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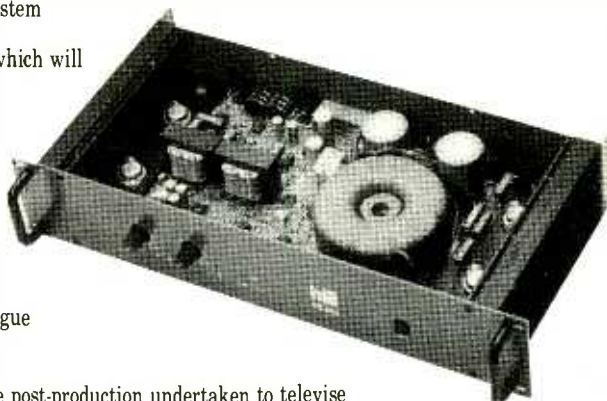
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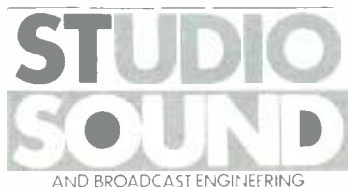
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July 1987
Volume 29 Number 7
ISSN 0144-5944

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Editor: Keith Spencer-Allen
Deputy Editor: Carl Anthony Snape
Staff Writer: Jonathan Kaye
Production Editor: Ann Horan
Production Assistant: Carrie Love
US Commentator: Martin Polon
Secretary: Cecilia Farrelly

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USA Agent: Joe Statuto, Rt 1, Box 40A,
Montague, TX 76251, USA. Tel: (817)
894-6923

Commercial Manager: Phil Guy
Director: Douglas G Shuard

CIRCULATION

Circulation Manager: Sally White

Editorial and advertising offices: Link House,
Dingwall Avenue, Croydon CR9 2TA, UK
Tel: 01-686 2599
International tel: +44 1 686 2599
Telex: 947709
E-mail: 78:DGS1071
IMC: STUDIOSOUND-UK/US
Fax: 01-760 0973

CIRCULATION ENQUIRIES

Controlled circulation: Controlled Circulation
Dept, Studio Sound, Link House Magazines Ltd,
Central House, 27 Park Street, Croydon CRO
1YD, UK
Paid subscriptions: Subscription Dept, Studio
Sound, Link House Magazines Ltd, 120-126
Lavender Avenue, Mitcham, Surrey CR4 3HP,
UK
2nd class postage paid New York, NY: Postmaster
please send address corrections to Studio Sound
c/o Expeditors of the Printed Word Ltd, 515
Madison Avenue, New York, NY 10022, USA
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Printed in England



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Studio Sound and Broadcast Engineering
incorporates Sound International and Beat
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EDITORIAL

There are times when we are allowed the luxury of discussion. There are times when it is right to express opinions. It is always right to listen. There are, however, times when the need for

positive action speaks so loudly that the only worthwhile response is a unified one.

As I write this I cannot believe how little informed our industry is on the subject of Copycode and what this will mean to them. For the background information I would refer you to recent pieces by Martin Polon and Barry Fox. I am not concerned at this point with rights and wrongs of home copying and/or what these mean to the record industry. These matters are irrelevant to the aspects of Copycode that we need to discuss.

The facts are clear. Copycode was developed by CBS Records Technology Center. It works by encoding a frequency notch into the recorded material at 3838 Hz. This notch has 3 dB points at 112 Hz width and a depth of approx 90 dB. This notch is cut by a Copycode Coder, a process that would most likely be carried out at the mastering stage. At the present time it is only CDs that are being suggested for encoding.

A DAT recorder would be required to incorporate a Copycode scanner that would detect the presence of the frequency notch in the intended material to be recorded and if present the DAT recorder would inhibit recording or at least degrade it.

At the time of writing there is legislation pending in the US that would prevent the marketing of DAT units not containing the Copycode scanner chip. Similar approaches have been made within the EEC pending the results of the US legislation.

The basis for the reasoning behind this system is that although the choice of a record sampling frequency of 48 kHz for DAT prevents direct digital copying from CD with a sampling rate of 41 kHz (and so the option of digital flags in the subcode) there is still the possibility of recording through the analogue inputs hence the need for a Copycode system.

This system was demonstrated in London a couple of weeks ago before a collection of well respected 'ears' in the recording industry. The system was shown working and then we were played extracts of unfamiliar recordings encoded and unencoded with Copycode. It has been claimed that the presence of the Copycode notch is inaudible. A booklet explaining the system prepared by the IFPI says that 'even professional studio listeners have been unable to detect the presence or absence of the Copycode notch in carefully controlled listening tests' and also that 'human listeners cannot tell the difference between unencoded and encoded albums'. At the demonstration we listened to unfamiliar speakers in an unfamiliar room in a far from ideal listening position and after a short period of acclimatisation most of the listeners present in the room could detect when the code was present. It was audible.

We have no gripe with the CBS Technology Center. They have produced a record protection system that works and we have to admit that the scale of audibility on some material is not vast. Our concern needs to be directed once again at the record companies who through their trade bodies are pressing for the legal implementation of a system that degrades the sound quality available to all consumers even for those who have absolutely no wish to home tape.

It is true to say that if you were given a recording that was encoded then it is fairly unlikely that you would be able to recognise the presence of Copycode as you would more likely think that the recording just sounded like that. This is of course little comfort to those (including the record companies) who have invested large sums of money in recording projects where quality was a concern or to studios who have invested money and effort in producing a high quality recording. You will all have been wasting time and money. As Copycode can only be cut in to the audio in the analogue domain at present (digital systems are still some way off) there will be all the degradation of D/A and A/D conversion for those of you working in the digital domain. You will have been totally wasting your time, money and effort. All notched recordings will have degraded not only by the presence of the notch in a fairly critical frequency band but also by the resultant phase problems that we know to cause sonic degradation.

Even if the public cannot detect the presence of Copycode it is quite possible that they might just not like what they hear from notched CDs—just at a time when we were really getting to grips with the little anomalies that digital audio has suffered from so far. The possible implications are legion and I will leave the possible scenarios up to you. Should Copycode become mandatory then studios would be wise to consider their future and the need for further investment in quality equipment. We will have been shot in the foot.

As a publishing house we are watching the situation very carefully and may incorporate an anti-photocopying feature into the magazine. Expect future issues to omit the letter 'a' from copyright articles. The joy of this idea is that you will never be able to make a perfect photocopy. Marvellous isn't it? We are also considering printing on dark blue paper for the same reasons to really make life difficult and some want to go even . . . (fade to insanity)☐



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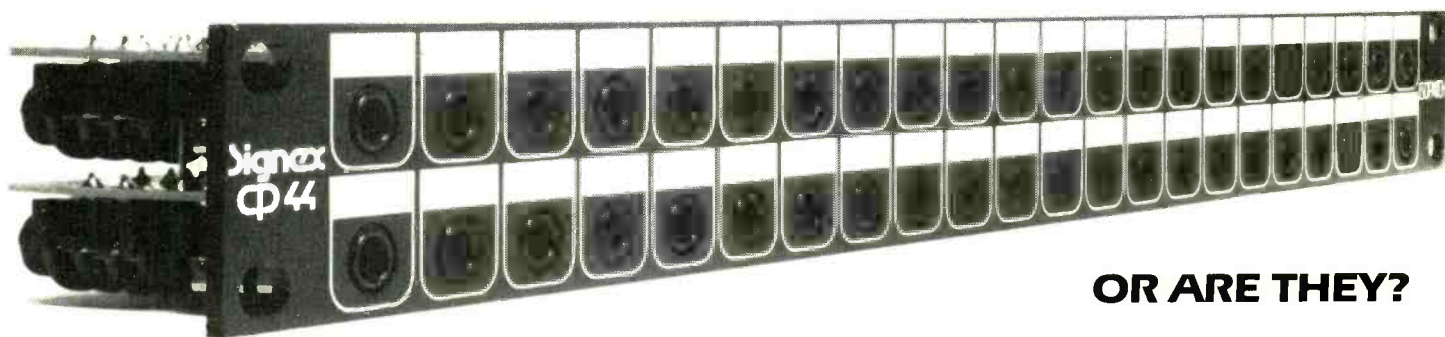
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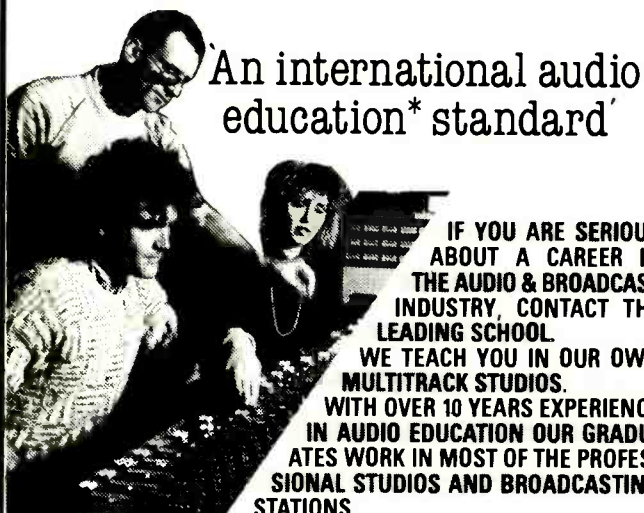
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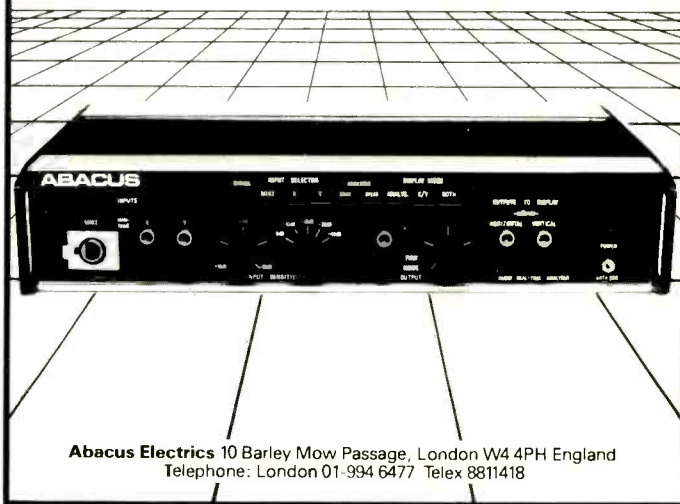


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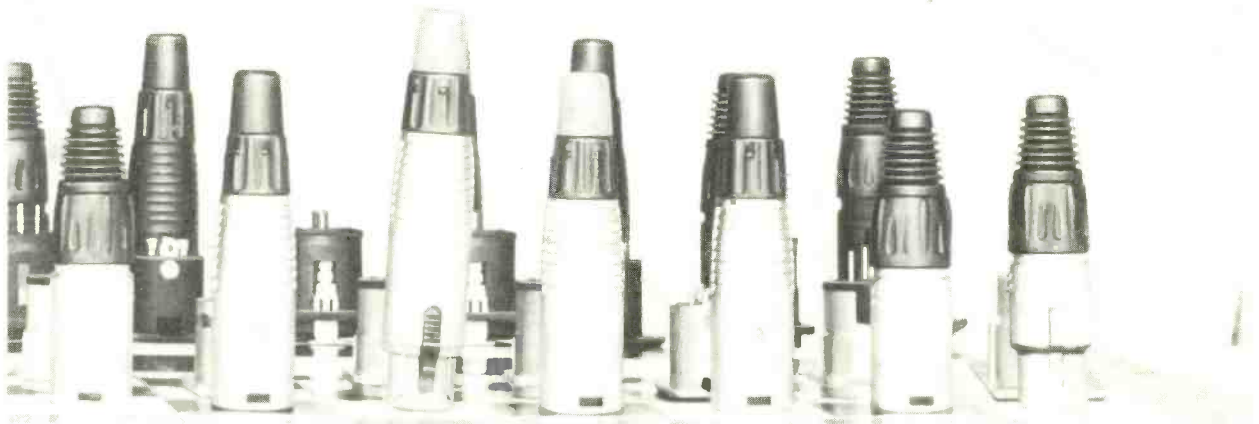
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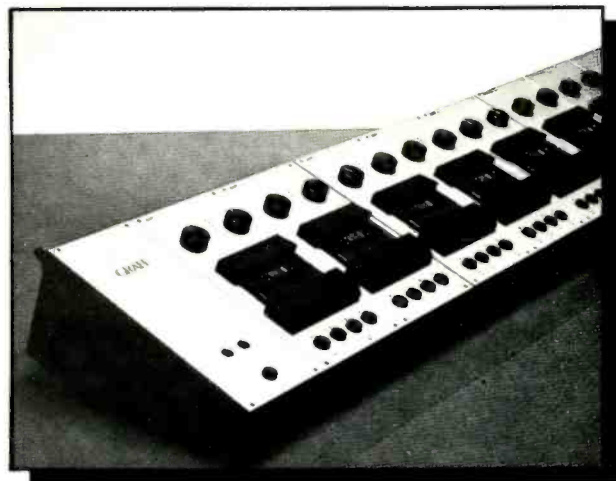
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Impedances	10 k Ω /10 k Ω Can be fed from 50-600 Ω	600 or 150 Ω Inputs or Outputs	Pys 60, 200 or 600 Ω Sy 5 k Ω down to 1 k Ω	600 Ω /600 Ω	200 Ω Balanced Primary Two 200 Ω Secondary	Py 600 Ω Sy 60 k Ω	200 Ω Py for 1k Ω loading (Bifilar) 8/1 step up
Frequency Range	20-20kHz	20-20kHz	30-20kHz	20-20kHz	20-20kHz	300-3k4Hz	20-20kHz
Performance	\pm 0.1dB Over above Range	\pm 0.25dB Over above Range	\pm 0.5dB Over above Range	\pm 0.3dB 40-15kHz \pm 0.5dB 20-20kHz	\pm 0.5dB Over above Range	\pm 0.5dB Over above Range	\pm 0.2dB Over above Range
Maximum Level	7.75V P.M.S. on Secondary	7.75V P.M.S. on 600 Ω	on 5k Ω 3.4V P.M.S. at 30kHz	26dBm at 30kHz	2.3V R.M.S. at 30kHz	0.6V p-p on Py	2.0V R.M.S. on Py at 30kHz
Maximum Distortion	With 10V P.M.S. at 40kHz only 0.12%	on 600 Ω Low source Ω 0.1%	Less than 0.1% at 1kHz	<0.1% at 30kHz and 26dBm	Negligible <0.1% at 1kHz	Negligible	0.1% at 20kHz
Shielding	Electrostatic Screens & Mumetal can	Mumetal can if desired at extra cost	Mumetal Can	Toroidal Can	Mumetal Can Rigid Fixing Bolts	PCB Mounting	Mumetal Can
Dimensions	33mm diam. \times 22mm high	36mm high \times 43mm \times 33mm	33mm diam. \times 22mm high	50mm diam. 36mm high	33mm diam. 37mm high	11.1mm high 19mm \times 17mm	33mm diam. 22mm high
Price each at works	1.5-£10.83 50-£9.77 100-£9.27	1.5-£9.67 50-£8.89 100-£8.69	1.5-£9.67 50-£8.67 100-£8.41	1.5-£17.12 50-£15.69 100-£15.35	1.5-£14.59 50-£13.37 100-£13.08	1.5-£3.89 50-£3.55 100-£3.29	1.5-£11.38 50-£10.12 100-£9.92

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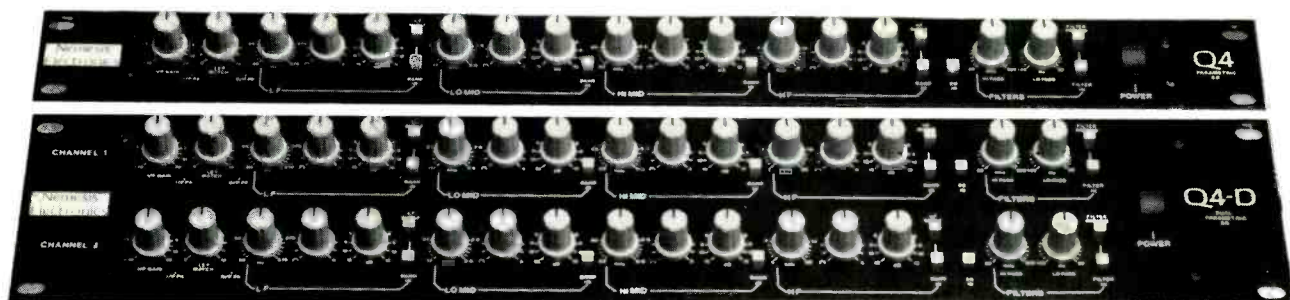
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NEWS

Emerald conglomerate in Nashville

Dale Moore, a Nashville music industry veteran, has announced the formation of the Emerald Entertainment Group in Music Row with the merger of the newly acquired and updated Emerald Sound Studio along with Robert Porter Management, Moore Publishing Company, Moore Aircraft Leasing and Park Place, a Montana music club. Emerald expect the move will allow for a fully comprehensive service to their clients.

The studio itself, updated by Tom Hidley, is now fully digital while

retaining analogue capability. Robert Porter brings to Emerald a history of successful management as well as international touring and promotion work. Moore Publishing will work closely with the management division to build a solid core of writers, and the Aircraft Leasing division makes available an eight-passenger jet for short term leasing and a handy service for Emerald clients. Emerald Entertainment Group, 1100 17th Avenue South, Nashville, TN 37212. Tel: (213) 392-9511.

Literature received

● Sifam Ltd of Torquay have updated their catalogue of control knobs and accessories, incorporating all new developments and products since the original catalogue. In full colour with easy to use coding, Sifam claim the guide covers more than ¼ million permutations of specification, thereby making choice at design stage a one-step affair. Copies are available free to companies from: Sifam Ltd, Accessories Division, Woodland Road, Torquay, Devon TQ2 7AY.

● Electronic and Computer Workshop

(ECW) Ltd have published a new book on getting the most out of oscilloscopes, aimed at anyone with even a basic knowledge of electronics. A wide range of topics are discussed, ranging from theory to a broad spectrum of practical applications. *How To Get The Best From Your Scope* is available by mail order for £3.50 from: Caroline Stewart, General Manager, Electronic and Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY, UK. Tel: 0245 262149.

Forthcoming events

June 24th to 26th APRS 87, Olympia 2, London, UK.

June 26th to 30th BKSTS '87, Metropole Exhibition Centre, Brighton, Sussex, UK.

June 27th to 30th NAMM Expo '87, McCormick Place, Chicago, Illinois, USA.

September 3rd to 7th SIM-HI-FI-IVES, Milan, Italy.

October 14th to 17th Broadcast '87, Frankfurt, West Germany.

October 16th to 19th AES 83rd Convention, New York, USA.

October 24th 12th Sound Broadcasting Equipment Show, Albany Hotel, Birmingham, UK.

March 1st to 4th, 1988 AES 84th Convention, Palais des Congrès, Paris, France.

March 9th to 13th, 1988 Frankfurt Musik Messe '88, Frankfurt, West Germany.

Agencies

● Altec Lansing have appointed Esco of Kentucky as its authorised industrial/professional sound contractor in Kentucky and southern Indiana. Esco of Kentucky, 1754 Watterson Trail, Louisville, KY 40299. Tel: (502) 491-1895.

● McKenzie Acoustics have announced the appointment of New Technology Marketing as distributor of their range of drivers and accessories throughout Egypt.

● Shuttlesound of London have announced that they will be carrying the Audio Digital (of Oregon) line of digital audio products, including the ADD series of digital delays.

● The Pro-Audio division of Tantek have appointed State of the Art Distribution as exclusive UK distributor for their *Master Matrix* range of MIDI-controlled audio patchers. State of the Art Distribution, Studio House, High Lane Village, Stockport, Cheshire SK6 8AA. Tel: 0663 22442.

● Alpha Audio Automation Systems of Richmond, Virginia, have announced an agreement with Gexco Technology International of New Jersey on international marketing representation for Alpha's *BOSS* automated audio editing system.

● Nemesis Electronics Ltd have appointed AV Technology International Inc as their international distributor with the exception of the UK and Italy. Audio Equipment SRL will be handling the Italian side, while Nemesis themselves continue to distribute in the UK. AV Technology International, PO Box 275, Newton Center, MA 02159, USA. Tel: (617) 965-5656. Audio Equipment SRL, 37 Via C Rota, 20052 Monza (MI), Italy. Tel: 039 836767.

● Mitsubishi Pro Audio have appointed Tecnad as distributor for their range of consoles in Switzerland.

In brief

● Space Logic Design Consultants have joined forces with architect, Alan Morris, to form Morris/Logic Architects and Designers, a studio interior design service with sophisticated electronics and digital recording in mind. Their address is: 94-96 Eversholt Street, London NW1 1BP. Tel: 01-388 3859.

● UK-based Pye TVT Ltd have been acquired by Varian Associates Inc of Palo Alto, California. The new company will be known as Varian TVT Ltd.

● Paul Farrah Sound have recently installed a high-performance Nexo and C-Audio sound system in the Capital Radio Rig, the station's promotional vehicle.

● Because of their growing commitment towards computer music software, sequencing, mono and poly MIDI converters, drum machines and so on, Rod Argent's Keyboards in London are changing their name to 'Argent's', while continuing its range of other keyboards.

● Alpha Audio of Richmond, Virginia, have announced the opening of its expanded facility at 2049 West Broad Street. The renovation of the acoustics and automation divisions effectively doubles the size of Alpha's operations in these areas.

● Perfectone Products SA of Switzerland have been taken over by Giese Electronic KG of West Germany. Their trading name will now be Perfectone SA, and their supply and production will continue as usual. Perfectone's address and phone number remain unchanged.

● The Canadian Users MIDI Group (C-MUG) have announced their merger with MIDICOM of Montreal, to form Canada's largest group of MIDI users and electronic musicians. C-MUG will remain as the national title, with regional identities being developed for general correspondence. C-MUG, Ontario Region, PO Box 1043, Belleville, Ontario, Canada K8N 5B6. The address for the Quebec region is: 771 Decarie Blvd, Saint-Laurent, Quebec, Canada H4L 3L3.

● The London College of Furniture is holding its annual, end of year exhibition from June 30th to July 3rd. Its musical instrument technology department produces a wide range of electronic and natural instruments, and this year will feature guitar practice amplifiers and a studio mixing console, as well as guitars, violins, pianos, harpsichords and other musical instruments. Oh yes, there will be a wide variety of furniture as well.

Stolen equipment

A pair of recently launched Spica TC-50 loudspeakers, serial number 5961W, went missing in transit after being picked up from UK distributors, Presence Audio. Any

information should be forwarded to the police or Presence Audio, Plummers Plain, Horsham, West Sussex RH13 6NY. Tel: 044485 333

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NEWS

Carlton acquires DAR

Carlton Communications have acquired London-based Digital Audio Research, which specialises in the design and manufacture of pro-audio products. DAR's first product, *Wordfit*, was an audio processing system that automatically synchronises replacement dialogue with actors' lip movement. It has been used in films such as *Passage to India* and *Killing Fields*, and been sold to Universal and Burbank Studios in the US, and to Video Sweden AB in Stockholm.

DAR's next product, due for release in mid-'87, is *SoundStation-II*, a complete digital audio recording, storage and processing system. It's

aimed primarily at the recording, broadcast and film post-production industries.

The directors of DAR have a relevant combination of experience in advanced computer techniques and familiarity with the audio industry. The two founders, Dr Jeffrey Bloom and Nicholas Rose, were responsible for *Wordfit*, and one of the leading experts and pioneers in digital audio, Guy McNally ex-BBC, has recently joined the team.

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

Designs and doodles

Composer? Arranger? Producer?—it doesn't really matter what you call yourself, there are a lot of people out there inventing new combinations of sounds and putting them on to tape. Some people went to college and know how to write musical dots on paper, others wouldn't know a crotchet from a crocodile but still manage to create music that rises up the sales charts like cream to the top of the milk. How do they do it? Come to that, how do *you* do what you do, how do I?

When questioned about their working methods, all composers (arrangers, producers . . .) could tell you how they set about producing their latest masterpiece, action by action, but it wouldn't throw much light on how it really came about. I often start a morning's work by producing a pile of sawdust on the floor (caused by excessive head scratching) before I produce a single note. I always do come up with something before long so I don't waste time worrying about it. It did prompt a chain of thought, however, so I assumed a thinking posture and came up with this . . .

Designs and doodles; two distinct ways of inventing new music which my observation has chanced upon. Let's see how the design process

works, first of all.

I hope I will not put too many people off if I start with the 'classical' example of design—the classical music composer of course. This is the chap, or chapess, who goes for long walks in the countryside, humming tunes and thinking up orchestrations. On arrival home, out comes the manuscript paper and the already worked-out composition is notated for posterity.

Many people, not necessarily in the classical field, have their inspiration in this way—working out the idea away from any instrument and only when it has reached a comparatively advanced state, writing it down or recording it.

Not far removed from this is the composer who sits down at the piano or strums a guitar, writing down or recording as he goes. This is still design music. It starts in the head, works its way down through the fingers to an instrument, where it emerges as sound.

A different situation is the person who sits down at a drum machine or Page R on the Fairlight. Tap in a note. Sounds good? Tap in another and try to make the combination sound better. Another way is to record a basic track on multitrack tape and then react to this, adding tracks as you go along, until a situation of completeness is reached—this is the doodling approach. I should say that I am not praising one method and denouncing the other. It's the end product that is important, but there are different ways of achieving it.

In my description of the design process I may have suggested that this is the 'skilful' approach but this is not necessarily so. You can design a piece of music without any of the usual musical communication skills such as writing down dots, chord progressions or making a demo recording. All that is needed here is some good instrumentalists to work with and a knack at verbal communication. You provide the design—pure gut musicianship—and the professionals supply the detail. It's another perfectly respectable way of working, and has an advantage over the classical composer who has to work out absolutely everything on paper before his piece can be played.

A design composer has the advantage of freedom. Think of the music first and then find a way to make the sounds. It's a separation of the two processes.

The doodler has the problem that

he is ruled by the machine. If you are working out a doodle on a *Linn* drum, then you cannot invent anything that the machine is not already capable of. It could account for the 'sameness' of a lot of drum machine tracks you hear. There are, however, powerful advantages.

I am convinced that when Roger Linn had his brainwave he was trying to make a machine which a clever operator could make sound like a real drummer. What his invention, and other drum machines, provide as a bonus, is the capability to perform things that a real drummer could never do. This is the wonder of the doodle, when you 'mess around' with a new piece of equipment—sequencer, sampler or whatever—new possibilities are opening up all the time, in terms of new sounds and new combinations of sounds, which the design composer could never imagine.

The designer can think of a new sound, but how to make it? That can be an enormous problem. The doodler, on the other hand, has just to experiment. New sounds will appear almost by magic. All he then has to do is think of a way of using them, a much more straightforward proposition.

What would be really good would be to combine the conceptual advantages of the design process with the discovery power of doodling.

My current scheme has four phases: *Research*—the doodling part, where I pick on an instrument or combination of instruments and effects, and try things I haven't tried before. When I come across something interesting, which never takes long, I copy it on to disk and scribble a couple of words on paper so I can get back to it. A few doodles later and I have some raw material to work on.

Development—now that I know what I have to work with, I can go back and make changes or combine ideas together, find something that sounds good.

Design—with some new sounds and musical ideas in my bag I can go away and have a think about what I am going to do with them. It's like having an orchestra of newly invented instruments. You know what they are capable of but you still have to write some music for them.

Construction—where it all comes together and, of course, it sounds great!

I don't really go through this process letter by letter, of course, but I am consciously trying to combine the design and the doodle approach to the benefit of my music. It seems to work.

I have more to say on the techniques of composing with modern studio equipment but it will have to wait for another day. In the meantime, I have a sample of a squeaky felt-tip pen to doodle around with.

David Mellor



ECHO TIMES

AMPEX

AMS

An Agreement has been reached between AMS and Ampex to share expertise and jointly develop an interface for the AMS AudioFile which permits simultaneous cutting of audio whilst cutting picture. The potential of incorporating AudioFile into an on-line video editing suite has been under investigation by the two companies since initial discussions in August of last year. Earlier in 1987, Ampex supplied several customers in the United States with AudioFile in order to attract comments and suggestions for the implementation of the control of AudioFile by the Ampex ACE video editor. Response to date to the approach has been very positive and both

AMS and Ampex will be showing the benefits and savings attributed to the technique for the first time at the Montreux Television Symposium this June.

Major attractions of the technique mean that any video edit will automatically produce an audio edit and all audio segments will be recorded on AudioFile's hard disc with pre- and post-roll prior to the in point and after the out point. Should a video edit produce an unacceptable audio edit, 'slop' at the beginning and end of all audio segments can easily be slipped, at the time, until an acceptable audio edit is established. Although the ACE video editor will have complete control of the AudioFile during the video edit, the video editor does not even need to be aware that he is assembling audio edits. The nature of access to the hard disc system means it does not slow down the video editing processes at all and, of course, the audio quality is preserved to the

highest standard. AudioFile may then be employed by the same facility for audio sweetening, or the audio edits can be digitally data dumped onto a video cassette and, along with an edit decision list, transferred for re-loading onto another AudioFile at any other specialist sweetening facility.

Ampex will be supplying the AudioFile system along with the specialist interface to the ACE video editor and have recently appointed Mr. Steve Krampf to head the project. Steve Krampf is well known to many members of the professional audio community in the USA, as he was Vice President, Sales and Marketing for Otari tape recorders for seven years.

For any further information on video editor interface to AudioFile please contact John Emmas at the AMS head office or, alternatively, Steve Krampf at Ampex in Redwood City, CA on (415) 367-4140.



THE AMS STUDIO COMPUTER

The acquisition of Calrec by AMS promised many advantages for both companies right from the start. The majority of the immediate advantages were described in Echo Times number 9. The first commercially available product will be on display at the forthcoming APRS exhibition in London - THE AMS STUDIO COMPUTER.

TASC has been designed as both a console automation system for the UA 8000 and a

machine management system for both audio and video recorders.

The UA 8000 has continued to grow in reputation following the purchase of the console by some of the world's leading recording studios. Although many have been left in no doubt concerning the features, facilities and audio quality of the UA 8000, the console automation options open to a prospective purchaser have not matched the calibre of the console itself. Nothing currently in the marketplace could turn the UA 8000 music recording console into a music recording system. Hence TASC.

TASC was designed using certain proven computer hardware and software already developed at AMS, along with invaluable input from Calrec and freelance users, with a view to building a studio computer system which when combined with the UA 8000 would provide a very attractive option for any studio.

Some of the features of TASC are briefly describe below:

- ★ Up to 8 M Bytes of battery supported RAM can hold a large number of mixes that are not lost on powerdown and are available rapidly for comparison and manipulation.
- ★ Highly intelligent automation allows mix updates to be inserted on any channel 'on the fly' without creating multiple mixes.
- ★ Mixes can be saved on inexpensive 3.5" 3/4 M Byte floppy discs.
- ★ Tape Machine Automation.
- ★ Snapshot mixes.
- ★ High resolution monitor.
- ★ Cuts are accurate to 1/10th. of a frame.
- ★ 80 channel capability.
- ★ Very flexible fader grouping completely under software control with any fader being available for grouping to two levels with clear status display on a monitor. Fader grouping can also be set on the channel strips.
- ★ Mixes can be run from a timecode-only reference.

AMS would like to take this opportunity of thanking a number of companies for their help during the development of TASC: - Audio FX, Hilton Sound, FWO Bauch, Otari and certain individuals who prefer to remain anonymous all freely contributed their knowledge and experience.



GETS CUT-AND-SPLICE

Cut-and-Splice editing is now available for AMS AudioFile.

This feature is the latest software addition to AMS AudioFile and provides the capability of editing the spoken word or music in a way that parallels the editing of documents by a word processor.

Not only can 'ums' and 'ers' rapidly be removed from dialogue but gaps between words can be inserted or lengthened, or complete new words or sentences can be introduced.

During April, thirteen people, all AudioFile users with a vested interest in CD mastering, visited AMS to try for themselves a version of Cut-and-Splice stereo editing. The AudioFile owners with experience of the system were very impressed with the editing page presented to them for their criticism and were confident that this approach would produce better results more quickly and with greater flexibility than conventional digital tape based techniques.

As well as the operational advantages that were identified, an AudioFile package can also cost less than equipping a studio with a tape based dub editing package.

As is normally the case with such developments, refinements and enhancements will continue to be made. The software package will be on general release following its introduction at the APRS exhibition in London during June.

LONDON CUTTING ROOMS GO FOR AUDIOFILE

The new Cut-and-Splice page for AudioFile has attracted several of London's leading mastering facilities to purchase AudioFile for CD mastering.

As well as offering a fast and accurate method of editing audio, AudioFile also has digital interfaces available which will cope with the majority of digital masters delivered to any cutting room.

Tape One, reputedly one of the world's leading mastering facilities, is intent on becoming the world's first totally digital hard disc mastering facility. To this end an AudioFile system is being combined with a new Neve DTC digital console.

Mr. Bill Foster and Mr. Barry Ainsworth of Tape One stated: 'Tape One were faced with several options once the decision had been made to take advantage of an all digital approach to mastering incorporating hard disc technology. Choosing the AMS/Neve route will permit two products, that have been individually proved, to come together as a system - both products already having enjoyed the benefits of considerable user feedback.' Among four other customers who have

examined the Cut-and-Splice page of AudioFile in London and made decisions to purchase is Mr. Adam Skeaping of The Digital Editing Company Ltd., Adam summed up his decision as follows: 'I have always been convinced that digital audio editing should be electronic based on hard disc technology and not dub editing on magnetic tape. I have carefully watched the progress of many companies in this direction and at the end of 1986 I became sufficiently convinced of the capabilities of the AMS AudioFile that I decided to build a facility round one.'

AMS are delighted to add this latest group of customers to their user lists and feel that this calibre of customer will continue to make a positive contribution to the development of new pages like Cut-and-Splice which will be available to all AudioFile owners.

AUDIOFILE NOW RENTS

AMS AudioFile is now available for rental from two of London's major and best known rental companies, AUDIO FX and HILTON SOUND.

Recent enhancements and new features have made AudioFile an attractive proposition for project work and for those not in a position to purchase, the option of renting is now available.

Both Audio FX and Hilton Sound will have the ability to offer 701 data dump with AudioFile which permits a master copy of all AudioFile hard disc recordings to be archived on video tape.

The AudioFiles for rent will always feature the latest and most up-to-date software and hardware and can be supplied to perform any of the current applications already being undertaken by AudioFiles in the field.

Audio FX 01-482-1440
Hilton Sound 01-708-0483

The 22,000 square foot extension on schedule for late summer to accommodate the Calrec Manufacturing Section.



UA 8000 APRS

London's 1987 Association of Professional Recording Studios (APRS) exhibition will be the premiere showing of the 'Calrec by AMS' UA 8000 music recording console and automation system.

Although the console has already been installed in a handful of the world's most prestigious locations, the UA 8000 has never been displayed to the recording industry at a professional convention before.

The console's stature is underlined when you consider that no-one who has tested the audio performance of the console has found fault with the statement that 'The UA 8000 is the world's best sounding music recording console.'

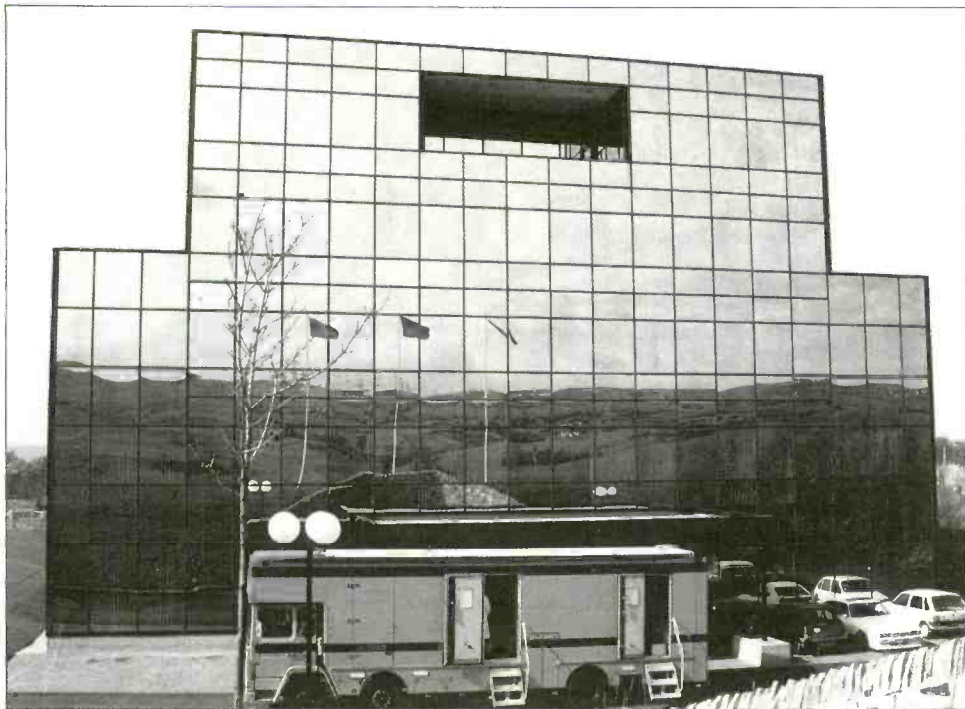
The UA 8000 that will be exhibited is a 64 channel console and will feature TASC, The AMS Studio Computer.

Interest in the UA 8000 has been steadily growing over the past 12 months and now, with the addition of TASC, an integrated studio system is available which has resulted in an unprecedented number of serious purchase enquiries.

Although confident that many of these enquiries should translate into firm orders, an already very full order book for broadcast consoles and other products means only a few production slots remain in 1987. This factor alone will ensure that for the time being the UA 8000 recording system will remain an exclusive item available to only a small section of our industry.

The move for Calrec from Hebden Bridge to the AMS headquarters in Burnley is on schedule for late summer. The relocation will provide 22,000 square feet of additional engineering and manufacturing area.

BBC OB WITH 112 INPUT CALREC CONSOLE GOES INTO SERVICE



The BBC's MSCV outside the A.M.S. Headquarters.

The BBC's latest and most prestigious Outside Broadcast vehicle went into service for the first time with the recent production of the Humanitarian Awards programme. Before being tried out at the Country Music Festival held at London's Wembley Arena, the vehicle, which houses a 112 input Calrec digitally assignable console, had been undergoing acceptance tests by the BBC at Calrec's Hebden Bridge factory. The vehicle is the BBC's Master Sound Control Vehicle and it is intended to be used on all outside broadcast applications, ranging from Royal weddings to concerts at the Royal Albert Hall, where audio takes a high profile.

The console has been supplied with Total Instant Reset and no less than 30 complete console set-ups can be recalled at the push of a button allowing just one console and one operator to do work which would previously have demanded several mixing consoles and several operators.

As well as offering Total Instant Reset, the console also offers significant space saving when compared with conventional mixing consoles allowing it to be mounted across the width of the vehicle with all 112 input channels easily accessible from the operator's chair.

This is the second digitally assignable console supplied by Calrec, the first being an 84 channel system delivered at the end of 1986 to Thames Television in London.

THE POD

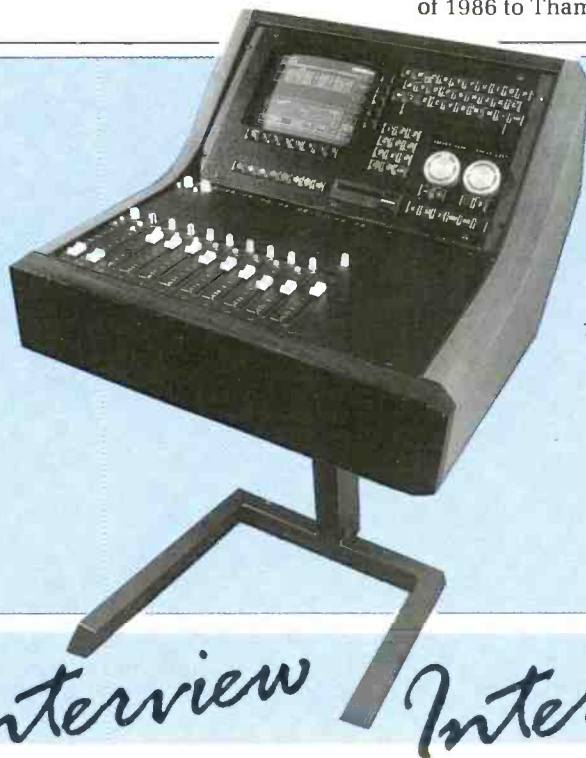
The Pod is a newly introduced work station for housing the AMS AudioFile control surface and is available in three forms.

Firstly, the Pod can be supplied as a workstation incorporating an author's desk for documents or scripts.

In the Sub Mix Pod the author's desk section is replaced by an 8 into 2 submixer complete with two channels of selectable mic/line input - all channels incorporating pan and solo controls.

Finally, a full Mini Mixer Pod is available incorporating the very successful Calrec Mini Mixer offering full equalisation capability.

Specifications and dimensions are available from AMS upon request.



The Sub Mix Pod, one of three new workstations for AudioFile.

Interview

Interview

Interview

THE BRIDGE

The Bridge is undoubtedly London's newest studio complex featuring a catalogue of equipment and personnel that is, to say the very least, extremely impressive.

The concept has been turned into reality by a seasoned campaigner who still describes himself as 'always having been a sound man' - Mr Robbie Weston. Robbie's history includes spells at Radio Luxembourg, Capital Radio and Molinaire before, along with a couple of partners, starting his own facility of Silk Sound in 1978.

The same partnership, which continues to successfully run Silk Sound, decided some two years ago to develop the concept of what they describe as 'the ultimate facility'. This facility would be a complex of two studios, no more no less, designed in the most thorough engineering terms, entertaining no compromises at any level and being based on the very best equipment available in the form of working and proven technology.

Adopting this philosophy entailed equipping two rooms with Solid State Logic mixing consoles and computer systems alongside the new and highly praised Studer A820 multitrack recorders. The

choice so far would raise no eyebrows. To include in the heart of this formula two AMS AudioFile hard disc systems may well call for a little explanation!

A.M.S.: *Silk Sound were among the first wave of London studios to buy and explore the potential of the AMS AudioFile hard disc system (see Echo Times number 7) - Was that a simple decision to make?*

Robbie Weston: The decision was neither hard nor simple, it was a logical one. If you examine how the industry has developed you can see it was a logical choice. Although my life has revolved around audio, I always knew when Silk Sound was



The Bridge, featuring two AudioFiles and two SSL Consoles.

started that we would move into video post production, and even from the beginning planned and worked on a sound effects library for that purpose.

I also always believed that one day technology would put a stop to the solution of synchronizing sound with picture by employing rooms full of looped mag machines nursed by hoards of people beavering away in back rooms. The first glimpse of light at the end of that tunnel came with the Audio Kinetics "Q Lock" system. In the early days there was Silk, CTCV and Molinaire working with a synchroniser, a 24 track tape recorder and video – and very few others that I recall.

A.M.S.: *So you consider the synchroniser/multitrack/video recorder route as the first step in synchronizing sound to video picture?*

R.W.: Yes I do. You have to be careful though, because the professional approach requires investment in 1" video, every form of Nagra pulsing, multi-standard timecode operation etc, etc, so a client can bring you anything and go away with a result he is happy with.

A.M.S.: *And the next step?*

R.W.: The one big disadvantage that has plagued audio post production for video using synchronisers and multitracks has been that there is no easy way to slip audio tracks on a multitrack recorder.

You can't just advance or retard by 5 frames quickly. If someone wanted to advance two or three spoken words in a paragraph by 5 frames it was a nightmare and that is where film people could always say – aha – that could be done in a few seconds on film. That is why AudioFile is so attractive and represents the missing link in the process as slipping tracks and even bouncing tracks is something that AudioFile can do so very easily.

A.M.S.: *You say AudioFile, but did you consider any of the other hard disc based systems that are being heavily promoted currently?*

R.W.: We looked at all sorts of documentation and took in demonstrations whenever possible. In one presentation of a certain system the first thing that was

shown was how the system could take a selection of vowels and consonants from spoken word and after a period of manipulation the system could synthesise the word ERIC! That sort of thing is so far from the mark of what we needed it was unbelievable and all for 3 times the price of AudioFile!

Since we started looking for a hard disc audio system no other company has even proposed a unit that looks as if it can perform the fundamentals of AudioFile – let alone demonstrate it. Many of the companies looking at hard disc based systems today seem to have difficulty defining exactly what it is they are wanting their system to do for the person who buys it.

With AudioFile it is different. A one minute demonstration can capture your imagination and shows you immediately just what a workhorse AudioFile can be, whether preparing material for radio or in conjunction with pictures.

A one minute demonstration should make you realise how cumbersome and hit and miss a process working with an events controller, carts, turntables and tape machine is.

A.M.S.: *Surely you still see a place in your studio for tape machines though?*

R.W.: Oh yes, but a lot of them can be replaced. The key to getting involved with AudioFile is that not only can it do a better job than anything we have had before, but it also costs less.

A.M.S.: *Can you explain that?*

R.W.: The sums show that the money that was needed to equip with cart players is about the same, if not slightly more, than equipping with AudioFile. So, forgetting all the other benefits of AudioFile my cart machine budget has literally bought me a better solution.

I worked out that I would have needed two triple stack cart players, noise reduction for both, an ITC 99 to give reasonable cart recording, noise reduction on that, a couple of 1/4" machines for playing in other tapes, ideally these machines should be synchronized, and so it goes on!

A.M.S.: *So how do you answer the question when someone comes into the Bridge and sees AudioFiles mounted in the centre of Solid State Logic consoles and says to you – "You told me you would have the ultimate facility based around tried and proven technology?"*

R.W.: I'd tell him that is exactly what he is looking at. AudioFile holds no magic for us. Don't forget we have had experience of one for almost twelve months now and we have had the opportunity to see the system grow in potential and capability. AudioFile performs a set of specific functions very very well, it also does certain things that are almost impossible with other equipment. Anyone who starts by considering replacing a cart stack, as we did, will soon see the host of additional benefits the system offers beyond simple triggering of effects – and of course the system's functions continue to expand – which is a hidden bonus. We considered the two AudioFiles we bought as actually less of a novel and unpredictable choice than some of the cassette machines we looked at!

Distributors

- **Australia:** Heaton Communications Pty Ltd, 26 Ridge St, North Sydney, New South Wales 2060. Tel: (02) 426 3430
Telex: 20149. Ref. ST281. CONTACT: Paul Heaton.
- **Austria:** Studer Revox Wien, Ludwiggasse 4, A-1180 Wien. Tel: (0222) 47 33 09.
CONTACT: Ing H. Mussmann.
- **Canada:** Manta Electronics Group, 204 King Street East, Toronto, Ontario, M5A 1J7. Tel: (416) 868 0513
Telex: 06218665. CONTACT: Marshall Freund.
- **Denmark:** Slit Studie & Lydteknik Aps, Skjulhoej Alle 57, DK-2720 Vanlose. Tel: (0) 1-71 33 44. Telex: 22924 slt dk. CONTACT: Ole Lund Christensen.
- **Finland:** MS-Audiotron, Laitilantie 10, 00420 Helsinki 42. Tel: 566 4644. Telex: 125778 msa sf.
CONTACT: Jarmo Roivas.
- **France:** High Fidelity Services SA, 4 Rue Pierre Semard, 75009 Paris. Tel: 285 00 40. Telex: 290585.
CONTACT: Jean Noel Kendirgi.
- **West Germany:** Elmus GmbH., Hohenzollerndamm 58, 1000 Berlin 33. Tel: 030 823 99 61.
CONTACT: Henri Keinert.
- **Greece:** KEM Electronics O.E., 28 Papadiamadi Str., 14452 Metamorfofis. Attkis. Tel: 2819151/2811626.
Telex: 222700 fimigr. CONTACT: Thimios Koliokotsis.
- **Hong Kong:** Audio Consultants Co. Limited, 9th Floor, Kai It Building, 58 Pak Tai Street, Kowloon. Tel: 3-7125251. Telex: 54640. CONTACT: John Ho.
- **India:** Katonix, C-15 Greater Kailash 1, New Delhi – 110048. Tel: 641-1369. Telex: 3163145 ktnx.
CONTACT: Manjal Prabhat.
- **Italy:** Audio International SRL, Via Santa Maria 100, San Maurizio AL Lambro, Milan. Tel: 0039-2-25390121.
Telex: 322251 AUDINT. CONTACT: Roberto Beppato.
- **Japan:** Continental Far East Inc., Sa Saki Building 18-9, Roppongi 3, Chome, Minato Ku, Tokyo. Tel: 583 8451. Fax: 5890272. CONTACT: Shingo Araki.
- **Netherlands/Belgium:** Audioscript BV, Nijverheidsweg 13, 3762 EP SOEST. Tel: 2155-20400.
Telex: 43953 AUDIO NL. Fax: 2155-22806.
CONTACT: Jan Slooter.
- **Norway:** Pro-Technic A/S, Lyder Sagens Gate – 19, Oslo 3. Tel: 02 460554 Telex: 72580.
CONTACT: Martin Viktorin.
- **New Zealand:** Maser Communications Limited, 3/7 Marken Place, Glenfield, Auckland. Tel: 444 3583/4.
Telex: 63100. CONTACT: Gareth Jones.
- **South Africa:** Tru-fi Electronics S.A. (Pty) Limited, P.O. Box 84444, Greenside 2034, Republic of South Africa. Tel: (011) 786-7177/8. Telex: 4-28708.
CONTACT: Fleming Ravn.
- **Spain:** Fading S.A. Servando Batanero 8, Madrid 17. Tel: 408 67 00/408 68 08. Telex: 44330.
CONTACT: Felix Mayor.
- **Kash Productions, S.A.,** Agastia 20, 28027 Madrid. Tel: 267 52 22. CONTACT: Jimi Kashishian.
- **Sweden:** Soundtrade AB, Rasundavagen 45, S 17152 Solna. Tel: 08-7300400. Telex: 10551.
CONTACT: Carl Langeskiold.
- **Switzerland:** BVS AG, Neuhof, CH 8164 Bachs. Tel: 010 411 858 13 13. Telex: 56857 ABQCH.
CONTACT: Rolf Jauch/Mark Ofner.
- **U.S.A.:** AMS – Harris Sound Inc., 6640 Sunset Blvd., Suite 110, Hollywood, CA 90028. Tel: (800) 233-1580
Telex: 265871 MONREF G. Quoting: 84:DGS1547
CONTACT: Harry Harris.
- **U.S.A.:** Calrec by AMS – Calrec by AMS, P.O. Box 31864, Seattle, WA 98103 – 1864, Canada.
Tel: (206) 633 1956. CONTACT: Nigel Branwell.

• Distributors currently with AudioFile Demonstration System.



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CISAC agrees tape levy

In their annual meeting in Sydney between April 6th to 9th, representatives from the 20-member countries of the International Confederation of Societies of Authors and Composers, welcomed the proposal by the Australian government to place levies on blank audio recording tape and then to provide royalties to authors and other rights owners for the private copying of their works.

But CISAC made it clear that royalty payments would be made only to those countries whose domestic legislation provided similar remuneration to Australian authors and other rights owners. This is in contrast to the principles on which the international conventions on copyright and neighbouring rights are based, namely the assimilation of foreign authors with national authors.

NEWS

No lacklustre clusters

On March 9th, Turbosound provided the Royal Albert Hall with its largest central cluster ever flown. Turbosound and London distributors Electromusic, created the cluster

from components of the *TSE* installation series, using a total of 42 *TSE-111* mid/high enclosures and two *TSE-118* bass enclosures.

Corrections

In the June issue we wrongly listed the Connectronics Corporation as US distributor of an audio jack cleaner. This is not the case and all enquiries should be directed to Canford Audio.

In the same issue we gave the wrong address for UK distribution of

Crown/Amcron mics within the Microphones update. It should have read HHB Hire & Sales, 73-75 Scrubs Lane, London NW10 6QU, UK. Tel: 01-960 2144.

Our apologies to all parties concerned.

Engineering course at Goldsmiths'

Goldsmiths' College of the University of London is in the process of validating a one-year certificate in Recording Studio Engineering. A two-week intensive induction course is followed by a day-release course for those already employed as tape ops/assistants, and those who will be referred to studios associated with the scheme. Goldsmiths' has fully comprehensive studio facilities,

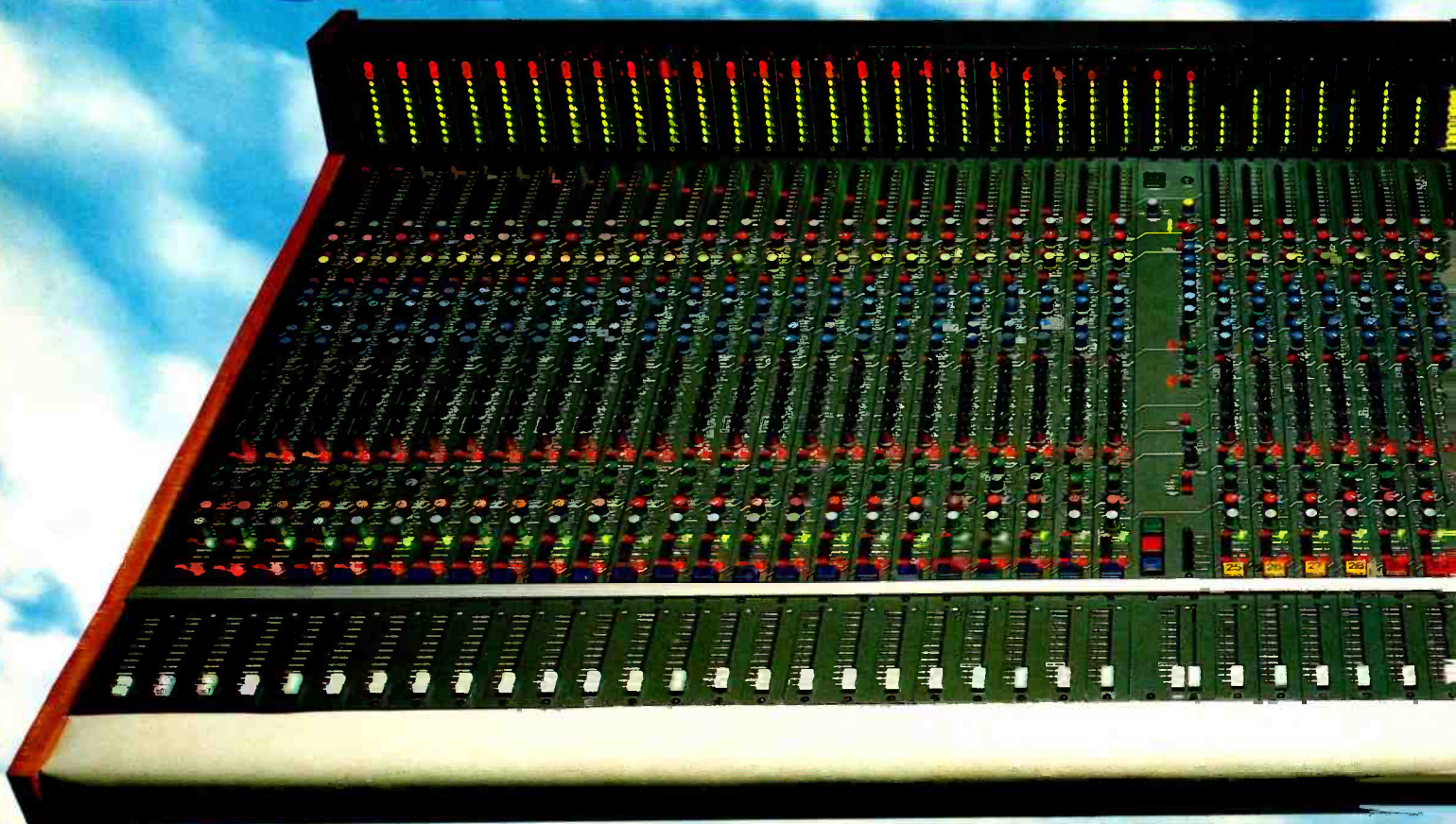
manned by studio staff and tutors with a wide range of professional experience in music, recording and education. Further details on being associated with the course and application forms can be obtained from: David Burnand, Director of Electro-Acoustic Music, University of London, Goldsmiths' College, London SE14 6NW. Tel: 01-692 7171, Ext 2298.

Change of address

- State of the Art Distribution of Cheshire have changed their telephone number to: 0663 62442.
- Milab International AB have

moved into new premises. The full address is: PO Box 510, Spinnegatan 3, S-260 50 Billesholm, Sweden.

DON'T GET ALL 1



People

● Robert Wilson, vice-president and general manager of Ampex Corporation's magnetic tape division, has been elected to the Board of Directors of the International Tape/Disc Association (ITA). Also in the magnetic tape division at Ampex, Steve Smith has been appointed marketing manager of audio tape products.

● Marion (Tony) Antonio has been named director of manufacturing at Altec Lansing, where he will be responsible for all materials, production quality and service activities.

● Paul Farrah Sound have appointed Chris Gilbert as sales co-ordinator with special responsibility for the company's sole UK distribution of Anchor Audio speakers and ROH comms equipment. PFS have also retained Tom Brodie as acoustic consultant, after his work on the purpose-built demo room in the company's expanded premises.

● Wilson Audio Sales of Nashville have appointed Jerry Whaley to their North Carolina office. Whaley comes from Electro-Voice where he spent 10 years in marketing and engineering.

● Sony Professional Audio have appointed Cary Fischer as director of market development for digital audio products, in which capacity he'll be

responsible for planning and implementing sales and marketing programmes for DASH-format recording systems and other professional digital audio products.

● Mike Pleasants has joined the Neve sales team as marketing manager coming from the Philips Group of Companies where he spent his last 10 years in the sales and marketing divisions.

● Following the closure of Olympic Studios, Anne Henry has joined CTS studios as operations manager.

● The Joiner-Rose Group, Inc of Dallas, an acoustical consultancy firm, have appointed Perry W Langenstein as principle theatre consultant.

● Tascam Pro-Audio Group have appointed Martin Capp as UK sales manager, who will be responsible for direct sales of the ATR-80.

● Shelton Leigh Palmer & Co have announced the appointment of Alan Meyerson as engineering consultant of their sound production complex in New York. Meyerson will be responsible for equipment, managing, marketing and mixing records and TV and radio commercials.

● Gexco International Inc have announced a number of new appointments. Edwin Cohen has been named as operations manager, while

Patricia Kynes moves to administrative assistant. Michael Fleyzer, with experience in international financial transactions, has been appointed controller.

● TimeLine Inc, manufacturers of Lynx synchronisers, have appointed Michael J Feniello as national sales manager. Feniello moves from Sony Professional Audio where he was in marketing administration.

● Soundcraft Electronics have announced the appointment of Ian Downs as sales engineer, joining UK sales manager Steve Gunn. Downs comes from Simmons Electronics, where he was involved in R&D.

● Totalsystems of Basingstoke have announced the appointment of Ian Richards as technical projects manager, who comes from Sony Broadcast where he was wiring engineer. Totalsystems have also announced the appointment of Debbie Mulcahy as principal secretary.

● Howe Audio Systems of Boulder, Colorado, have announced the appointment of Ken Marcoux as president and chief executive officer. Other appointments at Howe include Jeffrey Michael to vice-president of operations, Terry Sweeney to vice-president of marketing and sales, Joe Davis to vice-president of production, and Kristi Urquidi to senior engineer for R&D.

● Versadyne of California have announced the appointment of William O'Rhoades as national sales

director of their recently introduced 1500 series tape duplicating system.

● Charged with overseeing the development of new professional audio products manufactured in the US, Reul Ely has been appointed director of engineering for Sony Professional Products. Ely has been with Sony for 10 years as a development engineer.

● Mitsubishi Pro-Audio have announced the appointment of Mike Blackburn as their first European sales manager. Blackburn comes from Neve, where he held the same post, and Air Studios before that, where he was chief technical engineer.

● Roger Clemo has been appointed by Neve Electronics International as Siemens Support Manager, where he'll be responsible for commercial and technical liaison with the parent company and affiliates.

● UK-based Cameron Video Systems have announced three new appointments in their For.A UK sales and marketing division. Brian Dedden becomes broadcast sales consultant, Karlton Burn joins in a dealer support role, and Alan Webb, who's been with the company since '85, is promoted to dealer support manager for the UK dealer network.

● AF Bulgin have announced the retirement of Tom Smith, divisional director of design, after 46 years with the company. Smith will continue his association with Bulgin as a consultant.

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NEWS

Mitsubishi for Europe

The Mitsubishi Pro-Audio Group are now free to sell their PCM range of digital audio recorders directly to Europe. They were previously restricted by a licensing agreement with AEG-Telefunken that ensured direct sales to Europe could be achieved only on a gradual basis. Now, with the exception of Austria,

Germany and Switzerland, Mitsubishi UK is free to sell direct to the rest of Europe, and all restrictions will be lifted on April 1st, 1988. The Pro-Audio Group and its complete range of products will be represented in France by newly appointed Publison, based in Paris.

Contracts

- A 4-channel Meyer 833/834 monitoring system has been installed at Spot Shop Studio Inc in Vancouver, British Columbia.
- EFX Systems, a post-production studio in Burbank, California, have purchased two MXP-3036 recording consoles and ADS-3000 SMPTE-based hard disk automation systems. Sony have also supplied EFX with two PCM-3324 24-track digital recorders, and two PCM-3202 2-track recorders.
- Stock, Aitken and Waterman at the PWL studio complex in London have taken delivery of a Sony PCM-3324 multitrack, a move that complements their already existing 24-track analogue facility.
- Beethoven Street Studios in London have taken delivery of a DDA AMR24 mixing desk in a major refit of their 24-track facility.
- Mitsubishi have announced the delivery of a customised Westar

mixing console to London-based Worldwide Pictures, post-production facilities for TV, film and documentaries. The 36-channel Westar has been fitted with moving coil PPM meters as well as bargraph metering specifically for Worldwide's film application needs.

- The first AMS AudioFile to be purchased and installed in North America has gone to Little Mountain Sound studio in Vancouver, Canada, via Manta Electronics of Toronto.
- Harrison Systems of Nashville, Tennessee, have received their second Australian order for a series 10 console. Valued at over US \$350,000, the system is destined for Pro Image Group in Melbourne, a video and film post-production house with other locations in Sydney and Perth. The first Australian order went to Sydney's Soundfirm. Harrison have also supplied

\$500,000 worth of series 10 to Studio Des Dames in Paris. The totally automated system is an 80-position mainframe fitted with 48 modules which provide 96 inputs, and will be fitted into the main studio A. This was recently rebuilt completely under the directional of Tom Hidley to his 20 Hz specification.

Another \$150,000 worth of Harrison has gone to the Jimmy Swaggert Ministries in Louisiana. This is an SM-5 sound reinforcement audio console system, which has 48 inputs, 16 mix outputs and an 8x16 matrix output section.

● Advanced Communications Equipment Co Ltd of Hong Kong have sold 24 Lexicon model 200 digital reverb units to the China Broadcast Network, as well as eight racks of Valley People 800 processors.

● Gexco International have announced the sale of 80 Lexicon PCM 70 digital effects processors to the Kanda Shoki Corporation of Japan. Kanda Shoki is responsible for Gexco's musical instrument and home recording equipment, while Eletori remains Gexco's agent for their high end studio products.

● Neve Electronics have announced the installation of a new V series console with Necam automation in Studio Two at PRT in London.

● Theatre Sound of New York, who designed the new permanent sound system at Carnegie Hall, saw their efforts rewarded with the reopening of the theatre in December after six months of extensive renovation.

● London-based Studio Innovations have been given the go-ahead to design the new dubbing theatre at De Lane-Lea. The design aims to complement the other theatres in the complex.

● Dunstable College in Bedfordshire have taken delivery of a Fairlight Video Instrument to supplement their CCTV studio, which includes a fully comprehensive VHS editing suite plus peripherals.

● Along with several construction jobs to begin this spring, Eastlake Audio have supplied JM3-T control room monitors to EMI's Dutch studio location outside Amsterdam.

Construction includes the conversion

of the original turn of the century Pathé cinema-camera and projector factory to an Eastlake-designed five-theatre cinema-dubbing studio complex at Joinville in Paris; and the enlargement and re-build of Musigram's Madrid studio.

● Amek Systems and Controls have announced the installation of two of their G2520 multitrack consoles:

Studio Impulse in Japan and Studio Triton in Tel Aviv each had installed a 40/24 fitted with Audio Kinetics MasterMix automation. Orders have come from Total Access in Los Angeles, Tempo Studios in Montreal, Audio International in Italy, The Strongroom in London, Radio Clyde in Glasgow, the HTV television company, and U2's guitarist The Edge for his home studio.

● Stirling ITA have supplied the equipment used in the extensive update of The Club studios in London. This includes a Fostex E16 multitrack, TAC Scorpion 42-channel console, and Revox PR99 mastering.

● Totalsystems of UK have won an order to supply Sony Broadcast Ltd with alternative meter housings for the Sony MXP-2000 mixing console.

● Neve have announced the installation of a 51 series audio console at the news studio of HTV in Pontcanna, Cardiff. Neve have also provided HTV with a 36-channel V series console for their North Wales studios in Mold.

● Syco Systems have announced the installation of a Fairlight CMI series III in the MIDI programming room at Air London Studios. The positioning allows complete access to it from any of the four studio control rooms.

● Applied Research and Technology of Rochester, New York, have won a contract to supply China Central Television with seven of their digital reverb systems. ART's six DR1s and single 01a reverb will form part of an exhibition to be held at CCTV in May/June of this year.

● The first UK sale of an Otari MX80 2 in 24-track recorder has been announced by Stirling ITA of London who sold the machine to the Cocteau Twins, along with an Amek Angela console with Audio Kinetics MasterMix automation.



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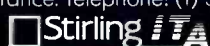
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NEWS

Contracts

- Mitsubishi have announced the first sale of their X-850 in Italy, two of them going to their newly appointed Italian agent, Audio Equipment Srl. Included in the sale was the X-86 digital mastering machine and a small Westar console.
- Turbosound agent for Australia, Creative Audio, have recently installed 16 TMS-4s at the Sydney Entertainments Centre.
- Red Bus Recording Studios in London have announced that their Solid State Logic console in Studio Two will be fitted with the TR Auto Scan in July.
- Sound hire company MAC of

Manchester have been given the contract to supply the complete sound system for the production of *The Mystery of Edwin Drood*, at the Savoy Theatre in London.

- US Audioscope distributors Apogee Electronics have announced the delivery of several 32-channel video-based metering systems to sound companies, Clair Brothers and Showco.
- Paul Farrah Sound of Surrey have recently taken delivery of 33 Soundcraft consoles, including the 200SR, 500, 600 and 200B series.
- Apogee Electronics of California have announced a number of

deliveries of their *Anti-Aliasing* filter, which retrofits to digital multitracks. Included in the new owners are Sixteenth Avenue Sound in Nashville, Bruce Springsteen, The Village Recorder in Los Angeles and composer Denny Yeager. The Village Recorder have also recently placed a second order.

- Sony Pro-Audio have announced the sale of several PCM-3324 DASH multitracks in Europe, putting the machine past the 300 mark in worldwide sales. In France, Radio France bought a third PCM-3324 and Studio Davout a fourth; Marcadet Studios, the George Pompidou Centre, ABS Studios and Le Voyageur mobile studio all bought their first. In the UK, PWL Studios bought their first PCM-3324, while Hilton Sound bought two along with two PCM-3402s. Stesco in Belgium has bought a PCM-3324 and Polygram's Hanover studio has taken two more. Bavarian Radio, the Power Sound Factory in Austria, the Italian Fonoprint studio and Sun Studio in Denmark have all placed single orders.

- Recently announced orders for SSL consoles include One on One in North Hollywood a 48-channel SLA056E with *Total Recall*, while Disque Debs in Guadeloupe opted for a 40-channel SLA040E, Kazuhiko Kato Studios in Tokyo a 24-channel SLA040E and Takomo Studios in Finland a 32-channel SLA040E.

Crown Records in Japan have ordered a 48-channel SLA048E with *Total Recall*, Digital Services in Paris chose a 56-channel SL6056 and Film Australia have a 32-channel SL55524. Finally, TNC 1 in Japan have taken delivery of a 24-channel SL5432.

- The Japan Broadcasting Corporation (NHK) in Tokyo had three of Otari's new BTR10J 2-track recorders installed, following their purchase of 10 Otari MX-70 multitracks.

● Ampex have announced that all re-recordings of the first four Beatles' albums on compact disc, in both open reel and U-matic formats, were made entirely on Ampex 467 digital audio mastering tape.

● Synclavier have announced several new installations of their digital audio system. Glen Glenn in Hollywood, Universal Studios in Chicago and Lucasfilm on the West Coast are major buyers, while Blackbox in Switzerland, Video Sweden in Stockholm and Eel Pie Studios in London are new European users.

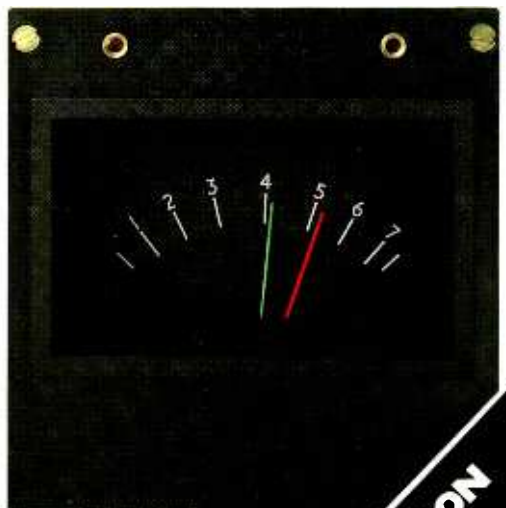
● Hayden Systems Engineering have won an order to supply the Royal Opera House in Covent Garden with a Sennheiser infra-red system. The system will transmit high quality stage sound, via infra-red light, to the hard of hearing, and represents an improvement over the previous 'loop' systems.

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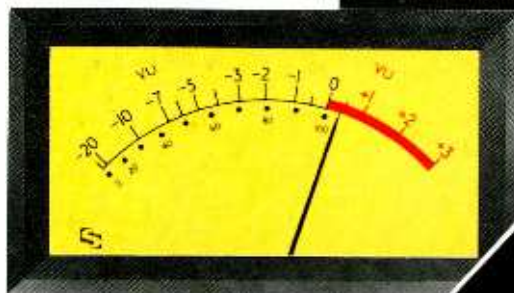


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FROM SONOSAX

The PR Series, a new line of extremely compact ENG/EFP stereo mixers. These small mixers are the best way to complete a video portable system, and they are ideal for high performance stereo recording with two or four microphones. Available in three sizes, the SX-PR Series is a totally modular and expandable system.

FROM WESTLAKE

The BBSM-15, a powerful reference monitoring system which still shares the same single amplifier design as the rest of the highly successful BBSM range. It combines remarkably clear stereo imaging with the low IM distortion you've come to expect of Westlake's smaller systems.

FROM ELECTROSPACE

The EX1, an ultra-sophisticated audio processor with an extremely versatile expander system which becomes an expander gate when in "down" mode. Expansion ratio and threshold levels are continuously variable, the attack and release times being linked to those of the compressor. The compressor/expander knee is switchable hard, medium or soft. The EX1 also has a peak reading limiter.

FROM BGW

The Grand Touring Amplifier. Delivering more than 1.2 horse power per channel and with a welded steel chassis, the GTA is designed for the most rigorous applications such as road shows and sub bass systems. By its introduction, BGW aims to set new standards for performance and reliability.

FROM SUMMIT

The EQ unit, a valve equaliser with three switch frequency ranges, which complements the compressor/limiter and microphone preamplifier. It combines the clean sound produced by modern valve technology with the solid state electronics of the Jensen 990 operational amplifier. The EQ has high headroom and is solidly constructed with a beautiful brushed aluminium finish.

So don't forget to come and see us on the Britannia Row stand at APRS because that's when all will be revealed.

35 BRITANNIA ROW LONDON N1 8QH

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01 226 3377

NEWS

Audio Digital delays

Three new digital delays are being manufactured by Audio Digital. The *ADD-2* and *ADD-3* are similar units, the former providing one input with two outputs and the latter one input and three outputs. The standard delay range is 0 to 490 ms which can be stepped in 15 μ s increments up to 10 ms and 1 ms increments up to the maximum. Inputs and outputs are electronically balanced with Jensen transformers available as an option.

Front panel controls are minimal with just three (select and up/down delay time setting) and gain trim pots. A security code must be entered

when altering delay settings.

At the top of the range is a fully modular delay system, the *ADX 2000*. This 1U high unit with RS232 interface provides up to six inputs routed to 40 outputs and is available with optional digital gain control. Additional units can be interfaced to provide an almost unlimited combination of inputs and outputs.

Audio Digital Inc, 1000 S Bertelsen, Suite 4, Eugene, OR 97402, USA. Tel: (503) 687-8412.

UK: Shuttlesound, Unit 15 Osiers Estate, Osiers Road, London SW18 1EJ. Tel: 01-871 0966.



Omni Craft GT-4A noise gate

The 4-channel *Omni Craft GT-4A* noise gate is an optical/resistive L-pad gate that, according to the manufacturer, contributes neither noise nor distortion to the signal passing through it. The gate avoids sudden 'snapping in' of a signal by fading it up over a 1 ms period. It will also turn on to pass a 20 kHz sine wave and adjust attack time to match the attack time of the input signal—a feature which is claimed to have no adverse effect on the

transient response but which helps make the unit inaudible in use.

Each channel features Threshold, Range and Release controls in addition to a Key switch and LED indicator.

Also available is the *GTX*, a single-channel version with additional front panel switching for Duck, LP and HP and a variable Duck Release control. **UK: Audio Marketing Group, Unit 19 Holder Road, Aldershot, Hampshire GU12 4RH, UK. Tel: 0252 319171.**



Carver power amplifiers

Two new amplifiers from the Carver Corporation are the *PM-350* and the *PM-175*. These feature Carver's magnetic field power amplifier technology and have the facility to incorporate optional plug in modules for traditional outboard electronics such as equaliser, compressor/limiter, noise gate and crossover.

The new amplifiers, which are bridgible and can drive a 70 V line, feature level controls, phone jacks plus XLR input connectors, input muting and a 'slow startup' to avoid turn-on surge.

Protection is provided against

shorting; excessive (non-musical) HF; excessive out of phase LF oscillation at the outputs; internal or external DC offset (2 to 4 V); internal low level supply faults and overheating (above 90°C).

All amplifiers are equipped with clipping indicators and are available in 2U high, 20 lb rack mounting packages.

Carver Corp, PO Box 1237, Lynnwood, WA 98046, USA.

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



AMR SyncController

The *AMR SyncController* is an SMPTE-based synchroniser/controller offering 24, 25 and 30 (drop and non-drop) frame timecodes. The basic configuration will control two machines (master and slave) and includes jam sync, 99 programmable events, MIDI clock and MIDI Song Position Pointer.

Event cue points can be assigned as punch-in and punch-out points for precise overdubbing (with rehearse capability) or Loop-begin and Loop-end points for automatic repeats. These event points can also be saved at the start of the slave tape and recalled as and when required.

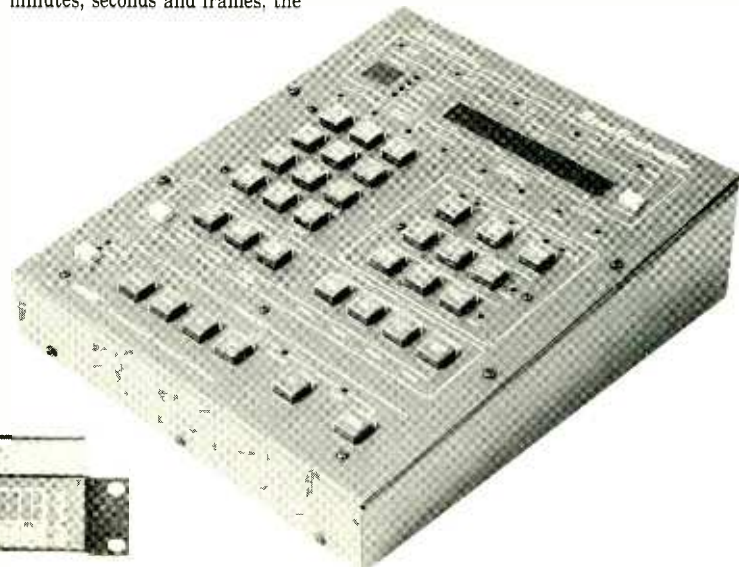
In addition to displaying hours, minutes, seconds and frames, the

LED read out gives displays of Event, Tempo, Master Time, Slave Time, Offset, Loop-begin, Loop-end, Punch-in and Punch-out points and Song Position Pointer.

According to the manufacturer the *SyncController* (which uses SMPL control system software) can be used with a wide variety of slaves and virtually anything that records audio can be used as the master.

Audio Media Research, PO Box 1230, Meridian, MS 39301, USA. Tel: (601) 483-5372.

UK: Peavey Electronics (UK) Ltd, Hatton House, Hunters Road, Weldon Industrial Estate, Corby, Northants NN17 1JE. Tel: 0536 205520.



PERFORMANCE NOT PROMISES

Exotic automobiles exude high performance and deliver it. A word of caution; in audio signal processing, a pretty faceplate does not translate to superlative performance.



Valley products are designed and engineered to set the standard for excellence when processing audio signals for the desired effect.

The processing circuitry in our equipment does not come from an electronics textbook. We invent it.

Fresh, new terms such as Linear Integration Detection, Peak Reversion Correction, Automated Program Dependency, Auto Slope, and Program Variable Release Shape, appearing in conjunction with our products are indicative of our commitment to deliver unequalled performance, instead of merely conforming to accepted practice.

The heart of our signal processors, the VCA (Voltage Controlled Amplifier), is not purchased elsewhere. We created it and patented it! Its employment in our products yields our distinctive clean, pure sound.

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Fax 01 57 9370 20 8940617 5547474 5010000

GEXCO
INTERNATIONAL



GEXCO International Inc., 317 St. Paul's Avenue, Jersey City, NJ 07306, (201) 653-2383, Telex 285261 GEXCO

www.americanradiohistory.com

NEWS

In brief

● Electrolube have developed a new contact cleaner and lubricant for edge connectors electroplated with precious metals such as gold, silver or palladium. *Gold Electrowipes* are lint-free pads impregnated with a special contact fluid and non-inflammable safety solvent. Packed in individual sachets, the wipes are safe for delicate components and are compatible with sensitive plastics.

● AMR have introduced a 4-track, synchronisation-capable cassette recorder. A 25-pin sync/control port provides full remote speed and transport control, tachometer and tally outputs. The recorder is fitted

with Dolby B and C but includes a noise reduction defeat switch for track 4 to optimise a wide range of synchronisation signals. Other features include optional rack ears, peak LEDs, variable pitch, LED counter/timer and headphone output.

● Studer have introduced the A727 professional CD player featuring digital outputs for audio and CD-I/CD-ROM data; varispeed; three pairs of analogue audio outputs (fixed level balanced XLR, variable level unbalanced and fixed level unbalanced) and integral rack mount flange. Fader start is provided and both serial and parallel remote

control can be accommodated.

● Celestion have developed a new range of sound reinforcement loudspeakers. The SR series currently features two components: the 500 W, full range SR1 and the 1000 W SR2 designed for bass reinforcement.

● The Postex SMPTE synchroniser system has been extended with the addition of the 4010 timecode reader/generator. The reader operates from 1/50 to 100 times play speed and an optional bi-phase interface is available. The programmable generator provides 24, 25 and 30 drop frame rates and can sync to external composite video or sync signals. Also provided is timecode regeneration with error correction and jam-sync capability.

● CRL have announced the availability of the CRL 2200 evaluation kit. The kit comes with a completed printed circuit board and full documentation including design guidelines and operational theory for the IC and the Dynafex system. Circuit Research Labs Inc, 2522 West Geneva Drive, Tempe, AZ 85282, USA. Tel: (800) 535-7648.

● The ROAM-8 is a 'remote on-location audio mixer' housed in a plastic carrying case. The mixer operates on AC or DC and has provision for an internal, extended life, battery pack. Eight switchable mic/line inputs are provided with full low, mid and high EQ. The unit also

features two independent headphone jacks with individual level adjust plus limiter, telephone logic and pink noise generator. Output is via a studio quality line feed or internal telephone transmission network. Precision Design, 27106 46th Avenue South, Kent, WA 98032, USA. Tel: (206) 852-5070.

● CANAL is a combination hardware/software package that transforms an IBM PC XT/AT or close compatible into a multichannel noise analyser and logger. The system combines the functions of a data capture and analysis instrument in the audio frequency range, a noise analyser and a dual-channel FET analyser. If CANAL is installed in a portable PC, instantaneous analysis can be performed in the field.

Thoroughbred Digital Systems Ltd, 28A Hills Road, Cambridge CB2 1LA, UK. Tel: 0223 358155.

● Carlsboro Sales have introduced their new CP range of MOSFET power amplifiers. The CP 250 (125 W/channel into 4 Ω), CP 600 (300 W/channel into 4 Ω) and CP 1000 (500 W/channel into 4 Ω) all include 19 in rack mounting, external stereo/mono switching, DC load protection, soft start for the 600 and 1000 models, surge-free turn-on, multiple protection circuits and comprehensive I/O facilities. Carlsboro (Sales) Ltd, Cross Drive, Kirkby-in-Ashfield, Notts NG17 7LD, UK. Tel: (0623) 753 902.

Source or sampling?

"There is no better sampling" *)



The TC 2290 is the first sampler/delay in the world to give you 100% accurate sampling up to 32 seconds. Make an A/B comparison with any analog or digital master tape or compact disc, and you will notice there is no difference.

The new TC 2290 digital delay is based on a totally new converter principle. With a linear frequency response up to 20KHz +0/-0,5

dB an additional roll-off up to 33KHz and a unique 100 dB dynamic range, the TC 2290 is very warm, transparent, crystal-clear, musical... with absolutely no noise. It has 18 bit resolution - better sound quality than a compact disc, and many new innovative effects.

Ask your dealer for a demonstration of the new world standard of delay + programmable sampling. Just a few features are: delay with

ducking, chorus and delay simultaneously, automatic panning 100 presets and MIDI feature making it possible to control the TC 2290 from a computer.

Big studios will like the extras, small studios will love the price

*) "There is no better sampling" is a quote from Bob Schwall - Right Track Studio in N.Y.C.

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Sidetraker

The NEW Eq. system featured on the CONCEPT 2200 - 3200 - 4400 - 6400 and 8400 range of consoles

'Sidetraker' 6 fixed frequency active filters with centres at:
12.5kHz, 4.5kHz, 1.5kHz, 500Hz, 150Hz and 60Hz. ± 12 dB
AND
1 high-Q filter sweepable from 50Hz to 5kHz and adjustable
from -24dB to +6dB

Although varying in performance and complexity, most Eq. designs have followed either of two classic principles:

parametric: or more usually 'semi-parametric equalisers are almost universally used on console input channels. Normally comprising four filters, two (or sometimes four) of the filters can be 'swept' up or down the audio band to centre on the exact frequency needing attention. Proven to work very well, semi-parametric eq's have two major disadvantages:

1. A tendency for audible phase shift 'ringing'
2. A limited ability to control the entire audio band at one time

For example: having used the 'high mid' to suppress the 'edge' on a singer's voice, there is no facility left to boost the critical 'presence' frequencies that lie either side of the unwanted frequencies that have just been cut.

graphic: normally used for system and room equalisation, graphic equalisers use multiple, fixed frequency, fixed bandwidth filters, to generate gentle, essentially phase-free control over the entire audio band.

The graphic principle has one major disadvantage:

1. A limited ability to control narrow band problems.

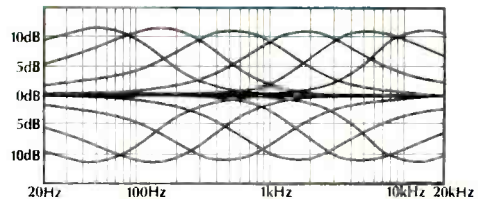
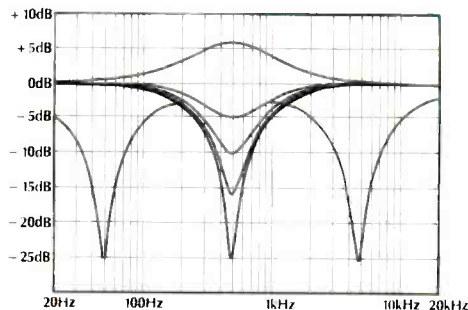
For example: although frequencies in the 'presence' band can be easily and cleanly boosted, that annoying 'edge' to the singer's voice gets boosted as well.

Up until now Hill Audio has uniquely offered the graphic solution on their consoles, believing the ability to keep good control over the entire audio band is preferable to having greater control over just part of it.

Now Hill Audio has the best of both worlds! 'Sidetraker'

The 'Sidetraker' Eq. system provides continuous control over the entire audio band via multiple, phase-coherent, fixed frequency active filters, PLUS a sidetracking, high-Q filter that can be swept over 7 octaves, enabling narrow band 'spot' frequency correction without any effect or compromise of the main Eq.

Now you can cut the 'edge' AND boost the 'presence' at the same time!



Total Audio Transparency

Manufactured in the UK:

Hill Audio Ltd., Hollingbourne House, Hollingbourne, Kent ME17 1QJ England
Tel: (062 780) 555/6/7 Tlx: 966641 HILL

U.S. Sales Office:

Hill Audio Inc., 5002B N. Royal Atlanta Dr., Tucker, GA 30084 USA
Tel: (404) 934-1851 Tlx: 293827 HLAD



Dynamic Precision power amp

The Dynamic Precision professional power amplifier No. 1 is a rack mounted unit designed for long life and durability. Special emphasis has been placed on heat dissipation and the amplifier is claimed to be able to withstand extreme amounts of shock and vibration. An elaborate safety and function monitoring system provides early warning of potential instability.

Power output according to the manufacturer is 250 WRMS into 8 Ω , 440 WRMS into 4 Ω and 650 WRMS into 2 Ω , all measurements 20 Hz to 20 kHz at 1% THD. Bridged outputs are 880 WRMS into 8 Ω and 1300 WRMS into 4 Ω . A-weighted noise is 116 dB below 250 W (8 Ω) and THD

distortion at 30 V output is 0.02%, 20 Hz to 20 kHz into any load. Frequency response is 1 Hz to 400 kHz (+0/-3 dB).

Parallel XLR inputs are provided at the rear along with XLR outputs and Monster Cable Laboratory colour coded screw terminals. An alternative version of the amplifier is also available with unbalanced, gold-plated phono input connectors but with no bridging possibilities.

Norwegian Audio Designs AS,
Jerikoveien 10, 1067 Oslo 10,
Norway. Tel: 02 32 20 40.

UK: Phase Audio UK Ltd, 80 St Mary's Road, Market Harborough, Leicester LE16 7DX. Tel: 0858 31717.

NEWS

Apogee 944 filters

Apogee have developed a family of replacement anti-aliasing/anti-imaging low pass filters for digital audio recording systems. According to the manufacturer the new filters provide near perfect linear phase response and low distortion to give improved sonic transparency. High stopband attenuation maintains excellent protection from aliasing signal components.

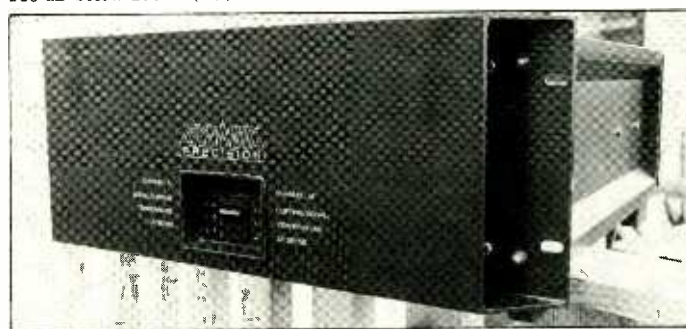
Two filter types are currently available—the 944-S, which has a sharp passband/stopband transition and the 944-G, which is more gentle. The filters are designed to replace existing modules and require no

additional circuit modifications.

Basic specifications include linear phase response $\pm 5^\circ$ deviation, 20 Hz to 20 kHz; amplitude response, low ripple design typically ± 0.09 dB from 20 Hz to 20 kHz (944-S) and no ripple design, flat response to 18 kHz (944-G); distortion, 0.003%; dynamic range, 110 dB; high stopband attenuation -80 dB (944-S), -60 dB (944-G).

Apogee Electronics Corporation,
1517 20th Street, Santa Monica,
CA 90404, USA. Tel: (213) 828-1930.

UK: HHB Hire & Sales Ltd, 73-75
Scrubs Lane, London NW10 6QU.
Tel: 01-960 2144.



Raindirk Audio Symphony console

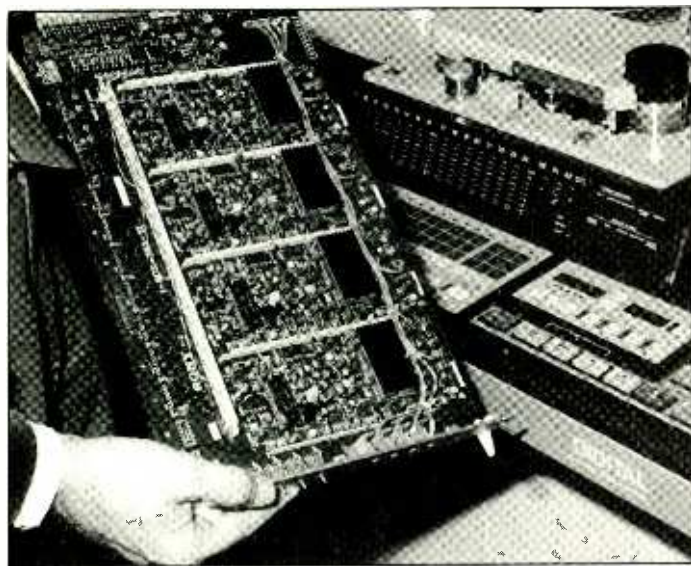
The Raindirk *Symphony* is a 40/24 in-line recording console with integral patchbay. The comprehensive channel facilities include 32-track routing (in pairs), channel pan, group mix level, phase, pad, 48 V powering, group mix level and separate mic/line gain controls. The EQ has treble, bass, three swept mid band sections and high pass filter. The EQ can be switched in or out and routing of the EQ to the monitor return or insert sends/returns is provided.

Switching and four aux level controls allow any of eight outputs to be addressed. Source switching is automatic according to console status but can be overridden at any time. Two independent stereo cue buses are included with level, pan and post switching. Other channel features

include monitor level fader, pan, solo and mute along with channel cut, solo, safe, two mutes and status switching.

Other main modules include talkback, monitor and echo return. The talkback master module includes talkback, aux and cue masters and 6-frequency oscillator. The monitor facilities allow three sets of loudspeakers to be connected and includes left/right muting, dim, mono and switching to one of three stereo tape machine outputs. The echo return module has three identical stereo sections and master status switching. A second module (without status switching) can be provided as an option.

Raindirk, 33A Bridge Street,
Downham Market, Norfolk PE38
9DW, UK. Tel: 0366 382165.



P&R Audio patchbays

P&R Audio have developed a range of patchbays that enable the user to quickly and easily normalise or de-normalise connections. Using a modular system containing two inputs and two outputs connected via a circuit board, normalisation for any front mounted pair can easily be changed by simply removing the module, turning lengthwise through 180° and re-attaching it to the front panel. In this way any combination of pairs can be created according to

individual circumstances or future needs.

All sockets are 1/4 in stereo jacks with self wiping action and mono jacks can be used for unbalanced operation with full compatibility. Two units are currently available: the 40-way PB-40, which is 1U high, and the 64-way PB-64, which is 2U high. **P&R Audio, 114 South Road,**
Hailsham, East Sussex BN27 3JP,
UK. Tel: 0323 845736.

THE DDA STORY AN EXCLUSIVE

DDA's quiet rise to eminence is a remarkable success story.

Since its first appearance the highly accomplished **AMR24** has acquired an enviable status.

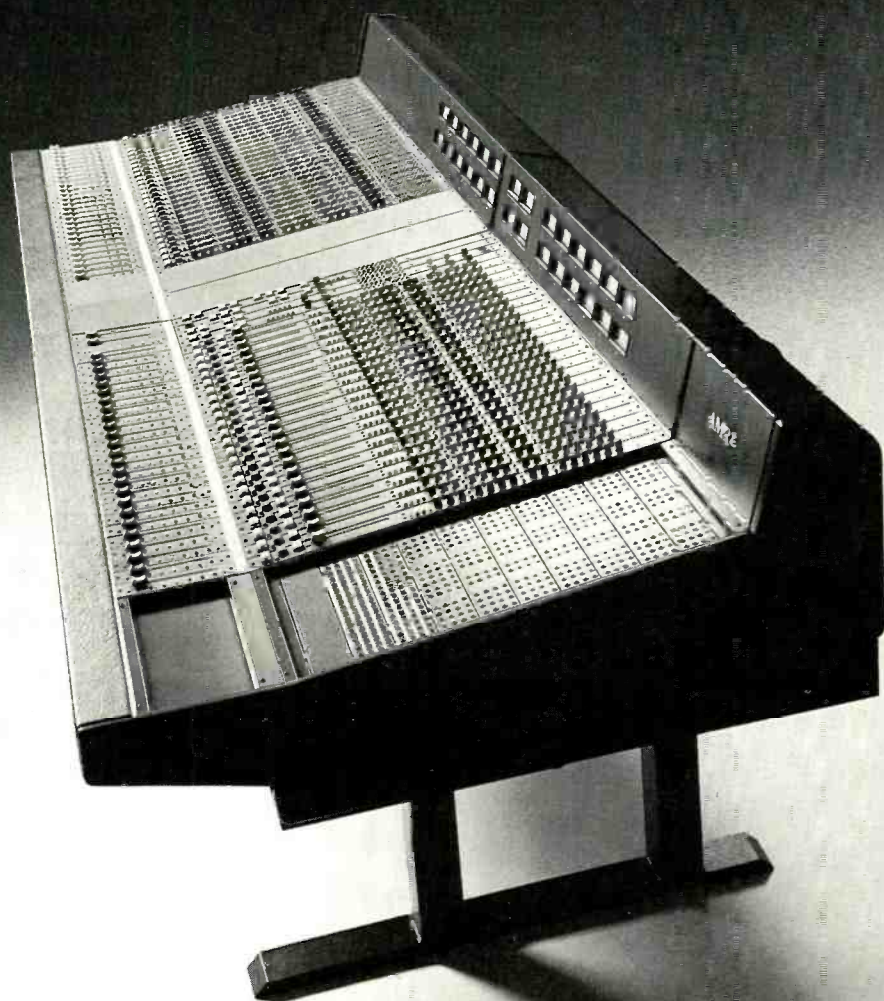
It's a top quality 'split' recording desk with central status control and excellent sonic qualities. In particular, a transparency and clarity few others can match.

As a result it's been attracting a lot of attention from top producers and musicians as well as leading studios, in both analogue and digital applications.

The **AMR24** can be ordered complete with Audio Kinetics' **Mastermix** automation, using AK's special VCA faders. It allows the engineer to store and recall four complete mixes in seconds.

Now DDA have appointed **Stirling ITA** as their exclusive UK dealer, adding the benefits of our special brand of expert information, advice and professional back-up. Making an outstanding product an even better proposition.

Call **Garry Robson** at **Stirling ITA** for more details.



◀ **DDA AMR24** in 28, 36 or 48 channel versions
• 2 frame sizes • Up to 68 mixdown inputs • Balanced mix buses to eliminate crosstalk, pickup and inter-modulation • 100dB+ dynamic range • Minimum 22dB headroom • Facilities not in use are bypassed to create shortest signal path • 26-way channel track assignment matrix • 4-band EQ • Facility to monitor two independent 24-track tape machines • Silent FET switches • Multimode solo and mute with failsafe master status control • Automation retrofittable • Mosses & Mitchell jackfield.

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1 Canfield Place, London NW6 3BT. Telephone 01-625 4515
Fax: 01-372 6370. Tlx. 946240 CVVEASY G Ref No. 19014280

NEWS

New drive units

● HH Acoustics have developed a new range of drive units designed for PA and musical instrument applications. There are six units in all, three 12 in (*1201 Super* series) and three 15 in (*1501 Super* series). Compared to the earlier range the new units are claimed to offer increased sensitivity, wider frequency response, increased power and a lower fundamental resonance. Design changes include larger and thicker magnets, improved 3 in high temperature voice coils, vented pole pieces, specially designed cones and polyamide laminated voice coil formers. Also new is the *HF201* bullet radiator which incorporates a new 1½ in voice coil and redesigned diaphragm arrangement.

HH Electronics Ltd, 9 Clifton Road, Huntingdon, Cambs PE18 7DW. Tel: 0480 432227.

USA: Audio Techniques Inc, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 359-2312.

● McKenzie Acoustics have introduced two new bass drivers—the *C15-500* and the *C18-500*. Both 15 and 18 in units will feature a 4 in voice coil with double coil suspension. The magnet assembly bolts together with six 8 mm tensile bolts and a flux gathering ring is used at the base of the pole piece in order to improve magnetic efficiency and centralise the ferrite core.

McKenzie Acoustics Ltd, Albion Drive, Thurnscoe, South Yorks S63 0BA. Tel: 0709 898606.

● Fane Acoustics have introduced two new co-axials to the 12 and 15 in units currently in production. These are the *CX10* (10 in) and the *CX18* (18 in). Also new are three extra high power options (*CX12PA*, *CX15PA* and *CX18PA*) intended primarily for stage use. The standard versions feature low resonance, urethane half

roll cone termination and a smooth response to 20 kHz. The PA options have a higher resonance, double half roll suspension and increased magnetic flux.

Fane Acoustics Ltd, 286 Bradford Road, Batley, West Yorks WF17 5PW. Tel: 0924 476431.

UK: Audio Factors, Robin Lane, Pudsey, Leeds LS28 9HY. Tel: 0532 561949.

● Altec Lansing have developed two new compression drivers, the *299-8A* (8 Ω) and the *299-16A* (16 Ω) for use in high level sound reinforcement systems where a wide bandwidth and a large acoustic output is required.

Using the new Pascalite diaphragms and Tangerine radial phasing plug, the units are claimed to have the power handling and output capability of drivers with 2 in exit throat diameters whilst maintaining superior HF power bandwidth.

Altec Lansing Corp, PO Box 26105, Oklahoma City, OK 73126-0105, USA. Tel: (405) 324-5311.

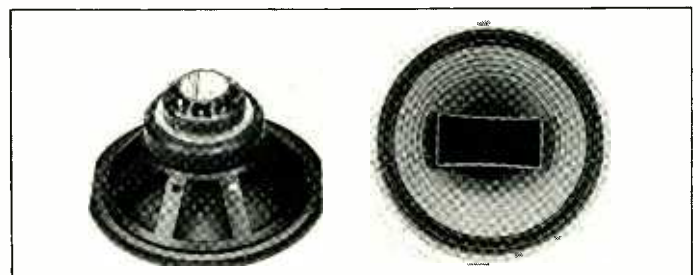
UK: Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4LG. Tel: 0799 40888.

● Community Light & Sound have introduced their new *SH2064M* and *SH1894M* horns designed to be used in compact clusters, arrays and enclosures. The first is a hyper-exponential flare horn providing full driver loading down to 270 Hz and, with an *M4*, can be packaged in a 22½ in deep enclosure. The *SH1894M* is slightly smaller, and capable of loading an *M4* or full power down to 300 Hz. Both are constructed of balsa-reinforced, hand-laminated glass fibre.

Community Light & Sound Inc, 333 East Fifth Street, Chester, PA 19013, USA.



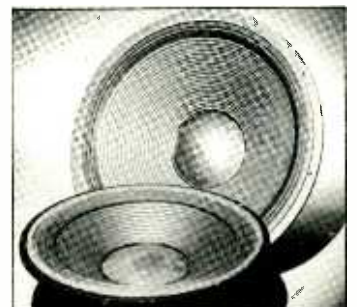
Community Light & Sound's *SH2064M/M4* horns in array



Fane *CX* series



Altec Lansing's *299-16A*



McKenzie *C15-500* & *C18-500*

NO-ONE KNOWS MORE ABOUT AMEK

- ▼ **AMEK ANGELA** In-line console • 3 frame sizes
- Onboard or external jackfield • Up to 62 channels (138 inputs on mixdown) • 4 'floating' stereo subgroups
 - Up to 30 aux sends • 6 FX returns • Mute group system • 8 DC subgroups with VCA faders • Full 24 track routing • Monitor pots double as aux sends in mixdown • Bargraphs as standard • ALPS, P & G or VCA fader options • Extremely high standard of construction • Handwired broadcast pattern TT jackfield • Special configurations to order.

The Amek **Angela** proves how far recording studio standards have advanced.

And how important a top quality desk is in achieving that improvement.

Producers and engineers who regularly mix with an **Angela** point among other things to a highly 'musical' EQ, the excellence of the desk's overall sound quality, the superb routing and the availability of up to 78 inputs at mixdown.

For our part, we can report that it's one of the most reliable consoles we've ever sold. And behind those successful Amek installations, behind each satisfied client, is another name that means Amek expertise. **Stirling ITA**.

We've literally years of collective experience with Amek and its applications in studios.

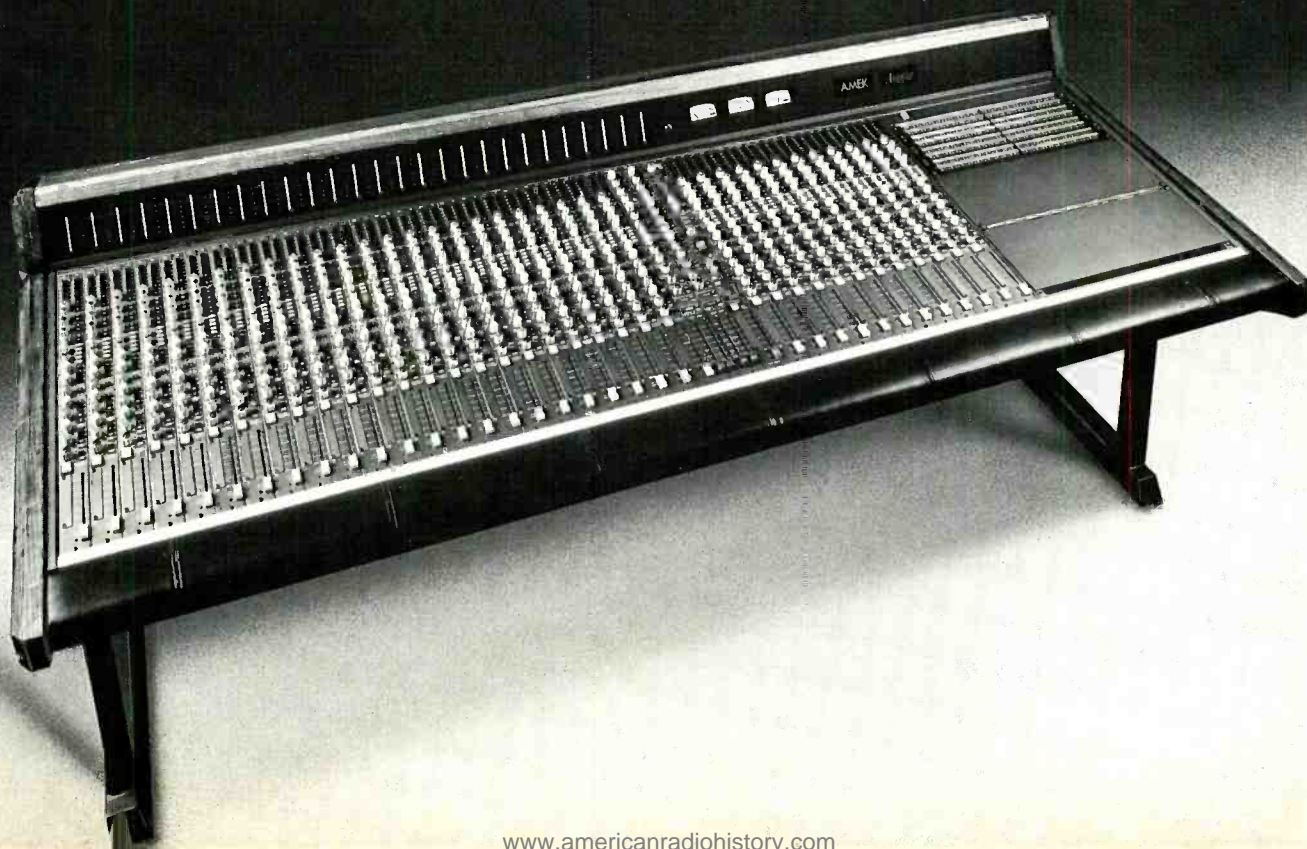
In terms of commissioning, of supporting services and back-up, that can make a world of difference to making the most of the **Angela's** capabilities.

The same holds true for the console's automation. **Audio Kinetics' MasterMix** is the logical choice and with Amek's own faders it's economical as well as powerful.

Call Mick Boggis at **Stirling ITA**. The Amek experts.

 **Stirling ITA**

1 Canfield Place, London NW6 3BT. Telephone 01-625 4515
Fax: 01-372 6370. Tlx. 946240 CW EASY G Ref No. 19014280



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NEWS

ART IEQ graphic equaliser

ART have announced the introduction of their *Smart Curve Intelligent Equaliser*. The IEQ is a microprocessor controlled 15-band $\frac{2}{3}$ octave graphic. Front panel controls allow adjustment of all parameters with mode and parameter setting displayed on a liquid crystal display.

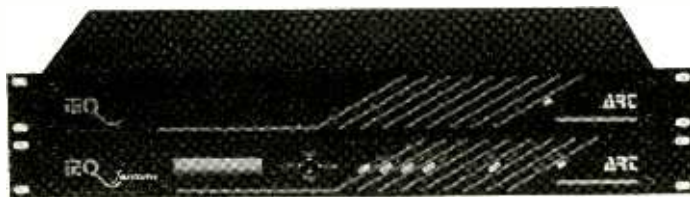
Actual frequency response, 'slider' positions and system status can all be displayed externally on a video monitor (composite video output) and ART can provide a 3U high, 19 in rack mounted monitor for this purpose.

The *Smart Curve* system is designed to ensure that the displayed fader settings accurately represent the actual response. This is achieved

by using a constant Q filter design and automatic compensation for any adjacent band interaction. As the unit is digitally controlled it is possible to recall any of 128 curves from memory.

The IEQ is 1U high, rack mounted and available as a master or remote option. The remote at around half the cost can be programmed from the master or a computer for the curve settings and once programmed curve memories can be recalled via MIDI. **ART, 215 Tremont Street, Rochester, NY 14604. Tel: (716) 436-2720.**

UK: Bandive, Brent View Road, London NW9 7EL. Tel: 01-202 4155.



Media Recovery Shockwatch system

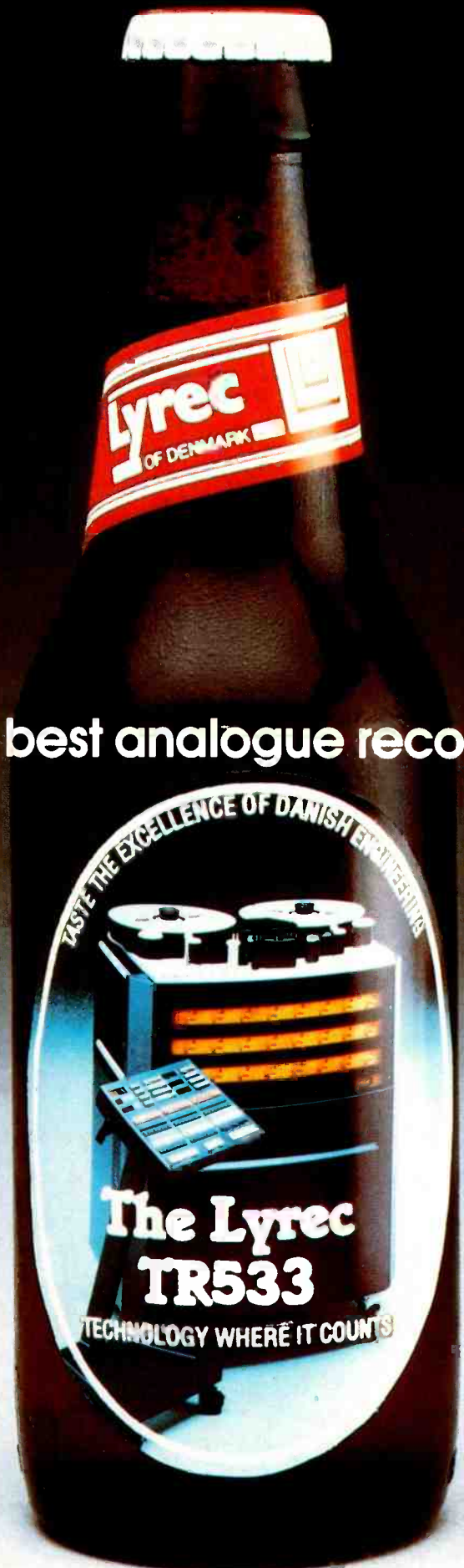
Media Recovery Inc of Dallas have developed the *Shockwatch* impact-detection system, which indicates if goods have been 'bumped, banged or thumped beyond manufacturer's specifications'. A small glass capillary tube, set in a plastic holder, contains a white liquid that turns bright red permanently if an impact above a predetermined level occurs. The levels, based on G-forces, are available in sensitivities ranging from 10 to 100 Gs. Three versions, denoted by the colour of label, protect goods in transit (attached to packaging), very delicate equipment

(attached directly to the product), and special *Shockwatches* protect computer disks and cartridges.

Shockwatch is intended to be used in conjunction with shippers, carriers and manufacturers, where inspection of products and appropriate noting of the *Shockwatch's* status can help pinpoint some of the liability in case of damage.

Media Recovery, 1435 Round Table Drive, Dallas, TX 75247, USA. Tel: (800) 527-9497.

UK: Scopus UK Ltd, Unit 2E, 7 Willow Street, London EC2A 4QH. Tel: 01-734 0670. □



“...probably the best analogue recorder in the world!”

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Lyrec (U.K.) Ltd., 'Ardhaven House', Old London Road, Milton Common, Oxford OX9 2JR. Tel: (08446) 8866 Fax: (08446) 8810 Tlx: 838725 LYREC G
Lyrec Manufacturing AVS Hollandsvej 12, DK-2800 Lyngby, Denmark. Tel: +45 2 876322 Tlx: 37568 LYREC

What does it take to pro-audio centre

*It takes more than a warehouse
full of the best audio equipment.*

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Names like Amcron – we have every

*Our directors started out building
sound systems for rising stars, and
the staff all have very similar
backgrounds.*

*We've found that customers
from way back are still
regulars – like Phil Collins,
who we knew when he
was just a drummer.*



WELCOME

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*It also takes experience: at HHB
you won't find slick salesmen, just a
team that knows its business inside
out.*

*You'll also find everyone at HHB
has a one-track mind. (Or 24 track
if you want to see our range of Amek
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demo room, you can be sure
that our service and hire*



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Our enlarged digital editing suite now includes AMS Audiofile, as well



and so in our new premises you'll find a high level of comfort that extends throughout the building.

And of course to make your visit more palatable we're always happy to offer you suitable refreshments.

We feel that, with our unmatched technical expertise, approachability and reputation – and our new premises – we've earned the

right to call ourselves the first pro-audio – centre in the country.



as Sony CD mastering.

It takes comfort: we realised that the hair shirt was out of fashion



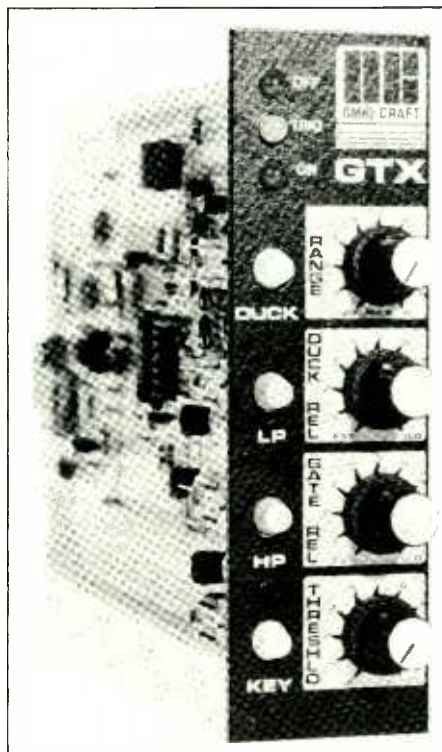
APRS PREVIEW

This year's 20th APRS exhibition will be held from June 24th to 26th inclusive. The venue is Olympia 2, Kensington, London. We have compiled a preview based on information that was available to us at the time of going to press

A

● **Abac Rustin:** French company new to APRS manufacturing systems for mixing desks, light and sound. ● **Aces (UK):** launch of the *SECA* 24-bus console, plus MkII version of their 16-track ½ in multitrack and new generation of studio/PA amplification. ● **Agfa Gevaert Ltd:** full range of magnetic recording products for the professional recording, duplicating, broadcast and video industries. ● **Akai UK:** will debut their patchbay system incorporating the *DP2000* A/V digital matrix patchbay and the *DP3200* audio digital matrix patchbay, and display the *MG1212* and *MG1214* 12-tracks, the *MG614* cassette multitracks, and their rack mount series of effects. Also on show will be a 24-track recording system for under £10,000, comprising two *MG14D* 12-tracks synchronised with SMPTE, and the *S700* and *S900* samplers with Steinberg software. ● **AKG:** established equipment will be complemented by recently launched *C522* stereo ENG and *C562* boundary layer mics, capsules for the *C460 EB* preamp (including *ULS Ultra Linear* and *CX* remote series), *ADR 68K* 16 bit sound processor, *TDU 8000* time delay unit and *K240 DF* studio monitor headphones. ● **Alice (Stancoil):** will be launching their *Silk 87* 32-track in-line mixing desk with automation control. Also on show will be the *Alice 2000* audio mixer, the *3000* community radio presentation mixer, a telephone balance unit and the *AS6* audio switch matrix. ● **Allen & Heath Brenell:** MBI/AHB Group will be showing a new version of the *Sigma 24* console, the *Studio 12* compact production and on-air broadcast desk and the *MBI 24* series on-air desk with ancillary equipment. ● **Amek:** a range of Amek consoles including the *G250* multitrack production console, an upgraded version of the *Angela* console and for broadcast and post-production, the *BCH* system and the recently introduced *Classic* console. ● **Ampex Great Britain:** full range of magnetic tape products for professional digital and analogue

applications. ● **AMS/Calrec:** will be demonstrating the *AudioFile* linear 16 bit record, edit and playback system. Latest software includes a new 'cut and paste' editing page, sync recording, punch in/out and direct machine control. Also on display will be the *RMX16*, *Timeflex*, the *DMX 15-80SB* broadcast delay and the *DMX 15-80S* with MIDI control and dual channel sampling with reverse playback. Calrec by AMS will be featuring the *UA 8000* recording console fitted with the latest AMS automation



Omni Craft plug-in noise gate module

system. Also on display will be the Calrec range of microphones and the portable broadcast *Minimixer*. ● **Applied Microsystems:** established equipment, such as the *CM250* control synchroniser comprising a compact control unit with 80-character LCD linked to a 1U rack, as well as the *CM50* autolocator. New will be the *CM200* chase synchroniser, based on the *CM250* software. ● **Aries:** range of live sound consoles and rack mounted mixers. ● **Audilec Distribution:** distributors for Audio Technica, TOA, 3rd Generation professional and audio, BSS and Formula Sound. New products on show include Unipoint *AT 871* boundary effect microphone, the *4000* series range of modular capsules and some new circuitry products including the *AT4462* stereo ENG mixer, plus the *ATW 1031/1032* and the *ATW 2012* radio microphone system. ● **Audio + Design Recording:** new *SoundStream* hard-disk recording system, the *PCM-701* conversions/interfaces with the *Admix* digital fader and the new professional conversion for the *PCM601*. Also displayed will be the *Scamp* range of signal processing equipment. ● **Audio Developments:** along with their current *AD066* range of *Port-A-Flex* equipment, they will be introducing a fully computerised 6-channel sound dubbing system, as well as the *AD145* edit mixer and *AD062* with studio style meter bridge. Also new is the *AD150* dual mic preamp and the *AD701* 4/8 battery/mains distribution amp. ● **Audio Digital Technology:** no information available. ● **Audio Kinetics:** will demonstrate the *Q.Lock* synchroniser with both the *Alpha* and *Eclipse 422* controllers, and a PC-compatible software package, *Offline*, will be shown for the *Eclipse*. Also shown will be the *Pacer* chase synchroniser and the *Striper* multispeed timecode generator together with the *Gearbox* reference conversion unit; new will be the *VTL Translator*, a variable window VITC reader and *LTC* translator, stereo VCA faders will be shown for the first time for *MasterMix* automation. ● **Audio Marketing Group:** in addition to the *C-ducer* range of contact microphones and the *Acoustic Percussion Trigger*, AMG will be showing the *Omni Craft GT4A* noise gate. The 4-channel, rack mounted *GT4A* can be keyed externally or from the gated signal and uses an optical gating system. ● **Audio Systems Components:** broadcast products will be the *Minx 3/1* outside broadcast/ENG mixer, 10 s stereo delay, modified *PR99* tape recorder and trolley, the *ASC* modified Technics *SL-P1200-ASC* CD player for professional users along with retrofit kits. Also on show will be products from CB Electronics, including timecode products; a Video Streamer, a reader/generator/insert, Video Cue, a video wipe insert, and Filmcode, a bi-phase to timecode converter. ● **Audio Video Marketing:** Ferrograph range of products. ● **Autograph Sales:** the Meyer established range of loudspeakers and associated products, including the *500* series (containing road box versions and stage monitors) and the new *MS-1000* stereo power amp. Klark-Teknik, Brooke Siren Systems and Micron products will also be on display. ● **Avcom Systems:** the *CD* series of Telex professional high-speed cassette-to-cassette duplicators.

B

● **BASF United Kingdom:** range of magnetic tape products including *Studio Master 910*, *920* loopbin mastering tape and *930* digital mastering tape for DASH format machines. Also details of

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Why is it always such a struggle to link audio and video tape transports through most synchronizers? Because each machine speaks a different control language. Translating reel and capstan commands for one type of transport is complicated enough. Factor in a multitude of machine-specific commands and transport design philosophies, and you have a real nightmare.

Rethinking the synchronizer

That was our first step in unraveling the machine communication and control problems that complicate your work. What makes LYNX the only truly universal synchronizer and machine control interface is an innovative design that uses distributed processing and a unique approach to software architecture. TimeLine's U.S. technology is so advanced, LYNX actually overcomes the "impossible" language barrier between audio machines and video editors.

Hands-on, not hands-and-knees

The transport synchronizer/resolver interfaces with your tape machine in one step through the front panel menu.

No DIP switches, no rotary switches. No opening the unit to change ROMs. No complicated alignment procedures. Simply hook up the cable and push two buttons.

Even the LYNX can't repair tapes or transports. But when peripheral problems do occur, LYNX has diagnostic messages and status indicators to help you track them down and get back to work fast. LYNX even reads, generates, resolves and translates timecode and pilot.

Take control

Next time you catch yourself daydreaming about how easy life would be if your tape machines could finally talk to each other, try a LYNX. See how TimeLine's universal machine control interfacing, intuitive front panel operation and outstanding reliability (our first production unit is still in constant use) can make all your audio and video transports work together — and make them all work for you.

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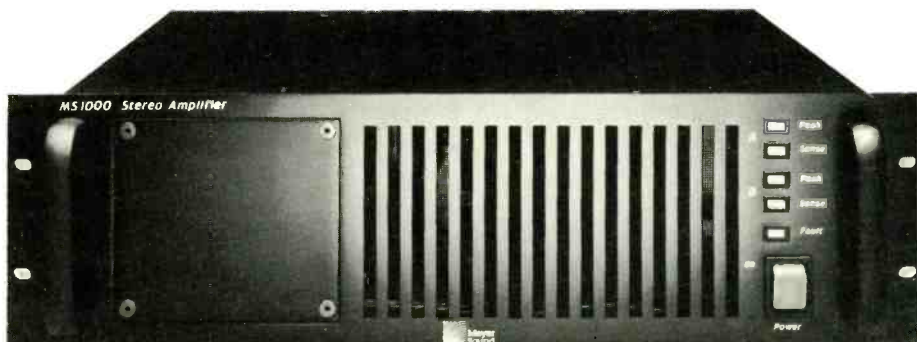
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GEXCO TECHNOLOGY INTERNATIONAL INC.

317 St. Paul's Ave., Jersey City, NJ 07308 USA Tel. (201) 656-7496, Tlx. 285261 GEXCL Fax. (201) 653-2396

APRS PREVIEW

range of calibration tapes and cassettes. ● **Bell & Howell:** prototypes of the new JVC PQ editor and error checker for the series 900 digital audio mastering system along with the current range of JVC professional audio products such as the MU-6200E Super Beam microphone. Also on show will be pre-mastering applications of the VP900 for CD-ROM together with the services provided by ADG, the Acoustic Design Group. ● **Beyer Dynamic:** new products include accessories for the MC740 studio condenser mic, additions to their range of stands, instrument racks, MPC60 and MPC40 boundary mics, M700 dynamic mic, MCE80 electret condenser and MCE81 condenser. ● **Branch & Appleby:** full range of replacement audio tape heads plus NAB cartridge, video sound and duplicator types. Electronic systems include the B&A looping video/film/sound post-production controller, Skotel and B&A timecode products, audio test and maintenance products (including the magnetic tape fluxviewer). ● **Britannia Row:**



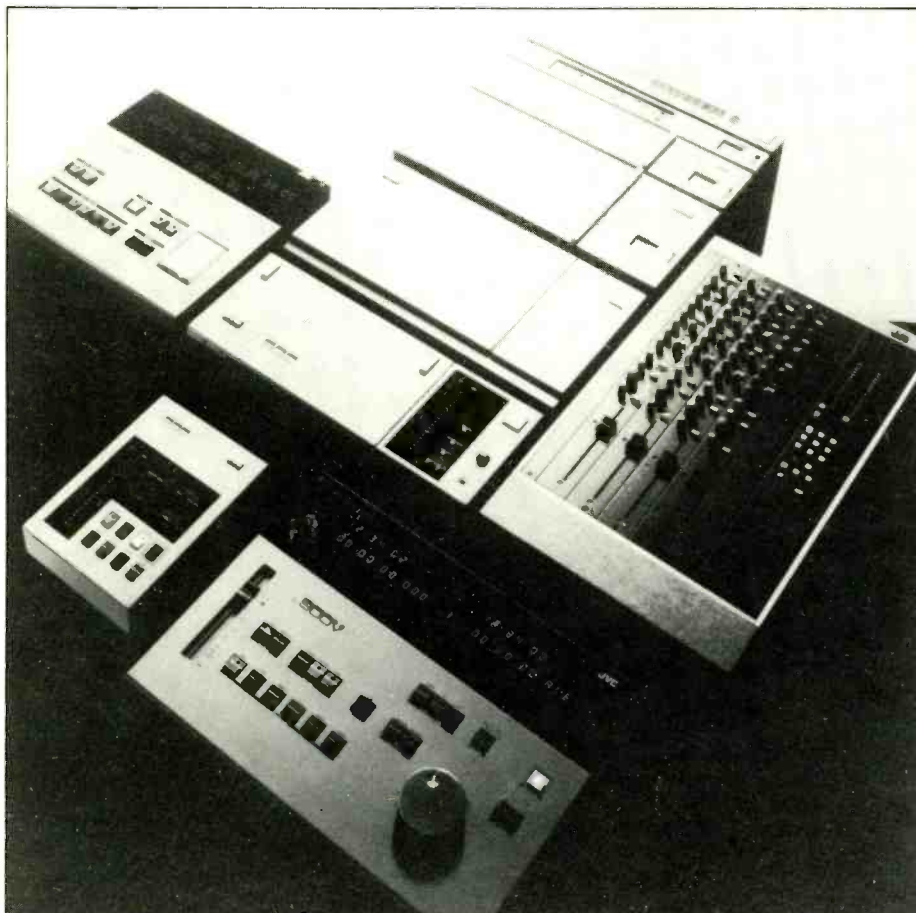
MS-1000 stereo power amplifier from Meyer Sound Labs

full range of products by Westlake, BGW Systems, Summit Audio, Sonosax and Electrospace. New products include the SPA/1 amp from BGW and

the TPA 200 stereo mic preamp and PEQ 100 equaliser from Summit. The Sonosax SX-T is a new portable mixer building up to 24 channels, while the Electrospace EX1 is a new multipurpose limiter/compressor/gate system. ● **Bruel & Kjaer UK:** range of professional microphones and extensive range of acoustic, vibration and electronic test, calibration and measurement equipment.

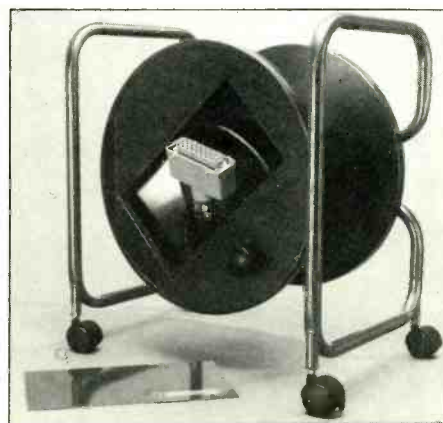
C

● **Cadac Electronics:** will have on display a working model of the new model E theatre desk, as well as models B and A, plus modules from the CD1000 studio desk. ● **Cameron Video Systems:** the For A Sirius disk based recording



JVC series 900 digital audio mastering system from Bell & Howell

system. ● **Canadian Instruments & Electronics:** wide range of cables, connectors and accessories. ● **Canford Audio:** range of products they distribute including new cables, jackfield cleaners, XLR patchpanels, studio headphones, tape hub flanges and the new Lynden Micros limiter/compressor PCB. ● **Cetec International:** range of high speed duplicating equipment. ● **Componex:** comprehensive range of audio meters, including VUs, PPMs and LED bargraphs. ● **Connectronics:** wide range of cables and connectors for the audio and broadcast industries. A new range of Sound Wires is available in pre-cut form, featuring high-grade connectors with a tough flexible cable and wide choice of colours and terminations. A new range of heavy-duty cable drums is also in the pipeline. ● **Court Acoustic Sales:** will exhibit several new products including the Sharnfield 40/16/2 PA mixing console with 4-band parametric EQ, 16 aux sends and returns. Also at the show is a new 3-way Linkwitz-Riley 24 dB/octave electronic



Connectronics' cable drum

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The number of tracks is one of life's dilemmas.

There are not enough for some, too many for others. So working on the theory that 24 tracks were enough for many projects but 48 were often necessary, we designed the PCM-3324. We followed that with the RM-3310 Remote Control and Synchronizer . . . 24 or 48 tracks as you like, when you like. Not only that, we made sure that the DASH format provided for up to 48 tracks on a single machine, guaranteeing upward compatibility.

Producers were not slow to realise the creative advantages of this way of working. Studio Managers saw a safer return on their investment, so thanks to them we had a success on our hands. Now we have added the IF-3310 and VSU-3310 to further improve system flexibility.

If you want to know how to solve the track dilemma, find out more about the Sony system, then contact our customers who'll tell you just how good it is. Who are they? . . . If you don't know perhaps you shouldn't be reading this advertisement.

APRS PREVIEW

crossover. ● **Crest Audio:** range of power amplifiers including the *Powerline* series and the high output *Thousand* range. ● **Cunnings Recording Associates:** range of tape duplication products, spools, boxes and other related equipment and accessories.

D

● **DDA:** a brand new 56-input in-line console with dual signal architecture providing up to 112 inputs for mixdown. The console has 32 output buses and full patching with master/individual input selection of two multitrack machines. Also on show will be the *AMR24*, the *S* series PA console and the new style *D* series frame.

● **Digital Creations:** *Diskmix* automation system, which is now available with moving faders as well as VCA faders. The PC-based system provides for unlimited mix storage on hard or floppy disk, the DCC moving fader retro modules use optimised circuit configuration. ● **Dolby Laboratories:** modules for Dolby SR, including a new one for multitrack use in *XP* and *SP* series interfaces; also the *XP* series interface and the *361* and *365* interfaces, available with *SR* or *A*-type modules. ● **Drawmer Distribution:** a range of signal processing equipment including noise gates, compressor/limiter, delay lines and expander/compressor.

E

● **Eardley Electronics:** the latest Neutrik connectors along with the Neutrik *TP401* audio measuring system, Preh potentiometers, Marquardt switches and connectors from Kaco of West Germany. ● **Eastlake Audio:** will be presenting examples of recent studio projects for both music recording and broadcast television in the UK and overseas. ● **Edge Technology Group:** full range of products from Brooke Siren Systems and Turbosound. New from BSS is the *DPR-502* noise gate. Designed for studio and live applications, the *502* incorporates ADE technology (Accelerated Dynamic Envelope) combined with bi-directional MIDI interfacing. Turbosound will be introducing a variety of new enclosures. New models include the *TSE-260* high frequency enclosure, the *TSE-211* mid/high enclosure and the *TSE-115* and *TSE-215* bass enclosures. Also on the stand will be the *TSE* Flying Bar system and a production version of the *TFM-2 TurboConcentric* floor monitor. ● **Elliott Brothers:** new *DSA* range of power amplifiers from Harrison, new Rogers *Studio 1A* monitors plus the launch of the Chromotech *TVU224* bargraph. ● **EMO Systems:** extensive range of stage and

studio ancillary equipment such as mic splitters, DI boxes, distribution systems and disc amplifiers.

F

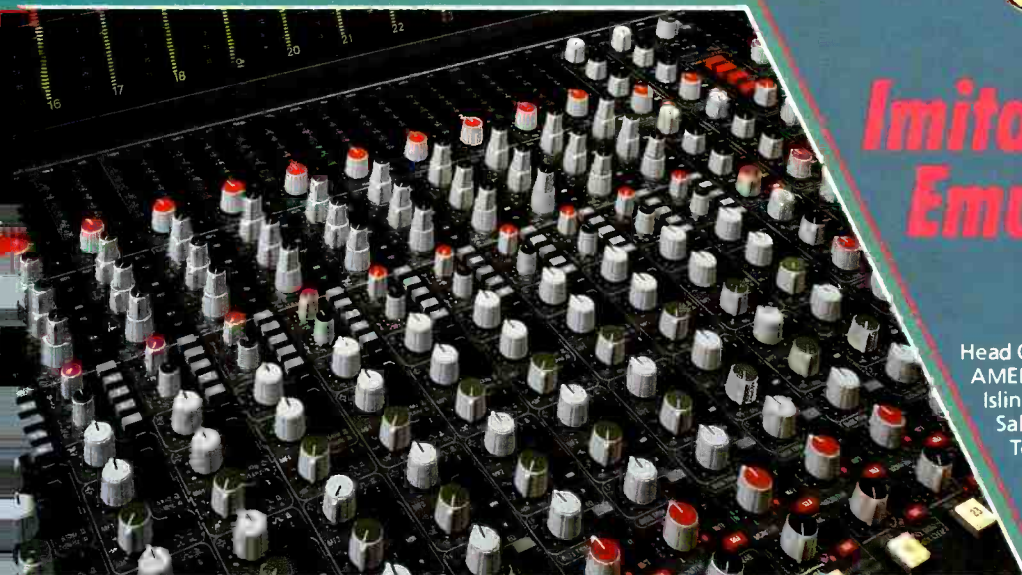
● **Film Tech:** along with their existing range of compact portable audio mixers and accessories, they will show the new *VTM800* audio mixer for use in the video edit suite, and the *Film-Tech PAM 42* portable, 4-input stereo mixer. They will also be displaying a range of products in their

role as supplier. ● **Focusrite:** a new range of modular signal processing devices designed by Rupert Neve for console retrofits, outboard racks or custom designed consoles; on show will be a rack frame with eight *ISA 110* modules, the new *ISA 115* module in single and dual configuration and a remote controlled mic amplifier, *ISA 116*. There will be a demonstration unit of two *ISA 10* modules. ● **Formula Sound:** will demonstrate the new VCA control module for use with their *PM-80* modular production mixer, and will also show the *QUE-4* and *QUE-8* studio headphone foldback systems with the *SE2* series tamperproof system equalisers. ● **Fostex:** full lock-up systems that include the *4030* synchroniser, *4035* controller and the *4010* reader/generator/jam sync unit will be demonstrated, as will the latest versions of the Fostex 8- and 16-channel multitracks. Also on show will be interfaces for all leading multitracks as well as the model *460* 4-channel cassette/8-channel mixer with SMPTE lock-up option. ● **Future Film Developments:** a wide range of products from Neumann, Tannoy, Philip Drake, Stellavox, RTS, Soundex and Canare. Additionally there will be a wide range of cables and connectors for the professional audio, video and broadcast industries. ● **FWO Bauch:** products from EMT, Harrison, Lexicon, Tannoy, Switchcraft, MRL, Gotham, Albrecht and Philips, as well as new products including the *A727 CD*



Opus audio production workstation from Lexicon

AMEK *Angela*



Imitation and Emulation

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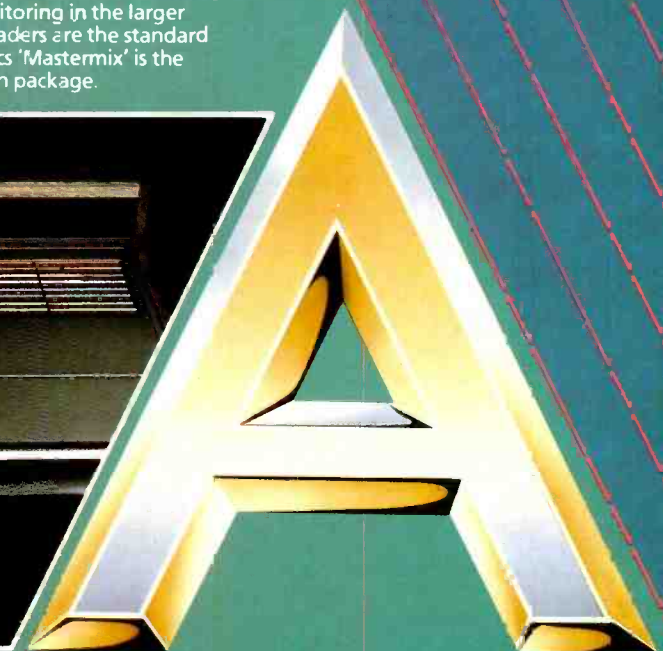
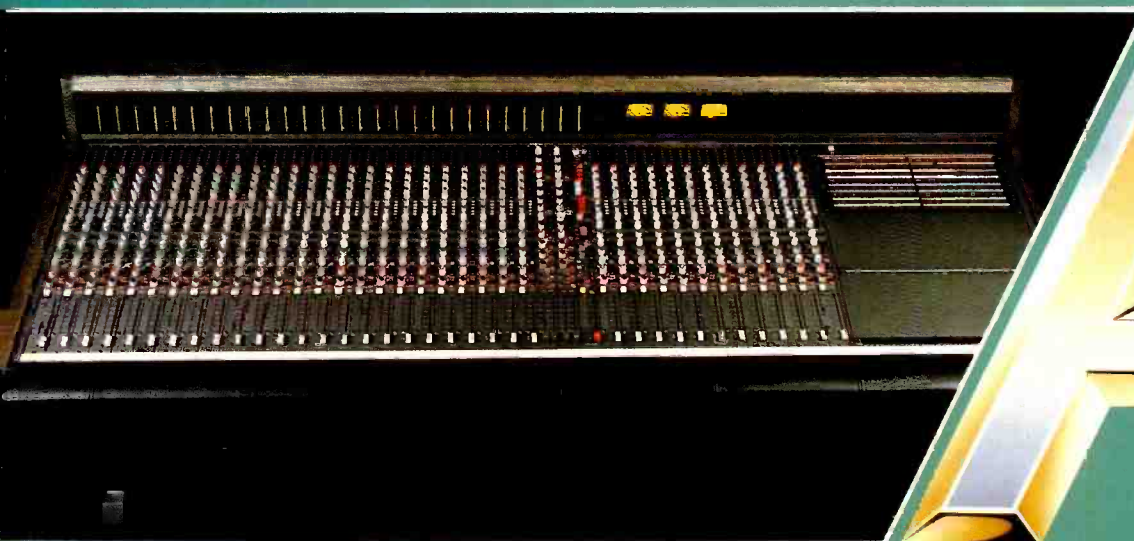
Today, the mid-range console market is crowded with manufacturers who want to fill the space in the middle of your control room with their console.

Each one of them has a marvellous claim about specifications, low-noise performance for digital, flexible signal path, strength of mechanical construction, equalization, price, ergonomics, multiple inputs, high-quality components, superior technology, and how they consulted a hundred top engineers before they set pen to paper.

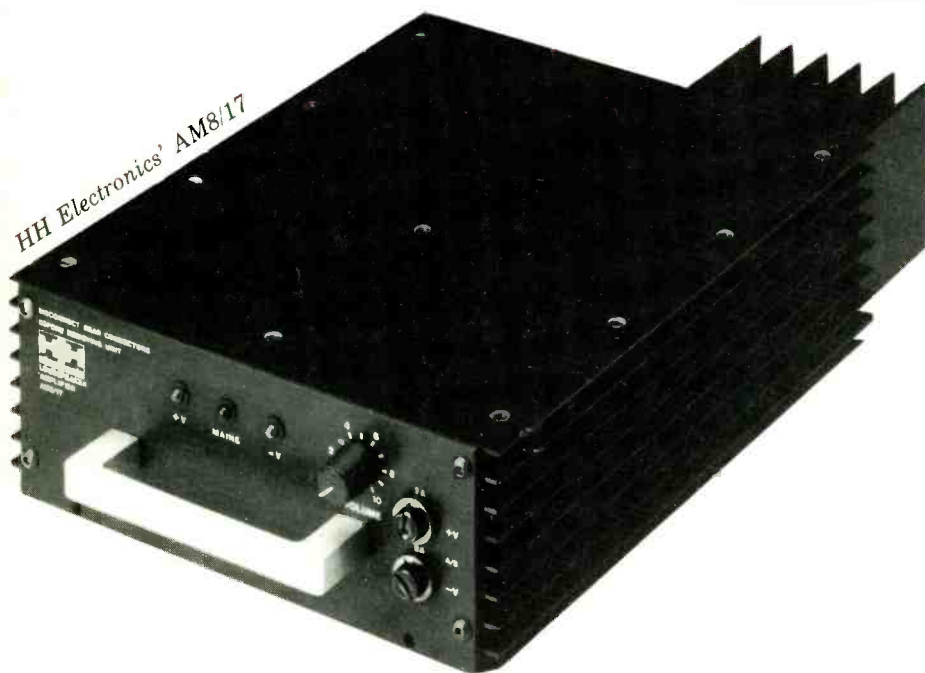
Let them claim. We wish them well. Fashions come and go; our emphasis is on engineering. There are now over 180

AMEK ANGELA installations worldwide. We set the standard in ergonomics, performance, specifications, equalization and build quality. Imitation is the sincerest form of flattery. Emulation is a little more difficult.

Actually, we admit one concession, but not to our competitors. The new 1987 ANGELA is now finished in grey, to harmonize with the rest of the AMEK product line. Otherwise, ANGELA is still available in 3 chassis sizes each with onboard or external jackfields, giving 28 to 62 dual-channel i/o modules (ie, 56 to 124 inputs, plus returns) and a choice of either 24- or 48-track monitoring in the larger versions. Manual or VCA faders are the standard options, and Audio Kinetics 'Mastermix' is the recommended automation package.



APRS PREVIEW



player and A721 cassette deck from Studer, the RSM190 stereo shotgun microphone system from Neumann, the C279 mini mixer from Revox, and a digital cartridge machine and audio routing switcher from ITC.

G

● **G2 Systems:** hardware and software computer graphics products for video production. New will be the recently launched sound mix automation system, *Shiva*, a rack mountable audio processor that can be connected to any existing audio mixer to provide remote level control.

H

● **Harman Audio:** products from JBL, UREI, Rauch and ART, including the complete range of JBL studio monitors, and the new 815C and 811C monitors from UREI. Rauch are unveiling two new amps, the DVT 300 600 W/channel and the DVT 25 100 W/channel. Also the full range of Tascam analogue recorders, stereo cassette decks, plus the CD 501 studio CD player. ● **Harrison Information Technology:** range of 100 to 600 W/channel digital switchmode power amplifiers, the GP series graphic equalisers with notch filter sets and I/O level matching switches. Also on the stand will be details of the SP series 19 in rack

mounted production and broadcast mixers, the AC active crossovers with built in limiters and



Westlake BBSM-15

MOSFET amplifiers. ● **Hayden Laboratories:** products from Nagra-Kudelski, Sennheiser, AEG and Dynacord. ● **HHB Hire & Sales:** new anti-aliasing filters from Apogee for Sony PCM3324, PCM1630 and PCM701ES, new oversampling chips for the same machines from the Electric Valve Co, a range of exclusive products from Amcron, Gauss, RTW and Sony, the *Clue*, plus a range of non-exclusive products from other major manufacturers. ● **HH Electronics:** new AM8/17 BBC monitor amp for the LSA 5/9 monitor loudspeaker, as well as the AM8/12. The VX range of seven power amps, and the HH Acoustic range will also be on display, including the 1201 and 1501 loudspeaker series. ● **Hill Audio:** the *Concept* series of consoles and the 00 and 000 series of power amps, as well as the *Mix* range of non-modular mixing consoles and full range speaker enclosures. ● **Home & Studio Recording:** recording magazine for musicians. ● **HVS Developments:** manufacturer of audio equipment, specialising in studio comms, will be launching their *Director* range of talkback products aimed at small to medium sized studios and OB vehicles; also on show will be the HVS8601 stereo distribution amplifier. ● **HW International:** full range of products from Shure including the new SM89 shotgun mic, the FP51 portable, gated memory compressor/mixer and a new wireless microphone system, the *Diversiphase* dual antenna design.

I

● **International Musician:** range of musician oriented publications.

J

● **Jackson Music:** specialist in used recording equipment from a single mic to complete 8- to 48-track studio packages. Also available will be details of valve equipment and vintage mics. ● **Ji Arbitrator:** the *Vestafire* range of rack mounted effects and recording units, including the MC-30 recorder/mixer and RVD-901 digital reverb, plus the *Dynamix* and *Dam* ranges of mixers and consoles.



YOU PROMISED YOURSELF A NEW 2" OTARI RECORDER, ONE DAY. TODAY IS THAT DAY.

There's a difference between Otari's new MX 80 and the 2" machinery on offer from other manufacturers.

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But here's the surprise. Otari's MX 80 is so keenly priced that a go-ahead studio like yours can probably afford it right now.

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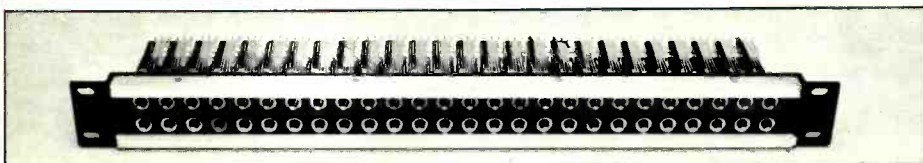
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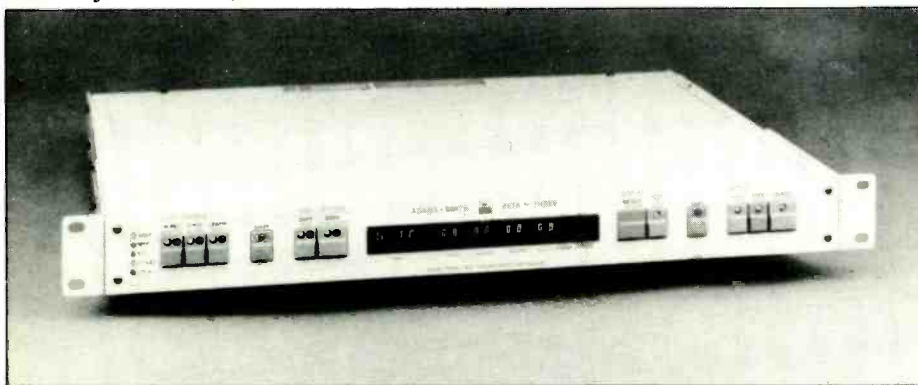
Jackfield from Mosses & Mitchell

K

● **Keith Monks:** new range of fishpoles and hand booms (five models) and the redesigned range of mix stands, including the *MSL* and *MSM* floor stands. ● **Kelsey Acoustics:** Carver *Magnetic Field Power* amplifiers including the latest *PM350* and *PM175* rack mounting power amplifiers and the established *PM1.5*. Also on show will be the complete range of Telex wireless mic systems including the latest *ENG* wireless microphone. ● **Kemps Publishing:** details of the *International Music & Recording Industry Yearbook*. ● **King**

Instrument Corp: A/V tape loading equipment for the duplicating industry. One of the latest products is the model *2500* VHS format automatic video loader. ● **Klark Acoustic/Munro Associates:** demonstrating the *JADE* active monitor. A high powered integrated 3-way version of the monitor, *JADE 2*, will also be shown. Details of Windmill Munro Design, an integrated design service for the video and TV industry, will also be available on the stand. ● **Klark-Teknik:** series *300* graphic equalisers, *DN60* real time spectrum analyser, *DN773* broadcast digital delay unit, *DN716* multiple output digital audio delay,

Zeta 3 synchroniser from Adams-Smith



DN305 noise masking processor and *DN780* digital reverberation system with new MIDI interface. ● **KW Electronics:** specialists in system design equipment, including consoles, switching matrices, talkback systems, etc.

L

● **Lindos Electronics:** demonstrating the *LA100* audio analyser, a versatile measuring system comprising the *LA101* synthesised oscillator and *LA102* measuring set. ● **Lyrec UK:** range of tape recorders including the *TR533* 16- and 24-track recorders, high speed duplicating equipment and the *FRED* editing tape deck.

M

● **Marquee Electronics Ltd:** new *Zeta 3* timecode equipment from Adams-Smith, plus compact studio monitors from Jones. Eventide, Nemesis, JBL, Otari, Tannoy, Entec and Soundtracs equipment will also be on show. ● **Martin Audio:** featured display will be the new *F2* modular flying system designed as a simple solution to flying a system that varies from venue to venue. Also on display will be the new *RS802* mid/high pack and the 2-way stereo or 3/4-way mono *MX4* crossover. ● **Michael Stevens & Partners:** Rogers range of monitor speakers, Ramsa power amplifiers and their complete range of compact PA speakers and mics, Audioscope audio level display and analyser equipment as well as the launch of the model *9000* modular audio measurement set. From Hiletron will be a complete range of power amps and outboard equipment and MS&P will be discussing their studio design and installation service. ● **Midas Audio Systems:** various audio consoles for theatre, recording and live applications. ● **Minim Electronics:** range of studio, broadcast and monitoring equipment including presenter's clock, Ambisonic decoder and *TV7* television sound tuner. ● **Mitsubishi Pro Audio:** range of PD format digital audio recorders including the *X-86* 2-track, the *X-400* 16-track and the *X-850* 32-track machines. Also on display will be the redesigned *Westar* console. The latest product to be featured will be the *ACS* audio crossbar routing/mixing switcher. The *ACS* system is available in two configurations: *MRS* Mono Routing Switcher and *SRS* Stereo Routing Switcher. ● **Mosses & Mitchell:** their range of audio and video jacks and jackfields, including their *440* range of miniature jack sockets. ● **MTR Ltd:** first time showing of the new *ME 16* console, an 18-channel, 16-track mixer for *B16* and *E16* machines; the series 2

SAM THERAPY

— Have moved to a new Andy Munro-designed studio —

— Studio 124/48 Video —

— Studio 2 16/24 Programming —

— Fairlight Series III —

— DDA AMR 24 —

— Massenburg Moving Fader Automation available from August —

— Otari MTR90 —

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APRS PREVIEW

multitrack and stereo mixers will also be shown. From Aries will be the 16 and 24/8/16 consoles and the new rack mounting 10/4/8 console, and graphic EQs will be on show from Cutec. Also the Rush Electronics 2-channel outboard equaliser, and the Madrack D7 stereo 7-tap analogue delay line. ● **Music Lab:** UK distributors for Rane will be showing the full line, including SM26 splitter mixer, MP24 production/disco mixer, AC22/23 electronic crossovers, and the full range of graphic and parametric equalisers, analysers plus the MA6 6-channel power amp. Music Lab Hire will also be represented.

N

- **NEAL (Lee James Electronics):** range of cassette recording and replay machines.
- **Nemesis Electronics:** will be featuring the Q4 and Q4-D parametric equalisers featuring four bands of parametric EQ, and the FBS 500 studio foldback system.
- **Neve:** for the first time at APRS the DTC 1 digital audio transfer console—DSP technology, snapshot recall, 250 memories, two stereo digital audio inputs, switchable sampling rates, a new 4-band equaliser; also on show will be the V series console and Necam 96 automation.

O

- **Otari Electric UK:** wide range of digital and analogue recorders including the DTR900 32-track digital multitrack, the MTR90II 24-track analogue recorder and the 24/32 MX80 2 in analogue multitrack. A wide range of twin-track recorders in addition to the latest CTM 10 cartridge recorder/playback unit and specialist duplicating products.

P

- **Paul Farrah Sound:** Nexa range of PA speaker systems including the Integrated, Mini Integrated and PCLine series. Also on show will be the C-Audio range of power amplifiers, ROH communication devices and accessories, the Martin Audio CX Compact speaker system and Anchor Audio range of portable self powered speakers.
- **Penny & Giles:** full range of motorised and manually operated studio faders, panpots and video controllers, plus an example of the new motorised rotary potentiometer in prototype form.
- **Playback:** new tape products from Maxell (DAT), Ampex (improved 456 Grand Master) and BASF (range of U-matics and VHS), plus disks from Fuji, automatic tape splicer from CAT along with TDK products.
- **PRECO:**

(BDE 2600 stereo delay with dual disk store).

- **Pro Sound News:** industry news magazine.

Q

- **Quad:** their range of power amplifiers (520f, 510, 405-2, 606 and 306), plus the studio version of the ESL-63 electrostatic loudspeaker.
- **Quested Monitoring Systems:** in addition to their present range, new models shown will be the H405 nearfield monitor, Q415 4-way monitor, and a range of budget priced passive monitors.

R

- **Radford Laboratory Instruments:** range of



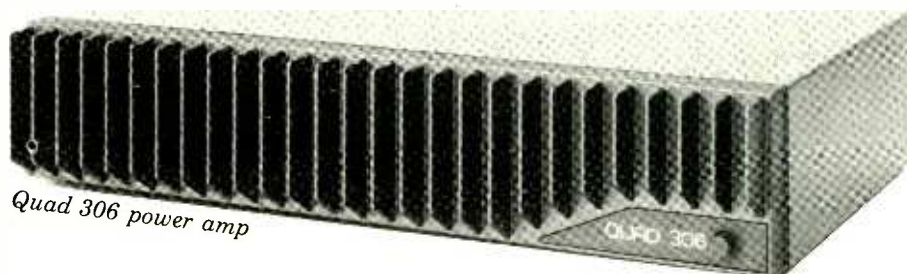
Jecklin OSS recording disc from Presence Audio

production version of the Sound Technology 3000 programmable generator/analyser together with the 1510 and 1700 series. Other products include the PRECO version of the Digitec F500 tape machine as supplied to the BBC; the Micromax range of cart machines from Pacific Recorders; Capitol Magnetics range of NAB carts; Leavers Rich bulk erasers and A/V erasers from Sanix.

- **Presence Audio:** are exhibiting for the first time and will be showing a variety of products including Dutch Audiostatic loudspeakers, the Spica TC-50 loudspeaker, Jecklin headphones and the OSS recording disc, the SAE 02 range of electronics and the French made Vecteur cable and YBA pre- and power amplifiers.
- **Professional Audio:** products from Renkus-Heinz, Aquarius, SCV Audio and Unisound, as well as from Lyrec (TR533 Mk II with TR55 stereo recorder and FRED editor), Trident (series 80c 32/24/48 console and series 65 24-track console), Court (Mk II versions of SN60, SN30 and SN20 soft dome studio monitors), and Bel

test equipment.

- **Raindirk Audio:** the 40-channel in-line Symphony recording console featuring digitally controlled status switching. The console is claimed to have ultra low levels of noise, crosstalk and leakage.
- **Rauch Precision Engineering:** range of precision power amplifiers for monitoring and stage applications from 250 to 1000 W/channel.
- **Re-An Products:** wide range of control knobs, connectors and other components for mixing desks, including custom-designed precision mouldings and knobs.
- **Rebis Audio:** new series of processors for the RA701 MIDI gate, including a dual compressor/limiter and 4-channel noise gate; also on display will be the RA200 modular signal processors.
- **Recording Studio Design:** range of recording consoles including the 16- to 40-input, 24-track monitoring series II.
- **Roland UK:** first showing of the new D-50 digital synthesiser with Linear Arithmetic



Quad 306 power amp

OUR NEW EQ SOUNDED GOOD HERE...

The "Bothy" at the bottom of our garden is where we work on advancing console design concepts.

In there the latest improvement to the sonic performance of our consoles — the new EQ — was initially developed.

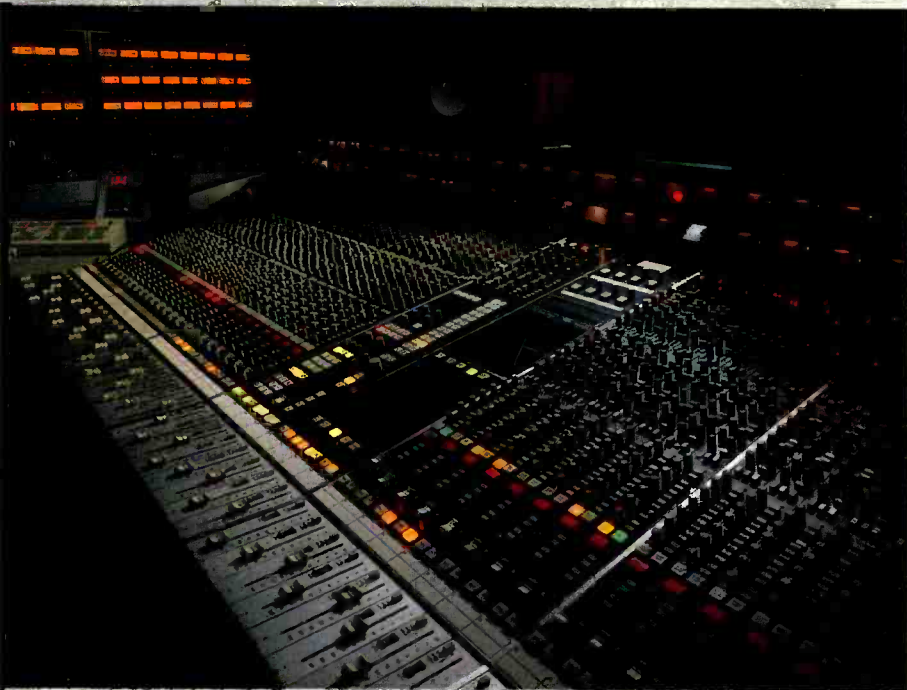
But we didn't stop there. We took the EQ into our own fully equipped 48 track studio where we tested it and analysed it, but most important of all we listened to it — exhaustively.

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There is also a new SSL Studio Computer, the G Series, which with its fast processors and vast data storage capacity enables processes that used to take minutes, to be carried out in seconds. The G Series too is fully retrofittable.

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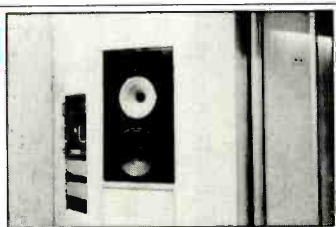
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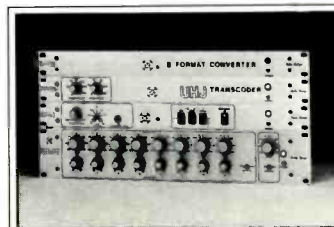
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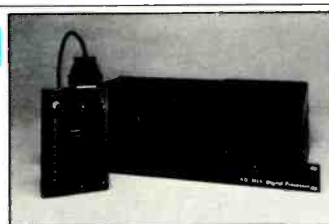
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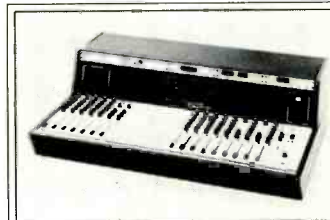
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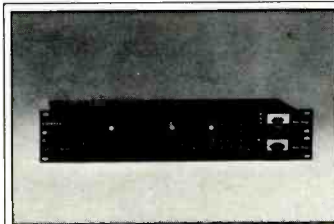
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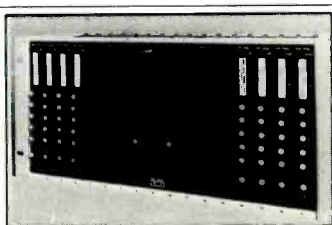
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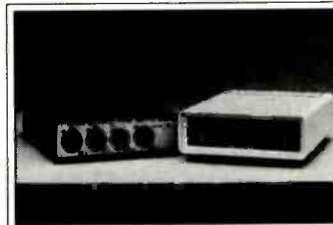
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STAND G24 – APRS 87

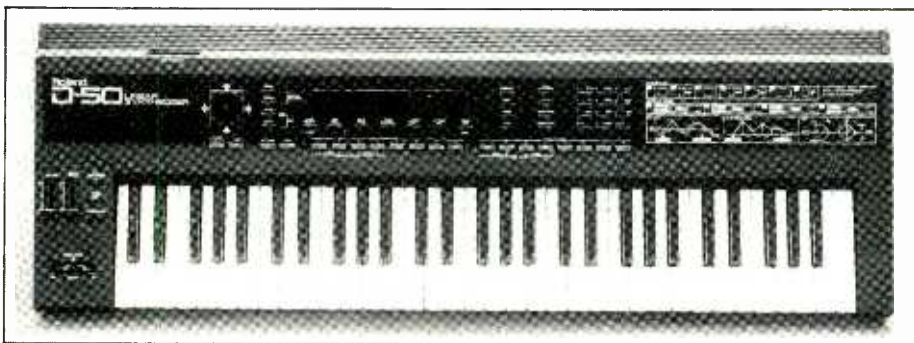
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Audio Design USA, 4611 Columbia Pike Arlington, VA 22204. Telephone (703) 522 7780.

APRS PREVIEW



Above: D-50 linear synthesiser from Roland. Below: MKS-100 digital sampler from Roland



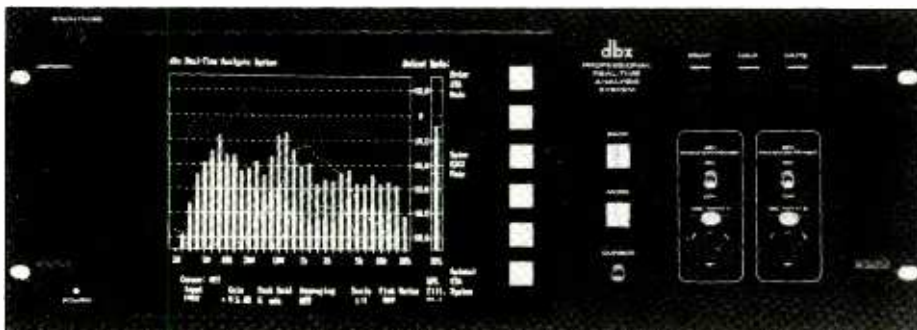
Synthesis. The D-50 has over 100 16 bit PCM wave forms, digital parametric EQ, eight types of digital chorus and 32 types of digital reverb including gated reverb and multi-tapped delay. Also on show will be the S-50/S-10 digital sampling keyboard, the MKS-100 digital sampler module, the MKS-50 and 70 polyphonic synthesiser modules, the GP-8 Guitar Processor featuring custom IC chips from eight different Boss effects and the VP-70 Voice Processor.

S

- **Scenic Sounds Equipment:** several new products include *Editron* timecode synchroniser and editing system, the *Co-operator* compressor/limiter from Orban, the *RTA* system from dbx, and a 31-band graphic equaliser from White Instruments. Also on show will be the range of Genelec monitoring, new Lexicon software, Schoeps condenser mics, full range of dbx outboard equipment, Orban compressors and equalisers, and the HH VX range of power amps.
- **SED:** products from Soundtracs, Tubetech, Stage Accompany, Bel and Court Monitors.
- **Shape Technology:** range of CD manufacturing and tape duplication products including the *Mark 10* audio cassette, video cassettes and Shape CD Analysing System.
- **Shep Associates:** specialists in customising Neve consoles will be discussing all aspects of

their work including the special modules and facilities they offer. ● **Shuttlesound:** a wide variety of products including a new range of dynamic microphones from Electro-Voice. The D/N mics feature N/DYM technology to provide improved sensitivity and lower distortion. Also on show will be loudspeaker systems and components including the *MTL-4* low frequency loudspeaker, the *SH-1800* subwoofer, Sentry *500E* monitor and the *DH1A/DH1A-16* HF compression drive units. Other products on the stand include Crown amplifiers, microphones and the *Techron TEF System 12*; Samson wireless mics; the Micro Audio computerised EQ system; Littlite lamps and accessories plus products from BBE and Audio Digital. ● **Sifam:** high spec VU's and PPM's, low cost audio level meters, control knobs and so on, plus a wide range of moving coil panel meters. Newly developed low cost audio level meter for bulk applications, such as on multitracks, will be shown, plus a dual PPM and a debut for a range of matte finished fuseholders. ● **Solid State Logic:** their new *G Series Studio Computer*, with high speed dynamic RAM, instant access, and 20 Mbyte transportable disk cartridges. Demonstrations of their complete range of consoles, computer systems and machine control systems. ● **Sonifex:** a variety of broadcast related products including *μHS-X* and *CQ* cartridge machines, the *CQ-R* cartridge recorder and the *CQ-HSE* automatic splice finder. Also on show will be a variety of racking kits and accessories.

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BOKSE US8 Universal synchroniser	£245
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APRS PREVIEW



Compressor/limiter, noise reduction system and quad expander/gate from Symetrix

● **Sony Broadcast:** on demonstration will be the *MXP-3000* 36-channel recording console designed for recording studio applications. In addition to the existing 12- and 16-channel versions of the *MXP-2000* broadcast console a new extended version will be on show with a frame size of up to 40 slots. The *MXP-2000* now includes interfaces to the latest Sony video editors. Originally developed as the *Expert System*, the new enhanced *Interactive Knowledge System* is now at prototype and the system, in conjunction with a *PCM-3324*, will be on demonstration. Shown for the first time anywhere will be the *DAL-1000* digital limiter designed for mastering applications with the *PCM-1630* processor. Other new products include the computer controlled compact disc changing system designed for audio post-production. A new system based on the *CDK 006*, it allows digital sound effects to be selected and laid on to existing masters with frame accuracy. In addition, to a variety of other professional audio products Sony will also have details of developments in R-DAT. ● **SOS Publications:** musician and recording magazine. ● **Soundcraft Electronics:** the recently launched *TS12* in-line production console, fully automated with their new disk-based automation system and interfaced to *Saturn* multitrack tape machine with *Total Remote*. Making its debut will be the *Digitor*, a 16 bit digital audio editor with a wide range of applications from studios to news room editing. Also the series *8000*, updated to incorporate channel VCA routing, the series *500* monitor console in the *Performance* series (to partner the series *8000* house console), the series *4* and the *200B*. Also present will be representatives from TSC who are UK distributors. ● **Sound Engineer & Producer:** sound recording magazine. ● **Sound Technology Ltd:** extensive range of outboard equipment including the 16 bit Alesis digital reverb; Aphex processors; Bokse timecode equipment; C-Lab music software for the Atari computer; Oberheim synthesizers; Ashly crossovers, graphic and parametric equalisers plus a variety of outboard recording equipment from DOD, Audio Logic and Symetrix. ● **Soundtracs:** first showing of completely new 24-bus multitrack console, incorporating high level of digital control and accepting automation. UK debuts include the *FME* series of fully modular consoles and the *MRX* series of 16-track consoles with up to 40 inputs in mono or stereo with or without patchbay. The *PC MIDI* series, with 16 or 24 channels and 40 or 56 inputs, will be demonstrated in a MIDI environment. The *CP6800*, *T* series consoles, and the *FM* and *FMX*

rack mount consoles will also be on display. ● **State of the Art:** Tantek equipment featuring the *Master Matrix M4000* series MIDI-controlled audio signal patchers, comprising the *M4100* controller, *M4200* expander and *M4300* remote control. Also products from TC Electronics and SMPL. ● **Stirling ITA:** featured products include the *DDA AMR24* and Amek *Angela* consoles, *MX80* and *MTR90* from Otari (plus Stirling's Dolby overbridge for the latter), complete Lexicon studio range and Sanken mics. ● **Studio Equipment Distributors:** products from Soundtracs, Bel and Tubetech. ● **Studiospares:** showing and discussing details of studio equipment, spare parts and ancillary supplies for professional users. ● **Studio Week:** recording and music news magazine. ● **Surrey Electronics:** along with their full range of pro-audio equipment, several new products including a twin twin *PPM* and *PPM9 (AM20/5)* rack mounting panel with A/B and M/S twins and stereo *PPM9s* under licence from the BBC, *PPM7* analogue model under licence from the BBC, *PPM8* high performance meter to IEC Type I requirements, stereo and ambisonics coder, and a 10-outlet distribution amplifier. ● **Syco Systems:** B&K mics, Massenburg automation system and processors, the Syco monitor system comprising speakers and amps, plus the Fairlight *CMI* synthesiser and associated products.

Stirling/ITA overbridge on Otari MTR90

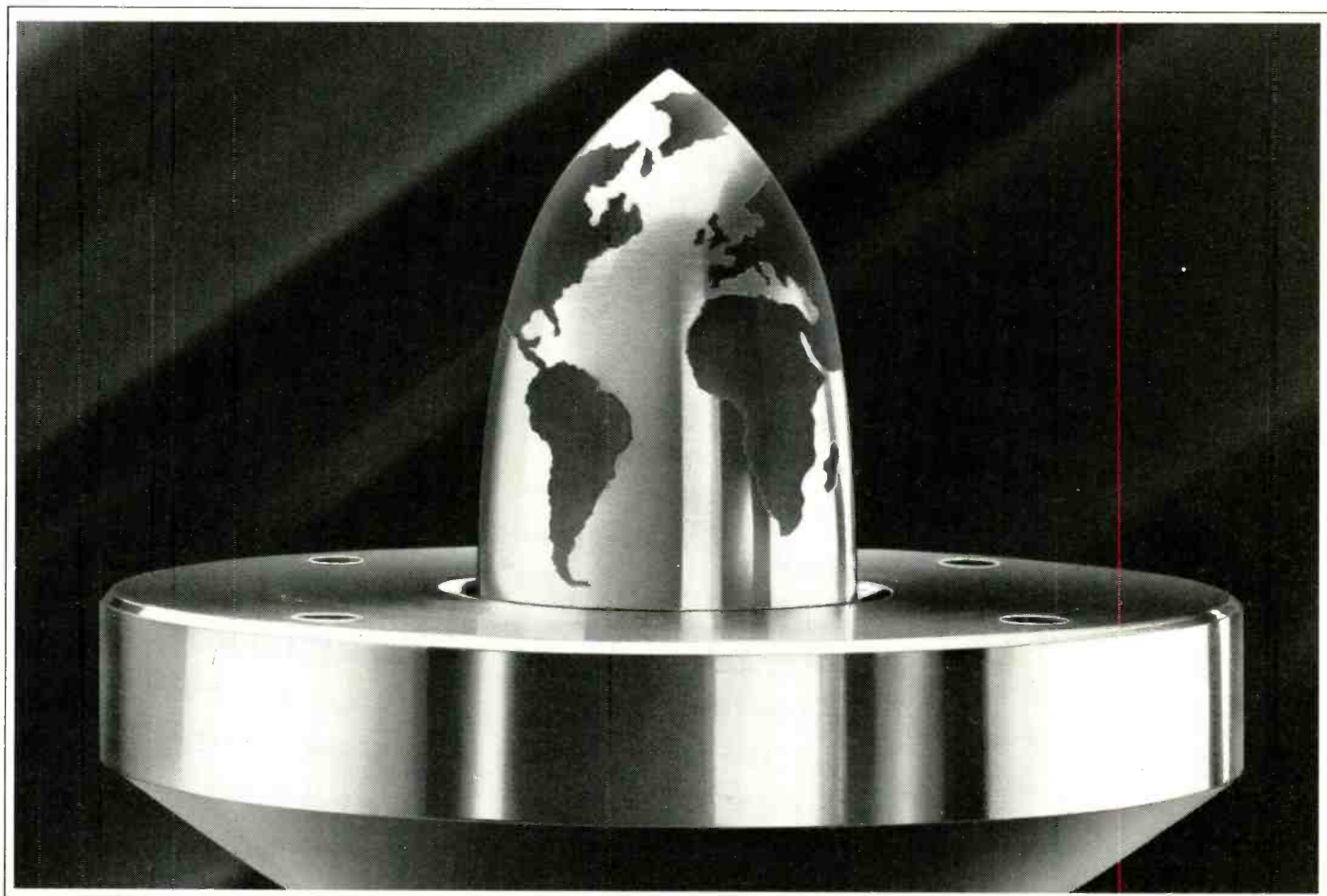


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APRS PREVIEW

● **Synclavier:** the full synthesis/digital recording system.

T

● **TAC:** an extensive range of consoles including the latest *SR9000* specifically designed for live sound applications. The *Scorpion* range has been extended with the addition of a large frame size. On show will be the *40/8/2 SR* and the *XPB Scorpion* with patchbay along with the *Matchless* multitrack console. ● **TAM/England:** complete range of disc cutting supplies, as well as Micropoint's range of lacquers and recording styli, and will feature special test records, such as the mirror blanks for accurate pick-up arm setting. ● **Tannoy:** *SGM* series of dual concentric monitors, consisting of the *SGM 10B*, *Little Gold Monitor*, *SGM 12X*, *SGM1000* and *SGM3000*. Also the *DTM-8* desk top monitor, *FSM-U* studio monitor and the *SR840* power amplifier. ● **Tape Automation:** tape duplicating equipment including the *XL Minor* cassette loader, master transport systems, slaves and the *Xenon* high speed video loader. ● **Tape One Studios:** will be providing details of their mastering and copying facilities. Staff on hand will be able to answer questions about analogue and digital mastering for CD, vinyl or cassette. ● **Teac Corp UK:** the *ATR-80-24 2* in 24-track recorder/reproducer, featuring claimed noiseless and seamless record punch in/out, contourless sync and repro head for improved low frequency crosstalk, edit rehearse, high torque reel capacity, heavy duty power supply and switchable NAB/IEC record and reproduce. ● **Theatre Sound & Lighting:** no information available. ● **3M:** range of magnetic tape products for analogue and digital applications for audio, broadcast and video industries. ● **TOA Electronics:** will launch a new version of their *ME* range of reference monitors designed for audio visual equipment; also on show will be the *P* series power amps, *K* series electret mics, *J* series dynamic cardioids and the *HY1* and *HY2* headset mics. ● **Trad:** details of used

equipment, products and other professional services will be available on the stand. ● **Trident Audio Developments:** will be showing a fully operational *Di-An* in conjunction with a *Mitsubishi X-850* digital 32-track.

W

● **Wellard Research:** the *Middle Monitor* loudspeaker, an active 2-way system designed to fill the gap between main and nearfield monitoring systems.

Y

● **Yamaha-Kemble Music:** extensive range of musical instruments and audio products including the *DMP-7* digital mixer, *MLA-7* 8-channel mic amplifier and *QX5* digital sequence recorder. The *MU802* rack mounting sub mixer, the *KM602* keyboard sub mixer and the *PM3000* PA console will be on show. New speakers include the *NS10M* and *S500* 3-way sound reinforcement loudspeaker and also on display will be the *PD2500* power amp. These will be used to demonstrate a variety of keyboards including the *DX7II*, *RX5* and the *TX81Z*. The full range of microphones, amplifiers and signal processors will also be shown.

Z

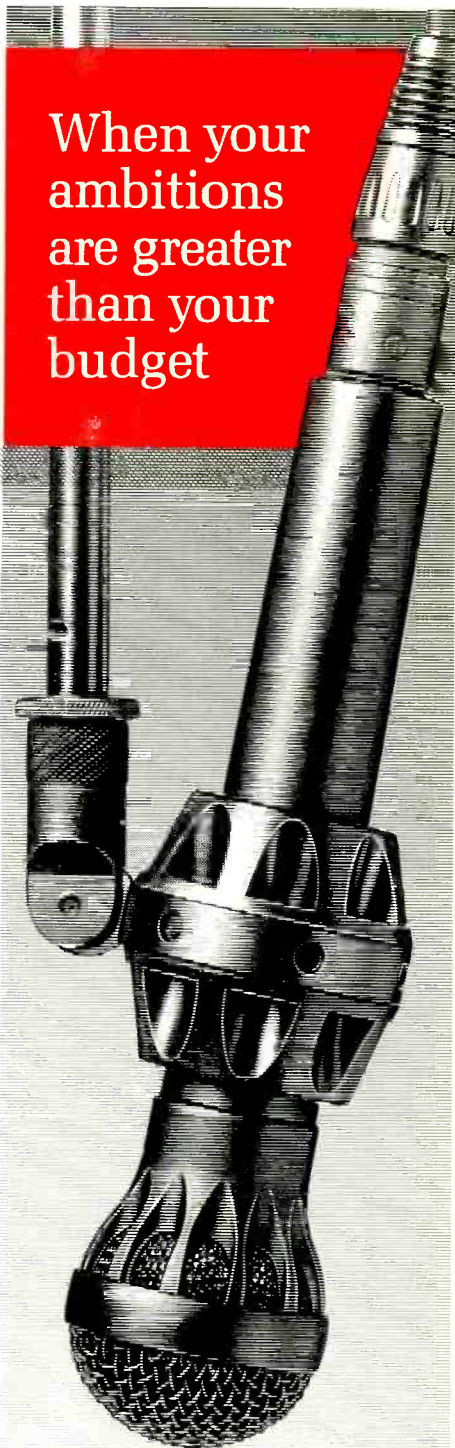
● **Zonal:** complete range of professional recording products, including *MSR* film, audio tape, logging tape, cassette tape and a cassette duplication service.

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R-DAT IN PRACTICE

Tony Faulkner describes some initial experiences with an Aiwa consumer machine and ways that R-DAT may affect the pro user

The intrusion of consumer audio equipment into professional recording and broadcasting has increased a lot over the last few years. The recent introduction in Japan of commercial R-DAT integrated digital audio tape recorders promises to hit the professional stereo tape deck market like Attila the Hun, finishing off the ground work done by the low-cost Sony *PCM-F1* and *PCM-701* converters, and probably rendering them obsolete in the process. In March earlier this year we took delivery of our first consumer Aiwa *XD-001* DAT machine, which sold in Japan for around £850, with 2 hr blank cassettes retailing alongside at just under £7.50.

My first experiences with video based digital audio date back to the Sony *PCM-1* at the very end of 1977, through the various generations of *PCM-1600*, *PCM-1610*, *PCM-1630*, *PCM-100*, *PCM-F1*, *PCM-701* and two or three different JVC systems along the way. Each new model brought its own advances, but video based digital audio is not without inherent weaknesses—the high expense of fully professional models, the mechanical noise of the recorders in operation, video/system incompatibilities, increased complexity of electronic editing, as well as some petty aggravations, such as difficulties with handling U-matic cassettes of longer than 60 min duration for compact disc master. Twin-track fixed head DASH/PRODIGI machines cope with some of these problems, but at quite a price and size. On paper the lightweight rotary-head R-DAT format

promises to remove most of the hassles, and in the few weeks of operational experience we have had, impressions have been very favourable. The powerful Reed-Solomon error correction from compact disc has been included to cope with tape dropout errors, and at no time have we heard any dropouts, crackles or spits—more than can be said for the existing systems we were auditioning in comparison. Many years of experience with Betamax and VHS have obviously taught manufacturers a great deal about how to make reliable low cost rotary head systems.

Hooking the Aiwa up to a professional mixer posed no new problems—the line input is unbalanced via high grade phono connectors (two switchable sets labelled Line 1 and Line 2), and the input record-gain level-set ganged controls wired right at the front-end of the circuitry so that normal professional studio high levels are adjusted passively rather than allowed to clip an oversensitive preamp. The Aiwa deck had no microphone inputs, but a professional portable recently shown at London AES included microphone preamps together with phantom powering options.

The line-out phonos are at a lower 'domestic' level, which could be amplified externally using one of the interface boxes marketed by various companies, or an unbalanced high level output may be taken from the front panel headphone socket. Personally I prefer the latter solution for three main reasons: simplicity, dissatisfaction with the sound quality of some of the adaptor boxes, and reluctance to pay good money for

something we do not really need. Tandy make some inexpensive moulded 2-way headphone splitter leads which can be rewired with a couple of *XLRs* to make reliable headphone socket-to-line driver leads—I have not always had the best of luck with home-made headphone-to-two-*XLR* leads, they seem to fall apart at the jack end after a couple of months.

The best setting corresponding to our normal headroom practice was with the headphone output level set to around 3 o'clock (ie slightly below maximum) and the input levels to give unity gain overall in-to out. In the fullness of time I shall probably change a feedback resistor in the headphone output amplifier to reduce the gain, so we can operate the line-out with the headphone volume control set to maximum, which is easier to set consistently. These interfacing details will be nothing new to those experienced with the Sony *PCM-F1* or *701*, and although unbalanced, they cause few troubles. Metering is via horizontal fluorescent bargraphs, with 0 dB on the display corresponding to 2 dB below peak-bits (digital end-stop). A red over light tells you when you have gone over the top, and the 2 dB 'overlap' is very helpful in optimising peak recording level.

Having the audio processing and tape transport in one box about the same size as a sophisticated domestic video cassette deck (it weighs just under 12 kg) is much more convenient than lugging around a *PCM-1630* and U-matic. With two DATs on a session one has automatically a full backup of A/D and D/A circuitry as well as tape-transport/tape, and these are luxuries few of us can afford with *PCM-1610s* and *PCM-1630s*.

The Aiwa consumer R-DAT machine has digital input and output via phono sockets on the back panel, so with two machines on a session you can link the recorders together digitally if desired in order to use one set of A/D converters for both sets of tapes. The digital interface format (also to be found on quite a few compact disc players, and the *PCM-601*) is similar in most respects to the AES/EBU format used by manufacturers such as Neve in their mixers/processors. Except for being unbalanced and having a status flag bit set in the wrong position ('off' for consumer, 'on' for professional, which should be sorted out by changing a couple of DIP switches somewhere in the pro interfacing, there is no major incompatibility problem.

The Aiwa *XD-001* will replay tapes made at various sampling rates as follows:
32 kHz sampling-rate: such as recordings previously taken off Direct Broadcast Satellite, and recordings made on other consumer R-DAT machines using 32 kHz recording options.
44.1 kHz: commercial pre-recorded tapes, digital transfers off *PCM-1630*, JVC or *PCM-F1*, and recordings made on professional R-DAT.
48 kHz: recordings transferred digitally from pro 48 kHz sources, and tapes made on itself or other consumer DAT recorders from analogue sources.

The player senses recorded sampling rate automatically, also the presence or absence or pre-emphasis flag, and displays this information. The consumer recorder tested will record at 48 kHz only, when switched to analogue source—from a digital source it is possible to record at 32 kHz or 48 kHz (if there is no COPY PROHIBIT flag-bit in the signal to protect copyright material), but the control circuitry has had a 'pre-frontal lobotomy' to prevent recording at 44.1 kHz in any circumstances and just sits jammed in RECORD PAUSE if you ask it to record. There are manufacturer options to utilise 12 bit non-linear quantisation and 32 kHz sampling for reduced quality at half tape speed, but I have had no

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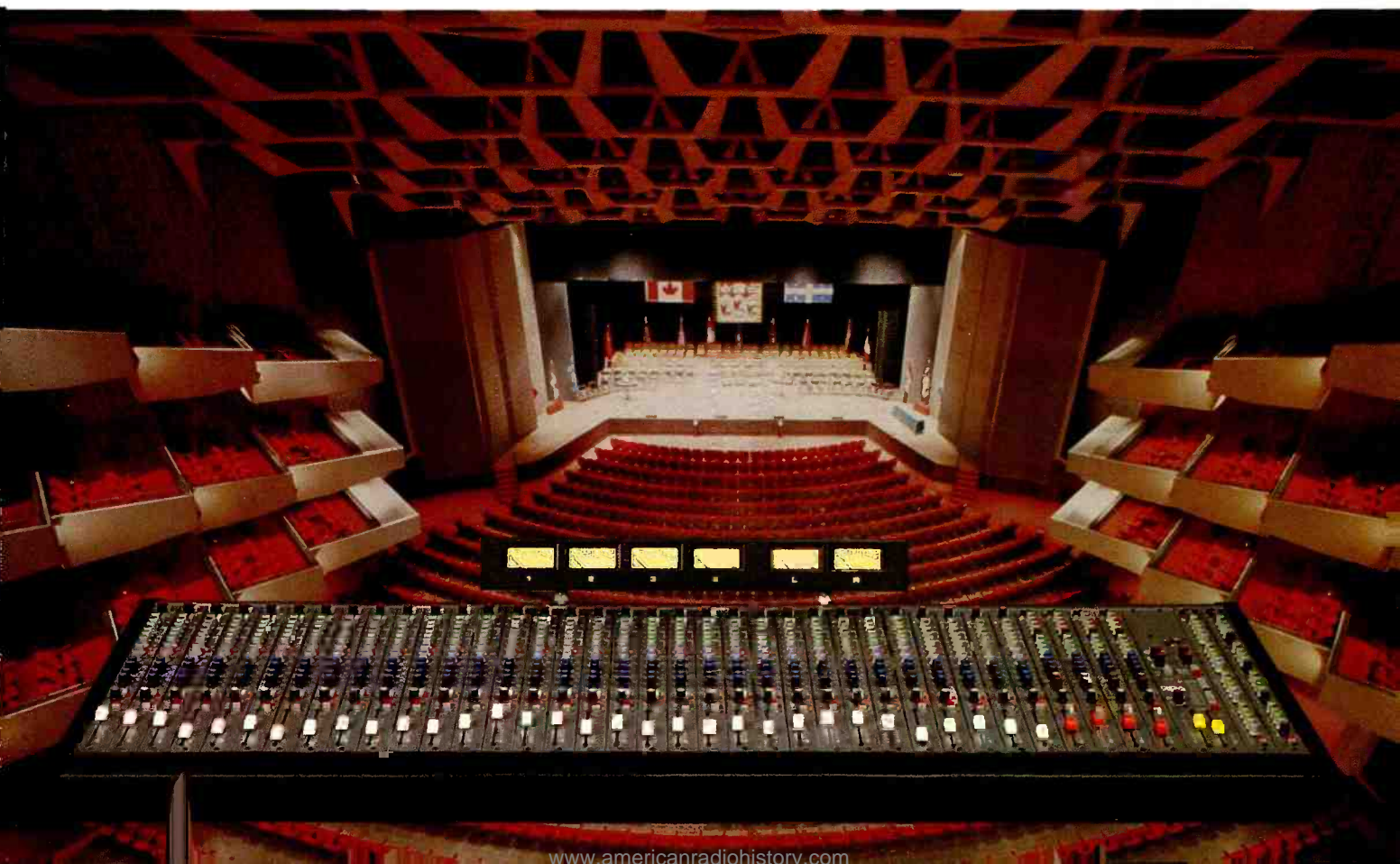
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R-DAT IN PRACTICE

opportunity yet to play with a sample, all the same I should be surprised if it would be of much interest to engineers and studios in normal high-quality mastering or copying.

The current arrangement of recordable sampling rates is political in origin, and a response to the demands from some in the music industry who have convinced themselves that the improving quality of consumer recording equipment is the main explanation for album sales being lower today than they enjoyed some years ago. Striving for improvement has always been a driving force in the audio and recording industry, and external political interference to try to reverse this natural process is very depressing. One of the reasons for the delay in releasing DAT in Europe is the prospect of Copycode (see for example US Senate Bill S.506 and House Bill H.1384, which in combination would go even further), requiring all consumer DAT recorders to incorporate scanners to detect Copycoded music and to automatically switch off the record circuitry. Judging by the demonstrations made by CBS Laboratories in London during May this year, CBS would do music lovers a favour to include the automatic switch optionally in power amplifiers as well. This would spare the discomfort of listening to the musical distortions produced by the 96 dB notch filter operating at 3838 Hz, which is at the heart of how Copycode will work, if engineers, producers and musicians sit back long enough to allow politicians to decide how recordings should sound.

Professional R-DAT machines will record at 32 kHz, 44.1 kHz or 48 kHz from digital or analogue sources, but almost certainly at non-consumer increased prices. Modification of consumer DAT recorders for professional application is likely to be possible and not too complicated, but would attract a great deal of attention from some of the music business executives hungry for blood, and in the short term at least will probably either go on secretly in back-room workshops or else by certain 'approved' or 'licensed' pro suppliers charging a premium.

The 48 kHz off-analogue sampling rate of our

consumer DAT recorder produced excellent full 16 bit linear sound quality that, during our brief listening tests, gave its direct competitors *PCM-1630* and *PCM-701* a good run for their money.

A brief internal inspection revealed that most of the circuitry was by Sony, but the fourfold oversampled playback was by Philips dual DAC *TDA1541* and *SAAT220* digital filter—a proven high-grade system in many of the best sounding CD players. Frequency response was predictably ruler-flat, meeting the published spec of ± 0.5 dB from 2 Hz to 22 kHz, with distortion at 1 kHz 0.04% at 0 dB, 0.06% at -20 dB; 10 kHz distortion was 0.06% at 0 dB, 0.08% at -20 dB. Overall recorded S/N ratio was measured as 99 dB unweighted, 107 dB CCIR/ARM weighted.

These figures are excellent by professional or consumer standards, and the dynamic range testament to the benefits of oversampling. As an advocate of pre-emphasis in most digital recording of classical music (at least until we have 18 bits worth of S/N to play with) I would personally have preferred to see optional record pre-emphasis with a switch somewhere hidden out of harm's way, but I imagine this facility will appear on pro models. I have not been able to inspect the precise digital formatting to see if it can be upgraded at some later date to 18 bit word length, however, I expect this will have been taken into account since it is certainly considered in other latest formats such as *PRODIGI* reel-to-reel.

Internal audio wiring was via, Hitachi LC-OFC cable, and some slight 'brown rice' audio improvements might be made by substituting higher grade audio path capacitors (such as the *Wondercaps*), JRC top quality *5532/5534* audio op-amps, and maybe replacing the Soshin anti-aliasing record low pass filters with Apogees. For the time being, editing of DAT recordings requires D/D transfer to another existing editing format (JVC, Sony or Denon 44.1 kHz), via a standards converter for 48 kHz recordings (a facility most post-production suites will have soon if not already). D/D editing to *PRODIGI* or *DASH*

48 kHz would work also for razor-blade editing. Direct pro R-DAT editors will appear in the not too distant future, although I have not been able to ascertain whether they will, as delivered, function fully satisfactorily with material originated at consumer DAT 48 kHz sampling rate.

The ability of consumer DAT models directly to replay tapes made on professional studio recorders (and vice versa) will make life much easier for post-production studios than at present. It is often necessary to copy transfers from Sony *PCM-1630* to *PCM-F1* format, or to 19 cm/s reel-to-reel analogue or audio cassette whenever a producer or artist asks for reference audition tapes—some of the digital transfers are troubled with odd crackles when sync unlatches for whatever reason, or else there is some loss of quality by going to analogue.

Features such as universal replay compatibility are just the start of what R-DAT has to offer the record producer in his work at the studio or at home listening on his own audio system. For the first time on a tape recorder, DAT offers random access of programme selections (similar to CD only not quite so fast). R-DAT has four times the 'user bits' capacity (273 kbit/s) of compact disc—enough for still-frame digitised video, with the picture changing every few seconds. The digital audio is recorded in time-compressed bursts of 5 ms for each 15 ms of actual sound, and since there are comparatively long 'pauses' between the bursts of time-compressed audio data these gaps makes it possible to include non-audio information and to reduce the time during which the tape-heads need be in contact with the tape, so the angle of wrap is reduced, thereby speeding up and simplifying the threading process. There is space on the tape for recording ATF automatic track finding signals, which align each head of the rotating drum with the proper track, and for subcodes (similar to CD-PQ) which record information such as selection numbers. Fragments of the subcode information may be read in fast wind (which is 300 times normal play) enabling the DAT to cue itself to any point in a 60 min tape within 36 s. Normal rewind is about 25 s for a 1 hr tape, which is mindblowing after years of using U-matic, or good old reel-to-reel 38 cm analogue. The fast wind is fast enough to bungle finding takes using the counter, but this is irrelevant (once you get used to it) when the subcode programming is so easy and included also on a wireless remote-control.

There are three basic subcode programming functions recorded on to tape which can be recorded at the time of the original session, or added/changed later. Firstly *START ID* for quick access, secondly *SKIP ID* for skipping unwanted segments, and finally *PROGRAM NUMBER* for indicating selection order. Using these functions it is possible during recording sessions to mark the tape (and cue-sheet at the same time) with program numbers corresponding to particular takes or events within them—so that when the singer comes in for a playback and asks to hear take 17, after the two false starts, the tape operator can look on his tape sheet, and see that the relevant take was labelled, say, 34 on his notes. The DAT will automatically wind to 34 if requested, cue itself a couple of seconds before and then go into play. The very fast wind makes artist playbacks far less time consuming than when using U-matic or 15 in/s, and 2 hr recording time means that you have much more material on the machine if the artist asks to hear something he recorded some hours previously.

The tapes themselves are reminiscent of a video cassette miniaturised to the size of a dictation

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Building this level of flexibility into a cost-effective console isn't easy. But DDA engineering has never been about settling for the easy solution: it's about finding the **right** one. It's an attitude we share with Klark-Teknik, our parent company.

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Status in a snapshot

Successful designs have to perform in the real world, not just on a test bench. The S Series includes status LEDs for Solo, Cut, EQ In/Out and other key functions, so you can see what's going on even in the dark. And the removable meter bridge lets the console fit into low-profile flight cases, making the most efficient use of your truck space.

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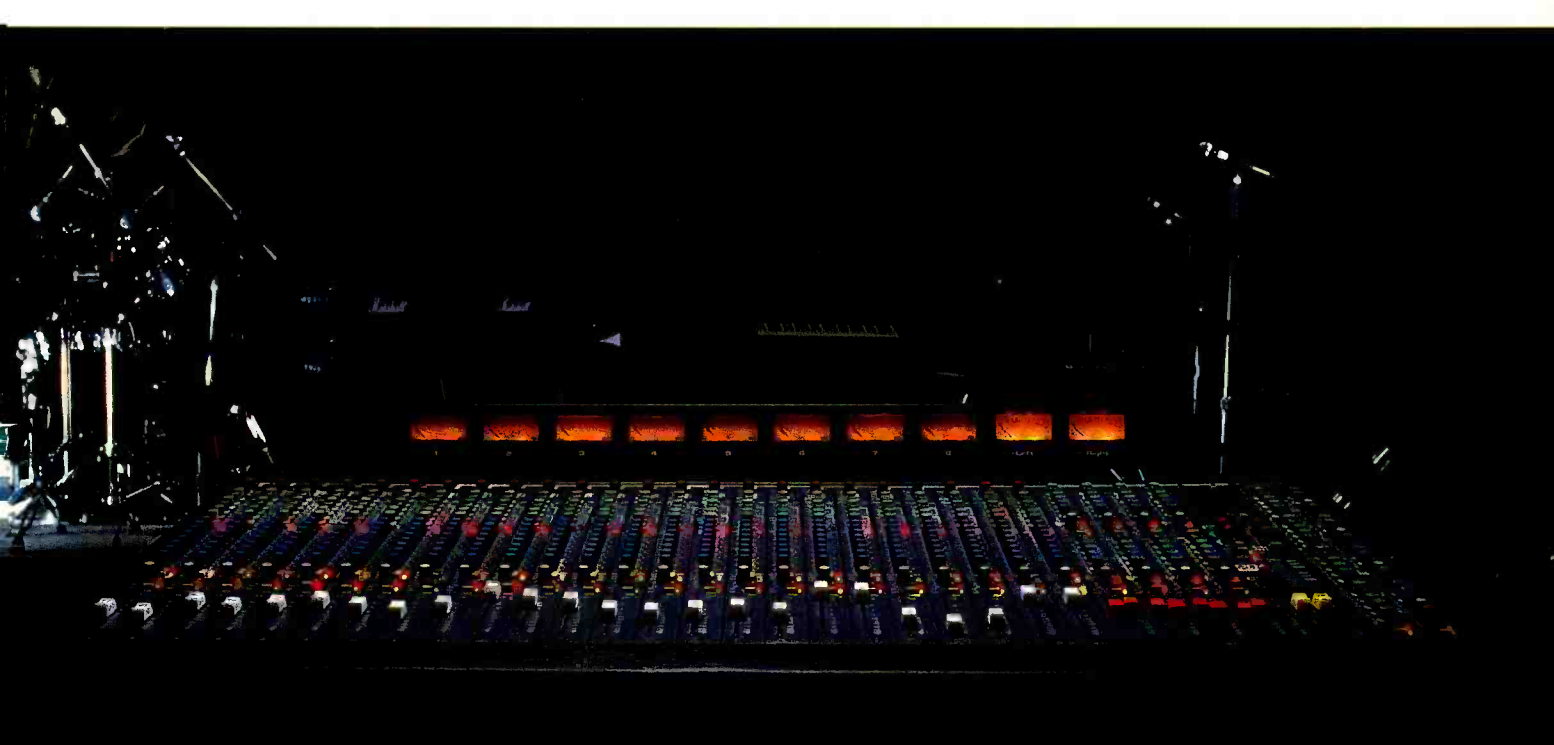
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R-DAT IN PRACTICE

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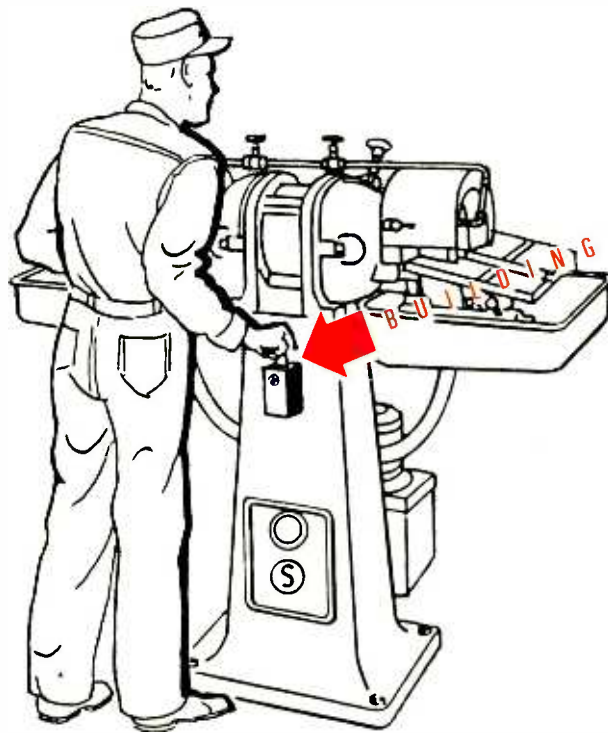
machine cassette (73×54×10.5 mm). The tape's surface is protected by a spring-held retractable hood like a Betamax, and the 'anti re-record lug' is a slidable plastic shutter on the cassette, so there is no need to patch holes up with *Sellotape* for re-recording, or to litter control rooms with red discarded U-matic 'Smarties'. There are hub-brakes to fix the hubs when the cassette is outside the recorder mechanism. Standard recording R-DAT tape is metal powder type, 3.81 mm wide, total thickness 13 micron, oxide thickness 3 microns, with coercivity 1440 Oe, maximum retentivity 2450 Gauss, and a running speed of 8.15 mm/s in the format discussed here. For duplication there are proposals for a high speed, magnetic contact, pressure printer system using Barium or Cobalt tape, and running under slightly different conditions (recorded overspeed with overwide tracks to make the printing process satisfactory).

I am hard pressed to think of any professional tape user who would not be captivated by this revolutionary concept in recorder, which represents the next step forward in sound recording. The audio quality is 'state-of-the-art', the recordings are universally playable on consumer or professional DAT machines, and the user subcode programming very novel, highly convenient and time saving. Long playing times will be a great improvement over 75 min U-matics for compact disc mastering, the low operating noise is a great boon for control room installation, and the light weight good for mobile work. My greatest worry now is a commercial one: what to do with all the old expensive video based machinery.

Consumer R-DAT recorders are available in Japan from Aiwa, Sony, JVC (Victor), Mitsubishi (Diatone), Onkyo, and Kenwood. Rumour has it that Philips are waiting in the background for a suitable moment to make a release and their involvement in D/A circuitry would indicate more than passing interest in the medium. So far as I know, only Sony has announced pro machines. We have sample blank tapes from That's, JVC (Victor), Sony, Maxell, Fuji (Axia), and Technics. It is widely rumoured that European and US tape manufacturers are looking at R-DAT, and indeed it would be a great disservice to their customers and shareholders if they did not take it very seriously.

Retail prices around the £1000 mark are unlikely at present to attract huge volumes of consumers but for most professionals and semi-pros the price is attractive. Since the recording part of R-DAT is primarily a system for uploading and downloading large quantities of digital information, it is foreseeable that the format may appeal to manufacturers of personal computers as a medium of inexpensive data storage. If this were to happen, the numbers of transports produced would obviously increase considerably and bring audio R-DAT prices down. When it comes to vibration the system suffers much less than compact disc (CD requires tracking precision of the order of 1 micron, DAT track-width is 13 micron) so maybe it will not be long before we see a 'jogging proof' R-DAT personal stereo about the size of a packet of 20 cigarettes. (*What about the batteries?—Ed*)

The recording industry will not be the same again after DAT: not because of the music industry politicians and their fears, but because the system extends the frontiers of what tape recorders have done before and will make professionals' work easier and better, as much as it will ultimately (*Maybe—Ed*) stimulate large numbers of consumers. □



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EBONY STUDIO

Tony Draper recounts the growth of a studio from an attic in Hull to a haunted mansion in Selby, Yorkshire



Two ghosts, rabbits, bats, three dobermans and three complete suits of armour (one on a fully armoured, life-size stuffed horse) cannot, by any stretch of the imagination, be regarded as typical occupants of a studio of the 1980s.

Let no-one call Hemingbrough Hall 'just another country place'. Darryl and Linzi Johnston have, over the last two years, transformed the massive 13-bedroomed, gothic mansion from a ramshackle, half-converted country club into a upmarket 24-track studio. But the Johnstons haven't always had the luxury of such an imposing residence from which to operate their successful studios and label.

While he was still a playing musician in 1977 Darryl began to record in his attic with a small mixer and recorder—an egg boxes on the ceiling situation. A mass of work from local bands soon forced an extension to the infant studio; and Darryl doesn't do things by halves. There isn't a lot of extension possible in an attic—so the whole of the ground floor of the small terraced house was converted into what was to be the most successful studio ever to have graced the streets of Hull.

Revolver Studios, as it was then called, rose steadily along the well-established road of 8-, 16- and 24-track recording and by the time the New Wave of British Heavy Metal arrived in '81/'82 (do you remember that!) the small studio had achieved a worldwide reputation among heavy rockers that was bringing bands in from Denmark, France, Sweden, Holland, USA as well as from all corners of Great Britain.

The studio was handling a variety of musical styles, including its fair share of synth bands but what Darryl saw the most of were the heavy rock 'n' rollers. The initial stream of demo bands and self-financed singles soon progressed to mastering records that gave bands such as Wrathchild, Savage, Chateaux, Shy and Grimreaper their success. These bands made numerous appearances in the independent charts and the popular music press in Japan and USA as well as the UK. The number of heavy rock bands that found their way, by word of mouth, to Darryl's studio led to the formation of the studio's own recording label—Ebony—for heavy metal only.

With a huge demand at the time for heavy metal, and subsequently for finished master tapes produced by Darryl, the label rapidly gathered pace; by the end of 1983 Ebony had licensed bands for pressing and distribution by a number of major recording companies including RCA and Virgin.

Darryl Johnston's engineering and production was well received, especially in America, and with no distribution at all Ebony bands Savage and Chateaux sold 25,000 and 20,000 LPs, respectively, while Grimreaper stayed in the Billboard charts for eight months with total LP sales of approximately ½ million. As the studio became increasingly successful and Ebony Records moved towards worldwide distribution, Darryl and Linzi decided that it was time for larger and more prestigious premises.

The search began in January 1984, and after a year which almost saw them moving into a castle in the north of England (they are both still kicking themselves for not doing so) they found accommodation in the reputedly haunted Hemingbrough Hall. Hemingbrough was chosen because it "is situated in the heart of England only minutes off the main motorway network, near to North Sea Ferries for the Continent, as well as Humberside, Leeds and Manchester airports".

Darryl and Linzi's foresight has proved the hall to be ideal for use as a professional studio, although this could hardly have been further from the truth when they bought the vast mansion two years ago. The building needed complete renovation; involving new plumbing, plasterwork, flooring and central heating. Three phase wiring has been installed throughout and virtually everything in the place has been separately MCB-fused, including individual strips of lamps. They have even converted the hall's exterior so that vans and trucks have unrestricted access into the main studio area itself!

Ebony has one main recording area although following the modern trend, the control room is large enough to accommodate a full DI'd keyboard rig and still leave plenty of room for engineers, producers and musicians.

"In line with today's preferred techniques, Darryl has opted for this type of design as musicians really prefer to work together, rather than being alienated and claustrophobic in separate little booths—plus the design gives a far better sound."

The main recording area is a large rectangular room of 35×30×16 ft, and with 1000 ft² has the

ability to take a full-size orchestra. It has been arranged in the standard live end/dead end fashion with the control room having an excellent view into the room through a large double-glazed window at the dead end of the recording area.

This end of the studio is carpeted 8 ft up the walls, as is the whole floor area. Above this Darryl has developed a method of altering the acoustic qualities of the room—by using hinged soundtraps on both upper walls and ceiling, which can be swung out from their closed position, the sound of the room, or any part of it, can be precisely tailored to suit individual tastes. Both upper walls and ceiling are stepped and sloped to avoid standing waves. "By the lavish use of hardwood maple on the walls the dead end gives warmth particularly suitable for vocals, brass and stringed instruments, thus creating a fuller and more rounded sound."

The most obvious feature of the recording area is a floating maple floor at the live end of the room, which is made of a sheet of rubber under a wooden framework with another sheet of rubber on top of this and finished off with the dancefloor maple. This type of hardwood floor has been used to get a powerful live sound from the resident 14-piece Ludwig kit (or anyone else's kit), while the floating floor prevents sound travelling across it when several instruments are being recorded in the room together.

"With the careful design of the studio, spill from other instruments is negligible and with the additional use of screens or *C-ducer* contact mics for bands playing at particularly high levels, this risk is effectively eliminated."

Above the kit at the live end an angled mirror stretches the width of the room which, apart from looking attractive, helps to make a very reflective area. The stone walls of the recording area are completely isolated from the structural exterior walls and are around 3 ft thick producing a completely isolated environment.

The area is well supplied with taps to the control room and as is Darryl's policy when it comes to wiring—safety first—RCCBs (Residue Current Circuit Breakers) have been fitted. The playing area is wired on to phase 1 of the electricity supply, the control room on to phase 2 and the rest of the building on to phase 3, thereby totally eliminating any mains borne interference.

The control room is at the dead end of the recording area, and was designed by Darryl after he'd absorbed masses of data about studio design over the years while working in their previous studio and other studios—both as a musician and a producer.

The feeling inside the control room is one of quality design and organisation, with colour co-ordinated mood lights adjusted to provide a relaxing environment in which to work. A floating floor has again been installed and the room is completely isolated from both the recording area and the outside world—although the isolation is only acoustic as visual contact with the recording area is excellent and large quadruple-glazed doors let daylight flood in along with splendid views of the grounds and Yorkshire countryside.

"The control room can be most easily described as having an 'Eastlake'-type appearance with the usual 'V'-shaped ceiling and angled walls at either side of the mixer housing the monitors, which have been built into the walls themselves."

The ceiling has been lowered and the resulting 10 ft gap filled with *Rockwool*. A large bass trap has been positioned within the V of the ceiling to deal with reflections from the large desk. The

wood used at the front of the room, and first part of the ceiling, is again maple with the rear being cork tiled. Sound traps have also been installed at both the rear and sides of the room with carpeting climbing 7 ft up the walls. The walls mounting the monitors have been angled to create a wide window of stereo imagery, allowing three people to sit alongside each other behind the desk and hear the same thing.

Although the monitors are built into the main structure and are flush with the walls, they have been totally isolated and suspended from the main walls with rubber to prevent structure-borne sound reaching the listener before the airborne sound. This, together with the choice of Tannoy monitors, creates a very time-coherent monitoring system.

Darryl has chosen Tannoy *Golds* for their warm, full round sound. The cabs are each able to house three 15 in Tannoy's and Darryl is prepared to exchange these for any make of monitor a visiting producer may wish to use. There are, of course, the usual Yamaha *NS 10s* for referencing.

The control room has been specifically designed to allow it to be used as a recording area either

by musicians not needing the sound facilities of the recording area, eg *Df'd* keyboards etc, or by those feeling uncomfortable with the isolation of the recording area. Playing in the control room also allows direct communication with the producer and has the added bonus of the musician being able to listen through the control room monitors instead of headphones.

With the use of tie-lines wired directly into the playing area, guitarists can play from the control room with their amps producing the result as loud as you like in the recording area. Because the dimensions of the control room are 20x20x15 ft down to 12 ft, there is plenty of room to move in.

The desk installed at Ebony is a large, newly built 32-channel Trident *TSM* with 56 channels of remix and wired up for 48-track. The desk was custom built for Ebony and has several important modifications.

These include LED metering on all output buses (each LED meter is individually switchable between PPM and VU characteristics); an improved and streamlined patchbay; quieter, improved specification ICs and in addition, the mainframe of this *TSM* has been built to house a

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Klark-Teknik Plc
Klark Industrial Park, Walter Nash Road, Kidderminster,
Worcestershire D11 7JJ, England.
Tel: (0562) 741515 Telex: 339821 KLARTK G Fax No: (0562) 745371

Klark-Teknik Electronics Inc.
30B Banff Plaza North, Farmingdale, N.Y. 11735, U.S.A.
Tel: (516) 249-3660 Fax No: (516) 420-1863

EBONY STUDIO

19 in rack unit thereby putting the most frequently used effects exactly where they are needed—in the mixer. The desk is truly quadraphonic with all effects returns and monitoring in quad as well as quad panning on all 56 channels. "This means that by working in normal stereo, all these extra outputs can be used as additional auxiliaries, or allowing two entirely separate and different stereo mixes to be done simultaneously on two different 2-track machines. Automation is also ready to be fitted."

In addition to analogue and digital mastering, Ebony offer some interesting options as far as multitrack recording is concerned. Most of the work is done on the Lyrec 24-track and the studio is particularly impressed with the remote



Equipment

Custom Trident TSM

Effects mounted in the TSM frame:

- AMS RMX16 digital reverb
- MXR digital reverb as backup
- Three MXR digital delays
- Full Rebis rack (3 compressor/limiters; 6 noise gates; 2 parametric EQs; 1 de-esser; 1 automatic programmable stereo panner/fader; 2 switchable LED meters)
- 2 stereo compressor/limiters

- Anhex stereo Compellor
- 2 stereo Aphex Exciters
- Lyrec 24-track tape machine
- Sony 701 digital process
- Sony C9s digital mastering
- Custom 24-track valve tape machine
- Various Revoxes and Studer mastering
- Klark-Teknik stereo graphic
- Two UREI LA4 compressors
- 4 channels Symetrix noise reduction
- dbx noise reduction
- MXR pitch shifter

- MXR stereo graphic
- Bel stereo flanger
- MXR flanger/doubler
- Eventide Instant Phaser
- 24 channels Bel noise reduction
- Roland 501 chorus echo
- Nakamichi cassette copying

Mics: AKG C28, 2 AKG D12s, AKG D1200, Shure, SM58s, C-ducers with ps, Neumann 87s, AKG 414s, AKG 202s, Calrecs, Sennheiser

facilities the Lyrec provides. The remote solo switching, for example, and the programmable automute and mute switching on the Trident means extremely complex mixes can be created by only one person. In addition to the Lyrec, the studio also has a 24-track valve machine.

The valve multitrack (along with a full remote) was custom built some five years ago to Darryl's specifications and is in use fairly regularly. In most cases, multitracks are recorded on the Lyrec but it is not unusual to find the reel being transferred to the valve multitrack in order to record a couple of 'valve' tracks. Sometimes whole projects are recorded on the valve multitrack (as in the case of the Grimreaper album).

According to Darryl, the machine has a certain 'warm' sound that ideally suits certain instruments and recording projects and, of course, it is possible to overdrive the electronics for added effect. Signal to noise is apparently no problem—in addition to the overdubs and heavy metal projects the machine has also been used for recording string quartets.

Not only are the musical and sound tastes catered for in the control room and designated recording areas but further acoustic use is made of other parts of Hemmingbrough Hall—uses the original occupants were blissfully unaware of. The entrance hall, for example, with its stone floor and thick, solid walls, produces a truly explosive snare beat which Darryl occasionally samples and puts to good use. And the large honeycombed cellars beneath the hall have found their true purpose in life as natural reverb chambers. Darryl has placed Tannoy Golds down there along with mics, and signals are routed down to the speaker then returned via the mics to the desk. The beauty of the system is that although there is a standard set-up in the cellars, the honeycomb nature of the rooms, and the variety of sizes, means there are virtually unlimited opportunities for creating different effects.

Additionally, Ebony Studios can offer (for a small additional cost) two Rolls-Royces complete with anti-terrorist trained chauffeurs, two full-time handymen doubling as security guards, security lights outside, and 7½ acres of grounds and woodland. "Although security is in no way a problem, anyone who may be concerned will find the measures available more than sufficient."

The hall is completely residential with ensuite bedrooms, four-poster beds, beamed ceilings and central heating. Downstairs a games room is provided with pool table, jukebox, telly and video along with a library of video tapes. However, the studio is available as a non-residential facility as some clients prefer to stay in the nearby market town of Selby or the historic city of York, which offers countless hotels and a tremendous nightlife.

Ebony also offer a specialist extension service to home studio recordists who, having started their recording, suddenly find themselves limited by tracks and facilities. On the other hand, artists who want to save money by recording the basics at a smaller studio or at home are welcomed to Ebony to complete the product.

Although Ebony's clients have a choice of

several engineers, outside engineers are welcomed and completely familiarised with the equipment; Ebony will even send out printed brochures on the mixer itself well beforehand and ensure someone is on hand during recording to help with any queries that may arise.

Darryl's design has produced a very powerful sounding studio which is obviously suitable for heavy rock. However, as virtually all of today's pop and even ballad records call for powerful sounds the studio is suited to any type of music; with the easily converted acoustics, even string quartets and choral works can be catered

for. Ebony Studios are aiming to build on their previous success and work with many other musical styles, a fact proven by their future plans which include opening a very large second studio in the 120 ft long stable block.

With rates considerably lower than similarly equipped studios in the UK and with facilities and an atmosphere that most places cannot approach, Ebony will be interesting a lot of people both at home and abroad.

Ebony Studios, Hemmingbrough Hall, Hemmingbrough, Nr Selby, North Yorks. YO8 7QS, UK. Tel: 0757 638812.

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Klark-Teknik Plc.
Klark Industrial Park, Walter Nash Road, Kidderminster, Worcestershire DY11 7FL, England.
Tel: (0562) 741515 Telex: 3399521 KLARK G Fax No: (0562) 745371

Klark-Teknik Electronics Inc.
30B Barfi Plaza North, Farmingdale, N.Y. 11735, U.S.A.
Tel: (516) 249-9660 Fax No: (516) 420-1663

DOLBY SR

Dolby Spectral Recording has changed a lot of ideas about the future of analogue recording. However, most of the proper explanations so far published have been far above the head of the average user. The Dolby company have prepared this article which we feel gives a clear explanation of the process

Fig 1: The analogue tape recording window

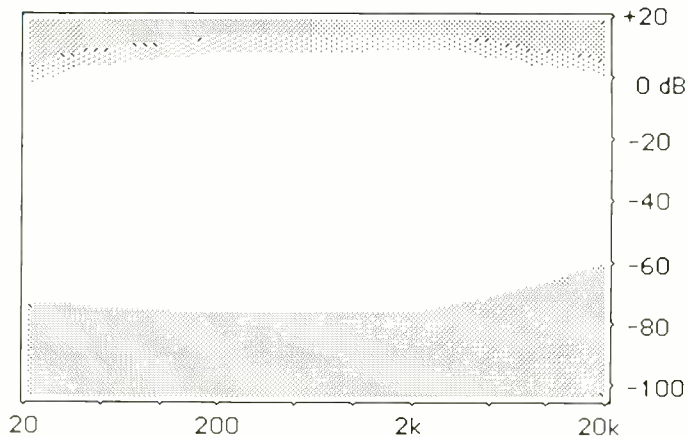
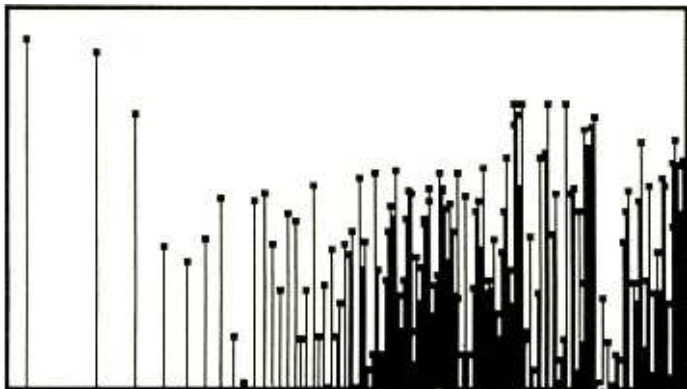


Fig 2: Recording a signal



Figs 3/4: Finding the right level



Dolby Spectral Recording (SR) is a new professional studio mastering system that yields recordings with exceptional purity of sound. Several important technical advancements are introduced in the new system. One is a substantial extension of available headroom, which allows the use of a uniformly high maximum recording level at all audio frequencies. Another is the practical elimination of the influence of noise and non-linearity on the reproduced sound. These advancements are achieved by new circuit functions, adaptive to the signal spectrum, and by the consistent application of minimum processing to the signal: the principle of least treatment.

The ear is the final destination of all audio signals, and the most sensitive instrument for their analysis. An ideal audio device or system would impose no audible limitation on the signal passing through it. SR has been designed with close attention to the properties of human hearing, especially the need to prevent any audible artifacts of signal processing.

At the lowest signal levels, or in the absence of a signal, SR applies a fixed gain/frequency characteristic that reduces noise and other low level disturbances by as much as 25 dB. Only when the level of part of the signal spectrum increases significantly does the circuit adaptively change its own spectral characteristics. When this happens, SR changes gain only at frequencies where change is needed, and only by the amount required. Adherence to this principle of least treatment is critical to maintaining the extreme purity of sound audible in SR recordings.

Laboratory measurements using test signals show that SR recordings contain very little noise, distortion and other impurities. However, meters cannot tell us how good these tapes sound, because equipment does not respond to a recorded signal in as complicated a way as the ear and brain. The most important and reliable test of any signal processor is a careful comparison of line-in and line-out signals while a live recording is made in a quiet studio. We urge engineers, producers and recording artists to carry out such tests with SR, and to compare these recordings to those based on any other technology.

All recordings and communication systems have definite dynamic range limits. However, a simple measurement of maximum level and noise level does not reliably indicate how recordings made with such a system will sound. Such a test says nothing about noise that appears only in the presence of a signal, or about system behaviour when the signal is at the overload level. Analogue tape, for example, saturates gently; digital recordings, on the other hand, clip fully if maximum level is reached even for less than a millisecond. Because SR increases recording headroom considerably, there is less risk of under- or over-recording. The engineer's working space is increased, and there is greater freedom for creative effort. Effective protection is provided during original recording, during mixdown, when equalisation or specialised signal processing requires the lowest possible noise level, and when multigeneration copies are needed.

Recording a signal

The limits of unassisted analogue recording, using a standard professional recorder and tape at 15 in/s, are shown in Fig 1. The limit at high signal levels, actually a gradual overload, is at

the top of the clear area. The noise level is the bottom of the clear area. Both the overload level and the noise vary with frequency. The central, open part of the sketch can be thought of as a window through which the signal must fit if it is to be recorded.

A music programme constantly changes in level and frequency content. A moment in such a programme might have the spectrum shown in Fig 2. The signal level varies with frequency. The gain setting that would give the best recording at middle frequencies would cause the high frequencies to overload. One design objective of SR is to achieve as nearly optimum a level as is possible at all audio frequencies.

Figs 3 and 4 show what happens when the recording gain is adjusted; the signal spectrum moves up or down in the window. Even when the recording gain is set at the highest safe value, as in Fig 3, much of the capacity of the recording system, that is, the spectral space above the tops of signal components and inside the window, is unused. SR makes use of this capacity.

The simple or broadband compander was first used in attempts to increase the dynamic range of recording systems. During recording, such a compander increases gain when the overall signal level is low; some companders also reduce gain when signal level is high. During playback, the compander's action is reversed; high level signals, regardless of their frequency, cause all frequencies to be played back at a high level (Fig 5a), while low signal level, or no signal, causes playback gain to drop (Fig 5b). The measured dynamic range of a recording system may seem to be increased greatly; however a simple compander meets its dynamic range specifications only when no signal is recorded. When a real programme is recorded, the compander is often at rest when it is needed most. When it works, on the other hand, critical listeners can hear artifacts, like 'pumping' modulation of the background noise or signal, as well as limited transient performance.

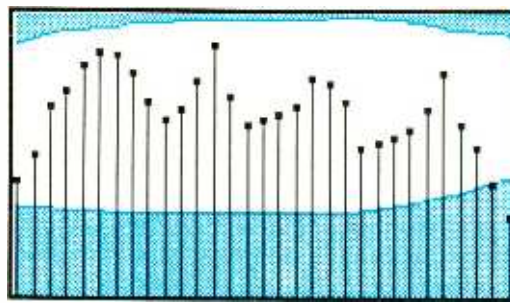
A-type noise reduction

Until now, 20 years after its introduction, no professional signal processor has ever been as widely used as Dolby A-type noise reduction. A-type processing improves the efficiency of magnetic and optical recording media and audio communication systems. It relies on compression and expansion but only at low signal levels, and separately in four frequency bands (Fig 6a). The signal components in each band (Fig 6b) are integrated; if this level is below a fixed threshold, it is boosted during recording (locations marked 'A' in Fig 6c), and attenuated during playback (Fig 6d).

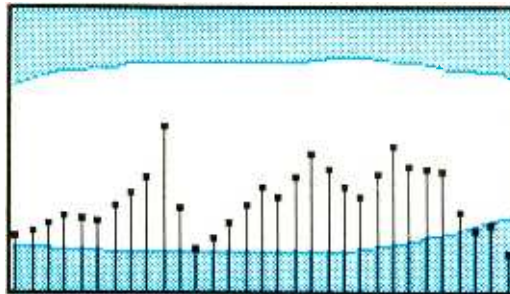
The boost is 10 dB across most of the audio band, increasing to 15 dB at very high frequencies. To improve recording further, it is not enough simply to increase these figures; the boost must conform more closely to the signal spectrum than is possible in a 4-band system.

Auditory window

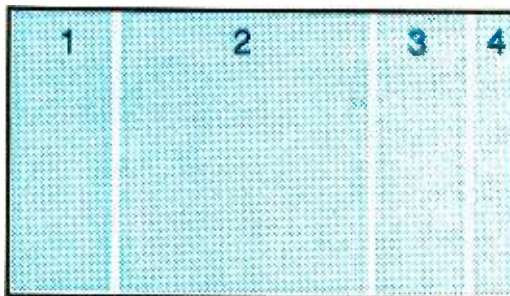
One way to define ideal sound reproduction is to show the limits of the human hearing system as a window, as we did for analogue tape recording in Fig 1. Such an auditory window is sketched in Fig 7. The top of the graph corresponds to 120 dB,



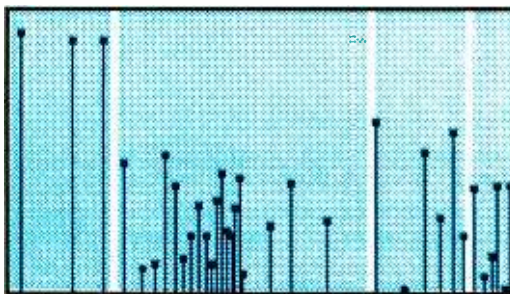
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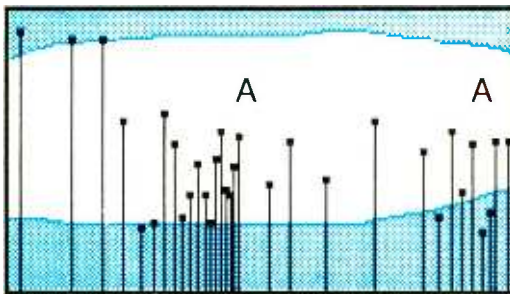
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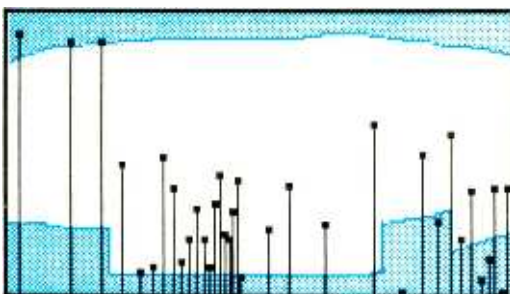
6a



6b



6c



6d

Fig 5: The simple compander

Fig 6: Dolby A-type noise reduction

DOLBY SR

Fig 7: The auditory window

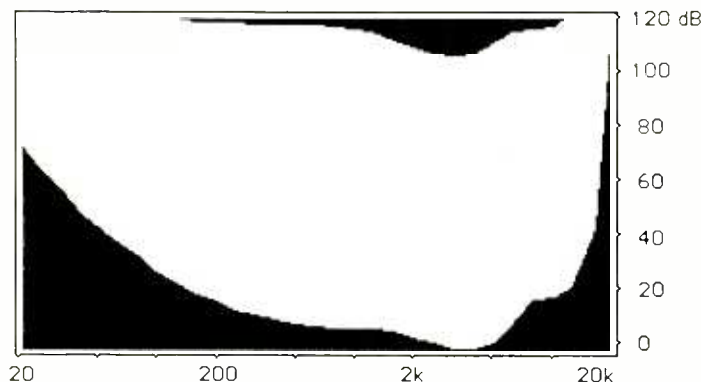


Fig 8: Playback of an analogue recording

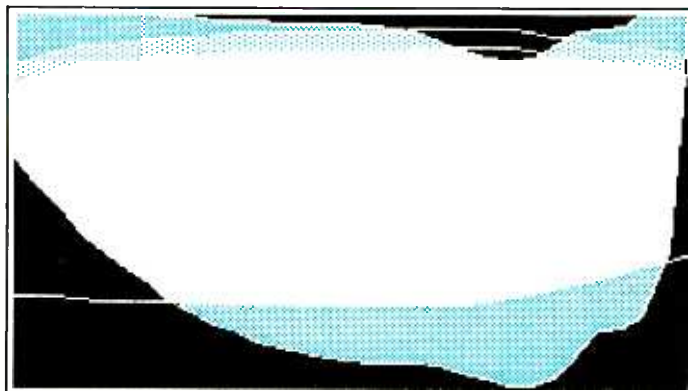


Fig 9: Disturbances produced by the presence of a signal

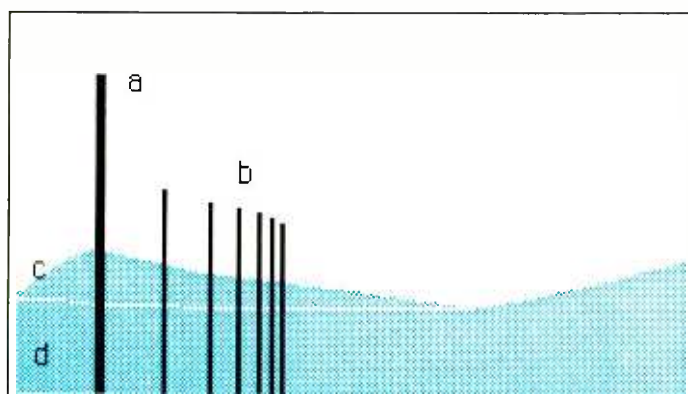
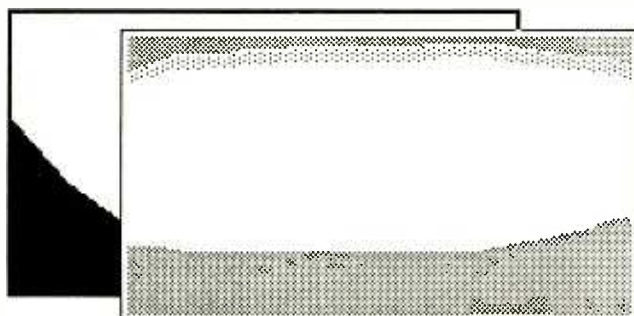


Fig 10: Available dynamic range



a continuous sound pressure level that is unbearably loud; at 5 kHz, sound changes to pain at about 110 dB. It is safest, of course, to leave a margin between such a level and the highest continuous sound level one aims at reproducing.

The boundary of the window near the top of the plot is 6 dB below the threshold of pain at each frequency.

The bottom of the window is the threshold of hearing; sounds at this level are just audible to a listener with sensitive hearing. The level of the background noise in a very quiet recording studio may be 10 to 15 dB. A recording system with a window like that shown in the figure could be played back without audible noise or overload, even if the highest level signals were literally at deafening levels.

Playback of an analogue recording

We can learn more about tape recording by superimposing the analogue tape window on top of the auditory window. Sliding the analogue window up or down corresponds to playing a tape at higher or lower level. In Fig 8 we have set the playback gain so that the maximum level signal that can be put on the tape lines up with a continuous sound pressure level of 110 dB. We will stay with that setting as we look at various recording system windows.

Several interesting facts are visible in this figure. One is that the noise of the tape will be audible only in a restricted range of middle frequencies, that is, where the auditory threshold is lowest. This is because noise or distortion components at higher and lower frequencies, even if only slightly below the threshold, are totally inaudible. Another observation is that if the audible noise in the mid range frequency band could be reduced by 20 to 25 dB, no noise would be heard at all.

When no signal is present, the only low level defect that can be measured is tape hiss. However, in the presence of a signal, the analogue tape recording window closes further as other artifacts are added to the signal, layer by layer. Fig 9 shows several components of noise and non-linearity that can appear in the presence of a signal. The signal is shown as the vertical bar at (a), and is at a level that causes 3% harmonic distortion. These harmonics are shown in correct scale at (b). Modulation noise, which appears only when a signal is present, is spread over a wide range in the spectrum (c). The bottom layer of noise, tape hiss (d), is caused by statistical fluctuations in magnetic domain orientation in the tape coating.

Another interesting fact is shown in Fig 10. Analogue recording might be thought to be deficient in dynamic range at very low frequencies because saturation occurs at lower tape flux levels in that part of the spectrum. However, the opening in the analogue window at low frequencies is actually larger than the opening in the auditory window. The same is true at high frequencies. If signal components at different frequencies were simply recorded at different gain settings, the effective dynamic range of analogue recording could be extended considerably.

Levels

The simplest way to suppress noise and other low level recording defects is to use as high a

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DOLBY SR

Fig 11: Dolby SR at low levels

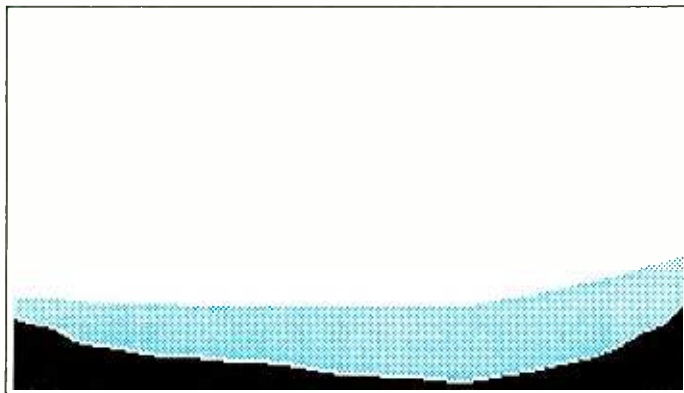
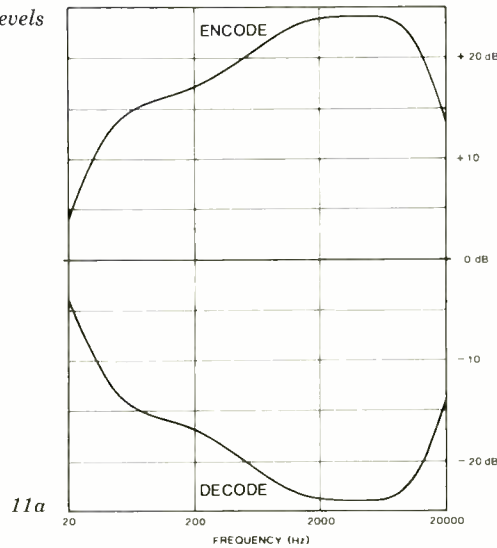


Fig 12: Dynamic action of Dolby SR at moderate levels

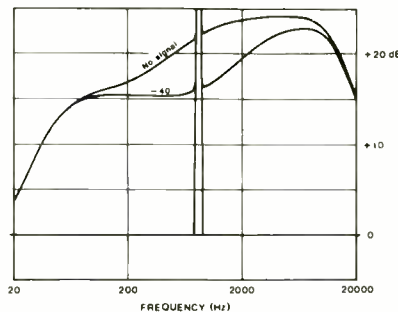
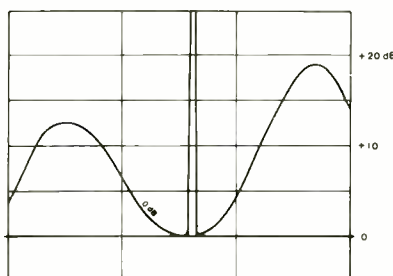


Fig 13: Dolby SR action at high levels



recording gain as possible. From what we have already seen, an even better idea would be to use the optimum gain in each part of the spectrum. This is what SR does at very low signal levels. The result is a form of fixed equalisation that does not change as long as the signal level stays below a certain threshold. When the recording is played back, the same equalisation is applied in reverse, and any background noise is lowered by the same amount (Fig 11a). The upper curve in Fig 11b is the noise level of a typical professional tape at 15 in/s. The lower curve shows the change in this level that results from the use of SR fixed low level equalisation. Since there are no dynamic changes taking place—the equalisation is fixed—no dynamic side effects, audible or inaudible, are possible.

If the signal increases in any part of the spectrum, some adjustment of gain must be made to ensure that overload will not take place. This is done in a very gradual way, so gradual that there is no danger of producing audible modulation of the signal or any other audible effect.

The principal mechanism of SR is a group of 10 fixed and sliding band filters with gentle slopes. Those with fixed bandwidth are electronically controlled to vary their gain; those with fixed gain can be adjusted to cover different frequency ranges. By selecting and combining from the group, the SR control circuit can create an infinite number of filters through which the signal must pass before it is recorded. During playback, filters are automatically created that are the exact opposite of those used during recording.

Filter selection and adjustment is controlled by a continuous analysis of the signal spectrum and a process called 'action substitution'. Action substitution determines which of the two types of filters will predominate and how each must be adjusted to produce the optimum composite filter (Fig 12). Even when the signal level increases substantially, the system is designed to deviate as little as possible from the fixed characteristic shown in Fig 11, in accordance with the principle of least treatment.

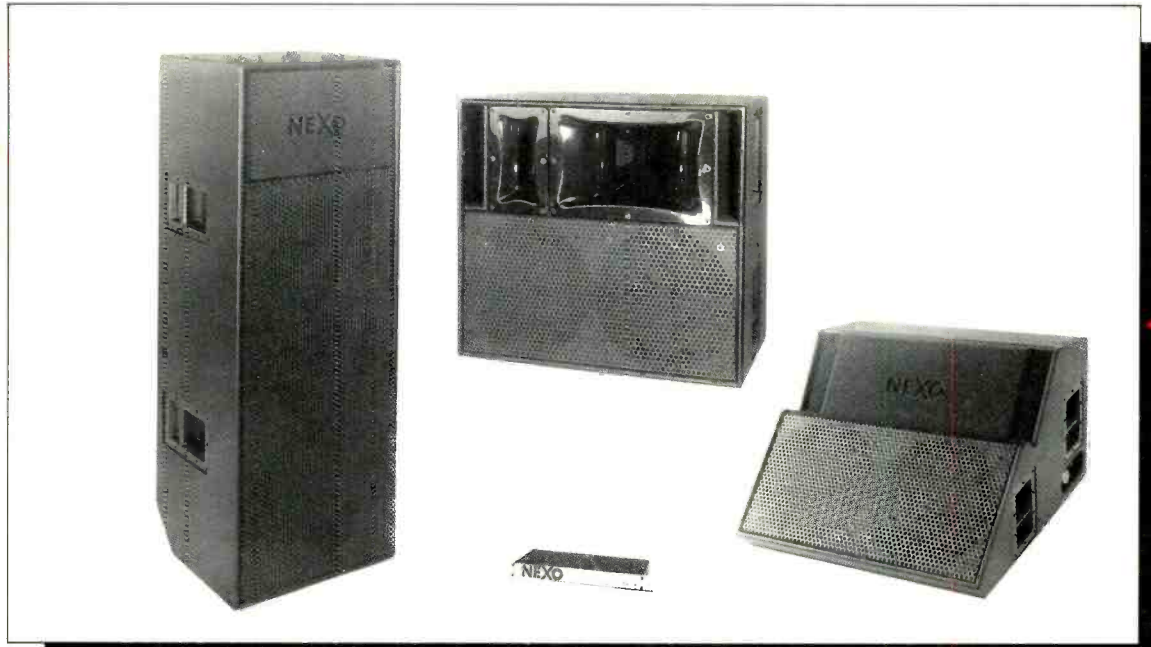
When a high level component appears in the signal spectrum SR assumes the kind of characteristic shown in Fig 13. In this example, a single tone at 800 Hz and at a level of 0 dB has been applied to the system input. SR reduces recording gain but only at and near the frequency of the tone, and only by the amount needed to prevent overload. Above and below this part of the spectrum, the curve returns to the fixed, low level characteristic. This action has results that are especially impressive when listening to an SR recording without decoding. Although bright in sound, the programme does not appear to have been subjected to any dynamic processing. Since the only other system action consists of fixed equalisation at very low levels, it is not surprising that during decoded playback, no trace of processing can be heard, except for remarkable clarity of reproduction.

Masking

The changes that take place in the SR circuit are adaptive; that is, the system filter always adjusts itself to maintain the highest practical gain at every frequency as the signal spectrum changes. The human ear and brain also respond to these changes in the signal spectrum; one such response is a form of signal processing known as 'masking', one of the most extensively studied aspects of hearing.

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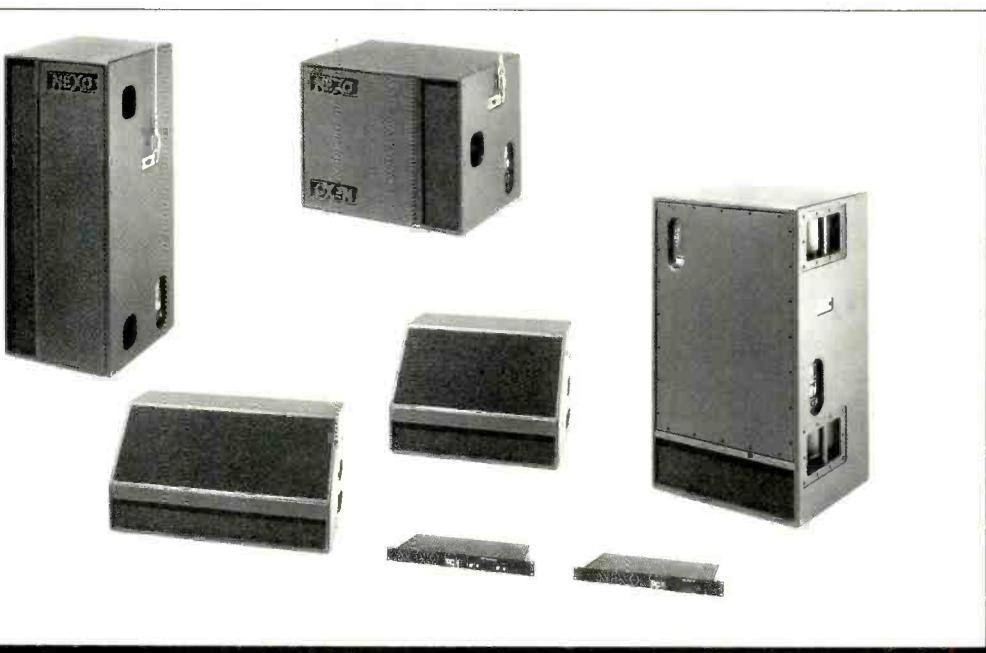
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DOLBY SR

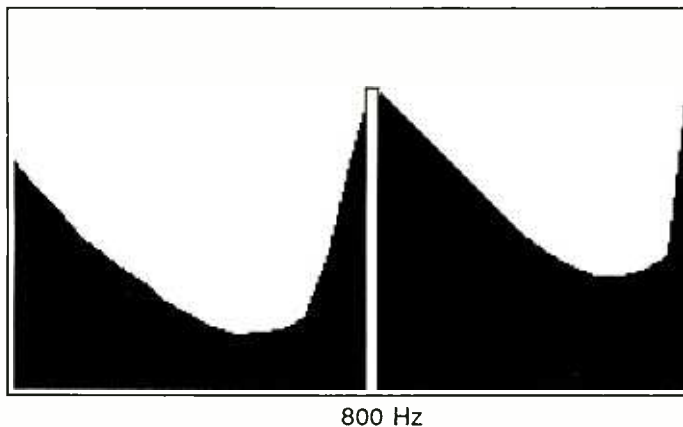
Masking is the concealment of a low level sound by a sound higher in level. A similar effect takes place in vision, when the daylight sky makes the stars disappear.

Most audio signal processing systems operate quite independently of the behaviour of the ear and brain, and always take the same action that they would if nobody were listening to the output of the system. The high quality of SR recordings is due largely to an elegant co-

operation of adaptive signal processing and auditory masking.

In masking, a high level signal component raises the auditory threshold above and below the signal frequency. Sounds lower in level and near it in frequency disappear completely in this psychoacoustic 'shadow' (Fig 14). In the SR circuit, feedback of the signal characteristics determines how each filter in the circuit must change to most closely envelop the masking

Fig 14: Masking and Dolby SR



'shadow'. This is the way as much gain as possible is applied everywhere in the spectrum. The only region of the spectrum that is not boosted in gain is the region that is controlled by masking, where audible low level information does not exist. SR electronic signal processing is silently traded for auditory signal processing in that part of the spectrum. It could fairly be said that although most of the system is on the circuit board, some of it is in the human brain.

Immunising against errors

Another feature is spectral skewing, which reduces the level of the incoming signal at extremely low and extremely high frequencies. Spectral skewing desensitises SR to minor aberrations in tape-to-head contact and azimuth alignment, which might cause fluctuations in high frequency response, and to head bumps or low frequency variations in alignment tape levels. Although these effects are often inaudible, they can disturb the operation of other signal processing systems.

Recording complex signals at high levels

Headroom is as important as any other property of a recording system. Analogue tape recording, as engineers know, has a gradual or 'soft' clipping characteristic. In digital recording, there is no saturation region at all; there is simply clipping, in which the same digital 'word' is recorded over and over as long as the signal remains above the limit. The SR circuit contains a feature designed specifically to deal with extremely high levels at low and high frequencies. The anti-saturation characteristic is shown in Fig 15, and the circuit configuration shown schematically in Fig 16. Low level signals pass through the side chain for processing, as signal level increases, an increasing proportion of the signal follows the direct path, which applies no dynamic signal processing. By introducing attenuation of high and low frequencies in this path, a significant increase in headroom is provided, further maintaining signal purity, with negligible effect on low level operation.

Comparisons

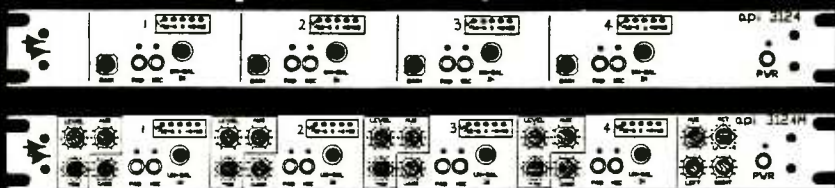
We can compare the static performance of different recording systems by superimposing their windows and the auditory window (Fig 7). Any limitation that might be audible will appear as an obstruction that reduces the size of the opening in the auditory window. It is important to remember that this method of comparison does not show audible dynamic effects, such as modulation noise of analogue systems; nor does it show low level non-linearities, non-monotonicity, or effects of DC asymmetry, all of which may occur to varying degrees in digital recording systems. These effects all close the corresponding system windows from the bottom when a signal is present. In the figures that follow, for unassisted analogue tape and SR, zero level is 320 nWb/m; for digital recording, zero level is 10 dB below the absolute clipping level. In all three examples, the relative vertical positions of the windows have been chosen so that the maximum recorded level

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will be presented at an acoustic level of 110 dB during playback.

Unassisted analogue tape recording shows characteristic limitations in available headroom

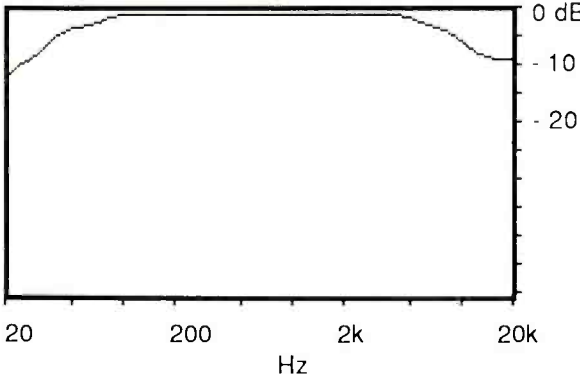


Fig 15: Recording complex signals at high levels

at low and high frequencies and a substantial level of noise at mid frequencies (Figs 17 and 18).

A typical digital recording (see Figs 19 and 20) provides performance that is better than

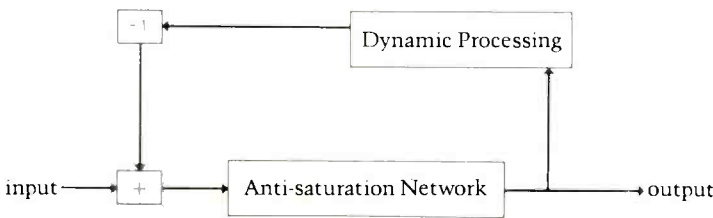


Fig 16: Circuit configuration schematic



Fig 17



Fig 18

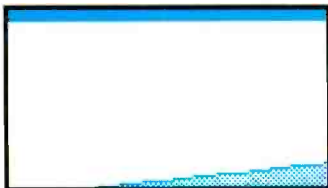


Fig 19



Fig 20

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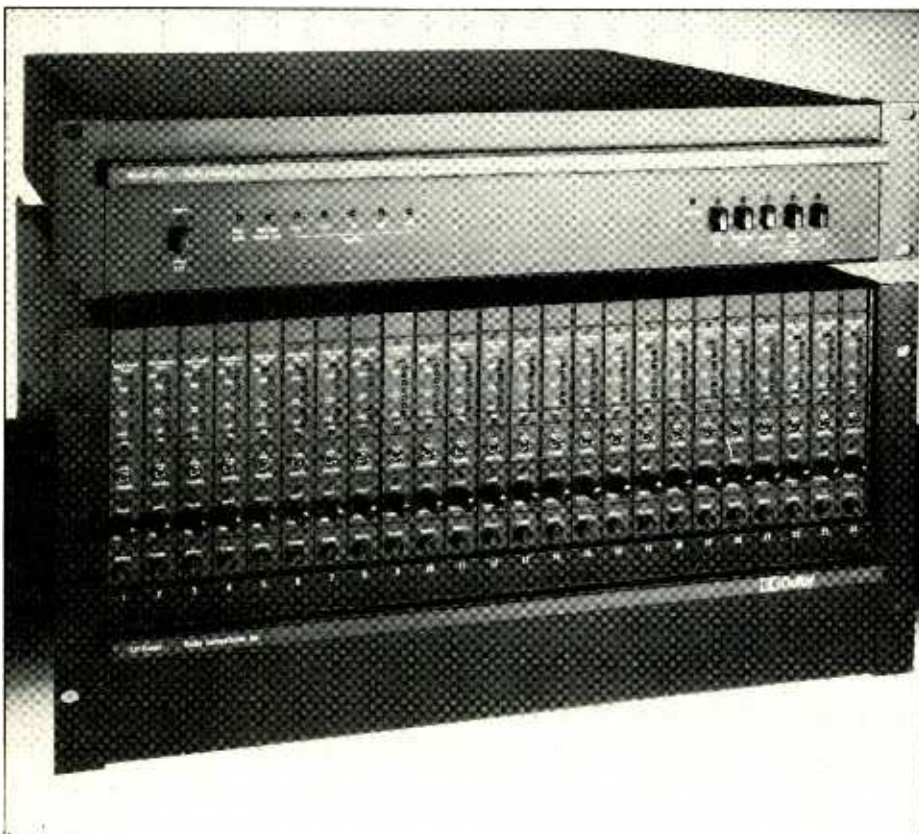
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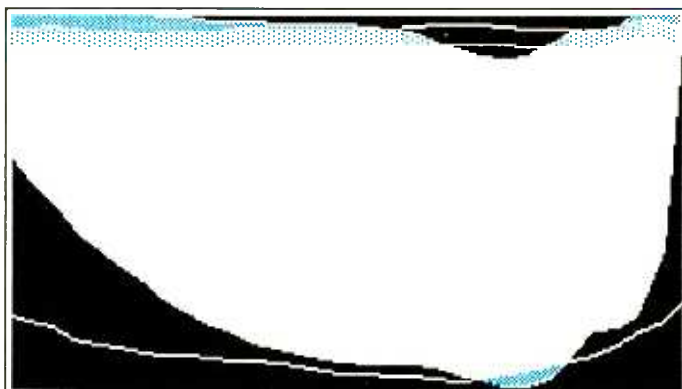


Dolby XP series with SR modules

Fig 21



Fig 22



unassisted analogue tape in several obvious ways. The main drawbacks are the hard clipping barrier of digital recording and the disadvantageous spectral distribution of noise. Although the measured dynamic range of a digital recording system may exceed 90 dB, the noise level is not uniform with frequency. The noise level is extremely low at very low frequencies, much lower than the noise of analogue tape, which is already more than adequate at low frequencies. However, digital system noise crosses the auditory threshold precisely in the spectral region where the ear is most sensitive. The usable improvement in noise level, especially in the presence of a signal, is not as great as theory predicts. Because the noise generated by a digital system is not random, and is therefore especially noticeable to the ear, it is normally masked by the addition of 'dither' noise, elevating the final noise level.

The data shown in **Figs 21** and **22** was obtained using standard tape and a widely used professional recorder operating at 15 in/s. The noise at the very bottom of the window could not be heard in a recording studio or control room unless the playback gain were increased considerably; under those conditions, maximum peak levels would approach or surpass the auditory threshold of pain. Played back at very high levels for test purposes, the audible noise floor of an SR recording is normally the noise of the microphone amplifiers, console electronics, or electronic instrument amplifiers. In a studio, with playback gain set as shown in the figure, and no signal present, the background noise is below the threshold of human hearing, and cannot be operationally improved.

Conclusion

SR processing can be used with any modern professional analogue tape recorder or high quality audio communication system. This means that nearly every recording studio and communications facility in the world is already equipped to install and use it. Often, changing over will only require the removal of the Dolby A-type noise reduction modules already installed. Its practical design makes recording with SR easier than recording without it; and editing, mixdown, copying, maintenance and other studio procedures are generally simpler because of the features of the new system. □

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THE PARTY POST-PRODUCTION

April of this year saw an event called The Party—a charity concert at London's Wembley Arena to raise money for AIDS research. Steve Turner of Molinare describes the process of turning the event into a major TV programme

On the evening of April 1st, there was a concert event at the Wembley Arena, called *The Party*. It was a charity pop concert to raise money for AIDS research, and the Visions television mobiles were there to record the event for three, 1 hour specials to be broadcast on the UK ITV network.

The artist line-up was based on a 'Super Group' of musicians that had been compiled by John Entwistle, who were to play behind various individual guest artists. The 'Super Group' included Andy Summers, Zak Starkey, Steve Nieve, Robin le Mesurier, The Lewis Sisters and,

direct from Hollywood with his Oscar still hot in his hand, Herbie Hancock. Herbie did not have any chance to rehearse with the rest of the band, so had been rehearsing in Los Angeles by listening to a tape of the songs on which he was to play keyboards. The guest artists were Bob Geldof, Boy George, Bobby Womack, Holly Johnson and Meatloaf. In addition to this 'combination' line-up were other performers appearing with their own backing bands: Aswad, Communards, Womack and Womack, Carlton Edwards, George Michael, Tom Robinson, Kim Wilde (with father Marty on backing vocals), Sandie Shaw, and giving his first performance

Programme logo taken from the opening sequence



since his throat operation, Elton John.

In addition to the intended TV broadcast, London commercial station Capital Radio were recording the event for later radio use. The sound recording of the concert was therefore to be used for providing radio programmes for Capital, and the soundtrack for the TV programmes. Capital invariably use an independent mobile on location work, in this case the Fleetwood Mobile was recording sound on 24-track analogue while taking code from the Vision television trucks for synchronisation in post-production.

The day of the concert was very busy, adapting the lighting and sound rigs that were still in the arena from the previous night's Level 42 concert, and rigging the additional facilities for the recordings. Sound checks were very short, for those performers that got them, and Womack and Womack had still not arrived at Wembley by the time the sound checks were over. Their line-up and plugging list was taken into the system that had been devised jointly by the PA and sound mobile crew, with the hope that they would not spring any last minute surprises. The system was to devise a plugging and assignment list based on the super group, and adapt that as necessary to fit the other bands and performers.

The basic plot was as shown in Table 1.

Audience reaction was miked with a crossed pair hanging from the lighting truss down stage centre, and two single mics on high stands behind the speaker stacks each side of the stage. These were mixed to a stereo feed that was recorded on tracks 22 and 23 of the multitrack, and also laid down on a 7½ in/s ¼ in tape ready for use in post-production. Track 24 was used for timecode. The sound mobile sent a feed of the monitor mix to the TV trucks to act as a guide track and this was recorded on all the video tapes.

Inside the sound mobile the director's voice could be heard through the open talkback from the television truck all the time. This is always useful as long as it doesn't interfere with the monitoring in the truck. There are often little bits of information to be learnt to anticipate something on stage. With a one-off event, as on this occasion, there is often little rehearsal and no chance of a second performance to correct mistakes. Switched talkback to the stage was also provided where one of the crew of the mobile was liaising with the PA monitor engineer. This is a very important point of reference both during rigging and patch checking, and during performance to check any microphone problems. One such problem occurred during the Tom Robinson set when Tom's guitar mic broke up making very loud spikes. The source of the problem was immediately discovered and solved before the next song.

The feeds from the stage were a mixture of DIs and mics. For the George Michael set there were eight keyboard feeds to take—all on DIs—in addition to the bass and tape feeds. The mics varied according to channel assignment as well as their own particular speciality. If a mic had been set for a sax (Shure 57 or 54) and was suitable for the next instrument that was coming on the same feed, then the mic would stay. The one predictable form of miking was the vocal mics, which were all Shure 58s. To speed the changes between bands there was a lot pre-rigging done on stage while the previous act was still playing. This meant that, when the time came, it was only necessary to re-patch for the new feeds, check all the mics and DIs, and re-set the desk. This was still quite difficult to do in the time allocated. When it came to setting for Womack and Womack, the mixing desk had just been re-set for their line-up with

the hope that it would not be too different when they actually came to play, when it was discovered they had still not arrived and that George Michael was going on next instead. Amid shouts of 'Hold' and 'We're not ready yet', all hands hit the mixing desk to re-allocate and assign the channels.

At the end of the evening the finale song was *Stand By Me*, sung by everyone who had been on stage earlier in the evening, plus a lot of other faces I had not seen before. This number obviously had not been rehearsed, and the predominant voices were simply those who were near to a microphone. In the sound mobile Michelle was very successful in keeping a record of the track layout on the multitrack for each of the different acts, but when it came to the finale the comment on the track sheet was simply 'Etc'.

The evening did not finish too far from schedule but it was past midnight before the recording crews wrapped. It is not often that one sees rushes code beginning with OO in the hours section.

Post-production

The recording of the concert by definition could not take more than one evening. The post-production, however, can last a lot longer. The hours of available vision shots need to be reviewed and built into basic programme blocks, and the music needs reviewing, overdubbing when necessary, and mixing. Then the programmes need assembling in both picture and sound terms for the television broadcast, and in terms of music and interview for radio.

The television edit was booked at Molinare where the director, Mike Mansfield, and the video editor, Rob Bannochie, assembled the pictures for the programmes. The audio post-production for



Back line for 'Super Group' during Boy George set

the television programmes was also booked at Molinare, where I was to assemble the soundtracks.

There were two distinct stages to the audio post-production. Firstly the music had to be mixed from the multitrack recordings, producing individual takes of each of the songs performed at *The Party*. These separate mixes then needed laying up against the edited pictures, placing the sound synchronously with the pictures and following each cut where they occurred. The placed tracks then needed mixing into each other in a way that would produce a continuous smooth soundtrack from beginning to end of the television programme.

For the first part of this process, the music mixing, I consulted with Keith Dickens at Capital Radio, who had engineered the recording in the Fleetwood Mobile on the night of the shoot, and who would also be mixing the music for the Capital broadcast. What we had to do was to strike common ground in the music mixing so that Keith had a suitable mix for his radio programmes that would also be good for the television sound. I wanted to produce a stereo soundtrack for the television programmes to maximise their potential in foreign sales and video cassette release, so the first thing we discussed was instrument placement in the stereo spectrum. It was important for Keith to have a copy of the video to determine the real placement of the musicians on the stage. It would have been odd to see the guitarist on the left of the drum kit but hear the guitar coming from the right.

It is not possible, however, to follow the pictures with the stereo image on every set. Sometimes the bass guitarist was way off on one side of the stage but the track would have been difficult to mix with mono compatibility if the sound of the bass was similarly on one side of the stereo spread. Also, as with all broadcast sound, one cannot forget the wide range of listening conditions, varying in this case from small television speakers, radios and in-car listening through to large stereo video cassette replay on high quality monitors. The mix we worked to had to be stereo/mono/radio/television/cassette compatible.

The music mix also had to be compatible with the requirements of the performers. From the morning following the concert, there were phone calls every day from the various artists' representatives, enquiring about mixing and overdubbing the multitrack recordings. A lot of musicians have a keen visual awareness and are interested in attending video edits, but usually it is the sound mix that will attract most attention from the performers. For *The Party* post-production there were a lot of performers involved. The production schedule for mixing music tracks had to be worked out to try to fit in all the artists who wanted to be present.

Audio post-production is the last stage because in order to make the final soundtrack one needs the edited pictures to lay the mixed sound to. There is no point in laying down sound to a picture if that picture is going to change its length or position in the programme. Therefore one has to wait for the two stages of video editing and music mixing before the audio post can take place. Being the last stage in the process, one not only has to wait for the others, but also faces the delivery schedule. So, I had to give as much time for mixing as possible but also had to make sure that the dubbing would be finished in time for the programmes to go to Cannes for this year's MIP, the international television programme sales forum. If I were to wait for the video edit and sound mix to completely finish I would not have had the programmes finished in time. So, when Rob had finished his first assembly of the programmes I took a copy of those.

This basic programme block was not the finished picture version of the programmes but the content was set to the right length and in the right place. Rob would then simply improve the existing pictures rather than change duration or running order. This version, then, was suitable for me to use to get the dubbing going.

In the lay-down process, a U-matic video cassette copy is made of the pictures, as a reference, with the timecode from the original video master on one of the U-matic audio tracks. At the same time a multitrack copy is taken of existing audio from the video master, also laying timecode on one of the tracks on the multi. Thus,

TABLE 1

Incoming stage feeds	Multitrack assignment
1 Simmons	7
2 Simmons	
3 Simmons	
4 Simmons	
5 Bass DI	8
6 Bass mic	8
7 DX7	9
8 Emulator	10
9 CP80	11
10	
11	
12	
13 Les top	12
14 Les Bottom	12
15 Guitar 1	13
16 Guitar 2	13
17 Guitar 3	14
18 Guitar 4/Brass	
1	14
19 Perc 1/Brass 2	15
20 Perc 2/Brass 3	15
21 Perc 3/Brass 4	15
22 Vox 1	16
23 Vox 2	17
24 Vox 3	18
25 Vox 4 (Backing)	19
26 Vox 5	20
27 Vox 6 (Backing)	21
28 Vox 7	21
29-32 not used	
33 Kick	1
34 Snare	2
35 Snare	2
36 Hi-hat	3/4
37 Tom 1	3/4
38 Tom 2	3/4
39 Tom 3	3/4
40 Tom 4	3/4
41 Tom 5	3/4
42	
43 Overhead left	5/6
44 Overhead right	5/6
45 Simmons	5/6
46 Simmons	5/6

THE PARTY POST-PRODUCTION

one has pictures lockable to 23 tracks of audio. In the case of *The Party*, two of those audio tracks had sound from the video master. This sound consisted of the guide audio of the music and the sync sound of various interviews that had been recorded back stage at Wembley.

Once the lay-down was completed I had to lay the mixed master music on to the multitrack dub tape, placing the sound in the right place relative to the pictures. In order to achieve this, the code that was recorded on to track 24 of the music recording multitrack at Wembley, was transferred along with the music mix, so that there would always be a reference with which to lock the sound. The music must be placed against the picture using an off-set which I worked out by comparing the mix music to the guide audio from the video. The music tracks are laid down in a checker board fashion, using the first pair of tracks for the first music track, the next pair for the second track, then back to the first pair, etc. This allows for recording the tracks with a suitable overlap between the two, so that crossfades may be made or other sound added to make the soundtrack a smooth continuous programme from start to finish. Once the tracks have been laid in the right place, they need to be mixed together, making adjustments to EQ and dynamic range as necessary.

This process is very successful, but means that the final track that returns to the video master is three generations away from the original music multitrack. This was something I wanted to avoid if possible in *The Party* programmes. If using short programme material one can use disk-based recording systems to make all the sound processing occur in the digital domain. However, for these 1 hr programmes, I needed at least 6 hrs worth of storage, so that ruled out disk-based recording, which does not readily have that much capacity. I also needed the ability to change from one programme to another without having to down-load and re-load the system, which one would have to do with disk storage.

One alternative would have been to use a digital multitrack machine, but it was still not clear during the planning stages exactly when I would be working on the programmes. The answer was very simple and also very effective. Dolby SR encoding/decoding of all the tracks used on the multi brought the performance of the Studer A800 used in the dubbing suite up to a standard at least equal to digital recording, without having to change the existing equipment schedule at all. It took about one minute to place the Dolby SR cards in the existing racks that we

use for Dolby A-type, and the line-up procedure is the same that would have to be used for A-type. Having secured this advantage at the multitrack stage I also asked Keith at Capital to provide my recording of the music mix Dolby SR encoded, thus maintaining the best quality possible. The net result was similar to mixing direct from the multitrack music tapes straight on to the video master, as everything in between had been SR processed. The interesting development from this will be the opportunity to record the music using SR also.

The use of Dolby SR was very successful in the post-production of these programmes. Since completing them I have used Dolby SR on several other music programmes, including the video special of Billy Ocean. Molinare recently purchased a full complement of SR cards making all tracks on the multi, and the 3-track ¼ in SR processed. This is a great advantage for all types of video dubbing, especially where sub-mixing and track lifting is required. It still allows instant

TABLE 2

1	Dub from VT (1)
2	Dub from VT (2)
3	} Safety dub of
4	
5	} Clear
6	
7	} Music tracks A
8	
9	} Music tracks B
10	
11	} Percussion
12	
13	} Stereo audience reaction
14	
15	} Clear
16	
17	} Mix—SR
18	
19	} Mix—A-type
20	
21-23	Clear
24	Timecode

Artist Sandie Shaw from opening sequence



access to any job and has no capacity limit. Using our original Dolby rack for the SR cards we can instantly re-plug for A-type whenever necessary.

With the system established, the first music mixes arrived, and I started to lay the tracks. During the interviews in the programmes there were several edits that Rob treated with a variety of visual effects, like flashes of white, or a tumble of the image, and I laid down some percussion effects to accentuate these visual effects. It was quite successful, with a hand clap for Andy Summers, a crash for Tom Robinson and a tom roll as Sandie Shaw tumbled through 360°.

The final track sheet for the dubbing was as shown in Table 2.

Artist involvement

One of the artists who was very keen to be involved with both the video and sound post-production was George Michael. He spent an afternoon in the edit suite looking at all the available shots from the 'iso' tapes as well as the mixed vision feed. He then went to Capital Radio to do some work on the soundtrack of his three numbers. They did not have time to finish the session there, so George took the multitrack tapes away to finish the mixes. He and his engineer were given exact details of the formats required: one ¼ in stereo, Dolby A encoded for Capital, and one ¼ in stereo Dolby SR encoded with centre-track timecode for TV. They delivered a very tight, good sounding mix, on schedule, and exactly as requested.

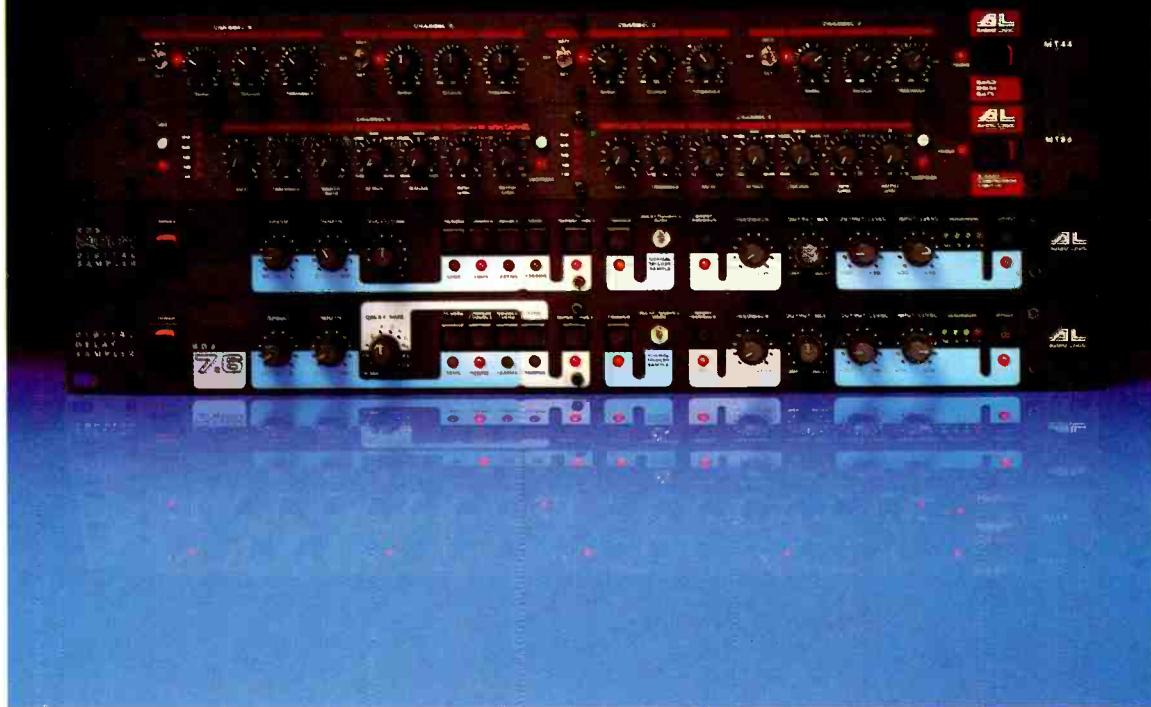
Other artists wanted to overdub as well as mix their performances, and Aswad came in for two separate sessions before they were happy with their sound. It was a shame that I had already laid down their first mix before I knew they wanted to do it again. In the end they produced a very heavy 'dub' mix with lots of moving images in the stereo spectrum.

Sandie Shaw was also keen to mix her three songs and produced a nice sound on the song she sang with a 'choir' of friends. However, this meant that her mixed tracks did not arrive until after midnight on the day prior to the delivery date. Each of her three songs were for each of the programmes, so I still had to do a final mix on all three. In preparation for this I mixed all of the programmes except for her songs, making notes of the settings at suitable drop-in and out points on either side.

When the complete mixes were finished, I then had to lay the finished sound back to the picture master. This is always an enjoyable part of the production. Although there are still checks to be made at this stage, there is little to actually do but listen and watch as the master picture and soundtrack play by.

The production of the programmes, from the shoot to the final programme delivery was very successful. At Molinare we were able to look after the complete production, with Vision Mobiles, Molinare editing the pictures, liaising with Capital Radio and producing the final audio dub and master programmes. The system worked very successfully to be in control of all aspects of production and to work well with Keith, Paul and Trevor at Capital Radio. At one time there was discussion about doing a simulcast of the programmes but unfortunately this did not work out. The television and radio programmes were both broadcast on the same long bank holiday weekend but with an off-set of between 6 and 36 hours between the sound on the radio and the pictures on television. Perhaps next time. □

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Shozo Kinoshita was with the Pioneer company of Japan for 17 years where he ended up in the development section of their TAD division. He left there in July 1984 to go independent and found his own company, Rey Audio. This enabled him to expand his ideas into complete systems without having to work within the confines of a large company although he still retains ties with TAD as a technical consultant.

Kinoshita's first involvement with studio monitoring was in the modifying of systems already installed, which gave a solid foundation

on which to build his own ideas for monitor speakers. From modifying systems it was but a step to go on to custom-building monitors for studios, and this ultimately led to the Hidley/Kinoshita monitor.

"The first, what I would call 100%, system was put into Sedic Studios in Tokyo in 1983. This was the first time that I worked with Tom Hidley and the ties were strengthened the following year at the Paris AES where we were able to have a real communication and lay down the parameters for the new speakers and our collaboration as it is now.

"I feel that the monitor system is the voice through which the creative language of the musician and engineer speaks. We expect musicians to be able to produce sounds that are pleasing to the ear and to be able to articulate correctly; they must also be able to interpret dynamics that range from the brutal to the subtle. It can therefore be considered an anomaly if the monitor system cannot do the same. The present range of monitors shows no breakup at sound pressure levels of over 120 dB while at the same time retaining a very linear response to low level signals."

Kinoshita feels that three main factors govern the design of a successful monitoring system for today's (and tomorrow's) studios.

- Directivity control: "The system must be able to present a linear response throughout the defined listening area. It thus follows that the monitor must be integrated with the acoustical design of the room for the optimum interface of the speaker to the room."

- Imaging: "The stereo imaging has to be very precise and give the correct localisation information. The room also has to be capable of reproducing frequencies properly down to 20 Hz."

- Simple design: "Though this might appear to be a contradiction in terms, it is important that the design of the system be as simple as possible."

Broken down into components, the Kinoshita system consists of a horn, ported cabinet, 2-way passive crossover and standard TAD drivers (these were designed by Kinoshita in the first place).

SHOZO KINOSHITA SPEAKER DESIGNER

Speaker designer Shozo Kinoshita (pronounced Kin-oshi-tar) is little known outside specialist loudspeaker circles. His part in the design of the monitor used in the new generation of Tom Hidley rooms, however, has evoked considerable interest in his design approach. Terry Nelson recently had the opportunity to discuss monitor speaker systems with him



RH-3 horn

The result of much experimentation over 10 years, the horn is made out of Apitong wood that, due to its extreme rigidity and damping, allows a very natural and smooth response. The throat features aerodynamically designed phasing fins for optimum control of directionality and very low reflection characteristics at the horn mouth for wide range frequency response.

The horn is driven by a TAD TD-4001 compression driver, which features a very light Beryllium diaphragm and massive ALNICO magnet, together with a precision annular phasing plug.

A peculiarity of the horn/driver combination is that the TD-4001 has a 4 in diaphragm looking into a 2 in throat. This permits an exceptionally wide frequency response of 630 Hz to 20 kHz.

Bass enclosure

After considerable computer analysis, Kinoshita found that it was possible to attain flat response down to 20 Hz using a ported cabinet. However, this meant that the enclosure had to be suitably massive and be braced in such a manner as to eliminate all standing waves. As with the horn, Apitong laminated wood is used for the cabinet

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24/8/2PA

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because of its excellent structural properties.

Drivers for the enclosure are TAD TL1601A (either one or two depending on the cabinet model) 15 in bass units which feature "excellent linearity and a clear, natural sound quality at all sound pressure levels". The roll-off point for the speaker is 800 Hz hence the crossover frequency of 630 Hz.

Crossover

A fairly surprising feature of the Hidley/Kinoshita monitors is that they use a 2-way

SHOZO KINOSHITA SPEAKER DESIGNER

passive crossover, so the obvious question was—why passive?

"In my case a simple but very good reason! I have over 20 years of experience in the design of passive crossovers so it seemed preferable to stay with that rather than explore what, for me, would be fairly new territory.

"I came to the conclusion during my development work at TAD that the simpler the system, the better it is, which is why I have chosen a 2-way system that features a wide frequency response in each band.

"If we look at crossover design, one of the main problems facing any crossover is that of phase. Whereas it is possible to adjust one crossover point for phase, it gets extremely difficult—to say the least—when you come to 3- or 4-way systems.

"This is not to say that things are easy. Let us take a basic 1-pole filter as an example (Fig 1a). Here we have a 90° phase difference at the crossover point which when summed gives us 0°. This may seem OK but a phase difference still exists between the high and low frequencies. In order to get over this problem we have developed a special phase compensation circuit that makes

the HF/LF sum in-phase at all phase angles (Fig 1b).

"Still on the subject of phase, it is also very important that the mechanical phase alignment of the system goes hand-in-hand with the electronic phase alignment. For example, the HF horn has a 270° phase difference at the cut-off frequency which also contributes to the very natural characteristic of the horn."

Other characteristics of the Kinoshita crossover include a compensation circuit for even power output from the HF and LF drivers as well as tailoring the horn response at both ends of its audio spectrum. "The compensation circuits that are usually found for use with constant directivity horns only correct for the high frequencies, here the low end is taken care of as well (Fig 2)."

The problem of crosstalk is also attacked by the use of a balanced network for the low pass filter circuit. "Crosstalk can occur in unbalanced networks through the use of a common earth; by using balanced techniques this can be eliminated."

Last but not least among the features of the crossover is its ability to handle high power without clipping. "The units are designed to handle 3 kW before clipping and all condensers and inductors are of the highest quality. The inductors use LC-OFC winding techniques and a special core which provides for a minimum of power loss."

The vertical monitor

"The general demand for high power and flat response has made the double 15 in woofer almost mandatory. Most systems place the drivers side by side and, providing the enclosure is aimed correctly, the audio image obtained is satisfactory (Fig 3). However, if the system is arranged vertically (Fig 4) problems will arise due to the difference between the distance from the woofers when listening on-axis to the horn, and result in poor definition.

FIG. 1a
1-POLE FILTER

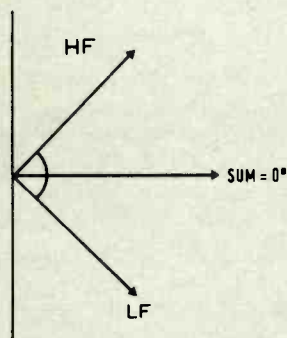


FIG. 1b
KINOSHITA PHASE
COMPENSATION

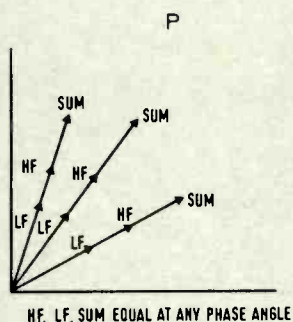


FIG. 2
CROSSOVER COMPENSATION

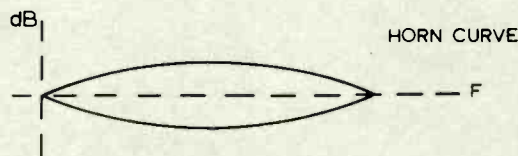


FIG. 3
GENERAL DOUBLE WOOFER SYSTEM

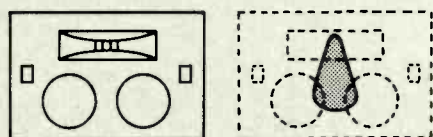
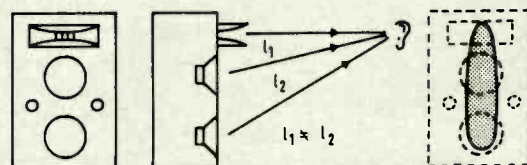


FIG. 4
CONVENTIONAL VERTICALLY ARRAYED
DOUBLE WOOFER SYSTEM



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"The solution to the problem is to place the horn between the woofers and, providing the enclosure is angled so that the listening point is on-axis to the horn, this enables the low and high frequencies to combine correctly and provide a clear audio image (Fig 5).

"If we come back to our first example, what I call a general double woofer system, research has shown that one of the most serious problems with this type of installation is that of interference between the direct sound and the reflections from the floor and ceiling of the control room, especially in the 100 to 300 Hz range (Fig 6). With the vertical monitor these interferences

disappeared due to the differing path lengths from the woofers, resulting in a very smooth response. An added bonus of the vertical array with a central horn is that the spacing of the woofers makes for better low frequency driving capabilities, providing of course that the enclosure follows the necessary construction and tuning techniques."

SHOZO KINOSHITA SPEAKER DESIGNER

FIG. 5
VERTICAL MONITOR AND ITS SOUND IMAGE

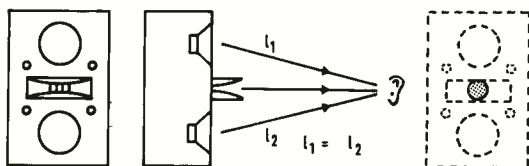


FIG. 6
LOW FREQUENCY RESPONSE OF GENERAL SPEAKER SYSTEM IN MONITOR ENVIRONMENT

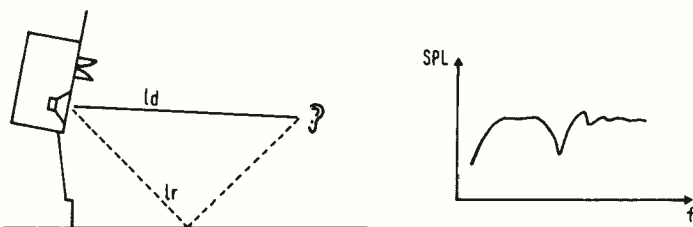
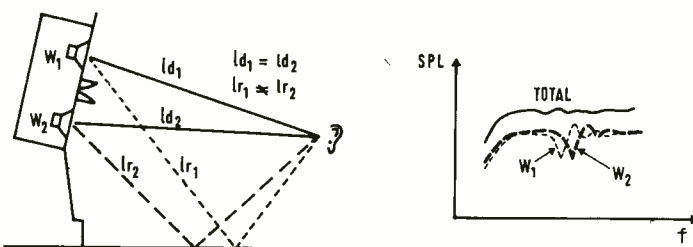


FIG. 7
LOW FREQUENCY RESPONSE OF VERTICAL MONITOR IN MONITOR ENVIRONMENT



Tom Hidley comments

The vertical monitor came about after the initial experience obtained at Sedic studios, where the monitors used employed a horizontal dual-woofer configuration. We were lucky enough to have the studio as a test-bed and make the necessary modifications to the system and the surrounding area when this type of monitor is used.

At present there are five Hidley/Kinoshita monitors: the model 1 which is a single woofer system; the model 2 which uses twin woofers in a horizontal configuration for control rooms where vertical height is limited; and models 3V, 4V and 5V which are vertical monitors with a low frequency response ranging from 31 Hz to 24 Hz to 20 Hz respectively. Experience has shown that the frequency response is better than the quoted ± 2.5 dB tolerance and I am amazed at the quality of the sound which shows up in the fidelity of reproduction and the complete lack of listening fatigue—even at high pressure levels.

My original intention for monitors sold outside Japan was to use the TAD components, crossover and horn and have the cabinets built in Europe and the United States. However, it soon became apparent that one of the secrets of the system is the Apitong wood that is grown in Japan where it has a different density to elsewhere. The weight/bracing ratio is an all-important element of the design and so all systems are handbuilt in Japan.

The 20 Hz monitor

"The advent of digital recording and the compact disc has brought an increased awareness of the importance of low frequencies. Whereas the human ear does not exactly 'hear' frequencies as low as 20 Hz, they are still perceived as vibrations and can play an important part in the overall perception of music or other audio signals.

"The reproduction of 20 Hz signals has led to the development of the model 5V monitor. This necessitated a large cabinet which gave the additional benefit of reducing the action of standing waves on the drivers due to the extended low frequency tuning."

Essential to the proper operation of the 20 Hz monitoring system is a suitable acoustical design of the control room. Installation in one of the new Hidley Design rooms requires that the enclosures be completely encased in concrete and isolated from the internal structure of the room. This means that all the low frequency energy being put out by the system is going out into the room and not being absorbed by structural deficiencies and resonances. It also follows that the room construction must be massive enough to provide proper control over the low frequency reverberation characteristic of the room in order to provide an accurate response.

Compression driver vs soft dome

A criticism often levelled at compression high frequency drivers is that they are prone to distortion. I asked Shozo Kinoshita how he felt about the subject.

"I think the real question here is one of measurement. If we accept the 1 W for a given SPL at 1 m standard then the average dome driver will give between 92 and 95 dB/1 W whereas a horn-loaded compression driver will tend to give around 112 dB/1 W, or a 20 dB difference. In order for the dome transducer to give the same SPL as the horn system at 1 W, we will need to drive it with around a 100 W of power. This in turn will cause the voice coil to heat up with the subsequent rise in impedance and it is under these conditions that the unit should be measured in order to give any meaningful comparisons.

"Control room pressure levels are often up to the 130 dB mark and the monitor system must be able to handle this kind of power capability while at the same time retaining an identical fidelity at low levels—which the Hidley/Kinoshita monitor does."

Future developments

"I personally feel that the Vertical Monitor is one answer for the future control room—there is never only one solution! The next stage for me is

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nearfield monitoring and I am already looking into the design of a high quality nearfield monitor that can be used for signal evaluation without introducing misleading colourations. If you really want to check how your mix is going to sound on the average hi-fi (or low-fi) speaker, the easiest thing is to play it through an average domestic system!"

Live sound

Shozo Kinoshita's company, Rey Audio, is involved with live sound as well as studio

SHOZO KINOSHITA SPEAKER DESIGNER

monitoring and is well-known on the Japanese concert scene.

"The enclosures we use are similar in conception to the studio monitors and the system

is 2-way. In fact the system is built out of high and low frequency modules which can be stacked horizontally or vertically, depending on the configuration required (Fig 8)."

The low frequency cabinets have a range of 30 Hz to 1 kHz and are direct radiator ported enclosures. Kinoshita gives his views on direct radiators versus horn-loaded bass cabinets.

"First of all it is a question of frequency response. With the ported enclosure we have, it is completely flat. With a horn enclosure there would be a 'bump' in the frequency response and the low end would not go down as far—unless of course the cabinet was so huge as to be unpractical. With our design we can cover the sub-bass through to the low mids with one cabinet. However, it is still quite large and very heavy!"

"I also feel that in general, direct radiator systems tend to have more 'punch' and have a more 'solid' feel to the sound. This said, very careful attention has to be paid to the stacking of the system. Too many people still think they can just put up boxes and that it will work."

We talked about the fact that some systems can sound very powerful close to but soon lose coherence at relatively small distances.

"This is a question of stacking and overall design. The longest throw situation we have done up till now has been 600 m and it sounded satisfactory at the back.

"The tuning of the bass cabinets is extremely important. Thiele and Small have done excellent work but they are still limited conditions. The tunings we use also incorporate computer design work from Bart Locanthi.

"When dealing with sound reinforcement systems it has to be borne in mind that everyone has their own idea of what they should sound like and how they want them to be used. It is therefore very important that systems being sold to PA companies be built in close liaison with the client.

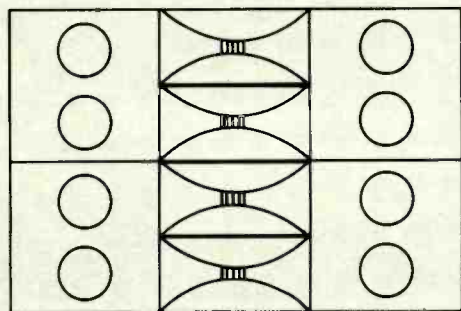
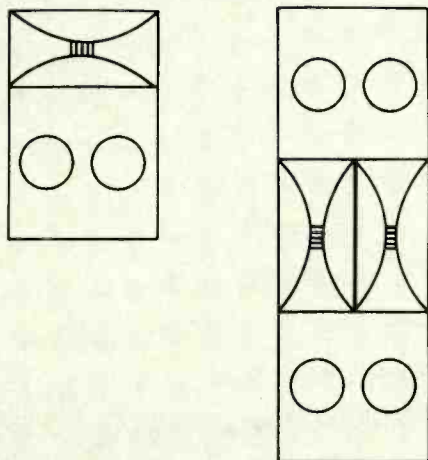
"For ourselves, the next area we will be looking at is that of stage monitoring (in Japan), which we hope to do this year. This is a field that is still very much in its early stages and should provide an interesting challenge."

At the time of this interview 80% of Japanese studios were equipped with Kinoshita monitors with 75 systems in use worldwide (a figure which will have already changed by the time this is read). A common feature to all these installations is the lack of equalisers in the system—"these are neither required nor desirable!"—together with what often amounts to unmitigated praise of the sound. However, that is something that has to be judged on an individual basis.

Studio monitoring is one of those subjects that can arouse fierce passions in partisans of this or that system and/or designer. However, the common goal is to let us hear the music as it really is and from this standpoint Shozo Kinoshita has to be placed among the more influential monitor designers. □

I would like to thank Larry Ishikawa of *Prosound* magazine in Japan, for his invaluable assistance as translator.

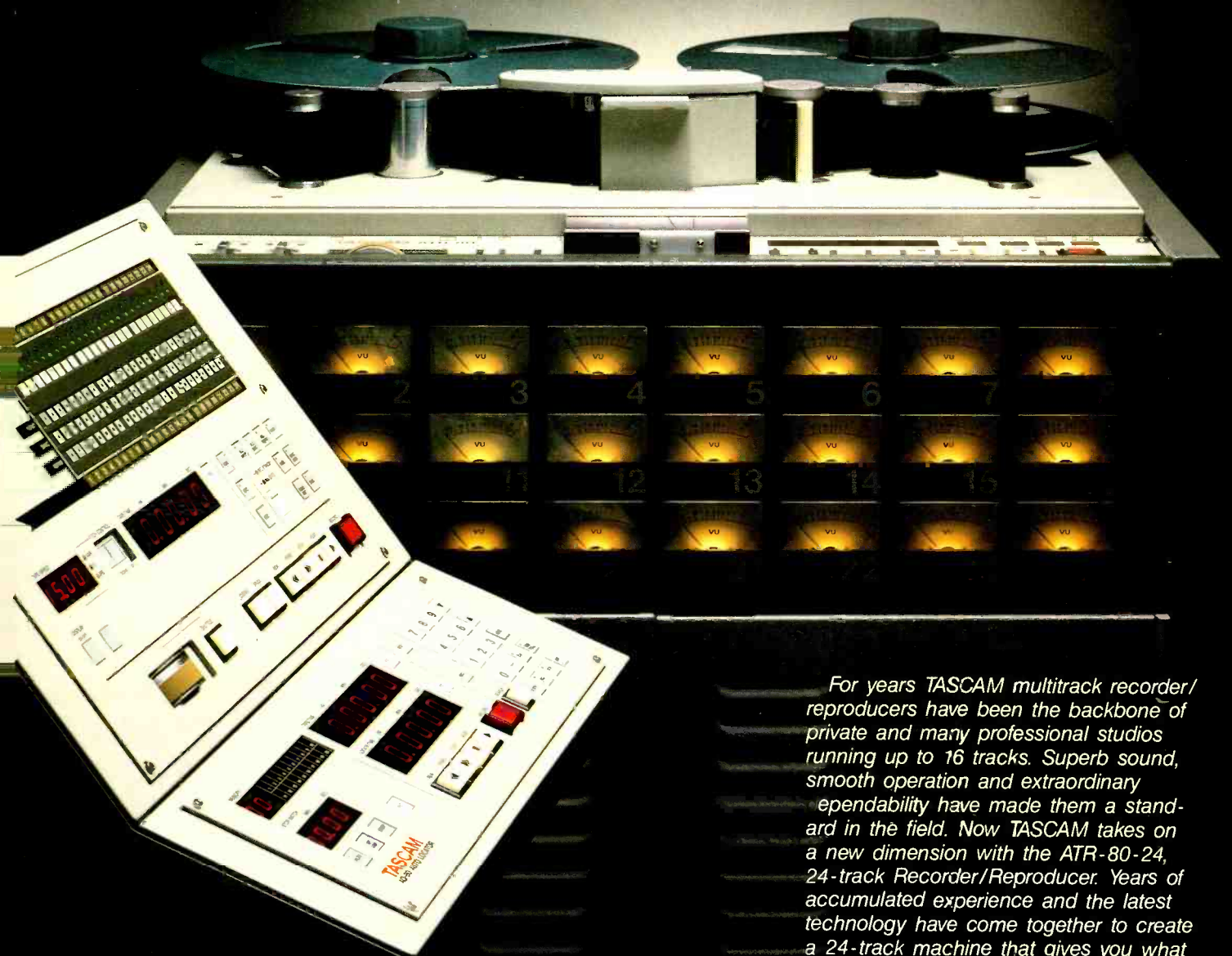
FIG. 8
SPEAKER CONFIGURATIONS - REY AUDIO



Specifications

Model	Response	Sensitivity	Nominal Impedance	dB SPL/m	Width (mm)	Height (mm)	Depth (mm)	Horn Protrusion (mm)	Weight (kg)
1	±2.5 dB 26 Hz to 20 kHz	95 dB SPL	8 Ω	120	1.118	762	508	183	110
2	±2.5 dB 28 Hz to 20 kHz	98 dB SPL	4 Ω	126	1.125	800	600	183	140
3 V	±2.5 dB 31 Hz to 20 kHz	98 dB SPL	4 Ω	126	725	1240	580	183	150
4 V	±2.5 dB 24 Hz to 20 kHz	98 dB SPL	4 Ω	126	850	1200	620	183	200
5 V	±3 dB 20 Hz to 20 kHz	98 dB SPL	4 Ω	126	1.100	1300	700	183	250

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BLACK BARN

Janet Angus visits a recently converted 24-track studio in the South of England

The small sleepy village of Ripley is the scene of the birth of one of the South of England's most recent 24-track recording studios: Black Barn. Not one, but three 100-year-old barns have been converted by the Black part of its name—Robin Black, ex-Maison Rouge Studio and of numerous production credits fame.

Having managed Maison Rouge for several years, when Ian Anderson sold the facility Robin took flight, working freelance all over the world for some 18 months.

"I did Black Sabbath at the Manor and then I went off to Paris, Ibiza, South America and Argentina. Eight months after the Falkland's war I was working with the number one Argentine group! It was an interesting year out."

Meanwhile his thoughts were converging on what must be every engineer's dream, that of designing and owning his own studio.

"It is something I really wanted—my own studio, a studio I know backwards. There is nothing better for a sound engineer than to have built his own studio, designed and equipped as he wants it."

After years of working in London, Black had a great desire for the countryside and finally settled on picturesque Ripley, with its history as a stop-over for the Portsmouth to London coaches on the old A3, for a number of reasons.



"We are reasonably close to London and yet in the countryside. I didn't go further out because then we would have had to provide accommodation. It had to be something like a barn because I wanted to be right out in the country—look out of the window and see fields. I hate going to London now.

"I bought the house with the barn and a bit of land, but we didn't choose this location simply because of the house. The village has a great atmosphere with nice pubs, restaurants and bed and breakfast facilities. Six minutes away there is a hotel and country club with squash and tennis courts, etc. Everything is much cheaper than in London. It is very quick to London and both airports, so for Europeans and Americans it is very convenient."

On taking over the property the Blacks found themselves getting into the farm atmosphere in a big way when they discovered six sheep in their newly acquired barn.

"They then had 12 lambs so it was lucky we had bought a bit of land with it. So we stuck the sheep out in the field but then some of them exploded."

Now when someone says something like that with an absolutely straight face what does one say?

"I was in France doing an album at the time," he adds, as if by way of explanation. It seems that this unfortunate incident produced an ultimatum from Mrs Black along the lines of 'it's either the sheep or me'. So the sheep went. His career as a smallholder thus terminated, Black concentrated his mind on designing his ultimate studio.

More by coincidence than design, the equipment choice has turned out to be almost exclusively British made.

"Everything except the cassette players, which are Aiwa and Denon. I think it is good for people in this country to fly the British flag."

Mixing console and tape machines are by Soundcraft.

"The TS24 console with *MasterMix* automation has superb equalisation; very clean. As a console it is easy to use, and it is important in a studio to make life as easy as possible. It is a very versatile desk and works superbly together with the *MasterMix*. I have not used *MasterMix* before and it is very important that automation should be easy to use when you are trying to concentrate on mixing.

"I chose all Soundcraft machines because they are very easy to operate; you don't need a screwdriver to line them up. On the *Saturn* multitrack everything is operational from the remote. It will memorise any setting you want—cycling or dropping in; it can also memorise tape line-ups which is useful as we do still get the odd tape that isn't Ampex. I chose the series 20 mastering machines for the same reasons really. Easy to line up; it is so advanced—if you change speed it automatically changes its line-up."

Control room monitor choice arrived at the Tannoy *FSMs*.

"These give the power that some of the early Tannoys didn't have. Years ago everyone had Tannoy monitors and then they suddenly wanted to have more power. Along came Eastlake and they all changed; but I have always liked Tannoys, they are very true."

Nearfield monitoring is on Yamaha *NS10s*: "A very good, very flat, small monitor."

The choice of outboard equipment was possibly the hardest, as having bought, built and equipped a studio, there must be a limit to how much money there is to spend. A good basic selection can always be supplemented by the various hire companies.

"We needed to get as many noise gates as we could. People don't like hearing hiss anymore, or noise between playing. With CD and digital mixdown you hear everything now."

Eight Drawmer 201 noise gates are joined in the effects racks by two Yamaha *SPX90* and one *REV7* digital reverbs, two Bel *BD80* and one *BDE2400* DDL/samplers, a Bel *BF20* flanger, Electrospace *Spanner*, six Drawmer 221 compressors and two UREI limiters. (Twelve further noise gates and Lexicon 480L digital reverb have also been added since our visit.)

Digital mixdown is available on Sony 501 and multitrack digital can be arranged.

Microphone choice includes AKG 414s, D12s, 224s; Electro-Voice *RE20s*; Shure *SM58s*, *SM81s*; and Neumann *U87s*.

"I've got about eight 414s which are fantastic, a good all round microphone."

In designing the rooms, Black's criteria included wanting to

BLACK BARN

make an environment with 'a difference' as well as retaining the period style of the barn. This was achieved by working the original beams into the interior design although for structural purposes they were actually replaced by new stronger ones. These and generous use of 'old stock' brickwork combine to maintain the barn-like atmosphere.



Below: Robin Black, designer and owner of Black Barn Studios



Having co-designed studios at Maison Rouge with Sandy Brown and Eastlake, and had a good look at the various studios he has worked in over the last 15 years, Black felt equipped to handle the design requirements himself.

"The barn is obviously totally detached. We started by doubling everything up; put a false ceiling under the apex because it was acting as an echo chamber, and we put *Rockwool* above that. The studio area is 820 ft². The ceiling and the left hand walls are totally dead with layers of *Rockwool*/air/concrete/air/concrete. To the right the walls consist of plaster/concrete/air/*Rockwool*/air/concrete. I didn't want any straight lines, that always makes an awful noise, so I have tried to break the room up 'Spanish style'."

This is achieved with the isolation booth, approximately 150 ft², which is constructed from brick and plaster, with a bare floating floor. Carpets and curtains may be implemented to obtain the required acoustic. The main studio area is covered in a pale grey carpet, with terracotta fabric on the walls. The angled, double-glazed windows look out on to the surrounding countryside. There is a separate access for equipment, thus avoiding a trek through the control room.

"I wanted to mix dead areas and more live areas. The iso room is very live but it is big enough to take a full, big drum kit."

Most important of all to Black was a large control room with space to accommodate as many musicians, keyboards, visitors, etc, as you like without feeling cramped. A bass trap was installed in the middle of the back wall to stop bass waves rebounding into the room creating standing waves. On either side of this are angled windows, located out of the path of the main monitor signal.

"The ceiling is rough plaster/air/*Rockwool*/air/soft sand and cement mix. You must have mass to stop bass frequencies zapping through. The walls consist of *Rockwool* and air gaps, except around the monitors where it is rough plaster work."

The ceiling area over the tape machines has been brought down to create a kind of soffit, in order to place the lighting closer to the machinery for more comfortable operation.

In the rear right hand corner a keyboard rack is hard wired into the mixing console, enabling quick and efficient setting up of MIDI keyboard rigs. Outboard effects are housed in *Standeasy* trolley racks on one side of the console which spans across the room facing the studio.

Monitors are mounted on concrete plinths, with terracotta drapes behind covering up the plasterwork. On top of one of these is a green frog. "It's a toad actually." Sorry.

"I was in Habitat buying a coat stand and he was there and I thought maybe he would like to come and live here." Of course.

As well as working the original beams into the design, Black had special doors made up from antique doors, put together and lead lined, "to retain the rustic look".

Other facilities include a small coffee lounge and newly finished games room with pool table, TV, video, fridge and microwave. The room has been designed to fit in with the overall 'barn style' and has windows that provide a view of the countryside. He is assisted in running the studio by studio manager Julie Morgan who looks after administration, bookings and accounts. Tape-op cum assistant engineer Teo Miller joined Black Barn shortly after it opened at the end of November.

One of the first bands to try the studio out was Jethro Tull, who were starting their next album. Black doesn't foresee any problem attracting work.

"I don't think we are too far away to get London work. There are lots of musicians in South London and near here. I also hope to get customers from Europe and America."

Apart from a few carefully placed advertisements Black Barn will rely on invitations to producers and engineers to feed its reputation.

"It is very difficult to drag someone away from a studio they are used to working in. You just have to get them through the door and let them see for themselves. The local rates are cheaper here and we can afford to be cheaper with our studio rates than London studios."

Plans for the future include building rehearsal rooms, starting a production company, etc, and eventually extending into video dubbing. But for the time being a new studio is born. □
Black Barn Studios, 3 The Green, Dunsborough Cottages, Ripley, Surrey GU23 6AL, UK. Tel: 0483 222600.

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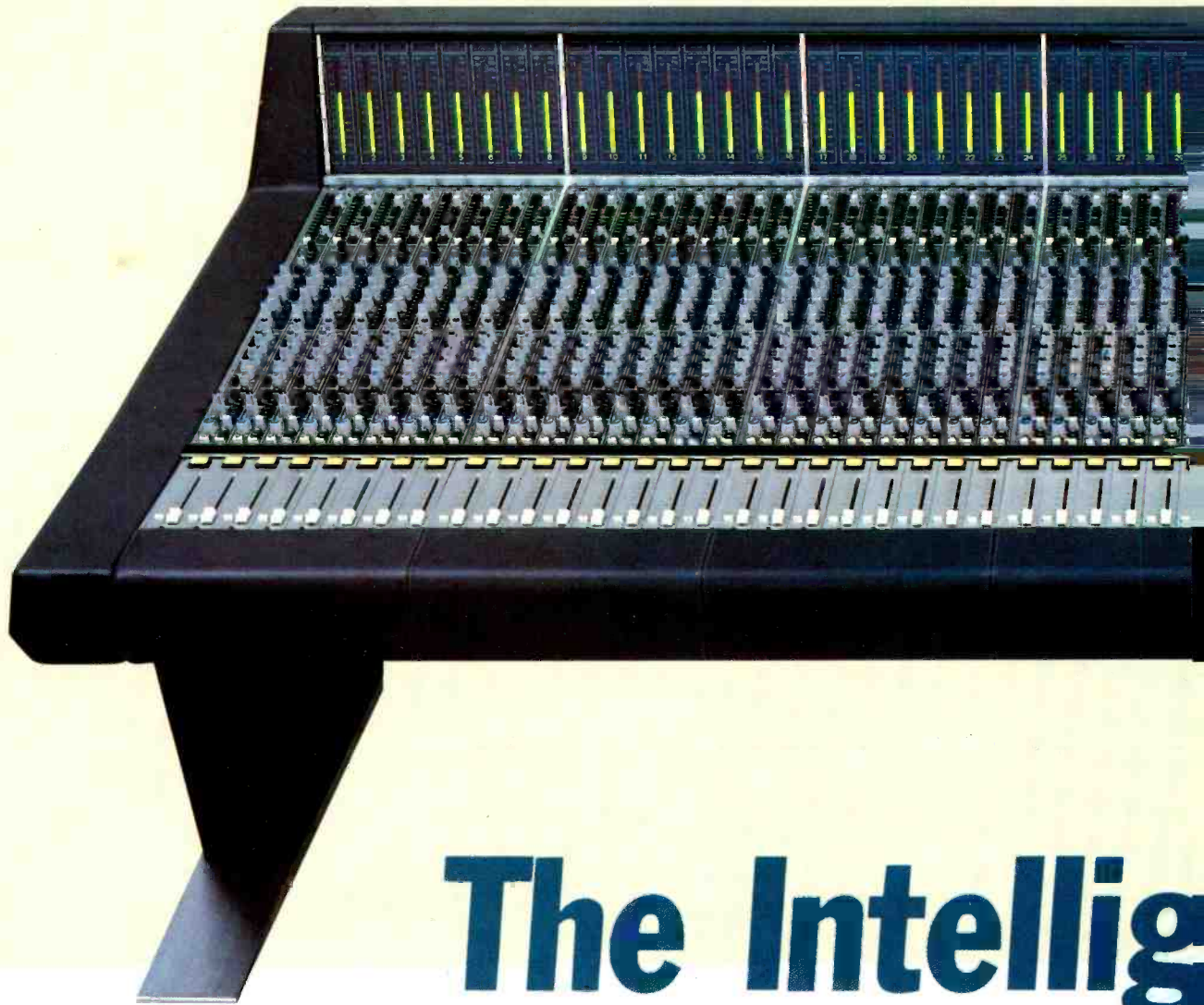
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BRUEL & KJAER

Keith Spencer-Allen visits this Danish company who are moving into musical aspects of pro audio

I don't know why but I had always assumed that Bruel & Kjaer were a small Danish company employing about 50 people. I think this is the kind of impression most people in the pro-audio industry have of them because although they have been solidly established as one of the leading names in pro-audio test and measurement, B&K's public face at industry trade shows has never really said very much about the company and its workings.

The launch of the 4000 series of music recording microphones a couple of years ago surprised a lot of people, as before this B&K had not appeared to show much interest in product areas outside test and measurement and certainly none at all in music recording. Strange as it may seem, however, the philosophy regarding the 4000 series mics is not that different from the ideas that have actively driven this rather unique company for the last 40-odd years.

Earlier this year I had the opportunity to take my preconceived ideas about B&K and compare them with the real thing. I could not have been more surprised.

Bruel & Kjaer are based in the small town of Naerum which is just a few miles north of the Danish capital, Copenhagen. At this location alone they employ over 2,300. Of these, 450 are engineers making B&K the biggest employer of electrical and electronic engineers in Denmark. Within this developed area of 60,000 m² are all the facilities of such a sizeable company including manufacturing and R&D, and an extensive block of new buildings has been added this year. Space has now run out, however, and a further 100,000 m² has been purchased nearby for future development.

Beyond this, are 22 wholly owned sales companies throughout the world that also function as a geographically distributed marketing department; something that is very necessary when the market for your test and

measurement equipment is worldwide and your home market can only account for 2% of your turnover (proportionately a very high amount). In 1985 the turnover of B&K was 832 million Danish Kroner.

Marketing of the studio mics is rather different. A network of 24 dealers throughout the world has been set up to work with the 22 subsidiaries—the first B&K products to be handled in this way.

History

As a company Bruel & Kjaer was founded in the early 1940s. Dr Per V Bruel and Dr Viggo Kjaer had met at the Danish Technical University and although the company apparently had simple beginnings with a voltmeter designed on a kitchen table both Bruel and Kjaer were particularly interested in the sciences of acoustics and measurement. Bruel & Kjaer have always remained a measurement company rather than becoming involved in the use of equipment, although this is sometimes done on a private basis. In the early days Dr Bruel was part of a small team that helped sort out acoustic problems in Danish Broadcasting Corporation's major new concert hall in the mid '40s and the idea of problem solving is something that has remained fundamental within the company.

Bruel & Kjaer had a variety of locations in Denmark before moving to the present site in 1948 where business really began to take off. Today there are over 5,000 items in the full B&K catalogue and all are connected with specific areas of sound and vibration measurement.

The founders of the original company included six members of three families. Of these only Drs Bruel & Kjaer are alive and active within the company today although later generations of all three families are still actively involved. A quite unusual aspect is that ownership of the company remains wholly with these families and all profits have been largely reinvested within the company.

With many years of successful trading this has given B&K such a strong financial base that they are able to undertake massive amounts of R&D and employ philosophies of operation that would just not work in any other company structure of a similar size. To me the most remarkable aspect is the way that perfectionism is not only tolerated but is actively encouraged to an extent that I have never seen anywhere else. All these aspects will be clearly shown later when we look more closely at the microphones themselves but I have to admit that initially I thought I was being sold a rather well prepared PR story. I think B&K are aware that this is a common reaction among outsiders encountering the B&K 'family' but during my two days there I found that a common attitude exists from the factory floor to the very top of the company which just would not work in a comparative company elsewhere.

Examples of the way that financial independence works within B&K were quite obvious to see on a tour of the factory. Virtually all manufacturing processes are contained within the factory. Wherever possible they prefer to manufacture themselves rather than subcontract with always the same reasoning: firstly, that it is probably cheaper because other than the microphones most products are far from being in large scale production and unit cost would be very high; and secondly, they feel everyone is happier with it in-house where the specification and tolerances of components can be far more closely watched.

In other areas there are vast numbers of R&D personnel who are given briefs to design specific pieces of equipment. The brief is generally to make it perfect rather than to a specific date or price—this would usually drive any marketing department crazy—but the company always thinks in the long term and that it is worth waiting for a better product. As a result once the product is introduced it has a very long life within the catalogue.

Even when dealing with staff the atmosphere of co-operation and consideration prevailed. On the assembly lines certain areas were sectioned off with low walls. When asked why this had been done they expressed surprise that we needed to ask the question but the simple reply was that it made staff feel good! On the instrument assembly lines there are conveyor belts but this is about the end of any similarity between B&K and any other concept of intensive mass production. Each of the employees sitting by the belt has a particular piece of equipment to work on that day but the conveyor belt is carrying a vast range of products each with a little flag. When the correct flag is seen by the employee he lifts it from the belt, works on it, replaces it on the belt and waits for the next one. Very rarely does this get at all intensive as there are gaps between working on units. In most companies this would be seen as a rather unproductive organisation but I was told that if you are making high quality instruments then you need employees to act as craftsmen and a pressurised working environment will not achieve that. Much of this is not just a B&K attitude but a generally Scandinavian approach to the importance of the individual and quality of life.

Still on the assembly area, I was very impressed by the way that there were full colour manuals made for each piece of equipment so that it would be quite easy for an employee to assemble a wide number of products simply by following the instructions.

Such an attitude to people has its other effects as well. For example, preplanning in production

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B&K's original premises

BRUEL & KJAER

becomes essential. On the instrumentation side the marketing departments are expected to estimate their sales requirements for the future periods as is normal. The company appears happiest when these estimates are met, with orders in excess of these figures being regarded in a similar way to those falling below. The nature of complex products rather dictates that sudden increases in demand are difficult to accommodate.

To a degree this can be cushioned by a truly vast stock of completed products being held. While being shown through this area I stopped at one point and counted a row of dual-channel analysers with a combined value of nearly £750,000; this was just a small part of the store capacity and only on one item.

It is very difficult to capture fully how B&K operates and what makes it different financially. Possibly the clearest indication of corporate policy on these matters was in a quote from Viggo Kjaer in an in-house publication. He started by describing how the company is divided into sections and divisions which can call upon assistance from any or all of the other sections as needed and that 'no one group is requested to make—or is necessarily rewarded for—its own profit; rather it is the contribution to the success of the whole that is important'.

Other organisational aspects

When dealing with the type of products and people that B&K do, properly organised literature is essential. To this end there is a special department to do this. Documentation employs 66 people of which 30 are engineers. In 1986 they produced 350 publications including manuals, technical handbooks, data sheets and periodicals. Most of these are published in English, German, French, Italian and Russian as standard although certain other publications such as the short form catalogue are available in 18 languages. All basic languages are handled in-house with some special word processing terminals that allow use of



Series 4000 professional omnidirectional mic Type 4006

alphabets other than our own. Such a scale of operation is not cheap and the cost of the department was about 5% of turnover for the last year.

The training department has a constant programme of training that broadly covers the full product range within different groupings and levels. The attitude has been that all the marketing and sales engineers need to be familiar with all the product areas so personnel from the marketing groups around the world are brought back to the factory for week-long sessions which include written exams and sometimes training in presentation.

With the market for music recording mics being quite different to that for the general test and instrumentation equipment it may be that this policy will have to be modified in the future but at the moment this is still the standard mode of operation.

The mics

The main purpose of the visit was to discuss microphones. The current range of studio microphones is known as the 4000 series and consists of four models—4003, 4004, 4006 and 4007. These fall into two different types. The 4003 and 4006 have 16 mm capsules and are acoustically similar. They basically have a 20 Hz to 20 kHz (10 Hz to 23 kHz for 4003) bandwidth and as a function of the larger diaphragm have a very low self noise. They are both supplied with an additional interchangeable protection grid—the standard version is silver and has a hole in the front centre. The black grid allows a more linear HF response when used freefield (more distant from the sound source). The major difference is that the grid is a little taller which creates a slight HF lift that counteracts the HF absorptency of the air. Models 4004 and 4007 have 12 mm capsules and as such have a frequency response of ± 2 dB up to 40 kHz, and improved phase response and a slightly better omni pattern, although marginally less quiet (functions of diaphragm size). They do, however, have a higher max SPL handling capacity of 168 dB peak at 4 kHz making them particularly useful for close miking of high intensity sounds.

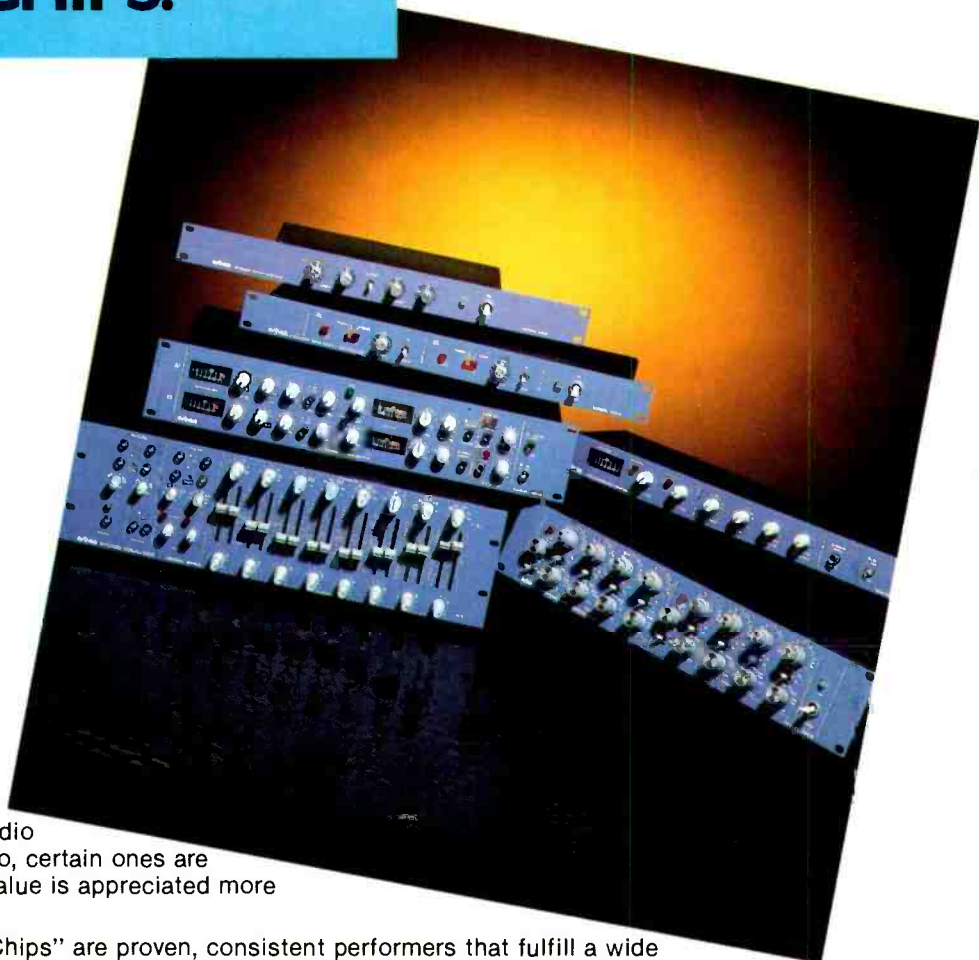
This latter pair of mics is further characterised by the more pronounced tapering of the body towards the capsule head. The remaining difference between the models is that 4006 and 4007 operate on standard 48 V phantom powering while the other pair requires the B&K 2812 2-channel power supply which uses a 130 VDC powering system for the preamp giving a significant increase in headroom, 18 dB higher output in balanced mode and operation in a transformerless mode. It is really intended to meet requirements for minimal signal path recording and as such there would probably be little advantage in using this system over the standard phantom power models within the multitrack studio environment.

The remaining products are the matched pair kits which comprise a matched pair of 4003s in the 3529 kit and 4006s in the 3530 set. Additionally the 3529 has the power supply for the 4003 mics (the others are of course phantom powered) while both have a sonically designed stereo boom bar, mic clips and windshield, cables and three interchangeable grids—the standard pair and the UA 0777, which looks quite different to the others. It is most easily described as a 'nose cone' and its function is to increase the linearity of omnidirectional HF response. Due to the body of the mic shadowing the capsule, HF response on all omnis is always down at the rear of the capsule, ie the mic is less omni at HF. I was shown measurement being made in the anechoic chamber and with the standard grid, response at 15 k was almost 10 dB down directly behind the mic. With the nose cone grid on, the behind capsule HF response was held within 0.6 dB up to 20 kHz.

To achieve the matching for these kits mics are paired to within 1 dB across the complete frequency band, tracking within 10° phase response and less than 1 dB difference in sensitivity. This having been said, apparently most of the mics being produced after three years of production are very close to this specification anyway and therefore the specifically matched pair is probably suited to only the most extreme quality requirements.

The only thing I have not mentioned so far is that *all* the mics are omnidirectional, which is not the most used of mic patterns within most modern recording requirements. Why?

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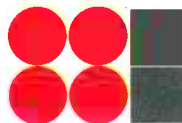
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412A/414A Compressor/Limiter: Transparent level control delivers the punch without the bruise. Very cost-effective. Ideal for installations and reinforcement work.

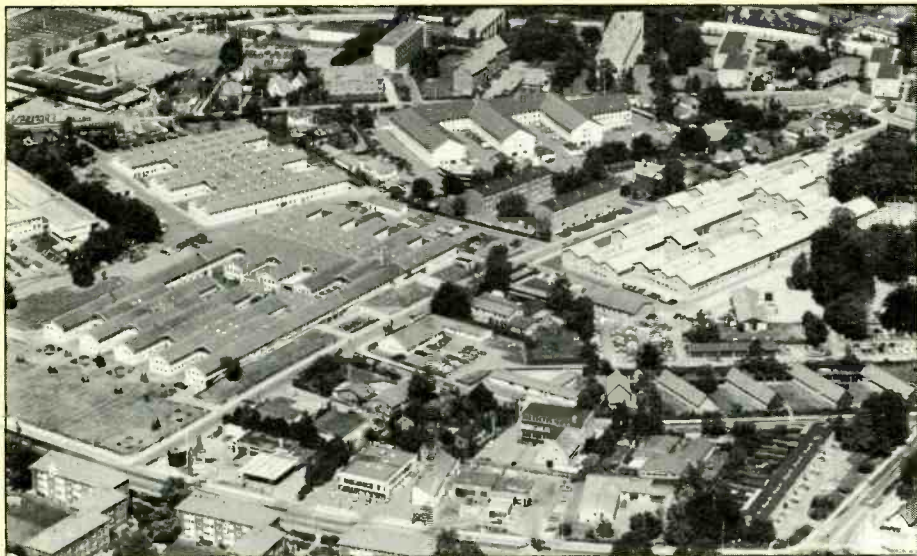
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B&K Naerum 1987

BRUEL & KJAER

The 4000 philosophy

Although it does not seem very widely understood, a mic capsule is inherently omnidirectional. To achieve directionality there are a number of differing techniques but in fixed pattern type microphones these normally require some form of porting in the form of apertures and other devices, which are naturally going to have some effect on sound quality. In the case of the cardioid pattern, for example, the low frequency response is generally compromised unless used very close to the sound source.

If we consider these points in conjunction with the B&K perfectionist philosophy then you can see why it would not be acceptable to them to produce anything that does not give the optimum performance possible from the given approach. In their eyes anything other than omni would have been a compromise of the worst sort. Don't expect to see any other pattern mics from B&K until they have convinced themselves that they have optimised the possible results.

There was, however, another side to this matter. B&K had been manufacturing instrumentation microphones since 1958 for a very wide range of applications. The requirements of such mics generally are for an extended HF response way beyond normal audio, high sensitivity and high SPL handling. The extended HF response was an attraction to some engineers (particularly in the US) not so much that they were interested in recording 60 kHz but it meant that any unpleasant aspects of the top HF response would be well out of the normal audio band.

Philip White, manager Electro-Acoustic division: "A number of people had been using a ¼ in instrumentation mic called the 4135 to record piano (perhaps with as many as two or four mics) and sax. Unfortunately the noise floor would be a little high but when used quite close it was not prohibitive. Some interest was also shown in using the ½ in types although the noise floor was still a little too high for orchestral or voice work. Some recordings had also been made with 1 in mics but with this size you start to hear the dimensions of the capsule—the off-axis sound is

rounded off, a little woolly."

B&K was receiving a small number of requests from outside the company for an application of their instrumentation mics for recording use. Although there was already some thought being given in-house to such a project it was an area that they did not have a great deal of expertise in at the time. A development programme was started and much liaison with external users was made, in particular with the engineers of the Danish Broadcasting Corporation who added the stipulation that any high spec mic should also be unbreakable!

Philip White: "The 4007 was designed to emulate many of the qualities of the ½ in mics—high SPL handling and high omnidirectionality. We then wanted to develop another mic that had the same sensitivity and noise floor as the 1 in mic but without the same size so that the HF shadow effect would be minimised and that is how the 4006 came about."

Within B&K there was also a great deal of interest in the studio mics on a personal level. Many of the people that I talked to said they had

Anechoic chamber being used for research and development



sometimes borrowed pairs for the weekend to record music, often their own.

R&D

One of the tools available to the R&D department is a CAD system for mic design. The programming was all done in-house and it allows the designer to try out ideas that previously might have meant going to prototypes. You make certain decisions on basic capsule parameters and then when a design is complete it is possible to display tabulated results or curves for noise, frequency response, phase, etc. You are also able to apply freefield correction to the results to give a more realistic set of results. (This correction is to allow for disturbances in the soundfield caused by the presence of the mic itself.) There are also separate programs for modelling electrical circuitry. The programs can also be used for design of mics with polar patterns other than omni but to quote Ole Brøsted Sørensen, head of professional microphone R&D, CAD systems such as this really show that "Cardioid microphones are just made of compromises."

Other aspects of the R&D work included investigation into HF resonance, standing waves and reflections around the mic and within it. As a consequence, the internal design of the mic and grid has a degree of randomness to reduce standing waves, and other problems were designed to be out of the audio range.

In the story of the development of studio mics, the name of Poul Ladegaard kept recurring. He is one of those rare people who manages to combine a fine pair of ears with a full understanding of the higher aspects of audio. Outside B&K he is known for the monitoring system at Puk studios and within B&K he has given direction to the R&D work on the studio mics. The R&D department, primarily used to designing measuring mics, initially found some difficulty in understanding why music recording mics had to out-perform measuring mics in some limited areas. Some practical demonstrations with experienced engineers consistently identifying mics from simultaneous recordings convinced the engineers of the need for this degree of performance. Poul knew the level of performance they wanted and it seems he was instrumental in delaying production of the mic for over a year until the response beyond 20 kHz remained flat leading to a gradual tail-off. As a result of this work there has been some feedback into instrumentation mic design.

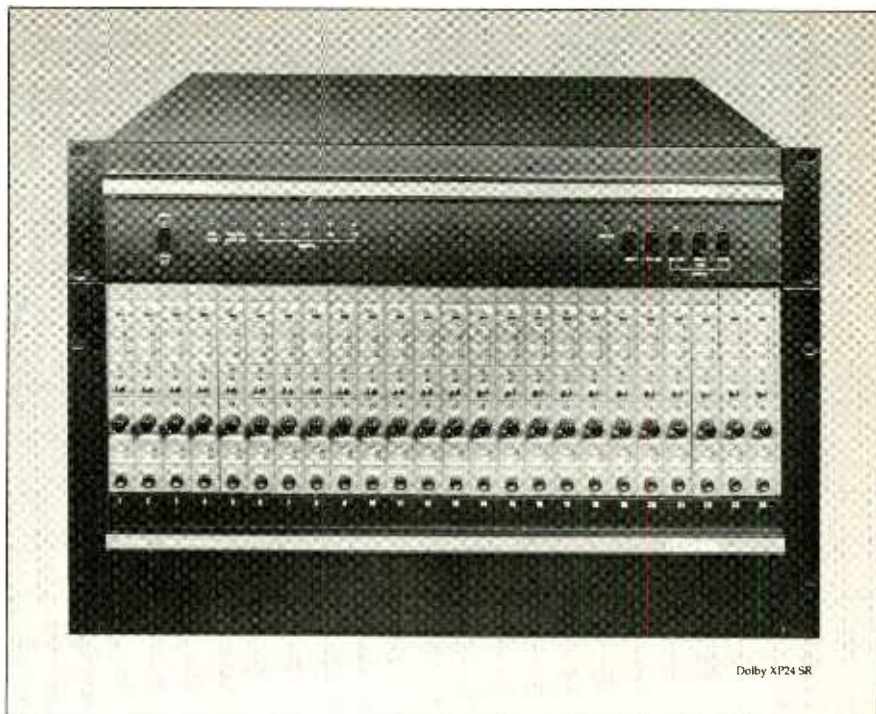
Resources available to the R&D department include two anechoic chambers and a reverberation room. The chambers use the 'acoustic jungle' principle, which consists of different sized cubes of absorbent material hung on wires in a random manner, which differs from the use of wedge-shaped absorbers. B&K claim that such a room is not only cheaper but also does not degrade over time. The reverberation room is irregularly shaped with angled finishes on the walls and ceiling. Standing in the middle of this room, it is virtually impossible to understand what is being said to you only 6 ft away because the reverb field is so intense (the RT is 15 s).

Mic manufacture

According to Karl-Erik Rask Jørgensen and Niels Jørgensen who manage the departments manufacturing microphones, there are over 180 different stages of manufacture. Only about 20 of these processes are purely mechanical and do not

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Lapping and final polishing operations on mic housing and backplate



Clean room assembly of mics by Neils Jørgensen

have any effect on mic performance. As a result of this the manufacture of the mics is treated as a craftsman's job. Almost all those in the section have been there over 10 years and appear to take great pride in their work.

One of the first things that surprises people about the 4000 range of mics is that technically they are electrets. A polymer film is deposited on the back plate using a process that they are very proud of and rather secretive about. (There are a number of processes in the manufacturing like this.) The manufacture of the diaphragm material is also done in-house by a fairly unique process that no-one was too keen to talk about. The resultant material is a nickel foil of about 2.2 to 2.5 micron thickness but so strong that it is almost impossible to tear with your hands. This foil is fixed over the rings and then soldered to form the diaphragm. This is a very delicate operation as the handling of material this thin is very difficult and it takes an experienced eye to check that the foil being selected is acceptable.

QC and documentation in clean room



After this these diaphragm assemblies are viewed in a dark room for pin holes in the membrane material and are discarded if present.

The backplate is assembled in a very high level clean area because with many of the mics, particularly some of the very small measurement types, the precision requirements are on a par with watchmaking.

One of the questions once asked of mics using pre-polarised material was, 'how long do they retain their charge?'. B&K have a very involved process whereby they cook assemblies to induce long term stability. The components are then subjected to 86% humidity and then they are checked to see how they have retained their charge. If they pass at that stage B&K are claiming a stability of 1/2 dB change in 900 years. At this point a polymer layer is applied to the diaphragm to protect against corrosion and great care is needed to avoid destroying the finely balanced mechanism and to maintain the design specification of the mic. The benefits are,

Individual calibration of mics



however, such that in certain rather extreme demonstrations mics have been used to stir a glass of mineral water and once shaken off, work fine.

Each mic is thoroughly tested for frequency response using an electrostatic actuator housed in a mini desktop anechoic chamber under computer-assisted control. The computer checks the response is within tolerance and prints out a plot that will accompany the mic. This spec is also held on disk against serial number for later retrieval if required.

Phase response and sensitivity are also checked. Matching of stereo pairs is currently done manually.

It was impressive how well-informed those working in one section were about the importance of their own work on the finished mic. For example, the department polishing the back plates knew exactly what effect scratches on the back plate would have on the completed mic and which were acceptable, an area many stages beyond its own work.

Summary

I have to admit that I was very impressed with Bruel & Kjaer. As a magazine we make large numbers of factory visits each year and B&K are unique, and I apologise if this seems as though it were generated by the PR department of B&K.

They do, however, have a problem on their hands. A manufacturer who introduces an omnidirectional mic into the pro-audio market has a product that is not readily accepted. Without a doubt the cardioid pattern rules. The problem facing B&K is that they not only have to introduce themselves as manufacturers of music recording mics (probably not so difficult) but also educate the industry about the virtues of the omni. There are signs that they are having some effect with regard to getting people to use them.

Within the last year, a Pro Audio group has been formed at B&K to deal directly with the pro audio market. They will provide easy liaison between the users and the R&D dept. The group has five members located in Denmark, UK and USA.

One exercise they undertake on quite a regular basis is that whenever a major rock concert takes place in Copenhagen they ask the sound crew to try some 4000s. From the initial resistance they have found that once the crew have tried the mic they are often favourably surprised. Apparently any preconceptions we have about the use of omni may not be correct—there is far less problem with feedback than might be thought and although there is more spill it is far less coloured and therefore not so much of a problem.

Within the studio omnis have a place and B&K are rather keen for people to try them for drum recording. They think that some of the problems that occur are due to highly coloured off-axis responses of most cardioids that pick up adjacent drums and so destroy the overall drum sound. They may well be right.

There is always a need for a fresh approach within recording even when the concepts are not really so new to the industry. Omnis are certainly worth looking at again and the effort that B&K have put into the 4000 series makes theirs especially worthwhile.

The development and expertise used in these designs is far beyond such a simple explanation as 'just an omni'. To quote Philip White, "We don't like talking about B&K omnis. It's much better to just call them B&K mics." □



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FOXHOLE

David Hastilow reports on a recording studio near Bristol

Martin Hilyer is a studio owner with visions of the future, for despite the demise of several studios in the Bristol area, he is planning a major recording facility, complete with two audio studios and a venue, for the centre of Bristol, a plan which he hopes to get off the ground before the end of 1987.

The present-day studio evolved from his combined interest in music and electronics, the former leading to his involvement in groups as a bass guitarist, and the latter to a career as an electronics engineer. Nowadays he can purchase used recording equipment and recondition the internal electronics and mechanisms, thus allowing him considerable savings in capital outlay, which in turn is reflected in the day rate of the studio.

The studio is situated at the southern tip of the Cotswold hills, in a large, oldish-looking converted barn. Martin takes up the story.

"In 1977 I went up to London and joined a punk band, did a bit of recording, then came back to Bristol and started another band. Because I'd always come from around here I knew where there were outbuildings, etc, for rehearsal rooms, and as a band, we wanted somewhere to rehearse permanently, and I found this place.

"It was crammed full of antique furniture, covered in dust. Despite the outside appearance the building is only about 18 years old. It was built originally as a flat for the caretaker of the nearby farm but never finished. I came in with the band and rehearsed with them for 12 months. As it happened, we only did two gigs then split up, but I decided then that if I didn't turn this into a studio I probably wouldn't get another chance, so I did.

"Not quite as simply as that though. It took me 18 months from the time of deciding to build it to getting the first band in. I rebuilt the floor, suspending it by putting a new joist that goes opposite to the main ones every 18 in and there is glass fibre insulation in between as well. It's not physically suspended but it is separated from the main floor. There are people living underneath on the ground floor but very rarely do they cause any problems. Then I put in the studio/control room partition, the drum booth and the live room. It wasn't all worked out beforehand. I did it as I went along which was a bit of a mistake as far as the installation of wiring goes. There came a point when I had to cut back into the floor to get the wiring back in, that's all. There are some problems with being out in the countryside, such as no amenities, etc, but this is counteracted by the fact that there's no interruptions, just plenty of peace."

All the work was done while Martin was also fulfilling electronic engineering contracts—prior to this he'd worked in the assembly and testing of RSD mixing consoles. But for the studio, it started with absolutely nothing in the way of brand name equipment other than a Tascam 8-track which was originally purchased for recording the band.

Martin continues: "I built the first console myself, but that was soon replaced by an Allen & Heath *System 8* 16/8 console. Then one Fostex delay was added and shortly after that four *Accessit* units, reverb, compressor and two parametrics. But the 8-track was very limiting (pun not intended); during one session in particular we had three instruments per track, instruments like mandolins and violins. It soon became obvious it's not the best way to work. Also, the microphone range was built up from nothing."

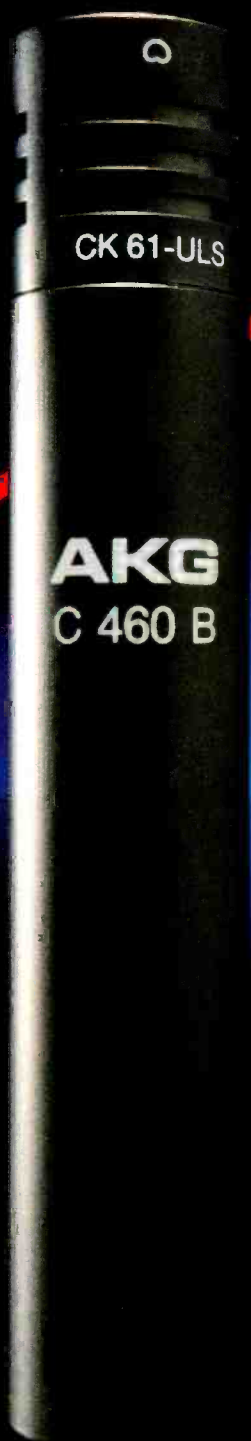
Needless to say, the 8-track setup was soon superseded by 16-track. In this case, a 100 series Scully 2 in machine.



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FOXHOLE

"It's an old classic but they gained a bit of a bad reputation for chewing tape up. As soon as I got it, I went right through the electronics, particularly the logic circuits, but also I discovered that hitherto someone had incorrectly set the internal voltages making the tape-tensioning all wrong. The heads were all over the place too but now it's running really well."

To facilitate the increased track capability, instead of acquiring a purpose-built 16-track console, Martin simply hooked



another *System 8* on to the existing one, giving 32/18 and 48 on the returns.

"At the time I thought it was the best quality for our budget. There are a few things lacking on it because the *System 8* is designed primarily for 8-track studios, but I don't place more importance on the desk than microphones and tape machines. I think they are more important."

To compensate for the limited EQ facilities, Martin practises a 'right microphone' for the job philosophy. His collection has now grown from small beginnings to a comprehensive range including Neumann, AKG *C451* and *D12s*, Sennheisers and Shures. There are also, from the less expensive range, many AKG *D80s*.

"Each microphone has its own individual characteristics and through carefully noting that response to particular instruments, one is able to work creatively within the limitations of the system. For instance, I have a Shure *SM78*, which is similar to, but smaller than, the *SM58*. It is particularly suited to snare drum applications, having an overall flat response but with a crisp, clear, top end."

Critical analysis of his microphone technique led Martin to choose Tannoy speakers for the control room monitoring.

"They are the perfect choice for this studio and the way I work it, having a natural 'uncoloured' sound on which I can always rely for a reference standard. This control room has minimal acoustic treatment but the sound is good and people like it. And I know exactly how hard to drive the monitoring before changes in the sound become significant or simply unworkable. But I realise that musicians coming in here for the first time have no reference, they're firstly not accustomed to big speakers and, secondly, the sound of this room, so for them there are Auratones and Yamaha *NS-10s* to bridge the gap or at least break the ice!"

The studio area, including its associated acoustic treatments, is constructed entirely of wood, thus achieving a naturally live environment well suited to the operatic and classical performances that have already been recorded in it. But the recent purchase of a Yamaha *REV7*, Bel delay, Aphex *Aural Exciter*, a Roland *SE 3000* and a Rebis *Rack* confirm the studio's popularity with reggae, synthesiser and other contemporary musicians. At the time of writing an 11-piece jazz band were in doing a live recording.

"The work load is about 50/50 demos and masters; groups who want a quality product to cut to disc or present to a record company but have only limited funds available. Numerous singles have been recorded here, there are four out at the moment and one at the cutting room. People like working here, it's relaxed, light and airy, and all the wood retains a bright, untiring sound."

From the engineering position, whilst pondering the miracles of musical science and recording technology, or rolling a cig, the engineer may survey the rural aspect through windows at either end of the console, and while the present layout isn't totally ergonomic, Martin has plans to eventually replace the Scully with an *MTR-90*, although clients requiring 24-track at the moment may hire the machine in, and move the position of the effects equipment to above the console meters where their parameters may be more easily adjusted.

Apart from recording bands in the studio, Martin also manages and produces them too.

"The only way to produce a band is to be totally involved with them and their music. Major artists are yet to record here but the studio attracts the top end of the independent market. I'm not competing with the other larger studios around here, who have SSL, etc. This is a budget system, used to its fullest. At the end of the day the product is comparable with that from other, larger studios with much more expensive equipment, facilities and overheads. Record company reps come here and they are impressed by what they hear, and from their comments I know that the name Foxhole will, by the end of the year, be more prominent than it is at the moment. There have been teething problems but now they're virtually ironed out, the studio is beginning to tick over, so a period of consolidation is ahead, through which the studio may grow. Expansion here won't really be possible, that is why future developments are being envisaged for the centre of Bristol." □

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VOICINGS ON VOCAL MICS

Approximately 18 months ago we became rather curious about which microphones were currently in use for vocal recording. This curiosity stemmed from the fact that there was an ever-increasing number of suitable new vocal mics becoming available, many of which clearly out-performed the established 'standard' mics, but we felt there was little indication that engineers were changing from their familiar models to any great degree. We felt that it would be interesting if this could be investigated to produce some specific data. This is particularly relevant as the human voice is perhaps the last 'instrument' that has to be recorded with a mic no matter what your musical style. (Sampling and synthesis are only partial answers for the voice and Dling is rather unpleasant!)

So, early in 1986 we compiled a very basic questionnaire asking just six specific questions on vocal microphones and a further two allowing the person completing the questions to qualify his replies further should he or she wish to. Nearly 450 of these were sent out to a cross section of studio-based and freelance recording engineers throughout the world largely chosen at random, within certain limits.

Unfortunately the response was rather poor. We don't particularly like being asked to fill in questionnaires either but we thought that the simple and open nature of the enquiries would have found far more positive response particularly as the final information would presumably have been of interest as well. But it was not to be and rather sadly we filed all the information away.

Towards the end of last year we decided to have another go with the same questions. The initial mail-out was repeated with all those who had replied before being mailed a copy of their previous answers to check that they were still correct. We also mailed a further several hundred engineers worldwide. This time the response was very good and there are now enough replies to present some meaningful results.

Whilst the results show a number of patterns of use and may be used to identify certain overall vocal recording microphone consistencies, great care needs to be taken in any further interpretation, if indeed any is possible. The survey specifically targeted studio engineers—not live sound nor broadcast engineers. Odd regional discrepancies can be caused by regional differences in price and distribution affecting numbers in use; and also the fact that replies from certain parts of the world were so low that there was no way

The Questionnaire

Name _____ Studio (if any) _____

The situation is: you are about to work with a singer you have never recorded before.

1 What is your first choice of mic for recording male vocal? _____

What is your second choice? _____

2 What is your first choice mic for recording female vocal? _____

What is your second choice? _____

3 What is your first choice mic for recording backing vocals? _____

What is your second choice? _____

4 Would your choice differ according to the type of music you are recording? Is this more important than the singer being male or female? _____

Have you any further comments to make? _____

that meaningful regional breakdowns could be prepared for those areas although the figures were included in the global totals.

For these reasons we would discourage manufacturers from making any statements that don't recognise these shortcomings. Remember these are not sales figures but the preferred choices of recording engineers who seem to have been generally very realistic: they always made it clear that their choice was made from the mics that would generally be available to them not from some 'cosmic wants' list.

So here we present our vocal mic survey and hope that you find it of some interest. We would like to thank everyone who took part and for your comments, both positive and negative.

The Comments

Tim Hunt, Marcus: The microphone technique of the singer is more important than the choice of vocal microphone. A great singer will sound great through almost any commonly available studio microphone.

Laurent Thibault, Le Chateau: A lot of singers have no bass response when they are shouting. Some who sing softly have a lot of difference of dynamics, more than with a powerful singer. The size of the mouth is very important. RE20 is good for large mouths.

Mal Luker, Arco: The mics listed are not always used as stated. The final choice is based on factors like how I feel at the time, how far I have to walk to find a microphone, mood, etc.

Gerry Kitchingham, R G Jones: I think a choice of limiter/compressor is more important than a choice of mic when recording different types of music.

Stephen Lipson: The answers are very academic as there are many other variables, ie music, desk, mood, limiters, singer, etc.

Brian Robson: Because the vocal is generally the thing that most people listen to for melody I find it important that the sound recorded does not need to be equalised excessively on the mix in order to ensure clarity, etc. The microphone must capture the sound and characteristics of the vocal in such a way that the natural quality of the sound allows it to sit in the track.

Dennis Weinreich, Videasonics: The choice is always down to texture.

All microphones are possible vocal mics. Depending on the space in the track and the match between the voice and mic. It's experience and trial and error. The other key thing is pattern. The U47 valve is so broad in cardioid that a singer who moves around a lot will be treated very kindly by it. On the other hand the Shure SM54/53 is a great vocal mic but with a narrow pattern. If your artist is able to use it the 53/54 will knock most of the popular condenser mics right out of the box.

Patrick Makin, Soundshop: For those who have forgotten, rediscover omnidirectional patterns for all types of vocal recording.

Paul Northfield, Le Studio: Type of compression would be more important to me with respect to the style of music than detailed comparisons of mics, obviously certain mics being more appropriate than others in any given situation.

Bill Titus, Sear Sound: The voice rather than style is the determining factor. With a singer I have never worked with I will quickly try all three mics listed (C12, U67, U47), male or female. If one doesn't sound great then something's wrong with the singer!

Phil Kapp, M&I Recording Enterprises: The actual mic (as opposed to just stating a brand and model number) is also important. Especially in dealing with older tube-type mics, the difference between two mics of the 'same' type can be great.

The Editor

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AKG Tube	6%
Calrec Soundfield	4%

Other preferences below these figures:
 Bruel & Kjaer 4007, Milab DC-63,
 Neumann KM66, Neumann TLM 170,
 Neumann U89, Sanken CU-41, Schoeps
 CMC5/MK 2, Shure SM87

USA and Canada

AKG C414	18%
Neumann U47	18%
Neumann U87	12%
AKG C12	10%
AKG Tube	6%
Neumann M49	6%
Neumann U67	4%
Telefunken ELA M 251	4%

Other preferences below these figures:
 AKG 535, AKG C24, custom tube,
 Neumann TLM 170, Neumann U48*,
 Sanken CU 41, Schoeps CMC5/MK 4,
 Sennheiser MD421, Shure SM5B,
 Telefunken U47*

Europe

Neumann U87	23%
Neumann U47	15%
Neumann TLM 170	12%
Neumann U89	12%
AKG C414	8%
Shure SM58	8%

Other preferences below these figures:
 AKG Tube, Bruel & Kjaer 4006, Bruel
 & Kjaer 4007, Neumann M269,
 Neumann U67, Neumann U86*

Worldwide

Neumann U87	24%
Neumann U47	21%
AKG C414	12%
Neumann U67	8%
AKG Tube	5%
AKG C12	4%
Neumann TLM 170	4%
Neumann U89	4%
Neumann M49	2%
Bruel & Kjaer 4007	1%
Calrec Soundfield	1%
Sanken CU-41	1%
Shure SM58	1%
Telefunken ELA M 251	1%

Other preferences below these figures:
 AKG 535, AKG C24, Bruel & Kjaer
 4006, custom tube, Milab DC-63,
 Neumann KM66, Neumann M269,
 Neumann U48*, Neumann U86*,
 Schoeps CMC5/MK 2, Schoeps
 CMC5/MK 4, Sennheiser MD421, Shure
 SM87, Shure SM5B, Telefunken U47*

* We have been unable to verify these model numbers

Female vocals 1st choice

UK

Neumann U87	25%
Neumann U47	21%
AKG C414	13%
Neumann U67	9%
AKG Tube	6%
Calrec Soundfield	4%
Neumann TLM 170	4%
Sanken CU-41	4%

Other preferences specified below these figures:
 AKG C12, AKG C28, Bruel &
 Kjaer 4007, Milab DC-63, Neumann
 KM66, Schoeps CMC5/MK 2, Shure
 SM85, Sony C48

USA and Canada

Neumann U87	15%
Neumann U47	14%
AKG C414	12%
AKG C12	10%
AKG Tube	8%
Neumann M49	6%
AKG C24	4%
Sanken CU-41	4%
Schoeps CMC5/MK 2	4%
Telefunken ELA M 251	4%

Other preferences below these figures:
 AKG 535, custom tube, Neumann
 KM84, Neumann KM86, Neumann TLM
 170, Neumann U48*, Neumann U67,
 Shure SM5B, Sony C500, Telefunken
 U47*

Europe

Neumann U87	27%
AKG C414	12%
Neumann TLM 170	12%
AKG Tube	8%
Neumann U67	8%
Neumann U89	8%

Other preferences below these figures:
 Bruel & Kjaer 4006, Bruel & Kjaer
 4007, Neumann M269, Neumann U47,
 Neumann U86*, Sennheiser MKH416,
 Shure SM58

Worldwide

Neumann U87	21%
Neumann U47	14%
AKG C414	12%
Neumann U67	10%
AKG Tube	6%
AKG C12	4%
Neumann TLM 170	4%
Sanken CU-41	3%
Neumann M49	2%
Neumann U89	2%
Schoeps CMC5/MK 2	2%
AKG C24	1%
Bruel & Kjaer 4007	1%
Calrec Soundfield	1%
Telefunken ELA M 251	1%

Other preferences below these figures:
 AKG 535, AKG C28, Bruel & Kjaer
 4006, custom tube, Milab DC-63,
 Neumann KM84, Neumann KM66,
 Neumann KM86, Neumann M269,
 Neumann U48*, Neumann U86*,
 Sennheiser MKH416, Shure SM58,
 Shure SM5B, Shure SM85, Sony C48,
 Sony C500, Telefunken U47*

* We have been unable to verify these model numbers

Male vocals 2nd choice

UK

Neumann U87	32%
AKG C414	23%
Neumann U47	19%
Shure SM58	6%
Neumann U67	4%

Other preferences below these figures:
 AKG C451/CK5, Beyer M201, Electro-
 Voice RE20, Milab BM-73, Neumann
 KM86, Neumann TLM 170, Shure
 SM57, Shure SM7, Sony C48

USA and Canada

AKG C414	27%
Neumann U47	25%
Neumann U87	15%
AKG C12	6%
Electro-Voice RE20	2%
Neumann U67	2%
Telefunken ELA M 251	2%

Other preferences below these figures:
 AKG C24, Bruel & Kjaer 4007,
 Neumann TLM 170, Neumann U48*,
 Sanken CU-41, Schoeps CMC5/MK 2,
 Telefunken U48*

Europe

Neumann U87	27%
AKG C414	19%
Neumann U47	15%
Electro-Voice RE20	12%
Neumann TLM 170	8%
Neumann U67	8%

Other preferences below these figures:
 AKG Tube, Sanken CU-41, Sennheiser
 MD441

Worldwide

Neumann U87	24%
AKG C414	22%
Neumann U47	21%
Neumann U67	6%
Electro-Voice RE20	4%
Neumann TLM 170	3%
Shure SM58	3%
AKG C12	2%
Sanken CU-41	1%
Telefunken ELA M 251	1%

Other preferences below these figures:
 AKG C24, AKG C451/CK5, AKG D202,
 AKG Tube, Beyer M201, Bruel & Kjaer
 4007, Milab BM-73, Neumann KM86,
 Neumann U48*, Schoeps CMC5/MK 2,
 Sennheiser MD441, Shure SM57, Shure
 SM7, Sony C48, Telefunken U48*

* We have been unable to verify these model numbers

Female vocals 2nd choice

UK

AKG C414	25%
Neumann U87	25%
Neumann U47	15%
Shure SM58	6%
AKG C12	4%
Neumann U67	4%

Other preferences below these figures:
 AKG C451/CK1, AKG Tube, Beyer
 M201, Bruel & Kjaer 4007, Milab
 DC-96, Neumann KM86, Neumann TLM
 170, Neumann U48*, Neumann U89,
 Sanken CU-41, Shure SM7, Sony C48

USA and Canada

AKG C414	29%
Neumann U47	25%
Neumann U87	13%
Neumann U67	10%
AKG C12	4%
RCA 77	4%

Other preferences below these figures:
 AKG Tube, Neumann M49, Neumann
 TLM 170, Neumann U49*, Sennheiser
 MD421, Sennheiser MD441, Sony C500

Europe

AKG C414	35%
Neumann U47	19%
Neumann U87	19%

Other preferences below these figures:
 Neumann TLM 170, Neumann KM84,
 Neumann U67, Sanken CU-41, Schoeps
 Collette M/S, Sennheiser MD441, Shure
 SM7

Worldwide

AKG C414	27%
Neumann U87	21%
Neumann U47	19%
Neumann U67	6%
AKG C12	3%
Neumann TLM 170	2%
Neumann U49*	2%
Shure SM58	2%
AKG Tube	1%
Neumann M49	1%
RCA 77	1%
Sanken CU-41	1%
Sennheiser MD441	1%
Shure SM7	1%

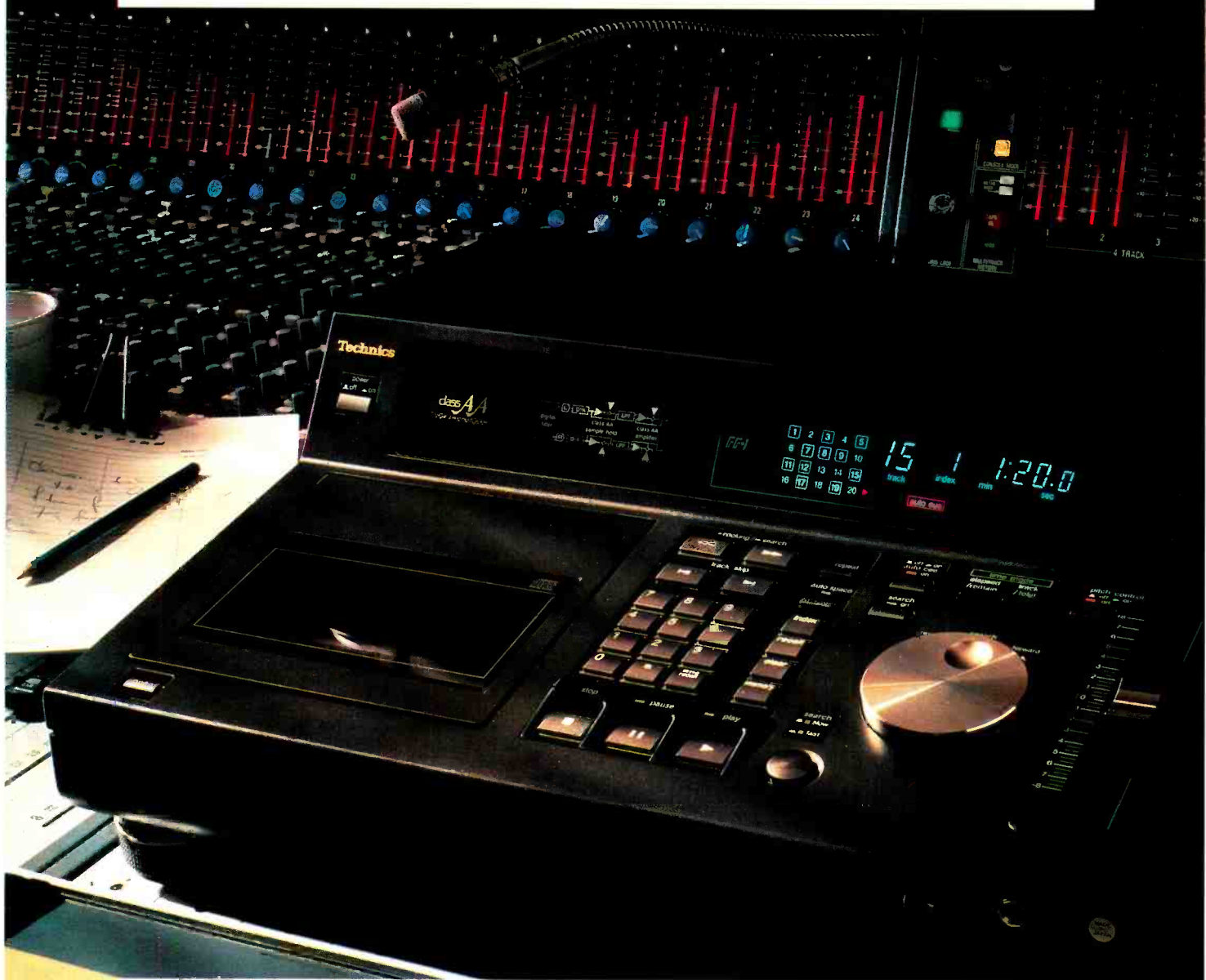
Other preferences below these figures:
 AKG C451/CK1, AKG D224, Beyer
 M201, Bruel & Kjaer 4007, Milab
 DC-96, Neumann KM84, Neumann
 KM86, Neumann U48*, Neumann U89,
 Schoeps Collette M/S, Sennheiser M421,
 Shure SM57, Sony C48, Sony C500

* We have been unable to verify these model numbers

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as long as you



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VOICINGS ON VOCAL MICS

Backing vocals Europe 1st choice

UK

Neumann U87	47%
AKG C414	13%
Neumann U47	11%
Neumann U67	8%
AKG Tube	4%
Shure SM85	4%

Other preferences below these figures:

AKG C12, Calrec Soundfield, Milab DC-63, Neumann TLM 170, Sanken CU-41, Schoeps CMTS 501, Sony C48

USA and Canada

AKG C414	32%
Neumann U87	22%
AKG C12	10%
Neumann U47	6%
AKG C24	4%
Schoeps CMC5/MK 2	4%

Other preferences below these figures:

AKG Tube, Bruel & Kjaer 4007, Crown/Amcron PZM, Neumann TLM 170, Neumann U249, Neumann U49*, Neumann U67, RCA 44, Sanken CU-41, Sony C37

Neumann U87	42%
Bruel & Kjaer 4006	12%
Neumann U89	12%
Neumann TLM 170	8%

Other preferences below these figures:
AKG C414, AKG Tube, Neumann KM88, Neumann U67, Neumann U86*, Schoeps CMTS 501, Shure SM58

Worldwide

Neumann U87	37%
AKG C414	17%
Neumann U47	6%
Neumann U67	6%
AKG C12	4%
AKG Tube	3%
Neumann TLM 170	3%
Neumann U89	3%
Bruel & Kjaer 4006	2%
AKG C24	1%
Sanken CU-41	1%
Schoeps CMC5/MK 2	1%
Schoeps CMTS 501	1%
Shure SM58	1%
Shure SM85	1%

Other preferences below these figures:
Bruel & Kjaer 4007, Calrec Soundfield, Crown/Amcron PZM, Milab DC-63, Neumann KM88, Neumann U249, Neumann U49*, Neumann U86*, RCA 44, Sony C37, Sony C48

* We have been unable to verify these model numbers

Backing vocals Europe 2nd choice

UK

Neumann U87	25%
AKG C414	19%
Neumann U47	19%
AKG C12	6%
AKG C24	4%
AKG C451/CK2	4%
AKG Tube	4%
Neumann U47	4%
Neumann U89	4%

Other preferences below these figures:

Beyer M88, Bruel & Kjaer 4007, Calrec CM 2003C (omni), Neumann KM86, Shure SM58, Shure SM85, Sony C48

Neumann U87	50%
AKG C414	23%
Neumann U47	8%

Other preferences below these figures:
AKG C34, Electro-Voice BK-1, Neumann KM84, Neumann TLM 170, Sennheiser MD441

Worldwide

Neumann U87	28%
AKG C414	24%
Neumann U47	13%
Neumann U67	4%
AKG C12	3%
AKG Tube	3%
Neumann TLM 170	2%
AKG C24	1%
AKG C451/CK2	1%
Neumann KM84	1%
Neumann U89	1%
Sennheiser MD421	1%

Other preferences below these figures:

AKG 535, AKG C34, Beyer M88, Bruel & Kjaer 4007, Calrec CM 2003C (omni), Electro-Voice BK-1, Electro-Voice PL80, Electro-Voice RE20, Milab DC-96, Neumann KM86, Neumann M49, Neumann U48*, Schoeps CMTS 501 stereo, Sennheiser MD441, Shure SM58, Shure SM81, Shure SM85, Sony C37, Sony C48, Telefunken U47*

* We have been unable to verify these model numbers

USA and Canada

AKG C414	29%
Neumann U87	21%
Neumann U47	8%
Neumann U67	8%
AKG Tube	4%
Neumann TLM 170	4%

Other preferences below these figures:

AKG 535, AKG C12, Electro-Voice RE20, Milab DC-96, Neumann KM84, Neumann M49, Neumann U48*, Schoeps CMTS 501 stereo, Sennheiser MD421, Shure SM81, Sony C37, Telefunken U47*

The Comments

Kim Stallings, Mediasound: Quite often the producer and/or singer asks for a specific mic. Old habits die hard!

Fred Catero: There is no 'one' mic for a job. A good engineer can get a good sound with almost any decent mic.

Rajesh Jhaveri, Rave Recording Studios: Choices are due to the fact that a very limited selection of microphones can be purchased by our studio in India for economical reasons. All need to be long lasting and multipurpose. 100% to 240% import duties on studio equipment plus rates as low as £5 per hour for studio hire generally prohibit too huge and expensive an inventory.

Hatsuro Takakami: In the case of rock 'n' roll, it demands less in comparison with classic and jazz because it is conditioned to a certain degree by EQ, echo treatment and processing. It can be more effective and powerful to use a mic that has relatively a small range with dynamic type.

Martin Rushent: This is the most ridiculous survey I have ever refused to become involved in!

A greater proportion of replies felt that type of vocal/singer and/or type of music were major factors in the choice which would involve a certain degree of experimentation.

Even from a casual glance you have to notice that there are very few surprises in those mics which lead the categories in numbers. It shows how very conservative we are in selecting vocal mics and that on the basis of these figures newer models, even from the leading manufacturers, are not being readily accepted for first or second choices under any of the categories here. Not really possible to show fully, were some of the replies we received from engineers who will carry out quite exhaustive tests to find the right mic for that particular voice, experimenting with models that do not include any of the mics listed by anyone for first or second choice. One wonders who tires first.

The number of obsolete mics in use is another interesting factor particularly when you consider how many of them are valve (tube) types. The AKG Tube made a respectable showing to the extent of being the most popular of the 'newer' mics indicating that a taste for valve (tube) technology may be independent of sheer antiquity of the mic itself. The only other new mic to make any significant impact in numbers is the Neumann TLM 170.

I would have liked to subdivide some replies into versions, ie U47 valve (tube)/nivistor/FET, but replies were not specific enough so all have been totalled together. However, 95% of all USA replies listed their mics as tube (if they were) illustrating a greater concern over this.

Multipattern mics predominate for all the categories although it is interesting to note a small number of omnidirectional types. However, the total numbers of omnis does not necessarily show the extent of the use of omni pattern—most users seem to prefer using the multipattern types in omni rather than dedicated omnis. It would tend to suggest then that multipattern choice may be an influential factor in selecting a suitable mic.

I don't know if the use level of dynamic mics will be a surprise. I think I would have expected more, particularly when considering the studios included who are based in less developed markets. It turns out that these studios generally follow the most popular line in our survey. But I do find it strange that mics such as Electro-Voice RE20 should make a notable appearance as a second choice male vocal mic and then only otherwise appear as a second choice backing vocal mic.

You will find one or two unexpected mics mentioned—the Calrec Soundfield being perhaps the most surprising. Together with one or two other choices these mics suggest a very specific way of working with the engineer looking for something quite different to the demonstrated norm.

All in all you are not very adventurous in choice. I sensed that engineers may be finding it difficult to present artists with vocal mics other than those the artist recognises immediately, which is understandable considering the fact that the artist must feel confident with the vocal mic just as much as be happy with the sound. Further, the mic is just a single element in a sound chain and as such some people do not see the choice of model as that important. You do have to use a microphone, though, and it was that initial decision process that we saw as still being important no matter what processing you apply later.

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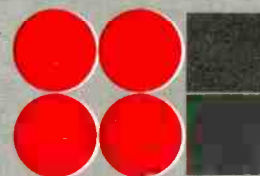
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MARTIN POLON'S PERSPECTIVE

To understand the impact of a world economy on the audio industry and the forces that propel change for entire economies, not just audio; it is helpful to take a stroll down memory lane. If we start in the late 1950s, say 30 years ago, we could find a typical English recording studio using Telefunken microphones, mixing with a hand-made console built in-house, recording to a Vortexion/Ferrograph tape machine and monitoring with Wharfedale loudspeakers and Quad amplifiers. In the United States, at the same time, we could find Western Electric microphones feeding an RCA console which in turn was sending signals to a Presto tape recorder while monitoring took place with RCA amplifiers and LCIA speakers. The product output of US and British professional audio manufacturers helped to establish the standards and equip many of the recording studios in the rest of the world.

Ten years later, in 1967, a typical English studio could have been equipped with a state-of-the-art staff-built custom console with components from any one of a half-a-dozen British audio electronics houses, using Neumann microphones to capture sound on a 4-track Ampex tape machine. The sound could have been monitored via Tannoy loudspeakers driven by Radford amplifiers. In the US the same studio could have had an Altec Lansing console feeding a multitrack Ampex and monitoring with Altec 604 loudspeakers fed by Altec amplifiers. Both countries were still net exporters in terms of the trade in professional audio equipment.

By 1977, both studios would have begun to resemble each other in terms of the use of microphones from the European Common Market, the universal usage of Dolby noise reduction, and Crown (or Amcron) power amplifiers driving JBL loudspeakers. The British studio would be likely to use a Neve console with Studer multitrack recorders while in the US, 3M machines could well be winding away from a signal fed by an MCI or Quad/Eight mixing board. Both countries had either become or were transitioning to the status of net importers of professional and (for that matter) consumer audio equipment.

In 1987, it would not be unusual to find in either country a studio where all the professional

audio products for virtually every use were made outside the country. In fact, although one could find on both sides of the Atlantic a 'Pan European' package of microphones from Neumann and Sennheiser, consoles from Solid State Logic, analogue and digital tape machines from Studer with monitoring supplied by Quedest loudspeakers; this might not be considered the norm—especially with the advent of the 'home studio'.

One would be just as likely to find an 'all-Japan' studio with digital tape machines from Mitsubishi, Sony or Otari; consoles from Sony or Mitsubishi or Yamaha; peripheral equipment from Yamaha or any one of a dozen other Japanese equipment makers; monitors from Fostex, Yamaha or others—etc. Both the United States and Great Britain have clearly assumed the status of net importers of high technology products for today's studio world of audio/video production and especially for the rising phenomenon of the home studio.

It is a curious fact that of all the audio equipment makers named in the above stroll down memory lane, precious few are still solely-held private concerns. Many have disappeared from the merchant electronic marketplace in total as with Presto and Ferrograph. Other major companies have quietly or not so quietly escaped the professional audio arena such as RCA with its complete line of studio audio, radio and television broadcast equipment and Western Electric (which transferred its audio line to Altec Lansing). Others have suffered from varying states of finances and undergone domestic acquisition by other companies as with Altec Lansing. Many have been acquired by foreign competitors as with Neve going to Siemens, MCI to Sony and Westrex and Quad/Eight to Mitsubishi. Some have dropped audio product ranges to concentrate on video and computer products, as Ampex did only to find the entire company placed on the sales block by recent parent Allied-Signal at the dawn of 1987.

So it seems a fact that no longer is the studio industry a major source of national pride in

Britain and the US, at least in terms of a sizeable export contribution to the gross national product. Times have clearly changed in the outward shipment of both studio audio hardware and consumer audio hardware as well as software in the form of records and tapes by domestically owned companies. In many cases, ultimate ownership has passed to foreign electronics giants who can afford the cost of developing state-of-the-art high technology professional audio equipment for a relatively low density marketplace by today's aggressive profitability standards.

One used to say that professional audio technology for the recording studio would 'dribble' down to the consumer marketplace. In today's climate of semiconductor development, the cost of producing a new digital audio chip must frequently be borne by the high powered consumer audio industry, with its \$10 billion sales volume in the US alone. The dollar volume of the worldwide professional audio industry has been estimated today to be in the range of \$300 to \$800 million depending upon what you label professional products (are home studio products professional or electronic music items?) and if you include the burgeoning sound reinforcement field. Contrast that to the computer industry, with its \$200 billion plus sales volume and research and development expenditures estimated in the range of \$20 billion. Computer product development accounts for a dollar figure that could approach 100 times that for the revenue of the entire professional audio industry.

This phenomenon has not been limited to the recording studio arena. Broadcasters and record companies were responsible for major contributions to the development of audio standards and professional equipment design. Those days have by and large passed into nostalgic history. Last year the BBC undertook major cuts in engineering expenditures, especially in terms of projects not contributing materially to the bottom line. The impending threat of having to raise licence fees or take on limited advertising has mandated the cost cutting. Similarly, the efforts of the IBA at Winchester and elsewhere have been impinged by finances. EMI/Capitol has reportedly seen significant deterioration of funding for audio-related research at its Hayes facility since its absorption by Thorn. Some question whether any significant audio work is going on at all. In fact, Thorn has been busily selling off the entertainment electronics assets of EMI for several years, seemingly to concentrate on computer, industrial and defence-related fields. The extensive Decca research programme into improving audio recording has been melded into parent Philips/Polygram. And so it goes on *ad infinitum*, or *ad nauseum* if you will.

In the United States, all three television networks changed hands in 1986. At CBS, founder William Paley and financier Laurence Tisch have taken control and instituted significant cost cutting and sales of several peripheral divisions. The CBS laboratory operation responsible for numerous breakthroughs in audio recording and reproduction was closed in one of Tisch's first acts. The Columbia record division was very nearly sold in a bid by current management in the \$1 to \$2 billion range but the dawn of 1987 saw the unit still in CBS hands. Co-ownership of the pioneering CD pressing facility with Sony in Indianapolis was relinquished. ABC was acquired

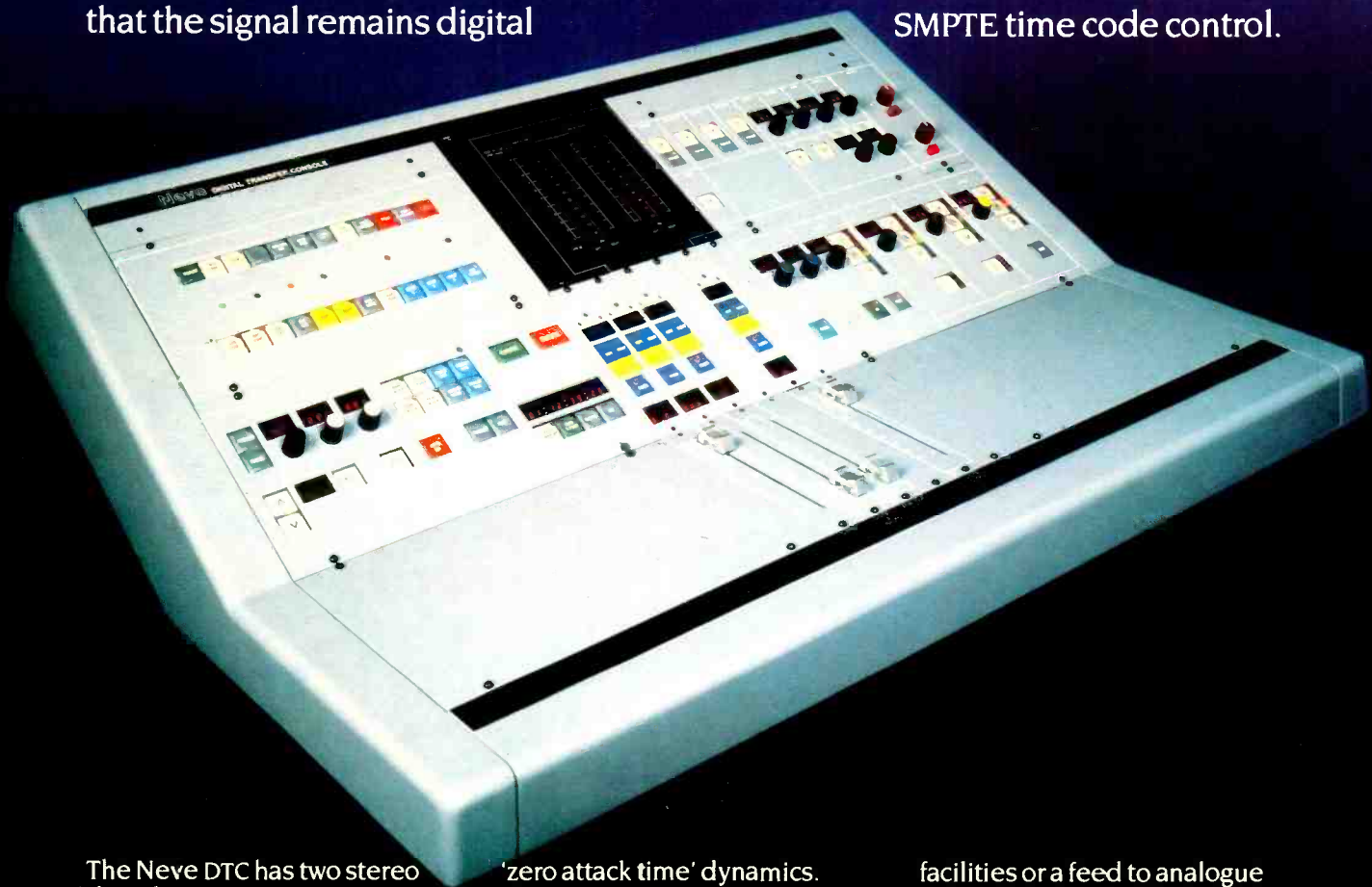
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MARTIN POLON'S PERSPECTIVE

by Capital Cities Broadcasting and immediately the first round of cost cutting began. NBC was purchased as RCA became the property of giant General Electric. Cost cutting at NBC was also implemented despite the fact that NBC was the only one of three American networks imminently profitable at the time. General Electric thought so little of the RCA-Ariola record division of RCA that it sold the entire operation—lock, stock and compact discs—to the German media empire of

Bertelsmann. The networks and their current or former record subsidiaries have agreed with the assessment that they can no longer financially afford to spearhead the development and application of new electronic entertainment technologies as they did previously with LP records and colour television.

The slow adoption of stereo television in the United States proves that point. Only NBC has made a major commitment in terms of

broadcasting over 80% of all programming available in stereo (much of the rest is non-network syndicated programming) and having nearly half of the 300-plus local television stations (less than ¼ of the total) stereo TV equipped as affiliates. In defence of these economies, it must be pointed out that both record and advertising revenues that had paid the bills for technological development had peaked in the late '70s and today's fiscal climate is indeed restrained.

Now it would be very easy indeed to write all of this off as yet another exercise in the relentless growth and associated cost of high technology. Yet the reality is one of a worldwide economy as much as of the technology. The US and Great Britain and inevitably the rest of Europe have not relinquished place or position in high technology across the board. What has been relinquished is production of goods that are not competitive in the economies of their respective countries. The US 'Star Wars' or the EEC's 'Eureka' could not be easily mounted in any of the wizard electronic manufacturing countries of the Orient without quantum investments of time and resources and virtual dislocation of other manufacturing priorities. But the shift of product development in audio has taken place in large part due to the efficiencies of manufacturing and product development resident in Asia. In Japan, the production of semiconductor computer chips has been nicknamed 'Industrial Rice'. A very telling simile indeed. It is not the technology that has forced the changes in the geography of production but the economies of scale offered by alternative geographies that have made the technology more attractive.

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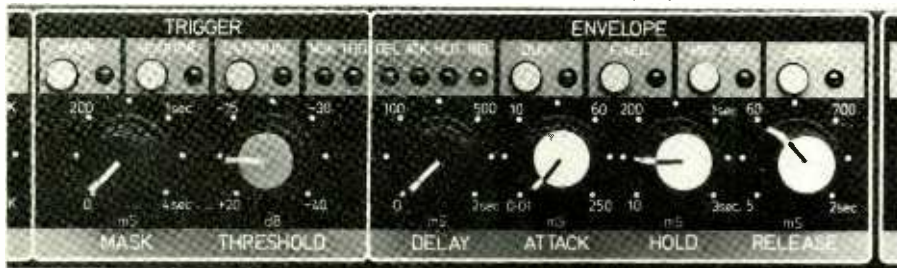
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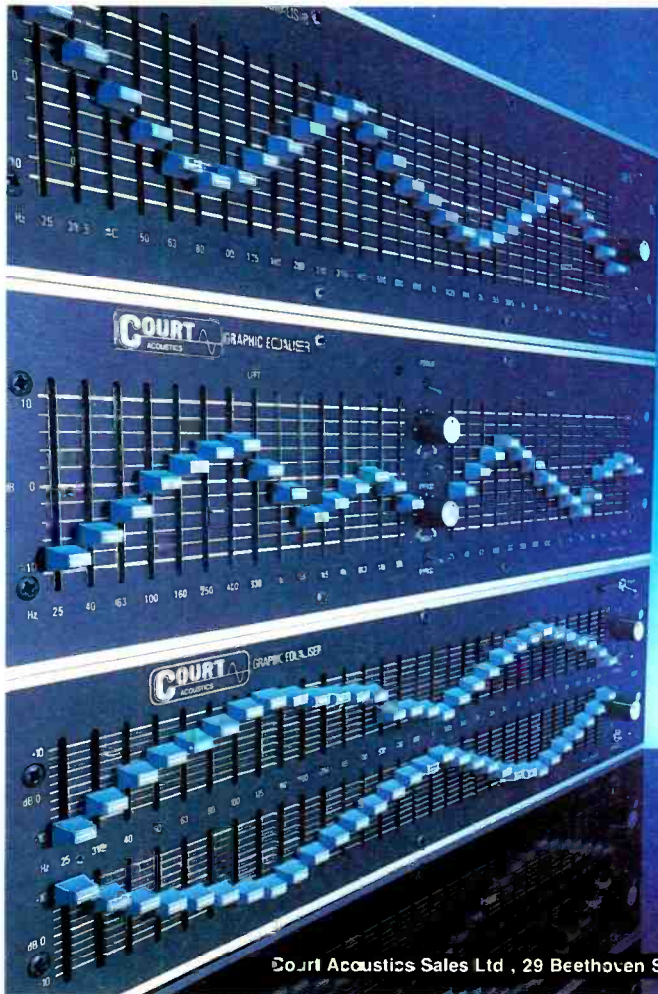
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Curiously, both the technology and financial cycles have been so foreshortened that the

Japanese and Dutch electronics giants who have swallowed so many domestic audio markets and companies in the US and Great Britain are themselves having difficulties with competition from emerging Third World manufacturing countries. Further, this cycle of change is not over. It is estimated, in the development of high technology electronics that increases in functional power and decreases in cost can be expected, accounting for a factor of 20% per year.

The 'Four Tigers' of the Orient are frequently cited as examples of this shift in productivity. Korea is seen as the most aggressive, followed by Taiwan, Hong Kong and Singapore. Often overlooked, India and China have, if that seems possible, even more promise in the long term than Korea or the other Tigers. This competition is felt in human terms as much as in the pressure of technology. Electronics plant workers who receive \$16 per hour in West Germany, \$14 per hour in the United States, \$12 per hour in the Netherlands, \$10 per hour in Japan, etc, will receive only \$4 per hour in Korea or Singapore and \$2 per hour in Taiwan and Hong Kong. The Japanese feel pressurised to counter this competition by using even higher technology to open up new marketplaces beyond the technical grasp of the Tigers. Hence, the recent strong push for success with home studio equipment, optical disc products and digital audio tape. Yet Japan has also conceded the existence of so-called Third World or non-aligned markets that could account for as much as a third of all audio equipment sold by 1995.

This is not to say that there is no justification for economic self-protection. Trade imbalances demand remedy, if only eventually. The next



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MARTIN POLON'S PERSPECTIVE

decade could bring incredible surpluses in audio, video and computer electronics as other countries begin the manufacture of technology-based products as well. At some point the incredible trade deficit of the United States and the impending balance-of-payments problem for Great Britain will have to be addressed. The real cost to both economies is measured by both the people and the politicians as the loss of manufacturing jobs. That perception exists today and will continue to raise hackles, even though in most cases the causes of national unemployment are

much more complex than just the presence of external competition. The presence of a 27% loss of factory jobs since 1979 in Great Britain, especially in the North, and a continuing 7% unemployment rate in the US coupled with a replacement of high paying manufacturing jobs with low paying service jobs, mandates trade issues for high visibility and potential action.

This could severely restrict, or cut off entirely, imports and exports of professional audio and video products and even components. The Japanese have recognised this possibility and are

taking measures to ensure their competitive positioning. To protect their major marketplace in the United States, Japanese companies are shifting production of mass market items to a broad range of manufacturing facilities already in existence or being built or purchased.

A list of Japanese electronics companies firmly ensconced in the United States is not necessary. What might be more useful is an accounting of those companies not based or basing in the US—it would be a short list. And that style is being used elsewhere. Numerous Japanese firms are chartered in the UK with 'Ltd' after their name. In Germany, Sony operates with a 'GmbH' added to its Asian identity. In short, the Japanese are both hedging their bets against the raising of trade barriers and solving the problem of repatriation of foreign profits (to Japan).

Today the fact that the world is awash in food is causing new tariff concerns over wheat,

citrus, olives, wine, brandy, hard liquor and full fat cheeses pitting the USA, the EEC and Japan against each other. Many describe the climate for world trade as the most perilous time since the disastrous trade wars of the late '20s and early '30s that helped to herald in the Depression. The glut in electronics could see similar trade walls erected. Akio Morita, the founding father of Sony, suggests in his new book *Made in Japan*, that the ease with which legislators single out industries that are marginal enough to tariff without measurable complaint from any sector is a current and historical fact. "I believe the world economic trading system is in great peril and the squabbles over specific trade issues and between countries only mask the real problems that are below the surface."

If the US and Japan do not resolve their current squabbles with the EEC, there is no way to predict which industries will be singled out to make an example. And of course, the discriminatory tariffs against Asian and American high technology products continue throughout the EEC and that concept appears to be gaining acceptance in the US.

The world audio industry must realise that it is just that: a world economic community. The time and energy spent on testing various kinds of toilet paper on studio monitor tweeters might well be better spent on lobbying governments keen on imposing disastrous trade restrictions. The audio industry has the energy to argue over whether there should be two pro-audio shows in London in the same year or in any year for that matter. That and similar energies must be focused on holding on to the trade advantages currently in place. Those who consume British gin in the United States may well continue to imbibe with the price increased by a 200% tariff. But British recording consoles will not sell nearly as well.

Morita provides a grim look at the economic present we all must work to change: "The world's economic system has slipped out of our control; increasingly, our economies are at the mercy of financial opportunists. Entire companies have become objects of exchange for the money traders, and great, old businesses are eating their own assets in pursuit of quick profits. Some nations are crushed under debt burdens they cannot hope to liquidate. And as some industrialists invest in the money trading game instead of the future, the ability of some countries to produce their industrial necessities is diminishing rapidly. None of this activity is helping to create the better, more stable world we say we want." □

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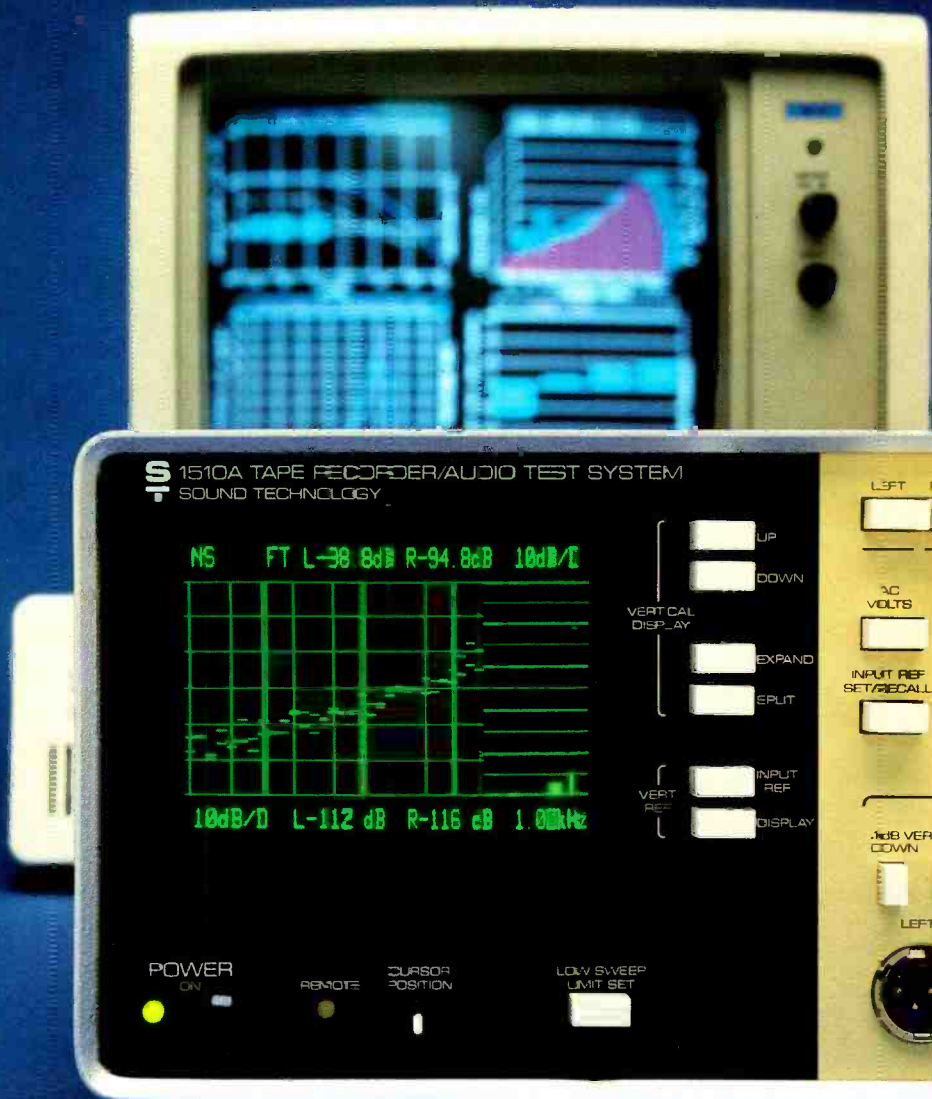
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BARRY FOX'S BUSINESS

A full year after the IFPI and RIAA first started lobbying American and Europe politicians for laws to make Copycode compulsory for DAT, CBS finally gave a semi-public demonstration of how the system works to stop recording and what it does to the music it protects.

On the first of a two-day industry shindig, around 200 record company executives from 20 countries, and a sprinkling of press, gathered in the Mayfair theatre to hear top brass of the IFPI preach the gospel of Copycode as the solution to home taping. Clearly most of the congregation were already converted. Enthusiastic applause greeted a string of DAT-attacks. Stanley Gortikov, Chairman of the RIAA, described the new format as 'Pearl Harbour'. A brave few in the audience who dared to suggest that they could hear the effect of the Copycode notch in the music played by CBS felt waves of hate.

For the IFPI and CBS and the record company execs who want DAT dead it was adjudged a good day indeed.

Never mind that Robert Summer, President of CBS Records, talked about Copycode preventing digital-to-digital recording. (It wasn't a slip of the tongue; it is in his written speech.)

Never mind Summer's admission that CBS will not start Copycoding its recording until legislation is passed to make the Japanese put Copycode chips in their recorders—thereby forfeiting the chance of future protection on back catalogue and missing the opportunity to demonstrate confidence inside CBS that Copycoding really is as inaudible as the company claims.

Never mind the admission by CBS that because the scanner circuit must be integrated with a DAT VLSI it will take "six to nine months of diligent work" for the Japanese to redesign their ICs; which means at least a year's delay on domestic DAT after any legislation is enacted.

Never mind that small studios and broadcasters will thus be forced to buy professional DAT hardware at 10 times the price, if they want to use DAT soon, and for dubbing.

Never mind, too, that there is now an unholy muddle over the IFPI's policy on taxing tape. Only George Martin "speaking personally and not on behalf of the IFPI" seemed able to put it clearly. "What the industry wants," he explained, "is a tax on analogue tape and Copycode for digital tape, but if we can't have Copycode we want a tax on digital tape too."

Politicians, who have been told for 10 years that a tax is the only answer to home taping, must be more than a little confused by all this talk of wondrous Copycode.

But never mind all this. Most people left Mayfair with the nice warm rosy glow you get

from mutual appreciation.

On the second day, at Abbey Road studios, things were rather different. Around 30 press and recording engineers, who had heard it on the grapevine, took CBS up on its sensible but belated offer of frank discussions on the technology of Copycode. I wish George Martin had been there.

The IFPI has officially endorsed Copycode and has taken to quoting Martin as someone who can hear no problems with the system.

"Please vote for Copycode," he implored at the Mayfair "I can promise you that every musician in the country wants it."

This endorsement carries a lot of weight because Martin is well-known and well-respected, both inside and outside the industry. But by his own ready admission Martin has only had the chance to hear encoded music provided by CBS. No one has had the chance to run their own A/B tests through an encoder because CBS has not yet let anyone have a decoder.

There is a world of difference between subjectively hearing nothing wrong with an encoded recording, and objectively being unable to hear the effect of encoding when compared with virgin reference material. Remember that CBS and the IFPI have repeatedly declared that the effect of Copycode is inaudible. That is the plank on which their lobby for legislation stands.

Politely but firmly, many of those present at the Abbey Road tests proved to CBS that this is patently untrue. The effect may be subtle and it may not always matter, but that is not the same as saying the effect is inaudible. It is like SQ, CX and FMX all over again. And, as with those systems, CBS is playing the moving target game. Criticism of the system demonstrated brings the response that the parameters are not yet finally set.

"There never was an SQ system," said one engineer with a long memory, "there was just a string of modified systems, all called SQ."

The puzzling difference here is that CBS says it stands to earn nothing from Copycode. The encoders will be sold at cost, around £2000 each. The Japanese will not have to pay a royalty. And developing and promoting the system has cost CBS "several hundred thousand dollars". It almost makes you feel sorry for the flak CBS is now getting.

In the USA the RIAA introduced two Bills into the US Senate and House of Representatives. These would require that any DAT recorders imported into the US must have a Copycode chip. The Bills would also make it illegal to defeat the system. Penalties include two years in jail. There was also an attempt at tacking the DAT and Copycode issue on to a much wider anti-Japanese trade bill. It failed because neither the US government, nor the EEC, nor the UK

government, wants the broad national issue of the East-West trade wars bogged down with a side issue like DAT, which they see as a parochial industry-to-industry dispute.

In the US, well-known audio writer and consultant Len Feldman described and demonstrated faults in Copycode to a rare joint Session of the US Senate and House of Representatives early in April. Feldman described Copycode as "a step backward" arguing that it "does, indeed, distort any music", making treated records "sound appreciably worse". Thus, said Feldman, anyone who bought records or tapes, or listened to broadcasts, would suffer—whether or not they had any intention of copying them.

Because Feldman could not get a CBS encoder, he made a replica circuit from CBS' published specs. Now CBS is saying that the specs are still being decided and thus the Feldman tests were invalid. At Abbey Road the notch was said to be 112 Hz wide and 90 dB deep instead of over 250 Hz wide and 60 dB deep as previously specified. Decca engineers warn that in their experience of filtering out rogue whistles, a narrow notch may be worse than a wide one. So expect more changes.

CBS had good reason to try to discredit Feldman. The Copycode notch is at 3838 Hz and CBS says this "does not affect the quality of music" because "it falls between the fundamentals, overtones or harmonics of notes on the musical scale". Len Feldman told the US House and Senate that the notch affects frequencies from 3715 Hz to 3965 Hz, so it has a direct effect on the highest notes on a standard 88-key piano. Notes an octave below are also affected because their overtones or harmonics fall near the notch.

"Remove the harmonics and you remove the qualities which make a piano sound like a piano and a violin sound like a violin," says Feldman. To prove his point Feldman made tones fade and notes from a piano clank. Feldman also argues that some music which is not encoded will switch off a recorder by mistake, because it happens to have an energy content at the notch frequency which matches the Copycode specification.

It seems likely that the London demonstrations were held to pre-empt a similar strike against Copycode in Europe. At the Mayfair, CBS played Beethoven's *Eroica*, a Beethoven piano sonata, a pop music orchestration for Barbra Streisand and solo voice in Kings' College chapel.

Listening conditions in the large theatre were poor, largely because CBS inadvertently left the public address microphones on during the tests. So music from the B & W loudspeakers (provided by Thorn-EMI's Central Research Laboratories) was picked up by the PA microphones and relayed through much lower quality speakers elsewhere in the room.

Even despite this, differences were heard. The effect on most music is subtle but noticeable, usually a slight roughening of high frequency sounds. Geoffrey Horn, a highly respected hi-fi dealer who reviews equipment for the *Gramophone* magazine, said of the solo voice recording: "That little choir boy was badly damaged."

The next day, a recording of the top four notes of an Abbey Road studio piano, played with and without encoding, was very revealing. The notes clunked when notched, as if from an interior instrument. By the end of the afternoon CBS was abandoning the claim that Copycode is inaudible and arguing instead that the audible degradation is an acceptable compromise.

Geoffrey Horn suggests that the record industry

should consider using Copycode only for pop recordings, which are heavily doctored before they even leave the studio.

Another suggestion is that the system should work in reverse. DAT recorders would refuse to record un-notched music. Only the small amount of non-copyright music on sale would then need to be notched.

CBS says that performers will have the final say. If they do not like the sound of Copycoding, they can refuse to allow their recordings to be copy-proofed. Alternatively the encoder may be switched in and out, to avoid audible effects on sensitive passages of the music. Or it could be used on some records as deterrent, like an electric fence turned on only occasionally.

All this is a far cry from the original CBS claim that Copycoding has no adverse effect on music.

Those who have been following the saga of Brad Kay and his recreated stereo from the 20s and 30s (using separate discs recorded at the same sessions) may be interested to hear the latest twist.

Last year RCA showed some interest in matching masters for release. But now the RCA record company has been bought by Bertelsmann, and head office is moving from New York to Germany. The Red Seal division recently told Brad Kay that, "the cost of researching the project would be prohibitive", Kay asked if it would be possible for him to lease RCA masters for fusion and release in stereo. "It would cost you many times over what you could ever hope to earn from record sales, tens of thousands of dollars", was RCA's helpful reply. In Britain EMI still postures publicly that it is all a load of nonsense. But inside there is mounting pressure for the company to have a go.

Meanwhile the University of Indiana Music Department has thrown Kay a challenge. Students made a digital stereo recording of the University Symphony Orchestra. They then separated the left and right channels and sent them to Kay in California for re-synchronisation. Kay will now transfer the two tapes to 78 rpm discs, sync them up in the usual way and send the recreated stereo tape back to Indiana for comparison with the original digital master. If he comes out of this one alive, it will be interesting to see what objections the cynics throw up next.

David Hatch, BBC Radio Director of Radio Programmes, talking to the Radio Academy in London about the industry's unsettled future: "While we are all sitting in here talking about insoluble problems, all the people with all the simple answers are out there driving cabs and cutting hair."

Ray Dolby asked by an engineer at the BBC's Institute of Broadcast Sound tenth anniversary lecture whether there is anywhere to go after SR: "I like to think we are nearing the end of the line and can stop designing for a while. It must have been like this several hundred years ago in the Scotch whisky industry. There came a time when the blenders said to themselves, 'hey, let's stop developing, and start just enjoying the product'. And since then everyone else has been doing just that." □

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CRITERIA

William Johnston takes a look at this long-established recording complex in Miami, Florida

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Over the years, Criteria has benefited from its close relationship with MCI of Fort Lauderdale, now a part of Sony. By serving as MCI's long-standing testing ground, Criteria featured equipment that was not yet available to the general industry. Until recently Criteria control rooms have been equipped solely with MCI gear and served as an integral part of the ergonomic design of the MCI family.

But technology aside let's face it Southern Florida has a certain appeal—especially in the winter. I mean, what more can you ask for than sunshine, a cold drink and digital recording?

Criteria's success and longevity can be attributed to the dedication and instincts of founder and CEO Mack Emerman. Mack had been closely involved with audio before the advent of tape machines, and he has always managed to sustain Criteria at the leading edge of technology.

Mack first fostered an interest in audio as a trumpeter at Duke University—he purchased a disc recorder to record the big band there. By 1953 he and his family had moved to Miami, so Mack used to cart a couple of Telefunken microphones and a Concertone tape machine to different jazz clubs in the area. By sheer coincidence, Mack ran into a producer from the Savoy label while recording the late pianist Herbie Brock, and according to Mack, "I got the job (recording Brock for Savoy)

since there really wasn't anybody else and at least I gave him the impression I could do the job."

Yet audio was still not a full time vocation. "I was basically making my living with my dad in the candy business," recalls Mack. "We had a salt water taffy manufacturing business and I also owned a record store." Then, in the mid '50s, Mack bought land in North Miami and Criteria was born.

A 30×60 ft building was constructed which included a large studio (30×40×16 ft), a control room, vocal booth and a disc mastering room. After this rather ambitious beginning, Criteria opened its doors in 1957. Mack: "The first studio turned out to be a trial and error studio. It was absolutely God awful when it started. It was designed by just putting stuff up on the walls and, having a decent ear, improving it from there." The studio featured a console designed similar to the well known Les Paul console of the day, an Ampex 350 as well as the Concertone and an echo plate. The mastering room was equipped with a Scully lathe rented from Larry Scully. "I got into the mastering business and stayed in it because I would send tapes out and when the records came back I was furious, I mean... all my genius down the drain!"

"People used to kid me, 'why in the world would you want a recording studio in Florida? There's no one recording there, no record companies, no nothing.' Well, that's what I knew and felt comfortable doing."

At the time the movie industry was beginning to make its mark in Florida. Two sound stages were built near Criteria and TV productions such as *Flipper* and the *Jackie Gleason Show* were shot locally.

To meet a growing demand, Criteria made the first of several additions and Studio A was opened in 1967. A huge studio with Criteria's trademark high ceilings (46×67×22 ft), Studio A was designed to be large enough to hold a symphony orchestra. It features a 90 ft hard cyclorama, a stereo live reverb chamber, it can serve as a dubbing theatre, a sound stage and a recording studio. Movable walls create a room within a room, and the acoustics are quite variable due to movable drapes, carpeting in the front and concrete flooring in the back.

Yet 1967 was a landmark year for the original studio too. Tom Dowd and Jerry Wexler of Atlantic Records began using the old studio (now Studio B) and it became known as Atlantic South. They brought in such artists as Aretha Franklin, *Layla* was recorded and suddenly Criteria was famous. Studio A became involved in the pre-recording of the *Gleason Show*, and eventually mixed 11 feature films, mostly for drive-ins.

Rock and roll was becoming the focus of the audio industry. "In 1971, we had a lot of influence from Crosby, Stills and Nash and they really required a different kind of studio, more suited to rock and roll," says Mack. "So we built Studio C which has a private entrance and bath because these people used to come and live here so they needed the privacy." The studio was originally outfitted with 16-track but moved to 24-track format as soon as it became available. Office space was added and Criteria boasted perhaps the most up-to-date and diversified studio anywhere.

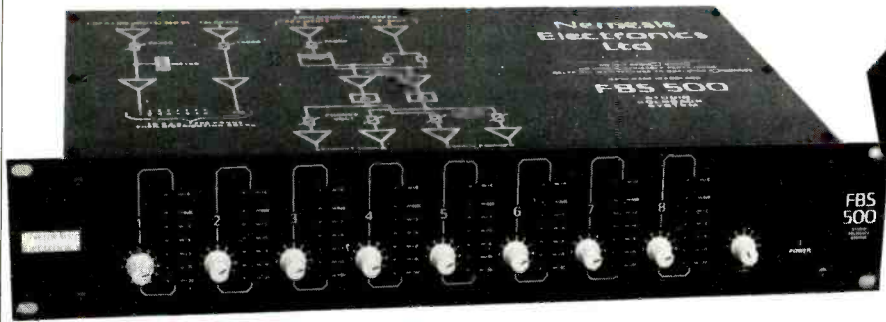
"I designed all of those rooms up to that point and I became opinionated," remembers Mack. "I believed in a lot of dispersion and a lot of bass trapping, basically I did a lot by my gut and the way it sounded in my head; some of it has since proved to be wrong. Then live end dead end (LEDE) came along which I liked and Studio C was converted to LEDE."

By 1977 Criteria's walls were getting fairly reflective from the numerous gold records. The studio was heavily involved with the Bee Gees and business was booming. A fourth studio, Studio D, was constructed to handle smaller projects like overdubs and mixdowns when a larger studio was not necessary. The control room however was the largest so far to be built at Criteria (17×19×11 ft). Cypress walls and a stained glass skylight give the studio a comfortable feel and like all the studios at that time it was fitted out with MCI.

This was the setting in which Mack and Tom Dowd began to make plans for a joint venture Criteria West, to be located in Southern California. "We went so far as to buy the Walter Lance Animation Studios... which is right across from Glen Glenn's new facility and it would have been a great location," Mack reminisces. "It was to be three studios and a cutting room. The concept was that all the control rooms including the cutting room would be identical but the studios would be



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CRITERIA

various sizes. I was going to have a garden and a jacuzzi . . . and basically this was over my head so I started negotiating with various designers—we didn't want to do the same thing everyone else was doing so we ended up choosing John Storyk.

"Between us we came up with a fantastic design and actually started construction . . . and January 1980 came, business stopped and interest rates went to 21%. We had to say stop and stop we did thank goodness.

"But because I put so much of my heart and soul into the design of that place, John (Storyk) helped me with another design (the new east wing of Criteria); I went ahead with this construction against the wishes of several other people. Basically, we've been struggling with a place that's too damn big, so now we are making better use of it."

The east wing was built originally with the same concept as Criteria West, but with only one large studio, a control room and a cutting room, which was identical to the control room. Several client lounges were added, an indoor garden, more office space, and private entrances were once again an important consideration.

Although this addition was completed in 1982, Criteria has recently renovated the east wing. The cutting room has been moved and its former home is now identical to the control room below. After a long and fruitful relationship with MCI, both rooms have been equipped with Solid State Logic *SSL 6000E* consoles with *Total Recall*, allowing clients to move between the two rooms with ease. Both rooms have access to a Mitsubishi *X-800* 32-track digital, or to 48-track analogue recording on MCI *JH-24* machines with *JH-45* SMPTE lock-up.

The John Storyk designed control rooms contain over 8000 ft³,

floating floors, acoustically isolated ceilings and a modified LEDE design. Careful attention has been paid to match the two rooms by including a similar glass surface at the front of the upstairs control room—although it looks at nothing. The monitors designed by Ed Long carry the *Time-Align* trademark. The triamped system has received nothing but praise from engineers and producers who claim that the rooms are accurate, reliable and non-fatiguing.

For nearfield monitoring, Criteria has built a 'lift-table' upon which the monitors are placed. Then by the flick of a switch, the monitors can be lowered out of the listening field when not in use avoiding unnecessary reflections.

The downstairs studio has an innovative design. Over 40,000 ft³, the room contains two isolation booths with floated floors and triple sliding glass doors. One room is carpeted; the other has teak flooring. For customers who don't like isolation booths, there is also a drum platform isolated from the studio floor beneath an 8 ft soffit with extensive baffling. The recent renovation has seen some of the original absorption removed from the room to liven up the sound. This coupled with the installation of two 'Acousta-Wings' units for variable reflections, give the room a wide possibility of acoustical environments. The 'Acousta-Wings' are motorised and can be set at any angle. The room has a comfortable feel and the ergonomic design allows eye contact from anywhere to the control room.

The upstairs control room is bordered by a small studio (15x16x8 ft), separated from the control room by sliding glass doors. The room is fairly dead but can open directly into a stereo live chamber, so the two rooms can be combined if desired. This flexibility makes the upstairs studio ideal for overdubs, electronic projects or mixdown where the large studio is not necessary.

The new Criteria cutting room has been moved across the hall. "I think going back to the 'controlled' living room concept for the final view of a mix is becoming more accepted again today," says Mack. The room is equipped with tandem Scully *LS-76* lathes and Ortofon *DSS 741* cutter amps that drive *GO731* and *732* cutter heads. The custom console incorporates Sontec *ME5430-B* equalisers, *DRC 200* controllers, four band parametric EQ and is custom automated with floppy disk storage. Video monitoring includes the console status as well as groove pictures. The room is relatively simple, with no fancy acoustical modification and is capable of any format from digital (Mitsubishi *X-80*) to direct to disk via tie lines from the studios.

Needless to say, Criteria also offers a microphone collection that has been carefully assembled over the years, and enough toys and outboard gear including Lexicon, EMT, Eventide, dbx, *Q-Lox*, UREI, ADR, MXR and so on.

At present, Criteria is using all of its rooms, except for Studio B which has been put into retirement, although plans are circulating to use this studio for video and film mixing. Criteria has stayed in business for so many years by always embracing current trends and it is obvious that the television revolution is making new demands on the audio industry.

What sets Criteria apart? First of all, each studio is separated by private entrances and lounges giving a feeling of intimacy but with all the advantages of a large studio complex. "The key to our success," according to Mack, "is creating an ambience in which the performer feels comfortable and can let his creative juices flow. That's a combination of how we treat them, the actual surrounding and our ability to keep up to date technologically throughout the years."

Criteria has also had the advantage of being able to build their studios from the ground up rather than forcing a studio into an existing building. And since real estate has never been a major concern, Criteria has been able to offer such luxuries as three quite large stereo live chambers, and superior office space and client lounges.

Criteria has been around for 30 years and without a doubt will be here for the next 30—quite an accomplishment. Furthermore, as Florida begins to enjoy a renaissance of recognition in television and film (thank you *Miami Vice*), business in audio for video will be increasing. Criteria certainly will play a major role in this market as well as maintaining its reputation in pure audio recording. □

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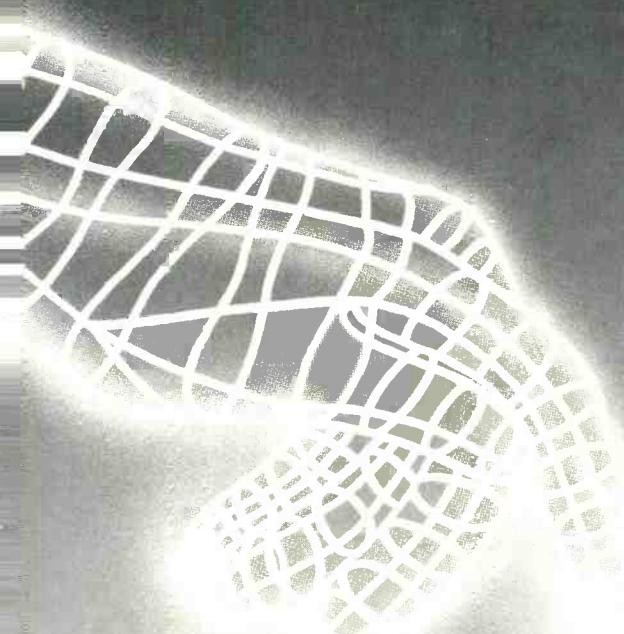
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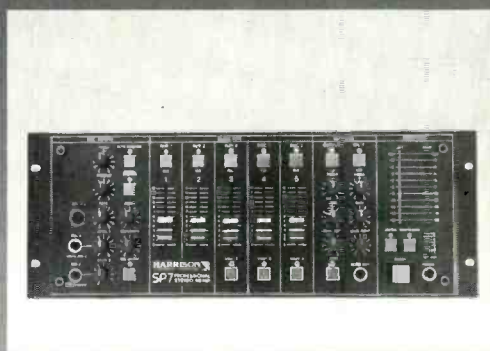
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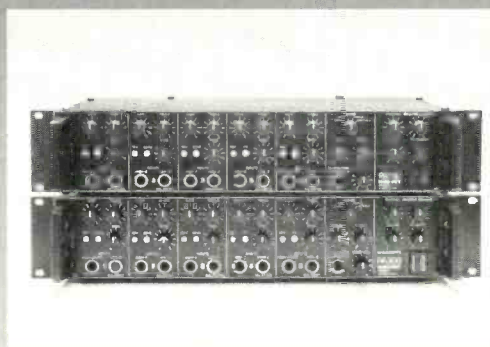


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MILO MUSIC

Terry Nelson reports from a studio in London's East End

In the past, London studios have been mostly situated around the West End area, traditionally the centre of the music industry but things are changing. Milo Music is a 24-track studio located in the East End and nearer to the financial centre of the City.

A new two-storey building at the rear of a converted factory building houses the studio and offices. There is a patio with benches, various vegetation and a fountain, which is a pleasant place to grab some fresh air between sessions.

The man behind Milo is Henry Crallan who has worked as a musician, producer and arranger, and as a live production manager, ending up running the staging department at Edwin Shirley where he was responsible for stages for acts such as the Stones, Genesis, Bowie, etc. His deep rooted ambition was always to have a studio of his own and develop some of the ideas that were in the back of his mind. The first obstacle was, inevitably, finding suitable premises. Henry takes up the story:

"While looking for a suitable site I soon found that the unit price of property was often nothing less than exorbitant—certainly for me. The 'for me' bit led to me thinking that it would be much cheaper if I could find other people who were

having similar problems and who would be interested in obtaining a large premises in order to form a complex. This idea struck gold and we found the Hoxton Square building which was in a quiet area yet very accessible—with the added bonus of being reasonably priced. In fact the whole area is starting to become a sort of counter West End and we already have what a lot of critics consider to be the best 'real jazz' club in London right here in the square."

Other companies now in the building are media-related: VCL Video is a small 1 in facility dealing with educational, industrial and promotional programmes; Videomatte specialises in the production of processors for the video market; Wadham Film (otherwise known as the Jazz Brothers) who are gaining a reputation for their documentary features on music and musicians; and, the latest addition, the European office of Clair Brothers, the US sound reinforcement company. Although the companies are independent, interaction between them is good; they share offices and reception, which Henry feels enables them all to have a wider view of the industry in general.

The ground floor of the studio building houses a small reception office and the rest of the studio. The rooms are quite small but this does not seem to hinder the quest for a good sound.

The floor plan of the studio is trapezoid with the long side at the front and tapering towards the rear. The walls at each side and rear are a combination of Helmholtz resonators and broadband membranes covered with hessian, together with a pair of low frequency traps behind the rear wall. The floor is carpet covered and running across the rear wall in the form of a bench is a tuned trap in four sections for the low mids.

In order to give some kick-back to the sound there is a rectangle of parquet behind the console. The front wall of the control room houses a large window looking into the studio and a smaller one looking into the isolation booth. Surface treatment is fabric-covered Rockwool to provide a non-reflective surface. All walls are decoupled from the main structure and both control room and studio have heavy chipboard floors floating on Rockwool.

Most of the acoustic design was done by Paul Gillieron who, as a practising musician, tends to approach design from the musical end rather than the theoretical. The isolation in the rooms, however, gave a low noise level of NR 12 for the control room and NR 16 for the studio—with the air-conditioning on!

The ceiling can be likened to an inverted W on a slant, with the high end at the front of the studio. The main part of the ceiling—or the main V-shape—is in the form of a slat absorber with wooden panelling in order to reflect the middle and high frequencies while clearing up the low frequency energy. The rear of the ceiling slants down to the rear wall and is also slightly V-shaped in the horizontal plane in order to splay the sound more effectively.

The reverberation time in the control room is a low 0.35 s although the sound quality is very even and both producers and musicians have commented on it. An attempt was made at the beginning to lengthen the reverb time but this tended to smear the high frequencies, so the room has been left as it was. It seems that clients take away tapes and then say, 'It sounded good in the studio and it sounds great at home! If anything, a little more live and punchy.' Henry feels that having a tight response in the room results in mixes with just a touch more 'life' in them so they tend to jump out more when played elsewhere.

The monitors were a first/last choice (meaning that they tried out many others in between) and are a design from Sean Davies. The Davies LS841 monitor uses a JBL 15 in bass driver actively crossing over to a Rogers BBC specification 12 in midrange driver with a polypropylene cone at 300 Hz. The system is then passively crossed over to a Celestion tweeter with lens for the high frequencies. The enclosure is designed for free-standing and is flown by webbing straps from two grid poles in the ceiling, which effectively isolates the loudspeakers from the control room structure. The original intention was to equalise the monitors with a pair of White 4000 ½-octave graphics but the room measured out extremely well and the minimal tweaking that was required for 'flat response' tended to detract from the overall sound; so by general consensus of opinion, no equalisers! At present the tweeters are on the outside but Henry is considering turning the speakers over to see if having the





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MILO MUSIC

tweeters more towards the centre would tighten up the imaging.

Secondary monitoring is Auratones and Visonik Davids. "I must say that I don't like the Visoniks, you really don't know where you are with them but some people like them—that's why we have them. The thing about Auratones is that you know they sound odd-grot and you do your mix with that in mind so that when you come to listen on the big monitors the mix will sound even better. We also have quite a few engineers who bring in NS10 speakers. I personally like them and it is encouraging when you hear that the mix stays to all intents and purposes the same when you switch between them and the Davies monitors.

"As a studio that was starting out we had to reconcile the age-old problem of keeping to a tight budget yet getting quality equipment to suit our needs. After weighty considerations this turned out to be a Studer A80 Mk IV 24-track recorder, A810 master recorder, Sony F1 (with Betamax and U-matic VTRs) and an Amek Angela console. I don't think many people question the quality of Studer and the Amek has proved to be a very popular choice. It has nearly all the facilities we would like, the basic sound and EQ is very good and the company are helpful to work with. It's also very reasonably priced! At present the console is a 28/24 but we are already thinking of expanding to more channels once we can sort out where to put them!"

Outboard equipment is housed in two wooden racks that fit in with the overall decor. The racks provide a handy surface for VTRs as well as a home for a Revox 700 recorder, Master Room Super C reverb, Eventide Instant Phaser, dbx 160 compressor and 155 noise reduction unit, Deltalab ADM 1024 delay, ADA stereo tapped delay, UREI 1176 limiter, two Drawmer DS201 stereo gates, Sony F1, AMS RMX 16 digital reverb, two Lexicon Prime Times, Klark-Teknik DN780 digital reverb and two DN27 graphic equalisers that are actually used for sound shaping a lot and not for the monitors, and a Studer balancing unit.

In addition to the racks there is a matching L extension wing to the console for flush mounting the A810 recorder, tape remotes, Eventide H910 Harmonizer, Drawmer DS201 stereo gate, Brooke Siren Systems DPR 402 compressor/gate/de-esser

("We are very pleased with the BSS, it works extremely well and provides a good alternative to other gain reduction units without being just another compressor") with a sloping penthouse for the A810 meter panel and Bel BD-80 delay and dbx 160 compressors. The wing also provides support for a Nakamichi cassette recorder and Garrard 401 turntable with transcription arm.

"It is very handy to have the master recorder within arm's reach," commented Henry. The multitrack is conveniently placed under the left hand monitor where the tape op can get at it without climbing round the people behind the console."

The studio measures 24×14 ft with an isolation booth of 7×7 ft. The latter has windows into the studio and control room and has a very dead acoustic, making it ideal for uncoloured overdubs and vocals.

The reflective section of the studio has floor to ceiling mirrors and wooden panelling. The microphone cupboard is also at this end of the studio breaking up the squareness of the architecture. The more absorbent part of the room has hessian covered membrane and Helmholtz absorbers together with tissue-faced Rockwool panels. Angled quadrants float away from the main ceiling soaking up standing waves. The distribution of the panels comprising the acoustic treatment eliminates any tendency towards ringing and provides an even response throughout the room with an RT of around 0.9 s in the live end reducing to 0.5 s in the absorbent area. The floor in the absorbent area is carpeted and is polished parquet in the booth and reflective region. Lighting can be modified as required though the concealed 'wash' of strip lighting around the ceiling perimeter is very popular.

The studio has 36 microphone lines through to the control room and these are divided into three wall-mounted boxes, one in the booth and two at either end of the studio. In addition to the mic lines, each box contains four foldback outputs with master pan and level controls and three jack sockets for direct injection.

Milo have a comprehensive microphone selection with models from Neumann, AKG, Electro-Voice, Sennheiser, Beyer, PMB and Shure. There are also several PZM microphones installed at strategic places in the ceiling.

Between the control room and the reception is a small maintenance room which houses the various HH, BGW and Quad amplifiers for monitoring and foldback, White equalisers and 140 analyser plus a cassette copying rack containing eight Alpage AL 80 decks.

Instruments do not abound though there is an Ampeg Reverberocket 2 amplifier for hardened session guitarists with long memories, a Rhodes piano and a Steck pianola that has a surprisingly rich, bright sound. Henry explained: "We don't have many instruments as I think they tend to suffer in studios and get knocked about. We deal with several good hire services and we can always get instruments in for a session should they be required."

Although Milo Music has only been open a short while the pressure of work is consistently on the increase, with people such as Marc Almond, Siouxsie and the Banshees, and Raymonde being recent visitors together with a lot of A/V and publicity work, however: "We also feel that we have a special obligation towards groups and artists who are just starting out. They are often in the hands of some A&R person from a record company who thinks he is a mogul producer and has them tied down with one 45 rpm per year over five years, thus effectively wiping out any chance of a career that they may have. We try to get involved as much as possible with what the musicians are trying to do and to pass on helpful advice."

Also in the Milo team are chief engineer Charlie Gray and the charming Charlotte who looks after bookings and the general well-being of the clients. The studio is also training up a tape-op.

The first floor over the studio is isolated on floating floors and contains the office and a large, airy relaxation room with pool table, hi-fi, television and video, etc. The white decor also makes it very good for use as a small video studio and quite a few after-session videos have been done with VCL Video in order to provide a full promotional package when the clients leave the studio. □

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Henry Crallan at the console

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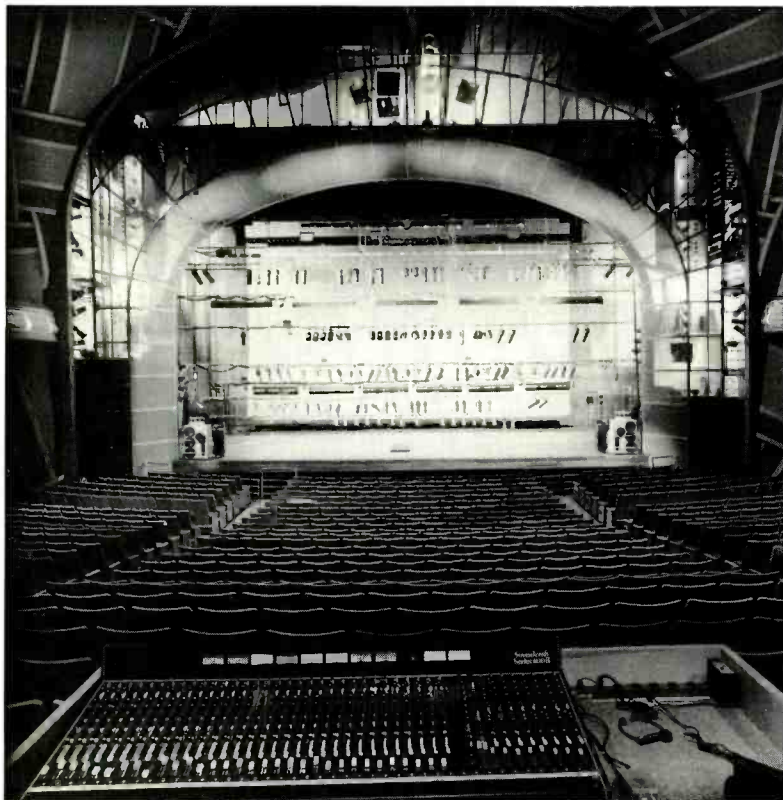
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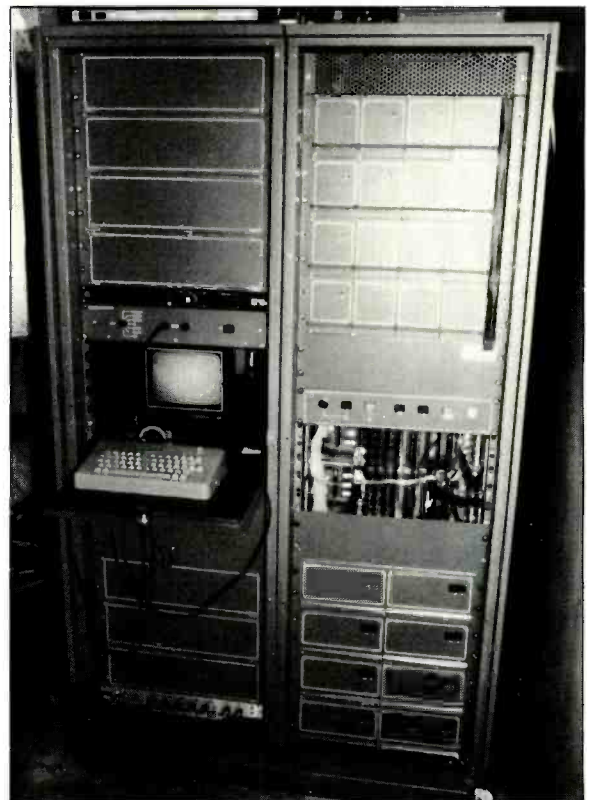
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A NEW APPROACH

The sound reinforcement systems at the Hult Center for the Performing Arts in Oregon, USA, depart radically from traditional sound enhancement. Paul D Lehrman reports



Silva Concert Hall from behind the sound mixing position shortly after opening



Processing modules and control computer for the AIRO system

Auditorium sound has come a long way in recent years. Wireless microphones, automatic equalisers, directional arrays and other technological developments have served the theatre sound contractor just as well as the rock and roll mixing engineer. It's a good thing, too—audiences have changed and are demanding the type of high quality sound they hear on records. As performing groups grapple with the changing economics of live music and theatre, however, halls are getting bigger and few performers have the lung capacity to fill them without help.

To meet the demands of today's audiences and performers, the Hult Center for the Performing Arts in Eugene, Oregon, has installed a number of sophisticated sound reinforcement systems in its two theatres, one of which—designed by AIRO Systems of Birmingham, England, and installed by Jaffe Acoustics of Connecticut—represents a radical departure from traditional ways of amplifying sound.

Eugene is not the kind of city where one would expect to find one of the most advanced auditorium sound installations in the world. Along with its sister city, Springfield, across the lovely Willamette River, and several outlying suburbs, Eugene has a population of only about 200,000. It's over 100 miles from the nearest major city, Portland. Its largest industry is the University of Oregon located on a sprawling green campus that makes up the eastern half of town.

"Some folks think it's a case of putting the cart before the horse," says Rich Scheeland, technical director of the Hult Center, "but the city wanted to build an entire civic centre, not just an auditorium. We have free noon concerts during the week and the lobby is open all day where not only do we sell tickets but there are also ongoing art exhibits. The rehearsal hall is rented out for functions and art shows as well."

Architecturally and technologically the hall is a success and it has been very well received by most visiting artists from rock bands to orchestras and ballet companies. Financially, however, the verdict is still out.

The city was responsible for building the Hult Center, with no Federal monetary contribution. The bill came to some \$23 million, raised by a bond issue several years ago and the centre opened its doors in September 1982, after 2½ years of construction. It contains two halls: the 500-seat Soreng Theater which is used for straight plays and chamber music concerts and

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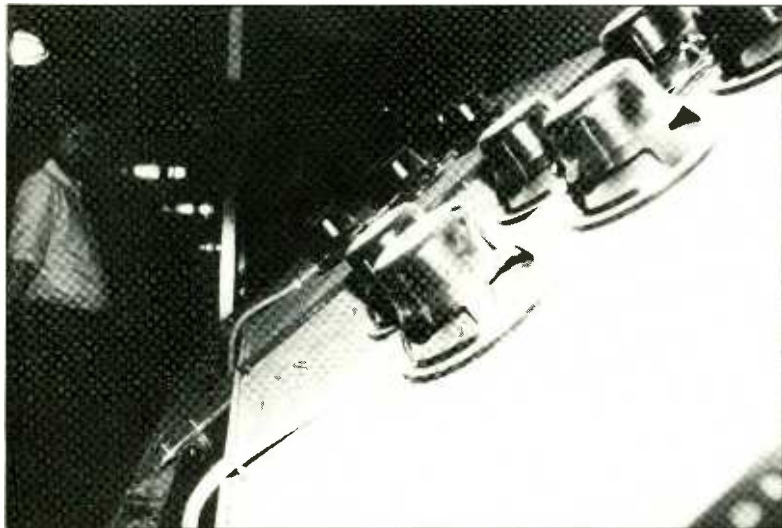
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A NEW APPROACH



Engineer Gary Hardesty at the Soundcraft 800B house console



Hardesty and some of the AIRO speakers in the ceiling

the 2500-seat Silva Concert Hall, the venue for rock concerts, opera, symphony orchestras and large scale musical theatre productions.

Although the centre has a conventional (albeit elaborate) sound system, it's the AIRO installation and another new system known as ERES, that make the Silva Hall stand out. Designed for music that is normally unamplified, the system uses a unique approach.

The AIRO system starts with microphones. Next to a catwalk in the ceiling—a major resonance point of the hall—hang 90 condenser and dynamic mics of various shapes and makes, each one surrounded by a Helmholtz resonator to restrict its response to a narrow band of frequencies. The signal from each mic is preamplified then sent to a rack in a room behind the hall made up of custom built electronic 'bricks' each containing a pair of 12 dB/octave filters and phase compensators, to undo the phase shifting effect of the filters. The outputs of these units are then summed in pairs and sent through 16 more 'bricks', each with three 50 W MOSFET power amplifiers (there are three extra amps, available for various tasks) and from there to a bank of 90 12 in Electro-Voice speakers mounted on rigid boards, infinite baffle fashion, above the balcony at the farthest point from the stage. The result is 45 giant acoustic/electronic feedback loops, each one set for maximum gain.

What the system is doing is increasing the resonance and decay time of the hall as a whole but with precise control over times and loudnesses of individual frequency bands, thereby providing a high degree of flexibility. "It's basically an error signal for the hall," explains Gary Hardesty, the centre's chief sound technician. "It's what the hall *wants* to do if it had the decay time. The hall's basic sound is very good and that is what is being resonated."

The system is supervised by a custom Z80-based computer running with a CP/M operating system which controls 45 6-bit D/A converters each providing up to 84 dB of attenuation in 3 dB logarithmic steps. The bandwidth covered by the system is from 63 to 1303 Hz and the individual band centres are carefully calculated so they are not harmonically related, minimising crosstalk and other types of interaction between the bands. When the mic signals are combined on the processing cards, non-adjacent bands are paired together, again to keep crosstalk down. Each of the 45 output channels goes to two speakers placed more or less at random at the back.

The Z80 computer has disk storage and even a modem so it can be remotely operated from just about anywhere. Hardesty has four different programs on disk which can be loaded in any time: Symphony Orchestra, Opera, a 'Short Shell', and Rehearsal. The programs are still under constant development and tuning. "You have to compensate for temperature, ambient levels and absorption characteristics," he says. "Obviously, the hall changes with the number of people in it. When we started we were using way too much gain but it's a slow process. We can't really experiment with the system unless there's a show running and there aren't too many shows where we use it."

The system is not turned on for amplified shows, like rock concerts or musicals where individual singers are miked, so the number of events each year that use it is between 25 and 35, which includes the local symphony orchestra's series of eight to 10 concerts, the 10 to 15 events of the Oregon Bach Festival and seven or eight operas.

Some of the changes have been more than just programming adjustments. "We found we didn't have to drive the balcony as hard as we were," says Hardesty, "so we installed a secondary feedback loop by flying some Bozak speakers in cabinets halfway down the proscenium arch, pointing downward at a 10° angle. That way we lowered the gain in the balcony." Other speakers were installed underneath the balcony to improve system response in that area.

Although the AIRO system is very effective (and although other AIRO systems were installed previously, the Hult Center's was the first to be completely computerised) it is not alone in Silva Hall. It is sometimes used in conjunction with another, full-bandwidth system designed by Jaffe Acoustics known as ERES. Four small Milliphonic condenser mics are mounted in the removable shell that is used for orchestral performances, two upstage and two down. Their signal goes through SpectraSonics mic preamps then a bank of digital delays made by Audio Digital (Hardesty's own company), SpectraSonics power amps

and finally to several racks of Bozak speakers spaced around the hall, in the catwalks, and at the rear of the stage.

The idea behind ERES is to increase the presence of the hall sound, which it accomplishes in a variety of ways. It interacts with the AIRO system, using the latter as a 'chamber', to increase the overall reverberant energy. It also reinforces the orchestra sound's early reflections ("a tiny bit—it's not a PA system," says Hardesty); each of the five banks of speakers has a different delay time.

In the smaller Soreng Theater a 'mini' ERES system is in place using a single pair of Milliphonic mics on the stage apron. Communication is through a Bozak distributed array to improve presence and using a digital delay to increase late reflections and therefore the room's apparent size.

A third system in the main auditorium is a more-or-less standard concert sound system but one extensive and powerful enough to be used by 85% of the visiting acts, according to Hardesty. "Maryland Sound, Clair Brothers and Showco have all come in here with bands and ended up with our system," he says. The acts he mentions include the Pretenders, Eurythmics and Talking Heads, who also used the hall—and the house PA—for their pre-tour rehearsals.

The system is centred around two Soundcraft boards, an 800B 32/8 console for the house sound and a 24/8 desk for monitors. Several Cetec Vega diversity wireless microphone systems are available. For processing, there are Orban equalisers, Symetrix comp/limiters and an Alesis reverb. An Otari MX-5050 2-track tape deck is on hand for pre-recorded effects. A total of 27 kW of amplification is available from Carver, SpectraSonics and UREI.

The extensive speaker array consists of clusters at each side of the stage containing six 15 in LF drivers and several long- and short-throw biradial horns and tweeters, all JBLs; a cluster behind the stage with eight Community Light & Sound horns with Emilar drivers, eight JBL 15 in drivers and four JBL biradial horns and drivers; another group of midrange speakers and tweeters under the balcony; two banks of subwoofers at the side, each with six 18 in JBLs. The crossovers are made by UREI but Hardesty says that soon he will be installing his own crossover circuitry in the system. Monitoring is handled

by nine custom wedges each containing a JBL 15 in LF speaker and a JBL biradial horn.

A separate mix is done on headphones (usually during the sound check) for an infra-red headphone system that provides quality sound for the hard of hearing who come to the centre's musical theatre productions. (It's rarely necessary for the rock concerts.) The infra-red system, made by Sennheiser, contains two radiators in the orchestra and two more in the balcony.

The mixing position is in the centre, at the rear of the orchestra seats. There are two glass booths a few rows behind it which house the ERES equipment, remotes for the AIRO system and various other technical systems. "The mixing console was in a booth originally, too," laughs Hardesty. "It wasn't a good idea."

Because the systems are so new and opportunities to use everything are limited, the four years the centre has been in operation have been one long experiment. "We're still working closely with Chuck McGregor at Jaffe Acoustics," says Rich Scheeland. "When the system was first installed we didn't even have a specialist acoustic consultant here. We really need someone at the hall to communicate with Jaffe."

Hardesty, a Eugene native with experience in tour sound, was hired as a consultant shortly before the centre opened. "I needed a laboratory for my company," he smiles. His company makes a wide array of digital processing equipment.

"We've spent the last four years sorting out various problems such as ground loops," he says. "Like any system that is electro-mechanical, you have to watch it carefully." For example, the AIRO mic preamps installed in the catwalk near the mics themselves, have unbalanced outputs. With the installation of hum rejection circuitry, however, and shielded metal conduits throughout the hall, problems have been few. "It's a little noisier than we would have liked but it's OK."

And the experimenting has not stopped yet: "We're working on replacing everything with digitally active processing," says Gary Hardesty, which will not only make the system cleaner but also significantly increase its responsiveness and flexibility. "It shouldn't be too hard," he says, "we'll only need to execute about 40 million instructions per second." □

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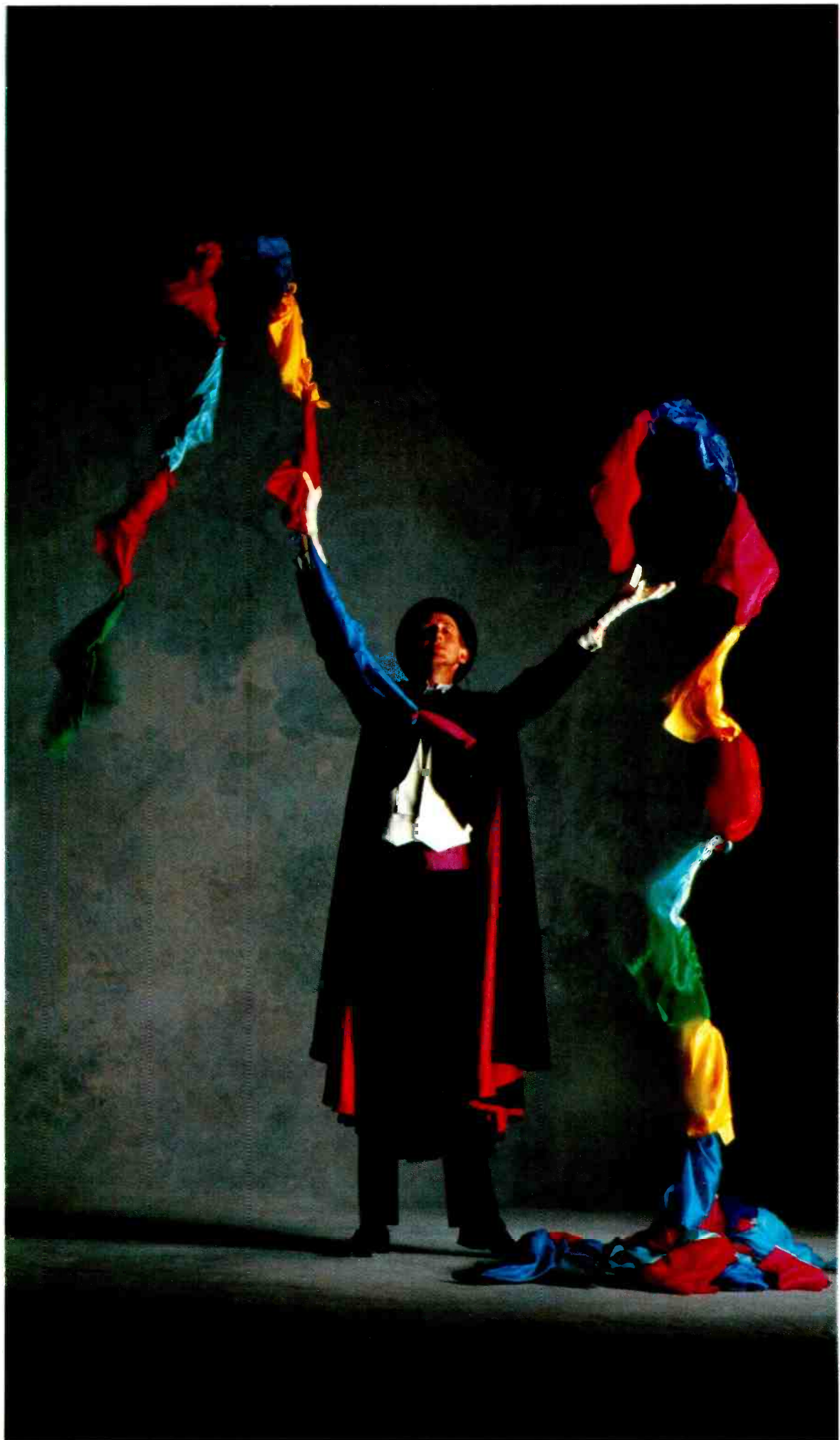
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FM GROWS UP

Paul D Lehrman takes a practical look at the Yamaha FB-01 and the TX81Z keyboardless synthesiser modules and their value to the studio when used under computer control

A musical instrument collection has always been a requirement for the well-equipped recording studio. A good piano, a drum kit, an organ, a set of quiet and reliable instrument amplifiers, and a comprehensive percussion toy chest are great helps to clients who don't want to have to drag in their own. But with the advent of sophisticated, convincing-sounding, pushbutton digital synthesisers, a stable of such beasts is

becoming just as, if not more, important than nearly anything else in the studio, for both drawing in clients and allowing them to work as efficiently as possible.

The most popular MIDI synthesiser, the Yamaha *DX7*, has now been with us for over four years. When the *DX7* was introduced, it knocked the musical world on its ear. Using FM-synthesis technology developed by, and licensed exclusively from, Stanford University in California, the *DX*-series of synthesisers showed that digital VLSI

technology could be used to create a huge variety of realistic-sounding instruments at low cost.

But Yamaha has not been standing still in its development of FM technology. Revolutionary as the *DX7* was, it was still a 'traditional' keyboard instrument, in that it was made to be played independent of anything else although it could also control additional synthesisers via MIDI. As MIDI matured, manufacturers began to think about other types of synth design and Yamaha soon came out with a keyboardless version of the *DX7* called the *TX7*, which was designed to act as a slave or expander to a *DX7* and cost less than half as much. They also introduced the *TX816*, the equivalent of eight *DX7*s in a rack, with virtually no controls of its own, and selling for about two-and-a-half times the price of a *DX7*.

These products, although enormously useful in the studio, had one limitation: they were monitimbral, in that each instrument (or in the case of the *TX816*, each module) could produce only one type of sound at a time. Programmers could get around this by using the keyboard scaling feature (in which the various operators sound at different levels over different parts of the keyboard) to 'fake' split voices, or by using the *TX*'s note-limit functions (if they had more than one), which restricted an entire voice to a certain part of the keyboard. These solutions were, however, inefficient and often didn't sound very good.

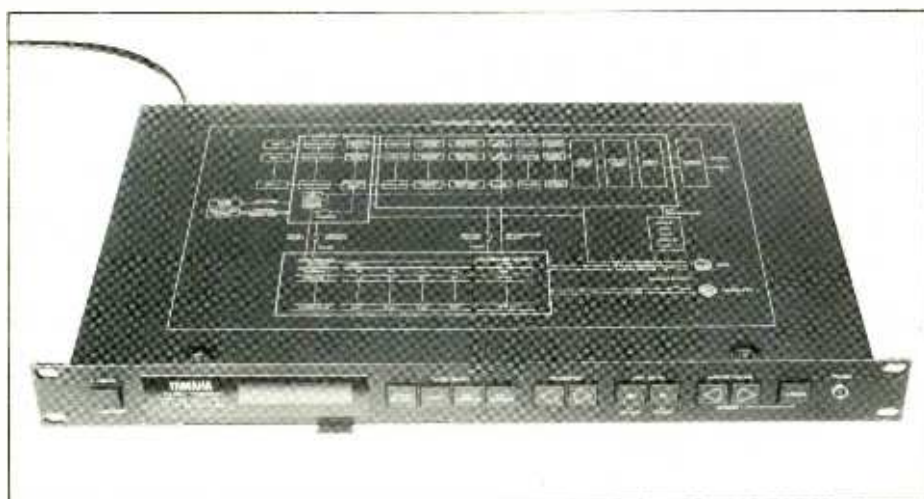
Other manufacturers, however, like Sequential Circuits, Oberheim, Kurzweil and Casio, were exploring a multitimbral approach in which one *n*-voice device could be made to act like *n* single-voice devices using a part of the MIDI specification known as 'mono mode'. Casio was the first to put multitimbral capabilities in an inexpensive package, with its *CZ-101*, whose four voices were independently configurable and addressable through MIDI. Using an external sequencer, the *CZ-101* could, for example, be playing a flute line on Channel 9, a bass line on Channel 10, a string drone on Channel 11, and percussive 'snaps' on Channel 12. The unit sold for the remarkable price of less than \$500, but its expressive capabilities were limited by a number of design compromises. It was not sensitive to key velocity, pressure, or controllers (save for an on/off response to modulation wheel), and only one voice at a time could respond to pitchbend information. In addition, the instrument could only be configured in one of two ways: four notes with the same timbre, or four timbres each playing only a single note.

The Kurzweil *250* could receive notes on all 16 MIDI channels, with a different sound assigned to each channel. The *250* has a limit of 12 notes in all, however, and at a price of around \$15,000, it is beyond the reach of all but the most well-heeled studio.

But with the introduction of the *FB-01* last summer and the *TX81Z* this winter, Yamaha has taken multitimbral synthesis into the next generation. These units have three major things going for them: they sound good, they're extremely flexible and they are ridiculously inexpensive.

Although there are significant differences between them, the *FB-01* and *TX81Z* have been cut from the same cloth. They are both keyboardless synth modules, rack mountable (the *TX81Z* directly, the *FB-01* with a special adaptor available from Yamaha that allows two units in one rack space), and have stereo outputs. The *FB-01* costs \$350, the *TX81Z* \$500.

Both models have eight voices, each of which can be assigned a particular timbre and a



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particular MIDI channel. Any combination is possible: two voices of 'cello on Channel 14, three voices of piano on Channel 6, and one voice each of guitar, bass and horn, all on Channel 2. These 'configurations'—which of the eight voices, and how many of them, go with which timbres and which channels—are stored in their own area of memory and are addressed separately from the voices themselves. The *FB-01* has 16 user-addressable configuration memories and four factory presets, while the *TX81Z* has 24 user-addressable slots. The configurations also specify upper and lower note limits on each voice, 'basic' channel (ie, which channel will receive system-exclusive information), and information like pitchbend sensitivity, detuning and transpose, stereo position (left/right/centre), controller/LFO mapping, and so on for each voice.

On the *TX81Z*, the configurations (which for some reason Yamaha insist on calling 'performances' on this unit) can be addressed by MIDI program changes—an internal map allows any incoming program change command to call up any individual patch or configuration. On the *FB-01*, however, the configurations have to be

selected by hand from the front panel; program changes only address patch numbers, and those only within a bank of 48 voices—if you want to call up a patch from a different bank, the bank has to be switched from the front panel.

The front panels of the two devices are quite simple. The *FB-01* has eight buttons and a single line, bright orange LCD display. The buttons are all single-purpose, and are used to edit configurations and certain patch characteristics, like pitchbend and LFO mapping (which are referred to in the *DX/TX7* world as 'performance data'—are you confused yet?). The actual patches themselves—the operator frequencies, envelope rates and levels, etc—are not editable from the front panel, and since there is no other synthesiser that exactly conforms to the *FB-01*'s data format (as the *DX7* does to the *TX7* or *TX816*), this makes the *FB-01* the first MIDI synthesiser that requires a computer for patch editing. On the other hand, Yamaha has provided 240 factory preset patches (in ROM, so you can never lose them), covering a lot of ground from 'EGrand' to 'Helicop'.

The *TX81Z*'s front panel is a little more

involved. There are 11 buttons, each of which serves at least two functions, and some serve three or four. The green LCD display has two lines. This unit allows front panel editing of voice parameters but it is not easy—if you can imagine a *DX7* with no data slider, just increment buttons, you get the picture. Although the unit's data format is more-or-less compatible with other Yamaha 4-operator FM synths (*DX100*, *DX21*, etc) there seems to be no way to use one of those synths to edit the unit's voices directly, and so a computer would be helpful here, too.

The sound quality of both units is excellent. The 4-operator FM synthesis method is, in theory, incapable of producing sounds as sophisticated as the 6-operator method used by the *DX7*, but for a number of reasons that's not strictly true.

First, the *FB-01* has a feature that the *DX7* lacks, which is velocity-based envelope tracking—you can set up an envelope so that the harder you hit a key, the faster the attack. This goes a long way towards producing more realistic and expressive string and wind sounds. Second, while the *DX7* uses sine waves as its operators, the *TX81Z* gives you a choice of eight wave forms, including non-symmetrical ones, which increases the complexity of the sound dramatically. (It also means the instrument works rather similarly to Casio's *CZ* series, which calls its synthesis method 'Phase Distortion'. I suppose this is as good a place as any to wonder how Casio got away with their 'borrowing' of FM technology—maybe this is Yamaha's way of striking back.)

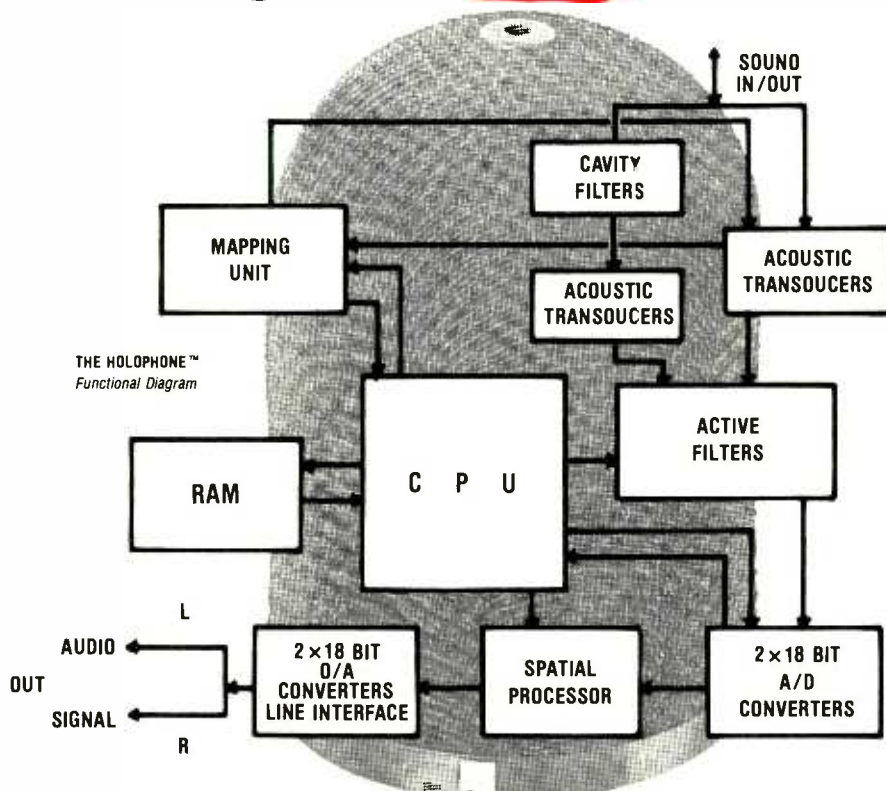
Third, both synthesisers offer microtuning (non-tempered scale) capability, reflecting a growing interest among contemporary composers in non-standard tunings. Fourth, the *TX81Z* includes some interesting programmable 'effects' including automatic chording (programmable per note, so

Opcode *FB-01* editor showing graphic voice editor and configuration editor windows

	1	2	3	4	5	6	7	8
MIDI Ch	9	9	3					
Notes	4	4	0					
Lo Limit	C-2	C 2	C-2					
Hi Limit	G8	G8	G8					
Bank	1	2	3					
Voice	1	4	1					
			Brass	Br				
Output	127	127	127					
Pan	L+R	L+R	L+R					
Octave	0	0	0					
Detune	0	0	0					
LFO	On	On	On					
Poly	Poly	Poly	Poly					
Porta	0	0	0					
PMDev	MW	MW	MW					
Bend	2	2	2					

		MIDI Channel	9	TstK	64	On/Off	1	Car	2	Mod	3	Mod
1	Output						127		0		0	
2	Adjust						0		0		0	
3	Velocity						0		0		0	
4	Attack						31		31		31	
	Decay 1						31		31		31	
	Sustain						15		15		15	
	Decay 2						0		0		0	
	Release						15		15		15	
	Atk Vel						0		0		0	
	Rate Scl						0		0		0	
	Freq						0.		0.		0.	
	Inharm						50		50		50	
	Detune						0		0		0	
	Scaling						Rlin		Rlin		Rlin	
	Depth						0		0		0	
	AM						On		Off		Off	

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that a particular tonality can be maintained all the way up the scale), transposed repeat (a marginally useful function which seems to have been included only because some Roland synths offer it), pseudo-reverb (an envelope release extender, also of marginal value) and an excellent auto panning feature. Finally, Yamaha's resident programmers have got much better at their jobs since the DX7 was released, and the factory presets represent excellent work, many of them sounding superior to the equivalent voices originally released with the DX7.

There is also one interesting feature in both units that reflects the designers' careful thinking about how they can be used in a studio environment. Either of the units can be set to respond only to even- or odd-numbered MIDI notes. If two otherwise identically-programmed FB-01s are used together in a MIDI setup, one set to receive odd notes and the other to receive even notes, the effective result will not be two 8-voice synths but one 16-voice FB-01.

In addition, the TX81Z has a unique feature whose value I have yet to be convinced of. It

takes incoming MIDI notes and 'alternates' them among various timbres as they come in. In the factory preset performance called 'Wind Band', for example, the first note sounded will be a flute, and then the next a clarinet, followed by oboe, french horn, etc. The manual suggests that only slightly different timbres be used with this feature, creating an ensemble effect. If they say so.

The non-standard scale capabilities of the units are particularly intriguing. On the TX81Z, there are 13 choices of microtonal scales, 11 preset and two user-programmable: one in which each note within the octave can be defined, and the other in which each note over the entire keyboard can be defined. The tuning resolution is 1/64 of a semitone, or 1.56 cents. Standard and microtonal scales can actually be mixed within a performance configuration: each configuration allows one microtonal scale to be specified, and then each instrument within the configuration can have the scale enabled or disabled.

The FB-01, according to its MIDI spec, allows microtuning any note with 1-cent resolution, but

only in real time, using something called a 'System Exclusive Event'; the tunings do not remain in memory. This type of event is part of a class of MIDI events that seem to be unique to the FB-01, which includes special note-ons and offs (with durations and fractional pitch values), controller changes, and parameter changes. So far, there is no device I know of that actually transmits these events but it's probably safe to assume something from Yamaha won't be long in coming.

So what's missing from this picture? Are these the answer to a studio synthesist's dreams? In many ways, yes. Their low price certainly makes them very attractive, and their sound (especially when the various effects are called into play) gives the lie to the myth that FM synths can't be 'warm'. It's obvious from this discussion that the TX81Z is capable of more complex sounds, and is indeed 'a poor man's TX816', as it has been called, but the FB-01 is no slouch either, and does an excellent job with more straightforward 'FM-like' sounds like brass, basses, organs, bells, metallic leads and electronic drums.

There are some minor limitations. In the case of the FB-01, the inability to call a patch from a bank other than the one you are in is annoying. The solution is to create your own RAM banks using just the sounds you need in a composition but that can get tedious (unless you have computer software to do it with).

A more serious problem has to do with LFO vibrato. Within a configuration, each voice can respond to a modulation controller in a unique way—one voice, for example, can read breath controller with maximum sensitivity, while another looks at modulation wheel and responds only slightly. However, all of these sources draw on the same LFO, so any vibrato on a clarinet, for

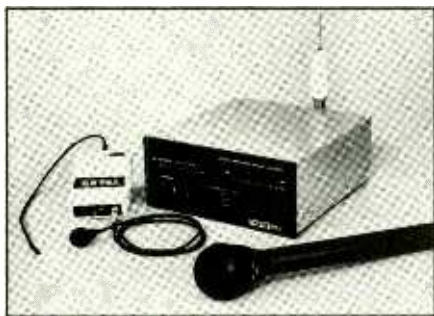
Digital Music Systems' FB-Pro showing multiple windows

The screenshot displays the Digital Music Systems' FB-Pro software interface. At the top, a menu bar includes 'File', 'Edit', 'Options', 'Window', and 'Template'. The main workspace is divided into several overlapping windows:

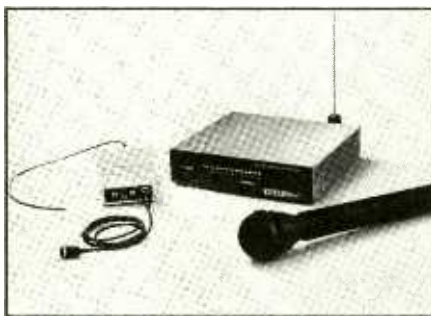
- FB rom 4**: A list of 32 instrument patches, including 'UpPiano', 'SPiano', 'Piano2', 'Piano3', 'Piano4', 'Piano5', 'PhGrand', 'Grand', 'EPiano5', 'HighTin', 'HardTin', 'PercPf', 'WoodPf', 'EPStrng', and 'EPBrass', 'Clav2'.
- Voice Editor - Instrument: 3**: A control panel for the selected instrument, featuring sections for 'TRANSPOSE' (transpose C2, mode POLY), 'LFO' (speed 202, sync OFF, waveform TRIANGLE), and 'PITCH' (op1, op2, op3, op4).
- Configuration Editor**: A central window for editing parameters. It includes a 'name' field (one key), 'configuration number' (1), 'mode receive mode' (ALL), and 'voice combine mode' (ON). It also features a table for instrument numbers (1-8) with columns for 'midi channel', 'number of notes', 'key limit /L', 'key limit /H', 'voice bank', and 'voice number'. A 'voice bank' window is also visible, showing a list of banks (5-8) and their corresponding instrument numbers (1-4).
- TELE**: A window for selecting a 'voice bank' and 'configuration'.
- voice comparison**: A window for comparing different voice banks.
- instruments**: A window for managing the instrument list.

At the bottom, an 'output level' row shows values of 127 for each of the 8 instruments.

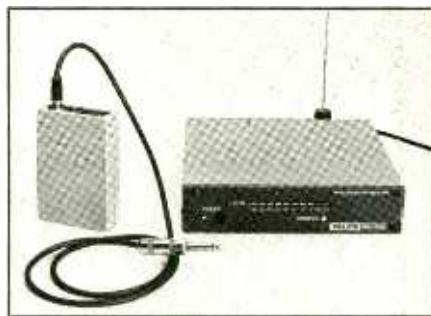
Why do you suppose one company seems to introduce the most new wireless systems?



1984: FMR-2 Pos-i-Phase Diversity systems



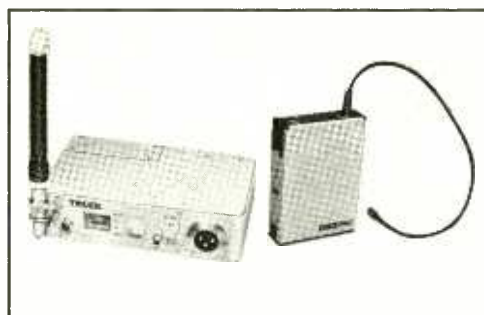
1985: FMR-50 Economic Non-diversity systems



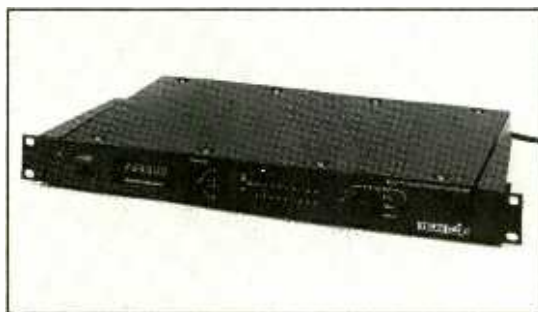
1985-'86: FMR-50G (pictured) Non-diversity and FMR 2G Diversity Guitar systems



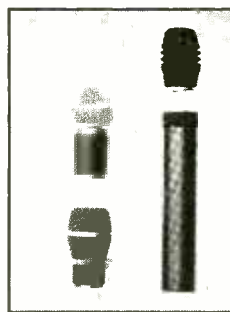
1986: Sound Enhancement, Personal Audio system



1986: ENG-4/WT400 Compact, Multi-Channel system



1987: FMR-4 Multi-Channel, Rack Mountable Receiver



1987: HT-400 2-Channel Mic/Transmitter with interchangeable heads

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FM GROWS UP

example, will have the same wave form, rate, and phase (although not depth) as the vibrato on the string bass. The same LFO is used no matter whether pitch or amplitude vibrato is being called for. (The LFO wave form and rate for the voices are those of the last patch selected, either from the front panel or through MIDI.) This takes away greatly from the naturalness of the ensemble sound, and means that vibrato must be used very carefully.

The *TX81Z*, on the other hand, allows a different pitch vibrato for each voice, although some sharing goes on when amplitude modulation is used, which is a far less serious drawback.

The major problem with both these devices is that, for serious use, a computer is essential. Besides the fact that patches on the *FB-01* can't be edited any other way, the complexity of these instruments—patches are in banks, and they go into instruments, which are assigned voices, and they go into configurations, which are assigned program numbers, etc.—requires a lot more visual feedback than the LCD displays can hope to provide, if the user is to maintain his sanity.

For the novice, the fact that a computer can cost a lot more than the synthesizers themselves is intimidating, but for studios that already have a computer (and that seems to be Yamaha's intended market), it's no big deal. Of course, you still have to spring for the software, which itself will set you back a significant fraction of the cost of the synthesizer.

A number of companies have been working on software, and taking various approaches. As of this writing (late March), the only commercially available program for either device is *FB Pro* for the *FB-01*, from Digital Music Services, the company that designed the original *DX Pro* for the Apple II computer, that was marketed for a while by Yamaha. *FB Pro* works on the Apple Macintosh, and takes advantage of that computer's multiple-windows format to display and edit patches, banks, and configurations. The arrangement of the windows (which is an art in itself) can be stored as a template, and up to 10 templates can be stored on disk, so that a user can call up a favourite program set up instantly. The program also contains a useful 'Compare'

feature, which brings two patches on the screen, and highlights where they are alike or different. (I'm waiting for someone to do the same for a *DX7*, so that I can find all the redundant patches I've been collecting and wipe them off my hard disk.)

Another company developing an *FB-01* editor for the Macintosh is Opcode Systems, who designed the first graphics-based *DX7* editor a couple of years ago. Opcode's program is, as you might imagine, graphics oriented, and includes a unique feature that translates *DX7* patches into *FB-01* patches, breaking the 6-operator *DX7* voice into two 4-operator *FB* voices if necessary.

Dr T's Music Software has combined an editor for the *FB-01* and the other Yamaha 4-operator synths (the *DX100*, *27* and *21*) into one package which runs on the Apple II, Commodore 64/128, and Atari ST. Included is a conversion utility for going back and forth between the *FB* and the *DXs*, and an upcoming version will incorporate the *TX81Z* as well. Dedicated software for the *TX81Z* will shortly be available from Digital Music Services for the Macintosh, and from Bacchus Software for the IBM PC and equivalents.

The *FB-01* and *TX81Z* show that we haven't heard the last of FM synthesis from Yamaha, and that the technology is a long way from being old hat. They are also forcing the issue of computer support—anyone who wants to really take advantage of these products is going to have to invest in a computer. (But Yamaha aren't forcing anyone to buy their own brand!) With the power that these units have, and at the price being asked for them, they are hard to resist. I doubt there are many studios who take their synthesiser collections seriously who would want to be without them. □

Digital Music Systems' *FB-Pro* showing multiple windows

The screenshot shows the *FB-Pro* software interface with several overlapping windows:

- File Edit Options Window Template**: The main menu bar.
- FB-01**: A vertical sidebar on the left with icons for voice banks, configuration, config editor, voice editor, voice bank, configuration, voice comparison, and instruments.
- FB rom 4**: A list of patches:

1	UpPiano	25	EPia
2	SPiano	26	High
3	Piano2	27	Hard
4	Piano3	28	Perd
5	Piano4	29	Wood
6	Piano5	30	EPS
7	PhGrand	31	EPB
8	Grand	32	Clav
- RAM 1: FB rom 3**: A window showing configuration options:
 - RAM 2: FB rom 4
 - Config: ROM Config 01
 - Config Editor (⌘F)
 - Voice Editor (⌘D)
 - Temp Voice
 - Temp Config
 - Compare Instruments (highlighted)
 - Hide All (⌘H)
- Instrument: 3**: A window showing LFO and PITCH parameters:

LFO	
speed	202 sync OFF
waveform	TRIANGLE
load enable	ON
amp mod depth	0 sens 0
pitch mod depth	60 sens 3
PITCH	
	op1 op2 op3 op4
tonic	0 0 0 0
ratio	1 1 5 1
tune	+1 0 +1 +1
sync	1.0 1.0 5.0 1.0
RING	
type	+LN -LN -LN -LN
pth	1 4 5 2
r ti	0 0 0 0
pth	1 1 1 1
- Config**: A window showing configuration details:

name	one key
configuration number	1
code receive mode	ALL
voice combine mode	ON
instrument number	1
midi channel	1
number of notes	1
key limit /L	C-2 C-2 C-2 C-2 C-2 C-2 C-2 C-2
key limit /H	G8 G8 G8 G8 G8 G8 G8 G8
voice bank	6 6 3 6 5 3 4 7
voice number	1 2 4 8 25 3 5 17
- output level**: A row of 8 sliders, each set to 127.

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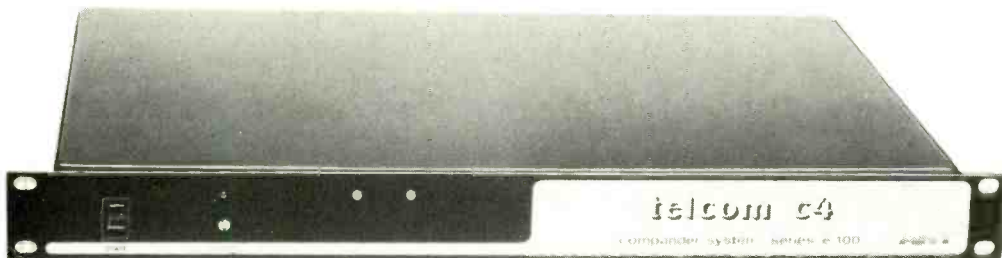
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REVIEW

Dave Foister looks at the Midiverb II and Microverb from Alesis

It really isn't that long ago that the idea of a professional quality reverberation device at the price of the subject of this review would have been laughable. Even a spring-based unit of real studio quality cost several times as much, and the early digital devices tended to be rich studios' toys. As elsewhere, however, the pro equipment got cheaper, and the cheap gear got better, until the two categories looked as though they had met in the middle—almost. The Alesis *Midiverb* became the product that nearly bridged the gap—the digital reverb device cheap enough for home recordists but offering studio quality—almost.

While it came very close, close enough to become a legend virtually overnight, there were reservations about its sound quality as far as pro studios went. Under anything approaching critical conditions, the *Midiverb* betrays its price and its number of bits by displaying noise breathing effects, limited bandwidth and gritty, obviously digital tails particularly on long reverb settings. While these problems are trifling in view of the price, they rule out serious use of the device under commercial conditions. However, the *Midiverb* is no more; in its place is the *Midiverb II*, which not only adds further delay-related effects of the kind which might be found on the *Midifex*, but uses 16 bit PCM to overcome the performance limitations of its predecessor. The result is almost as much of a leap forward as the original was.

Having got noticed with the bizarre (and less than ergonomically brilliant) styling of the *Midiverb* and *Midifex*, Alesis have reverted to a conventional 1 U rack-mount format for the *Midiverb II*, although the mains transformer is

still mounted outside the case—this time in the mains plug itself. This means the same basic unit can be sold anywhere in the world, packed with an appropriate mains adaptor, thus keeping costs down. Gone too is the awkward rear-mounted mix control; this, along with input and output gains, is on the front panel, next to the LED indicators showing signal present and overload. The gain controls mean that levels can be matched to most other types of equipment, and the unit works quite happily at studio line levels. Ins and outs are on unbalanced ¼ in jacks, and the only other connectors are the MIDI in and thru ports and a jack for a defeat switch.

Like its predecessor, the *Midiverb II* is entirely preset—none of the programs can be altered in any way—so the only further controls are soft rubber pushbuttons for calling up the programs and controlling the MIDI facilities. There are now 99 programs—plus '00' for defeat—and despite the name, many of them are not reverb programs at all, but other delay-related effects.

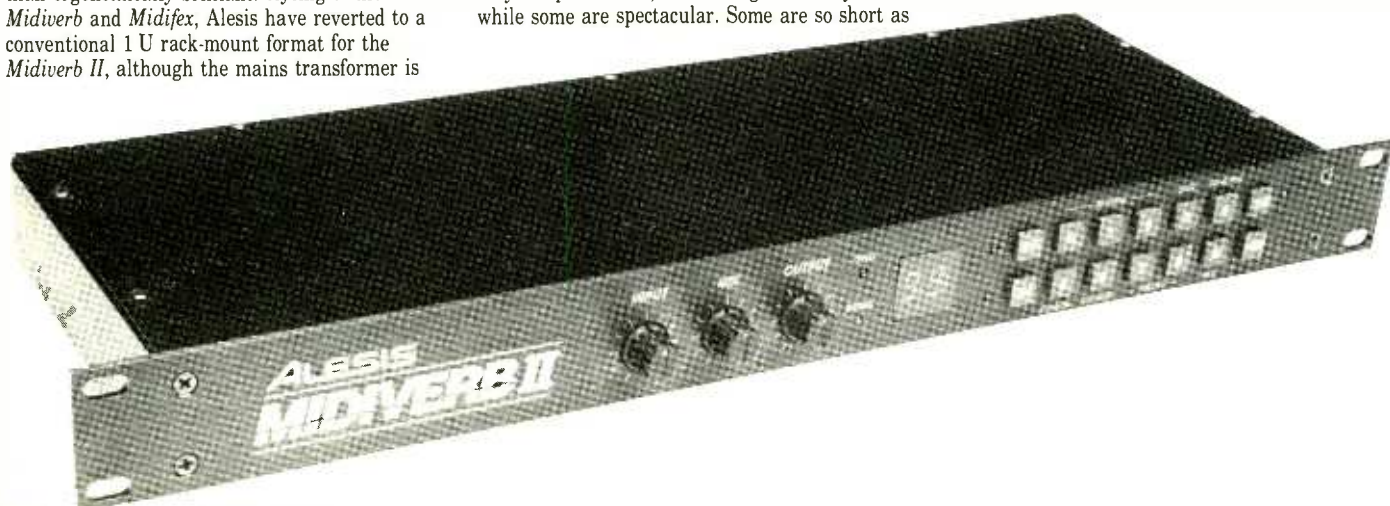
The first 29 programs are straightforward reverberation. Here a reference chart would have been useful for quickly finding the required type of effect because the order in which they are arranged is not immediately obvious. Generally the higher numbers are larger rooms with longer reverb times, but then 8 and 9 are longer and fuller than, say 10 and 11, presumably because at that point it moves to a larger, but deader, room. Admittedly it doesn't take long to learn what's where, but more detail in the instructions would have been nice. However, the range of effects is very comprehensive, some being extremely subtle while some are spectacular. Some are so short as

to hardly constitute reverb at all, giving instead the illusion of a very small live space, while some, particularly 28 and 29, are so long as to be only usable as special effects. The range has been well enough selected that the lack of programmability really isn't that much of a drawback. There would be something here for almost every occasion, with a good variety of decay times, pre-delay times, frequency response and damping, and all (except possibly the really outrageous ones) sound completely natural, with little to give away their digital origins.

In fact the outstanding feature of the whole unit is how clear it is. Gone are the noise breathing effects, even on the longest programs. The remarkably high bandwidth of 15 kHz via the effects, and 20 kHz dry, gives good, bright, sparkling reverb where needed, and there's little trace of the grittiness caused by poor diffusion on many other units, including much more expensive ones. Even the ends of the longest tails are smooth right down to silence. Alesis quote a dynamic range of 85 dB, and the device is indeed very quiet, although as one might expect, it goes into horrendous digital distortion if overdriven. Fortunately the overload indicator is a lot more helpful than some, so setting the unit up for optimum performance is very easy. Certainly the performance is good enough for almost any application, including the stringent demands of small-scale classical recording.

In addition to the straight reverb programs, there are 10 classic gated reverb effects, with varying gate lengths and tonal quality. Some have very sharp cut-offs, while others have slight tails, making them less severe effects. There are also 10 reverse reverb programs. These vary in their lengths and tonal quality, and some have repeats built in. Two of them, 45 and 49, are quite remarkable, and Alesis claim them as their own exclusive invention, calling them 'Bloom'. The reverberation builds quite slowly, and then goes into a very long conventional reverb. The result is a huge, ethereal sound which seems to hang on for ever.

That covers all the reverb programs; the rest are various delay-related effects. All the 50s are flange programs, all quite distinct. Some are negative flanges, some have feedback, and all have some degree of stereo swirl effect when used in stereo. As with the reverb, they range from quite subtle to severe, with an element of pitch shift. Three are triggered flanges, where the control oscillator restarts at the top of the sweep when the input rises above a fixed threshold level. These are useful for drums and percussion, but on continuous material, clicky glitches can be heard as the oscillator resets.



The 60s 'bank' contains 10 chorus programs, with varying degrees of depth, speed and pitch shift, again all incorporating a degree of stereo effect. As expected, all are extremely clean, and the variety of effects offered should cover most eventualities. What is perhaps surprising is that both the chorus and flange effects are as deep, warm and convincing as a dedicated DDL.

The next 20 programs show one disadvantage of the fully-preset design of the unit; they are all single-repeat delays, but because the delay time is not adjustable, a fifth of the unit's programs have to be taken up with different length delays, and you can bet the one time you need the repeat to be exactly in time with your track, none of them will fit. Admittedly the longer delays are a good length and extremely clean, but it does seem a bit of a waste of the unit's potential, considering that most studios will have some kind of DDL to do such things more quickly and with more control.

That leaves the last 10 programs, which are all special effects which don't quite fit into any of the other categories. There are some impressive stereo bounce and pan effects, some which give a stereo image from a mono source without any apparent modulation, and some delays with regeneration.

In fact there are so many effects, most of them extremely useful, that if one were relying on the device as one's main reverb unit, another one would be needed to get the full benefit but at this price, that's not an unreasonable idea.

The MIDI spec is basic but nonetheless useful. The unit will respond to any channel, and also has omni mode. In omni, any patch number sent to the device will select the corresponding program number. If a specific channel has been selected, then the programs are assignable to patch numbers, so that, for instance, transmitted patch 15 could select program 65. Unfortunately in this mode it will only recognise patch numbers up to 32, which is all right for DX owners and a few others, but not for those of us with instruments sending higher patch numbers (mine goes up to 94). This may or may not be cost-cutting, but it seems an unnecessary corner to cut. Sending patch 100 selects preset 00, which is the defeat setting, and the device defaults, on power-up, to whichever program has been assigned to patch 01—useful for selecting your most-used setting.

The variety of processing, simplicity and very good sound quality of the *Microverb II* would make it a worthwhile addition to any studio. At the price, the few little niggles wither into insignificance and it really becomes a must. It seems the gap has at last been bridged.

Alesis Microverb

The Alesis *Microverb* is an extremely inexpensive but high quality digital reverberation device, a scaled down version of the *Midiverb II*. It features 16 preset, unalterable programs: six small rooms, seven large rooms, two gated reverb effects and one reverse reverb.

The packaging and price suggest the unit is aimed primarily at the home recording market, but the sound quality is good enough for it to be useful in the professional studio as well. Unlike most other cheap digital reverbs, it uses full 16 bit PCM, giving a claimed dynamic range of 90 dB, very low distortion, and a bandwidth of 10 kHz, enough to give clean, bright reverb without the muffled dullness of some cheap units. It is indeed very quiet and clean, all the reverb settings being smooth and clear, and covering a sufficiently wide range of effects to be a useful





'spare' reverb alongside the studio's bigger devices.

In these days of complex reverberant fields it's not possible to have too many reverb units, and at this price and quality most studios could afford to have a few of these around for quick access to that extra effect. □

Alesis, PO Box 3908, Los Angeles, CA 90078, USA.

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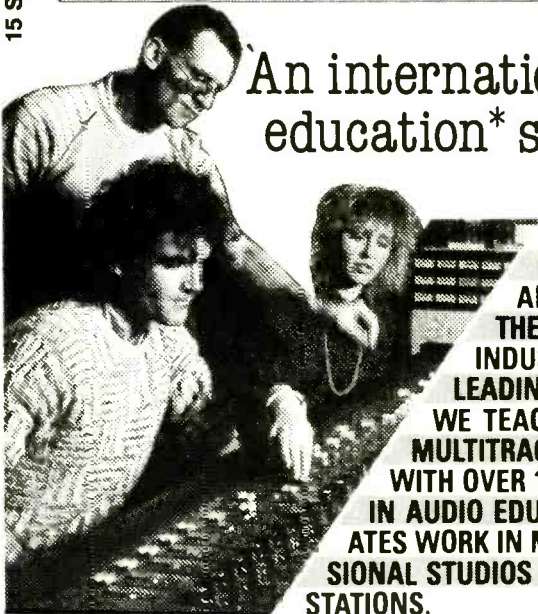




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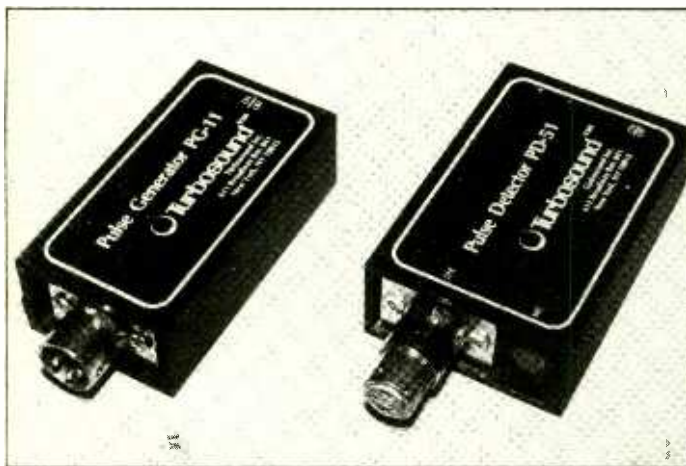
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REVIEW

Terry Nelson evaluates two phase checkers—the Turbosound TPC-1151 and the SCV PC80



With the super-abundance of sophisticated audio equipment these days, it is all too easy to lose sight of some of the basic rules concerning audio, such as phase and polarity. This review takes a look at two little tool sets which should easily

find a place in every engineer's briefcase. Turbosound and SCV have both had phase checker sets on the market for over 18 months yet I am still surprised at the number of people who say, "Hey, that's just what I need!" when they see me use them. Though both systems are basically the same—pulse generator and pulse

detector—there are some differences.

The principle of operation is to send a positive pulse through a system, be it acoustic or electronic, and then check that it is still positive at the test point. Obvious candidates for this test procedure are speaker systems, microphones, wiring assemblies, etc.

Turbosound TPC-1151

This consists of the PD-51 pulse detector and the PG-11 pulse generator. Both are mounted in rugged aluminium cases with a black anodised finish. In order to economise on XLR patchcords—and provide operating convenience—each box is fitted with an extruding XLR; male for the pulse generator and female for the pulse detector. This means that the boxes can be plugged in directly to the systems being tested. The plugs are non-latching for one-handed operation.

Controls are minimal: the PG-11 is fitted with a protected on/off switch and the PD-51 with protected on/off switch, built-in condenser microphone and red and green LEDs for

indicating phase/polarity. Both units each operate on a single PP9 9 V battery and feature very low current drain (approx 90 hours operation).

The manufacturer's rated specification for the PG-11 provides a unipolar pulse of -10 dBm (average) into a floating output. The frequency range is from 10 Hz to 10 kHz (-26 dBm ref 25 Hz). Peak output is +1 dBm with a -28 dBm point at 20 kHz ref 25 Hz. The PG-11 uses the 'standard' of XLR pin 3 hot.

The PD-51 incorporates a condenser microphone for acoustic measurements and this has a preset low sensitivity of about 85 dB SPL. The advantage of this is that when pulsing a system in a fairly noisy environment, the pulse detector won't be fooled by extraneous noises. The red and green LEDs are marked '-' and '+' respectively: a positive wavefront on the microphone will cause the green LED to illuminate and a negative one the red LED. All very simple.

For electronic measurements there is the balanced XLR line input and a positive voltage on pin 3 relative to pin 2 will cause the green LED to illuminate and vice versa.

As previously mentioned, the construction is



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very rugged and to guard against shocks (ie dropping the unit from a flying truss on to a concrete floor 40 ft below!) the circuitry is encapsulated in order to withstand the rigours of the road.

SCV PC80

This is similar in presentation to the Turbosound equipment in that it consists of a pulse generator and a pulse detector—or in this case what SCV call a generator and a discriminator.

The two units are built into diecast boxes and appear to be made to withstand hard use. Each unit is powered by a 9 V battery for a claimed 50 hours of operation.

The pulse generator features an *XLR 3M* line output connector with corresponding level control, a low profile on/off toggle switch with yellow LED power indicator and a miniature loudspeaker. The acoustic output is unaffected by the level control.

The line output of the generator can be varied from 0 to 1 V and the source impedance is 1 k Ω . Pulse rate of the generator is 1 Hz with an electronic frequency content of 1 Hz to 20 kHz; the acoustic pulse ranges from 200 Hz to 5 kHz.

The SCV generator is unbalanced with pin 3 hot. However, a strap on the PCB enables fast changeover to pin 2 hot should this be required.

The inclusion of the small loudspeaker is very handy as this enables the polarity of microphones to be quickly verified without having to set up a separate loudspeaker system. On the other hand, connection to a line or equipment input necessitates the use of a patchcord.

The discriminator features a recessed measuring microphone and *XLR* input, two low profile switches—on/off with yellow power LED and mic/line input selection—and recessed red and green LEDs for indication of phase or polarity. The mic/line switch is 3-position and enables either the in-built or an external microphone to be used as well as a line input source. Manufacturer-quoted input impedances are 1 k Ω for microphone and 10 k Ω for line with respective input level ranges of 10 mV to 1 V and 0.5 V to 50 V. As with the generator, the input is unbalanced and can be selected internally between pin 3 or 2 hot.

As with the Turbosound boxes the green LED indicates a positive polarity/phase and the red negative.

Operational comments

Both units were found to be very easy to use and in all cases battery changing proved to be no problem. (The SCV discriminator did have some connection problems due to a duff battery connector but I tend to feel that this confirmed Murphy's Law that the one-in-a-million will be the test model.) Though the principles of operation are the same, the Turbosound and SCV units each have their own approach and this virtually makes the two systems complementary to each other.

For acoustic measurements in situations where the ambient noise is high, for instance, the Turbosound is easier to use. On the other hand, the built-in loudspeaker of the SCV makes

microphone testing fast and simple. It really all depends on what you want to do and how you want to do it.

Users of both systems have their own anecdotes that illustrate the usefulness of these little gadgets and how much huge investment systems are at the mercy of a crossed wire, etc. These range from half of a PA stack being out of polarity with the other half to a top New York studio 'having problems with the mix' and finding out after three days that the monitors were out of polarity (a visitor just happened to have a checker in his briefcase!).

In short, invaluable little tools and every toolbox should have one. □

Addresses

SCV Audio, BP 50056, 186 Allee des Erables, Paris Nord II, 95947 Roissy Ch de Gaulle Cedex, France.

UK: Professional Audio Ltd, 53 Corsica Street, London N5 1JT.

USA: SCV Inc, 414 North Sparks Street, Burbank, CA 91506.

Turbosound Ltd, 202-208 New North Road, London N1 7BL, UK.

USA: Turbosound Inc, 611 Broadway #841, New York, NY 10012.

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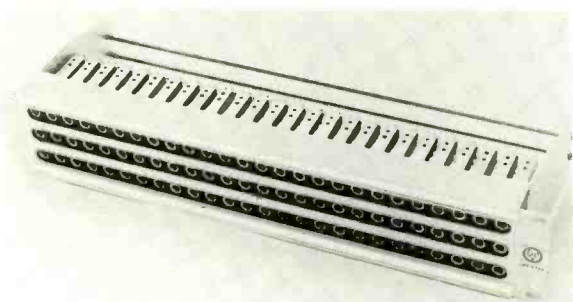
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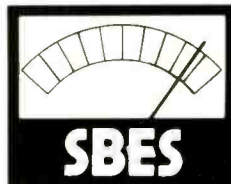
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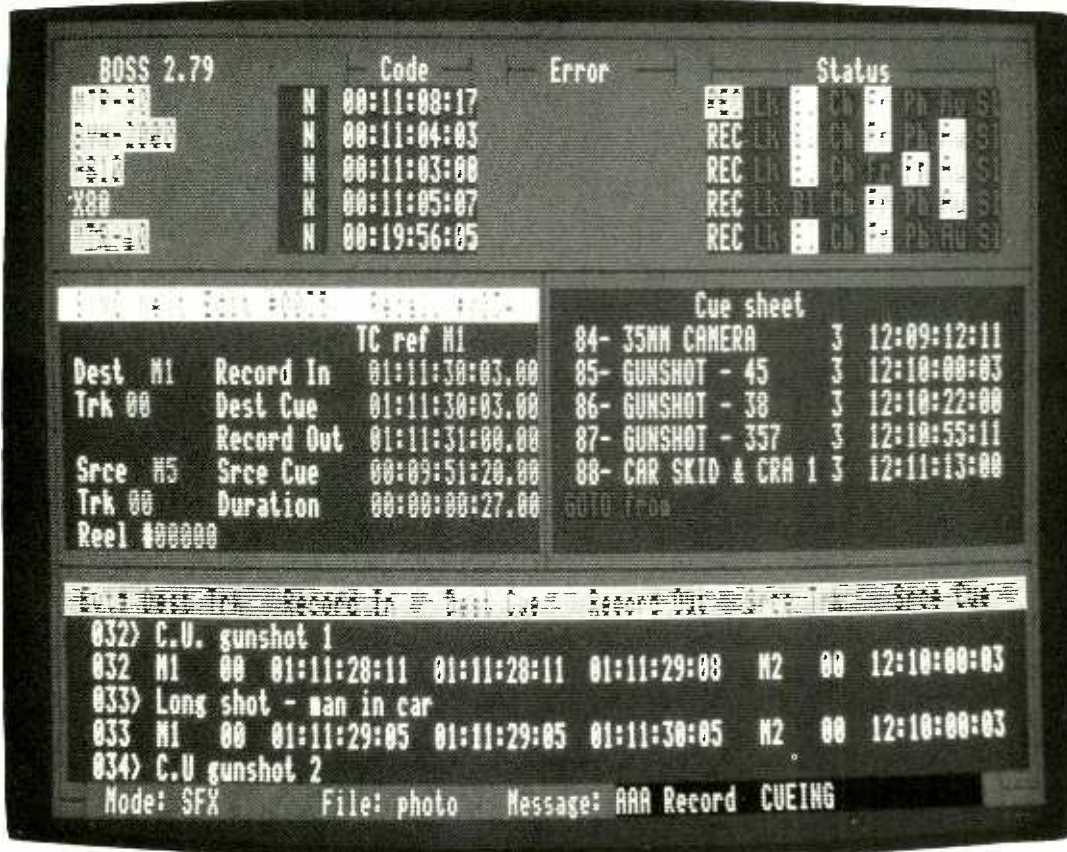
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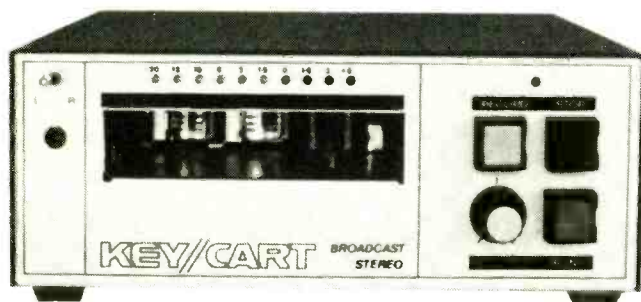
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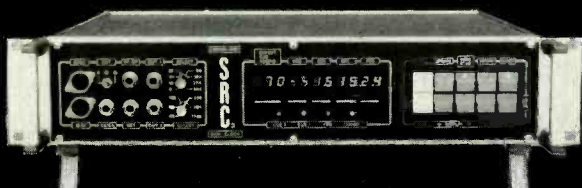
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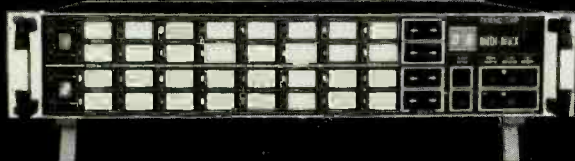
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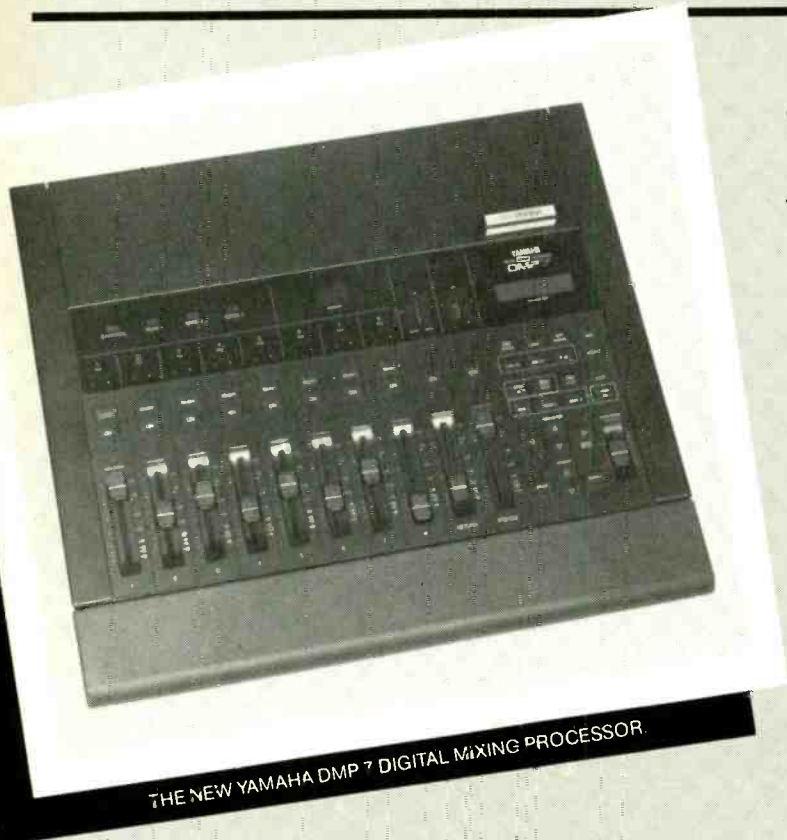
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C40-C49	33p	31p	29p	42p	40p	39p	52p	51p	50p	C45	46p	42p	40p
C50-C59	36p	35p	34p	50p	48p	46p	60p	59p	58p	C60	52p	46p	44p
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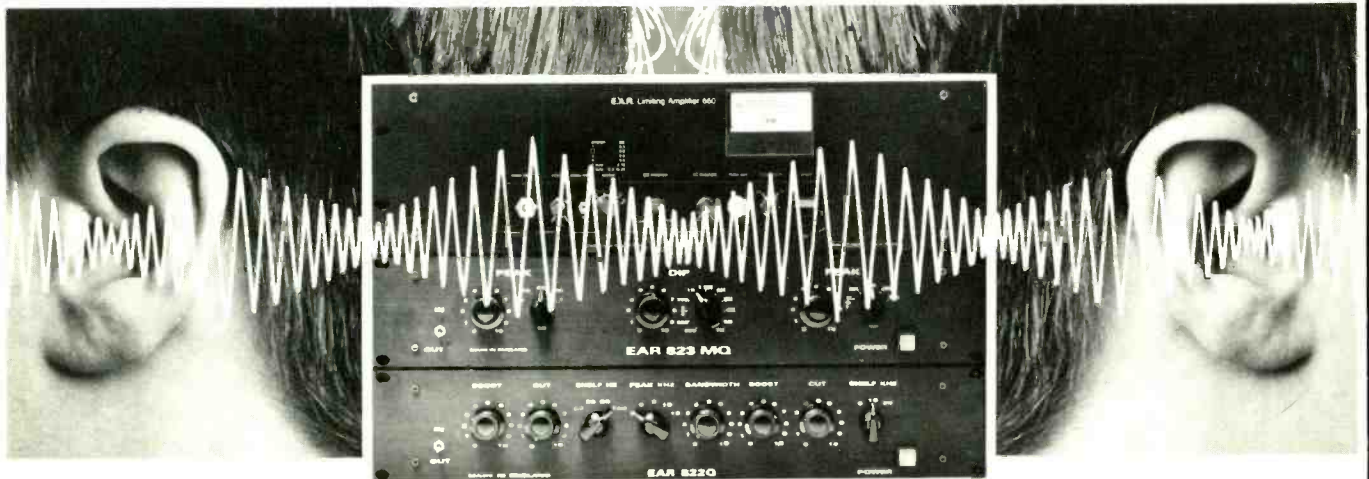
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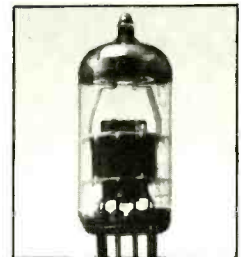
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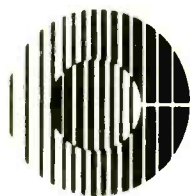
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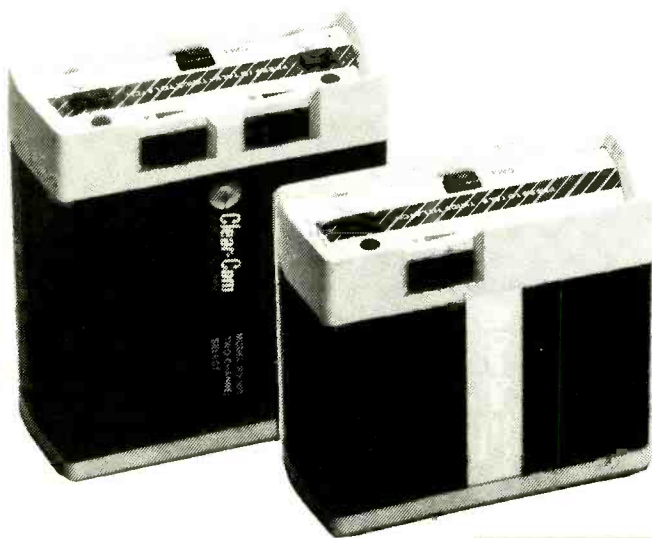


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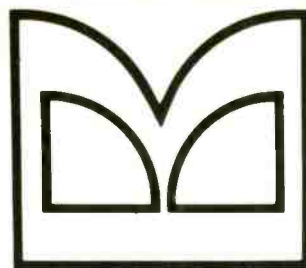
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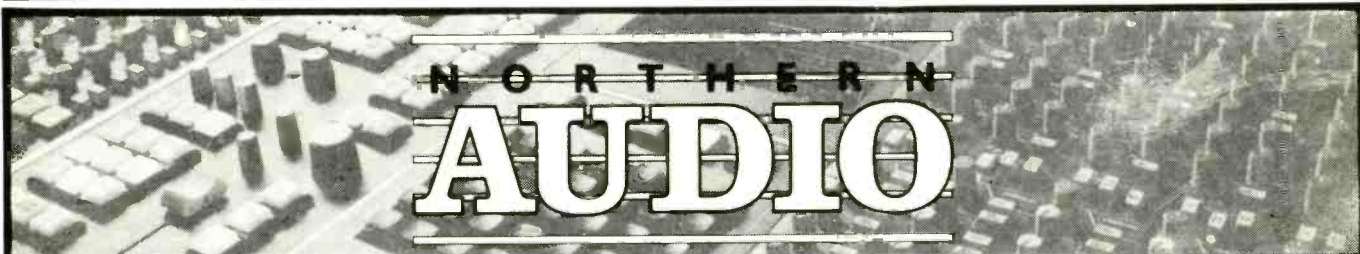
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When used interactively with the Pro-24 program:

SMPTE start offset and cue points together with tempo data can be saved as a Pro-24 song file. Tempo and time signature changes from the Pro-24 mastertrack govern midi sync. and clock out rates of the SMP-24. Each Pro-24 track is assignable to any of 64 separate midi channels via the SMP-24s' four midi outputs. The SMP-24 also has two mergeable midi inputs – overdubs can be made whilst syncing to tape for example. For on-stage use, the SMP-24 accepts Pro-24 song files into its' on-board sequencer negating the need to use your computer at all.

When used as a stand-alone SMPTE synchroniser:

63 sync. programs are available each of which stores start offsets and cue points. Four timecode standards can be selected including E.B.U. The SMP-24 will also read and write MTC (the midi timecode standard). One bit resolution means accuracy down to a sub. frame. Locking time is less than 3 seconds and there is no problem using varispeed codes. An external clock may be used as a tempo reference; this could be: an audio trigger, tempo-tap from front panel or footswitch, any trigger from 1-254 PPQN, or a midi clock. Naturally, the SMP-24 converts timecode to Midi sync. and other clocks up to 254 clicks per. beat. All data can be saved to tape.

When used as a midi processor and controller:

64 midi configuration programs each of which can route either midi input to up to four midi outputs and assign midi channels for all inputs and outputs. Each output may be transposed by pitch and/or velocity and a high and low split point can be set. In addition, there are 64 master midi programs which combine up to four of the configuration programs outlined above, and can hold 20 patch change programs. Furthermore, all programs have fully comprehensive filtering of midi data.

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