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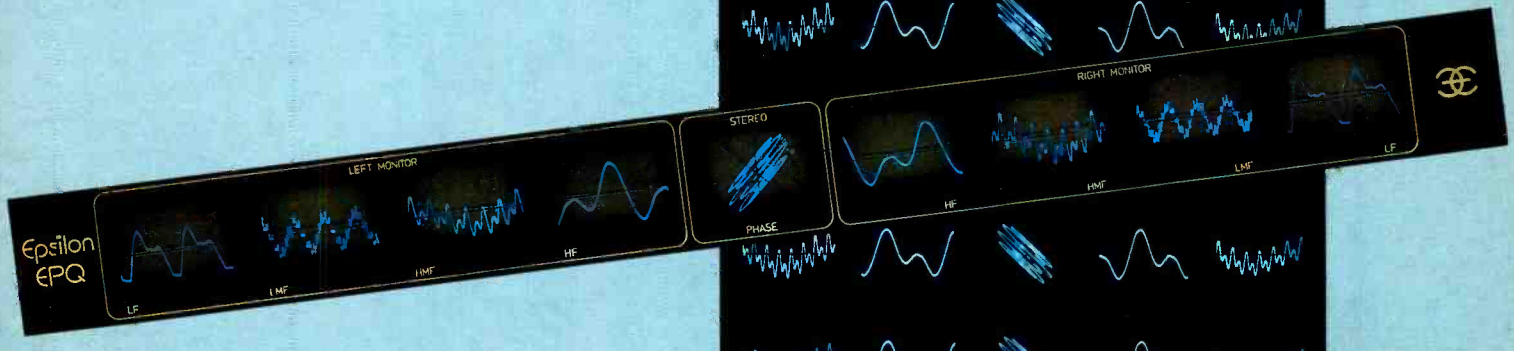
STUDIO SOUND

AND BROADCAST ENGINEERING

A LINK HOUSE MAGAZINE



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Soundcraft
6000

If only more expensive desks performed as well.

SOUNDCRAFT ELECTRONICS LTD, UNIT 2, BOREHAMWOOD INDUSTRIAL PARK, ROWLEY LANE, BOREHAMWOOD, HERTS, WD6 5PZ, ENGLAND. TEL: 01-207 5050 TLX: 211985CRAFT G. FAX: 01-207 0194. SOUNDCRAFT USA, TEL: (818) 893 4351. SOUNDCRAFT CANADA, TEL: (514) 685 1610. SOUNDCRAFT JAPAN, TEL: (03) 341 6201

STUDIO SOUND
AND BROADCAST ENGINEERING

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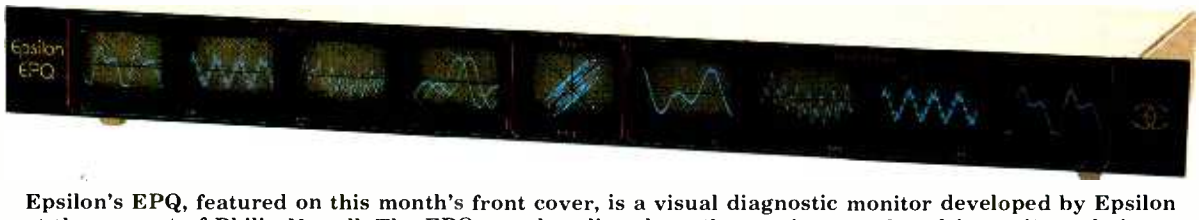

Epsilon's EPQ, featured on this month's front cover, is a visual diagnostic monitor developed by Epsilon at the request of Philip Newell. The EPQ attaches directly to the monitor speaker drive units and gives a visual display of the structure, balance and harmonic content of sound arriving at the drivers

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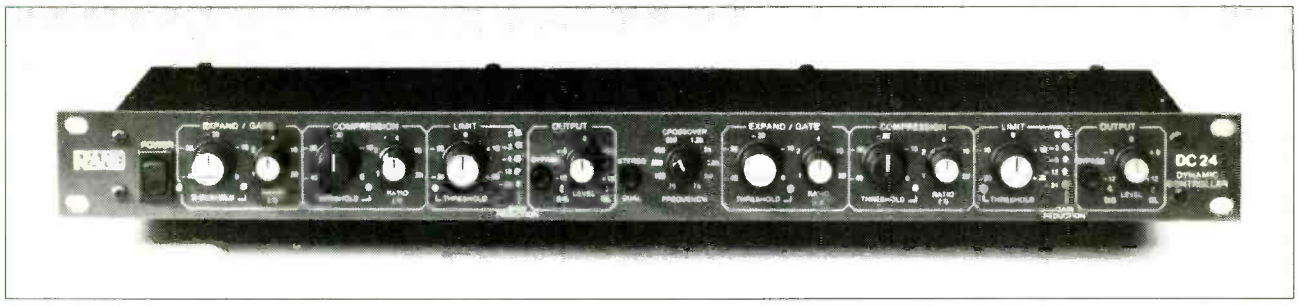

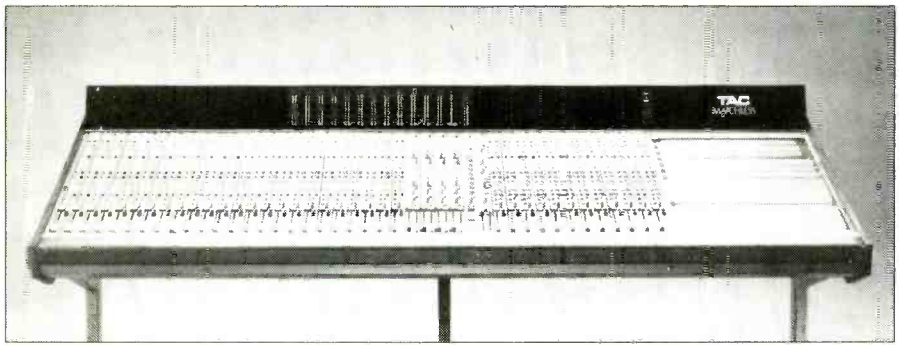

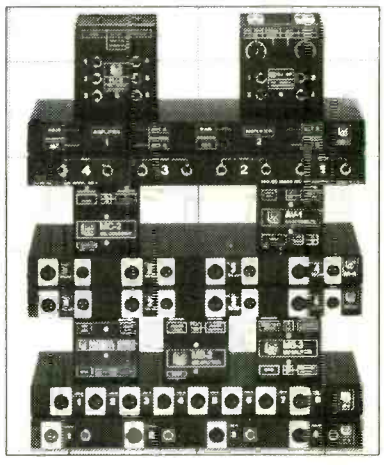

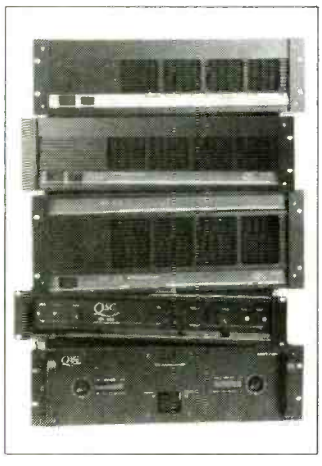

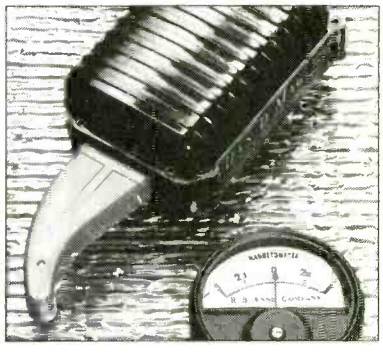

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Cover: Epsilon EPQ visual monitor. Photography by Roger Phillips

Other technologies threaten audio quality standards

In everything we do choices have to be made—all day and every day. On some matters the decision tends towards the most convenient path. Over another matter it may be quickest, cheapest or highest standard and so on. In our personal life we make choices such as this all the time. In our professional existence the situation should not be the same.

The danger is when we apply these personal decision criteria to the choice of technology. The most obvious example of this has to be DAT. Now there are a number of concerns being expressed about DAT and its suitability for professional use. Barry Fox's 'Business' column this month features aspects of this debate—it may be that the IRT report, and other research surfacing, is the natural laws of balance responding to a major positive DAT demand. These may be simply red herrings that we will dismiss in a few months time; on the other hand they may not. We will be covering this area in quite some detail whenever evidence arises. Currently it would appear that the sensible course is to use DAT as much as you like but take care—never let it be your sole chance at a critical recording. I have used DAT myself and have achieved some excellent results but it would be foolish to say that there will never be problems under more arduous conditions on the basis of success so far.

For two years Sony have made it clear that although DAT has professional applications it should not be regarded as a professional format at present. And there has been little to change from this stance except to say that if it had been intended as a pro-format then it would be quite different. It was designed as a consumer format and consumer products have a different set of priorities to match the decisions we make in our personal life. Namely these are price, convenience and quality—and arguably in that order.

I have used DAT as an example of how a particular piece of equipment may be chosen and to say that mere price and convenience considerations should not get out of proportion when making professional decisions. DAT is actually a bad example of this as it may have all the qualities claimed for it in abundance with sensible use.

We, however, only have to look to the video and film side to see sloppy standards abounding. A major US TV soap popular all over the world is an excellent example of technology being chosen for the wrong reasons. Earlier series were made on film and standards were high. For whatever reasons, the last two series have been shot on video and the quality drop is enormous particularly after standards conversion to PAL standard. If this were not a popular series I cannot imagine any reputable TV station considering it up to broadcast quality. There have also been cases of lip sync slip so disturbing in sections that even untutored eyes and ears comment.

As audio aligns closer to video, it is vital that we maintain our own standards as the increased pressures that can be placed upon audio production from the vast commercial interests behind TV production can cause serious shortcomings in quality. When audio and picture quality are both good the result is a far greater sum than the components. Let's try and hold our end up.

Keith Spencer-Allen

COMPANY ANNOUNCEMENT

Change of Company Name

The story so far!

1966 - MAGNETIC TAPE MECHANISMS LTD - Based in Richmond, Surrey - is formed for the manufacture of reel to reel tape recorders.

1969 - Company name changes to MAGNETIC TAPES LTD. Brand name CHILTON introduced, derived from name of factory, Chilton Works.

1971 - Product range expands to include the M Series of audio mixing desks. Beautifully finished in solid teak with black anodised control panels, they prove an early commercial success.

1976 - Owing to the demise of reel to reel due to the difficulty in obtaining specialised parts, a new range - the QM series of consoles - is introduced. The successful M series is replaced by the CM series modular broadcast/production desk.

1985 - Company purchases 6,000 sq. ft. factory in Ashford Middlesex.

1986 - January - move into new factory is completed. Company achieves full export order book for CM2-4 desks.
Receives trial order from BBC Local Radio for seven QM3 24/8 consoles with modifications. This is based on reports on 2 standard QM3 24/8 consoles supplied to BBC Radio Leicester and to BBC Radio Merseyside.

1989 - Company name changes to CHILTON AUDIO LTD. Brand name CHILTON continues.

For the record

No fewer than 36 QM3 consoles have now been supplied to BBC Local Radio for new O.B. vans and A stations.
In other fields the CM2, with its excellent reliability, has demonstrated that it is ideal for the Community and Hospital Radio.

CHILTON AUDIO LTD.
Chilton Works, 6-8 Wolsey Road, Ashford, Middlesex, TW15 2RB
Phone: 0784 247124 Fax: 0784 240159

For fuller details on the CM Series please contact Paul Reps.

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0666 Oslo 6
Tel. 02/641430

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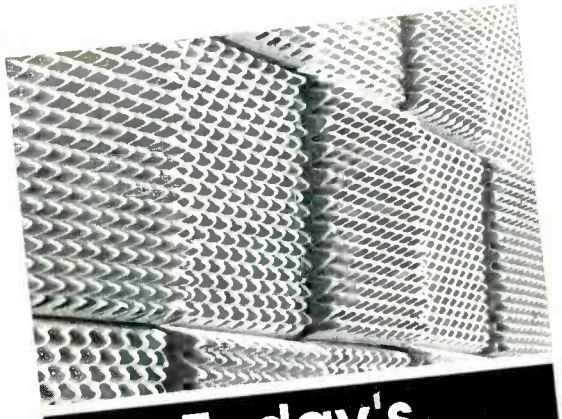

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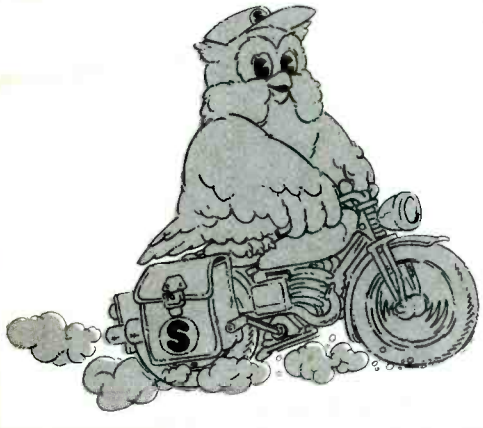

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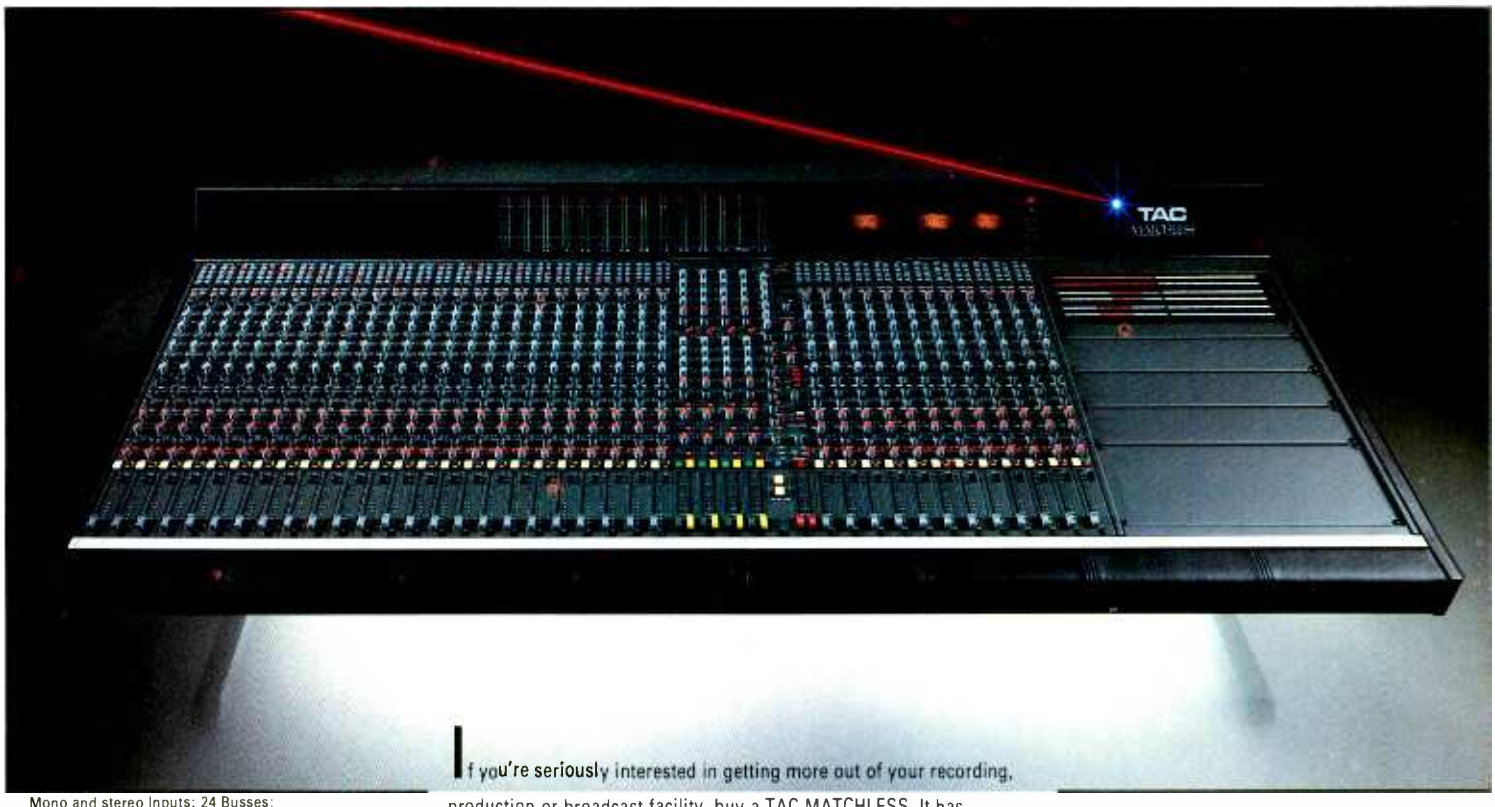

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TAC

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Telephone: 061-834 6747. Telex: 668127. Fax: 061-834 0593

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THE TECHNICS DAT RECORDER IS HERE.

The Technics portable DAT recorder would have been an admirable choice for the Admiral's Cup.

While the yacht sways and heaves, the last thing a journalist needs is an unwieldy tape machine.

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.

Like the U.S. America's Cup team, it goes really fast forward and like them is quick to rewind in the event of an error.

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.

Out of the studio, the DAT deck is equally effective on location.

Where it is often used for outside broadcasts.

Its popularity with the professionals is due to full digital in and out terminals, analogue sampling of 44.1Khz for C.D. mastering and hard wired remote control.

It's 4 DAC 18 bits also delivers higher fidelity.

Something yacht crews could learn a lot about.

Technics

FOR MORE INFORMATION ABOUT THE RANGE OF TECHNICS PROFESSIONAL AUDIO PRODUCTS CONTACT ONE OF THE FOLLOWING ADDRESSES:
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RAPER & WAYMAN LTD, UNIT 3, CRUSADER INDUSTRIAL ESTATE, 167 HERMITAGE ROAD, HARINGEY, LONDON N4 1LZ. TEL: 01-800 8288.

SONY

Sony Broadcast
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European Headquarters:
Basingstoke
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Dear Reader

Re: 48 channel digital audio multi-track

Sony is proud to announce the latest addition to its DASH family, the PCM-3348, the worlds first 48 channel digital audio multi-track.

Total compatibility with the already successful PCM-3324 means that it works with your existing master tapes. So, if you're already recording and need additional tracks, just move onto the 3348 - it's as easy as that! Whether you're tracking, mixing, overdubbing or simply putting guide vocals on a slave reel, just one tape means total flexibility. Featuring an extremely fast and stable transport to take the best possible care of your master tape, it will also save you studio time.

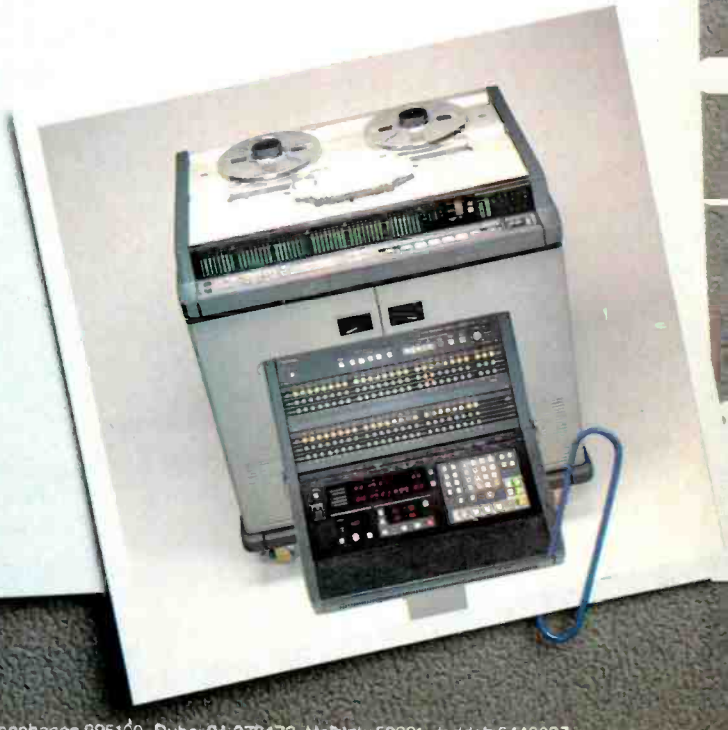
Unrivalled audio quality is achieved by means of two times oversampling A/D and D/A converters, together with both digital and analogue filtering stretching the usable frequency response to almost 22KHz.

Other unique features include real-time digital track bouncing for two channels simultaneously and a 20 second full resolution sampling memory for spinning sequences back onto tape.

Even a multi-standard timecode generator/reader has been included, plus a unique advance output which enables external processing delays from digital mixing consoles to be compensated for.

To achieve the ultimate in recorded sound, contact your nearest Sony centre now.

Sincerely
SONY



For further information contact:
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Quad Eight buy Quad Eight

A new Californian corporation, Quad Eight Electronics, has purchased the assets, goodwill, engineering and manufacturing facilities of the Quad Eight audio mixing console operation of the Mitsubishi Pro Audio Group.

Shinji Miyata, president of Digital Entertainment and Quad Eight/Westrex, better known as the Mitsubishi Pro-Audio Group, and William Windsor, president of the new Quad Electronics Corp have also agreed that Quad Eight Electronics will assume all warranty and non-warranty service obligations for customers in the US and the Far East while Digital Entertainment UK will service customers in the UK and Europe.

Console customers are requested to contact Quad Eight Electronics directly at 225 Parkside Drive, San Fernando, CA 91340, USA. Tel: (818) 898-2341. Fax: (818) 365-8310. The sales and service offices of Digital Entertainment Corporation in Nashville, New York, and Toronto will be closed.

Address changes

• **Decibel Audio**, pro-audio dealers, recently moved to new and larger premises where they can demonstrate many products in their wide range including Soundcraft, Yamaha, Ramsa and AKG. Decibel Audio, Unit 44, New Lydenburg Industrial Estate, New Lydenburg Street, Charlton, London SE7 8NE, UK. Tel: 01-853 2121.

• **Steinberg Digital Audio (UK)**, the UK marketing wing for Steinberg's computer-controlled recording products have moved to 1 Church Street, Stonesfield, Oxford OX7 2PS, UK. Tel: 099 389 8470. Fax: 099 389 8419.

Exhibitions and conventions

July 25th to 30th British Music Fair, Olympia, London. Contact: Music Industries Association. Tel: 0753 41963.

September 10th to 13th The Light & Sound Show '89, Olympia 2, London, UK. Contact: Clare O'Brien, O'Brien Associates Ltd, 10 Barley Mow Passage, Chiswick, London W4 4PH. Tel: 01-994 6477.

September 18th to 21st Media Visie '89, RAI International Exhibition Centre, Amsterdam, The Netherlands. Contact: RAI Europaplein, 1078 GZ Amsterdam. Tel: (0) 20-20-549 12 12. Fax: (0) 20-461006.

September 30th to October 1st Scottish Music Show, Glasgow's Scottish Exhibition & Conference Centre. Contact: Music Maker Exhibitions. Tel: 0353 665577.

October 3rd to 9th World Broadcasting Symposium Geneva, Switzerland.

October 18th to 21st AES 87th Convention, New York, USA. Contact: AES, USA. Tel: (212) 661-8528.

October 25th to 28th Broadcast '89, Frankfurt, West Germany.

November 7th to 9th Computer Graphics '89/Desktop CAD '89, Alexandra Palace Exhibition Centre, London. Contact: Katherine Lovatt. Tel: 01-868 4466.

1990

September 21st to 25th International Broadcasting Convention, Metropole Conference Centre, Brighton, UK. Contact: IEE Secretariat. Tel: 01-240 1871.

News from the AES

AES/EBU Interface Conference, September 12th to13th, 1989

The Digital Audio Interface is now four years old and like any four year old, it has learned a great deal since the standard was set back in 1985. This conference is not only a progress report from those associated with the birth of the standard, as it features papers from users and equipment manufacturers as well.

All the standards organisations concerned with the interface are represented, as will be all the major manufacturers using interface equipment.

On a lighter note, the evening guest speaker will be Gerhard Steinke from the German Democratic Republic who will be talking about his work on Delta Stereophony.

The conference will be held at the Independent Broadcasting Authority's Headquarters, 70 Brompton Road, Knightsbridge, London, SW3. The registration fee will include documentation of the conference and refreshments, including lunches and evening buffet.

For further information on the above conference or information on joining the AES please contact: **Heather Lane, AES Ltd, Lent Rise Road, Burnham, Slough SL1 7NY, UK. Tel: 0628 663725. Fax: 0628 667002.**

Conference Programme

Tuesday September 12th

Session A—Standards 10.00-12.30 Chairman: Chris Daubney, Channel 4

A1 Tutorial on the AES/EBU Interface, John Watkinson, Consultant

A2 The Consumer Interface, John Emmett, Thames TV

A3 Auxiliary Words in the Professional Interface, Neil Gilchrist, BBC Research Dept

Session B—Circuit Design 14.00-18.00 Chairman: Robin Caine, Pro-Bel

B1 The AES/EBU Interface and Audio-Digital Conversion, Mike Story, dCS

B2 A Single Chip Solution for the Interface User, Richard Lawrence/Simon Wegerif, BBC Designs Dept

B3 Channel Status Implementation, Serge de Jaham, Digitec

B4 Programme Labelling in the User Channel, Alain Komly, TDF

B5 Circuit Designers' Workshop

Evening Lecture 19.00-20.30

Delta Stereophony, Gerhard Steinke, RFZ, Berlin, DDR

Wednesday September 13th

Session C—Using the Interface 09.00-12.30 Chairman: Neil Gilchrist, BBC Research Dept

C1 Installation and Routing, Paul Evans, Thames TV

C2 Asynchronous Routing, Serge De Jaham, Digitec

C3 Measurement and Testing, Bob Metzler, Audio Precision

C4 Signal Analysis, Allen Mornington-West, Quad

C5 Synchronisation, Tim Shelton, BBC Research Dept

Session D—Future Developments 14.00-17.00 Chairman: Steve Lyman, CBC

D1 MADI, Alan Jubb, Neve

D2 Contribution Systems, Christer Grewin, Swedish Radio

D3 Television and SIS, George Davies, Kingston Polytechnic

D4 An Optical Multiplexed MADI Compatible Distribution System, Nick Cutmore/Richard Marsden, BBC Designs and Research Depts

D5 Discussion Forum

Courses and seminars

July 31st to August 5th StageTech '89, Birmingham University, UK. Contact: Patricia Webb. Tel: 01-226 4621.

August 26th and 30th Soundscape. The University of East Anglia, Norwich, UK. Contact: Jane Thorp, UEA. Tel: 0603 592802.

September 9th to 15th International Course for Studio Engineers, University of Surrey, Guildford, UK. Contact: APRS. Tel: 0923 772907. Fax: 0923 773079.

September 12th to 13th AES/EBU Interface. Contact: AES (British Section). Tel: 06286 63725.

The split and sale of dbx

Carillon Technology Inc (CTI) have announced how dbx has been split up and sold off. The announcement comes only a year after CTI had taken dbx over and will come as some relief to mixing console manufacturers who rely on dbx for important VCAs, circuit boards and modules.

Jacques Robinson, president of CTI has confirmed that the dbx Professional Products Division, manufacturers of signal processing equipment for broadcast and recording studio markets, have been bought by AKG Acoustics, the North American subsidiary of AKG, Austria.

The OEM products side, responsible for supplying VCAs, RMS detectors, circuit boards and modules, has been bought as a result of a management buy-out and is now owned by a newly formed company, THAT Corporation. THAT was founded by former dbx vice-president Les Tyler and two long-time dbx engineering managers Gary Hebert and Paul Travaline (the name THAT derives from an amalgam of their surnames).

Carillon are left with the dbx Licensing, Converters and Consumer Products business, the consumer side being a definite area of concentration for CTI.

In brief

• **TDK** have announced plans for a plant for full-scale production of magnetic recording media, in Luxembourg. The plant will manufacture audio and video tapes and is scheduled to open in November 1990.

• **A new arts venture** has opened up in **Dublin**. The centre includes a wide variety of facilities and resources including the Yamaha rehearsal rooms for young bands, many instruments and a range of recording equipment.

• **Trident** have announced a new, free service to all series *80* console customers, in the UK only, whose initial warranty period has expired. Irrespective of whether the console was purchased old or new, Trident engineers will visit any UK mainland studio and give the console a thorough check. For more information contact Trident Sales office on 0932 224665.

• **Molinare Sound Studios** have installed a permanent link to the new Satellite Media Services system of audio distribution. This means any client producing a commercial or a programme at Molinare will have access to instantaneous distribution to any or all of the 47 ILR stations.

• **Magna-Tech Electronic**, manufacturers of film and video post-production equipment, have opened a factory-owned service and sales facility for their UK customers at Unit 40, Sheraton Business Centre, Perivale, Middx UB6 7JD, UK.

• **Sypha**, hard disk recording consultants, are to publish a breakdown of all currently available tapeless systems, including details on both multitracks and stereo mastering machines.

• **Digital Solutions** are a new company set up to provide custom software and hardware, and consultancy services for audio and video post-productions. Digital Solutions, 2 Vallentin Road, London E17 3JH, UK. Tel: 01-521 8206.

Letter: The dreaded ESD

Dear Sir, In my full time job as a field service engineer for one of the world's largest computer manufacturers I frequently have to deal with the effects of static. Having just read Martin Polon's article on electro static discharge (*Studio Sound*, June 1989) I feel I must write this letter, which must of necessity be brief.

May I point out that Martin's article exposes only the very tip of the iceberg of the destruction that static can cause. It has been known for several years now within the computer industry that it is not just the discharge that causes the damage as mentioned in Martin's article but that the force field surrounding the body can create equally, and perhaps more, devastating damage.

As Martin so rightly points out, the body can be charged to anything like 40,000 volts and hence the field strength a foot or two away from the extremities of the body may be in the order of 1,000 volts or so, and it has been shown that even with the old TTL logic that a force field of 350 volts or more can blow a logic chip and with more modern technologies a force field as low as 35 volts can do irreparable harm. However, the greatest danger is not in devices that are blown by the force field and hence fail to work but the damage in the form of partial damage to devices that results in flakey operation for ever after until final failure, which may be many months or even years later. We all know of the problems that will never show themselves when the engineer comes to fix them and how disruptive they can be when any job is in progress, to say nothing of system crashes on computers.

It is perhaps these partial destructions of logic that are the most devastating in their effect. I can personally vouch for a reduction in field failures in my full time job in the order of 75% since all field service staff have been taking electro static precautions on site and the field service staff are the last to implement these, right through the manufacturing process.

To summarise then, where electronics are exposed, eg on an extender card, it is occasionally only necessary to point in the general direction of more up to date technology to cause serious damage, not actually touch.

Yours faithfully, Malcolm D Powell, Bracknell, Berks, UK.

APRS' Tape Label System

The APRS *Tape Label System* devised in 1986 with the British Record Producers' Guild has been totally updated to come in line with technological developments.

The APRS are talking to tape manufacturers in order to have the new *TLS* reference sheet form available to all users. They are also introducing the system to A&R departments, recording studios and duplication plants.

Together with the new system the APRS have produced a standard type of 'tape history' label, which will be included in a comprehensive APRS 'code of practice' for tape usage to be completed later this year.

Synton UK merges with Marquee

Synton International have announced that their UK arm Synton UK has merged with Marquee Electronics.

The merger is seen as being beneficial to both companies. Says Tim Hammil a director from Marquee, "After talking with Synton it was obvious that we shared the same goals, the two companies complement each other, taking Marquee Electronics' technical strength and combining it with Synton's commercial flair, it just made sense."

This merger has produced an impressive client listing including Adams-Smith, Eventide, Marion Systems and D&R mixing consoles, the last name being a result of a worldwide distribution deal Synton International signed earlier in the year.

All contact should be made at Synton UK's headquarters at Unit 12, Northfields Prospect, London SW18 1PS. Tel: 01-877 0787. But Marquee Electronics' theatre and conference hire will continue as usual at 90 Wardour Street, London W1V 3LE. Tel: 01-439 8421.

Console rebuild by PASS

PASS, Professional Audio System Services, is a new company founded in 1986 by Steve Butterworth to specialise in the design and customisation of quality recording consoles.

Butterworth, previously a project leader with Neve, has just completed his first rebuild and customisation, a Neve *80* series console for a client in the US.

The work included the complete stripping and rebuilding of the frame and all modules. The original 32-track mixdown section has been fitted with new modules with dual automated switchable inputs to each channel, which, with the Neve *1081* equalisers, gives a total of 104 inputs.

The original sound has been retained by re-using the original Neve amplifiers and technology as building blocks for the design of the audio paths, and all monitoring, metering and solo functions have been redesigned.

Professional Audio System Services, 9 Fisher Close, Haverhill, Suffolk CB9 0LZ, UK. Tel: 0440 706752.

Agencies

• HHB Communications have been appointed **Solid State Logic**'s first ever independent distributor in the UK but only for the broadcast versions of the *SL5000* series; they're also now distributors of **Soundcraft** broadcast consoles and have become main distributors for **Eventide** products. HHB Communications, London NW10 6QU, UK. Tel: 01-960 2144. Fax: 01-960 1160.

• Cue Systems have been appointed the UK distributor of the complete range of **Klein & Steck Technology Line** loudspeakers. Cue Systems, London N16 7UT, UK. Tel: 01-249 7294. Fax: 01-249 6915.

• **FM Acoustics** have named Firma Killerman-Riedel as their new German distributors. Firma Killerman-Riedel, In der Reuth 163, 8520 Erlangen, West Germany.

• Hayden Pro-Audio are the UK distributors for the **Syrinx** *USM 09-2* digital automation system. Hayden Pro-Audio, Chalfont St Peter, Bucks SL9 9UG, UK. Tel: 0753 888447.

• Michael Stevens & Partners have been appointed UK distributors for **np Elektroakustik AS** of Denmark. Michael Stevens & Partners, Kent BR2 9NT, UK. Tel: 01-460 7299.

• **Data Conversion Systems** (DCS) have appointed Syco Systems and Stirling Audio as the UK distributors of the *DCS 900 A/D* converter. Syco Systems. Tel: 01-625 6070. Stirling Audio. Tel: 01-623 4515.

• Beyer Dynamic have been appointed as a UK distributor for **Anner** pre-made cables. Beyer Dynamic. Tel: 0273 479 411.

• First Audio have appointed Britannia Row Sales as main UK distributors of **Crest Audio**'s range of professional power amplification products. Britannia Row Sales. Tel: 01-226 3377.

• Autograph Sales have become exclusive UK distributors of French-built **SAJE** consoles. Autograph Sales. Tel: 01-485 3749.

People

• **HHB Communications** have expanded their broadcast systems division with the appointments of Sean Meehan, formerly with the BBC, and Brian Binding formerly at BBC Radio Capital projects.

• **Bose** UK have appointed Colin Cartwright as their new general manager. Cartwright was formerly the sales and marketing director of Cimex International.

• **Video Village**, Bristol, UK, a TV post-production company have appointed Steven Stockford to be responsible for sound dubbing.

• **Agfa** have appointed Dr Klaus Gerlach as new chairman of the board for Agfa-Gevaert, its UK subsidiary.

• **Marcus Recording Studios**, London, UK, have appointed Nicola O'Leary as their new studio manager, O'Leary comes from Jacobs Studios.

• UK PA company **Martin Audio** have appointed Rob Peck as marketing manager. Peck comes from Audio and Lighting manufacturer Icelectrics.

• **DDA**, Hounslow, UK, have appointed Roger Patel to spearhead the company's customer support group.

Contracts

• Abbey Road Studios have ordered a pair of **Quested** *Q312B* monitors for their Studio Two.

• Odyssey Studios, London have had HHB Communications supply and install a **Soundcraft** *SAC200* desk, Sony ¼ inch, DAT and *F1* machines, and Sonifex record/replay cart machines, into their new Operations Centre.

• Recent **Hill Audio** sales include two *Concept* series consoles to a radio station and a live venue in Australia; a *DX3000* power amplifier to Tape One Studios in London, two *Multimix* rackmount consoles to Signal Radio in Stoke and The Duke Theatre in Lancaster, UK.

• Engineer Renate John has had a **Neotek** *Elite* console-based package supplied by Music Lab Sales.

• **Amek** have installed an *APC1000* assignable production console at Manta Sound in Toronto and a *Classic* 32/8/2/2 configured console at the Nihon Kogakuin Technical School in Nihon, Japan.

• UK Hire company Wigwam Acoustics have recently used a **Nexo** *S1200* cabinet system for the Pixies US tour and have also used Nexo equipment for overflow systems on the recent Billy Graham UK tour.

• **AMS** have supplied the Norwegian Broadcasting Corporation with a 48-channel, 48-fader Virtual Console System.

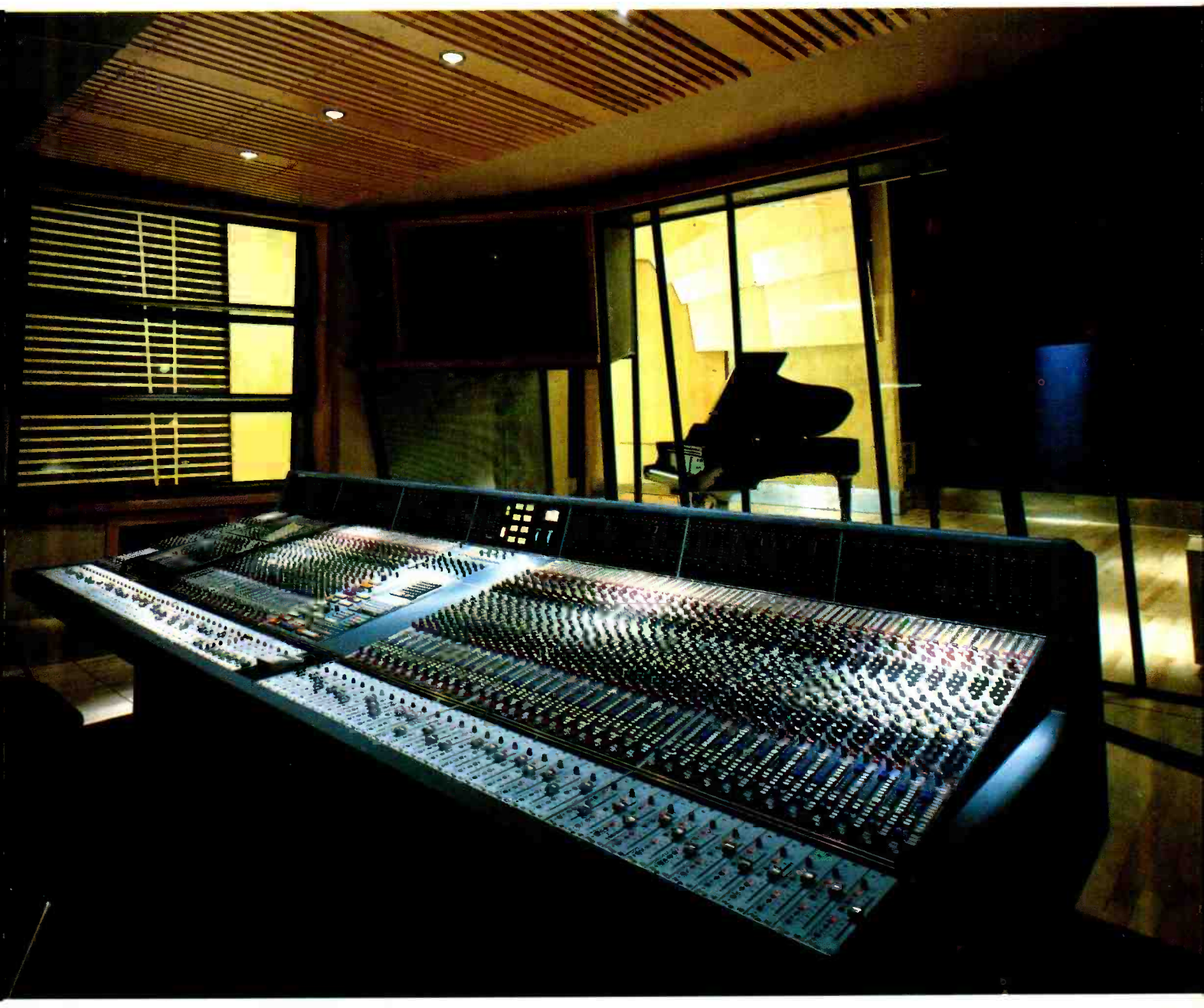
• Recent **Lexicon** *Opus* digital audio production system sales include Radio Canada, the French programming arm of CBC; Audio Recording Unlimited in Chicago, US; the General Television network in Detroit, US; Studio Marko in Montreal, Canada; and the new Advision mobile in London, UK.

• Anglia TV, UK, have chosen **Audio Kinetics'** *ESbus* as part of an upgrade of its post-production facilities.

• Berwick Street Studios have bought a DDA *D* series console for their new programming suite.

• Two **Soundcraft** *SAC 2000* on-air radio consoles have been bought by Ireland's newest radio station, Atlantic 252, due to start transmitting in the Autumn.

M E T R O P O L I S



The Neve VR Console with Flying Fader Automation in Studio A Metropolis London

Neve
A Siemens Company

NEVE ELECTRONICS INTERNATIONAL CAMBRIDGE HOUSE, MELBOURNE, ROYSTON, HERTS. SG8 6AU. TEL: 0763-60776. FAX: 0763-61886. TELEX: 81381.

DAT. We think you should seri

We've made the Sony DTC 1000ES the industry standard, but we're committed to offering choice. The world's most extensive selection of DAT equipment, from the only serious DAT manufacturers – Sony and Panasonic/Technics.

Take portable DAT recorders. We now stock four different models, including Sony's TCD-D10 and the new TCD-D10 'Pro'. Another newcomer is the Technics SV 260A, which combines excellent professional features with the best-sounding recording quality we've yet heard from a DAT portable. While our range of studio recorders has been augmented by the new Technics SV 360, the Sony DTC 1000ES, modified by HHB to record at 44.1kHz as well as 48 kHz, needs little introduction.

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,

HHB COMMUNICATIONS LIMITED, 73-75 SCRUBS LANE, LONDON NW10 6QU PHONE 01-960 2144 TELEX 923393

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HHB's knowledge of digital recording is legendary. So is the company's advice and service support. And while we back the best names in DAT technology, we also support our DAT range with Europe's largest selection of accessories. That means a full choice of DAT tapes, tape storage units, head-cleaning tapes, batteries, power supplies and stereo microphones, as well as 19" racks of our own design.

In fact, there's so much to show you in our stunning new demonstration facility, we couldn't possibly fit it into this ad. That's why we've published a new edition of our Digital Audio Times, containing full details and specification data. So send for your copy of HHB's definitive DAT bible now, or phone us on 01-960 2144.

For your copy of 'Digital Audio Times' post this coupon to the addresss at the bottom of this ad.

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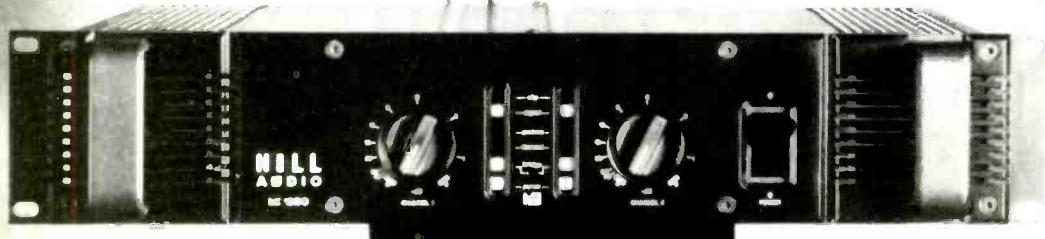
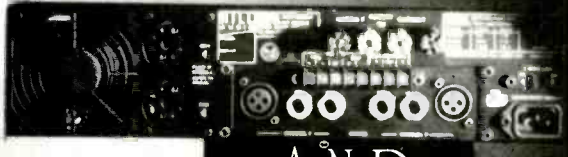
HILL AUDIO

LC SERIES POWER AMPLIFIERS



THE BEAUTY



AND THE BEAST

Hill Audio Ltd.,
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Telephone: (062 780) 555
Telex: 966641 HILL
Fax: (062 780) 550.

Hill Audio Inc.,
5002B N. Royal Atlanta Dr.
Tucker,
GA 30084 USA.
Telephone: (404) 934 1851
Telex: 293827 HLAD
Fax: (404) 934 1840.

HILL AUDIO

A range of six 2U Amplifiers from 200w mono to 800w per channel stereo

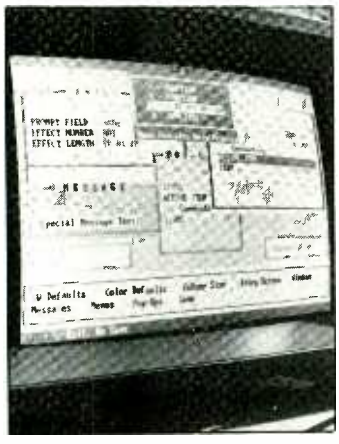
Leonardo Librarian

Leonardo Software have announced a new version of the *Professional Librarian* cataloguing program for sound effects and music libraries. The system has been restructured from a single all-in-one design to a modular system that allows easier user-upgrade for required features.

The new Advanced Features Module provides an auto-assigning category system that creates on-screen and printed catalogues, provides specialised data entry and cross referencing functions for broadcast tapes, digital tapes and samples. The Sound Supervisor Module helps create edit decision lists used in film or video work by linking the *Professional Librarian* library database with lists referenced to reel, scene, footage or timecode.

An interface to the Sony *CDK-006* CD jukebox links the program with CD libraries on the jukebox to provide automatic search and playback of sound effects or music with the ability to link up to 16 jukeboxes to the computer. There is also a Local Area Network Option that enables multiple users to access a central library

Leonardo Software, 10378 Holman Avenue, Los Angeles, CA 90024, USA. Tel: (213) 277-5161.



ERIC Level 2 automation

Soundtracs are now in production with Level 2 automation for the *ERIC* console. Known as *ERIC2* it may be fitted to any *ERIC* console and allows recording of all console recalls, set-ups and mutes against timecode. The system also reads and generates all forms of timecode with recording of events down to half frame accuracy. The system has been designed with a wide range of users in mind—all recorded console data can be recorded and updated in realtime or steptime. It is also possible to enter cues on the fly for later editing.

The display screen is compact with a wide viewing angle using windows, function buttons and a moving mix display. Disk operations can be performed automatically so that mixes may be saved to disk after each pass without any automation request.

A further enhancement of *ERIC2* will provide remote control of multitrack and master machines, automatic drop-in and generation of MIDI clock. It is also equipped to accept what Soundtracs call the Level 3 fader automation package.

Soundtracs plc, 91 Ewell Road, Surbiton, Surrey KT6 6AH, UK. Tel: 01-399 3392.

USA: Samson Products Corp, 124 Fulton Avenue, Hempstead, NY 11550. Tel: (516) 489-2203.

gtc Digiton and Edicom II

gtc have introduced the *Digiton* realtime sound editing and recording system and the *Edicom II* computer-controlled ADR system.

The *Digiton* is a hard disk recording system with a total capacity of eight disks for 16 tracks. The disk itself is interchangeable, meaning that a recording suite need only have the appropriate disk. Its main application is in the assembly and editing of dialogue tracks for film and television and it has the ability to compress or expand words or passages to synchronise with the images. It will follow timecode signals from video or film sources without any delay and the speed of the unit will be realised when transferring the film/video to video disc.

The control unit for the *Digiton* provides quick and easy access to the record and edit functions of the audio together with full remote controls for a video recorder.

The *Edicom II* is designed to work with the *Digiton* as well as with ATRs/VTRs and is a development of the *Edicom I*. The unit consists of a *Taker* mode in order to generate a take list with full systems management and a Dubbing mode with full control of two VTRs for automatic looping.

Other features of the Dubbing mode include control of up to eight synchronisers for ATRs, built-in video sync pulse generator with computer-controlled switcher for video and audio from the VTRs and automatic look-ahead cueing for the second VTR.

gtc Studiotechnic GmbH, Nordendstrasse 3, 8000 Munchen 40, West Germany. Tel: 89 278.04.04. Fax: 89 272.44.78.

Export: gtc Export AG, Rabbentalstrasse 83, 3015 Bern 5, Switzerland. Tel: 31 41.27.11. Fax: 31 42.26.08.

UK: gtc Ltd, Unit 40, Sheraton Business Centre, 26-28 Wadsworth Road, Perivale, Middlesex UB6 7JD. Tel: 01-991 9152. Fax: 01-991 9391.

For.A audio mixer

For.A have added an audio for video mixer designed for post-production work. The *AFV-500* allows for key frame programming of audio mixes as well as external control from a computerised video editing system. Programming of the *AFV-500* is accomplished via the Machine Bus Memory System, which has the capacity to learn 90 machine configurations with all inputs on the bus having their set-up stored including all source assignments, levels, equaliser and pan settings. Transitions between settings are programmable at video frame rates of between 0 and 999 frames with independent control of each channel.

In audio terms, the console has eight balanced mono inputs that can be assigned to one of two ouput channels. The console is under microprocessor control, which also communicates with a video editing system and an external computer for off-line storage. There is also an optional equaliser board that provides five bands of graphic EQ with high and low cut filters on each of the inputs. The control surface is designed to be familiar to video users and the system can interface with a number of production switchers.

For.A Company Ltd, 3-2-5 Nishi Shinjuku, Shinjuku, J-160 Tokyo, Japan. Tel: (0425) 46 49 74.

UK: Cameron Video Systems, Station House, 4-8 High Street, West Drayton, Middx UB7 7DJ. Tel: 0895 446661.

USA: For.A Corporation of America, Nonantum Office Park, 320 Nevada Street, Newton, MA 02160. Tel: (617) 244-3223.

Audio Kinetics MasterMix II

Audio Kinetics have recently announced a development from the original *MasterMix* console automation system. *MasterMix II* integrates the most important feature of the original version and the more recent *Reflex* automation system—both of which can be upgraded to *MasterMix II*.

The system combines the *Reflex MX844* mix computer and colour monitor with the *AK2* VCA fader unit from *MasterMix* offering a combination of control from the console and the terminal. AK say that the use of the *Reflex* computing functions increase the ease and speed of use of *MasterMix*.

Audio Kinetics Ltd, Kinetic Centre, Theobald Street, Borehamwood, Herts WD6 4PJ, UK. Tel: 01-953 8118.

USA: Westlake Audio, 7265 Santa Monica Boulevard, Los Angeles, CA 90046. Tel: (213) 851-9800.

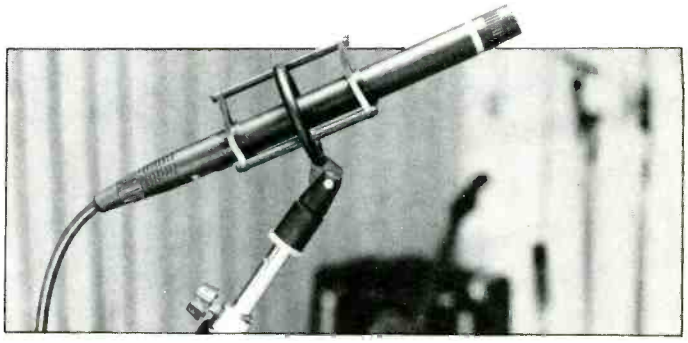
Studiomaster MIDI analyser

Studiomaster have just introduced a MIDI analyser that shows details of MIDI information being transmitted. The *MA36* is a 36-function analyser that is connected to the end of a MIDI cable of in-line in the cable and a LED display will indicate what information is being sent and what MIDI channel it is on. There is also an error sensing indicator.

Studiomaster are quoting a price that is very competitive.

Studiomaster (UK) plc, Studiomaster House, Chaul End Lane, Luton, Beds LU4 8EZ, UK. Tel: 0582 570370.

USA: Studiomaster Inc, 1340-G Dynamics Street, Anaheim, CA 92806. Tel: (714) 524-2227. Fax: (714) 524-5096.



B&K 4012 cardioid

Bruel & Kjaer have added a new cardioid pattern mic to their range. The type *4012* is described as a logical progression from the *4011* and offers an even higher cardioid specification. As with the *4011* it is a pre-polarised condenser and is powered from the *2812* power supply supplying 130 V to the *4012* enabling a peak SPL handling of 168 dB before clipping. The on-axis response at 30 cm is ±2 dB from 40 Hz to 20 kHz and an off-axis response described as smooth. The mic is finished in anodised matt black and supplied with a windscreen of 'measurement microphone quality' and a new type of mic clip designed with acoustic and ergonomic considerations.

Bruel & Kjaer A/S, DK-2850 Naerum, Denmark. Tel: 02 80.05.00.

UK: Bruel & Kjaer (UK) Ltd, Harrow Weald Lodge, 92 Uxbridge Road, Harrow, Middx HA3 6BZ. Tel: 01-954 2366. Fax: 01-954 9504.

USA: Bruel & Kjaer Instruments Inc, 185 Forest Street, Marlborough, MA 01752. Tel: (617) 481-7000.

IMS Dyaxis enhancements

IMS have been demonstrating new hardware and software for the *Dyaxis*. *MacMix 2.0* software offers faster and improved digital mixing capabilities, timecode slaving and realtime offset control, scrub editing and custom keyboard macros for dialogue editing. On the hardware side, IMS have developed an interface that allows *Dyaxis* to be slaved to an Abekas *A60* series digital video disc system and to be controlled from the master Abekas controller and trackball.

Further enhancements are planned including Ampex *VPR-3* interface protocols to allow the *Dyaxis* to be controlled from conventional video editors. There is also a Motorola *56000*-based DSP card under development and the announcement that *Dyaxis* will be able to offer up to eight simultaneous digital or analogue outputs later in the year.

Integrated Media Systems, 1370 Willow Road, Menlo Park, CA 94025, USA. Tel: (415) 326-7030.
UK: The Home Service, Unit 2, 12 William Road, London NW1 3EN. Tel: 01-387 1262. Fax: 01-388 0339.

QSC MX700 power amplifier

QSC Audio Products have added a new model to their range of power amplifiers. The *MX700* is a fan cooled design on 2U rack space and power ratings are 150 W/channel into 8 Ω, 225 W/channel into 4 Ω and 350 W/channel into 2 Ω. Inputs are electronically-balanced jacks and barrier strip input connectors. Outputs are 5-way binding post speaker connectors. Front panel features include gain controls, clip indicators and power on/off.

The design provides circuit protection for open circuit, short circuit and mismatched loads. All protection systems automatically re-set as soon as safe operation is assured.

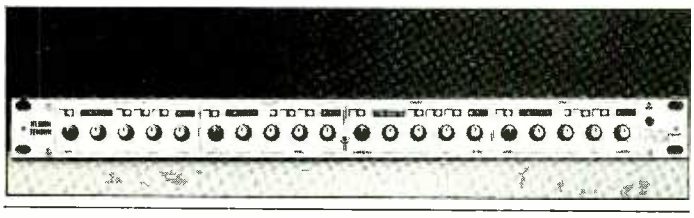
QSC Audio Products, 1926 Placentia Avenue, Costa Mesa, CA 92627, USA. Tel: (714) 645-2540.
UK: Music Lab Sales, 72-74 Eversholt Street, London NW1 1BY. Tel: 01-388 5392.

Klark-Teknik compressor

Klark-Teknik have recently added the *DN504* 4-channel compressor/limiter to their range of signal processors. This is a 1U 19 inch rackmount unit offering threshold, ratio, attack, release and output level for each channel. There is also the ability to switch the compressor between hard/soft knee operation on each channel as well as an auto/manual switch that selects between an auto-mode or full manual operation. There is the ability to link the channels as two stereo pairs. LED metering of gain reduction and output is included on each channel. Noise figures of less than −94 dBm 20 Hz to 20 kHz unweighted are quoted by K-T.

Klark-Teknik Research Ltd, Klark Industrial Park, Walter Nash Road, Kidderminster, Worcs DY11 7HJ, UK. Tel: 0562 741515. Fax: 0562 745371.

USA: Klark Teknik Electronics Inc, 30B Banfi Plaza North, Farmingdale, NY 11735. Tel: (516) 249-3660. Fax: (516) 420-1863.



3M DAT

3M have announced a new professional DAT cassette. The packaging is larger and more robust than the consumer jewel box design and also makes handling in the pro environment easier as well giving more room for professional labelling. The casing is a modified 3M Betacam box with a standard DAT case inside. The cassettes come in playing times of 120, 90, 60 or 46 minutes and are fitted as standard with an anti-static leader.

3M Corp, 3M Centre, Bldg 223-5N-01, St Paul, MN 55144, USA. Tel: (612) 733-7732. Fax: (612) 736-1246.

UK: 3M United Kingdom plc, 3M House, PO Box 1, Bracknell, Berks RG12 1JU. Tel: 0344 426726.

SSL Logic FX

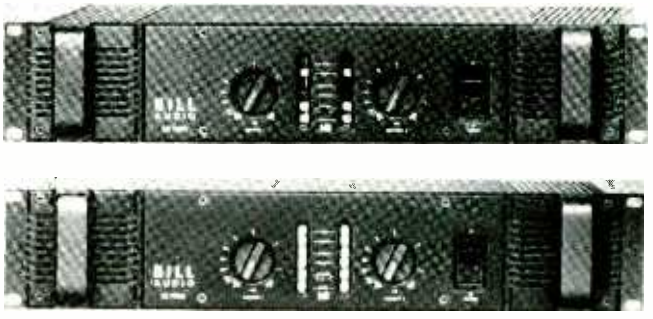
Solid State Logic have launched a range of standalone processors based on the *G* Series electronics under the name of Logic FX. The first two units introduced are 1U 19 inch rackmount designs: the *G383* dual mic amplifier and equaliser; and the *G384* quad stereo compressor.

The *G383* mic amp/equaliser contains two identical mic amp/EQ sections with transformerless balanced inputs and variable input impedance control over the range of 600 Ω to 8.5 kΩ. Gain is variable from +6 to 72 dB with other features including 48 V phantom power, phase reverse, insert points and LED level display. The EQ section is 4-band parametric with switchable variable highpass filter.

The *G384* compressor is available in quad or stereo (upgradable to quad) versions with both having external side chain input switching and autofade VCA control with a range of one to 60 seconds. There are variable controls for ratio, attack, release, threshold and gain make-up.

Solid State Logic, Begbroke, Oxford OX5 1RU, UK. Tel: 0865 842300. Fax: 0865 842118.

USA: SSL, New York. Tel: (212) 315-1111; SSL Los Angeles. Tel: (213) 463-4444.



Hill Audio new amps

Hill Audio have launched two series of power amplifiers. The *LC* series is a range of stereo power amplifiers designed to replace the *OO* series and consists of four models. There are four models offering between 200 and 800 W RMS/channel. All are 2U high and incorporate the latest design version of what Hill refer to as 'Super A' sliding bias design of bi-polar circuitry. All the amplifiers are modular in construction to aid servicing and employ a logic-controlled 5-way protection system. This enables the amplifier to withstand any fault condition in ancillary equipment or leads as well protecting the speaker against amplifier fault. Remote muting is standard with options available including VCA attenuation, plug-in transformer input balancing and crossovers, and limiter boards.

The second series of power amps is the *ML* range of two amps rated at 200 and 400 W. These are mono amps and have the ability to run into conventional 4/8 Ω loads and 50 and 100 V line systems. Their main intended area of use is the installation market.

On the console side, Hill have updated the *Concept*. This now incorporates a sweep EQ as an option to the Sidetracker fixed band EQ, a new black cosmetic design and the option of built-in bantam patch bays. All the other consoles have been also updated cosmetically.

Hill Audio Ltd, Hollingbourne House, Hollingbourne, Kent ME17 1QJ, UK. Tel: 062780 555.

USA: Hill Audio Inc, 5002B N Royal Atlanta, Dr Tucker, GA 30084. Tel: (404) 934-1851.

DAR SoundStation II new features

Digital Audio Research have recently announced new features for *SoundStation II* digital audio editing, recording and production system. *SoundStation* can now run a full 8-channel format in addition to the 2- and 4-channel formats already available. There is an optical disk sub-system for the back up of audio and edit-decision data writing to 800 Mbyte WORMS with a 60 minutes stereo cabability. On-line editing, playback and archiving are also possible applications with the WORM drive.

Software updates include the implementation of Timewarp, giving the power to shorten or lengthen audio segments without alteration of pitch; Reels which allows edited programme of up to eight channels to be saved as Project Reels, which may be recalled or saved instantly at different stages of production enabling easy comparisons of different versions; and Find, a command enabling swift location of a specific piece or category of audio from the *SoundStation*.

Digital Audio Research have produced a 15-minute demonstration video showing examples of editing and post-production routines and this will be made available to potential customers.

Digital Audio Research, 2 Silverglade Business Park, Leatherhead Road, Chessington, Surrey KT9 2QL, UK. Tel: 03727 42848. Fax: 03727 43532.

USA: Digital Audio Research, 6363 Sunset Boulevard, Suite 802, Hollywood, CA 90028. Tel: (213) 466-9151. Fax: (213) 466-8973.

G

D A T A B A S E

F I L E

GENELEC

S Y S T E M : 1 0 3 5 A

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S T A T E M E N T : O L Y M P I C S T U D I O S

"We tried these out for four weeks and the response from our customers was so encouraging, we bought three pairs."

D I S T R I B U T I O N

SSE MARKETING
UNIT 2
10 WILLIAM ROAD
LONDON NW1 3EN
TEL 01-387 1262

BEAT FACTORY

A London 24-track studio is visited by Caroline Moss

Richard Ashley (left) with Graeme Holdaway

The Euston Road is not considered to be one of London's quieter districts. Three lanes of traffic roar past in both directions and deep below the ground five underground train lines converge. Yet tucked away behind the Shaw Theatre is a 24-track studio called the Beat Factory. Situated in a mews and accessed by a small leafy courtyard, once inside the studio the noise and turmoil of the neighbourhood is replaced by the enthusiastic buzz of a productive environment.

The Beat Factory has been running as a successful commercial studio since 1984 but had it not been for a property deal that fell through at the last moment it would not have come to exist in its present form at all.

In 1984 Graeme Holdaway decided to buy Decibel Studios in Stoke Newington, of which he was manager. Holdaway had started out as tape op at Decibel, quickly becoming involved with the multifarious aspects of working in and running a studio, before embarking on a two-year stint as a freelance sound engineer both in live and studio situations. He returned to Decibel, this time as studio manager and chief engineer but before long, decided that in order to be running the studio as he wanted, he would have to buy it.

"I had decided to buy the place myself so that I could run it on a more business-like footing. When you are in the situation of managing a studio you have to be free to make your own decisions as to how to run the place, attract clients and above all to make improvements—one of the problems was that the existing owner didn't want to spend money in that direction. I actually lost the studio the day before the deal was set to go through—I'd taken out a mortgage and I was gazumped. In the meantime I'd set up the company, I'd got all the backing together and the plans were drawn up to actually revamp the place, so I basically had a business project, which was looking for an outlet. In a way it all happened for the best because I started looking for premises all over North London before eventually finding this place, which is very central. So in a way the initial setback made it much more likely that I would succeed."

An 8-track studio called Phoenix had existed on the premises but by the time Holdaway and his partner Marijke Bergkamp came to view it all that remained were concrete floors and ceilings—everything had been ripped out, including all plumbing and electrical facilities.

Holdaway: "In a way it was ideal for setting up a studio because we'd planned where the partitions would go, how the control room would be and so on. We were on a limited budget to build a studio—we could afford materials and consultancies to actually advise us in the areas in which we lacked knowledge ▷

In an age of disk and digital, why buy analogue?

We know there are some applications where our 32-channel digital machine, the DTR-900, is the only answer. But if your business is such that you can do anything you want to do in the analogue domain, and at the same time do less damage to your budget, then our brand new analogue 24-channel MTR-100A may be the perfect machine for you.

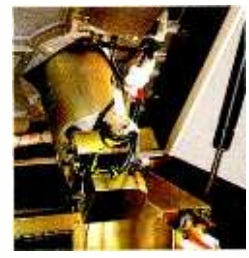
When you consider that the MTR-100A will literally *change forever* the way engineers interface with audio machines, and

The MTR-100's auto-alignment saves you hours of time by eliminating constant tweaking and re-tweaking between sessions.

that this new way will save you hours spent in non-productive time, the analogue choice begins to make even more sense. You see the MTR-100A features full Auto-Alignment that allows total recalibration of the record and reproduce electronics. This means you can compensate for different tapes in a *fraction* of the time that it previously took, and your studio is not bogged down with constant tweaking and re-tweaking between sessions.

And if you think only digital machines feature high performance transports, think again! The MTR-100A's new transport incorporates reel motors that approach one horsepower – you'll get fast wind speeds of up to 474 inches per second! Of course, the transport is pinchrollerless to give you the legendary tape handling and ballistics of our MTR-90.

What's more, with its optional EC-103 chase synchroniser, the MTR-100A maintains frame-lock in forward and reverse from 0.2X to 2.5X play speed and will typically park with zero frame error.



Reel motors that approach one horsepower are driven by pulse width modulation amplifiers to tape speeds up to 474 ips.

Then, there's the sound. New cylindrical-contour heads built by Otari especially for the MTR-100A result in remarkably low crosstalk and outstanding low-frequency performance. Pre-amps are located directly beneath the heads to further improve frequency response, and HX-Pro™ is built-in for enhanced high frequency headroom. (An optional internal noise reduction package houses Dolby™ SR/A.) Add all these features to gapless, seamless, punch-in, punch-out, which is also built in, and your MTR-100A's sonic performance will rival any digital machine in the world.

So there you have it. With these powerful benefits available in analogue, does it make sense to go digital? Certainly, for some applications, a top analogue tape machine like the MTR-100A is the right choice.

And because we can see both sides of the question, ask us. We have the information that can help you make the right decision. Call Otari (U.K.) Limited on Slough (0753) 822381, or Fax us on (0753) 823707 or call U.K. Main Dealers, Stirling Audio Systems on 01-624 6000.

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Otari (UK) Limited, 22 Church Street, Slough, Berkshire SL1 1PT.

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Dollar-per-watt-per-pound-per-rack-space it's a killer. This one amp can drive an entire stereo 100/300 watt bi-amp speaker system. It can drive six passive monitor wedges with separate programs. Or two tri-amped side-fills. Or six separate background music zones. No matter how your sound system requirements change, the flexible MA 6 is an investment that never becomes obsolete.

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◁ but basically we had to do most of the work ourselves."

Friends were enlisted to help with the building work, not least Peter Henson, an industrial acoustician who had previously worked on concert halls and conference centres and whose expertise resulted in a well soundproofed studio.

When the building work was complete the studio was equipped with an Alectron console, custom built by ex-Soundcraft designer Alex Alexandrou; a 24-track Lyrec and four effects units, and the Beat Factory commenced trading.

Holdaway: "In the early days it was down to my knowledge of how to get the best out of the limited equipment that kept us going. Each client that worked here always seemed to come back and we managed to survive. We handled a wide range of projects without specialising in any one area and began the slow process of building up the studio, adding another effects unit or a keyboard."

For the first year an arrangement was entered into with a keyboard programmer who set up his banks of effects and keyboards—most of them pre-MIDI—in a small room that became affectionately known as the Brain Room. When the deal ended after a year they had built up enough equipment to offer their own sequencing package.

At first the job of in-house sound engineer fell to Holdaway but at the beginning of this year Richard Ashley, a long-standing client and acquaintance, was employed to assist him, working both on his own projects and collaborating with Holdaway on others. They both have specialist areas, with Ashley responsible for programming and Holdaway concentrating on 'live' sound.

Holdaway: "We complement each other really well on the engineering side. We're also looking for projects the whole time and are listed as producers so we get an endless stream of cassettes coming in. We're always open to anyone who shows an interest in the studio or what we're doing, and can always make time to invite them around."

Taking care of the business side of the organisation is Marijke Bergkamp, who had previously worked for the video division of a large publishing company before teaming up with Holdaway. They are united in their opinion that although running a small organisation is quite often a high-risk concern, both the time saved in making decisions and the flexibility of being able to move with current trends form the backbone of the philosophy behind the studio.

Setting up any new business project from scratch and making it succeed requires much hard work and determination, and somebody who appreciates this is Graham Blyth, one of the founder members of Soundcraft Electronics, now technical director responsible for a large amount of console design at the company. In August of 1988 he joined Holdaway and Bergkamp as co-director of the Beat Factory, replacing their original partners who no longer had a day-to-day involvement with the studio.

Blyth: "I liked what Graeme and Marijke were doing at the studio, they were on the verge of upgrading and I was very interested in getting involved."

As part of Blyth's investment and with the enthusiastic approval of Holdaway and Bergkamp, a 44-input Soundcraft *TS12* console and a *Saturn* 24-track tape machine were installed, the studio underwent refurbishment and the result was, according to Blyth: "A nice studio with good sound and a very friendly environment. The whole situation is very interesting for me, both due to the fact that I'm a musician and because of my involvement with Soundcraft. I find the place very representative of what Soundcraft is all about."

Blyth plans to use the studio in the future to experiment with his new designs and ideas in a working environment. He approves wholeheartedly of the plans to move the studio into production and not to rely solely on commercial clients.

Like any wise owners of recent times, Holdaway and Bergkamp have set up a production company called the Music Method, which works with the various protéges of both Holdaway and Richard Ashley.

Holdaway: "We've been working with one artist for a year and a half, taking him through from being a single artist working with all the MIDI gear, to concentrating on songwriting. Now he's formed a band and we're doing an independently-financed album, which we're hoping to get an independent deal with."

Bergkamp: "As a studio we're in a powerful position in that we can create a finished product, which not a lot of people can do, but this does mean that we have to put in all the development work that a record company, publishing company and management company might do, as well as handling the production side. However if you have a really good product at the end of it, it's all worthwhile. It seems to be the way the music industry is going, people getting their own projects together by hook or by crook."

What do they think has contributed to the recent influx of young bands financing their own talent? Holdaway: "Major record companies currently aren't spending any money on development. They either spend £150,000 on one artist or they don't spend any money at all, especially not on something like giving a small band £5,000 to do some demos. Independents like us who have a belief in the product are doing the work that the major record companies should be doing, because they're not investing at all."

It has become apparent that the amount of self-financed projects by enthusiastic and talented musicians not only keeps the studio in work but also creates an air of excitement and creativity throughout the place. Bergkamp: "There's such a buzz about at the moment among the independent people we're doing sessions with. It's very exciting to see people who are getting an album together on a budget of £2,000—they're committed to their work and they'll sell it. At the moment the atmosphere here is inspiring—people are leaving from the daytime session as the night session arrives. Just recently we had three solid days where we were doing three sessions in a 24-hour period."

Although business is flourishing healthily at the Beat Factory, plans for the future abound in the pipeline. Expansion would seem an inevitability but they are unequivocal about which direction they will choose to go. Bergkamp: "We don't want to expand into a massive studio complex. Many people seem to think that's the way to go but I'd like to see our expansion going in a creative direction. That's certainly why I've freed myself up more with the employment of a receptionist to handle the administration, so I can concentrate on the projects. One of our ideas for the future is to team up with a small promotional company who could go out and promote the product we get together. We have a few people lined up that we are starting to work with and it's very exciting. People who promote dance music are out and about in the clubs every night and know exactly what the current trend is, but by the time they've gone through the major record companies it's too late. By having a direct line into somewhere like us they can produce the music and get it on to vinyl very quickly."

Holdaway: "And seeing as we are taking on most of the responsibilities and tasks that are associated with record companies, it would seem sensible that one of the things we should aspire to is running our own record label."

Situated in a small mews behind the Euston Road, physical expansion of the Beat Factory would not appear to be an easy option. But by limiting themselves to just one studio and keeping new ideas and inspiration alive, it seems as if expansion into progressive fields of activity will mark tangible progress for Holdaway, Bergkamp and everyone else involved.

The Beat Factory, 1 Christopher Place, Chalton Street, London NW1 1JF, UK. Tel: 01-388 7826.

POWER AMPLIFIERS

We have updated our list of amplifier manufacturers and agents, together with a brief description of their products, from information available to us at the time of writing

Adastra

Adastra Electronics Ltd, Hille Estate, 134 St Albans Road, Watford, Herts WD2 4AL, UK. Tel: 0923 248888/9. Fax: 0923 54607.
A80: 600 W/ch, 8 Ω; 950 W/ch, 4 Ω; 1500 W/ch, 2 Ω; 1220 W bridged, 8 Ω; 2000 W bridged, 4 Ω.

Altec Lansing

Altec Lansing Corp, PO Box 26105, Oklahoma City, OK 73126-0105, USA. Tel: (405) 324-5311.
UK: UK Sound, London. Tel: 01-871 0966.
9442A: 100 W/ch, 8 Ω.
9444A: 200 W/ch, 8 Ω.
1707B: mixer power amp, 75 W, 6 inputs.
1715B: mixer power amp, 150 W, 6 inputs.
1407A: 75 W mono slave amp.
1415A: 150 W mono slave amp.

AMR

Audio Media Research, PO Box 1230, Meridian, MS 39301, USA. Tel: (601) 483-5372.
PMA-200: 100 W/ch, 8 Ω.
PMA-70+: 35 W/ch, 8 Ω. Half rack width.

ARSonic

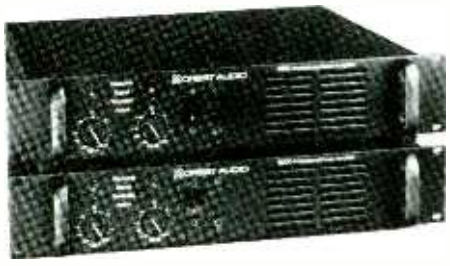
ARSonic, Nurnbergerstrasse 28, Postfach 100118, D-8580 Beyreuth BRD, West Germany. Tel: 0921 57711.
UK: Radius, Basingstoke. Tel: 0256 577222.
USA: ARSonic US, PA. Tel: (215) 647-9426.
Sigma 8.2: 110 W/ch, 4 Ω.

Australian Monitors

Australian Monitors, 53 College Street, Gladesville 2111, NSW, Australia. Tel: (61) 2 816-3544. Fax: (61) 2 817-4303.
USA: Australian Monitors, c/o Grafton Sound USA. Tel: (213) 306-0759.
AM 1600: 1600 W/ch, 4 Ω; 2200 W/ch, 2 Ω; 2200 W bridged, 4 Ω; 1600 W bridged, 8 Ω.
AM900: 900 W/ch, 4 Ω; 1400 W/ch, 2 Ω; 1400 W bridged, 4 Ω; 1000 W bridged, 8 Ω.

BGW

BGW Systems Inc, 13130 S Yukon Avenue, Hawthorne, CA 909250, USA. Tel: (213) 973-8090.
250D & E: 100 W/ch, 8 Ω; 300 W bridged, 8 Ω. Difference between models in metering.
750D & E: 250 W/ch, 8 Ω; 800 W bridged, 8 Ω.
750F & G: As above with uprated output.
GTA: 600 W/ch, 4 Ω; 1800 W bridged, 4 Ω.
GTB: 275 W/ch, 8 Ω; 400 W/ch, 4 Ω; 800 W one ch driving 2 Ω load.
620B: 200 W/ch, 8 Ω.
2125: single ch 100 W, 8 Ω.
7500: single ch 300 W, 4 Ω.
7500T: 300 W/ch, 4 Ω.
6500: single ch 100 W, 8 Ω.
85: 35 W/ch, 8 Ω; 90 W bridged, 8 Ω (broadcast).
150: 50 W/ch, 8 Ω; 150 W bridged, 8 Ω (broadcast).
SPA-1: amplifier system to power sub bass in sound reinforcement systems. Incorporates EQ crossover. 250 W/ch, 8 Ω; 1200 W bridged, 4 Ω.
SPA-3: 3-way amp system with crossover and EQ. 250 W/ch, 8 Ω; 1200 W bridged, 4 Ω.



Crest Audio 4801 and 6001

Boulder

Boulder Amplifiers, 3101 3rd Street, Boulder, CO 80302, USA. Tel: (303) 449-8220.
UK: Syco Systems. Tel: 01-674 6070.
500: 150 W/ch, 8 Ω; 250 W/ch, 4 Ω; 500 W bridged, 8 Ω.

BSS

BSS Ltd, Unit 5, Merlin Centre, Acrewood Way, St Albans, Herts AL4 0YL, UK. Tel: 0727 45242. Fax: 0727 45277.
USA: EDC, NY. Tel: (212) 460-9940.
EPC-780: 100 W/ch, 4 Ω; 1500 W/ch, 2 Ω.

Bryston

Bryston Ltd, 57 Westmore Drive, Rexdale, Ontario, Canada M9V 3Y6. Tel: (416) 746-1800.
UK: Roksan Engineering Ltd, Powys, Wales. Tel: 0597 4911.
USA: Brystonvermont, VT. Tel: (802) 223-6159.
2B: 50 W/ch, 8 Ω; 200 W bridged, 8 Ω.
3B: 100 W/ch, 8 Ω; 400 W bridged, 8 Ω.
4B: 250 W/ch, 8 Ω; 800 W bridged, 8 Ω.
6B: single ch 500 W, 8 Ω; 800 W, 1 Ω.

Carlsbro

Carlsbro Electronics Ltd, Cross Drive, Kirkby-in-Ashfield, Notts NG17 7LD, UK. Tel: 0623 753902.
CP 250: 125 W/ch, 4 Ω; 250 W bridged, 4 Ω.
CP 600: 300 W/ch, 4 Ω; 600 W bridged, 4 Ω.
CP1000: 500 W/ch, 4 Ω; 1000 W bridged, 4 Ω.
SX300: 150 W/ch, 4 Ω.
SX600i: 300 W/ch, 4 Ω.

Carver

Carver Corp, PO Box 1237, Lynnwood, WA 98046, USA.
UK: HW International, London. Tel: 01-607 2717.
PM-1.5: 450 W/ch, 8 Ω; 1500 W bridged, 8 Ω.
PM-175: 175 W/ch, 8 Ω; 500 W bridged, 8 Ω.
PM-350: 350 W/ch, 8 Ω; 900 W bridged, 8 Ω.
PM-100: 100 W/ch, 8 Ω; 150 W/ch, 4 Ω.
PM2.Ot: 465 W/ch, 8 Ω; 600 W/ch, 4 Ω; 625 W bridged, 8 Ω.

C-Audio

C-Audio Ltd, Barnwell Road Business Park, Cambridge CB5 8UY, UK. Tel: 0223 211333. Fax: 0223 410446.
SR 808: 850 W/ch, 4 Ω; 1700 W bridged, 8 Ω.
SR 606: 600 W/ch, 4 Ω; 1200 W bridged, 8 Ω.
SR 404: 400 W/ch, 4 Ω; 800 W bridged, 8 Ω; 1100 W bridged, 4 Ω.

Citronic

Citronic Ltd, Halifax Road, Bowerhill, Melksham, Wilts SN12 6UB, UK. Tel: 0225 705600.
PPX 300: 100 W/ch, 8 Ω; 300 W bridged, 4 Ω.
PPX 450: 140 W/ch, 8 Ω; 450 W bridged, 4 Ω.
PPX 900: 280 W/ch, 8 Ω; 900 W bridged, 4 Ω.
PPX 1200: 400 W/ch, 8 Ω; 1200 W bridged, 4 Ω.
PPX 1600: 480 W/ch, 8 Ω; 1600 W bridged, 4 Ω.
PPX 150: 75 W/ch, 4 Ω.

Crest

Crest Audio, 150 Florence Avenue, Hawthorne, NJ 07506, USA. Tel: (201) 423-1300.
UK: First Audio, Brighton. Tel: 0273 693610; Britannia Row Sales, London. Tel: 01-266 1266.
8001: 750 W/ch, 8 Ω; 1200 W/ch, 4 Ω; 2400 W bridged, 8 Ω; 3000 W bridged, 4 Ω.
7001: 900 W/ch, 2 Ω; 715 W/ch, 4 Ω; 550 W/ch, 8 Ω; 1600 W bridged, 4 Ω; 1510 W bridged, 8 Ω.
P1001A: 85 W/ch, 4 Ω.
P1501A: 150 W/ch, 4 Ω.
P4801: 480 W/ch, 4 Ω; 600 W/ch, 2 Ω.
P6001: 600 W/ch, 4 Ω; 720 W/ch, 2 Ω.
P7001: 810 W/ch, 4 Ω.
P8001: 1225 W/ch, 4 Ω.
FA401: 125 W/ch.
FA601: 200 W/ch.
FA901: 300 W/ch, 4 Ω; 400 W/ch, 2 Ω.
FA1201: 450 W/ch, 4 Ω; 600 W/ch, 2 Ω.
FA2401: 600 W/ch, 4 Ω.
CC300: 550 W/ch, 4 Ω metered.
CC301: same as 300 without meter.
CV601: 600 W/ch, 70 V line output.

Crown/Amcron

Crown International Inc, 1718 West Mishawaka Road, Elkhart, IN 46517, USA. Tel: (219) 294-5571.
UK: HHB Communications, London. Tel: 01-960 2144; Shuttlesound, London. Tel: 01-871 0966.
D-75: 40 W/ch, 8 Ω.
D-150A series II: 96 W/ch, 8 Ω, 280 W bridged, 8 Ω.

DC-300A series II: 180 W/ch, 8 Ω; 600 W bridged, 8 Ω.
MT-600: 300 W/ch, 8 Ω; 510 W bridged, 8 Ω.
MA-600: as MT-600 but with XLRs, display and custom front panel.
MT1200: 600 W/ch, 8 Ω; 790 W bridged, 8 Ω.
MA-1200: as MT-1200 but with XLRs, display and custom front panel.
MA-2400: 800 W/ch, 4 Ω; 1600 W bridged, 8 Ω.
PSA-2X: 220 W/ch, 8 Ω; 1200 W bridged, 4 Ω.
DO2000: single ch 600 W, 8 Ω.

d&b audiotechnik

d&b audiotechnik, Steinstrasse 40, D-7054 Korb, West Germany. Tel: (07151) 3 10 18.
UK: Michael Stevens & Partners, Kent. Tel: 01-460 7299.
AMP: 220 W/ch, 8 Ω; 800 W bridged, 8 Ω.

Dynamic Precision

Norwegian Audio Designs A/S, Jerikoveien 10, 1067, Oslo 10, Norway. Tel: 2 32 20 40.
UK: Phase Audio, UK Ltd, Leicester. Tel: 0858 31717.
No. 1: 250 W/ch, 8 Ω; 1300 W bridged, 4 Ω.

FM Acoustics

FM Acoustics Ltd, Tiefenhofstrasse, CH-8820 Wadenswil, Switzerland. Tel: 01-780 64 44. Fax: 01-780 0488.
USA: FM Acoustics USA, CA. Tel: (707) 745-6444.
FM300A: 100 W/ch, 8 Ω; 150 W/ch, 4 Ω; 180 W/ch, 2 Ω.
FM600A: 250 W/ch, 8 Ω; 350 W/ch, 4 Ω; 400 W/ch, 2 Ω.
FM800A: 400 W/ch, 8 Ω; 600 W/ch, 4 Ω; 850 W/ch, 2 Ω.
FM801: 420 W/ch, 8 Ω; 750 W/ch, 4 Ω; 1000 W/ch, 2 Ω.
FM1000A: 450 W/ch, 8 Ω; 750 W/ch, 4 Ω; 1400 W/ch, 2 Ω.

Hafler

David Hafler Company, 5910 Crescent Boulevard, Pennsauken, NJ 01809, USA. Tel: (609) 662-6355.
UK: HW International, London. Tel: 01-607 2717.
P125: 62 W/ch, 8 Ω; 125 W, bridged, 16 Ω.
P225: 105 W/ch, 8 Ω; 350 W bridged, 8 Ω.
P505: 255 W/ch, 8 Ω; 800 W bridged, 8 Ω.
P500: 255 W/ch, 8 Ω; 800 W bridged, 8 Ω.
XL280: 145 W/ch, 8 Ω; 400 W, 8 Ω.
XL600: 450 W/ch, 8 Ω; 150 W/ch, 4 Ω.

HH Electronics

HH Electronics Ltd, 9 Clifton Road, Off St Peters Road, Huntingdon, Cambs PE17 7DW, UK. Tel: 0480 432227.
USA: TMJ Inc, CA. Tel: (714) 250-1937.
VX 150: 80 W/ch, 4 Ω; 160 W bridged, 8 Ω.
VX 200: 105 W/ch, 4 Ω; 210 W bridged, 8 Ω.
VX 300: 155 W/ch, 4 Ω; 310 W bridged, 8 Ω.
VX 450: 230 W/ch, 4 Ω;. 460 W bridged, 8 Ω.
VX 600: 310 W/ch, 4 Ω; 620 W bridged, 8 Ω.
VX 900: 470 W/ch, 4 Ω; 940 W bridged, 8 Ω.
VX 1200: 610 W/ch, 4 Ω; 1220 W bridged, 8 Ω.
V800: 400 W/ch, 4 Ω; 800 W bridged, 8 Ω.
M900: 400 W/ch, 4 Ω; 800 W bridged. 8 Ω.
V150L: 150 W, 4 Ω mono; 100 W, 100 V line.
AM8/17: 50 W, 4/8 Ω mono.

Hill

Hill Audio Ltd, Hollingbourne House, Hollingbourne, Maidstone, Kent ME17 0QJ, UK. Tel: 062 780 555.
USA: Hill Audio Inc, GA. Tel: (404) 934-1851.
DX1000: 375 W/ch, 8 Ω; 1200 W bridged, 8 Ω.
DX2000: 400 W/ch, 8 Ω; 2000 W bridged, 4 Ω.
DX3000: 550 W/ch, 8 Ω; 3000 W bridged, 4 Ω.
DX1000A: 500 W/ch, 8 Ω; 1600 W bridged, 8 Ω.
LC 400: 200 W/ch, 4 Ω.
LC 800: 400 W/ch, 4 Ω.
LC 1200: 600 W/ch, 4 Ω.
LC 1600: 800 W/ch, 4 Ω.
ML 200: 200 W mono, 4/8 Ω or 50/100 V line.
ML 400: 400 W mono, 4/8 Ω or 50/100 V line.

HIT

Harrison Information Technology Ltd, Unit 3, Button End, Harston, Cambs CB2 5NX, UK. Tel: 0223 871711.
USA: Harrison Information Technology Inc, MD. Tel: (301) 604-7209.
Xi150: 75 W/ch, 4 Ω.
Xi300: 150 W/ch, 4 Ω.
Xi1000: 300 W/ch, 8 Ω; 1000 W bridged, 8 Ω.
Xi1200: 350 W/ch, 8 Ω; 1200 W bridged, 8 Ω.
XI2000: 1000 W/ch, 2 Ω; 800 W/ch, 4 Ω; 2000 W bridged, 4 Ω.
P900: 270 W/ch, 8 Ω; 900 W bridged, 8 Ω.
DSA300: 150 W/ch, 4 Ω. 300 W bridged, 8 Ω.
DSA800: 400 W/ch, 4 Ω; 800 W bridged, 8 Ω.
DSA1200: 600 W/ch, 4 Ω; 1200 W bridged, 8 Ω.

Industrial Research

Industrial Research Products Inc, 321 Bond Street, Elk Grove Village, IL 600007, USA. Tel.: (312) 439-3600.
UK: The Sound Department, London. Tel: 01-749 2124.
DH 4020: 100 W/ch, 8 Ω; 300 W bridged, 8 Ω.

JBL/UREI

JBL Professional, 8500 Balboa Boulevard, Northridge, CA 91329, USA. Tel: (818) 893-8411.
UK: Harman UK, Slough. Tel: 0753 76911.
6210: single ch 40 W, 8 Ω. Mounts on JBL 4400 series studio monitors.
6211: as 6210 but with mic inputs.
6215: 35 W/ch, 8 Ω; 90 W bridged, 8 Ω.
6230: 75 W/ch, 8 Ω; 300 W bridged, 8 Ω.
6260: 150 W/ch, 8 Ω; 600 W bridged, 8 Ω.
6290: 300 W/ch, 8 Ω; 1200 W bridged, 8 Ω.

Lab Gruppen

Lab Gruppen AB, Lilla Verkstadsgatan 7, S-434 Kungsbacka, Sweden. Tel: 300-168 23. Fax: 300-142 46.
SS1300: 650 W/ch, 4 Ω; 325 W/ch, 8 Ω; 800 W/ch, 2 Ω.
LAB100: 325 W/ch, 8 Ω; 550 W/ch, 4 Ω; 675 W/ch, 2 Ω.

Meyer

Meyer Sound Laboratories Inc, 2832 San Pablo Avenue, Berkeley, CA 94702, USA. Tel: (415) 483-1166.
UK: Autograph Sales, London. Tel: 01-267 6677.
MS-1000: 300 W/ch, 8 Ω; 1000 W bridged, 4 Ω.
MS-2: 300 W/ch, 8 Ω.
MS-3: 600 W/ch, 8 Ω.

Monitech

Monitech, Box 313, Cambridge, CB4 4WN, UK. Tel: 0284 705490. Fax: 0284 706049.
Quatro 1000: four channels 250 W/ch, 4 Ω; four channels 150 W/ch, 8 Ω, two channels bridged 500 W, 8 Ω.
Quatro 2000: four channels 500 W/ch, 4 Ω; four channels 270 W/ch 8 Ω; two channels bridged 1000 W, 8 Ω.
Quatro 3000: four channels 750 W/ch, 4 Ω; four channels 270 W/ch, 8 Ω; two channels bridged 1500 W, 8 Ω.

Monitor Systems Technology

Monitor Systems Technology, Blackhill Industrial Estate, Snitterfield, Stratford-upon-Avon, Warks CV37 0PT, UK. Tel: 0789 731 133.
DVT25S: 120 W/ch, 4 Ω.
DVT50S: 225 W/ch, 4 Ω; 440 W bridged, 8 Ω.
DVT250S: 550 W/ch, 4 Ω; 1080 W bridged, 8 Ω.
DVT300S: 600 W/ch, 4 Ω; 1500 W bridged, 4 Ω.
DVT500S: 1000 W/ch, 4 Ω.
PB 44: 500 W/ch, 4 Ω; 990 W bridged, 8 Ω.

Peavey

Peavey Electronics Corp, 711 A Street, Meridian, MS 39301, USA. Tel: (601) 483-3565.
UK: Peavey Electronics (UK) Ltd, Corby. Tel: 0536 205520.
CS 400: 200 W/ch, 4 Ω; 400 W bridged, 8 Ω.
CS 800: 400 W/ch, 4 Ω; 800 W bridged, 8 Ω.
CS 900: 450 W/ch, 4 Ω; 900 W bridged, 8 Ω.
CS 1000: 500 W/ch, 4 Ω; 1000 W bridged, 8 Ω.
CS 1200: 600 W/ch, 4 Ω; 1200 W bridged, 8 Ω.
M-2600 MkV: single ch 130 W, 4 Ω.
M-3000 MkV: single ch 210 W, 4 Ω.
M-4000: 200 W/ch, 4 Ω.
M-7000: 350 W/ch, 4 Ω.
DECA-424: 200 W/ch, 4 Ω.
DECA-528: 250 W/ch, 4 Ω.
DECA-724: 350 W/ch, 4 Ω.
DECA-1200: 600 W/ch, 4 Ω.

Quad

Quad Electroacoustics Ltd, Huntingdon, Cambs PE18 7DB, UK. Tel: 0480 52561.
USA: Tovil Distributors of America Inc, VA. Tel: (703) 631-8618.
520F: 100 W/ch, 8 Ω.
510: single ch 135 W, impedance from 2 to 75 Ω.
405-2: 100 W/ch, loads from 4 to 16 Ω.
606: 180 W/ch, 8 Ω.
306: 70 W/ch, 8 Ω.

QSC

QSC Audio Products Inc, 1926 Placentia Avenue, Costa Mesa, CA 92627, USA. Tel: (714) 645-2540.
UK: Music Lab Sales, London. Tel: 01-388 5392.
1080: 35 W/ch, 8 Ω; 100 W bridged, 8 Ω.
1100: 70 W/ch, 4 Ω.
1200: 100 W/ch, 8 Ω; 300 W bridged, 8 Ω.
1400: 200 W/ch, 8 Ω; 600 W bridged, 8 Ω.
1700: 325 W/ch, 8 Ω; 1000 W bridged, 8 Ω.

3200: 110 W/ch, 8 Ω; 280 W bridged, 8 Ω.
3350: 200 W/ch, 8 Ω; 600 W bridged, 8 Ω.
3500: 300 W/ch, 8 Ω; 900 W bridged, 8 Ω.
3800: 375 W/ch, 8 Ω; 1200 W bridged, 8 Ω.
MX700: 150 W/ch, 8 Ω; 225 W/ch, 4 Ω.
MX1500: 330 W/ch, 8 Ω; 1000 W bridged, 8 Ω.

Ramsa

UK: Panasonic/Technic UK Ltd, Bracknell. Tel: 0344 853176.
USA: Panasonic Professional Audio Division, NJ. Tel: (201) 348-7000.
WP-9110E: 150 W/ch, 4 Ω; 100 W/ch, 8 Ω; 300 W bridged, 8 Ω.
WP-9220E: 300 W/ch, 4 Ω; 200 W/ch, 8 Ω; 600 W bridged, 8 Ω.
WP-9440E: 750 W/ch, 4 Ω; 2000 W bridged, 4 Ω.

Reflexion Arts

Reflexion Arts, Atlantis Buildings, High Street, Bruton, Somerset BA10 0AE, UK. Tel. 0749 812260.

4180/700: 3U unit containing four 180 W/ch amps with pair 2-way crossovers.

SAE

Scientific Audio Electronics Inc, PO Box 60271, Terminal Annexe, Los Angeles, CA 90060, USA.
UK: Presence Audio, Sussex. Tel: 0403 891 777.
A202: 100 W/ch, 8 Ω.
A502: 200 W/ch, 8 Ω; 600 W bridged.

SECA

Studio Magnetics, Unit 4, Radfords Field Industrial Estate, Maesbury Road, Oswestry SY10 8HA, UK. Tel: 0691 670193.
International: Professional Audio/Video Systems, Toronto, Canada. Tel: (416) 364-4848.
SL30: 170 W/ch, 4 Ω; 120 W/ch, 8 Ω; 295 W bridged, 8 Ω.
SL57: 285 W/ch, 4 Ω; 180 W/ch, 8 Ω; 490 W bridged, 8 Ω.
SL96: 480 W/ch, 4 Ω; 250 W/ch, 8 Ω.

Seismic Audio

Seismic Audio, 62 Delhi Road, Pitsea, Basildon, Essex SS13 2EQ, UK. Tel: 0268 554276.
3500: 100 W/ch.

Stage Accompany

Stage Accompany, Anodeweg 4, 1627 LJ Hoorn, The Netherlands. Tel: (0) 2290-12542.
Stage Accompany, Vennweg 5, 446 Nordhorn, West Germany. Tel: (0) 5921-16196.
UK: Stage Accompany UK Ltd, Cambs. Tel: 0353 662278.
SA-PPA 1200: 350 W/ch, 8 Ω; 600 W/ch, 4 Ω.
SA 900C: 280 W/ch, 8 Ω; 420 W/ch, 4 Ω.
SA-500C: 135 W/ch, 8 Ω; 225 W/ch, 4 Ω.

Studer

Studer International AG, Althardstrasse 10, CH-8105, Regensdorf, Switzerland. Tel. 411 840 29 60.
UK: FWO Bauch, Borehamwood. Tel: 01-953 0091.
USA: Studer Revox America Inc, Nashville. Tel: (615) 254-5651.
A68: 175 W/ch, 4 Ω; 350 W bridged, 8 Ω.

Studiomaster

Studiomaster (UK) Plc, Studiomaster House, Faircharm Industrial Estate, Chaul End Lane, Luton, Beds. LU4 8EZ, UK. Tel: 0582 570370.
USA: Studiomaster Inc, CA. Tel: (714) 524-2227.
Mosfet 1000: 450 W/ch, 4 Ω.
Mosfet 500: 250 W/ch, 4 Ω.
Stellar Fet 1: 100 W/ch, 4 Ω.

TOA

TOA Electric Co Ltd, Kobe, Japan.
UK: TOA Electronics Ltd, Brentwood. Tel: 0277 233882.
USA: TOA Electronics Inc, CA. Tel: (415) 588-2538
P-300D: 300 W/ch, 8 Ω.
P-300M: single ch 300 W, 8 Ω.
P-150D: 150 W/ch, 8 Ω.
P-75D: 75 W/ch, 8 Ω.

Turner

Turner Electronic Industries Ltd, PO Box 49, Etchingham, East Sussex TN19 7NZ, UK. Tel: 0435 882581.
B502: 340 W/ch, 4 Ω; 190 W/ch, 8 Ω.
B302: 150 W/ch, 4 Ω; 100 W/ch, 8 Ω.

Yamaha

Yamaha Corporation, PO Box 1, Hamamatsu, Japan.
UK: Yamaha-Kemble Music (UK) Ltd, Milton Keynes. Tel: 0908 71771.
USA: Yamaha International, CA. Tel: (714) 522-9011.
P2040: 20 W, 4-way, 8 Ω; 40 W, 2-way, 8 Ω.
P2075: 75 W/ch, 4 Ω.
P2150: 150 W/ch, 4 Ω.
P2250: 350 W/ch, 4 Ω.
PC 1602: 160 W/ch, 8 Ω; 480 W bridged, 8 Ω.
PC 2602: 260 W/ch, 8 Ω; 800 W bridged, 8 Ω.
PC 2602M: as PC 2602 with meter.
PD 2500: 250 W/ch, 8 Ω; 500 W bridged, 2 Ω; 1000 W bridged, 4 Ω.□

Whilst everyone tried to copy the SM58, guess what Shure did?

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SHURE

HW International Ltd. 3-5 Eden Grove, London, N7 8EQ. Tel: 01-607 2717

Martin Polon

The moves towards digital technology invites interest in audio companies from outside conglomerates

They had divided up the world's electronic entertainment industries almost before the '90s had really started. Big Ear and Big Eye and Big Software. Just the three of them. They controlled it all: all audio equipment and all video equipment and all records released. It had started happening with the formation of a unified market in Europe. The conglomerates were set up to manufacture and distribute within the United States of Europe. 'They' had said to the smaller companies, "Let us help you". They had helped them all right. It had been accelerated by the cost of developing special digital chips. The 'big ones' could handle the expense of the research and development. The little ones really could not. And it had just snowballed. And once they had started to release music via digital fibre optics directly into the home, it didn't make sense to have any more small record companies. Small is too small their advertising used to say.

He thought about all this for a while. He reached into his pocket for a cigarette and lit up. He started to look around but then he remembered where he was. He had disconnected all the sensor sets in his vicinity. If he tried to light up most places the SP, or Smoke Police, would come after him and take him away. After the cigarette smoke riots of 1992, when they had definitely connected cancer and passive smoking, cigarettes became taboo. He thought about how they had removed all the ads on billboards and buildings and substituted other ads for 'cig' ads in old magazines in the data base libraries. It was as though they had never existed. But that was their thing, wasn't it? He smiled pensively.

Thank the heavens it had not come down on audio that way. He knew his risk was substantial. Under the latest regulations you couldn't record any music for release; only the Big Softie was supposed to do that. You could have a studio for 'private use' to make recordings but only if the studio audio equipment came from, and was hooked up to, the monitoring network of the Big Ear. He made studio equipment. Beautiful hand-wired studio equipment. The kind that had made the 'home studio revolution' so meaningful a long, long time ago. He built a nice little console using the incredibly plentiful analogue chips that were in all the electro-junk stores. He 'souped' up consumer analogue cassette decks that he bought from thrift shops. He built new monitor speaker enclosures for badly designed hi-fi speaker systems. And he had a store-room under a car park next to his workshop, full of old analogue studio gear he had purchased as a licensed and regulated scrap dealer. He was supposed to reduce it to scrap—and so his paperwork did testify—but in fact he stored it while substituting old video games, which he did shred and pulverise.

The bottom line was that the 'pirate' studios he had built for creative and rebellious individuals were being used to make the bootleg recordings that were becoming the rage of the intelligensia. The 'Big Brothers' tried to ban the illicit music by holding public cassette burnings. 'Only digital music on digital discs' had been their theme advertised over and over again on the communications sensors. But that was the point of it, wasn't it. Only digital music since it could not easily be bootlegged, and digital recording since the equipment was too complicated and expensive to be available for the small operator from the small manufacturer. Eventually, the MP would get him. He knew that. But he wasn't afraid of the Music Police. He had seen pictures of the work they had done to small pirate studios. There wasn't anything left but melted metal.

The knock on the door was insistent and frightening. It had shattered his reverie and jarred him into action. He went out the back door and up to the roofline that would be his 'motorway' to another place and another time and another crack at his chosen avocation—whatever the risk.

With significant apology to George Orwell, whose visions of England during World War II with such organisations as 'Mass Observation' led him to fear a mind-controlling consolidation as chronicled in his book *1984*. This despite the fact that he originally intended to use the title '1948' to indicate how close he thought total control and consolidation really was when he wrote the book. Needless to say, nobody is suggesting that the audio business is approaching an Orwellian state. And yet current happenings in the worldwide audio industry suggest that an unparalleled consolidation is now taking place.

According to well-respected sources, eight companies have significant influence on the professional audio field. These eight companies are thought by many observers to have sales figures near or in excess of 50% of all hardware sales in the professional audio field and to make around 50%, or more, of all profits therein. This consolidation has taken place over the last 10 years. The eight are Bose, Harman International, Mark IV, Matsushita, Philips, Siemens, Sony and Yamaha. Together these giants control directly, distribute or influence through investment the products from Aiwa, Altec Lansing, Audax, Bose, BTP, Cetec, Gauss, Electro-Voice, Harman, Infinity, JBL, JVC, Lydig, Mitsubishi, National, Neve, Panasonic, Philips, Pye, Quasar, Ramsa, Raymer, Soundcraft, Sony, Technics, University, UREI and Yamaha among others. There is some very limited interconnection among the eight with Philips in joint ventures with Sony on specific product areas and Matsushita on other specific product areas. AKG also seems headed for audio conglomerate status with its past efforts and the recent acquisition in the US of Orban and dbx professional.

Not that these companies are unique in being a part of a 'family' of companies. It is estimated that over 50% of all companies in the pro-audio arena are held by parent operations or financing. All one has to do is to look at the adverts in the various audio trade publications to see that this company is a subsidiary of 'Brand X Industries', to find that another company is a division of 'Brand Y Incorporated' and yet another company is a 'Brand Z Company'. In fact, several analysts predict that the number of small companies will shrink in relation to the total number of companies doing business in professional audio in the 1990s.

What is happening in today's audio industry reminds many people of the extreme stratification that marked the computer industry during the past two decades. The analogy may be a good one since the causitive factor is probably the same—the need for deep pockets to fund the absorption of a new technology base. As the world computer industry moved away from vacuum tube technology to semiconductor technology and changed memory from storage tubes and cores to RAM chips and magnetic disks, the ability to use off-the-shelf components common to much of the electronics industry disappeared. The computer industry had to define specifically those parts and products necessary to reach the future and that costs money. So it does today, where the world audio industry is about to mount the crest of the digitisation of audio.

Historically, the audio industry was dominated by the vacuum tube patent behemoths like EMI, GEC, RCA and Western Electric, who sold and/or licensed over 80% of all sound equipment used before World War II. The aftermath of the war was to see a new world of innovation in the late '40s. Government antitrust opened up the patent vaults, war work in the public interest produced many innovations that were accessible by all and returning soldiers with a garage and back pay in their pockets went into the audio business. The whole audio industry blossomed and diversified. Off-the-shelf parts were available for almost anything in audio due to commonality with television and radio products. Specific parts like microphones, speakers and transformers were in production for radios, TVs and related product categories as well. Audio makers did not have to spend money on part R&D (research and development), or on part fabrication. The parts makers did that, leaving the audio manufacturers to concentrate on circuit design and product development.

More or less that *status quo* has continued right on up-to-date, through the development of the transistor and of the integrated circuit. Today, however, the presence of products that not only 'do' audio but use microprocessors to think about what they are 'doing' digitally has changed the ground rules. The transition to digital audio has created a totally different continuity of audio product development. Digital recorders, signal processors, mixing consoles, hard disk recorders and editing work stations require complex and unique semi-conductor devices and application specific ICs (ASICs) and software. That all costs

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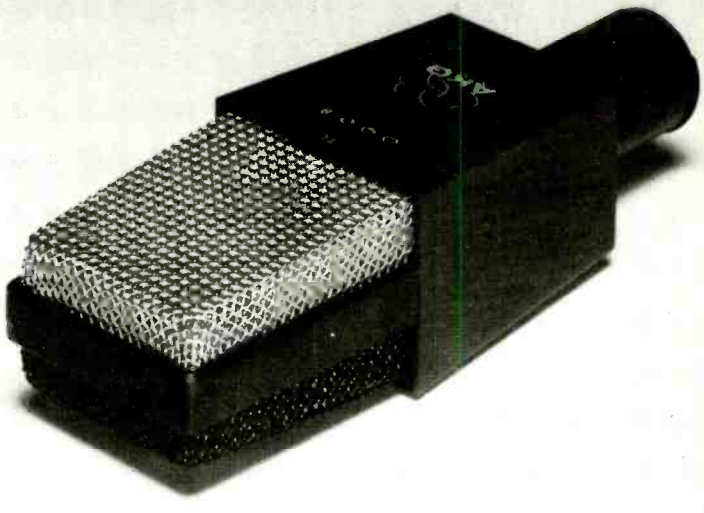

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money and it would seem that one of the driving forces of market consolidation has been the need for unique and expensive technologies. Another need for deep pockets is the ability to 'wait out' the development of the market for a specific new class of products. Despite the presence of a substantial investment in R&D and in specific semi chip development, a company may have to wait several years for a market to mature enough to support its new product concept.

It is curious to note that many of the leaders in audio related technologies, and especially those poised to profit from the future, are significantly involved with their own captive semiconductor research and development and production operations. Clearly, both IBM and ATT have a definite stake in audio-related products and both are investing tens of millions of dollars in the production of digital signal processors and other categories of audio-related semiconductors. Sony and Matsushita are each spending in excess of $30 million in semiconductor development and production expenses. This kind of continuity is available to all of our 'Big Eight' audio equipment makers either directly through in-house operations or via close ties to other semiconductor developers. Other companies that both produce various kinds of audio and video equipment and develop semiconductors could also show significant potency in whatever marketplace they decide to enter. It would be shortsighted to ignore the digital audio market potential of Hitachi, Sanyo or Toshiba, each with their $500 million annual outlays for increased semiconductor sophistication.

One thing that vexes some members of the audio trade in the UK and the US is the large number of companies that have been acquired as foreign holdings. Yet the phenomenon is perfectly defined in the inability of domestic investors to see value in such enterprises and the willingness of foreign investors to wait out slow economic cycles such as the one that is currently plaguing the pro-audio marketplace. An investment adviser who works the audio scene on both sides of the Atlantic commented: "Everyone is concerned only about short-term profit when it comes to high tech at the end of the 1980s. To most investors the buzz word for the former glamour child of 'high tech' is now 'high dreck'. But the industry has achieved maturity and the flash-boom-bang profits of the late '70s and the early '80s are history. The '90s look to be very good for all components of the electronic entertainment package but investors are going to have to wait a little while to see profitability over needed investments in new and future technology."

In England, Michael Heseltine—a recent former Thatcher cabinet minister and no stranger to making large sums of money through sound business practices, thank you—has been circulating a recent survey on British willingness to participate in the business flow of a unified Europe. The survey seems to indicate that a very low percentage of British managers of business enterprises, financial services institutions or manufacturing establishments have actually taken any steps at all to conduct market research, train their staffs in European languages or make actual staff assignments in Europe. A similar study by the US Department of Commerce reveals a similar export lethargy in the United States manufacturing sector. If domestic managers and financial experts aren't going to sustain domestic industries, foreign money will fill the void and in the audio business, as in so many others, it already has!

There are other problems that small companies have as well as those of attracting funding and poor management. One owner of a successful small audio equipment maker offered his tales of woe: "Of the worst things that can happen to a small business, the contempt of everyone you need to service you is probably the worst. Take parts, for instance. We need a steady flow of resistors, capacitors, inductors, power transformers, connectors, etc. As many of the parts we use as is possible, are off-the-shelf. We do business with one of the big electronic parts jobbers with a single word for a name, that implies rapid service. That is important to us because in our recent expansion we sacrificed our parts storage for a test lab. That seemed fine since we opted for the JIT (Just In Time) system used so successfully here and in Japan. But the distributor refuses to put us on a credit billing basis. We are too small to meet the minimum, so each order is always like our first with me on the phone to some teenage-airhead who is valiantly trying to prove that her bra size and her IQ are the same. We end up having to messenger over a cashier's cheque to get delivery on time.

"Or consider our relationship with the bank. Sometimes a cheque comes in with my name on it, even though the business uses an acronym of my name. It would be an undesirable co-mingling of funds if I put the cheque in my personal account. Yet the bank won't cash it in the business account. If we were larger, then we would have our own officer and none of these problems would occur.

"Then there are the taxes. Never believe clergy when they describe hell. Hell is staffed with old IRS and Inland Revenue agents. They issue completely revised brochures and forms almost daily for you to fill out weekly, and monthly, and yearly. Believe me, the only thing worse than the big G(overnment) tax boys are the little g(overnment) tax boys. They want you to collect transaction taxes if the buyer is obligated to pay local tax because his company has a branch in your bailiwick. Not to mention an inventory tax and a stamp tax, etc. When you read that the owner-founder of a small company has sold out, it is not always just for the money!"

As to the future, it seems safe to assume that there is going to be a lot of standardised hardware in the future of digital audio. Computers will probably serve as editing workstations, computer memory and/or hard disk recorders, CD mastering workstations, audio control desks for broadcast and sound reinforcement applications where a great deal of mixing isn't desired. In total, the next generation of personal computers is going to open up the audio business again because the 32 bit 50 MHz machines with 800 Mbyte hard disk, 100 Mbyte RAM and read-write optical drives require only software to become all things to all people. The '90s will be the decade of the small software firm with hundreds and perhaps thousands of small shops creating the software necessary not only for tomorrow's PCs but also for all of the dedicated digital audio hardware on the scene.

Is all this really so bad? The key to the pro-audio market's consolidation is indeed focused on digitisation, corporate size and the presence of product areas that can support product development. The phrase 'economies of scale' come to mind. It may well be that many digital audio products are just beyond the competitive scope of smaller operations, at least initially. Consumer technologies, present in the portfolios of so many of these A/V conglomerates, now serve to subsidise professional research and product development; a complete role reversal over 10 years ago. No small firm could afford the research that brought DAT from the consumer sector to the waiting hands of the professional audio practitioner.

One down-side of the audio conglomerates and of today's conglomerates in general is the use of junk bond funding to create the grouping. These relatively worthless instruments of debt have weathered the good times of the '80s with surprisingly few problems. On the other hand, if there is a recession or downturn anywhere, the worldwide linkages of the global economies will put considerable pressure on companies whose underpinnings consist only of these low value bonds.

It does seem likely as in the computer industry, that the smaller firms will survive and in fact prosper if they can find a service niche that the big companies are too inflexible to fill or to make the products that have too few numbers to attract the giants of the world marketplace. One thing can be regarded as fact about the '90s: there will be change and plenty of it. What seems to be the emerging *status quo* of today will be completely different by 1995.□

It may well be that many digital audio products are just beyond the competitive scope of smaller operations, at least initially. Consumer technologies, present in the portfolios of so many of these A/V conglomerates, now serve to subsidise professional research and product development

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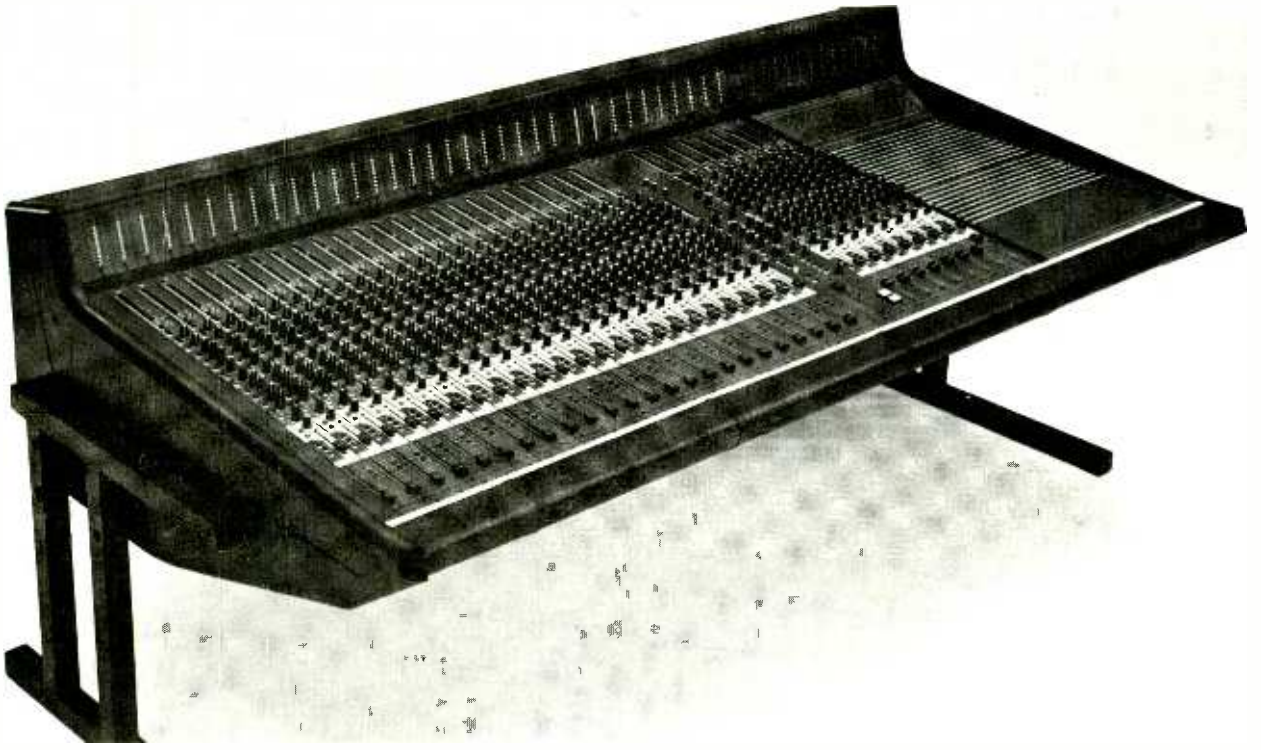

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Barry Fox

An AES Hamburg paper fuels the DAT debate. And compact disc degradation—still looking for proof?

During the AES Convention in Hamburg, IRT, the West German broadcasters' research laboratory in Munich (roughly equivalent to the BBC's Kingswood Warren) presented a paper that damned DAT as a professional tool. For a while there was silence. Although the content was highly contentious, the report from the Institut fur Rundfunktechnik looked dull. Obviously some people hoped it would simply go away or gather dust on shelves. Now that it's out in the open, everyone with an interest in DAT is commenting.

The IRT paper, signed by Siegbert Herla, asked the question, "Is R-DAT a recording format for professional use?" and came up with the clear answer, no, not in its present form.

Remember that DAT was developed as a domestic format and was killed by the IFPI and RIAA. It builds on video technology. The tape is 3.81 mm wide and a small drum spins at 2000 RPM to lay down oblique tracks each only 13.6 μm wide—around one quarter the width of a human hair. Professional formats have used wider tape, wider tracks and larger drums with more flywheel inertia, to give more margin for error. Last year IRT asked all radio stations in West Germany to help make a scientific evaluation.

To be accepted as a professional format, says IRT, any system must be able to copy a tape through at least 10 generations, without any audible defect caused by digital errors being heard on the last copy. Also, tapes recorded on one machine must play back perfectly on another.

IRT researchers bought three cassettes each from eight different manufacturers, made a half hour recording on each and played it back three times. Some cassettes worked better after playing twice, as the tape coating became smoother. Others produced audible click sounds through the loudspeakers. None of the cassettes tested, says IRT, satisfies professional requirements.

To check compatibility between machines, every radio station in West Germany made a DAT recording and sent the cassette to Munich. This gave IRT the chance to check recordings made on eight 'professional', six consumer and five portable DAT recorders. Tapes made on one machine would not always play back reliably on another.

The researchers found that the domestic and so-called 'professional' recorders performed in the same way, because they use the same mechanisms.

When IRT tried playing back the same cassette over and over again, the signal soon started to degrade. So IRT warns that DAT is no use as an audio store for the advertising and station identification jingles radio stations must repeatedly play.

The only way to make DAT a professional format, says IRT, is to make significant changes in the format. One idea is to increase the width of the tape tracks to 20.4 μm. This was the planned format for pre-recorded DAT musicassettes, made by high speed contact print duplication. The penalty is that the tape must run faster, 12.25 mm/s instead of 8.15 mm/s, so playing time for a 2 hr cassette is reduced to 80 minutes. At the same time the sampling frequency is set at 48 kHz (instead of the 44.1 kHz planned for pre-recorded cassettes). Coding remains the same at 16 bit linear.

Alternatively, says IRT, the DAT format could be junked, and the 3.81 mm tape cassette replaced with a larger cassette containing 6.3 mm tape. Rather condescendingly, IRT ends with the remark that DAT is "on the right path".

The way DAT was defended against the IRT attack was, if anything, more interesting than the report itself.

Don't be too hard on the format, I was told, because: there is no such thing as a fully professional broadcast DAT unit on the market yet; recorders being sold to professionals are still essentially consumer models, with modified input/output circuitry but exactly the same tape transport as those used in consumer models; errors can build up from dirty heads, unless a tape cleaner is used; there are some nasty DAT tapes available, which are of inconsistent quality, have inaccurately sized housings and suffer from drop-out; the laws of libel mean customers have to rely on the supplier's word of mouth and refusal to stock suspect brands.

No-one thought it necessary to make these points until after the IRT report had been publicised.

This is not, repeat not, to say that DAT does not offer remarkable value for money as a low cost digital recording format for news gathering, making high quality dubs of master tapes for clients, backing up sessions and making digital masters where cost or size of hardware would otherwise prevent it.

Says HHB's Richard Kershaw: "We and more than 2,000 professional DAT customers are very happy with the format's performance in professional applications, many of which are within broadcast environments."

The bottom line is that (as the DAT defenders now put forward as an argument against the IRT report) the format is being used in some situations beyond the scope of existing hardware.

IRT has been accused of mischief making, and being well-known for trying to rubbish technology invented outside Germany.

Adds Richard Kershaw: "The conclusions of IRT's paper are based on spurious methodology and a range of tests that are completely irrelevant to its practical use as a professional tool."

Kershaw cites another report, jointly prepared by Sony and Hewlett-Packard as part of their research on DAT for computer data storage. It is perhaps significant that although this report on the Digital Data Storage format (DDS) was published in October 1988, no-one made any real noise about it until IRT stepped into the picture.

Although the Sony/HP report concludes that DAT "lends itself very well to data storage applications" (with a blockbuster 1.3 Gbytes/cassette and transfer rate of 183 kbytes/second on a standard audio mechanism) the report also makes clear that DDS has been designed by Hewlett-Packard and Sony to *compensate* for deficiencies of the basic DAT format.

The 10^{-15} bit error rate promised for DDS (one wrong bit in every 10^{15} bits read) is achieved by an extra layer of error correction added on top of the audio DAT format. The Sony/HP report tells how errors can be caused by drop-outs, themselves caused by irregularities on the surface of new tape, which are worn away by burnishing; so some tape may improve with use. Errors can also occur at the beginning and end of a tape, caused by irregular winding. Tape weave must be minimised, says the report. So must tape width fluctuations. Regular head cleaning is needed to prevent clogging after the first 1,100 hours of use.

"DAT technology is relatively robust," concludes the Sony/HP report, explaining, nevertheless, "10 error rate improver facilities were developed and incorporated in the DDS format . . . to ensure that data is recovered reliably."

Remember the scare about compact disc production, with some of the inks used to print the labels said to be eating through the protective lacquer into the aluminium reflective layer?

The pressing plants all said they had solved the problem long ago so there was no risk of discs sold to the public later degrading. I have still not found any clear unambiguous examples of discs that played perfectly when bought but now won't play. But there is still a nagging feeling that because CD is a digital system, with error correction and interpolation designed to repair or disguise errors, life problems may not yet have come to light. Hopefully the big scare had the beneficial effect of forcing pressing plants to look again at their production process and tighten up on any loose ends.

The CD scare followed the laser rot story, which was without doubt all too real. Batches of video discs from both Pioneer and Philips plants had definitely degraded. It was only when faced with evidence that the trade knew what was going on, that the companies owned up. Faulty discs failed early because the picture signal on a video disc is analogue. Any degradation shows immediately as snow on the screen, then lost colour, then lost synchronisation and finally lost picture and sound. Hopefully the CD life scare will turn out to have been groundless but it's one that we'll need to keep on watching. If anyone out there, at any time now or in the future, comes across a disc they feel sure is showing signs of degradation, do please get in touch.

Seven of these error rate improvers were added on top of the audio DAT format.

These reports, along with industry reaction as their content becomes more widely known, can only be a good thing. In the short term they steer engineers clear of asking more of DAT than the format can yet deliver. In the long term they will drive DAT development to the point of delivering more.

Bert Vermeulen of Hewlett-Packard, co-author of the report, has no doubt that IRT was seeing the effects of head clogging. Each audio frame is recorded as a pair of tracks, by heads of opposite azimuth. So if one head clogs, only one track from each pair is read.

The audio system can cope with this by linear interpolation, because each track is divided into two halves, and the data continually switched between neighbouring track halves. So when one head clogs and stops reading, the other head still reads half the total amount of information. The player fills the gaps by averaging. This has the effect of halving the frequency response, from 20 kHz to 10 kHz. Although the music keeps playing, the effect is audible.

Obviously this is completely unacceptable for computer applications. Hence the DDS format has extra heads that either read after writing or read twice, like the confidence heads on U-matics used for mastering. The same system of using extra heads could be used for professional audio DAT. And you can be sure it soon will. After all Sony makes the double-head drives for Hewlett-Packard!

Significantly, Sony has been very quiet about the IRT report. Cynics will say that this is because Sony has never liked the idea of pulling the rug from under sales of the much more expensive *1630* hardware. True. But Sony has never pretended that DAT is a professional medium. When I spoke with Roger Lagadec in Japan, 18 months before the IRT report, I asked him about DAT as a mastering tool (see *Studio Sound*, January 1988). His answer bears repeating:

"The *1630* has become a *de facto* standard. It's reliable, trusted, robust. You can take that master anywhere in the world. If we change that standard it had better be to something long lived. The head drum scanner of the U-matic is big and tough (110 mm diameter). It can be used as a murder weapon if you want. There is room for both record and playback heads. There is not much room on the small DAT scanner (30 mm or 15 mm for half-size decks) for extra heads. DAT and U-matic are different animals. DAT is a consumer product. It has editing potential but not yet capability. It is designed for the entertainment of millions of people. U-matic is designed as a working tool for hundreds of people.

"Of course the *1630* CD mastering system will not last for ever. There will be attempts to introduce DAT as a mastering format. But DAT cannot deny its consumer origin. There will eventually be a new system. But we don't know what that system will be. It could be DAT. But if you were asked to specify a CD mastering system you wouldn't come up with DAT."

I would say that those words, taken verbatim from a 1987 meeting, pretty well predict what IRT said.

MONITORING DEVELOPMENTS

A round-up of speaker systems with studio monitoring capabilities introduced over the last year

Acoustical Physics Laboratories

The Acoustical Physics Laboratories control room monitor incorporates cone and dome driver technologies in a time corrected 3-way design, aimed at providing high levels of spectral, transient and spatial imaging accuracy. The monitors are available in component form or as complete systems and include a choice of active or passive crossover networks. Custom control room monitor designs with on-site TEF performance certification are available for special requirements.

Acoustical Physics Laboratories, 3877 Foxford Drive, Doraville, GA 30340, USA. Tel: (404) 934-9217.

AESD

AESD are a French manufacturer that come principally from the hi-fi area but have a full range of speaker systems with professional applications. The most directly relevant is the *Moniteur Studio 8* a small active monitor system designed for small main monitor or nearfield uses. There is provision for use of an external active aux bass unit in the form of the *Bass 12*. This sums the LF input from the *Studio 8* speakers and gives a combined LF output.

AESD, 83 Rue Des Vioes Du Bois, 92700 Colombes, France. Tel: (1) 47 60 28 13.
UK: gtc, Unit 40, Sheraton Business Centre, 26-28 Wadsworth Road, Perivale, Middx UB6 7JD. Tel: 01-991 9152.

ATC

ATC have launched a new studio monitor, the *SCM200*. These are designed to sustain very high SPLs for control room use; recommended amplifier ratings are 3×350 W/channel for the two bass units and mid drivers, and 250 W/channel for the tweeters.

The crossover *EC23* unit features pluggable headers for altering crossover points, phase adjustment at the crossover points, FET-based momentary gain reduction circuitry to avoid driving following amplifiers into clipping, and a smoke perspex tamper panel.

ATC Acoustic Engineers, Loudspeaker Technology Ltd, Gypsy Lane, Aston Down, Stroud, Glos GL6 8HR, UK. Tel: 028 576 561. Fax: 028 568 859.

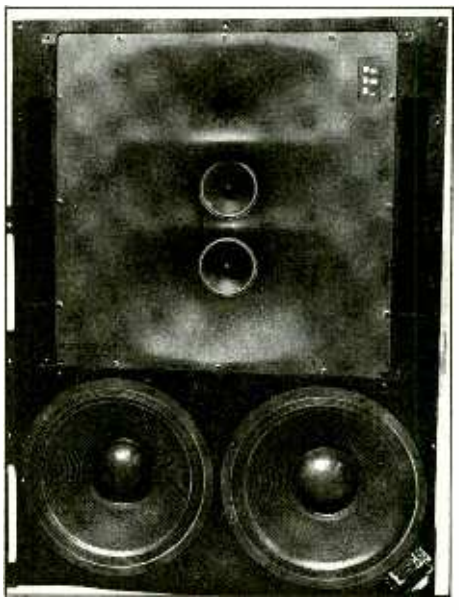
Dynaudio Crafft

Danish company Dynaudio launched the *Crafft*, a nearfield monitor of 2-way bass reflex design. Based around drive units that Dynaudio manufacture themselves, the *Crafft* uses a 6.5 inch LF unit (with 3 inch voicecoil) and a 1.1 inch HF unit. The LF unit uses a diaphragm developed by Dynaudio based upon polypropylene, which leads to a claimed absence of distortion, low self oscillation due to the materials damping effect, and the diaphragm geometry design apparently leads response at 60° off-axis being very close to on-axis measurements. The HF unit is a dome design developed especially for professional applications with the ability to handle up to 2000 W transients without compression. There are switched level adjustments for the two drive units to compensate for speaker positioning. Rated at 150 W with an impedance of 4 Ω.

Dynaudio ApS, Sverigesvej 15, DK-8600 Skanderborg, Denmark. Tel: (06) 52 34 11.

Genelec

Genelec added a completely new high-powered monitor to their range. The *1035A* is a 3-way active system based around a 600 litre enclosure and a modular 19 inch power amplifier/processing rack designed to match the drivers used and with ratings of 1000 W for the LF, 600 W midrange and 300 W HF. The processing unit contains the crossover, diagnostics/starting sequencer and driver protection circuitry. The cabinet uses a 2-chamber approach for the LF speakers using two 15 inch units crossing over to a pair of 5 inch direct drivers with the HF being handled by a 1 inch compression driver. The mid and HF are mounted on a sculpted aluminium driver panel known as the 'Directivity Control Waveguide', which can be rotated through 90° depending on the mounting position. Quoted peak acoustic output per pair at the engineer's position (2



Genelec 1035A

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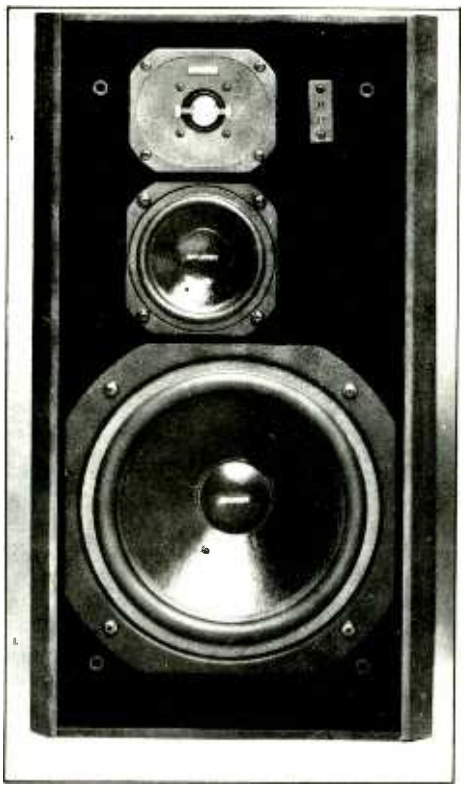

Studer A723 active monitor

metres distant) with music programme is 136 dB.
Genelec Oy, Tehtaantie 17, SF-74100 Iisalmi, Finland. Tel: 77-13311. Fax: 77-12267.
UK: SSE Marketing, Unit 2, 10 William Road, London NW1 3EN. Tel: 01-387 1262.
USA: Quest Marketing, PO Box 20, Auburndale, MA 02166. Tel: (617) 964-9466. Fax: (617) 969-7758.

Professional Audio Systems

Professional Audio Systems, a US speaker systems manufacturer has been demonstrating a 3-way monitor system based around their *Studio Monitor 1*. This was developed in conjunction with George Massenburg's The Complex studios and following some further development has been shown at a number of trade shows. The system uses a pair of 15 inch LF units, the new PAS *CX-2580C* coaxial 15 inch speaker and a TAD *4001* 2 inch compression driver. The crossover network of the *Studio Monitor 1* has been modified for accurate phase response.
Professional Audio Systems, 1224 West 252nd Street, Harbor City, CA 90710, USA. Tel: (213) 534-3570.

Studer

Studer introduced their first active studio monitor the *A723* which is a 3-way system. The monitor cabinets have a volume of 70 litres and are intended for applications within small or medium-sized rooms. Each of the drive units is powered by a dedicated amplifier of approximately 100 W and the crossovers contain compensation for drive unit alignment and group delay in the filters. Quoted sound pressure levels are 106 dB SPL, 1 kHz at 1 metre. Input is via an *XLR* socket and is balanced with coarse and fine level adjustments based around standard line levels.
Studer International AG, Althardstrasse 150, 8105 Regensdorf, Switzerland.
UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Tel: 01-953 0091.
USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 259-7619.

Tannoy

Tannoy have introduced the *TP1* small reference monitor. It is a 2-way design in a cabinet 15 inches tall and is constructed around heavy vertical and horizontal bracing. The mid/bass drive unit is a 6½ inch size with a new roll surround material that Tannoy say ensures linearity and robustness. The HF unit uses Tannoy's Differential Material Technology (DMT) with duralumin diaphragms and skirt with a separate polyamide-based suspension, which apparently gives the piston rigidity of titanium but without the high frequency break-up. The coil is ferrofluid cooled and the driver uses the familiar asymmetrical phase plate.

The crossover is of a hard-wired construction and when integrated with the drivers. Tannoy claim a matching of within ±0.5 dB between units over their specified range. The magnetic field around the cabinet has also been controlled and is less than 1 mille Tesla at any point outside the cabinet, so it doesn't affect video monitors.

The monitor is finished in black with an anthracite baffle and grey drive units.
Tannoy Ltd, The Bilton Centre, Coronation Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3SB, UK. Tel: 0494 450606. Fax: 0236 28230.
North America: Tannoy North America Inc, 300 Gage Avenue, Unit 1, Kitchener, Ontario, Canada N2M 2C8. Tel: (519) 745-1158. Fax: (519) 745-2364.

33 Audio

A 2-way nearfield monitor rated at 50 W. Fully shielded making it suitable for use in close proximity to video monitors. Drive units are sandwich-type construction cone LF unit and a glass fibre HF cone driver with a crossover frequency of 2.2 kHz. An active version of the *Neutron* is also available using a Class A MOSFET amplifier.
33 Audio, Bagnolet, France.
Tel: (1 61) 43 63 34 47.

Wellard

Wellard Research introduced a 'B' version of their *Middle Monitor* active speaker system. This is designed to meet the need to interface the monitor to external sources. Features include a switched attenuator on the input stage with a gain range of 20 dB in 2 dB steps and nominally set for −12 dB to +8 dB; a mechanical protection across the tweeter to protect the dome from probing fingers; a visual indication of the monitor being powered and an on/off switch.
Wellard Research Ltd, Basement, 139 Shooters Hill Road, Blackheath, London SE3 8UQ, UK. Tel: 01-853 5447.

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MONITOR SYSTEMS - A LOOK AT THE OVERLOOKED PART ONE

The start of an extensive new series by speaker and studio designer Philip Newell that looks afresh at the concept of monitoring and acoustics combining practical experience with new research

The monitoring system of a control room has been one of the fundamental tools of the broadcast and recording industries since their birth, around the turn of this century. Viewed somewhat simplistically it consists of a room, an amplifier and a loudspeaker system. While this view prevails extensively, even among many professional users, the system in reality has almost defied scientific analysis. The truth is that it is an enormously complex, interacting combination of component parts. Even with today's technology, these component parts can still only produce a reasonable, pseudo-analogue of the original sound. The search for perfection has, in many ways, been a battle to develop technology and has resulted in many differing paths towards the same goal.

Unfortunately, the position of the goalposts has never been clearly and universally defined. Many partisan shouts of 'goal' have been greeted by others with shouts of derision as well wide of the mark. While I cannot state that my opinions are definitive, I do draw on a great deal of practical and academic experience. One reason for airing my views so publicly, is to invite responses, be they critical or confirmatory.

Truths and myths abound, yet many users and designers alike are often unsure which are which. In this series the intention is to plant goal posts firmly in the ground, then outline the paths toward these goals. It is difficult to look at each link in the chain in isolation, for the requirements of the entire system may compromise and modify the 'purist' approach to the individual link. Despite this, an in depth study of each of these component parts will be undertaken, as only in this way can the more convoluted, individual requirements be truly seen. They will, however, always be viewed in what I believe to be their most relevant context, giving due consideration to the systems' overall requirements.

To use an analogy, one could decide that one wanted the ultimate aeroplane wing. It would be reasonable to assume that British Aerospace were likely to have the know-how but it would be futile asking them simply to produce 'the ultimate wing'. Which ultimate wing? For what flying speed? For what altitude? To carry what weight? For what minimum landing speed? In a recent Japanese paper on a 2-way monitoring system the principles were very much in agreement with an article I recently published, explaining the detailed concepts of a nearfield system. The

Preface

The aim of this series of articles is not to provide yet another mass of facts and figures, it is to look at the whole concept of recording room acoustics and monitoring, in a way that will, hopefully, bridge the widening gap between the academics and the practical people. We will study in depth, the relevant aspects of the approach to the whole and address the problems as they arise.

As technology rolls forward, specialisation becomes more necessary. Unfortunately, with specialisation, comes the attendant jargon, and the fixation of ideas. Some years ago, a company manufacturing tape recorders, put some very high quality but rather delicate switches on a machine. They thought they were the appropriate choice and were astounded at a very high, early failure rate. This counteracted the data gathered from cycling tests in their laboratories. Their eventual, somewhat mystified response was that they could only reproduce the rate of failure by hitting the buttons quite hard, adding "but of course, anybody doing that should be sacked".

They just hadn't realised that a recording studio maintenance engineer may bear some relationship to his cousin in the computer world but, in general, recording engineers are a different breed entirely. Some of them do hit buttons rather hard, especially after the 50th take of the same overdub, after six strong lagers and half a bottle of vodka, and at the end of an 18 hour day and very little sleep the previous night! Some very good engineers behave in this way.

The recording engineer is more a liaison person, between a group of artists, producer included, and a bunch of relatively hi-tech equipment. Strictly speaking, the recording engineer is still well inside the artistic domain. The front line technical people are really the maintenance engineers and despite working on the same equipment, the expectations and requirements of the two 'engineers' are frequently worlds apart. There are many instances where the required, initial, ability is equally divided between the operation and maintenance roles. It is usually not opportunity but an individual's personality that dictates the ultimate choice of direction.

As the choice of camps rests so heavily on personalities, it is no wonder that the fur flies at times, and that there is often much ongoing friction. There are exceptions but most experienced studio personnel would agree that this generalisation is quite acceptable. In the studio then, you have the business oriented types—managers and accountants; technically oriented maintenance staff; and the artists. Although all are trying to earn a living, there is still an over-riding conflict in how a sense of achievement is gained by each individual. This is of great advantage; in the above examples, they would be respectively looking after profits, technical excellence and artistic perfection. The manager's biggest headache is welding that team together and keeping it pulling in the same overall direction for mutual benefit. In close contact and under one captain, a working relationship is usually achieved.

The real problems arise between manufacturers and users. Back to the tape recorder buttons, the manufacturer's solution would have been to employ more technically oriented people at the mixing desk. They were blissfully unaware that in 90% of cases, the personality clashes between musicians and technical people would have become very strained after a short period of time in compulsory, close confinement. The results would probably be a technically and artistically uninspired recording as the correct, creative environment would probably not have been achieved. One type of character is guided by common sense and logic, the other, frequently by illogic and irresponsibility! If this were not the case, we would almost certainly plunge into an abyss of both technical and artistic mediocrity. Each to his or her own!

For these reasons, this series is written in 'a common language' understandable to all sides. Hopefully, it will look towards the best overall compromise and to evoke discussion that allows the greatest achievable results to be accomplished. Should specialist jargon be used, we will try to qualify it. Too many times people argue vociferously, while really trying to make the very same point. They have just not communicated on the same wavelength!

This series deals with concepts and caveats rather than dogma. Studio monitoring and acoustics is still very much an art form.

The number of variables is just too great to suggest that there is only one solution to any given problem. The most important step, however, in the search for any solution, is at least to know that the appropriate questions are being asked. It is in search of these questions and the sorting of the wheat from the chaff that we will now proceed.

difference was the size! What holds true for small, nearfield systems does not necessarily hold true for larger systems.

Different frequencies, at the same air temperature-density, have different wavelengths. Principles must be formed in the context of cabinet size, driver size and the wavelengths involved. A good choice of crossover frequency at one size, may be far less appropriate given a different size of cabinet/driver combination. I still feel that the generation of 800 Hz, with a wavelength of around 16 inches, is very imprecise when developed by two or more 15 inch loudspeakers. The prospects for phase cancellation are unavoidable. From a pair of 6 inch loudspeakers less than a foot apart, 800 Hz is a realistic objective! The choice of crossover frequencies must therefore only be made in the full light of the prevailing circumstances; they can't be chosen in isolation. One must always consider Phase—a whole subject in itself, which all too often has received only a fraction of its due attention. It has been the poor relation and in marketing terms has been totally subjugated by frequency response or, more correctly, pressure amplitude response. I believe that the truly audible and idiosyncratic signature of any given loudspeaker system exists in the domain of phase and the closely related impulse characteristics. Indeed, given the 'cruciality', of transient and phase responses, maybe this would be a good subject with which to begin these discussions. These areas are one of the cornerstones of the research currently being carried out on my behalf by Keith Holland BSc at the Institute of Sound and Vibration Research (ISVR) at the University of Southampton. Holland is currently conducting a three-year research programme to investigate and advance the understanding of the principles of midrange horns. The relevance of this research will soon become apparent.

Since my introduction into the recording industry in the mid 1960s, the importance of adequate system headroom has always played a great part in my thinking. Looking back, this has been an awareness of the necessity to maintain the integrity of transients. This holds true for both the electrical, and electromechanical links in the recording chain. With the seemingly ever-increasing size of control rooms, the demand on the output of the monitor system has increased alarmingly. This is the result of two major influences. Firstly, digital recording has realistically extended the lower recording limit by a full octave, while the improved transient performance of the recording medium, has made unprecedented demands on the transient response of the monitoring systems. Secondly, the so-called double distance rule, states that the sound pressure is subject to the inverse square of the distance. In other words, if you double your distance from a sound source, the power output from that source, must be increased by the square of the distance change—2^2 or four times. Four times the power is, of course, a 6 dB increase. While the double distance rule is a freefield condition and does not strictly hold for reverberant rooms, it does hold for transients in reverberant rooms.

So, 6 dB from the increased control room sizes and, say, 12 dB additional headroom to allow for the higher peaks and lower lows of digital recording technology. Realistically, this translates into a 20 dB increase in the output capability of a monitor system, compared to the requirements for a conventional, analogue studio of not so long ago. On the subject of power, I am still somewhat nonplussed by the number of engineers who ask of a monitoring system 'how much power will they take?' They are trying to ask about the relative, perceived volume level the loudspeakers will produce but this is a function of acoustic watts delivered into the room not electrical watts into the loudspeakers. The relationship is entirely a function of the conversion efficiency of the loudspeakers in their translation of electrical watts in, to acoustic watts out. One hundred watts into a driver of 20% efficiency will produce twice as much sound in the room, compared to 400 watts into a driver of 2.5% efficiency.

Given these facts, the problem of making monitor systems significantly louder, are particularly difficult in the midrange. As discussed previously, design considerations should always be made with due deference to the wavelengths involved. At 5 kHz, the wavelength is just over 2½ inches, so a prime requirement is to keep the source area small in order to reduce the potential for phase cancellation. Such cancellation is due to the different possible wave paths from a large transducer to the ear. If a 5 kHz signal were generated by a 12 inch loudspeaker, the listener would only have to be slightly off-axis, to find that the distance from the ear to one side of the cone, compared to the distance from the ear to the other side of the cone, would show a differential of around 1¼ inches. At 5 kHz, 1¼ inches or thereabouts, is 180° out of phase—total cancellation!

Midrange sound

So, the source of the midrange sound needs to be small. To be practical, it also needs to be light, in order to be capable of accelerating, decelerating, stopping, accelerating, decelerating, and stopping again, up to 10,000 times a second. These requirements may well be met by a cone or dome 4 or 5 inches in diameter but this type of driver has a typical conversion efficiency in the order of only 1 or 2%. An input of 1 watt of electrical power, would typically produce an acoustic output in the order of 94 dBA at a distance of one metre. In certain examples, however, this may be in the order of 100 dBA but, conversely, may be 88 dBA or less.

Soft dome midrange units have enjoyed a period in vogue but I believe that in the larger systems, they are on the absolute limit of their power output capability. This view is reinforced by the addition of limiters on some systems but this addition, I believe, is unjustifiable on monitor systems.

If you are going to hear a 'limited' sound, albeit at high levels, then you are not monitoring the input signal. It is obviously a workable system, as many people use it but I feel it is a last resort measure to drag the last ounce of output from a given philosophy of system. It is not possible to continue increasing the power handling capacity of direct radiators—cones and domes—as the larger coil adds weight, which is contrary to our requirement of light weight for fast acceleration and hence good transient performance. Even without such limitations, higher power from a unit of any given size, means more heat to be dissipated. A 10 dB increase in acoustical output would call for a 10 times increase in input power. A 20 dB increase in acoustical output power would, in turn, call for 100 times increase in input power. In direct radiator terms, we would be looking for something in the order of a 10 kW, 4 or 5 inch driver. Given 1% efficiency, we would be seeking to get rid of 9.9 kW of heat at peak, roughly equivalent to three, 3-bar electric fires, or three, 3 kW fan heaters. No wonder the direct radiator systems are prone to thermal failure at high levels.

The other path to follow in order to gain this 10 to 20 dB increase in output power, is to seek to increase efficiency to a similar degree. This involves creating a better match from the driver to the outside world—the fitting of an acoustical transformer—in other words, a horn! Typical sensitivity of midrange horn/driver combinations, range from 105 to 111 dBA for a 1 W input at a distance of 1 m. This represents the very 10 to 20 dB increase we were originally seeking. Such horn/driver combinations already exist, having adequate power handling, together with the benefits of lightweight diaphragms for fast transients and good high frequency response.

For me, horns hold the key to larger systems. They can deliver fast, clean, 'unlimited' power, from a relatively small source area. They also possess the potential for more easily controlling the direction of the radiated sound. This last point could provide tighter control of the acoustics in the intended soundfield of the monitors. Avoiding splashing it about in the areas where it is not required, reduces unwanted reflections in the larger rooms.

Although horns have suffered a somewhat mixed reception in the recording and broadcasting industries, much of the criticism seems based on unfounded or ill-informed prejudices. Some criticism, however, has indeed been quite solidly based. It certainly appeared that despite much textbook analysis of horn systems, fundamental gaps existed in the ability to describe accurately the perceived sonic characteristics that could provide an adequate basis to design and develop new, more acoustically accurate horn systems.

This was the basis of our work at the ISVR and although initially aimed at midrange horns, the information accumulated has very far-reaching repercussions; throughout the entire field of loudspeakers, associated equipment and the listening environment in general. I begin at the beginning as we very soon were drawn into aspects of impulse and phase non-linearities.

Research

Work began with an analytical re-appraisal of all that could be found on what was already known and held to be true. This was followed with a mathematical re-analysis of the problem to help with the definition of our objectives. One-dimensional mathematical modelling proved very time consuming, even with the help of computers. Two-dimensional modelling has proved to be even more formidable, as the interaction potential is enormous. Even more daunting was the full, three-dimensional modelling. This work is now being carried out in collaboration with Tonni Johansen at the University of Trondheim in Norway. Here, a purely mathematical approach is running in parallel with the intensive theoretical and practical research in Southampton.

At the end of the first academic year, we were armed with a good set of reference points to help make some order out of the incoming data from the practical experiments. With the students home for their summer holidays, the laboratories were commandeered for three months of practical experimenting. We began with an assessment of a large selection of horns, commonly used for monitoring, public address, hi-fi and even some from 'way-back'. The latter included gramophone horns from as early as the 1920s. Over the years, different horns have acquired various reputations for their perceived sound quality. In general, many JBLs have been deemed to be 'hard' while ▷

Tannoys were generally referred to as 'sweet'. Both manufacturers have for many years been great exponents of the use of midrange high frequency horns. Both have their partisan following and both, equally, have their opponents. Why?

We had horns made from metal, wood, glassfibre, cardboard (the LF cone of a Tannoy dual concentric forms the outer part of the HF horn) and plastic. Would there be a consistency of measured result that would group together shapes, sizes, construction materials or any other parameter? I had, from experience a pretty good idea of the horns I could group together according to acoustic properties. But would the measurements match any of those groupings?

We began with the frequency response derived acoustically and from measurements of the acoustical impedance of the horn. This used a technique employing the drive from a plane wave tube, as devised by Dr Frank Fahy and Keith Holland at the ISVR. Although producing a wealth of information for future digestion, the results were inconclusive, except in a somewhat negative sense. The horns with the most 'ruler flat' impedance response were most certainly not the smoothest or most natural sounding of the horns in our estimation. Another feature of some of the horns with the most tightly controlled impedance responses, was that the deviations from the norm were more 'spikey'; the deviations had a much sharper Q.

Could this be the result of a series of mechanical adjustments to iron out irregularities in the amplitude responses? This may be analogous to using a ⅓-octave equaliser to smooth out irregularities electrically by removing a large, broad, hump or dip, by a series of smaller, narrower dips or humps respectively. More of this later!

It was most apparent that some horns with a 'harsh' reputation had remarkably uniform amplitude responses. Subjectively, many engineers of repute would state that a certain frequency band on these horns needed reducing. Using equalisers, that given frequency band would be reduced to a level, considered to acceptably remove or significantly reduce the harshness. The truth was that the equalisers reduce a given band of frequencies, which when measured, rendered the output of the horn anything but flat. Still unconvinced, many engineers would insist that the frequency response was now smoother. It most definitely would not be so.

This reminds me of a time in late 1985 when I installed a set of 4-way monitors in Firehouse Studios, North London. There had been a hiccup in the supply of the prescribed JBL 10 inch low-mid drivers, which spanned the range from 300 Hz to 1200 Hz. As a stop gap, an Electro-Voice *EVM 10M* was substituted till the JBLs finally arrived. The E-V was a fine loudspeaker in its own right, although being primarily designed for PA. The system exhibited an acceptably uniform pressure amplitude response but the monitors were considered somewhat brittle at the extreme top. Reducing the level of the slot tweeter seemed to help but toilet paper over the slots was used as a temporary fix. These slot tweeters operated from 6 kHz upwards and at the time, there was much conjecture as to the source of the problem. Before the problem could be resolved, the JBL *2122s* finally arrived. Upon installation, the problem immediately disappeared to the relative consternation of all concerned. The tissue paper was removed from the slots, operating 2½ octaves above the uppermost frequency of the loudspeakers, which were changed. Investigations showed that the frequency responses of the E-V and JBL, over the relevant range, were to all intents and purposes identical to within very close tolerances. Once again, the problem proved to be neither where, nor what it originally appeared to be; even to experienced ears.

Despite the above problems not necessarily showing the same origins, in both cases a subjective alteration in the pressure amplitude response was initially deemed to be the fix, while in neither case, was a pressure amplitude response, the source of the problem! This is at the root of one of my main objections to the use of ⅓-octave equalisers on monitor systems. They are often seen as the potentially universal panacea for all monitor ailments, with endless twiddling of the knobs being undertaken, in a futile search for that elusive, 'correct' setting.

Obviously, a horn with a grossly uneven pressure response will sound unconvincing but within reasonable limits one thing was becoming abundantly clear. The frequency response was most definitely not the prime parameter, determining the perceived, sonic characteristics of the horns themselves.

Change of signal source

At this juncture, we decided upon a different signal source—a step. To this point in time we had been using PRBS a pseudo-random noise signal consisting of 500 discrete frequencies. This is similar to pink noise but is easier for the analytical computers to recognise and process.

The impulse responses of the step began to show a much greater disparity in the characters of the different designs of horn. As an extension of this programme, we started looking at the impulse responses all the way back through the system; all the way back into the textbooks and classic papers. Time and time again, the phase integrity of a system is cited as being of importance to the character of the leading edge or transient nature of a signal. In purist terms, this is a contradiction. Phase can only relate to a steady-state signal. A mathematically perfect sinewave, began at the dawn of time and continues to the end of time. At the other extreme is a pulse—a change in state, occurring in an instant and lasting for a small, fixed duration. Whereas a sinewave is of one solitary frequency, a pulse, or for that matter a step, contains all frequencies simultaneously. A common misconception when phase lead and phase lag are considered, is that they imply a lead or lag in terms of realtime. If a sinewave has existed for all time, such a lead is feasible. In the case of a pulse, however, no such phase lead could possibly anticipate the onset of the pulse. Mathematical precepts of such negative time values often appear to be used completely out of context. Such negative time has no place in the realms of impulses in practical loudspeaker designers.

Phase, albeit not directly appropriate in relation to transient impulses, is a close cousin of the frequency dependent time delay encountered in the propagation, either electrical or electro-mechanical, of a pulse, step, or transient of any nature. Recently, at the ISVR Professor Taylor performed a demonstration of the sound of various instruments, with their leading edges removed. Without this leading edge transient information, the various instruments involved, varying from violins to oboes, were almost indistinguishable from each other. This implies that the majority of the information that makes one instrument readily discernible from another, is the attack of the note, rather than the sustain or decay. This has, of course, long been known to the designers of synthesisers: a poor phase response automatically means an inaccurate transient response. So, while phase relates only to a symmetrical, steady-state signal, the root causes of its effects cannot in practice be separated from transient performance. This is probably why the ▷

Footnotes

- In 1971 the late Richard Heyser of the Jet Propulsion Laboratory at Cal Tech, published in the *JAES* a far-sighted series of papers on the subject of arrival times of impulses. Twenty years on, I am surprised that his work is not a by-word in this industry. Similarly, in the September 1982 edition, Lipshitz, Pocock and Vanderkooy published a paper 'On the Audibility of Midrange Phase Distortion in Audio Systems'. In their summary and overview, they stated that they did not understand why there were still reports appearing that state that the human ear is deaf to non-linear phase changes! I can only add to that, my own incredulity that probably less than 1% of studio personnel with whom I discuss monitor systems, can speak with any degree of lucidity, the concepts and clearly audible effects, of steady-state phase shift and impulse phase-slope characteristics. Almost all, top line, professional monitoring systems, have an acceptably uniform pressure amplitude response or frequency response. It must surely be obvious that one must look elsewhere to find the major discrepancies between different systems.
- Could it be that many previous attempts at assessing the general audibility of phase distortions, have been carried out using equipment with inherent, non-minimum phase properties. Such equipment could easily mask any potentially audible phase discrepancies being sought by the investigators. Probably the only readily available commercial loudspeaker system, exhibiting truly excellent, on-axis, minimum phase characteristics, is the Quad Electrostatic. Though not suited to studio monitoring purposes, the *ESL* has long held a reputation for clarity, sweetness, smoothness and transparency. These qualities can, almost without doubt, be attributed to the *ESL*'s on-axis linearity of phase response. The evidence has been before us for over 30 years.
- In the light of the effect of conventional 12 dB/octave crossovers with respect to transient response, I have never understood how any company could preach adherence to the principles of absolute phase, then use a 12 dB/octave crossover in their system. Absolute phase with respect to which end of the spectrum—the high frequencies or the low frequencies? Certainly not both!
- It may be worth pointing out that analogue, magnetic tape recorders suffered from considerable phase distortions. Once again, this may have masked many prior attempts to determine the necessity for phase accuracy, especially as a magnetic tape master was at the source of most reproduced audio signals. The advent of digital mastering may have now removed that mask. This problem must now be faced square on!

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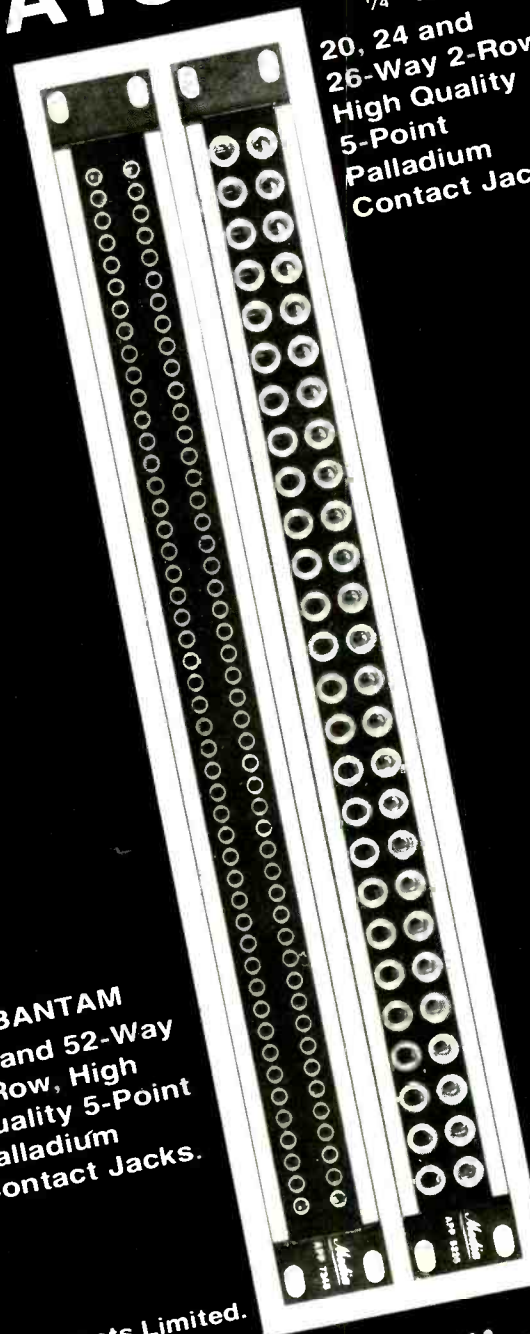

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terminology has become somewhat confused and interchangeable. As music is largely composed of transients and asymmetrical signals, the textbook statements about the relatively small, audible effects of phase, are somewhat misleading. Certain phase discrepancies on steady-state signals may not be readily discernible; but steady-state, symmetrical signals have little to do with music, save for the old chestnut of the 'lightly blown flute'!

Concepts of phase and absolute phase go back a very long way. There are, to the best of my knowledge, three manufacturers adhering to the principle of absolute phase. This principle implies that a vocalist, in a studio and facing the control room and engineer, when making a plosive 'p' or 'b' sound, would cause the diaphragm of the microphone to move inwards. This would be in response to the positive pressure wave emanating from the mouth. It follows from this that the loudspeakers in the control room, should move outward, in order to create a positive pressure in the control room. In order to achieve this, and assuming the electronic components of the system are in phase, the loudspeaker cone should always move outwards in response to a microphone moving inwards. The three loudspeaker manufacturers who seem to have adhered to this concept are JBL, Tannoy and Quad.

Although Tannoys and Quads, only rarely appear to be intermixed with drive units from different manufacturers, the same cannot be said of JBL. Drive units of JBL origin appear in the monitor systems of many specialist manufacturers such as Eastlake, Westlake, UREI, Reflexion Arts and many others. These manufacturers use JBL units in conjunction with drive units of other manufacturers, such as Altec, Emilar, Gauss, TAD and Electro-Voice.

In so many instances in the past, studio engineers have unwittingly attempted to substitute, say, a TAD compression driver instead of a JBL, or a JBL bass driver instead of a Gauss. Mostly it is not realised that such a substitution must be accompanied by a polarity reversal of the loudspeaker connections to avoid disturbance of the system design, most noticeably around the crossover frequency. A positive voltage on the red terminal of a JBL causes the cone to move inwards, or the diaphragm away from the phasing plug. This is in the opposite sense to Gauss, Electro-Voice and most other manufacturers where a positive voltage to the red terminal causes a positive pressure wave or, in other words, the cone moves outwards.

The consequence of such unwitting phase reversed substitutions is not necessarily disastrous. Although the loudspeaker system would not be functioning as the manufacturer intended, that could well be said to be the case merely by any substitution of components—in or out of phase. The answer to the conundrum tends to lie in the type of crossover used. Why? What is absolute phase?

While much more research is required on the subject of the audibility of phase shifts and phase slopes, I believe it is safe to say that the human ear, responds mainly to the rarefaction half of a sound wave. The ear is an extremely non-linear organ, further implications of which we shall discuss later. Strong evidence has existed for some time that a drum beat sounds different, depending on whether the initial, transient, pressure wave is positive or negative going. In other words, whether the initial attack of the pulse causes the loudspeaker cones to move inwards or outwards. This is the principle of absolute phase to which Tannoy, JBL and Quad have adhered, so if you

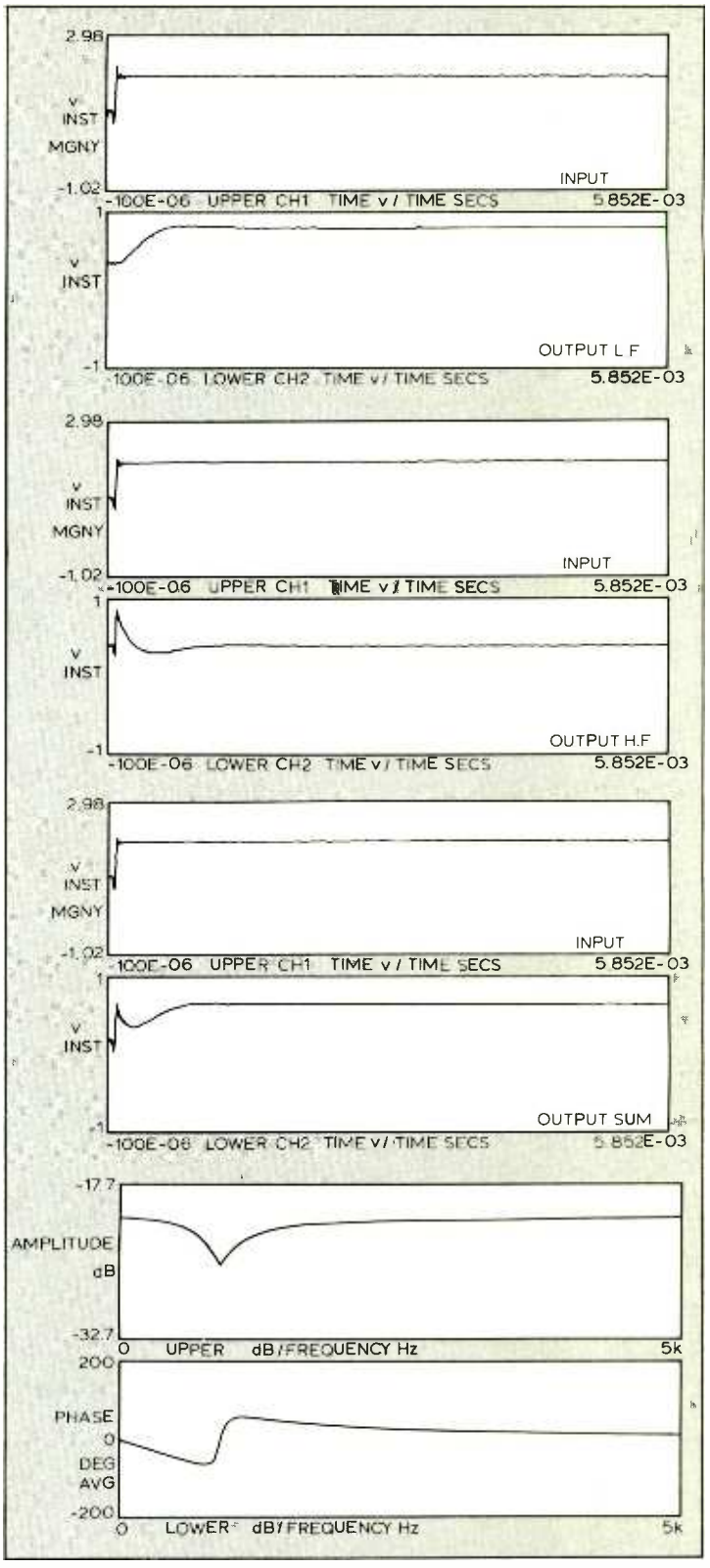

Fig 1: Low frequency output

Fig 2: High frequency output

Fig 3: Summed output—in phase

Fig 4: Summed output—in phase

are ever dealing with a non-factory re-cone, always double check!

Returning to the subject of the potential disaster factor of such interchanges being dependent on the crossover, it depends on the slope and the design. **Fig 1** shows the step response of the low frequency output of a JBL *5234*, 12 dB/octave, electronic crossover. This is a superbly engineered unit, which, being of excellent quality and typical of its genre, will very clearly show the normal characteristics. The top scale is the step input, the lower scale the output. **Fig 2** shows the high frequency output of the same crossover, responding to the same step input. **Fig 3** shows the summation of the two outputs—a respectably good approximation to the input signal. **Fig 4** shows the pressure amplitude response or frequency response of the combined outputs, along with a representation of the phase response. The frequency response shows a distinct dip at the crossover point, which can clearly be seen to relate to the sudden break in the phase response as the crossover frequency is approached. With all conventional 12 dB/octave crossovers, the two outputs shift in phase, one by +90°, the other by −90°, resulting in a 180° phase discrepancy at the crossover frequency. When summed, the 180° out of phase crossover point results in cancellations and hence the frequency response dip. ▷

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SONY 3324	£P.O.A.

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ITAM CM50 1", auto, spares E.C.	£3,500
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STUDER A80 VU ¼ inch/½ inch, 15/30ips	£P.O.A.
STUDER B67 15/30ips in console, ec.	£2,500
TASCAM ATR60 with centre track timecode	£4,450
TASCAM 38, 8 track, ex-demo	£1,295
OTARI MK III, 8 track, ½ inch, ex-demo	£2,750

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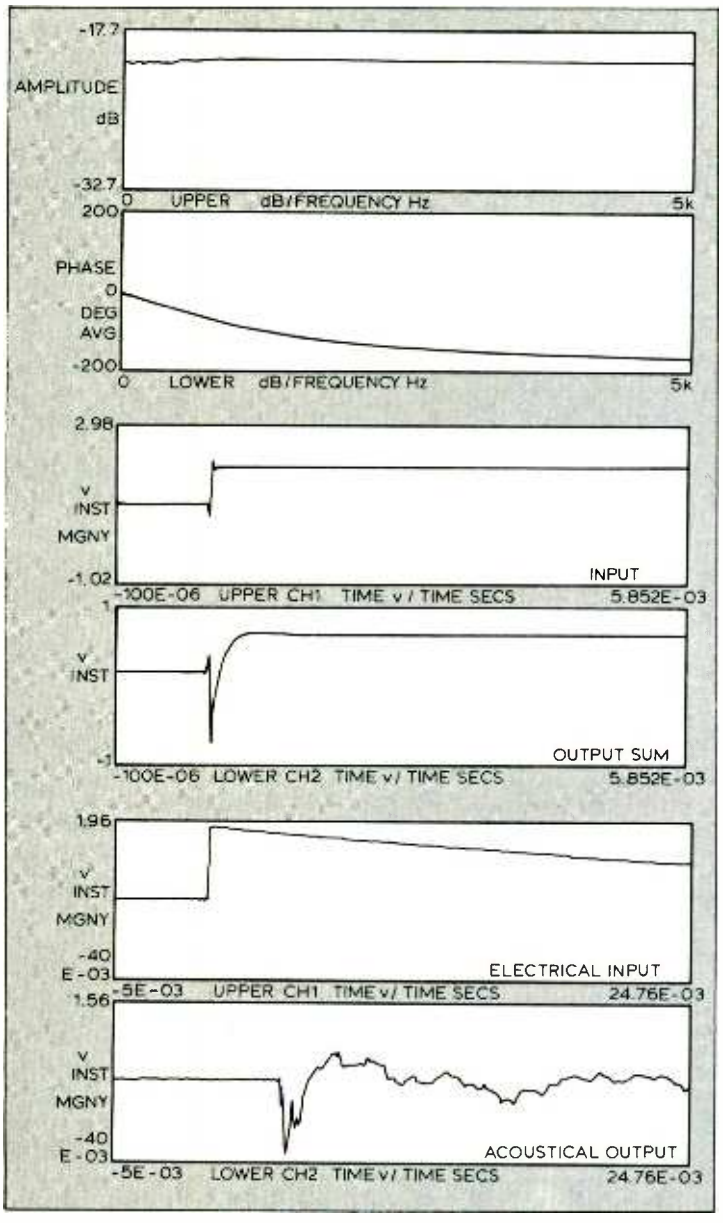


Fig 5: Summed output—180° inverted

Fig 6: Summed output—180° inverted

Fig 7: NS10

It matters not whether this summation is made electrically at the crossover outputs, or acoustically in front of the loudspeakers; the effect is the same—cancellation.

Over a period of many years hi-fi enthusiasts and studio personnel alike, have become accustomed to looking for a flat frequency response when assessing equipment from brochure or magazine reviews. Responding to this, the marketing departments of loudspeaker companies have been concerned when confronted with a pressure amplitude response as shown in **Fig 4**. **Fig 5** is identical to **Fig 4** in all respects other than that one of the outputs has been reversed in phase. *Voilà*, a flat frequency response.

This method of obtaining a marketable frequency response is standard practice for many loudspeaker manufacturers. Although the drivers are out of phase, any cancellation is significant only by the time they are well away from the crossover frequency. One octave above the crossover point the low frequency driver will be providing an output 15 to 18 dB below the corresponding output from the high frequency driver, and *vice-versa*. As such, this could contribute only to a very small degree of cancellation, borne out by the flatness of the pressure amplitude response. They are only out of phase with each other at frequencies where effectively, only one driver is operating. Therefore, it is deemed they are not out of phase *per se*.

Fig 6 shows the step response of a system connected according to this philosophy. It can clearly be seen that as one driver responds to the input in one direction, the other driver responds in the opposite direction. Obviously with these conditions prevailing, we cannot even pretend loyalty to the aforementioned principles of absolute phase. This is straddling the phase fence in no uncertain terms. I just cannot accept that the step response of **Fig 6** is audibly the same as the step response of **Fig 3**; but how does this work out in practice?

Fig 7 is the step response measured 4 ft away from the front of a Yamaha *NS10*. The similarity to **Fig 6** is totally unmistakable. This is borne out by the frequency response graph printed on the back of most pairs—very flat indeed. The *NS10* is by no means the only example of this phenomenon; I cite its case as it is currently, probably the most widely used nearfield monitor. Many other loudspeakers are connected in a similar way; it is almost standard practice for use with 12 dB/octave crossovers. On numerous occasions, when listening to studio monitor systems, people have noticed drums changing subjective pitch when switched between the main studio systems and the *NS10*s. This change in timbre can be partly attributed to the fact that minor disturbances in frequency response are easily audible in a random signal such as untuned percussion, or pink noise. There is, however, no shadow of a doubt that the phase considerations also play a major role. When phase is the prime casual factor, no amount of frequency response correction will bring the two systems into line.

The transient of **Fig 7** is, quite patently, not the transient of **Fig 3**. The fact, therefore, that there is a change in subjective pitch when switching between systems is likely to be caused by the fact that we are not only switching between loudspeaker systems but between **Fig 3** and **Fig 7**. No wonder the system sounds different. Many listening tests have been carried out with the high frequency drivers restored to their in-phase condition. By far the greatest number of people with whom I have conducted these tests, preferred the in-phase connection with its frequency response dip at the crossover frequency. The general impression was that the sound was more open, transparent or natural, despite the response dip being audible—though by no means alarmingly so. Try telling this to the marketing people!

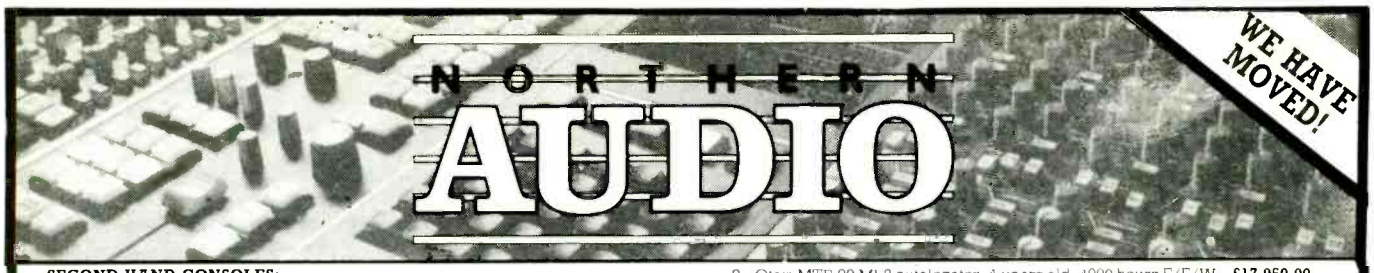
We thus have a situation where the requirements for the integrities of pressure amplitude and phase are in total opposition. For conventional 12 dB/octave crossovers, this must be the case. For passive crossovers, 12 dB/octave is a very useful compromise between acoustical performance, out-of-range driver protection, especially for tweeters, power loss/heat dissipation in the crossover, cost and numerous other factors. Such crossovers are used because they are practical and in most instances, acceptable. Bi-amp your *NS10*s and use a suitable 24 dB/octave crossover and you have a much more accurate system. However, such a device is not an *NS10* and as a non-standard device, no matter how 'improved' it may be, it is not acceptable to the industry by its very non-standard nature.

I have to admit that despite everything, I have had my burdens greatly eased by the general acceptance of *NS10*s as a basic point of reference. At least, everybody in the industry seems to know them. Whether they like them or not is of no consequence as any reference is better than none. This is especially true in an industry where subjective viewpoints had all but removed any points of reference. I therefore understand the 'don't tamper with your *NS10*s' philosophy.

In 1987 I designed a nearfield monitor system avoiding the above caveats and it cost five times the price! One does tend to come under the influence of the law of diminishing returns as one seeks to progress—in time, effort and money!

So what of the person who inadvertently replaces the JBL bass driver with Gauss and fails to realise the polarity reversal implications? With 6 dB/octave crossovers, it would be disastrous, though few, large systems would be likely to use 6 dB/octave crossovers. Should the system employ a 24 dB/octave crossover—equal disaster, both near and away from the crossover point, the drivers' polarity would be incorrect from the point of both pressure amplitude and phase. With 12 dB/octave and 18 dB/octave crossovers, however, the answer is not so straightforward. These crossovers cannot possibly sum up to unity with any integrity of phase. It is a case of deciding your own priorities and using your own ears.

Only one thing is certain, neither way is absolutely correct. It is in the light of this type of ambiguity that we shall continue to look at the various aspects of room acoustics and monitoring.□



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TWO TRU

Tim Frost visits the BBC's Transcription Unit—a mobile recording facility with wider applications than might first be imagined

One way and another, within the confines of the BBC there are more sound mobiles than in the rest of the UK audio industry put together. The Transcription Recording Unit's second generation mobile, fits a 24- or 48-track SSL studio in a 17 ton truck. With commercial bookings becoming somewhat more common, it was a good time to visit the Transcription Unit's facilities to see what they are doing and how the winds of change to the 'new commercial reality' are affecting this lesser known outpost of The World Service.

While it is housed in BBC buildings in Shepherd's Bush, Transcription Service gets its non-commercial funding, not from the TV licence payer, but from the BBC's Grant-in-Aid allocated by the Foreign Office. Its main brief has always been to supply quality radio programming to foreign broadcast stations. These programmes have a vast range. Some material is taken from the output of national BBC radio and TV, and some is originated by the Transcription Service itself. Of course, many countries have similar departments to generate programmes to disseminate their culture or cultural view of the world but only the TS has the bravado to charge for their programmes. And their international market is still one of the largest, which only goes to show that if you produce a better mousetrap, the world will still beat a path to your door—even when everyone is giving theirs away free.

Programme sales account for most of TS's income but in a move to generate increasing 'value for money', TRU is now making its recording facilities more available on the commercial market.

Their primary market is live performance recording for both classical and rock music. The new mobile, TRV2, is the key to this work. The original mobile started with no permanent desk but was latterly equipped with a Neve which, in keeping with the times, was fully quadraphonic. With the commissioning of TRV2 the Neve desk was put into the second remix room. The second generation of mobile gave the engineering team an opportunity to change the things that went on their wish-list from the original mobile.

The primary change was to make the unit more soundproof, especially as the van is used at open air rock venues, when it is difficult to be clear whether the bass is coming from the monitors or bleeding in from the PA stacks. The new van was commissioned with a 48-track SSL *SL 4000, E* series computer and *Total Recall*. The tape complement was 24-track Otari *MTR90* and *SP24*, a pair of Studer timecode *A810*s and a *B67*, a pair of *PCM C9/701* combinations and a smattering of AMS *dd*ls and reverbs. Monitoring is via *LS5/8* redesigned as angled corner cabinets. *LS5/8*s are BBC standard but may be replaced with customised ATC *100*s as they are felt to have greater headroom. Working for radio, TV and commercial recording, the mobile can be configured for recording direct to *701*s—the case for most of the orchestral work; as a mixing room for TV work; and either 24- or 48-track multitrack, for rock'n'roll. The original internal layout was organised by building a full scale mock up of the interior from Dexion and cardboard and fine tuning the layout accordingly.

Talking to Gareth Watson about the choice of desk, it appears the SSL came about as a 'cautious' choice.

"The BBC has quite a few SSLs and for us it's a well proven desk, especially with several other SSL mobiles within the organisation. As far as we know it's the only 48-channel SSL mobile available for hire in the world. The added bonus is that the desk is well-established in the commercial world. We did a gig with Steve Winwood and his sound engineer just zapped into it because he is used to SSL in the studios."

The truck is pre-wired for 48-track operation for a second Otari and Dolby rack that can be brought in from the main studio. There are no plans to convert to *SR* at the moment since the operating levels and material obviates any real benefit.

"Nearly all the multitrack recording is for live stage performances, which are a lot less restricting on tape noise floor. We drive the tape at 1000 nWb and we're very careful about levels. We're staggered when we see people using vu's. The desk is always used in the PPM mode and there is a separate headphone monitoring panel with its own Dolby decoder and BBC PPM for confidence checking on and off tape."

Nearly all of the classical work is recorded directly on to the *701*s. Occasionally they use ¼ inch if its being produced for the BBC's TV or Radio departments, who still primarily use open-reel rather than digital.

"We were already quite well into digital when we planned the new mobile. We use the *C9/701*s for all of TRU's stereo recording. They're reliable, need no line-up and the tapes last two hours. We don't have to change reels every half hour as we do with open reel."

TRV2 has been designed to run with a relatively low level of power consumption. Full demand is around 45 A from a 60 A supply line but the supply circuits have been arranged so that the mobile can run off two or even just one domestic 13 A socket in an emergency. The first 13 A line supplies the mixer and the stereo machines, with lighting coming off the van's 24 V supply. The second power line can be switched to supply either the air conditioning or the multitrack. This emergency life-line has saved the day on a Jazz Festival where a generator failed just 30 minutes before the first band came on stage. A couple of long extension cords and the

truck was up and running again.

In addition to the mobile, TRU has the main 24-track SSL studio with a sizable music floor, a Neve-based remix room, a voice studio for commentaries, voiceovers, interviews and discussions, a digital mastering room and two disc-cutting rooms.

In these days of cassette, CD and R-DAT, 350 hours of programmes are sent out, by post, on black vinyl. The LP is still the most universally acceptable distribution medium, especially in developing countries. The disc cutting rooms service both this and other BBC LP production requirements. Much of the programme material is supplied on PCM masters and an AMS delay is used to allow the preview signal. But CD is about to overtake LP, with all but the most far-flung broadcasters re-equipping to the 'new' technology. Any mastering can be done in-house in the mastering room which is set up around a Sony *DAE-1100* and their own computer system. At the Time of our visit they were mastering the 27th BBC effects CD. Like the previous 26 all-new, digitally recorded effects collected by specialist fieldworkers at Broadcasting House. The effects in this case, were 101 varieties of baby gurglings, originally recorded on Betamax. They were directly transferring from the *F1* to U-matic under the control of the Sony editor. Those who know the Sony, know that it has no control ports for *F1*s. The normal routine is to copy the originals up to U-matic and then start editing. TRU engineers have developed a system that slaves the *F1* to a U-matic. The editor is controlling two U-matics, master and source, exactly as normal but the source machine is loaded with a blank tape. By using a combination of timecode, BBC computer and the *F1*s remote control, it is chase-locked to the U-matic.

Watson explained, "As you control the U-matic, the *F1* follows accordingly. The Betamax run-up time on the *C9* is very consistent and the system works accurately enough even for music editing, without having to transfer to U-matic first. This speeds up programme turnaround by 30%. Just as well, as the suite is very busy with in-house work for music editing and CD mastering."

The main studio has an *SL 4000 E*, which was to be 48-channel and fully computerised from the outset. Financial restraints held back the inclusion of the computer and the last eight channels when the desk was originally installed. In the initial checks Watson found the compatibility between the *E* and *G* series computers to be excellent. There should be no

problems in transferring the *Total Recall* data from the mobile to the studio.

The mobile and the studio have been developed to work together—the mobile for original recording and the studio for remixing, editing and very occasional overdubbing. The Transcription Unit's expertise is in a wide range of live performance recording, both rock and classical. Paul Nickson, outlined their rock activities.

"One-day gigs—the live commercial gig—suit our expertise down to the ground, it's what we're doing all the time. We are used to working very quickly. Set up on the day and then maybe a couple of weeks later, depending on studio bookings, we will finish the remix normally in two to three days."

Despite the fact that TRU is recording live performance by first league bands, for worldwide distribution, there is a lot of resistance to major overdubbing work back in the studio.

"Overdubbing—it is the producer's policy not to do a live concert and then come into the studio and re-do it. It is important to preserve the integrity of the live performance. If something actually fails, then we'll try to fix it in the studio. With T'Pau recently, the bass DI went down on an important song, so the bass player came in and overdubbed the missing part."

There is a small amount of judicious editing as the programmes are aimed at the world market.

"The rule is that the programmes can all go out without having to be checked out first by the local broadcaster. We have to be in the 'expletive deleted' business, even if it is by nothing more sophisticated than dipping the fader to lose the occasional word."

The *Total Recall* has added to the material they can record at a gig. Now if they want to record both the headline band and the support, they can simply *TR* the main band mix and then set up for the support band. Then "go off for a beer and a worry", come back and do the support band and then *Recall* the main band settings.

The commercial work has developed out of these live recordings. Some of the first commercial work was for live B sides. Among others, Graham Parker, Lone Justice, Hothouse Flowers, Deep Purple, The Beat, Split Enz, Alison Moyet and Joe Jackson have released material from TS. The BBC Manchester mobile did a concert with Hothouse Flowers, which TRU remixed. They were sufficiently pleased with the mix and bought rights for the track as a B side. The live Smiths album was taken from a recording they had originally made for TS.

The longest commercial booking for the mobile was partly as a result of the Hothouse Flowers B side. Nickson explained: "Hothouse Flowers approached us to supply the mobile for their second album, which was to be recorded in a old manor house in Eire. We went over with the truck. It was a nerve-racking experience just to get the van into the place, 500 acres of grounds with a lovely mansion in the middle of it. As the main gate was just too low to get the van through, Pat McCarthy (the engineer) had discovered a rear gate, which was also just a little too narrow. The owner, Andrew Cavanaugh, said no problem, got out his JCB and dug out the gate. The 17 ton truck got stuck and Cavanaugh brought up the JCB again and used its arm to drag the van forward 10 ft at a time. When we had just 6 ft to go, it came to an absolute stop with the front wheels pointing in opposite directions with a snapped track rod. A local mechanic crowbarred the wheels straight while it was dragged the last 6 ft. It took eight hours to do that journey. They fixed the van on the site. We were working inside, while they'd got it jacked up and were working underneath it."

The mobile met the studio's work demands very well although the routine was entirely different in style and pace to Nickson's normal experience.

"We spent half a day to get a drum sound which seems exceedingly luxurious compared to our normal pace. Pat had a lot of his own stuff—tube levelling amps, Focusrite and Neve EQ.

The Flowers was the mobile's first major album. The three week lockout booking was a problem, as other BBC jobs come up at the last minute. A lot of the commercial work is centred on concert performances, which only require the mobile for a couple of nights.

"Decca have used it, as it makes more sense to use a mobile to cover live concerts in the Festival Hall, rather than install all the equipment just for a single night. We provide the technical resources and their engineer sits behind the desk. If you want a mobile with some expertise in serious music recording in a mobile form, our approach and our range of microphones is as good as anyone else's."

Despite the commercial overtones, the mobile is primarily booked for the Transcription Service's own use. Gareth Watson summed up:

"We've become more commercially aware; membership of the APRS and a little bit of low level publicity have made people aware of our existence. We're not a full-time commercial mobile like the Fleetwood mobile. TRV2 is actually expensive to rent. So people will come to us only if they particularly want the facilities we offer. If you want an SSL on the road, this is it."

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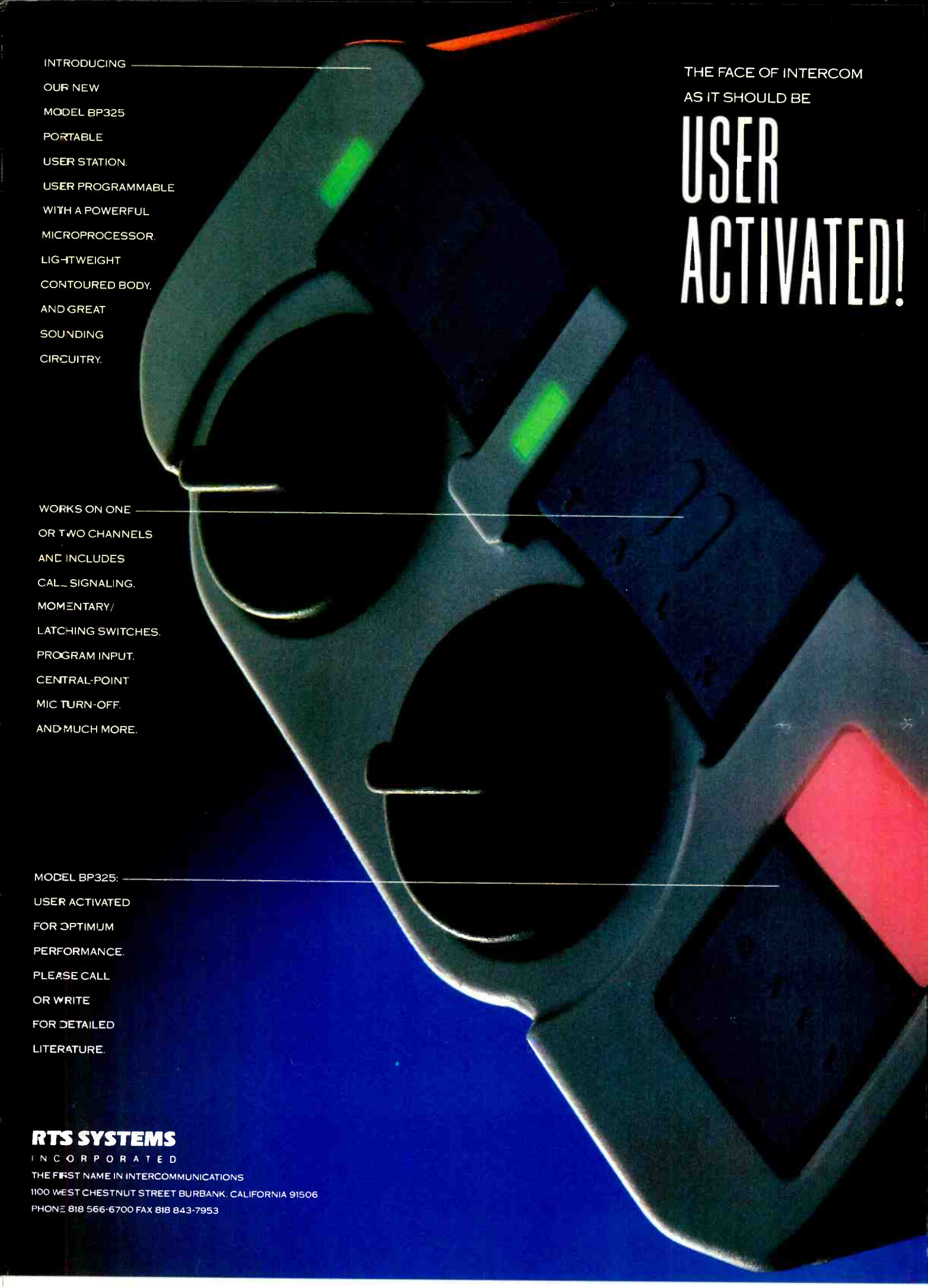

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VCAS INVESTIGATED PART THREE

Ben Duncan continues his survey of 'industry standard' VCAs, with ICs from all the manufacturers covered so far and outlines the test procedures to be used in their evaluation

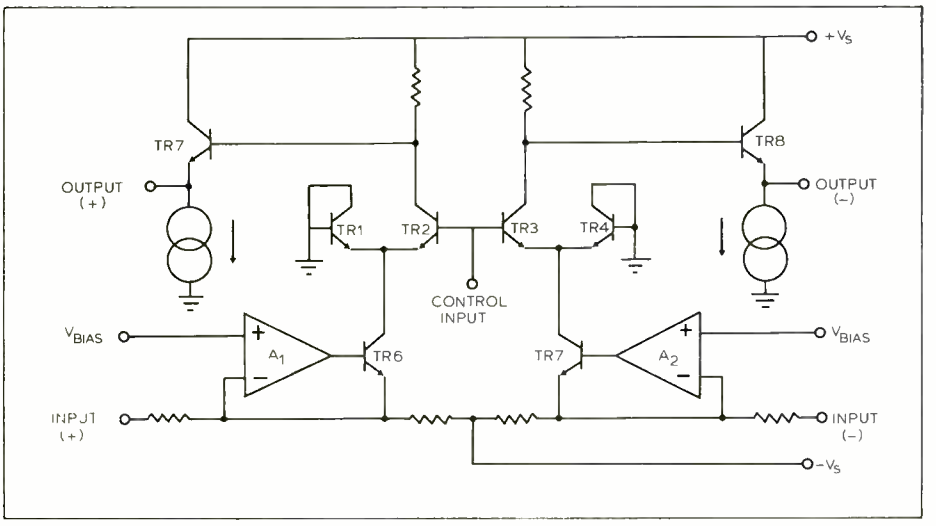

FIG 1: Simplified schematic of B&B 1537A VCA

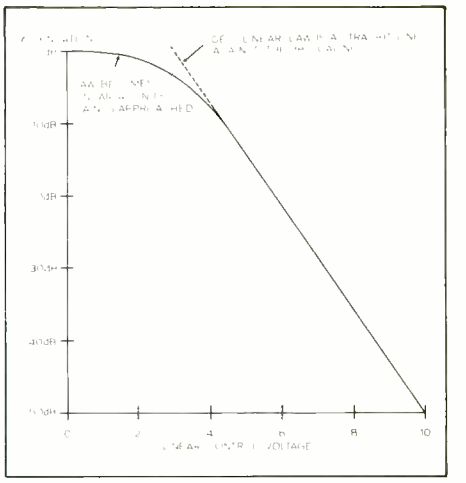

FIG 2: Typical gain control law of emitter-driven CRT class of VCA (includes model 1537A, MTA-1537 and VCA 1001). The 'deci-linear' or logarithmic portion produces a nearly linear rate-of-change or perceived SPL

Aphex and the emitter-driven VCA

Aphex Systems Ltd entered the VCA arena in 1978, when they began using and marketing the *1537 VCAtt*, designed and patented between '76 and '78 by B&B (Baskind, Bissot & Associates). As a processor manufacturer with a mission to make its wares as transparent as possible, the problems Aphex encountered with the VCAs readily available at the time (they were all log-antilog types) were overcome by employing a variant of the classic CRT cell (see **Fig 6**, Part One, June 1989). In this kind of topology[1] (sometimes called 'the AGC format', and previously developed for modulating or multiplying RF signals), are the same two differential amplifiers (*TR1-4*), coupled back-to-back (**Fig 1**). Only this time, the audio input is effectively coupled to their emitters. Before being applied, the incoming audio is both summed with one half of the control signal and converted into current by op-amps (A1 and A2). Note the input and output ports are differential, ie inherently balanced.

Once again, the four cell transistors are of like polarity, easing the task of precisely matched monolithic manufacture. And they can readily be either npn (as shown) or (if you want to be awkward) pnp—achieved by flipping the circuit on its head and reversing all the arrows. Like Gilbert's original current-ratioing transconductance VCA, the *1537A* and its derivatives have a preferred maximum gain of 0 dB. So much explains Aphex's preference for the term *VCAtt*. The AGC circuit's inherent bandwidth (typically >>1 MHz) and high frequency linearity is potentially far in advance of log-antilog types, regardless of gain setting. Over on the roundabouts, its gain control law, while logarithmic below −12 dB, changes to a linear curve when the attenuation command traverses −12 dB to 0 dB (**Fig 2**). With a straight control signal (as produced by a manual, linear fader or linearly rising/falling voltage), the rate-of-change of signal voltage in the upper reaches would sound highly non-linear.

Yet in certain processor applications, notably compressors, the progressive change of law close to unity gain has been found to be quite useful! Besides, the preferred deci-linear control law can be closely approached by placing piecewise correction circuitry in line with the control port (**Fig 3**). For accurate tracking in a multichannel set up, a circuit of this kind requires precision, low drift op-amps and close tolerance, low tempco resistors. The extra cost and complexity of these parts needs to be borne in mind when comparisons are made.

In being the first to promote and use a new species of VCA topology, Aphex have some suggestions as to why the log-antilog VCAs they experienced pre-1978 have been described in some quarters as imparting a sound that's 'compressed', 'grungy' and 'undetailed'. Aside from the objections dealt with in Part Two, npn and pnp transistors made with existing technology inevitably exhibit different gain-bandwidth products across the scale of collector currents (in the future, this might all change with new processes). So at high frequencies, the two halves of the signal will develop different and complex distortion spectra. Second, Aphex point to music's asymetric power envelope modulating the core devices' emitter junction temperatures, as a cause of distortion. Whether it's clearly audible or not, one thing's certain: it won't be evident in 'industry standard' tests carried out with continuous sinewaves.

In 1987, during development of a new expander-gate (now known as the *612*), the contemplation of a new generation of products, Aphex decided they needed a better VCA, one which would extend the dynamic performance of the 11-year-old *1537A*, considered by Aphex still to be the best available. In turn, they've recently released a completely new VCA of their own design. Their *VCA-1001* builds on the symmetrical AGC circuitry used in the *1537*. With the latest linear IC fabrication facilities, the transistor geometries have been optimised for a closer approach to truly isothermal conditions. Compared to the *1537A*, Aphex believe their *VCA-1001* has wider dynamic range, and better stability when hit by fast slewing control signals. Control feedthrough is specified at typically 10 times less than the *1537A*, or 100 times less than "many log-antilog VCAs".

Aphex's *VCA-1001* incorporates much of the external front-end circuitry required with the *1537A*, making its performance less dependent on layout and physical compactness. A bandwidth of several MHz is feasible along with a generous slew rate, one that remains comfortably beyond audio requirements, even under worst case circumstances. Altogether, Aphex claim the ▷

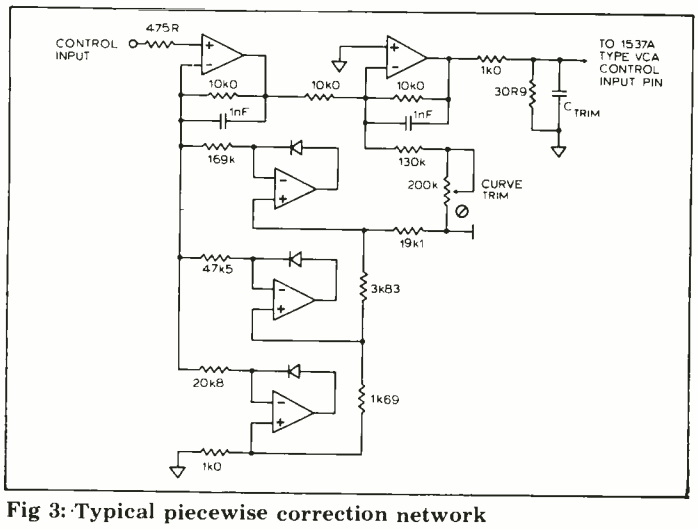

Fig 3: Typical piecewise correction network
This circuit converts the control voltage to a deci-linear law between 0 and −10 dB, removing the curvature seen in Fig 2

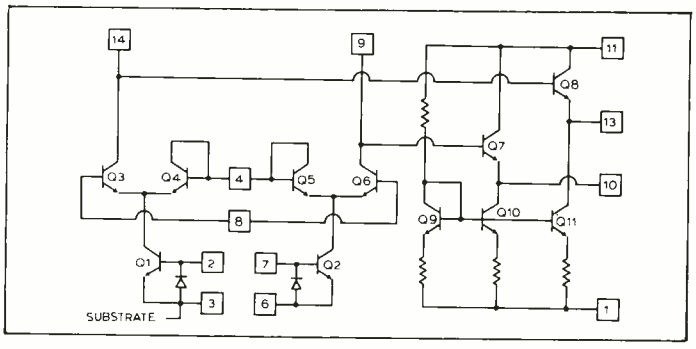

FIG 4: MTA 1537 internal schematic

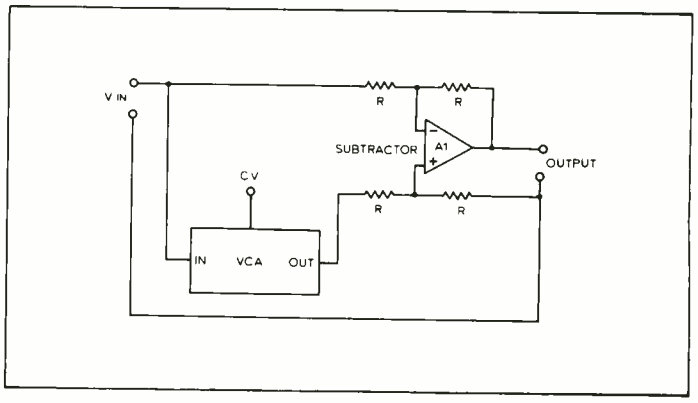

FIG 5: BSS Audio's substractive technique

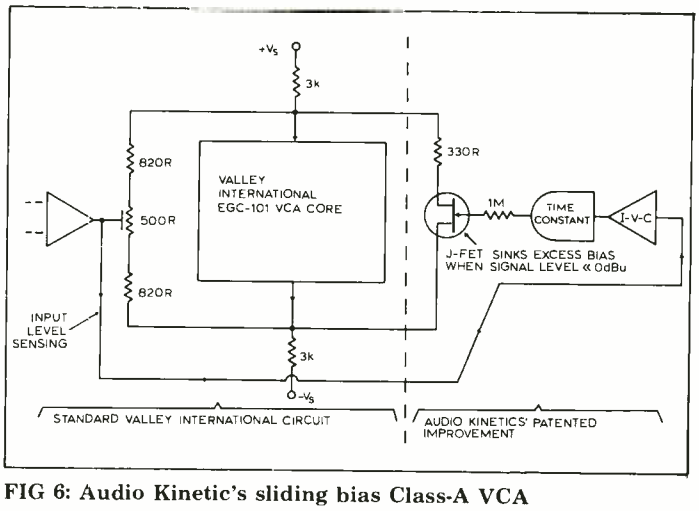

FIG 6: Audio Kinetic's sliding bias Class-A VCA

◁ *VCA-1001* is 'approximately 10 times better' than the next best available VCA 'in nearly all measurable aspects'.

According to Aphex's literature, low bass is said to sound cleaner, which makes sense if the *VCA-1001*'s thermal characteristics mean music's LF power envelope is inciting less thermal modulation. Modulation noise is quoted at 1 dB, a great improvement compared to some prior VCA art. Finally, the *VCA-1001* differs from all the other OEM VCAs we've looked into, since Aphex quite understandably reserve the right to use it exclusively in standalone signal processors. Otherwise, it's available under a no cost licence to "OEM manufacturers for use in most other applications".

VCA Associates

VCA Associates was founded in 1979 as a research partnership, to develop an advanced VCA for pro-audio, based on circuits devised by David Baskind and Harvey Rubens (one time director of engineering at Aphex and chief engineer at Aphex, respectively). Their work[1], using 'semi-custom' fabrication led to the Aphex *1537A*, hailed as the first fully monolithic (audio-grade) VCA operating in Class A. It was initially marketed through Aphex Systems. In 1984, VCA Associates began to design their own upgrade, the *MTA-1537*, using 'full-custom' fabrication (**Fig 4**). As every good IC designer intends, the cost is lower, while the new IC's specification claims improved performance. Like the *VCA-1001* and original *1537A*, device yield is good enough for the distortion or SYM (symmetry) trimpot found in most other VCA circuits not to be required. When the *MTA-1537* was released in 1985, VCA Associates was reorganised to market the *MTA-1537* directly.

Voltage controlled alternatives

The VCA ICs and transistor arrays discussed so far are the ones found in the majority of pro-audio equipment. With different approaches to design and production, each excels in different ways. Which model appears under the covers hinges on the weighting given by the manufacturers to price and to the different areas of measured performance *vis-à-vis* the VCA's purpose. If you're uncertain as to whose VCA is inside your favourite FX processor, console or automation system, the information in **Table 1** and **Table 2** will aid identification. The choice may have originally been made on the results of listening tests; later on, it may have been warped by the designer's, accountant's and buyer's own prejudices, for in manufacturing quantities, the prices of the OEM VCAs we've looked at ranges from under £2 (approx $3.00) to over £15.

A minority of VCA and equipment manufacturers have struck out in directions of their own, squaring the circle of cost *versus* performance by elegant means. In their *202X* module (1984) and, later, the *202XL* (1986), dbx have been making use of the partial noise cancellation achieved by paralleling integrated VCA cores. For example, two VCA cores in shunt produce 3 dB more noise than one but they can also handle 6 dB more signal, so dynamic range is effectively extended by 3 dB. For dbx, the cost of paralleling several ICs, like the *2151*, is less than designing and marketing a lower noise IC from scratch: a significantly reduced noise level would otherwise require an ultra large geometry device, and a correspondingly large dice. So yields would be low and prices doubly high. The elegance of dbx's shunt-configuration is that an IC that was designed nearly 10 years ago and is already in high volume production can service modern pro-audio requirements.

BSS's range of processors involves a different train of thought. Realising that no VCA is perfectly transparent, designers Stan Gould and Chas Brooke have literally reconfigured the audio signal path. Looking at **Fig 5**, the VCA in BSS's *DPR-402* compressor/limiter/de-esser is placed outside the direct signal path. The direct and VCA'ed signal are subtracted from each other by A1, a differential amplifier. When programme is below threshold, the signal doesn't 'see' the VCA at all. Above threshold, noise and distortion products are added gradually, and only in the same ratio as the subtracting coefficient. ▷

Technical definitions and abbreviations

AGC: Automatic Gain Control
ASB: (class) A Sliding Bias
CP: Conductive Plastic
CRT: Current Ratioing Transconductance (type of VCA)
dice: the innards of a chip
DIL: Dual In Line (package)
DUT: Device Under Test
NFB: Negative Feedback
RFO: RF Oscillation (>20 kHz)
SIL: Single In Line (package)
ZOL: Zero Operating Level

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◁ At the same time, the VCA's dynamic characteristics are turned on their head: when driven at unity gain by high levels, distortion is exchanged by noise, which is more easily masked by signal. BSS's design is restricted to attenuating over a 30 dB range, which is all one needs for everyday processor functions. Attenuation can go lower if anyone wants to trim individual subtractive losses at HF. BSS adhere to the school of engineering that prefers to avoid trimpots on the basis that anything that can be misaligned, will be—sometime, somewhere. This raises the question (carefully phrased by audio counsel) 'to what extent have VCA applications configured to require multiple or critical trimming for audibly coherent performance, amounted to the placing of a time-bomb under their maker's reputation each time the equipment is serviced?'

TABLE 1 Identifying proprietary VCAs

Manufacturer and model	Description
Aphex *VCA-1001*	Black 18-pin DIL IC with gold-painted aluminium heat-spreader plate glued to top
dbx *2151*	Black 8-pin SIL IC
dbx *202-XL*	20×50 mm PCB
SSM *2014*	Black 16-pin DIL IC
Valley *EGC-101*	Blue plastic, DIL module
Valley *TA-101*	Green, square plastic box
VCA Assocs *MTA-1537*	Black 14-pin DIL IC

TABLE 2 VCAs in commercial equipment

VCA	Users (Application and product name)
Aphex *VCA-1001*	Aphex (processors); Pacific Recorders
dbx *2151*	Audio & Design, BSS Audio, dbx, Orban (all processors)
	Amek, Calrec, Soundcraft, Soundtracs (all automation)
dbx *202-XL*	SSL (automation)
SSM *2014*	'Bourns/PMI adhere to a policy of commercial confidence'
Valley *TA.101, EGC.101*	Valley, Symetrix, UREI (processors); Audio Kinetics, Harrison Systems, Yamaha (automation); Audiotronics, Cinedco, Neumann, McCubbin Electronics, Neotek, Protech, Sontec, Sound Workshop (unspecified)
VCA Assocs *MTA-1537*	Hill Audio, Musically Intelligent Devices (Mega-mix), Steinberg Research (Mimix), Twister Console Automation, Walker Pro-Mix (all automation); Ampex, B&B, Ensoniq, Gauss, Ivie, McCurdy, Sony Pro-Audio (processors and unspecified)

Audio Kinetics have a patented technique that boosts the performance of Valley's discrete log-antilog VCAs. In their *MasterMix* automation modules, a Valley International (aka Allison) *ECG-101* VCA core is configured in a circuit that closely follows Valley's application note but with the addition of variable biasing to overcome the typical 6 dB reduction in noise with every 10 dB of attenuation. In other words, a 4 dB loss of SNR for every 10 dB of attenuation is fended off using a technique that amplifier designers call 'Class A sliding bias'. With no signal present, or signals well below 0 dBu, output noise is greatly reduced, as the FET, in **Fig 6** shunts bias current away from the core, according to its I_{DSS} (off-state current sinking) rating. When the signal approaches line levels (>0 dBu) the level sensing connected to the FET's gate progressively drives the FET off, ultimately unleashing the full bias current—enough to provide low distortion operation comfortably beyond the system headroom. The sensing circuit's time constants have been carefully chosen. Attack time is 200 μs, while the decay time is set to avoid audible bias modulation at 20 Hz.

Over the past decade, Dr Malcolm Hawksford (lecturer at The Dept of Electronic Systems Engineering, Essex University) has published a series of papers analysing shortcomings in diverse areas of audio electronics, and suggesting some radical new approaches. These include a fresh look at VCAs[2-4]. He reaches the conclusion that all current-steering translinear circuits (yet another name for CRT, Current Ratioing Transconductance VCAs) have a distortion residual or baseline more or less independent of attenuation. So with high attenuation, distortion approaches and (neglecting residual noise) ultimately exceeds the output signal. Hawksford argues that this shortcoming in the CRT class of VCAs is fundamental.

Aiming for a dynamic range >120 dB at 1 kHz (meaning that current levels in the cell are spanning a millionfold), Hawksford describes a circuit containing cascaded VCAs. Each VCA is optimised for a different range of currents, with an overlap. Their combined behaviour is akin to a twin choke carburettor. With high levels of attenuation, the noise floor reduces in proportion to output, maintaining a more nearly constant noise floor, down to the universal limits (circa −130 dBu at 20°C). Hawksford concludes that a parallel array of cascaded cells would yield still further enhancement, in turn expanding and cleansing the upper reaches of the dynamic range of CRT VCAs. Improvements of this kind will be valuable if the signal path in analogue systems is to continue to boast a clear lead in SNR over its digital cousins.

Testing VCAs for real

Still confused about which VCA performs best? Each of the manufacturers is dutifully adamant that their particular VCA is nearly as good as the best, if not better. As is so often the case, numeric comparison from data sheets isn't made easy seeing how widely the scope, depth and accuracy of the information varies, along with test conditions. The scope for masking the truth multiplies as soon as we look at VCA's *in situ*. Scattered across 101 brands of equipment, each would be saddled with different approaches to PCB layout, decoupling, alignment and general QA, let alone grounding technique. To check out the OEM VCAs in this way would save a lot of bother but it would be unfair to their makers, and ultimately, uninformative.

To push forward everyone's understanding of where VCA technology stands as the 1980's draw to a close, nine of the different VCA techniques we've looked into were tested using Audio Precision's *System One* PC-driven test set. I first used the AP over four years ago. Since then, it has become the daily tool of enough pro-audio manufacturers, designers and reviewers to become a solid point of reference. As most of the VCAs are in the form of ICs or modules for OEM use, this wasn't a task for the fainthearted: they had to be assembled from component parts together with their associated support circuitry. Having

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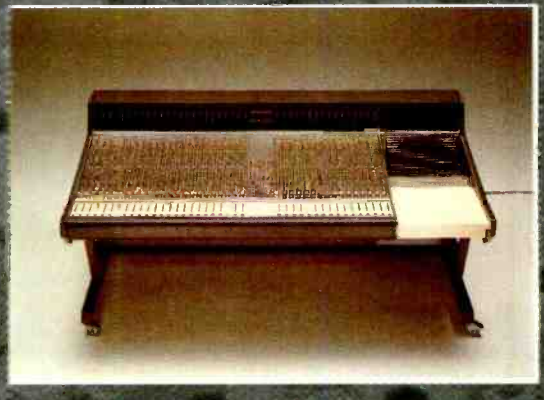

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done this, I can reveal that having to design and build the equipment before you review it is a *true* experience.

Testing the OEM VCAs in this way—at component level—means that data gained won't be diminished (by an unknown and variable amount) through the engineering compromises that lurk to some extent in real equipment, where the VCA is but a small part of the whole. Isolating VCAs from as much superfluous circuitry as possible has its limits though: All the OEM VCAs depend on one or more op-amps (mostly NE5534 and 5532), whose own anomalies aren't easily excluded from measurements.

Examining the maker's data sheets, each offers a range of circuit recipes like 'stereo on a tight budget' or 'reduced feedthrough'. In each instance the 'best standard circuit' was selected. Standard means 'no frills'—it's probably the circuit most equipment makers use, in most of their products. To assist readers who wish to verify the results for themselves the tests provide background details to be read in conjunction with the test configuration schematics presented in **Fig 7** to **Fig 14**.

Test methodology and configuration

In the instances where the sample ICs weren't supplied with evaluation boards, circuits were assembled on Fibreglass *Veroboard*. Great care was taken to keep circuit connections ultra-short and direct, notably the VCA cell's (current) output, which is particularly sensitive to extraneous magnetic pickup. DIL and SIL ICs were mounted in turned-pin sockets, allowing a second sample to be readily tested if required. Where the maker's recommended circuits indicated close tolerance resistors, 0.5%, 50 PPM/°C parts were used. Supply rails were generously decoupled, care being taken to return the larger +ve and −ve capacitors to a common point on the 0 V bus. Bus resistance was kept low by tinning with solder, giving an effective cross sectional area of 1 mm². Powering was from a lab supply with low ripple and noise (<−90 dBu) and nominally low source impedance across the audio band (<2 mΩ), degraded to around 50 mΩ below 100 Hz by the intervening supply connections and finite decoupling impedance. A second, identical lab supply was used to supply the fairly large (>1 V) control voltages required by the Aphex, PM1 and VCA Associate's VCAs.

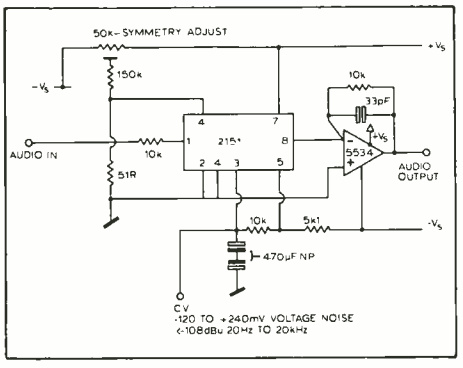

FIG 7: dbx 2151 test circuit

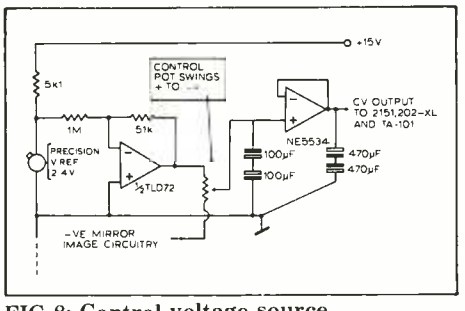

FIG 8: Control voltage source (low noise configuration, for log-antilog VCAs)

For dbx's *2151* IC (**Fig 7**), a precision voltage source (**Fig 8**) was assembled with an emphasis on keeping noise off the control voltage—in view of the the sensitivity of the *2151*'s control port. dbx's *202-XL* module and Valley's *TA-101* shared the same CV source. **Fig 9** shows the values adopted in the *202-XL*'s external support circuitry.

SSM's *2014* was fitted-up on their purpose-made evaluation PCB. Looking at the circuit in **Fig 10**, Class A and A-B operation were selected by switching the bias setting resistor. Despite consultations with the maker, a 'bubble' of RFO increasing with progressive attenuation and aggravated by 'A-B' Class operation, proved impossible to get rid of. With another chip sample, the symptoms receded a little, enough to make testing feasible. After the tests were completed, SSM shipped over a ready-stuffed board which worked perfectly. Although superficially identical it soon became apparent that the board tested by myself was an escaped 'Version 1.0', with a different and clearly defective track layout. It's a pity neither board had an ident, which would have meant the problem could have been rectified earlier on.

Valley's *TA-101* array was constructed according to the standard application circuit shown in **Fig 11** (to be read in conjunction with **Fig 3**, Part Two, July 1989). It was the only OEM VCA to retain a BiFET (TL0 series) op-amp in its ▷

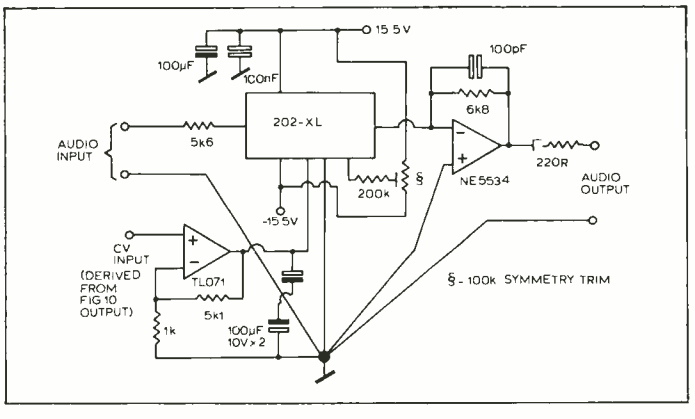

FIG 9: dbx 202-XL test circuit

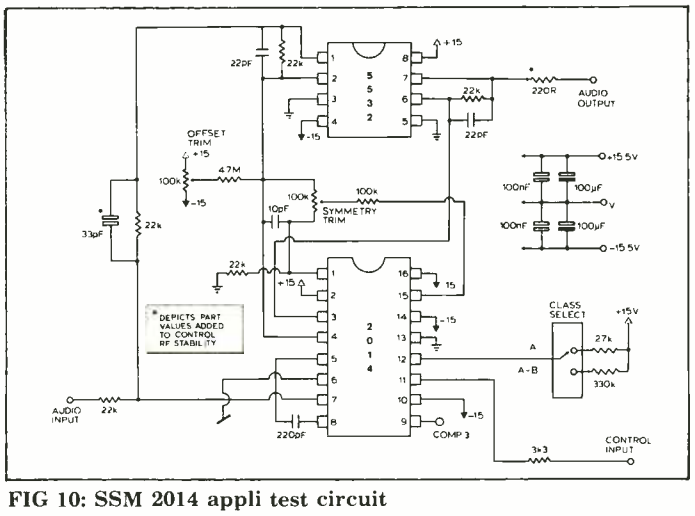

FIG 10: SSM 2014 appli test circuit

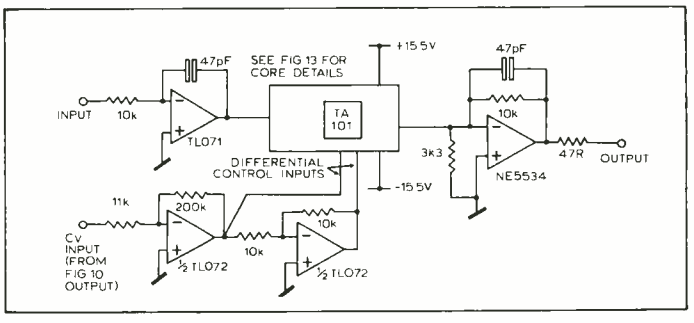

FIG 11: Valley TA-101 test circuit (based on Valley 'Fig 1, VCA-300' schematic)

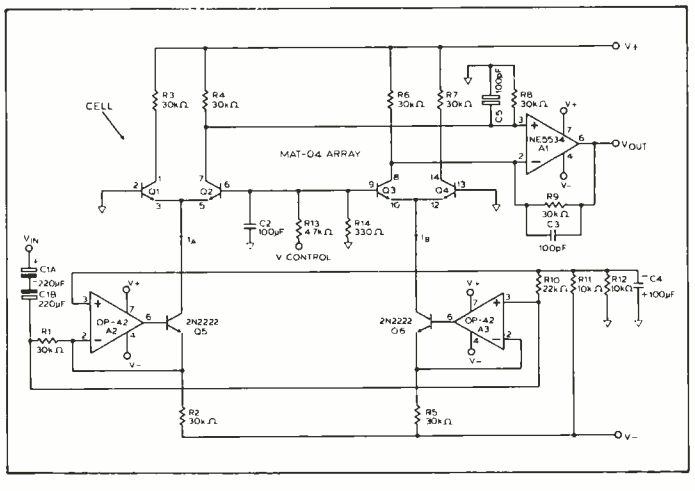

FIG 12: MAT-04 test circuit
Developed around PMI's MAT-04 'super-matched' quad array, this VCA circuit is a variant of 1537A topology, built from discrete parts with an unbalanced input and output

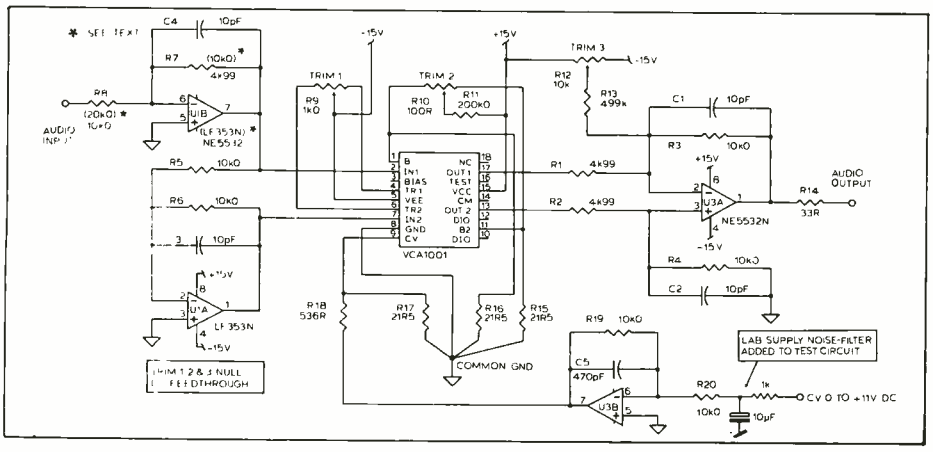

FIG 13: Aphex VCA-1001 test circuit

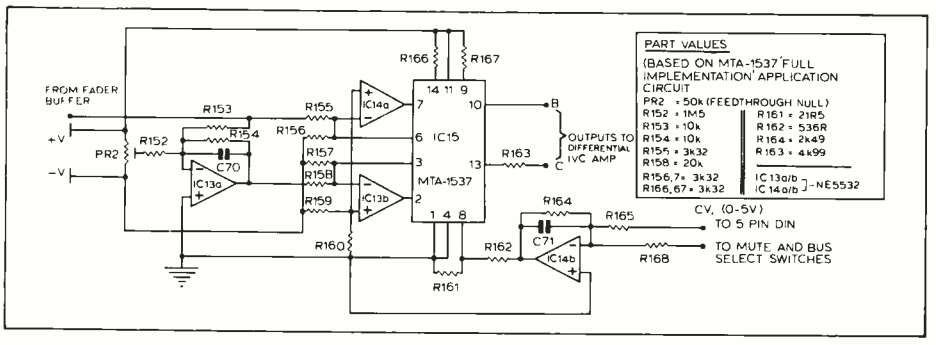

FIG 14: MTA-1537 test circuit (part of Hill Audio *Concept* series mixer module)

◁ audio signal path and should be judged in this light, particularly at HF, and for gain commands above unity.

I was intrigued by an application note in the PMI (Precision Monolithics Inc) IC data book, showing an emitter-driven CRT-type VCA similar in topology to the *1537A* (**Fig 12**). It's presented as an audio application for PMI's *MAT-04*, a super-matched quad array of large geometry NPN transistors. If Valley's *TA-101* constitutes a VCA building block, why not the *MAT-04*?

Like any other VCA, the performance of the *MAT-04* is dependent on the discrete circuit built around it. The originally specified OP41 and OP27 op-amps just weren't good enough. To make the circuit perform without bad slew limiting at 20 kHz, even with moderate drive levels, it was necessary to respecify the surrounding op-amps, as shown. PMI were notified and agreed with the upgrade. An extra compensation capacitor, C5 was also required, and even then, stability was marginal. While having sight of our interim results close to the measurement deadline, SSM's Ron Dow suggested the *MAT-04*'s operating current could be increased by a factor of 4 to realise its potential SNR. Here I was forced to draw the line at further redesign and tweaking; other than adjusting compensation capacitors to trim RF stability and changing op-amps when there was a good reason to do so, all the other VCAs were constructed strictly according to the maker's standard recipe.

The remainder of the VCAs were tested as completed assemblies in one form or another. Aphex's *VCA-1001* IC was straightforward, being configured on *Veroboard* according to the circuit in **Fig 13**. However, owing to the *VCA-1001*'s very low residual and either my imperfect soldering or knowledge of optimum component positioning (something that even equipment makers can only discover empirically), Aphex held that the test fixture returned a few anomalies in the measurements, eg higher than expected modulation noise. To preclude the unknown factors in my *Veroboard* construction while measuring just a few microvolts of residual, Aphex had their newly produced evaluation PCB expressed over just in time to meet the retest deadline. It came ready stuffed and mounted in the shielded box with integral, secondary regulation on the incoming supply. Trimpots were assumed to be optimally set. In comparing our preliminary results with their own, Aphex's Donn Werrbach discovered that some less than perfect THD readings above 3 kHz disappeared when the *LF353* (BiFET) input op-amp specified in Aphex's preliminary data sheet was substituted by *NE5532*. This change was incorporated in the test unit supplied. Additionally, the values of the input IC's associated resistors were cut by half (original values are those marked * in **Fig 13**). Otherwise, the circuit values were identical to the original test fixture. The figures that follow are based on this unit. The *Veroboard* version was later retested and found to give similar results except for the excess noise.

VCA Associates' sample IC failed to materialise in time. To make *some* kind of test possible, Hill Audio kindly agreed to loan a *Concept Series* mixer module containing a VCA based on the *MTA-1537*. The channel strip was modified to allow direct links to the VCA and its supporting circuitry (**Fig 14**), and powered by Hill's own *PS-1* supply. The control input (connected to the channel's automation socket) made a direct connection to the VCA, without RC filtering. **Fig 12** shows the IC's configuration. Overall, the handicap must be borne in mind; without casting any aspersions on Hill Audio's implementation, *MTA-1537* might have performed even better on a compact, purpose-built evaluation board.

Audio Kinetic's Sliding Bias method was evaluated in the form of their *MasterMix* module. A CP rotary pot was fitted and the module's digital control facilities were defeated with jumper links set by the maker. In being supplied ready-for-use, it was assumed to be pre-tested, so the trimpots were left untouched. Malcolm Hawksford's cascaded VCA is no abstraction. Hawksford kindly loaned his prototype, which came ready boxed with an integral control pot, and simply required plugging-in. Again, the trimpots were assumed to be pre-trimmed.□

Next month Ben Duncan will give an evaluation of VCAs with many detailed measurements covering nine of the VCA schemes featured in this series.

Principal VCA patents

All patent numbers are USA unless stated

Audio Kinetics
Robin Bransbury, Signal processing circuits (UK) 2,156,175A (1984)

dbx
David Blackmer, Multiplier circuits, 3,681,618 (1973)
Gary Bergstrom, Signal correction for electrical control systems, 4,234,804 (1980)
Log-antilog VCA improvements, 4,331,931 (1982)
202X paralleled VCA scheme, 4,403,199 (1983)

SSM
Doug Frey, Voltage controlled element, 4,471,320 (1981) and 4,560,947 (1984)

Valley International
Paul Buff, Voltage controlled amplifier, 4,225,744 (1978)
Paul Buff, Electronic control device, 4,341,962 (1980)

VCA Associates
Rubens *et al*, Voltage controlled attenuator, 4,155,047 (1979)

References

1 David Baskind, Harvey Rubens & Gary Kelson, *The design and integration of a high performance voltage controlled attenuator*, AES preprint 1555, 64th Convention NYC, 1979
2 Malcolm Hawksford, 'Low distortion programmable gain cell using current steering cascade topology', *J.AES*, Nov 1982
3 Malcolm Hawksford, Paul Mills, 'Topological enhancements of translinear two-quadrant gain cells', *J.AES*, June 1989
4 Robin Bransbury, Automation control techniques, *Studio Sound*, Aug 1981

Bibliography and further reading

W Allen, *Applications of VCAs*, 70th AES Convention, NYC, Oct 1981
D Baskind, R Harvey, *Techniques for the realisation and application of VCAs and attenuators*, AES 60th Convention, May 1978, preprint 1378(A-6)
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J Williams, 'Innovative Linear circuits', *EDN*, 1986
Y Wong, W Ott, *Function circuits, design and applications*, Burr Brown, 1976

Large Daylit control room, fully air conditioned, separate machine room. Live room with 7' Steinway also daylit and air condition, 24 track Sony MCI with full dolby SR, 40 input raindirk symphony, custom-built for instant dolby surround stereo if required, automated by Optifile 2HD. Monitors by ATC SCM100A's (3 full time MAX), NS10's on both console and keyboard rig, and little David's.

Mastering on Sony 3202 with centre track time with Dolby SR/A, Sony Ard... and F1 also pre-wired for 8 track mixdown if required. Sony 5850 pneumatic video, synchronisers by Adams Smith, Brookse, and C-lab, Trinitron monitors by Console, Keyboard rig, live room and office.

Outboards by Klark-Technic, Lexicon, Yamaha, Alesis quadraverb drawer, Roland, EMT gold foil plates and EP well.

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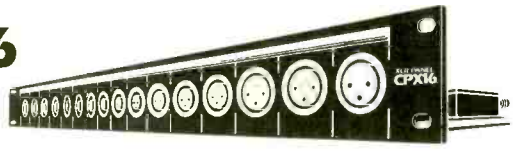

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Akai S1000

An operational report on Akai's most recent sampler by Dave Foister

The term 'eagerly-awaited' is one that manufacturers are understandably keen to apply to their new products; unfortunately many of them are greeted in this hard-nosed business with groans of 'Oh no, not another one'. The rare exceptions are those that follow in the footsteps of instant legends and industry standards. Akai produced such a yardstick in the *S-900* sampler and any further product from them in this area must surely qualify as eagerly-awaited.

Akai are keen to emphasise, and with good reason, that the *S-1000* is a wholly new product and not just a souped-up *S-900*. (For that we have the *S-950*, and upgrade on the *900* with all possible facilities for less money.) The *1000* has a new operating system, a new user interface, new signal handling architecture and, even a new disk format so clearly it fulfils Akai's claims for it although as the *S-900* is so familiar and well established, some comparisons are inevitable.

The *raison d'etre* of the *S-1000* sampler is, of course, its stereo capability and the CD-standard sound quality. The digital parameters are directly comparable with CD, with a sampling rate of 44.1 kHz and full 16 bit operation. The resulting sound quality is exactly what one would expect from such specs, and operating like this at full bandwidth the standard unit with 2 Mbytes on board provides over 11 seconds of stereo sampling (double in mono). The RAM capacity is expandable via 2 Mbyte plug-in boards up to a maximum of 8 Mbytes, which gives around 46 seconds of stereo. The sampling rate can be halved, with a corresponding halving of audio bandwidth traded off against increased storage capacity.

The samples on the disks supplied with the review model showed off the audio capabilities to good advantage—it was clean, quiet and crisp. The acoustic guitar programs were particularly impressive, along with a full-bodied grand piano, various saxes and stereo strings. A full *S-1000* sample library, prepared at Air Studios, London is available both on floppy disk and as audio on CD (*Air Sessions*) through Akai dealers worldwide.

The programming possibilities are a considerable expansion on those of the *900*. There are more analogue processing facilities, and there is increased flexibility in the setting up of keygroups and programs; for instance, there are now four possible velocity zones within each keygroup, allowing elaborate stacking of samples to crossfade or switch in and out as key velocity changes. Here and elsewhere the approach seems to have been to verge on overkill so that the machine stands the best chance of keeping up with the user's demands.

As *S-900* users will appreciate, the vast number of adjustable parameters and programming facilities on a machine of this scope and flexibility inevitably leads to considerable complexity for the user, and a major challenge to any designer of equipment of this nature is making its potential accessible to the average person. Too many devices require an inordinate amount of parrot-fashion book-learning to exploit their remotest nooks and crannies, with the result that all but the most adventurous of users only ever do the obvious things with them. The *S-1000* makes a good attempt at meeting this challenge, with a large informative LCD screen and a set of clearly-labelled softkeys for each page of functions. Most screen pages display several adjustable parameters with a large CURSOR knob moves around them. This can then be adjusted with the DATA knob. A useful idea here is the fact that for alteration of numeric values the cursor can be placed on any of the digits of the displayed value, thus effectively altering the scaling of the DATA knob. Thus, for instance, one of the loop points (there are eight on each sample) could be incremented in single samples or thousands of samples depending on the position of the cursor.

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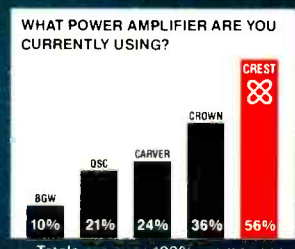

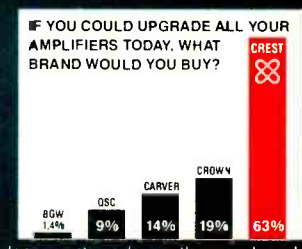

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functions, a process which is further helped by a GOTO function, which takes you directly to a previously-marked control page. The division of functions into groups and menus is clear and logical, making it surprisingly easy to dispense with the manual at an earlier stage than might have been expected and operate the machine intuitively. There is often more than one way to achieve a particular result, which can also help speed up the familiarisation process.

One major benefit of the new display format is the provision of graphic aids to sample editing and looping. The pictures produced on the screen are reminiscent of the Casio *FZ-1*, although the Akai screen is bigger and carries two graphic windows. The left hand display shows the whole sample in terms of its amplitude with respect to time, with vertical lines indicating start points, loop points and so on. The right hand display shows the meeting point of the end and beginning of a looped section so that glitch-free matching can be achieved, and like the *FZ-1*, a multi-layer zoom function allows extremely fine detail to be viewed when required. An automatic looping function is, of course, provided, although as with all samplers (and as the manual admits) its success is rather variable, so the detailed graphic aids to manual editing are a definite boon.

A small point that appears to have suffered on the new display format is the metering of input levels when recording samples. On the *S-900* this was slightly crude but about as big as it could have been, whereas the *1000*'s meter is very small, tucked away as a vertical bar about an inch high on the edge of the screen, with a shaded section indicating the trigger threshold. It could be said that with 16 bits the recording level is less critical, but if the high available dynamic range is to be fully exploited I feel a more informative meter would be useful.

On the other hand, the flexible display allows further graphic niceties, such as pictorial keyboards showing spans of keygroups and so on. The white-on-blue screen is legible under a wide variety of lighting conditions and from a wide angle; the viewing angle control is sensibly placed on the front panel next to the screen, not hidden on the back or buried in software six menus deep, as some are.

The new format on the *1000* means that the disk data format is also new, and only partly compatible with *S-900* disks. The *S-1000* will read *S-900* samples, but no other data—no editing, keygroup or program details. This of course means that an *S-900* sample library will not be totally redundant if the sampler is replaced but that a fair amount of work will be required to make full use of it. Opinions differ as to the success of transferring *900* samples into the new machine; I felt any difference in the sound was marginal, although there might have been a very slight reduction in audio quality. The *S-1000*'s drive will handle high density disks like those used on the *FZ-1* but can still use the more conventional type.

Variations on the basic *S-1000* model include a playback-only version and one with an interface card already fitted to allow the use of a hard disk, and of course memory upgrade cards are available.

The price of the *S-1000* puts it in a slightly different area of the market from the *900*. While it may be less affordable to the small studio or home set-up, several of its features should make it far more attractive to the commercial facilities already making extensive use of sampling, particularly in areas such as jingle production and remixing. The *S-900* has also become well established in the field of theatre sound for effects preparation, and the high quality, stereo capability and extended storage time should have a strong appeal here. The same factors enhance its usefulness in terms of general musical applications—after all, any sampler is only as good as the quality and realism of its samples, and the specification of the *S-1000* is a match for anything else on the market short of the likes of the *Synclavier*. A good reason why the *S-1000* has quickly become as familiar a sight as its smaller cousin.□

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Quantec CARL

Dave Foister presents an operational report on the dedicated remote control unit for the Quantec QRS/XL

If the renowned Quantec *QRS/XL* has a significant drawback it is that, in common with many other microprocessor-based signal processing devices (and synthesisers come to that), it is not possible to program the unit from the front panel; the only effects available are those already in memory. It has been possible for some time to access the internal parameters via MIDI and the RS232 interface, with a full protocol for control of the unit and file transfer supplied in the manual but use of these facilities obviously requires a degree of computer programming skill. A year or two ago, software was made available by Quantec for various computers—*STs*, *Macs* and IBMs—to control the *XL*, complete with comprehensive screen displays, and to provide disk storage of resulting effects but for those who own none of these computers, or whose computers are fully tied up with other tasks, Quantec have introduced a dedicated remote control unit consisting of a rackmount processor box, a small hand held or desk-mounting control unit and software on disk, and requiring a video or computer monitor for display. The system is known as the *Computer Assisted Remote Link*, or *CARL* for short, and any resemblance to the name of any other reverb remote is no doubt entirely coincidental.

In the case of the review sample the main rackmount box was enormous, being considerably deeper than its 19 inch width, although I understand it was a pre-production model and production versions will be significantly smaller. This box, anonymous in appearance yet styled to match the *XL* itself, contains a small *68000*-based computer and a 3.5 inch floppy disk drive, and carries connections for the *XL*, the remote control and the monitor. A thoughtful feature is a 'transparent' video mode, where some other video display can be fed through the *CARL* unit and have the *XL* information overlaid on it when required.

Presumably to simplify future updates, the operating program is supplied on a self-booting system disk, which also contains considerable file storage space. Program control is performed by the remote box, which has seven dedicated keys, five 'soft' function keys and a large data entry wheel known as a jog-knob. This has a very positive feel to it, since it is big, easy to turn with the fingertips and has gentle indents in its travel corresponding to its action on screen. The software is menu-driven and the jog-knob performs the tasks of menu item selection and alteration of parameter values; its current function is always highlighted.

The simplest task the unit performs is selection of the on-board preset programs, although this is indeed available on the *XL* itself. Its main functions are editing programs and storing them on disk; besides its 90 factory-programmed effects in ROM, the *XL* only has 30 user-programmable RAM preset slots; any additional storage has to be on disk.

The first step in creating a new effect or altering an existing one is to load a set of parameters into the computer's editor as a starting point. It struck me as odd when using the original ST software that program parameters always had to be loaded from disk, even when they applied to unalterable ROM programs; it seemed to me that it might have been possible to read the parameters direct from the *XL* memory rather than the slower process of loading up from disk. I am a little surprised to find that this is still the case with the dedicated controller. This means that before one can begin editing, a disk-file must be selected and loaded. This involves first selecting a function type, which on the *XL* corresponds roughly to other units' algorithms, that is to say the basic role the processor is being asked to perform.

The *XL* has four functions: Room Simulation, Delay, Filtering and Octave EQ. Selecting one of these will produce a listing on the screen of all files on the disk corresponding to the chosen function, which can be scanned with the jog-knob and the desired file loaded. Files are automatically loaded into one of the last four RAM slots, the actual slot depending on the chosen function type. The full set of parameters, together with their current values, is displayed on the screen and selection of any of them with the jog-knob allows that one to be adjusted, also with the jog-knob. The values are adjusted almost, but not quite, in realtime; any change made on screen is immediately transmitted to the *XL* unit, which is then set to the new value. This process is not, however, instantaneous, and is indicated every time by a box superimposed on the display reading 'Busy, transmitting'. For some parameters this transmission is very fast and the repeated flickering of this box can be a little irritating; for others it can take a second or two, and for these it would be nice if the automatic data transmission could be defeated, as every move (whether complete or not) is transmitted, which slows the procedure down a little. Having said that, the overall idea of having all parameters visible on screen all the time and immediately accessible is vastly preferable to the one-value-at-a-time systems normally built into such units, and the jog-knob beats any set of nudge buttons hands down in terms of speed and directness.

Once a new effect has been arrived at, the system allows its storage in an on-board RAM slot or on disk. The disk file naming system is largely automatic and consists almost entirely of numbers, which to my mind is less than ideal, although names and brief comments can be added that appear on a directory listing print-out (but not on the usual file selection menu). The system allows the options of saving the new set of parameters in place of the original file, as a variation on the original file, or as a completely new file; the variation idea does at least keep related presets grouped together in the disk listing.

A disk can hold up to 250 parameter sets, which is less than the total capacity of the disk since each data disk must contain a copy of the operating program itself. Copying this original system program on to a new disk requires the use of a special Copier program, which is supplied on a separate disk.

The dedicated keys on the remote unit make operation just about as obvious as it could be. They consist of a MENU key, which always returns you to the parent menu of the one you are currently in; an ENTER key, which performs much the same function as its equivalent on a QWERTY keyboard; a HELP key, whose function would be obvious if it were not for the fact that the Help feature is not yet available; + and – keys for selecting programs on the remote *XL* itself (*not* for parameter adjustment); a MUTE key, controlling the Mute function of the *XL*; and a key marked YES, which is used in brief security dialogues where files are about to be over-written. The soft FUNCTION keys perform tasks directly related to the particular *XL* Function (or algorithm) in use, such as Freeze for the reverb, input mute and so on; their current functions are displayed on the screen.

In use

Using the *CARL* system is a curious mixture of pleasure and mild irritation. Much of the software is extremely friendly and well-designed; the Quantec *QRS/XL* is one of the more sophisticated and complex processors on the market and yet *CARL* makes programming it very simple and intuitive, which is no mean feat. On the other hand, its disk handling routines seem more laborious and less helpful than one might expect these days, although perhaps this is being over fussy. It also seems somewhat paradoxical that while an *SPX-90* is fully programmable from its front panel, the Quantec *QRS/XL* needs all this add-on hardware and software to provide the same facilities, albeit with a higher level of sophistication, control and directness.

Existing users of the *QRS/XL* will need no convincing of its merits; the addition of a *CARL* unit will enable them to manipulate its undeniable power properly.□

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