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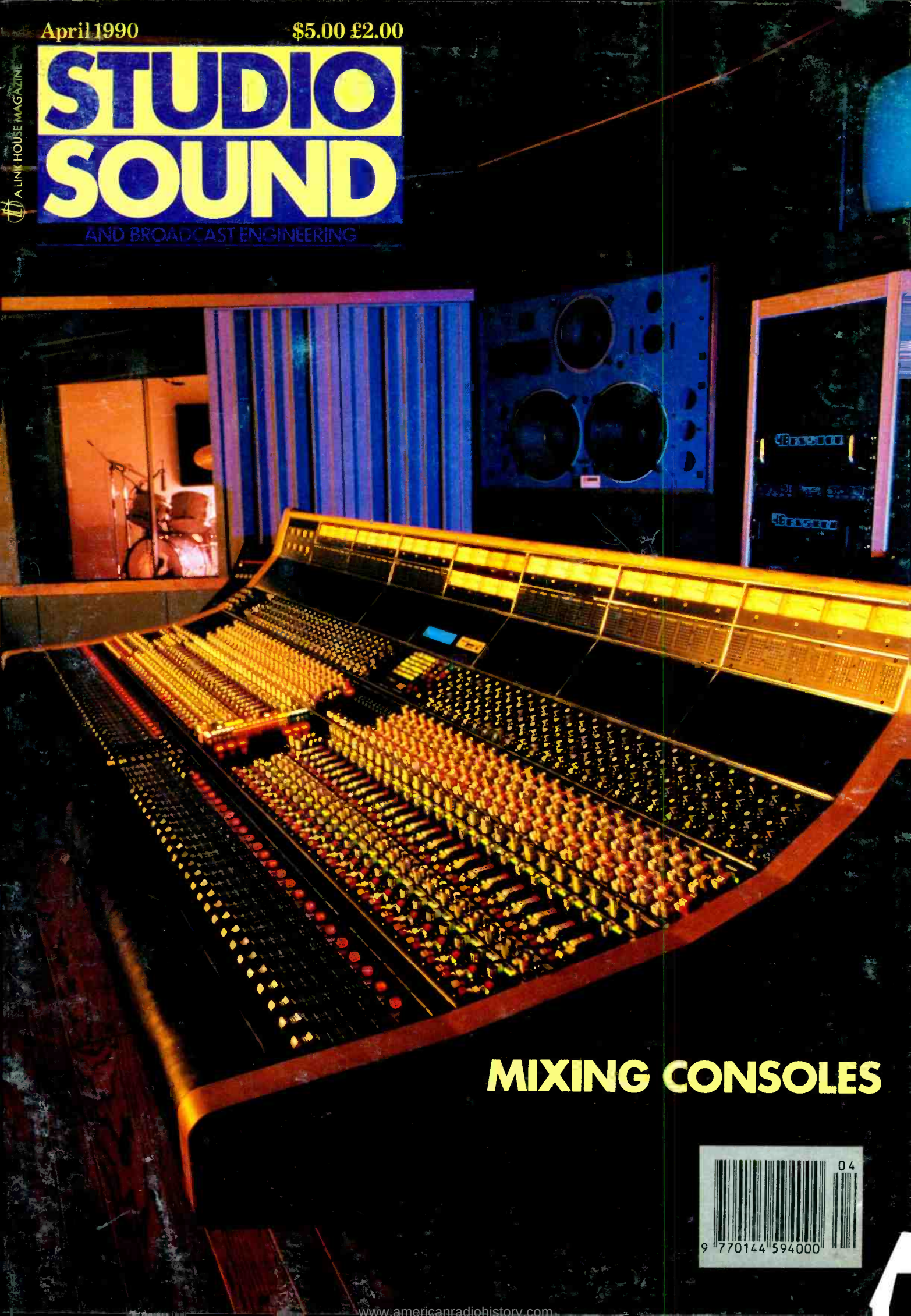
STUDIO SOUND

AND BROADCAST ENGINEERING

A LINK HOUSE MAGAZINE



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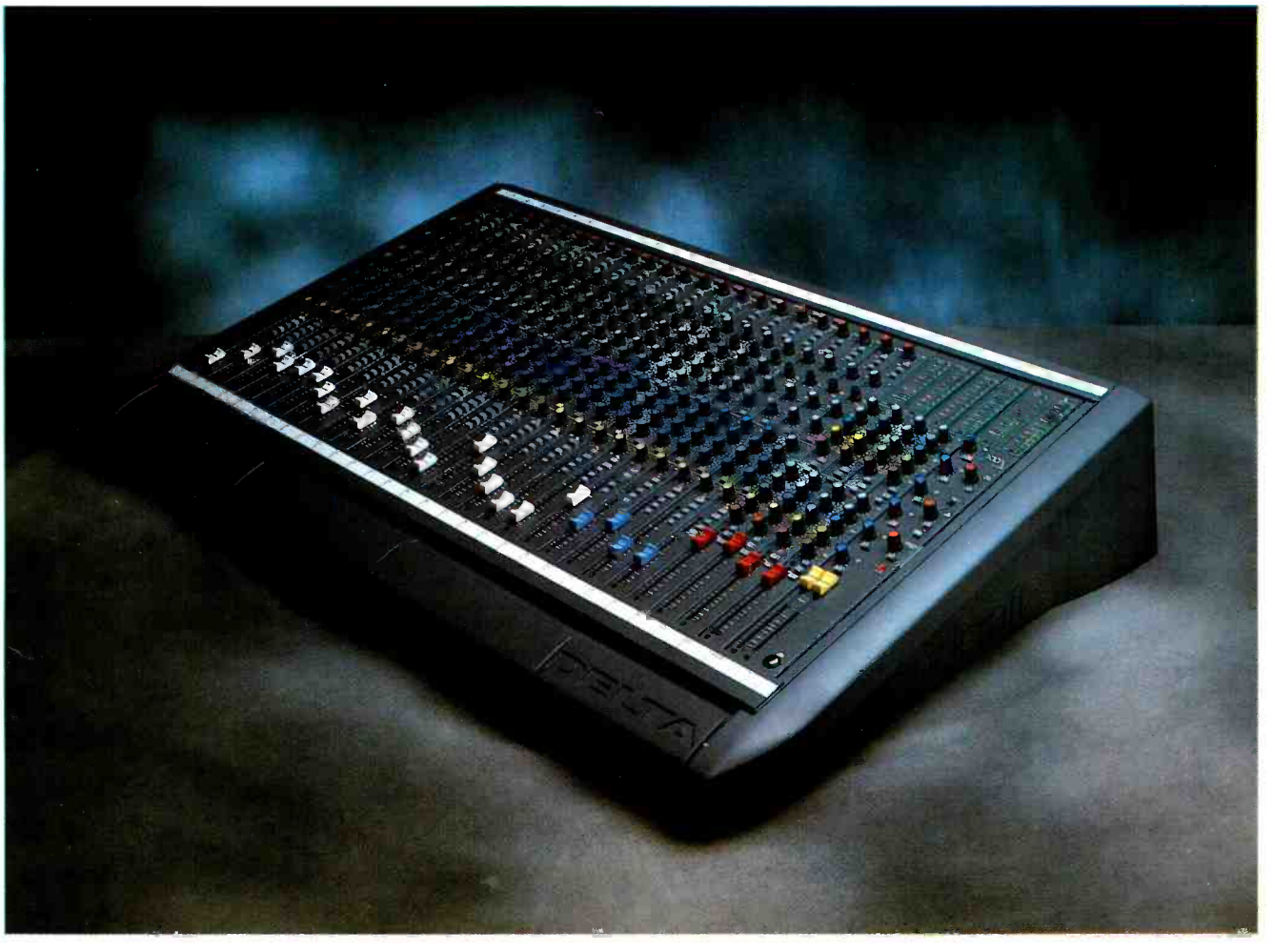

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Soundcraft 200 Delta

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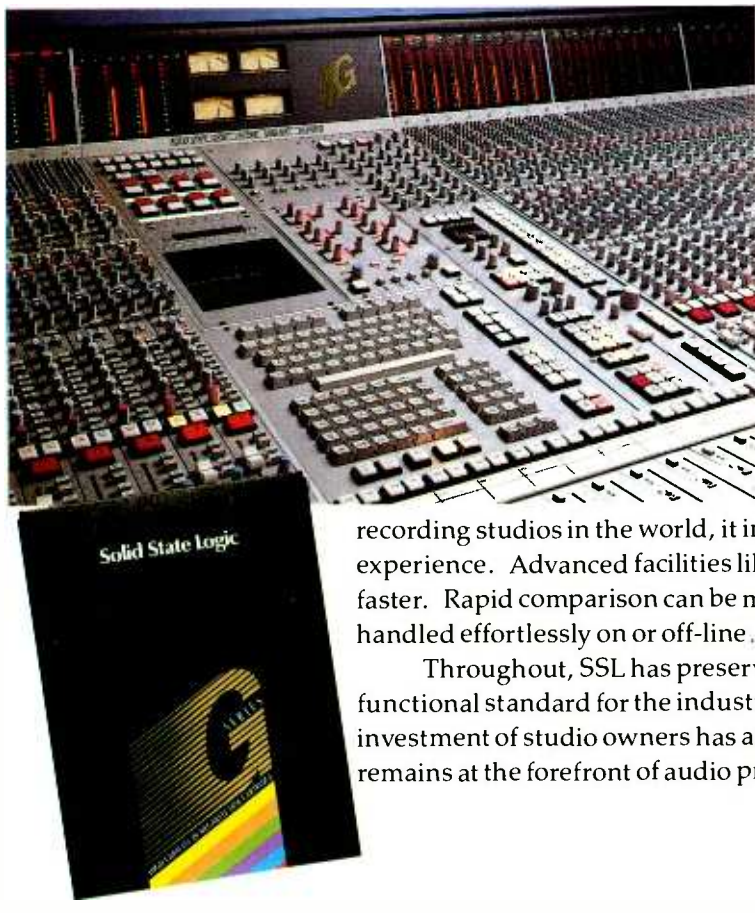
"No one will ever buy a console with a television in it"

Visitor to AES, 1977

It is hard to believe that a modest VDU could attract much attention. Today, even effects processors use visual displays. Why have they become so necessary?

Quite simply, the greater the number of functions in a system, the more flexibility there must be in showing its status. In the recording studio the central piece of creative hardware is the console. To unlock its full potential, Solid State Logic gave engineers digital control of its facilities. The VDU was a side effect of this plan.



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(ABC audited)

Let's go shopping

One of the reasons I became involved in the sound recording business was a simple love of the technology. It certainly was *not* the only factor but it was undoubtedly important. I really don't think I'm that unusual either—you're surely not in it for the money! On a personal level this attraction has frequently left me financially ill at ease—sometimes with worthwhile results, at others just a victim of my own misjudgement. I further think that I can draw comparisons with equipment purchases in the professional domain. To function in the industry profitably a professional opinion needs to be developed separate from our personal tastes. I go shopping.

One of the more difficult business functions in a technology orientated service industry such as ours has to be the ability to predict future trends. It used to be a far simpler matter: Is there work for another room? Should I alter the rates? etc. There was a straightforward relationship between the studio and its clientele. With the output of the record company largely restricted to two related vinyl formats and the fledgling pre-recorded cassette, they were far more in control of their market. They either marketed existing products harder or booked more studio time.

Today the record company is presented with so many possible formats and outlets for its products, many of which were not of their choosing. These include perhaps eight audio formats, increased broadcast outlets, a merging of audio and video media, and the rise of the music video as a saleable product. When presented with the full gamut of possibilities it seems that record companies have little idea which they wish to work with—at least not with the comparative certainty of 10 years ago. The approach of the record industry trade bodies exemplifies this dilemma to which they appear to have no immediate signs of a solution.

What, of course, has happened is that the hardware manufacturers and, to a greater extent, the consumer are dictating the market. It is not really of any great value for the recording facilities to look towards the record companies for guidance on long term market directions—they probably know less than you do. So let's bypass them completely and look at their customers in reality and how the consumers' personal decisions will affect some of the business decisions you will need to make. As mentioned earlier, if you are in the recording industry your personal tastes are probably not a reliable measure. So go shopping.

An hour or so spent wandering around the electrical stores and record shops on a regular basis will pay dividends. Avoid the hi-fi stores as they are not relevant to this research. The future media and trends will have to be mass market to repay the investment the manufacturing giants are putting into them and these will have to happen in the non-specialist stores. A Saturday morning is perhaps the best time to observe, to see what is being presented, what is being pushed hard, and what is selling. Against this knowledge can be set what future home media have the possibility of mass market appeal: DAT, both blank and pre-recorded; recordable CD; digital stereo TV; large screen TV; high definition TV and video formats; surround sound replay for TV and video; the multimedia computer approach with CD-ROM and CD-I; the video disc, etc.

The video disc is actually a very good example of everything mentioned so far. The CD-V format has a great deal to recommend it from recording industry point of view. When the CD-V format was launched in the UK last year players were to be found in about half of the electrical stores I monitored but the staff were obviously indifferent even then. I have not seen a player on demo in any general electrical store for the last 4 months. The stockists of the discs also fell from about 40% to 20% amongst my regular beat leaving mainly just the independent record stores. Now this coincides with the first advertising I have seen of new discs in the trade press for some months. The profile among many of the audio professionals I meet is very high but the consumer interest, or awareness, is very low—a contradiction.

I urge you to monitor the consumer market and with patience it can become a major insight into a possible future direction for purchase decisions. Window shopping is also quite a pleasurable pastime and it certainly helps exercise a little of that love of the technology—have you ever really listened to what stories some of those salesmen tell about the technology you enjoy so much?

Keith Spencer-Allen

Cover: API Audio Products console installed at Messina Music, New York. Photography by Lightscapes, Springfield, VA.

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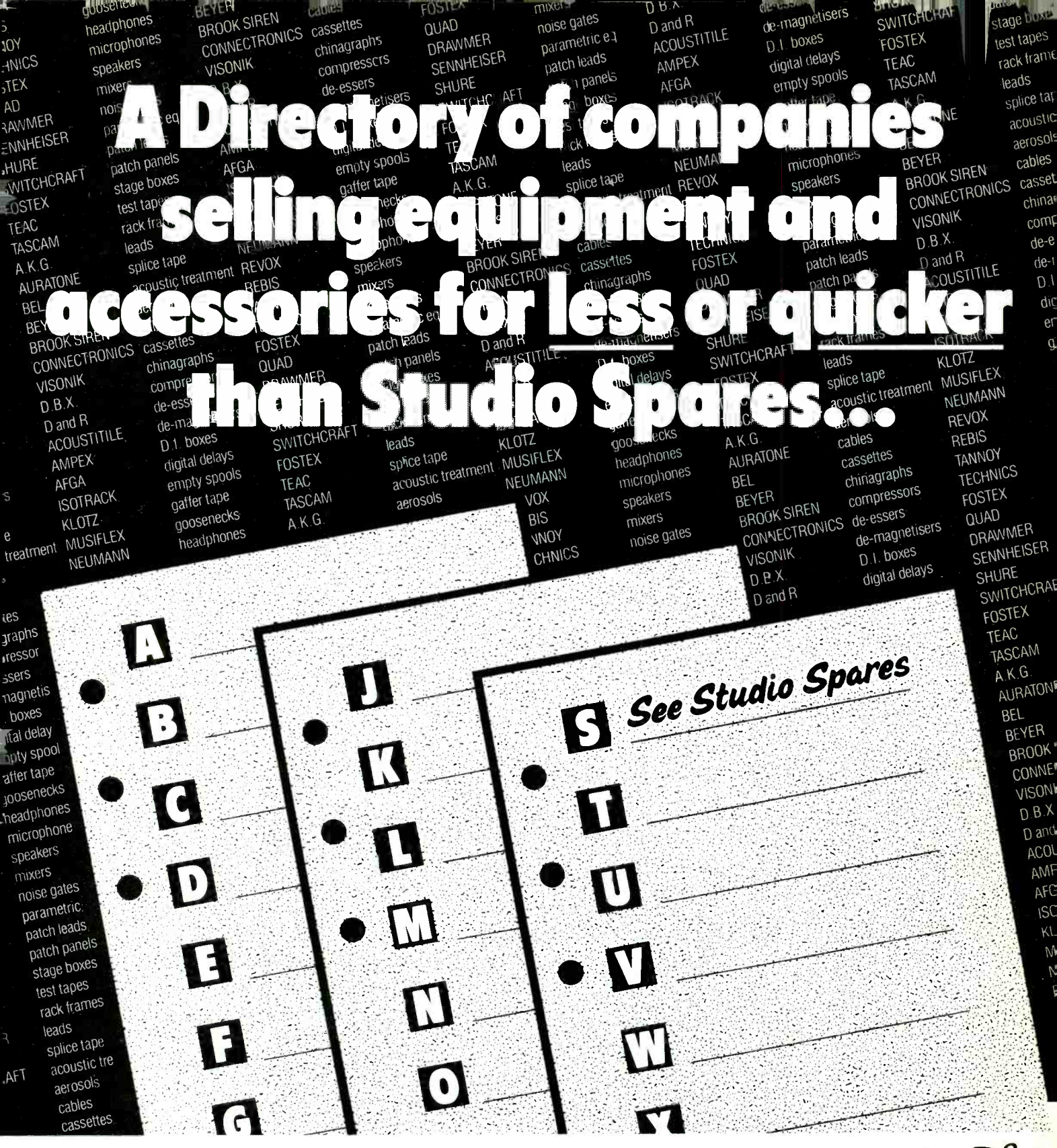

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16 TRACK

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D&R

We are pleased to be handling the new D&R Dayner console. An in line mixer with a unique floating sub group system that eliminates the need for complex route patching, full parametric eq, eight auxillary returns and a choice of input options to suit your budget. Automation is also available controlling both fader and mute operations. The build quality and performance of D&R is without doubt the best we have seen at this price, for details or to arrange a demonstration please call us.

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Soundcraft 6000 32:16 inc stand ex demo	£8970
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Yamaha Rev 5 Digital Reverb	£ 799
Akai XE8 Drum 16 bit 8 voice drum module new	£ 259
Simmons TMI trigger-Midi new	£ 169
Tascam 122 Master Quality Cassette recorder	£ 599
Casio VZ10M	£ 489
Akai S1000PB Playback ex demo	£1725
Digitech DSP128 four digital fx new	£ 299
Art Multiverb	£ 299
Art Proverb 200	£ 199

This is just a small example of the equipment we have, obviously our stock changes from day to day, if you are looking for a particular item don't hesitate to contact us and see if we have or can find what you want !! We can also sell your unwanted equipment for you... call us for details.

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The Technics SV-260 portable DAT recorder's small size is due to a 15mm head drum.

The quality however is heavyweight and on a par with a deck-type DAT recorder mainly due to MASH ADC and XLR balanced Cannon connectors.

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Using the portable recorder is plain sailing in dramatic productions and audio research, where DAT picks up the smallest vibration.

Docked in a studio, the SV-360 DAT deck is equally impressive.

Like the portable, it offers all the flexibility of tape with the sound quality of C.D.

It can be used on its own or as a back up system in a recording studio.

It can also be used alongside our already well-established C.D. players and turntables which have become classics in the studio.

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Harman acquire DOD

Following the release of Harman International's ½-year results the company has announced its acquisition of DOD Electronics Corporation.

DOD's principal trademarks include DOD, Digitech and Audio Logic.

DOD design, engineer and manufacture their own products.

Harman International chairman Dr Sidney Harman commented, "We are pleased with the direction of the company and are determined to continue investing in its future."

Mark IV buys Dynacord

Mark IV Industries, owners of Electro-Voice, Altec, Gauss and University, have taken a majority interest in Dynacord Electronic, a leading German manufacturer of sound reinforcement products.

Dynacord employs 350 people and last year had a turnover of over DM50 million (£12.5m). Lars R Frandsen, Vice President of Mark IV Audio said that the acquisition will have notable effects within the group, in which the name, the products and the structure of Dynacord will be maintained under its existing agreement.

Mark IV Industries, headquartered in Amherst, NY, achieved a turnover of $633.9 million (£380m) and an operating income of $72.9 million (£44m) during the first ¾ of the fiscal year 1989/90.

The Hit Factory London

CBS UK studios in Whitfield Street W1, has been bought by The Hit Factory, New York. The studio will be renamed Hit Factory London. Ed Germano owner and co-founder of New York's Hit Factory promised his clients a superb creative environment and 'state of the art' facilities.

There will be extensive modernisation and several million dollars of investment, particularly to The Soundstage, the Workroom and mastering facilities. The Rooftop Studio however has recently had a major overhaul.

Paul Russell, chairman of CBS UK commented, "On our side we have the facilities and local knowledge, on Ed's side he has a worldwide reputation in the studio business. I am delighted they will now bring not just their expertise to London but also their active personal involvement here."

The renovation work has already started and will be completed in a few months time.

Exhibitions and conventions

March 30th to April 3rd NAB, Atlanta, GA, USA.

April 22nd to 25th Vision and Audio International, Earls Court Exhibition Centre, UK. Tel: 01-776 0709.

May 8th to 10th Show Tech Berlin '90. Berlin Exhibition Hall. East Germany. Contact: AMK Berlin. Tel: (030) 30 38.0.

May 22nd to 24th CD-ROM Europe '90. Novotel Hotel, Hammersmith, London. UK. Contact: Elizabeth Beckett. Tel: 0733 60535.

May 29th to June 1st Broadcast Asia '90. World Trade Centre, Singapore. Contact: Joan Thompson, Electronic Engineering Association. Tel: 01-437 0678.

June 1st to 6th AV & Broadcast 90, China International Exhibition Centre, Beijing. Contact: Business & Industrial Trade Fairs, 28/F Harbour Centre, 25 Harbour Road, Wanchai, Hong Kong. Tel: 5-756333. Fax: 5-8341171.

June 6th to 8th APRS 90. Olympia 2, London, UK. Contact: APRS Secretariat. Tel: 0923 772907.

News from the AES Hard Disk Recording Conference May 16th to 17th 1990

Hard disk or 'tapeless' sound recording is proabably the fastest-growing aspect of digital audio technology at the present time; there is a rapidly growing number of commercial systems, and the need for a deeper understanding of the principles involved grows greater every day. The Conference is designed to include a full morning of tutorial introduction, describing disk drive technology and the way in which disk drives may be made to function as part of a digital recording system, given by well-known industry teachers and the Chairmen of the Conference, John Watkinson and Francis Rumsey. Complementary to this technical introduction will be a comprehensive survey of many current systems and their applications from digital audio consultants, Sypha. There follows a series of presentations both on technology and applications, given by end-users and product specialists, together with informal workshops and opportunities to discuss aspects of operation in more detail.

The Conference will be held at the IBA, 70 Brompton Road, London SW3. The registration fee will include documentation of the conference and refreshments including lunches and evening buffets.

Before that on Tuesday April 10th, also at the IBA, a lecture will be given by Paul Miller who will talk on the controversial subject of Amplifier Differences. In his talk he will discuss the audible difference between amplifiers which would seem to have a similar performance using traditional measurement techniques. Paul will be giving demonstrations to illustrate the points raised in the lecture. It will start at 7.00pm (coffee at 6.30pm).

For further details on either of the above or information on joining the AES, please contact: **Heather Lane, AES British Section, Lent Rise Road, Burnham, Slough SL1 7NY. Tel: 0628 663725. Fax: 0628 667002.**

Conference Programme
Wednesday May 16th
Session A—10.00-13.00
Chairman: Jeff Baker, BBC Television OB
A1 Tutorial, on Disk Drive Technology John Watkinson, Consultant
A2 Tutorial on The Disk Drive as an Audio Recorder, Francis Rumsey, University of Surrey
Session B—14.30-18.00
Chairman: John Watkinson, Consultant
B1 An Introduction to Systems and Applications, Jasmin Hashmi and Stella Plumbridge, Sypha
B2 An Introduction to Operations, John Gluck, AMS
B3 Applications 1—Post Production, Derek Lancaster, BBC TV
Session C—19.00-20.30
Evening Workshop

Thursday May 17th
Session D—09.30-12.00
Chairman: Francis Rumsey, University of Surrey
D1 Real Time use of Magneto-Optical Disks, Nikolaus Seidel, Fougerolle
D2 An Optical Disk-Based Recording System, Steve Howell, Akai
D3 Applications 2—Music Editing, Ben Turner, Finesplice
D4 Applications 3—Radio Station Automation, Peter Jackson, Capital Radio
D5 The Integration of Music Sampling and Disk Recording, Nick Williams and Max Hoskins, New England Digital
Session E—14.00-17.00
Chairman: Nell Gilchrist, BBC Research Dept
E1 Sychronisation of Disk-Based Systems, Mike Parker, DAR
E2 The Digital Audio Workstation—a Modular Approach, John Nelfinson, WaveFrame Corporation
E3 Integrated Audio Production using a Desk-top Computer, Sean Culley, Sound Technology
E4 Extended Discussion

Address changes

• **Motionworks** have moved to The STEP Centre, Osney Mead, Oxford OX2 0ES, UK. Tel: 0865 790577. Fax: 0865 794179.

• **Optical Disc Corporation** have moved to 12150 Mora Drive, Santa Fe Springs, CA 90670, USA. Tel: (213) 946-3050.

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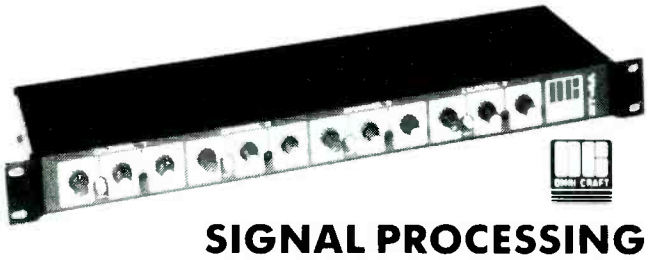

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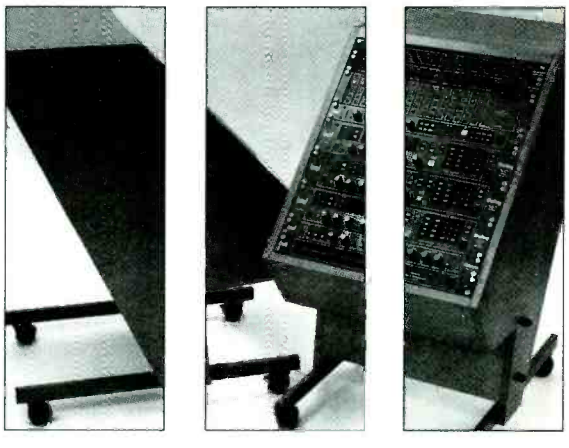

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WaveFrame merger

WaveFrame Corporation, manufacturers of the *AudioFrame* digital sound production system, have announced its planned merger with Cybermation Inc of Long Beach, CA, maker of the CyberSound editorial system.

Concurrent with the merger WaveFrame announced the raising of $3.5 million (£2 million approx) in capital to fund growth. WaveFrame will be headed by Charles Grindstaff as president and chief executive officer, John Melanson as chief technical officer and Steve Krampf as senior vice-president of sales and marketing.

Cybermation was founded by Grindstaff in 1988 to create a complete product for sound editorial that would fully automate the project management tasks of the sound editor. An OEM relationship was developed with WaveFrame for their disk recording technology in January 1989 in order for this product to come to fruition.

In brief

• Isle of Wight, UK: **Neutrik AG** are now marketing their range of audio test equipment direct in the UK through their subsidiary Neutrik AG (UK) based in Cowes, Isle of Wight. Sales enquiries should be addressed to Steve Wakelin, the new sales manager, and technical enquiries to David Higton, the internal product manager for test instruments. Eardley Electronics will remain as exclusive distributors for all Neutrik connecting products.

• Tokyo, Japan: The **BBC's Radio Data System** team is visiting Japan in a bid to encourage radio manufacturers to develop the system, especially the next stage in RDS development, EON (Enhanced Other Networks). EON enables an RDS radio to know what's happening on all BBC Network and Local Radio Stations not just on the BBC station the radio is currently tuned to. En-route the team stopped off to update the Ford Motor Company in America who are already line fitting RDS sets in their top of the range car the *Scorpio*.

Contracts

• Recent **Soundcraft** UK sales include a 32-channel series *6000* console to Hot Chocolate's lead singer Errol Brown; Rock City in Stoke-on-Trent and a special 52-channel *6000* to Soho-based Beat Farm studios. Sales of *Delta* consoles include the BBC for installation in their permanent sound system in All Saints Church, home of Radio 4's Morning Worship programme; BBC Northern Ireland for use as a sound effects unit in their drama studio; and P&O has ordered an 8-channel *200 Delta* for use on the Canberra ocean liner.

• Recent **Amek** *Classic* broadcast console sales include Chrysalis TV, UK, for their new OB truck; two consoles to Granada TV, UK; one to Sky TV's London-based studios; Boulogne Billancourt film studio in Paris through French dealer Cyborg Sarl.

Recent *Mozart* contracts include

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Neil Ross at REL Studios in Edinburgh, Scotland; M2 Video, London, UK; Brielle Music, New York, USA; Today Video, New York; Post Productions Ltd and Creator Studios in Taiwan; Studio AV-Enger in Belgium and Prisme Audio in Switzerland.

Recent *BCII* sales include Australian National University; Ravensbourne College, Bromley, UK; and Silk Sound Studios in London.

● CTS's Studio Two in London, UK, has been redesigned by **Recording Architecture**. The redesign programme involved the implementation of Recording Architecture's *Black Box* Acoustic Conditioning System; the installation of **ATC** *SCM 200A* monitors; the overhaul of the studio's Neve desk and the redecoration of the entire studio.

● **Soundtracs** have announced the purchase of *IL* series consoles by British producer Rupert Hine and Walter Becker of Steely Dan.

● *MLSSA*, Maximum Length Sequence Systems Analysis, from **Munro Associates** is now commissioned at Turbosound; Marshall; B&W; Rega Research; University of Southampton; Peter Mapp Associates; and AMS Acoustics. Orders have been received from Martin Audio and Cannon's UK Research Labs.

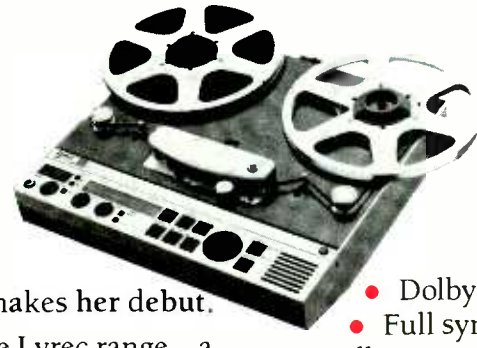
● Recent **DDA** sales includes *Q* series consoles to the Volkstheatre in Vienna, Austria; Eldorado Sound Productions of Helsinki, Finland; Philharmonie of Cologne, West Germany; Kabaret & Theatre Sound of Christchurch, New Zealand; Surrey and Southampton Universities in the UK; and the University of California in San Diego, USA. Also five **DDA** *DCM* consoles have been sold to Music Animals in Los Angeles.

● **Motionworks**, have been installed at the Power Station studios in New York. In each studio the *Motionworkers* interface the SSL studio computer with Adams-Smith *2600* synchroniser systems.

The new look Studio 2 at CTS

● Clive Green & Co Ltd have announced the recent installation of a customised **Cadac** console for the Royal Shakespeare Company at the Barbican Theatre.

On Cue



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Broadcasters are now enthusing about RSDAT – the latest device to demonstrate the flexibility of the DTC 1000ES. Converting and interfacing all audio and operational functions to broadcast standards – it brings cart-like control to DAT sources. Sony's PCM 2500 is especially versatile,

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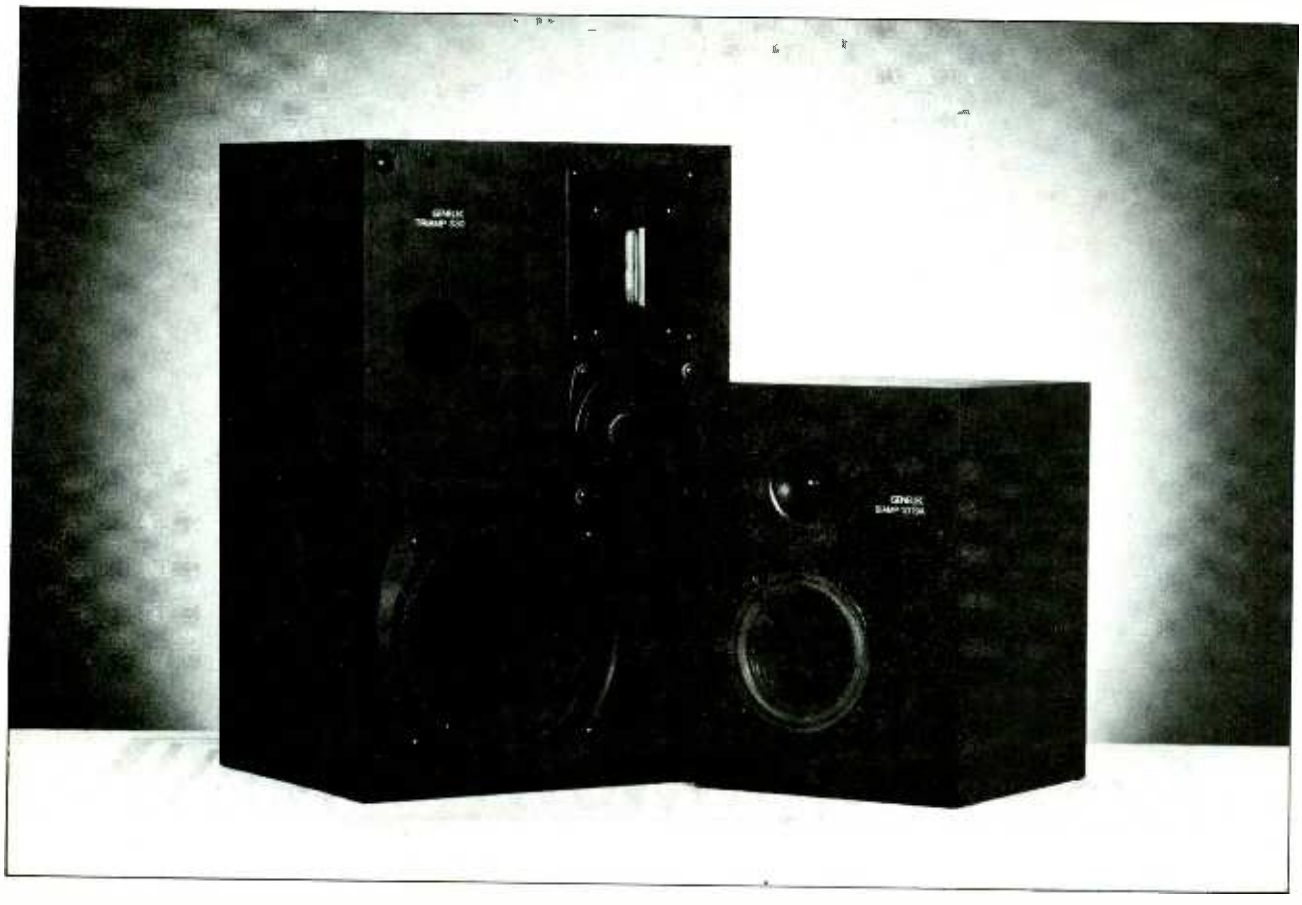

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30 years of Studio Sound

April 1962...Recently on French TV a play called *The Persians* was broadcast in stereophonic sound. It was an unusual transmission in that there were no left or right hand channels but rather a front and a back channel. The front channel was transmitted on the television sound channel with the receiver facing the viewer in the usual manner, whilst the back channel was transmitted on FM by the France IV Haute Fidelite programme, with the radio set behind the receiver. The TV channel carried the speech and the FM channel the various sound effects required as well as a choir. Before the play began the RTF introduced a 'TV family' who showed how to position the TV and radio receiver for optimum results.

April 1967...A slow motion television machine has been developed by the BBC Designs Department, comprising a modified video recorder and a magnetic disc unit. The equipment permits slow-speed reproduction or indefinite stop-motion within seconds of the scene being taped. The system was used for the first time during last year's football World Cup competition.

April 1967..."The most comprehensive and logical controls of any desk in production" is the claim made for a 22-channel mixing system made by Sound Techniques Ltd. The desk was produced for an American customer, Sunset Sound Studios for use with an 8-channel tape recorder and has a total of 10 output channels.

April 1979...Ultimate Support Systems has introduced a novel lightweight, portable loudspeaker stand. The stand is based on the construction techniques used in hang-gliding and is of a foldable design.

April 1981...At a demo session with musician George Duke held at Wally Heider Studio 4 on March 9th, Mitsubishi debuted its pre-production 32-track digital *X-800* PCM studio tape recorder.

Agencies

• Smart Acoustics have been appointed UK distributors of the **Australian Monitor** range of MOSFET power amplifiers, and UK distributors of **Ashly** products. Smart Acoustics, 38-42 Westgate Chambers, Commercial Street, Newport, Gwent NP9 1JP, UK. Tel: 0633 252957.

• **Michael Stevens & Partners** have announced their appointment as sole UK distributor of the Chromatec TVD on-screen level indicators.

• **Amek Systems and Controls** have announced the appointment of Fumeo, to distribute Amek broadcast products exclusively in Italy. Fumeo, Via Teocrito, 47-20128, Milano, Italy. Tel: 255 1651. Fax: 255 0793.

HEL for recording engineers

An American research programme has been investigating claims that operatives working in close proximity to High Energy Lasers (HEL) have been experiencing an increased incidence of migraine and they have made a chance discovery relating to recording engineers. Ten working groups of 100 volunteers each provided blood and urine samples and filled out an extensive questionnaire. Collection and analysis of data has taken the best part of a year and the results were published last month.

The research was conducted by Dr Avril Olof, head of Hormonal Research at Los Angeles' Trapacero Hospital and author of *Migraine Cause & Cure*. Half of the groups surveyed—computer programmers, doctors, actors, telephone engineers, accountants, taxi drivers, power station workers, traffic police and recording engineers—were involved in electronics-based professions.

A substance called Firstyadene, which is naturally secreted by the pituitary gland in minute quantities, has recently been associated with migraine, and a large proportion of those suffering regular attacks, displayed higher than normal blood levels. However, the samples taken from the HEL group were not abnormally high, and ironically they were one of four groups displaying below average susceptibility to migraine. The group with the highest concentration was the traffic cops.

Apart from testing for Firstyadene, the blood hormone content was thoroughly analysed, and this was where a remarkable discovery was made relating only to the recording engineers' group. The group was predominantly male, and of the 86 men tested 63 (73%) showed surprisingly high levels of testosterone, the steroid hormone responsible for developing and maintaining male sexual characteristics.

An effect of testosterone in large quantities is to increase stamina, and for this purpose it has been used illegally by athletes; it also encourages the growth of facial and pubic hair but accelerates male pattern baldness. It is said to increase virility and has been used to treat impotence; it can help raise a man's sperm count, and stimulates the production of pheromones, the chemicals that produce an individual's sexual scent designed to attract a partner.

Dr Olof admits to being baffled at the result, and is presently engaged in new research which she hopes will shed further light on the matter. But until then we can only assume that the typical recording engineer is a potent male who is extremely hard working and capable of putting in long hours without tiring. He probably sports luxuriant facial hair, although perhaps is not so luxuriant on top. He displays a strange, almost animal like, ability to attract the opposite sex, and is likely to be surrounded by progeny.

The sheer cost of purchasing new equipment is always a bitter pill to swallow. Add a fast-moving marketplace – and choosing the right technology becomes a major headache. Fortunately, a perfect antidote is now available: Hilton Sound's hire service.

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PIONEERS IN AUDIO ACCESSIBILITY

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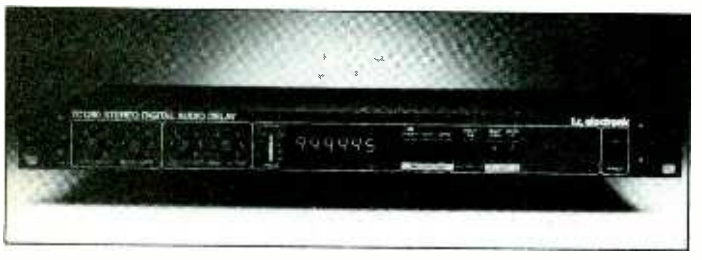
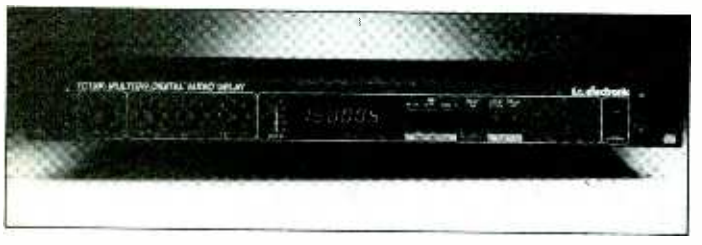
tc stereo and multitap digital delays

Danish company tc electronic have added two new digital audio delay lines—the tc *1280* stereo delay and the tc *1380* multitap delay. Both use a similar design to the established tc *2290* sampler. The units are quoted as 20 kHz bandwidth +0, −0.5 dB with a minimum of phase shift following the soft roll-off filter used, which is only −3 dB at 25 kHz. The manufacturer also claims fast processing times resulting in low group delay specified at 30 μs. Both these units can also enter delay times in metres or feet and there is resolution down to 5 μs. A preset option can be supplied enabling the unit to change presets by MIDI or another switching system. For permanent installation there is a security lock function. Each unit has *XLR* balanced ins/outs, relay bypass and 1U 19 inch rackmount format.

tc Electronic A/S, Grimhojvej 3, PO Box 1420, DK-8220 Braband, Denmark. Tel: 86 26 28 00.
UK: tc Electronic UK Ltd, 24 Church Street, Oswestry SY11 2SP. Tel: 0691 658550.
USA: tc Electronic USA Inc, 7325 Hinds Avenue, North Hollywood, CA 91605. Tel: (818) 503-0404.

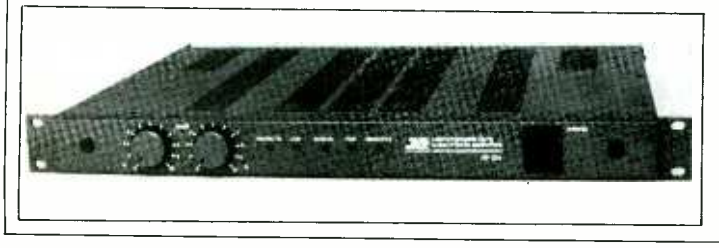


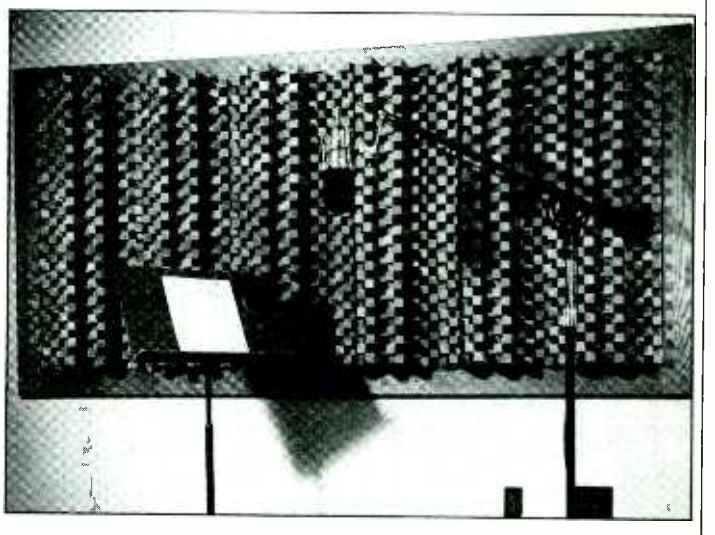


Third Generation compact amp

Third Generation have added a small power amplifier to their *HP* amp range. The *HP200* is a 1U 19 inch rackmount 2-channel amp rated at 100 W/channel into 8 Ω. It is similar to others in the series such as the *HP400* and *HP1000* with full protection for thermal, open and short circuit and DC offset; and 'soft-start' circuitry to protect attached speakers. Clip indication is provided by front panel LEDs as well as protection circuitry status and selection of bridged mode. Connections are by *XLR* with additional binding posts for the outputs. The amp may be run balanced or unbalanced.

Third Generation Ltd, Unit 19, Laurence Industrial Estate, Eastwoodbury Lane, Southend-on-Sea, Essex SS2 6RH, UK. Tel: 0702 420645.





SDG Art Diffuser

A US design consultancy by the name of the Systems Development Group has introduced the *Art Diffuser*, a broadband acoustic diffusor designed to have both an acoustic function as well as remaining aesthetically attractive. Designed as a modular system, the diffusors are available in two sizes—a 15 inch square and 15×30 inches. This system allows the diffusor modules to be positioned more easily within an acoustic space and with a suitable arrangement diffusion will occur in both horizontal and vertical planes, eg mounting as mirror imaged quadrants from a centre point. The *Art Diffuser* is available in cedar, oak, walnut, cherry and fir with the standard unit being in poplar. SDG also offer individual design variations to meet specific applications.

Systems Development Group, 18601 Darnestown Road, Poolesville, MD 20837, USA. Tel: (301) 972-7355.

dbx products available again

Following CTI's division and sale of the dbx company last year there were inevitable hiccups while the two new owners returned to production in the different product areas.

AKG Acoustics, the US AKG company, who bought the Professional Products Division, have announced that the following lines are now available again as of the beginning of this year: the noise reduction systems; *900* series modular products; the *Performer* series of compact audio processors; and the compressor/limiters.

dbx Professional Products Division, AKG Acoustics Inc, 645 Bryant Street, San Francisco, CA 94107, USA. Tel: (617) 964-3210.
UK: SSE Marketing Ltd, Unit 2, 10 William Road, London NW1 3EN. Tel: 01-387 1262.

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AKG acoustics

ADVANCED MICROPHONE TECHNOLOGY

The C426B Comb. represents the next logical step in the development of a legend amongst professional microphones, the C422, which itself is derived from an eariler microphone that set new recording standards, the C24.

The operating principles of the C426B remain the same - two twin diaphragm condenser capsules which rotate for MS and XY stereo recording, each with individually selectable polar pattens from a remote control unit. But as engineering standards have developed, so has every aspect of the C426B design, which now offers ultra low self noise operation, in-built electronics for the digital age, and a host of physical operating features which make it ideal for busy recording studios.

You might think it presumptious for us to predict a future legend, but with the success of its forebears the C426B promises no less.

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AKG Acoustics Ltd., Vienna Court, Lammas Road,
Catteshall Road, Godalming, Surrey GU7 1JG.
Telephone: Godalming (048 68) 25702.
Facsimile: (048 68) 28967.
Telex: 859013 AKGMIC G.

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Rane splitter/mixer modules

The Rane Corporation have added two new modules to their *Flex* series of modular signal processors. The *FPS 28* is a programme splitter that allows two mic or line level inputs (with switchable mic phantom power) to be split to eight mono or four stereo outputs with separate level controls. It is also possible to switch these outputs pre- or post-master input level controls.

The other module, the *FLM 82* provides eight mono or four stereo line inputs each with separate level and pre/post assignable aux send controls with additional master level control, aux loops and the *Flex Bus System* for single cable interconnection with other *Flex* series modules.

Rane Corporation, 10802 47th Avenue, Everett, WA 98204-3400, USA. Tel: (206) 355-6000.
UK: Music Lab, 72-74 Eversholt Street, London NW1 1BY. Tel: 01-388 5392.

Albrecht Universal Control

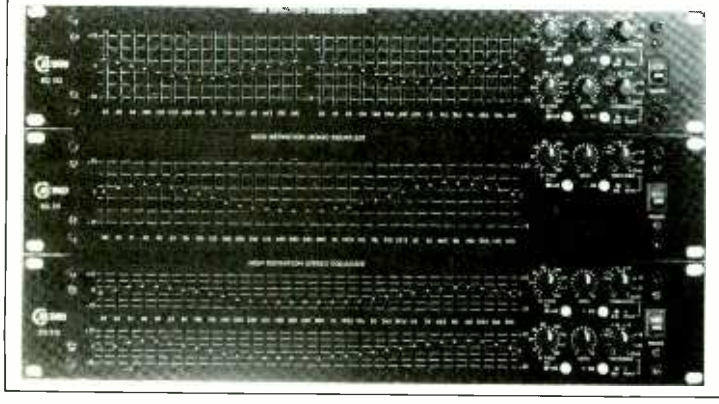
W Albrecht GmbH have introduced a system to integrate film transports, video and audio machines under timecode control. The *Universal Control System* (*UCS*) in its basic form can control up to 20 film transports and two audio or video recorders. The timecode output of the system allows control of mixing console automation or further tape machines. Up to eight controllers can have access to the pool of transports. The system uses a serial bus to interconnect transports and controllers on a simple two-wire (twisted pair) daisy chain. This system is described as simple and inexpensive to install and removes the need for separate transmission of positional information such as bi-phase pulses.

W Albrecht GmbH, Maybachufer, 48-51, D-1000 Berlin 44, West Germany. Tel: (030) 6236039.
UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Tel: 01-953 0091.
USA: Audio Intervisual Design, 1032N Sycamore Drive, Los Angeles, CA 90038. Tel: (213) 469-4773.

C-Audio graphic EQs

C-Audio have introduced a new range of three graphic equalisers. This includes the 2-channel 15-band *EQ 152*, the single-channel 31-band *EQ 311* and the 2-channel 31-band *EQ 312*. All three units are 2U high with level; highpass filter; threshold level control; LEDs for EQ in, peak and signal present, all duplicated on each channel. The highpass filters are variable from 5 Hz to 200 Hz with a filter slope of 24 dB/octave. The threshold control is used to set the peak LED indicators, which can be calibrated from −10 dB to +20 dB.

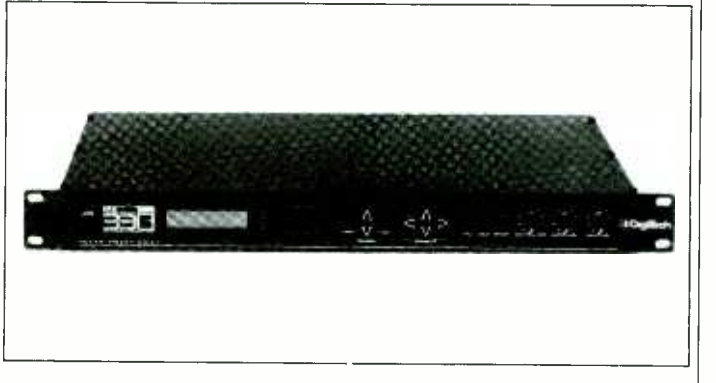
C-Audio Ltd, Barnwell Road Business Park, Cambridge CB5 8UY, UK. Tel: 0223 211333. Fax: 0223 410446.



Mastering Lab crossover

The Studio Products division of Doug Sax's company, The Mastering Lab have introduced a retrofit 'high resolution' crossover for the Tannoy *SGM-10B* speaker. The manufacturers describe the *Model 10* crossover as having meticulously selected components and air core inductors resulting in low distortion and enhanced resolution. The balance control is fully variable allowing precise matching with monitoring requirements especially in nearfield applications. The *Model 10* fits within the standard *SGM-10B* cabinet and price includes installation.

The Mastering Lab, 6031 Hollywood Boulevard, Los Angeles, CA 90028, USA. Tel: (213) 466-3528.



DOD DigiTech Smart Shift

DOD Electronics have launched the DigiTech *IPS-33B Super Smart Shift* 'intelligent' pitch shifter. This has the ability to create two- and three-note harmonies from a single input note. The unit generates user defined harmonies in 41 scales from natural minors and chromatics to Dorian and Mixolydian. DOD say that each harmony generated is pure and correct to scale.

Other facilities within the unit include stereo pitch detune, chorus and up to 1.5 secs digital delay both of which can be used simultaneously with generated harmonies. Also included is a tuning function that allows it to be tuned to an instrument or an instrument to it. The *IPS-33B* is a 1U rackmount design with 20 kHz bandwidth, MIDI control of all programs and parameters, LED display and a remote control.

DOD Electronics, 5639 South Riley Lane, Salt Lake City, UT 84107, USA. Tel: (801) 268-8400.
UK: John Hornby Skewes, Salem House, Garforth, Leeds LS25 1PX. Tel: 0532 865381.

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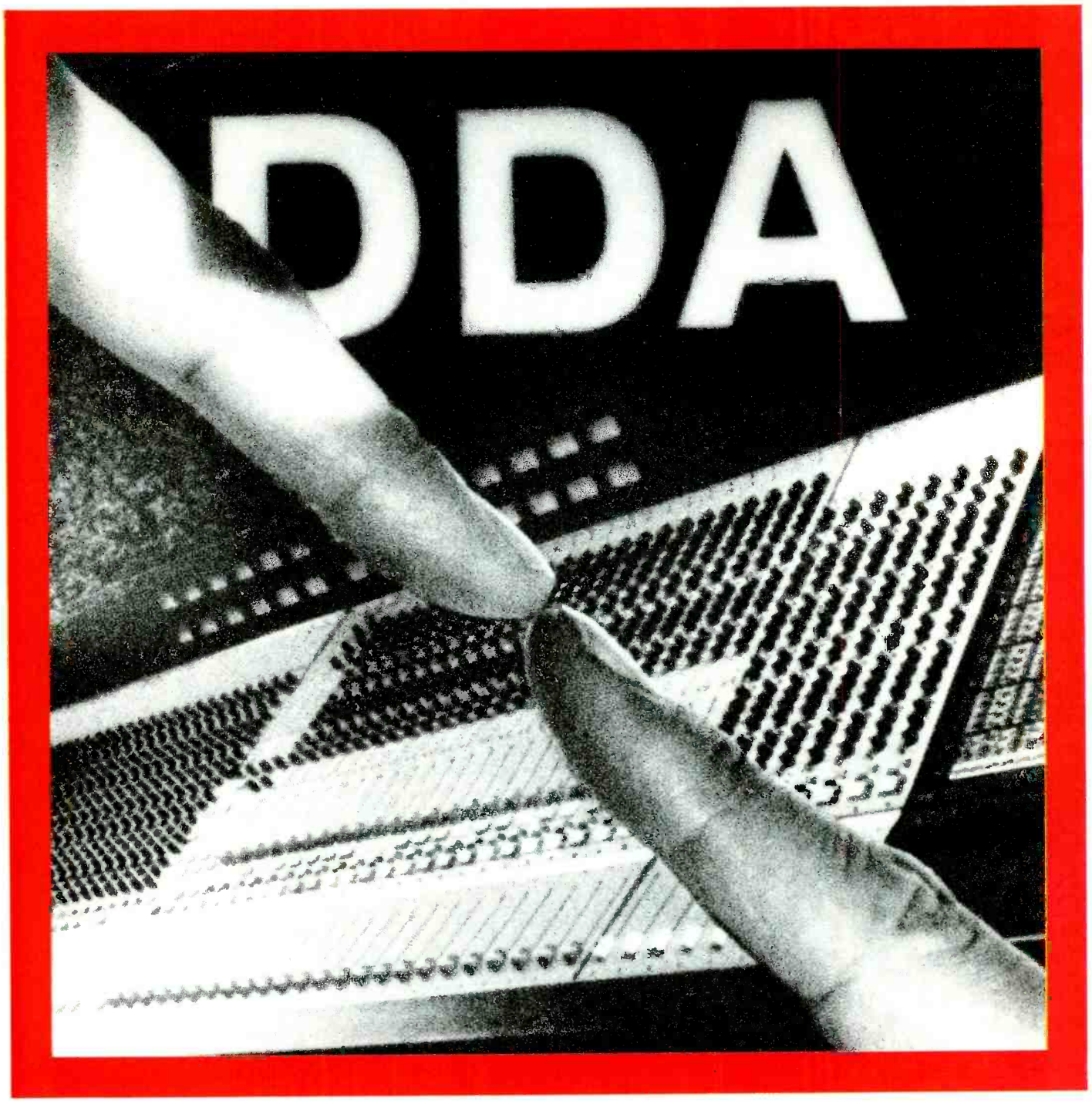

Touch is the subtlest quality in any console. If a console doesn't instinctively *feel* right, creativity and efficiency can be rapidly diluted. And an inspired touch is equally important inside, to ensure the design doesn't compromise essential sonic detail and quietness. It's precisely these factors that have earned DDA their enviable reputation. The AMR24's exceptional sonic purity is widely acclaimed; yet it's one of the most instinctive consoles to work with. The D Series combines the same abilities with a range of flexible options which make it equally perfect for recording, mastering, post production or live sound. Since you'll expect the same impeccable standards when it comes to back-up, Stirling's reputation for service, support and technical expertise is second to none. If you'd like to test the personal touch for yourself, call us for a DDA demonstration.

Stirling

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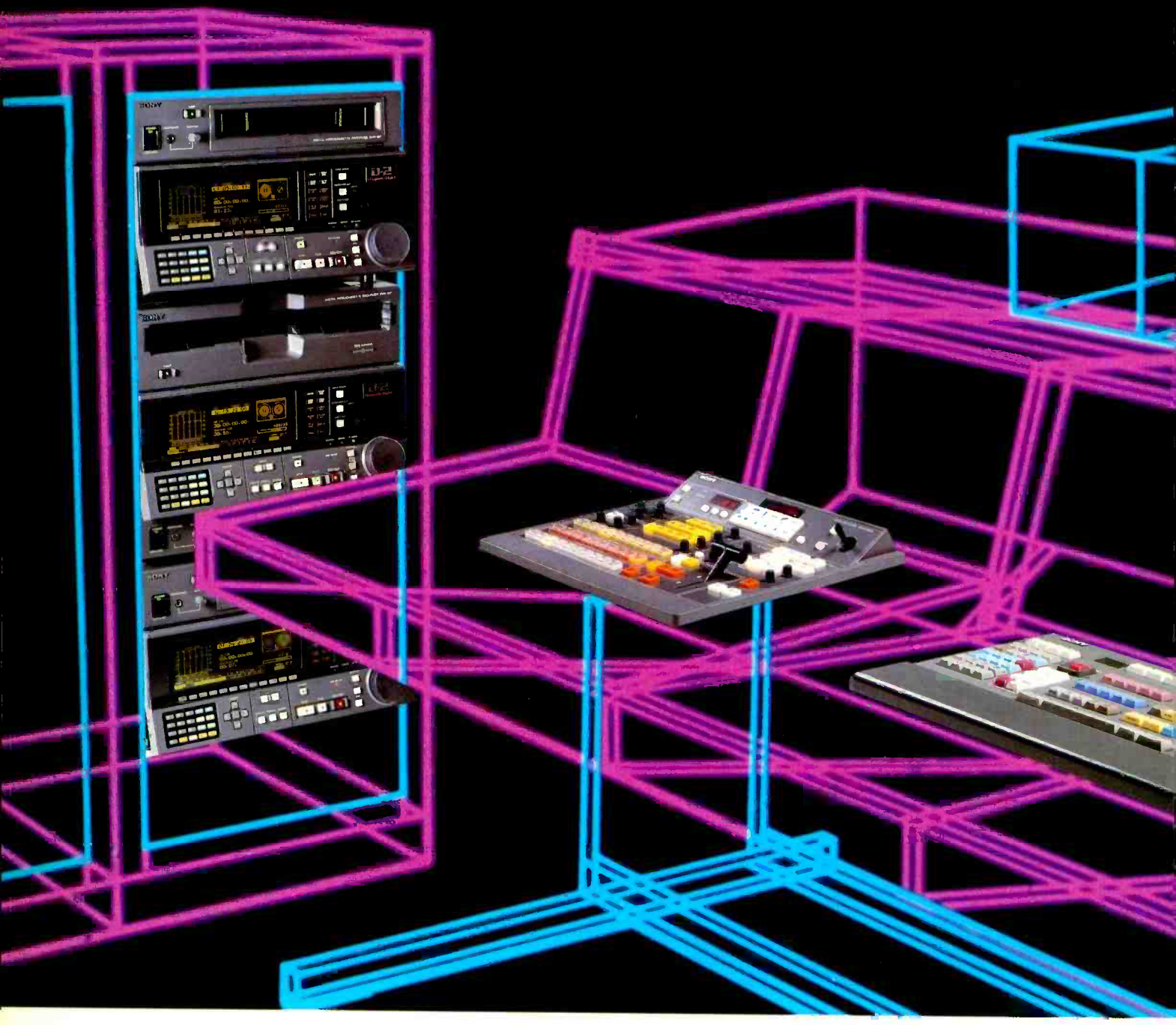
VSP-8000. Digital sound de



Full control over the PCM audio channels of digital VTRs in a post-production environment – that's exactly what the VSP-8000 Digital Audio Mixer is designed to do.

Operated manually or controlled from a Sony BVE-9000 editor, the 16 x 4 VSP-8000 has an optional 32 x 16 input routing switcher allowing support of up to 8 DVTRs. Other advanced, built-in features include preview switcher, audio delay control, snapshot memory capability and many more.

Sony has an unparalleled record in digital recording and has long been recognised as a supplier of the finest analogue audio mixers. The combination of the two technologies has led to the VSP-8000 – giving digital audio

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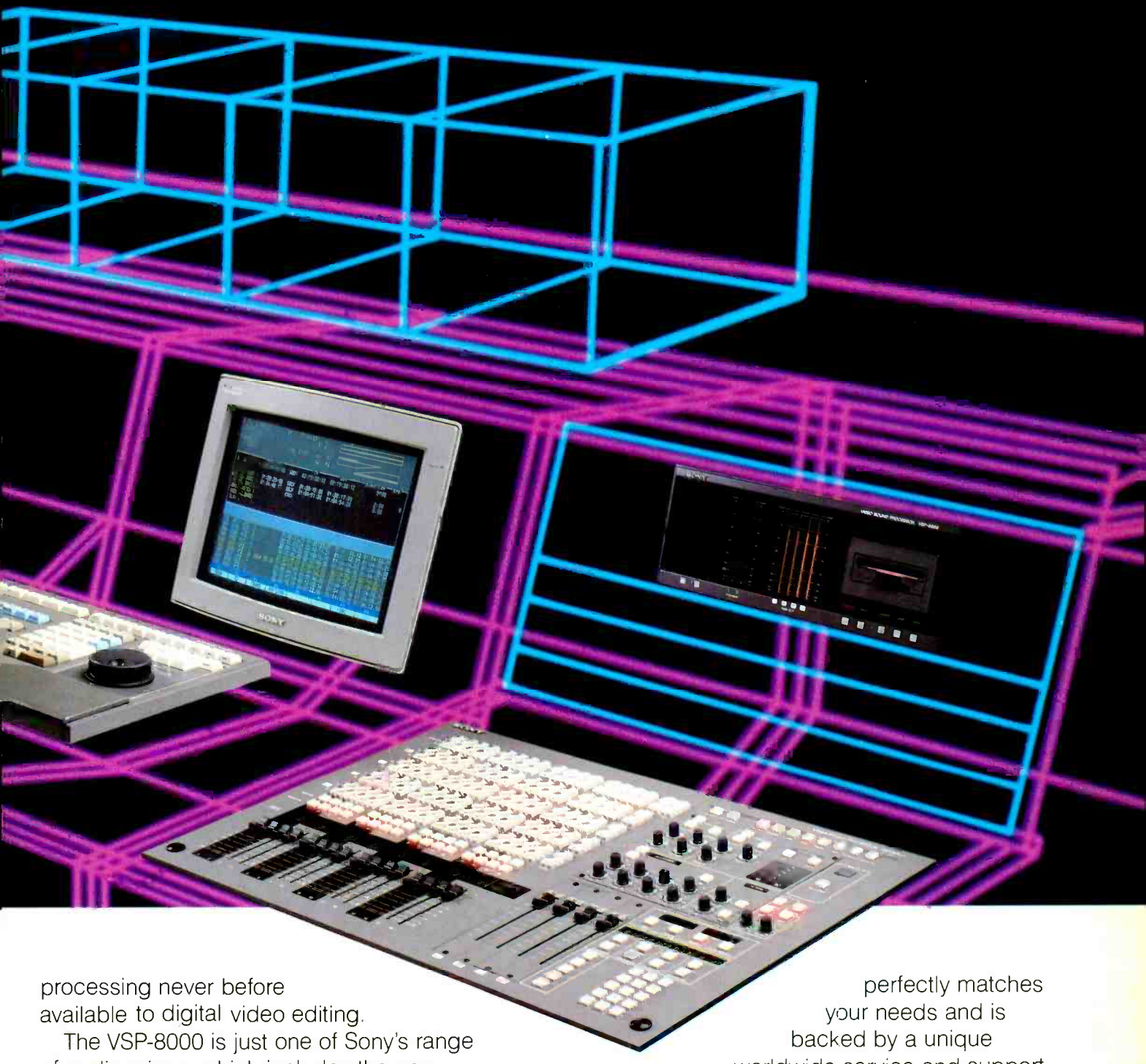
signed for perfect pictures.



processing never before available to digital video editing.

The VSP-8000 is just one of Sony's range of audio mixers which includes the new MXP-290, the acclaimed MXP-2000 series and the VSP-A600 – the perfect partner for the BVE-600.

Only Sony offers you a mixer that both perfectly matches your needs and is backed by a unique worldwide service and support network.

For further information simply contact your nearest Sony office.

Sony Broadcast & Communications European Headquarters
Jays Close, Viables, Basingstoke, Hampshire RG22 4SB, United Kingdom
Tel: (0256) 55 0 11, Telex: 85 84 24, Fax: G2/G3 (0256) 47 45 85

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Apollo has Landed

If the sound you generate from your audio mixer doesn't burst into life, your problems are over.

The Aries Apollo has arrived.

This brand new mixer is the latest in a long line of high performance equipment produced by Goutam Electronics for the modern recording studio.

And when it comes to sheer audio power, Apollo is, quite simply, shattering.
We think it's the best on the market – listen to Apollo and you'll agree.

- Low noise, mic and line input
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- – 20dB PAD
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- 4 Band EQ
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Aries

For full specification and prices contact:

Aries Goutam Electronics Products Ltd,
Unit 3B, 6-24 Southgate Road,
London N1 3JW.
TELEPHONE: 01 249 5306
FAX: 01 249 0252

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Report from the winter NAMM meeting

The winter National Association of Music Merchants meeting was a highly pleasant affair. Sunny weather (not as common as you might think at that time of year, even in Southern California), plenty of good parties (including one featuring a live elephant) and a feeling of newly-revived enthusiasm among attendees—plus, of course, more than a few innovative products—combined to lend a festive and optimistic air to the proceedings.

The surprises started early, at a dealers' meeting held by Roland the day before the convention started. They unveiled the *DM-80*, a 4-track hard-disk digital recording system (expandable to eight tracks) with cut/paste/splice editing, random access, digital mixing and an internal 100 Mbyte hard disk good for about 19 track-minutes at a sampling rate of up to 48 kHz. Inputs and outputs for SCSI, AES/EBU audio, SMPTE, MIDI Time Code and MIDI Sync are provided. The price is speculated at somewhere between $5,000 and $8,000, and delivery by early in 1991 is anticipated.

That same night, yet another step in the evolution of hard-disk recording was announced. Two Macintosh software companies, Opcode and DigiDesign, announced the release of *Audiovision*, which combines Opcode's *Vision* MIDI sequencer with DigiDesign's *Sound Tools* digital recording system. The combination will allow simultaneous recording, editing and playback of two tracks of digital audio with up to 32 channels of MIDI data, on a single Macintosh *II* with an integrated user interface and will be available in April. A few observers expressed disappointment that the system does not use the MIDI Manager music multitasking system developed by Apple, which would have allowed other music programs to be integrated as well. DigiDesign also announced that *Sound Tools* will be available in March for Atari *Mega* computers.

Software

When the show officially opened, there was a lot of new software to be found. There were two new potentially major Macintosh sequencers: Steinberg's powerful *Cubase* (already well-known by Atari users) and Dr T's all-new graphic-oriented *Beyond*. The onslaught of new synthesisers continues unabated and software writers are looking at universal patch editors and/or librarians, which can serve a large number of current and future instruments, as broader-market alternatives to traditional programs that work with only one model of synth. At the same time, many music-software writers are now developing their programs for several different computing platforms simultaneously.

At this show these ideas caught fire and there were at least five such products on display. Three are combined editors and librarians: Dr T's *X-oR* and Sound Quest's *Synergy*, both available for Macintosh, Atari, IBM and *Amiga*; and Hybrid Arts' *GenEdit* for Macintosh and Atari. The others are librarians only: Opcode's *Galaxy* (Macintosh) and Pixel Publishing's *Super Librarian* (Macintosh, Atari, IBM). Various methods were proposed to keep these programs current as new synths appear on the market—one manufacturer said they will be setting up a bulletin board for users from which software 'modules' for the new instruments can be downloaded at no charge.

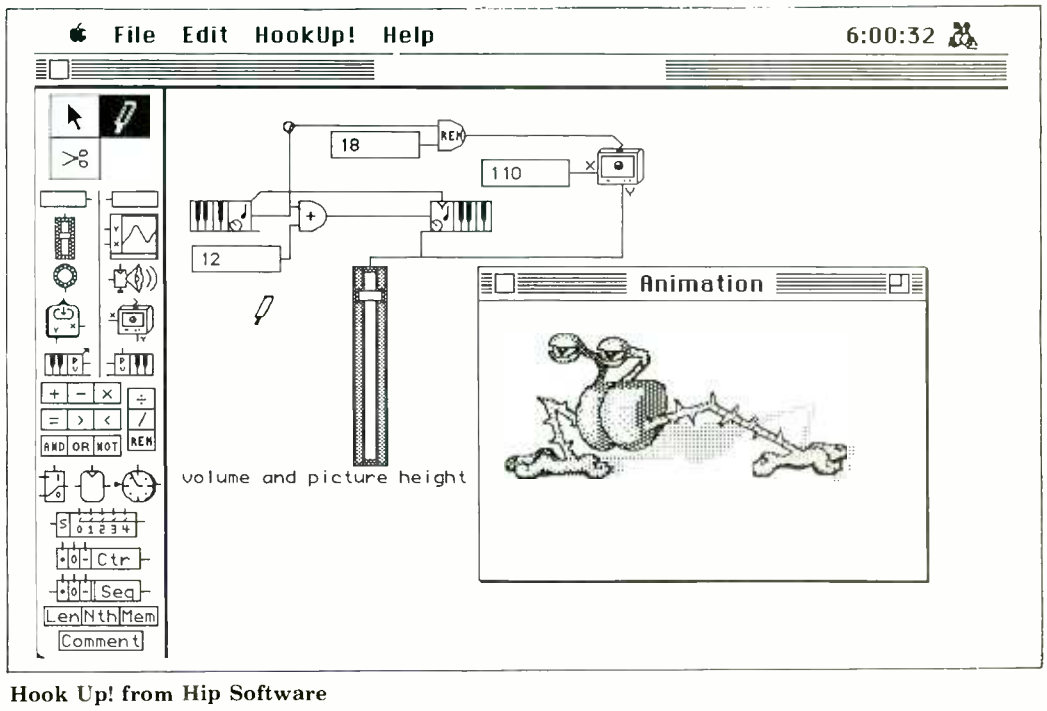
Two new graphic 'programming environments', both for the Macintosh, were being shown. At the Intelligent Music booth was a system called *Max*, developed in conjunction with the French national music laboratory IRCAM. *Max* is a toolkit for developing serious MIDI or other communications-based applications, allowing non-programmers to design and build custom MIDI software quickly, such as system-exclusive controllers, input mappers, and so on. Intelligent Music is hoping the system becomes a standard for music software development from many sources, and is planning a spring release.

Hip Software, a small company that grew out of the Massachusetts Institute of Technology, were showing *Hook Up!*, an expensive and intuitive interactive environment (already shipping), for designing software presentations and other 'gizmos', that can link MIDI input and output, mouse and keyboard control and even animation, in conjunction with the popular program *VideoWorks II*. And on the subject of fun software, Laurie Spiegel's *Music Mouse*, which can perform instant composition on Macintosh, Atari and *Amiga* computers, is now available in a *Pro* version and is being distributed by Dr T's.

Synthesisers

Of course, it wouldn't be a NAMM show without new synthesisers from Japan. Yamaha had their *SY77*, which was already reviewed at last Autumn's AES show but they also showed a couple of new, related boxes. The *SY77* combines sample-based sounds (what Yamaha call Advanced Wave Memory, or AWM) with complex FM synthesis, plus delay, reverb, distortion and modulation effects. The instrument is 16-voice multitimbral and has a built-in 16-track sequencer and floppy-disk drive. Additional AWM sounds can be loaded from ROM cards. For about half the price, you can get what is essentially the AWM half of the instrument in the *SY55*, which contains 64 ROM voices, 34 effects, and an 8-track sequencer. There's also a rackmount version with no sequencer, the *TG55*.

Korg were showing the *WS Wavestation*, which combines wavetable and vector synthesis, which is not surprising considering it was designed largely by former members of Sequential Circuits' and Ensoniq's engineering teams. The wavetable memory contains 250 entries, which are combined into an 'oscillator' with the user specifying the order, as well as the pitch, timing, crossfade and looping points for each segment. Each voice can use up to four such oscillators and the instrument supports 32 voices, with 8-channel multitimbral capability



Hook Up! from Hip Software

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Micro-Wave from Waldorf Electronics

and four audio outputs. ROM cards for additional wavetables will be available, as will a third-party modification that will let users record their own samples.

A well-known name in synthesis re-appeared at the Steinberg/Jones booth. The *Micro-Wave* from Waldorf Electronics in West Germany was designed by Wolfgang Palm, who was responsible for the PPG *Wave* synthesisers of the early '80s. The unit uses wavetable synthesis, with 30 ROM tables comprising about 2,000 individual waveforms. Soundshaping is done with four-pole analogue filters and multiple LFOs and envelope generators. The rackmount instrument is 8-voice multitimbral.

Consoles and such

Twister, the Danish company who came out with a MIDI-controllable multichannel volume controller a few years ago, have been very busy behind the scenes designing retrofittable automation systems for other manufacturers. They were showing a system at the Soundcraft/JBL booth that incorporates level control and a 10-parameter noise gate for each channel. The system can be run from an Atari computer using custom MIDI software by Steinberg (which can run simultaneously with the *Cubase* sequencer) and SMPTE input/output is provided to the computer's serial port for tape-based automation. Although the system shown was designed for the Soundcraft *6000* series, universal models are available as well.

Back in the Steinberg/Jones booth, a different 8-channel MIDI-controlled level module, made in the US, was on display. The *Niche* improves on previous, similar devices by featuring a non-VCA design with a claimed signal-to-noise ratio of more than 95 dB, a stereo mix output in addition to individual outputs and a price of less than $500.

The most elaborate automation system was not on display but could only be seen in a photo scrapbook at the Allen & Heath booth. The *Shadow*, which is being made in the UK and is planned for release in time for the APRS exhibition in June, is a full-featured console with five-band (three parametric) EQ, assignable function switches, extensive LCD displays and moving faders. Except for the faders, which respond to an internal sequencer, all functions are MIDI-controllable and the system will lock to SMPTE or MIDI Time Code. The price promises to be surprisingly low: a basic system with 16 mono and six stereo inputs will be less than $20,000 (£12,000 approx).

Rane were showing their three *MPE* models of MIDI-controllable graphic equalisers (single-channel ⅓-octave, dual-channel ⅔-octave and 4-channel 7-band), with 128 program memories, combinable curves and user-configurable change time to prevent clicks and pops. The company say they plan to produce a similar

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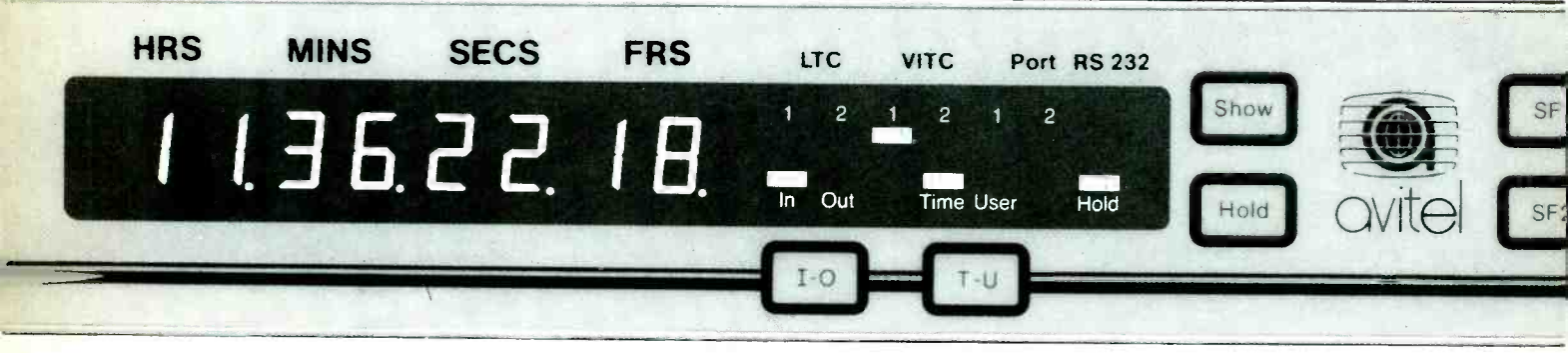

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The 'Ten Forty' is a new, highly advanced, unique Timecode Reader-Generator-Processor System.

— is elegant in concept, elegant in execution, powerful in resources.

— by exploiting Avitel's extensive Timecode ASIC Technology in combination with multiple processors, the 'Ten Forty' offers a remarkable range of facilities under the control of a sophisticated menu selection system.

Long experience in Timecode, extensive feedback from Users, and significant investment in the latest technologies have combined to produce in the 'Ten Forty' an outstanding, flexible, comprehensive and economical Timecode Processor.

By any standards, it is exceptional to find a Multistandard Reader-Generator with VITC/LTC inputs and outputs, jamming and slaving to either source, translation in either direction and offset capability, in addition to the 'normal' facilities.

The 'Ten Forty' has all of these — TWICE.

This dual channel feature, combined with a comprehensive character generator-inserter, RS232 remote and printer controls, plus uncommitted interfaces and user-definable preset default modes, offer a flexibility of operation quite unique in a single instrument.

And Remote Operation is simple — just detach the Standard Control Panel and extend on a 6-wire Link!

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line of parametric equalisers, which will respond to MIDI program changes, controllers and system-exclusive commands.

A non-automated console but one that will be of great interest to many synth-oriented studios, was being shown by Tascam. The *M-3500* series features 24- or 32-input frames, with prices starting at about $7,500 (£4,500 approx). Each input channel has its own in-line monitor system with a separate linear monitor fader and switchable input, so at mixdown time the console can actually accommodate twice the number of input signals as the basic configuration would indicate. Tascam expects this will make the desk especially useful in studios combining sequencers and multitrack tape.

Miscellaneous

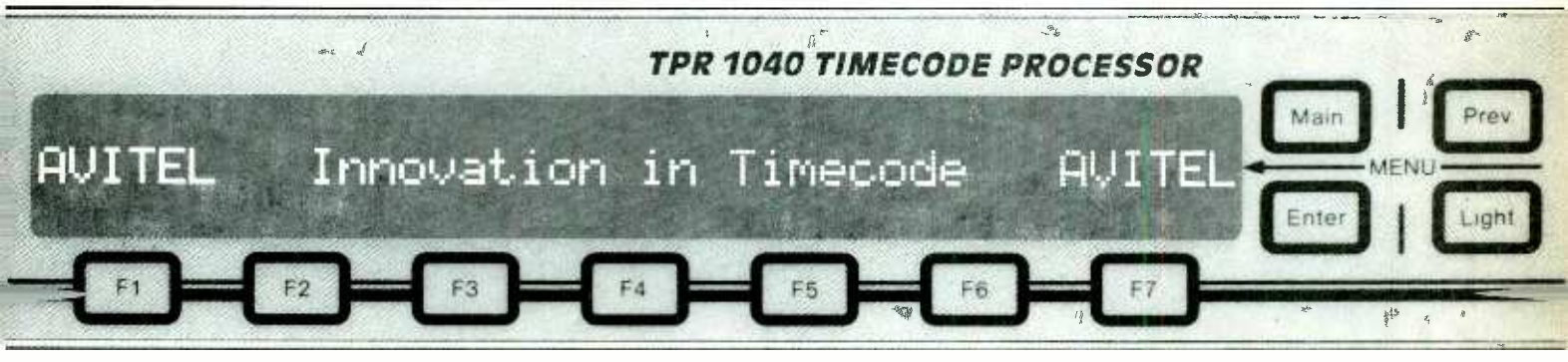
Finally, we come to the category of un-categorisable 'neat stuff', for which NAMM shows are well known. The two that stand out have the unlikely names of *Russian Dragon* and *Thunder*. *Russian Dragon*, from a Texas firm called Jeanius Electronics, is an ingenious (not my fault) device for referencing two signals against each other in time and visually displaying their relationship to each other with coloured LEDs. For example, it can show whether a drummer is ahead of or behind (rushin' or draggin'—get it?) a clicktrack, and by how many milliseconds. It is also useful for detecting delays in MIDI sequencers and for practising one's rhythmic chops.

Thunder is the latest invention of Don Buchla, whose name was once as well known in synthesiser circles as Robert Moog's, back in the days before *Switched-On Bach* made everybody run out and buy keyboard synths. Buchla's interest has always been alternative controllers and *Thunder* is pretty alternative. It uses 26 non-moving keys arranged in hand-like patterns, which respond to contact, pressure and finger location, along with 10 function keys for programming the device. The system allows the user to configure any hand gesture to produce any type of MIDI output, including notes, controllers and program changes, and also provides 32k of memory for recording and repeating groups of gestures. Inputs are provided for a foot switch and pedal. At $2,000 (£1,200 approx), every studio won't get one but expect to see this item show up on quite a few performance stages in the near future.

Russian Dragon from Jeanius Electronics

Harold D Osborne

(The National Association of Music Merchants meetings are held twice a year in Anaheim, CA (winter) and Chicago, IL (summer).)



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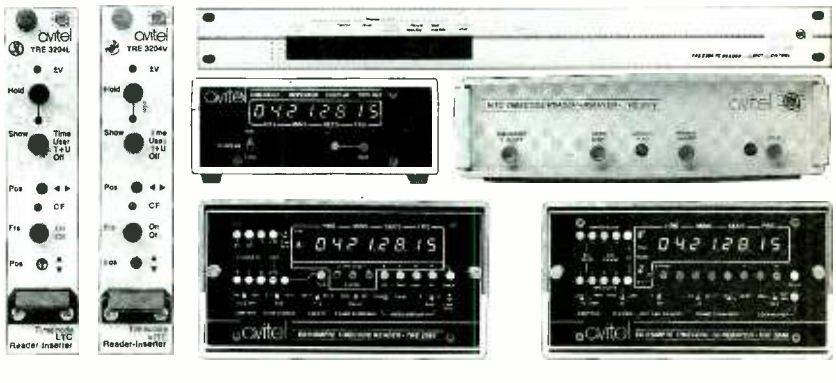
Individual Generator and Reader.
Free-standing and Modular Reader-Inserter.
Repeater Display.

Complementing the 'Ten Forty', Avitel's well-established TGE 2040 Generator and TRE 2060 Reader, offer comprehensive facilities for individual applications. For simple video 'burn-in', the Timecode Reader-Inserters in the stand-alone '200' Series and '3200' Modular Series, provide ideal and economical solutions.



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API PAST AND PRESENT

From a major name in the '70s to near obscurity in the '80s, API have now returned to console manufacture. Paul Wolff of API talked to Keith Spencer-Allen about past, current and future console developments

Towards the end of 1989 a name that had had little exposure for most of the '80s began to evoke some considerable interest. Many thought all that remained of API was a reputation gained in the '70s when they were one of the world's leading console manufacturers. During their heyday they were known for the 'API sound' and an innovative approach to automation technology. Well over 400 consoles were sold during this period (at a time when there were far fewer studios) but it could be said that they were a perfect illustration for the phrase 'right place, wrong time' as a number of factors including technological directions combined to reduce Automated Processes Inc to a shadow of their former selves. The reputation that they had gained for the 'API sound' among committed users, maintained the name through the '80s despite the company changing hands and almost disappearing at one point.

In the mid '80s the remains of the company were purchased by Paul Wolff to become API Audio Products Inc. Then began a considerable battle to revive the API name and product range, which had suffered from several years of products unsympathetic to the API reputation. This was mainly done by returning to basics and starting production of the component modules for which there was a demand. At the October 1989 AES Convention, API showed a completely new console that drew much from the designs set in the '70s but employing much learnt in the intervening years. This was the first of two consoles now delivered and installed, which puts them firmly back in the console business.

Automated Processes was formed in 1968 and started delivering fully modular consoles the following year. In 1972 they were offering a fully automated console with VCAs and the programmable equaliser appeared a few years later. In the mid '70s they were developing a complete automation system with Allison Research, known as the Model *256E/D* Programmer, which they described as a 256 function device, ie able to control up to 256 different console functions such as individual channel gain, channel echo send, channel stereo panning, channel EQ (four functions each), master levels and echo returns, and quad panning! The accompanying literature describes an automation philosophy that generally would still be accepted as the ideal. The ideas may have been right but the available technology lagged behind.

Paul Wolff: "One of the things that cost the company a lot of time and money was trying to develop a computer to run the console because at that time there weren't even microprocessors that were worth anything. They were using the Allison *65K* and stacking them up and streaming the data onto cart tape but it was very slow and sluggish. Too much time was spent on the computers and not enough on the audio—it was a bit noisy because the VCAs just weren't that good then. But it was a phenomenal console in its time and made a lot of things real easy. For example, you could subgroup the equalisers and, for example, if you assigned them to group 1, you could boost the high end on all the equalisers as you were fading them down. This was a real big project and they almost pulled it off—if only they had a PC or a Mac back then to do the filing!"

Wolff had been a user of API gear for many years before joining the company working in all areas of product development. He worked with Saul Walker, one of the originators of API, assimilating the API philosophy.

The late '70s saw API in trouble due to a number of business problems, an almost saturated console market, a decline in the growth of the record industry and a general air of stagnation. The company finally went under leaving the common financial problems for the customers. It was trying to solve one customer's problems for a batch of type *550A* equalisers that put API in contact with a Virginia company who completed the order and made an agreement to continue the product line after API went out of business. However, it was not quite so straightforward as they were active in many different areas of technology manufacture but were not so understanding of the finer points of audio that API had originally accommodated. Eventually they decided that audio was not for them and tried to sell the company but there was little interest—although a good reputation still existed for the old products. The current product range had little of this and there still remained much bad feeling from the original collapse.

Wolff had, by this time, left and started Wolff Associates, which was undertaking rebuilds and helping studios with their console problems. He eventually made an offer for API that was accepted and was soon joined by Kevin Raynor who was to become Vice President.

Wolff: "Two days later I turned up in a truck and hauled all the stuff away, moved into a shop in Springfield, Virginia, and started API. What we started off doing was building modules as API had originally built them to get confidence back while slowly introducing new products and this brings us to where we are now."

The equaliser

API are particularly known for their equaliser, the *550A*. This was originally designed in 1967 as the *550* and by current products looks rather basic with three bands of switched frequencies and a gain of ±12 dB organised on concentric pots. Its internal design is also rather different from current design practice.

"When you implement a cut you have a capacitor going to ground and when you boost you have a capacitor in the feedback, followed by gain. It is basically a passive equaliser with a couple of *2520* amplifiers in it and a two transistor buffer between each stage to isolate them, which grew to a three transistor buffer in later models (*550A*).

"Just before API stopped manufacturing in 1979, a version of the equaliser called the *550A-1* was designed using ICs in an effort to reduce the high cost of making the discrete *550A*. After putting this equaliser into production the reaction from the users was that it sounded horrid. It took 3 years to live that one down.

"We went back to the original drawings and blueprints. And one of the first things that we did was to return to the original blue knobs on the front of the *550A*s to make a time mark. Psychologically it gave us a little more credibility

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because people saw the blue knobs–they remember the old blue knobs–and were more willing to give us a chance. For a while we just concentrated on building old modules for people who wanted to expand their consoles.

"And then we thought it was time to see if people would accept us for real. So we came out with a new equaliser–the *5502*, which was a dual 4-band. To reduce confusion we put it in a rackmount package as we didn't want people to go 'That's not the same. Is it a *550A-1*, is it a *550A*, or is it an original circuit?' It was accepted very well. One customer asked for this 4-band design in the *550A* format module. So we looked at it and the hardest part was finding four switches that would fit in that amount of space. We could not use the original switches and the resistors were actually soldered directly onto them. It took 28 hours to build one of those equalisers and we were not charging very much. It was almost like the API public service equaliser company!

"We eventually found a high quality PC mounting switch that fitted but only left ¼ inch space for the resistors. So we had to come up with another way of doing that so we went to a ceramic vertical pack of silk screened metal film resistors, which are then laser trimmed. This then became the *550B* and we stopped the *5502*. They are also far more reliable and work when assembled.

"In the *550B* we had added 11 new frequencies half of which were in the bottom end that the *550A* was known for. We talked to engineers and found what they wanted and now you've got 30, 75, 150, 280 and 350 Hz at the low end and we added a 20 k on the top–when you turn it up it just adds air–you would be surprised at what you can hear. We have only sold one *550A* since the *550B* was introduced."

For API there were a number of problems in maintaining the sound of such an old design–many of the old components were not available any more. So is there a sonic difference?

"We try to use the same components but they are better these days. The capacitors have less inductance, less leakage–there are better electrolytics and, of course, non-polar caps which we didn't have a lot of back then. Also there is the consistency of the steel in the core of the transformers, which is going to be different. So there is a little change but most of the engineers in the know say that they seem to sound clearer and just a little bit cleaner. We have taken transformers and caps out of the old *550A*s and put them in the new versions and we have found that they sound absolutely identical."

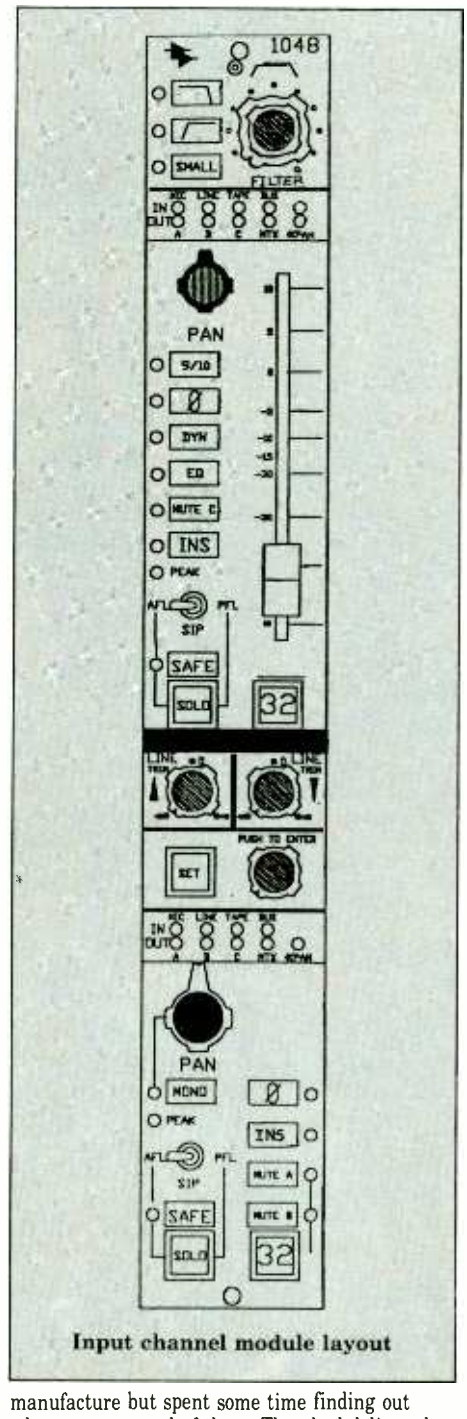
If they have managed to maintain the sound what are the circuit characteristics that determine the sound?

"One of the things is that the Q is not constant, it is proportional. When it was being designed they found that as they clicked through the resistors, the loading of the resistors caused the centre point to shift so they had to adjust the Q resistor to bring the frequency back to the centre. What it turned out to be is that when you boost 2 dB the Q is three octaves wide. On 4 dB it starts to narrow and when you get to +12 dB it is an octave wide. The area under the bell remains the same. This means that for 2 or 4 dB boosts you get a very broad curve–less than 6 dB/octave with 2 dB of gain and so very low phase shift. It is a passive filter too–not a circuit that is being regenerated or with inductors. Also the transformer and op-amp have an effect. The output transformer has a few bumps in the low end and this, with the op-amp which has a certain tone, combines to give a fat bottom end. It also clips at +30 dB and still sounds clean after boosting the high end.

"One of the reasons the *550A-1* was unpopular was because it was constant Q and you could hear the bell even when only on +2 dB."

New consoles

The new console was shown for the first time at the October 1989 AES Convention. It had been API's intention to get back to console manufacture but spent some time finding out what was expected of them. They had delivered a console 2 years previously but that was based around older modules and this was to be new. Known as the *Discrete* series, the idea is to make just a single model but within that to make it as flexible as possible. There is also a great deal of choice for the customer to configure it to his requirements. API have always used separate modules within the channel strip and the desk on show had six different module angles. The customer apparently can specify the order of the modules and the angles between them. If he has no preference then standard 15° breaks are taken and entered into the CAD machine, which, according to Paul Wolff, makes it all easy! Several of the modules such as the send module, the EQ and the dynamics use the same 'bucket size' and it is possible for the user to re-order the modules by unscrewing and moving the motherboard to the new position.



Input channel module layout

Because of the flexibility of the console and the possibilities to vary the components it is hard to look at the console as a specific item–more a console system and philosophy.

There is also an integral automation system developing with the console that looks set to evolve with time. At present it has control of the input and output routing as well as talking to the GML computer that can be used for fader automation. API have in fact been liaising quite closely with GML during the development of the console to ensure much future product compatibility.

It is nominally an in-line design in as much as its physical layout although there is the possibility to run the two sides as completely separate channels–even with its own EQ and automation.

Paul Wolff: "The sketches for this console are an evolution from 1967 to 1989. What we came up with was the idea to make all the inputs and outputs completely flexible. So the large fader can access mic, line, tape or bus, as can the small fader. The large fader can output to any of the three stereo buses (ABC); direct to the matrix or via the pan. The small fader has the same features and the only difference between them sonically or feature wise is that one has the GML fader and the other, the short throw. How you use the faders is controlled through software but the control is accessible from the module, from the computer (or from a stored file or against SMPTE timecode). This was considered a better way rather than generating proprietary functions and terms of differing console statuses.

There are no mic preamps in the console, the idea being that these will be remote. They do have a small one for those that require it designed so it will also retrofit into Sony mic pre modules. Selection of mic pre's would normally be completed at the patchbay.

Once the signal is in the module there are solos with AFL/PFL and solo-in-place functions; a mono button that bypasses the panpot; a phase switch; an automated insert point (under the GML computer which stores the timecode value of selection); two mute groups; ±10 dB of line input trim; and a soft mute. This is a circuit that uses a FET to short the audio out with a 10 ms ramp. There is also the relay mute in the GML fader which is fast and so there is a choice.

The small fader section has the same function and facilities. It is also possible to assign the EQ or the dynamics to the small fader. Should it be desired it is possible to install another equaliser rather than a dynamics module and so both with the right selection, both small and large faders could have a full equaliser. At some point this small fader could be motorised under GML control to give almost equal facilities–96 full 'no kidding' channels. The small fader can also become echo sends 9 and 10.

The send module has eight sends set so they can be manually or computer muted. These sends are arranged on four concentric pots with switches that allow assignment to the small fader. This is a passive module with balanced bussing.

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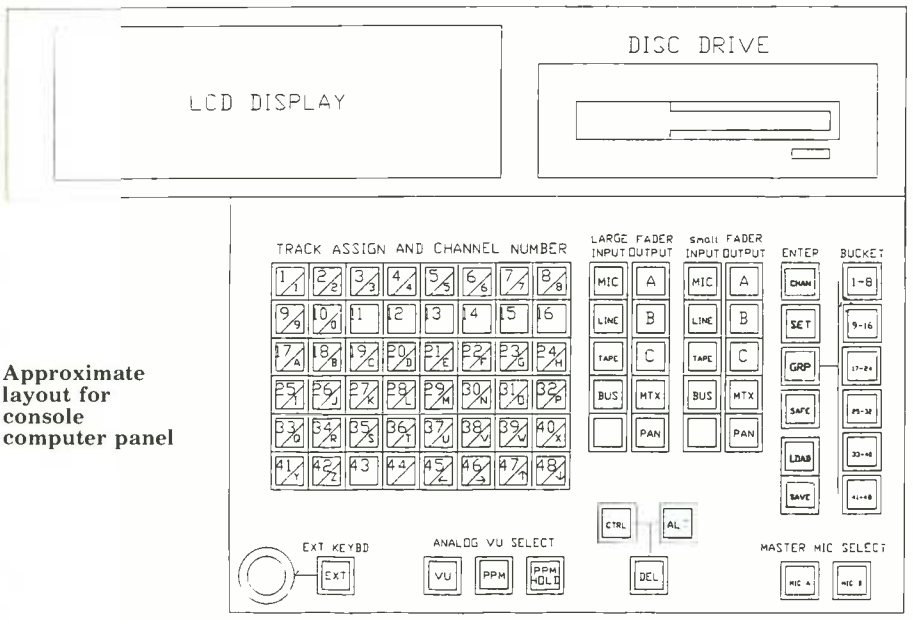

Approximate layout for console computer panel

After the EQ and dynamics modules there is the track assign display that is just an LED showing what track has been selected.

Metering is to choice. The console I saw had a meter for each group bus and stereo bus together with a switchable monitor meter. The main meters are switchable vu, ppm and peak ppm. The echo master section will have its own small meters.

The finish on the modules is interesting in that the module closest is light grey and the modules darken as they move away from the operator. David Hewitt, one of the first customers will be using the console in a remote truck and the colour scheme darkens towards the speakers and video monitors—the 'fade-to-black' look. It was decided to adopt the same idea for the console. The silk screened legends are very fine. Apparently they are also quite accurate having been measured out and then laid out on a desktop publishing program.

The console is available in sizes from 32-channel upwards. The maximum size in software is 256 but the realistic largest is probably one that is under discussion currently that would be 112 inputs, 96 buses and 24 echo sends per channel. The modular construction means that it is possible to increase the number of sends just by adding more send modules. The console is also designed so that it is not too difficult to increase the number of buses without losing the automation.

That sound again

How does this console sound? Unfortunately I have had no opportunity to find out as yet. I asked Paul Wolff about what they had achieved in this respect.

"One thing that we have done is to de-epitomise the sound in a way. The signal enters the mic pre with Jensen transformer that is very transparent and then passes to the op amp and transformer output stage so that sounds like the original API mic pre. Then there is the equaliser which still has its transformer but then after that you don't have the same chain anymore. In certain places we have a newer op amp that is very fast and very clear and still all discrete. This is used everywhere we would previously have used another of the old API designs. This has stopped reproducing the sounds over and over and prevents it building up to the point where it might just be a little too much. So if you want the sound it is there—and if you don't you can route around it".

Routing and patching

Part of the design philosophy was to rationalise the bus selection. Paul Wolff said he still felt it important to be able to select a bus on the module rather than through a central assignment panel or to have to address the computer. Routing on the module is by hitting the SET button and turning the rotary encoder causing LEDs to illuminate on the track assignment LEDs and on the channel input and output indication LEDs. When you get to the one you want, the SET button is pushed and this selects or deselects that connection. It is also possible to use the keyboard of the computer to route signals and this has been modified to be more responsive to the module layout. All settings can be saved on a disk file and recalled with a quote setup within one frame.

Computer control brings with it the problems of what happens following power failure. With API—should the power fail for less than two frames the console remains configured as it was. Should the computer go down then the setup will remain exactly as it was because the system is 'dead clocked'—data is only going through when something changes otherwise there is no clock.

Paul Wolff: "GML has released a preliminary set up of their computer that has 128 bits of useable data per channel for doing switch assignments and eventually this will take over our computer function although both computers will back each other up."

All the stereo buses and the track buses have been taken to a separate cross point switch frame which is external to the console. Paul Wolff says that this offers a number of advantages—the ability to use a higher level to drive it, it can be fully RFI shielded; kept away from other high level signals and it can be computer controlled. All the buses are balanced and relays are used for the switching. The relays are a high spec reed type designed for military use and rated at 10 billion tested cycles. After selection it turned out to be the same one GML had been using for some years with good results—sonically and reliably.

The patch bay is very comprehensive with almost every point available rather than an insert point that you can move around.

The future

The console will continue developing—something that is much easier with the modular approach. A new dynamics module with a gating function and a stereo broadcast module are shortly to be added. Also planned are motorised rotary pan pots and later motorised echo sends.

In a wider context there is the relationship with GML—API has adapted a bus they had been using and this will ease interchange and interfacing of new products. There also have been moves to standardise on a GML data protocol for assigning certain functions—ie bit 1 is mute, bit 2 is EQ in/out etc. There have been discussions with other manufacturers so that hopefully certain aspects of automation data will be transferable between different manufacturers' consoles.

There appears to be an air of cooperation between the small but high cost console manufacturers. There appears to be a degree of resignation to the fact that when you are paying the sort of prices some of these consoles demand, the customer will buy precisely what he wants and there is little that can be done to change that. He either likes the sound, the looks and the facilities or he doesn't. The API is perhaps not quite so expensive as some consoles in this category but Paul Wolff is not looking to make more than five a year. It is undeniably an interesting console with some innovative design approaches. It looks as if the API name (and sound) is back.

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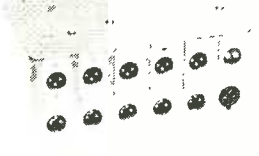

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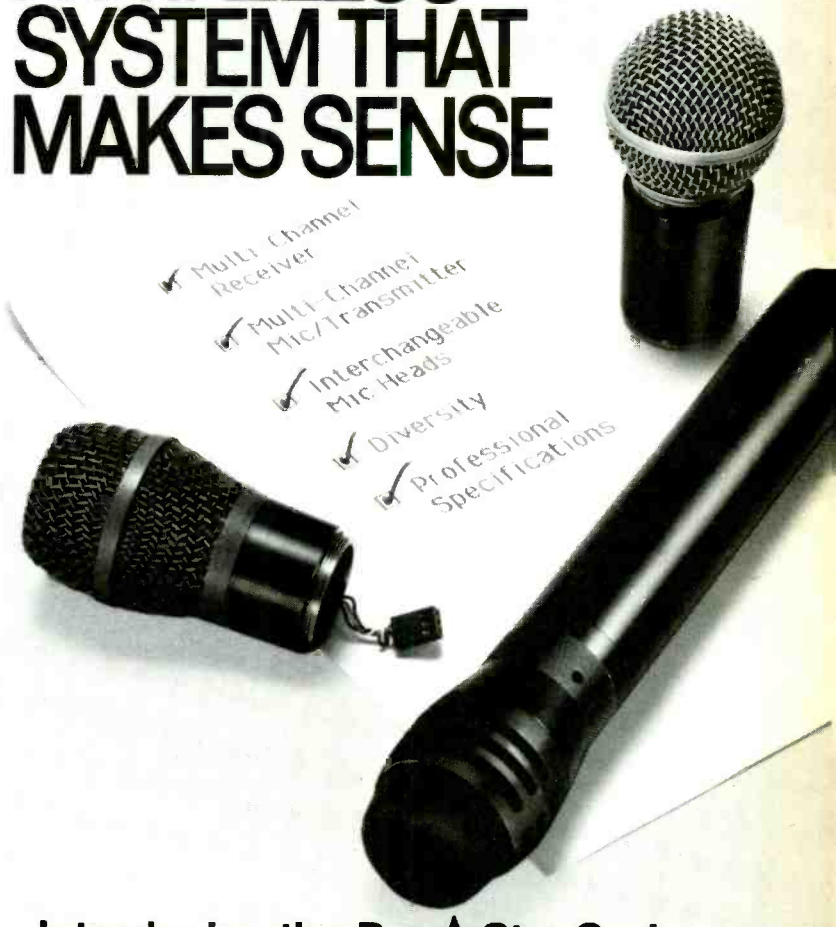

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PRACTICAL 20 BIT

Janet Angus interviews classical music recording engineer Tony Faulkner about his recent 20 bit recordings. Francis Rumsey discusses the techniques of 20 bit A-to-D conversion.

THE SESSION

The compact disc has brought about the rebirth of classical music as a popular art form. Not only have all the record companies resurrected their classical labels and re-released the old recordings on CD, it has now gone full circle and the repertoire is being re-recorded with the modern technology designed to complement the medium. At least that is the theory.

Last year engineer Tony Faulkner recorded the full set of Beethoven Symphonies for BMG Classics at London's Walthamstow Assembly Hall. André Previn conducted the Royal Philharmonic Orchestra through an astonishingly slick set of sessions under the guidance of producer Jay Saks.

The combination of artists and venue meant near ideal conditions for a recording team already well used to working together—the technical team simply had to eavesdrop. As Faulkner says, unless they really fouled it up they were guaranteed to come away with a good record.

"One particular problem with something like Beethoven *9* is the very large dynamic range from the outrage of the timps in the scherzo where the fellow goes bananas for a few bars every so often, right down to the slow movement, which remains very quiet for a lot of the time. You don't want to sit here pushing faders up and down all the time to stop the quiet stuff being inaudible and the loud stuff cracking the tape."

The hall itself is unusually appropriate for recording in that not only does it have a good acoustic, its location means there is not too much interference from outside noise. Most of London's churches and halls used by the classical recording companies have problems with traffic, school playgrounds, aeroplanes, etc, and it becomes very distracting, particularly when working on quiet slow movements. These places are seldom double glazed and problems simply have to be worked around.

Because Walthamstow does not suffer so acutely from these disturbances it is therefore extremely popular and consequently difficult to get booked into. "It's a shame we can't use it more often. It has plenty of acoustic but not too much to stop the players hearing each other. A lot of the places you go to record in can sound very nice in the control room, particularly if you put a lot of mics out but the guy who's playing second clarinet can't hear what the strings are doing. Generally speaking there are all sorts of delays recording in churches and big halls—it is very difficult for recording. Walthamstow is the premium place in London to record symphonic music. It's clear, bright, warm, people can hear each other, there is a place to park your car and you get a nice cup of coffee."

That's the priorities sorted out. The warmth of sound comes from the suspended wooden floor, which, according to Faulkner is similar to that of Henry Wood Hall but better damped and therefore doesn't tend to boom as much. With its high ceiling there is a feeling of space in the hall without the acoustic being overwhelming, which for example All Saints, Tooting, tends to be.

"It is not as big as Watford Town Hall but has a similar traditional shoe box design. I'm sure acoustic designers were involved but it is a hall primarily for other purposes, which means that not too many consultants have interfered with it and it is a natural hall which has been used for a lot of great recordings over the last 30 years.

"You can use simple microphone techniques in here because it's not overly reverberant. A pair of microphones near the conductor's head, up and back a bit, or forward—whichever you choose to work—will pick up just about everything audible in the hall. Whereas a lot of other places you have to put a lot of spot mics out just to make sure you don't miss anything."

On the Beethoven sessions although the spot mics were there they were seldom used. "We did Beethoven *8* with just two mics. There is always a pressure of time when you are recording and if suddenly the producer/conductor/first violin says 'Oh I can't hear the double basses' or 'I can't hear the brass' you can't always keep experimenting with lots of seating plans. People lose interest. You can put extra microphones out and use them discreetly but if you have to rush out and do that during session time people get bored.

"On these sessions we used two Neumann *M50* valve mics for the bulk of the recording.

"Omnidirectional mics work very well in this hall. If you use directional mics I find it loses bass and sounds a little bit crisp and 'studioish'. A lot of modern halls tend to be a tiny bit on the dry side and you are better off using omnis which means trying to improvise a technique which is going to give you a good stereo. The *M50* is set on an omni response. It's still quite directional and a bit bright. You need a stirrup to hold them on a stand and you need specific wires and power supplies. It's not as easy as plugging in an *87* in a cannon-to-cannon. I've just got to like them. They are not the answer to everything but they are amazingly quiet.

"When Telarc work in here they generally use three omnis across the front in the old traditional way. I do it slightly differently but it's the same philosophy."

Faulkner and Saks work together on the sounds: "He (Saks) is an old-style producer in that he definitely has an idea about the sound but is primarily a musician and we work as a team. He doesn't say, like some producers, 'I want *KM84*s behind the horn, a pair of *KM84*s on the back desk of the woodwind and I'd like an *SM81* on the timps...' This is not really a one man job, we all have our part to play. Saks is very sympathetic with musicians like Previn who don't want to be kept waiting too long—he's got a performance in his head and he and the orchestra are ready to go so why has he got to wait for us to go up and move the mics 2 inches and change this and that? The performance will degrade a vast amount if we keep them waiting longer than is absolutely necessary. If he feels it's necessary then he'll be quite happy but if he thinks we're just 'monkeying' around trying out different kinds of cable or comparing old and new microphones ▷

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◁ then he's going to think we're not there to work with him but to amuse ourselves. That's not the way to catch a performance."

In spite of the attractiveness of the Walthamstow Hall, for technicians the technicians conditions are hardly conducive to brilliant recordings. As ever, the engineer and production team must rely on their experience to know what the recording really sounds like away from this less than ideal monitoring environment. There are four back rooms behind the stage. Two of these are adjoining with a shutter in the middle. Decca, who has a vested interest in the hall has an installation in one half of the room behind the metal shutter and visiting engineers like Faulkner set up in the space that's left.

"This room is not very nice; it's got canvas sacking glued to the wall, a shiny plaster ceiling and nasty fluorescent lights, an air conditioning duct (which doesn't work in this half of the room) and a shiny lino floor, which is very resonant. The metal shutters rattle particularly if you monitor loud. In fact, apart from a bit of double glazing which is advantageous, the room is pretty disgusting and very resonant and a bit bass light. You have to be used to the room and reassure artists who are not used to it. The hall is good enough acoustically that if you did just stick two or three mics up there in what looked like a sensible place you wouldn't go home with a bad recording. You may feel like you should have fine tuned it a bit but everything would be audible."

These sessions were notable not only for the quality of the artists and venue but because Faulkner used the Mitsubishi *X86* digital reel-to-reel stereo machine for mastering for the first time. The trend towards digital mastering of classical music recordings has come in for a certain amount of criticism recently as engineers and producers begin to question new technologies. Faulkner is one of several who have come to the conclusion that there is a definite need for digital recording equipment offering 20 bit resolution.

In his opinion much of the problem lies with the digital audio converter technology in that commercially available products seldom offer the 16 bit performance they purport to, more often it's nearer 14 bit. With analogue it is possible to 'over-engineer' giving extra headroom as well as allowing scope for post-production with minimal degradation. It also meant that future media (eg compact disc) would be able to take advantage of the quality even if current—vinyl and tape—media couldn't. When recording straight to 16 bit, level setting is critical—over-recording results in gross distortion on peaks (whereas analogue gives a steady increase) plus grainy quality at low levels as the system 'runs out of bits.'

A commercial 16 bit converter typically gives 1% distortion at −30 dB and possibly several per cent at −60 dB, and that of a type our ears are not necessarily used to. The large dynamic range of classical music makes it difficult to set levels within a 15 bit window of optimum performance. For some time Faulkner has been using A/D converters by DCS of Cambridge who offer 20 bit resolution. Their analogue electronics do not require conventional high order brick wall filters and sample and hold circuits either. 128-fold oversampled flash conversion allows equivalent functions in the digital domain using a digital decimating filter after A/D conversion.

Twenty bit digital audio recorded from the DCS converter via AES/EBU interconnection to a standard unmodified Mitsubishi *X86* (which is '20 bit ready') gives a wider dynamic window with 120 dB S/N, 0.1% distortion at −60 dB. Any distortion therefore is typically masked by the input programme noise. In this way you can under-record without audibly unpleasant side effects. The recorded, edited and post-produced 20 bit master tape can then be 'number crunched' down to 16 bit for release on compact disc.

"If you buy a standard DCS converter it is 16 bit as delivered, 20 bit linearity," explains Faulkner. "Then they put some digital twiddles in there which makes the signal look like 16 bit and dither the 16th bit so you don't get any crackles at low levels. We have done six or seven albums so far—for Reader's Digest, Hyperion, BMG, CBS, Sony. The biggest thing has been these Beethoven sessions.

Sound engineer Tony Faulkner

"We ran the 16 bit version onto U-matic tape so that the client can take the tapes home and work on them as though they were ordinary tapes, and we've recorded on the *X86* the full 20 bit data off another set of converters running 20 bit in the hope that we will be able to do something with them at a later stage.

"I'm very impressed with the Mitsubishi *X86*. It is nice to work with a fully professional machine rather than video recorders that don't take well to travel and sometimes the tapes (particularly the longer play ones) tend to die on the third or fourth play. Using reel-to-reel you get 2 hours on a 14 inch reel of tape. Before this I couldn't see why I would want to spend £11,000 on another tape recorder when I've got a big Sony installation but I can see justification now.

"I want 20 bit, I'm getting very sick of running around with U-matic, I'm not happy about using DAT for professional work as I don't think it's man enough for the job (I've had some compatibility problems between machines).

"My U-matic machines seem not to enjoy sitting in editing suites day in and day out—the heads wear out and various bits fall off. The other thing is of course, that reel-to-reel digital machines can be locked to video. CD-V is a growth industry in the UK, in the States and Japan. If I'm going to be doing sound balances for CD-V release it would be handy to give the customer a tape that can be locked up to a C-format machine; the *X86* will synchronise to anything. Trying to lock a *1610* system to C-format with a chase synchroniser is just an impossibility unless you did a lot of clever work with buffers and buffer memory and fancy digital electronics."

Faulkner has also been favouring valve technology of late, specifically equipment designed by Tim de Paravacini. Best known as a hi-fi designer, Paravacini has a lot of experience of broadcasting and has definite ideas about the sound of typical modern hi-fi products.

"He helped me debug and fine tune my Neotek mixer and made some front end valves, which are terrific—just mic in/line out with lots of valves in the back. I asked him to make me a mixer just out of mischief really and he has made me an 8-channel valve board. I didn't use it on the Beethoven sessions as I thought we might need more channels but it is excellent."

Every engineer has his own thoughts and opinions about the pace and direction of recording technology. Faulkner is constantly looking for something new and is often quick to embrace new technology. He seems pretty convinced that 20 bit is the only way and that he is definitely not on his own in this. It is really a question of waiting for the manufacturers to take up the cause and supply the necessary product.□

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Mitsubishi's X-86 2-track digital recorder

THE TECHNIQUES

A number of interesting questions are raised by the recent introduction of 'super digital converters', such as the Data Conversion System *DCS-900* used by engineer Tony Faulkner at recent sessions in Walthamstow Town Hall in conjunction with Mitsubishi's *X-86* 2-track digital recorder. The *DCS-900* is an analogue-to-digital converter for professional audio applications that aims to offer the user a potential improvement in sound quality over the converters supplied as standard in most audio equipment. Using oversampling techniques, it claims to offer increased low level resolution, quantisation to more than 16 bits, and very low noise and distortion.

In order to take advantage of the increased number of bits per sample, which the *DCS-900* can provide from its AES/EBU outputs, a tape machine which has the format space to accommodate 20 bit samples is required. Currently, there are very few commercial formats with this capability, the 2-track ProDigi format being the only readily available tape format that will handle 20 bits when fed from its digital inputs. The point of this article is to consider what advantages there may be in such an approach when the final master is going to end up in the compact disc format, quantised to 16 bit resolution, as it may well be supposed that any advantage in recording to 20 bits might be lost in the mastering process.

Background

To date 16 bits has been accepted as the norm for digital audio sampling in professional audio, as it is the resolution used in CD, and this is the format that nearly all consumers of digitally recorded music will use. Sixteen bits is also considered by many to be an adequate resolution for a digital tape recorder although there are those who believe that nothing less than 18 or 20 bits could be enough. A similar argument has raged about the sampling rates used in professional audio (44.1 or 48 kHz), with many claiming that they are nowhere near high enough. The question that has to be answered is to do with whether the push for more bits and higher sampling rates is simply a marketing exercise, together with some dubious subjective reasoning, or whether there is any ground for supposing that there is value in increasing the quality of conversion.

An important factor in all this is that many converters claiming to have 16 bit resolution do not in fact live up to this, because of non-linearities in the conversion procedure, critical tolerance of resistive components, accuracy of counters and so forth. For this reason, there is certainly at least an argument for having 16 bit converters that are truly accurate to 16 bits, as it is likely that the inadequacy of some earlier converters may have contributed to criticisms of digital audio sound quality. A second point to consider is that the traditional linear 16 bit converter suffers from increasing error as a proportion of total audio signal the lower the level of the signal is (since the quantising error is fixed at a maximum of ±0.5 LSB, and with high level signals this is relatively insignificant). This error manifests itself as quantising noise or distortion (depending on the nature of the signal, the distribution of the error in the frequency domain, and whether or not dither is employed), which gets greater as a proportion of the signal at lower signal levels, although in absolute terms it is still at a very low level.

Problems of low level resolution have sometimes been wrongly interpreted in the past and many false arguments have been perpetrated but, as with most false arguments there is some value in them because they are usually based on real evidence of a problem. Tony Griffiths of Decca, among others a great believer in the value of dither in digital audio, has demonstrated very convincingly on numerous occasions the effect of adding dither at low levels in digital audio equipment, showing that it turns a digital fade

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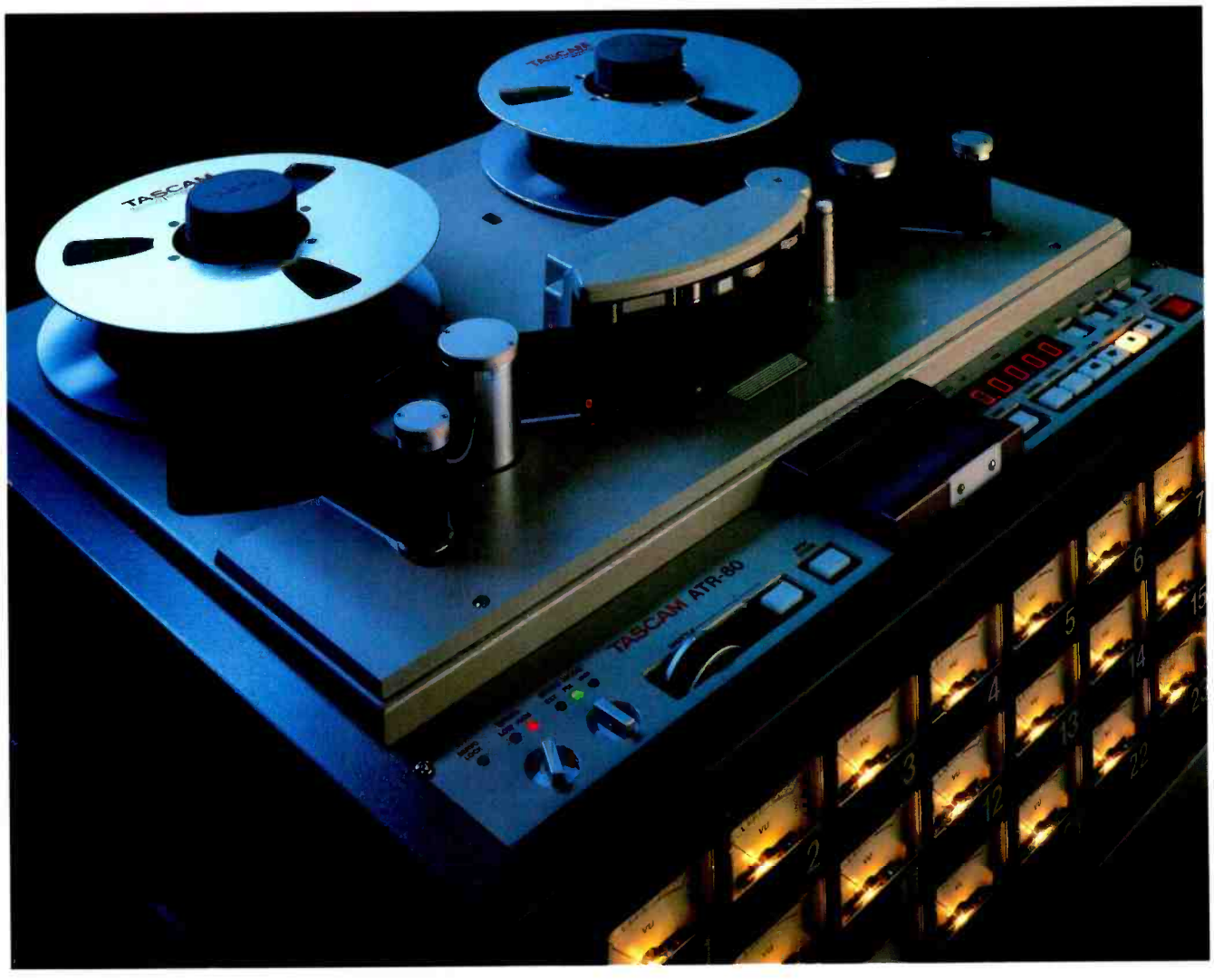

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◁ down to nothing from a dirty-sounding event near the bottom of the fader to a smooth fade into noise. Most people agree that although the 'dirtiness' only begins to appear at very low levels in relation to normal programme, it becomes important to get rid of it, especially in digital processing systems such as mixers, where signals may be changed in level, mixed with each other and otherwise processed. It is thus very important that the signal is quantised as accurately as possible at the input conversion stage before anything is done to it, in order that any error is not compounded. Certainly, if DSP and digital mixing equipment is to succeed, there is a need for more accurate conversion.

In many ways, whether misguidedly or not, the hi-fi world has tended to exist one step ahead of the professional audio world in the area of digital conversion. Compact disc players have sported D/A converters with specifications far higher than those on most professional equipment, using oversampling to 16 times and more, when the most that the latest professional systems use is either two or four times! Since it is the professional equipment that makes the CDs which the hi-fi enthusiast listens to, the whole issue becomes quite ironic, since the engineer balancing the original recording may be hearing lower quality sound than the domestic listener. It is only recently, though, that more attention has been paid to the quality of A/D conversion, this process being more complicated than D/A conversion. Attention to this area could be of potentially greater benefit to the consumer of high quality digital audio, as it is likely to affect the quality of what is recorded rather than what is replayed. Domestically, the consumer will be largely uninterested in A/D converters (unless he has a DAT machine) as domestic digital audio is generally 'replay-only', and so it is the professional who should consider improving his act in this area.

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Oversampling in D/A conversion

Oversampling was first introduced to audio in the hi-fi arena to improve the perceived quality of CD replay, and has been used as a tool by Philips to gain effectively 16 bit resolution out of 14 bit converters. Used in a system such as CD, which operates at a nominal sampling rate of 44.1 kHz, the benefits of an oversampling D/A converter can only be gained by multiplying up the replay sampling rate using digital filters so that it is perhaps four or more times the nominal rate. One effect of this is to spread any noise or distortion over a wider frequency band, much of which is out of the audio frequency range, thus the noise within the audio baseband is reduced. Coupled with this is the advantage that any anti-aliasing filters need not have such steep cut-off slopes (since components of the sampled spectrum have now been moved to a much higher frequency and are unlikely to alias) and thus the audible artefacts associated with steep filters are avoided.

Some manufacturers of CD players have used oversampling to claim 18 bit resolution, even though 16 bit converters are used. In the case of an oversampling CD player, the multiplication of samples at the original sampling rate of 44.1 kHz with appropriate coefficients so as to create new samples at the higher sampling rate may result in samples of a longer word length than 16 bits. If a 16 bit D/A converter is to be used then any extra bits resulting from the multiplication process must be removed before the sample can be converted, and it is the intelligent truncation of the less significant bits that is one of the keys to improved sound quality. Simply to chop off any bits less significant than the 16th will negate much of the advantage that might have been gained, whereas intelligent rounding based on the values of less significant bits will preserve much of the information that had existed in the less significant bits in the on/off modulation pattern of the least significant bit of the 16 bit word, once the output of the converter has been averaged by lowpass filtering. It is part of the principle of information theory that as much information can be transferred in 4 bit words at a sampling rate of n, as can be transferred in 1 bit words at a sampling rate of $8n$. In other words, it is possible to use a high sampling rate and less bits per word, or a low sampling rate with more bits per word to transfer the same amount of information, and thus potentially the same audio quality.

Despite the improvement in sound quality available through the use of oversampling at the replay stage, it is important to realise that oversampling D/A conversion cannot magically extract information (audio quality) which was never there in the first place. It is now necessary to understand how oversampling applies to A/D conversion, as this will help to show how more information can be stored in recordings.

Increasing the recorded resolution

It should be stressed that there is no escaping the fact that you can't get something for nothing. "There is no such thing as a free lunch," to quote the cynical business man! Digital audio sound quality can only ever be as good as the worst device in the signal chain, and the quality is limited by the amount and accuracy of information transferred, whether in the number of

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bits per sample or the number of samples per second.

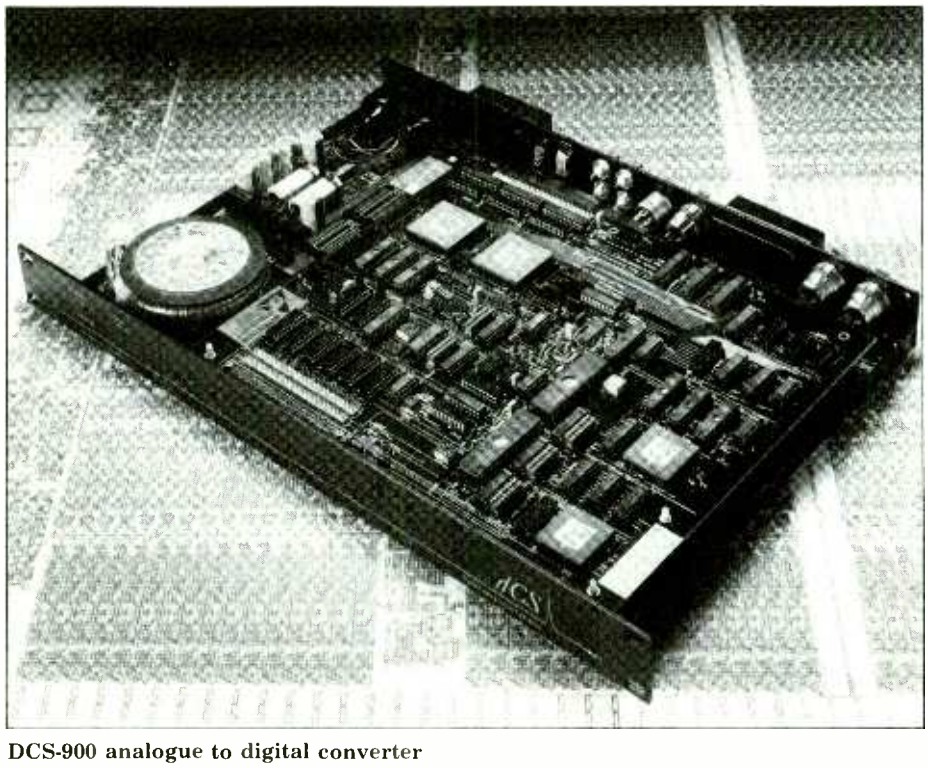
The *DCS-900* A/D converter that sparked off this discussion uses oversampling at 128 times the nominal rate of 44.1 kHz, which amounts to a little over 5 MHz. It also uses only 4 bit converters, which is the reason this feat is made possible. This bears out the theory that you don't need a 16 bit converter if you're going to sample at a high enough rate. In order that the output of such a converter can be recorded on a normal digital tape recorder operating at 44.1 or 48 kHz, the audio data sampled at the high rate (128 times nominal) must be converted to samples at the lower rate (effectively 1 times nominal) using a process known as decimation, and this results in samples at the nominal rate which have a word length much longer than 16 bits (the original information is now held in a greater number of bits per sample rather than in an increased number of samples per second). This is where the claim of resolution greater than 16 bits comes from, since the *DCS-900* produces samples from its digital output with up to 24 bits set (although, as DCS's Peter Gingold pointed out, he wouldn't like to guarantee the accuracy of bit 24!). The unit also has the capability to truncate the output intelligently to either 16, 18 or 20 bits.

In a trial session using the *DCS-900* linked via an AES/EBU interface to a Mitsubishi *X-86* 2-track machine, 20 bit samples were recorded on the tape. The 2-track ProDigi format has left space for this eventuality although the converters on the *X-86* itself do not operate to 20 bit resolution. Such an arrangement gives the engineer somewhat more freedom in level setting, as he now has a dynamic range of over 100 dB to play with, and he may be more free to allow a certain amount of 'headroom' for unexpected input peaks. The question is: 'What happens to the 20 bits when the recording is edited and mastered onto CD?'

It is possible that such a recording could be edited in a number of ways to preserve its 20 bit integrity. It could be splice-edited, or it could be copied to an editing system such as the DAR *SoundStation II*, which has 18 bit capability. Mitsubishi's electronic editor for the *X-86*, the *XE-2* could also be used. After editing the recording must somehow be truncated to 16 bits to be mastered onto compact disc and unless this is done with care, much of the advantage of improved conversion will be lost. If an engineer had taken advantage of the additional dynamic range of 20 bit recording, and intentionally allowed 10 dB or more of headroom (such that the recording peaked well below peak bits), truncation to 16 bits without gain correction would result in perhaps only a 14 bit recording. The correct approach would be to feed the recording through a digital mixer such as Neve's Digital Transfer Console *(DTC)*, raise the level such that the recording peaked near the maximum and then truncate to 16 bits.

There is therefore ground for suggesting that, in some cases, intelligent rounding to 16 bits at the A/D conversion stage, such as by using the switchable resolution provided in the *DCS-900*, might be more appropriate as a means of making a highly accurate 16 bit original recording to avoid the risk that somewhere further down the post-production chain the additional quality will simply be lost by equipment failing to recognise bits lower in significance than the 16th, or by people failing to realise the way in which the recording was made. In this way the engineer could be sure that the quality of his recording (even though limited to 16 bits) would remain intact throughout post-production without him having to keep track of its progress. Certainly, if a 20 bit tape is played back on the *X-86* via its analogue outputs, the four additional bits will not be recognised because it uses a 16 bit converter, and if the tape is copied to any other 16 bit format such as the Sony *1630* via AES/EBU it will also lose the four LSB's.

If 18 and 20 bit recordings are to become commonplace then there will be increased emphasis on the need for intelligent post-production and mastering, using equipment and people which understand about the technical implications of truncation, oversampling and so forth. One thing is clear, though, and that is that no matter how many bits per sample the original recording has, the consumer who buys the finished product will still only reap the benefit of 16 of them, at the ordinary CD sampling rate of 44.1 kHz. Because of this we would be back to the situation in which professional recordings can be of a higher quality than domestic equipment is capable of reproducing, it being part of the skill of the mastering engineer to relay as much of the master tape's quality to the domestic listener as possible.



DCS-900 analogue to digital converter

Further benefits

What other benefits might there be in using a 'super converter' to make one's digital master recordings? Again, Peter Gingold of DCS, points to the fact that the additional bits produced at the digital output are not the whole key to the story. There are factors such as the accuracy of the converter over the whole dynamic range and the 'noise shaping' employed, which avoids the traditional effect of increasing distortion with falling level. In fact he indicates that although typical distortion components are at around −105 dB with respect to maximum modulation, at a single level of around −50 dB the distortion is in fact as low as −130 dB. This can be measured digitally using an FFT analyser. (It should be noted that DCS has indicated its intention to develop a D/A of similar quality to the *DCS-900*.)

Other advantages of high quality A/D conversion will be the improved phase linearity and freedom from ringing at the high frequency end of the audio spectrum, due to the oversampling technique described above.

David Ward of Mitsubishi emphasises the fact that high quality conversion will become increasingly important as audio signals are processed entirely in the digital domain. The more gain changes and equalisation that a digital audio recording experiences during post-production, the more chance there will be for low level errors to be compounded, and thus there is value in original material with as high a quality as possible.

For the future

The industry is without a doubt committed to 16 bit mastering, as this is the resolution of CD. It is hard to imagine anybody trying to change the CD format for the foreseeable future, unless they have a very hard hat, as its success is proven and millions of machines have been sold. It is just possible that someone may find a way of squeezing 20 bits onto a conventional CD while retaining its compatibility with existing 16 bit players but this is unlikely to find particular favour with the average consumer who thinks that the dynamic range of CDs is already too great for the average living room or car and possibly would rather see it compressed than expanded.

Converters such as the *DCS-900* will score their real points in returning to the audio engineer the ability to record audio of a higher quality than that which eventually needs to be reproduced in the home, leaving room for flexibility in processing and perhaps a margin for error. The engineer has been used to this situation with analogue recording and there are many who would like to return to the security of knowing that the material which they submit on digital tape is of a similarly superior standard.□

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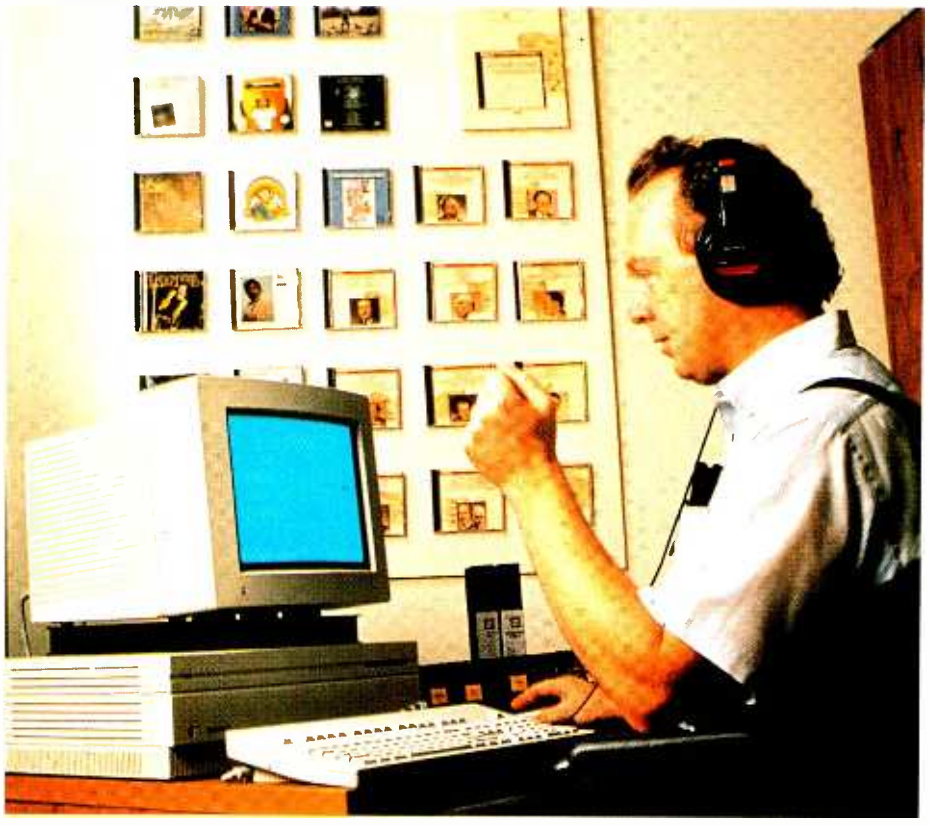

No-Noise in operation

A SONIC SOLUTION

David Miles Huber boots-up the Sonic System from Sonic Solutions and takes a look at No-Noise

Like myself, have you ever wondered what had happened to the Droid Works, the former Lucasfilm subsidiary who created that rather progressive digital audio workstation of the mid '80s? Well, it seems that the primary droids have banded together to create Sonic Solutions, a San Francisco-based company that is dedicated to the manufacture and support of a high-end digital audio workstation and its related processing software. This desktop workstation, which goes by the name of the *Sonic System*, received serious attention at the latest New York AES convention and has been raising digital eyebrows ever since.

The *Sonic System* is shipped as a complete hardware package that consists of a Macintosh *II* or *IIx* computer loaded with 4 Mbytes of RAM, a 40 or 80 Mbyte internal hard disk for programme storage, extended keyboard, high resolution monochrome monitor, video card and Sonic Signal processor card. Also included is a 793 Mbyte SCSI hard drive that is capable of holding up to 56 minutes of 16-bit stereo audio at 44.1 kHz.

The Sonic Signal processing card plugs directly into one of the Mac's available NuBus slots, however, in order to improve processing and disk scheduling a proprietary internal Sonic Operating System was developed to offer some rather impressive processing features. This card is capable of simultaneously handling up to four independent channels (or two stereo pairs) of digital I/O in AES/EBU or SDIF formats at sample rates of up to 60 kHz (with most programs operating at 44.1 or 48 kHz). Each card employs four Motorola *56001* microprocessors, which provides number crunching capabilities that show off some impressive realtime processing power. Although all digital audio is stored in 16-bit linear form, internal processing and data paths occur with 24 bit resolution, while the mixdown buses are processed using a full 56 bit wordlength.

Each card incorporates an SCSI port that is able to handle up to four external hard disks, which, due to the unique operating system, increased speed and data management capabilities, make the system able to simultaneously upload or download a soundfile to or from a destination while you're busy editing or otherwise processing a soundfile in the foreground. (With time saving techniques like this and a desperately hoped for backup and file standardisation, maybe random access technology will be taken more seriously by the audio and video industries in the future.) Four RS-422 serial ports are also included to allow for software control over external digital tape transports during the edit and up/download process.

On a final hardware note, the *Sonic System* does not include A/D converters as Sonic Solutions prefer to let customers choose the converter that best suits their personal taste.

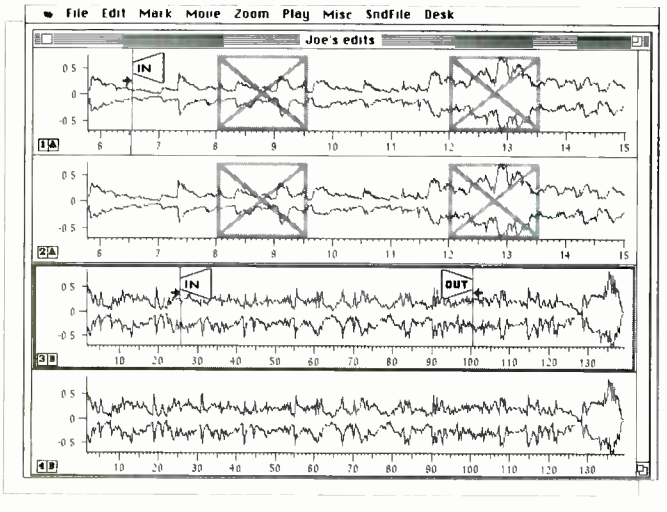

Fig 1: The CD pre-mastering desktop editing screen

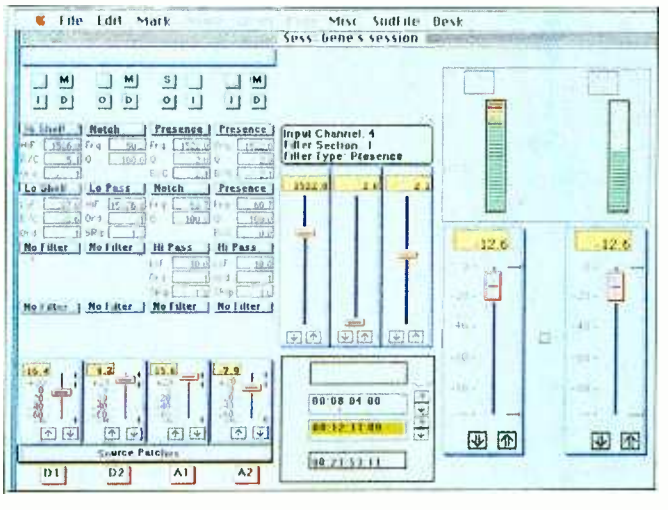

Fig 2: The CD pre-mastering desktop mixing screen

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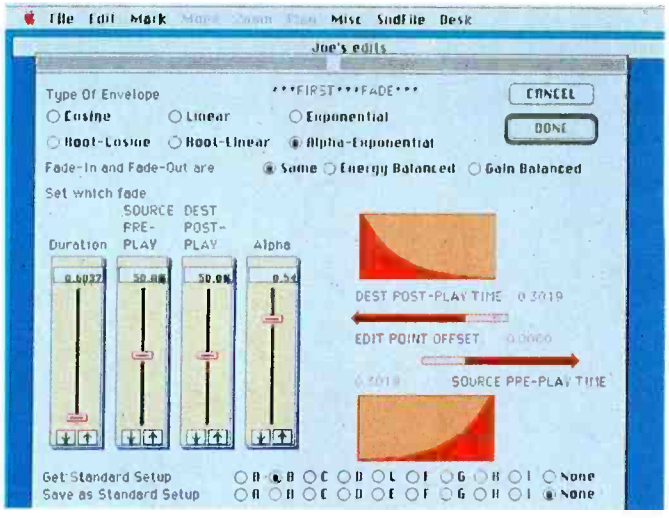
Software

Sonic Solutions provides a number of 'Audio Desktop' programs tailored to perform particular tasks. Currently, five Audio Desktops are available with more on the horizon.

CD pre-mastering: This applications program is designed to give the user the benefits of both digital signal processing and random access editing in order to fully prepare a project for direct mastering to CD.

This desktop makes use of three basic screens: the Edit screen, the Mixing screen and the Crossfade screen.



The CD pre-mastering desktop crossfade screen

The Edit screen enables multiple samplefiles to be visually displayed on the screen at any point in time, of which up to four channels may be directly assignable to the digital I/O ports. The basic screen (**Fig 1**) is logically laid out to let the user perform the usual tools of visual waveform editing (cut, paste, dynamic adjusting, special effects, etc). Should the programme material exist over multiple soundfiles or should the user wish to re-edit a stereo soundfile, defined segments may be pasted into a stereo soundfile, which can then exist as the final edited program.

The Mixing screen (**Fig 2**) lets the user mix up to four discrete soundfiles into a final stereo soundfile by using an on-screen emulation of a digital 4/2 mixer. This section includes all the tight control over EQ and dynamics that you'd expect from a well designed digital mixer, including realtime moving faders.

The Crossfade screen allows for an extremely wide range of user defined crossfades to be performed within or between soundfiles. In addition to the expected range of linear and log crossfades, this process will allow you to set source and destination start times. This useful feature means that a crossfade could totally fade-out at one point, with the in-fade beginning 1 or 2 seconds later (leaving a space between them) or the two could be overlapped by several seconds or more. Once a crossfade is defined, an on-screen edit marker will be placed over the effected waveform.

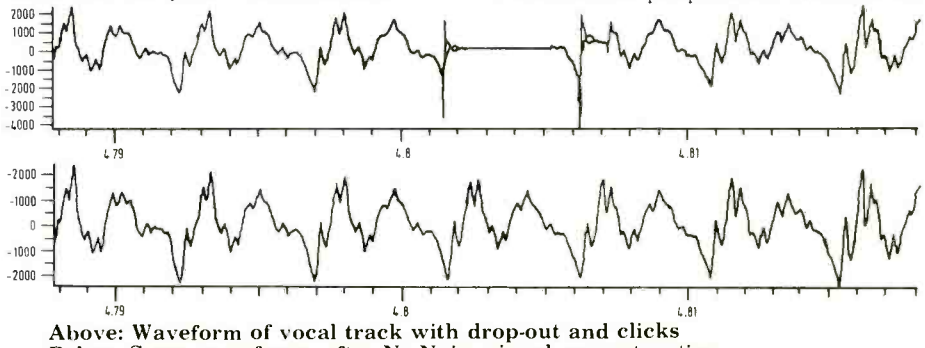
All the above might be expected from a high-end system, however, now we can get to the meat of the program: due to its processing power, all edits, mixing, crossfades and other processing functions are performed in 'realtime' on-the-fly. Unlike some systems, there are no off-line coffee breaks while the system crunches numbers. Everything is instant access with the original data being left intact. Mixer movements are also recorded and reproduced on-the-fly, allowing the user to update movements at any time.

Sample rate conversion: This is a straightforward conversion program for converting sample rates from 48 kHz to 44.1 kHz.

PQ code editing: This desktop allows for the preparation of a finalised program soundfile onto a completed CD pre-master. It accomplishes this via complete computer generation of all necessary PQ subcodes and/or setup log sheets in any of three formats:

- for generation of complete/frame-accurate subcode log for manual entry into the mastering computer at the disc cutting facility (this method is most commonly preferred in the United States)
- for synthesising the table-of-contents/subcode data directly onto channel 1 of the final U-matic master for loading into the mastering computer and CD (this method is most commonly used in Europe and Japan)
- for creating a final CD pre-master onto RDAT. Since CD cutting systems generally will only read the first 58 seconds of program timecode before an internal jam synced code is generated; it seems that Sonic Solutions have found it possible to modulate subcode and timecode data onto a DAT's audio tracks before the system takes over in the jam sync mode and the audio program begins (this is currently being tested by a few US mastering facilities, with favourable response)

Sound for picture: This software package enables the *Sonic System* to fully synchronise to an external video source (via a serial controller) for audio-for-video post-production. It also includes



Above: Waveform of vocal track with drop-out and clicks
Below: Same waveforms after No-Noise signal reconstruction

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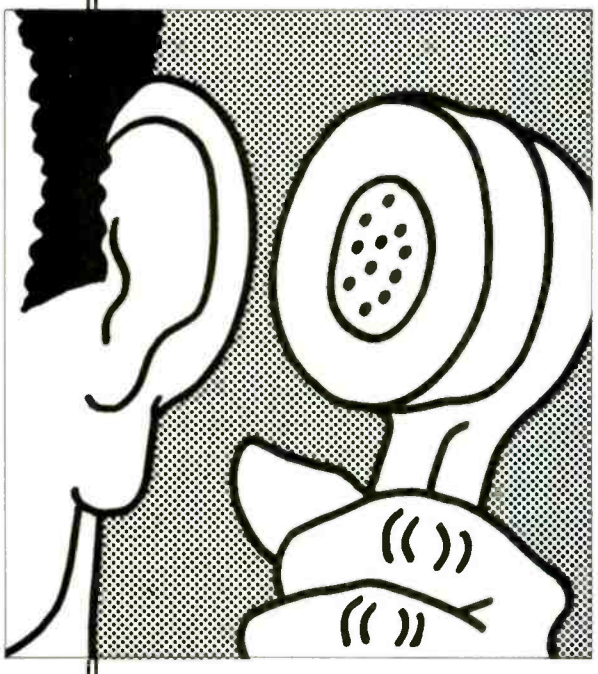
Could this be the way to hear the best studio monitors on the market?



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The above equipment is a very small sample taken from hundreds of items listed every month in a **FREE** magazine called BULLETIN BOARD. If you don't already receive your copy call me or fax me on the following numbers: **TEL: 01-994 4433 or FAX: 01-994 9321**

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the capabilities for generating background and dialogue loops and for time compression/expansion.

No-Noise: Sonic Solutions has perhaps gained its greatest recognition from the distribution and sales of the *No-Noise* digital noise removal process.

No-Noise is a single-ended noise removal system that is most commonly used to restore and clean up problematic programmes from the 78 rpm record and early analogue eras for remastering to compact disc. It may be most likened to an intelligent multiband expander, however, in this case 'multi' means the audio spectrum is divided into more than 2,000 frequency bands and requires over 53 million computations to process just 1 second of sound. Such complex algorithms cannot be done in realtime and thus will typically require from 8 to 10 hours to de-noise 1 hour of music (a process often left until the early hours of the morning).

The *No-Noise* process will often involve a series of three stages: visual analysis, de-clicking and de-noising.

The visual analysis stage involves searching through a soundfile in order to visually and audibly determine the extent to which *No-Noise* must be applied to rid the programme of noise and click pollution.

Once the soundfile has been checked out, *No-Noise* may be used to remove clicks and pops automatically. Until the digital age, we were required to get out our trusty old razor blades but *No-Noise* does not edit out these noises, instead it reconstructs and repairs the problem portion of a recording by performing a Fourier frequency analysis upon a segment of audio, both before and after the click. The process is thus able to sample enough of the surrounding material to make a plausible 'guess' as to the original waveform content and then paste a re-synthesised segment of audio over the offender.

This process may be set into automated motion, however, it isn't capable of eliminating clicks 100% of the time. At these times, it is artful enough though to mark those areas that couldn't be recovered automatically and notifies the user that the 'de-click parameters' in question must be varied manually until the noise is successfully eliminated.

This process may also be used to 'fill-in' momentarily segments of missing audio (**Fig 3**). This feature has gained a great deal of recogniation in the US press for reconstructing missing audio that occurred during a Doors concert in 1968 at the Hollywood Bowl. It seems that, at the beginning of the recorded performance, Jim Morrison knocked loose the mic lead that ran to the mobile truck. The PA line was unaffected, so the concert proceeded and it took the engineers about 15 minutes to find and correct the problem. This segment, which included the intermittent vocal track, was considered useless until co-engineer Bruce Botnick approached Sonic Solutions whose efforts wound up saving about 12 minutes of the show.

Once transient noises have been eliminated, the next task is that of lowering the background noise floor such as tape hiss, surface noise or recurrent background noises (hum, buzzes, air conditioners and the like).

The de-noising aspect of *No-Noise* involves a set of complex computations that are able to make intelligent estimates as to when a background noise will or will not be audible at any point in time. Specifically, the process breaks down the audio spectrum into over 2,000 frequency bands in order to predict how louder sounds (programme) will mask a softer sound (noise). This process makes use of fast Fourier transform techniques to create a frequency analysis of the programme material. This analysis makes judgements as to what is signal and what is noise by comparing the signal with a noise 'fingerprint' known as a signature. This signature is taken from a sample of pure background noise, which might exist at the beginning or end of programme, or within a momentary pause.

Once the system is in action it will search both forward and backward in time over a range of samples for each instant of music to determine what is noise and whether its removal would damage the music or not. As levels within one of the analysed frequency bands falls below or equals the level of the noise signature, the processor will decide that the content is most likely noise and digitally expand this narrow bandrange downward, thus reducing the final noise content.

As every audio program to be *No-Noised* is different in nature, this system is not a 'one click of the mouse does all' application. Processing variables, such as depth of reduction, are up to the user (or producer) who has the final say as to how much is to be used without adversely affecting the original program material.

Upcoming desktops

On a final note, Sonic Solutions will in the near future be releasing additional desktops including an application that functions as a multichannel workstation. The basic system would work as a 4-channel workstation, however, an 8-channel system (8 in/8 out) could easily be implemented by plugging in an additional processor card. A desktop, which is due to be released early this year will allow CDs to be directly cut to CDHR discs, directly from the PQ code editing desktop. This could serve several purposes, including on-the-spot CD test pressings, limited edition or effects CDs, etc.□

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M&M PLASMEC SPRING '90

THE NEWSLETTER OF THE MOSSES & MITCHELL DIVISION OF PLASMEC SYSTEMS

CONNECTIONS

TAP INTO THE FUTURE

Whilst MIDI has of course many real strengths (in particular the first MIDI synthesisers are compatible with the latest), up till now it has been limited in capacity and flexibility. Now Lone Wolf have developed MediaLink, which dramatically expands the capabilities of MIDI systems. MediaLink is a protocol that will transmit performance data in real time and can handle many types of information in a high-speed network configuration. Real time performance is achieved by using two operating modes. The Set-Up mode is used for transferring large amounts of information such as MIDI files, digital samples and other non real time data. In Performance mode the size of data packets is limited and priority is given to performance and synchronisations messages.

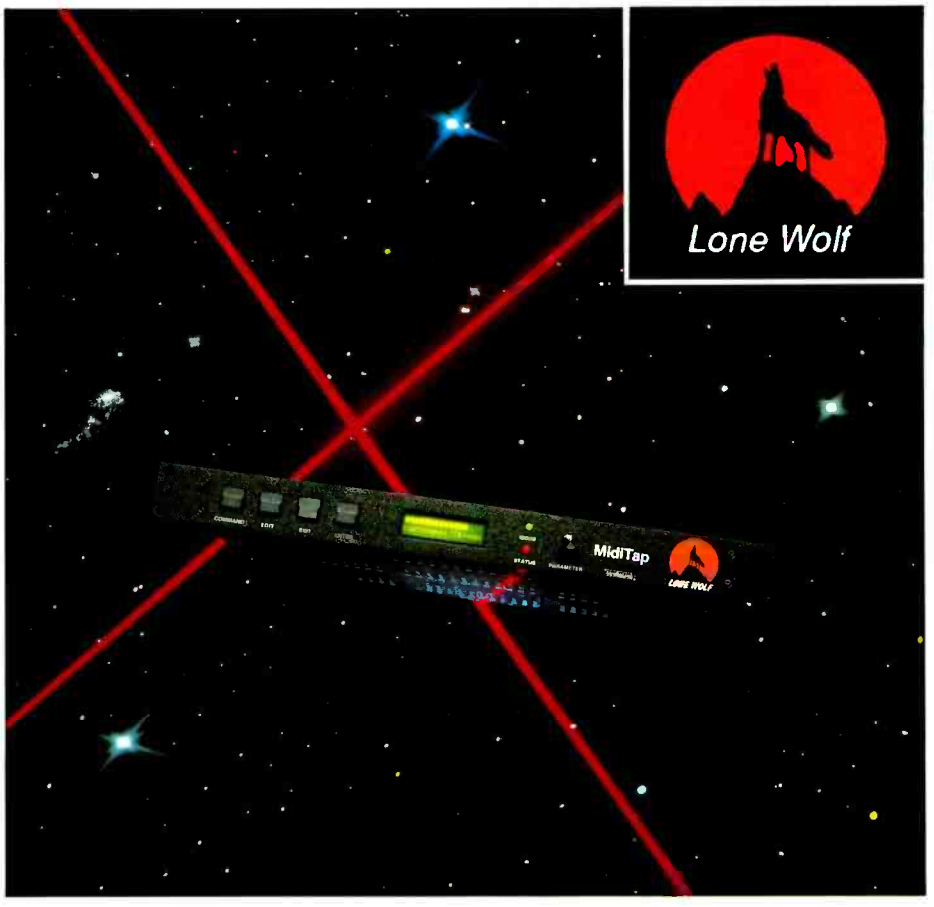
As a first building block for MediaLink, Lone Wolf have introduced the MidiTap, a rack mounted unit which serves as the interface between MIDI and MediaLink. MidiTap includes a complete distributed database operating system which allows you to set up all MIDI network devices.

MIDI systems are no longer limited to 16 channels. MediaLink provides up to 32,768 'groups', each of which supports all 16 channels (that's well over half a million!).

Traditionally MIDI cable runs are restricted to 50 feet to ensure reliable operation, but this system makes use of fibre optics and can span distances of 2.5 kilometres.

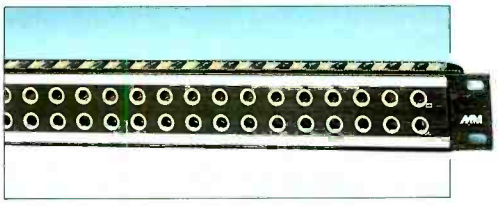
If you are already finding that MIDI is limiting your creativity, contact Plasmec for detailed technical information on the system that will take you into the nineties.

M&M further information circle no 106.



NEW HIGH DENSITY JACKFIELDS

If you have a preference for ¼" Jacks, but are limited for space, take a look at our new JF2/1U range of Jackfields which incorporates two rows of Jacks in the space normally required for a single row.



The range is available in 20, 24 and 26 Jacks per row and is assembled in an aluminium front panel anodised in black or silver with two integral designation strips.

M&M further information circle no 102.

EQUIPMENT INSTALLATION

Plasmec have recently extended their facilities for the assembly and pre-wiring and installation of broadcast equipment at customers' premises is now being offered on a turnkey basis or as required.

We are currently building a 4,000 input monitoring system for a major British broadcasting organisation. The heart of the system is a version of the compact 64 x 64 audio matrix from DK Audio. The Matrix is built on 16 cards in a 3U Eurorack. Specifications include transformer inputs and outputs and a processor on board each output card addressed by the ES-BUS.

M&M further information circle no 103.

NEW PREMISES

By the middle of the year Plasmec will be moving into a brand new purpose built facility in Farnham. Our new factory provides 30,000 square feet of self contained B1 accommodation. Now all our activities manufacturing and assembly, warehousing and distribution and sales and marketing can be housed under one roof.

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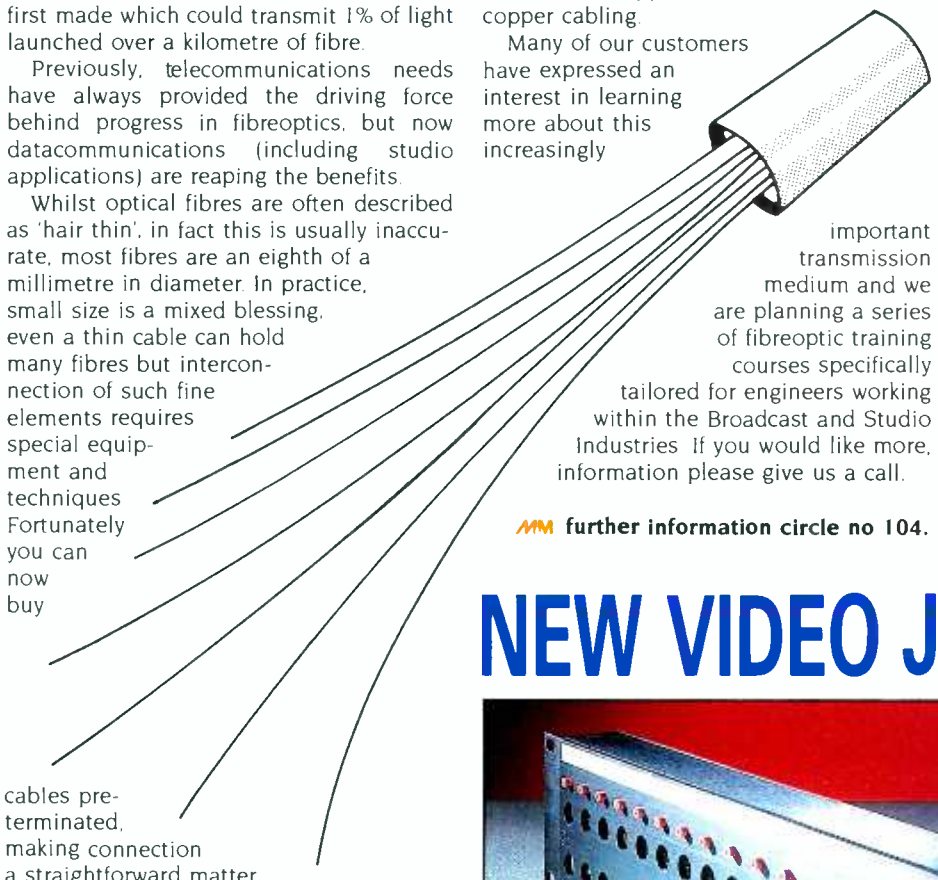
WHY USE FIBRE?

It is now 20 years since optical fibres were first made which could transmit 1% of light launched over a kilometre of fibre.

Previously, telecommunications needs have always provided the driving force behind progress in fibreoptics, but now datacommunications (including studio applications) are reaping the benefits.

Whilst optical fibres are often described as 'hair thin', in fact this is usually inaccurate, most fibres are an eighth of a millimetre in diameter. In practice, small size is a mixed blessing, even a thin cable can hold many fibres but interconnection of such fine elements requires special equipment and techniques. Fortunately you can now buy cables pre-terminated, making connection a straightforward matter.



Savings in weight and size compared with copper systems can be impressive, particularly with large capacity systems.

In addition fibre is immune to interference. You can run optical cables in the same duct as power lines without problems. Crosstalk between fibres in a cable just does not happen, unlike conventional copper cabling.

Many of our customers have expressed an interest in learning more about this increasingly important transmission medium and we are planning a series of fibreoptic training courses specifically tailored for engineers working within the Broadcast and Studio Industries. If you would like more information please give us a call.

further information circle no 104.

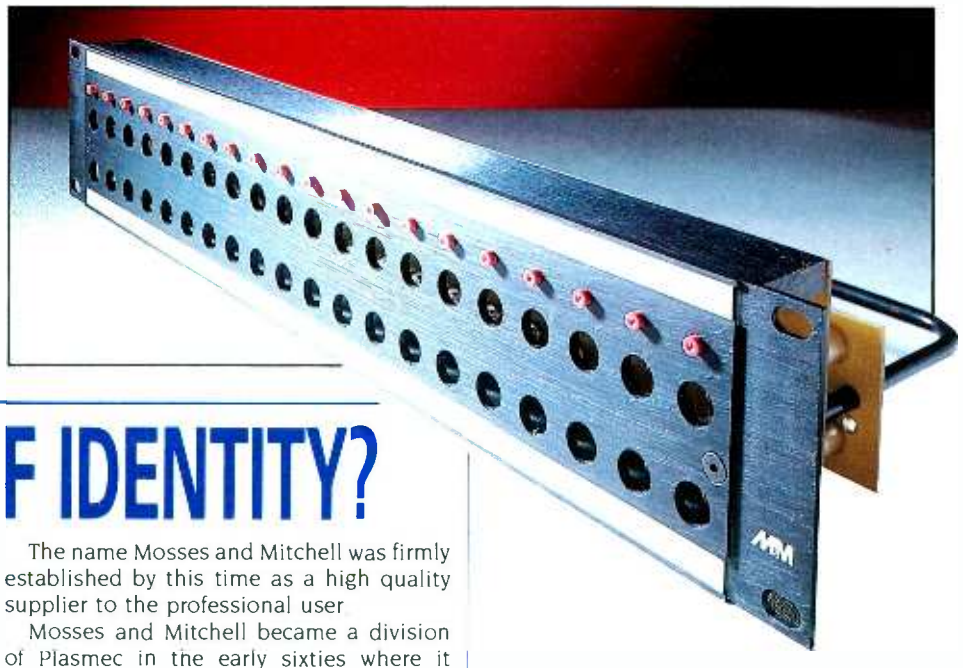
PEAK AND AVERAGE DISPLAYED

The loudness monitor from Dorrough Electronics shows both peak and average levels on one meter. This could be the solution to your problems if you have to compare compressed and uncompressed material for transmission.

The bar displays the average power of the signal and therefore indicates loudness whereas the moving dot shows the peak signals, as fast as one half cycle of 15kHz! The ratio of average power to peak signal is a useful indicator of compression and could be used on-air to balance compressed against non-compressed programme.

The meter is available in various sizes

NEW VIDEO JACKFIELDS



We are pleased to announce a new range of video jackfields, which includes models with 18, 20 and 24 MUSA connectors per row.

The range is designed to meet the very highest broadcast standards by using top quality components throughout, including MUSAS with solid standard silver plug pins.

All models in the range are available with test points, if required, to allow the use of scope probes without degrading the signal.

To complement the range, we offer a full selection of video patchcords and U-links available in traditional form or with moulded finger grip.

All Mosses and Mitchell video jackfields and accessories are available on an ex-stock, next day delivery basis from Plasmec direct, or from usual stockists.

further information circle no 108.

A QUESTION OF IDENTITY?

Whilst our established customers have come to terms with our 'dual personality', no doubt there are those who would welcome a few words of clarification concerning the relationship between Plasmec and Mosses and Mitchell.

Mosses and Mitchell was established in the middle of the eighteen hundreds as a specialist manufacturer of laminates and related products. In the middle of this century the company went from making piece-parts used in the manufacture of jack products to making complete jacks. The reputation of Mosses and Mitchell jacks grew rapidly and the customer base developed to include all major Broadcast and Studio companies in the UK and overseas.

Mosses and Mitchell

PLASMEC

The name Mosses and Mitchell was firmly established by this time as a high quality supplier to the professional user.

Mosses and Mitchell became a division of Plasmec in the early sixties where it became the focus for our developing broadcast and studio activity.

Our broadcast and studio division is only part of the Plasmec picture. Within the Plasmec group we have a diverse range of activities including specialist plating and moulding facilities which supply the telecommunications and datacommunications markets. We also manufacture sophisticated document handling products.

Our site facilities (to be enhanced significantly with the completion of our new purpose built factory) include the assembly of specialist electromechanical and electro-optic products and a fabrication department (with sophisticated CNC equipment) producing precision components and sheet metal items.

Mosses and Mitchell — a division of Plasmec Systems Ltd.

further information circle no 101.

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VERAGE LEVELS IMULTANEOUSLY

and formats. The largest is suitable for use under picture monitors.

A wide range measuring set is also available. The 1200 test set is said to have the widest range ever designed and is simple to operate. It allows stereo measurements of level, balance, crosstalk and signal to noise over the entire dynamic range of your system from noise floor to clipping. It offers a solution to the monitoring of balanced stereo lines.

further information circle no 105.

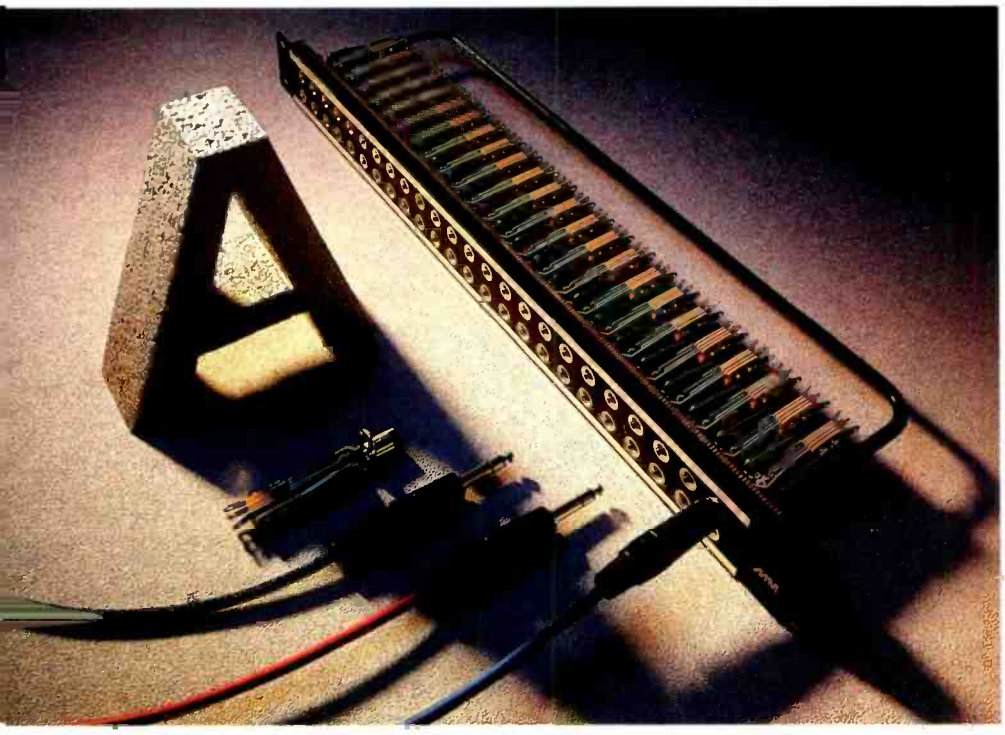
A IS FOR "A" GAUGE

The A-gauge jack is one of the most widely used means of connection in the Audio Industry as a whole. However the Broadcast and Professional Audio Market have had an uneasy relationship with this jack. They prefer the similar but not compatible B-gauge jack. This jack is also known as the Post Office 316 type, which refers to a specification that is now over 50 years old. The original purpose of this jack was, of course, for manual telephone switchboards.

Most members of the public, let alone musicians, know the A-gauge jack since they use it to connect their headphones to their Hi-Fi, or guitars to combos. It is widely used in low to medium price sound mixing consoles, amplifiers, effects boxes, electronic musical instruments etc., etc.

The miniature or bantam jacks and the B-gauge jacks have dominated the professional market and the A-gauge jack has been neglected.

With the recent improvements in the quality of plugs on offer. ('Designer' plugs with gold plating have recently emerged) and leading companies such as Neutrik have applied their famous high standards to give a robust high quality product. We at Plasmec have been persuaded that at last there is a real demand for a professional A-gauge jack socket and are widening our Mosses and Mitchell range to meet this need.



Our professional A jack socket has a long frame steel chassis and long leaf springs with palladium contacts giving greatly superior performance to that previously available.

further information circle no 107.

EIGHT TIMES BETTER THAN REMOTE CONTROL

Remote volume control has always been a problem for professional audio designers. Usually either audio quality or convenience had to be sacrificed. The Oxmoor DCA-2 (Digital Control Attenuator) puts digitally precise volume control in as many places as you want it but won't degrade professional audio signals.

A preset adjustment on the rear panel sets the default attenuation so systems always wake up predictably and a simple external contact closure will let you return to this setting during operation. Another external contact will temporarily change or even mask the audio level so that interruptions such as paging announcements will always happen at the level you set.

The RC-16 remote controller was designed specifically to fill its role in these demanding applications.

Several remotes, looped together with simple modular phone cables, can control the same device — All at the same time — Simply — Efficiently. There's no need for awkward take-control switching and levels never jump from one value to another. Unlike up/down buttons, the RC-16 controls the rate of change, the faster you turn the knob, the faster the setting is changed.

You would think that you were turning a straightforward professional quality calibrated attenuator but actually it is a shaft encoder that translates knob movements into a precise string of digital pulses.

In use, the setting is shown simultaneously on the virtual pointer on each control in the loop. As any knob is turned, the LED displays all follow until the top or limit is reached. At that point, only movement in the opposite direction will have any effect on the level or the displays.

The fact that there are no end stops makes the controls much less vulnerable when mounted in public locations. There is an optional keyswitch to turn off the control and the LED virtual pointer. You can move any RC-16 to another control circuit with a simple 4-pole switch without affecting levels or other controls in the loop.

further information circle no 109.

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BROADCAST DIARY

Exhibition	Date	Venue
Music Industries Assoc. Music Fair	March 21-26	Exhibition Centre, Ludvig Erhard Anlage 1 POB 970126, D6000 Frankfurt 1
National Assoc. of Broadcasting Convention	March 31-April 3	Georgia World Congress Centre, Atlanta, Georgia, USA
The MIDI Music Show	April 7-8	Novotel, Hammersmith, London W6
Vision and Audio '90	April 22-25	Earls Court Exhibition Centre, London
A.P.R.S.	June 6-8	Olympia 2 Exhibition Centre Kensington, London
Pro Audio Asia	July 11-13	Hong Kong Convention & Exhibition Centre, Hong Kong
International Image Sound & Electronics Exhibition (SONIMAG)	Sept 10-16	Feria de Barcelona Avda Reina, M[a] Christina 08004 Barcelona, Spain
I.B.C.	Sept 21-25	Metropole Conference & Exhibition Centre, Grand Hotel, Brighton, Sussex
Audio Engineering Society (AES)	Sept 21-25	Los Angeles Convention Centre, Los Angeles, California
All Imported Audio Equipment Show	Oct 30-Nov 2nd	Tokyo, Japan
Lighting Dimensions International	Nov 17-19	Orange County Convention Centre, Orlando, Florida, USA
International Broadcasting Equip Exhibition	November	Sunshine City Convention Centre, Tokyo, Japan
	1991	
Korea International Audio Visual & Musical Instrument Exhibition	February	Korean Exhibition Centre, Seoul
National Assoc. of Broadcasting Conv.	April	Las Vegas USA

Whilst every care has been taken PLASMEC cannot be held responsible of any information given in this newsheet

For further information on any of the products highlighted in this newsletter please circle the appropriate number and return this section to:

Plasmec Systems Ltd, Mosses & Mitchell Division
Weydon Lane, Farnham, Surrey GU9 8QL.

101 102 103 104 105 106 107 108 109

Name _____ Position _____

Address _____

_____

_____ Tel No _____

Alternatively telephone our sales department on **0252 721236** or fax this completed form to **0252 712718.**

NEW FACES

We are pleased to announce the following new appointments:

Alan Peoples has joined us as Applications Engineer with particular responsibility for the Studio Industry.

Alan originally trained as a musician but then turned to the more technical aspects of the industry. He has spent over 12 years

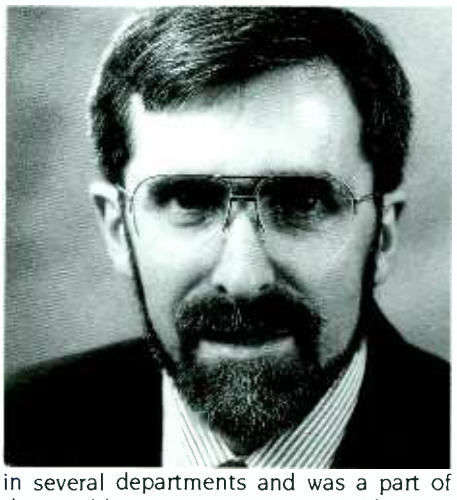
in the Pro-Audio field, working in purchasing, production and product marketing management.

For the last four years, he has specialised in selling interconnection and switching products.

Alan will be working with Plasmec's Mosses and Mitchell range of Jackfields and plugs for both audio and video applications, as well as a wide range of studio products from principals including Oxmoor, 360 Systems and Dorrough.

We have also appointed David Bennett as Applications Engineer with particular responsibility for the Broadcast Industry.

David has many years of engineering experience with the BBC, where he worked



in several departments and was a part of the World Service Projects and Planning Department team working on their new Central Technical Area.

In addition to his involvement with the Mosses and Mitchell range, David will also be working closely with Plasmec's design and installation teams.

Mosses and Mitchell

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Finally, a "stable-image" monitor. The Jade I is a result of a joint experiment conducted by Klark-Teknik and Munro Associates. It is the first monitor designed to eliminate the problem of inconsistent imaging during mixdown. Unlike conventional reference monitors, whose non-linear phase characteristics cause instruments to "drift" during a mix, the Jade's linear phase response keeps each instrument in its place. No drifting, no blurring.

Active Design is key. Each Jade monitor has two 100-watt Mosfet amplifiers built right in, each perfectly equalized with its driver. Its highly accurate 24 dB/octave crossover is also fine-tuned, creating a perfectly matched system that delivers linear phase response as well as excellent frequency response. The result? A highly accurate and *stable* soundfield.

State-of-the-studio features. The Jade's two-way base reflex system offers sound that is incredibly clean, accurate, and musical. High and low frequency controls compensate for individual room and placement discrepancies. And the high-density cabinet features precision construction and a sleek elegant profile.

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Martin Polon

'I got it off the powerline'. Comment from our US columnist

The night was dark and stormy. But it really didn't matter to the session going on at Atomic Recorders. The main studio was filled with performers and the digital tape machines were recording for all they were worth. Jack Bailey felt good about all this. He had worked hard. Very hard to get where he was now. But it all seemed worth it. The two 24-track digital machines, the new 48-track digital, the 64-channel digital-ready console, the three other 24-track analogue rooms—two of them with *SR*—the hard disk digital editing room, the post-production room, it was all the result of his hard work. He had paid his dues. His start with an Ampex 8-track had been hard but he had persevered and was one of the first 24-track operations in the city. He had fought his landlord about expansion and rent and finally had moved out to the suburbs. Some business had stayed away at first but now his plate was full and he felt good. Real good.

STOP. Hold the presses. Now many of you out there are loyal readers who lust after my column every month. "Mergatroyd, my love Marmalade, don't wrap the spoiled fish in *Studio Sound* until after I read Martin Polon's column. Use Mrs Thatcher's latest pronouncements instead." (God, how I wish!)

Anyway for those few of you who follow this with some regularity it is clear that impending doom lies just around the next paragraph. Nobody ever, or rarely, prospers for long in these lead-in stories. What could it be? What are the clues? Jack Bailey worked hard, 'damned hard,' for his success. Foreclosure by the bank because he lied about the amortisation time for his 48-track machine? Noooo! A gang of Gypsy- travelling intinerant digital audio thieves who steal to order and will strip Jack Bailey of his last zero and one to boot? Nooo. Absolutely noooo. Let's see...hmmmm...no sexy broads wearing static-producing underwear capable of reproducing the electromagnetic forcefield created by a Red Chinese nuclear weapon? Nooo.

Maybe the hint is about moving to the suburbs. If the suburb is upscale, it could be a mob of angry, bored suburban housewives driving to the studio in their *Range Rovers*, trying to stop the introduction of 'digital recording' into their neighbourhood. All this because the local health food store gives away a free newspaper that says digital recording affects brain patterns in small rodents, possibly causing sexual identity problems in gerbils. Further suggested was that this may have dire consequences for the kids who play with the digitally altered gerbils. "Jimmy...oh Jimmy, you were playing in the alley behind Atomic Records with a gerbil and now you want to wear your sister's dresses?" Noooo. Noooo. A thousand times no. Well, for Gosh Sakes what is it? We can't just sit around this column waiting for lightning to strike? Or can we?

Lightning! Plain old garden variety lightning. What happens during a storm as electrical potential builds between planet and cloud formations. Wham. Bam. Not even thank you—Mam. Consider Atomic Records. Built in a small industrial zone on the edge of a recent single family detached housing development, sited on an old river flood plain. The highest structure around for several miles. "All that height will give you great acoustics. Might as well take advantage of being a 'purpose-built' structure," said the architect. All that wonderful, expensive electronic equipment and not a protective circuit in sight. The electrical storm intensifies and a single bolt of lightning strikes a power transformer on a pole two blocks from the studio. In a nearby house, the heating elements in the electric oven fuse with a light-rivalling fusion. The refrigerator motor is exterminated, as is the doorbell transformer, dishwasher, clothes washer and the clothes dryer. The TV set was spared as if by a hand from the heavens. Nothing else was plugged into the line as it had been cleaning day. No other house is touched.

Then the lightning finds its way into Atomic Recording. Right down the powerline. And intriguingly, millions of volts and thousands of amperes find their way to earth in less time than it takes to blink an eyelid. Jack Bailey, who often wondered metaphorically 'if lightning strikes twice,' now knows that an oxymoron may indeed be a description of himself and his Oxford education. Atomic Studios looked just that. It had been 'nuked'. Anything that was on the line was affected. Even units that were unplugged or turned off from the AC line were stricken. Damage ranged from every 'semiconductor device with a junction' in a digital multitrack recorder to 'every contact, switch and connector' in a major console. Most of the damage was unrepairable. The studio was a disaster area. It would take months and hundreds of thousands of dollars before the studio would be back to normal. And then, lightning struck the structure itself, and started a fire in the roof. Jack thought: "Well, when it rains, it surely pours."

In the so-called good old days, a recording studio and a battleship had lots in common. Both used a lot of steel, both painted everything battleship grey and both were virtually indestructible. The recording industry had grown up with inheriting many practices and technologies from the telephone company (in the days when there was only one!). Reliability was the watchword if not survivability or possibly even invulnerability. As studios adopted semiconductors and then integrated circuits and finally entered the world of computers and computer chips; all bets were off. Today's studio has more in common with a computer room in a major data processing facility than with anything else. It is time the recording industry—and, for that matter, all other users of modern digital audio equipment—recognise the fragility of their systems in the face of the electrical megaforce produced by lightning.

Lightning strikes involve currents in the range of 2,000 to 100,000 A, with a theoretical maximum in the limits of 225,000 A. Voltages have been suspected to range as high as 5,000,000 V, with lower values the norm. The time frame for lightning is extraordinarily short. A typical strike might have a rise time of a few microseconds and a decay time of 1 ms or less. However, a complete lightning discharge may consist of a sequence of such strokes following the identical path and lasting as much as a full second in duration. And if a single second is made to sound here like an eternity, consider being in the vicinity of 2,000,000 V and 100,000 A for any length of time at all. These figures always fascinate me because the concept of standing around a lightning strike and measuring it sounds a lot like 'living life to its fullest'. One would certainly quickly become a 'live wire', if not eventually developing a 'shocking personality'. A lightning strike can literally vapourise the apparatus on a power pole. It can cause improper joints on a metal roof to explode as will wood or brick if the lightning causes steaming to occur. The intensive heating effect of a direct hit frequently does cause fires.

Common sense is the only guide one needs to protect a recording facility. Consider how lightning could enter and then identify all the paths the lightning might take in its electrically relentless search for ground. It is amazing how few audio people take the simple precautions that have become standard in the computer industry, despite the fact that most recording studios today have as many computer chips in them as a mid-sized data processing facility. First and foremost is the use of lightning protection on the building itself. A carefully designed system of lightning rods and associated cabling to ground is important if the studio building is isolated from other structures. Clearly, a studio on the ground floor of a 44-storey building and surrounded by other 44-storey buildings in the middle of a large city will not have much need for special structural lightning protection—dedicated to the studio itself. But a suburban studio will and should have protection designed by a compentent registered electrical engineer who deals regularly with such issues. One way to protect from lightning is to keep it out of action by providing a low resistance path to earth. Such a path would have a resistance of less than 10 Ω to ground. Needless to say, the entire grounding system for a studio has to be very well designed. One can no longer just throw a few ground wires together and connect them to the electrical ground. Digital audio is nearly as strict a task master as lightning when it comes to grounding.

The real danger as evidenced in our example above, is the effect a lightning strike can have on the nearby electrical infrastructure. On average, half a mile is the effective limit for power line or telephone line 'pass through' from a lightning hit. In fact, even the term nearby is not always accurate as

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recent experiences with lightning strikes tens of miles away has proven. One can no longer depend on how lightning will enter but rather that it could and probably will. A direct hit or near miss on a studio building could induce audio cabling to act as an antenna, momentarily moving huge amounts of energy around inputs and outputs in the studio system. The same antenna phenomenon could affect the telephone wiring and/or the power wiring for the studio facility. In fact, the greater danger from telephone and power wiring is that of a direct hit somewhere in the system.

One broadcast engineer, having lived through such a strike, tells his story in words of awe: "The lightning hit the telephone system. There was a blue 'flame' that seemed to dance from the phones and phone wiring as the lightning looked for a path to escape on. It found that path where the phones joined the racks. It burned out every audio output device in the station that was connected through the racks and did not have audio transformer isolation."

The greatest danger arises from transfer of lightning 'hit' energy to equipment via the power line. Many studio 'tech' types assume that the power company will protect them from lightning strikes 'on the grid'. In fact, like the telephone company, the power utility spends large sums every year to protect from and repair lightning damage. The extraordinary speed and power of lightning makes most forms of outside protection frequently marginal at best. The extraordinary unpredictability of lightning plus its ability to 'leap' contacts several feet apart further complicates protection plans. It is generally true that a 'hit' far enough away to have the lightning enter a utility plant or switching facility will probably be 'downed' in the facility and not passed on. It may do onerous damage to that power facility, however. What will stop some 'hits', will only accelerate others. And a 'hit' on nearby power lines frequently has no place to go but 'down the lines'.

A dubbing plant operator hit by the big 'L' looked back at his experiences with the power company warily. "They did absolutely nothing in a positive way except perhaps to identify the possible reason for our disaster. It's like a toxic waste spill—there are so many possible causes and no one wants to take any responsibility. They came out and inspected our facility. We didn't lose all 60 of our $500 dubbers. But we lost lots of signal processing equipment. It seems that everything we lost was on one side of the breaker box. A single phase, as it were. The utility people showed us that our electrician had not properly tied down the neutral wiring for that phase. They put in test meters and monitored our AC line for 2 weeks. That was a big help. Like putting a seismograph on San Francisco for 2 weeks after October 1989 and saying, "No major earthquakes here!" We were left wondering if our electrician had really been smoking something good the day he wired us up and missed the neutrals or if the power company was just playing 'cover our posterior'. They cannot afford to take any responsibility for such occurrences since they would be bankrupted. And my own insurance was no good since the insurance agent called it an act of you know who."

Lightning does other damage in a less spectacular way on the power grid. It can cause high-voltage transients as well as create persistent electrical noise that can penetrate all but the most stringent power line treatment. Stopping lightning can be a very difficult task since the variability of lightning activity makes it hard to stop. Conventional electrical input cut-offs at the studio's portals are problematic since they do not always work during a lightning storm and sometimes do work during other more minor disturbances on the power line. Imagine the impact of a total cut-off of AC power to your studio during an important session. There is a broad range of products proven in computer industry usage that can minimise or elminate the risk of lightning damage.

Yet lightning strikes are just part of the litany of power pollution that plagues many urban environments today. 'Brown Outs' have become regular summer phenomena in many large cities. Voltage is reduced to conserve energy on the grid as air conditioning demands burden the power system. 'Cycle Outs' work in the same way except that the utility in question adjusts the cyclic rate to ease pressure on the system. Power line faults and fault-clearing systems of the utility can frequently create voltage variations on the system. Heavy equipment startups such as elevators, building heating and cooling plants or neighbouring manufacturing or other industrial facilities can cause the AC line voltage to jump around the meter. In certain sections of a utility's network, aged facilities are 'distribution over-burdened' with a redeveloped business environment yielding chronic low voltage.

Some facilities normally draw power from 'Co-Generation Systems' where existing steam power from heating is used to generate electricity or else garbage for an entire project or building is burned to generate energy. Such installations can be problematic for poor voltage and cyclic rate regulation. Dangerous over-voltage spikes can enter the studio premises from other sources besides lightning. 'Utility network switching' is frequently the culprit with these spikes. Utilities also switch in and out capacitive power factor correction systems. This is another source for spikes. So is equipment startup on or nearby the studio premises. All these electrical problems and the others indicated herein can be rendered barely noticeable if not completely removed, through the use of a well-engineered power distribution system using surge suppressors and isolator/regulators plus gasoline or diesel-powered generators or uninterruptible power supplies (UPS) in case of a total outage.

Now the question here is what this really has to do with recording studios and other audio facilities. One could argue that lightning-related damage will impact only about 1/10 of 1% of all studios in a year. That figure could translate to about 15 'hits' in the US and the UK in a year. But, would you want to own the professional or project studio so impacted? Damages equivalent to at least half the total investment are almost guaranteed for the unprotected facility. If computer industry experience with lightning damage is any guide, insurance coverage for high technology equipment left unprotected from lightning ranges from zero to non-existent. Home or project studios are especially vulnerable since the home setting has far less lightning security than an urban business setting.

The cost of adequate protection is measured as a small percentage of capital investment per studio. One source uses a rule of thumb of ½ of 1% of the total investment for any high technology facility needing lightning protection. That means a $5 million studio complex can protect itself for about $25,000. A $1 million facility would have to spend about $5,000. And the $100,000 invested in a first class project studio can be protected for about $500. These are rough estimations but the point is made that there is no reason not to spend a few pounds or dollars to protect the many.

There is so much money invested in today's studios, that the excuse that proper electrical supply protection and treatment is too expensive just doesn't wash. Not only is the lightning threat defused but the potential for interference from electrical noise is eliminated and the option of being taken off the air due to Brown Outs, Cycle Outs or outright failures is eliminated. It seems a small price for such a fortuitous addition to the security of the studio. Perhaps that is why so few studios have it. Not to mention in a completely different vein the use of computer-type gaseous fire suppression systems. Again a small investment for complete non-damaging protection as opposed to the use of sprinklers with their heavy water damage of technical apparatus or no protection at all. Almost a standard item in computer rooms, little use is found in the studio business for these gaseous systems. I guess the point is that studios don't expect lightning to strike once, let alone twice or thrice.□

Consider how lightning could enter and then identify all the paths the lightning might take in its electrically relentless search for ground.

Dangerous over-voltage spikes can enter the studio premises from other sources besides lightning

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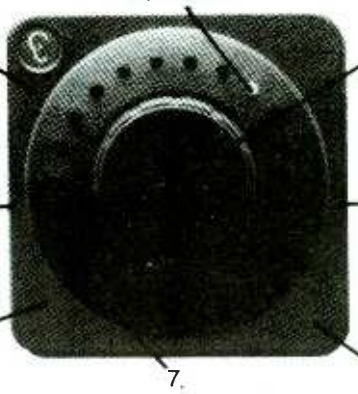

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THE OXMOOR RC-16 REMOTE CONTROL

The RC-16 is the perfect partner for the Oxmoor DCA-2 two channel remote-controlled attenuator system. Oxmoor products form part of Plasmec System's extensive range of broadcast and studio equipment.

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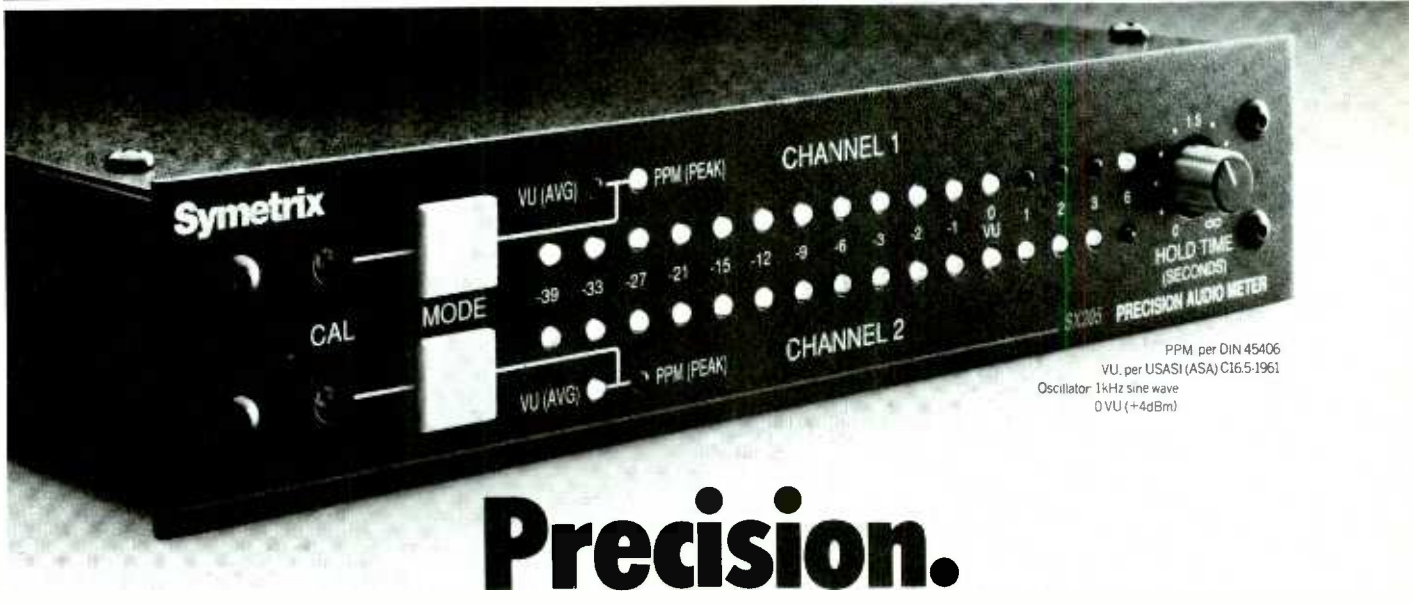

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Danny Leake at the Synclavier computer in the Synclavier room

UNIVERSAL

Ken Dibble tours Universal Studios in Chicago and comes out 2 days later for the facility and personnel

Universal Recording Corporation are unlike any other studio operators one is likely to come across and are most probably the largest. Into their fifth decade they have survived many changes and realised considerable investment in new technology and a great deal of experience.

The studio complex is all under one roof, right in amongst the traffic and hubbub of downtown Chicago. It comprises two film mixing theatres, four 32/48-track and five 16-track music scoring and video post-production studios, one 8-track media studio, two *Synclavier* studios, four film/video transfer suites, one optical film transfer suite and three tape copy rooms. It also has a library search and storage room containing a trillion sound effects and enough space in its tape vaults to store 25,000×32-track sessions. Universal has been digital for 9 years and has no less than 20 digital recorders including several 32-track, one 16-track, one 4-track and several 2-track machines from 3M, Sony, Otari, Mitsubishi, AMS and New England Digital. Among its hardware is included a Neve *8048* 32/32 with *Necam 96*, an SSL *6000E* with *G* series and *Total Recall*, several Steinway and Bosendorfer grand pianos, a mountain of vintage tube condenser microphones and all the outboard gear anyone could wish—their publicity handout actually suggests that anyone who missed AES, NAB or SMPTE should visit Universal as the next best thing! There are over 40 staff on the payroll offering full in-house technical support and virtually any language likely to be needed in the recording business. Their clients have ranged from The Police to Ella Fitzgerald, Chicago to Duke Ellington, Ray Parker Junior to The Platters and United Airlines to McDonalds. The studio boasts literally hundreds of gold discs and Grammy, Oscar and Emmy nominations and awards. After some 44 years in the business Universal has become the epitome of success.

Studio management and policy

Universal are very much into the world of film soundtrack recording and dubbing and video post-production—the latter being responsible for a number of major USA commercials including the current large campaigns across America by the likes of United Airlines, Amoco Petroleum, Coca-Cola and McDonalds. But the studio started with music and today music is still a major part of the business. One is left with the impression that music is the heart and soul of the operation—even though the commercial and film side probably accounts for most of the profits.

The day-to-day management of the complex is firmly in the hands of a business/commercial manager who is not a musician, is not in any way technology orientated and is not a producer. Foote Kirkpatrick's roots are not even in the recording business but she is firmly in control of all aspects of studio operations.

"Just about the only thing we cannot do out of this building," extols Foote, "is to send a team to a location shoot. We even used to do that but these days freelancers can do it much more cheaply—and since there's no money in it, we don't do it any more. The only other thing we don't do now is mastering. We used to have a lacquer channel at Universal but that has become so specialised. It is an expensive facility to build and since most of the record companies have their executive offices in LA or New York, that's where you will find the high-tech mastering facilities, not here in Chicago. But for anything else—records, film, television commercials—all the audio work can be born and finished ready to go on air, literally straight out of this building. And I don't think there is another studio in America that can make that claim."

Executive management is, and has been for many years, in the hands of Murray Allen—one of the doyens of the industry, especially in the USA. But Murray is in such demand that he spends more time away at conventions and conferences, in high level project negotiations and in his various consultancy projects than he does in his office at Universal.

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Dynamic Processing Has Reached A New Peak.

The name Klark-Teknik has always been synonymous with audio technology at its highest level. Innovative engineering combined with quality components ensure products of outstanding musical purity and durability.

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The DN500 is the only two-channel compressor/limiter/expander that lets you use its processing functions in any combination — with full function variable knee compression, independent peak limiting and clipping. Plus a variable ratio expander/gate for total dynamic control.

Most importantly, it delivers all the clean, quiet sound quality and reliability you'd expect from Klark-Teknik.

The same high standards are common to all Series 500 products — from the compact DN504 Quad Compressor/Limiter, to the flexible DN510 Dual MIDI Noise Gate and DN514 Quad Auto Gate.

If you're looking for the ultimate in dynamic processing, visit your local Klark-Teknik dealer and find out more about the Series 500. Because at Klark-Teknik, we never set a limit on quality.

KLARK TEKNIK

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Tel: (0562) 741515

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N.Y. 11735, USA.

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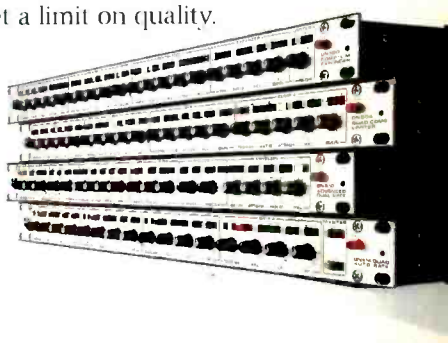
Singapore 0719



A New Approach To Noise Reduction...

The recent advances in recording technology; R-DAT and affordable digital multitracks have highlighted the necessity for extremely low-noise mixing consoles.

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THE NORTHERN ALTERNATIVE

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Studio B

Murray Allen

Murray is a quiet, unassuming but totally dedicated professional who loves to talk about the industry and to reminisce his own contribution to it. But first how did their commitment to digital recording come about?

"Well, I suppose about 1978, we bought the Bosendorfer *Imperial Grand*. Wonderful sounding piano. And, you know we had the best available analogue machines here with the Ampex *ATR 102*s and *104*s—even perfectly set-up I still didn't like the way we recorded piano, I was hoping for something better. Because minute amounts of wow and flutter and tape saturation was happening it just didn't sound right. So 3M invited me up to their place at St Paul, Minneapolis. They had a Bosendorfer *Imperial Grand* and recorded it on a new digital machine. Then they played it back and I heard what I wanted to hear. The percussion was there, and it was loud and dynamic. It sounded so good that I asked if we could have a couple machines down here to see if we liked them. For about a month we used both analogue and digital because we weren't too sure about the reliability—but we fell in love with them and we got 6½ years good service out of them. We set them up in a cold room and just left them running 24 hours a day."

Was Allen concerned, at the time, about going out on a limb? Is standardisation or compatibility of systems not an important consideration? Or did it sound so good that it just had to be?

"Well, to be honest I was concerned about it. But if I have any business philosophy at all it's that I got into this business because I didn't like the way I was being recorded—I played sax with Glenn Miller, Bobby Sherwood, with Frankie Laine's backing band and then with Lena Horne for a while—and I wanted to improve things. I don't believe in wasting money on garbage or whim ideas but if something really improves the sound then I'm all for it, and really, digital is so good right now."

Control Room B

Universal's more recent machines are Mitsubishi, so how had they decided between these and, say, the Sony, digital systems?

"We'd gotten used to having 32 tracks on our 3M machines. Sony could only offer 24 tracks. Our clients were used to the 32-track capability so we went with Mitsubishi. The Mitsubishi machines were 32-track but more reliable than our old 3Ms and had better error correction. We didn't like the sound of them at first but now we have our own filtering we get better results than they do with the Apogee conversions. We get something like ±0.015 dB across the board so these machines do sound very, very good. Everyone coming into our studios gets digital as a matter of course and at no extra cost—they have to ask if they want to record analogue."

As he had started out as a musician how did Allen get into the recording business in the first place?

"I started working studio jobs around Chicago in 1957 as a second call woodwind player for about 15 years and was doing a lot of back-up work with The Platters, Stevie Wonder—all those hits that came out of Chicago at that time. Then, little by little I started getting into engineering because I didn't always like the way I was being recorded. So around 1961 I bought myself a couple of tape recorders and started foolin' around with them. And then I started doing more because a lot of friends—musicians—wanted mixes that were more musical, you know."

Would this have been during the time that the late Bill Putnam was running Universal?

"Yeah, Bill left here about that time. So I was doing more and more mixing. Then rock and roll was coming in and the saxophone was in less demand. Then I developed arthritis in my little finger—I had trouble manipulating and that sort of thing—so I started getting more serious on engineering. I had a very good reputation for big band music and jazz. I did the last three Stan Kenton albums—got nominated for a lot of Grammies—that kind of stuff. Then I did rock. Everybody did rock. And so on. Then I started my own studios in '68 and we got so busy that Universal—who weren't doing too well at that time—made us a deal to come back and operate the studio. We did and since that time we've done a lot of plum things. Now, this year, we've done the Manhattan Steamroller, Man o' War and we're just finishing off Ramsey Lewis' new album. We started work this week on the jazz pianist Ahmad Jamal and Evelyn 'Champagne' King. We do a tremendous amount of album projects for our clients—CBS, Capitol, Columbia and Atlantic."

What happened to Bill Putnam?

Allen again—by now in full flow: "Yeah—Bill founded these studios about 1944. We bought Bill out in 1975. Bill owned United Western over in LA and also started United Recording Electronic Industries—UREI now owned by Harman. Bill was a good inventor. Some of the early things he invented was the first clicktrack generator, and the earlier limiters were all made by him—the *1176* was for years the state-of-the-art thing to use. Altec Lansing, too, were pretty much ahead of their time and they joined together to produce the UREI *Time Align* monitor speakers and they're still pretty much the standard—even though there's better speakers around now, of course—but that's what everyone's used to listening to.

Having drifted into the subject of monitoring Allen's feelings on studio design are unequivocal.

"When I started out as a musician—as a studio player in A, the one thing that we loved about A was that when you played in it you could resonate the room with your horn—you could kind of activate the room. It's like when you're out on the road and you play in these great halls—like the Amphitheatre here in Chicago—I used to be out with Tony Bennett and guys like that. If you hit a real good room you don't need any microphones at all—it works. And we all had that sort of feeling in A, so the performances were good and I still think that's the key. The basic problem today is that so many consultants know their science but they're not musicians.

"For example, when Hidley comes into confession and says everything he did with his original rooms was wrong and now

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Rob Jones and Max Rooks. RPM Studios
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he can fix them up again—so what did you pay him for the first time?—you know! You get some guys in and they'll say, 'Let's try a piece of wood here or try this there.' Acoustics is more of an art than a science. I have many friends who own studios and when everybody says that this guy or that guy did a great job, what they mean is he really screwed it up! I've seen some rooms around the country, though, that I really like. Soundwise, different people are looking for different things. Some want a great deal of separation while others don't want quite so much. So much of it is taste. The thing we always try to develop is that whatever comes through the speakers translates well, so when you take it out of the studio it will still sound pretty much the same way. The thing that we find most important is to get a good performance. If you get a poor or even average performance—and I don't care who it is—you cover up with equalisation and tricks and gloss. But a good performance is a good performance. It's still there and when the record gets played, it sounds good. So we are more of a performance orientated studio than a nit-picky studio. I don't think anybody goes into more detail than we do. OK, so we've got all the peripherals in the world here but provided the performance is on line, that's just the icing on the cake."

The grand tour

As one walks around the complex it is obvious how much of Murray Allen's approach shows. There is little or no concession to cosmetics or fashion, on the exterior of the building, in the studios themselves, or in the administration offices. Everything is functional and workaday. As Kirkpatrick puts it:

"Don't tell Murray about any new piece of gear you want for Studio A if Studio B needs a new carpet—because the piece of gear will be bought but the carpet won't get done!"

The studios look and feel like a 1950s radio station and from the street you would not recognise the complex as anything other than a fairly mundane downtown office building. Yet the whole place has this buzz about it. A sense of purpose and of being very much for real.

Studio A is the largest studio in the complex and is used as the principal music facility. It measures 54×45×28 ft to the ceiling (68,000 ft^3). This really is a spacious room, which creates an aural as well as a visual impression of space. Acoustically it is fairly lively with a hardwood strip floor and bare painted plaster walls broken up with panel absorbers. Some lightweight draping is provided and a fair number of movable screens are available. Lighting is mainly by conventional fluorescent strips. The studio can accommodate a 100-piece orchestra and it is this room which has the 9 ft 6 inch Bosendorfer *Imperial Grand* piano in it. In addition there are no less than seven different drum kits to choose from, a full set of timps and LA percussion, vibraphone, a Moog synthesiser, two Hammond *B3* organs with Leslies, three Fender *Rhodes* pianos, a *Prophet 5*, Yamaha *DX7*, Hohner *Clavinet*, and full MIDI interface linked to the *Synclavier* Room. Probably unique are the 35 mm and 16 mm carbon arc movie projectors—now redundant and covered with dust but still residing in a projection room (above and right of the control room window), complete with screen and Altec *A7* 'Voice of the Theatre' film sound channel, all of which date back to the days when this was the principal film music studio in the mid-west. The room was built over 30 years ago but as Kirkpatrick put it:

"Probably every great band in America has been recorded in here. This was Duke Ellington's favourite room. Count Basie, Buddy Rich, Stan Kenton. They've all been here. It is a wonderful sounding room. It is everyone's favourite room, whether he be a Chicagoan, from New York or LA. This room has a reputation—it's acoustically glorious. We did The Police in here as well and Sting was knocked out by it."

With the current 'designer studio' approach, do Universal find that they are still able to offer a competitive package without addressing the creature comforts, the cosmetics and the mood lighting?

"I think that's probably getting to be not true," replied Kirkpatrick. "Some time in the future we may have to look at that and it may not be here in Chicago. But really our clients don't mind the cosmetics. They just love the way the room sounds and the recordings that come out of here."

Was the room ever actually designed or did it just evolve?

"I guess it just happened. Bill Putnam probably had something to do with it but it's still a real functional room. It's live enough to get real contemporary sounds in here, but at the same time it's controllable."

Another feature here—which Richard Breen (one of the studio's six in-house technicians) showed with some pride—is the continuing use of reverberation rooms and plates in preference to digital time domain processing. There are six EMT plate echoes buried deep in the basement and two reverberation rooms, each containing an E-V *Sentry* loudspeaker with various microphones spaced along the length of the room.

The control room is equipped with a Neve *8048* 32/32 with *Necam 96* automation and UREI *813* and Yamaha *NS-10* monitoring driven by UREI *6500* amplifiers. The recording facilities are extensive, comprising an Otari *DTR-900* 32-track digital, Mitsubishi *X-86* and *X-80* 2-track digital, Sony *DTC-1000ES* R-DAT, two MCI 24-track analogue recorders with sync-lock to provide 48-track working, an Ampex *ATR-102* analogue mastering machine and a JVC *8250* U-matic video recorder locked to all other recorders and film projection equipment throughout the building by BTX *Softouch/Shadow* synchronisation. Adams-Smith SMPTE timecode generator/reader and AMS *AudioFile* facilities are also provided

Control Room C

and the studio is linked to a coast-to-coast satellite relay service.

As a policy, outboard equipment is provided from a buffer store and may be booked out and used in any studio within the complex. The inventory includes just about anything likely to be required, the more popular items being available in multiples. It looks something like a trade show with a whole load of vintage classic gear.

Reverberation facilities dedicated to Studio A include the two reverberation rooms, an EMT *140S* plate echo, Lexicon *224-XL*, Lexicon *102* DDL and Roland *2500*. In addition to which, 24-track Dolby *A* and dbx noise reduction, UREI *1176* limiters and a UREI digital metronome is dedicated. There is also a superb collection of vintage tube condenser microphones, on original George Starbird dollies and booms, available.

Studio B is in effect a scaled down version of Studio A, with very similar, if more intimate acoustics, a similarly warm 1950s character, and again it is popular with many musicians. But even this studio is by no means small, measuring 40×20 ft, with a 20 ft ceiling (16,000 ft^3) and can accommodate up to 20 people. Here a 7 ft Steinway grand piano is provided and access is also available to the keyboard and percussion provisions of Studio A. This studio is used primarily for music recording but also for radio and television commercials and still some motion picture work. The desk is an SSL *6000E* with *G* series and *Total Recall*. The digital machines are Mitsubishi *X-850* 32-track with one each Mitsubishi *X-86* and *X-80* 2-track and another Sony *DTC-1000ES* R-DAT. Analogue machines include two MCI 24-track, again lockable to 48-track, one Ampex *ATR-102* mastering recorder and a Nakamichi *MR-1* cassette machine. Monitors are again *813*s and *NS-10*s with other options

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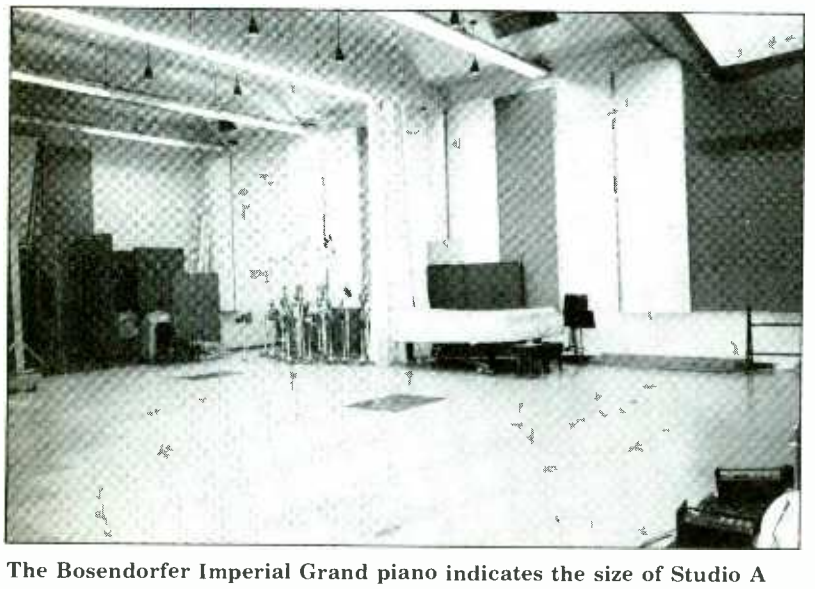
The Backroom

available. The dedicated peripherals include dbx *160* and UREI *1176* limiters, Roland *2500* DDL, Eventide *H949 Harmonizer* and UREI digital metronome. A drum booth and isolation booth are also available.

The *Synclavier* Room and Studio C comprise a box-within-a-box, triple-glazed room construction at first floor level alongside the administration offices and overlooking the main street, East Walton, outside. The two rooms are linked by a control room window so that the *Synclavier* Room is the control room and Studio C its associated studio. It is MIDI linked to Studios A and B and is used in conjunction with sessions in those rooms, or for keyboard-only composition. The principal *Synclavier* installation has 32 outputs, 64 voices with polyphonic and FM sampling, a 200-track sequencer, 20 Mbytes of RAM, 320 Mbytes of disk storage, 4-track *Direct-to-Disk*, 2×8 MIDI and music printing. The console is a 32/24 Harrison *Raven*. 32-track and 2-track Mitsubishi digital, Otari 24-track analogue and Ampex *ATR-102* mastering machines are provided. Monitoring is on UREI *811*s, Yamaha *NS-10*s or *Auratones*, powered by Ashly FET series amplifiers. An appropriate range of dedicated peripherals is provided.

Although much smaller than A or B, Studio C has another Steinway grand piano in it, this one with a 14×6 MIDI interface built in! Although it has a noticeably shorter RT60 and is more quiet than A or B, this room retains a degree of liveliness. Richard said that although this room was originally built as a small demo room, certain jazz musicians prefer to play in Studio C while the recording is done on the SSL and the digital facilities of Studio B's control room. It is a small room—approximately 12 ft square with a 9 ft ceiling, in which you can just about manage a drum kit.



The Bosendorfer Imperial Grand piano indicates the size of Studio A

The Backroom is essentially for mono—mainly speech—recording with the odd jingle thrown in, for commercials, etc. Apart from an R-DAT machine this studio does not have digital recording facilities. The console is an MCI *628* 28/24, monitoring is again UREI *813*s and *Auratones* and the machines include an MCI 24-track, another 24-track machine but fitted with 16-track and 8-track heads and a JVC C-format 1 inch video recorder and *8250* U-matic. There are also some interesting vintage Ampex 2- and 4-tracks lying around—*440*s and *350*s for example, and still in use. There is generally much more in the way of video equipment in this room—several monitors, etc, and again, the room is tied in to the house sync system.

The Penthouse is called so because, according to Kirkpatrick, "It's the only studio on the 3rd floor and because we get awfully sick of A, B, C, etc. Which is why one we call The Backroom, this The Penthouse, etc."

She went on to explain that this studio was recently let for a 2 year period to a production company making videos of the *Golden Book* series (a hugely successful series of USA children's books loosely based on nursery rhymes and colourfully illustrated). The desk is a fairly basic Ramsa *8616* with an Otari *MX70* 1 inch 8-/16-track and two *MTR-12* 2-track machines. VHS video recording is also available. Peripherals here include Technics *SL1200* turntables with Stanton *681* cartridges, dbx *160* limiters, a Lexicon *PCM 41* DDL and Yamaha *REV7* digital reverb. Monitoring is on the baby UREI's—the *809*s. There are four more rooms similar to the Penthouse.

The film/video transfer suite comprises four rooms, two for optical film transfer and two for magnetic.

Studio A with projection room windows and film sound speaker systems

"There was a time, not too many years ago, when every single television commercial went to optical. There was no video when I first started here and this was one of our busiest facilities. We had a technician who did nothing else except sit in here every single day, from 8.00 am until 5.30 at night and run opticals. Now, of course, that business is not what it was—people transfer straight to video and then go to dub. Amazingly these rooms can do more different kinds of transfers than any room in Chicago, because not only can we handle 30, 25 or 24 frames, we can do centre and edge sound tracks. In fact there are over 300 different kinds of transfer that can be done out of these rooms!"

The two film theatres are arranged back-to-back with a common projection/machine room in between. Each has its own Zitron 16/35 mm projector and 16 synchronised dubbing recorders. As we entered Theatre One I was startled by a siren sounding and a fish on the wall suddenly lighting up and wagging its tail! Kirkpatrick explained: "The guy who has this room is a real character, and when any producer gets out of line down here, he lets him have it! Both our film mixers—Bill Reis and Ed Goyola—have enormous reputations in this city, since they do almost every television commercial in Chicago. They are popular guys. Whatever they do is OK."

Another use of these theatres is ADR or automatic dialogue replacement. It's used to dub language translations onto films going to, or coming from, other countries, or to replace dialogue that was not recorded too well on location. They do a lot of ADR for *Miami Vice* and at the time of my visit, had just finished *The Equaliser*.

Foote summed up the tour: "Studios today, if they're in the music business they're not in the video and film business. There are very few studios in America or anywhere else for that matter, that are involved as we are, in everything audio."□

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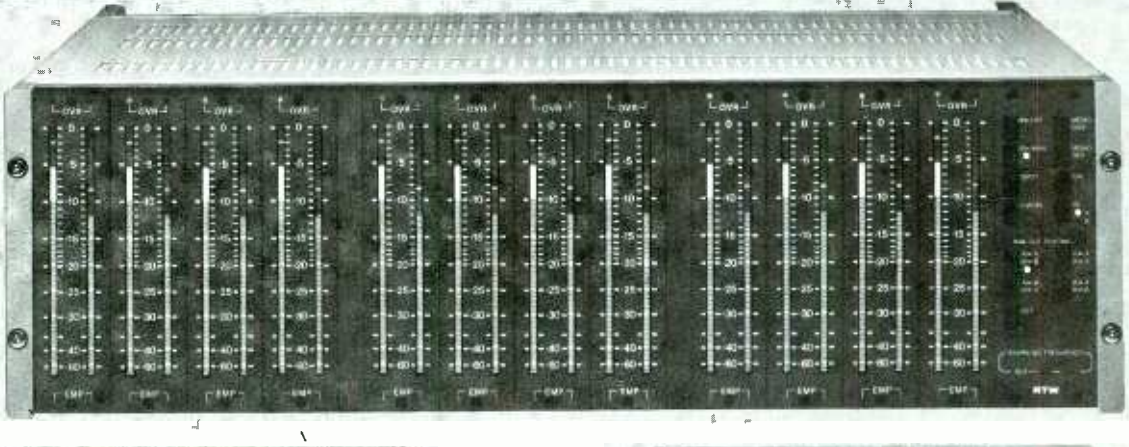

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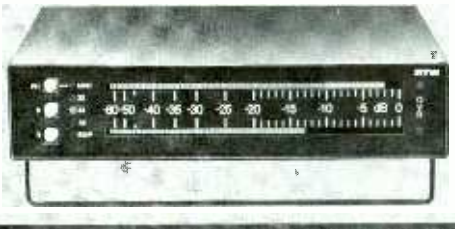

RTW 1152 EBU

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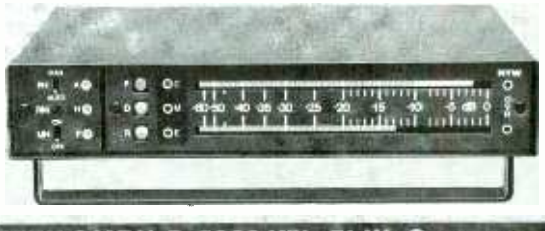

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Barry Fox

'Non-tracking' digital, musical stealing and generics

In late January Sony in Japan announced a digital 'dictation' machine that puts 2 hours of broadcast quality sound on a cassette the size of a postage stamp. Sony carefully say it's not a replacement for DAT. But I reckon it could reshape the future. Some very clever lateral thinking has enabled the mechanics of a high quality digital recorder to be almost as simple as a personal stereo.

Instead of trying to make the rapidly rotating heads of a digital recorder accurately track the narrow tracks across the tape, Sony have developed a 'Non-Tracking' (NT) system. The NT heads rotate at twice the normal speed during playback, gather all the digital code from a broad target area and then sift wanted from unwanted digits. The system thus relies on electronic circuits rather than precision mechanics. The electronics can be integrated into microchips, and the simplified mechanics can be made cheaper and smaller.

The plan is to start selling an NT dictation machine, by the end of this year. This unit, says Sony, would be ideal for taping a conference or interview. But it seems clear that the technology could be applied to other types of digital recorder, for computer data, hi-fi stereo and even video in future.

In a conventional DAT recorder, the recording heads on a rapidly rotating drum scan the tape obliquely, to lay down parallel, helical tracks, like the threads of a screw. Each track is less than 14 μm wide—a quarter of the width of a human hair. On playback an electronic servo system is used to steer the heads over the track pattern with micrometre accuracy. The servo must compensate for changes in the tape, caused by temperature or stretching with use, and for errors when different machines are used for recording and playback.

The new system records helical tracks in much the same way but divides the digital data into numbered blocks. On playback no attempt is made to follow the tracks accurately. The heads move at twice the speed used for recording and sweep over the general area of the tracks, reading at least four at a time. So the same data is read at least four times over. All the data read is stored in solid state memory, where it is re-assembled in correct order and redundant blocks discarded. So the system accurately reconstructs the original data pattern from only a rough reading.

Relieving the heads of the burden to track with micrometre accuracy means that the mechanism can be much simpler. Instead of carefully lacing the tape round the drum, the recorder mechanics simply move the drum into the cassette and against the tape. The drum is just 14.8 mm in diameter; the tape is 2.5 mm wide (instead of around 4 mm wide for hi-fi DAT) and coated with a thin film of evaporated metal to reduce thickness. This allows a cassette just 3×2×0.5 cm in size to contain enough tape to record 2 hours of sound in 12 bit digital code and with a frequency range of 15 kHz. This gives sound quality similar to FM radio.

Already there is a dispute brewing. Inventor Henry Ray Warren and RCA in the US (now owned by GE) filed patent applications back in 1971 on a continuous loop video recorder. This recorder played back the last few recorded seconds, eg for instant replay in broadcast sports coverage. The patent, US number 3 766 328, was granted in 1973. At around the same time Warren and RCA filed another patent application, which eventually resulted in US patent 4 025 959.

The RCA patents show an 'in-cassette scanning system' that looks uncomfortably close to that used for Sony's new No Track system—although of course there is none of the clever digital coding now used by Sony. The RCA system was intended for use with a home video system called MagTape *Selectavision*. The cassette or cartridge held ¾ inch tape, and the video head drum pushed through a hole in the cartridge so that the tape never left the cartridge housing. *Selectavision* tape was never sold. The name was used instead for RCA's ill-fated CED video disc. The patents remain alive though, in the US until 1994 and in Japan until 1997.

All the record industry trade bodies (IFPI, RIAA and BPI) have always argued against the theory that home taping creates music awareness. The theory is that people who borrow and tape when they are young and poor, buy records later in life when they can afford them; people who tape in later life, do so from their own records.

Needless to say this argument cut no ice with the late Nesuhi Ertegun, then IFPI president, who fell back onto his shirt stealing analogy—"It's like saying you can steal one shirt but no more."

If you get the chance, try reading Arnold Shaw's very readable book on New York's 52nd Street, *The Street of Jazz* (Da Capo Press, New York). This is based on interviews taped in the early '70s, with musicians, club owners and jazz buffs reminiscing about the good old days of the '30s and '40s when 52nd Street was known as 'The Street' and every building was a brownstone club.

Despite the rosy-tinted spectacles, Shaw's interviews make it clear that not everyone was happy. The musicians were scuffling on poor wages and the clubs were struggling to make ends meet.

By an odd coincidence, one of the people Shaw interviewed was Ahmet Ertegun, Nesuhi's brother. Ahmet tells how he and his young brother were keen jazz fans.

"We would start at one end of The Street," Ertegun told Shaw, "and the thing was just to go with one bottle of beer. We would sit and stand with that for 2½ hours until the bartender or the bouncer threw us out unless we bought another. We had just enough to buy one beer each at eight different clubs. Having listened to the band the idea was to catch the musicians as they went out and go around the corner with them to the White Rose Bar, where there was free lunch. You bought a beer for a dime and you could pick up on a little bit of cheese, stale pickles, etc."

That sounds to me like getting a taste for music at someone else's expense. But that free taste set the Ertegun brothers on the road to running record companies, which later generated a whole lot of work opportunities for jazz musicians.

Pioneer has donated its trademark, *LaserDisc*, to the public. Until now, the name *LaserDisc* has only appeared on Pioneer's own brand of video disc and combination audio/video disc players.

Philips dropped its own brand name, *Laservision*, when sales flopped. Philips then coined the new name CD-Video but this has never caught on. A 12 inch/30 cm disc is hardly 'compact'. By relinquishing its trademark protection on the brand name *LaserDisc*, Pioneer hopes to create a new generic catchphrase, laserdisc, which can be applied to all optical audio and video disc systems. CD-V can now go back to where it belongs—as the tag for 5 inch/12 cm CDs with 5 min analogue video clips.

The only question now is what will the industry call a 5 inch/12 cm disc with 60 min of compressed digital video? Philips claim to have achieved this with an extension of the CD Interactive format. Intel has demonstrated a rival system called *DVI*. JVC has a system similar to *DVI*.

The trademark move saves Pioneer time and money, too. The trade, press and public have already started to use the name *LaserDisc* generically. To keep the mark registered Pioneer would have had to mount an expensive policing campaign like those continually run by the owners of trademarks like *Formica, Ansafone, Jacuzzi, Velcro, Portakabin, Sellotape* and *Tannoy*. They must continually beg people not to use the words generically, without capital letters.

With Pioneer's blessing *LaserDisc* now joins the long list of words, like aspirin, dynamite, escalator, hovercraft and lino, which were all once trademarks but with misuse passed into public domain.

Meanwhile, entrepreneurs are taking advantage of profitable loopholes in Latin American trademark law.

In most countries trademark law prohibits the registration of everyday words and simple acronyms. Like car, bike or tram. In future *LaserDisc* will fall into this category. This prevents any individual or company monopolising a word that belongs in the language. The law also prevents 'trafficking' in trademarks, registering a mark with the intention of selling it. Anyone can contest a trademark registration on the grounds that the owner had no *bona fide* intention of using it on goods for sale.

But in some Latin American countries entrepreneurs can hold industry to ransom, by filing trademark applications on words they think big firms may want to use in the future. The latest ploy is to try to pirate rights for generic expressions used by the Japanese audio-visual industry. First in Brazil, and now in Venezuela, enterprising individuals have filed trademark applications for the generic phrase 'DAT—digital audio tape'. If the applications are successful, all the major Japanese electronics companies, such as Sony, Matsushita and JVC, may end up paying for the right to use generic words that are part of everyday language in the West.□

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Soundcraft Delta 200

A technical report by Sam Wise on Soundcraft's new compact and flexible mixer series

The Soundcraft *Delta* is the second in what looks like a series of major product overhauls, this replacing the aging *200* series, which has been around for many years, though modified and improved over time. The first one is what we were led into calling *Bigfoot*, launched at last year's AES in Hamburg. The common feature between these two very different products is the care over visual detail.

First impressions

At first glance, the *Delta* is all new. It is shaped like a flying wedge, being surrounded on the front and two sides with moulded foam styling pieces. Visually, it is very attractive, standing well out from the crowd of flat panel mixer surfaces and knobs, which mesmerise an exhibition visitor after a very short time. A sense of quality is immediately conveyed by the moulded-in Soundcraft and *Delta* logos. Aside from the visual appeal, the surround provides a comfortable resting place for the sound man's elbows and wrists, and the side buffers should increase longevity in the hire business, all other things being equal.

The panel legends are screen printed in a beige colour, which although it sounds a strange choice, is quite attractive against the grey background, and of high contrast, making things easy to read in low light conditions. All module fixing screws are hidden beneath clip-on legend strips at both the top and bottom of the modules, making useful this often wasted space. The label strips are made of plastic extrusions, with a groove formed to hold the module number legend. This appears to be well held in by double sided adhesive. The legend strip retaining system seems adequate for years of use.

Internal LED illumination is now incorporated within the more important console switch pushbutton caps, which should prove more reliable than LEDs physically mounted adjacent to the switches and liable to subject pressure.

Under the surface

Beneath the moulded exterior is a rigidly constructed welded steel frame, a departure from Soundcraft's years of practice using aluminium extrusions bolted to side plates. The review mixer is a small frame accommodating only eight inputs, but it seems to be very rigid, generally a good thing. The frame is finished in a textured paint which looks like a powder coating (noted for endurance), while the modules are a flat matt finish. The moulded sidepanels are easily removable to allow the mixer to be recessed into a larger working surface as is common in the video industry. Additionally, the eight input frame can be fitted with mounting ears and installed in a 19 inch rack.

The module construction is also a departure from previous Soundcraft construction techniques being reminiscent of Midas consoles. Traditional practice in the majority of mixing console designs is to mount the connectors on panels attached to the rear of the frame. These are connected to their module by flexible wiring. This obviously gives great flexibility in the frame layout and makes it relatively easy to add extra facilities. But, it is relatively costly to build and wire and mixer faults often wind up appearing in the areas that are not easy to access.

In the *Delta*, the module electronics and rear

panel are all constructed in one unit. Radically, the front panel and rear panel are even formed from a single piece of aluminium, a testimony to the accuracy of modern computer-controlled metal forming techniques. Advantages are manifold: all the 6.35 mm jacks are directly mounted on the channel PCB, allowing both cheaper and more reliable construction; the PCB can be simply mounted by the pot bushes since it is stabilised in the other two planes of motion by the rear panel connections; intra-frame wiring is simplified; the number of connectors is reduced; and for servicing, everything is self-contained.

With the module mounting screws covered by the legend strips, Soundcraft have completed the front panel details by countersinking the fader mounting screws, making the mixer free from cuff-catching irritation.

Internal construction

Since the review mixer has been fitted out with a collection of most of the module options, it is possible to give a quick but thorough round-up of internal construction and components used. All PCBs are made of glass fibre, with a mix of through-hole plated and single-sided types with links. It appears that this choice has been made

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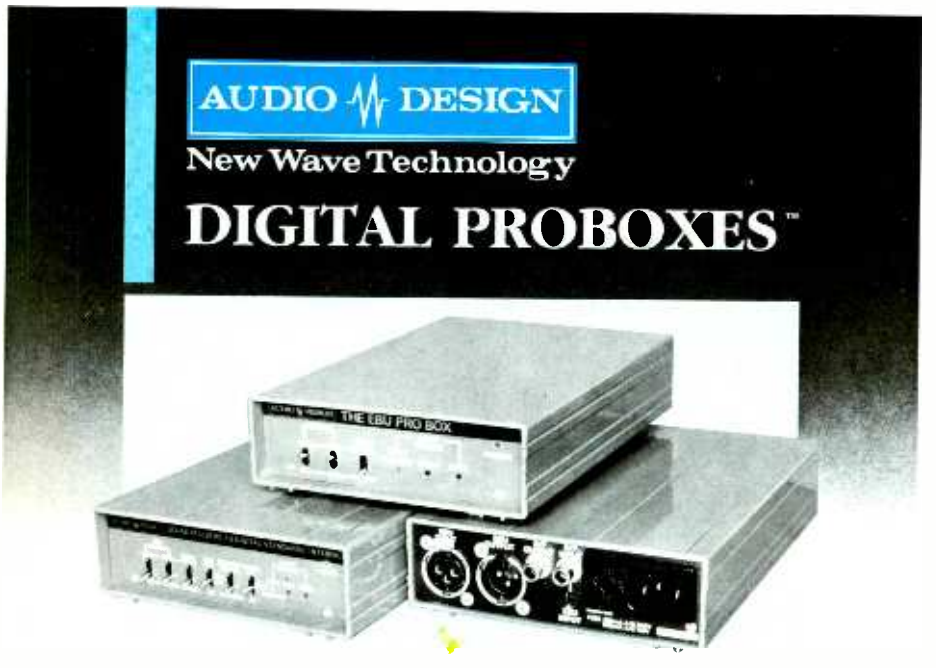
on expected manufacturing volume, with low quantity types being plated-through and probably manually assembled, while high quantity types are probably automatically inserted. The only wiring within the modules is used to connect the fader, and the Neutrik *XLR* types, which cannot be PC mounted due to width constraints. Faders and pots are all Alps, which have a nice feel and, in my experience, a reasonable life expectancy. Centre detents are provided on boost/cut tone controls and panpots, with thankfully no detents elsewhere. Module interconnection is by ribbon cable with latched headers and enough length for easy individual module removal.

Only a few types of standard ICs are used, with *TL072* most in evidence, *NE5532* used for outputs and mix amps and *LM290* within the metering system. Interestingly, the mixing amplifiers are built from the *5532* with a transistor pair at the front, to reduce mixing noise. Construction and soldering quality could not be faulted, with clear component legends on all PCBs. In all, this appears to be a very economically engineered mixer, designed to a price but with the cost savings made in the right places, by careful engineering rather than brute force. One additional encouragement is evidence on each PCB of careful quality control procedures. There was a day when Soundcraft got a bit careless over this, apparently expecting the dealers to do a final product debug. These modules show evidence of at least eight quality control steps, including functional test, which on a mixer is hard to do without.

Although not listed in the manual or other publicity, the internal examination reveals that Soundcraft have left the door open for a few further goodies in the future, including matrix outputs and eight group buses. Since *Delta* competes directly with the DDA *S* and *Q* series, we may see these sooner rather than later.

Lastly on the overall front, the manual is very well presented but with some minor omissions like their address and phone number—necessary for service—or when you find out that instead of pages 10-13, two lots of 14-17 are installed, as I did. In fact a closer look at the manual revealed a printing error with page 9 printed on the rear of page 14. Not bad as the only complaint so far.



ProBox 1™

Domestic SP to be Converted to EBU, and EBU to be transferred to a SP domestic format. The unit also provides for a word-clock output which can act as a house master-synch, or enables locked operation with other equipment. A further important feature is that it will allow the transfer of CD digital code, to be read in EBU/SP format. 'Good lock' and emphasis indicators. Sampling frequencies: 48, 44.1 and 32 kHz.

ProBox 2™

ProBox 2 provides a full interface between the F1 format and EBU (both send and return). It is necessary to fit a small interface board to the F1 format processor (PCM701 or 501) to provide a digital input/output. CD digital code can be converted to AES/SP as in Pro-Box 1 and 'Good Lock' and emphasis indicators are provided.

ProBox 3™

ProBox 3 provides a full send and return interface between Sdiff 2 and EBU with slaving capability, having separate word-clock IN and OUT. The system is in a 1u rackmount case.

Level ModeDefier™

This unit provides all the functions available in ProBox1 (the ModeDefier function), plus a dithered real-time fader for use on EBU/SP lines. A studio law fader offers gain scales switchable between unity and a +12dB range; channel balance has a ±6dB range; phase and channels can be reversed. The unit is a 1u rackmount format with a slim-line fader control box that can be extended by 15 meters from the processor unit.

Error Status Report Writer™

This is a small computer system which interlinks with PRODAT series of R/DAT recorders. It will provide a full hard-copy of various combinations of error correction flags against time. Intended for quality assurance of master tapes.

AUDIO DESIGN
New Wave Technology

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Unit 3, Horseshoe Park, Pangbourne
Berks RG8 7JW U K Tel 07357 4545
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Facilities

The *Delta* does not attempt to be a super-power mixer, with every facility known to man. In fact, it is fairly simple, indicating a market focus in A/V production, small scale radio, up-market home studios and other tasks where people are too busy with other things to get complicated with audio. The review mixer was fitted with three types of input module out of four available, providing the essentials for these applications. It is possible to mix all these in one frame should you so desire, since the module and back panel are one piece and internal wiring is a standard ribbon cable for all modules.

Connectors

Back panel connectors are standard throughout the range of modules. Microphones are on Neutrik *XLR* types, as are the group and main outputs. Everything else is connected on inexpensive 6.35 mm stereo jacks. Mic and line inputs, and returns, have differential inputs, while the main L/R outputs are electronically balanced. Auxiliary and group outputs are unbalanced and described as ground compensated. Inserts are concentric and wired Ring-Send, Tip-Return. Microphone inputs can optionally be fitted with transformers. The back panel is recessed just enough to allow it to stand safely on that surface without damaging the connectors.

Input modules

The input module layout is very traditional, with +48 V on/off at the top, followed by the mic/line input gain control and mic/line switch. In the mixer handbook, it is stated that with input gain, and input and group faders set to 0, the system gain should be +4 dB. At various gain settings,

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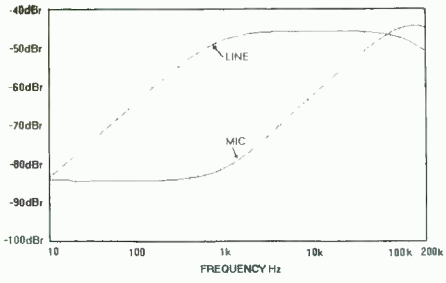

Fig 1: Common mode rejection ratio of mic and line input D201 deluxe module routed to group 1 output

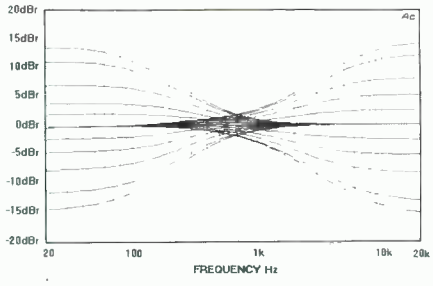

Fig 2: HF and LF EQ frequency response D202 standard input module

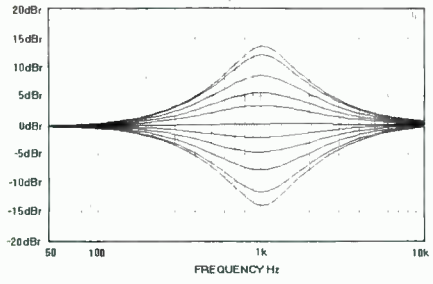

Fig 3: Mid band EQ frequency response D202 standard input module

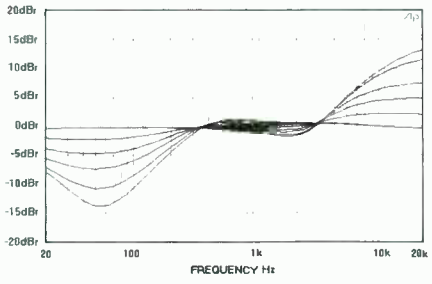

Fig 4: HF and LF EQ frequency response D201 deluxe input module

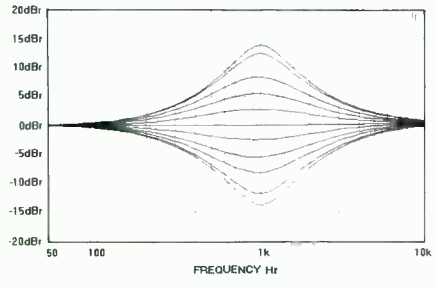

Fig 5: Low-mid band EQ frequency response D201 deluxe input module

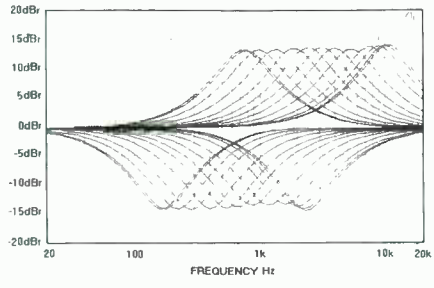

Fig 6: Low-mid frequency EQ response D201 deluxe input module

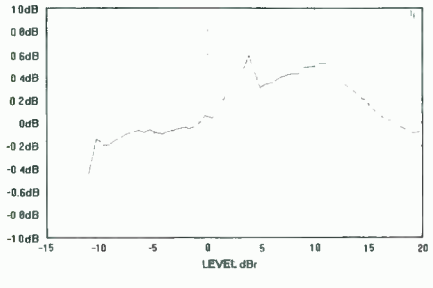

Fig 7: Left/right channel level difference vs input gain setting

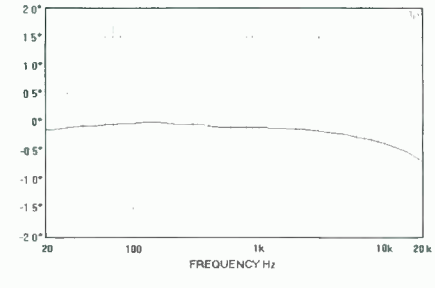

Fig 8: Phase difference D205 stereo input module channel A, L/R inputs at 0 dB gain

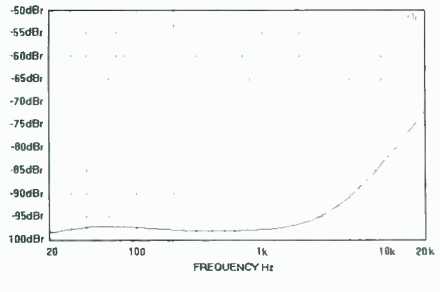

Fig 9: Left/right crosstalk D205 stereo input module, channel A, L/R inputs at 0 dB gain

this system gain was actually measured as 3.6 dB, near enough.

Input noise was measured at three microphone gain settings: 20 dB, 50 dB and 70 dB. The results, are good giving an equivalent input noise of better than −127 dB RMS at 70 dB of gain. The input amplifier noise predominates for gains right down to 30 dB. At that point, the main noise source is from the mixing system at −75 dBu with one channel selected. Unusually, the equaliser noise level never intrudes. During all tests, there was no sign of any hum or mains harmonics. This is as it should be but is rarely seen in practice.

The range of control of the microphone and line inputs is as specified; 70 to 0 dB gain on the mic input and +20 to −10 dB of gain on line. The common mode rejection of both inputs measures as shown in **Fig 1**. The lower curve shows that the more important microphone input performs quite well, with a lower, but within specification, performance by the line input.

On the standard input module the next control is the HF equaliser but the deluxe version provides a phase invert switch and highpass filter. The HP filter is 3 dB down at 90 Hz, close to the specified 100 Hz, with a slope of 12 dB/octave. Phase invert does as expected but is not silent in operation when signal is present.

At the equaliser the modules differ. The deluxe version equaliser is 4-band, with two sweep mid equalisers and shelving HF and LF, the standard and stereo line input equalisers are 3-band with one sweep mid. Deluxe and stereo versions have EQ in/out switches, while the standard does not. Many features of the stereo module match those of the standard module but stereo performance will be outlined in a separate section below.

The standard equaliser has a useful range and good control law as shown in **Fig 2** and **Fig 3**. Note the LF shelving characteristic. It is shaped just like the name implies, having an equal effect on all frequencies below the turnover point of 100 Hz. HF is the same while the mid is bell shaped, correct for this frequency band. Each curve represents a 3 dB step on the control knob legend, faithfully reproduced on the measurements. This equaliser should be good in use.

The deluxe equaliser shown in **Fig 4** is quite different, although in the manual this, too, purports to be a shelving equaliser. Only boost or cut has been shown for each control to help clarify the action taking place at mid frequencies but boost and cut are actually symmetrical. First note the interaction in the middle, where a boost of 10 dB at 10 kHz produces a cut of 2 dB at 2 kHz. An unexpected side effect. Then notice that while bass is cut 14 dB at 60 Hz, it is only cut 8 dB at 20 Hz. Compare this with the correctly operating shelf in **Fig 2**. Some might say this is inaudible. Having had experience of trying to equalise the house sound of an on-stage band with the curtains shut, under certain circumstances it certainly is audible. Using an equaliser as **Fig 4** to cut the bass making its way through the curtain, the band sounded just like pigs wallowing in the mud. All the kick was taken out of the bass but the real LF came through, both curtain and sound system, making any sensible sound impossible. Changing mixers the following night,

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and using an equaliser as **Fig 2** made things considerably better. Yes, on the *Delta*, it is possible to switch in the highpass filter as well but an equaliser like that in the standard input module is better. The mid on the deluxe module is, however, good, a sensible shape and law, enabling either subtle or radical changes in sound to be made. **Fig 5** shows a mid boost/cut and **Fig 6** the range of frequency control of both mids together.

When the equalisers are set flat, or switched out, the frequency response is within the specified limits of ±0.5 dB from 20 Hz to 20 kHz. There is not much roll-off above the audio band, so be careful if you are located near a long wave transmitter.

Next on all modules are four auxiliary send controls. Ex-factory, the top two are linked pre-fader/post-EQ for foldback use. Internal links (no soldering necessary) allow these to be set pre-EQ, or post-fader. The lower two auxiliaries are fixed post-fader but have a front panel switch allowing them to be routed to auxiliary buses 5 and 6 instead of 3 and 4.

The panpot provides control from full left or right, to a centre position specified to be −4.5 dB of the maximum left/right levels. This is one answer to the discussion about how much acoustic power is necessary for a centre source. Between the argued limits of 3 dB and 6 dB, 4.5 dB sounds like a good compromise. Measurements confirm −4.6 dB in the centre, with an 80 dB rejection of the unwanted signal when panned fully over. An excellent performance.

Next is a peak LED, which is connected post equaliser on all modules, and which illuminates (with the channel and group faders at 0) when the channel reaches an internal operating level of about +15 dB. At this point there is a further 7.5 dB of headroom before the clipping is reached, a sensible warning level. The LED remains illuminated for a short time after overload has occurred. While Soundcraft have chosen the highest risk point in the channel to detect overload, sensing pre-EQ and post-fader points as well would decrease the chance of accidental overload.

Last on the module are PFL (internally illuminated, latching); ON (also illuminated); and three routing switches, MIX (direct to stereo L/R), 1/2 and 3/4. To me, as a live sound/theatre person, individual switches for each group are very useful but the standard setup on the *Delta* will suit most people.

The fader law is sensible and matches the front panel legend accurately.

Both standard and deluxe input modules are provided with insertion points, while only the deluxe version has a post fader channel direct output.

Manufacturer's specification

Total harmonic distortion:
Measured at +20 dBu, 10 Hz to 80 kHz bandwidth, unweighted

	1 kHz	10 kHz
Group, mix and aux output	0.003%	0.007%
Standard input to mix output	0.008%	0.04%
Deluxe input to line output	0.005%	0.015%
Oscillator to group output	<1%	—

Crosstalk:
Measured at 1 kHz
Channel muting >90 dB
Maximum fader attenuation >80 dB
Panpot isolation >85 dB
Routing (channel to groups) >90 dB
Maximum aux send attenuation >80 dB
Mic input at max gain, CMRR >80 dB
Line input at unity gain, CMRR >40 dB

Noise:
Measured 22 Hz to 22 kHz bandwidth, unwtd
Mic in at max gain, EIN with 200 Ω source −127.5 dBu
Line in at unity gain, EIN with 40 Ω source −93 dBu
Mix bus noise (16 channels routed, faders down) −80 dBu
Typical mix output noise (16 channels routed) −75 dBu
Aux bus noise (16 inputs) −78 dBu

Frequency response:
Mic or line input to any output (20 Hz to 20 kHz) +0, −0.5 dB

Input and output levels:
Mic input max level +18 dBu
Line input max level +27 dBu
Insert send max level into 5 kΩ +21 dBu (−2 dBu nominal)
Direct output max level into 5 kΩ +21 dBu (−2 dBu nominal)
Direct output nominal level −2 dBu
Group output max level into 600 Ω +21 dBu (−10 dBV or +4 dBu nominal)
Group insert nominal level −8 dBu
Aux output max level into 600 Ω +21 dBu (+4 dBu nominal)
Mix output max level into 600 Ω +27 dBu (−10 dBV or +4 dBu nominal)
Internal operating level −2 dBu
Oscillator max level at group output +16 dBu
Headphones output max level (600 Ω) +20 dBu

Input and output impedances:
Mic inputs, electronically balanced >2 kΩ
Line inputs, electronically balanced >10 kΩ
RIAA inputs 220 pF, 47 kΩ
Insert sends 75Ω
Insert returns 10 kΩ
Outputs 75Ω

Metering:
20-segment LED bargraph
Selectable, peak or average reading
Calibration range '0' dB=−2 dBu to +20 dBu
Accuracy relative to '0' dB ±1 dB

Soundcraft Electronics Ltd, Unit 2, Borehamwood Industrial Park, Rowley Lane, Borehamwood, Herts WD6 5PZ, UK.
USA: Soundcraft Electronics USA, PO Box 2200, 8500 Balboa Boulevard, Northridge, CA 91329.

Stereo input performance

The stereo module has an equaliser like the standard input module and this was found to create a total channel difference error of less than 1 dB at any position that was checked. **Fig 7** shows a measurement of channel level difference versus input gain control setting. Over the 30 dB range measured, the error was never more than 0.6 dB, a creditable performance. The stereo fader was even better, with a variation of less than 0.3 dB. These Alps pots and faders are certainly good value for money. Good choice Soundcraft.

Also tested was stereo phase matching, which is shown in **Fig 8**, varying less than 1° over the whole audio band. **Fig 9** shows stereo crosstalk, which stays below −80 dB up to 10 kHz.

On the stereo module the top two auxiliaries are fed a mono sum of the stereo input signal and can be linked pre- or post-fader. The lower auxes are always post-fade but can be linked to a mono source, or as a pair of left and right aux sends (stereo). A useful set of options.

The BAL control on the stereo channel attenuates fully at extreme rotation like a standard panpot, unlike many stereo balance controls which have only a limited range. This does enable the channel to effectively route to one group only if required.

Dual line input module

One input module not fitted to the review mixer is the dual line input. This has no linear fader or routing, feeding directly to the stereo bus. It contains two identical line input sections, one above the other. Each has an input gain control, 3-band sweep mid equaliser, four auxiliary sends, pan, rotary volume, PFL and on switches. These can be used in a frame without any group modules fitted, allowing up to 24 line inputs in a single rackmountable frame. This could be very useful as an auxiliary desk or keyboard mixer, providing lots of useful facilities in a small space.

Breakthrough

Fader attenuation measured better than 90 dB at 1 kHz, reducing to about 78 dB at 10 kHz. Breakthrough on the mic/line switch with a signal on the line input measured −105 dB at 1 kHz and −95 dB at 10 kHz; while the mic in to line breakthrough was −87 dB at 1 kHz and −68 dB at 10 kHz.

Group routing switch breakthrough measured −110 dB at 1 kHz and −90 dB at 10 kHz. Bus crosstalk, measuring group 1 with mix L/R and groups 3/4 driven to +22 dBu was −108 dB at 1 kHz and −88 dB at 10 kHz. These are all good results, particularly in a relatively inexpensive mixing console.

The auxiliaries were also good, with the breakthrough of an auxiliary pot turned fully off at −98 dB at 1 kHz and −96 dB at 10 kHz. Bus crosstalk in the worst case, driving aux 1 and 3 to full output, with aux 2 turned full off was −88 dB at 1 kHz and −84 dB at 10 kHz.

Groups

The group modules begin at the top with a flush mounted LED metering system. This is again more visually attractive than past designs, using a moulded lens system between the rear of panel LEDs and the front panel. As supplied, the nominal meter '0' point equates to +4 dBu at the output. The meters include a front panel

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accessible METER 0 preset control, which can be adjusted for an output range of −2 dBu to +20 dBu or more. Internal links allow the outputs to be set to −10 dBu for interfacing to semi-professional equipment.

The meters have selectable peak or average characteristics, controlled by a back of panel switch. When tested in peak mode, these were found to have a −1 dB reading for a 40 ms burst, with a decay time of 1.3 secs for a 20 dB drop. This is similar to a ppm for bursts down to 1.5 ms; below that they read significantly lower than ppms. The decay rate is also ppm-like, just a little faster than specified in BS5428. Soundcraft have published 4 ms for a −1 dB reading where the measured result is 40 ms, which I assume is a printing error, since 4 ms is too fast to be useful.

Switched to AVG, the meter requires a 210 ms burst for a −1 dB reading, compared to a specified 150 ms, while the decay matches the specification at 250 ms for a 20 dB fall. These are similar to a vu response. Three LED colours are used, green up to '0', orange to +8, then red up to +16.

Below the meters are two similar sets of returns. Each has HF (8 kHz) and LF (60 Hz) shelving equalisers, pre-fade aux 1 send pot, pan and vol. These all work as expected. Each also has internally illuminated PFL and on switches. The upper return (A) feeds the main L/R stereo mix bus.

The lower return (B) has a further two switches which affect its function. With all switches up, the group mix directly feeds its rear panel connector and also goes via the return controls to the L/R mix. Pressing the RET button at the top of the module selects the rear panel Tape B input to the return making it a multitrack monitor return, or aux return onto the L/R mix. The group signal remains only on its rear panel outlet, suitable for driving a multitrack recorder.

Pressing the SUB button lower down the module bypasses the equaliser, aux and volume sections of the return, feeding the group output directly to the L/R mix via the panpot. In this case, the return input will still feed the AUX 1 send and PFL switches.

Pressing both RET and SUB routes the return input into the group mix, which is then routed through the panpot only into the L/R mix.

Usefully, the *Delta* mixing amplifier operates about 12 dB below the rest of the console. This should help prevent bus overloads, a common problem with a usually unrecognised cause, which many mixers including earlier Soundcraft models have not taken fully into account. This means that the group fader can be pulled back from its nominal 0 position without great risk of bus clipping. Clipping on virtual earth mixing buses is particularly bad when it does occur, because upon clipping, the bus is no longer operating at its normal very low level and impedance but instantaneously goes high level, spewing rubbish all over the adjacent bus wiring. Thus, overload on one bus can seriously affect signals it is not even connected to.

The group outputs are described as 'ground compensated'. They are not balanced, or symmetrical about earth but are referenced to the external earth. It was not possible to determine whether this is a help in practice. Groups also have a pre-fader insertion point on a single 6.35 mm jack wired Ring-Send, Tip-Return. Such insertion wiring is often an irritation, requiring specially made leads, which are different from those required when plugging through an effects device from channel direct out to another channel's input. Usually manufacturers choose this method due to lack of panel space but in the case of the *Delta*, there is room on the channels and groups for the extra connector. Why not fit it and save the customer trouble? The cost is minimal, especially when deluxe input modules are sold at a premium anyway.

Output levels on the groups measure +22.5 dBu into 100 kΩ and +20.5 into 600 Ω against a specified +21 dBu. Insert sends measure similarly into loads greater than 1 kΩ. Group insert sends are driven from the mix amp, which runs 12 dB below normal console operating levels at −8 dBu. The channel inserts (deluxe input only) operate at the normal +4 dBu level, however, creating a disparity between the two which could cause confusion. These could have been engineered to match without compromising performance. If cost is the issue, it is better to accept things not matching at the inserts and to gain the benefit of bus overload protection.

Distortion

The input to output chain was tested for various forms of distortion, all of which proved uninteresting. THD+N was below 0.01% up to 2 kHz, rising to 0.04% at 20 kHz on the microphone and line inputs. All intermodulation products measured by any method were negligible.

Master module

The master module contains the L/R main mix amplifiers and controls, aux master controls, monitoring, talkback and a fixed frequency oscillator.

At the top are two meters, set to read the L/R mix output level or 2-track return if 2TRK is pressed. These are identical to the group meters, with a single internal switch from peak to average mode.

On the left of the module are the auxiliary master level controls, each with an internally illuminated AFL switch. This allows the auxes to be monitored and metered on both L/R meters. The auxiliary channels have enough gain to allow both channel and master level controls to be set to position 8 (out of 10) and still get standard output level.

The internal talkback microphone can be sent to aux 1-2 or all buses using latching pushbutton switches. The talkback mic is flush mounted and accordingly is omnidirectional, with an adequate pick-up range and level. The switches cause the monitor to dim when talking to auxes and mute when talking to all, superimposing the mic onto the output's other signals.

The oscillator is fixed to a frequency of 1 kHz ±10%, and measures 979 Hz and THD+N of 0.6%, both within spec. It is routed directly to group and L/R mixing buses, producing a maximum level of +14 dBu with the faders fully open against a specified +16 dBu. The oscillator level control goes down to 0, and an on/off switch is provided.

One monitor level control affects both the front panel headphone socket and rear panel monitor outputs. The level from this is a maximum of +15 dBu into >5 k Ω, adequate for any monitor power amplifier. Plugging in headphones disconnects the loudspeaker outputs. The monitor outputs and metering automatically changeover when any PFL or AFL switch is selected, indicating the state by a warning LED on the monitor panel.

The final L/R stereo mix outputs are electronically balanced and provide a maximum output level of +25.6 dBu into 600 Ω, less than the +27 dBu specified. Shorting one leg of this caused no ill effects but did reduce output level by 0.4 dB. The L/R outputs are also provided with insert points, and in this case there is no panel space for separate send and return sockets, perhaps the reason they are not fitted elsewhere. They operate at −8 dBu like the group insert points.

Power supply

The power supply is separate, fitted into a free-standing box. This has a front panel on/off switch, and three green LED indicators for +48, +17 and −17 V supplies. The output DC cable is captive at the PSU end, and fitted with a high quality connector at the other, with an overall length of 3 metres. Its resistance to short circuits and heat were not tested but the ripple must be low, as shown by the lack of hum components in the mixer outputs.

Summary

The Soundcraft *Delta* is visually attractive and sturdily built, with a combination of useful features and simplicity of operation, which will make it welcome to many users of audio mixers. The addition of an output matrix module and separate routing switches would broaden the applications even further.

Performance in many areas, particularly noise, bus headroom, crosstalk and breakthrough is well above average, making the operation of the mixer virtually 'quirk free'. Buffer amplifiers are fitted to both faders and channel panpots, removing level changes caused by routing and auxiliary selections, historically another troublesome source of irritation.

All in all, though some specifications are not met, this is a good value for money product that many users will find brings a smile to their faces each time they see it and use it.□

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ARSonic Sigma 1.2

An operational report by Dave Foister on an unusual recording level monitor

ARSonic's *Sigma 1.2* is an unusual piece of equipment in many ways and one is that it is impossible to tell what it does just by looking at it. The first question everyone who has seen my review sample asked was "What is it?" followed closely by "Why is it that peculiar colour?" Maybe the world would welcome a change from various shades of black and grey but I'm not sure it's ready for ARSonic's maroon.

The reason for the puzzlement is partly that none of its panel legending says very much about it, and partly that it is, as far as I know, a unique piece of kit addressing a small but underrated problem in an interesting way.

The main function of the *Sigma 1.2* is to monitor stereo recording levels and ensure that they never rise above a preset peak level. It is not, however, a limiter in any sense, and its gain during recording remains constant so it cannot strictly be called a dynamics processor. Although this all sounds paradoxical, it is really very simple; the material to be recorded must be played through the unit once before the final recording is made. During this dry run the unit senses any peaks rising above the required limit, and then a single button push adjusts the whole gain of the unit to bring the highest peak exactly within the allowable range. The aim is to ensure that the maximum possible use is made of the available dynamic range of the recording medium in a more efficient and accurate way than a human engineer watching flickering meters ever could.

Of course, in most circumstances the required 'dry run' will be happening anyway. In a live recording situation there will always be rehearsals and when mixing there will be plenty of opportunity for the unit to check levels before the mix is recorded. One could argue that live musicians never play at the same volume twice, particularly when the second time is a take, but a mix from multitrack will almost certainly contain the same peaks from one pass to the next.

The unit contains sophisticated peak detection circuitry and the different overload characteristics of analogue and digital recording media have been allowed for by a choice of two response times: fast (1 ms) for digital work and slow (10 ms) for analogue.

During its dry run the unit continuously displays the highest level encountered so far on each channel, expressed as dB above or below the chosen maximum. This can be +6, +8 or +9 dBm, selected by a front panel switch, although I would have thought a wider and finer range of adjustment would have been necessary in order to really exploit the unit. It may be that the level never reaches the chosen maximum, in which case the display shows exactly how much more gain is required to fully exploit the recording medium. In this case the gain would have to be added at the console, since the *Sigma* will only attenuate by up to 16 dB. The idea is not only to avoid overload but to remove the need for cautious undermodding, even by a few dB.

Once the dry run is complete, the ADJUST button forces the necessary gain adjustment, which, of course, is applied equally to both channels in order to preserve stereo imaging. If a problem occurs during the dry run producing an unrealistic peak (someone kicking a microphone stand for instance) the peak hold circuitry can be reset simply. At any time the current gain setting can be shown on the displays and edited manually although this would appear to defeat the object; perhaps it is to allow a couple of dB safety margin to cover the enthusiasm of the take.

I found this main function of the unit to work very well. Having calibrated it so that its maximum allowable level corresponded to FSD on my *PCM-F1* meters, I was surprised to find I was consistently low with my levels and therefore not making full use of the *F1*'s dynamic range. When levels were high, it was good to know by how much; an *F1*'s peak hold light stuck at the top only tells you you've got a problem, not how big it is.

The *Sigma 1.2* contains a couple of other functions that strike one as having been added out of a feeling that level adjustment alone was not enough to sell the device. Firstly, it incorporates switchable *Dynafex* single-ended noise reduction, usable in conjunction with the main function. *Dynafex* is a combination of downward expander and dynamic filter, and on suitable source material works surprisingly well. It offers an adjustable threshold, although I felt that the lowest available value of −40 dB was too high for some material, pumping the quiet sections up and down where a threshold of −50 would have left them alone while cleaning up the real noise. Variable brilliance is also provided to compensate for the loss of transient information inevitably caused by the noise reduction process.

Also included is an automatic fade facility, which fades the signals at the press of a button in a pre-programmed time. Unfortunately the fade is not smooth, dropping suddenly to nothing before the signal has fully disappeared; this surely renders this feature of limited use.

Another disappointment is the method of operation, which appears to have been designed with little thought for the demands of quick checking and adjustment. Most of the main buttons have two functions, the first of which is to select a parameter to view and/or edit. Once a button has been pressed the keys all become numeric entry or increment keys for editing the chosen parameter. This means that once a parameter key has been pressed, both ENTER and either the UP or DOWN key must be pressed to 'accept' the current setting (whether it has been changed or not) before another parameter can be selected. It is far too easy to try to select another parameter without remembering to go through all this first; the result is that one frequently finds oneself unintentionally editing values and trying to remember what they were originally. The simple inclusion of an EDIT key would have avoided all this.

The unit incorporates several program memories for storing virtually all its variables, and storage and recall is quick and simple.

The build quality appears to be extremely high, almost to the extent of overkill. For instance the unit is fitted with a fan, an item not normally felt necessary on equipment handling mere line levels; necessary or not, it makes quite a loud mechanical whir when in operation, made the more noticeable by the fact that it switches in and out thermostatically. The design quality is reflected in the audio specification, which is as good as transparent—as indeed it ought to be considering it is designed to have complete final mixes passed through it.

The manual takes a commendable amount of trouble explaining in some depth the niceties of levels, decibels, metering and impedances but unfortunately fails to describe the unit's operation quite so clearly; one is left interpolating the gaps in what appears to be a fairly average translation.

The *Sigma 1.2* is one of the quirkiest pieces of equipment I have ever encountered in almost every respect. It sets out to do a job few people realised wanted doing but proceeds to justify the attempt by doing it well, if a little awkwardly, and proving its usefulness in its limited application.□

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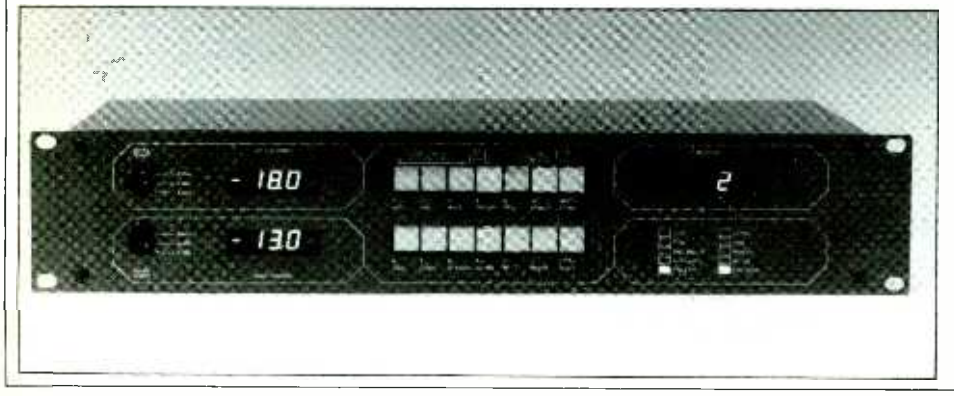

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Raindirk Symphony LN

Patrick Stapley presents an operational report

Raindirk Audio was set up in 1972 by Cyril Jones (still MD today) and Ron Pender, who were both ex-Sound Techniques. Their first console was installed at Ian Gillan's Kingsway Recorders and, amazingly enough, it's still in regular use 17 years later in a Hamburg studio. In 1976 Raindirk launched their most successful console, the *Series 3*, which was to be manufactured over the next 6 years selling a total of 50. 1977 saw the introduction of the *Concord* in-line desk, which was produced until 1983 selling over 40. In the first half of the '80s the company concentrated on manufacturing customised broadcast and film consoles, and during 1981 to 1985 they sold 47 desks to South Africa alone. During this period, Raindirk's sales to music studios tailed off, so in mid 1985 work began on designing a high quality but reasonably priced music console—the *Symphony*. The first console was delivered to Jon Hiseman's South London studio in December '87 where it replaced a *Concord*, and since then just over 20 desks have been sold, with more than half going overseas.

The standard *Symphony* is a 32-group in-line console, providing 28 to 72 channels in five frame sizes; a 40-channel desk measures 39¾×44¼×97 inches (hdl). A 48-group version is also available which adds just under 8 inches to the channel length. There are four different types of module that make up the console and I shall go through them in detail.

I/O channel module

Working from the top down, the group routing buttons are arranged in 16 odd/even pairs, there is also a STEREO 1 button that routes out to one of two stereo mix buses—all routing buttons have LEDs and follow the channel pan. Alternatively the signal can be sent direct, bypassing the mixing buses and summing amps—the direct function disables all other sends to that particular group. The DIRECT button has no LED. A GROUP MIX LEVEL control is provided for trimming the group output from off to +5 dB and a centre detent position marks normal 0 vu operation.

The input section has switching for 48 V phantom power, 20 dB pad and phase reversal, it also includes a detented line level (±15 dB) and mic gain (0 to 70 dB). With the pad in use, the mic amp caters for a wide range of input levels (up to +26 vu) because it also switches the input impedance value (3,300 to 30,000 Ω), direct inputs from instruments with high impedance (synths, bass guitars, etc) can be accommodated without the need for DI boxes.

The equaliser is divided into six sections. There are high and low frequency shelving sections each with a choice of two frequencies—8 k to 16 k and 80 to 160 Hz. MID 1, 2 and 3 provide peak/dip EQ with swept frequencies measured at, 1.4 k to 17 k, 280 Hz to 8.4 k, and 28 Hz to 3.4 k, each has a fixed Q of 1.5. All EQ level controls are ±15 dB. A highpass Butterworth filter operates over a range of 30 to 330 Hz 12 dB/octave and can be switched in independently, causing the EQ in/out LED to come on at half power. The design and character of the EQ retains continuity with previous consoles, having a smooth and accurate response. MON switches the EQ into the monitor signal path but leaves the filter in the channel. An INSERT button also appears in this area, acting as a bypass button for anything patched into the channel insert—inserts are pre-fade.

The cues and auxs are arranged in four sections giving two stereo cue sends and a total of eight aux sends (although only four can be used at any one time). The auxs have been combined in pairs so that Send 1 feeds either Aux 1 or Aux 5, Send 2 feeds 2 or 6, etc. Sends 1 and 2 share controls for source selection and pair switching (Aux 1 and 2 or 5 and 6); Sends 3 and 4 (Aux 3 and 4 or 5 and 6) have an identical arrangement. This idea first appeared on Raindirk's *3200* console in 1984 but sadly the console was never put into production; it has also been adopted by Amek on their *Mozart* and provides a neat method of doubling the auxiliary capability without taking up extra space. It does, however, require a degree of pre-planning to be used successfully, ie if you decide to use Aux 6 as an effects send, you have to be absolutely sure that the effects being fed from Aux 1 and 2 will not be required from that channel, and so on. Having said that, the desk already offers eight sends without the aux switching facility, plus the ability to use the 32 groups as further sends via the monitor fader.

TABLE 1 Source switching

Status	Default	Override (post button)
Auxs:		
Record	Pre/post mon fader	Post chan fader
Mix	Pre/post chan fader	Post mon fader
Cues:		
Record	Pre mon fader	Post mon fader
Mix	Pre chan fader	Post chan fader

The source switching for both auxs and cues automatically follow status, as shown in **Table 1**. The source is always pre-fade, unless overridden by local controls.

Auxs have PRE/POST and POST switches, the cues have just POST switches. I must admit to finding the terminology a little curious in regard to the aux POST switches, as they perform a CH/MON function. There are no cut buttons for either auxs or cues.

In practice the automatic switching for cues and auxs is a considerable time saver and if the aux PRE/POST buttons are left permanently in post there is little manual switching to be done between record and mix, other than switching the cues pre to post. The cues and auxs have been designed economically with a minimum of local controls; although this results in a very compact layout, it also has certain limitations—for example cues cannot be switched between channel and monitor while in a fixed status.

The monitor section consists of a 60 mm Alp fader, a panpot with centre click position, a MUTE button (with LED) and a SOLO button that acts destructively unless solo status is switched to

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This combination of service plus value proved unbeatable, and last year we sold nearly SIX HUNDRED eight and sixteen track systems. During this period though, two significant things happened. Many of our customers began asking if we could supply more advanced systems – budget 24 tracks for producers and artists, and full-blown systems for large installations. Unfortunately there seemed to be a huge price gap between sixteen and twenty-four track (in any case, top end multitrack was already handled very capably by existing companies).

At the same time though, technology came to our assistance! Many of the companies we dealt with who were known for budget multitrack suddenly started launching leading edge technology items at previously unheard of prices. For the small professional studio, or producer/artist, Tascam developed the cheapest 24 track in history, Allen & Heath at the same time designing a medium price, full feature MIDI console with 24 track compatibility. For more advanced systems the Yamaha digital multitrack, the Fostex timecode R-DAT and the Digidesign hard disc recorder were all examples of high tech initiatives from a new breed of companies.

We could not only fulfill the demand for this high quality professional but affordable equipment – in many ways it was a logical extension of what we already did (no other company had the experience we had with regards to the manufacturers producing the new product ranges). We realised however, that to capitalise on this advantage we would have to rival the facilities of the most up-market retailers.

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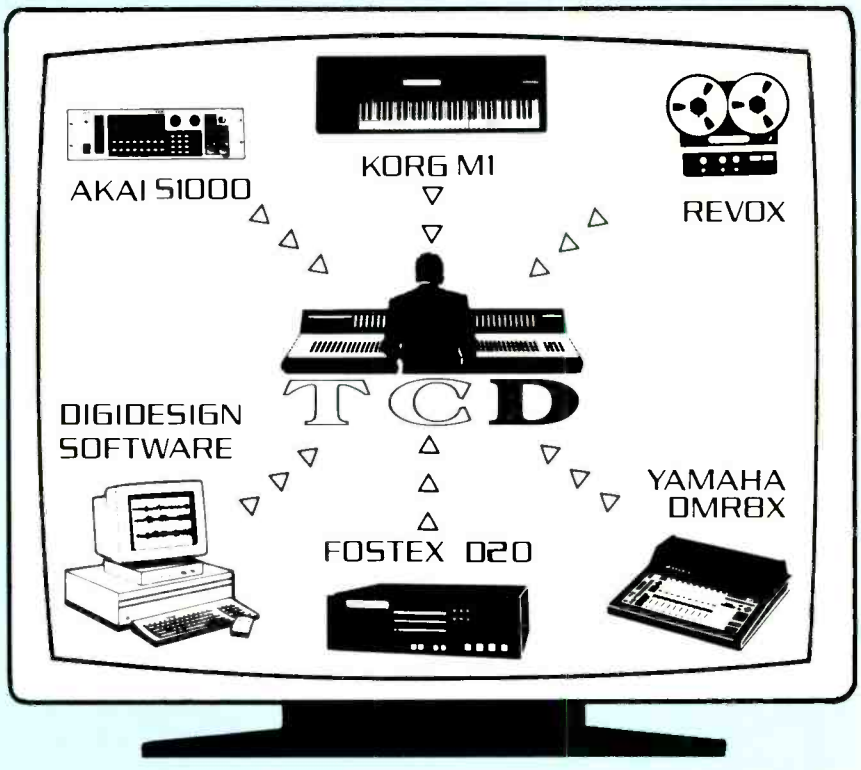

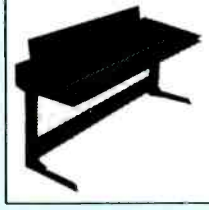

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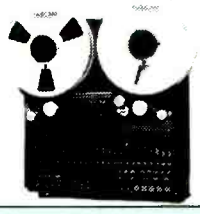

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AFL from the centre of the desk.

The output of the monitor pan can be switched to feed into a second mix bus called STEREO 2; this disconnects the signal from the normal ST 1 path, and routes it to a second centrally placed master fader, which can be used to give a completely separate stereo output. Alternatively the ST 2 output can be switched back into the ST 1 path, and there are two ways of doing this governed by central switching: ST 2 TO ST 1 MIX will feed the output of ST 2's fader to the input of ST 1's fader, providing a mix subgroup that follows ST 1 fades; ST 2 TO ST 1 OUTPUT feeds the ST 2 output directly to the ST 1 output so that ST 2 operates independently of ST 1's fader– ideal for stereo crossfades. Yet another use for the ST 2 group is to disconnect unused channels from the ST 1 bus, thus reducing noise and creating even quieter mixes.

Each channel contains four local status buttons that override master status selection; a yellow LED indicates local control, a green LED indicates that tape is being monitored and the monitor mute LED doubles up as a status error indicator. Console status will be covered in greater detail later.

The channel cut is a large numbered button at the bottom of the module that lights when the channel is on. The solo function is destructive, muting other channels unless individual SAFE buttons have been selected. If channels used as effects returns are switched to safe, an in place solo with effects can be set up. All channel and monitor solos are put into safe by the master AFL button; a channel will also locally adopt AFL mode if its SAFE button has been selected.

The last two controls on the channel module are MUTE 1 and MUTE 2, which provide group muting of channel faders via master controls.

The channel faders are 100 mm Alps, although Audiofad or P&G faders can be fitted as an option (most consoles have Audiofad faders fitted to ST 1 and ST 2 masters). A black scribble strip is incorporated above the faders.

Talkback module

The talkback module contains the line up oscillator, the aux and cue masters, and talkback controls. The oscillator has six frequencies (40 Hz, 100 Hz, 1 k, 10 k, 15 k and 20 k) selected on buttons, there is a level control with a centre detent calibrated at 0 vu, an on/off switch and individual switching to multitrack and stereo with flashing LEDs to act as a warning.

The eight aux and two cue masters are arranged in a column, with Aux 1 at the top, each master has an AFL button.

Talkback is via a recessed FET mic and is controlled by two large pushbuttons marked STUDIO TB and COMMS. STUDIO TB is self explanatory but COMMS is dependent on a further five buttons that route the talkback to Cue 1, Cue 2, Stereo, Multitrack and a spare position that can be wired as wished. TB TO TAPE does not output a slate tone, which in these days of striped tape and sophisticated autolocators may be something of a redundant feature anyway. A HOLD button with a flashing LED enables the talkback to be locked on. Included in this section is the red-light switch, which can be wired to inhibit destructive soloing.

Monitor module

The first half of this module is taken up with three echo returns, offering on/off, level, balance, mono, AFL, Stereo 1 or 2 routing and sends to each stereo cue.

Directly below this are five selector buttons for different sets of speakers. Each has its own level control enabling the speakers to be level matched pre the main monitor pot, successfully preventing those nasty jumps in volume that I'm sure we've all experienced. As no dedicated studio playback facility is fitted, one of these speaker positions can act as an SLS send, although it will not, of course, have an independently switchable source.

There are eight monitor source buttons—ST 1, ST 2, and TAPE 1 to 6—these selectors are additive, making it possible to listen to all eight at once if you really want to. The monitors can be dimmed, mono'ed and muted left and right; at present the dim level is preset within the module, somewhere between 10 and 30 dB to suit the client but it is proposed that the talkback to cues should have an independent dim level to facilitate 2-way conversations.

TABLE 2

Channel				Monitor
Status	Source	Fader To	Meter Source fader to	
Rec	Mic	Large Group LI	LI small stereo	
Rec+FR	Mic	Small Group LI	LI large stereo	
Tape	Mic	Large Group LO	LO small stereo	
Tape+FR	Mic	Small Group LO	LO large stereo	
Mix	Tape O/P	Large Stereo LO	Post ch small group	
Mix+tape	Tape O/P	Large Stereo LO	LO small group	
Mix+FR	Tape O/P	Small Stereo LO		
Mix+FR+tape	Tape O/P	Small Stereo LO	LO large group	
Mix+rec	Tape O/P	Large Group LI	LI small stereo	
Mix+FR+rec	Tape O/P	Small Group LI	LI large stereo	

The monitor module also houses the ST 2 MASTER buttons, the group mute masters and the AFL master button (flashes when on) all of which have been described.

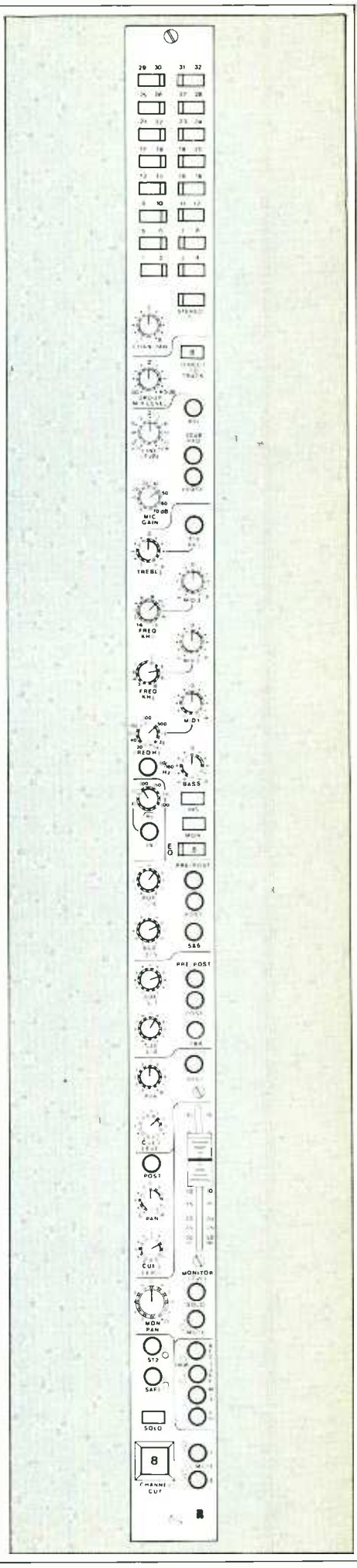
Status module

Another three echo returns have been incorporated in the module but this time they include 3-band fixed frequency equalisers operating at 80 Hz, 2.8 kHz and 8 kHz ±15 dB with EQ in/out switch. Otherwise they are identical to the ERs in the monitor module. All ERs, if switched to mono, will pan using the BALANCE control.

At the bottom of the module are the four master status buttons—RECORD, TAPE, MIX and FR (Fader Reverse). These keys globally set the console to a number of status combinations, which, as mentioned, can be overridden locally. A STATUS LOCK button is fitted to guard against accidents. **Table 2** shows the various combinations.

Patchbay

The standard patchbay on a 48-channel console offers a total of 720 Mosses & Mitchell patch points, in 15 rows of 48 sockets, including 232 for



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Specification

Microphone Input	
Electroncially Balanced Input Impedance	3,300 Ω
Input Impedance with pad	30,000 Ω
Maximum input without pad	+10 dBV
Maximum input with pad	+30 dBV
Gain range, including pad	90 dB
Line Input	
Electroncially Balanced Input Impedance	10,000 Ω
Maximum Input	+22 dBV
Trim range	±15 dB
High pass Filter	
Butterworth response	−12 dB/Octave
Frequency range	30-330 Hz
Equalisation	
Gain range on all 5 bands	±15 dB
Frequency LF Shelving	80 or 160 Hz
M1	30 Hz to 3 kHz
M2	3-8 kHz
M3	1.6-16 kHz
HF Shelving	8 or 16 kHz
Outputs	
Output Impedance. All outputs less than 50 Ω	
Max o/p into balanced load of 600 Ω	+23 dB

Noise	
Microphone noise Rs 150 Ω Gain 70 dB	−130 dB
Stereo mixing noise 36 Channels	−86 dB
36 Channels, Line I/P open circuit EQ in, all faders at zero	−84 dB
Distortion (THD)	
Microphone Input to Group Output Gain 40 dB O/P level +10 dB	0.008% at 1 kHz
Line Input to Group Output	0.005% at 1 kHz
Frequency Response ±0.5 dB	
Microphone Input to Group Output Gain 40 dB	20 Hz to 50 kHz
Line Input to Stereo Group Output	20 Hz to 50 kHz
Leakage	
Line i/p to microphone amplifier	100 dB at 20 kHz
Across Chan. Mute or Solo switch	100 dB to 20 kHz
Crosstalk between adjacent Groups	100 dB at 20 kHz
	0 dBV=0 dBm=−4 dBVU

external equipment, six stereo tape I/Os, nine stereo ERs, aux, cue and monitor O/Ps, osc, parallels, channel inserts, 48 multitrack I/Os including monitor returns and the option to wire through mic inputs. It is normally fitted to the right of the engineer but can be on the left if required. It is also possible to mount it remotely allowing extra space for additional modules. The patchbay is hinged for easy access and has JST edge connectors rather than traditional soldered connections, making patchfield re-arrangements a much easier task. There is space allowed directly below the patchbay that will accommodate an additional eight rows.

Metering

Mechanical vu meters are standard, although switchable vu/ppm bargraph meters should be available now. These will comprise 40 LEDs and offer peak hold, an offset zero facility and two expansion modes for accurate tape alignment. Meters are provided for all 32 groups, ST 1, ST 2, cues and auxs—on desks with 48 or more channels 48 group meters are standard. A phase meter and mono meter are extra.

Noise

The console is noticeably quiet. Raindirk provided me with test figures made as part of a final QC on a console before delivery giving noise measurements of −130 dBm for the mic (150 Ω, gain 70 dB) and −87 dBm for the stereo output, ie 36 channels all faders set to 0 dB. Switching on the desk was also quiet. Crosstalk performance was impressive throughout the console with Raindirk's figures showing 100 dB at 20 kHz and a frequency response (−1 dB points) of: line I/P to stereo O/P—16 Hz to 62 kHz; mic I/P to group O/P—16 Hz to 65 kHz (gain 40 dB).

PROMS

The *Symphony* offers additional options by replacing a PROM within each channel, and using the status REC+TAPE. In the standard console this status causes the cues to switch from the tape to the input path, enabling musicians to carry on rehearsing during a multitrack playback. Other alternatives are to provide simultaneous monitoring of tape and group, or to provide a switchable mic/line facility (useful for example if a large bank of synths are permanently plugged into the channels). The final PROM issue combines the post-channel and monitor fader outputs to the routing matrix, allowing two mic inputs to be fed into one channel and mixed to a single track or split to odd and even tracks.

The ideal of dual mic inputs has been taken a stage further on the 48-track *Symphony*, where a second dedicated mic I/O section has been added to each channel. This crams in a gain control, phantom power, pad, phase, HP filter, rotary fader, monitor fader flip (allowing the mic input to be controlled by a linear rather than rotary fader) and three subrouting buttons that select mic 2 to the left groups, the right groups, or groups 25 to 48. The console has been designed with the mobile market in mind and 72-channel (144 mic inputs) and 52-channel versions have been sold to The Manor Mobile in the UK and to El Camion in Spain.

Future

Raindirk is a reasonably small operation with a total staff of 14; this year they intend to produce 15 *Symphony*'s along with their other orders. There are also plans to build a smaller *Symphony* suited to high quality classical recording and a larger more expensive version offering enhanced facilities.

At present the *Symphony* is mute and fader automation ready, and will accept any of the popular systems, although it is proposed to fit a proprietary automation system, which will include dedicated local controls (rather than cursor controlled channel switching). Other additions, which should be incorporated before this year's APRS in June, include a master AFL/PFL switch, and a new module for foldback mixing.

Conclusion

The Raindirk *Symphony* represents extremely good value for money. As would be expected, with keeping costs low, certain small compromises have been made but the overall quality of the desk shows no sign of compromise. Indeed it offers one or two features that are absent on other much more expensive consoles. Its noise floor, crosstalk and general specifications are impressive and reflect the professional standards that one would expect from its pedigree. Taking into consideration the console's price and quality, along with its ongoing evolvement, the *Symphony* should put Raindirk's name firmly back in the music studio.

Raindirk Audio, Tweedmain Ltd, 33A Bridge Street, Downham Market, Norfolk PE38 9DW, UK.
UK: The Home Service, Unit 2, 12 William Road, London NW1 3EN.
USA: No distribution at present.

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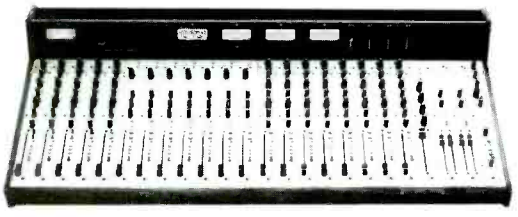

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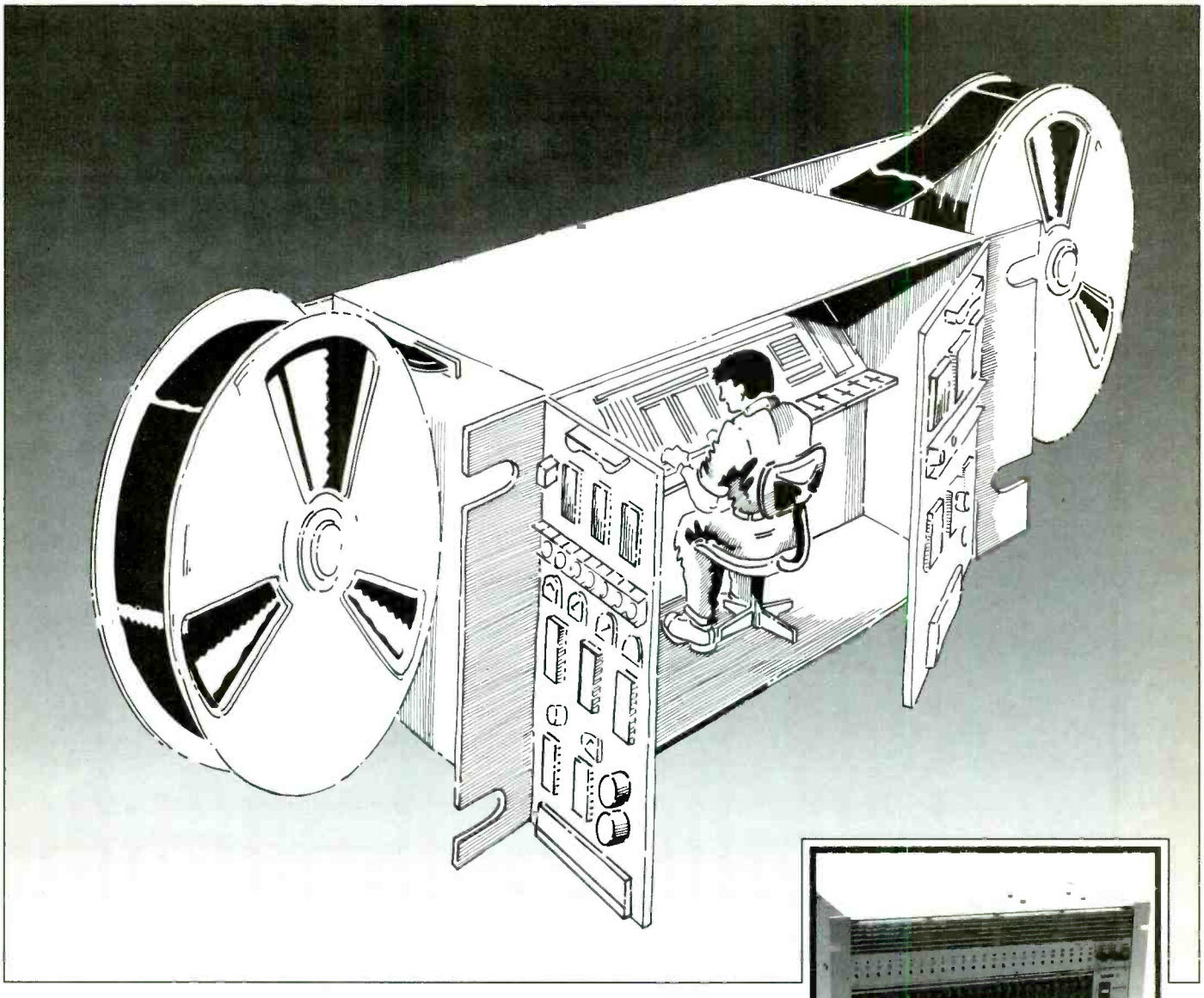

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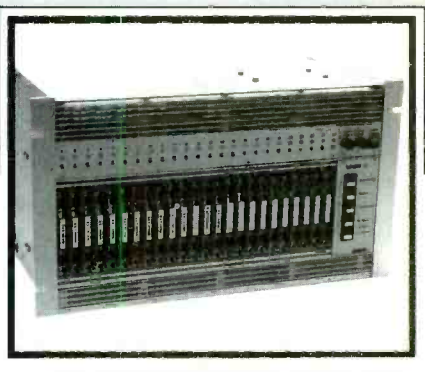

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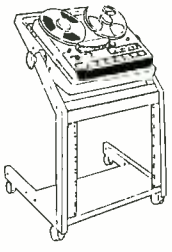

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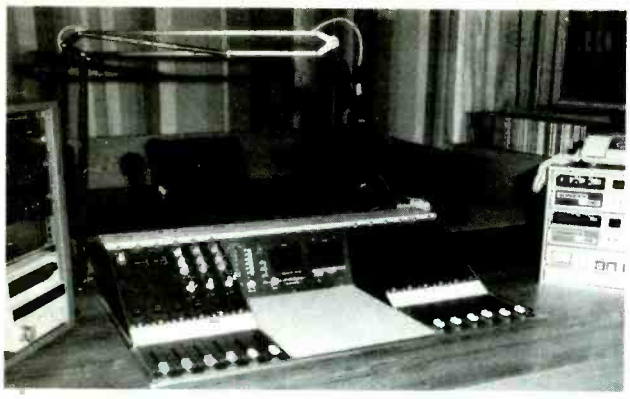

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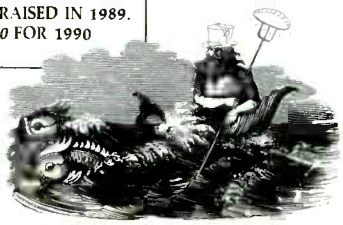

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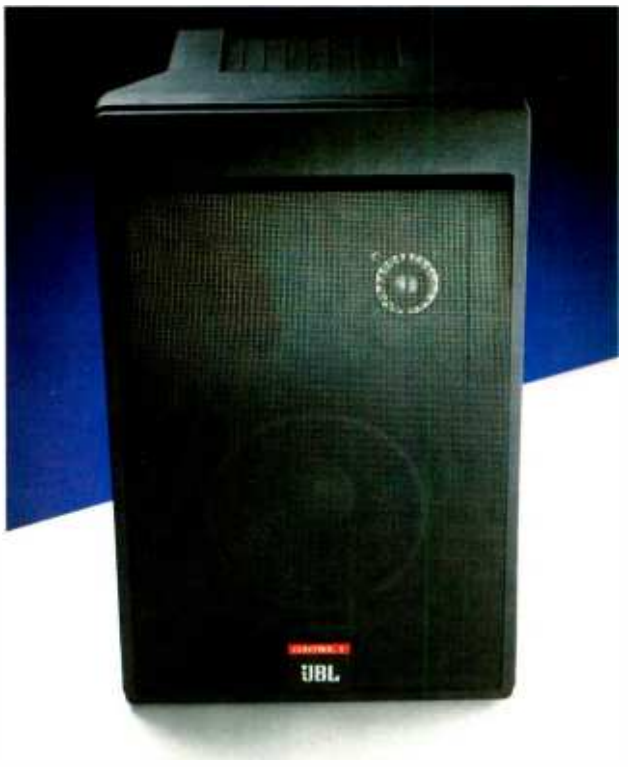

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If you are looking for a versatile compact loudspeaker, a little control might be in order. Specifically, the JBL Control 1. It's the smallest system in the famous JBL Control Series. The Control 1 combines the well known JBL sound with a unique approach to enclosure construction. Molded from dense polypropylene structural foam, the enclosure is both nonresonant and very durable.

The 130 mm low frequency driver is matched to a 19 mm high frequency device by a sophisticated dividing network incorporating a power protection unit. As a bonus, both drivers are magnetically shielded, making the Control 1 ideal for audio/video applications.

Where space permits, the Control 5 offers even more control. Using the same construction techniques as the Control 1, the Control 5's larger enclosure permits the use of a 165 mm low frequency driver for better sensitivity and extended bass response. JBL's remarkable 25 mm pure titanium high frequency unit extends your control beyond the limits of human hearing. A dividing network featuring the highest quality components, bypass capacitors and a power protection device complete the system. As in the Control 1, both drivers in the Control 5 are magnetically shielded, permitting use near video monitors without sending the picture out of control.

By now you should be getting the picture: the JBL Control 1 and Control 5 put you in control of all your sound decisions. Total control.

JBL

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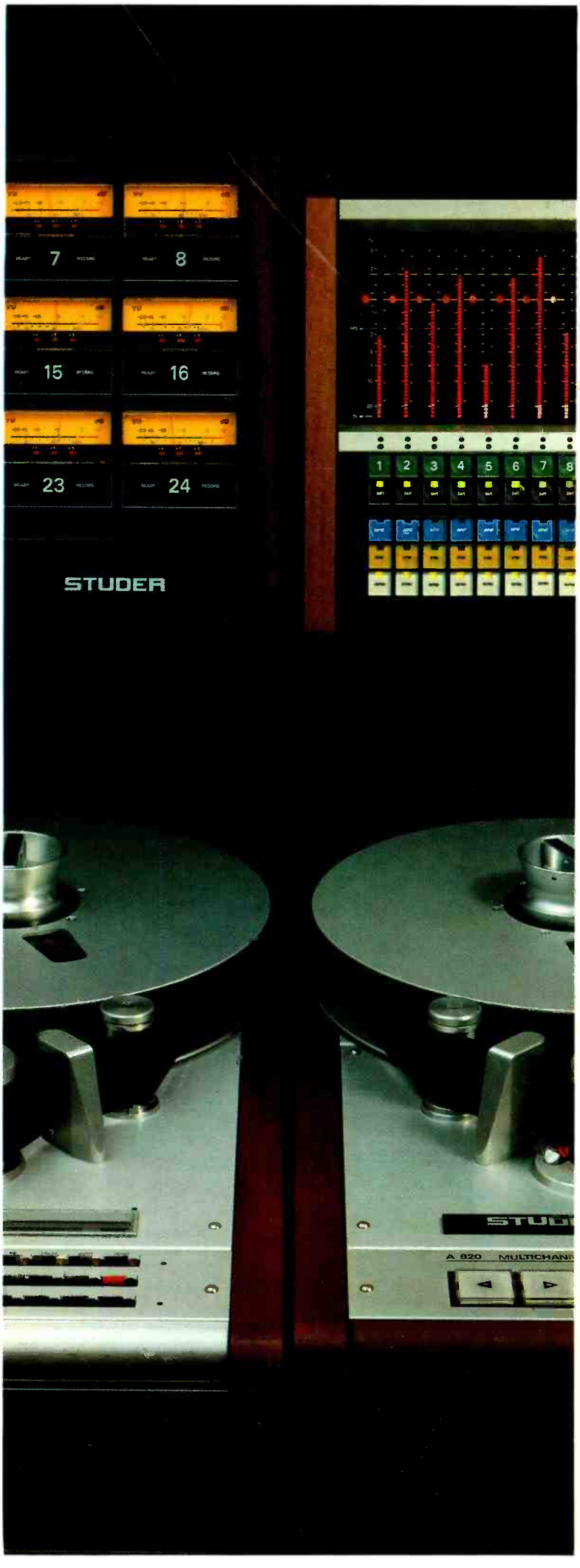

SPOILT FOR CHOICE

Choosing between Studer's A820 and A827 multitrack machines is not easy.

True, the A820 is the flagship model and the A827 has been produced as a cost-effective solution, but fundamentally they are very similar. Both have the ultra fast proven tape transport with 14" reel capacity giving the highest spooling speeds (up to 15m/s or 590ips) for 24, 16 and 8 track tapes. Both feature the same microprocessor controlled DC capstan motor for standard 7½/15/30ips, with reverse play and varispeed functions, and both incorporate the same comprehensive interfaces for the tape deck and audio peripherals.

The Features

A820 - The Flagship Model
- Intregration of Dolby A/SR noise reduction system
- Full automatic alignment of audio parameters including noise reduction
- Bar graph metering PPM/VU with a resolution in alignment mode of .1db per segment

A827 - The Cost-Effective Model
- Optional integration of TLS4000 Synchroniser with local control panel
- Permanent sync output per channel for triggering noise gates etc.
- Microprocessor controlled audio alignment (MDAC)

Whatever decision is made, it will not have been easy. Such is the luxury of being 'Spoilt for Choice'.

STUDER REVOX

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