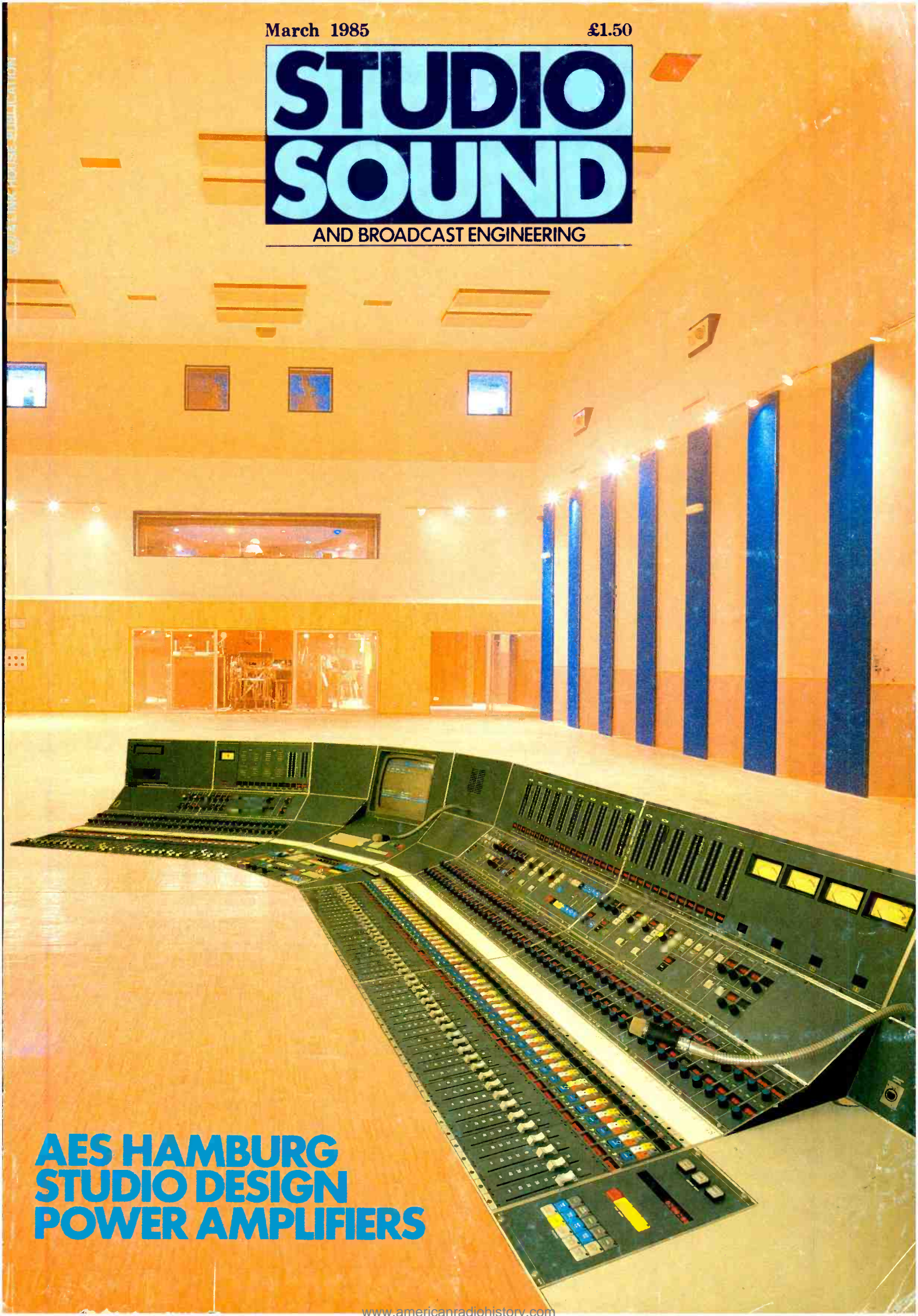


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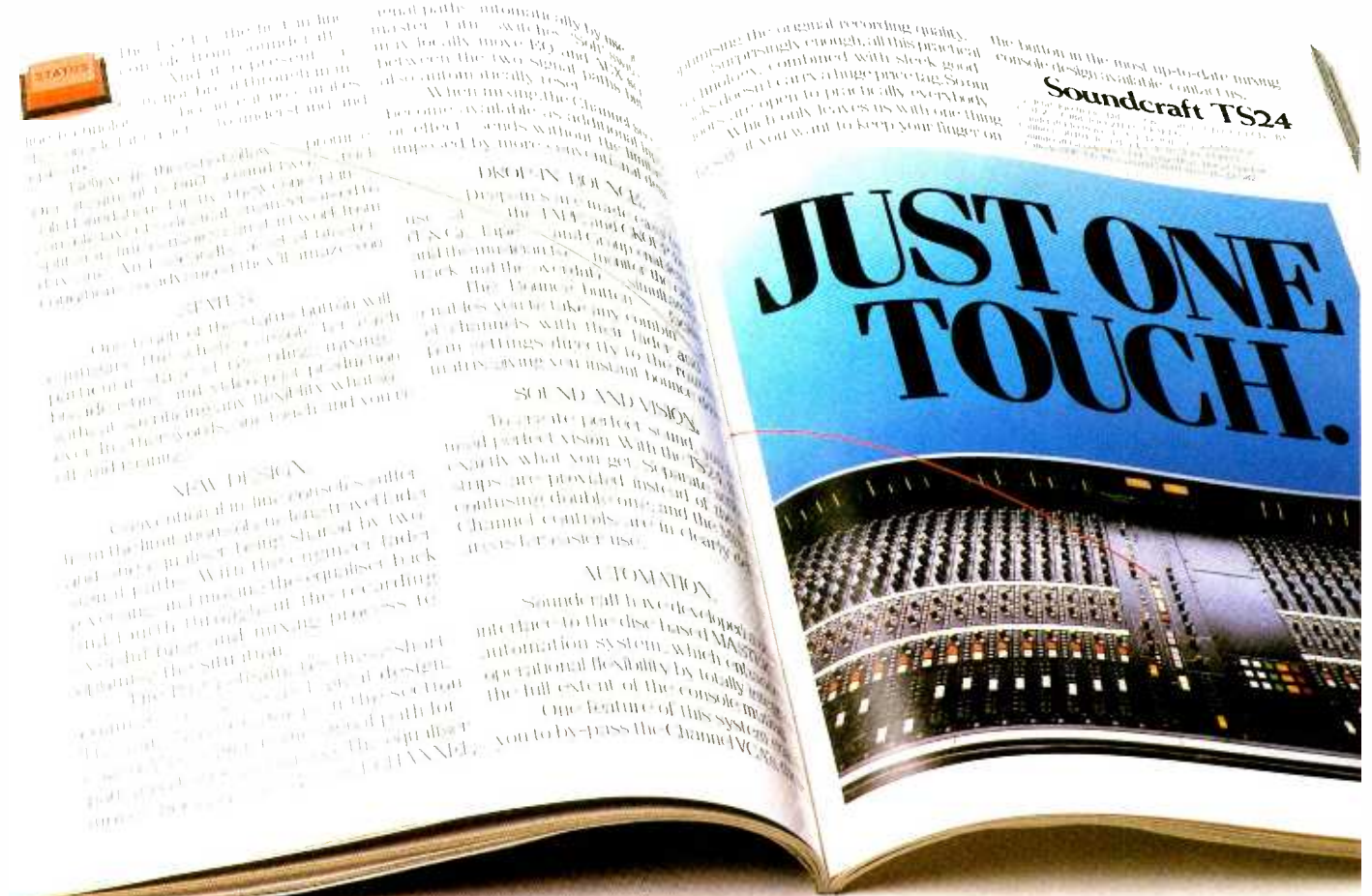
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# EDITORIAL

# EDITORIAL

This month's comment from Keith Spencer-Allen

## Studio design

Once upon a time, the design of a control room or studio area would fall to the studio manager, the chief engineer, the maintenance department or some permutation of the above. Expectations of the design were limited by today's standards with most aiming purely to achieve an approximation of the desired RT. Multitrack meant higher sound levels all round and design became more difficult to guess at as a part time occupation. Therefore, enter the studio designer, or perhaps I should say, the dedicated studio designer, as previous to this studios were only seen as part of the overall field of acoustic design.

The most influential of these designers has undoubtedly been Tom Hidley. We are now in the second decade of his influence which has been truly worldwide—in studios he has designed and also those he has not. You have to think back to the average facility in the late '60s and early '70s to see how things have changed.

The field of acoustics relating to studio design has become far more precise with it being more possible for the final performance of a room to be predicted at the design stage even on a first time design. We have a greater understanding of how to control sound to achieve certain effects as well as knowing more about how the ear/brain combination affects the way we perceive sound. There is, of course, always the danger that this knowledge may be applied to removing deviations from a fashionable 'sonic norm' leading to all studios becoming far too similar. There are arguments for this—uniformity of monitoring being one. We all know of studios which epitomise this danger, being very average at everything and exceptional at nothing. Dependent upon the type of person we are, they either attract or repel us. There is undeniably less variety within studios these days although, thankfully, there are fewer studios being built that pretend to be capable of recording every type of music—they normally just don't work.

It is not the acoustic side of design that should be causing concern at the present time. If you don't like the acoustic philosophy of designer A there is always B or C or D and so on—all with track records—and they will respond to varying degrees to specific requirements posed by the location and intended uses.

My concern is the appearance of the studios themselves. Tom Hidley set a pattern of design that we are only now beginning to break out of. Uniformity of visual design is not something that can be blamed entirely upon the designers either. Although there were many stories of world-famous jet-setting record producers having to ask the engineer what part of the world they were in after a long and gruelling session, we have to look deeper to see the reason for this anonymity than just the taste of the designer.

The roots of the problem lie in the way a designer is

chosen—almost always on a track record which means that there are aspects of a previous design that the new client likes. It is this that the new client will seek to repeat or modify to meet his requirements. All too often this will also include a similar decor. We are only just beginning to realise that there are only so many combinations of thick pile carpet, timber and curtains. If you speak to any of the major studio designers you will find that they welcome a totally different approach but need a considerable input from the client to achieve a workable result. This apparently is very rare with so many people just handing the project over with the first deposit cheque.

I find this attitude very strange particularly as international studio competition is increasing at the same time as studio equipment uniformity becomes more common. The appearance of your control room should be a prime selling point. It has to be time well spent and may not involve higher costs.

We cannot expect great visual designs from designers—they must concentrate on the acoustics and are likely to tread the middle path unless directed by a client. Returning to Tom Hidley, a man whose designs were often most criticised in the late '70s for just this aspect; the man was advocating different kinds of approaches—witness his article in *Studio Sound* December 1975, where he was suggesting the integration of environment into the studio—perhaps even going beyond simple scenic views for the daring! A glance through the project books of the better known studio designers will show how few clients responded to this stimulus and those that did stand out to such a degree that they prove the 'rule'.

The appearance of a studio is without a doubt one of the most under-rated aspects of design although it has a very great influence upon the creativity of the work done there. If you are making heavy investment in equipment (or even if you're not) why not produce an environment to reflect the studio or the clients you want. I know we are a very conservative industry but we are also meant to be at the heart of a creative process and why can't we reflect and generate a little of this ourselves? This does not necessarily mean denigrating the efficiency of the acoustic environment nor destroying the feel of a working type studio but just enough thought to prevent your facility looking like anywhere else.

A related point perhaps is the way that multi studio facilities insist on calling their rooms 1, 2, 3 or A, B, C etc which is throwing away the opportunity to integrate a design theme with a name and so make a more memorable facility within the minds of your clients.

Designers are definitely open to ideas beyond simply repeating their last project. The choice is wide open and potentially yours. □

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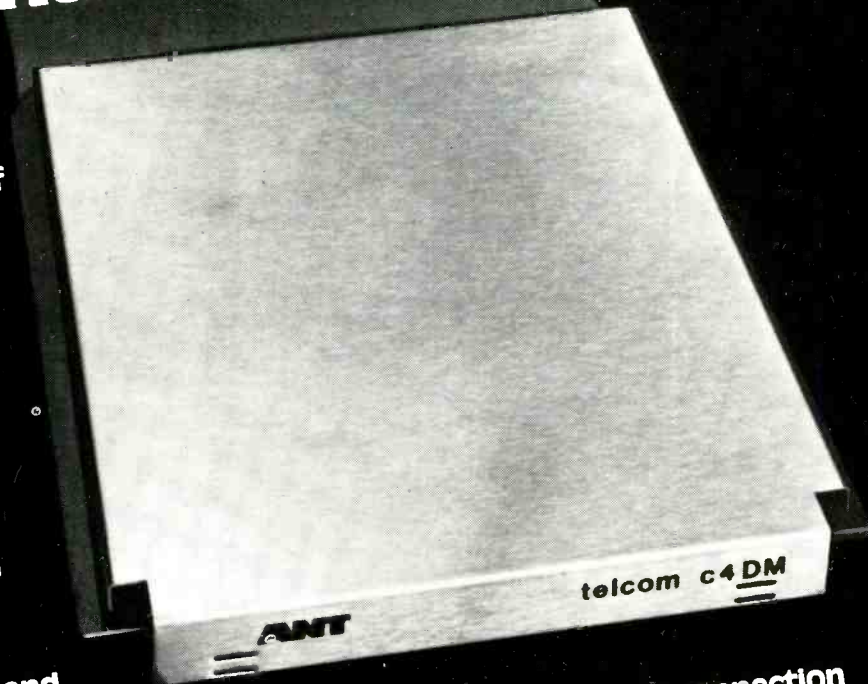


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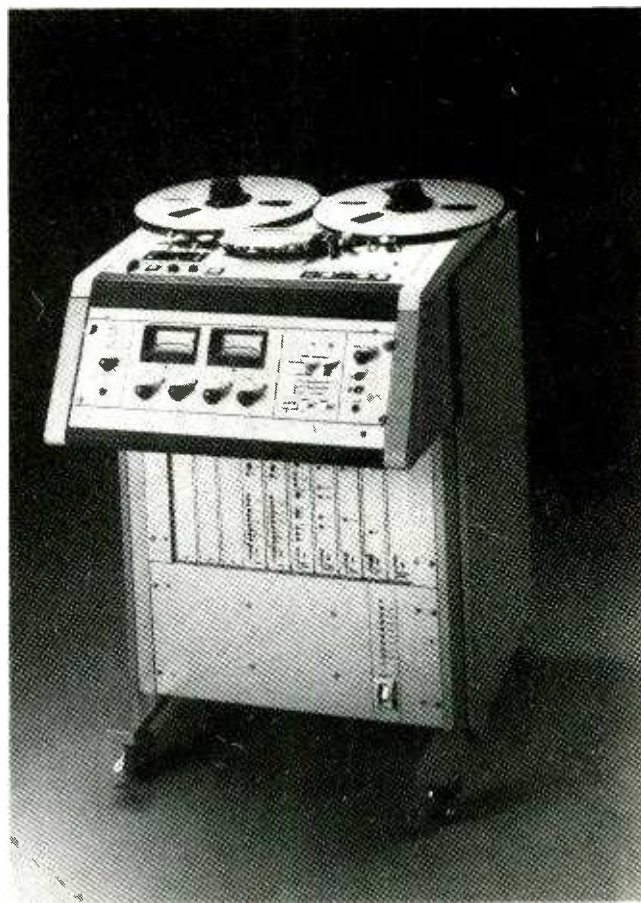
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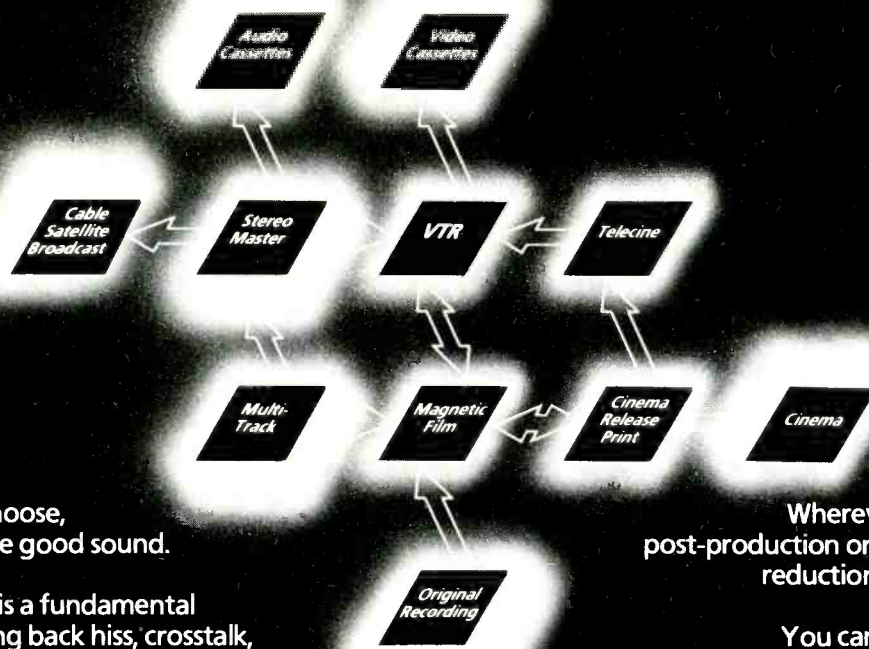
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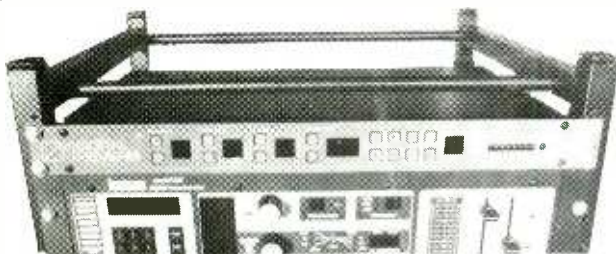
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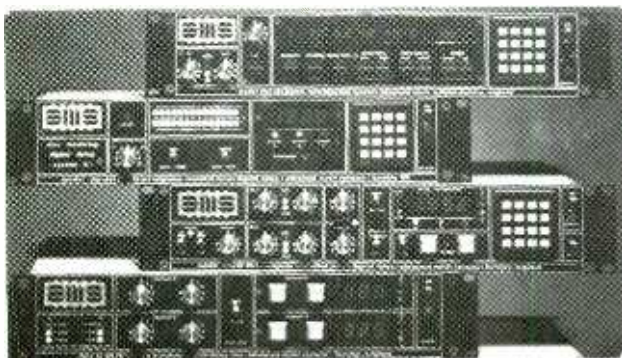


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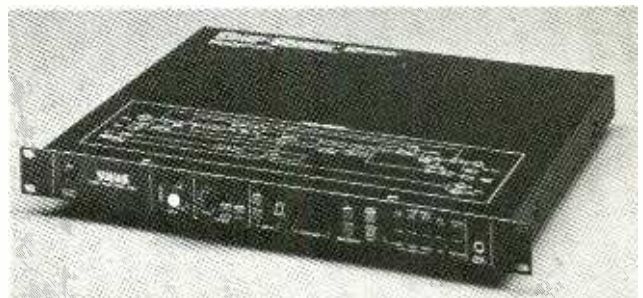
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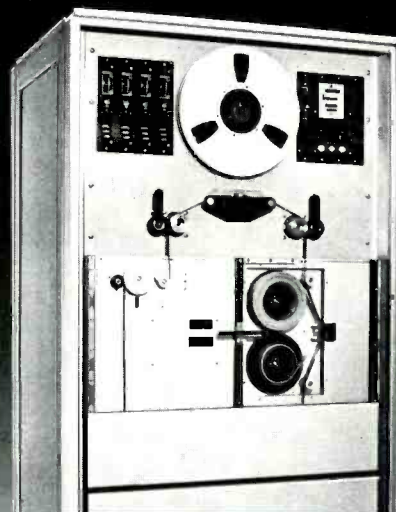
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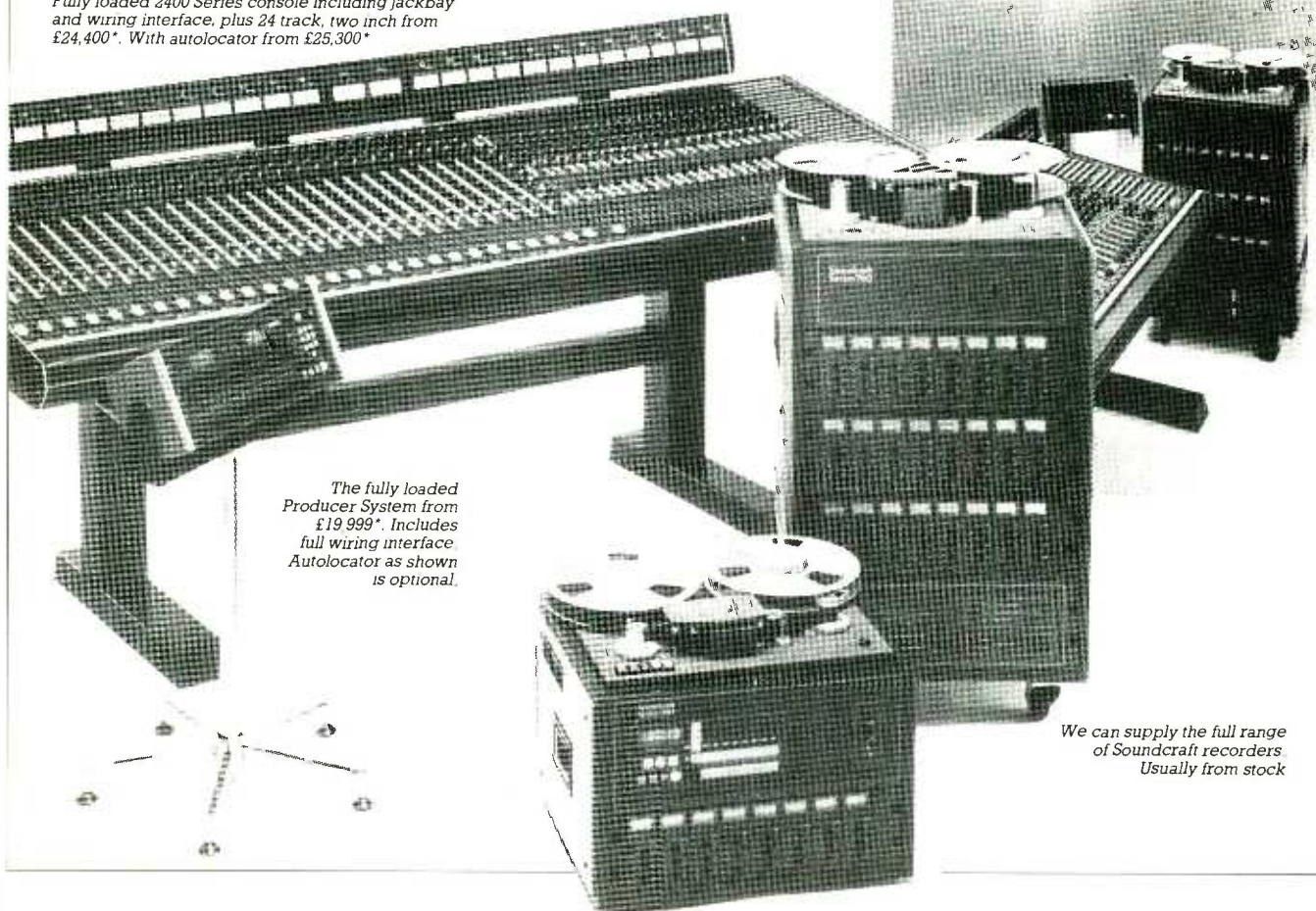
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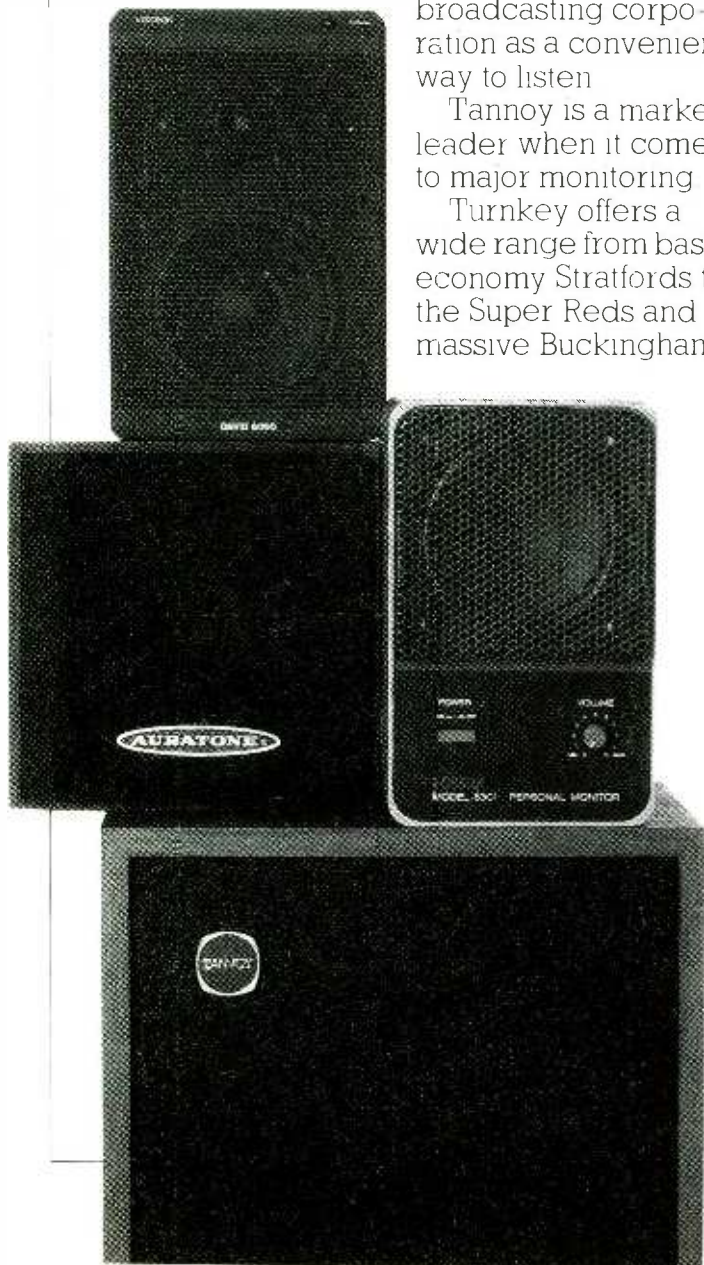
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# LOGIC AT WORK



THE H969 PROPITCH HARMONIZER FROM EVENTIDE



## LOGIC IN LAYOUT

CLARITY OF DISPLAY, EASE OF CONTROL, LOGICAL GROUPING OF FUNCTIONS, AND FRONT PANEL INSTRUMENT CONNECTORS ALL COMBINE TO MAKE THE 969 A JOY TO USE.

## LOGIC IN CONSTRUCTION

RIGID FRAME, MODULAR CIRCUIT BOARDS, AND A WIPE CLEAN FRONT PANEL CONTRIBUTE TO RELIABILITY, EASE OF SERVICE AND EQUIPMENT THAT REMAINS GOOD-LOOKING AFTER YEARS OF USE.

## LOGIC INSIDE

HIGH-SPEED LOGIC WITH AN INTELLIGENT SPLICING ALGORITHM THAT DELIVERS CLEANER PITCH-CHANGING THAN EVER BEFORE.

### The H969 features:

Full bandwidth delay to 1.5 seconds and 3 seconds at half-bandwidth.

Twelve preset pitch ratios at musical intervals.

Five delay user-presets, with non-volatile memory.

Digitally set pitch ratios that don't drift.

Flanging and Doppler effects.

16 bit PCM linear coding.

Remote control of pitch by voltage or keyboard.

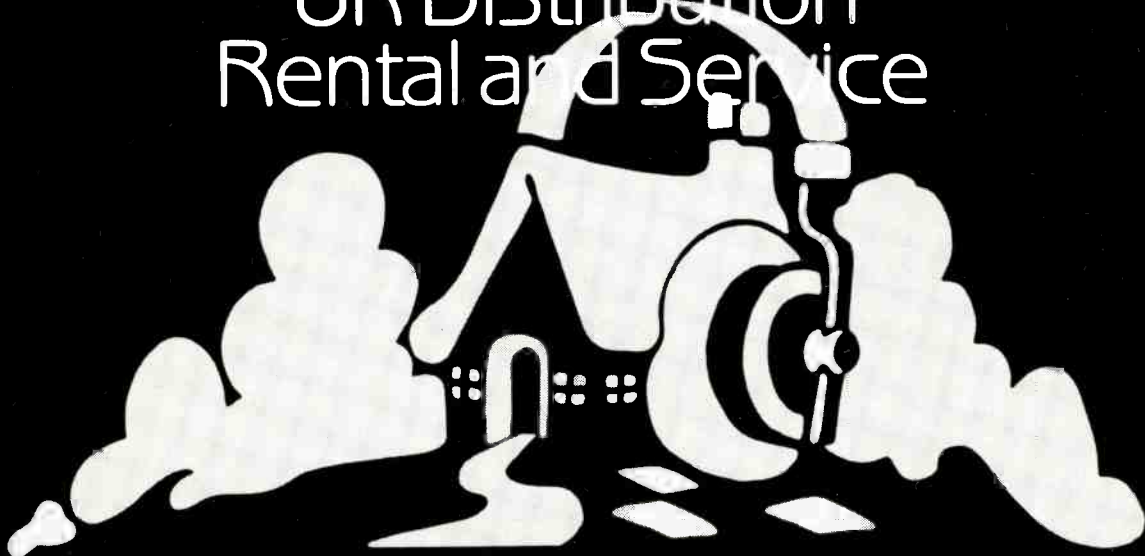
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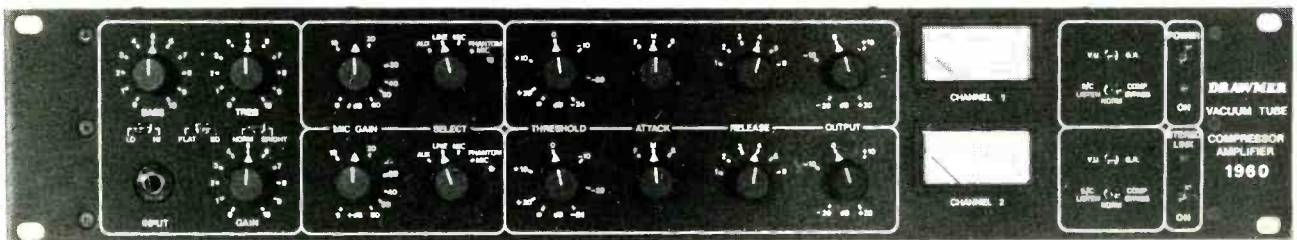


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# ...and here are some more!

During the AES Show period, we are offering special package price deals on many of our products including some of the following:



JH-24-24 Multi track Analogue Recorder



PCM-3324 24 track DASH Recorder



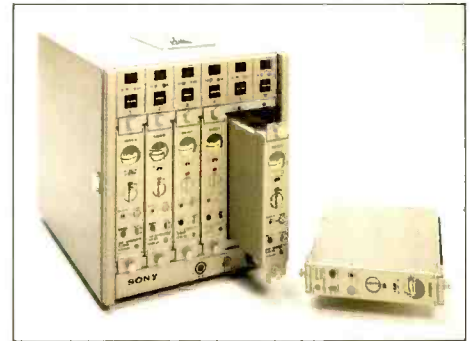
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Designed and produced by Bell Carter Elliot Richards Limited Basingstoke, England

If you're building a new multitrack facility or upgrading an existing one, the combination of an Otari 24 track and an Amek console has probably already presented itself to you as one option.

The Otari MTR90-II is now firmly established as the world's best-selling, as well as the most advanced analogue recorder. The many advantages of the MTR90 are best appreciated with the machine in continuous hard use, earning its keep, but among those most often-quoted are its brilliant sonic performance, its excellent ballistics when synced to video and the stability of alignment.

The Amek range has been extended to include the versatile Angela console. The Angela is built to an unus-

ually high mechanical standard and offers an extremely musical eq section.

Careful consideration at the design stage to the requirements of a variety of multitrack users has resulted in a console that allows great flexibility in operation.

ITA can supply you with both an MTR90 and an Angela but that's just the start. We specialise in putting together complete systems for every application. This can include monitoring,

all outboard effects, foldback, microphones . . . indeed, everything down to hardware and accessories.

The ITA service doesn't end there. Included in every systems package is full installation, all studio and control room wiring and the kind of service backup which can only be offered by someone with 12 years' experience as the U.K.'s leading systems specialist.

And even that's not all. If you require, we can provide a comprehensive design service for your studio. This can include structural alterations as well as acoustic treatment if necessary.

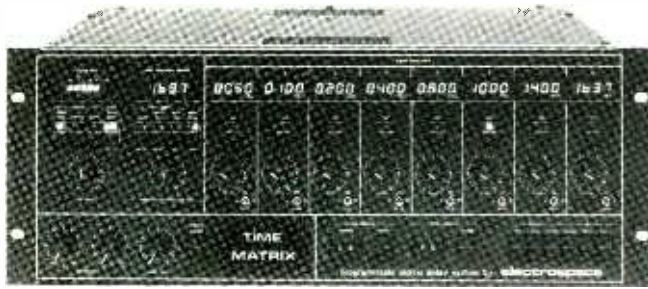
Amek and Otari are just the start – call us for the rest of the story.



# It took a great deal of thought to come up with a package for 1985.

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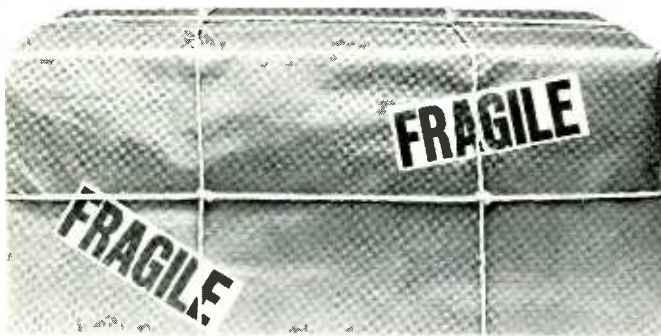


### The Family:

The **Time Matrix**, a versatile multitap digital delay system. 1.637 secs on each tap. 80 memories, LF and HF controls. Output level and delay display of each tap, on-board two output mixer. Optional eight outputs are available. Electronically balanced XLR's.



The **Spanner**, the first digitally controlled stereo panning system. Auto-pans from once every 12 seconds to 6 times per second. External/internal trigger pulse count up to 8 beats. Asymmetrical panning and modulated stereo imaging.



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#### TCD 910 Master Cassette Recorder.

TCD 910 is designed to replace the conventional combination



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## THE BREAKTHROUGH CASSETTE DECKS

of both reel and cartridge machines.

Features include:

- High precision 4 motor tape transport.
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- Auto stop and/or rewind after cut.
- Wide range of options and accessories

#### TCD 911 Playback Cassette Deck

Offers the same quality of construction and design as TCD 910 with special features such as

- Playback pitch control.
- External playback azimuth control. The TCD 910 combined with the TCD 911 makes for an ideal match of performance and price.

## TANDBERG TCD 900 SERIES PROFESSIONAL CASSETTE DECKS

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### NEW SOFTWARE RELEASE AUGUST 1984

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32 CUE-POINTS, autocorrection to the metronome, improved CUE SETTING, CLEAR CUE, CLEAR ALL  
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DATA TO TAPE via the SMPTÉ chanal saves START, CUES, TEMPOS

### NEW INPUT MODULE

reads any\* clock or FSK from metronome up to 1536 clicks, multiplies and divides  
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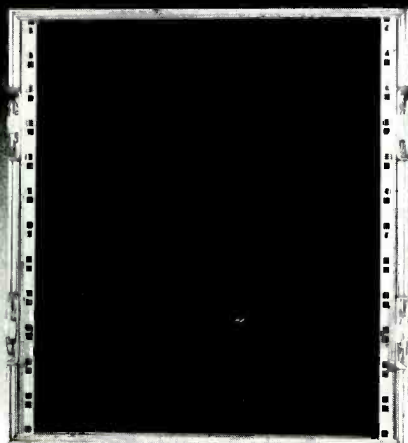


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*For a moment, we were puzzled, until we realised that Mike Berry was referring to our new I-CON sync unit. As a musician with his own 16 track studio, he really appreciates the convenience of an efficient autolocator. But where does the sync unit fit into the story? Well, now our family is complete. First came the Spin-Time tape timer, then the CM50 autolocator and the I-CON complete tape controller — and now a sync unit to lock audio to video or even audio to audio.*



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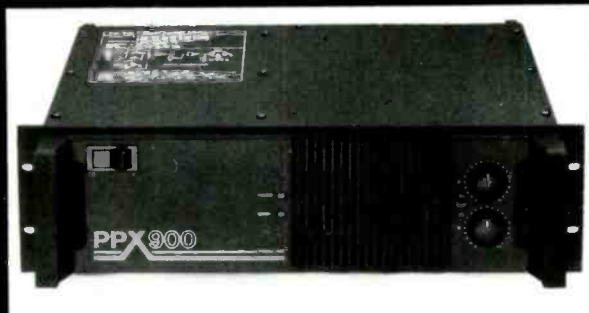
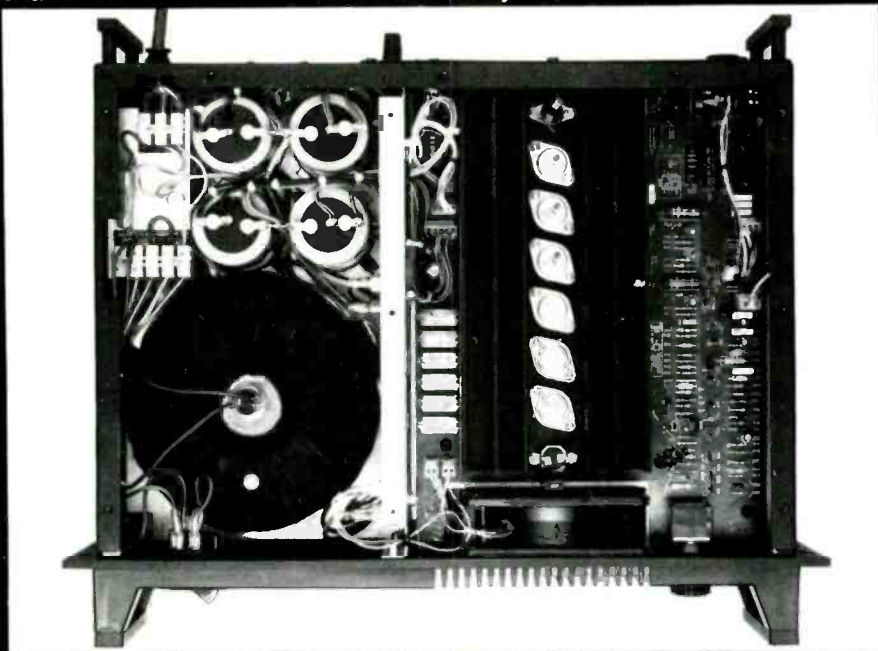
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Like the CM50, it is a 9 memory autolocator plus record select. It simply plugs into the remote socket on the B16. Most exciting of all, if you buy a Sync Unit you can link two B16s – instant 32 track at its most revolutionary cost yet. You too can drop-in Over The Road.



## Fostex Collection

Everybody knows about Fostex and Teac and all the rest; but it's not every day that you can try it all out with an extremely patient and knowledgeable recording engineer. You can do it Over The Road.

## Soundcraft Machines

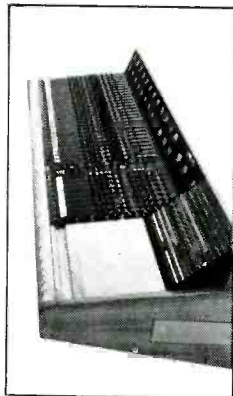
The Soundcraft Series 20 Stereo Mastering Machine takes the concept of conventional analogue tape machines into a new era. The Series 20 meets the highest professional standards at a very competitive price. The end result of this revolutionary design is a very impressive product indeed.



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The top professional range of consoles and multitrack machines from Trident for which D.L.A.S. are sole UK agents. The Series 70 mixer is the ideal instrument for the producer/engineer and comes in many different configurations. The Series 80B is for the fully professional studio. Come and fix a mix Over The Road.



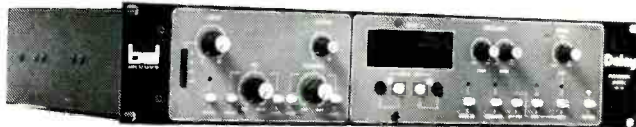
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## Bel BD80 DDL 8 Secs Delay / Sound Sampling

Yes, the amazing new DDL from Bel Marketing is expandable, with optional cards from 2 to 8 seconds at 15kHz bandwidth (16 secs 7.5kHz).

The most fascinating feature of this new delay is that it will record a sound which can be edited into a loop and replayed by a trigger on the front panel or from an external signal source. As for the price – you simply won't believe it. And remember; you heard it first Over The Road.



## SOUNDTRACS™ 16/18/16 Mixer

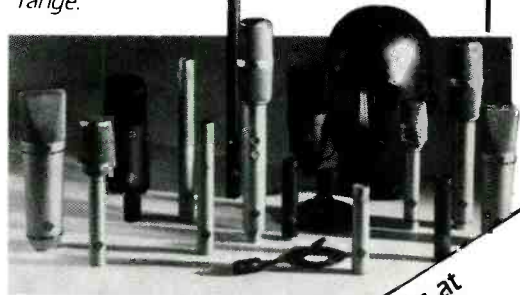
Now a firm favourite in both home and professional studios alike, the Soundtracs 16/18/16 continues to enjoy a sound reputation for quality; coupled with its extremely competitive pricing this mixer is a must!

Features now include ALPS faders (standard), dual level inputs and outputs via stereo jack sockets (compatible with Japanese and European equipment), 3 band EQ, 3 Aux Sends channels and monitors, plus EQ and fader reverse on 8 monitors allows use of the monitor channels as further inputs on mixdown.



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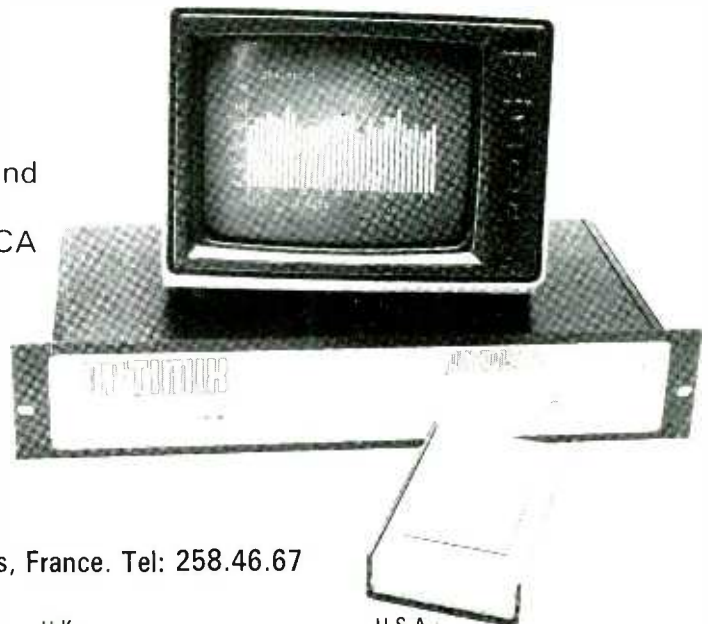
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- Totally Fail-Safe
- Incorporated by many console manufacturers including: Amek, Trident, Rebis, Raindirk



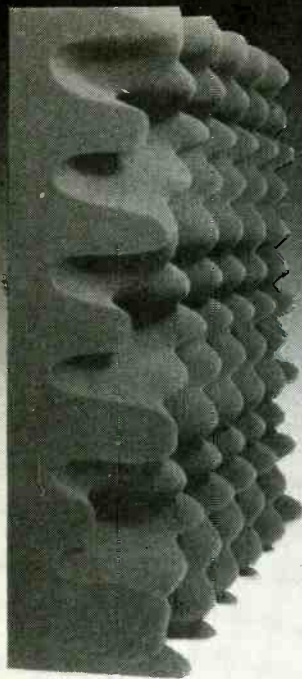
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Tel: (0 21 73) 7 80 60

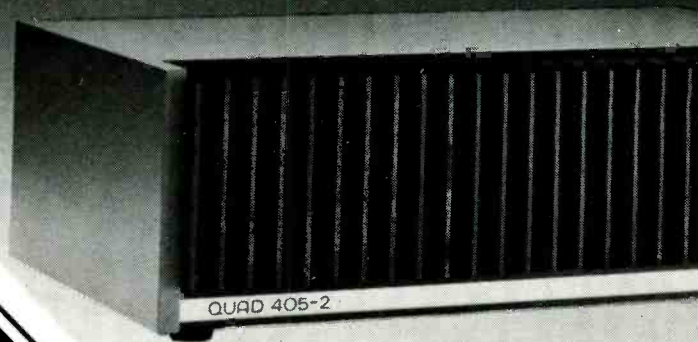
**Japan:**  
Continental Far East Inc.,  
Sasaki Bldg. 18-9,  
Roppongi 3 Chome,  
Minato-ku, Tokyo 106, Japan  
Tel: (03) 583-8451

**U.K.:**  
Branch & Appleby Ltd.,  
Stonefield Way,  
Ruislip, Middx HA4 0YL,  
England  
Tel: (01) 423 3597

**U.S.A.:**  
Jim Canacho Audio Marketing,  
280 Mill Street Ext.,  
Lancaster, Mass. 01523,  
U.S.A.  
Tel: 617-365-2130



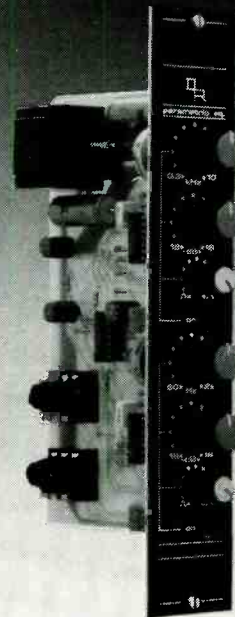
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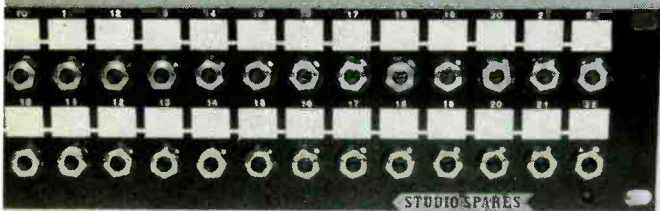
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# SERIES 65

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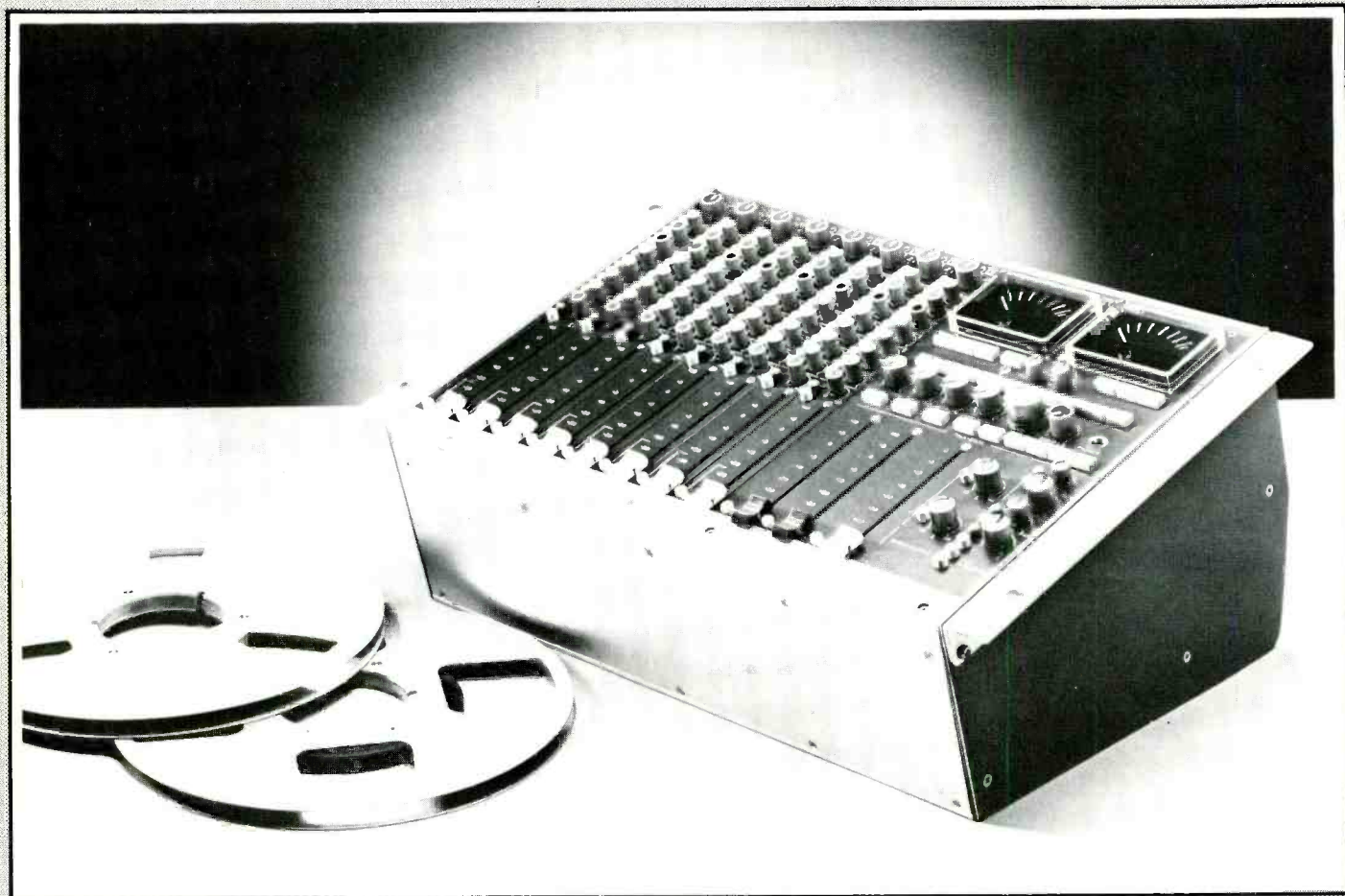
Tel: Chertsey (09328) 60241. Telex: 88139282 TRIMIX G

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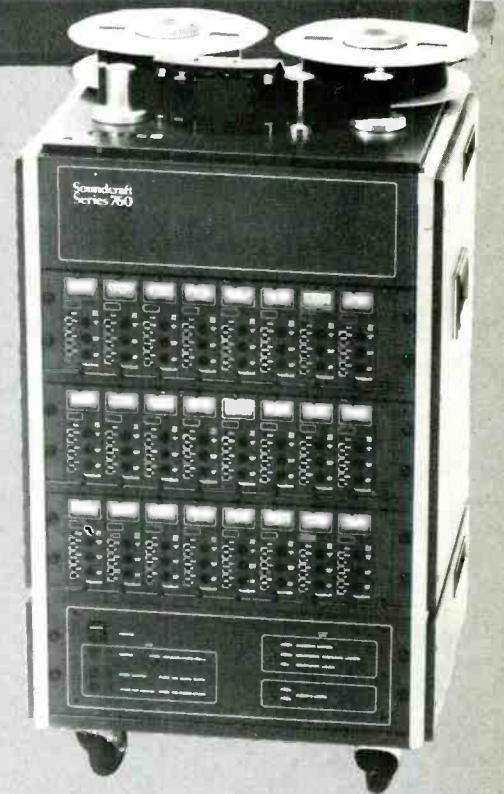
### **SOUNDTRACS™ CM4400 Console Features:**

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Suite 209, N. Hollywood,  
California 91607, USA  
Tel: (818)980 5717



**AUDIO KINETICS**

# DIARY DIARY

Events, agencies, exhibitions

## PRS donates to Band Aid

The Performing Rights Society (PRS) has decided that it will donate to the Band Aid trust fund an amount which corresponds to that part of the administrative expenses which would normally be deductible from the royalties due to composer PRS members Bob Geldof and Midge Ure paid in

respect of the performance and broadcasting of the two songs. Apparently due to the collection method of rights, it is not possible to exclude the administration charges from the royalty distribution process and so this donation will mean that the service fees of the PRS have been fully waived.

## BBC license LS5/9

The BBC have signed a licence agreement with British companies Spendor Audio Systems and Swisstone Electronics, allowing them to manufacture the LS5/9 studio monitor. A quarter of the volume of the much larger LS5/8, it weighs 14 kg and measures 280×460×275 mm.

The speaker uses two drive units with a passive crossover

and an equaliser which provides a flat, free-field axial response over the range 50 Hz to 16 kHz. The tweeter is a proprietary soft dome type and the low level frequency unit is of BBC design using a polypropylene diaphragm. A 50 W amplifier is required to obtain the maximum sound level output of 105 dB relative to 20 µPa at 1 m.

## In brief

During the April 6, 1984 flight of the NASA space shuttle (flight 11) Crown PZMs provided the soundtrack for a 70 mm film showing life aboard the space craft... Philips have manufactured their 100 millionth television set and to celebrate they donated 100 sets to the National Society for the Prevention of Cruelty to Children... Music Box is the result of three of entertainment's giant companies joining forces to provide a music channel for cable and satellite television throughout Europe. Music Box, which will carry advertising, will be transmitted on the ECS satellite to a potential European audience in excess of 5 million.

## Soundcraft NY

The new opening of Soundcraft offices on Broadway, Manhattan, has brought about a number of personnel appointments.

Heading up the operation is Paul Yurt, who comes from Digital Effects Corp (with a wealth of recording experience gained from a former appointment with Rupert Neve).

Another newcomer is ex-Soundworks studio engineer Phil Wagner; he will be in charge of local technical sales support on the dealer and consumer sides.

They will be assisted by Patty LaMagna.

Soundcraft New York can be reached at Soundcraft Electronics, 1841 Broadway, 511 New York, NY 10023, USA. Tel: (212) 315-0877.

## Quested news

Following the recent success of his monitoring systems, Roger Quested has left his position as studio manager of DJM Studios, London and formed Quested Monitoring Systems who are now located at The International Business Centre, 29 Glasshouse Street, London W1R 5AP. Tel: 01-734 6080.

Following their launch at the APRS 84 exhibition, there are, at the time of writing, now seven systems in major London studios.

## Forthcoming events

- March 3 Cassette & Duplicating '85, Plaza Hotel, Hamburg, West Germany
- March 5 to 8 AES Convention, Hamburg, West Germany
- May 3 to 6 AES Convention, Anaheim, California
- June 12 to 14 APRS Exhibition, London
- October 8 to 10 Internepcon, Brighton, UK

## Agencies

● Enertec has appointed PRECO (Professional Recording Equipment Co Ltd) as UK agent for their F462 and F500 tape machines. Contact is Tony Costello. PRECO, 319 Trinity Road, Wandsworth, London SW18 3SL. Tel: 01-874 9054. Telex: 8954667.

● Rebis Audio has appointed as sole Swiss distributor EMM Studio, Im Neumattli 27, CH-4145 Gempen, Switzerland. Tel: 061-728972.

● Aphex Systems Ltd has announced the appointment of 3M France as the new Aphex distributor for France.

● Audix Ltd, in their role as

UK distributor of Altec Lansing, have announced the appointment of a third regional dealer: Studio 4, 29 Forth Street, Edinburgh, Scotland.

● Quad-Eight/Westrex have been appointed sole US distributor of AEG-Telefunken professional tape recorders.

Quad Eight/Westrex, International Headquarters, 225 Parkside Drive, San Fernando, CA 91340. Tel: (818) 898-2341.

Quad Eight/Westrex, 2400 Crestmoor Road, Suite 327, Nashville, TN 37215. Tel: (615) 386-7127.

## Recording exhibition

A public exhibition/entertainment under the title Music World is being planned by Cornish Leisure World—a local holiday and entertainment company. The aim is to show the development of the music business and the company is appealing for help from the record and studio industry.

MD Graham McNally has been running the complex's Coliseum Theatre very successfully for a number of years, attracting the kind of crowd-pulling acts which would probably not normally consider Cornwall when planning a tour. He has been thinking about the idea of a special music industry-related entertainment—a theme park without the rides; a Mme Tussaud's with action.

McNally's idea is to use a variety of devices including video and audio tape loops, dioramas, posters and photographs, exhibits of cylinder and record players through the first century of

recorded sound, films, life size scenes with models, and settings such as the interior of a recording studio or a record factory. He is well aware that the project is ambitious and will not be easy to organise, but he has English Tourist Board approval and finance will be forthcoming from other quarters.

Any studio or individual with an item which could be included in the exhibition (on loan or for sale) should contact Graham McNally at Cornish Leisure World Ltd, Carlyon Bay, St Austell, Cornwall PL25 3RG, UK. Tel: 072681 4261.

In 1983 Cornish Leisure World had a total of 705,000 visitors (summer holidays, concerts, casual, disco and roller rink attendances combined). It turned over £1.9m and the top five shows in the Coliseum (all sell-outs) were Bucks Fizz, Police, Tom Jones, Johnny Mathis and Kids From Fame.

Terri Anderson

## NCAC directory

The National Council of Acoustical Consultants has published its 1984-5 directory which, as well as listing the council's 88 members, gives practical advice on how to select an acoustical consultant, explaining the broad categories of services the members provide.

A worldwide organisation, NCAC can offer architectural and industrial acoustics,

'environmental impact assessment' and community noise studies, testing and management, seminars, expert witness testimony and product development.

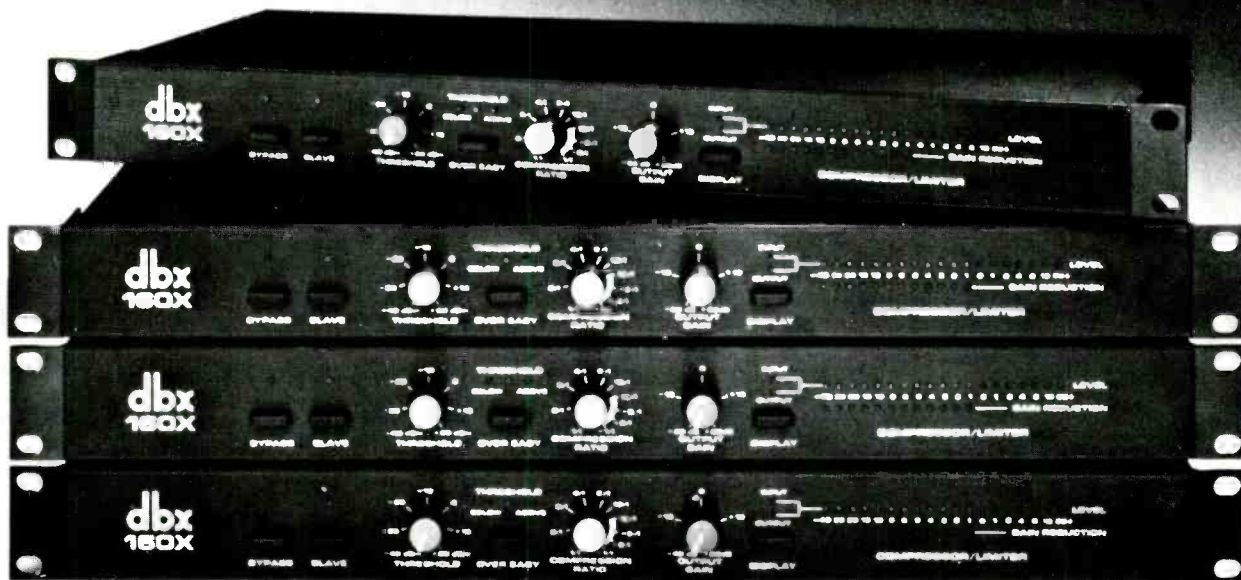
Further information and copies of the directory are available from NCAC, 66 Morris Avenue, Springfield, NJ 07081, USA. There is a small charge for postage and handling.

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# DIARY DIARY

Addresses, contracts, books

## Address changes

● Autograph Sales Ltd are now located at 2 Spring Place, London NW5 3BA. Tel: 01-267 6677 and 01-485 3749.

There are two direct lines on the 01-485 3749 number for all general and sales enquiries.

● Auvis-Asona KG has moved from Munich to Kippenheim, West Germany where they are now located within the premises of EMT, their parent company.

● Crow of Reading has announced that the Singapore based member of the Hudsons-Crow Group, Crow Broadcast Equipment (Pte) Ltd has now moved to larger premises at 100 Beech Road, 19-01/02 Shaw Towers, Singapore 0718. Tel: 65 295 3807. The telex number remains the same: RS 33565 CROWBD.

● Whitetower Records, the Calrec *Soundfield MkIV* microphone hire service, has moved. Whitetower also offers new and used microphone

sales; Sony *PCM F1* hire and real time cassette copying are amongst its services. Contact Mike Skeet at Whitetower Records, 44 Challacombe, Furzton, Milton Keynes MK4 1DP. Tel: (0908) 502836.

● Don Larking Audio Sales have opened a northern branch, offering a similar service to the Luton facility. Don Larking Audio Sales, Stafford House, Clough Street, Hanley, Stoke-on-Trent, Staffs, UK. Tel: 0782 24257.

● Waugh Instruments Ltd is the new trading name for a company formerly trading as Otter Electronics Ltd, manufacturer of oscilloscope add-on amplifiers.

Unfortunately they have been compelled to change the company name as the name 'Otter' was already registered by someone else. Waugh Instruments, Otter House, Weston Underwood, Olney, Bucks MK46 5JS. Tel: 0234 712445.

## Wayne Kerr AMS1 review

Following the publication in the January 1985 issue of a review of the Wayne Kerr *AMS1* test set, Wayne Kerr have informed us that this particular model is no longer in production following the decision of that company to

move out of the audio field. Stocks of this model are, we are informed, very low and will possibly be non-existent by the time that you read this.

Our apologies for any inconvenience that this may have caused to all concerned.

## Now it's ART

Following the demise of MXR, the rights to that company have been acquired by Applied Research & Technology Inc, a company formed by some former employees of MXR. They have selected some of the strongest of the MXR products and will market them under the name of ART. These include the *Ø1a* digital reverb, the Model 171 dual  $\frac{1}{3}$ -octave

graphic equaliser and the Model 172  $\frac{1}{3}$ -octave graphic, the 1500 digital delay, and the *Pitch Transposer*.

ART (Applied Research & Technology), 215 Tremont Street, Rochester, NY 14608, USA. Tel: (716) 436-2720. UK: Atlantex Music Ltd, 3 Caldwell Lane, Hitchin, Herts SG4 0AG. Tel: 0462 31511. Telex: 826967.

## Corrections

The telephone number for Powerplay Studios in Zurich published in our December issue should have read 41 1 980.15.21.

Ergonomic design of mixing consoles (November/December issues): all textual references to note 28 should have read 26, and to note 31 should have read 30.

## IEC books

The International Electrotechnical Commission (IEC) has published their IEC Multilingual Dictionary of Electricity, and IEC Handbook of Letter Symbols, both of which are available (in the UK) from BEAMA Ltd, 8 Leicester Street, London WC2H 7BN. Tel: 01-437 0678. Telex: 263536.

## Contracts

● Elliott Brothers have recently supplied two DDA *S* series desks to the new HTV Studios at Culverhouse Cross, UK; to be used for PA and monitor mixing on the studio floor; a 16/4/2 *S* series DDA desk to Ian P Kinloch & Co for an overseas turnkey sound control room project; and have been awarded the contract to install the complete sound communications and video systems for the Gardiner Arts Centre in the City of London.

● Fantasy Studios, Berkeley, California has recently installed a Mitsubishi *MX800* 32-track digital machine.

● FWO Bauch have supplied a Harrison *MR-4* console to Stewart Copeland of the Police for his home 24-track studio.

● FM Acoustics Ltd—the recently opened US branch of the Swiss company—has supplied a 4-way active system to bass player Anthony Jackson. The system comprises two *FM1000* and one *FM600A* amps driving Turbosound speakers. Masterfonics cutting studios in Nashville have also purchased three systems (two *FM800A* power amps and *FM236* crossover) and Soundstage Studios have bought a biamped system. FM Acoustics has also supplied an *FM800A* to London's Tape 1 digital cutting studio.

● Calrec have installed their first music console, the *UA8000*, at Polar Music in Sweden. Features of the console include simultaneous and totally separate mic/line inputs, normally feeding to track, and tape/group inputs, normally feeding to monitor. Thus the 48-channel version offers 96 line inputs which may be routed to any destination. There are also four mono and four stereo auxiliary sends per channel.

● Nova Studios, London, re-opened recently having undergone major changes to the control room and studio, and with the addition of a digital edit suite and video post production facilities. Under new ownership (Glebeview Ltd), the studio's director Dave Carey appointed Feldon Audio's Roger Cameron as the project's overseer.

Alangrove Associates carried out the acoustic treatment, design and building work.

New equipment includes Soundcraft *TS24* 40-way mixing console, *Q.Lock* SMPTE interlock system, Sony *PCM 701*/Audio+Design digital recording facilities. The digital editing suite has the Sony *DAE1100* digital audio editing system, Sony *PCM1610* digital audio processor and two *5850 D/A U-Matic* recorders.

● Tom Hidley's return to the design and construction of audio and video facilities has led to the following contracts currently in design/construction or recently completed: in the USA two studios for Solar Studios, New Jersey; two studios for Saturn Three, and a mobile for After Silence—both in Dallas, Texas; also in Texas—a facility for Southcoast Studios, Austin, Texas; a studio for Nightwing Studios, Louisiana; two studios for January Sound, Dallas, Texas; two control room updates at the Record Plant LA; in Honolulu—a studio for Channel 13 KHNL TV, and at Powerpoint two studios, two acoustic echo chambers, one mix room and a 20 Hz control room.

In Europe contracts have included Studio 'Hawaii' for Eurosonic, Madrid; two cutting studios for Tape One, London; control room updates for Studio Davout and Lark Studios (Paris and Italy); a 250 ft yacht for Michael Kelly in Holland and a studio for Denmark's Radio in Copenhagen. Work has also been commissioned for Konk Studios, London; Ginza Theatre, Tokyo; Regent Sound, New York; House of Music, New Jersey; Rox San's Cabaret, Honolulu.

● Solid State Logic recent console installations have included: Windmill Lane Studios in Dublin—Ireland's first SSL, an *SL4000 E* series Master Studio System complete with studio computer and plasma bargraph display; an *SL6000 E* series Stereo Video System for Imagination, London; an *SL4000 E* series for Peter Gabriel's home studio; once again an *SL4000 E* series at Jacob's Studio in Farnham, Surrey; and another first—Merseyside's only SSL studio Amazon's Studio 1 which is now equipped with an *SL4000 E*.

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

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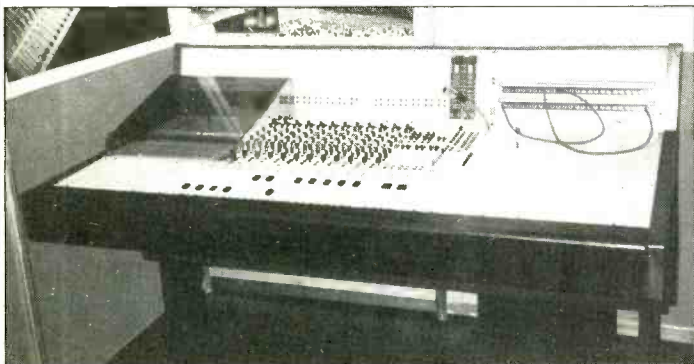
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# DIARY DIARY

Around the Tonmeistertagung

## Around the Tonmeistertagung



ANT's TRS 800 for broadcast or theatre work

The Tonmeistertagung is a West German convention with associated exhibition arranged in a manner that is not dissimilar to the European AES Conventions although on a rather smaller scale with regard to the exhibition area. It is held every three years with the most recent being in Munich during November 21 to 24 1984. It is really a local

German show with exhibitors ranging from manufacturers and dealers not well known outside the country to the big international names all mixing in a very pleasant and relaxed atmosphere.

The convention papers programme was very full with the majority of topics being based on broadcast audio and related subjects, many having

the participation of some West German broadcast networks whose OB trucks parked outside the centre quite often made access difficult. The majority (all except two) of the papers were presented in German and as my technical German is non-existent, we are struggling through the reprints to find any interesting material although it presently appears to be largely outside our main sphere of interest.

In the exhibition area there were a number of items—some totally new and some only new to us as outsiders to the West German market—which deserve a brief mention to a wider audience even though there may be difficulty in obtaining some of them worldwide.

A few general impressions became very clear during even a brief wander around the exhibition and one of these was the large number of home grown console manufacturers. Their consoles largely seem to

be designed around a form of cassette module system so each channel is made from perhaps five cassette modules which are probably all individually cased and screened. This is a necessity for some of the broadcast applications although the similar standards are to be found in many of the recording consoles which tends to make them virtually solid metal—very heavy and expensive in comparison to their UK or US equivalent.

ANT: a new clean lined console system known as the TRS 800 which can be configured for broadcast or theatre work; although it lacks a routing system for multitrack recording it could handle mixdown. The precise facilities depend upon choice of modules and the cost has been kept down by using slightly simpler mechanical construction than the aforementioned German tradition. Of particular

# Selected effects from HHB.

The staggering range of signal processors that has become available on the back of low-cost computer technology can be overwhelming.

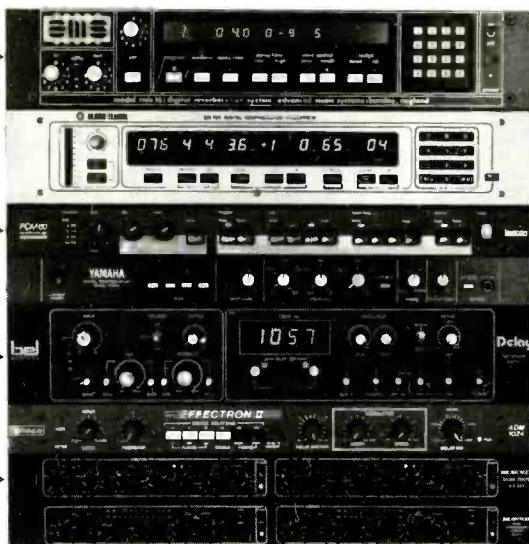
To help you make the right choice, HHB has selected a few that we think are special, representing best quality and value for money.

AMS RMX16 Digital Reverb: Undoubtedly the state-of-the-art in digital reverb. 12 factory presets, 9 user stores for user-edited sounds plus loadable programs. Up to 800ms pre-delay, 9.9 sec decay. Hi- and lo- filters. DDL capability. Stereo. £4680.00.

LEXICON PCM60 Digital Reverb: Brings famed Lexicon 224X quality at a realistic price. Plate or Room simulation, each with 4 decay and 4 size presets. Hi- and lo- filters. Stereo. £1475.00.

BEL BD80 DDL: Amazing value with full bandwidth, 2 sec delay as standard, up to 8 secs available. Digital sampling with loop editing facility. Internal or external trigger of sample. Modulation and phase controls. £695.00 (2 secs) + £200.00 per extra 2 secs.

DRAWMER DS201: This sophisticated low-cost dual noise-gate, offers attack, hold and decay controls, frequency-conscious keying gate or duck function, 80dB attenuation and stereo link. £275.00.



KLARK-TEKNIK DN780: Flexible new digital reverb from KT, offering choice of Plate, Hall, Chamber, or Room simulation, as well as delay, ADT, SOS, and multi-tap echo. Up to 990ms pre-delay, 99 sec decay; also reflection pattern and intensity controls filters. 39 presets + 50 user stores. Stereo. £3580.00.

YAMAHA'S R1000: The lowest cost, high quality digital reverb. It features 4 presets and a nifty 3 band parametric EQ for flexibility of effect. Digital quality at the price of a spring. £449.00.

DELTA-LAB ADM 1024: We are glad the Effectron II range is once again available here, because of all the many 1 sec DDL's now on the market, we think this one is the best. Features one second delay at full bandwidth, fine time control, modulation etc. £399.00.

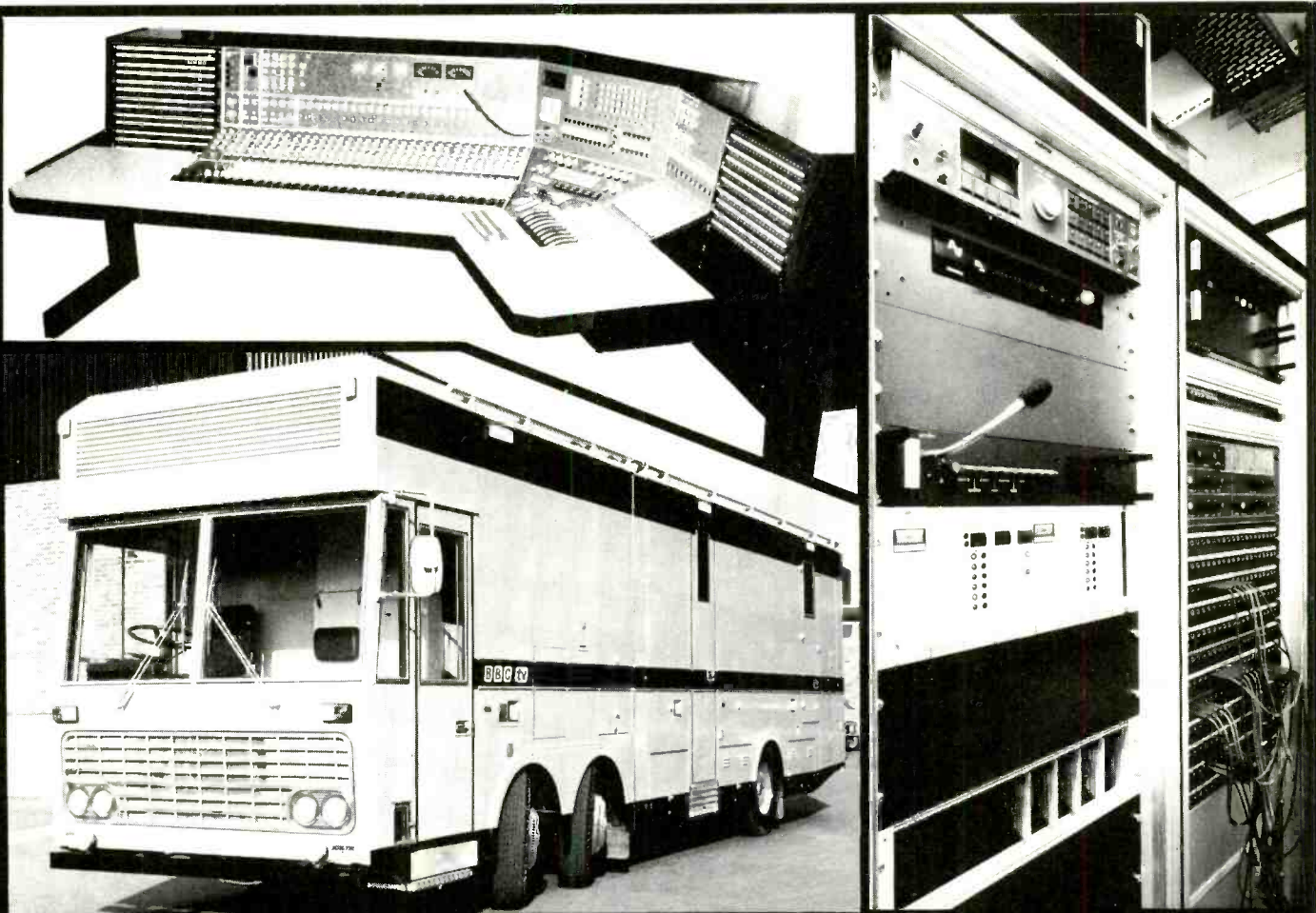
DRAWMER DL221 Compressor/limiter: Linear performance and flexible control, plus a separate limiter and side-chain functions make this a steal at £325.00.

All these units (and more) are permanently on demonstration at HHB if you need to try before you buy. If not, why not take advantage of our mail-order service for best possible prices and free delivery. Call now on 01-961 3295.



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# Audio & Video Jackfields for Recording and Broadcasting

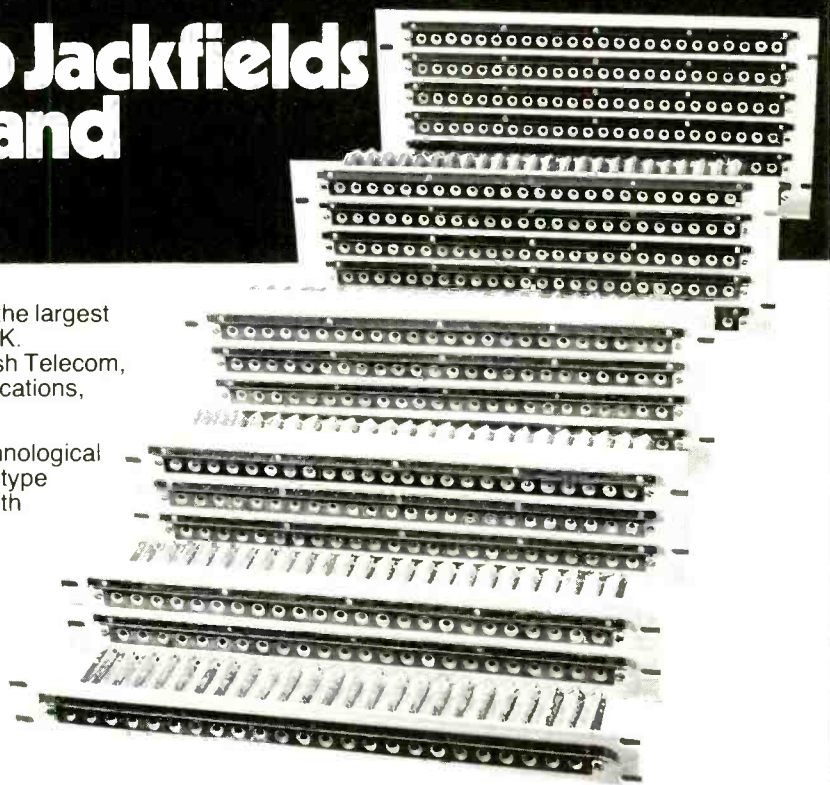
Mosses and Mitchell are recognised as being the largest manufacturer of Jacks and Jackfields in the U.K. We are approved suppliers to the B.B.C., British Telecom, the Post Office, Pye T.V.T., Pye Telecommunications, Mercia Sound and many other major users.

We have a policy of continued design and technological innovation and are now able to offer miniature type Jacks and Jackfields which can be supplied with wire wrap terminals as an alternative to the traditional solder terminals.

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# DIARY DIARY

Around the Tonmeistertagung

interest are the pin matrix routing systems.

**Lawo Geratebau:** this is a company very involved in broadcast audio equipment and medical electronics with a fair number of impressive installations to their credit. One of the featured items was a prototype digitally assignable console with analogue audio signal paths. The system is apparently some way from being finalised although they said that reaction to the prototype had been very strong so they were proceeding with the project.

**BFE:** several ranges of mixing consoles that look quite American in design. The *C301* is a 16/8/2 designed for both live and recording work. The larger unit on display was a 32-channel system known as the *S500* studio console. This features a 4-band parametric EQ, what appeared to be a choice of three preset channel gain levels in addition to variable input trim, six aux sends all pre/post switchable, eight sub groups, a very comprehensive metering system and four onboard expanders with keyable inputs.

**Sennheiser:** had a new compact 8-channel portable console known as the *M8* in a fully modular format with a very full range of features for such a small unit including switchable 24/48 V phantom power, phase reverse, pan, PFL, 3-band EQ, etc. There was also a new high performance mic, the *MKH 40*, a pencil-type cardioid condenser unit designed for

digital recording use having the necessary low self noise, high max SPL, etc.

**Enertec:** had a new modular portable mixer, the *UPS 6000*. The precise facilities offered depend on the modules selected and there are max frame sizes of up to 17 inputs. Channel facilities include balanced mic and line, 2-band EQ, LF and presence filters, 48 V phantom power, pan, PFL, two aux sends with switchable pre/post and a fader. At the different end of the scale, the digital console they were showing at the Paris AES was only present in the form of a wall schematic although I was informed that the prototype was undergoing tests with a French broadcast network and that 'production' models were a possibility in late 1985.

**ADT:** manufacture more recording orientated consoles, several of them of interest. Current top model by facilities is the *A1500B* although this is very much in the traditional German style. The *C24* is a

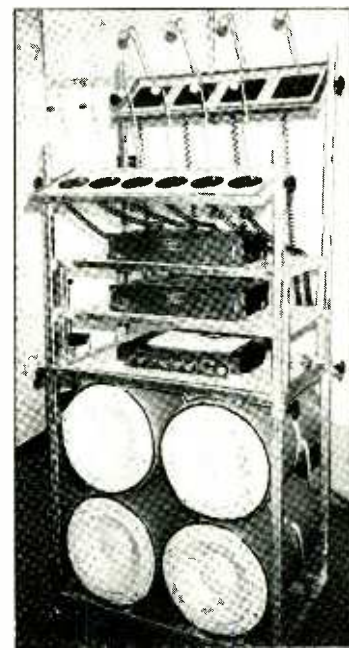
large multitrack console being shown for the first time. The demonstrated model had 40 input channels with 4-band EQ, switchable 1-12/13-24 output routing, VCA subgrouping, two cue and four aux sends and provision for an automation system currently under development by ADT. They also manufacture a wide range of replacement electronics for tape machines and mag-film transports which allow update of the performance of existing systems.

**Philips:** a surprise on the Philips stand was a new range of professional microphones—the *BPE* series (Back-Plate Electret). Information was rather limited and hopefully greater detail will soon be available. Together with the previously covered professional CD players and other products—does this signal a return to professional audio by Philips?

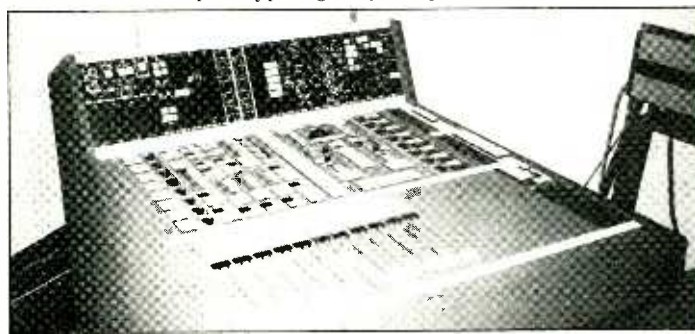
**Gieger Acoustic System:** manufacturers of speaker systems ranging from home

systems up to the illustrated system intended for concert hall use. The technology is not conventional and unfortunately Hans Gieger's English was not up to explaining the full implications of the design. We do have however a number of pamphlets which we are working on to try and make a little more sense of the design ideas. The system uses Carver power amps with the drive units being Isophon—four *PSL 320/400* for LF, one panel containing four *KM 135* and a HF panel containing six *SKK 10*.

An unconventional concert hall speaker system from Gieger Acoustic



Lawo Geratebau's prototype digitally assignable console



## Addresses

**ANT Nachrichtentechnik GmbH, Fachbereich, Elektroakustik, Lindener Strasse 15, D-3340 Wolfenbüttel, West Germany.**

**UK:** Audio+Design Calrec Ltd, Unit 3 Horseshoe Park, Pangbourne, Reading, Berks RG8 7JW (telcom only).

**USA:** Solway Inc, PO Box 7647, Hollywood, FL 33081.

**ADT—Analoge & Digitale Tonstudientechnik, Scholtwiese 4, D-4390 Gladbeck, West Germany.**

**BFE, An der Ochsenwiese 3-6, Postfach 23 00 80, D-6500 Mainz-Gonsenheim, West Germany.**

**EMT-Franz GmbH, Postfach 1520, D-7630 Lahr, West Germany.**

**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts, WD6 4RZ.

**USA:** Gotham Audio Corp, 741 Washington Street, New York, NY 10014.

**Enertec Department Audio Professional, 1 rue Nieuport BP 54, 78140 Velizy-Villacoublay, Cedex, France.**

**UK:** PRECO, 319 Trinity Road, Wandsworth, London SW18 3SL (recorders only).

**Gieger Acoustic System, Postfach 24 12, D-3300 Braunschweig, West Germany.**

**Hogel Studio-Technik GmbH, Siemensstrasse 2a, 8044 Unterschleissheim-Lohhof, West Germany.**

**Lawo Gerätebau GmbH, Am Aberwald 8, D-7550 Rastatt-Ottersdorf, West Germany.**

**MB-Electronic GmbH, Postfach 60, Neckarstrasse 20, D-6951 Obrigheim, West Germany.**

**UK:** Libra Electronics, Benfield Road, Stansted, Essex CM24 8HS.

**Philips Industries, Electro Acoustics Division, Building HBS 2, Eindhoven, Netherlands.**  
**UK:** Pye TVT Ltd, The Broadcast Company of Philips,

PO Box 41, Coldhams Lane, Cambridge CB1 3JU.

**USA:** Philips Audio Video Corp, 91 McKee Drive, Mahwah, NJ 07430.

**Sennheiser Electronic, D-3002 Wedemark 2, West Germany.**

**UK:** Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG.

**USA:** Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018.

**Teldok Film, Television & Dokumentar Film GmbH & Co, KG Schillerstrasse 52, D-78 Freiburg, West Germany.**




# Let's Celebrate!



Since 1974, Ampex Grand Master® 456 has not only grown 10 years older, but 10 years better. Improvements, year after year, continue to keep Ampex professional audio mastering tape at the top of the musical charts.

Come to the Ampex Corporation booth at AES, join our celebration, and see how the best tape just keeps getting better.

**AMPEX**

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# DIARY DIARY

Around the Tonmeistertagung

**Teldok Film:** had an optical preview display designed for previewing a soundtrack from an advance or preview head and displaying it on a row of 32 LEDs. The delay time of the light beam is variable to match the advance preview time needed and the threshold is adjustable so that even pauses in speech can be seen. The *Prescope* is intended for film or video sound mixing and there is also a version available with a light bar of 1 m long using large LEDs.

**Hogel Studio-Technik:** a very diverse product range of ancillary products that includes the manufacture of fully finished consoles, less electronics, for custom equipment; a very effective down-lighting system for positioning over consoles so that variable intensity light falls only below the unit; and lastly a very useful splicing tape dispenser filled with lead shot which doesn't move at all when used (a

Klebebandabroller).

**MB Electronic:** were showing a number of new mics—the *PMB 240*, *PMB 235* and the *PMB 230* and these are replacement models for the *PMB 119*, *219* and the *219 SM* which have now been discontinued. Of particular interest was the *BO* which is a stereo boundary type mic with the capsules being forward facing at the boundary rather than facing the boundary, and separated by a half-Jecklin disc. This mic is a 'proper' condenser, ie not electret and is only available to order. At the opposite end of the chain, they were demonstrating their ranges of speakers for monitor use and the active version of the *Quart 560A* sound very good indeed—as far as could be judged within the booth.

MB are gathering quite a reputation as experimenters with new ideas. The *KLSM 2000* speaker system looks quite ridiculous at first but has a very practical purpose.



The *KLSM 2000* personal system is part of a study project

Far from being a new concept in personal stereo, it is part of a study project being undertaken with the IRT (Institute für Rundfunk Techniken). The idea is to try to create a near field monitoring environment that is constant no matter in what room it is being used. Uses being suggested are classical recording sessions where the control room is often installed in differing or the only available rooms where there is no way to reference the monitoring and so the idea is to dispense with the room acoustics completely although

not to go to headphones which is also misleading in its own way. As you would expect, the size of the speakers precludes any deep bass being heard although the shoulder harness is adjustable so that bass frequencies are felt rather than heard. A candid reaction was that it is a very good idea but for it to work properly you have to move shoulders and head as one or the sound changes—as would happen if leaning forward to alter a console control. Perhaps they should look towards fixing to the head rather than the shoulders...

**EMT:** a new version of the 266 transient limiter known as the *EMT 266X*; the *EMT 448 Unimatic* which we understand to be a digital short term storage unit; and the *EMT 445* which is a programme delay line with 16-bit 48 kHz sampling and a delay time variable between 1 ms and 10.9 s and a memory store for 99 settings. □

# We test your equipment, not your patience.

Technical Project's new microprocessor-controlled *MJS401D*, Audio Measurement System is a powerful cure for test frustration, leaving engineers with more time and energy for solving problems. Here's the prescription:

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# When no manufacturer will discuss equalizer performance, Spectra Sound still does.

*Have you ever noticed how few, if any, graphic equalizer manufacturers will discuss the measured performance of their product? At Spectra Sound, we believe that measured performance is an essential factor in the selection of an equalizer.*

## **The Model 1500: Performance You Can't Hear**

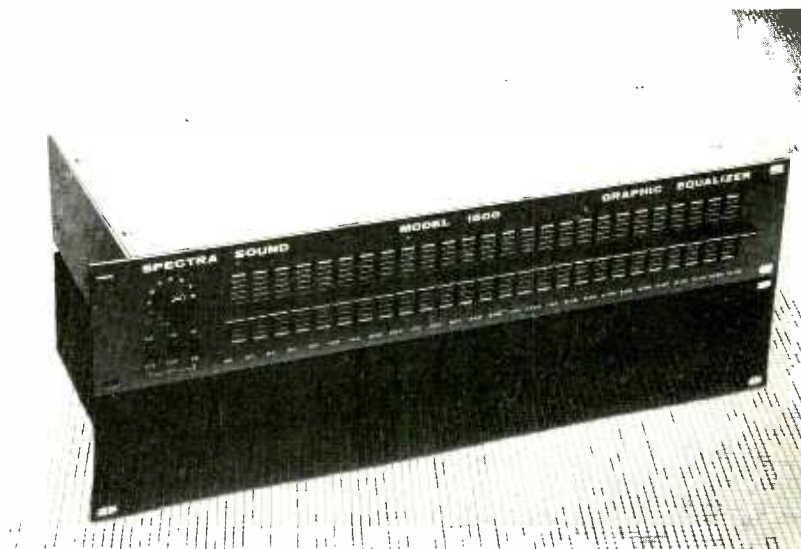
The measured performance of the Spectra Sound 1500 is second to none. Unmeasurable distortion, (I.M. and T.H.D), and extremely low noise, (104dB, +4dBv, unweighted), represents a significant, performance improvement over any other professional twenty seven band graphic equalizer.

In addition, band-centers are calibrated by hand to be within two percent, and an output impedance of below one ohm, (typically .3ohm), minimizes the disastrous effects of long cable runs.

## **The 1500 is also affordable**

Surprised? Well don't be. In fact, the 1500 is priced well below the majority of twenty seven band graphic equalizers on the market.

In a day where performance is often judged by price, the 1500 is truly a bargain.



3750 Airport Road  
Ogden, Utah 84405  
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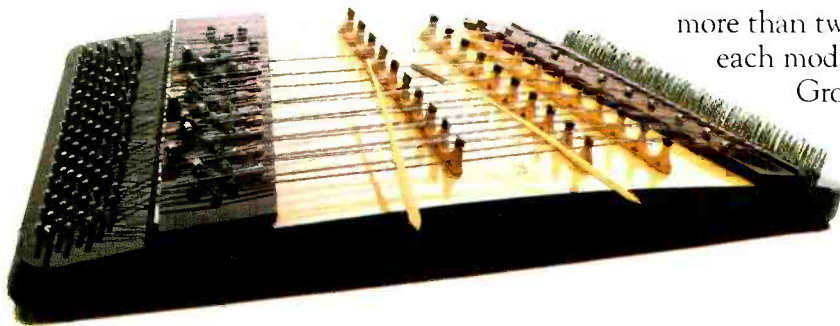
# Why do the world's leading studios turn to Solid State Logic?

Every day, music of all kinds is being made on this planet. And every week, another studio somewhere in the world switches on their new SL 4000 E to record it. When so many different people agree, there has to be a reason.

Perhaps it's that Solid State Logic lets them hear the sounds and the silences that were missing before. Through short, clean signal paths that add nothing to the source unless the engineer or producer so desire.

Yet when the desire strikes, the SL 4000 E responds with musical precision and a tremendous range of creative power. Only SSL provides the easy flexibility that invites each engineer to shape the console to suit their personal style. And the natural transparency that allows each instrument to speak its distinctive voice.

From the studios of China Records in Beijing to the famed broadcast concert halls of the BBC Symphony Orchestras, Solid State Logic sets the standard for audio integrity. Study the charts. Ask the producers. You'll find SSL at the top in rock and pop, country and western, rhythm and blues, jazz and dance. The world of music turns to SSL. Because, purely and simply, SSL delivers the musicians' intent.



## The Art of Technology

It's one thing to build a collection of audio electronics into a big box. It is quite another to create high technology for the recording musician. In every detail, the SL 4000 E Series supports your artistry with the experience and awareness of the world's leading console design group.

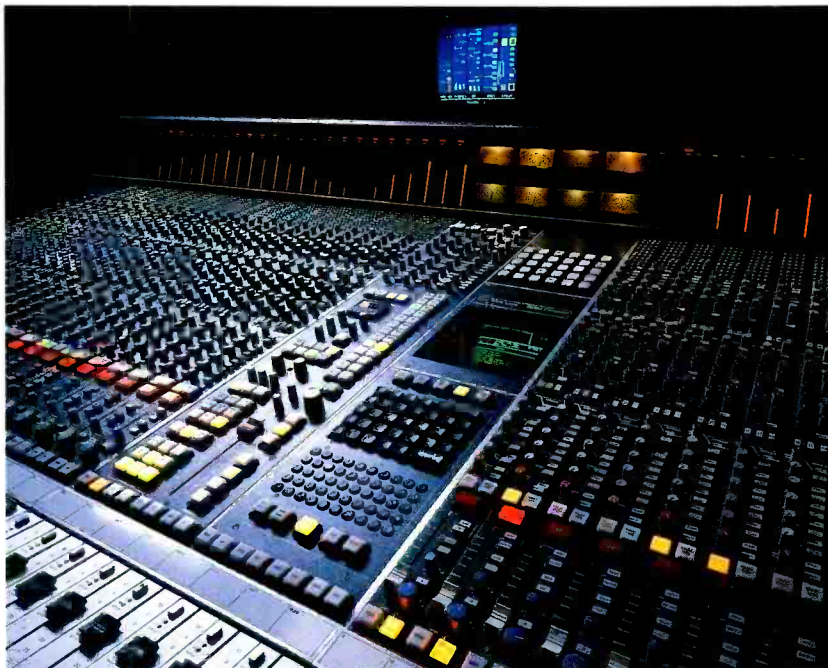
In every channel, SSL presents the tools required to perfect your sound. Superb four band parametric equalisation and filters. Versatile compressor/limiters. Noise gates, Expanders. And virtually unlimited possibilities. Because the SL 4000 E Series not only helps you shape the sound, it lets you structure the signal flow itself.

Pushbutton signal processor routing provides more than two dozen useful variations within each module. Six master statuses, 32 Output Groups and SSL's unique patchfree audio subgrouping direct the audio paths throughout the desk to serve your individual requirements and preferences.

## Making Life Easier

To give the artist and engineer complete freedom to explore these new potentials, SSL invented Total Recall™. At the end of each session, Total Recall scans every knob and button on all Input/Output modules. Then, in less time than most people take to find a pen that works, it creates a permanent and portable record of these settings on floppy disk. Which means that you can stroll into any SSL Total Recall control room anywhere in the world and recreate last week's monitor and cue mix, or last year's incredibly complicated but not quite final version.

Control accuracy is within a quarter of a dB! Best of all, Solid State Logic has accomplished this without affecting the audio path. Providing a dynamic range and bandwidth that comfortably exceed the performance of the best 16 bit digital converters and recorders.



Other system elements include events control, programmable equalisation, and a variety of mainframe and metering options to suit many different requirements and budgets.

Whatever your initial specification, all SSL systems are designed so that economical upgrades can be performed on site as your business grows and diversifies. This policy is supported by continuous software development that enables SSL studios to keep pace with an increasingly inventive clientele.

We can build an SL 4000 E Series Master Studio System for your control room in about three months. We'll be happy to assist with your technical and financial planning. We'll provide expert help with installation and training. And we'll back you up with prompt parts support and worldwide field service.

When it comes to keeping a studio booked, nothing is quite so effective as giving your clients the sound they want. And that's where SSL can help the most. Please telephone or write for further details.

## A Comprehensive System

Total Recall is just one aspect of the SL 4000 E Series Master Studio System, an integrated range of hardware and software components designed to make even the most elaborate productions more humanly manageable.

Practical innovations such as the SSL Studio Computer provide the world's most versatile mixing automation. The SSL Integral Synchroniser and Master Transport Selector offer computer-assisted control of up to five audio or video transports in perfect lock.

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# NEW PRODUCTS

# NEW PRODUCTS

Equipment, modifications, options, software

## Ursa Major MSP-126 stereo processor

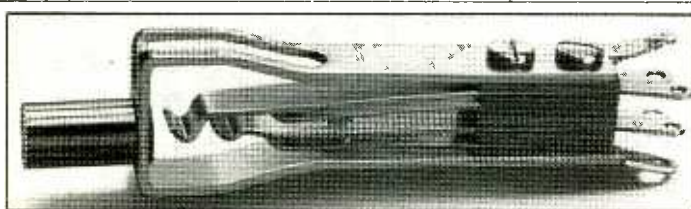
The new *MSP-126* multi-tap stereo processor from Ursa Major is a very interesting combination of stereo functions in a single box. The unit uses standard PCM digital techniques and has a 20 kHz bandwidth. Operational controls are very straightforward with basically eight operating modes each of which can be modified with two 16-position rotary switches controlling a variety of performance parameters. The eight modes are: Multi-tap stereo processing which creates a stereo image from a mono source with complete mono compatibility and adjustable in width; Comb Filter stereo processing which creates 'stereo' using comb filters, mono compatibility and adjustable width; Panpot is a function that places source at desired position within stereo field using time delay, signal energy is equal in both channels with position and overall width being adjustable; Binaural Manipulation is similar to Panpot but in the binaural mode for headphone applications 'front-to-back depth' is added to the image, source position and depth are adjustable; Room generates

the early reflections of a room or concert hall with adjustable delay and dry/wet mix; Delay cluster generates a cluster of signal repeats with adjustable pre-delay and mix; Repeats generates from two to 10 equally spaced repeats alternating between channels with adjustable overall length and rising or falling gain; and Scale provides a stereo comb filter whose 'teeth' are at precise musical intervals, adjustable up a chromatic scale from unison to an octave plus a minor third. The signal source can have a pitch transposed signal added to it.

The 19 rack mount unit features an alphanumeric readout for mode and parameter identification and adjustment. Separate input and output levels are provided as are input level indication and a bypass mode. The unit is also totally software driven and new programs can be developed. User suggestions will apparently be welcome.

**Ursa Major Inc, PO Box 28, New Town Branch, Boston, MA 02258, USA. Tel: (617) 924-7679.**

**UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314.**



## Audio-Line SKINI jack

Audio Accessories Inc have announced the availability of the *SKINI*, a narrow profile version of the standard 1/4 in audio jack (tip-ring & sleeve type). A standard 19 in rack panel can normally accommodate 26 standard jacks per row and if more are needed bantam jacks have to be used. The *SKINI* will however enable up to 32 jacks to be configured in one row.

Aside from the narrow width, there are a number of other features including an offset ground terminal for easier bus wiring, contacts of 0.078 in length, and a nylon support bumper that allows springs to exert the correct downward pressure to ensure good contact.

**Audio Accessories Inc, Mill Street, Marlow, NH 03456, USA. Tel: (603) 446-3335.**



Studer A80 QC Mk II quality control recorder

## Studer products and upgrades

Studer have recently introduced a number of new products and upgrades on several established items. The first such unit is a new mark of the *A80* mastering recorder, the *A80VU MkIV* which incorporates significant changes in both the audio and transport systems. These include the replacement of the in/out transformers with active balancing circuits; a redesigned record driver amp; high bias reserves and more record headroom (such as might be required with future tapes allowing levels of up to 3000 nWb/m to be accommodated by the machine). The record driver may be equipped with an optional processor for Dolby *HX Pro* headroom extension system. A new quartz referenced master oscillator incorporates a central switch for all channels equipped with Dolby *HX Pro*. Other features include new record and replay heads made from a long-life alloy; redesigned head shielding and an improved tape tension control system.

Two machines used for tape cassette duplication have also been updated. The *A80MR MkII* is used for recording of duplication masters and the update *MkII* offers transformerless in and outputs; a new multi-roller headblock design which offers improved HF phase stability; a new master oscillator; a new record driver with improved headroom; full compatibility with chrome tape formulations

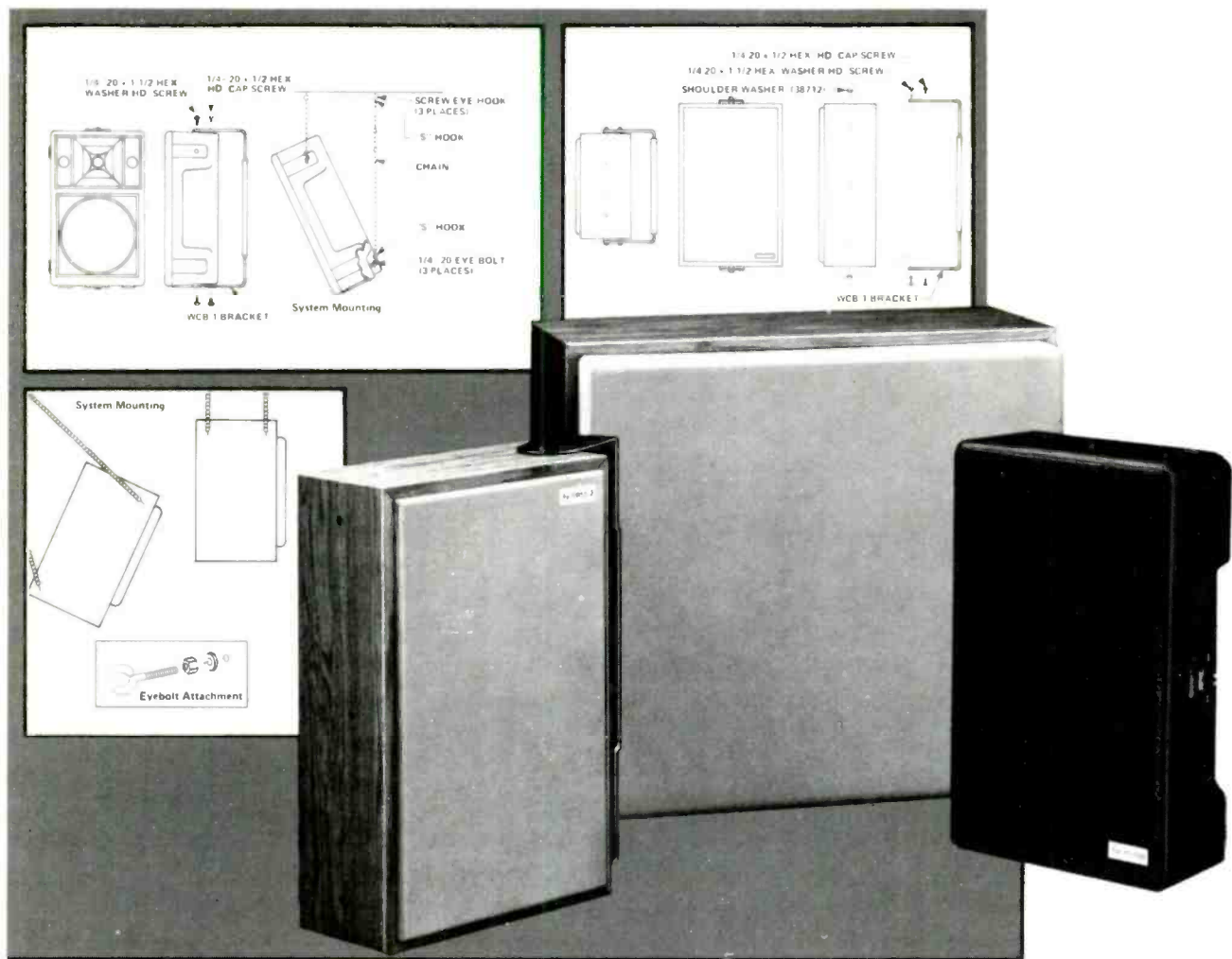
and an option for Dolby *HX Pro*. The machine is available in 1/2 and 1 in formats with 2, 4 or 8 channels.

The *A80QC MkII* is a dual capstan machine for QC of 1/2 in cassette tape. The new *MkII* features include a diecast steel headblock chassis with calibrated azimuth control and anti-scraper flutter guidance; a high efficiency reproduce head improves S/N play performance while a new ferrite record head is compatible with IEC type I, II and IV tapes. The machine also provides switchable EQ for these tape types. An option is available with VU meter panel and built-in monitor speaker.

The *PR99* has been updated in the form of a *MkII* version incorporating a LED real-time tape counter, a built-in varispeed control along with zero locate, address locate and auto repeat functions. Less visible improvements include expanded facilities for reproduce treble adjustment, a serial remote connector and automatic braking adjustment for large or small reel sizes.

**Studer International AG, CH-8105 Regensdorf, Althardstrasse 10, Switzerland. Tel: 01 840.29.60. Telex: 58489. UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 254-5651. Telex: 55-4453.**

# EV SHUTTLESOUND



## Great Sound In Small Packages

We went into the field to find what you wanted most: a wide-angle speaker system that works like a component array, but installs with ease and looks great anywhere. Then we designed our new FR15-2, FR12-2 and P1100 speaker systems to make your job easier.

All systems are factory-fitted with threaded inserts to facilitate suspension. And, with an optional telescoping bracket, the FR12-2 and P1100 can also be wall or ceiling mounted in six versatile positions. For constant-voltage operation, an optional TK60 line transformer kit replaces the normal direct input panel.



TK60 TRANSFORMER KIT

The FR15-2 and FR12-2 have oak-grained, vinyl-covered enclosures, for use indoors.

The P1100's one-piece molded polyethylene enclosure is tough enough to go outdoors.

All three new units are two-way, full-range systems featuring EV's own constant-directivity design which radiates sound over well-defined coverage zones: 90° x 40° for the FR15-2; 100° x 100° for the FR12-2 and P1100. They're all substantially more sensitive (96/97 dB, 1W/1m) and more rugged (100/200 watts long-term average power capacity) than most competing systems.

The FR15-2, FR12-2 and P1100 speaker systems from Electro-Voice. Outstanding performers that install with ease and look as great as they listen. Let us tell you more.

### Shuttlesound Limited

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Telephone: 01-871 0966 Telex: 27670 Shutso G

# NEW PRODUCTS NEW PRODUCTS

Equipment, modifications, options, software

## Otari MX-70 series

Otari have introduced a new range of 1 in multitrack tape machines which will be available in three versions: 1 in 8-track; 1 in 8-track prewired for 16-track; and 1 in 16-track. The *MX-70* series will have many of the features of the *MTR-90* series such as microprocessor governed constant-tension; logic interlocked controls, a remote controller and an interface connector for any SMPTE/EBU timecode based equipment. An optional conversion kit is available for ½ in 8-track tapes. Both RS232C and RS422 serial data ports may be ordered with the machine.

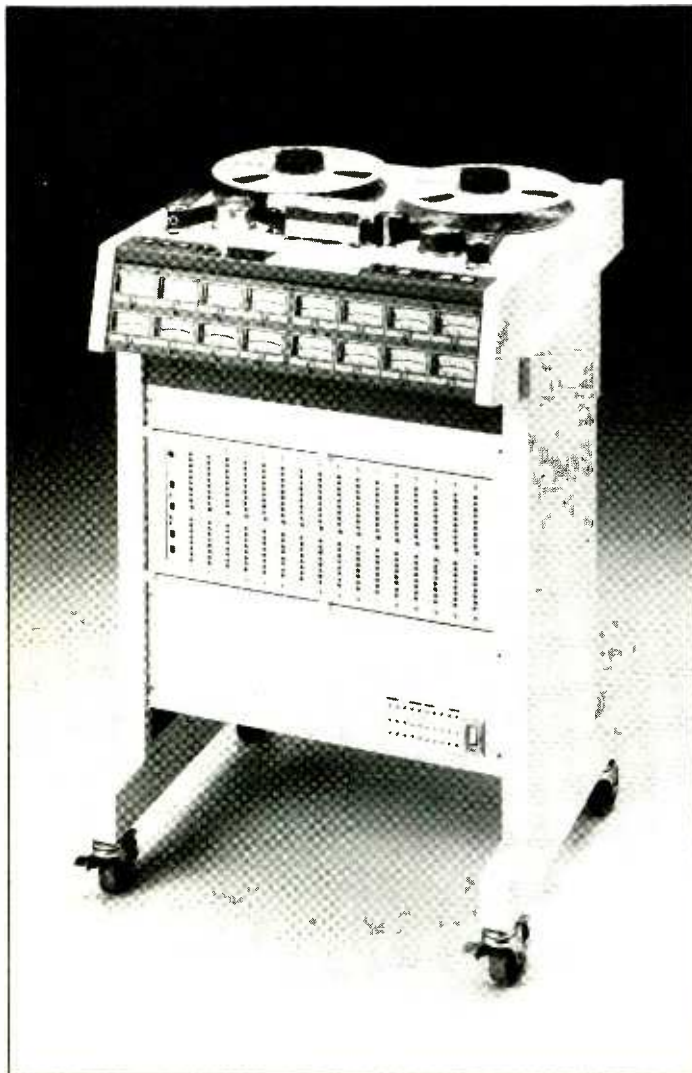
A full function remote session controller is standard with an autolocator having multiple memory, search and repeat shuttle capabilities

being optional. The machine can run at selectable pairs of speeds—7½/15 in/s or 15/30 in/s; with other features including switchable IEC/NAB equalisation; noise reduction switching interface logic; transformerless active balanced in/outs, and an LED multifunction tape/time display.

**Otari Electric Co, Otari Building, 4-29-18 Minami, Ogikubu, Suginamiku, Tokyo. Tel: 03 333-9631. Telex: 26604.**

**UK: Otari Electric (UK) Ltd, 22 Church Street, Slough, Berks SL1 1PT. Tel: 0753 38261. Telex: 849453.**

**USA: Otari Corp, 2 Davis Drive, Belmont, CA 94002. Tel: (415) 592-8311. Telex: 910-376 4890.**



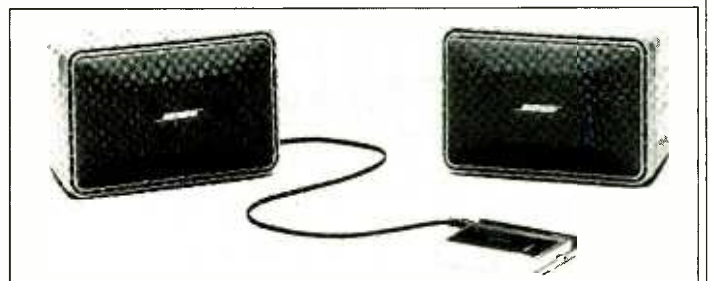
## Compelling excitement from Aphex

Aphex Systems launched two new products at the New York AES. The first was a new modular *Aural Exciter* known as the *900B* designed to fit in Aphex rack systems or dbx *F900* rack systems. The units are single channel and feature improved circuitry using a proprietary hybrid developed by Aphex. Operation is similar to previous *Aural Exciters* with the exception of a single additional control which allows the user to shape the characteristics of the high pass network. Aphex hope that the relatively low cost of the units

will allow experimentation with *Aural Exciters* on every audio channel rather than stereo mix processing.

The second item was a mono version of the *Compellor* which in its standard form was two channels of audio compression/levelling with a peak limiter. **Aphex Systems Ltd, 13340 Saticoy Street, North Hollywood, CA 91605, USA. Tel: (213) 655-1411. Telex: 910-321 5762.**

**UK: Atlantex Music Ltd, 3 Caldwell Lane, Hitchin, Herts SG4 0AG. Tel: 0462 31511. Telex: 826967.**



## Bose RoomMate

Having feet in both camps, Bose has found a professional application or two for its decidedly domestic *RoomMate*. The *RoomMate*, a self-powered pair of Bose *101 Music Monitor* mini-speakers, was conceived as an add-on speaker system for Walkman-type personal hi-fis. With the appearance of the Scholtz *Rockman*, that ingenious little unit for practising guitar without disturbing the neighbours, Bose has recognised the *RoomMate*'s suitability for converting the *Rockman* into a portable practice amp of room-filling capability.

The combination of *Rockman* and *RoomMate* might worry the *Pignoses* of the world, for it's eminently portable and stereo to boot. A bigger challenge, though, for Bose and the *RoomMate* is selling it to studios as an alternative to the ubiquitous Auratones. The company has designed a line of rugged power amplifiers to pair with the *101s* for whatever variety of tasks non-domestic users might consider. The company claims that the

sound quality of the *101s* compared to similar-sized units should lay to rest the concept of mastering recordings for the lowest common denominator.

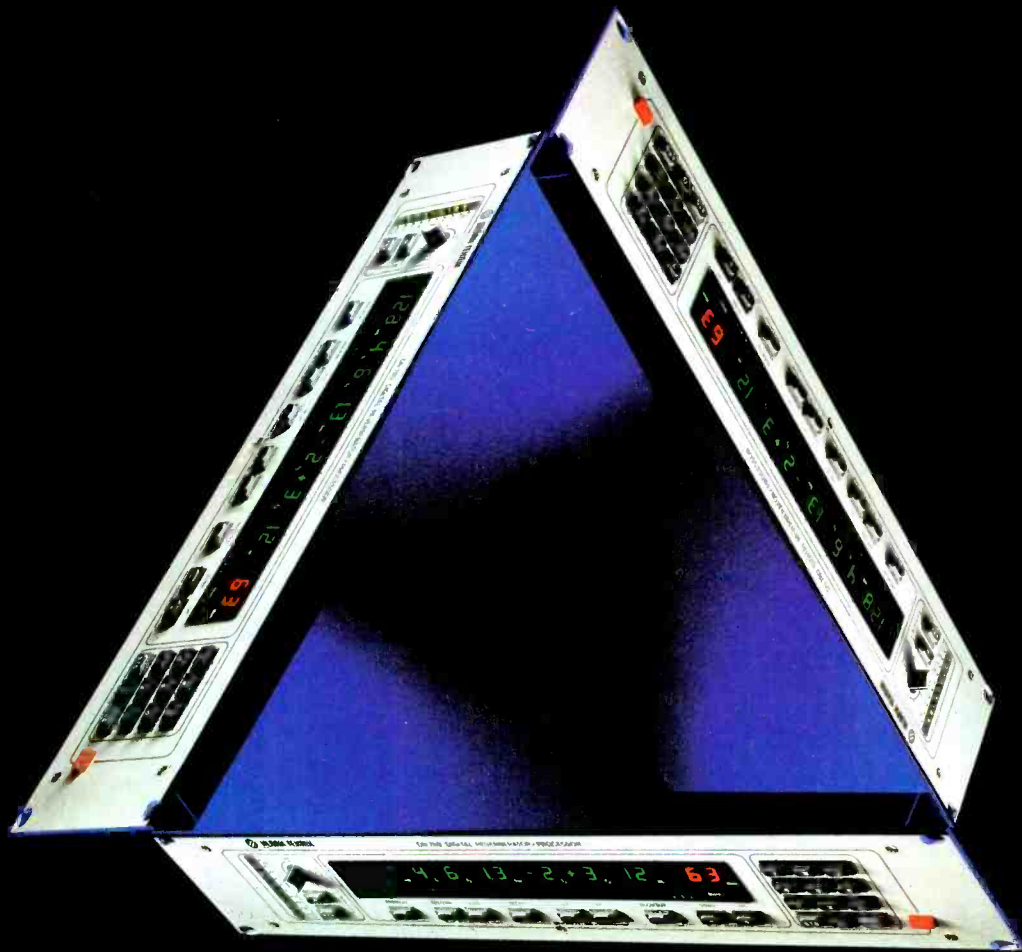
A recent application for the *101s* was conceived in-house by the UK division, who have come up with a true digital system utilising modified Sony Beta machines for audio playback. The new system is designed to replace the horrible sound systems we suffer in shops, wine bars, boutiques, and restaurants, usually based around £169-worth of sub-standard 'music centre'. The novelty of the system is that it does not use software which can be replaced by staff who insist on hearing Frankie Goes to Hollywood for their entire work shift. Neither will the tapes do them any good if they have sticky fingers. But best of all is the sonic effect on those who have been driven from public places because of the sound systems. With *101s*, the shop or restaurant can dot speakers all over the premises and not upset the interior designer.

**Ken Kessler** ▶



# A small universe

325  
164



## Create space The DN780 – Reverberator/Processor

Klark-Teknik's ongoing investment in research leaps into the age of variable space with the new DN780 reverberation simulator. Its *Very Large Scale Integration* technology and a superfast *Digital Signal Processor* (DSP) allow the world's first practical application of specifically developed algorithms, creating "added density"<sup>TM</sup> reverberation: reflections with much smaller intervals between them.

The result is simply – greater realism.

From natural concert hall reverberation through remarkable small room and plate sounds to an impressive "infinite space" effects programme, the DN780 will uncannily place you in the musical environment of your choice.



**KLARK TEKNIK**



British designed, British made  
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262a Eastern Parkway, Farmingdale,  
NY 11735, USA. Telephone: (516) 249-3660

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# NEW PRODUCTS

# NEW PRODUCTS

Equipment, modifications, options, software

## Sony VTRs for digital audio

Sony have introduced two new U-matic VTRs which have been optimised for digital audio requirements. The *DMR-2000* is based on the widely used *VO-5850* U-matic having all the conventional functions, it features a recording head cleaning system that is automatically activated every 5 min to reduce the possibility of dropouts. The VTR internally handles colour subcarrier suppression and cut-off of the dropout compensation that are requirements for digital audio recording. The unit also features a built-in timecode generator which is useful when compact disc mastering. The *DMR-2000* will interface with the *DAE-1100* editor via the *IF-5850* interface box.

The other new machine is the *BVU-800-DB* which is a version of the standard *BVU-800* providing all the specific digital audio functions of the *DMR-2000* in addition to a direct interface with the *DAE-1100* editor. With the optional *BK-806* timecode generator/reader, the VTR is switch selectable for the recording of SMPTE code on either audio channel 2 for CD mastering or on the address track for conventional digital

editing purposes. The unit is also capable of standard video recording.

## ... And a new U-matic cassette

Also introduced for digital audio is a special video tape developed in conjunction with the Sony 'K' series U-matic tape introduced early last year. Sony claim the new *D-¾-75U* video tape uses cobalt-enriched iron oxide with the magnetic particles having a smaller diameter and greater uniformity resulting in increased retentivity. The cassettes also have a higher degree of tape polish which extends tape life under heavy shuttling use. One extremely interesting aspect though is that the *D-¾-75U* series comes in 75 min lengths allowing the 60 min CD 'barrier' to be raised to 70 min.

**UK:** Sony Broadcast Ltd, City Wall House, Basing View, Basingstoke, Hants RG21 2LA. Tel: 0256 55011. Telex: 858424.

**USA:** Professional Audio Products Division, The Sony Corporation of America, 9 W 57th Street, New York, NY 10019. Tel: (212) 371-5800. Telex: 424595.

## Crown/Amcron Micro-Tech 1000

Following a number of new power amplifiers that appeared to be designed with a size-no-object ideal, Crown have launched a high powered amplifier that heads in the other direction. The *Micro-Tech 1000* is a 2-channel amplifier that can deliver 1 kW 'continuous average power' in mono mode at less than 1% THD into 1 or 4 Ω. There are two mono modes—'parallel mono' which combines the outputs of both channels to provide a mono output of 1 kW into 1 Ω; or the 'bridge mono' mode obtained by an internal jumper will give 1 kW into 4 Ω. In standard stereo mode the unit provides 250 W/channel into 8 Ω or 350 W/channel into 4 Ω.

The *Micro-Tech 1000* is of standard 19 in rack mount design and has a unit height of only 3½ in and a depth of 16 in. Weight is 38lb. One fairly unusual feature is the fact that the forced air flow for cooling is reversible should the specific installation requirements need it.

The design aspects of the unit feature two new circuit

developments—Grounded Bridge Output and Output Device Emulator Protection. The first, Crown claim, will improve quality and reliability and uses dual floating power supplies to provide output voltage swings twice as large as the voltage appearing across the output devices. The second feature is the ODEP which apparently continuously models the output transistor operating conditions and predicts overstress from excessive voltage, current or heat and rather than shutting down, reduces the amplifier capacity by the amount of the overstress.

A further version, the *Micro-Tech 1000 LX* will shortly be available having the same specification and a greater number of options and features.

**Crown International Inc,** 1718 West Mishawaka Road, Elkhart, IN 46517. Tel: (219) 294-5571. Telex: 810-295 2160.

**UK:** HHB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10. Tel: 01-961 3295. Telex: 923393.

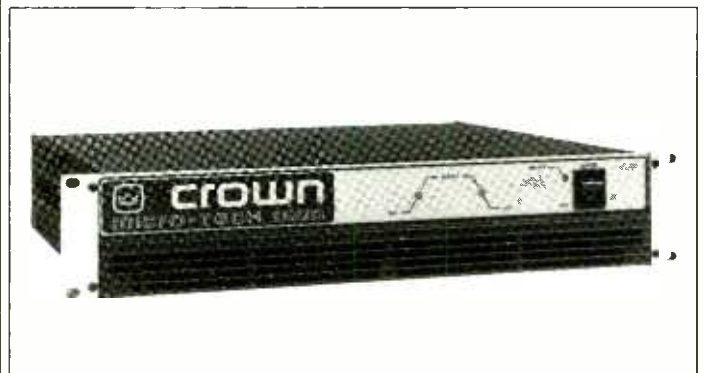
## Alice digital control

As a result of development work in the field of digital control of analogue audio over the last 18 months, Alice is about to deliver an audio control system to a theatre in Helsinki, Finland. The system consists of a 24 input 48 output switching matrix using balanced switching throughout and controlled from a computer system of original design offering instant control of both individual functions and master format 'arrays' of preset routings. Operation of the system is from a purpose-made keyboard which incorporates a QWERTY layout for text, X/Y numerical control of crosspoints and function keys for preset arrays and high level functions.

In the area of consoles and automation, Alice have two automated consoles under construction at present using many of the software routines

generated for the matrix switcher. The consoles, for Greenwood and Blackwood Studios in Switzerland, are based on the *Silk* series featuring balanced analogue audio throughout with digital control of all channel switching functions. Console format is 24-track in-line with six stereo subgroups and features preset console function states to eliminate the need to reconfigure routings and channel status for commonly used functions. The analogue design makes extensive use of solid state transformerless floating balanced inputs and outputs and is claimed to achieve a dynamic range in excess of 110 dB through any signal path.

**Alice (Stancoil Ltd),** Alexandra Road, Windsor, UK. Tel: 07535 51056/7. Telex: 849323.



## Orban security covers

Orban have recently started manufacturing what they describe as the first general purpose security cover for rack mount products. It is made from acrylic and will fit most standard EIA panels with a maximum protrusion of 1¼ in. They are available in four sizes—equivalent to 1, 2, 3 or 4 rack units respectively; and also in three colours—clear, blue transparent and light grey translucent. The material

may also be over painted. Three sets of screws are supplied—thumbscrew, Philips head and hex socket head for differing levels of security.

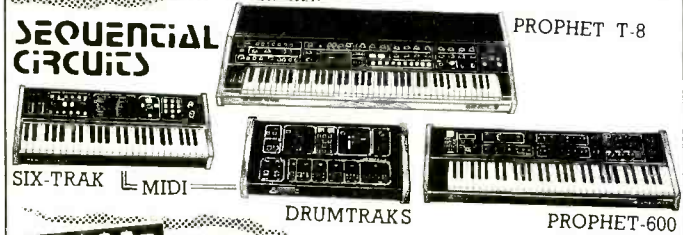
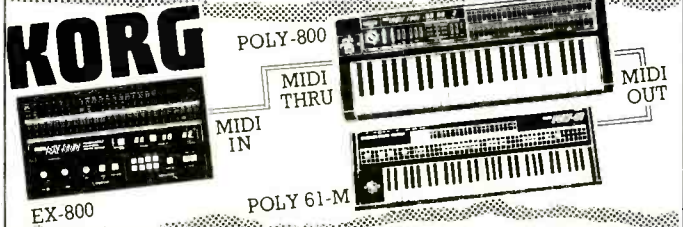
**Orban Associates Inc,** 645 Bryant Street, San Francisco, CA 94107, USA. Tel: (415) 957-1067. Telex: 17-1480.

**UK:** Scenic Sounds Equipment, Unit 2, Comtech, William Road, London NM1. Tel: 01-387 1262. Telex: 27939

# AUDIO SERVICES

**NEW LUXURY MIDI COMPUTER KEYBOARD SHOWROOM**  
 The only place in Great Britain where you can experience the full production potential of all the HI-TECH digital equipment shown on this advertisement.

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 High Lane Village, Nr Stockport  
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**06632 4244**

# the next step

The advent of a truly classic instrument is a rare occurrence. The sort of instrument that revolutionises the musician's art and leaves its mark on the music of an era. The SDS 5, the world's first electronic drum kit, was such an instrument. Its successor would have to embody its pioneering spirit while taking full advantage of relevant advances in technology. The SDS 7 is a system fully equipped to shoulder such a responsibility.

The rack can house a maximum of twelve modules. Each has two independent sound sources; the analog section which generates the classic "Simmons sound" and the digital section which is a recording of a real drum, stored in memory.

A variable level of either or both of these sounds can be routed through a versatile group of filter controls, providing an incredible range from real drums, through the classic "Simmons sound" to outrageous percussive effects.

The "programmer pad" enables one hundred different "drum kits" to be compiled giving a total of twelve hundred user programmable sounds and a choice of sixteen of these pre-programmed "drum kits" can be recalled by striking the appropriate section of the "selector pad".

The newly designed drum pads feature a specially developed, "softened" playing surface, reaching new heights in dynamic control.

We started a revolution. Ask your dealer for demonstration of the next step.



# SIMMONS

**Simmons Electronics Limited**

Alban Park, Hatfield Road, St. Albans, Herts AL4 03H  
 Tel: (0727) 36191 (5 lines) Telex: 291326 HEX DRM G

# THE BLACK & WHITE S

The concept of playing acoustic or 'sampled' sounds on a keyboard, first introduced by Fairlight with the CMI in 1979, has now become a requirement of today's synthesiser users.

Syco, the specialists in 'sampling' keyboards, have selected the 'state of the art' instruments, instruments which meet the varying demands of our clientele.

The choice of the best sampling keyboards. The Fairlight CMI, the Emulator II and the Kurzweil 250. The Black and White Collection.

Fairlight CMI is much more than a musical instrument. It is an integrated music production system, expandable to cope with the ever-changing needs of today's musician. Consistently upgraded since its introduction in 1979, the CMI has become legendary for its compositional software. Now the largest selling computer musical instrument in the UK, the options arriving in the next six months will increase its already fantastic potential tenfold.

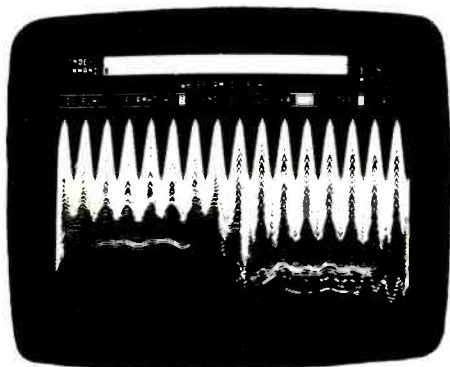
EII, successor to the popular Emulator, brings the power of high quality sampling within the reach of most professional musicians. Featuring a five octave dynamic keyboard with a variety of possible keyboard modes, the inclusion of filters, VCAs, envelope generators and independent LFOs allows you to extensively modify any sampled sound. An eight track sequencer with MIDI and SMPTE interfaces enables complex compositions to be recorded. These features, together with a dramatically increased sampling memory make the EII a powerful creative tool.

Kurzweil 250 features an 88 note piano-type keyboard. Utilising technology from the fields of artificial intelligence and pattern recognition it achieves extraordinary realism of sound with unprecedented expressive capabilities. It's supplied with thirty preset sounds, (expandable to 60), can accommodate up to 40 keyboards set-ups, and features a twelve track sequencer. Ideally suited to live performance and studio work, the Kurzweil 250 is the only viable alternative to an acoustic grand piano.

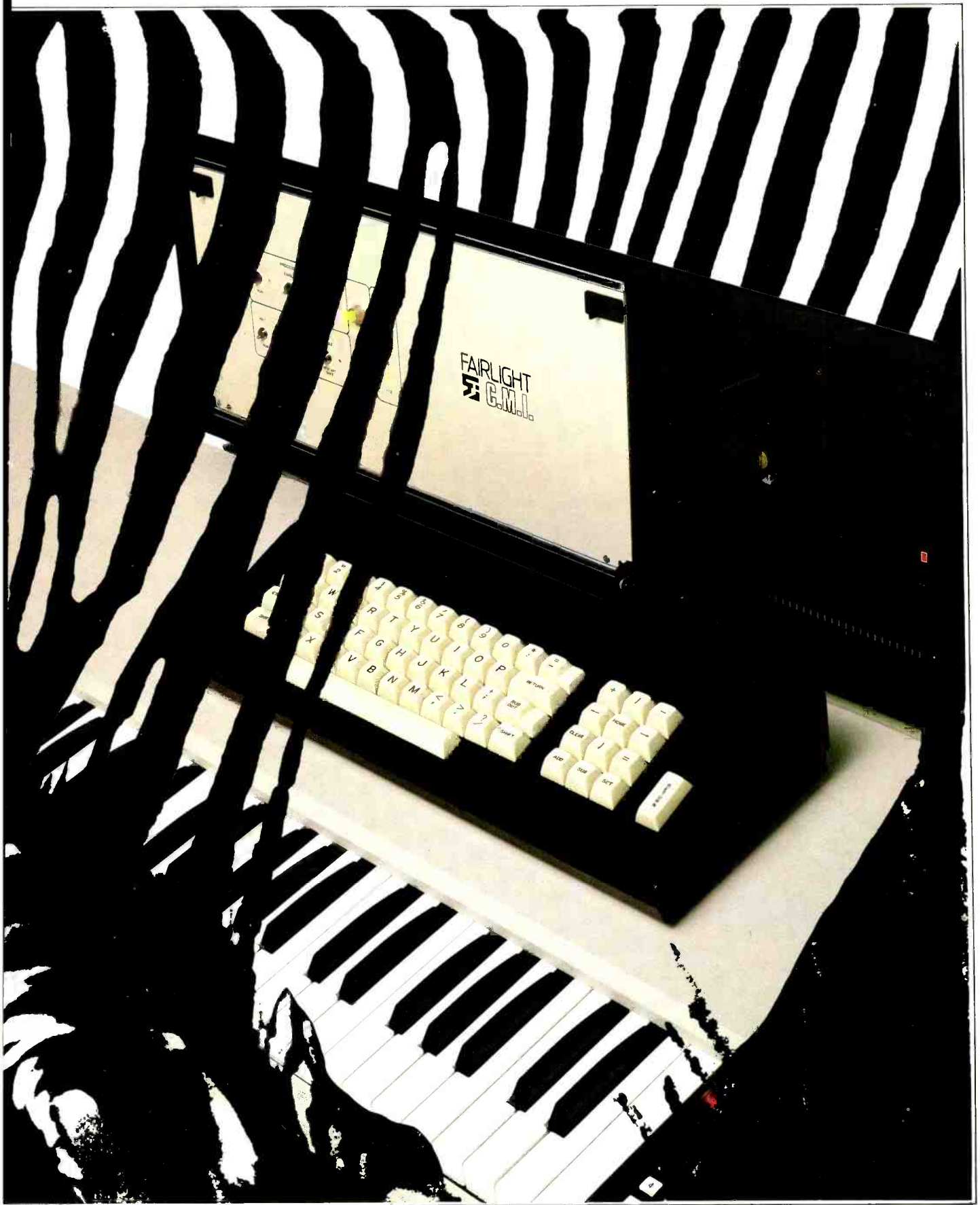
All of these instruments are available for you to see and hear at our demonstration suite in W2. So next time your looking for something very special, try the best sampling keyboards.

The Black and White Collection.

Syco, 20 Conduit Place, London W2.  
Telephone 01-724 2451 for an appointment.  
Telex 22278 Syco G.



# ELECTION FROM SYCO



Syco. We are

## EXHIBITION PREVIEW

# AES 77TH CONVENTION HAMBURG

**T**he 77th AES Convention will be held at the Congress Centrum Hamburg, Am Dammtor, Hamburg from March 5 to 8. This will be the third Convention held here with the previous years being 1978 and 1981. The Congress Centrum has 17 conference halls and the exhibits of the Convention will be located in Halls 3, 4 and 5 with rooms 7 to 15 serving as demonstration rooms. As usual the convention will comprise a wide range of technical papers as well as the associated exhibition.

## A

● **Adams-Smith:** featured product will include the *2600* modular synchronising system which will be shown with the new remote panels. ● **Audio+Design/Calrec:** full range of products including *A+D AD-MIX Digital Fader* production model now fully developed; *Calrec Minimixer* and the *UA8000* music console will be demonstrated, alongside the rest of the A+DC ranges. ● **AEG/Telefunken:** full range of professional analogue tape machines from ¼ in formats to 32-track in addition to the *MX80* and *MX800* Mitsubishi digital machines marketed under the Telefunken name. ● **AGAP/ATEIS:** range of custom designed radio systems including the *CORA* console which comes in many configurations. ● **Agfa-Gevaert:** full range of audio and video tapes including *PEM 297D* digital ¼ in tape and the new *PEM 469* professional studio tape for multitrack requirements. ● **Akai:** will be showing the *MG1212* 12-channel mixer/recorder which, together with the *AX-80* synthesiser comprises the *Micro Studio System*. ● **AKG Acoustics:** wide range of microphones, headphones, reverb systems and accessories. New items will include the new generation of 'ultra-linear' capsules *CK61-ULS* and *CK62-ULS* designed for the *C460* preamplifier. Other new items will include the *C568* short shotgun microphone and the *D451* intercom mic. ● **Alpermann:** range of timecode generators including the *AV TC10* and *AV TC12*. ● **Amcron-Crown:** full range of Crown products including the *Delta Omega 2000* and the new

## We have compiled our usual preview of the exhibition using the lists of exhibitors and information available to us at the time of writing

compact *MicroTech* power amplifier; the full range of *PZMs* and the *Tecron* audio measurement system. ● **Amek:** entire range of Amek/TAC equipment. New products will be the *BC01 series 2* (an update of the original *BC01* broadcast console), and the *TAC Scorpion* series first shown in New York. They are also hoping to exhibit the *GML* moving fader computer mixdown system. ● **Ampex:** the full range of Ampex mastering tapes for audio and video applications. ● **Ampco:** no information received. ● **Amptown:** no information received. ● **AMS:** will show complete range of digital audio processing systems. New products will be the *Timeflex*, a specialised version of the *DMX 15-80S*, and the *DMX 15P* profanity delay with edit and catchup circuitry. There will also be updates to the *RMX 16*, the *DMX 15-80S* and a remote control for the A/V sync. ● **ANT Nachrichtentechnik:** will be showing the full range of *telcom c4* noise reduction systems; the range of high quality PA systems series *950*, and sound columns series *940* for 100 V and low impedance use; a new mixing console system *TRS 800* that allows the user to choose from a wide range of modules with the specifications meeting the German IRT requirements; and a new MOSFET 360 W power amplifier, the *LV300*, will be introduced. ● **Aphex:** The full range of Aphex products including the *Aural Exciters* and the *Compellor* dynamics unit. New units will include a modular *Aural Exciter* that will fit racks including the *dbx* system, and a single channel version of the *Compellor*. ● **Applied Microsystems:** represented by SCS will be showing

real time tape counter and *CM50* autolocator, and the *I-CON* synchroniser package. ● **AVM:** no information received. ● **AVS:** no information received. ● **Audio Developments:** range of compact mixers featuring three items in particular: the *AD062 Multimixer* with some variations; the *AD145 Pico* mixer in 8-input version; and the *AD160* semi-modular ENG mixer. ● **Audio Kinetics:** the full range of products including the *MasterMix* console automation and the *Timelink*. The *Q.Lock* system will feature new enhancements including battery backed-up memory. It is hoped to launch a number of new products in addition. ● **Audiotechnica:** range of microphones, phono cartridges and headphones. ● **Audiomatic/Electrosound:** the full Electrosound range of cassette duplication systems including the series *8000* and the series *2400*. Of particular note will be the application of Dolby *HX-Pro* to the duplication systems. ● **Audioscope:** range of test equipment including model *3013* real time spectrum analyser, models *3113* and *3211* level monitors and an LED spectrum analyser display. ● **Auditronics:** the *300* series audio production console for 4- and 8-track use with facilities for up to 32 mono or stereo inputs; the *200* series on-air broadcast console and the *PPEQ* programmable parametric equaliser system. ● **Audix:** range of audio equipment including the *Assignable Mixing System* with full recall facility, and the *Access* digital intercom/control system. Also on display will be the *MXT1200* modular mixing system and *MXT500* portable/OB mixer. ● **Auvis-Asona:** will be demonstrating a complete new slave unit for their tape duplicating system which itself will be exhibited with improved new electronics. Also on display will be a newly designed splicer-block which is the first step for a second generation of automated cassette winders.

## B

● **Barth:** signal processing units including a compressor limiter expander, equaliser, delay/transposer, vocoder and an audio distribution system. ● **BASF:** full range of professional audio and video

# EXHIBITION PREVIEW

tapes, cassettes, magnetic film, and calibration test tapes. ● **Beyer**: full range of microphones, headphones, radio mics and accessories. New items include new versions of *DT 108* and *DT 109* headsets; the *MC 734* handheld condenser mic and the *MC 736* and *MC 737* short and long shotgun mics.

● **BFE**: range of recording and broadcast systems including modular, portable and automated mixing consoles, control systems and video systems. ● **BNS**:

selection of loudspeakers including the *394* and *Noble Sound One* models. ● **WH Brady**: range of splicing and sensing tapes for audio and video applications.

● **Bruel & Kjaer**: comprehensive range of test equipment and range of music recording microphones. New items will include the type *4427* programmable noise level analyser; model *2317* portable level recorder; type *4224* portable sound source and the type *3527* noise and vibration measuring kit.

## C

● **Cabasse**: range of loudspeaker systems. ● **Capitol Magnetic Products**:

will be showing cassette duplicating tape in pancake form; *Audiopak* NAB cartridges; cassette production sundries; *Apollo* lacquer master discs and featured will be a new cobalt encapsulated duplicating tape. ● **Cetec-Gauss**: range of studio monitors, individual drive units and tape duplication systems. ● **Comel-Power**: range of power amplifiers.

● **Connectronics Corp**: wide range of cable and connectors for audio applications. ● **Crompton**

**Messinstruments/Ernest Turner**: complete range of PPM and VU meters. The VU meters comply with the international standard ANSI C 16.5 1954

and the PPMs comply with BS5428. The meters come in analogue, solid state or neon gas plasma formats. Back of panel and illumination kits will also be shown for most models. ● **C-Tape**

**Developments**: *CX* professional range of *C-Ducer* microphone systems, the *Gigster* battery powered and supplied with belt clip designed to be compatible with stage amplifiers, and the *Saxman* which employs a reed transducer for saxophone and clarinet applications. C-Tape will also be showing the *Cactus* range of electronic drums.

## D

● **D & R Elektronika**: ranges of console from small portable to large systems including a very wide range of signal processors, reverb units, noise reduction and rack effects systems. ● **Dateq**: range of power amps. ● **dbx**: full range of dbx products including noise reduction systems, rack mount signal processing systems and the *700* series digital processing system. Also the prototype of the model *166* dynamic processor will have its first European showing.

● **Denon**: details of the company's digital products and CD manufacturing services. ● **Dolby**: full range of noise reduction products for mastering, duplication use, multitrack applications,

portable 2-channel units and cards for VTR installation. First European showing of the *DP85* digital system.

the turntable line. ● **Enertec**: wide range of consoles, tape recorders and amplifiers, including the new *UPS 6000* mixing console and a new version of the *F500* tape machine. ● **Estemac**: no information received. ● **Eventide**: three new items will be shown for the first time outside the USA—the *H969* *Harmonizer* also known as the *ProPitch* and using 16-bit linear PCM coding for the first time in the *Harmonizer* range; *Generation II* software for the *SP2016*; and the *Signal Processor User Development* (SPUD) system for user software development with the *SP2016*.

professional record, playback and erase heads for all magnetic tape and film dimensions in ceramic metal or metal. Also heads for cassette duplicating in Sendust metal. ● **FM Acoustics**: featured item will be the *FM 236* Linear-Phase electronic crossover. This uses fully discrete class A circuitry throughout and proprietary filters that achieve 36 dB/octave. Additionally the established range of power amplifiers will be shown from the *FM 300A* to the *FM 1000*. A new power amplifier, the *FM 801* will be shown for the first time in Europe. It is the successor to the *FM 800A* and incorporates many of the *FM 1000* features in a 2-channel form.

● **Future Film Developments**: comprehensive variety of cables, cords, connectors, jackfields, wiring aids and associated components plus a wide range of audio accessories.

● **Genelec**: will be exhibiting a full

range of microphones, headphones, radio mics and accessories. New items include new versions of *DT 108* and *DT 109* headsets; the *MC 734* handheld condenser mic and the *MC 736* and *MC 737* short and long shotgun mics.

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Top to bottom: E-V ELX-1 mic/line mixer, EMT445 digital audio delay, FM Acoustics FM230 linear phase electronic crossover

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## E

● **E2A**: range of product including the *Square 1000* high power amplifier and the *Quest* series of mixing consoles.

● **EAP**: no information received. ● **Eela Audio**: series of broadcast on-air production desks designed for local and regional stations; the *S100* and *S200* range of consoles; the *Reportophone S20* and *S22*; and the *S300* series of broadcast consoles. ● **Electro-Voice**: on show for the first time in Europe will be the *DH 2012* HF compression driver which provides 7 dB more output at 20 kHz than the previous model achieved by the use of a new type of low mass aluminium alloy diaphragm and an optimised suspension. Also featured will be the *ELX-1* portable mic/line mixer—a 4-channel, lightweight unit for field work; and the *Sentry 100EL* studio monitor which features a built-in power amplifier and 2-way operation.

● **Elektroimpex**: studio tape recorders of all sizes, portable studio mixing console, broadcasting studio system, cardioid studio monitoring loudspeakers.

● **EMT**: in addition to its established full equipment range, featured items will include the *EMT 445* digital delay line which is a stereo unit with 16-bit resolution, 48 kHz sampling and delay time adjustable between 1 ms and 10.9 s; the *EMT 448 Unimatic* short duration audio storage unit with recording on a Winchester disk drive; a much improved version of the *EMT 266* Transient limiter with increased dynamic range exceeding 100 dB; as well as the *EMT 252* remote controlled digital reverb and

the turntable line. ● **Enertec**: wide range of consoles, tape recorders and amplifiers, including the new *UPS 6000* mixing console and a new version of the *F500* tape machine. ● **Estemac**: no information received. ● **Eventide**: three new items will be shown for the first time outside the USA—the *H969* *Harmonizer* also known as the *ProPitch* and using 16-bit linear PCM coding for the first time in the *Harmonizer* range; *Generation II* software for the *SP2016*; and the *Signal Processor User Development* (SPUD) system for user software development with the *SP2016*.

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# EXHIBITION PREVIEW

series of active monitoring speakers consisting of the 1019A, S30, 1022A, 1024B, and the 1025A. Featured will be the new 1022A speaker—a tri-amped system with a frequency response of 37 Hz to 20 kHz  $\pm 2$  dB, 108 dB SPL. The three built-in amplifiers produce 150 W each with overload protection provided by electronic self-checking routines. The cabinet is specially shaped and very rigid to ensure symmetrical radiation, stable stereo imaging and minimal coloration.

● **Giese:** range of SMPTE/EBU synchronisers and timecode generators. ● **Gotham:** wide range of products including items from Amber, Fabec, Lexicon, Switchcraft, Valley People, MRL and Quantum Audio. All equipment on display in demonstration room. ● **Graff:** a number of high speed cassette duplicators will be on demonstration together with playback facilities. ● **GTC:** will be showing the *Editon* audio/audio and audio/video synchroniser using SMPTE/EBU timecode on audio or CTL pulses.

## H

● **Harman:** will be showing products from Teac/Tascam, JBL and other lines that they distribute. ● **Harmonia Mundi:** details of the company's digital transfer and production services. Featured item will be the *BW 102* professional digital-audio interface for direct digital transfer between *F1/701*, *1610*, *AES/DASH* to any of these formats. ● **Harrison:** wide range of mixing consoles including two new products: the *HM4* for front of house live work and the *MX-8* rack mounting stand alone or premix input expander. Also on show will be the *TV3*, *TV4*, *PRO7*, *AIR7* and *MR4* consoles. ● **H Haufe:** no information received. ● **Heco Hennel:** range of active loudspeaker systems including the *Activ 2000 K*. ● **Heyna:** range of duplicating systems. ● **Hidley Design:** acoustics and studio design consultancy services from Tom Hidley—now based in Europe. ● **Hill Audio:** wide range of Hill products including high power amplifiers, mixing consoles for sound reinforcement, monitoring and multitrack use; compact rack mount mixer and Hill-designed speaker systems.

## I

● **ICM:** wide selection of C-O cassette shells and library cases. ● **Illbruck:** acoustic foam tiles for sound absorption control. ● **Ilsemann:** cassette

manufacturing machines including labelling, boxing and foil-wrapping and a sorting machine for compact cassettes.

● **International Tapetronics Corporation/3M (ITC):** will be displaying their full line of audio cartridge machines. Featured will be the new *Omega* cart machine that offers 'affordable performance'. Also on show will be the *99B* series and the *Delta* line of NAB cart machines. Part of the demonstration will involve a comparison of audio from the ITC machines and a CD player. ● **Ivie:** wide range of products including audio analysis systems, pink and white noise generators, microphones, mic preamps and amplifiers. ● **Ivo Lola Ribar:** no information received.

## J

● **JBL:** selection of products from the wide range of sound reinforcement products and studio monitor systems. ● **JVC:** Digitally related equipment, equipment for PA applications and signal processing systems.

## K

● **Keith Monks:** wide range of microphone stands, cable drums, monitor loudspeakers and record cleaning machines. ● **King Instruments:** will feature the model *793* fully automatic audio cassette loader with automatic pancake/hub changeover and tape threading, alternator/feeder and display for machine monitoring. ● **Klark Teknik:** the *DN780* digital reverb/processor makes its debut along with the *USA* active monitor loudspeaker system. These and the rest of the Klark Teknik range of graphic EQs and DDLs will be exhibited in their demonstration room, not in the main exhibition hall. ● **Klein + Hummel:** range of compact active monitor speakers.

## L

● **Lawo Geratebau:** wide range of modules for broadcast orientated console use. Possible showing of the prototype digitally controlled assignable analogue console. ● **Leonhard:** no information received. ● **LPS:** full range of power amplifiers covering all aspects of sound amplification and PA and monitor systems for studios, TV, radio and cinema. ● **Lyrec:** range of multitrack and stereo tape machines, high speed

cassette duplicating machines and *Fred*—the portable playback and editing machine.

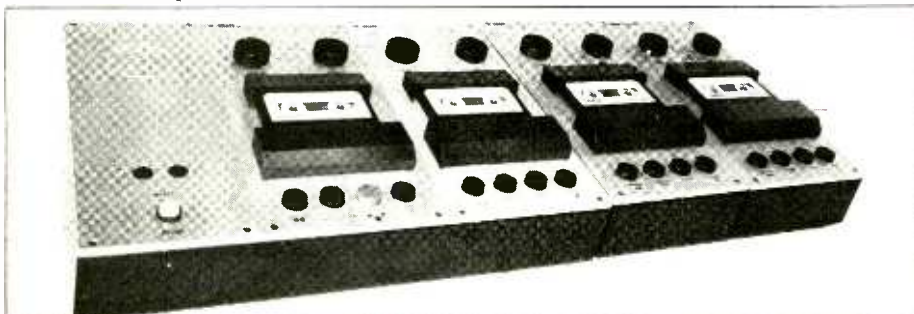
## M

● **Magna:** full range of audio and video cassettes. ● **MBI:** demonstration of its turnkey radio studio design, installation and commissioning service enabling visitors to operate the complete studio system. Equipment will include the MBI series *24A* broadcast mixer, the *Sonifex* range of NAB cart machines, ancilliary equipment and an FM stereo transmitter. ● **Meyer:** full range of sound reinforcement systems and the *833* studio monitor. ● **Milab:** the complete range of Milab microphones. Featured will be the variable pattern mic/line level mic *VIP 50*. ● **Mosses & Mitchell:** examples from their ranges of audio jacks and jackfields meeting BT and BBC specifications. Featured will be the *440* range of miniature jack sockets with Palladium contacts and available with wire wrap or solder terminals. The company can also undertake custom arrangements. Also on display will be the *Video Jackfield* with 18 or 20 Musa connectors per 19 in row. ● **MS-Audiron:** no information received. ● **Musicbox:** full range of cassette products including C-O compact cassettes, blank cassette tape, head cleaner cassettes, digital cassettes and short time cassettes. ● **Musik Produktiv:** no information received.

## N

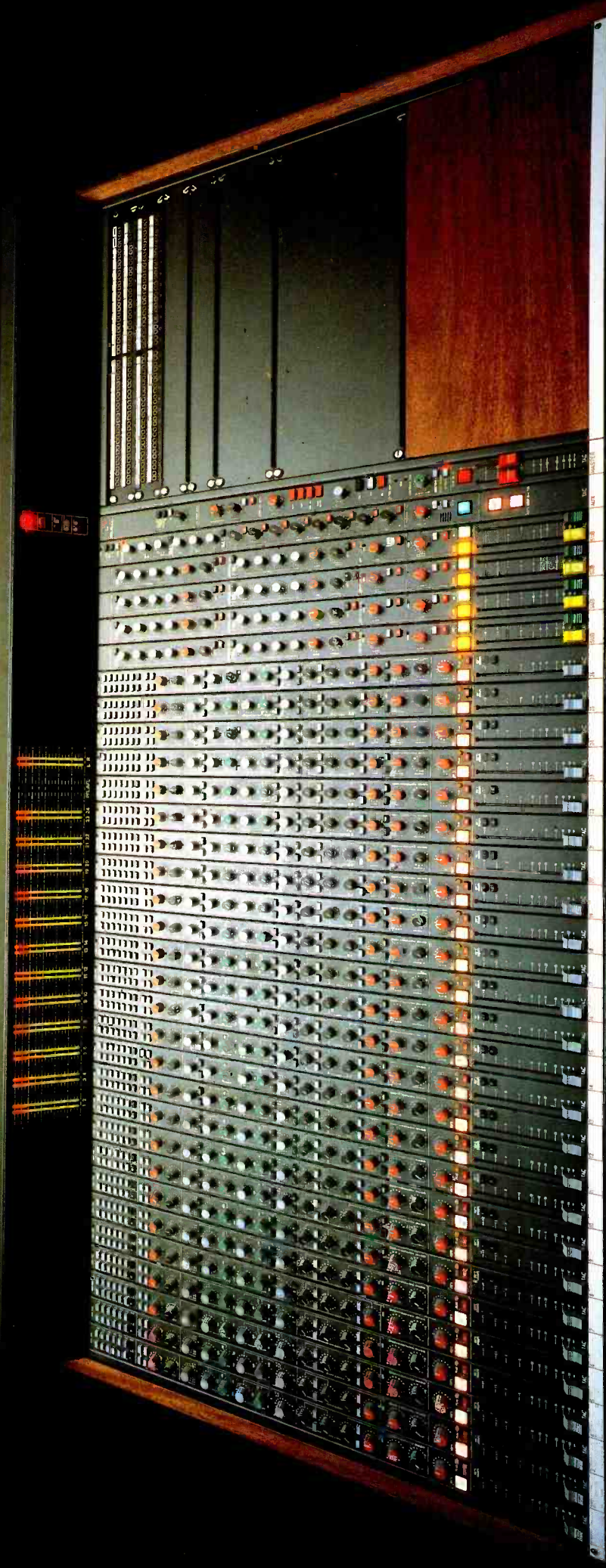
● **Nagra/Kudelski:** full range of professional tape recorders including *T-Audio* twin capstan multi-format recorder and the *1V-S* stereo machine with built-in SMPTE/EBU timecode generator record/playback circuit. ● **Neumann:** the complete line of studio condenser mics including the transformerless *TLM 170i* and the short and long shotgun mics. The new Neumann *DMM* stereo cutterhead *SX 84* for *DMM* mastering will be shown as well as the range of microprocessor controlled mixing console modules including the *AME 591* equaliser system; the *AMR 544* fader system and the *AMM 576* remote controllable microphone amplifier system. ● **Neutrik:** wide range of connectors and sockets including the new *X* series of *XLR*-type units. Also featured will be the *Audiograph* modular measuring system. ● **Neve:** precise details not available at time of publication but will include analogue and digital console on display. ● **New England Digital/Turnkey:** on show will be the latest developments of the Synclavier music system including a new velocity pressure sensing keyboard, advanced synthesiser software and music printing enhancements. There will also be full details of the new 16-bit polyphonic sampling system with feature sample rates of up to 100 kHz. ● **Nexo:** semi-modular speaker enclosures for sound reinforcement and dedicated electronics for signal processing. ● **NTP:** will be showing their complete range of

Graff cassette duplication





# TAC MATCHLESS



- The incredible new industry standard in cost-conscious multitrack consoles, featuring:
- Full 24 buss, 24-track in-line monitor functions
  - 8 auxiliary sends and 8 effects returns
  - 8 audio subgroups with separate stereo buss
  - 4-band, advanced semi-parametric equalizer on all i/o modules
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- Separate monitor mix and stereo busses
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**In the USA:**

**AMEK CONSOLES INC**, 10815 Burbank Blvd,  
North Hollywood, Ca 91601 tel: (818) 508 9788  
telex: 662526 AMEK USA

# EXHIBITION PREVIEW

products consisting of PPM meters, compressors and limiters, equalisers, phase meters and telephone hybrids. Featured new items include the Video Peak Programme Meter type 377-700 for on-screen level display, and the Automatic Telephone Hybrid type 535/200/300/400. There will also be a test system for an audio switcher.

## O

- **Optimix:** console automation system.
- **Ortiplas:** a wide selection of audio and video cassettes and magnetic tapes.
- **Otari:** wide range of audio and industrial products including the *MTR-90/II*, *MTR-12/II*, *MX-5050* series, *MX-70*, *BTR-5* and *MTR-20* machines along with the *DP-80* and *DP-4040* series cassette duplicating machines.

## P

- **Penny & Giles:** selection from wide range of faders including the recently introduced *4000* series providing up to four output channels, accurate taper and tracking with balanced or unbalanced log, linear tapers, and VCA networks. Also showing the *3000* series and a selection from the *1500* and *1100* series faders and the new motorised fader.
- **Philip Drake:** wide range of products including audio distribution amps, intercoms and talkback systems for studio, theatre and broadcast applications with the hardwired *PD600* and *PD6000* models on display. There will also be information on custom

RTW PCM-Set 2



Sony MX-P61 12-channel compact analogue console



design details available on the stand.

- **Publison:** range of signal processing products including the *Infernal Machine 90* digital effects generator which offers internal delay of up to five minutes, and the *Nature Boy* 6-octave polyphonic keyboard.
- **Pyral:** range of audio tape products including sprocket-hole punched tapes for 35 mm use, and a new line of lacquer masters.

## Q

- **Quad Eight Westrex:** the *Westar* console, the *248* modular console system, the digital fader system, details of the company's custom film console services and the Westrex line of products.
- **Quad Manufacturing:** range of products from Quad featuring their new range of professional power amplifiers.
- **Quantec:** demonstration room for the *Room Simulator QRS*, the infra-red remote control option, and the new *QRS/L* simplified version of the *QRS* which has the same features but only a single input and two outputs.

## R

- **RTS:** full range of products including intercom systems, preamplifiers, IFB systems, phono preamps, monitor amplifiers, distribution amplifiers and mini mixers.
- **RTW:** will feature its analogue and digital interface *Studio Processor—Set 2* designed to match the Sony *PCM-701* PCM processors enabling direct digital transfer between *PCM-701* 16-bit code and *PCM-1610* 16-bit code in

both directions. Also featured will be the new type *1109* bargraph peak meter designed for digital recording offering selectable attack time and a +10 dB extended scale. Lastly the *CL-1* cassette loader system will be shown. This is suitable for medium and small quantity production.

## S

- **SAJE:** wide range of recording consoles for a variety of applications.
- **Saki Magnetics:** range of hot pressed glass bonded ferrite tape heads.
- **Sanken:** range of high quality microphones.
- **SATT:** range of portable audio mixers including the *SAM 82* 8-input unit; the *SAM 42* 4-input unit and the *SAM 31* mono 3-input mixer.
- **Schoeps:** the full range of Schoeps microphones and accessories.
- **SCS:** range of SCS effects including *BD80* DDL and *BC3* noise reduction. Range of audio effects and consoles, Applied Microsystems autolocators, tape machines, monitors and microphones etc both new and used. Also studio design and installation—information available on the stand.
- **SCV:** wide range of signal processing units, accessories and associated equipment including the *EQ 129* and *EQ 213* graphic equalisers in addition to active crossover systems, active DI boxes, buffer amps, mic, line and distribution amps, etc.
- **S Seidel:** no information received.
- **Sennheiser:** the full range of dynamic and condenser mics, radio mic systems, headphones and a wide range of accessories. Featured items will be the *M8* portable console and the *MKH 40* high performance condenser mic.
- **Shure:** the full range of dynamic and condenser mics, phono cartridges, sound reinforcement systems and accessories.
- **Solid Stage Logic:** the *SL 4000* music recording console; the *SL 6000* video production console and featuring the new *SL 5000* broadcast console system, together with the *Master Synchroniser* controller, *Events Controller* options and the programmable EQ system.
- **Sonosax:** range of mixers intended for broadcasting, audio/visual, mobile, video post production and PA applications.
- **Sony/MCI:** selection from the company's wide range of products including the *AV-500/AVS-500 Sync Master*; the *RM-3310* remote for the *PCM 3324* multitrack; the professional CD system *CDP-3000/CDS-3000*; the *K-1105* digital console; the *PCM-3102* digital mastering recorder; the 12-channel compact analogue console *MX-P61*; and the range of studio mics and digital equipment; and a selection of tape machines and consoles from MCI.
- **Soundcraft:** examples of the full range of Soundcraft products including the *TS24* in-line console, the new *500* and *600* series consoles, the series *20* mastering tape machines and the new range of power amplifiers.
- **Soundtracs:** main exhibit will be the *CM4400* 32/12/24/2+2 console fitted with optional patchbay and linked to a 24-track machine via a SMPTE/EBU clock. It will also be the second showing of the new *M* series modular range of PA

# Dawn of a new technology

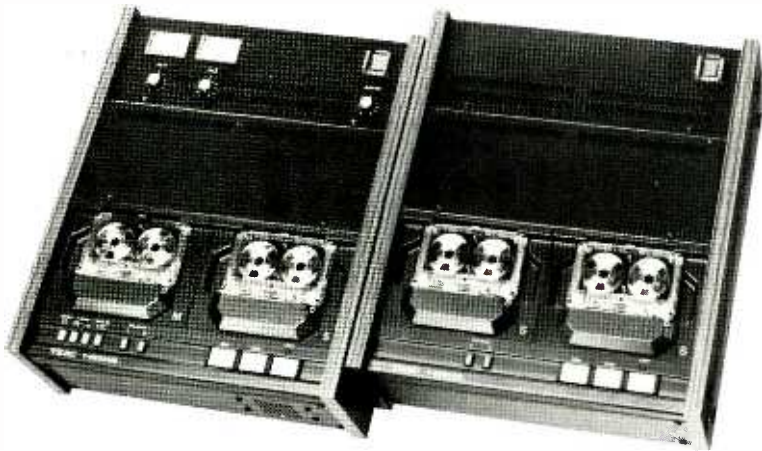


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# EXHIBITION PREVIEW



Teac high-speed cassette duplication

and 8-track mixers alongside the established *S* series, *Monitor*, *OMNI* and the *16/8/16* and *24/8/16* mixers.

● **Stanton Magnetics:** wide range of phono cartridges. ● **Start:** no information received. ● **Stax:** wide range of headphones, headphone preamps and monitors. ● **Stellavox:** the new multi-standard studio tape machine *TD 9* for ¼ in, ½ in and perforated 16mm for mono/stereo, multitrack and with or without synchronisation facilities. Also on show will be the self-contained portable multi-standard tape machine *SU-8* with SMPTE timecode generator; the film use orientated *SP-8*; the *SM-8* master recorder; the *SP-8* used mainly for radio applications and the portable mixer *AMI 48*. ● **STR:** very wide range of products aimed particularly at the broadcast field including OB installations. ● **Struven:** selection of the products distributed by the company and featuring the digital editing systems and techniques that they have developed for both *PCM* and *dbx 700* series, also Brooke Siren Systems products. ● **Studer:** wide range of products including the *900* series consoles, the new digital *D-820* DASH format recorder and the analogue equivalent *A820*, the new *Mark IV* versions of the *A80VU* mastering machines, the *Mk II PR99* recorders, the *A725* professional CD player; the *Mk II* versions of the *A80MR* and *A80QC* duplication mastering recorders. ● **Studio Technik Klever:** no information received. ● **Synton:** range of vocoders and a flexible compact synthesiser.

## T

● **TAM:** range of products including *STL 732* 2-channel regulated filter (treble limiter) for disc cutting and cassette mastering systems and broadcast applications; also *ALO 831* oscillator, *LA 851* valve limiter, *CPS 741* mastering console and a selection of cutting heads. ● **Tandberg:** full range of professional products including *TD 50* ¼ in reel-to-reel 2-channel tape recorders. ● **Tannoy:** a selection of studio monitor loudspeakers, the *Wildcats* high level PA series and the *SR840* professional power amp. ● **Tape Automation:**

cassette duplication products. ● **Tape Technology Laboratory (TTL):** high speed automatic cassette loader. ● **Tapematic:** wide range of cassette manufacturing and duplicating machines including *TMD3000* (video) and *TMD2002* (audio) cassette loaders; the *5000* series duplicating system; *670* boxing machine; *1000* labelling machine and *ST30* real time spectrum analyser. ● **Teac/Tascam:** aside from the normal range of Teac/Tascam products, there will be three new products launched: the *MS-16* 16-track tape machine; the *M-300* series mixing consoles; and the *T-2600* series high speed cassette duplication system. ● **Technical Projects:** new additions to the product range will be the *MD404* oscillator, *MS781* and *MS721L* talkback systems for largescale speaker-based uses, Auditorium *1000* and *2000* live mixing consoles, as well as the *ART421* automatic reverb timer and the *4000* series production/post production modules will be exhibited. ● **Tekpa:** marketing company for the Tek group will be displaying selection of range of audio and video cassettes. ● **TOA:** complete line of professional sound systems from microphones to speaker systems, largely intended for the live sound market. ● **Tonographie Apparatebau (TAB):** will be showing a range of mixing console equipment with low noise specifications, largely intended for use in digital recording applications. Also on display will be a variable pre-emphasis device for protection against adjacent channel interference in VHF FM broadcasting. The unit also has optional time constants for applications in disc cutting and optical sound equipment. ● **Tore Seem:** featured will be the *SEEMIX* computer controlled console with system sizes up to 48 channels with digital faders. DC subgrouping is available and the console is prepared for automated mixdown. Also on show will be the *SEECON* for general broadcast applications based on the larger *SEEMIX* but without the automation. Finally, the 3-channel *Pluto* mixer will be shown. ● **Trident:** will be introducing several new products including the series *65* in a new colour scheme of dark grey with a custom designed range of control knobs; the new series *75* which is based around the

series *65* input modules but provides full 24-track assignment and monitoring, fader reverse and an integral patchbay; and a new version of the established series *80B* which includes a new monitor section incorporating 3-band EQ with fader reverse. This new version means that there are now a further 24 EQ'd inputs available. ● **tts-Electronic:** range of audio products including noise gates, equalisers, tape machines, mixing consoles, monitors and noise reduction systems including the new *NR-3* modular system with integrated RF filters for all inputs and outputs and LED overload. ● **Turnkey Two:** acoustic and studio design consultancy services.

## U

● **UREI:** wide range of signal processing units, sound reinforcement products, broadcast consoles, power amplifiers and studio monitor systems. ● **Ursa Major:** complete range of signal processors including the *Space Station*, *8X32*, the *StarGate* and the new multitap stereo processor *MSP-126*.

## V

● **VCL Audio:** no information received.

## W

● **Wandel & Goltermann:** range of audio analysing and measuring equipment for development, production, installation and maintenance operations. ● **Westec:** no information received. ● **Westlake:** range of speaker systems and audio accessories. ● **Woelke Magnetics:** range of multitrack record, play and erase heads and cue track heads for ¼ in use. Also a range of test equipment.

## Y

● **Yamaha:** full range of Yamaha professional sound products on show in a demonstration room.

## Z

● **Zonal:** full range of magnetic sound recording products including *675* series and the new *610* series audio tape available in a variety of widths for mastering and broadcast, as well as acetate and polyester magnetic sound recording film for post sync, dubbing, pre-mixing and editing.

● **Studio Sound:** we will be exhibiting the latest issue together with copies of our new sister publication Broadcast Systems Engineering, in addition to our other reference publications. Both editorial and advertising staff will be in attendance at the stand or around the convention and we look forward to meeting anyone who wishes to drop by for a chat. □

# IMPORTANT ANNOUNCEMENT

Sony PCMF1/SLF1



Sony PCM701ES/SLC9



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

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

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

**3** HHB are pleased to announce ex-stock availability of CLUE (Computer Logging Unit and Editor) which provides editing facilities for PCMF1 or PCM701ES/Betamax recording, as well as intelligent autolocation and logging.

Call now for more information about this exciting new product.



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# THE BLACK & WHITE S

**T**ime manipulation is one of the most fundamental effects used in modern recording and sound reinforcement. The ability to produce delays, reverberation, phasing and other time-related effects to order, in a creative manner suited to the material, is recognised as a vital factor in adding life, movement and interest to music.

And modern technology allows a vast number of possibilities to be realised: so much so that there is today almost too wide a choice of time-domain systems covering a range of possibilities.

With these possibilities, and the problems of choice firmly in mind, Syco have assembled a collection of time-domain systems which offer the musician, studio, broadcaster or sound reinforcement specialist the widest range of sound possibilities according to your requirements. Each unit has been chosen with creativity, quality and flexibility in mind.

## TIME FOR MUSIC

**AMS 15 80S** is a computer-controlled delay processor with 20Hz to 18kHz bandwidth – essential for today's quality requirements – and the ability to store up to 30 seconds of sound. The sampled sound can be transposed with a keyboard – up or down two octaves. It's more than a delay: it's a creative musical tool.

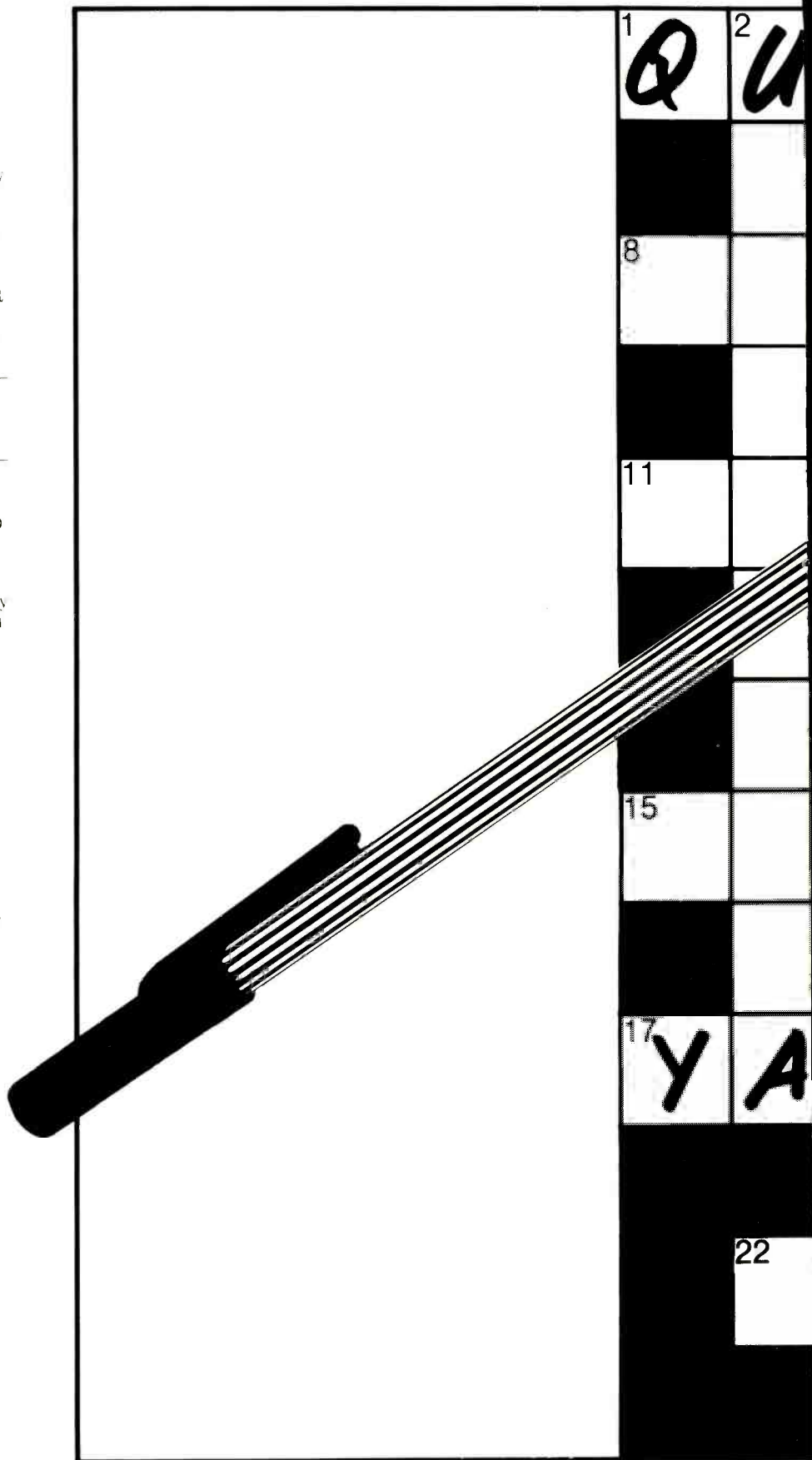
**Quantec** Room Simulator is renowned for its ability to recreate the sound of a real acoustic environment. You simply dial-up the volume of the room, and add the acoustic treatment, reflections and other effects you desire. What could be simpler?

The QRS is available in two versions: the standard 2-in, 4-out unit is ideal for both stereo and surround-sound applications, while the new QRS/L offers a cost-effective mono-in, stereo-out package for the budget-conscious.

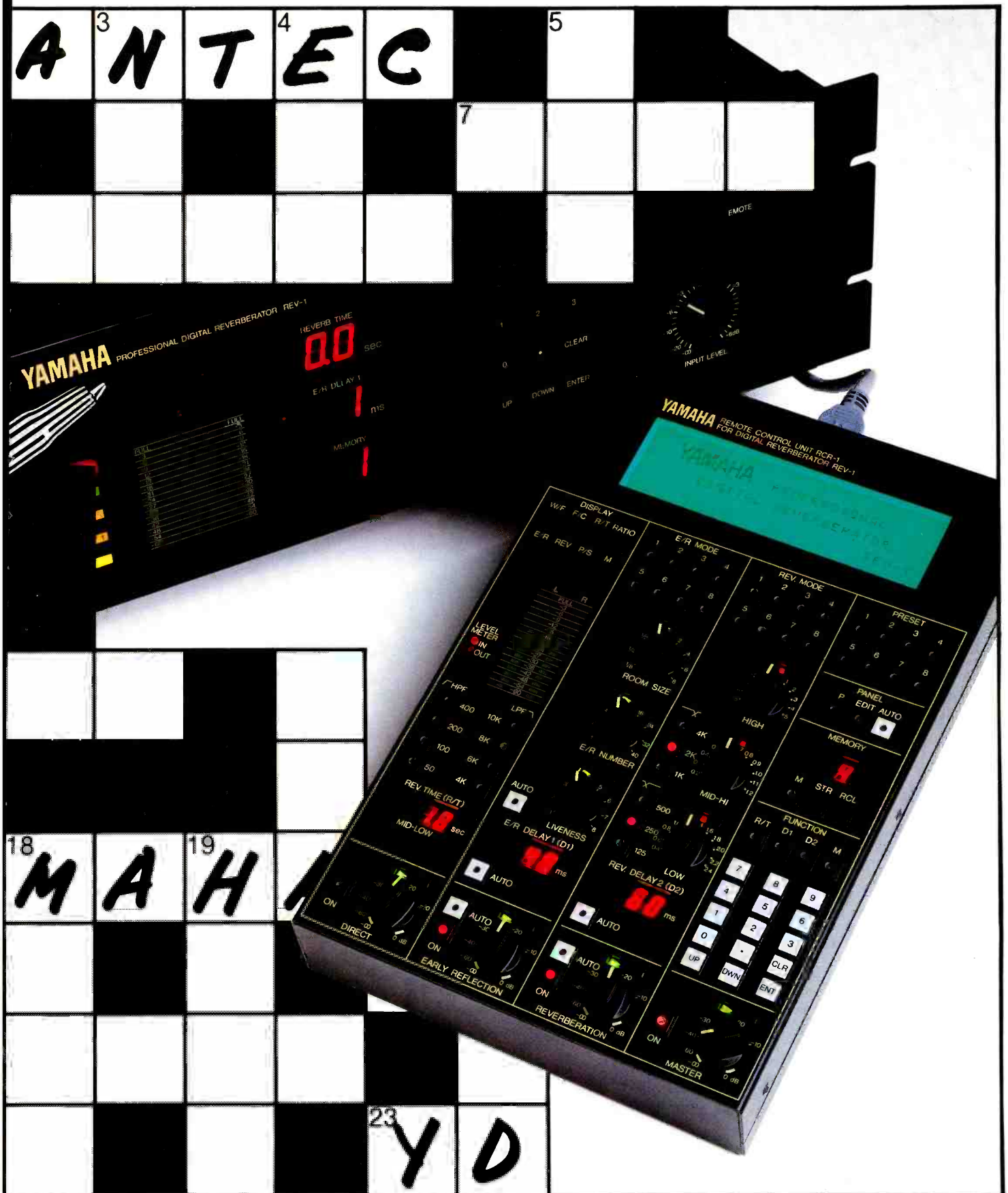
**REV-1** and the **YDD 2600** new from Yamaha. The REV-1 is a sophisticated digital reverberation system in which almost every reverberation parameter can be individually tailored to your needs. The unique LCD-display remote unit shows both settings and a graphical analogue of the reverberation characteristics you have established. The YDD 2600 is an unusually flexible delay system with many configuration possibilities especially useful for live sound applications. The unit offers up to eight separately variable delays and up to four inputs, with a maximum delay of 2.6 seconds per channel (the number of delay channels, inputs and the length of the maximum delay depends on configuration).

At Syco you'll find the time-domain system that's right for your needs: systems that offer sophistication, quality and flexibility. At Syco, we've got time for music.

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# ELECTION FROM SYCO



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# LARGE SCALE ACOUSTICS

## David Hawkins of Eastlake Audio relates the background to the redesign of CTS's massive Studio One recording area which coincided with the digital refit

**C**TS Studios Ltd, of Wembley, near London, is justifiably described as a Recording Complex. Under the same roof are four recording studios ranging in size from small to very large, film-editing, digital editing and disc cutting suites, a small video studio and all the necessary administrative, catering and technical support.

Unlike most recording operations, CTS is not located in an unfrocked church, redundant factory, crumbling mill or converted cinema but in a building purpose designed in 1969 and completed in 1971, on a part of the Wembley Stadium Estate that was originally an ornamental boating lake!

A unit of the giant BET Group, whose interests range from cruise ships in Fiji through flight simulator design and manufacture to half ownership of Thames Television, the Complex opened in late 1971 as the De Lane Lea Music Centre. This title continued the name of the original De Lane Lea Music Studio in Kingsway, Central London, which had been so successful during the mid to

late '60s that it had inspired the Wembley investment.

The first year of operation within the complex was marred by technical problems with the recording consoles and tape-machine electronics. These had been (in retrospect, over ambitiously) designed and made by a company which has subsequently departed the audio business.

In 1972 CTS, a well established London studio specialising in scoring major films, merged with De Lane Lea Music at Wembley upon the sale of the lease of the CTS studio building in Kensington Gardens Square in London. (The same premises were some years later to be refurbished and opened again as Marcus Music UK, but that's another story...)

At the time of CTS's integration into the new complex, a comprehensive programme of replacing all consoles and tape machines with Neve/Studer packages began. Eventually, the name of the Wembley Complex was changed to CTS and Peter Harris, technical supremo of CTS at their original Bayswater location, became managing director of the Wembley Complex, which

remains a unit of the BET Group.

**I**n 1981, Eastlake Audio was appointed by CTS to re-design and reconstruct Control Room One, attached to Studio One, the largest recording room within the Complex.

The control room measuring 10.5 m (34 ft 5 in) wide x 4.5 m (14 ft 8 in) deep had been adequate to accommodate the small console and 8-/16-track recorders installed in 1971. The depth measurement however was a constraint on installing a new wraparound console, angled front monitor-housing wall, etc.

The structural drawings of the building indicated that it would be possible to move the control room rear wall by 3.8 m into the over-generous reception area and have a new

control room shell size of 10.5 x 8.3 m (34 ft 5 in x 27 ft 3 in) thus making it a very large control room by any standard. At the same time, there were plans to install a new package type air-conditioning system to serve the enlarged control room area, install appropriate room geometry and LF absorbers and install, within the front wall system, three Eastlake *TM3T* monitoring loudspeakers (the centre speaker to be used during movie scoring). The control room shell preparation and rebuild was carried out during four weeks in August 1981.

In early 1983, CTS asked Eastlake to propose various schemes for redeveloping the recording area of Studio One. The reconstruction was to be carried out in early 1984 at the same time as the projected

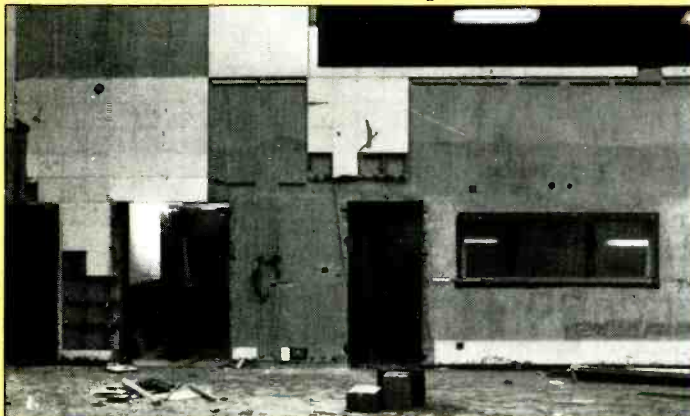
The finished studio in use



Finished studio looking towards control room and booths



Area beneath control room window during demolition





installation of the then newly ordered Neve Digital Sound Processing console.

**S**tudio One's dimensions, of 24 m (78 ft) long x 14.5 m (48 ft) wide x 10 m (33 ft) high, alone were intimidating. In addition, CTS stipulated clearly that the new design must be capable of meeting the requirements which would be imposed by digital recording. To this end, we carried out a survey of two key areas: firstly, the plant noise penetration to the studio was measured and found to be

quite low, with figures generally better than NC 15. This reflected well upon the large duct-work sizes originally installed and the longevity of the rotating plant.

Secondly, the reverberation time of the studio was analysed. Almost all exposed surfaces were absorbent. The only exceptions being the doors (hardwood) and the projection room windows (optically corrected glass).

The ceiling and walls were finished in Armstrong type perforated tiles and the floor was carpeted. Fabric-covered absorbers of the Helmholtz-type covered approximately

50% of the area. We had naturally expected to read short RT60 values but were surprised at just how short these values actually were. At the time of construction of the Complex, it was intended that Studio One would be used for rock as well as orchestral recordings. At that time, most rock bands brought their mega-powered stage rigs into the studios for recording. The overall RT60 of the studio had been therefore kept short, to allow recordings to be made which preserved reasonable separation when intense sound pressure levels were used.

We discussed the measured results with CTS and defined more closely their requirements. Firstly (and not unexpectedly), they wished to increase the RT60 value of the studio to a value that would not only sound better on the final recording but which would be more appropriate as perceived by the musicians within the studio as they played.

Secondly, CTS wanted to retain a high degree of flexibility of set-ups on the studio floor and were therefore loathe to have permanently assigned areas for drums, bass guitar, piano, etc.

Thirdly, they were conscious that the arrival of digital recording, and the wide variety of work it was expected to attract, necessitated the availability of at least one effectively isolated large booth, off the main studio floor. An added bonus would be the opportunity to provide a different reverberation character within the booth area.

In dealing with the first requirement, we originally considered a scheme which would incorporate mechanisms allowing the adjustment of reverberation performance within a range. Experience, however, has shown that the cost of providing variable performance over a significant range is high in relation to overall project cost and, in practice, an optimal setting is established and thereafter rarely varied. When commercial considerations prevailed, it was decided to opt for a fixed design which could be fine-tuned easily, after completion, if desired.

**A**n RT60 value of 1.6 seconds would be appropriate for orchestral performances within a hall of 3,500 m<sup>3</sup> volume. Because CTS undertake recordings ranging from orchestral to popular music,

within Studio One, a slightly lower RT60 value was targeted.

Neither the classical formula of Sabine, which links room volume, surface material absorption and reverberation, nor the subsequent formulae of Eyring give consistently accurate results when used for calculating the RT60 value of an enclosure such as CTS Studio One. Fortunately, we had access to some excellent software, written around the performance of large acoustical enclosures, and these promised close and consistent correlation between predicted and physically measured values.

In looking at ways of fulfilling CTS's second requirement, for an isolated booth, we looked closely at the area directly underneath the control room and on the same level as the main studio floor. It had at one time housed a minute vocal booth, a storage room and an echo plate room. The echo plates were being moved or disposed of, as electronic devices had rendered them less popular. A structural survey showed that the entire area under the control room and an adjacent equipment room could be opened up with the installation of suitable steelwork, to provide a main isolated room 8.5 m (28 ft) deep x 9 m (29 ft 6 in) wide, a smaller L-shaped isolated booth 4 m (13 ft) wide x 4.5 m (14 ft 8 in) deep and a plant room to house the air-conditioning equipment which the two isolated areas would require. Both isolated areas would be separated from the main studio floor by double-glazed sliding glass door units.

On measuring the vertical isolation between control room and proposed isolation areas, LF values of 30 dB were recorded and considered inadequate, given that even during orchestral recording, monitoring levels of 100 dB (lin scale) are not unknown. The control room monitors have a capability of 125 dB! A conventional studwork isolation wall approach, with a capped ceiling, was ruled out because of restricted height. Isolation walls were therefore decided on, with the ceiling employing an under-slung sheet lead barrier with high-density mineral fibre above and below it. We projected an improvement of 12 to 15 dB by these means.

The final layout is shown in **Fig 1**. CTS's brief of symmetry and uniformity is fulfilled within the main studio floor area which has 5 m high LF absorbers evenly spaced

Construction around control room window after fitment of brick piers and structural steelwork to form full opening for sliding glass doors to booths

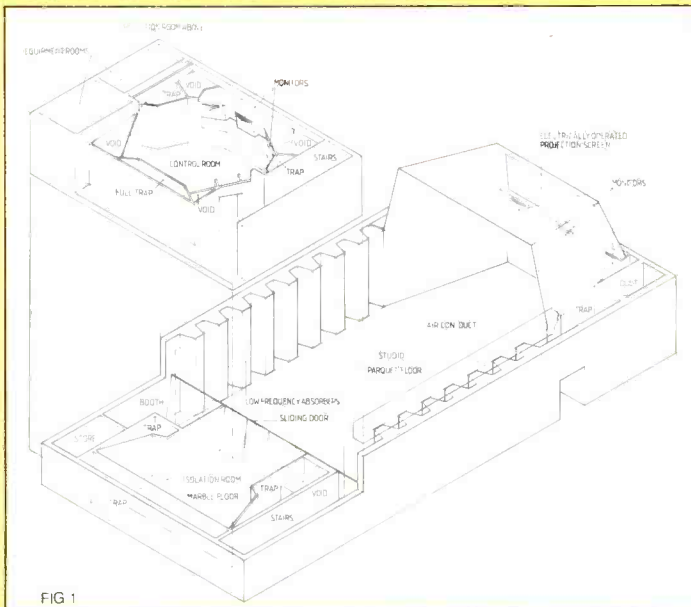
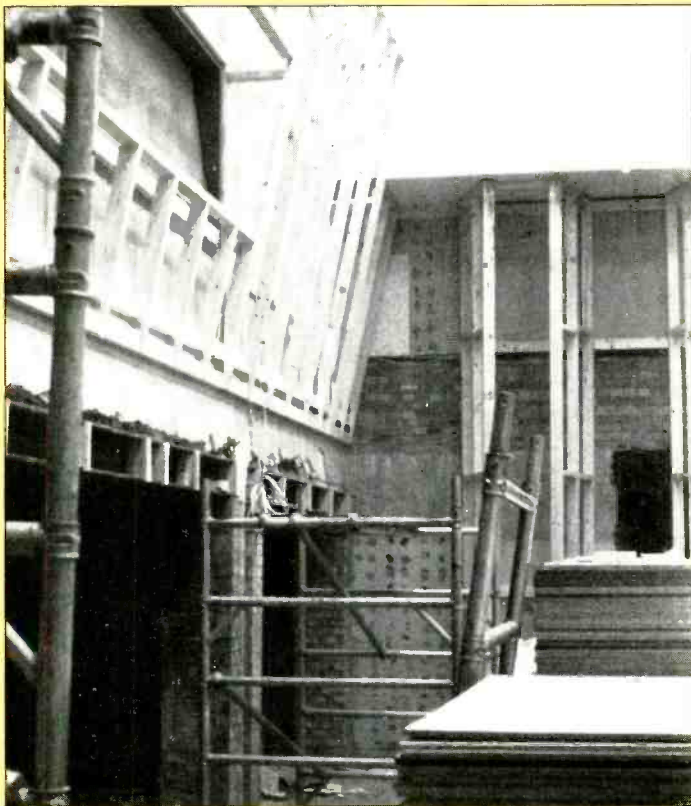


FIG 1

## LARGE SCALE ACOUSTICS

around the perimeter. At the far end of the studio, an electrically lowered projection screen is built within the sloping ceiling. Playback speakers are incorporated within the, again, sloping rear wall. Low frequency absorbers are located behind the hardwood panelled geometrically opposed wall surfaces, and this end of the studio has a slightly longer RT60 than the main part of the studio.

The only non-reflective surfaces within the studio are the ceiling (the Armstrong tiles originally installed were repainted) and the front cover to each LF absorber. The dimensions and numbers of the absorbers were calculated to allow even absorption of the low frequencies and prevent the LF character of the room resembling that of the nearby Wembley Arena! The exceptional ceiling height available made it possible to design absorbers of sufficient height to be effective down to 28 Hz.

The absorbers are stagger-tuned and removal of the acoustically transparent grille-cloth cover over the opening allows easy modification of the interior elements, for tuning purposes. The side-cheeks of the absorbers are reflective (although adjacent side-cheeks are geometrically offset) and aid in producing a high degree of 1st order reflections within the reverberant field. The floor within the main studio is gloss varnished parquet of unusual form. It consists of countless small pieces of French Chestnut, each piece measuring 150×25×10 mm. The blocks were adhesive fixed, in 450 mm wide sections at a time, to a cork substrate, in turn adhesive fixed to a tongued and grooved chipboard layer fitted over the well worn original felt carpet. The entire studio floor is thus well decoupled from the structure of the building. The small (10 mm wide) exposed face of each block ensures even wear of the floor and the 25 mm depth will allow many sanding and re-varnishing operations to be carried out in the future.

**T**he reflective surface finishes on the walls within the main studio are mainly laminate material on chipboard base. Some hardwood panelling of the same species (chestnut) is used on both end walls of the studio.

Within the isolated areas, marble floors were provided, together with hardwood panelled wall surfaces, offset with relation to each other as necessary.

The original fluorescent ceiling lighting, within the studio, was augmented with tracks of dimmable incandescent lighting around the studio perimeter. In the two isolation areas, dimmable incandescent fittings were installed to augment fluorescent luminaires with remotely installed ballasts.

The project commenced on February 20, 1984 and completion was required within five weeks because of booking commitments. Approximately one week was spent in stripping out the original finishes, then the structural preparation and steel installation work was undertaken. The existing air-conditioning duct-work was raised by 2 m, to allow installation of the bass absorbers, no less than 7 tonnes of wooden flooring were installed, studwork framing was completed for all the new geometry, cladding of all surfaces was completed and the new electrical power and lighting circuitry was installed.

Concurrently, CTS's technical staff installed the new studio audio wiring required by the digital console.

The project was completed at the end of the fifth week with the knowledge that, at the end of the sixth week, the studio was required for recording the *Chess* album with the male half of ABBA and 84 members of the London Symphony Orchestra. This was a powerful incentive to all concerned!

At the completion of work, RT60 measurements were made and found to be no more than 10 ms of the previously calculated values at any octave band centre frequency.

Since completion, the studio has been enthusiastically received by both the producers and engineers, who assess it from the control room, and the musicians, who make their assessments when playing within it. It was gratifying during a recent visit to CTS to overhear Don Lusher, a well known session trombonist, telling Peter Harris, in the Reception Area after a session, that the studio was now "so pleasant to play in, as each musician can hear a natural balance on the studio floor". □

# CTS & DSP

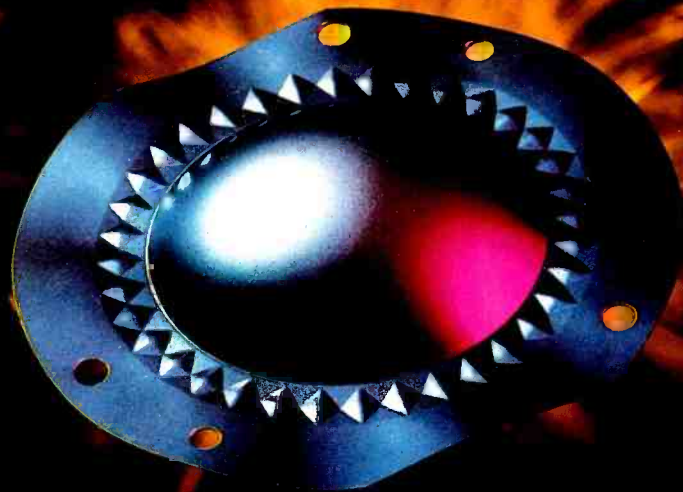
**The Neve Digital Signal Processor (DSP) system has been the subject of vast amounts of words—both written and spoken, some true and many just plain rumour. The development of DSP involved much research in hardware, software and user operational requirements, needing a considerable amount of external liaison with the industry—far more than most products would need at such early stages in their development.**

**The first of the full DSP systems is now in regular use at CTS Studios, Wembley, London. In this article Keith Spencer-Allen relates the background to the DSP choice, the basic CTS design and installation requirements together with an operational description of the console—or at least part of it.**

**P**eter Harris, managing director CTS Studios—"We placed the order for the *DSP* in March 1982. This was subsequent to having seen the Neve prototype *P3* model in place at BBC Broadcasting House in late 1981. I went away to think about it—I know some other studios at the demonstration dismissed it out of hand but we were more interested and went to see it at least twice more until we took the plunge in March 1982. CD was about to arrive and to us it appeared a sensible direction to take. At the time of the order it was

anticipated that delivery would be within a year; it was thought that having made a prototype it would primarily be an upgrading job. As it turned out, it was not quite so simple—more a start from scratch routine to make a larger console with delivery being moved from March 1983 to November."

It actually wasn't until Spring 1984 that the studio saw the finished console. In the meantime it had been decided that the *DSP* was to be installed in Studio One at CTS—one of the largest recording rooms in Europe. The decision was made to update the acoustics of the



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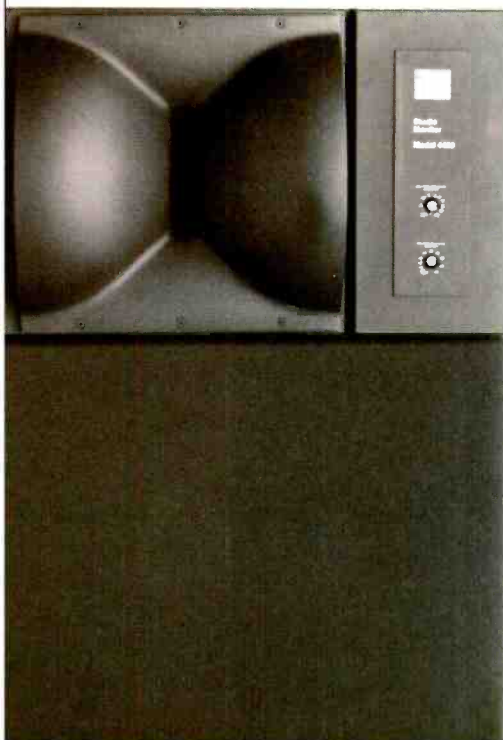
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# CTS & DSP

studio area (as covered elsewhere in this issue), the control room acoustics having been rebuilt 18 months previously. It was intended that the DSP would be installed during the acoustics update and go into full operation shortly after. Slightly later than intended, the desk was installed and test sessions were begun. These apparently went well, with all involved being very pleased about all aspects of performance. The decision was made to start full operation but unfortunately, as is well known to everyone in every field of electronics, problems simply don't show themselves until the worst possible time—ie session time. The problems were in fact fairly minor considering the system complexity. They lay largely in the control system of the DSP and were giving rise to spurious noises that were far from musical. The session was continued by running tie lines to another control room.

As there were a number of heavy orchestral sessions booked, it was decided to move the DSP out and re-install the original analogue Neve. The DSP was moved to the tape copying suite where it could be run in parallel with the analogue Neve using heavily buffered feeds from the mic lines. A dedicated team of Neve engineers ate and slept with the console until all the bugs had been traced and all were happy again. During this time, having had the console to play with for several weeks, several operational modifications were made and a number of new features implemented meaning that the overall system has already evolved beyond the system that was originally delivered.

Studio One has always been busy; as the Autumn was particularly so, it proved too difficult to move projects around enough to find the necessary time to re-install the DSP. (It was eventually moved during the Christmas 1984 holiday and worked fully the

moment the power was applied.)

Philosophically, CTS takes the attitude that after a few months of operational DSP, they will probably feel that the delay was beneficial in many ways. It has meant that they have had some extra 'customisation' time on the DSP; the chance to train engineering and maintenance staff on what is a substantially new approach as will be shown later; and lastly to allow the engineers to become familiar with the new room acoustics and the DSP at separate times enabling them to keep a reference to work with.

As I write this just prior to the installation of the DSP, the engineers are very keen to get into operational use with it—even those who suffered the early problems. All in all things are looking very positive at CTS—we even spent some time at the beginning of our conversations in swapping the more unbelievable rumours that had been circulating about the studio. Contrary to rumour they are quite happy with their present situation and very excited about the next few months. So much for history, on to the console itself.

What follows is the result of a day spent at CTS where chief technical engineer Henry Edwards ran through as much of their particular DSP as time permitted. It is worth mentioning that although the basic DSP building blocks have now evolved, there are great differences in software and to a certain extent hardware between the systems under construction and awaiting full installation. This article is based upon the CTS system and the way in which their particular DSP functions may differ in certain functions and facilities from other units. For more general DSP theory, I would refer you to the article by Dr Martin Jones in October 1983.

## DSP—the basic installation

When you first encounter the CTS DSP, the first aspect that strikes you is its sheer size—a straight input and producer's section; a slightly angled monitoring section at the left hand end with the master control area set in the angle, giving maximum dimensions of  $4\frac{1}{2} \times 1\frac{1}{4}$  metres. One of the advantages that Neve stress in their literature is the compactness of the system. Why the difference?

Henry: "We have a large

control room and therefore size is not a problem for us. We do a lot of film scoring work where there are large score sheets so we have added a metre long producer's section. It also gives some racking space near to the engineer. It would have been possible to have had the desk simply the width of the input channel faders—about 5 ft, but that would not have met our needs. The shape evolved also from our working methods. With our film work we like having a separate monitor section and with the angle it means that the console can be conveniently operated by one or two people."

It was apparently proposed to CTS by Neve that the control panels could be any shape from flat (except for the meters) and vertical (except for the faders). Angles were chosen that allowed easy reading of the alphanumeric displays which form an essential part of the console. Although some people have commented on the height of the console, it is something of an illusion as it has the same vertical dimension as the analogue Neve that it replaced.

Console construction is standard Neve but as the contents are solely for control functions, it is fairly light. It splits at the angle and four people can carry the halves. The heart of the DSP lies in six racks contained in a separate room with its own air conditioning system. Surprisingly, two thirds of the rack space comprises the analogue sections (ie converters) with the digital electronics actually being very compact. The power supplies are also housed within this room. While on this topic it is worth noting that the complete system draws 32 A which is not excessive for digital electronics of this size.

Connection between the console and the racks is via a fibre-optic link—a single cable containing two fibres with an overall size about the same as that of a standard mic cable. This of course means that there are power supplies within the desk for the LEDs and displays—power transfer in fibre-optics being far in the future!

CTS have opted to have all their analogue-to-digital (A/D) and digital-to-analogue (D/A) equipment in the one room which means rather than taking the Neve option of the A/D converters being on the studio floor with fibre-optic links to the racks, they take their mic lines right through to the rack room. By careful

planning of the wiring on the mic lines, long runs have still been kept to a minimum although to a certain extent with such a large room as Studio One, such things are often a fact of life anyway. The actual floor of the studio has 48 mic inputs in blocks of 16 with one set duplicated in the booths. They also removed the original mic-line patchfield which is now redundant with the DSP. It is worth mentioning at this point that above each mic input on the studio floor is a small alphanumeric display which is a repeater legend and will display whatever that input has been named as on the console. This is of course very useful in sessions where there is no need for lists of mics or the confusion that can occur when tracing faulty mics/leads, etc. Outputs carrying line level distribution systems, foldback and power amp sends are similarly labelled on the console.

As mentioned earlier, the console contains only control functions although there are two small sections containing analogue audio: for the talkback and the programme feed for the in-console reference speakers. The converters for these functions are situated within the console. Apart from the use of external processing units, the patchfield is largely redundant although CTS does have facilities for patching up to three analogue tape machines, for tie-lines to the rest of the building, and to the studio floor.

## DSP specifics

To a certain degree it is possible to draw comparisons to a standard non-assignable analogue desk to give some idea of the basic capacities of the CTS DSP system. The specification allows for 48 mic inputs, 32 group outputs, a capability of mixing 72 line level inputs dependent upon how the system is configured, eight aux sends, full monitoring section, plus quite a lot else. On top of this in any mode there are 12 fully floating inserts for use with analogue effects units. There are converters tied to these insert points and use of these has a number of advantages that will be covered later. Should more effects be needed there are many other analogue access points that could be used.

The DSP interfaces correspond to the standard AES/EBU digital bus standard. The principle multitrack to be used with the

system is the Sony PCM 3324 which is digitally interfaced to the DSP (CTS had the second 3324 in the UK).

The console operates at a 48 kHz sampling rate. CTS toyed with running a 44.1 kHz system at one time to remove the necessity to standards convert for CD mastering, they however decided against it and opted for the then proposed AES/EBU professional standard.

## Operation

One of the slight misapprehensions held about the DSP is that you have to 'build' your console before you can start work. This is not quite true. On turning the desk on, it goes through a sequenced power-up taking about 30 s and can be fully operational and stable in under a minute. After passing through a number of basic 'Welcome to DSP'-type displays, the start-up menu is reached. This lists five options available and in the case of CTS these are (1) track laying mode—48 inputs to multitrack outputs; (2) mixdown mode—multitrack returns plus line inputs; (3) mixture of one and two with inputs and track returns available immediately for routing so that track bouncing, etc, can be implemented quickly; (4) minimum mode which uses a minimum of hardware which should make it possible to configure the system even if there has been a problem—a sort of emergency safety position; (5) the possibility to configure the console to the way that it was set when last turned off. The desk has six internal memories and one of these is non-volatile and stores the last settings of the complete console.

Henry: "I expect that we may well change these default settings once we have been using them for a while and found out the most usual way people want to use them. You will still have to start with one of these options however and grow or prune from it."

The far top left corner of the console houses the disk drive which is an essential part of the console. This takes standard 5¼ in single-sided double-density disks on which it is possible to record up to five stores containing information to reconfigure every control and routing facility on the console. It takes 10 s to download a disk into the desk memory and then a further 10 s to reconfigure the complete console. Smaller changes take proportionately less time and most global

changes of certain functions are virtually instantaneous.

Having chosen your basic system configuration from the menu it is then possible to start work with no further system alteration. You have of course not sorted routing yet but it may be most logical to proceed now to the basic channel functions that are available.

## The channel

Because input channels are not fixed in any permanent hardwired schematic chain and also due to the other channel control features, it is rather difficult to think of channels in a way that relates to practical DSP. Because of this the term *paths* is far more appropriate. If we follow an input channel trying to draw analogue analogies it will be easiest to explain.

The fader is a standard 6 in travel fader similar to those used with NECAM (Fig 1). For the input paths they are motorised and those on the monitoring section are not. Above the fader is a display with four alphanumeric segments and this could be considered an electronic scribble strip. Using the QWERTY keyboard in the master section of the console, names may be written in these displays to replace the default mode which simply reads IP followed by the number of the path. It is this display that reads above the mic input on the studio floor. Because it is possible to access paths by these names as well as numbers, the desk will not allow duplicate names—bleeping very loudly at you should you attempt to do this.

Next up comes a row of three LEDs labelled I/P, GRP and O/P and these light up dependent upon the status of the fader path. The fader in this console is of course purely a device for communicating with the digital processors both as a display of level and a level setting tool. Therefore a fader can be controlling any of the three input, group (sub not output) and output (track sends).

Above these LEDs is possibly the most important button on an assignable console, the Access key (ACCS). By selecting this on a fader (only one possible at a time) you are accessing this path for modification of EQ or dynamics.

Above the Access key is a group of four keys. The lower pair, PFL and Solo are fairly standard in operation in many ways although there are a number of clever aspects of

their operation selectable by menu choice. The upper pair of buttons are Source (SCE) and Soft. Source enables the user to step through the paths that might be assigned to that fader. In many cases the fader will probably be the controlling element for only the input channel. There is no reason however that virtually any number of paths should not be assigned to a single fader. If for instance the fader was controlling levels for the input channel and the track send (output level), touching the source key would switch to the path not being displayed and both the legend above the fader and, due to the motorised fader, the fader position would also change to reflect the different level setting. Henry set up one demonstration that allowed every input channel on the console to be controlled by the one fader and it was possible to simply step through them (this is not a recommended way of working, just an impressive demo).

The Soft-key is a multifunction button—an assignable switch if you like and in the CTS system it has eight different possibilities all of which relate only to that signal path. It is possible to assign these switches individually with a different function on each path or globally across the console so that they all have the same effect.

Top of this section is the mute switch—a sideways mounted rocker type that allows manual muting on a large number of channels simply by running your finger across the line of them—with a minimum of discomfort. Immediately above this switch are three LEDs that simply show the path status.

The next panel up the console contains two assignable knobs with their display legends (Fig 2). As with all the knobs on the console these are continuous rotary types and you depend on the display legend to give the actual value of the setting. These two knobs handle all the path ancillary or secondary controls which again may be selected globally or on a path by path basis. The function that they control is selected from a central panel (Fig 3) on the level immediately below the meters. This contains 16 buttons arranged in two horizontal rows of eight. The function for the upper of the assignable knobs is selected from the upper row, and the lower from the lower. The top row includes such functions as

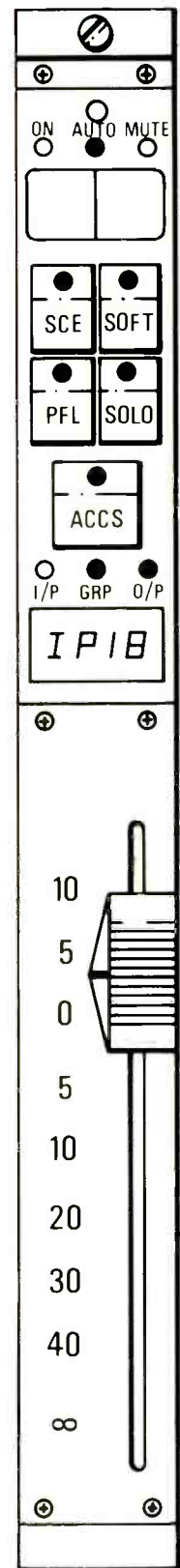


Fig 1: Fader and input module

# CTS & DSP

Gain Make-Up (GMU: may be required if there is a compressor in circuit); Gain of the mic or line inputs to the path; Width which becomes operative if the path is stereo (which the system will support) and gives the range from mono to 'hole-in-the-middle' super stereo; Delay (DEL) on the input path which is currently allocated at 70 ms per path and is adjustable in ms steps from zero; and then four uneven numbered aux sends levels. The lower row contains Pan; a spare function; Multitrack Return trim (MTR); Auto-fade (AUTO) which is adjustable in 1/2 s steps between 1/2 s and 30 s; and the other four even numbered aux send levels.

In the above secondary control mode, it is normally only possible to adjust the same selected pair of functions on all the input paths. If you preferred to have totally separate control functions on each path, this is achieved by pressing the SEL button that sits between the two rows on the functions panel. The upper control knob then becomes a switch that allows selection of any of these 16 secondary functions while the lower of the knobs adjusts the level or setting. One clever feature of the system is that if a particular function is not possible, eg width with only a mono channel, that option will not appear as selectable.

There are a couple of other clever aspects to this console such as if a control knob is turning faster than an average, there is an intelligent algorithm that also increases the rate of change in the adjustment. Each block of 24 inputs has 2 1/2 s of delay memory available and as mentioned earlier this is initially allocated at 70 ms to each path although this can be changed as required up to the total delay available.

One of the DSP concepts that I found difficulty in adapting to was the fact that although you have very few knobs on the channel, that pair of assignable knobs is

acting as at least 16 controls and the settings are still operative even if the knobs are controlling a totally different function. It was not really so much at this level of operation that we have reached so far, but later on in higher levels of control where I found myself hitting a barrier in my understanding and it was really only due to the difficulty that I found in accepting such a difference from my experience as normal.

On the other hand, I had thought that the fact that all the controls were not in channel strips and had to be referred to centrally would prove a problem. The total reverse is actually the case. You can remain in a fixed place at the console without having to lean awkwardly across the producer to adjust EQ etc.

## EQ and dynamics

These sections are panels situated above the input channels on the module strip below the meters. They are automatically called up by selecting the Access button on the required input fader. The EQ (Fig 4) is fairly conventional in offering four bands with the top and bottom bands shelving with two mid

bands peaking with four position adjustable Q. Each band has a selection of 21 different frequencies which are displayed in the alphanumeric display window above that control. Each band has a  $\pm 18$  dB gain and individual bands may be switched out of circuit as can the complete section. The bands healthily overlap giving plenty of capability. The cut or boost is controlled by incremental buttons and the actual gain is displayed by LED ladders beside the band.

When the Access button is pressed the EQ controls are activated for the accessed path. Any settings already programmed are recalled instantly the Access button is pushed. There is also an alphanumeric display window that carries the name or number of the channel being EQ'd—there is very little chance of being confused in this respect. As soon as you have accessed a channel and set your EQ, you simply move on to the next path to be EQ'd. The settings are remembered, there being no need with any of these path functions to even touch the master keyboard.

There are in fact two EQ panels with one over each block of 24 input faders.

Either panel may be used and the selected displays repeat the information as if they were running in parallel. Should you wish to EQ two paths against each other, the Hold button on one EQ panel is selected and this overrides the channel Access path. You can then adjust both channels in real time as they appear on the separate EQ panels. There are also powerful facilities for copying within the desk. It is possible to copy complete EQs to various channels or to the complete desk or virtually any permutation although these functions are performed through the central assignment panel.

The filter panel initially travels with the EQ when Accessed. It is a standard high and lowpass filter with highpass from 280 Hz to 25 kHz and lowpass from 15.7 kHz down to 2 kHz. The filter section may be assigned separately to the EQ and as such has its own path name display, in/out select and Hold facility.

The dynamics unit (Fig 5) is accessed in the same way as the EQ and it is also doubled with a hold facility. Physically these panels are on either side of the EQ panels. The dynamics offer limiting, compression, expansion and

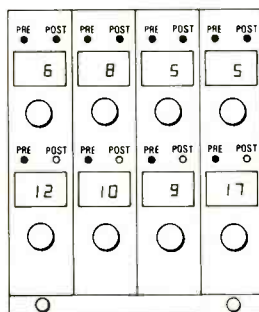


Fig 2: Multifunction assignable controls (four channels shown)

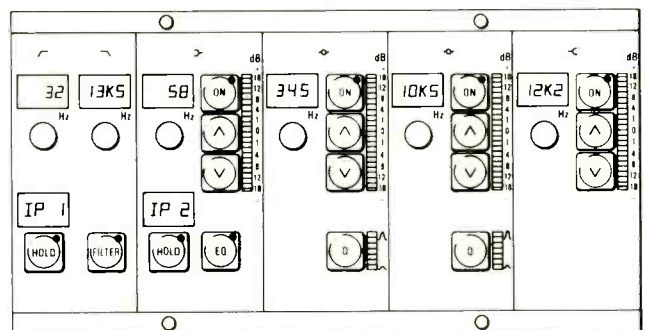


Fig 4: Equaliser panel

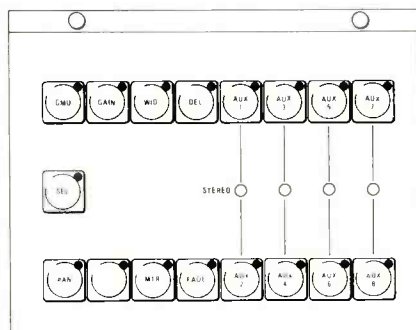


Fig 3: Assignment panel for multifunction controls

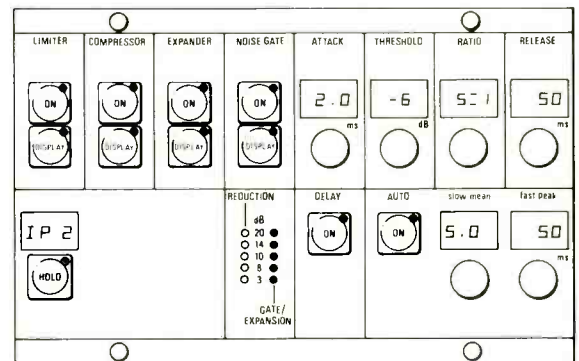
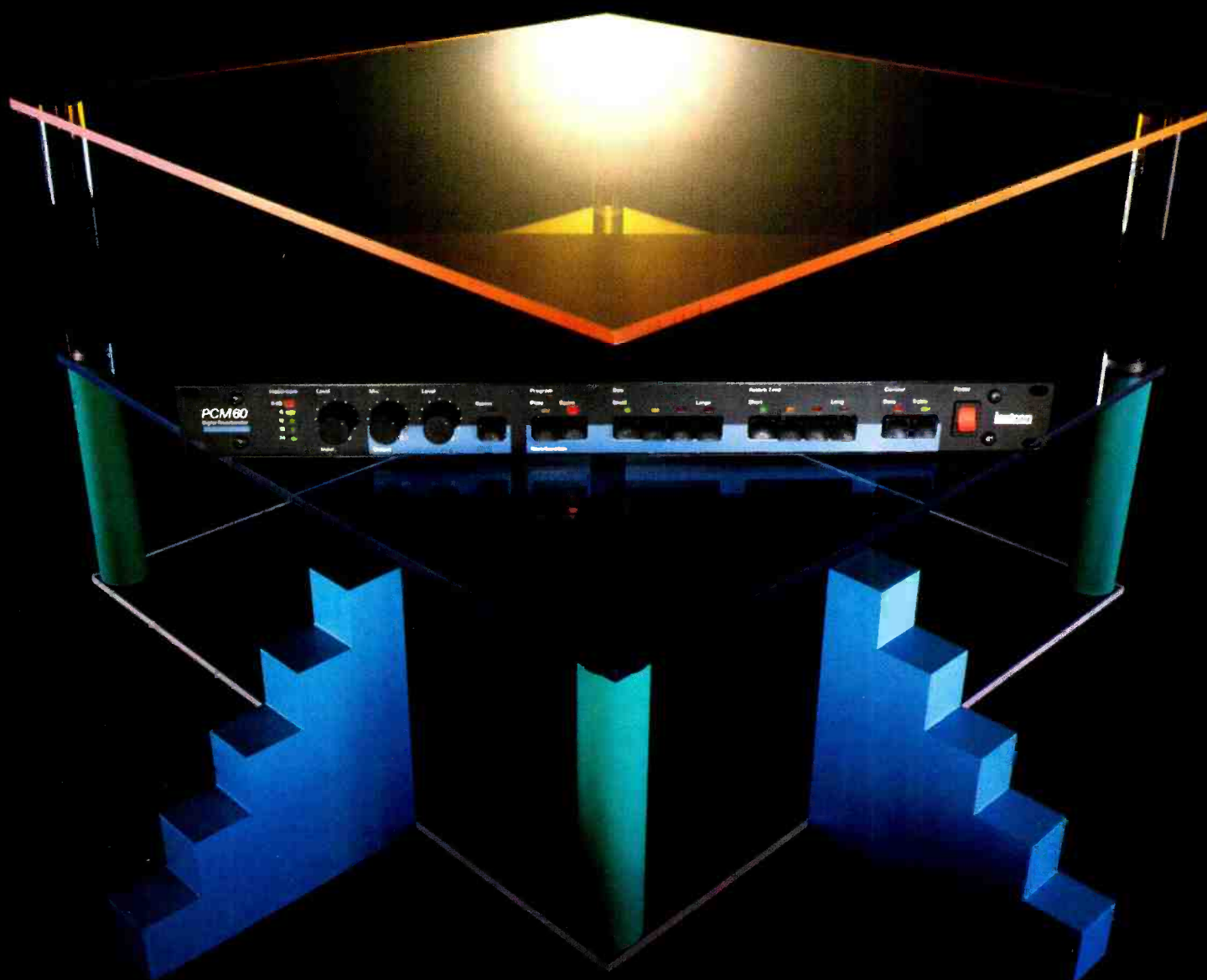


Fig 5: Dynamics panel

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# CTS & DSP

gating with each section individually switchable in/out and fully adjustable. There are six controls associated with each of the sections these being attack, threshold, ratio and release with two further controls forming part of a programme controlled auto-release system. The *DSP* has a software control that doesn't allow opposing settings, eg you cannot expand and compress at the same threshold. All the controls offer a wide range of settings with there also being a 200  $\mu$ s switchable delay to allow side chain anticipation.

I was curious about overload within the console which could of course have some fairly horrific effects on the signals. The major danger areas for this problem are of course where the system returns to 16-bit operation, ie at the input and output interfaces, because this is the standard at which the external equipment operates and this is really the limiting factor. Neve claim a dynamic range of 196 dB within the mixing sections—had there been any problems in operation?

Henry: "With this dynamic range of 196 dB you would have to put on a massive amount of gain to try and overload the system internally. So far we haven't found a way to get a digital wrap round out of the console at all—and we have tried!"

## Metering

The desk has 32 high resolution bargraph meters. A display below the meter names the path that it is displaying. They can operate in a true peak mode (not PPM) or a VU mode or both at the same time. They are calibrated from -36 to +24 dBu. These meters are assigned to either track sends or returns. Above each meter there are multicolour LEDs to show track status—green safe, amber ready and red record and these refer to the multitrack tape machine.

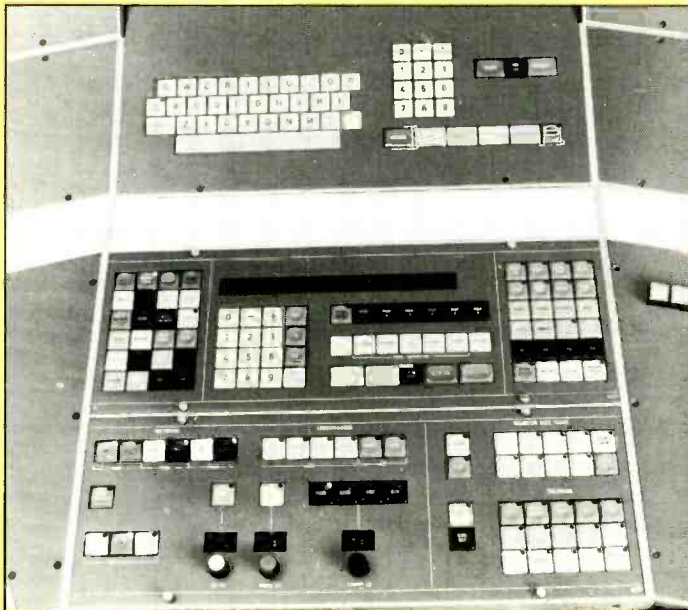
In addition to these meters there are 18 assignable meters of which four are the high

resolution bargraph type, four are traditional VU meters, and then there are eight low resolution bargraphs to meter dynamics operation. All the assignable meters have displays to show what they are reading after assignment. Additionally there is a traditional phase meter.

## Other channel facilities

So far we have just discussed a path in the standard operating mode supplied by the operating menu. The advantage of the assignable console is that most of the blocks of the console can be moved around. If we turn to the central assignment/master panels and keyboards below the video monitor, it is possible to call up displays that show the required path. The path display gives you a graphic representation of what blocks you have in the path with the default mode being delay, filter, EQ, dynamics, and then the fader. It gives you the path name and tells you which fader it is on. It also gives you a crude graphic representation of EQ, filters, and of the dynamics by putting initials under the box. The delay time will be shown out of a maximum available. At the bottom of the screen there is more information about the path including if it is part of a mute group, what the soft key function assignment is: solo status—normal or solo cut immune; mic or line selection; phase reverse; phantom power on/off. Looking at the path display gives you a quick overview of that path. If you alter the configuration of the path it is immediately displayed on the screen.

Master control panel



## Routing

So far we have not touched the subject of routing. The VDU is an essential part of the routing system. There are two ways of routing—one requires the use of the keyboard to specify which inputs should go to which tracks and naming or numbering the routing tracks. An alternative is to specify the TRACK SEND from the assignment panel and then to touch the Access keys on the required input paths. It is possible to show tables of the routing either as what goes to where or which inputs are routed to a particular output— from either end if you like. Path numbers don't have to be used, the system works as well using the path names.

## Soft-key

As mentioned earlier, the Soft-key is an assignable function button. The possible functions involve things that you want to activate from the fader soft-key, eg cutting EQ or filter without having to access; cutting post fade sends; cutting all aux sends; executing a mute group if that fader is a member; starting group fade if that fader is a member of a *NECAM* group; switching an insert; and several more.

## Other matters

The *DSP* gives the option of *NECAM* or *VCA* grouping. The *NECAM* is of course similar to the standard system in concept. The *VCA* system is of course only a software representation of how the system is controlled.

There simply isn't the room within this article to list all

the functions of this console and it would probably mean very little without hands on experience anyway. One of the areas that does show the power of the console is the variety of VDU displays that are available to work from in moving the blocks of the system around. There are displays, tables, lists for virtually every operational section of the console and it quickly becomes second nature to check the screen.

This is particularly true of the diagnostic tests. The *DSP* is continuously running diagnostics and it is possible to run through the many layers of the system until trouble areas are located and then delve deeper into that area, still using the screen.

The far end of the console from the input paths houses the monitor section and it possesses many of the same features as the input paths. Situated around this area are items such as the aux master levels and the like, test oscillator, etc. Master monitor controls and the very comprehensive talkback system to allow communication around the complex, are all situated on the central section of the console.

## A finale

By the time this issue is published there should be quite an amount of fully digital material available for evaluation. The test sessions that have taken place are described as being 'incredibly clean', so that does sound encouraging for CTS.

Although one of the reasons for installing the *DSP* was for digital recording work, CTS are still continuing their analogue work as well. They have recently invested in another three Studer *A800s*. Although many of their film soundtracks are being digitally recorded such as the recent project for composer Maurice Jarre *Passage To India*, much work is still analogue and it should be interesting to see how the combination of analogue recording and *DSP* works.

Peter Harris: "The *DSP* will be a good console whatever the destination of its outputs, analogue or digital."

Now the desk is installed, how do they feel? Peter Harris: "We think that our original feelings have been justified when we look at what CD is currently doing and at the impact digital is having on the industry. We still think that we took the right decision." □



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Pete Townshend  
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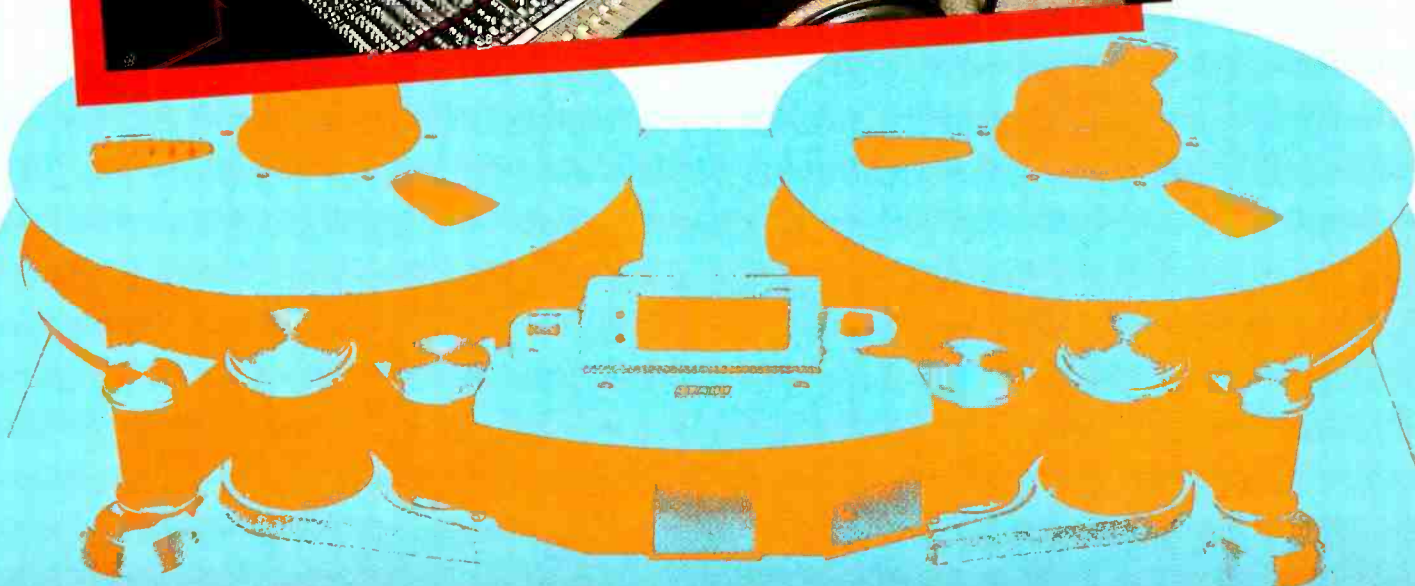
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# BUSINESS BUSINESS



Barry Fox investigates the facts behind the industry news

## Mind your Ps and Qs

PQ coding is becoming a hot digital potato. This is the digital flag buried in the CD bit stream, which identifies the beginning and end of a music track. The home user can program a player to jump to the beginning of any track and then lift off at the end.

Obviously there has to be a slight margin for error, to make sure that the player does not miss the beginning of a track or cut off before the end. The snag is that no-one seems to agree on what the margin of error should be. To make matters worse, low cost domestic players have different standards of accuracy. Some need a wider margin of error than others. Things get particularly hairy when there is a cross fade between tracks, rather than a silent band. To compound the problem, negative codes aren't possible. In other words you can't play safe, and put the start cue for one track before the stop cue for the previous track.

If you want an example of what all this means in practice, try listening to the Joe Jackson CD, *Night and Day*. Between the *Target* and *Steppin' Out* tracks there is a cross fade. Try programming a player to drop in at the start of track 5 (*Steppin' Out*). You will end up hearing an irritating chunk from the end of track 4 (*Target*). It's because the PQ codes are all over the place.

I tried to find out what standards are recommended. Polygram in Hanover is explicit. "Considering the inaccuracy of some current CD players," writes Bjorn Blüthgen, in a note sheet to producers. "operators are in a dilemma. If we allowed say 0.5 s before every programme for an inaccurate CD player, a well-performing unit will annoy the listener by playing at least 0.4 s of the previous track first. Alternatively the programme tail will be cut off."

Blüthgen recommends a gap of five SMPTE-NTSC code frames, which is  $\frac{1}{6}$  s. Note well that we are here talking about SMPTE frames in NTSC video format which run at 30 a second, not CD digital frames which run at 75 a second. PQ coding is by convention now measured in SMPTE frames.

I asked Sony in Japan what they recommended. The answer was decidedly odd. "There are no special written guidelines," said Sony! In fact Sony seems to have been telling some mastering engineers to use a gap of 30 frames, or one full second, before a track and 15 frames, or half a second, after a track. But another engineer told me that he thought the Sony recommendation was 15 frames or half a second at either end. In other words there's complete confusion, and it is small wonder that different records behave so differently

when cued up. For domestic use it's a nuisance. For broadcasters, it's a damned nuisance.

Unless the CD pressing plants get their act together and agree a PQ standard, the situation can only get worse. In the future creative PQ coding will become part of a record producer's job. Where there are cross fades, the start and stop points become an artistic choice. Because the start and stop points need not be the same (provided they do not overlap and create a negative code) the PQ coding point can go on either side of programme material that some people may wish to edit out.

A recording of a live concert, for instance, may have on-stage chat, instrument tuning, jokes and applause that disc jockeys will want to avoid and home users may want to program out after the first few plays. There is nothing more irritating than hearing the same joke over and over again. Carefully selected PQ coding can make this easy. But creative PQ won't work unless there is a standard approach to the coding points which must be burned into the master. In a pre-mastering studio, a PQ editing unit can give the producer the chance to replicate switch points, before marking them on tape. In other words it can give dummy runs, like a digital editor. But why bother if the pressing plants can't agree on a rule book to implement artistic decisions?

## DSP at CTS

The Neve DSP desk at CTS is now up and running following numerous delays.

These delays and problems haven't made life easy for Neve. But just to put things into perspective, think for a while about what the technology involves. Building a DSP is equivalent to building a super-brain computer. You need diagnostic software to find hardware faults. And there are bound to be some. There are around 150 circuit boards, each with some 250 chips. Each board has around 20,000 connections. That makes a total of 3 million joints.

## Binaural film sound

I spent some time in Hollywood recently, visiting studios of all kinds. More of that later. First a big no thanks to MGM for being just about the only film studio not to co-operate. No visit to the MGM lot, even though I gave them months of warning.

The word in Los Angeles, I found, was that MGM seems more interested in building hotels (like the one in Las Vegas that burned down) than making films of the kind that made the roaring

lion famous. I can understand that. The only new MGM film I could find was an awful piece of rubbish, called *Red Dawn*, which is about a bunch of high school kids fighting a guerrilla war against Cubans and Russians who have happily invaded America and occupied most of it. The next on the horizon from MGM is *2010*, the sequel to Arthur C Clarke's *2001*. I can only hope for MGM's sake it is better than the 'Dawn' debacle.

For studio engineers there is an interesting question mark hanging over *2010*, or 'twenty ten' as it is known in the trade. Will it have Holophonic sound? When I originally interviewed Hugo Zuccarelli he talked about the possibility. A few months ago I contacted Zuccarelli Labs in London and asked what was happening. All I got was a we'll get back to you message. So in Hollywood I asked a few questions.

The film is being directed by Peter Hyams, a film maker well known for his interest in things new. The Sean Connery space movie *Outland* was one of his. It had some very interesting computer graphics. The *2010* set was guarded by armed security but the word out of MGM was that Hyams had heard a demonstration of Holophonics. It was rigged in MGM's Number One screening theatre, with a pair of speakers on the floor at the side of the audience area.

This harks back to early days of binaural dummy head recording when a Chicago inventor called Bartlett Jones suggested that stereo sound in the cinema could be reproduced by putting a pair of speakers on each seat. You need this, of course, to get the binaural effect from speakers rather than headphones. Speakers at the side are acting in the same way as headphones. But the effect only holds good where phase relationships are maintained. Speakers down the side of the cinema will produce a dummy head effect only for the few seats which are spaced the right distance from a speaker pair. The MGM theatre holds only around 20 people. Unless MGM are intending to give everyone in the audience a pair of headphones, or a pair of speakers on their seat, the idea is surely a no-no. Also, Holophonic demos have been sourced from digital tape.

Film recordings have nowhere near the same phase coherence. I await the coming of 'twenty ten' with much interest.

In the meantime, how many audio engineers went to Disneyland while at the Anaheim AES? How many went on the Haunted House and Inner Space rides? On these rides you sit inside a capsule which is transported on a conveyer past all manner of scary gizmos. Those capsules would be the ideal place to reproduce binaural audio; two small speakers close by the ears of the rider would work in much the same way as headphones. If Disney takes up the idea I shall expect a free ride. □

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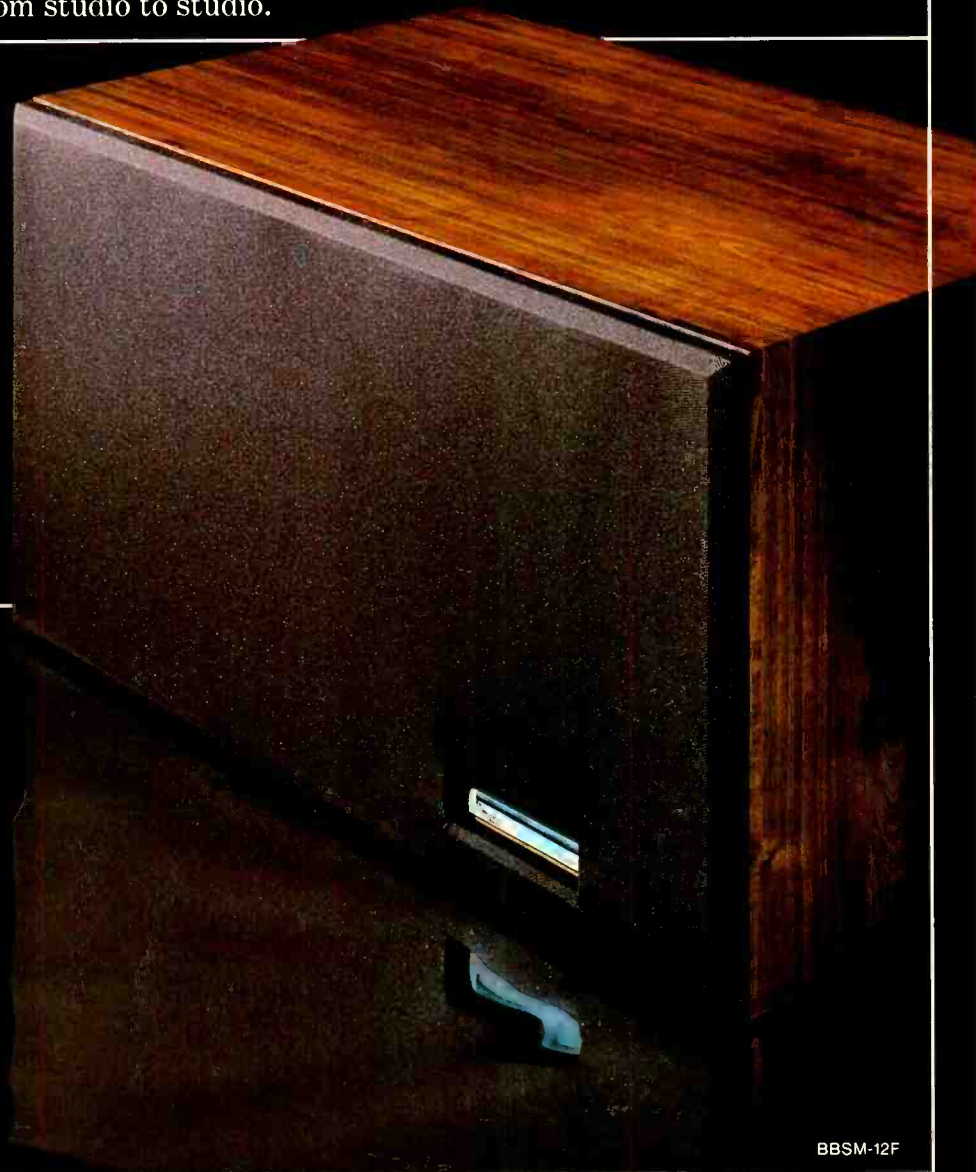
Knowing exactly "what's on the tape" is of paramount importance to the professional recording engineer and producer. Unfortunately, many recording, mixing, mastering and listening rooms are less than ideal, making truly accurate monitoring difficult.

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# STUDIO FILE

# STUDIO FILE

The name CBS Studios W1 probably has an unfamiliar ring to it. What about CBS Records London? Is that any better? The latter may be more familiar but it does, however, belie the fact that it refers to one of the largest purpose-built studio complexes in central London. Who could be blamed for assuming that the large greyish building in Whitfield Street was actually the record company headquarters.

So, for reasons of clarity, CBS changed their name last summer and, hopefully, there the confusion will end. It is all part of a carefully planned campaign to make a lot of noise about the fact that, although they bear the same name as the main CBS corporation, they are in fact totally autonomous and very friendly to anyone coming from outside!

The complex contains three recording studios, two mastering suites, two copy rooms, maintenance workshops plus newly installed leisure facilities including lounge/playroom and kitchen.

Sheer quantity of facilities as well as variety within that framework means that CBS' workload is, indeed, diverse. From classical to TV, to rock, to video, to 'A' and 'O' level aural tests, and jingles. They are now, however, actively trying to increase the number of rock album long-term-type bookings as these of course bring in more return.

CBS are also trying, if not to drop then perhaps hide, the corporate image that they have acquired over the years. It is no easy task with an institution such as this. They

## CBS Studios W1, London

feel that somewhere so large may seem slightly intimidating to a young band.

The recording side of the actual corporation seems to be contracting slightly. CBS in New York recently ceased to function as a recording studio which is doubly sad since it was actually the first to open. Facilities now only exist in Mexico and Kenya. Other activities include CBS records, distribution, Steinway, Fender, CBS News, CBS Books, CBS Toys, CBS Labs—the studio is but a cog. Nevertheless its independence and institutional status have led to 12 very successful years. As far as recording work is concerned approximately 60% is from outside and 40% comes from the record company. Those figures do an about turn for cutting work.

Although not a lot of classical music is recorded here since the majority of that type of work is done on location and they do not possess a mobile, the American CBS Masterworks classical label sends over a lot of their cutting, editing and cassette preparation work.

Because of the size of the

building and the variety of uses to which each room is put, a lot of the machines and effects and digital equipment move around which is why you will find a separate equipment list for this article.

The complex is three storeys high. Studio Three is positioned appropriately on the third floor. It is, at the moment, the only facility up there and the whole floor is very quiet and shut away from the rest of the world. The only reason for coming to this floor would be to go to the studio—there is no through traffic. This facility, used at the moment mostly for jingle work, CBS demos, voiceovers and A/V work, is about to undergo a complete change.

The present Neve console will be replaced, probably, by an SSL—mainly due to extraordinary demand and also for the *Total Recall* facilities. The rooms will also be virtually replaced with the machines recessed into the control room walls, etc, although at the time of writing they had not confirmed which of four design quotes they were going with. The overall finish will be a

combination of timber and cork replacing the present parquet flooring and hessian covered walls.

There are other rooms on this floor which CBS have plans for. One of these had a lost-looking Neve console sitting on its own. It has been a dubbing/editing/copy room which they may well convert into a voiceover room, the adjacent storage room being utilised as a live room for Studio Three.

The refit will also bring with it many new effects units such as Drawmer noise gates and AMS processors. As for the desk, although undecided, the SSL seems inevitable. They feel it is too early for them to have a digital desk—let somebody else suffer the teething problems, and hope to have their own in around three years' time.

The room designs were originally created by CBS people in New York alongside George Balla who is head of all things technical at W1.

The second floor is the home of all the cutting, mastering, copying, editing facilities where cutting engineers Andy DaCosta and Tim Young operate the *VMS80* and *VMS30* lathes and Steve Shin, Laurence Diana and Beryl Richie are installed variously in the copy/mastering suites. There are facilities for copying any tape to any tape and cutting from any format. It was in one of the cutting rooms that one of the custom digital racks had to come to rest, so all we could do was peer at it through the window! All the digital gear has been installed in trolley racks so that it can easily be

CBS control room Studio One



## Equipment

### Studios One and Two

MCI 556C automated 56-channel console (Studio One); MCI 542A 42/32 console (Studio Two)  
JBL 4350 monitors with Gauss bass drivers  
JBL 4311s  
Auratones  
Tannoy (Studio One only)  
Yamaha NS10Ms  
Crown DC300A amps  
EMT 140 plate  
MCI JH24 multitrack  
MCI JH110B ¼ in and ½ in machines  
Studer A80 16-, 8- and 2-tracks  
Dolby throughout

### Studio Three

As above except Neve 28/16 console  
MCI JH24 multitrack and Studer A80 machines only

### Disc cutting

From ½ in, ¼ in or digital Sony 1610 with Neumann *VMS80* or *VMS30* lathes

### Cassette submasters

¼ in, ½ in or digital Sony 1610 to 1 in or digital 1610 submaster

### Copying

¼ in, ½ in and digital copying, real time cassettes—20 Alpine cassette machines

### Digital

Sony 1610 with 5850 PDA U-matics, 1610 processor, DAE 1100 editor, 1510 delay/preview unit, F1 package with SL2000 (NTSC), Sony SLC 9UB (PAL) cassette recorders, F1 (NTSC), PCM 701 (PAL) and RTW A/D interface

### Video

Sony receiver/monitor CVM 2000 PSB, two Sony colour monitors KX27 PSI, Sony 5850 U-matic recorder  
Q.Lock 310 for multitrack locking or 5850 master

with multitrack and 2-track slaves  
Studer A810 2-track with centre track timecode

### Outboard

dbx and Allison limiters  
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Drawmer, Kepex and Meyer noise gates  
Pultec valve equalisers  
MXR and Bel phasers  
Eventide *Harmonizers*, delay lines and flanger  
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Orban De-esser  
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Sony PCM F1, PCM 701 and RTW A/D interface

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Beyer M201  
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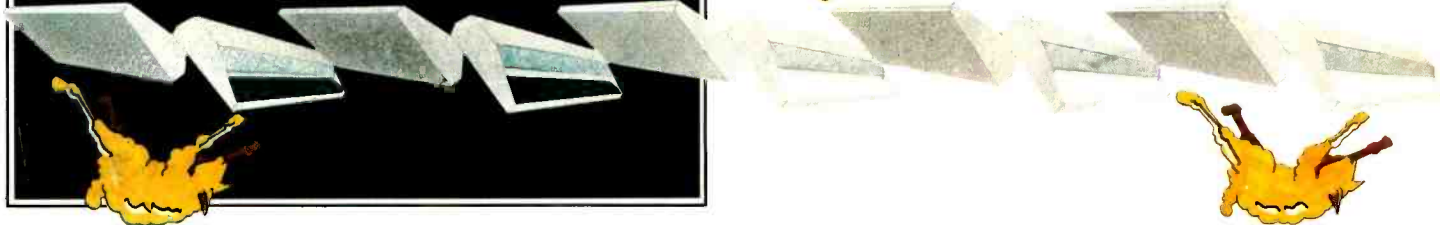
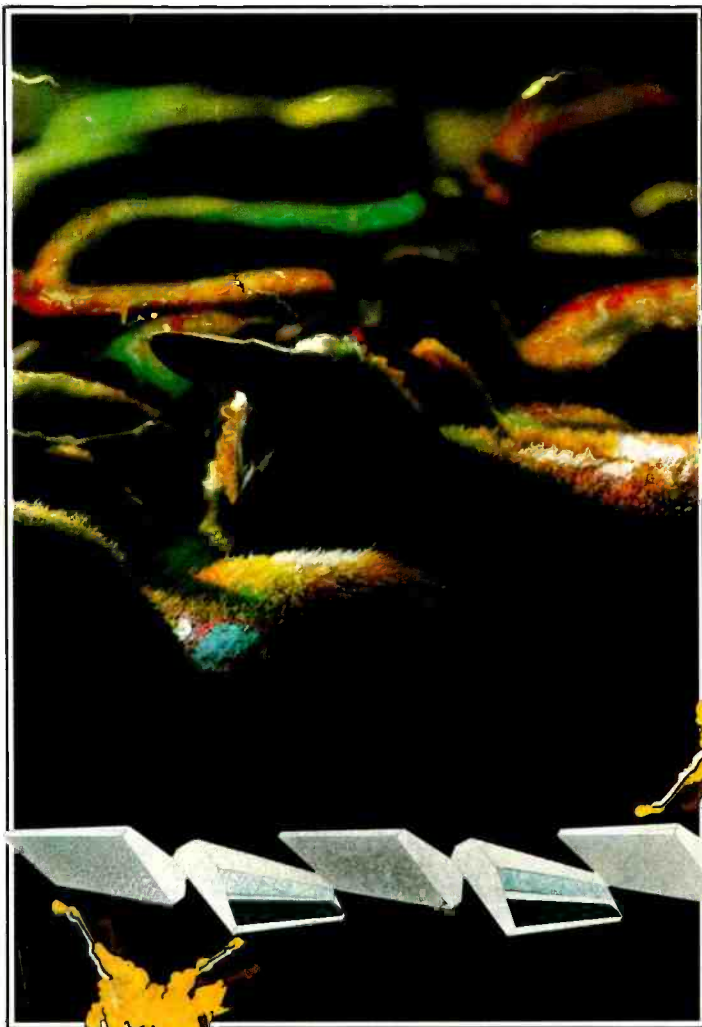


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# STUDIO FILE

# STUDIO FILE

transferred between the rooms whenever it is required. Some of the tape machines (16-, 8- and 2-tracks) are also fairly well travelled within the premises.

The digital trolleys include the Sony 5850 U-matic, the 1610 processor, DDL and digital editor. It has proved so useful that their present two racks will have to be supplemented with a third in the very near future. The company is now beginning to receive digital masters from CBS New York for cutting.

Down a floor brings you to the administration and lounging areas. The new lounge has hi-fi, TV, video games, pool table, and the kitchen facilities include microwave, fridge and cooking hob. These are in addition to the coffee facilities provided in every work area. It was in the lounge that we came across most of the engineering staff... well it was quite early in the day after all. They are: Mike Ross-Trevor (chief) who has worked for the CBS company for over 20 years, but has been installed at the studio from the word go, ie 12 years. The others are Walter Samuel and Andy Todd, both of whom have been there for around five years and Mark Chamberlain who has been there for six. Incidentally Steve Levine started life at CBS as a tape-op. Not many people know that.

The rest of the vast 22 members of staff includes John Davis who runs the tape library; Gloria Luck and Caroline Jacobs look after studio and mastering bookings respectively; Carol in accounts communicates through the

## CBS Studios (continued)

mainframe computer with CBS accounts headquarters in Shepherds Bush.

The maintenance work area is also on this floor. Down on the ground floor are the remaining studios.

Studio Two is used primarily for rock projects and will accommodate approximately 25 musicians comfortably. Since all the control rooms are more or less the same and certainly the monitoring is, this room will serve as well as any other for illustration. All the rooms are, of course, floating. They are also all tied-lined to each other. Studio Two's control room is long and thin with the MCI console facing the fixed window. There is a bass trap above the desk, and cupboards run underneath the window along its length. The JBL 4350s with Gauss bass drivers are uniform throughout the control rooms and the various other monitors such as Tannoys, Auratones, Yamaha NS10Ms and JBL 4311s are available also. The walls are completely covered with acoustic panels built on timber frame with Rockwool in the middle. Behind these there is a 6 in gap before the wall of the room is encountered.

As for the recording area here, when the studios were first built this room proved to be a bit of a problem. To cut a long story short, the ceiling was more than a trifle too high and there were standing waves. Something was needed to break the ceiling up. Their answer makes the room look like a baby Albert Hall clone. There are a number of 'aeroplane wing' shaped baffles

of various shape and size suspended at various and variable heights.

The studio floor is parquet with carpet available when required. In this room, as in Studio Three there is a Yamaha grand piano. These and the others in the building are tuned daily by Roger Pick at 6 am, poor chap. He is also available if the pianos are due to get a battering during the day—he will nip in swiftly during a break and check that all is well. Studio Two also has a Hammond C3.

Studio One is huge. It is approximately 60 ft long, 40 ft wide with a ceiling at least 30 ft up in the air. Those aeroplane wing baffles were also introduced here but for a different reason: floor to ceiling baffles may be distributed around the room at will—they consist of lengths of acoustic panelling hung like curtains which either all hang in the corners or down parts of the walls or across the studio which may in fact be divided up in this manner. The ceiling acoustics therefore benefit from being adjustable, although both studio manager Rodger Bain and Dick Plant confessed that they didn't think anybody ever bothered! The theory's good!

With such a large recording area (100 musicians would have ample room to manoeuvre) CBS have been thinking about installing a large screen at one end and using it as a television studio.

There is a supplementary 'dead' room between control room and studio, but as far as the eye can make out it seems

to be more useful as a store room. Studio One has the Steinway full size concert grand as well as a Schubert upright honky tonk.

The control room is very similar to that of Studio Two—perhaps slightly larger, and is the home of the MCI automated 556C 56/32-channel console.

The car park and loading bay have direct access to Studio One and the ground floor. The other floors are served with lifts.

Over this lot Rodger Bain presides. Having started out as a producer/publisher working with ear bashing bands such as Black Sabbath, Judas Priest and Budgie, followed by three years as A&R director at Phonogram, he is well qualified for this awesome task. In addition to all the new facilities Rodger has introduced a new service: 'One call does it all'. What this means is that if you require hotel bookings, car hire or any of the other myriad necessities in life, particularly if you are not working in your home country, you simply tell CBS what your budget for this is and they will arrange it for you.

One's first impression of CBS might be of an immovable, large corporate facility but in fact this couldn't be further from the truth. All the changes which have taken and will be taking place only go to reinforce the fact that they are all fully awake and constantly watching for new ideas.

**Janet Angus**

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Descending into Sinus Studio, Bern, is very much akin to entering a tomb from some ancient civilisation—the slanting square doorway and sharply descending stairs all add to the mood. However, once through the main door and into the funeral chamber, I'm sorry, into the studio, things get back, to the 20th century.

Sinus is situated in one of the numerous cellars that form an underground warren beneath the old city of Bern. Whereas most of these have ended up as cafés, restaurants and boutiques, Sinus have

## Sinus Studio, Bern

taken advantage of the location and installed a studio right in the heart of the city. It also means that clients have to choose where to go to eat and/or drink rather than having to try to find something open! Of course, there are other amusements very close at hand...

One might think that Bern, being the capital of Switzerland and having quite an active local music scene, would have several studios but this is not the case, with Sinus being the only 24-track facility

in the city. There are various 8-track 'demo studios' and a 16-track studio bringing up the rear, but that is all.

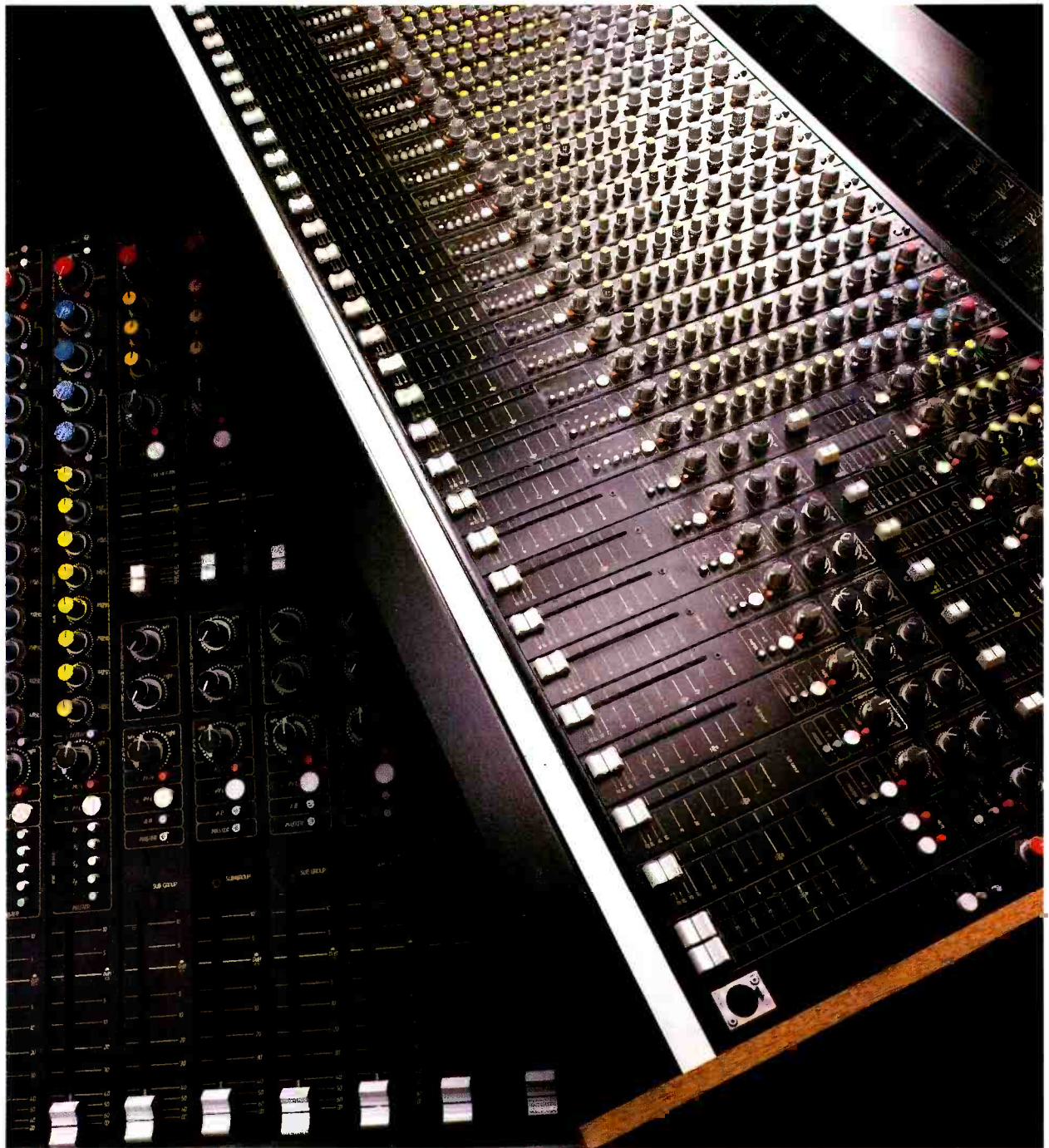
In operation now for around 10 years, Sinus have pretty much the monopoly for the bands in the Bern area and have customers coming in from the rest of German Switzerland as well. The established reputation of Sinus is also instrumental in the lack of competition from new studios—no-one really wants to take the risk. Due to the 'them and us' attitude that

exists between the French and German speaking Swiss, clients are rare from the Romande (French speaking Switzerland). However, it is undeniable that Sinus produce good results unlike some other studios in Switzerland, Sinus are also kept busy most of the time.

In order to facilitate this, the studio has two resident engineers (who are also business partners in the studio) in the persons of Eric Merz and Peter McTaggart.

Having descended the fairly steep stairs the studio lies through a door, then down





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# STUDIO FILE

# STUDIO FILE

four more steps. Though not the easiest access when carrying heavy equipment, at least you can park the car (not for long, though!) right by the steps and there are no corners to turn. The studio is quite small, about 30×15 ft with a concave ceiling that is high enough to avoid being claustrophobic while keeping the 'cellar atmosphere'. In order to reduce focusing effects, three panels composed of acoustic tiles and placed at different angles have been installed along the ceiling centreline. The rest of the acoustic treatment consists of glass fibre placed directly on the walls and ceiling with wood panelling here and there—such as by the piano—for a bit of extra diffusion. The floor is completely carpeted. Though very 'homegrown' in appearance, the acoustics work, and musicians generally like the atmosphere which is very conducive to getting a good group sound with everyone working together. Separation screens of differing heights and surfaces are also available in order to cut down on leakage or for special effects. Miking a guitar amp in front of glass tiles can sometimes work wonders, for instance.

Sinus have a selection of in-house instruments including: a Steinway baby grand, Hammond T200 with Leslie, Rhodes 73, Prophet 5, Oberheim OB-1, Korg vocoder, Simmons electronic drums and an Emu Drumulator; Vox AC30, Mesa Boogie, Fender and Ampeg amplifiers; plus a whole assortment of percussion instruments. The mic selection is sufficiently varied with manufacturers such as Neumann, AKG, Sennheiser, Shure and E-V being well represented.

Though there is a small control room window it is more like an observation port and most of the action is observed through several TV cameras placed round the studio. Access to the control room is through a vestibule that also serves as a relaxation area, with the control room and isolation booth leading from it.

The isolation room is large enough for an average drumkit plus drummer, though it tends to be used more often

## Sinus Studio (continued)



Peter McTaggart at Sinus' MCI console

than not for acoustic instruments that need to be separated off from the main studio. A TV monitor keeps the musician(s) in contact with the rest of the band with a small camera feeding a monitor in the studio to let the band know he's still alive. Visual communication to the control room is direct through a window. The acoustic treatment is similar to that in the studio and makes for a dry sound, thus providing for easy utilisation of processing equipment.

The dimensions of the control room are virtually the same as the studio's as the two rooms are made from two cellars side by side. The acoustic treatment is again fairly basic in appearance, being a mixture of acoustic tiles and moquette with a flattened off false ceiling. However, all is not as simple as it seems and the inner sub-structures, as well as the floor, have been floated from the main building with the result that surprisingly little structure-borne noise comes in from the road just outside. The neighbours are no problem, either, as the dividing walls are at least 5 ft of solid stone! While working there earlier I had noticed some noise from heavy roadworks nearby but they were pretty exceptional circumstances. There is also a certain amount of hidden bass trapping and the response of the room is pleasantly bright without being overbearing together with a smooth sound in the bass.

Monitoring is by two JBL 4330 speakers powered by a Harman-Kardon Citation 16 amplifier and equalised by Dolby E2 cinema units (this is

the first time I have encountered these in a studio but they certainly seem to do the job). The cabinets are mounted on a shelf just above the height of the console meter bridge, this same shelf also providing a support for the three video monitors for the cameras in the studio and isolation room. Nearfield monitoring is by a pair of console-mounted Auratones powered by an Amcron D75 with BGW amplifiers powering the foldback lines to the studio.

Recording centres around an automated MCI 500 Series console with 28 I/O channels routing into 32 buses and an MCI JH-24 multitrack, complete with associated rack of Dolby M24 noise reduction. Mastering and copies are carried out on Studer B67 and B62 machines and these both have Dolby as well. Cassettes for the musicians are not forgotten, either, and an impressive-looking Pioneer is deck-mounted in one of the racks. For special effects you can take your choice from an AMS DM2-20 Tape Phase Simulator, SAE parametric equaliser and ½-octave graphics, Roland pitch to voltage synthesiser and Dimension D processor, original Aphex A, four Valley People DynaMite gain reduction units, a pair of UREI LN-1176 limiters, Eventide Omnipressor, Instant Phaser and Flanger, H910 Harmonizer, Orban De-Esser, A+D Panscan and two Astronic (remember those?) 9-band graphics. Delay and reverberation effects are well catered for with Lexicon 224, 200 and a pair of PCM 42 units, Deltalab DL-4

Acousticcomputer, MXR DDL, AKG reverberation unit and, for the nostalgic, a Fairchild Reverbertron (2) 659 (now there's a name for you!).

In addition to the effects mentioned above, Sinus have various Filtek modules incorporated into the desk. Apart from not having to get up, it means that you can twiddle from the listening position. The selection of modules includes seven compressor/expanders, a pair of parametrics and a prototype compressor. Filtek are somewhat of a legend in Switzerland and though their products tend to be rather expensive, they do perform very well and have a characteristic sound.

In addition to their own premises, Sinus also have another studio 'wired for sound'—in this case, Bern Cathedral! This is literally just down the street and microphone lines have been installed so organ recitals, concerts and other events in the cathedral can be recorded. Provided they get permission beforehand, studio clients can also take advantage of the marvellous acoustics of the Münster, though this depends pretty heavily on the programme material.

Like most successful studios, Sinus would like to see more international custom. However, they do have one faithful with Stefan Sulke who enjoys worldwide success, especially in German-speaking countries and the US. For Peter McTaggart the pleasure of working with top professionals is very important and provides a much needed relief from the somewhat amateurish approach of many Swiss musicians. However, as he says, "We are here to serve the music, you know, and to do the best we can. We have to transfer on to tape what the artist is trying to express and not let our own feelings interfere with the vibrations. The music is the important thing, the technology is only there to serve it. We must always be careful not to let it come between the music and the realisation but use it to help it along."

**Terry Nelson**  
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# VARIABLE ACOUSTICS AT DANMARKS RADIO

**Keith Spencer-Allen visited Denmark's national broadcasting organisation's studios in Copenhagen to report on their recent extensive acoustical retrofit**

**D**anmarks Radio, the Danish national broadcasting organisation, has always had a very forward-thinking attitude to the recording of music and all sound programmes even from the days when recording was not so common place and much of their output was broadcast live. The majority of Danmarks Radio's production studios are situated in Radio House in central Copenhagen. Even in the late '30s when construction of the centre was started, the plans were for six studios with specific acoustics to complement the music that they were intended to be used for. For example Studios One and Two were to be used for orchestral music, Studio Four was for chamber music, Studio Three for light music and Studio Six was for jazz. The Second World War delayed the completion of the studios which were finally finished with the opening of the studio concert hall in November 1945.

To give a fuller background to the more recent studio design work, it is necessary to look at some of these earlier studios a little further. Not all the studios that were built as part of the original complex have been modified as yet, although there is a policy to gradually work through updating certain aspects of all the studios. Studio Two is a very good example—it was finished in 1942 and has a reverb time of about 1.2 s. It can accept up to 60 musicians and is these days normally used for orchestral light music. The studio area is totally wood, having a volume of 1,800 m<sup>3</sup>, and has not been touched since it was finished acoustically. The real problem with this studio is the control room (and in this case the literal English translation of the Danish word as 'cubicle' is probably more accurate) which is really too small to accommodate modern requirements.

The studio concert hall is one of the most incredible halls that I have seen and is again almost all wood, a very high ceiling and four tiers of audience with the rear of the very large stage area dominated by a large pipe organ. It has a capacity of 1,100 people, 13,000 m<sup>3</sup> and a reverb time when empty of 1.8 s. While great for listening to music in, the musicians could not hear each other so

well due to the ceiling height and so in the '50s large clear sheets of plastic were hung over the stage to reduce the effective ceiling height. For all its magnificence, again the problem with this recording area was the size of the control room and this was not something that could be cured so easily as the hall and musicians' difficulties. A few years ago, a completely new large control room was built at the side of the hall and this has solved that problem.

So firstly there were size problems with the control rooms and with changing emphasis in the recording process this became more acute. A second aspect was the previously mentioned variety of acoustics. The studio designed for jazz work had a reverb time of 0.5 s—already in the '30s they understood that jazz production needed a very well controlled reverb time while keeping a very even response at the low frequencies.

Studio Three had a variable acoustic system installed when it was first built in the early '40s. This was a highly complex system using panels that were hinged from the wall and could be set at differing angles which together with some variable high/low frequency absorbing panels could be adjusted from the control room and considerably vary the reverb time-against-frequency curves. At the extremes of the variable settings

it was possible to tilt the curve completely the other way. It was used to optimise the response for different music types in the one room. The panels were divided into 12 separately controllable sections and measurements proved it quite effective. Apparently there were drawbacks to the system in that although it was very flexible, it was really too complex to optimise easily for music. And possibly the greatest drawback was that the control system for moving the panels was pneumatic and it became quite noisy, with the occasional BANG in the middle of a live transmission. In the mid '50s the system was taken out of operation but there remained a feeling that perhaps they had not been too far away from the ideal situation with variable acoustics enabling a single room to be used for a wide variety of music types and applications rather than necessarily totally dedicating rooms.

This brings us to the purpose of this article—that 40 years after these early experiments Danmarks Radio are repeating the idea and have developed, together with Tom Hidley, a system that is easy to use and fast to change, effective—and lastly should not make any noise in operation.

## The early stages

It was in the late '70s that the subject of changing the equipment for the fourth time was considered. Dan Popescu, head of audio facilities design group radio and TV at Danmarks Radio: "We realised that it was nonsense to spend a lot of money on 24-track facilities without making changes to the acoustics. We started talking to Tom Hidley in 1977 and a layout was suggested and scrapped. It wasn't until June 1982 that the plans for the current studio were finalised."

Work on the reconstruction started in January '83 and was completed in December of the same year. This may seem like a long time but as you will see, there are a number of facilities that had to be developed especially for the studio and this of course takes time.

It was decided to use Studio Three for the new facility although by itself it was not large enough so the adjacent Studio Four, the old chamber music studio, was also included in the plans.

Rhythm studio looking towards percussion, drum and piano cages (left to right)



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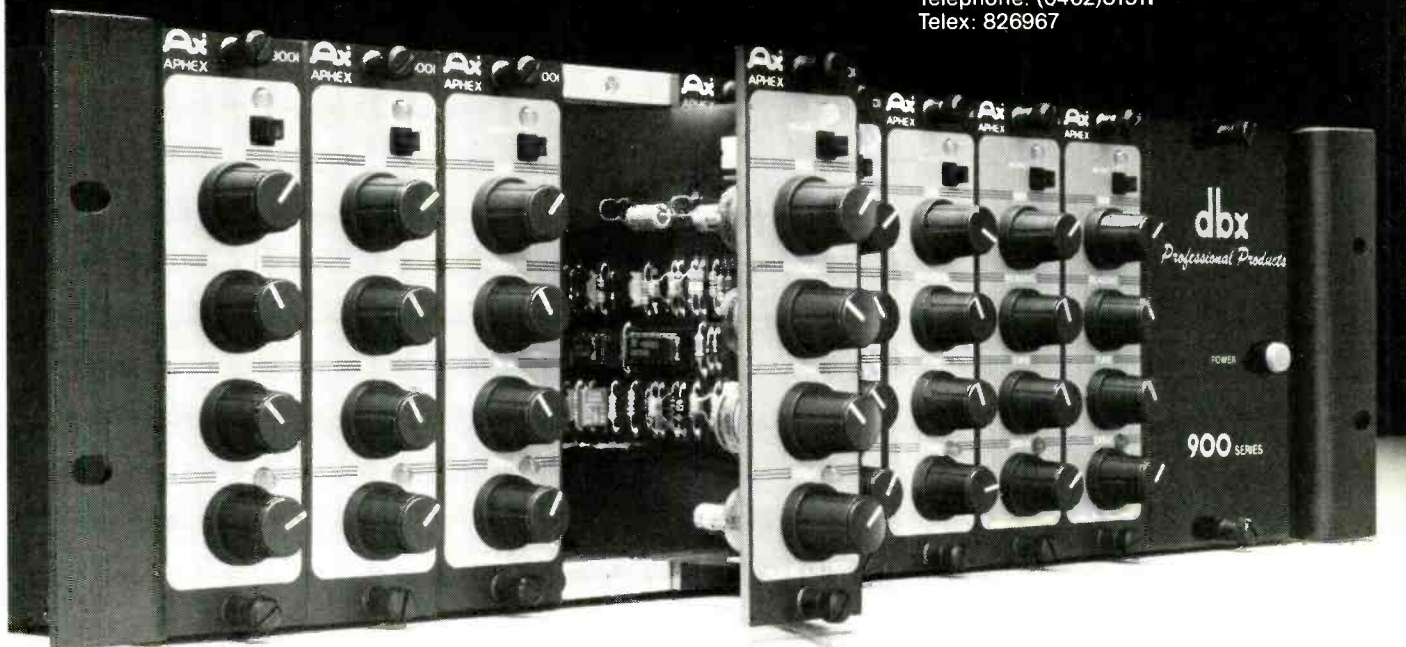


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## VARIABLE ACOUSTICS AT DANMARKS RADIO

Dan Popescu: "The existing control room in Studio Three was about 12 ft by 14 ft as they all were in the building and you really couldn't do anything with them."

It was decided that the completed studio would be used for music types ranging from chamber music and large light-music orchestras to big band and rock music productions not forgetting some radio drama work. These criteria meant that specific acoustic environments had to be created for types of instruments without compromising the sound and visual requirements of the musicians involved in recording. The large areas of the studio of course had to have variable acoustics that were easily changeable to meet these variable requirements.

The requirements for the control room were less experimental although equally stringent—it had to be large with good visual contact with all areas of the studio; as wide a uniform listening area as possible; and on the acoustic side, a uniform reverb time across all frequencies of about a 0.25 s and special consideration to be given to reducing early sound reflections to the listening position.

These were criteria that Sierra/Hidley felt quite happy about meeting. It should be noted that this was not the first such variable acoustics studio that Tom Hidley had been involved with although this project contained a great deal of input from the Danmarks Radio engineers with their special requirements and so it is substantially different in many areas.

### Construction

The final design involved removing the walls between Studios Three and Four so that Four became part of the recording area while the new control room was built at the opposite end of Three to the original, which will become a rest room. Removing the walls gave rise to a number of problems as the roof of the two studios supports a garden at the centre of the complex with a number of fairly mature trees. This meant that a couple of pairs of supporting pillars had to be introduced that can be quite clearly seen at the boundary of the two original rooms. Further, I understand, due to the increased weight of the new installation, the foundations had to be further strengthened.

### Finished studio

The main entrance to the Studio is through a wide door into what was the old Studio Four and this is normally referred to as Iso Room One and has a floor area of about 75 m<sup>2</sup>. It is an irregular wedge shape with a hardwood ceiling and floor, and the wall on your left as you enter is also hardwood although this may be covered by a

curtain. The long wall facing into the studio is 9 m long with six mirror sections that are 2 m tall and angled backwards slightly at the top to direct incident reflections towards the ceiling.

Dan Popescu: "If you stand in the centre of this iso room, you can tell that your voice is amplified—it is very live. The reverb time more than doubles from 400 Hz to 7 kHz jumping from 0.3 to 0.7 s and 0.7 s is not too much although for a room of this size it is enough.

"Secondly, it is very important for musicians to have strong reflections so that they can hear themselves and each other. This is most important with acoustic instruments such as violins and brass or wind sections. I was very happy a couple of months ago when I came in here one evening and there was a cellist playing here who said that this was wonderful as his cello was playing as never before."

Which goes to show the effect care for musicians' acoustic environment can have on musicians themselves.

The variable aspects of the acoustics are controlled from two panels—one within the iso room to control the

mirrors and another panel just inside the main studio floor. If the mirrors are remotely moved they slide across the wall and take about 1 min to stack behind a wall section in the corner exposing a very absorbent wall. They may also be independently positioned anywhere along the wall. Using time delay spectrometry techniques they have found that with the mirrors removed there is a 10 dB reduction in reflection level from this wall.

Using the other control panel which has a schematic diagram of the studio floor, it is possible to adjust many other acoustic parameters. The hardwood ceiling in the iso room contains several groups of remotely controlled louvres—about 20 in total each being about 18 inches wide and 3 ft long. They gradually turn as selected with the maximum position being vertical to the ceiling. Standing in the same place as before in the iso room, the sound is now very dry, the louvres exposing a large volume 40 Hz trap in the ceiling. These louvres form a substantial part of the ceiling and so the absorption effect is very strong but maintains a flat response

Looking towards rhythm studio from iso room



Iso room showing partially opened ceiling and mirrored rear wall



in the low frequencies. It is possible to alter areas of the ceiling for more localised effects if required and the louvres may be opened by different amounts—not just all or nothing; and the degree of movement is displayed on the panel by meters meaning that settings of the acoustics are repeatable.

This large control panel also adjusts the drape curtain over the wooden wall by the entry door as well as the lighting throughout the studio floor. All these controls are duplicated within the control room so it is possible for the engineer to adjust the acoustic while at the console.

Also controllable from the panel are interlocking glass doors that separate the iso room from the main studio area by sliding along the boundary from both sides of the room. It is also possible to remotely adjust drapes to cover this glass partition by sliding along on both sides—in the iso room and main studio sides. With the glass fully across, communication between the two halves of the studio is through an opening glass door in the sliding glass section so it is not necessary to open the partition to get out quickly. With the drapes, the louvres and the mirrors in their 'deadest' position, the sound is remarkably dry for a room of its size. The partition adds a separation of between 12 and 15 dB between the two areas. I found it impressive that it takes under two minutes to change the acoustic from one extreme to the other and proportionately less for any position in between. And that this can be achieved remotely and repeatably from the control room is very powerful in acoustic terms.

The iso room is generally used for the strings and woodwind sections of a light orchestra and can seat about 25 musicians.

## Main studio area

More generally referred to as the Rhythm Studio this is immediately opposite the control room window and has a floor area of about 90 m<sup>2</sup>. As mentioned in the design criteria, this room has dedicated areas for a selection of instruments including drums,

percussion, guitar amplifiers and piano and can hold about 20 musicians.

Part of the design criteria for this area was to achieve a tight, well-controlled rhythm sound. In general, the room has either hard reflective surfaces or heavy trapping spread around the walls which are a highly irregular shape, with the control room almost reaching out into the room.

The drum 'cage' is open in design, having a far lower ceiling height than the main room, a floating floor and is fronted by moveable screens. Even here there are variable acoustics—there are heavy wooden walls behind the drummer that give a very live effect to the player but the reverb time is very short. There is first reflection from this wall but then everything is absorbed as the low ceiling hides a vertical trap of about 2½ m and to aid this the walls of the rear of the cage are angled slightly backwards. The floor is heavily carpeted. The heavy-duty screens at the front of the booth are generally absorbent side in, although it is possible to reverse the sides and have the reflective hardwood side in.

Dan Popescu: "We had a very interesting rehearsal with a big band in here a few weeks ago. At first the drummer was quite happy with the sound he was hearing from his kit but he had to stop when the orchestra played more quietly and ask for headphones. The alternative in this case could be to draw the drapes that hang either side of the rear reflective surfaces and lose that first reflection."

The percussion cage is to the left of the drums looking from the control room. This is similar to the drum cage but there are no reflective walls or screens although there are the hanging traps. The acoustic in this area sounds quite different even though it is right next door.

Although referred to as the 'piano cage', this is really just an area at the far end of the studio to one side of the drum cage which is surprisingly open. The end wall is heavily trapped and of course this is the side that the piano opens up to. Between the drums and the piano trap is the only bit of rock in the

studio in the form of a panel reaching to the ceiling. Its main function is to disperse the HF energy from the drum cage.

A low velocity air conditioning system has been fitted—those are the tubes in the wall above the drum and percussion cages. The noise generated is apparently about 15 dBA. It is a large capacity system that can cope with up to 70 musicians. I found the system completely inaudible in operation although in certain areas of the studio you could feel air movement.

What were the general feelings so far about this area of the studio? Dan Popescu: "After two days trials with our big band, the musicians were saying that it is very dry but still pleasant to play in—as well as being very analytical. But the day before we had an orchestra of non-professional musicians and they didn't like it as it showed too much. All they were hearing is what you are finding at the console anyway."

The roof of the rhythm room is angled up to meet the multi-angled control room window. There are also two variable rotating ceiling panel areas as there were in the Iso Room One ceiling although it is not yet known quite how effective this will be.

## Ambiphonic system

The studio has what Dan Popescu describes as an 'ambiphonic' system. This is largely intended for use when the studio is used with a live audience such as for a chamber music concert. The musicians would be in Iso Room One and the audience in the rhythm area. A microphone near the musicians picks up the sound of the music which is then distributed throughout the rhythm/audience room by 11 Bang & Olufsen type 5702 speakers arranged asymmetrically in three groups with two speakers on the wall. However in between the mic and speakers there is a Klark Teknik DN700 digital delay line with delays at 35, 65 and 105 ms together with a Lexicon 224 digital reverb on the large concert hall program on 1.8 s average reverb time and 30 ms predelay. The delays and reverb are level matched and distributed to the speakers in a particular pattern.

The system is apparently very effective on music although experiments are still to be carried out for more specialist uses such as speech. It was demonstrated to me using someone talking in Iso Room One. The effect was subtle, not exactly startling although turning off the system is very noticeable. An experiment had previously been tried with the audience in the iso room and a jazz band in the rhythm room—without the ambiphonic system of course—and apparently the results were again very good which certainly shows the flexibility of this studio.

## The other iso room

The way into the control room from the studio area goes through another iso room. This feels very dry although it does have two wooden reflection walls and a wooden floor so the room is not so claustrophobic as its very short reverb time would suggest it may feel.

Towards iso room from rhythm studio area



## VARIABLE ACOUSTICS AT DANMARKS RADIO

Obviously designed as a vocal booth, it has a glass door into the studio area to maintain contact.

### Control room

This is a very large control room of about 50 m<sup>2</sup>—one of the few I have seen where a SSL 4000E 48-channel console has room to breathe. Danmarks Radio opted for this room size—partly as a reaction against their previous small control rooms and partly because of increasing pressures from musicians to get their keyboards in there. This is not something that they try to resist. 'The engineer, producer and the musician are all the same family so why not bring nearly everything into the control room?' was the comment made.

The control room window is in three sections affording good coverage of the studio area. It is also a three layer window with glass of 14, 12 and 10 mm thickness. I was told that measurements have given about 70 dB separation from 250 Hz upwards and still keeping very high even at bass frequencies.

The monitors are Genelec 1025 which are active 3-way systems, the power amps being mounted either side of the TV monitors. These are the first Genelecs in Danmarks Radio—they had previously used Lansing 4343s although they had tried Eastlake monitors in Studio One. They felt that the Genelecs offered a good compromise—high power handling capacity while still sounding good on both rock and classical music.

The room is perfectly symmetrical, with particular attention having been taken to avoid uneven left right reflections and so all the processing equipment is installed in a rack no higher than the desk. Aside from the normal *Harmonizers*, delay lines, etc. this rack contains four stereo mic controllers for XY MS conversion with width control, an intercom system, connections to a 120 m<sup>3</sup> echo chamber, remote controls for a camera with pan and tilt for obscure corners, lighting dimmers and the remote controls for the studio area acoustics.

The majority of surfaces within the room appear to be wood although there are traps under the control room window, to the sides of the desk, above the ceiling and to the rear of the room. All the tape machines are in a recessed area that runs across the rear section of the room. These include Studer A800 multitracks with editing and mastering machines, the Studer A80R which in the opinion of Danmarks Radio is the machine most suited to them—as Dan Popescu put it: "The man machine interface is very important and not just something to present papers to the AES on—you can get your knees under the A80R."

The SSL 4000E console has 48 channels with SSL *Primary Studio Computer*, *Total Recall* and *Real-Time*



Spacious control room housing SSL 4000E, producer's desk and Studers

systems and printer. Danmarks Radio appear to be standardising on SSL consoles with this console being their fifth and with about as many again on order. Due to the fact that some of their work may be live on-air, there are extensive back-up facilities including spare power supplies with automatic changeover unit and a computer bypass unit that will switch the SSL faders back onto the VCAs if you don't intend to use the computer, or bypass it in the event of problems.

With the remotely controllable acoustics being variable from the control room it is only a short step to try to place the settings under the SSL *Total Recall* system. This is under consideration at present and is apparently quite feasible.

Behind the console there is a producer's desk equipped with talkback facilities. Aside from this there is no more equipment in the control room, as most of it is placed in the equipment room which is through a door at the rear of the control room. This houses the SSL computers, power supplies, back-up power supplies, with automatic changeover unit and the computer bypass unit. The air conditioning is a separate system from the studio to allow complete control.

Remaining equipment within the racks includes patchfields for inter studio patching and video lines in the case of TV work, and the noise reduction systems for the multitrack—telcom *c4* in *TTM* frames which they have now standardised upon, the power amplifiers, ambiphonic system processors and some of the neatest wiring that you will ever see.

On the way to the equipment room, it is still possible to see part of the original room with its 8 m ceiling height—plenty of room for trapping.

### Listening

It was not possible to listen to very much

material although a programme feed from one of the other studios was linked up. My only subjective comments could be that the room sounded very natural in that it would not take a great deal of getting used to before you felt quite at home. In fact you could really say that in many ways the room was really not audible and you were only really listening to the speakers. I think that the most difficult thing about the studio would be getting used to the size of the control room rather than the sounds within it. As this room was designed by Tom Hidley while he finalised details of his update design package, and uses non-standard speakers to his norm, it is particularly interesting and I think something that everyone can be rightly proud of.

The studio area is quite remarkable and the only way to appreciate what variable acoustics really means is to stand in the room and hear it change from one extreme to the other in under two minutes—or sit at the desk and hear it change through the monitors.

On the afternoon of my visit to the studio, it was being officially handed over for regular use. It was very interesting to talk to some of the engineers, one of whom had been engineering when the studio was in its original style with the pneumatic variable system and the tiny control rooms. It was to me the final word to discover he was as keen to experiment within this wildly different studio as were the younger engineers. It shows that Danmarks Radio have not only developed a spectacular new studio but also found a way to continue a tradition of experimenting across major design changes. □

#### References

Readers who would like to follow up certain aspects of this studio and in particular measured results should consult AES Preprint 2075, presented at the 75th AES Convention Paris by D Popescu entitled 'A studio with variable acoustics for multitrack recordings'.



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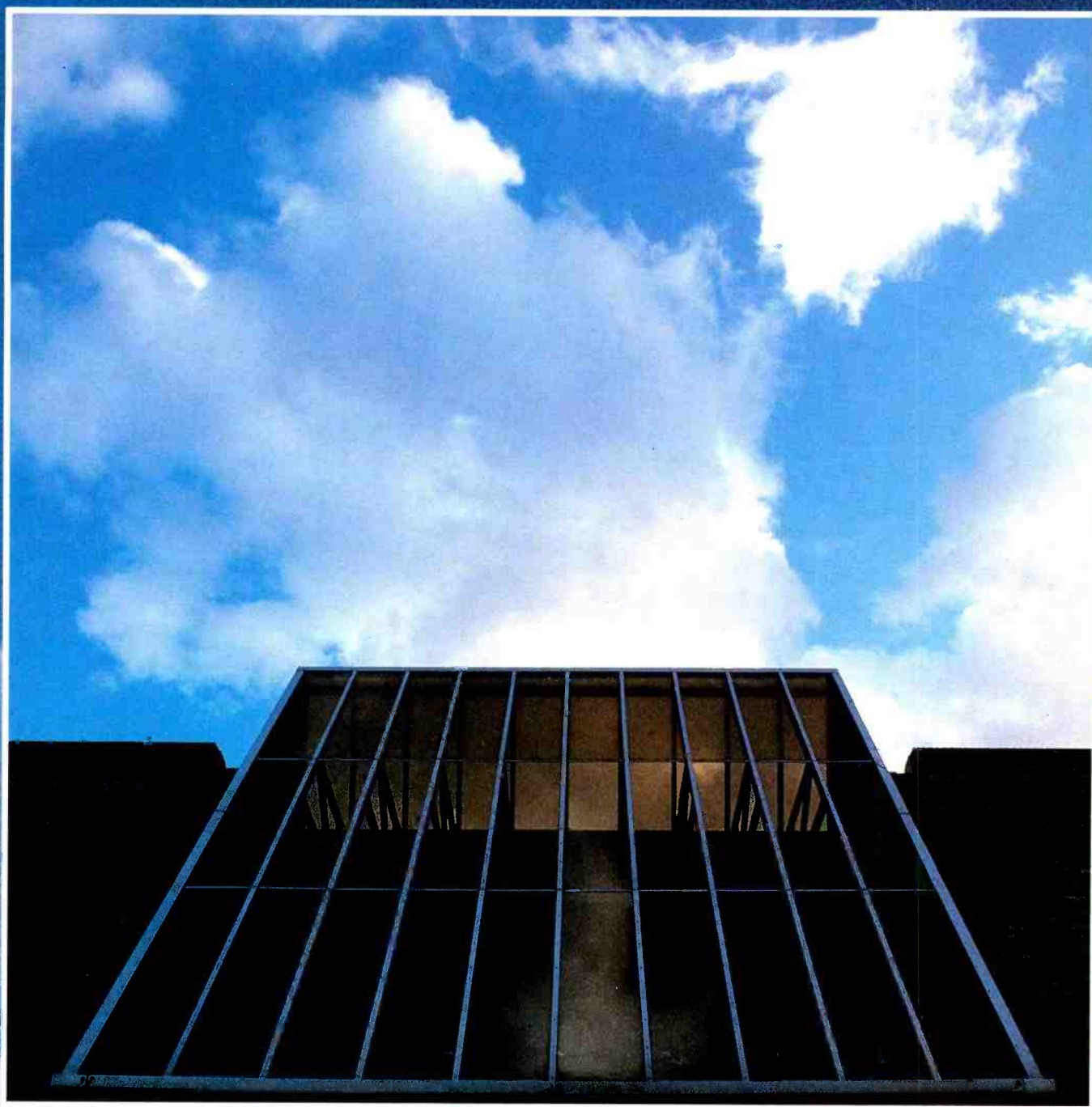
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# LETTERS LETTERS

Letters should be marked 'For Publication' and sent to the Editor at the Croydon address on page 3

## Permanent PA

Dear Sir, Stephen Court's article 'Live Sound Evolution' (June 1984) raised some points upon which I would like to comment.

Perhaps no one on your side of the ocean has installed a permanent or semi-permanent sound system, but here in Montreal, it seems to be de rigueur! I personally have the pleasure of operating such a system, comprising of a Soundtracs Omni 16, Fane Bullets (bless your British gear), and QSC power amps. While admittedly the venue is small (capacity: 100), there are halls of 800+ capacity that operate house systems that are complete from mic to loudspeaker, or at very least, supply loudspeakers and amplification. In fact, off hand I can think of at least five such equipped venues in the city.

The advantages are many: wear and tear on the equipment (and engineer) can be minimalised, and, more importantly, systems can be fine tuned to the nth degree.

No one has yet installed a permanent system in an arena for an obvious reason: it is simply not cost effective, in light of the fact that any arena you care to name is used at least 85% of the time for sports events and other gigs which would not require extravagant sound reinforcement. However, to state outright that no one has gone this route is not true in these parts. Yours sincerely, Neil Schwartzman, House Engineer, Station 10 Pub, Montreal, Quebec, Canada.

Your point is taken. The introduction to Stephen Court's article did however mention that 'Live Sound Evolution' was intended to present the 'UK angle' and not necessarily be accurate on a worldwide basis.

## Equipment dilemma

Dear Sir, While I fully accept that brand loyalty should not be the sole reason for buying a particular item of equipment (your editorial September issue), with the current reluctance of manufacturers to publish comprehensive specifications for their new digital 'babies' there are often no other criteria left. For example, when Tape One ordered its two Neve DSP consoles there was not even a laid down frequency response curve. Our only 'guarantee' was that, after around 15 years in the mixing desk business, we believed they would not develop and manufacture a product which did not exceed the capabilities of their existing consoles.

Tape machines present their own set of decision making problems. Most studios have a favourite make of recorder, but when it comes to digital machines a number of new names have emerged.

Alongside Studer, MCI, Ampex, etc. we now have Sony, JVC and Mitsubishi. OK, for Sony read also MCI but where does this leave the marooned Ampex customer? Brand loyalty poses my company a particular problem in this respect. With 14 Studers and two 1610 systems in-house, from whom do we purchase the two DASH machines we intend to acquire next year? Neither are yet available for evaluation but to wait until they are will put us way down the delivery list. The answer, I suppose, is to order one of each!

Until manufacturers stop playing their new developments so close to their chests and are prepared to commit themselves to intended performance figures, studios will continue to be faced with this dilemma, especially as most larger organisations have to allocate their budgets some considerable time in advance.

Yours faithfully, Bill Foster, Director, Tape One Studios, 29/30 Windmill Street, Tottenham Court Road, London W1P 1HG, UK.

## Tape speeds

Dear Sir, Further to Barry Fox's item on tape speeds (Metric vs Imperial) in the July Studio Sound; could he explain why early EMI tapes were recorded at 30.31 in/s (77 cm/s)? A well known example of a master tape recorded at this speed is the Furtwangler Tristan of 1952, but there are also others. I had always assumed that this arose from a similar mystical and convenient size for the mechanics of the BTR-1, but nobody has ever given me a convincing explanation.

I seem to have read frequent complaints by Mr Fox about the lack of a biography on Blumlein. I think it's time he stopped harping on about this and wrote the book himself!

Yours faithfully, David A Pickett, Director of Recording Arts, Indiana University, School of Music, Music Building, Bloomington, IN 47405, USA.

## Barry Fox replies

In short I can't answer your question, but hopefully if your question is published, someone else will.

With regard to your comments on a Blumlein biography the answer is very simple. For 10 years Francis Thomson of Stamford has been saying that he is writing it. Many of the people who have supplied him with biographical information are now dead. There is no way that I or anyone else can write the book without access to material made available to Mr Thomson. A biographer who has collected material is hardly likely to make it available to someone else while still interested in writing his own biography. We can only hope that when Mr Thomson's biography of Blumlein is finally published, or if he finally decides to abandon the project,

the original material will be made available to other researchers.

## Wayne Kerr AMS1

Dear Sir, I would like to point out to you what I consider to be slightly misleading comments in the January 1985 issue of Studio Sound.

On page 90 there is a review of the WKR test set. Near the beginning of the article written by Martin Colloms is the following statement:

'Through various company tie ups, Wayne Kerr absorbed the Ferrograph instrument division. Engineers familiar with the latter's long established RTS series will see some of that inheritance reflected, in the AMS1 which to some extent picks up where the RTS left off, continuing a trend towards greater performance and enhanced facilities.'

I should like to point out to you the following:

● At no stage in the past has Wayne Kerr ever owned Ferrograph as is implied in the statement. Ferrograph and Wayne Kerr were both owned by the same parent company until September 1977.

● The statement leaves the reader with the impression that the Ferrograph RTS2 is no longer produced and has been superseded by the AMS1. This is not the case. The Ferrograph RTS2 is still manufactured and sold by AVM Ferrograph and is still an extremely popular machine with its many thousands of users.

I would be grateful if you could point out these discrepancies to Martin Colloms and also to your readership.

Yours sincerely, T. Batey, Managing Director, Audio Video Marketing Ltd, Unit 20/21, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 3HR, UK.

## Styli and mastering

Dear Sir, Your articles on mastering and lacquer manufacturing (August and October, 1984) make an important statement about the necessity of improving analogue record quality. However, they left out significant contributions made by other companies. As the largest manufacturer of recording styli we were dismayed to find no discussion about the importance of the recording stylus in mastering. The article on lacquer manufacturing did not mention our 100 series master lacquers, which have had a substantial effect on improving mastering quality. These lacquers, on the market only two years, are used by virtually every major studio in the United States.

The recording stylus, a component critical to mastering quality, is consistently overlooked in discussions on mastering. To reduce this tendency, Micro-Point has been publishing technical articles on styli for the past 17 years.

# LETTERS LETTERS

However, the omission of information on styli in both of your articles leads us to believe that much more attention to styli is needed! Many areas have never been covered at all; such as developing a procedure for testing lacquer and styli performance, magazine reviews of the different lacquer brands, and analysis of the different characteristic 'sound' of each lacquer.

In addition to technical bulletins, our company has introduced new products series 100 master records) and concepts (matched mastering components) to improve mastering quality. Spending large sums of money on new equipment to improve quality can often cover up quality control problems. Solid technical support from studio suppliers and careful attention to detail offer the most profitable avenue toward improved recording quality. They are both relatively inexpensive and extremely effective. We have outlined below some key aspects of our approach to improving mastering quality.

- Styli dimensions affect mastering performance. There are trade offs in performance with different sizes such as changes in S/N ratio, maximum recorded levels, inner diameter distortion, stylus life, etc. Studios should first determine which trade offs are most important, and then choose stylus dimensions.

- Studios should stock styli with at least two different facet dimensions to allow them to be matched to the varying characteristics of lacquers and lacquer brands.

- By matching our recently introduced master records with our own styli, we have developed a new concept in mastering—matched mastering components. This allows studios to use products designed and tested to work together, while still offering choices in stylus dimensions.

To achieve the highest mastering quality, one must continually evaluate and test each component involved in the process. From our 18 years of experience as a supplier to mastering studios, we recognise that consistent quality is a difficult but attainable goal.

Thank you for giving us the opportunity to present our views.

Yours sincerely, Edward Schwartz,  
President, Micro-Point Inc, 45  
Kensico Drive, Mt Kisco, NY 10549,  
USA.

## Putting the record straight

Dear Sir, It has been brought to my attention by Polygram in Hannover that, in my article on CD Mastering (October 1984), I wrongly attributed a comment on pre-emphasis to them and I would, through your magazine, like to put the record straight.

Polygram's reason for recommending that pre-emphasis is not used when preparing masters for CD manufacture is solely because of the reduction in recording level which may be required when emphasis is used, resulting in a CD of lower audible level.

My comments about the HF distortion which may occur when signals with a high HF content (such as those with emphasis) pass through the A/D and D/A converters at close to full modulation, were the result of a conversation between

myself and some other engineers at a recent AES. However, it would seem that I was mistaken in my belief that it was a Polygram engineer who brought this particular phenomenon to my attention at the time.

I hope this will clear up any misunderstanding that I may have created about Polygram's CD policy.  
Yours faithfully, Bill Foster, Tape One Studios, 29/30 Windmill Street, Tottenham Court Road, London W1P 1HG, UK. □

## There are many ways to split a mic, but only one way is best

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When you need to split a mic, you should use a transformer because it provides a balanced, isolated signal to the input of each mixer; none of the mixers' grounds need be connected to each other (via the mic cable) so ground-loop induced noise is easily avoided. There must be a Faraday shield on each winding so that the transformer will not provide a path for capacitive coupling of common mode noise.

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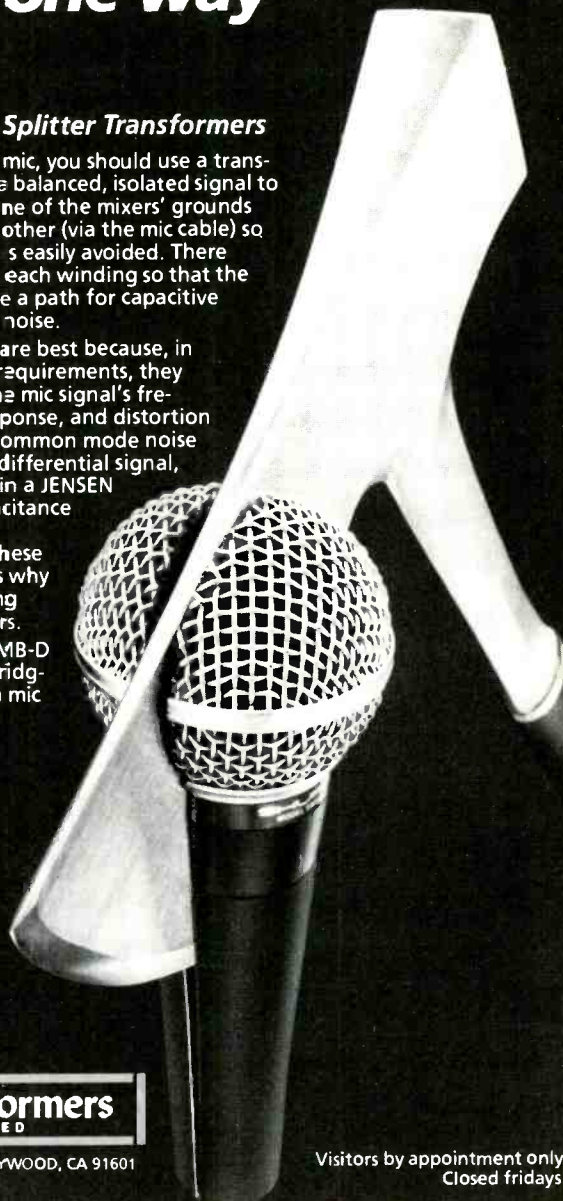
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# INTERNATIONAL COMPUTER MUSIC CONFERENCE PARIS

**T**he 1984 International Computer Music Conference was held during October 19 to 23 at IRCAM in Paris. IRCAM, which is an acronym for the *Institut de Recherche et Coordination Acoustique/Musique* (which translates rather obviously into English), is the high-tech centre attached to the George Pompidou Centre, set up in the first half of the last decade by the French government and composer Pierre Boulez.

This year's ICMC was the tenth such event, previous ones all being held in the United States, except for the 1982 conference, which was in Venice. There were four days packed with papers, concerts, and demonstrations, preceded by opening night ceremonies that featured the premier of Boulez's latest grand opus for instruments and computer, and extended into four days of post-session sessions on music printing and musicology, and more concerts.

## Papers and more papers

The papers were grouped under headings like Studio Reports, Software, Signal Processing, Control in Live Performance, etc. The Studio Reports ranged from a rather hastily-assembled videotape featuring the voice and visage of Lucasfilm's Andy Moorer describing the ASP (Moorer himself declined to come), to a treatise on the efforts of a group of Swiss musicians to assemble a computer-music studio in the face of the 'Byzantine, Baroque, and complex politics' of that country. The technical papers often had names such as 'An expert system for Schenkerian synthesis of chorales in the style of J S Bach' and 'Musical sound synthesis by means of two-variable functions', or described esoteric composing languages to be implemented on various mini and mainframe computer systems.

The papers were given simultaneously in French and English, with a pair of extremely competent translators encased in a glass booth—United Nations-style—at the side of the Projection Space at IRCAM, doing their bit over wireless systems that conferees could receive over multi-channel headphone systems given out at the door. The acoustics in the space were muddy enough to make some attendees keep the headphones on at all times—when they selected the channel with the language that the lecturer was speaking they got a direct feed from his microphone.

Although a lot of the conference was pretty dull stuff to the average working

## Paul D Lehrman reports on an annual conference which attracts composers, programmers and technical types from all over the world

musician/journalist, there were some significant high points. For many attendees, the highest was a lecture/demonstration by Barry Vercoe of the Massachusetts Institute of Technology's Experimental Music Studio, with the assistance of flautist Lawrence Beaugard. In true IRCAM style, Vercoe gave his lecture in the Projection Space on the bottom floor of the underground complex, which was set up for large audiences, while Beaugard performed in Studio V, a small room two storeys above, in front of half-a-dozen listeners, and the two communicated via audio and video links.

Vercoe has spent much time recently exploring the relationship between live performers and computers. One program he has written allows the computer to act as an intelligent accompanist to an instrumentalist. The computer reads data from the instrument, a flute in this case, by a set of optical sensors mounted around the pads of the flute, and by a

Some exhibits were staged outside



Concerts were a large part of the ICMC



pitch-reading device. The first example Beaugard played was a Handel sonata, in which the computer produced short, harpsichord-like sounds ("No-one who's ever heard a real harpsichord will be fooled by this," said Vercoe), to accompany the flute. The machine followed, Vercoe explained, the beginning of each flute note; if Beaugard slowed down or sped up, the computer would follow right along.

The second example was a bit more complex. It was a slow movement by W F Bach, in which the computer played longer, string-like tones. In this case, the machine not only had to adjust the initial timing of each note, it also had to calculate the proper length of each note to make it fit the tempo. In the third example, a highly complicated piece by Vercoe featuring fast tempo changes, oddly-divided measures, multiphonics, and sundry other contemporary techniques, the computer had to swiftly calculate attacks, note lengths, and rhythms in a very intricate counterpoint with the flute, and even know when the player made a mistake and how serious it was. It did so marvellously.

"The pitch detector has to be simple and straightforward," said Beaugard. "If the algorithm is too complex, it introduces delays which upset the relationship between the player and the machine. The optical sensors can't be used by themselves, because players' finger notes before they actually play them. If the machine is sensitive only to which keys are pressed, it gets a very warped sense of the tempos." Various versions of the program had different response times, and Beaugard found he would unconsciously adjust his playing to the machine, but each time a new version of the program was implemented, he would have to realign his sense of timing. He likens the system to a heat-seeking missile: it keeps adjusting its course as it gets closer to the target. "But if the target disappears—that is if the performer skips a beat—it gets lost." There is also a certain amount of 'play' in the system, and the performer has to keep on his toes. "The machine has good and bad days," said Vercoe.

The system, which works now only on a dedicated mini-computer system, but has significant commercial potential down the road (although Vercoe never talked about commercial applications, heaven forbid) allows the player to input special instructions without playing notes by pressing particular non-conventional fingerings. The low-B key, for example, when pressed alone, can be read by the computer as a timing pulse, ▶

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so that the performer has control over the speed of the accompaniment even when he is not playing—in effect, he is 'conducting' the automatic orchestra.

Another remarkable lecture was given by Richard Teitelbaum of West Berlin, under the title 'The Digital Piano'. Teitelbaum has linked together three grand pianos equipped with Marantz *Pianocorder* systems through three 6502-based microcomputers, all controlled by an Apple II+ equipped with a 68000 co-processor. He has written a musical performance program called 'Patch Control Language' which contains some 32 command 'modules', which handle such functions as transposition, looping, speed change up to nine times faster or slower, reverse play, random note generation, etc. Music can be played on one piano, recorded, modified through the Patch Control Language, and then played back on either of the other two pianos, using a Marantz *Vorsetzer* system, which uses solenoids to actually push down the keys—hence the system is quite portable, and can be installed on any piano.

Teitelbaum's demonstration tape consisted simply of major scales, continually building on each other to create a sound environment not unlike something by Steve Reich, but infinitely denser.

## A little trade show

Besides the lectures, there was a product display room, behind the main reception area at IRCAM. David Bristow, of Yamaha-UK, who also gave a paper on voicing the *DX-7* in a session called 'Affordable Systems', was showing Yamaha's *CX5 MSX*-based music computer with 8-note polyphonic FM sound generation, 16-colour graphics, and 32 kB of user RAM, all running off a *Z80A*; the *QX-1* digital sequencer; and the *TX816 FM Voice Generator System*, which is essentially eight *DX-7*s in a rack-mountable box with no keyboard or controls, but is meant to be addressed by external controllers through a MIDI bus. The *CX-5* will be available around May, while the other units are scheduled for delivery to Europe during the first quarter of 1985, and in America a bit later. Bristow depressed quite a lot of people at one point by linking his toys together and performing a very loud *Bolero*.

Fairlight was showing its *Voicetracker*, which it had premiered two weeks previously at the New York AES conference. The self-contained system is essentially a real-time pitch reader that uses a microphone for an input, and outputs MIDI data, for use by a Fairlight *CMI* or any other synth. As shown, it reads incoming sound and displays it as a constantly-shifting horizontal line that scrolls across a video screen, showing relative pitch within a specified range. Eventually, it will have some 16 functions on board, like adjustable response time, smooth or stepped pitch display, and the ability to show amplitude and harmonic content as well as pitch, but for the show only a couple of the functions were operational. The unit, built around a 68000 processor, will be available around March, with a

## INTERNATIONAL COMPUTER MUSIC CONFERENCE PARIS

projected price of \$2,000 to \$2,500.

Fairlight was also dropping many hints about its *Series III CMI*, which will have true 16-bit audio resolution and 16 voices, and may feature a touch sensitive keyboard made by Key Concepts, the American makers of the *Notebender* system (see May 1984 issue).

## Music—sort of

Concerts were a large part of the ICMC, as they are every year. In addition to formal programs given in various rooms at IRCAM, the Pompidou Centre, and Radio France across town (conferrees were shuttled over by buses that invariably left 10 minutes before they were supposed to), informal presentations were given at the petite Salle at the Pompidou Centre (which were not very well organized or produced) and attendees could also sit in one of IRCAM's reception areas and listen to up to 16 different compositions each day over two 8-programme headphone systems, and even watch a performance of a Stockhausen piece on video.

Much of the music performed at the concerts had just about as much life as the titles of the papers, an unfortunate but unavoidable consequence of putting so many academic types in the same room. A case in point was the opening night concert of Boulez's *Repons* conducted by the composer, a truly gala affair. The grand Salle at the Pompidou Centre, a rather acoustically undistinguished room resembling a whitewashed warehouse, held an audience of about 1,000, who showed up in all manner of dress from blue jeans to tuxedos. Conference attendees were given free tickets for the event, but Parisians could be seen lining up at the box office for days before the concert, and it was completely sold out.

This was actually Boulez's third version of the piece, the first having

been performed in October 1981 on a commission by the Southwest German Radio, and the second 11 months later at a BBC Proms Concert in London. It calls for an orchestra of 24 musicians playing conventional instruments seated in the centre of the hall, with six soloists or duos seated in the corners. The instruments in the corners were miked, and the signals were fed through IRCAM's *4X* computer-based synthesiser, as well as various Publison and Audio+Design processors. Mixing was handled by a bank of EMT consoles, and a rack of Studer power amps pushed some frighteningly large JBL speakers hanging over the audience.

The piece started with a lengthy statement from the orchestra, in the by now-familiar impenetrably dense style that is Boulez's trademark, which was interrupted by a beautiful loud clanging noise from the amplified/modified soloists. The piece continued back and forth like that, with dreary stuff from the centre, and much more interesting looped, filtered, time-delayed, pitch-shifted stuff coming from the corners. As it was the only piece on the programme, many in the audience were afraid that they were to be forced to sit through 90 minutes of this; fortunately for them, it was slightly less than half that length. As Boulez took his bows, his first acknowledgement was to his technical crew, followed by nods to the musicians.

The Sunday night concert at Radio France was the only other formal performance I had a chance to attend. The auditorium at the *Maison de Radio* contains a full concert-hall type stage, complete with pipe organ, but the seating area is only about 10 rows deep; approximately 250 or so seats in all. This night, instead of the stage being occupied by the members of the ORTF, it was filled with some 15 pairs of loudspeakers of all shapes and sizes, from tiny Yamahas to DCMs to giant JBLs, as well as some unidentifiable spherical and hemispherical things that were also scattered throughout the audience. Each speaker was softly lit from underneath with a tiny floodlamp, giving the audience the eerie sense that these inert

Demonstration on the Yamaha stand. David Bristow of Yamaha-UK also presented a paper





boxes were somehow going to perform for us.

In the middle of the audience sat a computer terminal, which remained dark throughout the evening, and a mixing console/speaker switching matrix, which the composers used to enliven their pieces. There were three pieces, from the composers Jacques Lejeune and Arnaud Petit of France, and Richard Karpen of the USA. Occasionally the composers manipulated the sound system well, other times it was done rather jerkily and obviously. Someone quietly voiced the suspicion that actually none of the speakers was hooked up, but rather all the music was coming from a pair of 4311s stuck in the far corners of the stage. Probably none of the pieces will be remembered into the next century, but some interesting sounds were produced. For me, the chief purpose of the concert was to inspire me to jot down an axiom that I humbly believe should be engraved on the terminal screen of everyone who attempts to compose music with a computer: any sound, no matter how interesting, becomes boring if repeated often enough.

And there was another useful aspect to attending this concert: on the bus back to IRCAM I found myself engaged in a conversation with the most unusual person I met at the conference: a gentleman from Ireland who is not a computer composer by any means, but is involved in developing a computer program that will analyse and categorise several thousand Irish folk melodies. He has also been handed the assignment of building an official archive of traditional Irish music, and we got into a delightful discussion of the pros and cons of various cheap digital recording systems.

## MIDI—no longer a dirty word

This year, for the first time at an ICMC, the word MIDI was officially uttered. In fact, there was even a panel discussion on the subject, with representatives from quite a variety of the MIDI developers and users having their say. Many were dismayed that, because the pop music community had gone ahead and done something without the help of the heavy-duty researchers and academicians, serious computer musicians were poo-hooing the whole idea. "With MIDI, we're lagging behind the rock-and-roll community," said Canadian composer Bill Buxton, "and that's a first." Gareth Loy of the University of California at San Diego put it another way: "Everyone says that MIDI is rock's answer to computer music and what can we salvage from it?—but I think this condescension is unjustified." All agreed that the available software is far behind the capabilities of the hardware, and all agreed that the data transmission speed of the MIDI protocol is a significant disadvantage. Another problem cited is that the system is essentially one-way: computers can tell synths what to do, but the synths cannot report back to the computer how they're doing. There were also several questions from the floor about how interested parties could get in touch with the International MIDI

Association, whose existence was announced in the issue of *Computer Music Journal* that came out simultaneously with the conference, but which seemed to have managed to sink without a trace during the magazine's six-month lead time.

Antonio Boseto of Italy proposed a 'SuperMIDI' that uses vertically-organised data (it was a little unclear, but it sounded as if he was talking about a parallel interface, as opposed to the current serial set-up), but Emmanuel Favreau of IRCAM said that the most important advantage of the current format is that it was a standard, and that coming up with a new incompatible format would be extremely dangerous.

Buxton and expatriate American George Lewis both proposed ways of getting around MIDI's speed restrictions: distributed processing. Lewis described a system that uses three Apples that communicate 'fake MIDI' to each other in the form of RS232 codes, and then each one controls its own synthesiser with a real MIDI bus. Buxton went a

little further. "Software writers have to understand the difference between a data structure and a communications protocol," he said. "The two are completely independent. If you write software that will only do some form of primitive communication, you lose all chance for any kind of sophistication." He proposed that someone designed a bi-directional local area network (LAN) for handling music data, with individual convertors for each channel to feed the individual synthesisers. "It would make a great Master's thesis for somebody," he laughed.

"All of the fancy stuff that Barry Vercoe talked about can be handled by an Apple or an IBM PC," he said. Interconnection problems can be eliminated—he pointed out that in his equipment setup, which has a 'spaghetti' of cables handling control-voltage and gate information, the breakdowns all occur in the cable connectors. "MIDI allows us to get past the technical problems," he said, "and allows us to deal with musical problems." □

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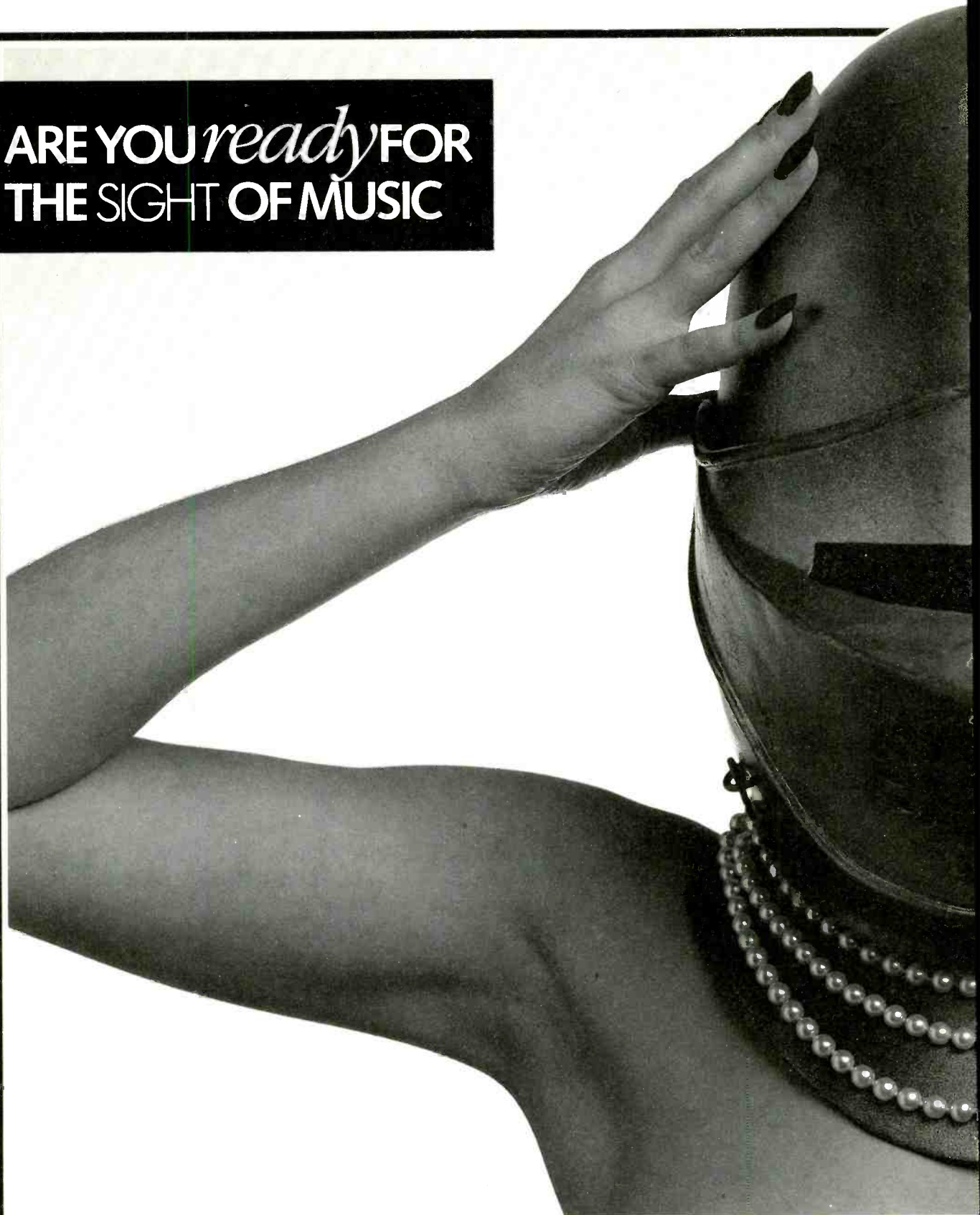


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# ORAL HISTORY OF SOUND

Surprisingly, the recording industry is rather lacking in records of its own history. Terri Anderson looks at the activities of the National Sound Archive in trying to correct this situation in the UK

**A**lthough it made no great mark on the London social calendar, a very special party was held a few months ago in Kensington.

The guests included Joe Loss, Eric Cooper, Madeline Hawkyard of PRT (who helped to set up Pye Records), Mrs Doreen Walker (the widow of Alan Blumlein), Anthony Pollard (editor of *Gramophone*), Sir David Willcocks (director of the Royal College of Music), conductor Neville Marriner, Adrian Farmer of Nimbus Records, Mrs Cecil Watts (whose husband invented the *Dustbug*), John Deacon (director general of the British Phonographic Industry), Duncan MacEwan (controller of ops and engineering at the BBC), Dame Eva Turner (who is still teaching opera singing at the age of 92), former EMI chairman and MD Sir Joseph Lockwood and L G Wood, John Borwick, and Derek Lucas (engineer in charge of maintenance of the British Telecom talking clock).

There were people among the guests who had not seen each other for many years, and who had seen the recording industry—the only certain link between so many diverse professionals and personalities—change and grow dramatically since they had last met.

They had been brought together for one reason, and it is probably the only possible reason which could bring such a guest list together at one social event: they were all people who had been interviewed by Lawrence Staply and Liz Brett. Their taped interviews now form part of the ever-growing oral history section of the National Sound Archive in Kensington, London.

Staply and Brett are two dedicated and enthusiastic historians, struggling against time and precarious funding to construct a comprehensive collection of

taped conversations with people who are, or were, involved in the development of the recording industry in any sense. The interviewees represent the technical, creative, manufacturing, marketing, promotional, and critical aspects of (predominantly music) recording. Classical composers and pop producers, studio equipment pioneers and working studio engineers, businessmen and artists—all are represented on the tapes.

The NSA approach is to obtain unedited first hand accounts. The obvious problem would seem to be that even first-hand accounts can contain both lies and unintentional inaccuracies. The two oral historians are well aware of this, and use huge amounts of time and patience to minimise the risk. They always go to see their interviewees in their own homes or offices because they

want the recordings to sound natural with the ambient noise of their surroundings. They spend time talking about the interview and building bridges of liking and trust. Then they start the tape running and record the conversation for as long as anyone wants it to continue—one acting as recordist and very unobtrusive director/producer, while the other concentrates wholly on the interviewee.

**T**he relaxed, intimate, fascinating and highly revealing nature of the resulting taped conversations is proof that all concerned are giving their best. Since questions are often repeated in slightly altered form and various people in the same line of business (likely to have recollections shared with other interviewees) are unwittingly given the opportunity to corroborate each other's statements.

This grand yet so accessible project goes back, as an idea, to the time before the NSA became part of the British Library. Lawrence Staply was then chairman of the Archive Committee (whose distinguished members included David Attenborough).

"We were concerned about the archive side of things," Staply recalls, "and we wanted to do an oral history section. We decided to compile an oral history of the recording industry, interviewing people who had a significant part in this."

Anyone who has ever toyed with the idea of researching and then producing a comprehensive history of the recording industry will be aware of the huge and complex task the Archivists were planning to set themselves. As Brett says: "It's a tree with so many branches that we did not know how to tackle it. We decided that the trunk of the tree had to be the music recording industry; it made sense to start with that."

"This should have been done 15 years ago because several of the pioneers have already died (in fact one person we were hoping to interview about the early days of the British recording business died just before we were going to contact him) and there are others we feel we must speak to urgently. If only we could afford

National Sound Archive oral history project researcher/interviewers Lawrence Staply and Liz Brett



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# ORAL HISTORY OF SOUND

to have help with the project, and to have a better budget for doing the recordings."

Where an important figure in the history is no longer available, the two researchers try to talk to close family or friends, to get a warm, personal portrait in words. One such figure, a human cornerstone of the recording industry, was Alan Blumlein, and it was just such a warm and fascinating picture which was committed to tape. To those who know of the man's technical genius and know him through what he gave to the recording industry it gives a full and multi-coloured picture of one whose perfectionism led to his disappearing at four or five in the morning to work, sending his wife flowers during the day to apologise for his abrupt disappearance; a man who preferred not to read poetry or literature himself but who welcomed having it read to him—and would ask for a poem or a speech from Shakespeare to be repeated: "Once more, and then I'll have it"; or who could be something of a social trial because "he was only interested in fine minds" and so would consent to meet small talkers once—but never again.

Similarly, audio pioneer Cecil Watts is revealed through interviews with those who knew him, because it was too late to interview the man himself.

**A**part from attempting to trace the history of technical developments and discoveries the interviewers looked to figures in the record business. "We concentrated on the record companies," Staply explained, "and have gone to the top of the tree—to such as Sir Joseph Lockwood, L G Wood, and the current CBS chairman, Maurice Oberstein.

"But we also talked to those at the grass roots, the engineers and producers—people like Arthur Haddy who was engineer in charge of Decca (and sat on the Board there). We were unable to talk to Walter Legge, but have interviewed Nicholas Boyle and Suvi Raj Grubb."

There are conductors like Neville Marriner (who had made over 400 recordings). Among the musicians are Yehudi Menuhin, Humphrey Lyttleton, and Joe Loss; among the producers are George Martin and Steve Levine.

They have recently been working on the history of film sound, and noticed the significant fact that most of the people they have talked to in that connection started their careers in sound recording for record companies or music studios. For example John Mosely (now living in Hollywood) was chief engineer at Pye Studios and worked on the first commercially released stereo album.



Part of the collection made available to the archivists by George Frow

Determined to look at the present and future as well as the past they have already taped an interview with Adrian Farmer of Nimbus.

One branch of the tree they are scaling (or descending, depending on your point of view) and one that they consider to be very important, is that of wildlife recording. Interviewees in this area have included Eric Sims and David Attenborough. The NSA already has, of course, a significant collection of wildlife recordings.

Quite properly, the oral history collection includes the reminiscences of many BBC engineers, among them Martin Pulling, who was at one time in charge of all the Corporation's recording, and who, in 1946, went with a colleague from EMI to research how far the Germans had progressed with developing tape recording (and found that the progress was considerable). Another person they would love to have talked to was the late Jacques Levy.

"The structure of each interview is very simple," Brett explains. "We ask how people got started in the industry and let them talk freely; we just try to keep the account chronological. Wherever possible we ask them for technical details."

**N**ot every interviewee has a direct professional connection with the recording industry. One of the most interesting was with George Frow, who has possibly the most comprehensive collections of recordings and playback machines in the UK. He talked about them and played some of the cylinders on to tape.

The NSA project takes full account of the fact that many people are already attempting to put together partial histories of recording. Staply and Brett want to compile 'the definitive, complete version' and they are well aware of the enormity of the task.

From their own live tapes, made using a Uher stereo recording unit, for reel-to-reel, and a Sony cassette recorder they have recorded listening tapes for use in



Avid collector George Frow proudly displays part of his collection

the Archive's listening room. They have compiled a simple catalogue as they've worked, and painstakingly constructed written precis of each interview, to help both serious researchers and casually interested listeners to find particular topics and sections of interviews that they want to hear. They recognise the need for a much fuller and more detailed cross-referenced catalogue, plus an inventory of the tapes aimed at schools and colleges, but the very tight budget makes these currently impossible.

In terms of cataloguing, the complete catalogue will have to take account of the fact that almost all the interviews involve a degree of overlap. This helps to verify much of what is recorded and it gives the listener a chance to appreciate different views of the same stories. "One interview led to another, and we cannot thank our contributors enough," said Staply. The contributors gave their time as generously and willingly as the interviewers. Some, such as Frank Lee (an engineer with Decca in the '30s, later manager of Radio Luxembourg and then back at Decca as manager of popular music) required two visits in order to record full interviews, because there was so much to say.

As Brett explains: "It's a difficult job. We go to these people after ringing up out of the blue, and we have to create an empathy very quickly. But they treat us

as friends, sharing confidences with us, forgetting that the tape is running. And after the interviews many of them keep in touch with us.

"Many of them give us things; Edward Mortimer had started writing his own history of Garrard, but gave it to us for the Archive; and Maurice Roach (one time promotion man with Decca) gave us a mountain of newspapers and posters which he had collected in connection with the history of the company at the very beginning when it was Samuel Barnett."

**W**hat started as a three month project in September 1983 was still in progress after a year, with no sign of ending, as long as there are some funds, however meagre, to keep it going. There is still so much to be covered properly such as specialist musical style like jazz and folk, or the history of tape technology. Brett and Staply would dearly love to be able to go to the US and liaise with the Smithsonian Institute, but that is not possible as yet. They need a full-time oral history officer at the NSA, but that too will have to wait. Meanwhile they go on making all their own introductory calls, doing all their own typing and administration. The general rule seems to be that at any time there is only enough money available to keep the project alive for couple of months. The great hope is that the British Library will be able to offer better, more long-term help after the move to larger and more commodious premises takes place.

Despite the difficulties, both frequently stressed their gratitude to everyone in the recording industry, past and present, who have given them so much help. "The most significant thing we have discovered through this project," remarked Staply, "is that all these people have absolutely no sense of exclusiveness or rank. They all mix together and work together easily in the same cause."

"Another thing which came out strongly was the importance of the engineer working with the artists, and the rapport they develop (on the rare occasion when they don't develop it they don't make a worthwhile recording). Artists are very appreciative of the understanding they get from engineers, and the lengths that engineers and producers will go to to get the sound that the artist wants are enormous. It has also been very interesting to note the way that the recording engineer's life has changed from the days when they wore white coats and worked office hours to the present."

Lawrence Staply joined the BBC in 1946 as a sound balance engineer, often working with big bands and orchestras. Later he headed the department responsible for exploiting all the various BBC sound libraries. Working on the BBC's spoken word recordings library brought him into contact with the National Sound Archive, of which he then became a governor.

"My background in recording gave me preconceptions and I knew that recorded music had great significance in people's entire lifestyle—dress, entertainment,

everything. Without recording, most radio stations would not exist; that's just one reason why I think this is so important."

Liz Brett is also ex-BBC, having worked there for 10 years as a production assistant on various types of programmes, and later moved to LBC as a producer. For some years she was a freelance presenter and reporter.

"I am very interested in people. In this plastic age it's very important to capture things which are real, and easily lost, and to me the most important part of people is the voice, which can tell you everything about a person."

"Kids who use all this recorded music have no idea of the history of it, and it makes me so angry that we are not in a position to push this project properly for their benefit."

Staply added: "There are books on the subject, but they are not readily available and they are not well read (and some are not at all easy to read). But the whole fascination and romance of the

industry has never really been put across in a book.

"One of the ideas we had which is coming out of this was that we should work more closely with the Science Museum and incorporate some of our oral history project recordings in an exhibit for them. But without the money to use it, this whole project will be stuck on a shelf and only a very few people will find and use it."

They do accept that 'the oral historian has to be on guard, because people remember things wrongly' but they can confidently say that from the professionals they have been working with they have overwhelming evidence that they are being told the truth, and that details are correct in almost every instance. When they track down a fact which has been remembered incorrectly by someone, they do not edit the tape but go and ask that interviewee to record their answer to a particular question again, to set the matter straight. □



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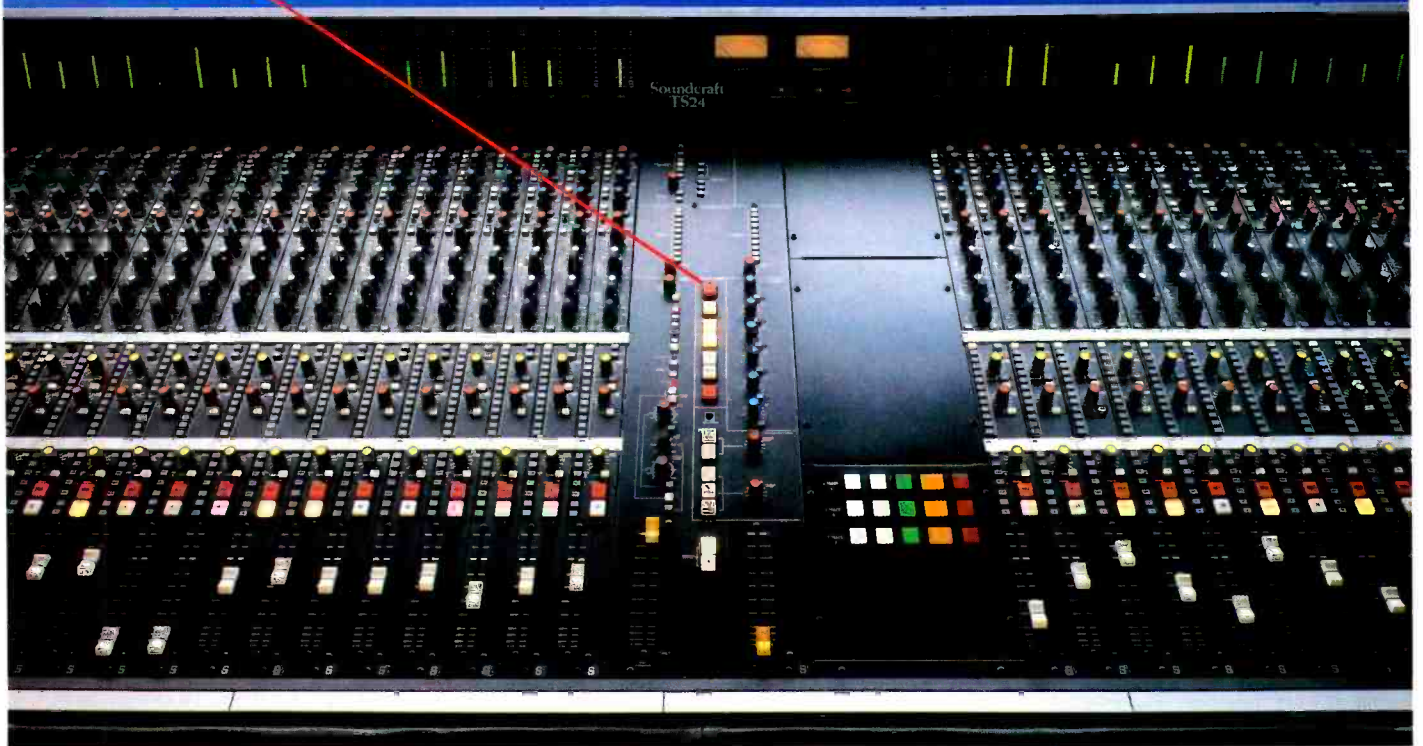
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# JUST ONE TOUCH.



# POWER AMPLIFIERS

• **AB Systems:** changed hands about a year ago and the resulting new influences are now beginning to show in their products. The complete range has been separated into a number of different series and to clarify the products available, here is a complete listing with wattage ratings into 8 Ω: Professional Series 2220 50 W/channel; 6220 175 W/channel; 9220 300 W/channel; 1200 Series modular: 1200A 300 W/channel; 1200B 400 W/channel; Multiple amplifiers with crossovers, 8120 125 W/HF, 300 W/LF; 9130 125 W/HF, 125 W MF, 300 W/LF; the Advanced Technology Design Series: is intended for permanent installation and includes the 221 150 W bridging amp; 421 single-channel 300 W and the 821 2-channel 300 W/channel; 712 single-channel biamp 250 W/HF and 500 W/LF; 524 2-channel biamp 125 W/channel HF, and 250 W/channel LF; 713 single-channel triamp 150 W/HF 150 W/MF 300 W/LF; and finally the 7132 which is similar to the 713 but with three outputs.

• **ACES:** no new models but have worked on consolidating a dealer network in many parts of the world hence making their products far more easily available.

• **ANT Nachrichtentechnik:** ANT will be launching a new MOSFET power amp at the March 1985 Hamburg AES. Known as the LV300, it is rated at 360 W and is equipped with two stages of protection. Design intentions were for high efficiency sound systems. A battery powered version is available.

• **BGW Systems:** has recently introduced upgrades of its Model 85. The updated version delivers 35 W/channel into 8 Ω and additional features are improved noise characteristics and redesigned front panel. It is available in three versions—unbalanced input, active balanced and transformer balanced.

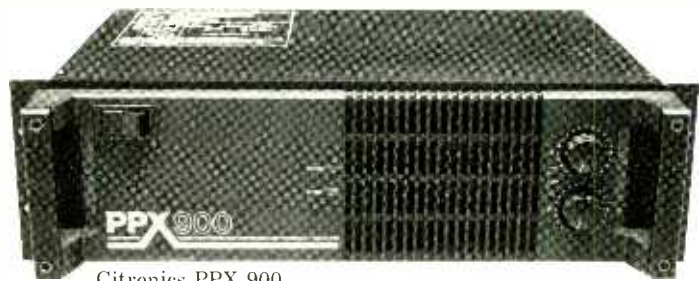
• **Citronic:** two completely new power amplifiers forming the PPX Series have recently been introduced. The PPX 900 is rated at 280 W/channel into 8 Ω, 450 W/channel into 4 Ω and 900 W bridged mono into 8 Ω, while the other model PPX 450 has ratings of 140, 225 and 450 W under the same conditions. Both units feature forced air cooling, clip indicators, detented level controls, full protection circuitry with standard rack

**This brief update lists the major models and changes introduced within the period of time since we last covered power amplifiers (June '84). As always we must make it clear that such lists can never be complete or totally up to date and is compiled purely from information available to us at the time of writing**

power with small physical size particularly with the 1000. This is a 2-channel amp offering a choice of bridged or parallel mono operation with a claimed maximum mono rating of 1000 W into 1 Ω. Further details on this amp can be found in the new products section of this issue. One other feature that is worth repeating is the reversible air flow capability which means that hot air can be exhausted through the front or rear dependent on the installation.

• **Daub:** a West German amplifier manufacturer by the name of Delat Elektroakustick GmbH manufacture Daub power amplifiers and they have only recently come to our attention. The current range appears to contain four models all 2-channel and rated at 70, 130, 280 and 420 W/channel into 8 Ω for the D120C, D300C, D500C and the D700C respectively. A new model, the ES 400 has recently been added and this is rated at 200 W/channel 8 Ω.

• **FM Acoustics:** two new models have been added recently. The first is the FM1000 which is a single-channel unit rated at 450 W RMS into 8 Ω, 750 W RMS into 4 Ω rising to 1,800 W RMS



Citronics PPX 900

mount chassis of 3U.

• **Crest:** has introduced four new low-profile power amplifiers. The Model 2501A will provide 1 kW RMS in bridged mono mode into 4 Ω, 200 W/channel into 8 Ω and is only 2U high. Model 1501A is 1U and will deliver 100 W/channel into 8 Ω; the 2001A is rated at 125 W/channel into 8 Ω although will also give 300 W/channel into 2 Ω; and lastly the Model 1001A is a 1U rack mount chassis rated at 35 W/channel into 8 Ω.

• **Crown/Arcron:** last year's introduction of the Delta Omega 2000 took Crown into the realms of high power and large physical size. The newly launched Micro-Tech series has high

into 1 Ω. Design features include non-polarised discrete input stage, discrete class A circuitry throughout; protection circuitry continuously checking many variable parameters and specially designed output connectors. The other amplifier is a development of the FM1000 having the same technology and features but in a 2-channel format. To be known as the FM801, it will deliver up to 1000 W/channel driving loads down to 1.5 Ω and will be available in early summer.

• **JBL:** have recently added two new amps, the 6230 and 6260 rated at 75 W/channel and 150 W/channel into 8 Ω respectively with bridged mono 8 Ω ratings of 300 W and 600 W. Designed for live and studio use, features include low TIM distortion, high slew rate and a low level of overall feedback, full protection systems, active balanced inputs and output devices running at only 25% of rated power dissipation at rated power into 8 Ω.

• **Mustang:** a completely new range of power amplifiers is due for launch this March under the provisional name of the VX range. These are compact high power amplifiers that mark quite a departure for Mustang in many ways. Details available at present are still provisional but there will be four models, all 2-channel with ratings into 4 Ω of 500, 250, 100 W/channel and a 200 W with

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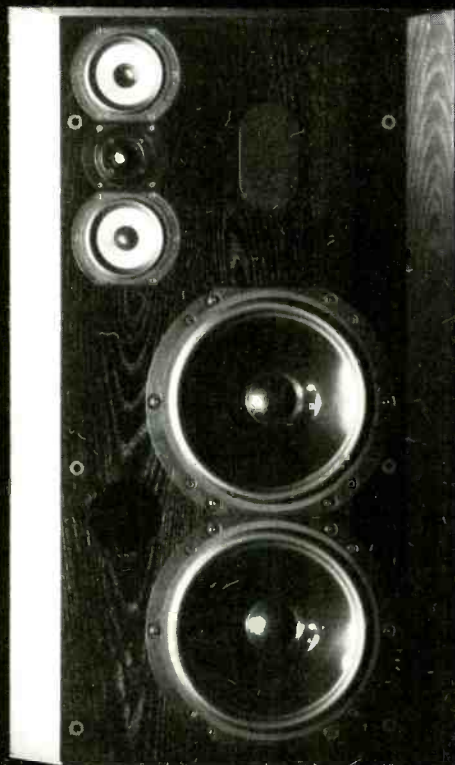
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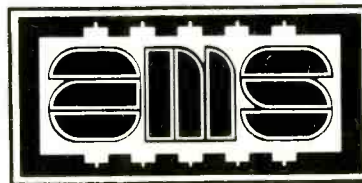
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100 V and 4  $\Omega$  outputs, with model numbers most likely being VX2500, VX2250, VX2100 and VX200 respectively. All models are standard 19 in rack mounting and 2U high. The construction uses plug-in VMOS power sections that are accessible from the top and fan cooled, together with a system of dedicated multilayer plug-in modules for a variety of EQ and gain/balance functions. A high standard of performance is claimed and all units feature electronic thermal detection/load disconnect circuitry.

● **ProTech:** a pair of models have recently been introduced, the model 874 and 875. They are rated at 60 W and 125 W respectively and provide an 8  $\Omega$

# POWER AMPLIFIERS

and a 70.7 V transformer isolated output. Both are standard rack mount units.

● **Quad Electroacoustics:** in many ways the surprise of the year was the new professional power amplifiers from Quad. With the live sound companies and recording studios having used and modified the standard Quad amp for so many years there seemed to be no likelihood of Quad ever producing a pro

version, but here they are. The 510 is a single-channel unit with a 600  $\Omega$  bridging input and a multiple tapped output transformer which will apparently deliver 100 W into any load from 2 to 100  $\Omega$  with optional cards in addition to 70 or 100 V line use. The 520 is a 2-channel amp with ratings of 100 W/channel into 8  $\Omega$ . Both amps use a refinement of the current dumping circuit found in the 405.

● **Rauch:** the recently introduced DVT series is a development of the X-FET series incorporating much customer feedback. The DVT250S has a rated output of 525 W/channel into 4  $\Omega$  or 1 kW into 8  $\Omega$  bridged mono and the DVT125S is 260 W/channel into 4  $\Omega$ . The DVT series are fan cooled with modular POWERFET sections, 3U high and use a very robust construction—the front panel being 8 mm thick. There will be two more amplifiers in this range introduced in the near future.

● **Roland:** although Roland have had two power amplifiers within the Roland Rack System, professional power amplifiers are not something that they have been noted for. The SRA-4800 however is a new 2-channel amplifier with ratings of 240 W/channel into 8  $\Omega$  and a mono mode of 800 W into 8  $\Omega$ . Intended for sound reinforcement applications, the SRA-4800 features detented level controls, full protection circuitry, slaving facilities, bar level meters and clip indicators.

● **Sescom:** the Model SH-1 is a compact low power stereo power amplifier. Rated at 20 W/channel, the unit is standard 19 in rack mount and 1 $\frac{3}{4}$  in high. The SH-1 is intended as a low cost unit for powering small monitors, or perhaps headphone foldback systems.

● **Soundcraft:** although Soundcraft released information on a range of power amplifiers nearly 18 months ago, it was not until far more recently that they became available. There are three models, the SA2000, SA600 and the SA150 rated at 435, 150 and 85 W/channel respectively all being standard rack mount but with U sizes of 4, 2 and 1. The basic circuitry design features came from Norway and claimed features include the elimination of the concept of TIM distortion; a combination of MOSFET and bipolar designs to respond to dynamics within the programme as if they were higher powered, low phase shift and high current and voltage slew rates.

● **Studiotec:** first an introduction; Studiotec is a Finnish company manufacturing recording equipment although unfortunately we know little more of them or their other products. The System 4200 FET is a modular power amplifier system based around a mainframe card rack and is intended for permanent installation. The mainframe is equipped with a power supply and space for four modules. Each amplifier module can deliver 300 W into 4  $\Omega$  and has full protection facilities, LED indication of protection and clipping, switch-on delay, MOSFET output stages, adjustable input sensitivity, bridging capability in pairs, and a 6U card size. Other options for the frame include sub-cards for limiters and crossovers. Due to the construction system, cost of the unit is described as low. □



Roland SRA-4800

Soundcraft  
SA150, SA600  
and SA2000

BECOME A

## SOUND RECORDING ENGINEER

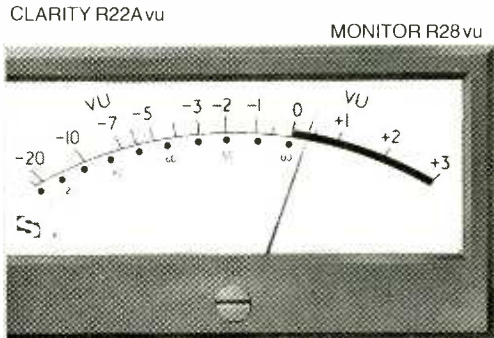
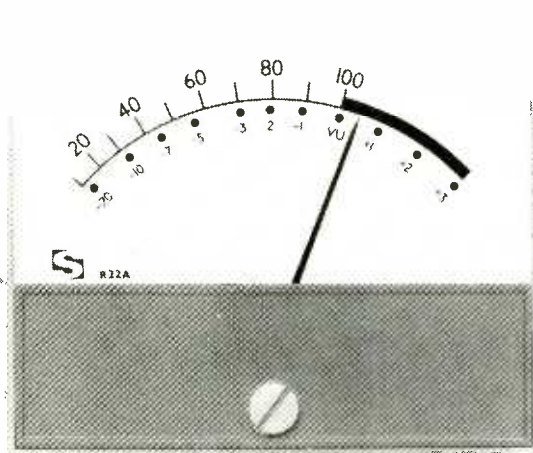
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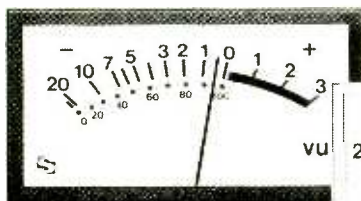
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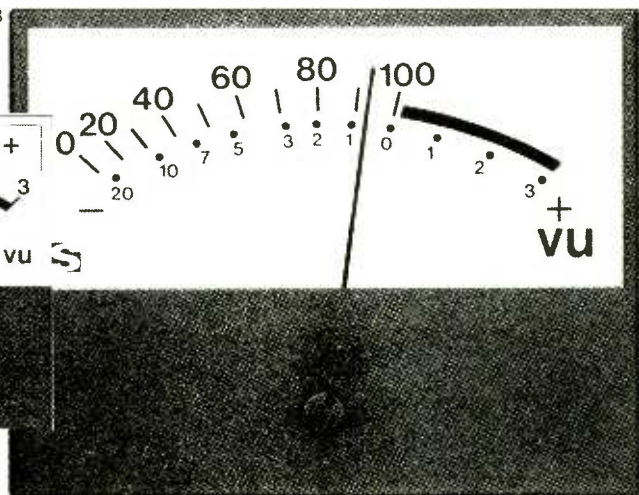
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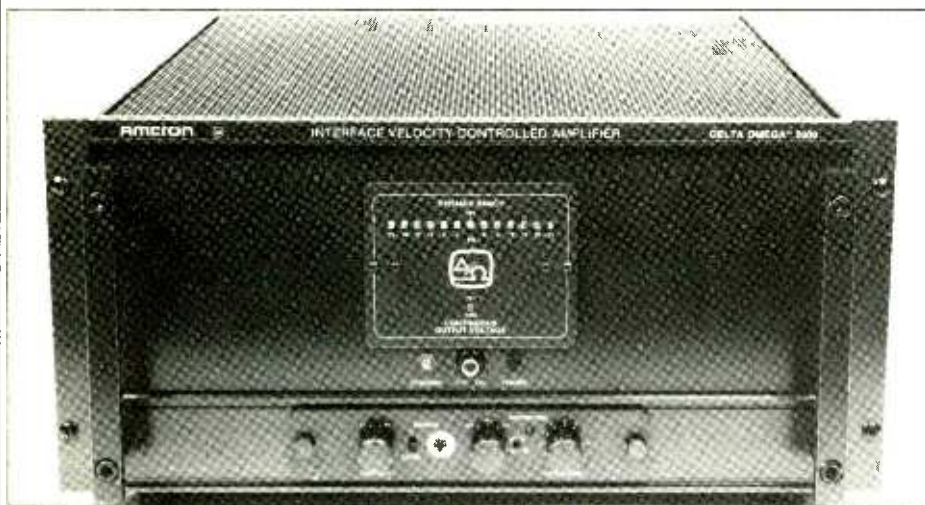
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# REVIEW REVIEW

Hugh Ford reviews a power amplifier

# CROWN DELTA OMEGA 2000



**T**he Crown/Amcron *Delta Omega 2000* is a massive single channel amplifier rated at 600 W into 8  $\Omega$  from DC to 45 kHz and capable of delivering 2 kW into low impedance loads. It is thus aimed at sound reinforcement and industrial applications (and some high power studio applications, Ed).

In typical Crown style the black front panel has white legends with all external features being very clearly identified. The 19 in rack mounting front

panel 5U in height has very strong handles which protect the front panel controls and indicators whilst the rear panel features are recessed.

At the rear, power is applied by a 5 ft fixed cable with two properly identified fuses providing primary protection. The audio balanced input and the output are at barrier strips with an 11-pin 'octal style' connector providing various remote functions. These include remote standby control, an inverting input, the 'hot' output and  $\pm 15$  VDC rails for adding

accessories such as crowbar protection of the output.

Finally at the rear are two slide switches, one for activating a turn on delay of 4 to 5 s and the other to insert the LF protection circuits.

Coming to the front panel at the top centre are 13 yellow level indicator LEDs which show 0 dB,  $\pm 6$  dB,  $\pm 12$  dB,  $\pm 15$  dB,  $\pm 20$  dB and  $\pm 25$  dB. Below this a green LED is illuminated when the output reaches 70.7 VRMS (625 W into 8  $\Omega$ ).

Power is connected by a pushbutton Schadow switch with a red (power) and a yellow (standby) indicator. At the bottom centre a removable panel secured by two knurled non-captive screws has front panel controls and a plug in printed circuit board to the rear. The normal controls are a gain potentiometer and a rotary switch which selects AC or DC coupling.

The remaining features are peculiar to the *Delta Omega* design and are concerned with the amplifier/load interface. In effect the output impedance may be increased or decreased to match the characteristics of the load whilst operating at low power. A 3-position rotary switch on the plug-in unit selects normal unprotected operation (with the unit operating as a conventional voltage amplifier); protected operation (where the amplifier is velocity interface controlled); and an adjust position. In the latter position a screwdriver operated ' $\Omega$ ' control becomes accessible through a hole in the front panel. A socket on the front panel with an adjacent recessed slide switch allows the ' $\Omega$ ' control to be remote controlled.

The front panel is an alloy plate reinforced to the rear with steel bars to which two massive laminated power transformers are attached. Having these behind the front panel brings the centre of gravity of the amplifier forward and thus reduces the bending moment on the mounting rack.

The level indicators are on a small printed circuit board behind the middle of the front panel where the  $\pm 15$  V

## MANUFACTURER'S SPECIFICATION

**Power response:** DC to 45 kHz at 600 W continuous average output power into 8  $\Omega$  with no more than 0.05% total harmonic distortion.

**Power at clip point:** (less than 0.01% THD) music power at clip point into 2.2  $\Omega$  load, 10 to 500 Hz, 2000 W RMS using a 50 Hz, 50% duty cycle tone burst signal source.

**DC output:** (*Delta Omega 2000* used as a conventional voltage amplifier) typically, 2 A maximum at 100 V or 2 kVA.

**Frequency response:**  $\pm 0.1$  dB DC=20 kHz at 1 W into 8  $\Omega$ .

**Phase response:** +0, -15 DC=20 kHz at 1 W into 8  $\Omega$ .

**Slew rate:** 32 V/ $\mu$ s (slew rate is the maximum value of the first derivative of the output signal, or the maximum slope of the output signal).

**IM distortion:** (60 Hz to 7 kHz 4:1) less than 0.05% from 0.01 W to 600 W (peak equivalent to a single sinusoid, RMS) into 8  $\Omega$ ; less than 0.01%

at 600 W into 8  $\Omega$  or 1200 W into 4  $\Omega$ .

**Harmonic distortion:** (true RMS measure) less than 0.05% from DC=45 kHz at 600 W into 8  $\Omega$ ; less than 0.001% from 20 Hz to 400 Hz and increasing linearly to 0.05% at 600 W into 8  $\Omega$ .

**Output impedance:** variable (+8  $\Omega$  to -8  $\Omega$ ).

**Load impedance:** primarily used at 8  $\Omega$  or less; maximum continuous sinusoidal output power, lower impedance affects only maximum power; unit will drive a completely reactive load with no adverse effects.

**Input voltage gain:** 20 V - 1% (26 dB) at standard input with input attenuator fully CW (-1 V  $\pm 1\%$  at remote protect connector input).

**Standard input sensitivity:** 3.46 V RMS  $\pm 5\%$  (1.73 V RMS  $\pm 5\%$  selectable).

**Input impedance:** 25 k $\Omega$   $\pm 5\%$  with standard balanced bridging input; 44.76 k $\Omega$   $\pm 5\%$  at unbalanced remote protect connector input.

**Hum and noise:** (20 Hz to 20 kHz) 120 dB below 600 W into 8  $\Omega$ ; typically 128 dB.

**DC drift at output:** typically less than 100  $\mu$ V  $\Delta$  with all inputs grounded.

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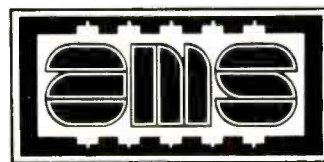
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# REVIEW REVIEW

FIG. 1  
CROWN DELTA OMEGA 2000  
COMMON MODE REJECTION

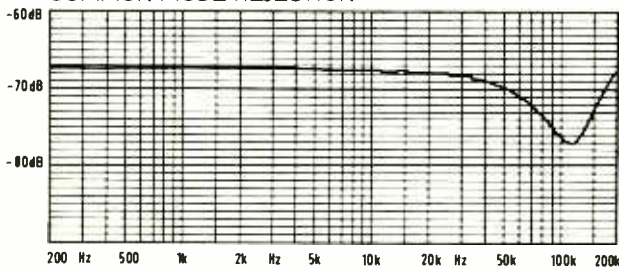
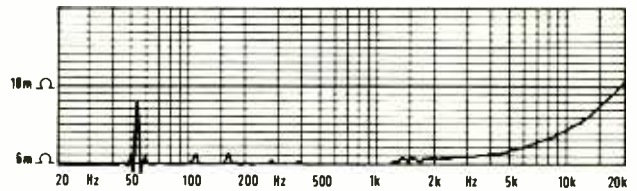


FIG. 2  
CROWN DELTA OMEGA 2000  
MODULUS OF OUTPUT IMPEDANCE



power supply is located with some rather untidy wiring.

The 32 output devices each rated at 150 W are mounted in eight sections each having car radiator type cooling fins, four sections at the top of a cooling tunnel and four at the bottom. Air is blown by a 2-speed filtered fan in the side of the amplifier into the tunnel and through the cooling fins.

To the rear of the tunnel two small plug-in printed circuit boards house the low level audio circuits and the protection circuits. These appeared to be well made but lacked component identifications and no servicing data was provided with the amplifier. Whilst the overall standard of construction and finish was satisfactory, all the hand wiring was rather untidy with quite long lengths of unsupported wires.

As the sides are solid alloy plate the top and bottom covers are perforated to allow the exit of cooling air. Thus a stick-on label on the top cover warns that foreign bodies dropped through the cover may cause amplifier damage—bitter experience of an earlier Crown design confirms this feature!

## Input and output

The balanced input had an impedance of 20 k $\Omega$  which remained constant with the gain setting, the maximum gain being an input of 3.544 VRMS for an output of 600 W into 8  $\Omega$  at 1 kHz. Common mode rejection as shown in Fig 1 was good, being in excess of 67 dB up to 200 kHz.

At the output the modulus of the impedance in the normal mode of operation is shown in Fig 2 with the damping factor into 8  $\Omega$  being extremely high. When operating in the *Delta Omega* mode the output impedance is varied nominally from +8  $\Omega$  to -8  $\Omega$  with the measured impedance remaining constant up to 5 kHz above which it fell at 6 dB/octave.

The DC offset at the output was minimal, remaining at <2.2 mV under any conditions. The protection circuit operated if the DC level at the output exceeded +18/-20 V. After the operation of the protection circuits the amplifier retries the output with a 200 ms burst of signal if the over-voltage remains present. ▸

## MANUFACTURER'S SPECIFICATION

**Heat sinking:** forced air with high efficiency coolers (eight) which can dissipate 1900 W with 25°C intake air at 1 atmosphere. (Dissipation derates to zero at 75°C.) A two-speed fan with an intake filter (washable) forces air through the coolers and out both the top and bottom of the amplifier. (A dual fan single speed option is available for high temperature environments.)

**Turn-on:** may be switch selected for instantaneous or 4 to 5 s of delay after applying power.

**Low frequency load protection:** may be switch selected to produce shutdown of the high voltage power supply for DC outputs >6 V or low frequency outputs >600 W at 20 Hz and 8  $\Omega$ .

**Output transistor protection:** short, mismatch and open-circuit proof; electronic protection operates without thumps or shutdown.

**General protection:** high line voltage or over-temperature result in shutdown of the high voltage power supplies. Controlled-slewing-rate voltage amplifiers protect the amplifier against RF burnouts. Input overload protection is furnished by a resistor at the input of the amplifier to limit input current.

**High voltage power supply:** two transformers with computer-grade capacitors storing 100 joules are powered through a 50 A solid state switch.

**Low voltage power supply:**  $\pm 15$  VDC supplies are provided by current-limited shortproof regulators which have automatic thermal shutdown. Shutdown of these supplies results in shutdown of the high voltage power supplies.

**Power requirements:** 50 to 60 Hz AC with adjustable taps for 100, 120, 200, 220 and 240 V  $\pm 10\%$  operation; draws 80 W or less on idle, 1 kW at 600 W output into 8  $\Omega$ .

**Display:** SPI (signal presence indicator) yellow LED lamp (indicates source material signal is present); dynamic range 6 to 25 dB amber LED lamps (indicate instantaneous dynamic range of source material signal, comparing average amplitudes to the peak); STANDBY amber neon lamp (indicates high voltage power supply is deactivated); 70.7 V RMS green LED light (indicates that output voltage has reached 70.7 V RMS); POWER red neon lamp (indicates power is

applied to unit); PROTECT red LED lamp (indicates that *Delta Omega*  $\Omega$  pot or remote device has reached the critical point; Push/Push OFF/ON power switch (turns unit off and on); AC/DC Input Coupling dial (selects proper input configuration, AC or DC); local/remote switch (permits *Delta Omega* procedure to be done using the local pot or an external remote device); OFF/ADJ/ON Mode dial (selects the mode of operation for the unit); *Delta Omega* Adjust Pot (permits adjustment of desired match of *Delta Omega 2000* and speaker load); INPUT ATTENUATOR dial (permits adjustment of volume); LF Protection switch, on rear panel (puts unit into Standby if low frequency outputs of more than 10 V occur); delay switch, on rear panel (inserts a 4 to 5 s time delay in the state transition from Standby to high power supplies on).

**Remote protect:** the unit may be removed to external control to place in standby mode. The standby mode may be initiated by closing an external common to ground contact of 15 V 3 mA rating (ie an open collector high voltage TTL output or an opto-isolator output).

**Connectors:** input three terminal barrier strip routes to input plug in—terminal number 1=ground, terminal number 2=positive, terminal number 3=negative; AC line—3-wire 20 A, 120 V male connector with 5 ft minimum cable; Remote Protect—11-pin octal-type socket.

**Construction:** aluminium chassis with ¼ in thick front panel, reinforced with steel to retain the power transformers; ½ in aluminium side panels; heavy duty handles on front for ease of transport; plug-in PCBs.

**Dimensions:** (whd) 19 $\times$ 8¼ $\times$ 16½ in/ 482.6 $\times$ 222.2 $\times$ 419.1 mm (depth behind mounting surface, handles extend 2 inches in front of mounting surface).

**Weight:** 92 lb/41.7 kg.

**Centre of gravity:** nearly centered at 5 in behind mounting surface.

**Finish:** front panel is coated with durable textured polyurethane. Charcoal front panel and black anodised aluminium chassis and covers.

**Manufacturer:** Crown International Inc, 1718 W Mishawaka Road, Elkhart, IN 46517, USA.  
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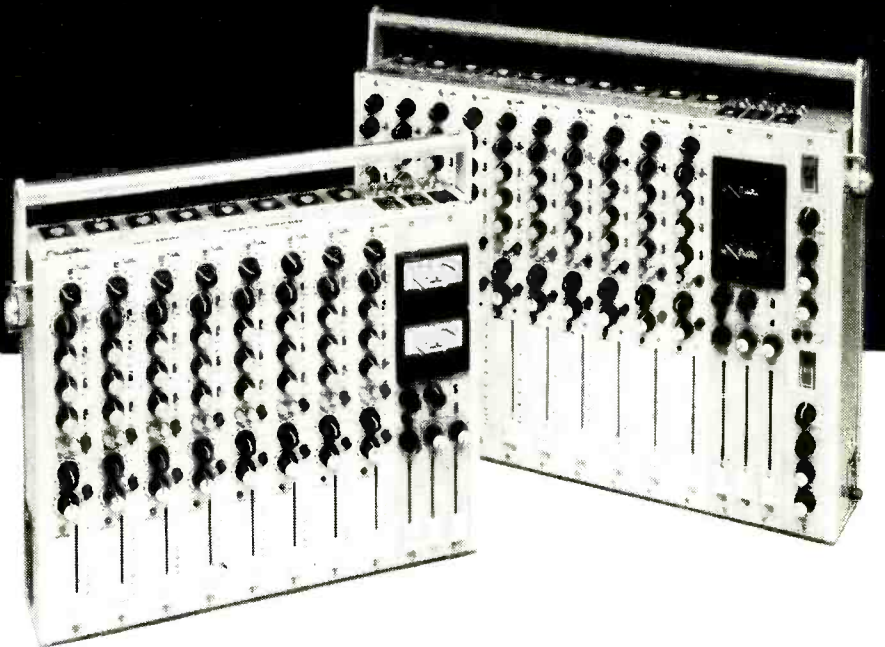
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# REVIEW REVIEW

FIG. 3  
CROWN DELTA OMEGA 2000  
FREQUENCY RESPONSE 1W INTO 8Ω

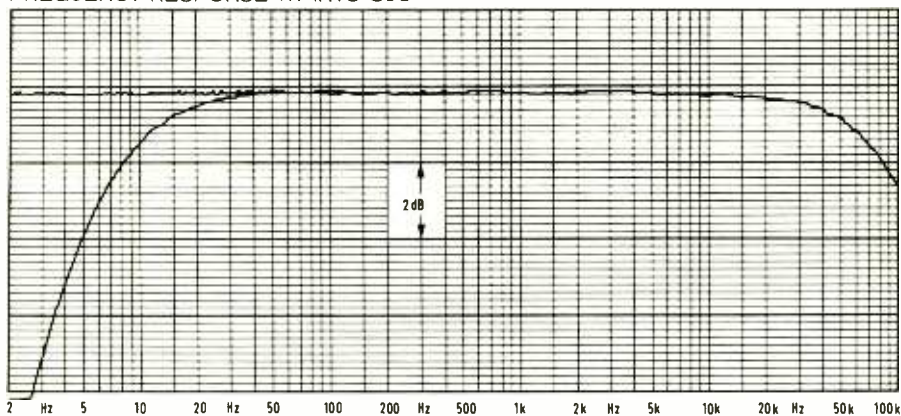


FIG. 4  
CROWN DELTA OMEGA 2000  
HARMONIC DISTORTION 600W INTO 8Ω

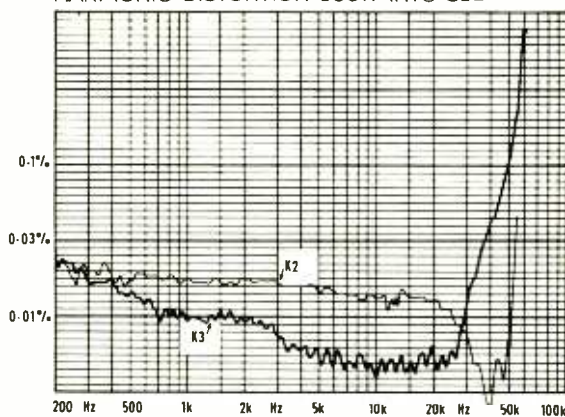
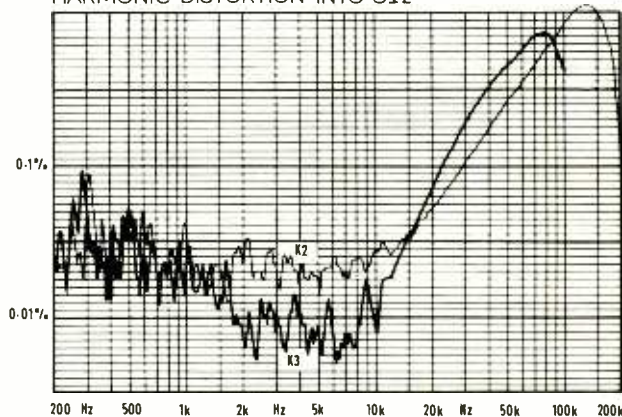


FIG. 5  
CROWN DELTA OMEGA 2000  
HARMONIC DISTORTION INTO 8Ω



## Frequency response and noise

The frequency response at 1 W into 8 Ω is shown in Fig 3 with and without the highpass filter switched into circuit, this being a 12 dB/octave filter with its -3 dB point at 6 Hz. The overall frequency response did not change up to power levels of 600 W into 8 Ω below 20 kHz with no sign of triangulation or other visible waveform distortion.

Noise in the output depended upon the setting of the gain control as well as the switching in/out of the *Delta Omega* facility which polluted the output with power line hum when switched in. Table 1 relates noise to an output of 600 W into 8 Ω.

Other than the above complaint regarding hum no significant tones occurred in the output at any gain control setting.

## Power output and distortion

Using accurately calibrated load resistors within 0.5% together with a stabilised ±1% power supply and an accurate

TABLE 1

	Noise related to 600 W/8 Ω			
	Delta Omega out		Delta Omega in	
	Max gain	Min gain	Max gain	Min gain
22 Hz to 22 kHz RMS	-106.6 dB	-115.3 dB	-95.3 dB	-106.5 dB
A-weighted RMS	-111.9 dB	-123.8 dB	-103.2 dB	-108.6 dB
CCIR-weighted RMS	-104.0 dB	-115.8 dB	-102.8 dB	-107.4 dB
CCIR-weighted quasi-peak	-100.0 dB	-111.5 dB	-98.0 dB	-102.6 dB
CCIR/ARM ref 2 kHz	-110.2 dB	-123.0 dB	-109.2 dB	-114.2 dB

TABLE 2

Load	Continuous	Burst
8 Ω	718 W	724 W
4 Ω	1225 W	1250 W
2 Ω	—	1760 W

digital voltmeter the power output at clipping was as shown in Table 2 for continuous 1 kHz sinewaves and 10 ms bursts every 100 ms.

When running the amplifier in the normal mode the harmonic distortion at the rated 600 W into 8 Ω is shown in Fig 4 to be <0.02% up to 30 kHz above which the third harmonic rises. Full power distortion was not the worst case which occurred around 1 W into 8 Ω as shown in Fig 5 where the second and third harmonics remained below 0.03% up to 15 kHz.

CCIF type twin tone intermodulation distortion at a peak equivalent of 600 W into 8 Ω was good as shown in Fig 6

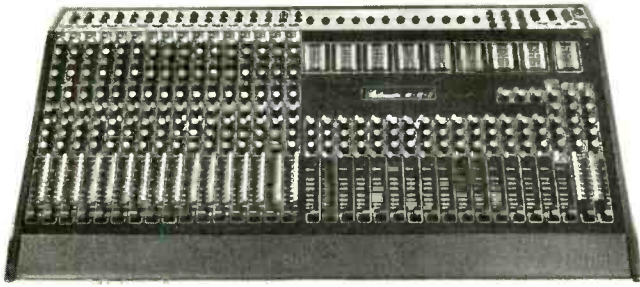
with the rapid rise in the actual difference frequency distortion at 12 kHz disappearing at lower levels. The result of applying a 10 kHz squarewave into a load of 8 Ω in parallel with 2 μF as shown in Fig 7 demonstrating overshoot but no ringing.

The rise and fall times were symmetrical at 4 μs with the maximum slew rate being 35 V/μs.

The *Delta Omega* system was investigated using the laboratory workhorse Sendor BC3 loudspeakers as a load. Firstly it was noted that the adjustment of the control had a very noticeable effect upon the reproduction of music. Considering the large effect the

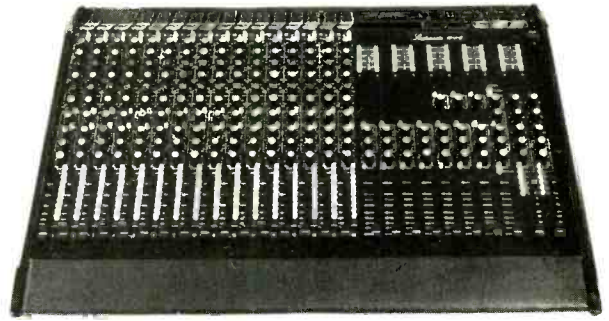
# STUDIOMASTER

## 16-16-2



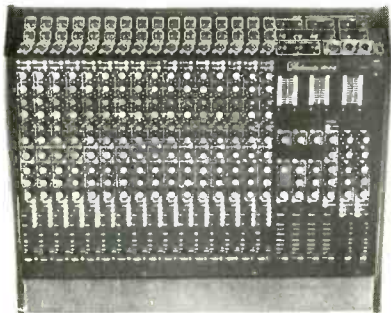
The 16/16/2 is designed to complement budget 16-track recorders. It features its own external P.S.U. which can supply even a fully expanded 16/16/2 (a 32/16/2!). All mic. channels have 48V Phantom Power, parametric E.Q. network, and 3 auxiliary sends. Full 16 channel monitoring is included in the 16/16/2 package. 12 segment 2 colour bargraphs are fitted to the 16 sub-mix stages and the master output which is also fitted with 3 band E.Q. As well as optional expander modules for the mic. channels, a double patch bay is available.

## 16-8-2



The 16/8/2 is compatible with 8-track recorders and has all the versatility of the 16/16/2, like optional expander modules for the mic. channels (an extra 16 mic. channels may be fitted without altering the unit's P.S.U.) and a double patch bay. Mic. channels feature 48V Phantom Power, parametric E.Q. network, 3 auxiliary sends and 90mm faders. Full monitor and foldback systems are included. Master outputs have 3-band E.Q. and 2 colour 12 segment bargraphs. These bargraphs are also fitted to the 8 sub-mix stages. Applications for the 16/8/2 include small 8-track studio mixing and live sound reinforcement.

## 16-4-2



The 16/4/2 is the mixer that the 16/8/2 and 16/16/2 developed from and consequently contains all their superb features. It is expandable to 32/4/2 on its existing P.S.U. and a patch bay is also available. Mic. channels have parametric E.Q. network, 48V Phantom Power, 3 auxiliary sends and 90mm faders. Full monitor and foldback systems, 3-band E.Q. on the master outputs and 2 colour 12 segment bargraphs are all supplied on the 16/4/2. Use of this mixer include live sound reinforcement and for use with 4 track recorders in small studios.

## 6-2-1



The STUDIOMASTER 6-2-1 mixing console offers features and performance normally obtainable from mixers costing twice the price. Mic. channels feature three band e.q., effects and monitor sends as well as the usual gain and pan controls. 2 colour, 12 segment bargraphs allow monitoring of channels, auxiliaries and both stereo and mono sum outputs. This outstanding specification makes the 6-2-1 ideal for sub-mixing, P.A. and recording.

## Mosfet 500



With distortion not exceeding 0.005% (1kHz sinewave at 200 watts/4ohms) this amplifier provides reliable amplification of outstanding fidelity in all applications. The extensive protection circuitry ensures failsafe protection against D.C., thermal overload and short circuit conditions. The front panel carries LED indication allowing instant monitoring of the amplifier's operational status. The Mosfet 500 is ideally suited to all professional applications requiring medium power, accurate reproduction.

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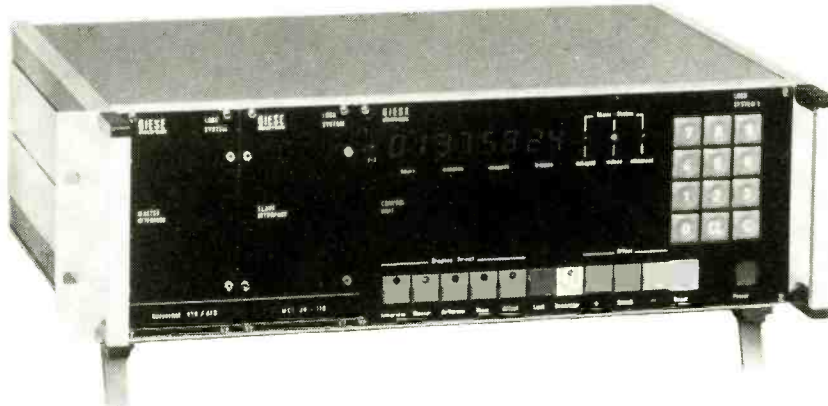
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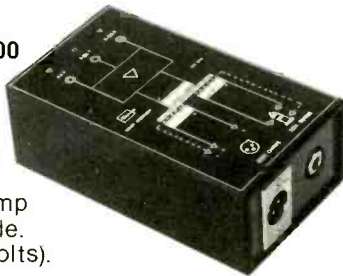
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# REVIEW REVIEW

control has upon the output impedance this comes as no surprise. However any differences between normal and *Delta Omega* operation were very small using this load.

Whatever the setting of the control the squarewave performance using the loudspeaker load was slightly degraded and unless great care was used in adjusting the control the intermodulation distortion at 1 W output was also degraded.

In conclusion the *Delta Omega* system did not appear to offer any advantage with this particular load. There may, however, be loads where the facility does improve reproduction and certainly the control does offer a wide choice of sound reproduction qualities.

## Other matters

The phase shift with and without the highpass filter in circuit is shown to be minimal in Fig 8 within the audio band.

Operation of the 70.7 V green warning indicator was very fast with a single cycle at 10 kHz giving a reasonably clear indication.

The level indicators are not of the conventional type but show the dynamic range of the input signal. They compare the average level of the input signal with the peak level such that on steady

tones no indication is given. Using tone bursts the indicators gave a reasonably accurate indication of the peak to average levels and were fast in operation and very clear to read.

In operation the amplifier had to suffer very severe punishment before the cooling fan went into high speed operation. In normal operation the fan was unusually quiet and even in high speed was not excessively noisy.

When set for 240 V AC operation the over-voltage protection system operated at 255 V AC input such that the amplifier remained in the standby mode until a safe input voltage appeared.

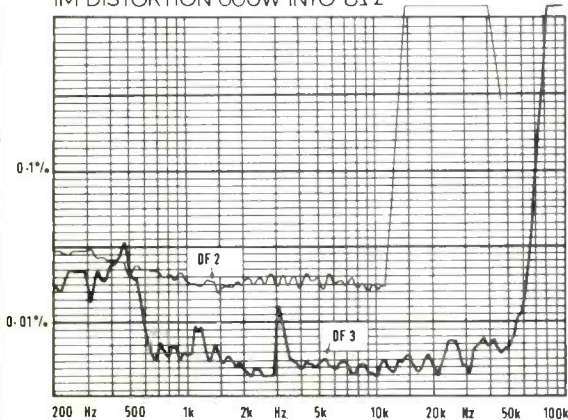
The turn on delay was silent in operation and did not produce instability or thumps.

## Summary

This amplifier is clearly a well protected unit capable of driving a wide variety of loads with a good distortion performance and low noise. It may be that with some loads the *Delta Omega* system offers an advantage. However, its range is far wider than can be used and it appears that adjustment of the system is critical.

The amplifier is certainly of interest for driving any load at high power and low distortion where a rugged unit is desired. □

FIG 6  
CROWN DELTA OMEGA 2000  
IM DISTORTION 600W INTO 8Ω



NB: A practical appraisal of this unit is in preparation and will be published in the near future.

FIG 7  
CROWN DELTA OMEGA 2000  
10 kHz SQUAREWAVE INTO 8 Ω

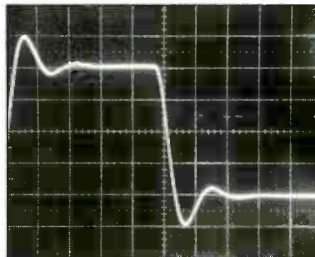
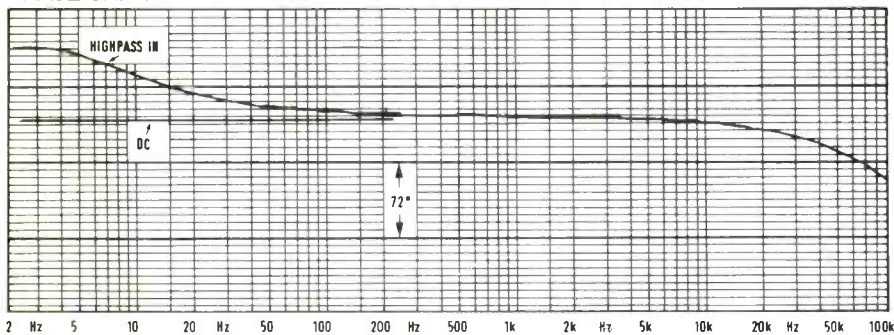


FIG 8  
CROWN DELTA OMEGA 2000  
PHASE SHIFT



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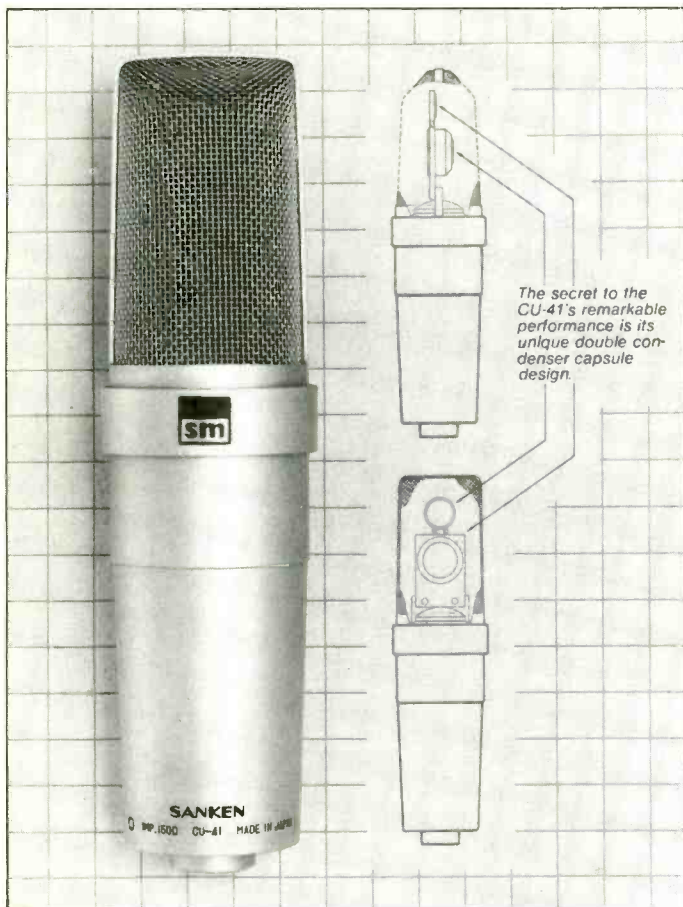
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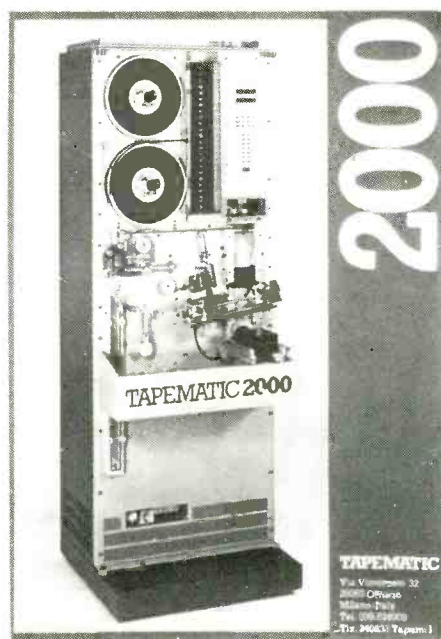
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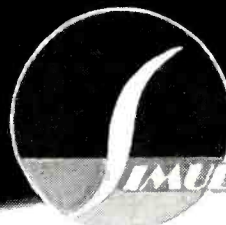
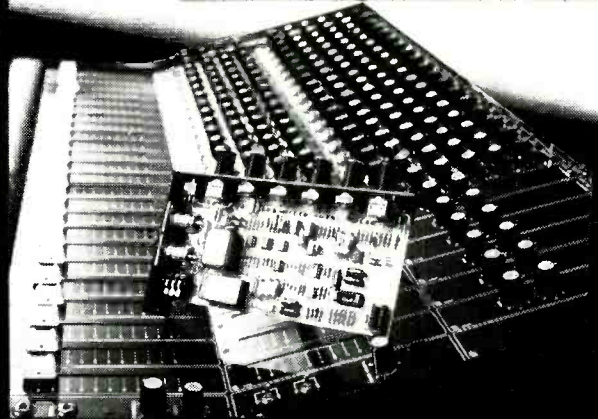


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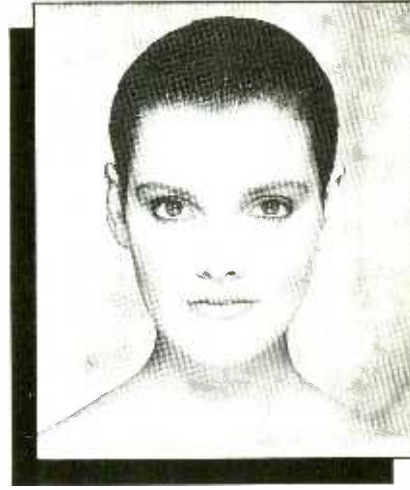
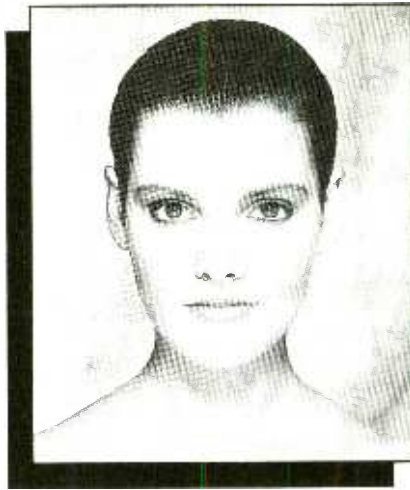
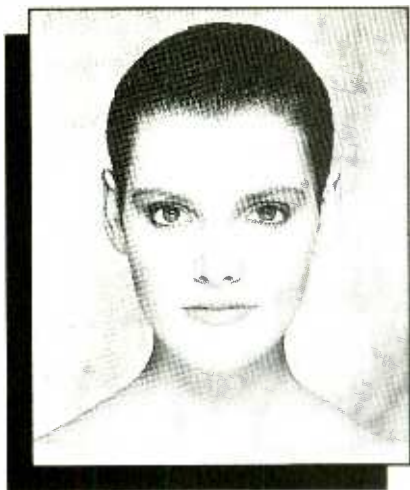
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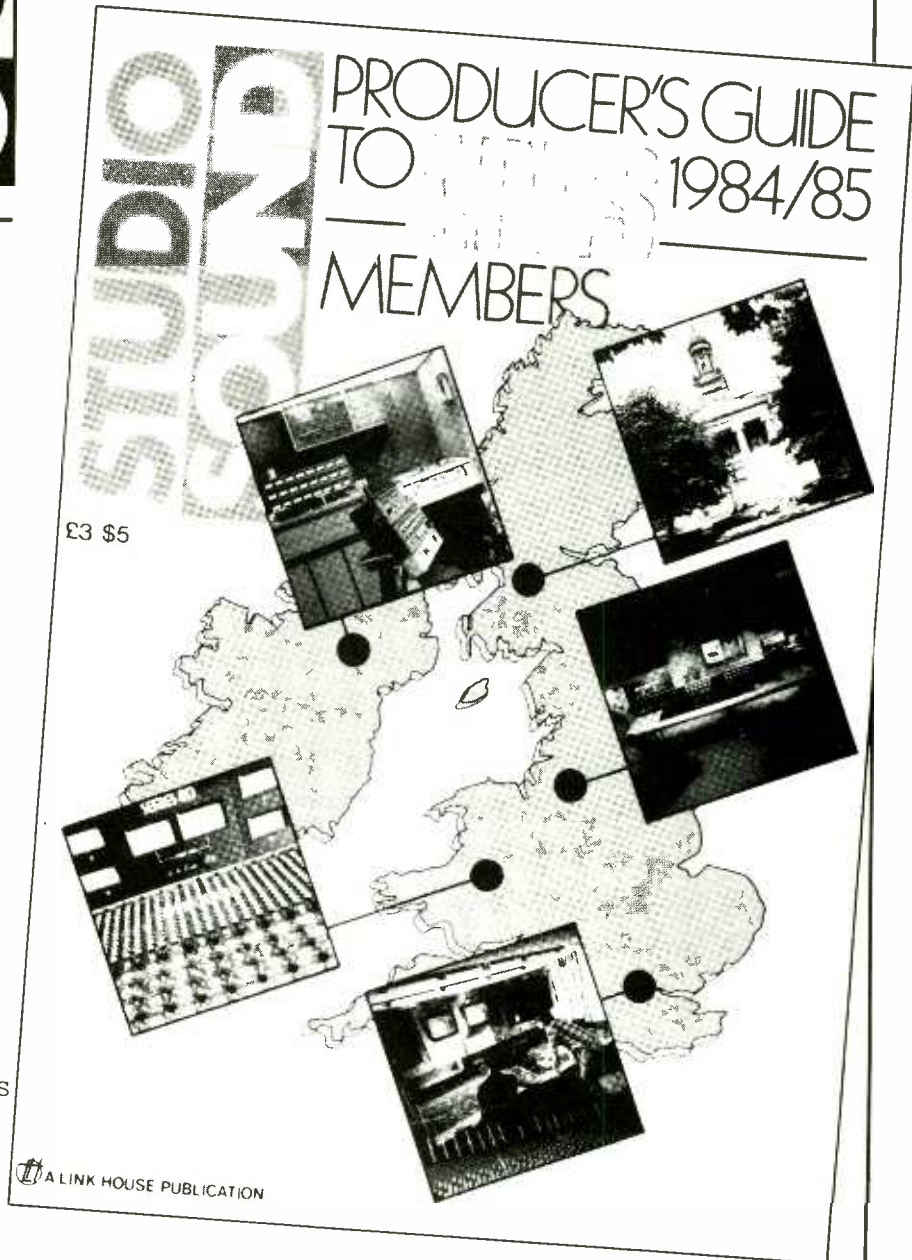
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- \* Master studio address file.
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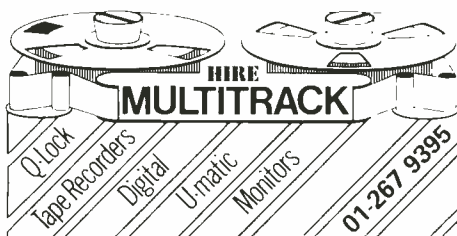
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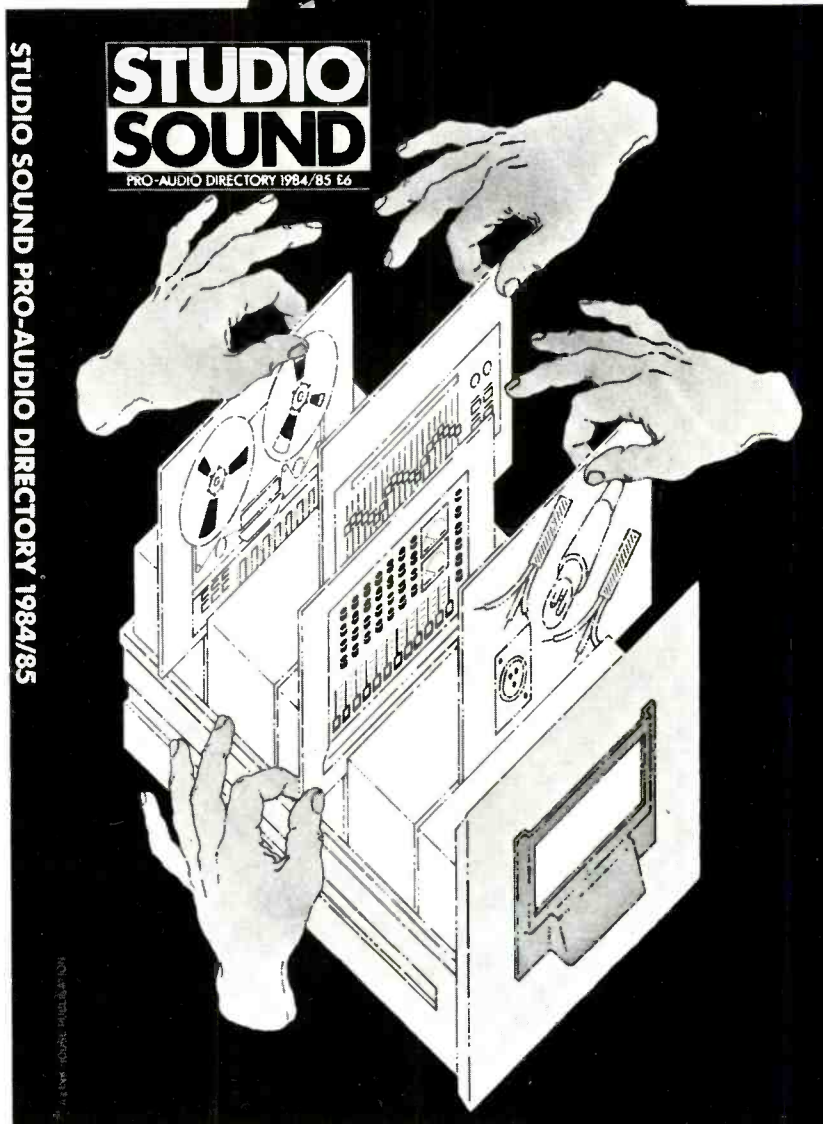
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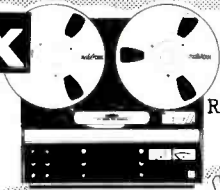
# AUDIO SERVICES MIXERS & MACHINES

STUDIOMASTER



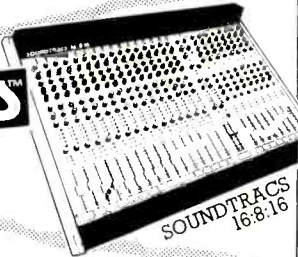
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REVOX



REVOX B77 MkII

SOUNDTRACS

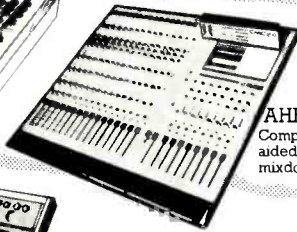


SOUNDTRACS 16:8:16

AHB



AHB SYSTEM 8:24:16:2

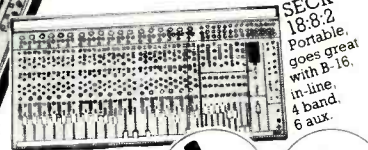


AHB CMC Computer aided mixdown.

SECK

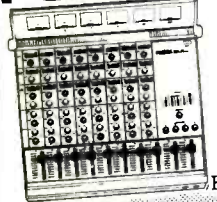


SECK 12:2



SECK 18:8:2 Portable, goes great with B-16, in-line, 4 band, 6 aux.

FOSTEX



FOSTEX A-8

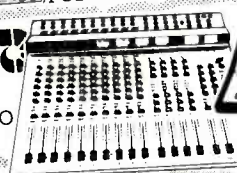
FOSTEX 350



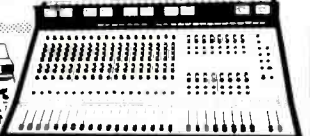
FOSTEX B-16 A new std. in multitrack recording.



RAM

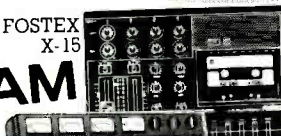


RAM MICRO



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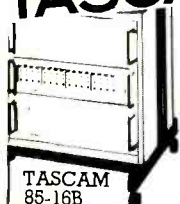
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