciate that most MIDI systems comprise multiple units and so have equipped the *MM16* with two banks (Main and Auxiliary) of six, parallel MIDI Outs, so removing the necessity for a MIDI Thru box. Additionally, a merging MIDI In is provided so that a MIDI keyboard can be incorporated into the system, and a Control MIDI In is intended to be connected to a sequencer's MIDI Out so that any *MM16*-specific data can be acted on. A pair of footswitch sockets and a RAM card input complete the rear arrangement.

Belts and keys

Each of the 64 patches holds information concerning the 16 belts, 16 keys and a setup message. Editing such data is remarkably easy; a swift press of the EDIT button and the display changes to show the setting for the current fader or key. At the moment, the cursor has to be moved to the part of the screen displaying the belt-key number to select the particular element you wish to edit; P&G assure me that in the final software version the simplest action will make an item active. Once selected, any aspect can be changed.

A belt can be set to control any of the major MIDI functions, namely: MIDI Controllers, Aftertouch, Polyphonic Aftertouch and Pitch Bend. Any belt can be designated as a Group Master to control any number of other belts, a particularly helpful facility when handling group fades or swells. Also, a string of MIDI data (up to 64 bytes) can be set which is very useful when dealing with the System Exclusive side of life. The belt value can be inserted in such a string so that different messages are transmitted dependent on the position of the belt. While this lets you make real-time parameter changes to MIDI equipment, no allowance has been made for the checksum facility used by various manufacturers. Consequently, this facility of the *MM16* does not work with any modern day Roland equipment (post-*Sound Canvas*) among others. Another minor beef is that for those of us who prefer to use the buttons for increment-decrement rather than the wheel, it would be nice if said buttons scrolled through numbers when held down rather than require you to repeatedly click on them. The same can also be said of the cursor movement buttons; it is frustrating to have to continuously click on these in order to scroll through a MIDI string.

As might be expected, the keys access the more switch-orientated types of MIDI message such as notes, program changes or specific MIDI Controller values. Keys can be set to either momentary or toggle which is particularly useful for accurate control of note lengths or MIDI Controller functions such as sustain pedal. In a similar vein, independent strings of MIDI data can be set for both the press and release of a key; this can be put to very good use with rackmounted synths whose sound functions are usually a closed book. For instance, MIDI strings can be used to set and control the filter cut-off or resonance of an analogue synth such as the Oberheim *Matrix*

1000. A key can also mute its associated belt which gives you the opportunity of effectively removing a belt from the scene, setting its position according to the displayed value and reintroducing it.

Snapshots

At the heart of the *MM16* is its ability to save all current belt positions in one of 128 available snapshot locations simply by pressing SNAP followed by STORE. A snapshot can then be fired off at the press of the SEND button. Also, the snapshot number can automatically increment so that you can easily recreate all necessary scenes for a performance.

This particular aspect of the machine has been well thought out. Selection of a particular patch via the front panel or an external program-change command can also be accompanied by the sending of a snapshot, and either of the rear panel footswitches can carry out the same task as hitting the SEND button, including incrementing or decrementing the snapshot number. From a live point of view, this is most desirable.

If there is a fly in the ointment, then it has to be that snapshots are not reviewable—you simply cannot check the various settings.

Other facilities

The optional RAM card can be used to back up all programs or all snapshots and you have the option of operating directly from the card if you wish. This effectively gives you easy access to 128 programs and snapshots.

With the ability to transmit MIDI Clock, the *MM16* can act as a central master timing device. The inclusion of the two dedicated sets of MIDI sequencer and MMC keys adds strength to this. However, it would be more sensible to allow you to set the strings of MIDI data for these keys; not all transport-based devices can recognise MMC commands.

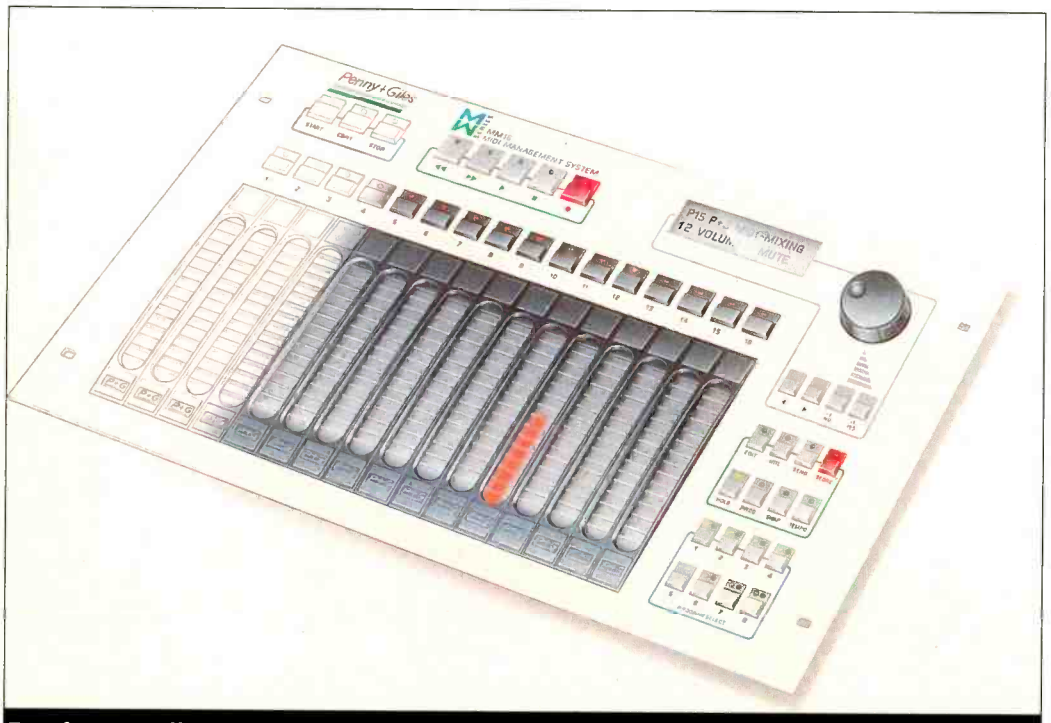
By incorporating a Control In port, MIDI Controller data from a sequencer can directly manage the positions of the belt LEDs. As there are occasions when this would be undesirable, there is the option of stating which belts and keys will respond to update information.

Apart from sending snapshots, the footswitches can also recall programs, transmit MIDI program changes, drop in and out of MMC record, operate the start-continue feature or create a tempo change by pressing on a pedal twice. All of these functions add to the general worth of the *MM16*.

Conclusion

There is little doubt that the *MM16* has been built on the back of the Endless Belts, but there are aspects of the unit that are of concern bearing in mind the UK price tag of £1,575.

It is almost impossible to edit at speed in a live situation. Take the ▶



Development illustration of the *MM16*

typical situation of working within a bank of eight programs—to save having to hit two numerical keys each time (the first for the bank number, the second for the program within that bank), the *MM16* has a HOLD key which freezes the current bank. After entering Edit mode, manoeuvring your way to the relevant key or belt, (as noted above, keys and belts cannot be selected by operation in this mode), altering a particular aspect and exiting, the HOLD key is automatically disabled. In a tight spot, it is easy to forget to turn HOLD back on with potentially disastrous results. It is fair to say that the review model had software v0.94; some of the noted problems are likely to have been corrected by the time v1.0 is available. An internal memory dump via System Exclusive will definitely be included.

It would be encouraging to see either an external video monitor socket or a computer interface. This would make it possible to immediately overview all parameters for a program and to see snapshot settings. The external power supply is also of dubious quality —having opted for a locking metal plug and socket at the body of *MM16*, P&G have then used flimsy bell-wire cable that may snap.

Were the *MM16* to be priced at, say, £600 or £700 then it would appeal to almost all those who want a professional quality, real-time MIDI control device. As it is, the price tag will certainly place it out of the reach of any nonprofessional interested parties (especially as the Peavey *PC1600*, which offers similar facilities, is available for a small fraction of this asking price).

There is one question that begs an answer; which console manufacturer will be the first to utilise these faders? They offer all the advantages of expensive, up-market systems (and a few more besides) at a fraction of the cost— as such they appear to be custom-made for a budget automated desk. Perhaps they should be renamed the poor man's moving faders... ■

Penny & Giles Studio Equipment Ltd, Blackwood, Gwent NP2 2YD. Tel: 0495 228000. Fax: 0495 227243.

Think about fast multitrack editing, go Xtrack audio workstation.

Think about a powerful tool for real-time creativity, immediately operational, without tedious start-up delays, for which everything is fast and easy.
The sound is perfect*,
playback is instant.
Your manipulations
are intuitive,
your movements are natural,
let your inspiration go free,
everything is allowed.
Spontaneously,
you can forge your sounds
on several tracks,
make loops,
use time-stretching...
In the post-production,
you edit your audio directly
synchronised to the frame.
At any moment,
you can quickly modify,
change or enhance
your audio track.

The sound library is
immediately accessible
and multiple levels of backup
let you undo as you like.
Production security is total,
your mind is free,
nothing can stop you...
Think about and go for
an audio workstation
easy to install
and largely compatible,
far from the cost
and complexity
of dedicated systems.

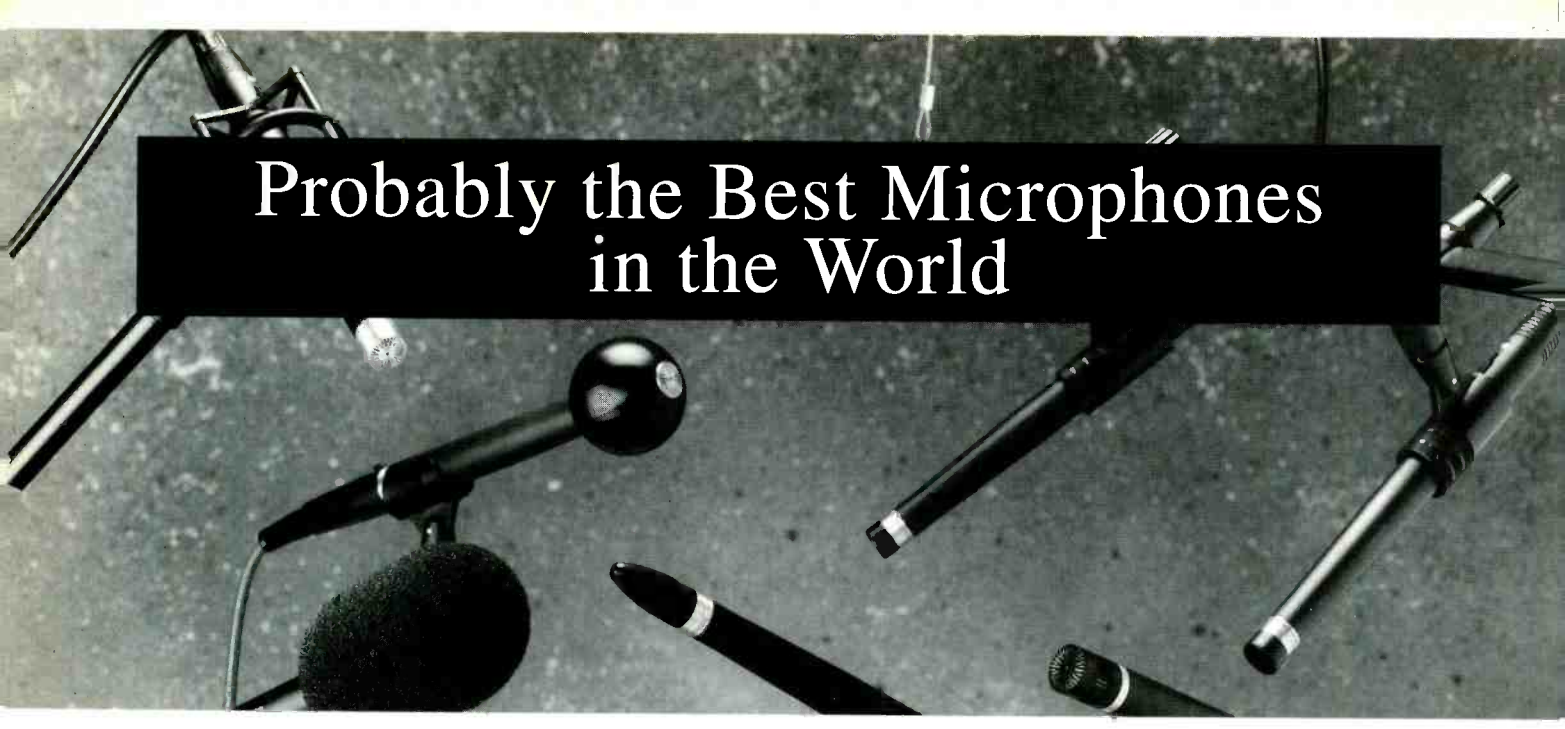
To discover Xtrack,
just return this reply coupon
to receive a demonstration
cassette or documentation.

Digigram
Parc de Pré Milliet,
38330 Montbonnot France.
Phone: 33/76 52 47 47.
Fax: 33/76 52 18 44.

Xtrack supports layers 1 and 2 of the ISO/MPEG Audio standard (Musicam).

Name:..... Surname:.....
Position:.....
Company:.....
Address:.....
.....
Phone:.....
Please send me an Xtrack demo tape.
❑ VHS format ❑ PAL ❑ SECAM ❑ NTSC
Betacam SP format on request
❑ Please send me an Xtrack documentation.

Digigram



Probably the Best Microphones in the World

Listen to the Truth

Three good reasons why people like George Massenburg and Bruce Swedien use B&K microphones when they record their award-winning albums: clarity, accuracy and transparency. Calum Malcolm, producer of the Blue Nile and Simple Minds, uses B&Ks in preference to all else. *"In ten years, I haven't found anything that will outperform the B&K 4003."*

Brüel & Kjær

Danish Pro Audio ApS
Hejrevang 11 • DK-3450 Allerød • Denmark
Tel.: +45 48 14 28 28 • Fax.: +45 48 14 27 00

Australia (03)4289797, Austria (022)3626123, Belgium (02)5227064, Denmark 48142828, Finland (90)582055, France (01)46670210, Germany (081) 4253980,(061) 714026, (022)16401326, (030)559 6627, Holland (03) 4025 2570, India (22) 6150397, Ireland (01)545400, Italy (02)5084272, Japan (03) 54207307, New Zealand (07)847343414, Norway (66)904410, Poland (02)2275061, Portugal (01)692456, Singapore (065)7489333, Spain (03) 2034804, Sweden (046)320370, Switzerland (01) 8400144, UK (081) 4524635, USA & Canada (519) 7451158, Venezuela (582) 358082

MasterDisc™ . . . A kind of magic

MasterDisc™ is a new series of CD-Recordable discs by Audio Design. Experience indicates that users, who intend their CDs to be masters, require the best possible disc performance. All discs have variations in tolerance and many makes are marginal in certain areas. This fact, coupled with further variations in the CD-Recorder mechanisms, can mean higher error rates than ideal.

Audio Design's policy for MasterDisc™ is to constantly monitor disc manufacturing sources, so as to select the best disc available for mastering purposes.

Each Masterdisc™ has two additional top protective layers, so that information can be safely written with a soft felt-tip, or used with the Audio Design label segments.

Audio Design offer a range of **competitive CD-R media**, plus specialist CD-R services, including fast turn-round **custom screening**, small quantity **label and inlay printing** in mono-chrome, full process or line colour.

™MasterDisc is a trademark of Audio Design

AUDIO DESIGN

Unit 3 Horseshoe park, Pangbourne, RG8 7JW, UK
Tel: +44 (0) 734 844545, Fax +44 (0) 734 842604

FABULOUS FOCUSRITE

Focusrite's 72-input *Studio* console with *GML* automation in the Crescente Studios, Japan

Patrick Stapley gets an exclusive preview of Focusrite's forthcoming in-line console design

Since Focusrite were taken over by Phil Dudderidge in 1989, the company have sold nine of their prestigious *Studio Consoles*. During this time there have been two persistent comments coming back from potential customers that Focusrite have associated with the possibility of lost sales. The first is that the *Studio Console* lacks inputs relative to its size, and the second is that it does not include a recall system.

Focusrite have decided to address both these issues by developing a dual-path in-line module that includes a recall system for the pots and automatic reset for the switches. As yet the module exists only on paper, but *Studio Sound* have been given an exclusive preview of the design and permission to publish the preliminary CAD drawings.

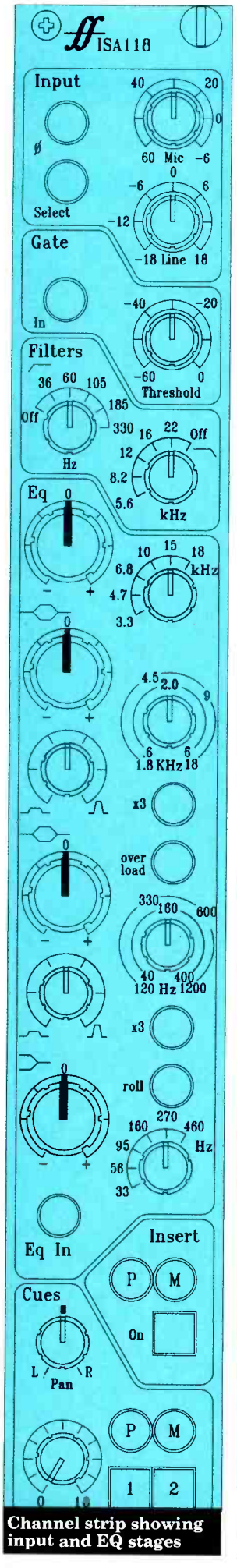
Apart from offering an alternative in-line version of the *Studio Console*, the newly designed module can also be used together with existing single path modules to form a hybrid 'split-line' desk. Although the new module is not directly retrofittable to the old frame, due to physical differences and different bus cards, it is available by means of exchanging or adding complete bays. In-line bays remain identical in external appearance and dimensions to the existing bays; they contain eight channels and can be supplied to form either a curved or a straight console format.

The module

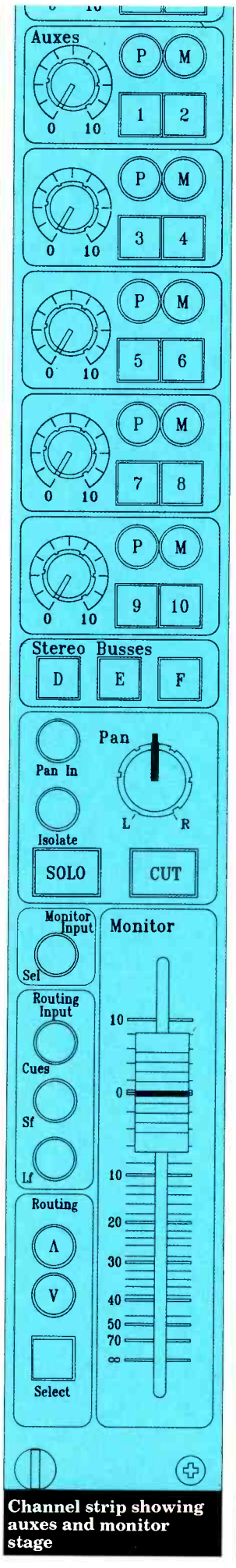
The current arrangement of the *Studio Console* is such that each channel splits into three separate modules—the ISA 110 which contains mic-line preamps, equalisation and phase inversion; the ISA 111 containing insertion switching, auxiliary sends, routing control, and pan; and the ISA 112 which houses the fader with its solo, cut and group-tape switching. The new in-line version has just two modules—an ISA 119 channel fader-module and a full-length ISA 118 both of which retain the Focusrite circuitry exactly while adding a second signal path with its associated switching, and a noise gate.

The decision to combine the original channel-strip modules into a 1-piece module was principally for 'hunger of real estate', and has resulted in a 2.5cm gain of usable panel space where the two modules were previously joined. Internally space has been maximised by running two large boards down the full length of the strip achieving a 20% increase in board area.

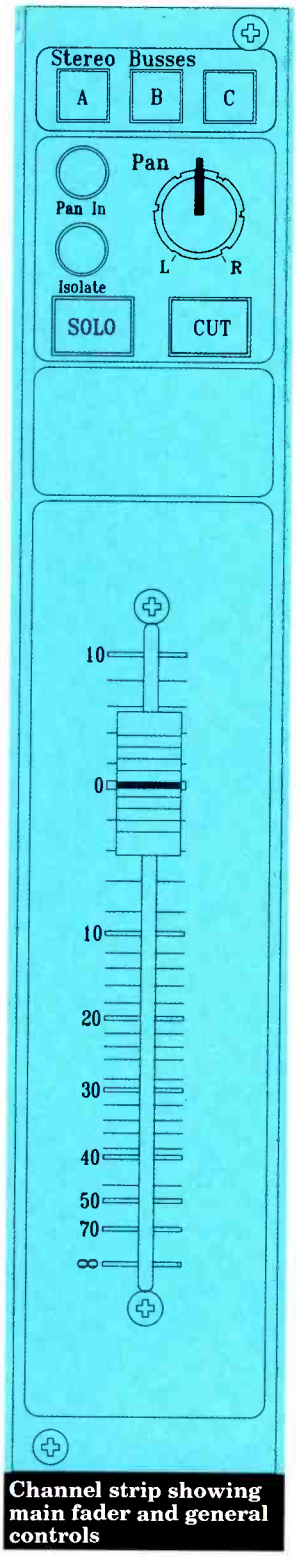
Working from the top of the channel down, the first noticeable change is to the input section which now incorporates a SELECT button. This operates in a similar way to the console's routing assignment, by stepping through input source selection (Mic, Line or Tape) which is indicated by a display in the penthouse section of the channel. As before Mic and Line inputs have separate gain controls, while the ▶



Channel strip showing input and EQ stages



Channel strip showing auxes and monitor stage



Channel strip showing main fader and general controls

Tape input (once selected) is controlled by the Line gain (-18dB to +18dB). The TRIM control that was previously included has been removed and the gain controls are now continuous rather than 6dB stepped to compensate. Also in this section is a PHASE INVERSION switch.

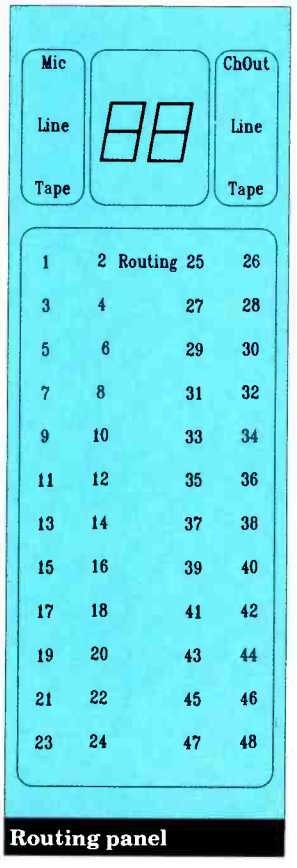
Below the input section is a simple gate operating at a fixed fast-attack and with an envelope controlled ratio which has been designed to avoid tail cut-off. Although the design has been derived from previous Focusrite dynamics it does not use a VCA. Focusrite have always resisted VCA circuitry in their consoles to avoid compromising the signal path; but exactly how this device works remains, for the time being, an R&D secret. The gate operates only in the channel path.

The next change is to the equaliser, which has been differently laid out. Instead of the high and low-pass filters appearing at the bottom of the section, they have now been moved to the top; also the four bands have been repositioned and are now organised in terms of frequency with HF controls at the top and LF at the bottom, rather than being sectionalised into shelving and peaking filters. The new arrangement does away with individual switches for shelf and peak sections, and there is now just one overall EQ IN-OUT switch. The frequency range and curves remain identical although a roll-off selector (marked ROLL) has been added to the low-frequency shelf—Focusrite's Development Director, Richard Salter, explains why.

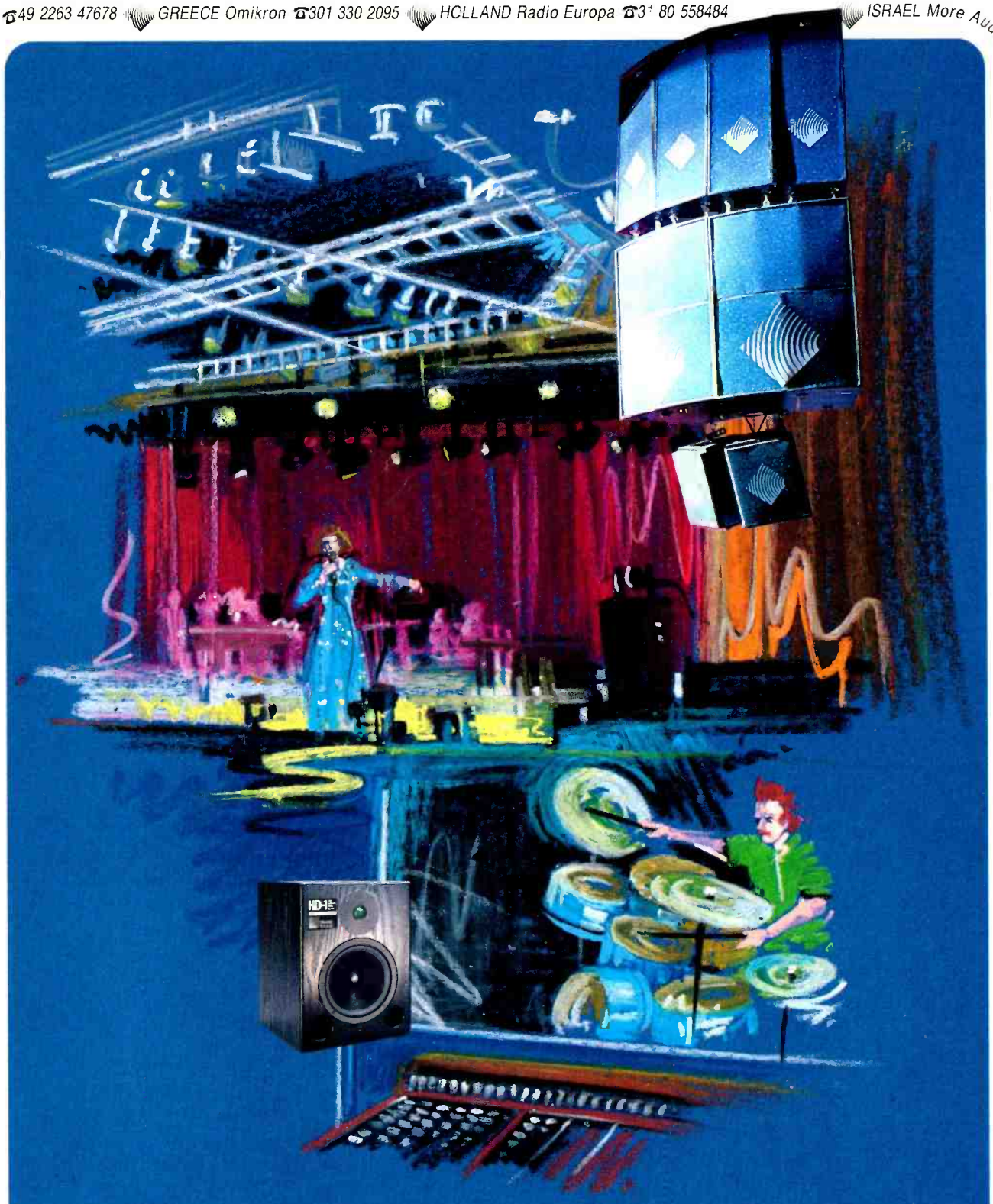
'The ISA 110 equaliser is often compared with the *80 Series* of Neve consoles—particularly the *8070* type which have the 1073 equaliser fitted. In the older Neves they used to roll-off the bottom end from about 20Hz downwards with a very mild phase shift so it produced quite a benign effect. In the case of the ISA 110, the response is flat down to about 4Hz, and this can produce problems with an LF shelf when you come to boost signals as it will also bring up the crud between DC and 15Hz. To avoid this we've added a selectable roll-off from 20Hz which mimics the style of the gentle roll-off electronics used 20 years ago. When boosting, you end up with a broader curve than a traditional bell which has a flat rather than a rounded top to it; when cutting frequencies the curve will look like a double step going from a flat shelf plateau to roll-off at 20Hz.'

Perhaps one of the biggest surprises for an in-line design is that the EQ section is not assignable between the channel and monitor paths. Instead it remains fixed in the channel path. Richard Salter provides the rationale behind this.

'This was the subject of some debate, but what finally drove us to leaving the EQ in the channel path came down to one fundamental issue—audio quality. We have a signal path that is extraordinarily quiet and extremely clean; and by putting a second input into the same channel strip you obviously introduce the problems of crosstalk and interaction which must be addressed. With functions such as cue sends where selection is sourced from one path or the other it's like an input selector switch and there is little chance of crosstalk finding its way back into the main signal path even though the two paths are in very close proximity. However, allowing two signals to get as close as they do in an EQ crossover relay and maintain a crosstalk separation of better than -96dB right the way through to 20kHz is a little difficult. With other large manufacturers, where crosstalk figures are not as clean as ours, it's not so much of a problem, but ▶



Routing panel



Perfect images

For perfect images, Meyer has the Total Solution™ - long-throw arrayable loudspeakers for an arena system, unobtrusive high power units for theatres or night clubs, and compact high-definition studio monitors.

Meyer's successful formula combines high performance, top quality loudspeaker systems with state-of-the-art tools for real-time analysis. The results satisfy clients and delight audiences throughout the world.

Meyer Sound

The Total Solution™ for quality, performance and value.

MEYER SOUND

given that we are endeavouring to maintain bus noise at better than 100dB down, it is obviously essential to keep the crosstalk as low as possible. There's absolutely no point in having a good noise-floor if all you do is compromise it with poor crosstalk, so we made the decision to retain audio integrity by leaving off EQ path switching.

'The way round this operationally is in the way we've configured the inputs so that both Tape and Line can be sourced by either path. So for example, if a tape return on a monitor fader requires EQ, it can simply be sourced by the channel path.'

In the centre of the EQ section is the channel overload LED which operates at 3dB below clipping as measured at a number of critical gain points throughout the channel path. A monitor path overload LED is a likely addition that will appear at the top of the small fader.

Directly below the equaliser are the Insert switches which now include a MONITOR button allowing the insert point to appear either in the channel path pre or post the EQ, or in the monitor path pre or post fader.

The auxiliary sends are arranged as before into pairs with stereo CUES 1 and 2 at the top. Each individual send has an ON-OFF switch, and each pair share gain control, pre-post and chan-mon switching. The number of auxiliaries have been reduced from 12 to 10 due to space restrictions and also to allow for the extra stereo buses available to the monitor.

The 65mm Penny & Giles monitor fader is flanked by three routing source selectors (Channel, Monitor, Stereo Cue) and the routing control buttons. The 48-track routing operates as before with the UP-DOWN cursor buttons accessing tracks in the routing display, while the SELECT button confirms or cancels selection.

The small fader is not motorised although room has been left inside the module to fit motor control cards and so on, in the event that the customer may require it. The input to the monitor fader is sourced either from Tape, Line or from the Channel Output and as with channel inputs a single selector switch steps through the sources. All selections can also be switched from the centre of the console either globally or by individual bays.

Another operational surprise is that the desk contains no switchable Tape-Group monitoring facility or record machine Safe-Ready switching —both of which are present on the existing console.

'We looked very closely at the way people were using our consoles—and, indeed, other manufacturers' consoles,' says Salter. 'What we discovered was that the vast majority were using the tape machine remote to control Group-Tape switching and other machine functions, rather than using onboard controls.

'The view we've received from existing and potential clients is that this is something of a redundant facility given the sophistication of today's tape machine remotes, and is something that wouldn't be terribly missed. However, if a client particularly wanted us to incorporate this type of facility, it would be possible to provide a Group-Tape switching bank in the centre of the console that could be patched-in to control, say, half-a-dozen channels. But in our opinion to do it on a channel-per-channel basis is consuming a disproportionate amount of space for the utility it is providing.'

Both channel and monitor paths have separate access to a possible total of six stereo buses. The channel has routing buttons for stereo buses A, B and C, and the monitor for D, E, and F.

'We had a lot of good feedback concerning the three stereo buses in the original console,' comments Salter, 'as it allows studio owners to cater for elementary film and picture work very easily. One of the comments that has come out of that regarding the in-line module is that we should include access to all three stereo buses from the monitor path, and this led on to people asking if these buses could be different to the channel buses. If customers want all six buses rather than just three we will extend the cross-mixing matrix in the centre of the desk so that there are seven faders rather than four (A, B, C, D, E, and F with a final stereo output master). This has no penalty as far as noise is concerned but does, of course, improve operational flexibility.

'There will be another version of the module that will be totally transparent from the front panel, which along with modifications to the central monitoring panel, will provide film monitoring. In this configuration the implementation of the pan controls will change and the six stereo buses will become six triple-buses thus providing Left, Centre, Right panning.'

The new in-line channel is practically identical to the previous design when it comes to details such as colour scheme and the type of control knobs and switches that have been used. So far the only changes have been to reduce the size of some of the EQ BOOST-CUT knobs, the pan control knobs, and the SOLO and CUT switches to save valuable space.

With regard to automation and recall-reset, Focusrite are currently half-way through discussions with a particular automation manufacturer and it is still too early for them to say very much about it. However, they do confirm that they will not be manufacturing any of the moving fader system or recall package themselves, apart from some of the switch reset and data recall acquisition parts that will be in the module itself.

The company remain very aware of the importance of customer choice, and although they will be offering a proprietary automation system, they still fully intend the console to be used with other systems as Richard Salter confirms.

'We're aiming to make the console as flexible as possible, the last thing we want to do is stifle its appeal by restricting the choice of automation system. In the past we've supplied consoles with *GML*, *Flying Faders* and *Uptown*, and what we hope to do is offer packages whereby automation and recall-reset are combined.'

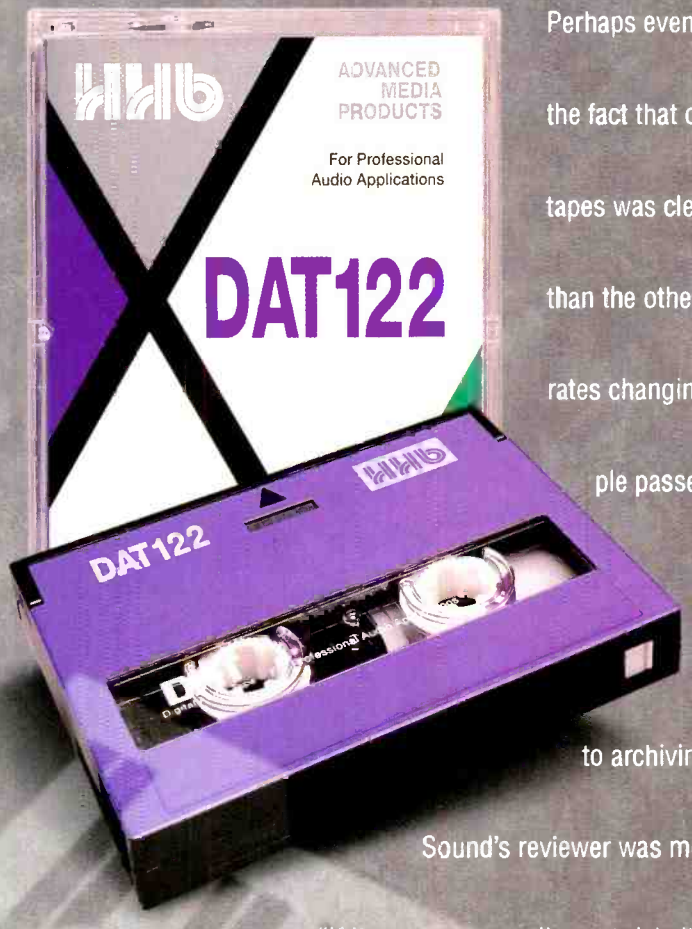
Focusrite expect to show their in-line console for the first time at the San Francisco AES in the autumn. The price will be on a par with the current console on a channel-for-channel basis, although, of course, the number of available inputs will have doubled. The new configuration will also enable something that before would have been a contradiction in terms—a small Focusrite desk.

As mentioned the information and drawings contained in this report are preliminary and should be viewed as such as changes may still take place. However, it does give a good indication of what the in-line configuration will have to offer, as well as providing an insight into the company's philosophy of listening to clients, being forward thinking and above all continually striving for audio excellence without compromise. ■

Focusrite Audio Engineering Ltd, Unit 2, Bourne End Business Centre, Cores End Road, Bourne End, Bucks SL8 5AS. Tel: 0628 819456. Fax: 0628 819443.
US: Group One, 80 Sea Lane, Farmingdale, New York, NY 11735. Tel:+1 516 249 1399. Fax: +1 516 753 1020.

ALL DAT TAPES ARE NOT THE SAME BUT DON'T TAKE OUR WORD FOR IT

Ask Studio Sound, one of the world's most highly respected professional audio publications. They recently subjected eight leading DAT tape brands to an exhaustive series of tests and the results should be of interest to everyone serious about audio.



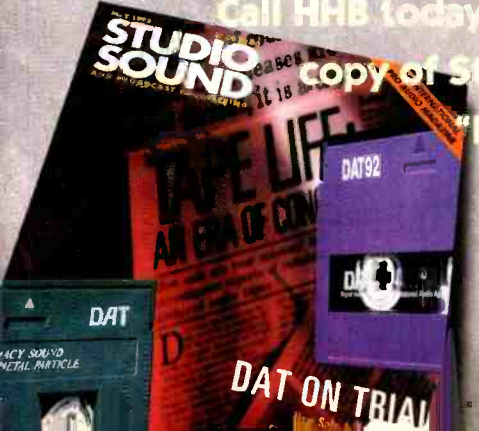
In the critical area of block errors, the tapes fell into two distinct categories of performance. Three exhibited similarly low error rates with the others presenting error levels considerably higher. HHB DAT Tape was one of the leading three.

Perhaps even more significant was the fact that one of these leading tapes was clearly more consistent than the others, with its low error rates changing very little over multiple passes. That tape was HHB.

And when it came to archiving stability, Studio Sound's reviewer was moved to write:

"If it were my recordings at risk, it is clear which choice I would make". His choice? You guessed it – HHB.

HHB DAT Tape. Would you trust your recordings to anything less?



Call HHB today for your free copy of Studio Sound's "DAT On Trial".

HHB

HHB Communications Ltd · 73-75 Scrubs Lane, London NW10 6QU, UK.
Tel 081 960 2144 · Fax 081 960 1160 · Telex 923393
In North America: Independent Audio · 295 Forest Avenue, Suite 121, Portland, Maine 04101-2000 · Tel 207 773 2424 · Fax 207 773 2422

THEY DO MORE. THEY DO IT BETTER. THEY DO IT FOR LESS.

It's rarely easy to say it all in just a few words: in fact even those words are superfluous, since the dynamics processors COMPOSER and INTELLIGATE® are already among the best-selling signal processors in the world today. Whether they are working hard on stage, e.g. with Metallica, Def Leppard, Aerosmith and others, or being put through their paces in thousands of professional recording studios such as Lucas Arts LA, Robert Scovill etc, With our unique Interactive Technology and the famous Behringer quality, we have set new industry standards that are considered sensational by the international trade press.

THEY DO IT BETTER

The COMPOSER is a high-end Compressor, Expander/Gate and Peak Limiter. The IKA (*Interactive Knee Adaption*) circuitry automatically combines the musical "soft knee" function with precise "hard knee" characteristics – without "pumping" as other compressors do. The IRC (*Interactive Ratio Control*) Expander/Gate eliminates the troublesome "chatter" effect experienced in conventional gates and the IGC (*Interactive Gain Control*) Peak Limiter guarantees 100 % protection against signal peaks, serving as a zero attack, distortion-free gain threshold. Thus, perfect digital compatibility is ensured.

Do you know a better compressor?

Because of its UTR (*Ultra Transient Response*) circuitry and an attack time of only 3 micro seconds, the INTELLIGATE® is probably the fastest expander/gate/ducker in the world. High-performance Class A VCAs eliminate click noise even with percussive signals and provide exceptional audio transparency. High-precision Key Filters permit frequency-selective keying.

Do you know a better gate?

THEY DO MORE

Behringer stands for performance without any compromise: servo-balanced inputs and outputs, jack and XLR connectors, hard-bypass relays, key extern and key listen functions, additional key inputs and outputs, transformer option, backlit switches, high-precision potentiometers, cut-in delay etc, etc.

Can you think of any further features?

THEY DO IT FOR LESS

And if you still believe that excellence is only achieved by spending US$ 2,000, – on a unit, compare Behringer products with any other product on the market and listen to the difference. The sensational price of US$ 450.–* and a full 5-year warranty and your only decision can be to invest in Behringer quality. If you want more information about the COMPOSER and INTELLIGATE or any others from the extensive Behringer range please feel free to contact us or your local distributor.

BEHRINGER.
Your Ear Is The Judge

*Recommended list price may alter slightly within countries

BEHRINGER Specialized Studio Equipment Ltd. ● Otto-Brenner-Staße 4, D-4156 Willich 1 ● (0) 21 54/42 85 21 I Fax: (0) 21 54/42 85 23

Kevin Hilton

Convergent technology and the changing face of audio working

It all used to be so simple: the Post Office looked after telephone calls, computer programmers busied themselves with arcane code, recording engineers were confined to the latest music fad, and broadcast technicians rarely ventured out of their cosy studios. Technology has changed that, and the edges have started to blur: telecommunication agencies now deal in computer languages, computer bods can record music, rock-and-roll-types now do postproduction on cerebral documentaries and broadcasters wrestle with satellite up-links.

Convergence is the word that is being applied to this new order. Technology is enabling a crossover between different disciplines, enabling faster access to information and better economies of scale. If money can be saved by using a digitally-coded communications link (as opposed to a first-class air ticket, three nights in a top London hotel and the associated *schoomzing)* to obtain the services of a leading actor or voice-over artist, then all to the good, reason the TV and film producers.

While the technology is still in its early stages, a great deal of work has been done in both America and Europe. The breakthrough came two years ago when soundtrack mixes were fed to studios in Los Angeles from Lucas Films' Skywalker Sound complex in Northern California along high-quality communications links.

The General Manager of Skywalker, at the time Tom Kobayashi, later formed his own company to specialise in the new technology, EDnet (Entertainment Digital Network). Based in San Francisco, EDnet are now offering the service worldwide, working on their own private network. A recent contract was a five-hour ADR session for the movie *Searching for Bobby Fischer*, with actors Ben Kingsley and Robert Stephens in London revoicing scenes postproduced in Hollywood.

Since this event, others have begun to offer facilities and equipment for the application. Dolby Laboratories have introduced the AC-2 unit, which can be used in stereo mode or as two discrete channels, covering a bandwidth of 20Hz–20kHz. The device used in conjunction with either telecom giant Pacific Bell's Advanced Broadcast Video Service (ABVS) or T1 digital fibre-optics.

One user of the AC-2/ABVS combination is TV Producer Steven Bochco, cocreator of *Hill Street Blues* and *LA Law*, who has been using it on the postproduction of *NYPD Blue*, transferring the Dolby Surround soundtrack between his central LA production offices and the Pacific Ocean Post facility down the coast in Santa Monica (see *Studio Sound*, January 1994).

Although the Americans have been leading in this new technology application, the Europeans have been establishing their own facilities and networks over the past year. Telecommunications provider British Telecom have been active both in their domestic UK market and in mainland Europe, working with the national telecommunications companies of other countries to create a usable European network.

These ventures are based on the ISDN (Integrated Services Digital Network) standard, which was developed by various Postal, Telegraph and Telephone Administrations to supply one fibre-optic service for a variety of signals—speech, low and high-speed data and video—on a single platform. An ISDN connection can either be formatted as one Basic-Rate Access line, giving two channels with a total data rate of 128kbits/s, or as two lines, providing four-channels with a data rate of 256kbit/s.

A company taking advantage of ISDN is The Audio Exchange, founded by former Tape One studio partner Bill Foster, whose intention is to build up a network of studios throughout the world equipped with the codecs to enable the exchange of material over communications lines. Users pay an annual fee (at the moment £250), which gives access to The Audio Exchange's list of members and directory, plus technical support.

The company recommend only two coding systems, one the AC-2 (costing £9,450 + VAT, coupled with the ascend terminal), the other the CCS *CDQ2000* (costing a little under £7,000), which uses the Musicam Layer 2 standard. With these devices, The Audio Exchange have linked a number of studios in Europe, including Magmasters in Soho, central London, CTS in north London and DUY Studios in Barcelona. Foster has said that his target is to have 100 studios in Europe on the network.

A great deal of the company's work is in with telecom major AT&T, they have enabled a daily link to New York. At the end of last year Pacific Bell installed lines into studios in Burbank, California, allowing connections with major film companies. While this transatlantic traffic sounds impressive, there are benefits to be had on a local level. Dave Immer of New York studio Digifon, which specialises in music and voice-overs for advertisements, observed that sometimes it was easier to link between two NY studios than put tapes at the mercy of the city's traffic gridlock.

This kind of local trade is being targeted by a newly founded UK company, On Line Radio, who are offering one-to-one interviews with radio stations around the country from their studio in North Kensington, London. A major problem for local radio stations, especially those on the BBC network, which have a higher speech content than their independent competitors, is getting worthwhile or 'name' guests on a tight budget. Conversely, it is often difficult for publicity companies to get clients round the many stations to promote their book, film, record or self.

> It was easier to link between two NY studios than put tapes at the mercy of the city's traffic gridlock

Using BT's ISDN links, On Line Radio reckon they can set up a two to three-hour session, during which links can be made with up to 12 stations. Each local service gets a one-to-one interview between the celebrity and their own presenter, and the object of all this attention does not have to venture beyond the safe confines of the M25 motorway encircling London.

The company was founded by Simon Wynn & Nicola Mayhew, both publicists who have been involved in a number of charitable events which have required national attention. On Line have already won a £3,000 contract from BT to supply a series of interviews for the *National Swimathon '94* event, which will involve 450 swimming pools and 50,000 participants.

Based in Kensington's Canalot media building, On Line's facilities consist of a speech booth and equipment room. The crux of the setup is the CCS *G722* codec, linked with a Northern Telecom dual adaptor. This allows instant connection with the BBC local radio network, which is already equipped with compatible equipment. 'We kicked off with BBC stations because they're the most obvious, having the greatest amount of speech to fill,' says On Line's Simon Wynn.

At present the ILR (Independent Local Radio) stations, if they are connected at all, are using the aptx system, which is not compatible with *G722*. 'The BBC have got the kit anyway,' says Wynn, 'so there's no outlay for them and it's cheaper for them to have ISDN. From the news gathering point-of-view, they're really well connected. A bigger problem is ILR, because they've not got very much money to spend.' Wynn adds that the service involves an initial outlay of £5,000 for the equipment, plus rental charges.

The company are currently gearing up for the *Annual Charities Event*, to be held at the Business Design Centre in Islington, North London, this month. As well as BT ISDN lines, this will also feature satellite connections. Commenting on the use of advanced telecommunications technology, Wynn comments, 'It's going to change the face of broadcasting because it is so much more flexible.'

On Line Radio's equipment was supplied by Nicral of Swindon, Wiltshire, who are the UK representatives for CCS, as well as manufacturing their own range of ISDN equipment. One of these is the RePort unit, a custom-built battery or mains powered three-channel outside-broadcast commentary package that can be programmed to use aptx, Musicam or G722. ■

UK: Dolby Laboratories. Tel: 0793 842100.
USA: Dolby Laboratories.Tel: +1 415 558 0200.
UK: The Audio Exchange. Tel: 071 437 8273.
UK: On Line Radio. Tel: 081 964 4720 and 081 960 6608.
UK: Nicral. Tel: 0793 845271.

Martin Polon

US audio education: learning to swim or treading water?

Over the last 15 years or so in America, there has developed a stratified educational system in audio. A number of private schools have developed elaborate curriculums devoted to enhancing skills in studio audio—for a period of study of two years or less. During the same period, a number of four-year programmes leading to the baccalaureate degree have embraced the study of sound and music recording as part of a greater programme of studies—usually music. Many of these programmes run at publicly-financed 'state' universities although some run at private institutions.

Although in the past audio education within the context of higher educational institutions as well as through short courses has been justifiable, it may be more appropriate for many to forego four years of educational commitment; what has changed the ground rules so dramatically is a combination of six factors.

First is the changing and declining face of audio employment. Compared to the base number of jobs available in 1980, entry-level positions in music studio and related recording activity—the primary focus of over 90% of all audio education programmes—had decreased by more than 50% in 1991. This was before the current worldwide economic recession had taken effect.

In 1980, 80% of the activities undertaken at a mainstream recording studio were focused on recording music for release on records. In 1993, well over half of those studios extant in 1980 have been replaced by owner-operated personal and project studio activities, and the remaining mainstream studios spend considerably less than half of their billable time in sound recording for record release.

Second is the increasing cost of any and all audio education programmes, and especially of four-year programmes. Recent US government figures indicate that four years of instruction plus room and board at any institution of higher learning will cost no less than $60,000 on average, and could run as high as $100,000.

Third is the difficulty that four-year graduates have recently experienced in using their generic education in application-specific employment opportunities other than studio audio. This is the tightest job market in the US since the great depression of the 1930s; both in and out of the audio industry.

Fourth, the 'cash crunch' at educational institutions nationwide in terms of equipment currency has never been worse and has struck audio programmes especially harshly. Top administrators accustomed to 10-year life cycles or longer for 'capital' equipment are shocked to find out that studio electronics are frequently obsolete in three years or less. Additionally, the audio industry has the lowest percentage of support of college-level teaching programmes of any comparable industry in the US—chemical companies, computer manufacturers and even the funeral industry provide more to education in terms of equipment donations, library materials, paid internships and even teaching 'sabbaticals' on campus for working audio professionals.

Fifth, limited financial resources are frequently hotly contested between the various teaching specialisations in a faculty.

Sixth, the extraordinary computerisation of the audio industry and its melding with video and multimedia, is creating an future audio industry that is less orientated towards music. At a recent conference, attendees noted that the 'audio industry seems to be reinventing its academic programme: training received may not be as valid at the end of the period as it was at the beginning.'

To assist in making an appropriate decision over an educational course, the answers to the following questions might be sought:

1. Is the equipment base at the school current and relevant to the study of audio practices?
2. Does the curriculum focus on recording-studio engineering or is the programme optimised for assorted 'audio opportunities'?
3. Does the educational programme being considered have a real pathway for the study of audio with video and multimedia development?
4. How much time do students spend 'hands on' with the programme's audio equipment; especially in a studio environment?
5. Does the school have a specific library within the audio studies department or in a section of the school's main library devoted to audio trade magazines, equipment manuals, books and other literature vital to all audio professionals?
6. Do students in a programme get to work with audio in the campus audio-visual services area, campus radio, instructional television or an on-air broadcast facility?
7. Are students offered the opportunity to learn in their last year or so through 'internships' in established audio firms—for which the student may receive a grade and credits. Does the faculty actively participate in matching the students to an internship 'job'?
8. What are the student-to-faculty ratios within the programme and to the larger music or other 'host' programme as a whole? Unfortunately, it is not uncommon to find music departments in which the audio students account for over half of the total number of students enrolled in music, while the dedicated musicianship faculty number in double digits—and the audio programme has but one or two full-time instructors.
9. Are audio professionals brought in on a regular basis to enrich the teaching programme?
10. Does the programme support a chapter of the AES or SMPTE? If the programme is less isolated geographically from the 'big city' sections of these organisations, is the school well represented?
11. Is the programme close to some geographical centre of audio business enterprise? LA has film and television production; NYC has much the same as well as corporate A-V and live theatre; Washington DC has government agencies and military activities that require audio support, recording and reinforcement; San Francisco and the Silicon Valley support multimedia and computer development; Nashville has country music performance, recording and theme parks and Florida has theme parks, film making and Latin-American music recording. Other places such as Chicago focus on some particular element such as television and radio commercial production. International audio centres support film, broadcast, television and studio recording.
12. What are the professional qualifications of a programme's faculty and the individual who heads the programme? In some cases, staff have impressive professional contact with the real world of audio.
13. How does a prospective audio student make the 'right' decision? How does anyone judge a programme? The above criteria are helpful in evaluating what a school will and will not provide to it's students, but the most reliable way to measure an education programme is to question graduates as to their subsequent experience in gaining employment and career advancement.

How does anyone judge a programme?

The bottom line for anyone considering an education in audio is to contemplate very carefully the choice of formal educational against that of going it alone—or a combination thereof. Make no mistake, there *are* excellent programmes of instruction in audio as related to music, available at all levels of the educational spectrum. What would be a desirable alternative for some who are committed to a four-year degree effort is to undertake a course of study in Computer Science, Engineering, Management or the Law that would allow continuance at the Masters' degree level, immediate employment, or the undertaking of a specific six-month, one-year or two-year short course in audio after graduation and-or any combination of the above.

However, for certain individuals willing to make the commitment of $60,000–$80,000, a marvellous personal and-or project studio is a real alternative. Two young persons would have an even greater fiscal base to expend on setting up a facility and even have a little left over for a six-month or one-year vocational programme in audio for each person. I am quite serious when I suggest that a short course followed by the construction and operation of a start-of-the-art project studio might be an equally valid use of the financial and human calendar resources earmarked for a college education in audio for certain individuals.

The crisis in academic relevancy in America and elsewhere has struck all corners of the educational landscape, but we are dealing with peoples' lives here and a four-year commitment in audio that finds the college student working at McDonald's after graduation serves neither the graduate, the audio community nor the community as a whole very well. ■

NEW
EQUIPMENT FROM AUDIO WAREHOUSE

USED
EQUIPMENT FROM AUDIO WAREHOUSE

ALL PRICES EXCLUDE VAT

UK's LARGEST STOCK OF USED EQUIPMENT. WE SHIP WORLDWIDE

TLA
Quality Audio for Professionals

TLA produce top quality audio products that demand your attention. Value for money + no-compromise design. Call for FREE brochure.

NEW TLA Valve Equaliser
Quality, warm, valve equalisation for professionals

NEW TLA Valve Compressor
An affordable dual valve pre-amp compressor

NEW TLA 8:2 Valve Mixer
The first product in a new range of mixing consoles combining low noise solid state circuitry with classic valve techniques for a very high performance and unique sound quality

NEW TLA Portable 4:2 Professional Mixer Portable mixer for film, video and ENG professionals.

SOUNDTRACS PLC
Mixing consoles

BUY A SOUNDTRACS SOLO NOW AND GET A TLA STUDIO WORKSTATION ABSOLUTELY FREE

The Soundtracs name in synominous with console quality. We stock them all from the low-cost Solo to the stunning Jade Production Console. Call for FREE brochures.

Soundtracs Solo Midi and Solo Logic
16, 24 and 32 frame sizes available offering 40, 56 and 72 inputs in remix. In-line format with the addition of 8 floating buses. Automated MIDI muting on all channel/monitor inputs. 4 band EQ with 2 swept mids. 4 stereo FX returns with 2 band EQ.
You won't get better quality at this price.

Soundtracs Jade
When pros like: Steve Lipson, Paul Fishman, Charlie Skarbeck, Stevie V and ICC studios all buy the same console - you KNOW its got to be good.

Call for info about the NEW SOLITAIRE

KRK MONITORING SYSTEMS
Setting a world-wide standard

KRK Model 9000
Sets new world-class standards for compact close field listening. The 9000's drivers are made from Kevlar. The 9" woofer uses a copper wire edge-wound voice coil for increased power-handling while the Tweeter uses KRK's inverted dome design for very low distortion and excellent off-axis response.

Some KRK users... Billy Joel, Sting, The Plant Recording Studios, Paul Fishman, Bob Clearmountain, Konk Studios, MCA, Bruce Hornsby, Trevor Horne, Phil Manzanera and more.

ALESIS
Alesis ADAT digital

PART EXCHANGE YOUR MULTITRACK

In stock NOW at Audio Warehouse. Call for FREE brochure!

Part Exchange your existing multitrack recorder
Want to go digital? What will you do with your current multitrack? Don't wait any longer. You won't believe the super part exchange deals we've got waiting for you. Just call 0462 480009 and speak to our ADAT expert, Mr Steve Gunn.

MANLEY
DESIGNERS REFERENCE SERIES
BY VACUUM TUBE LOGIC OF AMERICA
Manley Valve Technology Mics

Audio Warehouse is YOUR UK source for these superb mics from the USA

Reference Series
Regarded by some as some of the best mics in the world. 3-micron GOLD diaphragms with black plate design. FULL-GAINBLOCK electronics design.

CR3-A - A cost effective 48V FET mic for broadcast & general studio.

Baby Tube - Single triode tube, great for close miking

USED STUDIO EQUIPMENT WANTED
CONSOLES, MULTITRACKS, OUTBOARD, COMPLETE STUDIO CLEARANCES UNDERTAKEN.

FOR A COMPLETE USED LIST BY POST
CALL 0462 480009 AND QUOTE YOU ADDRESS - We'll get a complete updated used list out to you within 48 hours!!

CONSOLES (USED)

AMEK
Angela 36 cha, p/bay with Master Mix 2 ..... POA
Angela 36 frame fitted 28 chan, p/bay £7,995
DDA
DDA AMR24 28 channels, p/bay ..... POA
DDA S Series 32/4/2 NEW £4,495
HARRISON
Harrison MR3 32 channels, p/bay. £9,995
Harrison Series 10 32 dual inputs (Total 64)
Private use only. vgc. £65,000
HELIOS
Helios 32 channel custom console ..... POA
Helios 40/32 40 channels, 32 monitors,
72 inputs in remix, bantam p/bay ..... POA
Helios 24/8/2 discrete electronics ..... POA
NEVE
Neve 542 8:2 vgc £2,500
NEVE EQ & SPARES
33114 classic EQ Modules £995pr
33115 classic eq modules £895pr
PPM meters + driver boards £50ea
Stereo PPM meters + driver boards £199
VU meters £25
RAINDIRK
Concord 28 ch. in line. Bantam p/bay. £2,995
Classic 70's Raindirk Series 3 26 channel console with p/bay, to be refurbished & 24 monitors added, giving 50 line inputs. ..... POA
Series 3 10/4 P&G etc. a true classic £1,495
SECK
Seck 24/8/2 with flight case £995
SHURE
Shure FP42 portable mixer x 2 ..... £495ea
SONY
MXP 3000 48 chan, 24 groups
+ remote patchbay £24,995
SOUNDCRAFT
Soundcraft Sapphyre NEW ..... POA
Soundcraft 600 32/8/26 p/bay £5,995
SOUNDTRACS
Soundtracs IL36/32 p/bay £11,995
Soundtracs IL48/32 p/bay 96 inputs in remix,
Automation, private use. £25,000
Soundtracs Quartz 48 **New** p/bay ..... POA
Soundtracs Quartz 32/24
+ p/bay. Private use. immaculate £11,995
Soundtracs Megas **New**
40/24/24 with Tracmix 2 Automation
Normal Price £15,000 ..... **Sale Price £9,995**
Soundtracs MRX 40/8/16 ..... £3,995
Soundtracs Solo 24 channels ex demo £2,750
Soundtracs FM8/4 (2 available) £995ea
SSL
SSL6048E 48 channels Total Recall
G-computer, remote patch, ... **available Feb '94**
SSL 4056E Total Recall ..... POA
TAC
Tac Matchless 26 channels, p/bay £4,995
Tac Scorpion 16/8/8 ..... £2,500
Tac Scorpion 2 30 channel inc 6 stereo, 4 fx
returns, 8 groups 16 monitors,
ext. patchbays & looms £4,995
TRIDENT
Trident TSM
40/40 frame, 32 channels, 24 groups,
24 monitors, p/bay. Automation £15,995
Series 70 28 frame fitted 20/16/16 p/bay £5,995
Trident Vector coming soon ..... POA

RECORDERS (USED)

AMPEX
Ampex ATR102 & 104 coming soon.
..... **Call for details**
ALESIS ADAT
Part exchange your old recorder for 1 or more of these excellent machines. ..... **Call for details.**
Alesis A-DAT 3 months use £2,250
FOSTEX
Fostex D20 ..... £2,995
Fostex E16 ..... £1,995
Fostex M20 2 track with centre
track for time code £550
Fostex 4030 syncroniser + remote £995
LYREC
Lyrec 532 24 track + full remote ..... OFFERS
MCI
MCI - SONY JH24 + auto 3. Private use VGC £7,995
MCI JH110 2 track, 71/2-15-30ips.
1/4" & 1/2 " head blocks £1,500
MCI JH110 2 track 1/4" VGC £995
3M
M79 24 track £2,995
M79 4 track 1/2" ..... OFFERS
OTARI
Otari MX80 24 track with remote.
Private use, Immaculate £9,995
Otari MTR90MK2 + remote £11,995
Otari MTR90MK2 + remote
with over-bridge & Dolby-A £12,995
OTARI SPARES
Otari MX80 audio cards ..... £250ea.
Otari MX80 32 channel 2 " head block
(as new) with 8 audio cards. £1,995
REVOX
Revox C270 2 track. VGC £1,495
Revox B77 MK2 71/2-15ips £595
SATURN
Saturn 624 24 track with remote. Private use.
immaculate £8,995
SONY
Sony JH24 24 track + remote &autolocator.
Private use. VGC £7,995
Sony APR 5000 3 speed 1/4" VGC £1,995
SOUNDCRAFT
Soundcraft 760 MK3 24 track with remote.
Private use. VGC £4,995
Series 20 1/4" recorder in console £750
Series 20 1/2" recorder in console £750
SOUNDCRAFT SPARES
Soundcraft MK3 24 track remote £295
STUDER
Studer A800 MK2 24 track with hard heads £11,995
Studer A827 24 track + remote £19,995
Studer A80MK4 8 track with Dolby -A £1,995
Studer A80MK2 8 track with Dolby-A £1,995
TEAC/TASCAM
Tascam MS16 16 track 1" + console Unused £2,300
Tascam MSR24 vgc £4,995
Tascam ATR60 2 track 1/2" in console VGC £1,495
CASSETTE DECKS
Aiwa F770 x 2 ..... £150ea
Tascam 122 ..... £195
TIME LINE LYNX SYNCHRONISERS
- 2 FOR LESS THAN THE PRICE OF 1
Yes 2 used, serviced Lynx 1 time code modules (supplied with full 1 year warranty) for less than the price of 1 new Lynx module.
£2745 pair / £1495 each. While stocks last.

DIAL-A-FAX FOR AN INSTANT EQUIPMENT LIST

Dial 0336 413 733 on your fax & press start when instructed. Some machines may need to be switched to polling mode to use this service. Calls @ 36p per minute cheap rate & 48p per minute all other times.

P/X YOUR OLD EQUIPMENT FOR NEW

Why solder on with your old equipment when Audio Warehouse can give you a cracking food part exchange deal?
PLUS: FINANCE AVAILABLE - USE YOUR EXISTING EQUIPMENT AS A DEPOSIT!
Yes! In certain cases (subject to status) we can treat your Part Exchange as a deposit. (Written details available on request).
You just start paying the finance payments when they become due.

TELEPHONE OR FAX
FOR THE BEST NEW & USED GEAR
TEL: 0462 480009 FAX: 0462 480035

TONY LARKING professional sales ltd, LETCHWORTH, ENGLAND.
Contact; Steve Gunn, Howard Jones, Tony Larking.

audio warehouse
QUALITY NEW & USED EQUIPMENT AT AFFORDABLE PRICES
U.K.'s Largest stockist of new an used pro audio equipment.
Delivery arranged worldwide.
LTD
tony larking professional sales

All equipment is used unless otherwise stated & subject to availability. Prices EXCLUDE VAT E&OE.

ROUND THE HORN

P(3M) = 75dB						
Loudspeaker	**f(Hz)**	**Input(v)**	**2nd**	**3rd**	**4th**	**5th**
	1K	2.04	-59	-60	-69	-66
QUAD	2.8K	5.6	-62	-49	–	–
	5K	3.5	-66	-51	–	–
	1K	1.01	-59	-54	-68	–
AUDAX	2.8K	0.75	-61	-60	–	–
	5K	0.64	-62	-59	–	–
	1K	0.2	-53	-75	-77	–
JBL	2.8K	0.18	-38	-27	-46	-38
	5K	0.19	-47	-31	-59	–
	1K	0.24	-61	-66	–	–
EMILAR	2.8K	0.17	-58	-73	-70	–
	5K	0.3	-47	-57	–	–
P(3M) = 85dB SPL						
Loudspeaker	**f(Hz)**	**Input(v)**	**2nd**	**3rd**	**4th**	**5th**
QUAD	2.8K	6.02	-57	-57	-80	–
	1K	3.8	-54	-49	-78	-67
AUDAX	2.8K	1.7	-57	-57	–	–
	5K	2.5	-47	-67	–	–
	1K	0.67	-42	-44	-60	-59
JBL	2.8K	0.44	-43	-36	-49	–
	5K	0.54	-41	-37	-61	–
	1K	0.73	-50	-55	-76	–
EMILAR	2.8K	0.44	-49	-65	-73	–
	5K	0.87	-38	-54	-71	–
P(3M) = 95dB SPL						
Loudspeaker	**f(Hz)**	**Input(v)**	**2nd**	**3rd**	**4th**	**5th**
	1K	10.1	-50	-44	-79	-69
AUDAX	2.8K	5.7	-49	-49	–	–
	5K	7.7	-37	-57	–	–
	1K	2	-41	-49	-55	-53
JBL	2.8K	1.5	-35	-53	-67	-53
	5K	2.1	-29	-55	–	–
	1K	2.45	-40	-53	-68	-59
EMILAR	2.8K	1.4	-40	-55	-61	-63
	5K	2.9	-29	-48	-71	–
P(3M) = 105dB SPL						
Loudspeaker	**f(Hz)**	**Input(v)**	**2nd**	**3rd**	**4th**	**5th**
	1K	7.8	-26	-41	-58	-51
JBL	2.8K	4.4	-27	-43	-55	-57
	5K	7.1	-19	-37	-60	–
	1K	10.5	-28	-32	-45	-55
EMILAR	2.8K	4.4	-29	-52	-57	-59
	5K	8.8	-20	-36	-51	–

Fig.1: Measured harmonic distortion levels of drivers under test

Philip Newell re-evaluates horn drivers in midrange studio monitoring and answers some long-standing questions

Together with higher efficiency and aspects of their far-field propagation qualities, the generally higher output capability of horns means that they still have a role to play in studio monitoring loudspeakers. The 'horns versus direct radiators' debate has continued for decades with partisan factions supporting each point of view, but few horns have been developed purely for studio use, thus most studio systems have borrowed technology from cinema, sound reinforcement and public address. In order to discover whether there was further potential in the use of midrange horns in studios, a five-year study was undertaken by Keith Holland at the Institute of Sound and Vibration Research (ISVR) at Southampton University, England. One of the main objects of the work was to attempt to determine whether the less favourable characteristics of horns are a function of horns *per se* or whether some of these characteristics were inherited along with aspects of the borrowed nature of the technology.

This article discusses the findings of the above research programme. It details aspects of horn performance considered undesirable for studio purposes, and separates individual physical parameters of horn design which give rise to many unwanted acoustic properties. The conclusion attempts to define the limits of horn performance within which the greatest number of unpleasant sonic attributes can be designed out. The work is based on physical and mathematical analysis of the problems, closely related to a rigorous series of listening tests.

The use of horn loudspeakers for public address and cinema applications is almost universally accepted as good practice. Indeed, in many of these instances, there is no practically viable alternative, as the requirements of high electroacoustic efficiency and flexibility of directivity control are not easily achieved with anything other than horns. Changing practices in the techniques of music recording have brought with them a tendency towards larger control rooms. Concurrently, control room acoustic-design ▶

philosophy has tended towards lower reverberation times and in many, true reverberation does not exist at all. In these relatively large and acoustically 'dead' control rooms, a borderline case has been reached between studio monitor systems and small public address systems. Sterling attempts have been made by numerous designers to develop direct-radiator technology to meet these needs, but while many fine systems now exist, they usually require high amplifier power, and live much of their working lives close to their power handling performance limits.

On the other hand, systems using horn-loaded, midrange systems, even in control rooms of 60m^2 or more, are rarely driven much beyond 20% of their design power handling capacity. As such, a long and stable working life can be expected. together with lower amplifier power-requirements and a good reserve of damage tolerance. Another desirable attribute of horn loudspeakers is that they tend to produce an output in the form of a spherical expanding wave, free of many of the 'lobing' problems of the pistonically derived output from direct radiators.

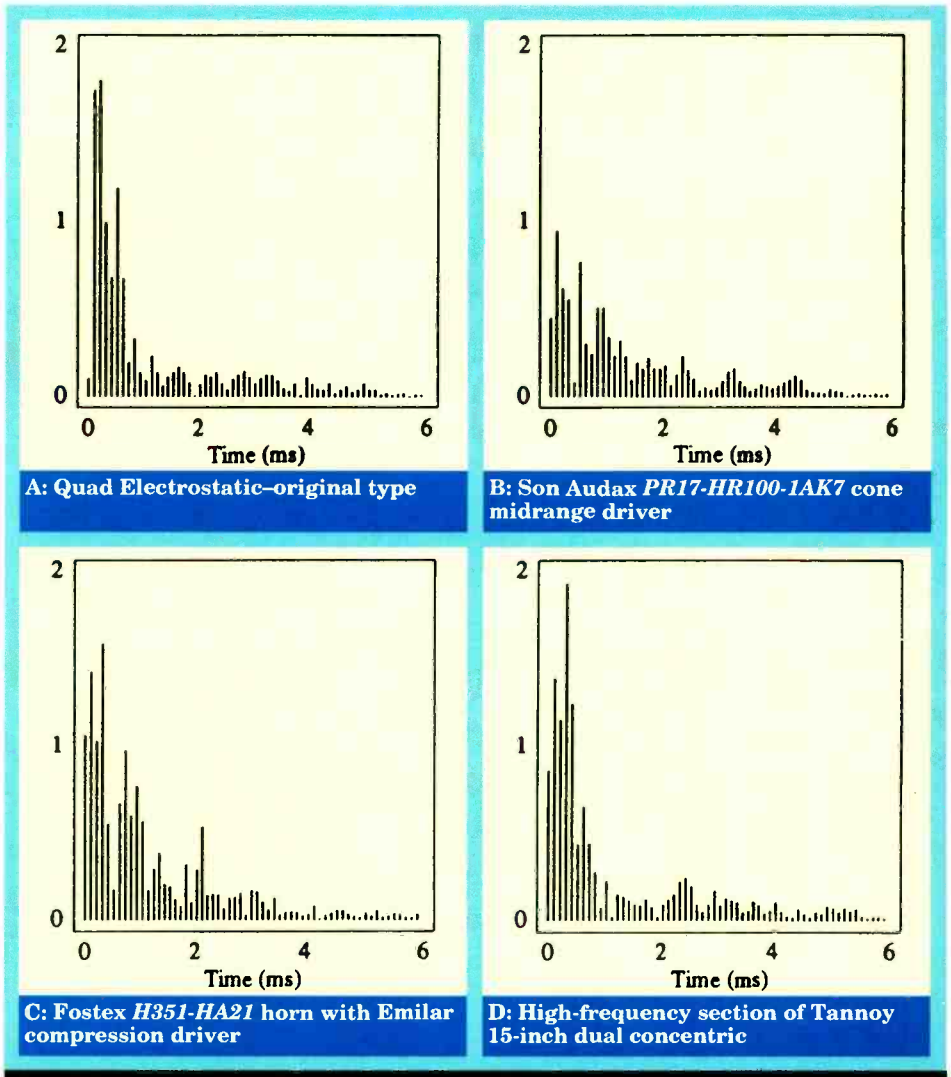
No attempt is being made here to claim overall superiority of any one type of drive system, as many subjective aspects of performance differ greatly from one listener to another. However, if some of the negative attributes of one system can be detected, isolated, and ultimately circumvented, then it will provide designers of future systems with more options in their quest for *their* optimum design requirements.

The test programme

The basis of the research work was to find links between measurable characteristics of horn performance and perceived subjective sonic characteristics. In order to reduce some of the tedium and general impracticability of first manufacturing, then setting up experiments for the measurements of every interesting development suggested by the research, a 1-parameter computer analysis technique was developed, then rigorously tested against actual measurements of real horns. This technique has already been published [1,2] together with the development of an impedance tube measurement system[3] which made practical the rapid measurements for the physical-numerical cross correlations.

An extensive programme of listening tests was carried out in the large anechoic chamber of the ISVR, and again, a general outline of this procedure has already been published.[4] Measurements of nonlinearities, both in the horn flares themselves, and in the horn-driver combinations were cross-referenced with the results of the above listening tests, and a finite amplitude model was developed[5,6] to predict nonlinearities in different flare shapes. Cepstral analysis was undertaken[7] in order to isolate discrete reflection patterns in different horns not easily discernible from conventional measurement techniques. The research project was compiled into a thesis for which Keith Holland received his PhD at Southampton University in December 1992.[8] As individual aspects of the research are so well documented in the papers[1–7] above, this article concentrates on the less-widely promulgated aspects of the conclusions.

Cepstral analysis was undertaken in order to isolate discrete reflection patterns in different horns not easily discernible from conventional measurement techniques



A: Quad Electrostatic–original type

B: Son Audax *PR17-HR100-1AK7* cone midrange driver

C: Fostex *H351-HA21* horn with Emilar compression driver

D: High-frequency section of Tannoy 15-inch dual concentric

Fig.2.1: Power cepstra of archetype loudspeakers

The listening tests involved over 7,000 comparisons of 20 different drive units and nine different sounds. The drive units consisted of horns of many different flare shapes, moving-coil direct radiators, and an Electrostatic. The nine sounds were essentially nonmusical, but contained different combinations of transient and steady-state or tonal content. They were band-limited (1kHz–6kHz) on playback, in order to avoid problems either solely due to horn cut-off or other out-of-band anomalies. It was hoped that the different combinations would help to isolate any 'horn sound' which the units may possess. The initial question was whether all the horns would group together, either on some of the sounds or on all of them. After the results had been numerically, statistically, and 'common sense' analysed, there were groupings—but not in ways which had been anticipated.

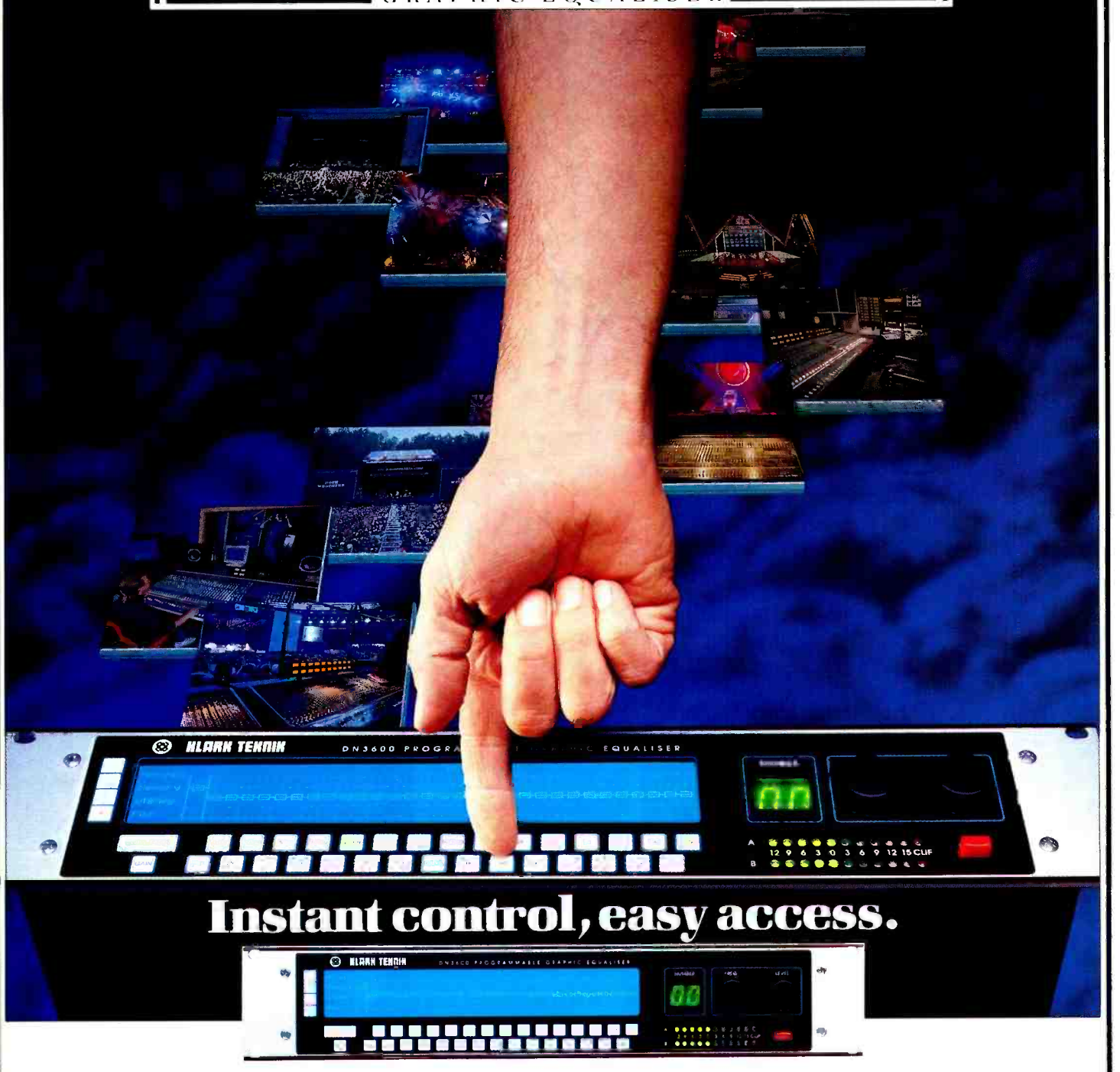
Of the four reference 'archetypes' to which other samples were compared, two were direct radiators and two were horns. Of the direct radiators, one was a Son Audax 6½-inch moving-coil unit (**B**), and the other a Quad Electrostatic (**A**). Of the horn 'archetypes', **C** was a Fostex *H351-HA21* long (490mm) sectoral horn driven by an Emilar *EK175* drive unit, and **D** was the 'high' frequency section of a Tannoy 15-inch dual concentric, with the bass cone forming the high-frequency horn flare.

General findings

In general, the horns with a throat-to-mouth distance of more than about 350mm were deemed to sound like archetype C, while the horns with a throat-to-mouth distance of less than 350mm were generally judged to sound like archetype B. Within each of the long-short groups however, there were some odd exceptions. One of the 'long' horns was a Fostex wooden-flared sectoral horn, 440mm in length from throat to mouth. Possibly more strongly than any other horn in the entire test, this horn was judged to sound like the direct radiator cone, archetype B. The whole thing consisted of a very short 'throat extension', coupled to what were effectively large semicircular lips with a horizontal flare of 140°. The horn produced undesirable throat impedance plots, implying an uneven pressure amplitude response when connected to a driver, nonetheless in auditioning before the tests began, the horn was generally considered 'musical', ▶

DN3600

PROGRAMMABLE
GRAPHIC EQUALISER



Instant control, easy access.

The new DN3600 provides a perfect union of Klark Teknik precision with breathtakingly straightforward control.

The largest LCD display available in a 2U rack space shows either a single 1/3 octave 'graphic' display, a combined curve, or both channels. Also shown are high and low pass filters and two notch filters per channel.

The unique Alphanumeric memory display allows fast save/recall; four 'soft keys' access display sub-menu options and there's full Password Protection.

Dedicated backlit switches include each equaliser centre frequency, while rotary controls for band and level provide extra instant access. You may link channels for accurate stereo tracking and 'Q' can be switched between DN360 and DN27 curves. There's Auto Gain, maintaining constant level whatever the curve; Pro MIDI; 66 memory patches and a DN60 interface.

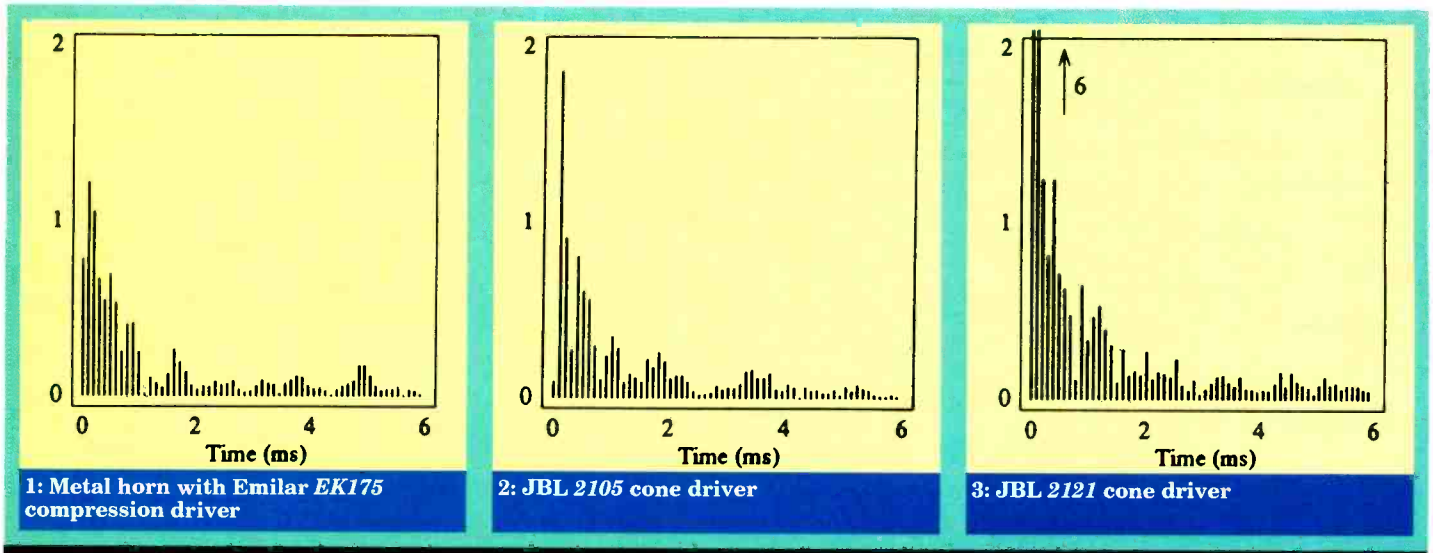
Audio quality is stunning, too, with unrivalled dynamic range and headroom. We've even sealed the front panel behind a tough membrane for years of trouble-free use.

The DN3600 from Klark Teknik. For instant control, nothing touches it.

KLARK TEKNIK
a **MARK IV** company

The first name with sound system designers

Klark Teknik PLC, Klark Industrial Park, Walter Nash Road, Kidderminster, Worcestershire DY11 7HJ, England.
Tel: (0562) 741515 Fax No: (0562) 745371.



1: Metal horn with Emilar *EK175* compression driver

2: JBL *2105* cone driver

3: JBL *2121* cone driver

Fig.2.2: Power cepstra of sample loudspeakers

pleasant to listen to, and definitely not horn-like.

Among the short horns (350mm or less) two failed to group with the direct radiator, archetype B. One horn was the *AX2*, specifically designed for the tests as a result of the 'seminumerical' 1-parameter modelling, and information gleaned from the use of the impedance tube. The horn was 180mm from throat to mouth, and possessed a rapid flare which prior analysis had suggested to be a requirement for a desirably smooth mouth termination, avoiding any sudden cross-sectional changes where the mouth meets the baffle. The horn showed an overall similarity to archetype D, the Tannoy dual concentric, which was itself a short, axisymmetric horn. The third nongrouping horn was a Yamaha aluminium sectoral horn which was a 'borderline' 300mm in length. Unsurprisingly, this horn straddled groups B and C, but also gave a great number of results showing it dissimilar to any of the archetypes. Only on four of the nine sounds did it clearly group with B or C.

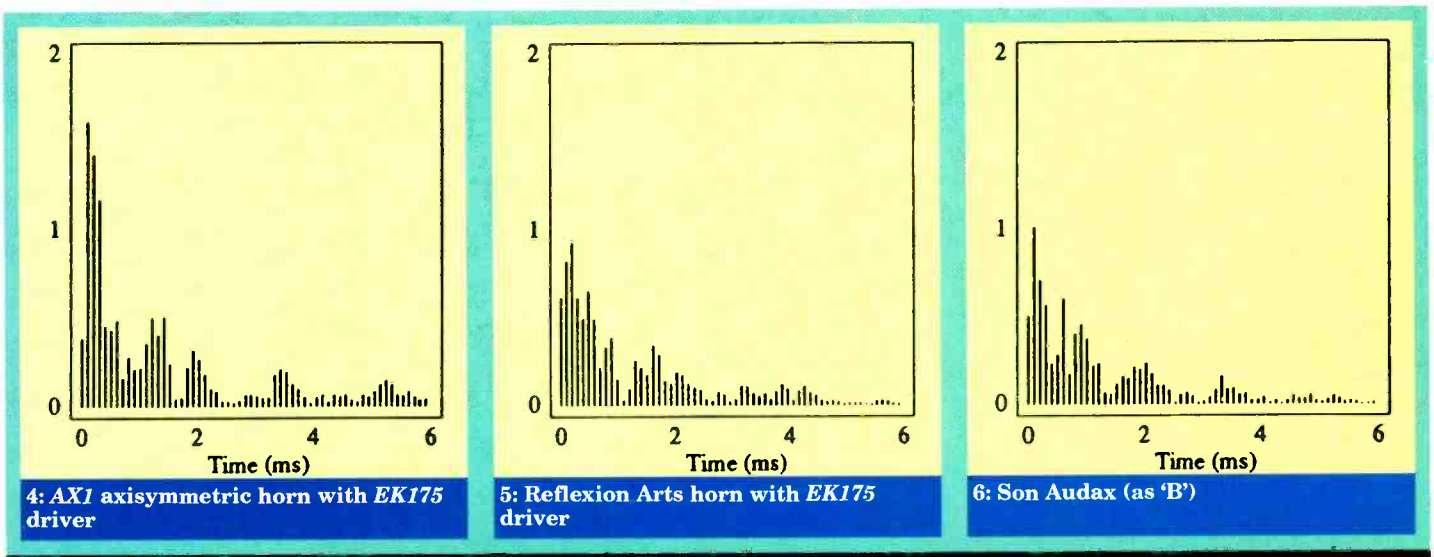
Nonlinear distortion

The first attempts to explain these anomalies—and the 'break' at 300mm to 350mm—focussed on nonlinear distortions. Much has been presented on the subject of horn distortion, to the extent where it is taken as a fact in some circles that it is harmonic distortion which makes many horns sound hard and unpleasant. There are three predominating sources of this harmonic distortion. Firstly, there are the electromechanical limitations of the drive unit, including thermal power compression effects, suspension nonlinearities and magnet-gap problems. Secondly, is the nonlinearity produced as a function of the volumetric changes between the diaphragm and the phase plug on positive and negative half-cycles; and thirdly is a distortion produced by nonlinear propagation within the horn itself, which can, at very high levels, lead to shock formation.[9]

To test the less well-documented third cause, a finite amplitude model was devised for computer prediction. Most standard 'horn' formulae are calculated on the basis of infinitesimal wave amplitude but, in reality, usable sound waves have finite amplitudes. Superimposed on the initial sound waves are reflections from the mouth and obstructions within certain horns, plus complications due to phase dispersion within the horn flare. The model[5] proved highly successful and gave good correlation with actual measured results, which used a Community *M4* as a signal source, capable of producing signals with less than 1% harmonic distortion, even at 150dB. The test setup was complicated and unwieldy, requiring the use of two specially-treated, adjoining rooms, so once adequate verification of the computer model had been achieved, it was certainly the most practical choice for further study on other horns.

Fig.1 shows a table of actual, measured results comparing harmonic distortion levels of a direct radiating cone, an Electrostatic, and two horn loudspeakers, all used in the listening tests. The results show that at low levels (below 90dB) at 3m, there is no significant difference in distortion levels of the different devices. At high levels, say >110dB, very few drivers can produce such continuous sine wave levels, so comparison is not really relevant. Furthermore, certain audiological reasons reduce the relevance of very high-level measurements in a studio environment. From the above measurements and the computer analysis of the finite amplitude model, it was possible to separate out the distortions attributable to each of the three main causes previously mentioned. Much second harmonic distortion can be attributed to propagation nonlinearities, with most higher-order harmonics being driver related. None of this,

Once adequate verification of the computer model had been achieved, it was certainly the most practical choice for further study on other horns



4: *AX1* axisymmetric horn with *EK175* driver

5: Reflexion Arts horn with *EK175* driver

6: Son Audax (as 'B')

Fig.2.3: Power cepstra of sample loudspeakers

however, falls into any sort of pattern when cross-correlated with the similarities and groupings found in the listening tests. Indeed, whichever ways the results were dissected and analysed, no link could be demonstrated between harmonic distortion and audible similarity. Units with up to 20dB difference in distortion levels were deemed to sound similar, while others of almost equal distortion figures were considered to sound totally different. From the results of these tests and analyses, nonlinear distortions were emphatically *not* responsible for any characteristic horn sound.

Amplitude and phase responses

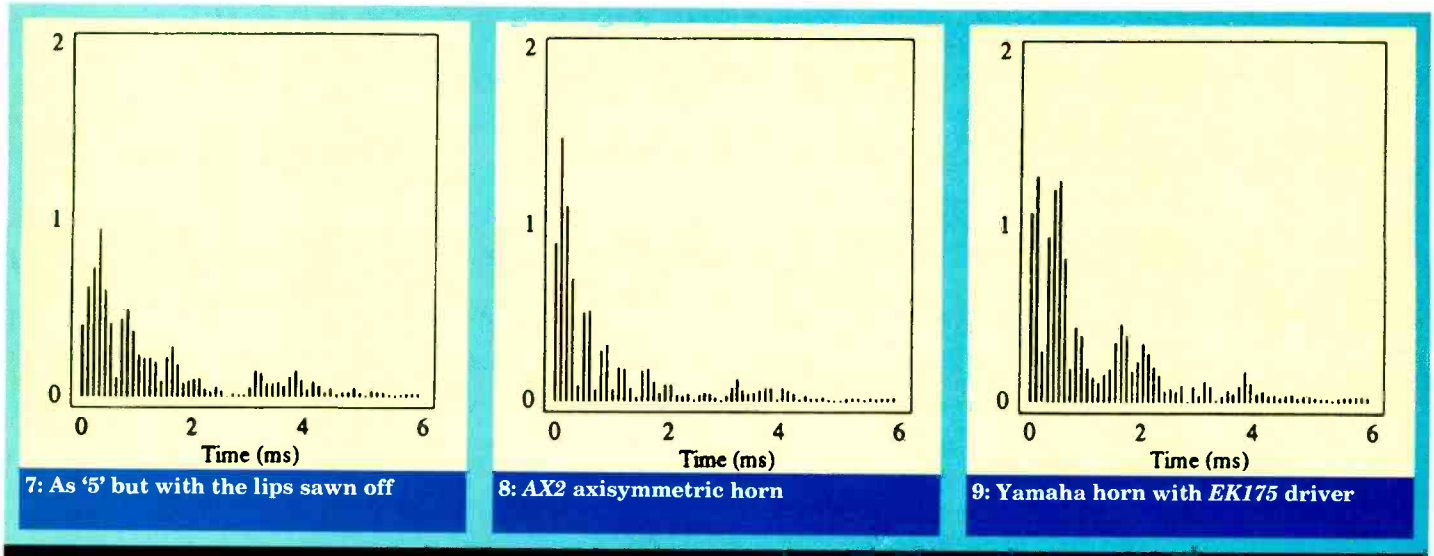
Pressure amplitude response (frequency response) was another prime candidate for producing sonic similarity or dissimilarity. After the tests were completed, a Waveform Spectral Similarity index was calculated for each loudspeaker on each sound. This was derived by calculation of the root-mean-squared error between the spectra of the original signal, and that radiated by each loudspeaker. A comparison was made speaker-to-filter-input, and speaker-to-speaker for each sound. A reasonably good tie-up was achieved here (around 80% similarity) between the calculated waveform similarity and the listening tests. Unfortunately, some of the results which refused to correlate, did so in a glaring way. Usually, when a sample driver which was deemed to be sonically similar to an archetype failed to show a similar pressure amplitude response, then a strong similarity was noted in the phase response. This has so far not yet been adequately explained.

Certainly, the agreement between listening test results and comparisons between the spectra of the reproduced signals indicate that a large part of the cause of acoustic similarity *is* due to the on-axis amplitude frequency response, but clearly, this was not the sole reason. For example, a JBL *2370/2426* combination was very similar in its waveform spectral similarity to the Son Audax cone driver, archetype B, for all nine of the test signals, yet in the listening tests it showed a reasonable similarity with B on only one of the nine sounds. It closely resembled the horn C on five of the signals, and was judged similar to none of the archetypes on the other three signals. The phase response of the JBL combination was more similar to archetypes C and D, the two horns.

Cepstral analysis

With neither amplitude, phase, nor harmonic distortions clearly explaining the sonic similarities or otherwise of the different drivers, it was decided to make further studies in the time domain. In order to further identify any reflections that may be produced at the mouth or within the flare of a horn, a form of power cepstrum was calculated from the modulus of the measured throat impedance. In this type of analysis, the frequency-domain representation of the modulus of the throat impedance is treated as a spectrum; the power cepstrum is then calculated using Fourier transforms. Cepstral analysis was first defined in the mid-1960s as a means of helping to separate echoes from 'clutter' in seismic research. The power cepstrum of a transfer function is the Fourier transform of the log of the amplitude of the transfer function. The power cepstrum of each driver was plotted using a y-axis scaled in nondimensional dBs and an x-axis plotted in terms of both time and distance. **Fig.2** shows the power cepstra of the 20 units used in the tests. The power cepstra plots proved to be revealing, as they are very effective in showing reflections. In a conventional pressure amplitude plot, a reflection would show as a comb-filtering effect, but on a complex spectrum, this can be difficult to recognise. On a power cepstrum, however, reflections exist as single spikes along the time-distance axis, and can thus readily be recognised.

In general, what followed from the cepstral analysis was that the audible similarity groupings from the listening tests could be described in terms of the reflection patterns shown in the power cepstra. The various reflections and resonances produced in the cone of a direct-radiating loudspeaker can give rise to irregularities in the frequency response function that are similar to those due to mouth reflections in short (sub 350mm) horns. This explained the anomalous behaviour of the 'long' Fostex wooden horn in the listening tests. As previously mentioned, the horn was strongly identified as sounding similar to the direct radiating cone, archetype B, but the cepstral analysis showed that the true 'horn' was the 150mm throat section only, with the 140° horizontal wooden flare acting ▶



7: As '5' but with the lips sawn off

8: *AX2* axisymmetric horn

9: Yamaha horn with *EK175* driver

Fig.2.4: Power cepstra of sample loudspeakers

only as waveguide 'lips' for directivity control. The unevenness in the throat impedance was largely due to the abrupt, horn-to-lip termination at about 150mm from the driver diaphragm. The horn was consequently reclassified as a 150mm horn with 290mm lips (the shortest horn of all tested), explaining the similarity between this horn and the direct radiators. It should be remembered that there is no absolute dividing line between horns and direct radiators, as a direct radiator can be considered as a 180° conical horn of zero length.

The longer horns, even those with relatively good mouth termination (which is usually easier to achieve in a long horn,) are identified as horns by the temporal spacing of the reflections. Even when the reflections are significantly lower in level than those of the short horns, the greater separation in time of these reflections are recognised by the ear as a pattern which we know as a horn-like sound. The two horns which were not identified in the listening tests as sounding like archetypes B or C, were both shown by cepstral analysis to exhibit minimal mouth reflections. One of these horns was long, and one was short. The long horn, though showing some similarity to C, did not have a particularly strong resemblance, and was considered on some sounds to be similar to archetype A, the Electrostatic. The short horn showed a considerable sonic resemblance to archetype D, the Tannoy dual concentric: both the Tannoy and the Quad Electrostatic have their roots in 1950s design, yet are still in daily use in 'quality control' suites. Furthermore, both of these units had historic 'difficulties' in the low and high-frequency ends of their performance, but both had a clear midrange, suiting them to quality control applications. Apart from reasons of inadequate (woolly) bass, and limitations on maximum sound pressure level, these loudspeakers also lost favour as studio monitors as a result of not sounding representative of other loudspeakers in general. From the cepstral analysis the reason for this is clear, but it poses an interesting philosophical point: should a monitor loudspeaker be rejected because it does *not* possess the midrange problems inherent in most other production loudspeakers?

While the Electrostatic, archetype A, was deemed similar to the sample loudspeakers on a relatively small number of occasions, it was frequently noted that one of the nine test signals (a recording of a waterfall, band-limited 1k–6kHz on playback) sounded more 'wet' on A than on any other loudspeaker; a testament to its reality. ▶

Discover Gold

Search no further. SoundStation Gold has it all.

A complete audio production centre, allowing you to record, edit, play and mix projects using hard or removable optical disk storage.

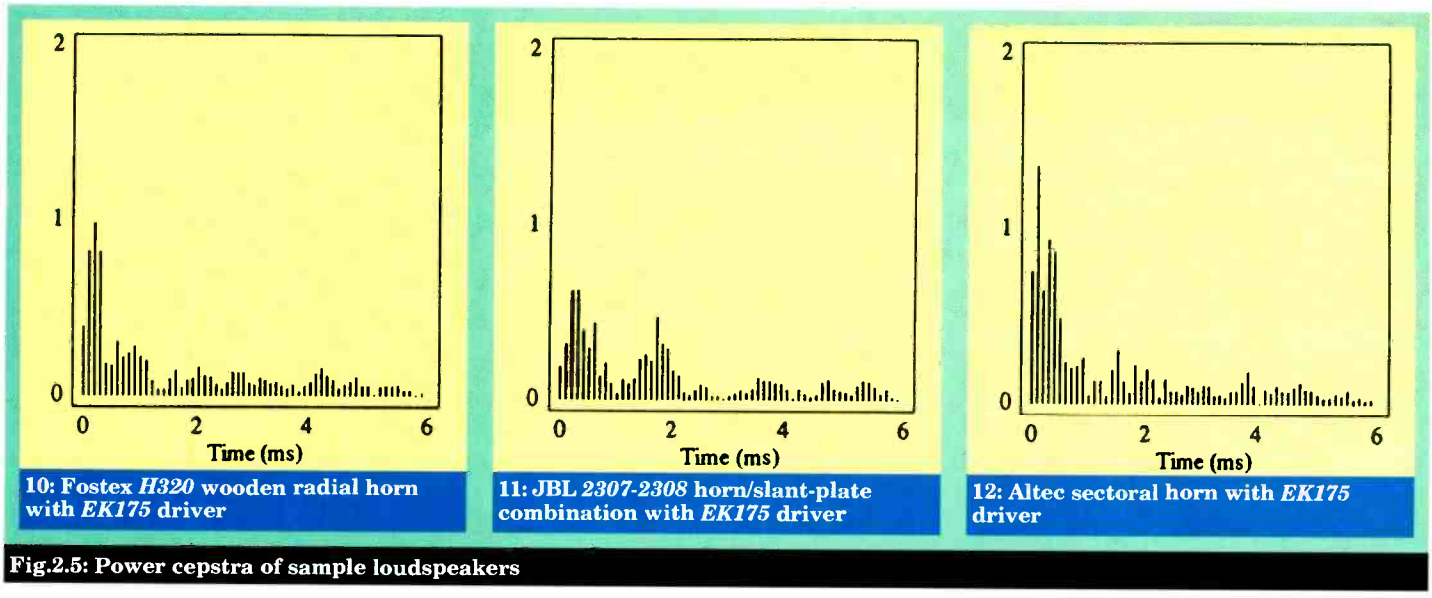
Edit with your choice of intuitive, dedicated interface (compact or touch screen based console) and mix using a dynamically automated mix controller with 9 assignable motorised faders, 4 instantly accessible 8 channel layers, grouping and controls for DAR's stunning Segment Based Processing and EQ.

There's even more top-quality signal processing, with multichannel scrub and varispeed, TimeWarp®, and optional WordFit®. SoundStation® Gold is available in 8 and 16 channel configurations, without the limitations found in other systems, to give you maximum performance, pure digital quality and exceptional value.

DIGITAL AUDIO RESEARCH

DAR

Digital Audio Research Limited,
2 Silverglade Business Park,
Leatherhead Road, Chessington, Surrey, KT9 2QL, UK
Tel: +44-(0) 372-742848; Fax: +44-(0) 372-743532



10: Fostex *H320* wooden radial horn with *EK175* driver

11: JBL *2307-2308* horn/slant-plate combination with *EK175* driver

12: Altec sectoral horn with *EK175* driver

Fig.2.5: Power cepstra of sample loudspeakers

Design implications

Throughout the tests, a watchful eye was maintained for evidence of the material from which a horn was constructed showing any patterns in the sonic test results. Other than certain materials having specific problems due to bad design or construction, no evidence was found to indicate that any well-damped, solid material could not be used in the manufacture of horns. Obviously, certain materials lend themselves more readily to the manufacture of different shapes, and it could be that some materials have had sonic characteristics attached to them because they are only found on certain generic designs.

Wave shapes

Investigations into the actual wavefronts leaving the different horns, showed that the axisymmetric designs generated waves which resembled flattened spherical caps, midway between a true spherical expanding wave and a plane wave leaving the mouth. The waves leaving rectangular horns were of the form of spherical expanding waves which struck the walls of the horn at 90°. Early in the tests, 'bubble-blowing' experiments were performed—wire loops were bent into the mouth shapes of the horns to be tested, and it was noted that only circular, or near-circular mouths would produce complete bubbles; rectangular shapes causing the bubbles to tear themselves apart before they could leave the wire. It was also noticed that rectangular horn designs would produce disturbed responses when listening to them or measuring them from a position 90° to any discontinuity. Such discontinuities include waveguide plates, the top-bottom to sidewall junctions, and any other departures from a smooth surface. The mouth shape and any internal discontinuities tend to produce reflections from the mouth or strange aberrations in the off-axis responses. All of these things were strong pointers in the direction of the concept of axial symmetry being the only viable option for the highest quality reproduction.

Axial symmetry

For public address and sound reinforcement applications, directivity is a prime factor in horn design; in studio monitoring, the on-axis ±20° response, together with an off-axis response ▶

What a concept ...

Concept One
Digitally Controlled Production Consoles

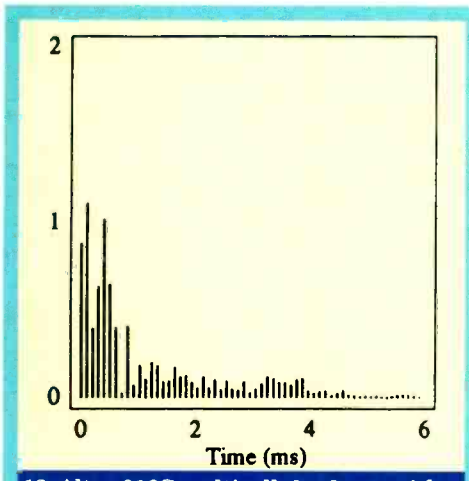
Although new to Otari, Concept 1 is the culmination of over twenty years of console design and manufacturing expertise. Given the unusally attractive price, what else is different?

- True symmetrical inline design with up to 48 dual I/O modules featuring 96 automated mix channels. Each channel path uses its own dedicated, identical 4-band equalizer with a 100 mm large fader.
- Console-wide snapshot automation allows storing and recalling of switch functions, manually or with reference to SMPTE/MIDI timecode. DISKMIX™ dynamic fader & mute automation enables fader grouping with VCA or moving faders. Additional console screen dynamics will follow.
- User programmable softkeys per I/O module and the additional virtual master status control create a new level of operational flexibility.
- Each channel's switching functions may be accessed from the easy to understand master section in form of an active color-coded block diagram (photo insert).
- CompuCal™ allows precise digital calibration of output and meter levels.

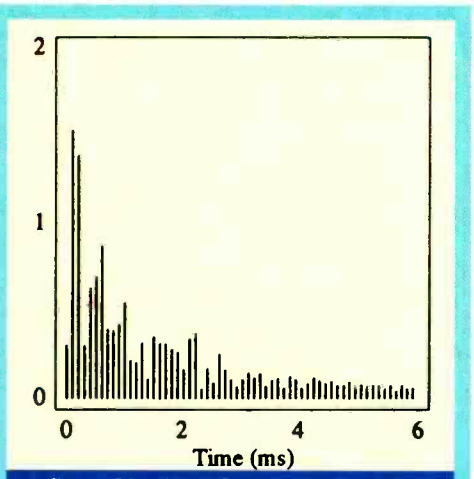
The particulars are endless, but the bottom line is simple:
Otari has done more than just reinventing midrange audio consoles.

OTARI®

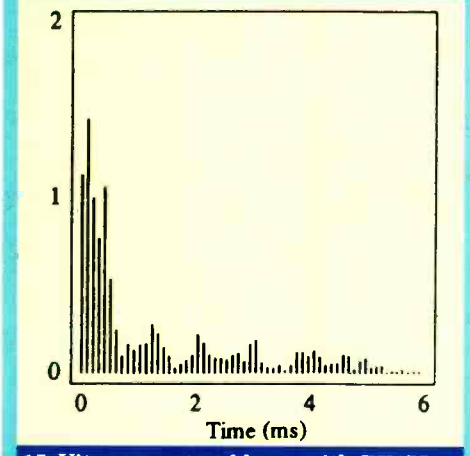
OTARI Deutschland GmbH
Rudolf-Diesel-Straße 12 · D-40670 Meerbusch
Tel. 02159-50861
Fax 02159-1778
Telex 8531638 otel-d



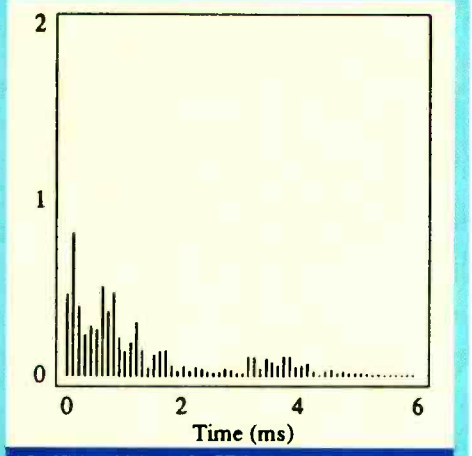
13: Altec *806C* multicellular horn with *EK175* driver



14: Starr *Singing Throat* wooden gramophone horn with *EK175* driver



15: Vitavox sectoral horn with *EK175* driver



16: JBL *2370* with JBL *2426* driver

Fig.2.6: Power cepstra of sample loudspeakers

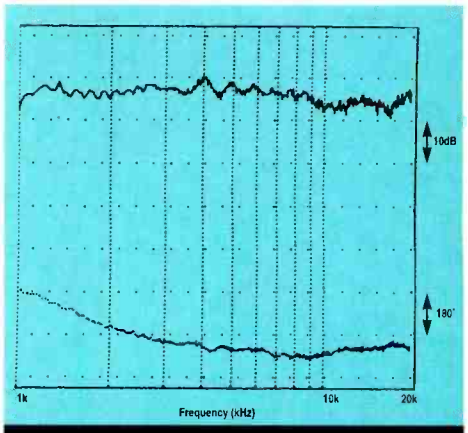


Fig.3: Frequency response and phase response of *AX2-TD2001* combination on axis, in room, at 2 metres

which changes in its frequency balance in a smooth and uniform way, is usually more important. In the above tests, the axisymmetric *AX2* horn was driven by an Emilar *EK175* compression driver. In the cepstrum plots shown in **Fig.2.4** the *combination* is sample **8**, and a small reflection can be seen at a distance of about 50mm from the diaphragm. Investigation showed this to be due to the slightly differing flare rates of the driver throat and the throat of the horn. When mated with the TAD *TD2001* compression driver, the flares match exactly and the reflection disappears. The power response of the TAD is also such that its falling high-frequency response is closely matched by the gradually narrowing directivity of the *AX2* horn, producing a smooth on-axis pressure amplitude response, together with an off-axis response where the fall-off of high frequencies takes place in a smoothly controlled manner. These responses are shown in **Fig.3**.

Monitor systems using the *TD2001-AX2* combination are now in commercial use, particularly in control rooms of a very nonreflective nature where the on-axis response is highly important. These monitor systems, especially in inexperienced hands, do suffer from some of the criticisms formerly aimed at the Quad Electrostatics and Tannoys, in that they are not necessarily representative of other loudspeakers, but equally, many *experienced* engineers praise their ability to pinpoint fine detail. Most studios' use of large and small monitor systems—one representing 'truth', the other a 'real world' mix—still seems to offer the most viable partnership.

In many ways, the *AX2* could be defining the limits of midrange horn design. The axisymmetric shape (**Fig.4**) seems to be the only one which can produce an output free of the irregularities of response caused by pillars, plates, other obstructions or surface junctions. Horns much more than 300mm in length begin to produce 'horn-like' sounds unless the mouth termination is close to perfect. Given that the rate of flare dictates the throat cut-off frequency, and the mouth size controls the smoothness of the low-frequency termination to the room, then a horn with a low cut-off frequency, possessing a mouth which smoothly flares into the baffle, would be of such great length and mouth size that close coupling to the other drivers in the loudspeaker system could be almost impossible. The *AX2* has a cut-off frequency of around 750Hz, but is so smooth in its response that it can be used *through* cut-off. This is the lowest cut-off frequency that can be achieved, consistent with a flare which smoothly blends into the baffle, originating from a 1-inch throat in a diaphragm-to-mouth distance (with *TD2001*) not exceeding 300mm.

However, a high-efficiency horn system, usable from below 1kHz to over 20kHz, with a mouth diameter of 12½ inches, capable of producing very high fidelity and a maximum output of 125dB at 1 metre is certainly a useful tool. What is more, it definitely is not 'horn-like' in its sound. Clearly, when the many variables are fully understood and appreciated, horn systems *can* be produced which do not possess any typically horn-like vices. Attention to detail is a prerequisite, as is a comprehensive knowledge of the caveats.

Two further aspects of horn design are called into question as a result of this research, both requiring further investigation. Firstly, given the extreme sensitivity to small disturbances in the throat region, can the Tannoy concept of having an actual gap in the horn, (the voice-coil gap of the bass cone) ever be expected to produce optimal results? More particularly, when that gap is modulated by high levels of bass driver movement, can a variable length, variable flare, gapped throat ever be expected to produce optimal results? Secondly, the results show that any abrupt flare-rate changes within the horn, can, do, and will cause reflections which will superimpose themselves on the transfer function. As the whole concept of constant-directivity horns relies upon flare-rate changes of no subtle nature, then can the best results ever be achieved from constant-directivity horns?[10] **Fig.5** shows the measured throat impedance plot of the *AX2*, ▶

ADVERTISERS' INDEX

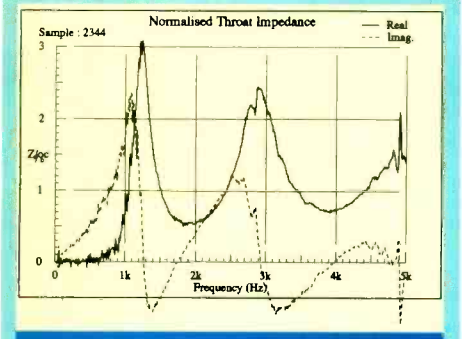


Fig.5a: Throat impedance plot of a typical constant-directivity horn

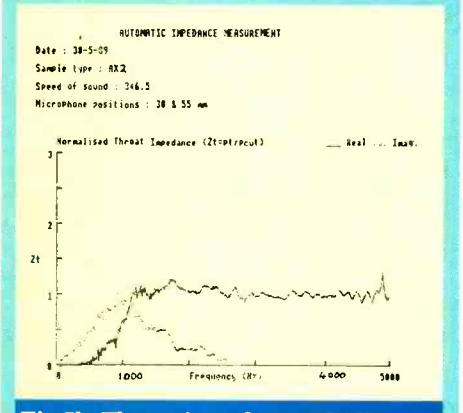


Fig.5b: Throat impedance of *AX2* axisymmetric horn

compared to that of a widely-used constant-directivity horn of reputable manufacture and of similar dimensions. However, this should not overly concern manufacturers of constant-directivity horns, as the bulk of their sales are in the PA/SR field, where their smooth coverage of a desired area far outweighs the sonic subtleties discussed here. For studio purposes though, constant-directivity horns would not seem to be the ultimate solution. ■

References

1. K R Holland, F J Fahy, C L Morfey and P R Newell, 'The Prediction and Measurement of the Throat Impedance of Horns', *Proceedings of the Institute of Acoustics*, Vol.11 (7), Reproduced Sound 5, pps 247–254, 1989.
2. K R Holland, F J Fahy, and C L Morfey, 'Prediction and Measurement of the One Parameter Behaviour of Horns', *Journal of the Audio Engineering Society*, Vol.39 (5), pps 315–337, 1991.
3. F J Fahy, 'Rapid Methods for the Measurement of Sample Acoustic Impedance in a Standing Wave Tube', Letter to Editor, *Journal of Sound and Vibration*, Vol.97 (1), p 168, 1984
4. P R Newell and K R Holland, 'Do All Midrange Horn Loudspeakers have a Recognisable Characteristic Sound?' *Proceedings of the Institute of Acoustics*, Reproduced Sound 6, pps 249–258, 1990.
5. K R Holland and C L Morfey, 'A Model of Finite Amplitude Sound Propagation in Horns'. *Proceedings of the Institute of Acoustics*, Vol.12, Acoustics 90, 1990.
6. K R Holland and C L Morfey, *Finite Amplitude Sound Propagation in Waveguides of Variable Area*, Presented at the 12th International Symposium on Nonlinear Acoustics, Austin, Texas, 1990.
7. K R Holland, 'The Use of Cepstral Analysis in the Interpretation of Loudspeaker Response Measurements' *Proceedings of the Institute of Acoustics*, Reproduced Sound 9, pps 65–71, 1993.
8. K R Holland, PhD Thesis, Southampton University, 1992.
9. P R Newell, 'Monitor Systems—Midrange Horns Part 2', *Studio Sound*, Vol.31 (a), pps 62–72, September 1989.
10. M A Dodd, *A Wide Dispersion Constant Directivity Dual Concentric Driver*, Presented at AES 92nd Convention, Vienna, 1992, AES Preprint No 3257.

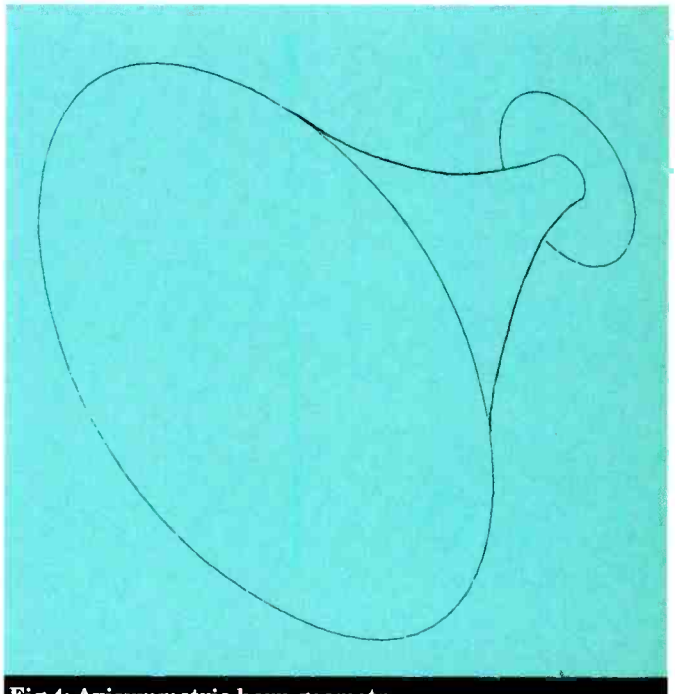


Fig.4: Axisymmetric horn geometry

STUDIO DIRECTORY

LEGEND TO SYMBOLS:

Mobile Recording
Digital Console
Residential Studio
Full-Time Maintenance
Digital Editing
Audio for Video
D Digital - Tracks
A Audio - Tracks

ABBEY ROAD STUDIOS

abbey road

3 Abbey Road, London NW8 9AY. Tel: (071) 286 1161; Fax: (071) 289 7527. Owner: Martin Benge - Managing Director; **Studio/bookings Manager:** Colette Barber; **No. of studios and dimensions:** Studio 1: 94ft. x 55ft. x 42ft.h, Studio 2: 58ft. x 37ft. x 28ft. h, Studio 3: 28ft. x 23ft. x 24ft. h, Penthouse: 20ft. x 20ft. x 9ft. h. **Mixing consoles:** Studio 1: Neve VRP Legend 62 cm. Studio 2: SSL 4000E with G Series computer 56 c+/-i. Studio 3: SSL G 72 channel with ultimation. Penthouse: Neve Capricorn digital. **Recorders:** Studer A820, Sony 3348, 20 Bit DAT, Sony 3324A, Mitsubishi x880, Sony 1630 1/2inch, 1/4inch etc. **Digital audio workstations:** Sonic Solutions. **MIDI set-up:** Atari Notator, Akai Samplers, Korg KeyBoards. **Monitors:** Quested, Bdw, JBL, Nearfield: Yamaha NS10's, ATC, B&W 805. **Special services:** Accommodation, Restaurant/Bar, Games Room.

D x48 A x48

DOUBLEWTRONICS

Eugenio Salazar 42. +34 (1) 519 0566; Fax: +34 (1) 519 1496. Owner: Jesus N. Gomez. **Studio/Bookings Manager:** Regina Marfil. **No. of studios & dimensions:** 1 - 70m* (studio), 1 - 9m* (mastering suite). **Mixing consoles:** AMEK Custom G2520 W/Master Mix (48CH). **Recorders:** Sony PCM 3348 - MCI JH24. **Digital audio workstation:** (3) Mac II FX W/SD II (Sound Tools II). **MIDI set-up:** Two large systems to be described here! (emulptor II, III x P, Akai S1100, MP660, Yamaha....). **Monitors:** MDIN - Custom JBL 4435 (3 way-active) W/Crown AMPS (Macro Reference), Small - JBL 4401 - JBL 4412 - Yamaha NS10M (W/Crown DC 300). **Specified outboard:** Lexicon (224XL - 480 - PCM70 - etc) - AMS DMX 1580 - Eventide H3500 - Valley People (Ketex II - GAIN BRAIN - 610 MAXI Q - etc) - UREI - DBX - TC Electronics - KORG - Yamaha... **A/V equipment:** UMATICS, VHS, Color Monitors (Sony). **Special services:** Specialises in digital work. Mastering suite (PCM 1630 w/PQ for CD Prep.) **Association member:** AEGS.

A x 24 D x 48

FONOPRINT RECORDING STUDIOS

V. Bocca di Lupo 6, Bologna, Italy. +39 51 5852 54; Fax: +39 51 3340 22. Studio/Bookings Manager: Nicolini Luciano. **No. of studios & dimensions:** Studio 1 Control Room 60 m* Recording room 85 m*. Studio A Control Room 26m* Recording room 56m*. Studio B Control Room 27m*, Recording room 30m*. **Mixing consoles:** SSL 4064 G Series with total recall, MC1 500 28CH with Automation, DR 8000. **Recorders:** 2 x Sony PCM 3324, 1 x Otari DTR 900 II, 2 x Otari MTR100. **Digital audio workstations:** Sound Tools with MacIntosh II Ci. **Monitors:** Quested Q412B, Urei 813B, Yamaha NS10M. **Specified outboard:** Lexicon 480, 224, PCM70, AMS RMX16, 1580S Yamaha Rev5 Rev7 Eventide H949, H3000S, K.T. DN780, Prisma Neve. **Special services:** Studio Design By: ADG Acoustic Design Group. Kitchen, Catering, Satellite TV, Biliard Table.

A D

PINK TONSTUDIO

PINK

Luzernstrasse 123, 4528 Zuchwil, Switzerland. +41 (0) 65 25 24 88; Fax: +41 (0) 65 25 30 31. Owner: Jurg Naegeli AG. **Studio/Bookings Manager:** Jurg Naegeli. **No. of studios & dimensions:** a) Studio 40m*, Control room 30 m*, c) ProTools & MIDI room 24 m*. **Mixing consoles:** a) Soundcraft 2400 28/24/2, Bargraphs, c) Yamaha DMP 11. **Recorders:** A): Otari MTR 90 MkII; Studer A 812, Dolby SR; Studer A 812 TC; Studer D780 DAT; Studer D 740 CD-Recorder; Sony & Tascam DAT's & Cassette's. **Digital audio workstations:** DigiDisign PROTOOLS. **MIDI set-up:** Akai S 1000 KB, 12 MB, HD; Emulator II; 2 x Emu Proteus 1; 2 x Emu ProCussion; Korg M1 & M1R; Yamaha DX 7; Roland JX8P & D110 & Juno 60 (Midi); ARP Odyssey; Oberheim Matrix 1000; Hohner String Ensemble; Alesis HR 16B Atari 1040 ST, 4MB; C-Lab Notator; Mac Quadra; Opcode Studiovision. **Monitors:** MANGER Schallwandler; JBL 4313; JBL 4315; Yamaha NS 10M; Auratones. **Specified outboard:** Lexicon 480L & PCM 70; AMS RMX 16; AKG BX 15 Spring Reverb; Roland SRV 2000 & DEP-5 & 3x SDE 2000 & Dimension D & PH 830 & SBF 325 & SVC 350 & 2x Chorus Echo; 3x Yamaha SPX 900 & 2x SPX 90; AMS dm 2-20; Eventide 910; DeltaLab DL-2; SPL SX-2; Aphex Compellor & Dominator & Exciter III & C; Alesis Quadrave ; Ibanez DM 1000; 2x DBX 160; DBX 120X-DS; SCAMP-Rack w. Comp., gates, param. EQ's, De-Essers & Drawmer gates; Klark Teknik graphic EQ's; Yamaha graphic EQ's; T.C. param. EQ's, Behringer Composers, Intellicates. Denoiser, Ultrafax, Edison, Bassfex; T.C. 2290, a.s.o. **A/V equipment:** Sony U-matic Hi & Lo Band; Sony Monitors; Fostex Sync. Roland SBX 80 SyncBox. **Specials:** Bosendorfer Grand Piano; Hayman Drums; Hammond A 100 & L 100 with Leslies; selection of rare Gtr. - & Bass Amps & -Cabinets; selection of Gtr. - FX - Pedals.

D 2+4 A

PILOT TONSTUDIO GmbH

Rumfordstr.15 D-80469 Munchen, Germany. Tel: +49 89 296 396; Fax: +49 89 299 891. Owner: C. Cress, A. Volker, Mambo Musik. **Studio/bookings Manager:** Hans Menzel. **No. of studios & dimensions:** Studio I/ SSL 50 sqm 6m height, Studio II/Harrison Ten. 6sqm, Studio III Midi, 6sqm, Studio IV/Hard Disk-Mastering. **Mixing Consoles:** SSL 4000 G-Series 56 Channels Total Recall, Harrison Series Ten, fully automated Sony Estec 32 channels, Studer Dyaxis II. **Recorders:** 2 x Studer D820 48-track digital, 2 x Otari DTR 900 32-track digital, 2 x Studer A 820 24 track analogue with Dolby SR. **Digital audio workstations:** Studer Dyaxis. **MIDI set-up:** EMU XP 32MB, 105 MBinternal, Akai S1100 HD 26 MB, CD-Rom, 60 MB Hard Disc, Roland W-30 Sampler-CD ROM, Roland D550, Roland D110, Roland Suiper Jupiter+Programmer Prophet VS, Korg M1, Yamaha DX7 II, Yamaha TX 802, Yamaha RX 5, Yamaha RX 7, Yamaha TG 77, JD 800, Korg Wave Station AD, 2 Atari Mega ST4, 2 Atari 1040 ST, 2 Atari Hard Disk. **Monitors:** Quested Monitor System Custom Made in Studio I + II, III, Westlake BBSM 4, Yamaha NS10 M, Tannoy Eclipse. **A/V equipment:** Studer Dyaxis II.

(160) D (48)

SAFE & SOUND STUDIO

Midden Akker 72, 1446 GS Purmerend, Holland. +31 2990 49354; Fax: +31 2992 1620. Owner: Olof Bosma/Marc Christian. **Studio/Bookings Manager:** Marc Christian. **No. of studios & dimensions:** 1 studio, dimensions: 7.5 x 5 meters (New larger studio shortly available). **Mixing consoles:** TAC Matchless (Cmix), Side car: D&R 4000. **Recorders:** Soundcraft 2" (24), Ampex ATR 1000 2" (16) track, Awai DAT, Tascam D, TEAC Master Un. **MIDI set-up:** Atari 1040 Cubase - Akai Sampler, Akai Audio, Midi Trigger. **Monitors:** Tannoy Little Reds & Auratone. **Specified outboard:**Lexicon PCM 70 - Lexicon LXPI, Yamaha SPX 900 - Yamaha R100 - Boss Multi-Effect, Master Room Spring Reverb Unit - Aphex Aural Exciter BBE Maximizer - Drawmer Comp/Limiters - D&R Limiters D&R Gates. Microphones U87-AKG - Beyer Sennheiser. **Special services:** 24 track digital available on request. **Associated Member:** RE-PRO/APRS.

A

CLASSIFIEDS

Please call Steve Grice or Phil Bourne
Rates and details +44 (0) 620 3636

The attention of advertisers is drawn to "The Business Advertisements (Disclosure) Order 1977", which requires that, all advertisements by person who seek to sell goods in the course of business must make that fact clear.

All job advertisements are bound by the Sex Discrimination Act 1975.

Advertisement copy must be clearly printed in block capitals or typewritten and addressed to: Steve Grice/Phil Bourne, Studio Sound, Spotlight Publications Limited, 8th Floor, Ludgate House, 245 Blackfriars Road, London . SE1 9UR

SOHO SOUNDHOUSE/ TURNKEY

Require a mature person (not necessarily in age!) to run our accessories department. The ideal candidate will have previous experience in this field, and whilst this is not essential, a comprehensive knowledge of this marketplace is.

Please send a CV and letter outlining the benefits you could bring to our company. Excellent salary/ prospects. We are an equal opportunity employer.

114-116 Charing Cross Road, London WC2H 0DT. Fax: 071 379 0093

Part of the Arbiter Group PLC

NEW TAPE HEADS SUPPLIED FOR MOST MAKES. TAPE HEAD RE-LAPPING/RE-PROFILING. Same day turn round. Head technology, 11 Brittania Way, Stanwell, Staines, Middx. Tel: 0784 256046

CASSETTE DUPLICATION - Second to None. Simon Stable Promotions. Lyrec Loop-bin. On-body printing. Shrink-wrapping. Blanks wound to length. *Sample tape available.* Tel: 0869 252831

SERVICES

FOR SALE

NEVE V3 – 48 CHANNELS
Flying Faders...1,500,000 French Francs
SONY 33/48 – UPGRADED
1600 Hours, Mint Condition
.....1,000,000 French Francs
Total sale of both for
2,400,000 French Francs
£270,000 – U.S. $480,000
For enquiries, Call:
+ 33 (1)-47.24.66.55 in France

Digital and analogue editing, mastering. **Duplicating of any format including One-off CDs from £19.90** Also CD testing, custom wound blanks and voice-over recording

Ref SS591, 13a Hamilton Way London N3 1AN
Tel: 081-346 0033
Fax: 081-346 0530

FAIRLIGHT SERIES THREES

Sold, repaired, serviced, hired. Stock constantly changing, please phone or fax for list.
Tel: + 44 (0) 71-700-1852. Fax: + 44 (0)71-607-1410
23a Benwell Road, London N7 7BL
HORIZONTAL PRODUCTIONS

AUDIO & VIDEO TECHNICAL SERVICES. Custom electronic design – signal processing and switching – on screen metering – logic control – wiring – complete installations. **COLOUR SOUND 0483 574545 or 081 898 3838.**

HAMMOND C3 TYPE ORGAN, 25-note Pedalboard, Bench, Leslie & PR40 Tone Cabinet. Extensively rewired. £1495. **Tel: 0453 752142 (daytime).**

REAL RECORDINGS

THE CASSETTE DUPLICATING SPECIALISTS
Real time & high speed loop bin duplication, printing & packaging. Blanks wound to length
TEL: 061-973 1884

BABEL HIRE

NEW & USED EQUIPMENT SALES WORLDWIDE

Otari MTR90 MkII	**Lexicon** 224xl
remote & locator	**Lexicon** PCM70
MCI 2 inch 24 track	**Eventide** H3000 harmonizer
Fostex G24sS	**Roland** RSS system
Studer A800 MkIII	Maasenburg GML eq
Roland DM80 4 track system	**AMS** 1580S
Roland DM80 8 track system	**Fostex** 4050 auto locator
Roland DM80S Mac software	**TAC** matchless 32 frame
Akai ADAM digital recorder	**AMEK** Mozart 56 frame,
Alesis adat 8 trackdigital	supertrue automation
Alesis BRC remote	**SSL** 4000e 56 frame 48 mono
Lexicon LARC	channels Producer desk
(for 480L or 224)	**Soundtracs** Jade 40 frame
Lexicon 480L	36 inputs

Tel: +44(0)81 749 8222 Fax: +44(0)81 749 8767
7 Goldhawk Mews, London W12 8PA

CRYSTAL!

SET UP BY AN ESTABLISHED COMPANY TO MARKET A NEW RANGE OF AFFORDABLE PRODUCTS

CALL FOR FULL PRICE LIST

WHY PAY MORE FOR DATS?

DAT R48 - FROM £2.75 + VAT!
DAT R62 - FROM £2.75 + VAT!
DAT R92 - FROM £3.30 + VAT!
DAT R122 - FROM £3.69 + VAT!
WE USE MAXELL TAPE
- RECENTLY RATED FIRST IN A NATIONAL SURVEY

TEL 0223 208937 - FAX 0223 208937
NORTH ROAD WENDY ROYSTON HERTS SG8 0AB

MANUFACTURERS CLEARANCE SALE

We must sell a quantity of PLATINUM Level 4 recording desks. Available in 24 or 32 channel frames. 8 group, 24 track monitoring or as 12 group monitor desks. Bar graphs on every channel and output. Fully Modular design, excellent specs.

Prices start at under £3000. Phone for a brochure and price list.

☎ (0444) 400432. Trade enquiries and Export sales welcome.

SITS VAC

Technical Support Engineer – c£18k

Located Herts. Technical support to manufacturing. An understanding of analogue and digital electronics plus an understanding of the design process required.

Digital Audio Sales – £neg

Experience selling digital products advantageous UK and export sales. Knowledge of post production important.

Service Engineers – £12-17k

HNC Electronics and knowledge of analogue and digital. Tape machine experience also revelant.

For further information please contact **Mike Jones, Broadcast & Communications Professionals, Unit 9b, Intec 2, Wade Road, Basingstoke, Hants RG24 8NE. Tel: 0256 470704. Fax: 0256 844054.**

Recruitment specialists in Audio and Video

SOUNDTRACS PLC

CUSTOMER SERVICE ENGINEER

· Analogue and Digital Circuitry ·

Soundtracs in Surbiton require an experienced audio engineer with extensive knowledge of analogue mixing consoles with digital control of analogue to liaise with customers over technical queries both overseas and UK.

This vacancy will suit an engineer with a minimum of an HND qualification and over five years practical experience. An intelligent and coherent telephone manner as well as an exacting and detailed approach to analysing problems is vital. Knowledge of database, spreadsheets, MS-DOS computer systems is also desirable for retrieving information.

Circuit knowledge to include discrete integrated circuits, CMOS, TTL microprocessors and DSP is sought.

System knowledge to include interfacing consoles with the real world.

The position will entail some overseas travel.

The salary and benefits including a company related bonus scheme will be commensurate with the responsibility of the position.

Please apply in writing to:

Simon Payne
Soundtracs PLC, 91 Ewell Road, Surbiton, Surrey KT6 6AH
Telephone 081-399 3392, Fax 081-399 6821.

NO AGENCIES PLEASE

FOR SALE

Buying and Selling quality professional equipment throughout Europe

nick ryan ☎ +44 (0)892 861099 Fax: +44 (0)892 863485

Sounds incorporated

TONY LARKING

PROFESSIONAL SALES LIMITED

ENGLAND'S LARGEST STOCKIST OF

USED

PRO-AUDIO EQUIPMENT

For a complete new and used equipment list contact Tony Larking
Worldwide Delivery Service

Tel: +44 (0)462 480009 . Fax: +4 (0)462 480035

(Visitors strictly by appointment only)

audio warehouse
QUALITY NEW & USED EQUIPMENT AT REALISTIC PRICES
U.K.'s Largest stockist of new an used pro audio equipment
Delivery arranged worldwide
tony larking professional sales LTD

SERVICES

EAST MIDLANDS AUDIO

STUDER-REVOX
NEW AND USED SALES
SERVICE – SPARES
APPROVED CONVERSIONS
STUDER A62 B62 SPARES

STUDER A80 24-TRACK	£500.00
STUDER A80 16-TRACK	£6000.00
STUDER A80 2-TRACK	£1200.00
STUDER A810 4-SPEED	£4000.00
STUDER A812 4-SPEED	£7500.00
STUDER B67 PORTABLE VU	£1400.00
STUDER B67 Mk II	£1000.00
STUDER C37 STEREO VALVE	£1000.00
STUDER A725 CD PLAYER	£650.00
STUDER B62, TROLLY	£600.00
REVOX PR99	£1200.00
REVOX B77 Mk II	£1600.00
REVOX A700 3-SPEED	£800.00
STUDER A80 8-TRACK	£1500.00
REVOX C221 PRO CD	£1200.00
REVOX B126 CD PLAYER	£650.00
REVOX A77 HS	£600.00
REVOX C279 WITH EXP	£1400.00
REVOX PR99 Mk III	£2868.00
REVOX B77	£2100.00
STUDER D730 PRO CD	£2265.00
STUDER D740 CD R	£3600.00
REVOX MB16	£7500.00
REVOX PR99 BROADCAST	£1800.00

ALL PLUS V.A.T.

TEL: 0246 275479
FAX: 0246 550421

Make it with us . . .

Sound Recording TECHNOLOGY

•D•I•R•E•C•T•

- COMPACT DISCS
- FULL MASTERING
- LATEST 32-BIT DSP
- SUPER BIT MAPPING
- 20 BIT DIGITAL RECORDING STUDIO
- 20 BIT EDITING
- SOUND RESTORATION, DE-CLICK etc
- COPY MASTERS
- DIGITALLY DUPLICATED CASSETTES
- PRINT/REPROGRAPHICS

MARKET LEADERS
☎ 081 446 3218 LONDON
☎ 0480 461880 CAMBRIDGE

SITS VAC

SALES ENGINEER

SCV Electronics manufacture and distribute world-wide one of the most extensive ranges of signal processing equipment for P.A., contracting and broadcast applications.

As part of a group owned by the largest independent professional audio distributor in Europe, we are fast expanding and are therefore seeking an experienced sales professional to market the line primarily in the UK.

The successful candidate will possess a sound technical knowledge and initiative to develop our contractor/installer market sector. The candidate should also be able to assist with U.K. dealer sales and seminars and our extensive world-wide marketing plan.

Naturally, we offer a flexible and rewarding remuneration package coupled with the opportunity to be part of an exciting and stimulating team.

Applications in writing including CV to the Sales Director at:

SCV ELECTRONICS
3A 6-24 Southgate Road, London N1 3JJ
Fax: 071-241 3644

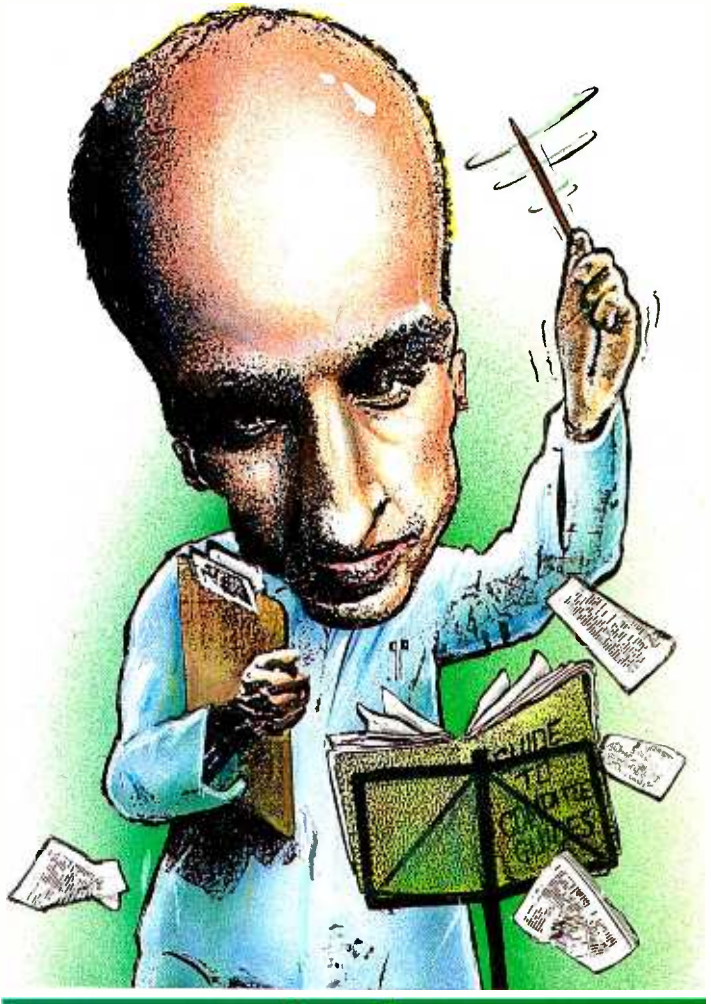


ILLUSTRATION: CARL FLINT

Barry Fox

Last night of the PROMS: the need for education on information technology

At the Annual General Meeting of the Performing Rights Society (PRS) in September, John Timperley asked a question that seemed innocent enough at the time but only later revealed its full significance.

'What qualities does new Chief Executive Ted McLean feel he brings to the post?'

Earlier PRS Chairman Wayne Bickerton had told the PRS members that McLean's appointment in April had, '...set us on the road to efficient and properly-tailored new information systems, and to management restructuring which will contribute to a decrease in administration costs.'

McLean told Timperley: 'He had been responsible for the information technology function in a large company in the past.'

Just a month later, the PRS sent out a letter to its members.
'Mr Edward McLean has offered his resignation and it has been accepted by your General Council...
Mr McLean was selected from several appropriate candidates who had been short-listed from a very large number of applicants... the appointment was made on the basis of the information given to the interview panel... certain information, which has recently come to light, was brought to the attention of the General Council and, after discussions, Mr McLean decided to resign.'

For obvious reasons, the PRS are saying no more, other than to explain that Ted McLean had previously worked for movie distributor UIP. What the PRS will say, however, is that they have now created and filled a new position—Director of Information Systems—and the PRS are talking seriously with the MCPS about some kind of a tie-up or merger to cut administration costs. This would bring Britain into line with other European countries, like Germany and Holland, where work on the collection of royalties on musical performances (done in the UK by the PRS) and on collecting royalties on recordings (the MCPS) is handled by a single bureaucracy.

It is the infamous PROMS episode that has concentrated the copyright collectors' minds.

In 1988, the PRS decided to make revolutionary, rather than evolutionary, changes to the computer system which kept track of royalty collection and distribution. The new system would be called the Performing Rights On-line Membership Service, or PROMS. The plan was to get rid of the ICL mainframe computer used by the PRS, and replace it with a database program run on a network of personal computers. The PRS earmarked £10m for the project, which inflation pushed to £12m. Hardware and software were bought and project managers appointed. Almost immediately things started to go seriously wrong. The PRS had grossly underestimated the difficulty of automating a system which relied so heavily on human beings helping the computer.

As one insider astutely put it: 'The human beings had been the chips. They had been tying all the loose ends together, and it was impossible to create a single all-embracing electronic system'.

In November 1992, the PRS froze all further development of PROMS. Ewen Fletcher was commissioned to produce a report which was only ever seen in full by the PRS Council. A synopsis quite bluntly told the PRS that PROMS would never work —however much money was thrown at it. The report also recommended that the PRS create a new post, Director of Information Systems. The new Director is John Rathbone, who was working in the role as consultant before he got the permanent job.

PROMS was a complete failure. The system never went on line. On Rathbone's advice, the PRS have now scrapped the idea of revolution and gone back to evolution of the ICL mainframe. In all, the PRS spent £11m of the budgeted £10m, but reckons that only (!) £8m of this was a complete write-off, because £3m was spent on hardware, software and training.

Although the PRS and MCPS had been talking for years about a possible liaison, the watershed was the anger of PRS members who saw their royalties squandered on the PROMS debacle. The two industry bodies are now committed to joint working within five years, probably far sooner. The PRS accept that copyright collection is too costly in the UK. Already royalty information is going into the MCPS computer, and from there being relayed electronically to the PRS.

If the PRS had known a bit more about IT in the first place, they would surely have seen the need for an IT Director to pull the PROMS project together, warn of the risks and perhaps warn against even trying to replace the human element. Or the PRS could simply have talked to Brian Eno.

Eno started out playing with flamboyant 1970s rock art-group Roxy Music, went on to earn himself an enviable reputation as the producer of records made by David Bowie, Talking Heads and U2, and makes his own 'ambient' music as well. He spends his life working—in part—with computer-controlled synths, such that the pop music press dubbed him 'Professor Eno'. Recently the University of Plymouth gave him an Honourary Degree.—so Eno is now a Doctor of Technology.

With the Professor's kind permission I quote from a letter he wrote to a friend after buying a new computer and struggling with the instruction manual.

'Welcome to your new computer. We would like to thank you for agreeing to sacrifice the best years of your life trying to understand an under-evolved technology. If you have never used a computer before, then this is a really bad time to start.

'The first section of the manual explains how to use the section of the manual that explains how to use the rest of the manual. Before you read this section, please familiarise yourself with the following section which will make clear why the first section was important. When you have read the manual you will not be able to understand your computer, but you will be considerably older.

'Setting up your modem: Where you will learn the difference between application folders, modem startup documents, SCSI disk mode and autoremounting.

'If your modem will not work...

'Please consult Troubleshooting...

'Problem: Modem not working...

'You have run out of memory, or acquired this product before its design phase was completed, or the salesperson who told you that the use of the modem was straightforward was a pathological liar.' ■

Out on Location

Superb audio performance time after time.

Anyone involved in TV, radio or film production will appreciate the value of rugged, portable sound recording equipment built to withstand the rigours of location shooting.

The LM1 portable audio mixer is a product of Soundcraft's specialist design and manufacturing experience. It is robust, compact and built to last, with a range of features specifically geared towards modern production.

Lm1

- Long life batteries sustain the LM1's trouble-free repeatable performance in the most inaccessible places.
- Wide range input gain, switchable in 5dB steps, coupled with low noise circuits guarantees the best results in the worst conditions.
- The mono and stereo mic inputs both offer 3-band equalization sections with independent HP filters and 2 auxiliary sends with master faders.
- The mono, stereo and stereo line inputs are all equipped with 100mm long-throw conductive plastic faders.
- Comprehensive M/S encoding and decoding allows for input modules to be paired for M/S working, then decoded for metering and L-R monitoring.

For further information on the LM1, please contact Soundcraft at the number below.

Soundcraft

HARMAN INTERNATIONAL INDUSTRIES LIMITED. CRANBORNE HOUSE. CRANBORNE INDUSTRIAL ESTATE. POTTERS BAR. HERTFORDSHIRE. EN6 3JN. ENGLAND. TEL: 0707 665000 FAX: 0707 660482

A Harman International Company

Now Sony is setting a new standard in audio mastering.

The audio mastering revolution starts here.

Because now, Sony sets a new standard in audio mastering to take you into the next century.

MSdisc.

For the first time, there's an audio mastering system that incorporates the latest laser technology.

It means a storage medium on ready-formatted, erasable magneto-optical disc, providing random access that's virtually instantaneous.

It means a pristine recording surface, untouched by any part of the record/playback mechanism.

And it means that a single unit for recording and simple editing can be all you need. Compatibility with current and future Sony editing systems is guaranteed.

The new PCM-9000 MSdisc recorder is exceptionally compact, and because it has a modular design, you pay only for the functions you need.

What's more, it offers 80 minutes of full 20-bit digital sound quality today, with 24-bit capability already built in for tomorrow.

Put it all together and one thing's clear.

Audio mastering will never be the same again.

Sony Broadcast International

SONY

SONY BROADCAST INTERNATIONAL, JAYS CLOSE, VIABLES, BASINGSTOKE, HAMPSHIRE, RG22 4SB, UNITED KINGDOM.
SIMPLY CALL US ON: AMSTERDAM 020 6581911; BASINGSTOKE, UK 0256 483666; BRUSSELS 02-7241711; COLOGNE 0221 59660; COPENHAGEN 042 995100; DUBAI 04 313472; HELSINKI 0 50291; ISTANBUL 0212 224 5961;
LISBON 01 837 2566; MADRID 091 536 5700; MILAN 02 61838440; MOSCOW 095 253 2575; OSLO 02 2303530; PARIS 01 4945 4000; ROME 06 549 131; STOCKHOLM 08 7950800; VIENNA 0222 61050; ZURICH (SCHLIEREN) 01 733 3511;
EAST CENTRAL EUROPE, CIS, BALTIC STATES – UK 0256 483294; MIDDLE EAST/NORTH AFRICA – GENEVA 022 7336350; AFRICA – UK 0256 483248.