

January 1990

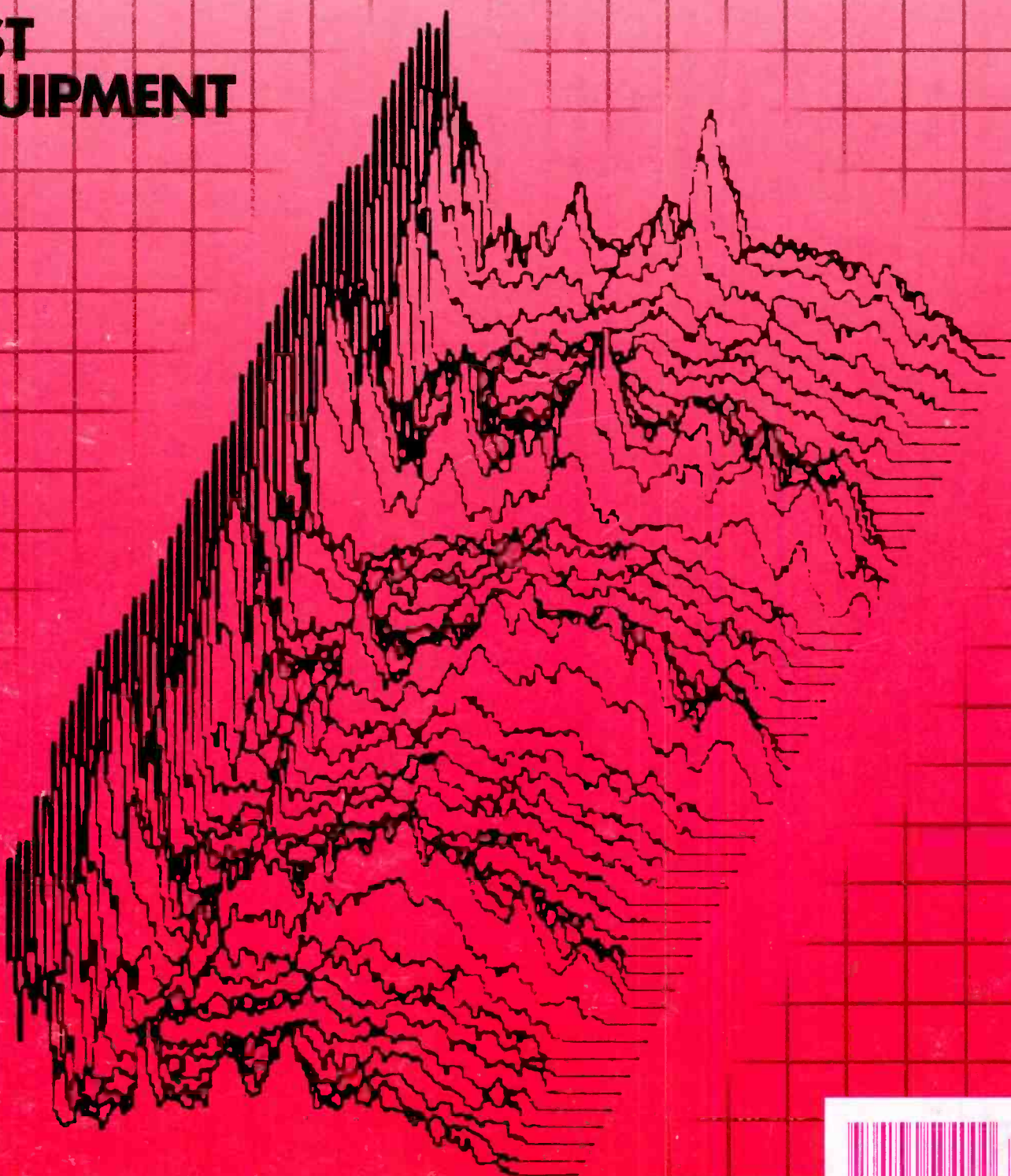
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BY A HUNTER HOUSE MAGAZINE

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AND BROADCAST ENGINEERING

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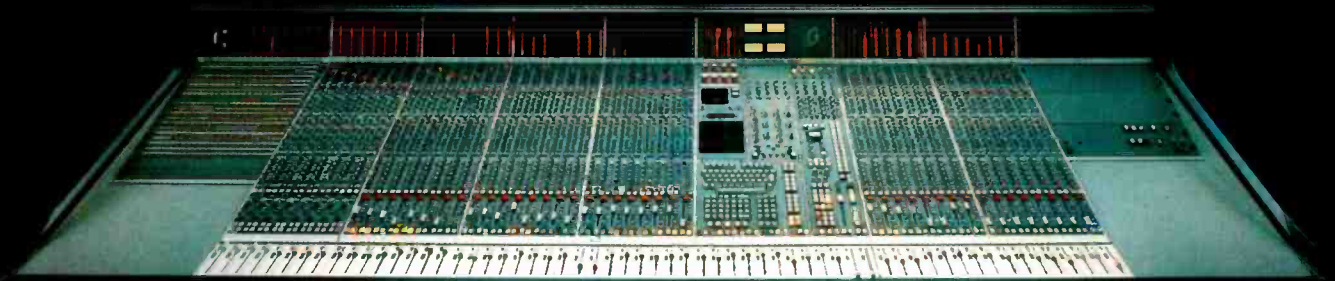
AND BROADCAST ENGINEERING



Real World, Bath, UK

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# STUDIO SOUND

AND BROADCAST ENGINEERING

January 1990  
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UK: 5,675. Overseas: 13,889.  
(ABC audited)

## Finding fault with fault finding

Test equipment drags along the subject of maintenance, which in turn raises the deplorable situation within the recording industry. The topic has been aired many times and I don't propose to go over old themes, such as a surfeit of facilities lowering rates leading to the forced exiting of the seemingly disposable maintenance staff with the facilities turning towards the equipment seller for increased support or the occasional call on the technical freelancer. A word of warning for the facilities—many manufacturers and dealerships are currently throwing around ideas about charging for customer support after an initial period following the sale. Multiplied by the number of separate items in the studio this could change economic strategies quite considerably. Equipment may have become more reliable but what about those problems that occur when two pieces of equipment refuse to work together? Whose responsibility is that?

To balance this there are also the rather public statements recently made by certain record company A&R departments about how they always look to booking studios with full time maintenance back-up and how necessary they feel it to be. It is a shame that invariably they will not wish to pay for it.

As equipment gets more complex we are looking for a higher standard of maintenance engineer. Even with the right engineer, the studio probably could not afford the gear to fault find its more complex pieces of equipment. And if the engineer were any good he would quickly tire of the board-shuffling 'TV repairman' level of approach that he would be reduced to and head for far better salary and conditions within the video or computer world.

So is there a solution? The courses set up to supply maintenance engineers may have been supplying excellent industry-capable recruits but even they cannot change the market situation.

There are perhaps only two choices. We cannot expect facilities, which are unable to provide full technical back-up to service their clients fully, to close down, reduce the glut of facilities and let rates rise for those remaining. Does the answer lie in another area. Sony have several times shown their interactive video disc/computer servicing system for the digital multitracks that makes fault finding relatively easy on such a complex product. The arrival of other CD formats will allow CDI and CD-ROM versions of manuals and fault finding systems to be implemented. It could be possible with the right software that a full diagnostic could be run together with a CDI manual to such a level that a fully trained maintenance engineer would not be needed to interpret it although this may be somewhat optimistic. It seems a viable approach that becomes far more realistic as CD production costs come down. However, I suggested this as a possible direction over a year ago when I was invited to sit on an AES workshop panel and I must say that the response from others was less than enthusiastic and even the comment made that you would *still have to place the CD-type disc in the player* to obtain the information—as if to suggest that this was a realistic barrier to the use of such technology. If this is truly the level of approach from the industry then there appears to be no hope whatever we do.

## Convention clash

On a completely different topic, we have just had it confirmed that the US AES Convention for 1990 in Los Angeles is now in September. In their efforts to avoid a clash with SMPTE the AES have chosen dates that clash directly with the UK IBC Convention in Brighton—the second largest broadcast show in the world after NAB. This is a great shame, not just because of the problems that this has now presented to exhibitors but rather undermines the case that the AES was making a few months ago that it was prepared to listen to those that support it. If, as the AES claim, such a clash were unavoidable in their efforts to distance the Convention in time from SMPTE, then it does rather suggest that the AES is currently acting as a myopic inward-looking body rather than the international organisation it has been seeking to promote itself as.

Keith Spencer-Allen

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Viewing 5th & 6th February 1990

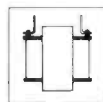


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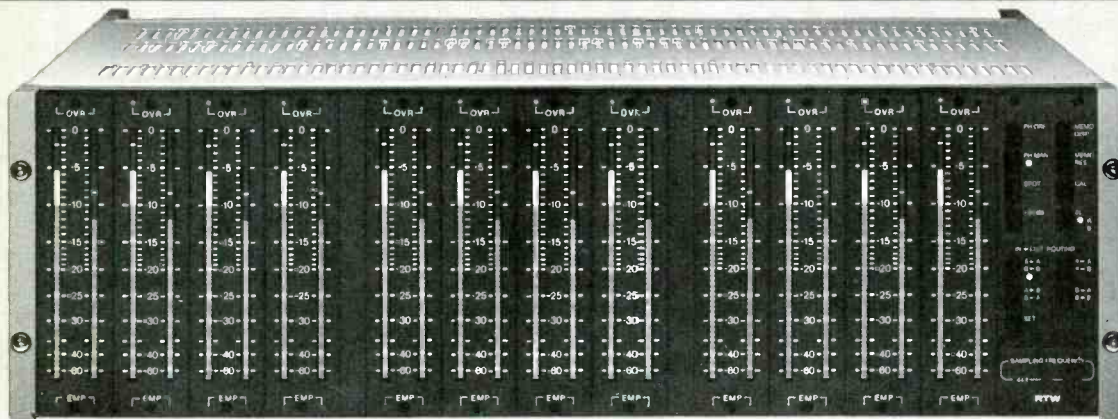
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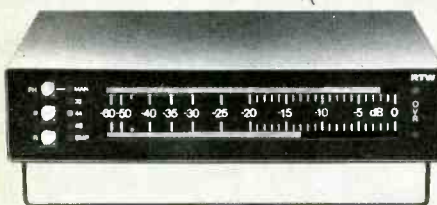
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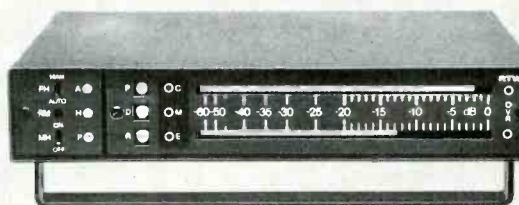


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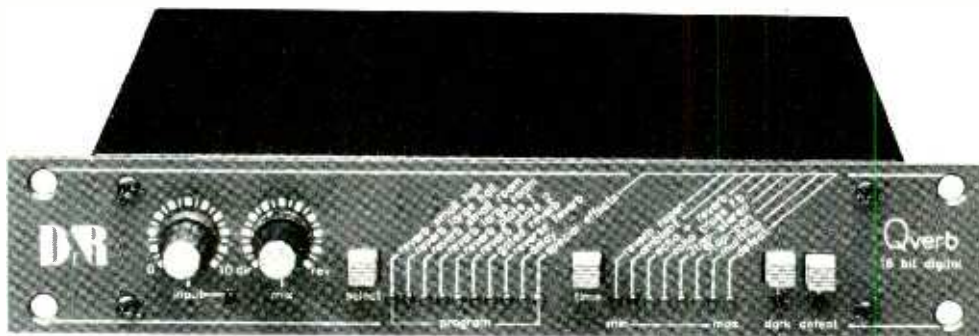


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# NEWS

**“At last, all the best gear and best value – in one place!”**

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The London Studio Exchange is now open. The 3,500 sq ft showroom houses the best permanent display of new equipment for recording, video and broadcasting in the UK. Along with a large selection of second-hand equipment. Plus a trade counter with selected items from the Canford Audio range. All under one roof and staying there, all year round.

**“It’s about time someone did it – thank goodness it’s the Jacksons.”**

Ken Townsend, Studio Manager, EMI, Abbey Road.

The sales team at the London Studio Exchange is Malcolm Jackson and Janet Boon. They’re both members of The Jackson Music Group – a company with a very wide knowledge of the business, based on a total of 70 years experience, much of it international. In other words, they really know their MIDIs from their SMPTEs. Other features at The London Studio Exchange include a flexible control room facility where you can test the equipment in peace, however loudly. And a dedicated technical department will be added shortly.

**T H E  
LONDON  
STUDIO  
EXCHANGE**



Malcolm Jackson and Janet Boon at the opening of the London Studio Exchange.

**“Unique, excellent and an exciting adventure for package buyers.”**

Phil Dudderidge, Managing Director, Focusrite Audio Engineering.

The London Studio Exchange is conveniently located at 6 Erskine Road, NW3. It’s right by Primrose Hill, 5 minutes by car from Oxford Circus and there are no parking restrictions. There are some 42 studio and post production houses in the immediate area alone. Along with many delightful restaurants and watering holes. The London Studio Exchange is open now. For further details phone Malcolm Jackson or Janet Boon on 01-722 8833.



# Look! Hear!

How do you find top sound equipment when there's no APRS at Olympia and no AES at wherever?

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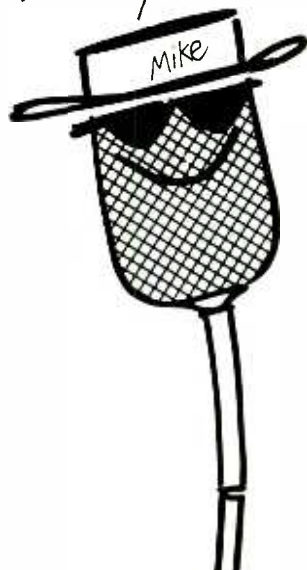
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# Earthquake

Stories filtering through from the San Francisco earthquake include one from Summit Audio. They had to relocate their office as it was completely demolished. Their president, Mike Papp's house was also badly damaged. Summit's factory is fortunately sited outside San Francisco and was unaffected.

E-mu Systems' factory was closed on October 18th, the day after the

main earthquake, and operating at 50% capacity the next day. No E-mu personnel were injured and no serious damage was sustained to their buildings.

Other companies who were affected by the disaster include Orban Associates; Dolby Laboratories; Otari Corporation; Ampex Corporation; Meyer Sound and Sony, who have some warehouses in the area.

## Address changes

- **Opcode Systems** have relocated and are now at 3641 Haven Drive, Suite A, Menlo Park, CA 94025-1010, USA. Tel: (415) 369-8131.
- **Teledyne Acoustic Research** are now located at Alexandra Street,

Hyde, Cheshire SK14 1DY, UK. Tel: 061-367 8871. Fax: 061-367 8104.

- **NED Europe** have moved to Elsinore House, 77 Fulham Palace Road, London W6 8JA, UK. Tel: 01-741 8811. Fax: 01-741 8613.

## In brief

- Ontario, Canada: **Tannoy North America** have changed their name and are now known as TGI North America. This is to reflect changes in the UK-based parent company known as TGI pic as from 1988.
- Manchester, UK: **Salford College** have introduced two new courses. A 2-year BTEC Higher National Diploma course and a 3-year Bachelor of Arts Honours degree. Both under the description 'Popular Music and Recording'.
- Leeds, UK: **Wharfedale Loudspeakers**, have formed a new division to supply original equipment manufacturers (OEM). The OEM division will be divided into three areas: Hi-fi OEM; Power OEM, for pro-audio use; and System OEM, which will produce complete speaker systems for other manufacturers.
- Mexico: Bhaskar Menon, chairman of EMI Music worldwide, Capitol-EMI Inc and EMI Music Ltd, is the new president of the **International Federation of the Phonographic Industry**. Mr Menon succeeds the late Nesuhi Ertegun who died earlier in the year.
- London, UK: **The Barbican Arts Centre** has incorporated the Music Performance Research Centre (MPRC) and its growing archive of digitally recorded live concert and opera performances. A purpose-built audio facility within the music section of the Barbican library, sponsored and digitally equipped by Sony Broadcast & Communications

UK, allows musicians, composers, students and music buffs to access the collection.

- Hertfordshire, UK: **Thatched Cottage Audio**, are opening a new digital division to cater for the new generation of professional 16- and 24-track machines becoming available. Thatched Cottage. Tel: 0223 207979.

- Waltham, MA: **Scholz Research and Developments** have brought a legal suit against Bernhard Kurzke and MS Music Services of West Germany for infringement of the *Rockman* patents.

- Huntingdon, UK: **Quad** have announced that all the amplifiers in their professional amplifier range will be fitted with the Neutrik *NLA* output connector.

- New York, USA: The 'TLS' identification for pro-audio recorded tapes, which is now coming into use in UK recording studios, has been approved for equivalent operations in the USA. Agreement to adopt the Tape Label System as a standard for the US recording studios was announced by Dave Porter, the incoming president of SPARS during last October's AES in New York.

- Leatherhead, UK: Surrey Sound Studios are now operating as a fully residential studio. Accommodation has been bought next to the studio and negotiations are underway to acquire a second property. A games room has also been added.

# News from the AES

There is a broad spectrum of subjects to be covered in this year's session of British AES evening meetings and more details will be available on each nearer the time. To help future planning the dates, speakers and titles are listed below.

## 1990

January 9th  
**Satellite Distribution of Audio**  
Chris Hibbert

February 13th  
**Digital Audio in the TV Studio**  
Paul Evans

March 20th  
**To be announced**

April 10th  
**Amplifier Differences**  
Paul Miller

May 8th  
**DAT Timecode**  
Sony

June 12th  
**Active Acoustics**  
Philip Newell

The next lecture is on the subject of **Satellite Delivered Audio and Data to Radio Stations** by Chris Hibbert of Satellite Media Services. Chris Hibbert will give a brief history of methods employed to date of distributing audio by satellite, leading to the introduction by SMS of the digital multiplex approach to delivering high quality

multichannel audio and data with remote controls, to the Independent Radio network in the UK.

He will describe the decisions leading to the choice of equipment, its functions, the setting up of the network and the development of unique software for the trafficking of audio and data through the system. He will also explain the use of Rotary head Digital Audio Tape (RDAT) in the SMS system.

This lecture will be held at the IBA, 70 Brompton Road, London SW1 starting at 7.00pm with coffee at 6.30pm.

We are now able to supply the revised edition of John Watkinson's book **The Art of Digital Audio** priced at £39.95, a new book **Stereo Sound for Television** by Francis Rumsey at £12.95 and the proceedings of the recent **AES/EBU Interface Conference** at £20. A number of other publications have recently arrived and preprints from the last AES Convention in New York are now available. These can all be obtained from the address below.

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

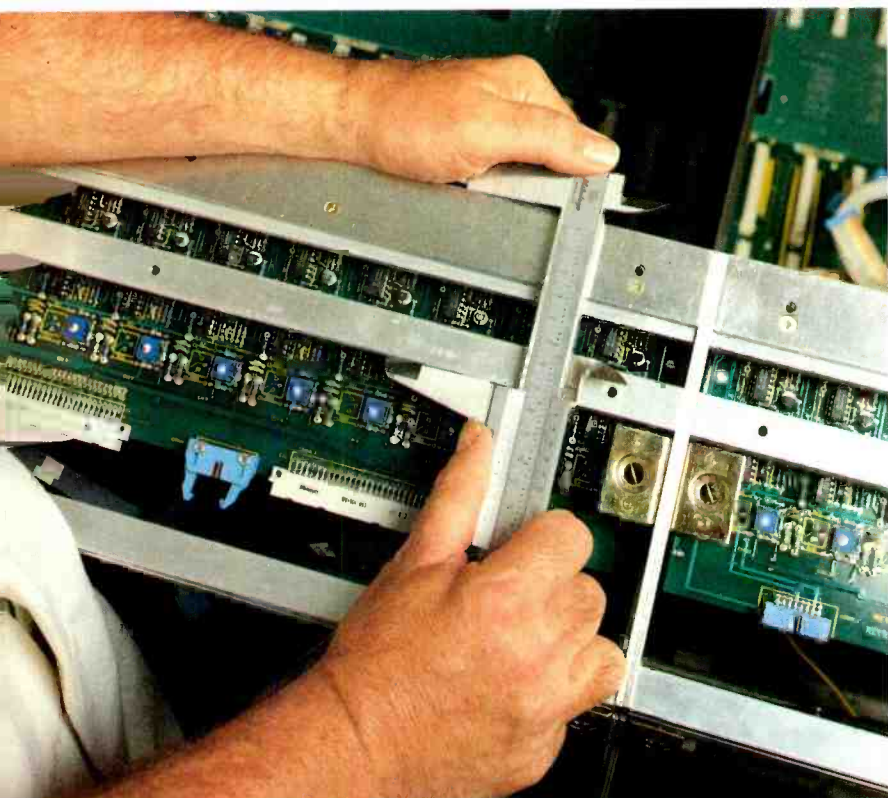
## People

- **Opcode Systems** have announced the appointment of Mark Lentzner as director of research and development. He was previously with Apple as manager of Music Products Engineering.
- **Casio Electronics**, UK, have appointed John Wright as product executive in the Casio EMID team.
- **Britannia Row Productions** have recently appointed Chris Hey as the company's production and logistics manager. Hey had been rentals manager with London dealers Electromusic.
- **Neve** have appointed John McDiarmid as UK sales manager looking after recording studios. McDiarmid comes from being

regional manager with Magna-Techtronics.

- **Klotz (UK) Ltd** have appointed John Wheeler to a newly created post as field manager for the UK subsidiary.
- Dr Ronald Lambert has joined **Ampex Recording Media Corp** as vice-president Engineering.
- **Imagination Studios**, London, have appointed Larry Bartlett as studio manager and Julian Scott as creative producer/engineer at their new studio complex.
- **Carlsbro Electronics**, UK, have appointed Rob McFarlane as consultant projects engineer. McFarlane comes from HH Electronics.

**Another Neve Console speeds off the production line.**



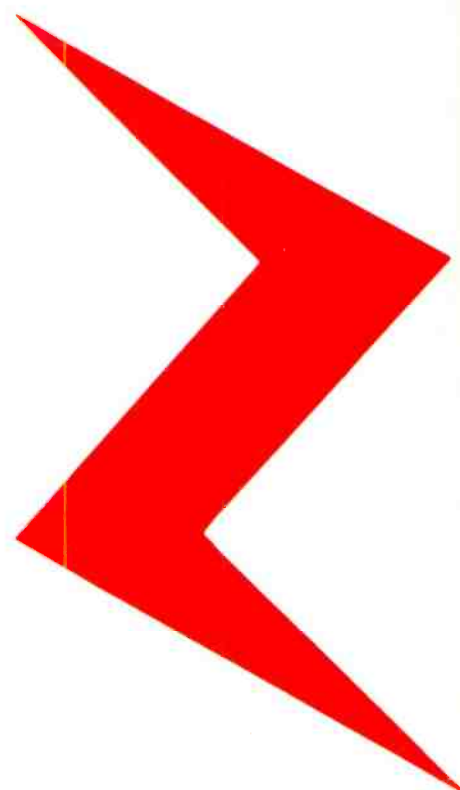
Actually, we don't have a 'production line', and as for speed we're as quick as perfection takes because at Neve we understand the lasting value of quality and attention to detail.

A typical Neve console contains over 200,000 separate components, which demand stringent testing at each stage of its creation. To maintain and improve our reputation for excellence we employ a total of 23 dedicated technicians whose prime responsibility is the control of quality.

The production of each Neve console requires the skills that are only found in human hand and eye, combined with the most up-to-date computer technology the world has to offer.

With this exceptional meeting of art and science is it surprising to find so many Neve consoles in daily use after twenty five years?

# Neve



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# API representation

Iain Roche, ex-marketing manager of Audio Kinetics, has formed an audio distribution company, Professional Audio Distribution based in central London. Two companies are currently being represented: API (worldwide outside US and Japan) and Outboard Electronics moving faders (international and UK) although it is planned more lines will be added.

It is their intention to set up dealer networks for product lines rather than direct sales except in the case of API where modules will be through dealerships but the new discrete console introduced at NY AES will be represented directly. Professional Audio Distribution, 142 Randolph Avenue, Maida Vale, London W9 1PG, UK. Tel: 01-289 6637.

# New dates for AES

The dates for the 89th AES Convention, to be held at the Los Angeles Hilton this year, have been

changed from October 11th to 15th to September 21st to 25th.

# Exhibitions and conventions

**January 21st to 25th** Midem '90, Palais des Festivals, Cannes. Contact: Handel Communications on 01-627 8083.

**February 20th to 21st** Sound 90, Heathrow Penta Hotel. Contact: SCIF. Tel: 0628 667633. Fax: 0628 665882.

**March 13th to 16th** AES 88th Convention, Centre de Congres, Montreux, Switzerland. Contact: AES Exhibition Director, Herman A O Wilms, Zevenbunderslaan 142/9-B-1190 Brussels, Belgium. Tel: (2) 345 7971. Fax: (2) 345 3419.

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

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

**June 1st to 6th** AV & Broadcast 90, China International Exhibition Centre, Beijing. Contact: Business &

Industrial Trade Fairs, 28/F Harbour Centre, 25 Harbour Road, Wanchai, Hong Kong. Tel: 5-756333. Fax: 5-8341171.

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

**August 19th to 22nd** Video Expo '90, Palacio Das Convencoes do Anhembi, Sao Paulo, Brazil. Contact: (UK) Ms Alison Carew-Cox. Tel: 021-455 9600. Fax: 021-456 1785. (Brazil) Para maiores informacoes. Tel: 021-220 3386.

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

**September 21st to 25th** AES 89th Convention, Los Angeles Convention Center and Los Angeles Hilton, Los Angeles, CA, USA.

# Agencies

● **Klotz** have appointed a US distributor for the Oak Link optical audio communication system. Klotz Digital, c/o Electronic Systems Laboratories Inc, 120 SW 21 Terrace C-104, Fort Lauderdale, FL 33312. Tel: (305) 791-1501.

● **WaveFrame Corporation** have announced Martin Audio as their representative for New York state including all of the New York City metropolitan area. Martin Audio Corp, 423 W 55th Street, New York, NY 10019. Tel: (212) 541-5900.

● **Michael Stevens & Partners** have announced their appointment as sole UK & Eire distributor for Bel products. Michael Stevens & Partners, Invicta Works, Elliott Road, Bromley, Kent BR2 9NT. Tel: 01-460 0499.

● **Klark-Teknik** are to distribute the Turbosound and BSS range of products in the US. Klark-Teknik, 30B Banfi Plaza North, Farmingdale, NY 11735. Tel: (516) 249-3660.

● **EMO Systems** have announced the appointment of Per Meistrup Productions Co of Karlslunde as their product distributor in Denmark. Per Meistrup Productions, Motorgangen 7-9, PO Box 34, DK 2690, Karlslunde,

Denmark. Tel: (42) 15 13 00.

● **ATC, UK**, have appointed Joseph Magee Audio Engineering as distributors for their loudspeaker systems in the US. Joseph Magee, 11288 Ventura Boulevard, Suite 462, Studio City, CA 91604. Tel: (818) 753-9510. Fax: (818) 753-9320.

ATC themselves have been appointed UK distributors of American-made **Sumo** products. ATC Loudspeaker Technology. Tel: 028576 561. Fax: 028576 683.

● **Carlsbro Electronics** have appointed South Sea Souvenirs as a distributor in the Fiji Islands. Further details available from Carlsbro Electronics, Cross Drive, Kirkby-in-Ashfield, Notts NG17 7LD. UK. Tel: 0623 753902.

● **SSE Marketing** have become sole UK distributors for **Digital Audio Labs**, manufacturers of desktop recording boards for IBM compatible computers; and **Momentum Data Systems**, manufacturers of software for the design of digital filters. SSE have also become distributors for **Ariel Corporation's** range of DSP products. SSE Marketing, 10 William Road, London NW1 3EN. Tel: 01-387 1262.

# Best AES yet

The 87th AES Convention in New York attracted 14,359 audio engineering attendees during the four days of the convention. The exhibition occupied four floors of the New York Hilton Hotel and a major part of the adjacent Sheraton Centre Hotel exhibition hall. The combined areas hosted 262 companies from

around the world.

Attendees at the Convention, which marked the 40th year of audio exhibitions and conventions conducted by the AES, attracted attendees from all 50 states, Puerto Rico, the US Virgin Islands, Canada and 28 overseas nations.

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## 30 Years of Studio Sound

**January 1961** . . . Recording studios are designed and built 'acoustically dead' to minimise the rebounding of sound from walls, ceiling and tables. Imagine the frustrated designer who after removing all trace of echo heard singers and guitarists demanding it. Nowadays records without echo can be counted on the fingers of one hand.

**Just announced in the UK is the Binson Echorec Baby**, a portable echo machine that consists of a magnetic recorder, using a rotating metal disc instead of tape. Recording and erase heads are fitted, together with replay heads which are fitted at varying distances around the disc. Four echoes can be selected, with the additional feature of 'swell' which feeds the output back into the recording head to provide reverberation.

**January 1970** . . . Readers who missed last month's leader article are reminded that, from next month, our title will be called *Studio Sound & Tape Recorder*. The Tape Recorder title will retain prominence in the February, March and April issues, after which Studio Sound will dominate the cover artwork.

**January 1978** . . . The BBC and 3M have collaborated in the development of a digital recording system that comprises a 32-channel multitrack using 25.4 mm tape, a 2- or 4-channel mastering machine using 6.35 mm tape and the necessary interface hardware. Both the multitrack and mastering machine are based on the 3M M79 Isoloop transports and record the digitised audio signals longitudinally along the tape rather than in a helical-scan format utilised by most experimental digital recorders derived from video tape machines. The present system is derived from a 10-channel machine that the BBC Research Department has been developing over the last 2 years.

## Contracts

- SSE Marketing have delivered a 4-channel DAR *SoundStation II* to Sounds Effective, a London Soho-based post-production facility.

- AMS have announced the installation of a 48-channel 'Virtual Console' system in Control Room C of the Turner Broadcasting TBS Super Station at Atlanta, GA.

- AMS have announced recent *AudioFile* orders including Scene Three, Nashville, TN; Atlanta Productions, Stockton, CA; Inner Vision Productions, St Louis, MO; Bill Young Productions, Houston TX; QDD, Honolulu, HI; and Photo Mag, USA; Danmarks Radio (8 hour system), Denmark; NHK (2nd system), Japan; Sokia Gakkai (upgrade), Japan; Audio Arts, Manila, Philippines; Vector Television, Stockport, UK; Reel Good Productions, Northern Ireland; Video Village, Bristol, UK; BBC Wood Lane and BBC Bristol; LWT (5th and 6th systems), London; and Yorkshire TV (3rd and 4th systems), UK.

- Otari will be supplying a custom 64-input automated three-man mix console to the Saul Zaentz Film Center, Berkeley, CA. Known as the *Premiere*, it is being designed to the specification of the Film Center's engineers and will be the first of a new series of such consoles offered by Otari.

- Digital Audio Research has announced sales of *SoundStation II* systems to CD mastering company Digipro, Brussels and to Studio L'Equipe, a Belgian film post-production studio (through SED/ASC); and through Spanish distributor Promovisa, 4- and 8-channel systems to new Madrid-based complex ADV studios.

- *Miss Saigon*, a new West End musical, has been using one of the largest *Cadac E-Type* mixing consoles seen in the UK. Produced by Clive Green & Co, the *E-Type* system provides a total of 86 inputs to handle the sound of the 41-strong cast, sound effects and 30 musicians.

- Tele Edit, a video editing and graphics house in Minneapolis, have bought a *Lexicon Opus* digital audio production system. Telemation, a post-production facility in Seattle, Washington have also recently bought an *Opus*.

- Ancha Electronics, Chicago, US, have installed another *DDA S* series console. The latest unit has been delivered to Arlington Park Raceway as the main mixer for the track.

- Lyrec of Denmark have equipped



Cadac E-type mixing desk used for London's new musical 'Miss Saigon'

the newly extended Sonopress plant at Weaverville, NC, USA, with 15 P-2518 high speed twin slave units for their audio cassette duplication operation.

- Gnome Productions, New York City, have recently acquired a *Clarity XLV* to automate outboard effects and synthesisers.

- Dreamhire in London have recently bought two *Akai DR1200* digital multitrack recorders.

- Imagination, a London-based corporate marketing design and facilities house have chosen *Audio Kinetics ES. Lock* products to control the audio and video machines in their new studio complex.

- TV2, a new TV station in Denmark, have taken delivery of three *Soundcraft* series 6000 recording consoles for use in their various production suites. These were supplied by Soundcraft's newly appointed Danish distributor, Audionord. Dutch distributor Selectronic have completed the installation of a 24-channel *TS12* console for the Dutch Motion Picture Academy in Amsterdam. UK dealers

Palm Audio have completed the sale of three series 200 SRs to the National Motobike Museum in Birmingham.

- Warner Communications Inc, Lorimar Studios, CA, US, have invested in audio-editing equipment including custom-designed audio pre-lay consoles from Trident.



Winter Olympics stadium, Grenoble, France

- Nexo have won the contract to supply and install the new sound system for the 1992 winter Olympics in Grenoble. The contract was won by ATEs, one of Nexo's French distributors.

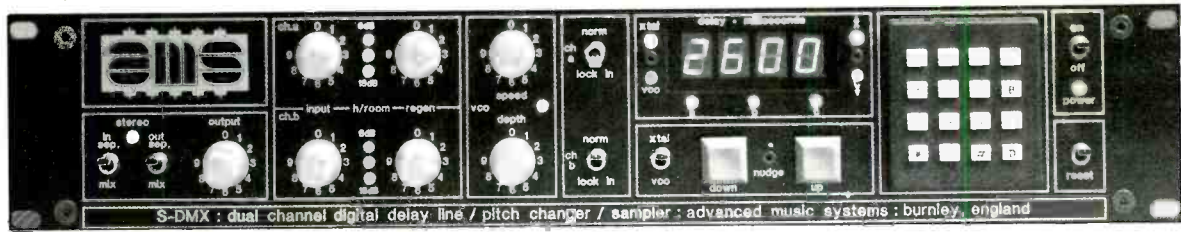
## Obituary: Deane E Jensen

Deane Ellsworth Jensen, founder and designer of Jensen Transformers died suddenly at his private audio engineering laboratory at Jensen Transformers, North Hollywood, CA, during the weekend of October 21st 1989 at the age of 47. Deane was well known for his efforts to improve the

fidelity of sound in the recording, reinforcement and broadcast industries.

Jensen Transformers Inc was dedicated to high quality, both in its hardware and software. The company will continue Deane's work, building quality products and serving the audio community.

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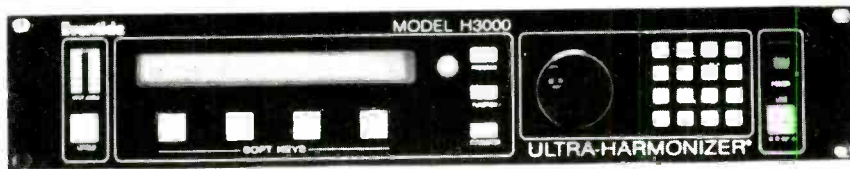
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'PSYCHO-PRONER'; 'SHAKY'; 'SIMPLE DELAY'; 'SISSY'; 'STADIUM'; 'STEAM BATH'; 'ST PETERS CATHEDRAL'; 'STUTTER'; 'STUTTER DUPE'; 'STUTTER  
RANDOM'; 'STUTTER UP'; 'STUTTER DOWN'; 'STUTTER UP/DOWN'; 'SWEET FLANGE'; 'TELEPHONE'; 'THREE OF ME'; 'THREE ON TWO'; 'TIME WARP';  
'TRAFFIC REPORT'; 'TV IN NEXT ROOM'; 'UNDERWATER'; 'WAH WAH'; 'WARRPED 45'; 'WARRPED UP'; NOT TO MENTION 15 EFFECTS THAT REQUIRE NO  
INPUT SIGNAL: 'A 440'; 'ALERT'; 'BOINGY BUZZ'; 'DODRBELE'; 'JET'; 'JETTISON'; 'LASER ECHO'; 'PUCK'; 'SIREN'; 'SONAR'; 'STEREO COOPTER';  
'TRAK ATTACK'; 'THUNDER'; 'UFO'; 'WAVE' AND WIND STORM.  
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## Drum set design by sampling

Among musicians, sampling is considered to be the most common way of successfully recording and reproducing acoustic sounds. Industrial laboratories on the other hand, have adopted sampling as a powerful way of measuring and testing, from frequency response of electronic gears to mechanical noise vibration. This article intends to show a sampling application between these two worlds, thus hopefully stimulating new hybrid ideas and potentially opening a much wider marketing target for sampling microphones.

During the past five years, high budget pop music has returned to the use of real acoustic instruments for live concerts. In turn acoustic instrument manufacturers have increased production. Most drum set manufacturers in Italy, however, are small companies devoted to handmade custom-tailored drum set production. One of these companies looking for a way to make high quality drum sets more affordable, asked me to help them in designing their new product. A good way to cut

costs is to avoid production on a simple trial and error basis. Even if every part of a custom handmade drum set is individually sound some design theory and production planning can go a long way in obtaining an acceptable standard of quality. That way you hope to achieve good results from almost every drum set you make.

My task in particular consisted of designing a measuring system to study the acoustic behaviour of a snare drum in order to

mathematically pinpoint what made it sound good or bad, and to try to find the best way to realise the snare drum on a mathematical basis. The first stage of the system was to sample the snare drum to allow us to compute subsequent frequency analysis without worrying about realtime constraint. Bruel & Kjaer make excellent realtime spectrum analysers for sampling, but my clients being basically musicians and not engineers, were wary of what they couldn't understand and worried about losing control of the situation. All they needed were just simple rules of thumb to design a snare drum, even if supported by specific analysis.

Luckily, my clients owned a rackmount digital sampler with CD quality specs (16 bit linear PCM conversion and 44.1 kHz sampling rate), a personal computer with a MIDI interface and a good software editing package. Thanks to MIDI (something like RS-232, serial asynchronous interface, plus a spot of high level music language) musical instruments can exchange

information, control and sound data, and can even 'talk' to computers equipped with a MIDI port. In particular, a sampler can save PCM sound data to a computer, wait for it to analyse and manipulate numbers and then reload data from the computer, to play the result of PCM software editing.

I decided to set up the system shown in Fig 1 (very simplified). The snare drum sound is sampled through the microphone and then sent to the computer as PCM (digital) data, via messages and saved to disk. Thanks to the sample editing software, you can view and change PCM data, using the computer keyboard. The software is able to perform an FFT of the sound, and display the snare drum sound spectrum visually. You can save the results to disk and/or print them out. You can also edit PCM data and reload the sampler with RAM of both the original and edited version of the snare drum sound. Then you play back both sounds and compare them. If the edited version sounds better, you have to try to repeat the same

# Breakneck





modifications to the actual snare drum sound, concentrating on the drum construction (type of wood, dimensions, snares, heads etc). Finding out how to do this is quite another story but at least you know what your goal is.

Studio microphones are generally intended to make a musical timbre sound better, in order to get a good recording. But we wanted a microphone to capture a sound as faithfully as possible. I chose the B&K 4011, cardioid mic. The on-axis frequency response up to 20 kHz is very smooth, the cardioid polar response is regular at every frequency and the noise floor is very low. The 4011 can also tolerate very high SPL peaks and still perform smoothly and with low harmonic distortion, which is normally hard to get from studio mics, which although very reliable, are still delicate. I prefer cardioid mics for two reasons: firstly musicians and studio engineers are more accustomed to cardioids than omnis, so they work easier and faster. Secondly, you can avoid building an expensive anechoic

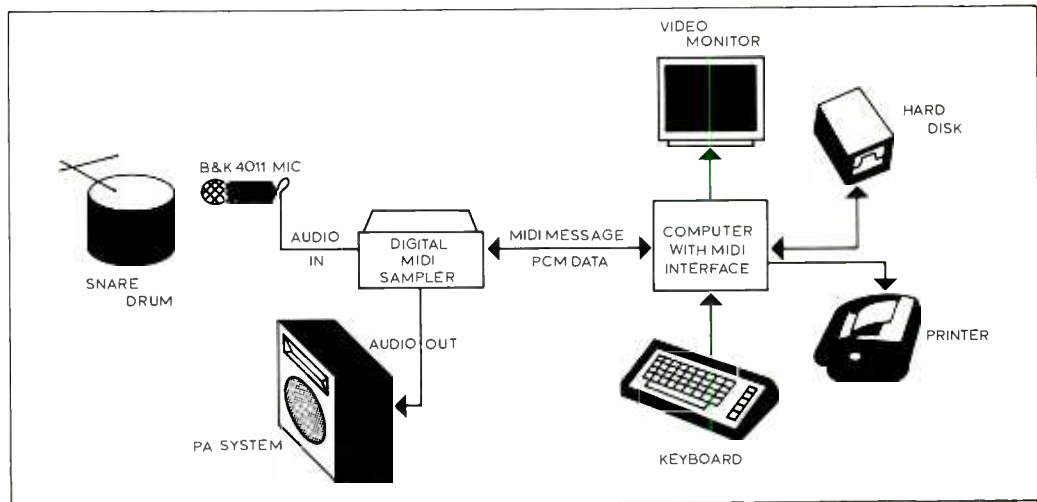


Fig 1: a simplified drum sampling setup

chamber to avoid picking up too much ambient reverberation. But despite close miking techniques being generally adopted for single drum track recording and sound measuring, the sound picked up at a certain distance is more like what your ears actually hear, after all you don't put

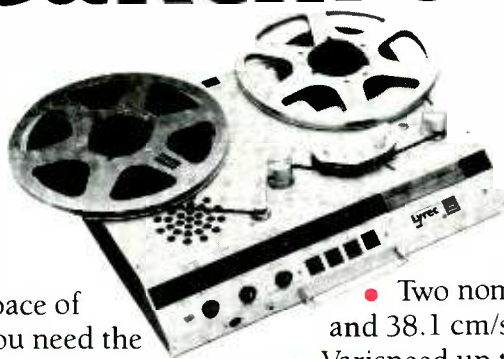
your head 1 inch from the snare drum to hear its sound. The right distance (and position) depends on room characteristics, and there are no hard and fast rules to find those out, I can only suggest experimenting by ear.

**Attila Baldini**

*Since 1985 Attila Baldini has been a columnist for Italian musical instruments*

*Strumenti Musicali. He specialises in popularising sampling, MIDI and signal processing principles among musicians and studio engineers. Since 1987 he has also been a hardware/software consultant to some major Italian distributors and manufacturers of musical instruments and sound reinforcement systems. Since 1988 he has been technical editor of X-Club News, the official Italian Yamaha-users club magazine. At present he is a last-year undergraduate in electronic engineering at the University of Bologna.*

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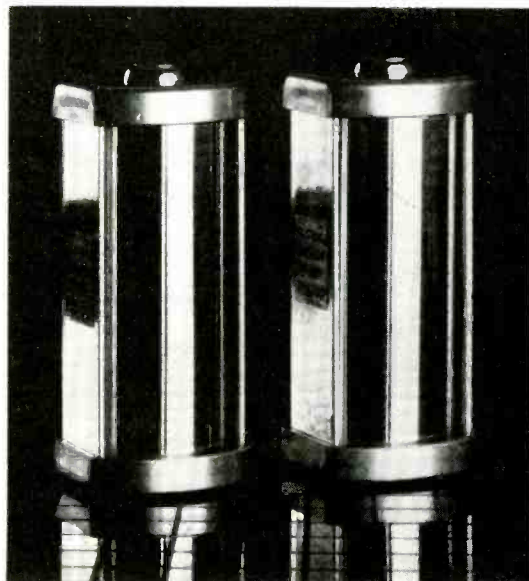


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In fact we are the largest pro audio dealers in Britain for Alesis, Korg, Drawmer, Casio, Fostex, Seck, Yamaha, TOA, Tascam, Studiomasster, Allen & Heath, C-Labs and a good many more! (Last year we sold nearly 600 new 8 + 16 track packages and around 200 s/h machines!) It's always worth ringing us for a quote on new equipment and if you're still unconvinced, ask yourself why we became the biggest in such a short time (or better still ask the rest!)

If you are bewildered by the vast amount of multitrack recording products currently on offer, Thatched Cottage fax packs should make the job of choosing the right equipment that much easier. There are 5 in the series; P.A. - Portastudios - 8 Track - Financial advice and MIDI. To obtain any of our fax packs just phone or write.

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When it comes to new equipment you may have noticed that we don't say 'phone for the best deal, POA, or "lowest price guarantee" (Ha! Ha! if the prices are so great why don't they just print them and amaze us all). Our bulk buying policy can usually guarantee that a telephone call to us will not be wasted and in any case we can throw in those "hidden" extras - cables with multitracks, patchbays with desks. (By the way, next time a dealer "guarantees" the lowest price and then can't deliver, try reporting them to the local Office of Fair Trading - it will teach them not to waste your time!)

To be honest though, if you spend all afternoon on the telephone the chances are you might find someone somewhere who will undercut us by a pound or two. The difference at THATCHED COTTAGE is if your E16 breaks down on a Sunday morning or your Drum Machine blows up on a Bank Holiday Monday you CAN ring us, we'll be here and we WILL do something about it - 365 days a year. Have you ever needed help and advice outside shop hours? If you are serious about your music you will know that it is quality of service that makes the difference and at THATCHED COTTAGE it's only a phone call away!

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At last a fully professional 24 track system for £14,000 + VAT. Combining the best selling Allen & Heath Saber with a 36:16:24 format (24 metering) and brand new Tascam MSR24 1 inch 24 track. Complete with jack patchbay + all plugs and cable. If you are thinking of trading up, why not give us a call for information or arrange a demonstration.

### THATCHED COTTAGE RECORDING SCHOOL

In response to popular demand we now run a one week recording course, designed specifically for those of you who feel they can make a go of running a professional 8, 16 or 24 Track Studio. The emphasis will be largely on the practical side and topics covered are finance premises, running a recording session and hints and tips on every aspect of recording. Class sizes are limited to eight at a time and guest speakers will cover relevant areas. The price is just £200 for the week, including accommodation. Interested? Telephone or write and we'll tell you more. We also run "arranging courses", useful for samplers, call for details.

### SANSUI WS-XI

By now you have probably heard about the brand new recording workstation from Sansui. 6 tracks, a full feature mixer, built-in effects and even a stereo mastering machine make it the most versatile single unit on the market today. If you don't like wires this is the recorder for you!

At Thatched Cottage for a limited period we will be GIVING AWAY an Axxeman, Bassman or a Korg P3 piano module with each Sansui to provide a complete recording/writing package. At £1126 + VAT it might be all you'll ever need! The phone lines are open.

THE SECOND ISSUE OF OUR FULL COLOUR QUARTERLY MAGAZINE FULL OF PRODUCT NEWS RECORDING ARTICLES AND DETAILS OF OUR BARGAINS IS NOW AVAILABLE. WRITE OR TELEPHONE FOR YOUR FREE COPY.



Dealers constantly complain about our secondhand and ex-demo list - it seems they are losing too many customers!

Being by far the largest supplier of 8 + 16 track equipment in Britain, we've decided we can afford to give away a few secrets! We simply tell customers that if any new equipment they purchase breaks down in the first two months we won't fix it, we will REPLACE it!

Result! Yet another customer who KNOWS they can rely on Thatched Cottage, and a secondhand list full of the latest gear, factory repaired, in mint condition with a full guarantee. Simple? We didn't become the biggest without being the best!

By the way, when it comes to s/h gear we care what we part-exchange. We only accept equipment which is in first class condition after all, when you buy from us it's our guarantee you are relying on!

### SOME SECONDHAND AND EX-DEMO BARGAINS

Seck 12:8:2 Mixer, Mint	£750
Seck 18:8:2 Mixer (black)	£899
Drawmer DS201/Dual Gates	£249
Nomad Axxeman	£199
32 Way Patchbays (new)	£30
XRI X300 SMPTE Generator	£199
Aphex Type C Exciter	£3250
Tascam MSR16 1/2" 16 Track	£599
Dynamix 168 inc. flight case	£499
Fostex 450 8 Track Desk	£999
Akar S950	£2999
Tascam ATR 60 1/2" 2 track (inc. trolley)	£199
Yamaha WX7 wind controller	£1499
Fostex E8 large reel 8 track	£199
Kawai K3 rack synth expander	£699
Casio FZ10M rack sampler (new)	£199
Tascam MX80 8 channel mic/line amp	£875
Yamaha MT100 4 track	£999
Korg MR	£375
Fostex 4030 synchroniser	£2750
Fostex 4035 controller (for above)	£299
Fostex E16 (secondhand with new heads/full guarantee)	£199
Apple Computer plus Greengate sampling software	£99
Steinberg Pro 24 (new)	£499
Steinberg DMP7 software (runs up to 4 units)	£1999
Fostex 260 (demo)	£1999
Fostex E22 (1/2" centre timecode) Demo	£649
Fostex E2 (1/2" centre timecode)	£199
Beyer MC740 the ultimate condenser mic (new)	£199
Drawmer LX20 compressor gate	£1399
Allen & Heath 24:16 System 8	£1299
RSD Series 1 28:8:2 Impressive!	£5999
Allen & Heath Saber large frame 24:16:24, as new	£399
Teac 3340 4-track	£13,000
Allen & Heath Sigma 32:24:24 (full automation fitted)	£650
RSD Stellamix 12/8/2	£3500
RSD Series 2 36:16/2	£299
Fostex 160 (Demo)	£250
Alesis HR16 (Secondhand - Mint)	£185
Akak S1000 + 2 meg expansion (full guarantee)	£399
Alesis MidiVerb 2 (IS/H)	£250
Casio S210M	£99
Toa D3 Mixer 8:2	£79
Yamaha R1000 dig. reverb	£199
Yamaha TQ5 (TX81Z + sequencer)	£199

We have a certain number of ex-demo Fostex E16s available all in mint condition with boxes - Give us a call (All prices exclude VAT)

### SPECIAL OFFERS (ALL NEW)

Nomad Axxeman - the Ultimate Guitar Processor	CRAZY PRICE £199 + VAT
NOMAD BASSMAN - the Ultimate Bass Processor	CRAZY PRICE £199 + VAT
Seck 18:2 desk (exclusive to us)	£649 + VAT
Tannoy DC100 monitors (per pair)	£150 + VAT
Yamaha TX16W 16 voice sampler with full library (new)	£799 + VAT
Fostex 460 - Rolls Royce of Portastudios inc full 8 track mixing desk RRP £2125 Our Price	£725 + VAT
Memory expansion boards for AKAI S1000 (2 meg)	£260 + VAT

We usually have large stocks of used + demonstration machines, call us for our comprehensive list.

### THATCHED COTTAGE SERVICE

At our fully equipped in-house service centre we can service all types of equipment (esp. 8-16 tracks) Every reputable audio dealer should have one on site (don't let anyone tell you any different). Believe it or not, some retailers actually sell complex electronic equipment from their front room or garage (nothing wrong with that of course - we all had to start somewhere - when you are successful though, you outgrow it pretty quickly!) It does though tend to suggest a lack of back up facilities. So if your multitrack needs a service or the heads looking at give us a call before its too late.

For those of you who are seriously considering starting a commercial studio we've come up with three packages, each containing everything you will need for your first paying session, from the Multi-track Machine right through to DI Boxes and Cables. The price of the 8 Track System is £4,300 + VAT, the 16 Track is £7,800 + VAT and the 24 Track is £15,750 + VAT. At Thatched Cottage we proved it could be done, and we have helped many new studios to open and start making money - our experience could help you. Give me a ring and have a chat - what have you got to lose? Plus, FREE Thatched Cottage Recording School Course to package buyers!

### THATCHED COTTAGE PRIVILEGED CHARGE CARD

In our efforts to make life easier for our customers we have launched our own credit card!

Like Access and Barclaycard, our Privileged Charge Card allows instant credit up to £1000 and some VERY special discounts.




For larger purchases we have arranged a unique loan/lease scheme for amounts up to £25,000.

Full details of all our new financial services (including equipment insurance) are contained in our new Financial Fax Packs - Give us a call.

### NEW PRODUCTS

CASIO DA2 - brand new updated DAT. Still only £649 + VAT inc. free rack kit + RSD PROLINE 16:8:16 plus MIDI muting, TASCAM 1" 24 Track - revolutionary at just over £7000 - VAT + DIGIDESIGN SOUND TOOLS HARD DISK RECORDING - call for demonstration + KORG M3 their brilliant new expander + YAMAHA FX500 + TASCAM 644 and 688 PORTASTUDIOS + ART SGE guitar processor + BEL BDE 2400ES 24 seconds (stereo) Delay/Sampler RRP £3000 - £699.

# Thatched Cottage Audio

Telephone (0223) 207979 Fax (0223) 207952     
 Thatched Cottage Audio, North Road, Wendy, Near Royston, Herts.

# Fairlight

## THE NEXT STEP

### FAIRLIGHT SERIES III XDR

**ELECTRIC SOUND & PICTURE, THE NEW NAME BEHIND FAIRLIGHT, PROUDLY PRESENTS THE LATEST SERIES III UPGRADE - XDR, A POWERFUL HARDWARE AND SOFTWARE ENHANCEMENT**



#### THE XDR SOLUTION

XDR is Electric Sound & Picture's first release for the Series III, and incorporates many users' requests and suggestions from recent years. It significantly increases

Series III productivity and comprises ESP's Waveform Supervisor, Rev 8 Software, Digital Input Module, Dynamic Output Router and expanded Waveform RAM card.

#### SHHHH!



ESP's new stereo input module utilises the Motorola 56001 DSP processor and provides digital AES/EBU and analog inputs with 64 times oversampling! This new card delivers an impressive improvement in signal to noise, high frequency clarity and stereo imaging.

#### SAVE TIME



The heart of XDR is the Waveform Supervisor central processor. Based on the Motorola 68020 32 bit CPU and 68881 Math Co-Processor, the Waveform Supervisor brings dramatic improvement in system speed. Series III users say that the addition of the Waveform Supervisor with Rev8 software is doubling their throughput on some projects.



#### THANKS FOR THE MEMORY

Up to 32 megabytes of Waveform RAM can now be installed providing six minutes of sound storage. To take advantage of the increased memory capacity we have introduced an 8 megabyte Waveform RAM card, slashing last year's WRAM prices in half!



#### REV8

Rev 8 integrates our new hardware developments with powerful new software tools. CAPS is expanded and improved, Cue List is enhanced with many new features, a

Global Information Window is provided and MIDI time code and System Exclusive are supported.

#### TRAFFIC CONTROL



The Rev 8 Dynamic Voice Allocation capability is complemented by ESP's new Router Output Module. This permits Fairlight voices and sub-voices to be dynamically assigned to up to twenty four polyphonic outputs.

Expand the capabilities of the Fairlight Series III with the XDR upgrade - the next step towards the ultimate solution.



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Fax: (01) 372-6370

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Tel: (061) 281-2045  
Fax: (061) 281-2042

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NSW Australia 2007  
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Fax: +61(2) 281 6503

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Fax: (089) 812 7429

**BENELUX**  
TRANS EUROPEAN  
MUSIC-BELGIUM  
Tel: (02) 466-5010  
Fax: (02) 466-3082



## Summit full range tube EQ

Summit Audio have extended their range of vacuum tube signal processors with the *EQF-100*. This is a single-channel equaliser with four passive overlapping bands of seven frequencies each plus high and low filter sections of three frequencies each. Highest and lowest bands are peaking or shelving with vacuum tubes used for gain make up and 990 op amps used for the output stage. Cut and boost is up to 16 dB and

bandwidth is variable. Input and output are electronically balanced with an option for a transformed coupled output. Housing is 2U 19 inch rackmounting.

**Summit Audio Inc, PO Box 1678, Los Gatos, CA 95031, USA. Tel: (408) 395-2448. Fax: (408) 395-1403. UK: Autograph Sales Ltd, 102 Grafton Road, London NW5 4BA. Tel: 01-485 3749. Fax: 01-485 0681.**

## Wadia DigiLink 20

The Wadia *DigiLink 20* series Fibre optic transmission system provides accurate signal transfer over distances ranging from 10 to 10,000 ft or more and interfaces with most of the popular digital formats such as AES/EBU, S/P DIF, SDIF-2, JVC DAS and PD DUB-C.

A digital 30-channel microphone snake with 96 kHz (optional 384 kHz) is also available.

**Wadia Digital Corp, 511 Second Street, Hudson, WI 54016, USA. Tel: (715) 386-8100. UK: Acoustic Energy Ltd, 3A Alexandria Road, London W13 0NP. Tel: 01-840 6305.**

## Studer Editech Dyaxis additions

Studer Editech have introduced several new products to the *Dyaxis* line. The *Dyaxis 2+2* is designed for radio, music and post-production applications and provides two channels of recording to hard disk with up to four channels of simultaneous playback and/or overdubbing from two audio processors.

The *System Synchroniser* is an advanced clock module capable of sync'ing the *Dyaxis* to timecode, film tach or house clock. The system also functions as an extra timecode playback channel with LTC, MTC and VITC read/write capability.

The *DAT Back-up* software package allows any *Dyaxis* with digital ports to use any DAT recorder for file back-up. Sound files are recorded on tape with edit information being put on floppy disk. The option allows DAT machines to be used for recording or for realtime tape back-up storage.

The *Dyaxis EX-cellerator* card features a Motorola 56000 processor and a direct digital interface between a *Mac II* and the *Dyaxis* processor,

thus providing both realtime and non-realtime 24 bit signal processing functions.

The *Time Scaling* software option is designed to work with the *EX-cellerator* card and allows the length of programme material to be altered without any pitch change.

The *Dyaxis* is now available with increased storage capacity in the form of a 760 Mbyte drive option. This drive provides over 2 hours of recording time and brings the total capacity of *Dyaxis* up to over 12 track hours. A 1.2 Gbyte 4 mm tape back-up device that uses a standard DAT cassette is also available.

**Studer International AG, Althardstrasse 10, CH-8105 Regensdorf, Switzerland. Tel: 1.840.29.60. Fax: 1.840.47.37.**

**UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Tel: 01-953 0091. Fax: 01-207 5970.**

**USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 254-5651. Fax: (615) 256-7619.**

## Orban RX processor and 764B equaliser

The *RX* from Orban is described as a 'Cure for Tired Audio' and has three basic functions: harmonic restoration, spectral restoration and a sophisticated single-ended noise reduction system. Applications range from studio to broadcast to mastering use. It can be used as a stereo unit or two independent mono channels and features an uncluttered control layout and comprehensive process displays.

The *764B* is a stereo equaliser with digital control over all parameters of four-band parametric EQ with constant Q characteristic and separate high- and lowpass filters.

Settings can be stored into 99 memory locations. The filter parameters are adjusted by three large knobs with instant access and the *764B* can also be equipped with MIDI, RS-232 and 422 for external control.

A *764B/SL* slave version is also available for multiple systems under common control.

**Orban, 645 Bryant Street, San Francisco, CA 94107, USA. Tel: (415) 957-1067. Fax: (415) 957-1070. UK: SSE Marketing Ltd, Unit 2, 10 William Road, London NW1 3EN. Tel: 01-387 1262.**

## AR Red Boxes

Acoustic Research have introduced two new compact speakers in a series they are calling *Red Boxes* as part of a sponsorship arrangement they have with rock band Simply Red. Both systems are in fact black but with red logos. It is, however, the larger of the two which is of greater interest to us. *Red Box II* has been designed to satisfy the demand for the original paper-coned *AR 18*, which has found many pro users but has not been made for some years. The *II* is basically the *AR 18* in a slightly larger and more rigid cabinet.

*Red Boxes* are available worldwide except for the US. The US company will however endeavour to meet direct requests for units.



**Teledyne Acoustic Research, USA. Tel: (617) 821-2300. UK: Hayden Pro-Audio, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Tel: 0753 888447.**

## Optodigital Designs Lightspeed 12

Optodigital Designs, a division of Monster Cable Products, have released the *Lightspeed 12* fibre optic audio distribution system for broadcast, studio and live sound applications. The system can be configured as a direct, bus, star or ring LAN using a simple set of armoured fibre optic cables to enable 2-way distribution of microphone and line audio signals.

Features of the system include reliability, unlimited expansion, elimination of earth (ground) loops, video and lighting system noise, simple installation and better than

CD audio quality.

The 'building blocks' of the system consist of the A/D Encoder and Decoder units (12-channel) with full 16 bit at 48 kHz and the Tranceiver Heat Unit, Tail Unit and Optical DA Unit.

The system enables up to 96 audio feeds to be sent with 24 returns. Separate splits for recording, monitor mixing, etc. can also easily be derived.

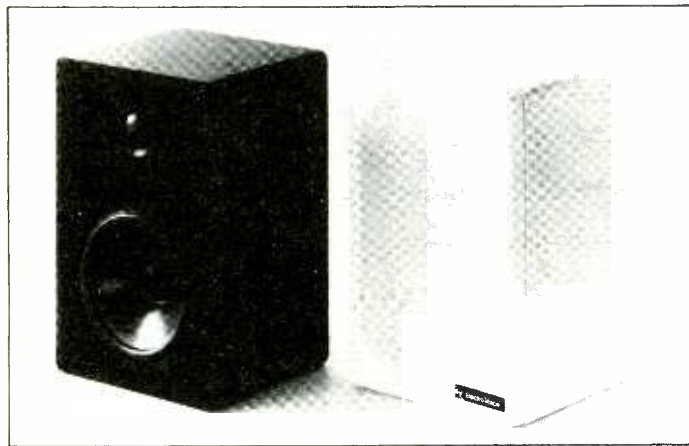
**Monster Cable Products Inc, 274 Wattis Way, South San Francisco, CA 94080, USA. Tel: (415) 777-1355. Fax: (415) 896-1745.**

## E-V Sentry 30 monitor

Electro-Voice have added a compact speaker suitable for nearfield monitoring and other applications to the *Sentry* range. The *Sentry 30* is a 2-way system using a polyethylene coned 5¼ inch LF unit in a vented enclosure together with an HF unit with its own protection device that will automatically reset after being tripped. The casing is magnetically

screened to prevent stray fields allowing use in close proximity to video monitors. Claimed frequency response is 90 Hz to 20 kHz ±3 dB. **Electro-Voice Inc, 600 Cecil Street, Buchanan, M1 49107, USA. Tel: (616) 695-6831.**

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



## Otari recorders

The Otari *MTR-15* master recorder provides ¼ and ½ inch tape formats in mono, stereo, 2-track and 2-track with centre timecode.

The *MTR-15* has the same automatic alignment system as the *MTR-100A* and can be installed either in a 19 inch rack or in a console. The recorder accepts 12½ inch reels and features a four-position autolocator with versatile tape timer display, microprocessor-controlled transport, built-in digital test oscillator, Dolby *HX-Pro* and remote control interface ports.

A wide range of optional accessories is available including the *EC-102-S* chase synchroniser.

The *DTR-900* digital multitrack has now been replaced with the *DTR-900B*, which features improvements in both soft and hardware. The electronics PCB are also being manufactured by Otari now and feature VSLI technology to provide higher reliability, less power consumption and additional features. The machine's power supplies have also been improved and special attention has been given to earthing (grounding) to ease installation in the studio.

There are also two new accessories for the *DTR-900B*: the *EC-104* chase

synchroniser and the *CB-503* PD/DASH converter that provides bi-directional digital transfers between the Otari and any DASH format multitrack.

Most of the *DTR-900* soft/hardware updates can be retrofitted and enquiries should be addressed to your Otari dealer.

Otari have also introduced an improved in-cassette duplicator, the *DP-4050E* series, which will replace the *DP-4050*. The new series comprises the *DP-4050E-C2* (one master, two slaves), the *DP-4050-Z3* (three slaves) and the *DP-4050E-Z* buffer unit. The *DP-4050-OM* open reel master is still available.

In addition to software and hardware improvements, the new *DP-4050E-Z* buffer unit allows the total number of slaves to be expanded to 65, ie: one C-2, three Z buffer units, 21 Z-3 units.

**Otari Inc, 4-33-3 Kokuryo-cho, Chofu-shi, Tokyo 182, Japan. Tel: (0424) 81-8626. Fax: (0424) 81-8633.**  
**UK: Otari (UK) Ltd, 22 Church Street, Slough, Berks SL1 1PT. Tel: 0753 822381. Fax: 0753 823707.**  
**USA: Otari Corporation, 378 Vintage Park Drive, Foster City, CA 94404. Tel: (415) 341-5900. Fax: (415) 341-7200.**

## TAC Magnum console

TAC have introduced the *Magnum* 24 bus recording console, which while retaining the features that were popular with the *Matchless* console, has new facilities such as four-band EQ, which can be split for simultaneous operation in the channel and monitor paths, status switching for PFL and solo, fader reverse, eight auxiliary sends, FET muting, 30-segment LED metering and discrete tape monitor input trim. Optional MIDI muting and fader automation systems are also available.

MICE (Multiple Interface Control

Element) enables the automation of mute switching via MIDI commands (72 switches on a 36-input console). Snapshots can be taken of current mute settings and stored into Pages and Sequences for later recall, either manually or via MIDI.

**Total Audio Concepts Ltd, Unit 17, Bar Lane Industrial Park, Bar Lane, Basford Notts NG6 0HU, UK. Tel: 0602 701002. Fax: 0602 785112.**

**USA: Amek Consoles Inc, 10815 Burbank Blvd, North Hollywood, CA 91601. Tel: (818) 508-9788. Fax: (818) 508-8619.**

## Hybrid Arts ADAP II soft and hardware

Hybrid Arts have released new software and hardware for the *ADAP II* hard disk system, including a low-cost digital interface, an erasable optical disk option and enhanced editing software.

The digital I/O module supports the AES/EBU and S/D DIF formats with sampling rates of 32, 44.1 and 48 kHz, and Hybrid Arts see the new module for use of DAT for editing and mastering.

The EOD option allows for the archiving of sound effects with easy retrieval via *ADAP II*'s Sound File System and File Manager. A single optical disk has a capacity of 800 Mbytes, which is sufficient for 1 hour of stereo audio at 44.1 kHz. The option consists of an 800 Mbyte SCSI optical drive and interface card that fits in alongside the Winchester hard disk plus one erasable optical

disk.

The enhanced editing software includes crossfade editing, SMPTE chase lock and the MIDI Performance Page. Crossfades can be made fully variable to suit the effect required and are non-destructive. The SMPTE chase lock enables edited sounds to be put on tape 'on the fly' and provides true timecode synchronisation. The MIDI Performer Page allows up to eight mono or four stereo sounds to be triggered simultaneously and also supports MIDI pitch and volume commands. The page also allows the *ADAP II* to mimic a MIDI sampler.

**Hybrid Arts Inc, 8522 National Blvd, Culver City, CA 90232, USA. Tel: (213) 841-0340**

**UK: Hybrid Arts (UK) Ltd, 24-26 Avenue Mews, London N10 3NP. Tel: 01-883 1335.**

## Symetrix SX200 modules

Symetrix have added two new modules to the *SX200* half-rack series.

The *SX205* Precision Audio Meter is a 2-channel display for voltage and power indication with switchable vu or ppm response together with a peak hold function. Other features include a 1 kHz calibration oscillator, input switching for power level indication and reference impedance and 0 vu adjustable between -20 dBV to +12 dBV.

The *SX206* Multi Dynamics Processor is a single-channel device that can be used as compressor/limiter, gate, expander, ducker or as a slave for stereo

operation. A rear panel DIP switch allows the initial status on power-up to be determined. Features include balanced input and output, sidechain access (the S/C input becomes a Key input in gate mode), soft knee transition and panel controls for Threshold, Attack, Release, Range and Output Gain.

**Symetrix, 4211 24th Avenue West, Seattle, Washington 98199, USA. Tel: (206) 282-2555. Fax: (206) 283-5504.**

**UK: Sound Technology plc, 6 Letchworth Business Centre, Avenue One, Letchworth, Herts SG6 2HR. Tel: 0462 480000. Fax: 0462 480800.**

# *Sheer Opulence of Sound*



## **TLM 170**

The studio microphone which achieves that elusive perfection.  
There is no comparison. Each one handcrafted by NEUMANN—the world  
leader in microphone technology for over half a century.

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Switzerland: (01) 3913939 · Turkey: (04) 1262919 · USA NY: (0212) 7653410 · USA CA: (0818) 7852211 · Taiwan: (02) 3214454-6

## Ramsa/Panasonic WP-9440 power amplifier

The *WP-9440* is a high power amplifier for sound reinforcement applications and studio monitoring. Rated at 2x350 W into 8 Ω at less than 0.05% THD, it will drive loads down to 2 Ω.

Features include dual-mono construction for greater reliability,

balanced inputs, comprehensive 'intelligent' protection circuitry and remote monitor connector. The chassis is 3U for a depth of 486 mm. UK: Ramsa, Panasonic UK Ltd, 300-318 Bath Road, Slough, Berks SL1 6JB. Tel: 0753 34522. Fax: 0753 38781.

## Dorrrough 1200 test set

Dorrrough Electronics have introduced the model *1200* stereo signal test set. This consists of a 2U rack chassis with two Dorrough 'B' scale meters (1 dB increments), servo input amplifiers, 30 step precision attenuator with two ranges: -6 dB to +24 dB or -36 dB to -6 dB, two buffered monitor outputs and a function switch.

The 100 dB dynamic range of the unit makes it suitable for measuring signal-to-noise ratio, programme balance, separation, crosstalk and headroom. Applications from stereo broadcast to recording and mastering. Dorrough Electronics, 5221 Collier Place, Woodland Hills, CA 91364, USA. Tel: (818) 999-1132.

UK: Plasmech Systems Ltd, Weydon Lane, Farnham, Surrey GU9 8QL.

## Sony APR-24 update

Sony have updated the *APR-24* analogue multitrack recorder with new 'firmware' that supports Sony's 9-pin ATR dialect, SNPAD. This serial communications capability allows the *APR-24* to control player functions of a Sony VTR to aid visual and audio cueing. The integrated functions of the recorder can also be accessed via production consoles, synchronisers and audio editors. Sony Corp, PO Box 10, Tokyo, AP, Tokyo 149, Japan. Tel: 03 448-2111.

UK: Sony Broadcast & Communications, Jays Close, Viables, Basingstoke, Hants RG22 4SB. Tel: 0256 483506. Fax: 0256 814397.

USA: Sony Corporation of America, 9 West 57th Street, New York, NY 10019. Tel: (212) 418-9427.

## Studio Master Systems management software

The *Studio Master Plus* software package for *Macintosh* computer from Studio Master Systems is designed to make the day-to-day running of studios easier and more efficient. Eight different programs allow such things as the noting of settings on outboard equipment by graphics, track sheets, billing, maintenance log, etc.

*Studio Master Plus* with CCL (Console Control Logging) allows the position of every knob and control on

## NED 2.1 software

New England Digital have introduced a new *Macintosh*-based software package for the *PostPro* and *Direct-To-Disk* ranges of disk-based multichannel recorders/editors.

Release 2.1 features EditView audio editing, which uses *Mac* graphics to represent all audio cues as blocks and by clicking on a block it is possible to change timings, durations, fades in and out as well as programming volume envelopes for events and events triggering. NED say that 2.1 is the first software release to make full use of the NED

## Alesis Midiverb III and DataDisk

The *Midiverb III* 16 bit digital effects processor features 200 memory locations including 100 pre-programmed) and is capable of generating up to three effects simultaneously from Delay, Reverb, Chorus and Flange. Front panel pushbuttons provide easy access to the program parameters as well as to MIDI mapping.

The *DataDisk* MIDI data storage and retrieval unit is a 1U rack unit capable of storing up to 800 Kbytes of MIDI system exclusive data directly

## Audio/Digital PAD-300 delay lines

Audio Digital have introduced two new 1:3 digital delay lines, the *PAD-300/16* (16 bit) and *PAD-300/18* (18 bit). Both units use sophisticated delta-sigma modulation in the A/D conversion. Standard delay times are 650 ms in 20 μs increments and a variety of options for memory

expansion, presets and RS-422 ports are available.

Audio Digital Inc, 1000 S Bertelsen, Suite 4, Eugene, OR 97402, USA. Tel: (503) 687-8412. UK: Shuttlesound, Unit 5, Osiers Estate, Osiers Road, London SW18 1EJ. Tel: 01-871 0960.

## Shure L series radio mics

The *L* series of radio microphones from Shure, including the *L1* body-pack transmitter and the *L4* diversity receiver with 'intelligent' MARCAD circuitry.

The *L* series has been designed to give high performance at an economical price and all receivers are rackmountable. Antennae are detachable and may be placed in remote locations as performance conditions dictate.

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, IL 60202-3696, USA. Tel: (312) 866-2608. Fax: (312) 866-2279.

UK: HW International, 3-5 Eden Grove, London N7 8EQ. Tel: 01-607 2717. Fax: 01-609 0295.

## Rane MPE EQ

The *MPE* series of programmable equalisers is available in three versions: *MPE 28* 1/3-octave, *MPE 14* 1/2-octave, *MPE 47* 4-channel seven band. All feature 128 memory locations with full MIDI implementation, curve-weighting (combining), realtime change and multi-EQ tandem control capability. Full attention has been paid to the ergonomics of the system and operation is virtually as fast as with conventional slider graphics.

Also from Rane, the *Flex* series features a range of modules in the new half-rack format and enables custom processor racks and small mixers to be easily created by the user.

Rane Corporation, 10802 47th Avenue West, Everett, WA 98204-3400, USA. Tel: (206) 355-6000. Fax: (206) 347-7757.

UK: Music Lab, 72-74 Eversholt Street, London NW1 1BY. Tel: 01-388 5392.



**RECORD****CUE 1****STOP****START**

# At last DAT is cued up for the broadcasting industry.

Setting new standards in simplicity as well as sophistication, HHB's RSDAT brings cart-like control to digital sources. Augmenting the Sony DTC 1000ES's own logic system, RSDAT transforms the industry standard DAT recorder into a dynamic broadcast

standard device.

Large illuminated buttons guarantee simple, problem-

free operation at the speed broadcasters demand.

Without compromising the range of benefits that only digital tape technology can provide.

A recorder as well as a playback unit, fully-programmable RSDAT is equipped with balanced audio connections and an optional 19" rack mounting kit. Up to thirty different events can be cued and played back in any order, with two hours of continuous programming available. RSDAT

arrives at the next cue point ready for instant playback and maintains start-up consistency. It can even generate an inaudible end-of-message tone to trigger other devices. Powerful interfaces offer a wide variety of remote options, including

fader starts, button operation and computer control.

With this level of versatility in

such a cost-effective



**RSDAT** package, it's little wonder that RSDAT represents one of the safest hardware investments the broadcaster can make.

Of course, just like RSDAT, HHB is cued up to serve the broadcast industry. As the exclusive European distributor for RSDAT, the company has now established a network of Europe's finest suppliers.



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## In brief

- **Mitsubishi Pro Audio** are now fitting all *X-86* 2-channel digital recorders with digital interface (DIF-2) cards as standard. With this interface the *X-86* can make and replay recordings of up to 20 bit resolution when connected to suitable external converters (bypassing the internal 16 bit converters).
- Software is now available from **AMS** to enable *CMX* and *Sony* format edit decision lists to be prepared and transferred to *AudioFile* via a PC. The PC must be IBM compatible and equipped with two disk drives, one of which must be a 3 inch floppy drive. The software enables the transfer of EDL in and out times to *AudioFile*, creates programme record events from the EDL and includes a *CMX* format editor. **AMS** say some familiarity with *DOS* is required. The software does not form part of the standard *AudioFile* package and so a nominal charge will be made that will include



support and further development where applicable.

- **Eventide** have released the *SE* (Studio Enhanced) version of the *H3000 Ultra-Harmonizer*. The *H3000SE* features six new algorithms (including the *Instant Phaser*)

together with a new *Function Generator* that adds dynamic parameter modulation capabilities. The *H3000S Studio* version now also includes the *Steve Vai* collection of presets.

## Ariel DM-N digital microphone

The **Ariel Corporation** have released the *DM-N* digital microphone. All the necessary electronics are contained in the microphone body, including two 16 bit *Motorola 56ADC* analogue converters for a dynamic range in excess of 90 dB at less than 0.005% THD.

The microphone has input connectors for external sources (eg, CD players, tuners, etc) and in the case of a single input being used, the other microphone element remains active.

The *DM-N* has been designed as an accessory to the *NeXT* range of computers and the sampling rate of the microphone can be altered by software from 88.2 kHz down to 5.5 kHz to suit specific applications. **Ariel** will also make the *DM-N* available in other protocols and digital formats.

**Ariel Corporation, 433 River Road, Highland Park, NJ 08904, USA. Tel: (201) 249-2900. Fax: (201) 249-2123.**

## Tascam MSR-24 tape machine

Based on the *MSR-16* transport, the new *MSR-24* 1 inch multitrack features 15/7½ in/s tape speeds, built-in dbx type *I* noise reduction, bargraph meters with peak hold, full microprocessor control for gapless drop-in/drop-out, three-position autolocator and serial/parallel ports for synchroniser/computer control.

The recorder also has front-access plug-in rec/repro amplifier PCB's for easy calibration and maintenance, a sync-lock function that switches track 24 for sync track operation and newly developed reel motors that

have low power consumption and minimum torque ripple.

A full-function remote control unit is available on option, as is a remote drop-in/drop-out footswitch.

**Teac Corp, 4-15-30 Shimorenjaku, 4-Chome, Mitaka-Shi, Tokyo 181, Japan. Tel: (0422) 45-7771.**

**UK: Teac UK Ltd, 5 Marlin House, The Croxley Centre, Watford, Herts WD1 8YA. Tel: 0923 225235. Fax: 0923 36290.**

**USA: Teac C America Inc, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303.**

## Otari 54 and TC-100 mixing consoles

Otari's Console Products Group have released two new consoles, the first since the acquisition of *Sound Workshop* in June 1989.

The series *54* consoles are designed to meet the needs of all types of audio production and features true dual signal paths (Channel and Mix with independent stereo buses), four-band EQ, 24-track busing, 10 auxiliary buses, matrixed input section and versatile control room and studio feeds. The console is optionally available with Otari/Digital Creations *Diskmix 3* automation (either moving fader or VCA) for both the Mix and Channel paths, which means that 46 input module console would have 92 automated mixdown channels.

The *TC-100* transfer console has

## Fostex FAME

**Fostex** have released the *FAME*, or *Fostex Automated Media Editor*, software package for editing applications in audio/video work. The software is available for *Macintosh*, *IBM* and *Atari* computers, however, some features may be different.

The software is designed to work with the *Fostex 4030* synchroniser and *4010* generator/reader and

## Ramsa WR-C900 console

The *WR-C900* series sound reinforcement console is available in two frame sizes (32- and 20-input). It features a variety of input modules and configurations and very flexible routing via groups, main output buses and an extensive 8-way output matrix. Extensive monitoring facilities are also provided.

The console provides four groups, left/centre/right main buses with 3-channel panning, four auxiliary mono sends and a stereo send bus with pan. The main pan can be switched across either the group or L-C-R buses.

**UK: Ramsa/Panasonic UK Ltd, Panasonic House, Willoughby Road, Bracknell, Berks RD12 4FP. Tel: 0344 853176.**

**USA: Ramsa/Panasonic, 6550 Katella Avenue, Cypress, CA 90630. Tel: (714) 373-7277. Fax: (714) 373-7242.**

been designed for transfers and dubbing in film and video production.

The console consists of one or more rackmounted card frames for the audio signals, a rackmount meter panel and separate power supply. Input capacity is from nine to 18 per rack with four bus outputs, solo, headphone output and fader bypass.

**Otari Inc. 4-33-3 Kokuryo-cho, Chofu-shi, Tokyo 182, Japan. Tel: (0424) 81-8626. Fax: (0424) 81-8633.**

**UK: Otari Electric (UK) Ltd, 22 Church Street, Slough, Berks SL1 1PT. Tel: 0753 822381. Fax: 0753 823707.**

**USA: Otari Corporation, 378 Vintage Park Drive, Foster City, CA 94404. Tel: (415) 341-5900. Fax: (415) 341-7200.**

mimics the action of a video editor, thus facilitating the audio-for-video process.

**USA: Fostex Corporation of America, 15431 Blackburn Ave, Norwalk, CA 90650, USA. Tel: (213) 921-1112. Fax: (213) 802-1964.**

**UK: Harman (UK) Ltd, Mill Street, Slough SL2 5DD. Tel: 0753 76911. Fax: 0753 35306.**

**SONY**

**Sony Broadcast  
& Communications**

European Headquarters:  
Basingstoke  
Hampshire  
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*Dear Reader*

Re: 48 channel digital audio multi-track

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

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

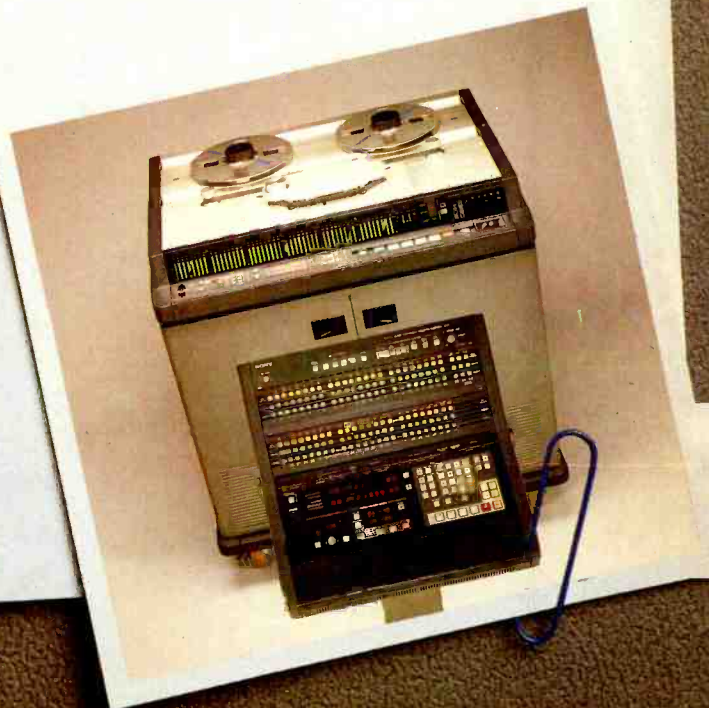
Unrivalled audio quality is achieved by means of two times oversampling A/D and D/A converters, together with both digital and analogue filtering stretching the usable frequency response to almost 22KHz.

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

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

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

*Sincerely*  
SONY



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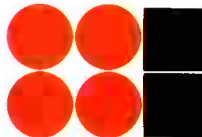
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"We tried these out for four weeks and the response from our customers was so encouraging, we bought three pairs."



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## Opcode systems software

The Korg *M1* Editor/Librarian for the *Macintosh* includes editors for each of the synthesiser's specific abilities. The Program Editor has graphic display of all parameters including envelopes and key tracking curves. The Effects Editor has graphic display of signal flow. The Combination Editor features an Opcode feature called TimbreDraw. The program allows user-programmable PCM card names that are stored with programs and drum kits. The Drum Editor has graphic editing and display of note ranges for each drum sound. Also, effects banks and libraries (of any number of items) can contain user definable names.

The *Proteus* Editor/Librarian for the *Macintosh* is the first available on any computer. The new Editor/Librarian includes a Preset Editor for changing aspects of the timbre, a Master Parameter Editor, a Program Map Editor and a Tuning Editor. Because of the sophisticated internal processing of the *Proteus*, and the fact that all RAM banks are full of presets, the Editor/Librarian becomes not only a useful companion but a necessity for creating and storing new presets.

A Librarian Desk Accessory (DA) program is now available free from dealers and is also included free with every Opcode Editor or Editor/Librarian package. This program allows the user to open and send either single memory patches or banks to any MIDI device for which the user has an Opcode Editor or Editor/Librarian. The desk accessory may be used at any time, no matter which program is running on the *Macintosh*. An important feature is that patches may be sent to MIDI devices while Vision sequencer is playing a sequence. This allows the user to try out different sounds as the music plays.

The update to Vision includes moving faders, scrolling graphic and list editing windows, a curve and pencil for 'drawing' data in the strip chart, and a 'play note' option when selecting in either editing window. In addition, the update allows the user to name programs and notes or import the names from Opcode Librarians and display them in editing windows with custom pop-up menu access. Each of the 32 MIDI instrument setups can now have their own Program and Note maps.

A vertical line can be used instead

of, or along with Vision's 'bouncing ball' (which follows as the music plays). Also, a speaker icon follows each event as it is played in the list editing window. Both of these enhancements work with the new scrolling edit windows.

**Comment:** The Korg *M1* is currently one of the most popular instruments available, and the E-mu *Proteus* is all set to become the next. This is a timely release from Opcode of two Editor/Librarian packages, which are sure to be in demand.

The Librarian Desk Accessory is a great idea to make the process of selecting sounds for orchestration purposes while running the actual sequences much easier.

The updates to Vision have come very quickly after the original release of this program and demonstrate that Opcode are paying close attention to feedback from their users—a sign of a responsible approach.

**Opcode Systems, 1024 Hamilton Court, Menlo Park, CA 94025, USA. Tel: (415) 321-8977.**

*Studio Sound's Music News is compiled by Mike Collins*

## Quadrant AVC products

• *HyperStudio* is a custom Apple *Macintosh* Hypercard Stackware package designed to be used by any type of recording studio. The program will allow you to document your clients, log their phone messages, keep track of sessions—including studio time, log materials used and equipment rentals—and it even does maintenance prompts. *HyperStudio* allows the engineers or the studio owner/manager to fully document the studio operation specific to each client. Also included are inter-related 'track sheets', plus a studio database for studio directories, rental companies, restaurants, outboard gear and just about everything needed to log all studio activities. The control room stack is a graphic notepad for all the console settings, including EQ, buses, patches, sends, outboard and so on. *HyperStudio* currently contains over 80 stacks and can easily be modified to cater for the requirements of your studio.

**Comment:** As the world becomes more and more computerised, more people will wish to take advantage of these time-saving tools when the need arises to organise and file information of just about any type. Studio personnel can now 'get on the bandwagon' with a program that could quickly become a standard item available in studios throughout the world.

• The *QuickRhyme* on-line rhyming dictionary is a *Macintosh* desk accessory intended for use by professional songwriters. Used with a wordprocessor such as *Macwrite*, *QuickRhyme* will allow you to look up rhymes for the currently selected word in your text from a dictionary file of over 22,000 words. A built-in suffix processor allows you to enter not only suffixes but also plurals, verb conjugations or superlatives, enabling you to find rhymes for a combined total of one million words. Nonsense rhymes and slang expressions are included as well. The rhymes are listed in *Thesaurus*-style—in approximate order of usage rather than in alphabetical order—for ease of use.

**Comment:** This is a 'cheap and cheerful' but extremely useful accessory for any songwriter who uses a *Macintosh* computer. Works well in practice and could just make the difference between finding that last piece of lyric for your next hit record, or not!

**Quadrant AVC Ltd, 1 Peerglow Centre, Marsh Lane, Ware, Herts SG12 9QL, UK. Tel: 09204 66566.**

## Hybrid Arts

Interval Music Systems has announced a new update to its popular GenWave Waveform Editor for Atari *ST* and *Mega* computers. GenWave/16 is the first universal stereo waveform editor available for *ST*s and features new digital processing functions previously unavailable on the *ST*. Sound samples can be edited in either the frequency or time domain under an extremely intuitive user interface.

Time domain editing functions include visual looping, waveform drawing, mouse drawn digital enveloping and stereo panning, waveform replication, gain normalisation, phase inversion, mixing, cut & paste and five different crossfade loop algorithms.

Frequency domain editing functions include digital EQ, high order sample rate conversion and pitch drawing. A high resolution rate conversion 3-D Spectral Analysis module performs a Fast Fourier Transform (FFT) on any part of or the whole sound. GenWave/16 supports up to eight loop points and loop fine tune controls in an interactive Loop Overview screen; also a simultaneous loop window is linked to an overall memory display and users can save

and recall all loop settings.

Stereo editing functions allow any two mono samples to be combined to create a stereo sample. Users can draw a stereo panning curve between two channels and all waveform editing functions can be carried out in stereo. There is sample playback monitoring via the internal Atari speaker, externally through an optional D/A converter (ST Replay/Master Sound ST), or via triggering notes on the sample itself. GenWave/16 also functions as an audio-MIDI note trigger when used with the external D/A converter.

GenWave/16 supports nearly all popular 12 and 16 bit samplers, and has complete 16 bit file compatibility with its forerunner, GenWave/12. The GenWave/16 will also convert waveforms for sending to a Sequential *Prophet VS*.

*MegaSTations* are custom 19 inch rackmount units for Atari *Mega ST* computers. Up to four *Mega ST*s can be put into a rack, with a shared QWERTY keyboard and monitor, together with a switching facility allowing you to switch between any of the *Mega ST*s. The *MegaSTation* takes a stock Atari *Mega ST* and adds an Audio Out allowing a

metronome tick to be routed to your desk or to an amplifier. In addition to MIDI In and Out sockets there is a proper MIDI Thru, and the QWERTY keyboard is fitted with a warm reset button. An optional extra 3.5 inch floppy disk drive can be added above floppy drive A, and an extra long QWERTY keyboard cable and extra length monitor cables can be provided. A rackmounted *SM124* hi-res mono monitor is available also. Packages are available at competitive prices to include Hybrid Arts SMTTRACK, MIDIPLEXER or ADAP 1 with racked computers.

**Comment:** GenWave/16 is a very powerful program with a host of professional features. It supports all the latest 16-bit samplers and makes a welcome addition to the range of MIDI software from Hybrid Arts.

The *MegaSTation* and its optional extras provide a long-awaited solution for racking Atari computers and monitors in the studio or on stage.

**Hybrid Arts Inc, 11920 West Olympic Boulevard, Los Angeles, CA 90064, USA. Tel: (213) 826-3777. UK: Hybrid Arts (UK) Ltd, 24/26 Avenue Mews, London N10 3NP. Tel: 01-883 1335.**

**AKG**  
ACOUSTICS

# ADVANCED MICROPHONE TECHNOLOGY

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

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

You might think it presumptuous for us to predict a future legend, but with the support of our customers, the C426B promises to be one.



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

# Test equipment news

**Audio Precision** made two announcements in the last year. The first was the IEEE-488 interface for the *System One*, which allows integration into a wide range of automated test systems. The more important aspect for audio was the availability of the *DSP-1* module allowing digitally based analysis and synthesis in both analogue and digital domains. It is equipped with parallel and digital interfaces, can handle AES/EBU signals and is electrically compatible with the Sony/Philips consumer interface.

A collaboration with Studer resulted in software for the *System One* to allow automated alignment testing of the Studer tape machines equipped with electronically accessible adjustments via RS-232 ports (A820, A812, A810 and A807) (see *Studio Sound*, March 1989). The trend towards automation of test and performance evaluation continues with most of the major hard disk recording systems now running diagnostics on power-up continues and as long as the accompanying manual provides the necessary back up information this is a worthwhile direction. The power amplifier and control electronics of the new Genelec 1035 monitoring system carries out a very similar operation so the trend is not just restricted to digital audio gear.

**Dorrough** introduced the stereo signal test set known as the *Model 1200*. Using a pair of the Dorrough *Loudness Meters* it has the ability to measure stereo programme material in left and right or sum and difference formats while displaying both peak and average amplitude. With the capability to measure levels down to -75 dB the unit has uses in measuring crosstalk, balance and level setting.

**Gold Line** added the *30M8* battery powered realtime analyser offering 30 filter bands and eight memories. The display consists of a 300-LED matrix calibrated in vu style scaling. Three responses are available—flat, C- and A-weighting—and the unit will accept mic and line inputs.

**Audioscope** introduced the model *9000* audio analyser. This a 3U frame with external keypad and colour monitor. Fully menu driven, optional modules will be available to add to system capabilities. Features available at introduction were 1/3-octave spectrum analysis, pink and white noise generation, an oscillator, level metering, automation level indicator with future provision for frequency curve plotter and RT analyser. There is provision for connection to an external printer as well as an RS-232 port for external computer processing or disk storage of data.

**ARTA 80** is a new portable 1/3-octave analyser from **Abacus Electrics**. It uses an LED display calibrated from -20 to +4 dB that can be used as a 12 or 24 dB display range, fast or slow response. Pink noise generator is incorporated as are 30 non-volatile memories, which can be displayed at the same time as 'live' display. It has RS-232 and parallel ports for computer and printer interface.

**Masterswitch** introduced a simple battery powered audio signal generator from Linstead. The *G3* offers sinusoidal, square and triangular wave outputs. Claimed pure sinewave performance over 20 Hz to 20 kHz with max distortion of 0.04%.

MIDI is another area that needs test equipment and **Studiomaster** introduced a low cost MIDI analyser. The *MA36* is a 36-function analyser that simply connects to the end or in-line within the cable and an LED display will indicate what information is being sent and what MIDI channel it is on as well as an error sensing indicator.

**Techron** announced the *TEF 12+* analyser, which will run all the standard *TEF* software but with greater speed and storage capability. Upgrade kits for the *TEF10/12* are available.

Although slightly out of our main field of interest, the *SIAT* audio test system from **Schmid Telecommunications** is interesting. *SIAT* stands for Short Interval Audio Testing and is designed for stereo broadcasting applications where a quality-conscious broadcaster can check all the programme lines from the studio to the transmitter in a 5 sec test, which is particularly useful when on remote broadcasts and a test is needed before going on air. The system measures frequency response, phase difference between channels, THD, crosstalk, noise weighted and unweighted, dynamic and expanded noise, channel transposition and IMD. Should all functions be within spec then a 'GO' response is output by the receiver end of the system. If a problem is detected a breakdown of the results is printed out for action. It is intended that this 5 sec test could be carried out at fixed intervals with the possibility of storing the info on computer via the RS-232 interface allowing monitoring of system performance and so direct pre-emptive maintenance.

## Gold Line SPL-120



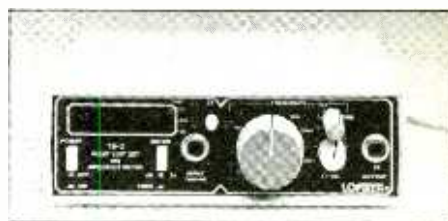
Gold Line has added a new portable sound level meter with a numerical display. The *SPL-120* features auto-ranging SPL and highest SPL settings and the SPLs can be read in either flat, A- or C-weighting. The basic SPL range is from 45 to 120 dB with accessory adapters to expand the range from 25 dB to 152 dB. ANSI class II filters are used and the manufacturer recommends the unit for general purpose simple sound level measurements.

**Gold Line, USA. Tel: (203) 938-2588.**

**UK: Smart Acoustics Ltd. Tel: 0633 252957.**

## Loftech Model TS-2

The Loftech *TS-1* has been a popular low cost piece of test equipment for the last few years. It houses an audio oscillator, a frequency counter and a decibel meter. A new model has just been added that incorporates all the *TS-1* features plus an impedance meter. It can read simple and complex impedances from 1  $\Omega$  to 10 k $\Omega$  including input and output impedances of a wide range of electronic devices plus the impedance of distributed and coupled 70 and 100 V speaker systems.



**Gold Line, Box 500, West Redding, CT 06896, USA. Tel: (203) 938-2588.**

**UK: Smart Acoustics Ltd. 38-42 Westgate Chambers, Commercial Street, Newport, Gwent NP9 1JP. Tel: 0663 252957.**

## STEREO STABILIZER 5



- Rack mounting frequency shifter for howl reduction in public address and sound reinforcement
- Mono version, box types and 5 Hz fixed shift boards Mark 5 also available

**SURREY ELECTRONICS, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG  
Tel. 0483 275997 ★ Fax. 276477**



## Rohde & Schwarz audio analyser

The UPA 4 audio analyser from Rohde & Schwarz is designed for testing a wide variety of audio components. Rohde & Schwarz claim it has abilities not available in the majority of conventional measuring instruments such as the measurement of total distortion including quantisation noise over the entire bandwidth and in addition measurement of single harmonics, or the RMS value of all harmonics. It is equipped with an IEEE 488 interface and has a semi

automatic plot facility to either printers or XY recorders.

**Rohde & Schwarz, Postfach 80 14 69, D-8000 Munchen 80, West Germany. Tel: (089) 41 29-4685.**

**UK: Rohde & Schwarz UK Ltd, Ancells Business Park, Fleet, Hants GU13 8UZ. Tel: 0252 811377.**

**USA: Rohde & Schwarz-Polarad Inc, 5 Delaware Drive, Lake Success, NY 11042. Tel: (516) 328-1100.**

## Ivie extend PC40 capability

Ivie have introduced two new software packages for the computer-based PC40. The PC40-PC software link allows individual memories or the block of 20 memories to be stored initially within the PC40 and then transferred to a PC where the data can be manipulated by adding or subtracting A- or C-weighting. A second curve can be superimposed over the first or a graph can be plotted against NC or PNC curves. Comments may then be added before the files are saved or printed.

The second package is RT60 software that allows fast measurement of all 10 octaves or all

30x $\frac{1}{3}$ -octave bands simultaneously and as many samples as required may be automatically averaged. The data can be printed in tabular form for every band giving early decay and RT60 calculations to ISO20 and ISO30. It is also possible to select any portion of the delay curve and receive an RT60 calculation based upon this point.

**Cetec-Ivie, 1366 W Center, Orem, UT 84057, USA. Tel: (801) 224-1800.**

**UK: Smart Acoustics Ltd, 38-42 Westgate Chambers, Commercial Street, Newport, Gwent NP9 1JP. Tel: 0633 252957.**

## Bruel & Kjaer sine/noise generator

B&K have introduced the type 1054 sine/noise generator designed for automatic test and calibration from design to service. The 1054 offers a calibrated output from 1 mV to 5 V with better than -60 dB distortion. Frequency range is from 0.01 Hz to 2.54 MHz with a resolution of 10 mHz with narrowband, pink and white noise outputs available. B&K claim great attention has been taken over spectral purity and stability to meet high specification requirements such as A/D converter test. The user can select lin/log sweeps

with a wide range of sweep modes. The generator has a full IEEE interface and storage for nine frequently used configurations.

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

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

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



## TASCAM European Distributors

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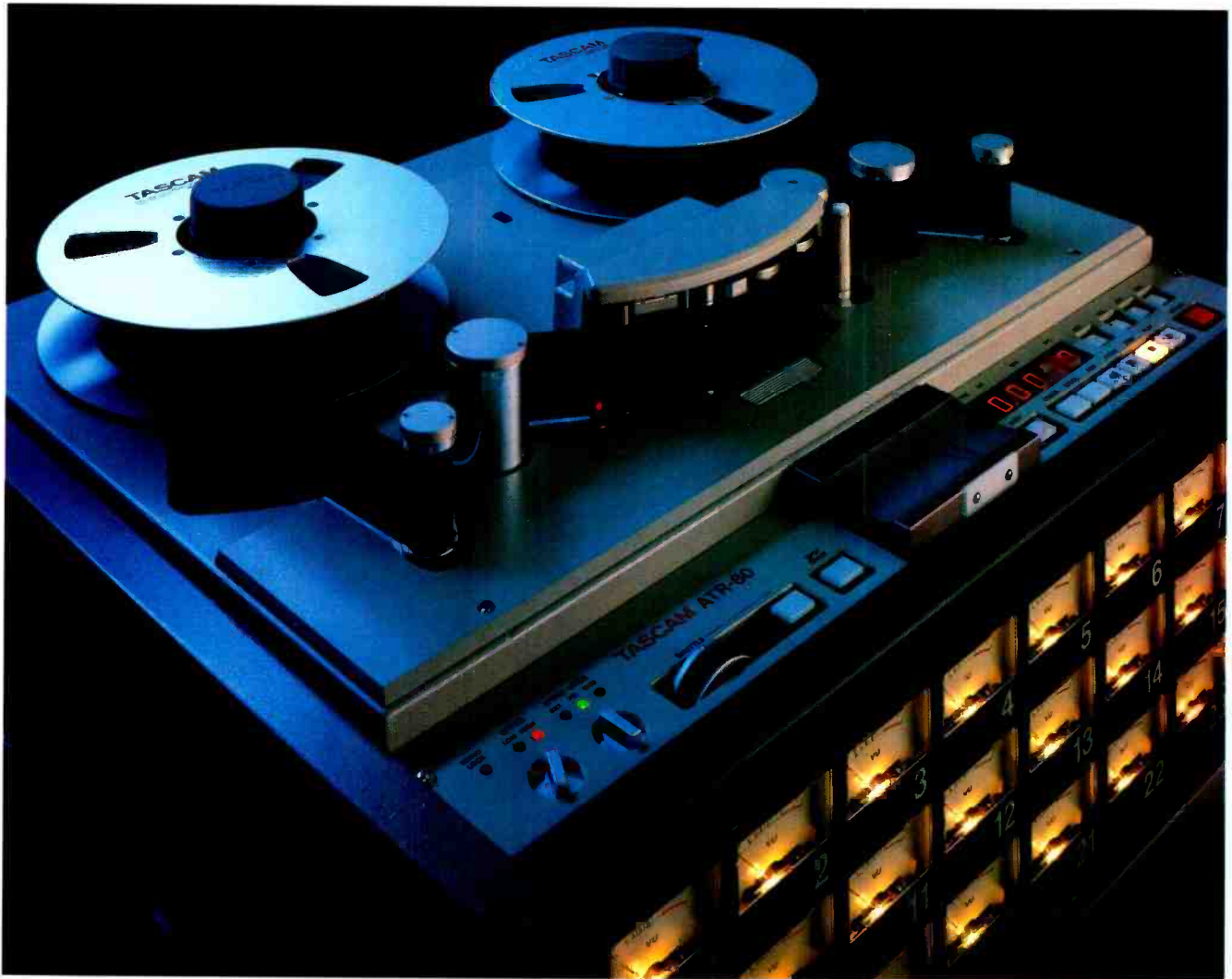
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# TASCAM

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# Compact discs as test equipment

Test discs are nothing new. Vinyl test records have been around for decades but the large number of variables in their replay frequently meant that replayed reference tones, etc, from a disc were really not a reliable source. They did of course have an excellent application though in analysing the performance of the disc player/cartridge combination and, of course, as much of the signal chain that followed on from that point as you wished. There was a similar situation with compact cassette test tapes and the more familiar reel-to-reel test tapes but these were far better at their intended purpose than the discs. It was preferable to use a signal generator or other test equipment, no matter how basic, rather than rely on recorded signals.

The arrival of the compact disc 7 years ago brought a whole new range of possibilities. The medium is predictable enough that good replay accuracy of tones, etc, can be achieved from even

a modest CD player. Unlike vinyl, the making of test discs does not require a special production procedure to meet high quality applications.

CD test discs appeared many years ago. We carried a survey of the then available discs in January 1987 and it appears that most are still available. There have, however, emerged a number of new discs that offer a wide variety of tests and evaluation signals in quite different areas.

## NAB Broadcast & Audio System Test CD

The US National Association of Broadcasters had a vinyl test disc for many years and introduced this CD about 9 months ago. It contains sets of test signals that will be of use to audio and

broadcast engineers and may actually find more application with the latter. It begins with basic tests for monitoring the performance of the CD player itself and then proceeds with 99 separate tracks. Aside from the basic tone sections and signals more tailored for AM/FM broadcast applications there are some useful tests such as the phase shift section where there are calibrated phase shifts between channels of 10°, useful for calibration of phase meters; a dual tone phase linearity signal to check phase linearity at high and low frequencies; flutter test signals; indexed level sweeps for calibration of level devices, ppm/vu test signals and tone bursts for peak flasher calibration. As mentioned it does contain a great deal of test signals that will not be of any use to the average recording studio but then the advantage of test CDs is that they are not very expensive in terms of test equipment anyway.

## Prosonus SRD

Another test CD that has created a lot of interest is the *Studio Reference Disc (SRD)* from US company Prosonus. This 62-track disc is probably the nearest thing so far to a sinewave generator on a CD with nearly two-thirds of the tracks being pure sinewave reference tones. The introduction track (1) helps set levels by introducing 15 sec sets of 1 kHz tones at -20, -10 and 0 dB relative to the internal reference level of the *SRD* disc itself, which has been set to correspond to 6 dB below overload on the front panel meters of the Sony *PCM-1630* digital processor. These levels are indexed within the CD subcode individually so with some players it is possible to select the track and then the index tone within that track.

Next comes the *Caveat Header*, which is a set of eight test signals designed to be recorded at the top of any tape particularly for audio for video use. This is followed by 1 kHz, 10 kHz and 100 Hz tones at 0 dB for a minute each. Tracks 6 to 22 contain 17 sinewave tones at frequencies from 15.525 Hz to 16 kHz at 0 dB and this is followed by the same frequencies but at -10 dB level. Tracks 40 and 41 are frequency sweeps but at differing speeds, useful for final checking of response.

We then enter a section of tracks with more specialist application—*TEF* (Techron) sweeps, pink and white noise in both continuous form and bursts, impulse clicks for reverb time measurements, channel phase reference, sawtooth waveforms at A-440 Hz, A-442 Hz, A-444 Hz, then a full octave of sawtooth waveforms running from A-220 Hz to A-440 Hz and then repeated with piano notes.

Track 50 was developed by the Acoustic Sciences Corporation for the evaluation of control room monitoring systems and acoustics. The *Music Articulation Test Tape*, which formed the basis of this track is a complex 75 sec sequence to be used with external test equipment to determine how well a monitor handles a carefully defined complex waveform. It is also possible to use these tests subjectively.

Track 51 is a set of tests known as LEDR or *Listening Environment Diagnostic Recordings*. These are two sets of psycho-acoustic tests with each set consisting of three defined audible signal paths where the sound appears to move up, over and laterally. The perceived signal movement will often differ from the 'correct' path and this difference can be used to examine anomalies in the signal chain from CD player to the monitor speaker and room. □

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# REAL WORLD

Peter Gabriel's unusual studio complex near Bath in the UK, has been built to realise Gabriel's own concept and is generating much interest worldwide

“Only an idiot would build a studio next to a railway line,” chuckles Real World's general manager Mike Large, as the London to Bristol Intercity hurtles past behind us. “but strangely enough it hasn't caused any problems, other than the occasional grumble from someone trying to conduct an interview.” In fact it's just another detail that adds to the wonderful eccentricity of this impressive and original complex, which offers the largest purpose built control room in the world, and as far as I know the only one to be visibly below water level.

Real World is situated on the edge of a village called Box, 7 miles east of Bath, UK. The three studios have been built into a four storey, 18th-century water mill, set in 12 acres of land and surrounded by a collection of new and old buildings—all mixing in well and sharing the same local ashlar construction. The complex began in 1986 when Peter Gabriel decided to move his studio from a nearby cowshed and to expand his working environment. The three studios, various offices, accommodation, etc, were built over the next 3 years, and credit for the



Control Room One

completed project lies very much with a close knit team of people including Peter Gabriel, Mike Large, local architects Feilden Clegg, structural engineers Buro Happold, and acoustic designers Harris, Grant Associates.

Just as the studios have grown over the last few years, so too it seems has the Real World empire, and the complex is home to a number of ventures.

Real World Design is a small scale electronics designer/manufacturer responsible for the custom electronics in the studio—in particular some interesting additions to the SSL consoles—as well as commercial projects like their Automated Send Matrix, of which more later. Real World Records specialise in World Music and are a joint venture with WOMAD (World of Music Arts & Dance) who have their premises in the next field, also owned by Real World. Real World Associates are a financial management company looking after Gabriel's affairs, along with those of a number of non-music business clients, such as famous French chef Raymond Blanc. A Real World building company has been set up to deal with the specialist requirements of the studio complex and according to Mike Large, look set for a busy future—“I'm cynical to whether building work will ever stop, I think it's going to be like painting the Forth railway bridge.”

Box Products is a company making designer lighting and furniture, and since designing a couple of exterior lights for the studios that bear a striking resemblance to apparatus from Frankenstein's laboratory, they have become part of the Real World group. There is of course also Real World Research who make the *Audio Tablet* disk-based editor but they have a London address.

Although there are three studios at Real World, they are not organised in the conventional sense with a control room and a dedicated connecting studio, instead each control room shares a collection of recording areas, which are linked together via the building's extensive patching network. Everywhere one looks there are the elaborate yet compact Real World connector panels, providing lines for audio, MIDI, video and data—they even put one in the kitchen. A central patchbay ties all the areas together and makes extensive use of DL connectors for audio.

Large: “What we've tried to do is have a standard connector panel that incorporates all requirements to allow for maximum flexibility, so for example if I hire in a machine to do multitrack backups, I can wheel it into the nearest room, plug it into the wall and I've instantly got all the audio, transport and track switching control from whichever control room I patch to.”

Nice touches have been incorporated into these panels, such as providing both sexes of XLR on the first eight audio lines, thus helping to eliminate the often frantic search for sex converters. Balanced jack sockets have been wired in parallel with XLRs, doing away with the need for masses of DI boxes. Two-way video links are installed but many studio areas have direct sight of the control room. MIDI is transmitted via a Real World Design ‘long range MIDI system’ that ensures best quality data with the least amount of delay. DC is provided in 6, 9 or 12 V supplying power for foot pedals, etc, and an alternative quiet earth has been made available. In fact the studios installed two earths when new foundations were being laid; a clean technical earth is on 40 ft deep steel piles, and the quiet earth consists of two very long copper strips buried 3 ft below ground. The building supplies domestic mains, clean technical mains and 110 V throughout.

Just as there are no restrictions on where one records—a recent track was recorded entirely from a rowing boat in the middle of the mill pond—there are similarly no constraints imposed on the way people wish to work; a very strong philosophy at Real World is that the working environment should be adaptable to suit individual needs, and should never be fixed or uncompromising.

Large: “We attach a great deal of importance to artistic performance, and the right environment for a good performance is what influences the design of the place rather than what is always right technically. Incidentally, in our view engineers are as much a part of the performance as the musicians, they just play on different instruments. So we try not to impose any rules on how things are used, and depending on how people feel, who they are and what they're trying to achieve, the layout will change radically. Control rooms are designed with this in mind, so that everything can be moved around, the only thing that

can't move at the moment is the console, but we're even working on a way of doing that in the big control room because of the increasing amount of recording actually taking place in there."

When you walk into Control Room One, you begin to understand why people are using it as a recording area. The oval, cast concrete room is a vast 2500 ft<sup>2</sup>, measuring 15×17×10 metres (lwh), and even the enormous 80-channel wraparound SSL appears dwarfed in this cavernous space. Perhaps the most eye catching feature is the ceiling to floor broad band RPG diffusor (40 Hz to 20 kHz), which takes up the entire back wall; made from metal, wood and glass, this computer-modelled structure soars to the ceiling like a cathedral organ, accentuating the height of the room, and making a bold contrast with the mainly windowed front end. Natural light is an important consideration throughout Real World, and more windows appear high up in the ceiling. Below these are suspended two rows of multiband diffusor boxes, also containing absorbent material. These eight diffusors have all been angled towards the listening position, as have a further eight much larger diffusor/absorber panels placed along the side walls. Broadband absorption has been built into the void under the raised perimeter floor, and also placed in the ceiling. The central, sunken work area is covered in a light coloured industrial flooring material called Altro, which is soft yet hardwearing enough to make a good base for the console and two large movable outboard racks. To the left of the console,

built behind the control room wall, is a machine room containing two Studer A820 multitracks, an A820 ½ inch and an A807 ¼ inch; likewise there are two separation booths, one to the right of the console and another behind the back diffusor wall. A Mitsubishi digital 32-track has just been installed.

The control room has been equipped with an SSL 4080G with *Total Recall*, integral synchroniser, Neve *Prism* and the Real World *Automated Send Matrix*. The console includes in-house customisation in a number of areas. The back stereo buses have been modified to provide an extra stereo send tracking the main panpot, which can be used to drive stereo reverb, Aphex, etc—they include a master send section identical to the stereo cue master. External monitoring has been extended to allow for a total of 28 inputs, and an extra 15 selector buttons have been added to the desk. Four pairs of stereo audio subgroups, accessed from buses 25 to 32, have been built into the central section near to the main fader: they offer basic EQ, full quad balance, automation and insert patch. The console can be individually configured in groups of eight channels to any status or combination of status, using a cleverly laid out matrix panel situated above the subgroups. The split cues system introduced on the G series console, which allows independent sends from the left and right sides of the desk, has been modified to split at channel 24 or 32. Headphone sockets, on standard and 3.5 mm 'personal stereo' jacks, have been provided with a selector switch to monitor foldback from the same amps as the musicians, or to follow desk monitoring. All of these modifications have been



## Real World's Automated Send Matrix

The Automated Send Matrix is the first major commercial product to come from Real World Design, and so far five systems have been installed worldwide. The system evolved out of the increasing complexity of sessions in Peter Gabriel's studio and hence the need for extra auxiliary sends. Although designed with SSL consoles in mind, the ASM will interface to most desks. The system will add two to eight sends per channel and, depending on the size of console, will accommodate up to 96 channels. In addition snapshots are stored and MIDI control room information transmitted and received.

There are two main parts of hardware—the audio frame and the computer frame. The audio frame contains two types of horizontally mounted modules—the buffer module and the bus module. Each module caters for 16 channels, and in a four-send system, will be arranged with a buffer module at the top followed by four bus modules. Bus modules contain 16 groups of controls—level pot and momentary on/off button with an LED indicator—and each module provides control for 16 channels outputting to one send. The buffer module, which provides balanced inputs to the bus modules, has no controls and is faced with a numbered scribble strip. The audio frame comes in 5 or 7U 19 inch rack sizes, holding 10 or 15 modules respectively. Obviously several racks may be required for large systems.

The signal to the audio frame, in the case of the SSL console, is usually derived from Cue 4 on each channel—after the Pre and Small Fader switches but before the level pot. This results in all the sends following Pre/Post, VCA/Small Fader selection from Cue 4, although if preferred the signal can be sourced from anywhere within the channel. Outputs from the channel, and inputs to the audio frame are normalised, appearing on the console's patchfield, providing a useful break-in point.

The computer frame is a 2U 19 inch rack unit containing up to four master audio sends on the left, and the computer controls to the right. Each master send is identical to the SSL cue masters, with a level pot, and basic HF/LF EQ. At the base of each send is a monitor button which interfaces to the console's External To Monitor/External To Studio source selectors. If preferred these master controls can be fitted in the console.

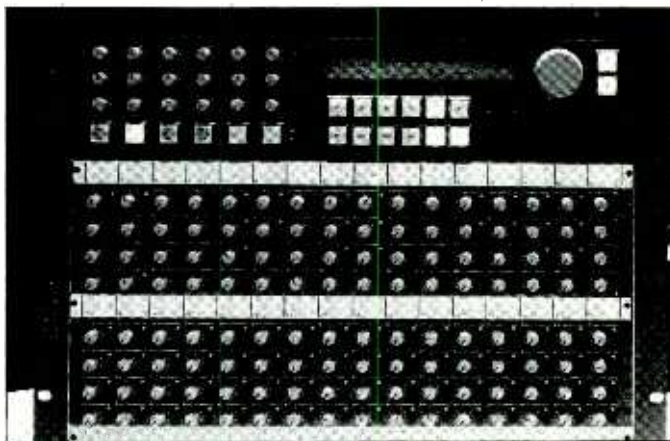
The computer section consists of a 40 character backlit display, a number of soft and dedicated keys, a large soft knob, and a 3.5 inch floppy disk-drive. The computer continuously reads the on/off status of switches and updates them accordingly. In addition snapshots of the switches can be taken, and stored as Presets (128 available in non-volatile memory), and run in a sequence against timecode.

The ASM has also been designed to function with MIDI, and switch status is output and input as Note On/Off data, enabling the system to be run with a MIDI-based sequencer. This means that switch status

and Presets can be recorded, edited and quantised in the same way as a MIDI instrument, allowing complex editing both on- or off-line. Final mixes are stored on floppy disk along with any useful Presets.

A 16-input, eight-send system has recently been supplied to US-based Sun Sound for use on the road. As a lot of live work will be non-sequencer based and therefore without timecode, Real World Design have developed a manually cued MIDI remote system based around the Atari ST.

The system provides three levels of data storage—Patch is a block of



MIDI program changes on up to 16 channels that is sent to the ASM at a relevant cue point; Song contains a total of 32 Patches which can be named and recalled in order; Show contains up to 32 Songs arranged in a running order, and there are 32 Shows available. So once the engineer has all the Patch and Song information stored, he can, if necessary, re-arrange the running order to suit any last minute set changes, store it in Show, and then just press a button each time there is an effects change during the performance. Overrides are provided at all levels to guard against the unforeseen, and any Patch or Song is easily accessible. The system enables extremely complex and impressive changes to be made effortlessly.

In the studio the ASM provides all the obvious benefits of extra effects sends for mixing, and additional foldback when recording, but due to the patchable nature of the system, it can also offer automated muting in other areas, for example echo returns.

The average installation time is 3 days, and involves fitting a small buffer PCB to each channel, extra patch rows and power/interconnecting cables. □



The Workroom

◁ incorporated in an unobtrusive manner, and have been designed to leave the console operating as normal when they're not in use. Also fitted in the desk are the room's lighting controls, and switches to operate motorised blinds.

The outboard racks are on wheels so they can be positioned anywhere, plugging into numerous floor connector panels. Outboard includes Lexicon 480L, PCM 70, PCM 42. AMS reverb and DDLs, Quantec Room Simulator, Delta Lab DL2, Roland and Yamaha multiprocessors, dynamics units from Drawmer, BSS, Neve and UREI, and equalisers from Neve and Tube-Tech.

Each control room is part of the complex's computer network and is equipped with a Macintosh SE 20 or 30 with MIDI interface. This provides numerous uses, for example to access a laser printer in one of the offices to print out lyrics, track sheets, etc. There are at present 15 Mac's throughout the complex.

Control Room One is an addition to the original mill building, and its stepped, oiled lead exterior juts out into the mill pond like some strange fortified gunboat. Sitting at the console the outside water level is at about knee height, and the view is wonderful: instead of staring at the usual studio glass, one watches ducks paddle to and fro with a backdrop of gardens and trees. However, the room is not what one might term as cosy, and it certainly shouldn't be recommended to anyone suffering from even a hint of agoraphobia. With a reverb time of just over 0.4 secs it takes a little getting used to.

"Everyone finds it a shock initially, and they need to be accustomed to it. Occasionally when people are mixing, we'll position some screens around the console, but generally speaking people seem to adjust to it quite quickly and end up asking us not to change anything."

Due to the mass of diffusors returning energy to the room, it

is extremely efficient and the 4 kW Boxer system has no problem in driving it. Although the majority of engineers tend to work more on nearfield monitors the big speakers generate a lot of excitement especially during overdubs, and there's even a plan afoot to provide a small sound reinforcement rig if clients would like it.

Recording in the control room can be traditionally fraught with monitoring and separation problems but most sessions, even if they start with the conventional arrangement of putting the band in the studio, inevitably end up recording in the control room. How did staff engineer Richard Evans cope?

"Separation is a problem that we can always get round somehow but often people prefer to put up with it because they're much happier working this way. It's common for example to record drums in here—you have to first ensure the kit's sounding good, and then trust your skill at choosing the right mics and putting them in the right positions. The rest is down to getting levels to tape, and worrying about EQ and exact balances later on—the results have been really good especially from the playing point of view."

Another development, making the engineer's job even harder, is a preference by some artists to monitor their foldback through small stereo speakers like NS 10s, and it's not unusual to find the control room full of musicians all with their own pairs of monitors.

During my visit, rehearsals were going on for an evening performance by a group of Pakistani Qawwali (Islamic devotional music) musicians called the Sabri Brothers. The performance was to be recorded in front of an invited audience for Real World Records, and on this occasion it was preferred not to record in the control room. Three formats were to be used simultaneously: 24-track analogue, ½ inch analogue and the Linn Numerik system coupled to Sony 2500 DAT transport. Mike Large explained what the label was trying to achieve:

"What we're doing with Real World Records is providing the very best in recording technology to World Music. There's a lot of products on the market that haven't been recorded properly due to the obvious problem of restricted budgets—selling a few thousand LPs doesn't buy you a facility like this one—but because this is a joint venture with WOMAD and because we're great fans and believers in the music, we're prepared to put up the studio time."

The Sabri Brothers had set up in Studio One, which next to Control Room One is the largest recording area (14×6.5×9 metres). This lofty room has been formed by removing two upper floors, and hefty wooden cross beams and the old windows remain to mark the original levels. The honey-coloured timbers and Bath stone walls, give the room a lovely warm atmosphere especially when bathed in natural sunlight. A floating oak floor runs throughout, and at the south end it's partitioned off to form a booth with patio doors, above which a mezzanine floor has been installed. This in turn joins onto a metal walkway that criss-crosses its way through the length of the building finally connecting with the main stairs.

Large: "One of my requirements for the design of the building was that you should be able to get through from one end to the other without touching the floor. Why? Because it's more fun!"

An added practical advantage is that as the walkway crosses the studio it forms a platform, providing an additional if unusual recording space, accessed by a steel ladder.

Another unusual feature cropping up throughout the complex is the choice of air conditioning ducting.

"We have a pathological hatred of studio air conditioning, and consequently we've steered clear of the usual metal ducting that has been lined with Rockwool and covered in tissue paper. Instead we've ensured that all air is delivered through natural materials, and in Studio One alone there is 35 tons worth of clay piping suspended from the ceiling."

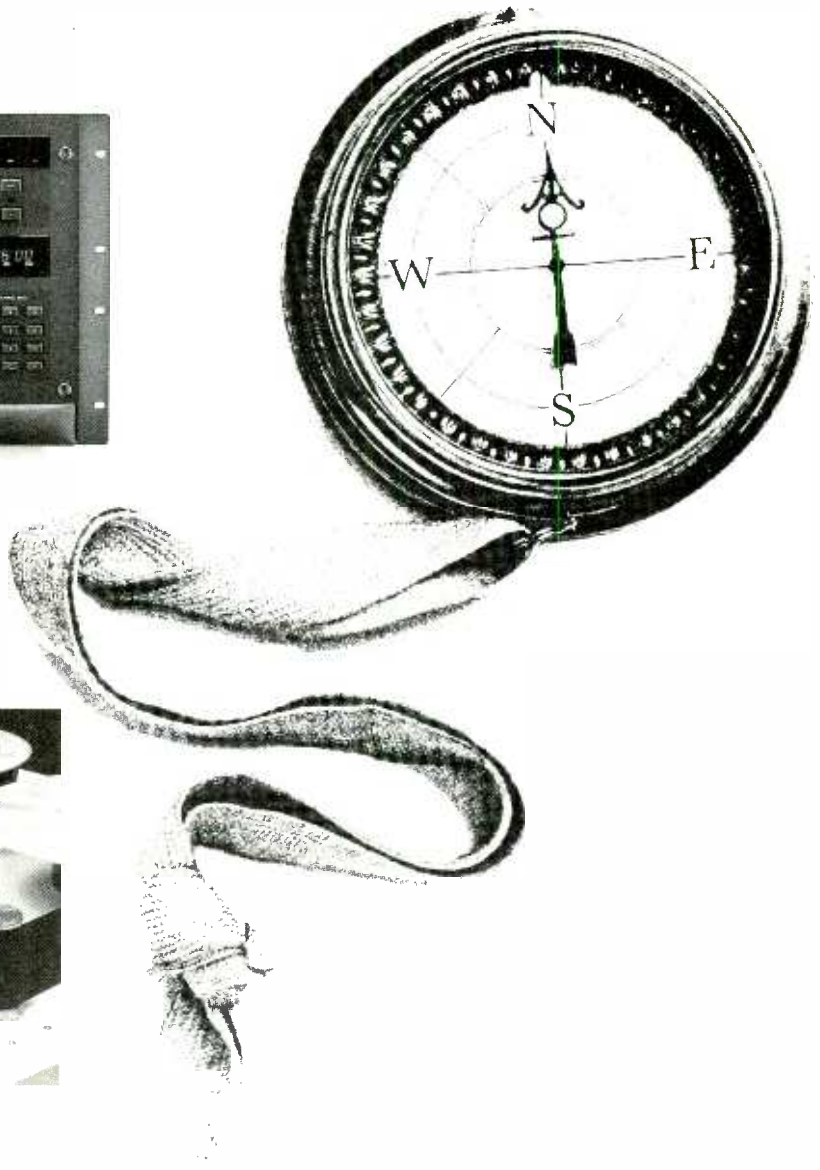
This clay pipe turns out to be substantial 600 mm sewage pipe, and requires regular strapping and harnessing to support it. The exposed nature of the air conditioning combined with the room's factory-like metalwork, and heavy beams, creates an industrial feel which is, of course, very much in keeping with the historical nature of the building.

A doorway from the booth opens into the Stone Room (6.5×6.5×6 metres); this was the site of the old water wheel, which is sadly long gone, but a glassed section in the floor gives a spectacular view of its original travel with the mill race ▷



Studio One recording area prepared for Sabri Brothers

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◁ running below. The sluice gate controls do, however, remain and are in working order, standing as a kind of curiosity on the flagstone floor. The floor itself had to be raised by a couple of feet to gain adequate flood protection, and it is also floated on rubber turret mounts; the sluice mechanism now runs through constant velocity joints from an old Mini to achieve proper acoustic isolation.

The Stone Room is diagonally dissected by the continuing overhead metal walkway, above which the ceiling is hung with thickly cut squares of Welsh slate, suspended at different levels on stainless steel rods, to form an effective 2-dimensional diffusor. Acoustically the room produces a tight reverberant sound suited to drums, brass, etc. There are windows in all four walls providing both daylight and visual communication back into Studio One and The Production Room.

The Production Room (6×5×4 metres) takes up the end portion of the building and was originally intended as a lounge; instead it became a pre-production room but due to the amount of recording being done in there, it has now evolved into a fully operational control room. This is the smallest and most conventional looking of the three control rooms with its pale fabric-covered walls and built-in UREI 813B monitors. A 40-channel SSL 4040E with G series electronics and software fits in snugly, behind this is a tabletop outboard rack and patchbay. An enclosed back gallery, which is the last stage of the walkway, overlooks the room and, apart from being an ideal place for visual eavesdropping, acts as a compact recording space.



Production room

The Production Room is the cheapest studio at Real World, and has proved very popular.

“We like to give people a price worked out against the project and its requirements, rather than a set studio rate. Often now we’ll work a project with a combination of rooms, and this can obviously help to keep costs down. With this in mind we offer an extensive range of nearfield monitors so that a project can take the same speakers from room to room, and retain continuity.”

Like the Production Room, Studio Two was originally conceived with a different purpose in mind. Situated at the opposite end of the mill this was to have been the reception area, and a huge wall-hanging by artist Graham Dean, painted on paper made from banana leaves and water hyacinths, would have made a striking introduction to the studios. This livish flagstoned room (6.5×6×6 metres) offers a useful and workable acoustic, but, due to construction is not good for very quiet work. In addition there is a small dead booth (2×3 metres) which is built in place of the receptionist’s office.

The ground floor of the building is a warren of connecting spaces, and apart from those already mentioned, there is a small kitchen area, and various storage rooms, one of which houses the studio’s collection of reconditioned plates.

The Workroom is the final control room and along with a

small live studio, it takes up the whole of the top floor.

Generally considered to be Peter Gabriel’s personal studio—although recently it’s been so busy he’s been unable to get in—this room has the same solid construction as Studio One, which is directly below it and separated by a 250 mm high density concrete floor.

The room is a spacious 13×7×5 metres and is light and airy; the pitched roof has been opened up to expose beams, and windows have been built into its length. More windows give fine views over the complex and the surrounding area. Two large, octagonal, wooden air conditioning ducts run lengthways at ceiling height on either side of the room, and blend in sympathetically with the roof timbers and beechwood floor. At the back, sandwiched between two windows, is an enclosed area housing racks for amps, computers, patching, etc; above this, accessed by steep metal stairs, is a small mezzanine floor which in turn lets out onto a small platform giving more excellent panoramic views, as well as an impressive view down onto the tiered exterior of Control Room One. Another platform at the side of the building acts as a loading bay, and all the equipment, including the 48-channel SSL 4048E, was hauled up from the driveway far below by a motorised chain hoist.

There is little in the way of acoustic treatment other than some absorbent material in the ceiling, and the room remains intentionally live. The floor is semi floating on a sandwich made from hardboard, Rockwool and Lamella barrier mat. Again the design allows equipment to move around to suit the occasion, and staff engineer Dave Bottrill was busy preparing the room for the start of a new Peter Gabriel album. The main monitoring is via Neil Grant’s Boxer system, and the speakers are left free-standing on specially designed slate and sewage pipe stands.

The mixing console offers *Total Recall* and is fitted with G series EQ and computer; it also has an integral synchroniser, the *Automated Send Matrix* and is equipped with some of the modifications already described in Control Room One’s desk. There are two Studer A820 24-track machines, an A820 ½ inch with interchangeable ¼ inch headblock, Sony DC 1000 R-DAT and PCM F1. Outboard includes Lexicon 480L, Lexicon PCM70, AMS reverbs and delays, Quantec Room Simulator, Delta Lab DL2, Massenburg EQ, multiprocessors from Roland and Yamaha, and a range of dynamics units from UREI, BSS, dbx and Decca.

Accommodation at Real World is split between the large Edwardian mill owner’s house, and the much smaller producer’s cottage, which is 250 years old. There are six double bedrooms at the mill house, four of which have en-suite bathrooms. If necessary additional sleeping areas can be provided in loft spaces in three of the bedrooms. All bedrooms are kitted out with satellite TV, as is the large comfortable living room. The dining room, with its two large open fireplaces, can seat 30, but there is also a smaller eating area. All kinds of tastes and styles of cooking are catered for, and judging from the wonderful authentic wafts of Indian cuisine permeating the air, the standards at least smell very good.

The cottage is completely self-contained with a master bedroom, bathroom and kitchen/eating area on the ground floor. The upper floor is open plan and has been split into two levels, which can be used for a sitting room, extra sleeping space or even a small demo studio.

One of the joys of recording outside the big city, is the indulgence in country pursuits, and the beautiful countryside around Box offers a wide range of recreational facilities. Riding can be organised through a number of local stables, there are tennis courts nearby, and badminton and croquet are available on site. The studio also has an arrangement with two local sport and health centres—Lucknam Park and Cannons Country Club. There is also a games room/TV lounge in a separate building across the drive from the mill.

Future plans abound at Real World—a writing room for Peter Gabriel, and an offline video facility are two that are high on the list. Another consideration is to build a budget studio to attract more localised work, and an existing rehearsal room, on the WOMAD site, would be prime for developing. □

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# NOVATION ALPHA MIXING CONSOLE

A new audio console offers some innovative facilities to the recording studio. Francis Rumsey takes a look

**N**ovation International an associate company of Harrison Information Technology, has introduced an innovative audio mixer which has significant implications for the recording industry. Its most apparent challenge to other manufacturers is that it provides the assignable equivalent of a 32-track in-line mixer with full dynamic automation of every control (both 'monitor' path and 'channel' path) at a price which should surprise many.

## Background to development

A major consideration for the developers of *Alpha* has been the result of feedback from studios around the world concerning the way that recordings are now made, the change in the economic climate for studios, and the perceived growth of smaller studios (perhaps with one or two man operation) that need to operate on a cost-effective basis with the maximum amount of flexibility. Research has indicated that the market is perhaps polarising towards two limits: at the one end there is the large country residential studio where the rich may record their latest albums in the lap of luxury, and at the other is the 'work-horse' studio which produces results of arguably equal quality, yet on a much tighter budget and thus with greater efficiency.

The latter extreme is perhaps no better exemplified than by the growing number of 'composer-engineer-producer' outfits that are

springing up, perhaps to provide library music, video dubbing, or other specialist services, and that cannot justify the purchase of one of the recognised 'name' consoles that cost upwards of £100,000. These people are interested in a value-for-money package which will increase their productivity, offer a return on the investment, and not sacrifice audio quality. To some extent it is these people that the Novation team has designed its product around, and they have gone to considerable lengths to ensure that the console sits at the point of maximum value-for-money on the cost vs benefits curve.

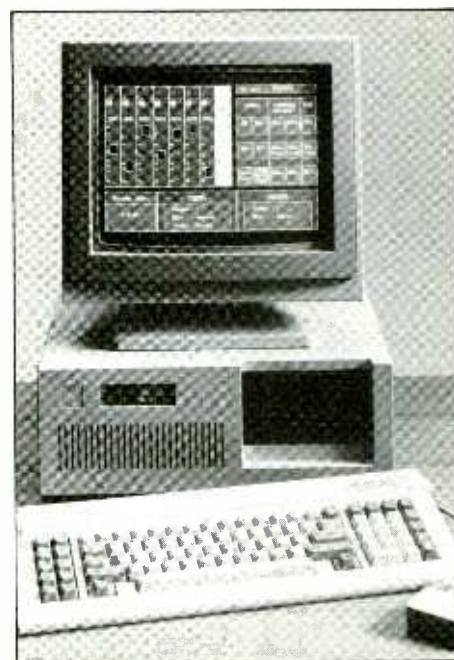
Total automation is one of the primary keys to increased productivity, and this is achievable using modern technology, particularly as it is inherent in the principle of assignable or 'virtual' controls. The *Alpha* is indeed an assignable mixer, if such a term is correct, in that it makes use of a number of large control panels for the main functions which can be assigned to a channel as required. The mixer uses analogue audio signal paths but with digital control.

The brains behind the project have come largely from a small team of people led by David Kempson, technical director of HIT and Novation, a former Neve employee previously involved with Neve's digital console projects. The team includes four other ex-Neve employees and three ex-Focusrite (one of whom was with SSL prior to Focusrite), thus there is a certain pedigree in the group. Using advanced CAD and PCB layout systems, the team has taken the mixer from inception to launch in about 12 months, the *Alpha* being kept a remarkably good secret during this time.

## System layout

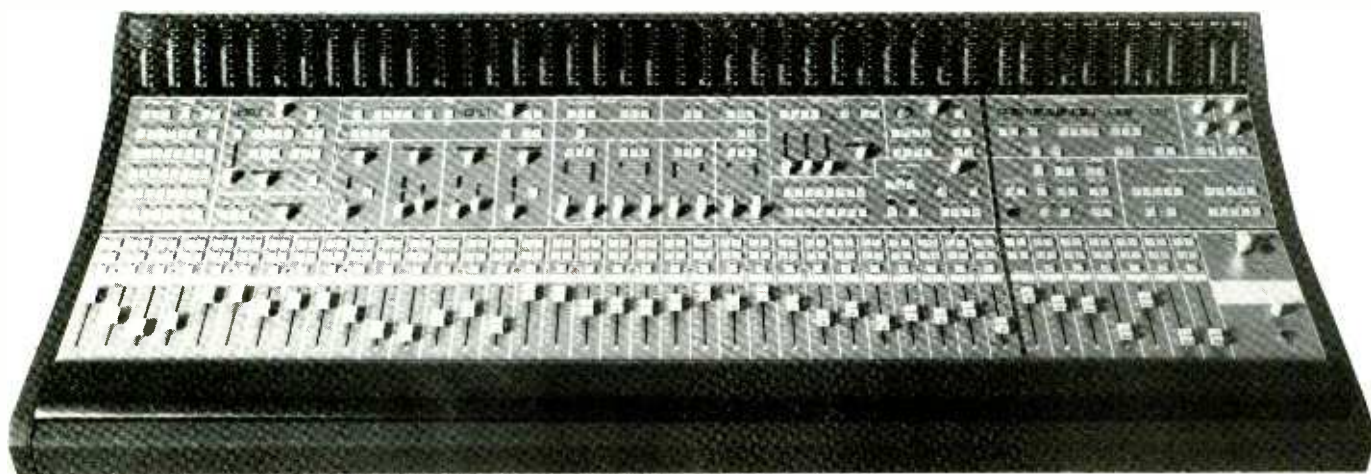
As already mentioned, the *Alpha* is what has become known as an assignable mixer. As such, its control surface is remote from the audio electronics which reside in a rack about 3 ft high, and this rack may be located at a considerable distance from the console because the only link between the two is a couple of high speed serial interfaces on thin cables. The rack contains all the audio inputs and outputs on XLR connectors, with insert points and effects sends and returns also provided on bantam jacks. It contains fans but these are quiet and unlikely to disturb monitoring. Within the rack are contained all the input/output modules for the channels, designed for maximum serviceability and ease of access, together with the monitoring and auxiliary sections as well as the central processor.

A third unit is optional, but almost mandatory for automated mix storage, as this is an off-line



Off-line editing station for automated mix storage

editing station based around a standard desktop PC which interfaces with the console's processor. Here, mixes can be edited and complete console setups can be prepared prior to a session using a graphic interface which mimics the appearance of the mixer surface. This implies considerable

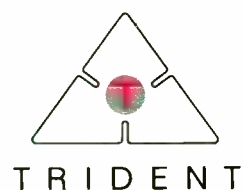
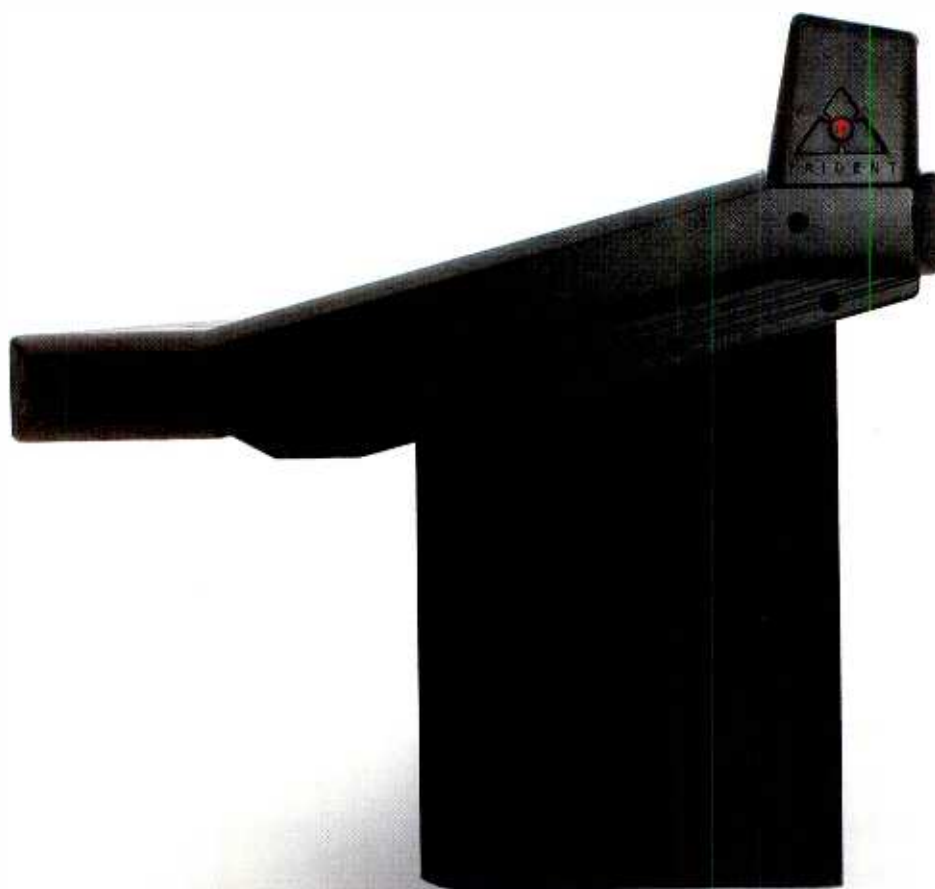


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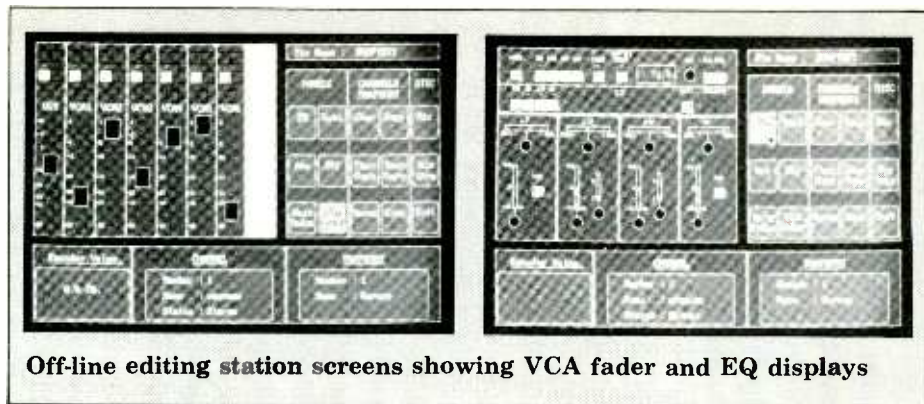


◁ potential for the improvement of productivity because of the possibility that a producer or engineer for one session could be setting up the console off-line for a forthcoming session, while the real thing was still in use.

## Technology

The heart of the system is a 32 bit RISC (reduced instruction set) processor from Advanced Micro Devices. Compared with a conventional microprocessor, the RISC processor is capable of a greater number of instructions per second, partially because the instruction cycle is shorter. This is necessary to ensure accurate realtime automation of all the console controls, providing the user with immediate audible response from controls, and automation of mutes to 1/4-frame accuracy.

On each I/O module is mounted a digital ASIC



Off-line editing station screens showing VCA fader and EQ displays

(application-specific integrated circuit) which handles communication with the processor and control surface, as well as interfacing with the various hybrid digitally-controlled attenuators on the board which control audio levels, EQ and so

on. Both the ASIC and the hybrid DCAs are designed specially for this console, this being a reasonably economical proposition these days provided that a suitable quantity is envisaged, the cost of each ASIC in this mixer amounting to no more than around £3.40 (\$5) after the initial tooling costs.

By ensuring that all the high speed digital communications stop at the ASIC (which is mounted at the edge of each I/O board), digital interference with the audio is kept at bay, as the speed of changes in information fed to the DCAs is relatively low, corresponding to the rate of change of front panel controls. Also, in order to ensure noise-free dynamic alteration of audio functions such as EQ, changes in gain are synchronised to zero crossing points of the audio waveform which apparently reduces audible effects such as zipper noise.

To simplify servicing, there is one hybrid per audio function, clearly marked on the PCB, such that a failed device can be easily exchanged by a relatively inexperienced maintenance engineer. Only two types of hybrid exist, making it a reasonable proposition for a studio to keep spares in stock, and to exchange on a plug-in basis in the event of a fault. Likewise, ICs are all socket mounted, again to simplify maintenance procedures. Factors such as this become considerably more important as technology marches on, because the more complicated the system the more daunting it may be to service.

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## Facilities and ergonomics

Although an assignable design, it is clear that the terminology and layout have been arranged in such a way as to imitate (in assignable automated form) the operational concepts of an in-line mixer. This said, it is not limited by some of the constraints of the in-line design, making a number of things possible that would previously have been either very difficult or impossible.

As an example of the translation of in-line concepts, it is still possible to perform a 'fader-swap' between monitor and channel paths, and there is one 4-band EQ per I/O module which can be swapped or shared between the two signal paths. As a step on from the average in-line design, the *Alpha* automates both the channel fader and the monitor fader, providing the user with up to 72 automated inputs with echo returns during mixdown. But one must remember that this is a mixer which has been designed with total automation in mind, and thus it is not just fader levels which are memorised, it is also every other function which might be changed in either signal path.

The assignable control panels are arranged such ▷



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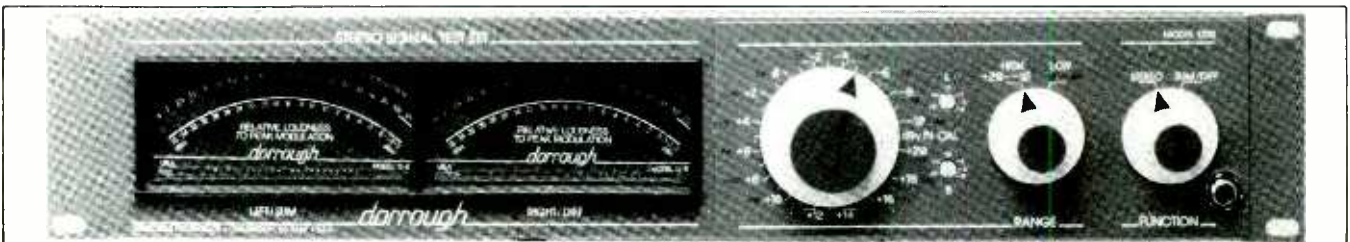
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that the ones most often used are largest and closest to the middle (EQ and auxiliaries), and in conventional manner these are accessed for each channel by pressing a button by the relevant channel's fader. There is a fader per channel, and these can be configured to act as stereo masters for a pair of adjacent channels, with setup parameters being copied from one channel to the other when a pair is assigned to be stereo. Each assignable panel uses a combination of light action switches and continuously rotating controls with displays. The main displays are arranged as vertical or horizontal rows of LEDs to indicate the settings of rotary controls, and the whole surface is covered with a non-reflective plastic overlay in grey. It is thus unlikely that any labelling of controls or displays would become erased by wear.

The 4-band equaliser can be arranged such that two bands reside in the channel path and two in the monitor path, or that the whole EQ resides in either path. Bands are arranged from 80 Hz to 1.6 k, 300 Hz to 4.8 k, 3 k to 15 k and 5 k to 18 k, with bands one and four or two and three together being switchable between the signal paths. Auxiliaries are configured to allow either global switching of a particular numbered aux send to be mono, stereo, pre- or post-fader, as well as allowing individual setting for each channel.

## Further operational features

Since both monitor and channel paths are automated and would both be likely to be used as inputs to the mix in mixdown, it is possible to link the solo mode such that a solo in either path will mute unwanted channels in both monitor and channel. Furthermore, either the monitor or channel paths can be made to feed the multitrack routing matrix in mixdown.

There is also the facility for rehearsing drop-ins on multitrack. In order to rehearse a drop-in, the user determines the estimated drop-in point while tape is running, at which the relevant module's monitor input switches over from monitoring sync tape reproduction to monitoring the channel line output without actually dropping the tape machine into record. Once this point has been trimmed to be correct an automatic drop-in can be effected, although it is left to the user to determine which track will drop-in by selecting on the tape machine's remote, as the console's interface with the tape machine is really limited to simple transport remotes and timecode.

On each I/O module there is an assignable insert point which can be set to occur at a choice of points in the signal chain, this appearing on the audio rack as a jack socket. Four effects returns exist, in addition to the channel and monitor inputs, and these are provided with basic EQ.

## Automation

As previously implied, due to the virtual nature of the controls on the *Alpha*, it is a short further step to the storage and re-iteration of these controls' positions. Since all rotary controls have no pointers and no end stops, they can always be in the 'right place' without needing to be nulled to a stored position before they can be altered, the display showing the actual system position of the control. Each operational control panel is provided with READ and WRITE buttons, as well as a means of isolating the function from automation

control, to dictate whether a certain function for a specified channel is to be memorised in the mix or whether it should be under the control of a previously memorised mix. Naturally these can be globally selected to save time when writing or reading a completely fresh mix.

Rotary level controls such as EQ settings are set and memorised to 0.5 dB resolution (64 steps per control) and are accurate to one timecode frame when recalled. Channel mutes are made accurate to a ¼-frame as these can be more sensitive to absolute timing accuracy. All settings are stored dynamically against timecode, but additionally it is possible to store up to 999 snapshots of full console status, with a variable crossfade between the old and the new status. This would have considerable benefits in live applications, such as theatre, where different settings apply to different scenes.

Presently, fader automation is achieved using standard VCA techniques, requiring nulling in order to update a mix, which is perhaps a backward step from the non-nulling procedure involved with all other controls on the mixer, but it is apparent that a motorised fader option is planned for the future. In the master section, six VCA group faders are provided, which may be assigned in the conventional manner to control any combination of channel faders.

In order to store a number of different mixes and console setups it is necessary to use the off-line workstation, which is a PC-based system providing a wide range of facilities for editing and merging mixes, as well as storing and recalling settings from the desk. The desk uses battery-backed RAM to hold information when the power is off. Using a mouse and a graphic representation of the mixer surface which appears on the workstation screen it is possible to change mixes by clicking on the required control and changing it to the desired setting at the relevant timecode location. Further to this, it would be possible to prepare the entire console for a session without needing to be anywhere near it, simply bringing along a disk to the session and dumping the setup to the mixer.

## Conclusion

The Novation *Alpha* is something of a revolution in console design, as although it is not the first to use an assignable control surface it has made all the advantages of assignable controls (eg total automation, better display, instant reset, larger controls) available at a reasonable price. Provided that potential users feel that the audio quality is what they want, there could be little reason to spend any more, as there is no other totally automated console available with these facilities at a price anywhere near it.

There is a natural reticence within the industry to accept assignable controls as a good thing, 'because you can't just reach out and grab the HF EQ for channel three', but this is perhaps only surface bias as many will say things like this without even trying it. The large parallax errors that can occur in judging which EQ control affects which signal in large in-line consoles often result in mistaken adjustments because the controls are so far away, whereas the assignable control could be at the fingertips of the operator with a large well-labelled knob and a clear display of the setting.

It is perhaps the increased operational flexibility, productivity, and thus profitability that can result from total automation, though, which should be the deciding factor in the argument. □

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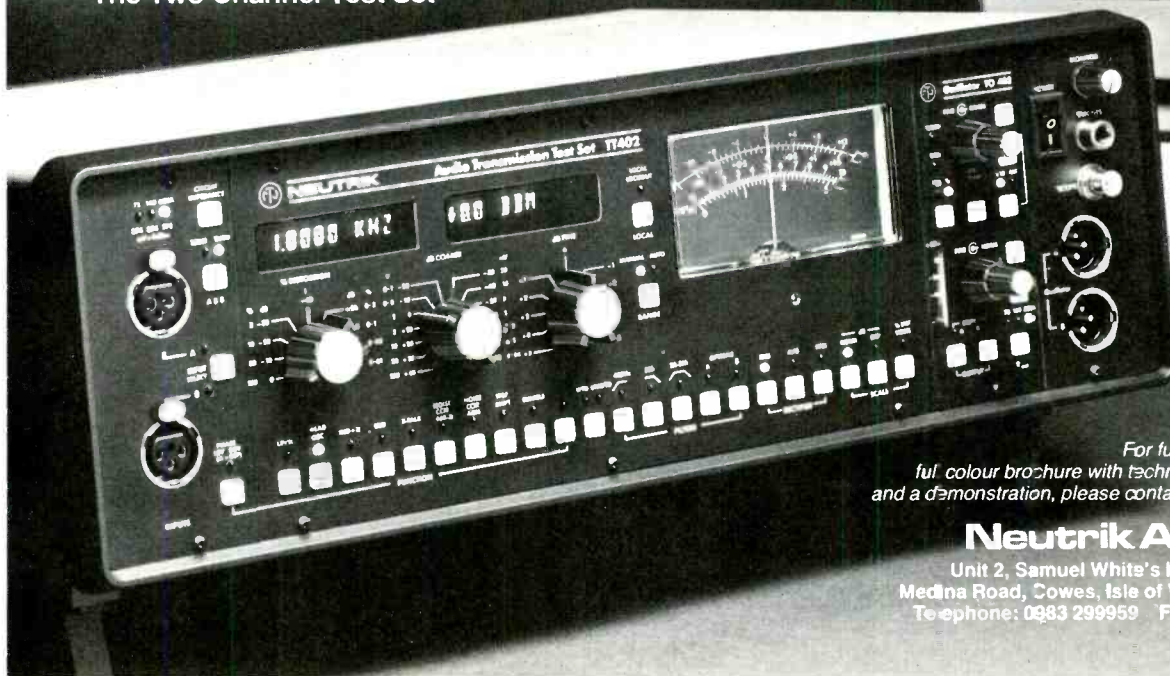
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# MONITOR SYSTEMS- CROSSOVERS

## PART SIX

As with so many other things, the law of diminishing returns applies to monitor system improvements. More amplifiers means more expense but I believe it is the price that must be paid for more accurate monitoring. It is now 5 years since I gave up the high-level, passive option and while keeping abreast of developments, I still see no likelihood of changing from my decision to opt for the active, low level crossover. Another advantage of the use of low level, active filters is the ease of providing adequate transient overload headroom. To achieve a 20 dB voltage margin over a 1.23 V line level is relatively simple. In terms of power, 20 dB represents a 100-fold increase. Were a high level passive crossover to be designed with a 20 dB headroom margin, if the system were rated at 100 W continuous, the reactive components would be required to saturate at a level not below  $100 \times 100 \text{ W} = 10,000 \text{ W}$ . The best transient performance at high levels, more or less dictates the choice of the active, low level option unless very complex loads can be tolerated by huge amps.

The next question to be faced is that of the slope, together with the shape of the curve at the turnover point. The most commonly used rates of roll-off are 6, 12, 18 and 24 dB/octave. This is no arbitrary choice of figures. Conventional filters, be they electrical, mechanical or electro-mechanical, tend to produce slopes in multiples of 6 dB/octave. Cascading two simple 6 dB/octave filters produces a 12 dB/octave filter, three produce 18 dB/octave and so forth. Unfortunately, with the exception of the 6 dB/octave, or first order filter, they not only create a roll-off, they play havoc with the phase response. The only crossover filters whose outputs can recombine to produce a squarewave are the 6 dB/octave filters. The outputs from the highpass and lowpass sections can be electrically recombined to produce an exact replica of the input signal (see Fig 1) as the 3 dB hump at the crossover point is exactly cancelled by the 3 dB loss due to the  $\pm 45^\circ$  phase shifts. Unfortunately, a slope of 6 dB/octave is too shallow for most monitoring purposes, and not only from the point of view of the prevention of low frequencies from entering the tweeters. The individual drive units would need to have excellent response characteristics for two or three octaves below the crossover frequency, as their output would only be around 15 dB down, two octaves below the crossover point; assuming each filter section was 3 dB down at the crossover point itself. Any irregularities in their individual responses would be clearly audible.

Furthermore, with such a range of audible overlap, two octaves either side of the crossover frequency, that would mean four octaves over which two, dissimilar, spacially separated drivers would be contributing to the audible output of the system, losing any hope of achieving a point source. This would inevitably lead to lobing of the polar pattern and time smearing of impulses. Anyhow, drivers capable of responding three octaves beyond the desired crossover point would

## With the second part of his personal view of crossover options, the design problems and subjective audibility, Phil Newell continues his series

be difficult to achieve when designing for high power levels. I do sometimes use 6 dB/octave filters to bring in a tweeter at high frequencies, say 5 or 6 kHz. This is to compensate for the mechanical 6 dB/octave roll-off above such frequencies, which is characteristic of certain mid-range units. In the mainstream of things, however, I do not consider them practical propositions.

Second order filters of 12 dB/octave are very widely used in commercial crossovers. The slope is becoming sufficiently steep to reduce the problems of driver overlap. The cost and power loss are also acceptable in the high level, passive versions. Unfortunately, however, electrically they just will not sum (see Fig 2). Connecting the outputs of the highpass and lowpass sections in phase, a dip is produced in the amplitude response graph at the crossover point. As the frequencies approach that crossover point, phase shifts in the filter sections

cause one output to develop a phase lead of  $90^\circ$ , while the other section develops a phase lag of  $90^\circ$ . The differential between  $+90^\circ$  and  $-90^\circ$  is  $180^\circ$  or antiphase. This is the cause of the cancellation at the crossover point. The common 'fix' for this is to invert the phase of one of the drivers to achieve an in-phase, summed output at the crossover point, removing the amplitude dip and straightening out the frequency response. On steady state signals, this is fine, as away from the crossover point where the drivers are once again out of phase, due to the steepness of the filter slopes, only one driver will be contributing to the total output. As one driver cannot be out of phase with itself, this is usually deemed to be acceptable.

Unfortunately, music is rarely steady state, it is full of crashes, bangs and sharp leading edge transients. A uniform, positive-going impulse (an impulse or  $\frac{1}{2}$  cycle square wave contains all

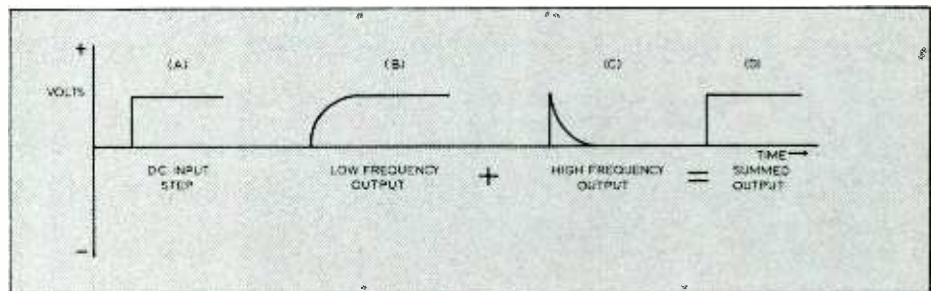


Fig 1: 6 dB/octave crossover impulse summing

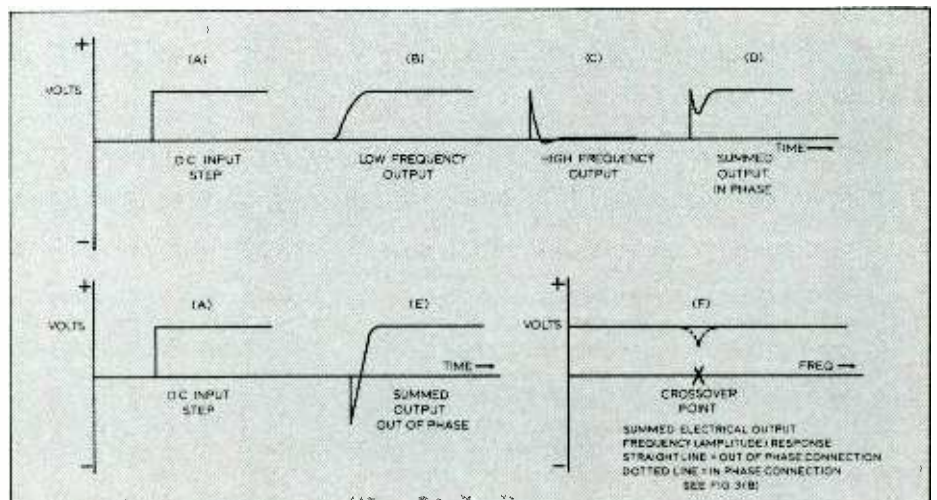


Fig 2: Typical electrical impulse (step) responses for 12 dB/octave crossover. Note that in-phase, or out-of-phase, the output is not a true replication of the input



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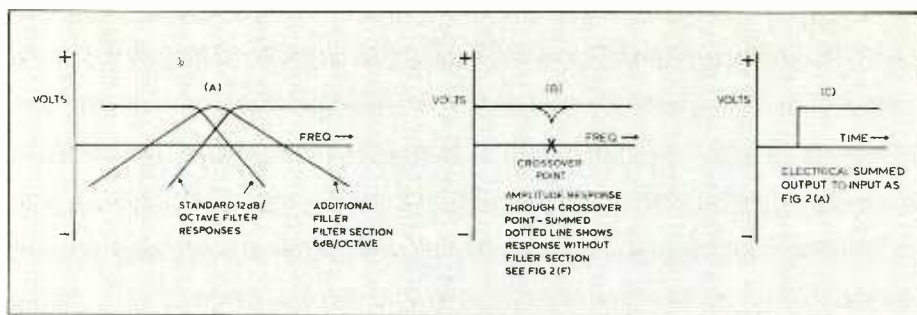
△ frequencies simultaneously) applied to the input, will cause the bass driver to move forward and the treble driver to move backward. This clearly cannot be construed as being representative of the input signal. The choice is clear, either to have phase-coherent transients with a dip in the frequency

response, or a 'flat' frequency response with phase-distorted transients. There effectively is no choice, it's the proverbial choice between a rock and a hard place—neither is desirable, they are both wrong. This point is now being brought home rapidly with the availability of phase coherent, digitally recorded material, free from the inherent phase distortions of analogue recording techniques.

Before somebody mentions 'filler drivers', yes, there is a technique for overcoming these problems. A system is connected in-phase with the response dip being filled in with a filler driver (see Fig 3) contributing the missing output at the crossover point. The filler driver must, of course, be fed from a suitable bandpass filter, and its audible characteristics must be chosen carefully to match the other drivers in the system. On-axis response is accurate but the spacial displacement of the drive units create off-axis problems. A 4-way system using this technique would become 7-way, with seven crossover sections: the four main outputs along with three 'fillers' at the crossover points. In other words, chaos! Anyhow, 12 dB/octave is still marginal on high power systems, both in terms of, out of range driver protection and the necessity for smooth responses either side of the crossover points. I rejected 12 dB/octave crossovers as a practical solution.

Third order filters, 18 dB/octave. The slope of these filters is generally adequate in terms of both driver protection and overlap. The Butterworth, or maximally flat filter design, frequently used with third order filters, produce slopes that are 3 dB down at the crossover points. The voltage outputs are in phase quadrature (90° out) at all frequencies; in actual fact they are 270° out of phase, being shifted by 135° in each direction but in steady state terms, +90° or -270° are effectively one and the same thing. As the filter slopes become steeper, the areas of overlap become much narrower. Phase discrepancies at the crossover points become of less overall importance, being confined to very narrow bands of frequencies. As we saw earlier with the inductive (reactive) machinery, power factor (phase) problems do not always mean that summing voltages mean summing power. To achieve a voltage sum at the electrical outputs of the crossover does not always guarantee an acoustic power sum from the loudspeakers and vice-versa.

The group delays which exists in each filter section are the cause of another summing problem with high order filters. It takes a finite time for the signals to pass through a filter, a time which is a function of the filter slope and the upper frequency limit. Because of this property, we once again have a phase preference on impulses which do not apply to steady state. In phase or out of phase correction of third order crossover outputs, render little difference to steady state signals, +90° or 270°. On transient signals, however, the



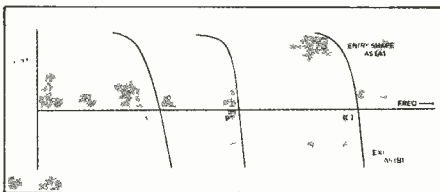
**Fig 3: Typical 12 dB/octave crossover with additional 'Filler Driver' filter section. All filter section outputs to be connected in-phase**

out of phase connection is preferred as the group delay between the filter section outputs, is much closer at the crossover point than the in-phase delay. 18 dB/octave crossovers are popular and effective. They are capable of excellent audible characteristics and the Butterworth slope shapes are probably optimum in the smooth transfer of sound from one driver to another. Differing cone/dome/diaphragm materials will inevitably produce a different timbre to any signal to which they may be subjected.

Crossing over from a paper cone to an aluminium diaphragm compression driver, can produce a noticeable change of character on rising sections of voices or strings, especially if the crossover is too steep and abrupt. Careful choice of the drivers can obviously mitigate this problem and, with the appropriate choice of crossover slope and shape, the effect can be rendered almost inaudible. 18 dB/octave Butterworths are excellent from this point of view. We still, however, have the problem of the outputs being in-phase quadrature, ie 90° out, with the attendant implications for the impulse/phase/transient response.

Fourth order, 24 dB/octave crossovers go full circle, 360° phase shifts. Effectively, in steady state terms, 360° = 0° = in-phase! In so many ways, they seem ideal but I had initially rejected them on the grounds that the transfer from one driver to another was too abrupt, audible quite clearly on certain demanding signals as previously mentioned. The maximally flat, Butterworth 24 dB/octave filters do not sum to unity directly at the crossover outputs. Although each filter output is in-phase with the input, the group delays associated with the individual filter sections have the effect of becoming a little out of step at the crossover points. The Linkwitz-Riley fourth order filters are produced from cascaded second order Butterworths and are in-phase in all frequency bands. The slopes are 6 dB down at the crossover points, so there is a corresponding 3 dB dip in the power response. While they thus do not power sum to exact unity, the notches in the overall frequency response are so narrow as to be virtually inaudible on normal musical programme.

There are two ways of addressing the group delay problem. One way is to use digital delays



**Fig 4: Comparison of slope entry shapes and final slope rates of Butterworth 18 dB/octave (A), standard Linkwitz-Riley 24 dB/octave (B) and Clarke 24 dB/octave hybrid (C)**

on the crossover outputs, delaying the faster outputs to come in-line with the slower, more delayed outputs. The second way is to physically re-align the drive units with respect to their position in front of, or behind the baffle.

There are two drawbacks to this second approach.

Firstly, causing drivers

to be recessed or projected from the baffle plane can cause diffraction surfaces which break up the simple, flat, plane of the baffle. Axial response anomalies can also result from such uneven surfaces. Secondly, due to the speaker cone materials having finite speeds of sound transmission, together with propagation delays relating to the reactive couplings to the air and phase dispersion in horns, no specific point can be regarded as the centre of propagation of the sound. The phantom propagation sources can move backwards and forwards with frequency. One of the advantages of the digital delay approach, is that it can also be used to compensate for driver misalignment, instead of repositioning them with respect to the front baffle, thus avoiding the diffraction problems. The delays can be given compromise settings, to take the best, overall, mean values to compensate for group delays and driver alignment. Although this can never be absolutely precise, especially due to the impulse smearing within the drivers themselves, it does seem to be the best way to overcome the problems using relatively conventional technology.

Taking account of the delays in the drivers is very important. Sound does not emanate from them immediately upon the application of an input signal. There are finite propagation delay times inherent in the mechanical system; a certain amount of springiness and elasticity. Even the molecules are not totally rigid, you get a shunting effect rather like the clatter of railway wagons as the train starts and takes up the slack. There's a lot of free space in molecules and atoms. If the outer electron orbits of an atom were the size of Wembley Stadium, the total 'solid' matter in that atom, would be about the size of a football. There is a certain compressibility in that space. That is why neutron stars can weigh thousands of tons per cubic inch. They are very, very, dense. Gravity of enormous strength has squeezed out most of the space to render them 'solid' in a rather more true sense of the word. It is these spaces that X-rays use as they travel through the body. Nothing on Earth is truly solid!

Returning to the problem of smoothly and gradually crossing over from one driver to another, many filter shapes were considered. The Bessel filters are very abrupt, peaking slightly before they steeply roll off. These made the problem very noticeable. The Butterworth and Linkwitz-Riley filters were better but still produced certain audible anomalies. In solving the problems of the abrupt transfer from driver to driver, I am indebted to Colin Clarke. Using state variable filters, he modified a Linkwitz-Riley design slugging the entry into the slope, to replicate the initial shape of a Butterworth, 18 dB/octave filter. The design gradually assumes the 24 dB/octave slope but initially, it is remarkably similar to the third-order Butterworth (Fig 4). An advantage of state variable filters is



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◁ that only one slope is generated, which is mirror-imaged to provide its counterpart on the adjacent filter section. Conventional filters require very tight, long term component tolerances, as any drift or component error, can make the overlapping filter sections misalign, causing dips or peaks in the summed response. As the overlapping filter sections are derived from the same filter slope in state variable designs, any drift in one section will automatically be tracked by the adjacent section, thus maintaining a uniform overall response with excellent long term stability.

There are commercial crossovers available that incorporate variable boost controls to attempt to compensate for crossover point response dips. Other units use variable delay control, though not in the sense of broadband digital delays. Both of these systems are intended to compensate for mislocated drivers, especially in the PA and sound reinforcement fields where placement of such widely spaced drivers can never be ideal for accurate phase/impulse responses. I would not advocate the use of these controls on monitor systems, as they arbitrarily compensate for problems, rather than solve them. The results are frequently one step forward when measured but one step backwards when heard.

Another element of the monitor system which, strictly speaking is in the crossover domain, is the physical, three-dimensional placement of the individual drive units in the system. Effectively, there are two options; dual concentrics or discrete drive units. The loudspeakers themselves are the mechanical components of the crossovers in terms of their relative positions and their inherent electro-acoustic roll-offs. Should a crossover have a 12 dB/octave roll-off at, say, 500 Hz, and be connected to a bass driver that begins, naturally, to roll-off at 6 dB/octave above 500 Hz, then it is no use crossing over into a mid-range driver that begins to rise below 500 Hz at 3 dB/octave. The result would be an 18 (12+6) dB octave crossover on one side of the crossover, and a 9 (12-3) dB/octave crossover on the other side. This is another reason, except in special instances, for drivers to maintain a smooth, relatively flat response, well beyond the desired crossover point. Erratic, high Q peaks and dips can not only disrupt the crossover slopes, they can also introduce responses of a non-minimum phase character.

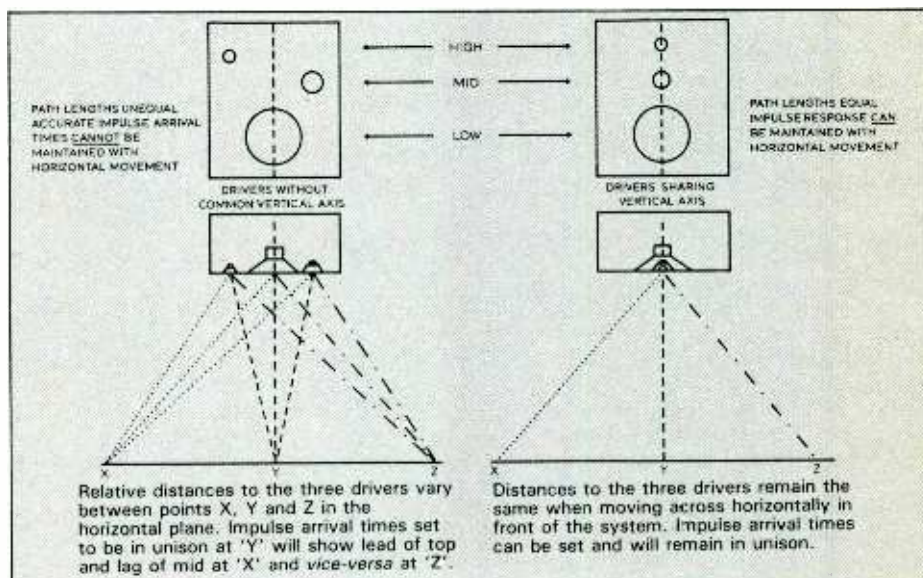
Responses said to be non-minimum phase, are those for which restoration to an even response by means of appropriate equalisation, will compensate in terms of amplitude but will not restore the original phase relationship. Once again, it is of little concern to steady state signals but is most destructive to transients. Such non-minimum phase effects can be produced in the off-axis response of a loudspeaker system, by the physical, wide separation of drive units. Here, the dual concentric designs do have an advantage in that they can be made to be near perfect three-dimensional point sources. In the horizontal and vertical planes, the drivers of a dual concentric share common axes. By judicious use of delay, the drivers can be synchronised to create the impression of sharing a common point on their front-to-back time axis. Horizontal and vertical directivity is maintained by such systems to a greater degree of phase accuracy than their discretely located counterparts, which can only maintain such accuracy over a relatively narrow angle. Almost inevitably however, for high level applications dual concentrics must be augmented by separate bass drivers. The reasons for this are two-fold. It would be difficult to produce a single,

say, 15 inch driver with the desired characteristics for both clear low-mid and deepest bass at high levels; also very high level bass excursions in close proximity to the high frequency source, would tend to modulate those higher frequencies, producing intermodulation distortion. If the crossover frequency is kept below 200 Hz or so, where the wavelengths are around 5 ft long, the coincident source should not be too disrupted by the physical separation of the bass drivers from the common axes.

The other main restrictions caused by the dual concentric option, is the limited choice of units available to a system designer. The 'mix and match' option is not available, which on the higher power systems is sometimes a necessity; no single manufacturer always produces the entire range of drivers desired by a designer. Back to the point of the non co-location below 200 Hz. At this point in time, I am not prepared to throw myself wholly into the 'bass is omnidirectional below 300 Hz' camp. Strong evidence is now coming to light that while this may be true, once again, for steady state signals, the implications are that on transient impulses, the low frequencies are both directional and critical on

though lobing and non-minimum phase cancellation will be more apparent, especially in terms of the reflected energy from a hard ceiling (see Fig 5). It does not quite require the fixing of one's head in a clamp to hear phase accurate monitoring from non co-located drive units but in this area, dual concentrics do have an advantage. The option of separately mounted drivers does has the advantage of allowing the designer specific choice of drivers, in terms of audible matching of characteristics, power handling, and the ability to split the system into as many ways as may be deemed necessary. It also offers a potentially higher, total system, acoustic output.

We are currently working on a means of solving all these problems. It is complicated but it does offer enormous hope for the near future. Although the individual filter sections of a practical crossover may be minimum phase in themselves, they will not sum in a minimum phase manner. This is largely because the group delays in each section increase in proportion to the steepness of the filter slope, and in inverse proportion to the frequency. In the centre section of the passband, the group delay is more or less constant but towards the roll-off point the delay shifts.



**Fig 5: Effect of shared vertical driver axis on impulse arrival times**  
**NB: Neither system can maintain accurate impulse with vertical movement of listening position. Only dual-concentric units can maintain response in both planes.**

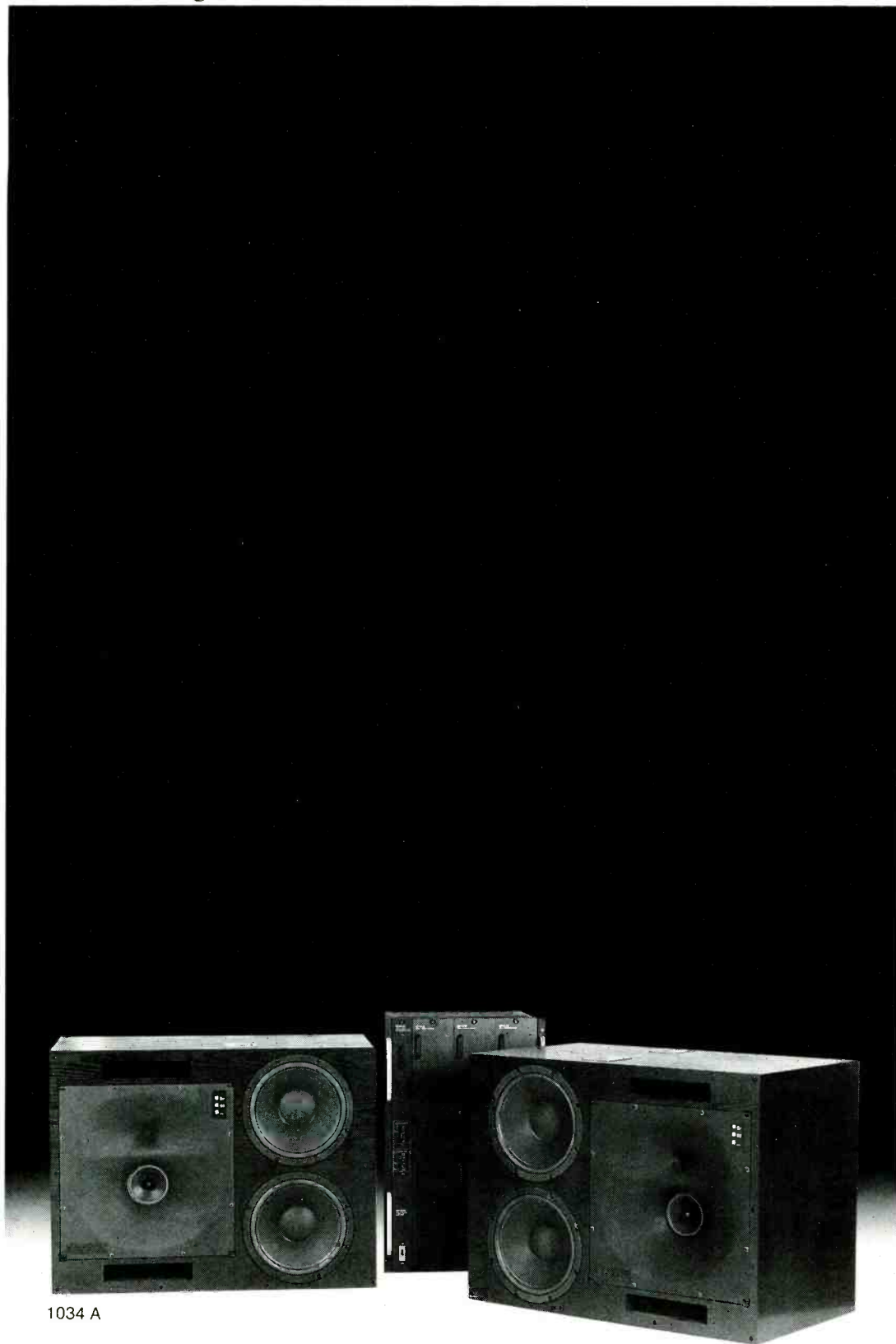
arrival times. This places a great question mark over the 'common sub-woofer' philosophy, especially where that sub-woofer is located in some out of the way place. It may sound good but I doubt that it will be accurate! Furthermore, many so-called 'linear phase' loudspeaker systems have fallen short of the mark, because the only criterion that will judge an accurate system, is the acoustic reconstitution of the impulse response at the listening position. 'Linear phase' is also a misnomer. What is actually meant is 'minimum phase'; 'linear phase' actually means a time delay. You get a 'linear phase shift' when you walk, say, a foot nearer, or further away from a sound source.

Systems that use discrete, physically non co-located drive units, can only really achieve such impulse accuracy, over a more limited directivity field; especially as the wavelengths shorten when the frequency rises. Given that head height in a room is relatively constant, the main variation in the position of a person's ears, is in the lateral plane as they move around the room. Locating the individual drivers, or pairs, around a common vertical axis will minimise these problems,

Any attempt to use say, a digital delay line, to bring the sections into line, will succeed in a general manner, certainly improving things, but will not compensate for the changing delays towards the crossover points. Corrections to this cannot be made by conventional means, as where a 'phase lead' was incurred, correction would need to be applied before the signal appeared. As no effect can be experienced before its cause, this is clearly out of the question by all conventional means. The answer lies in 'Acausal Adaptive Digital Signal Processing and Impulse Reconstitution', using a system of 'Multiple Point, Least Mean Squares, Spectral, Phase, and Transient Equalisation'. It does offer the prospect of a reasonably large area in the room with near-perfect audio reproduction.

Yes, I am serious but, unfortunately, we really cannot go into the details here. Last month, in my opening sentence, I referred to the studio owner who did not previously think that crossovers were very significant to the sound of a monitor system. I do not feel that he was alone, if you thought the same way, then think again—very hard!□

*p r o f e s s i o n a l i s m*



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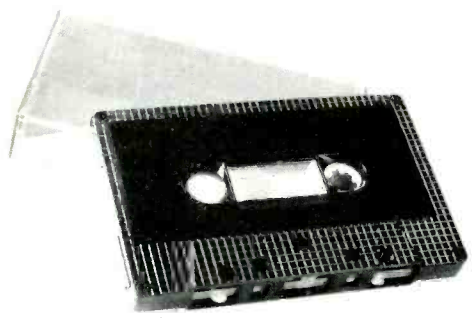
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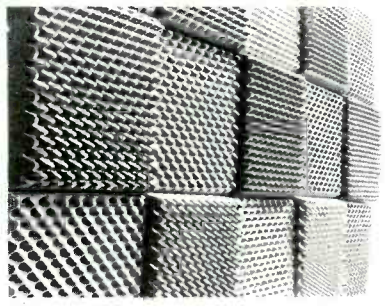
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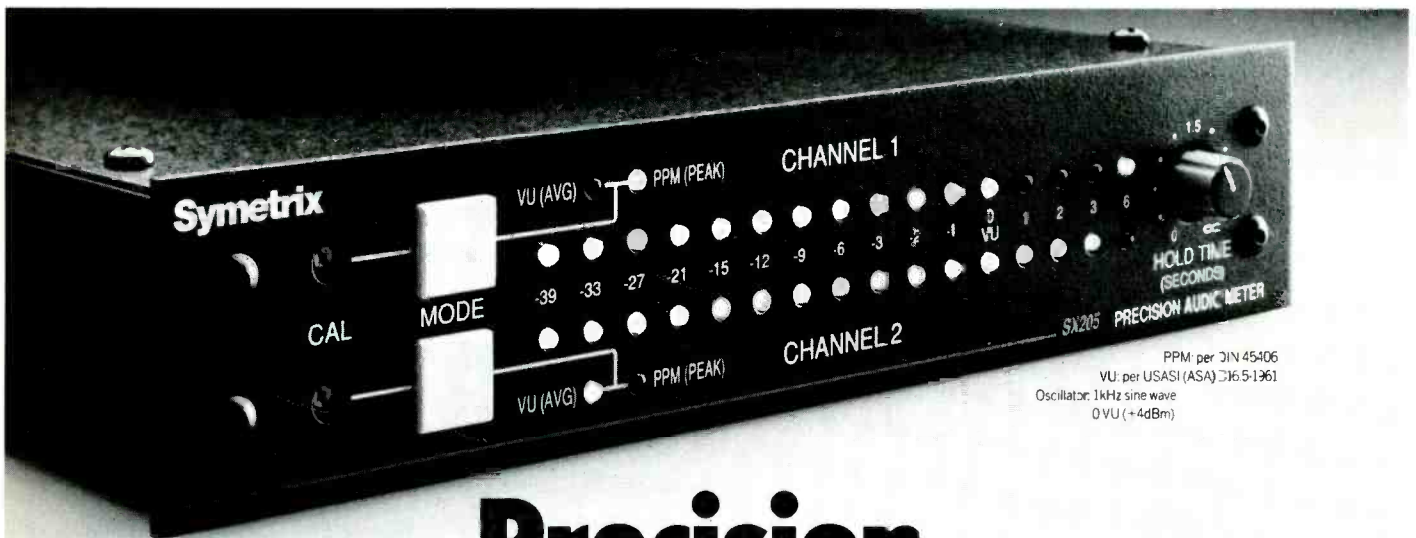
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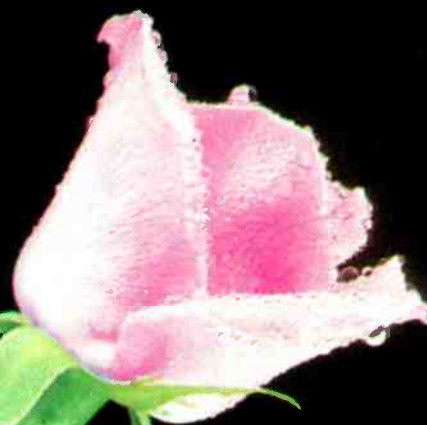
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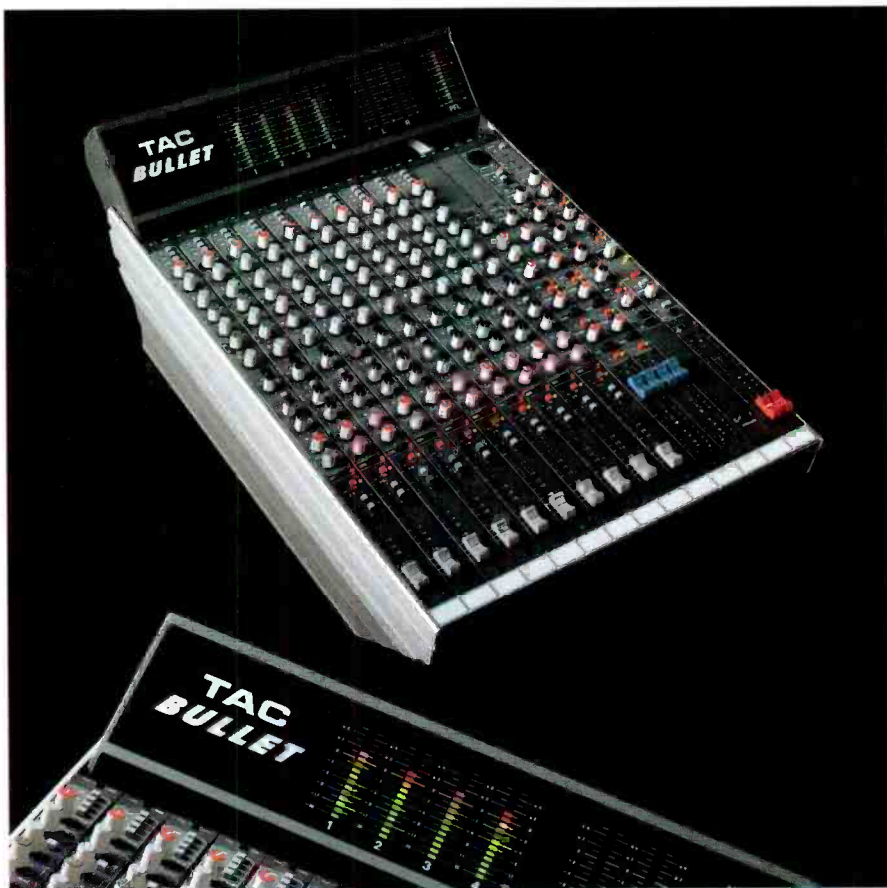
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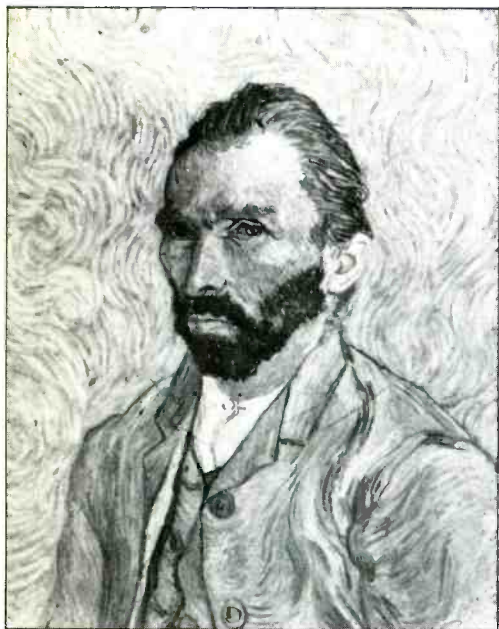
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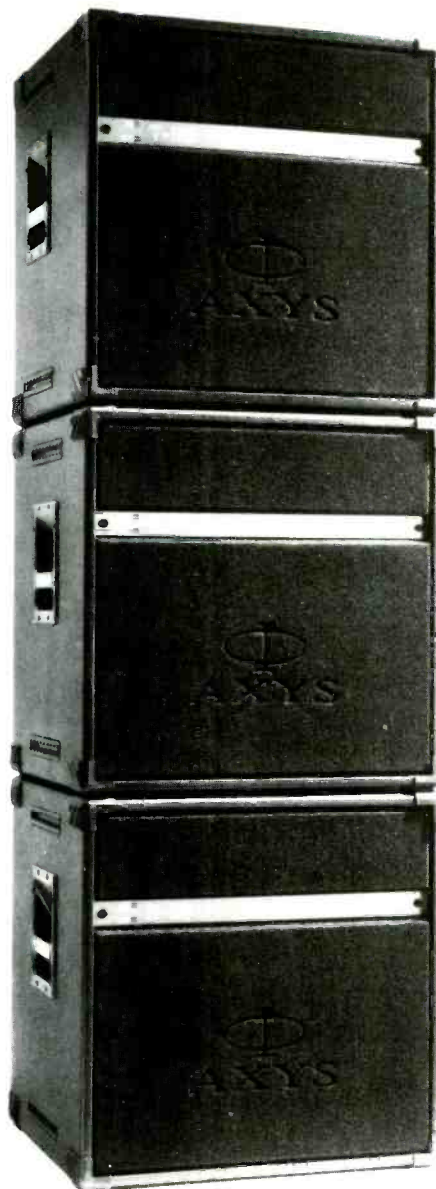
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Anyone in the studio business can expect a lot of long-haul flying. It should be a nice escape to sit back with some duty-free drinks and enjoy the inflight entertainment.

More often than not, the technical standard of the sound and vision system is so poor that passengers listen to their own portable stereos and sleep through the film. The airlines, regard inflight as a 'go' system. To upgrade it costs hundreds of thousands of dollars in lost flying time, plus the cost of the new hardware.

For this reason TWA still inflict those awful acoustic stethoscope headsets on even First Class passengers. Mercifully most airlines have now gone over to electromagnetic headsets, often made by German company Sennheiser—with non-standard plugs to discourage people from stealing them. Competing firms are offering Taiwanese electromagnetic headsets for a dollar a time.

The World Airline Entertainment Association (WAEA) was formed in 1979, has its own quarterly newsletter (Avion) and meets every year to discuss new developments. This year's conference was held in Basel, Switzerland.

There is a clear trend of confusion over where the airline entertainment industry should go next. Everyone agrees it is time for a change. The airlines all want higher quality and longer playing times from both sound and vision carriers. No-one can agree on how to achieve this.

Movie projection used to be from Super 8 film, now it's from video, usually Beta format. Sony bought Trans Com of California from Sundstrand. Trans Com is now moving over to the use of Hi 8, the high band, high quality variant Video 8.

Some airlines are now installing small individual LCD colour screens on seat backs or arms, often with individual Video 8 players. Virgin loan each First Class passenger a portable video 'Walkman', Video 8 playback unit. A steward brings a choice of tapes. Passengers squabble and try to jump the queue by taking them directly from their neighbours.

Be warned. Avicom, a division of Lockheed, has developed a system that turns an aircraft into a mail order shopping mall. Each seat-back LCD TV screen is touch sensitive and displays a choice of pay entertainment channels, and a menu of goods for sale with ads extolling their virtues.

To pay, the passenger slides a credit card through a slot above the screen. This sends a signal to an onboard computer, which collates all sales data and transmits the shopping list to a ground centre that mails purchases to passengers' homes. This 'ground fulfilment' is going to be the airlines' way of making money after duty free sales in Europe end in 1992.

The first sound systems used a clumsy endless loop cartridge developed by Trans Com—rather like a bulky metal version of a jingle cart. These loops of tape ran for an hour, with four audio tracks. The cartridges cost around \$500 each, had to be sent back to Trans Com for re-recording and needed internal lubrication. The lubrication used to shed, clogging the heads and trimming treble response. When it failed, the tape jammed.

Then there was a system that used a cartridge with 1 inch tape that shuttled backwards and forwards past a playback head. The head read 16 tracks and the tape held 32 tracks; the head

## Barry Fox

### The state of entertainment on planes and trains

switched sideways at the end of each shuttle, rather like an auto-reverse cassette recorder, to give 16 tracks at any one time. These could be allocated to eight stereo programmes, 16 mono, or a mix of both.

Around 5 years ago Matsushita's Avionics division introduced a new system, which uses standard Philips cassettes, albeit with a slightly modified track format. This has four equal sized tracks running in the same direction, with dbx noise reduction.

The playback unit has six drives, arranged in back-to-back pairs. Three of these drives play a total of 12 channels, while the three other drives rewind their tapes. Tones at 30 Hz control switching, with phase comparison tricks to avoid the music misleading the machine.

With C-120 cassettes, the system can provide a choice of 12 2-hour audio channels, either 12 mono programmes, six stereo or a mix of both.

Japan Airlines have just installed DAT players to provide audio entertainment. The installation is a test to see how DAT tapes and deck mechanisms stand up to the vibration, heat and humidity of an aircraft that is flying around the clock, around the world. Even Matsushita, who installed the systems, do not think DAT is sufficiently robust to be a standard IFE tool.

Matsushita is also doubtful whether CD will become a standard tool. The airlines do not want to use commercially pressed discs. They need to provide passengers with custom programmes and it is not cost effective to master and press the small quantities of CDs that would be needed. So recordable CD becomes essential. Sony already provides inflight CD players and recently struck a deal with Japanese chemical company Taiyo Yuden, to develop Taiyo's recordable CD system for industrial use.

CD is still limited on playing time to around an hour of stereo. For IFE use, the system will have to be modified, perhaps by adoption of the CD Interactive standard, to provide four or even eight audio channels of reduced quality, interleaved to provide passengers with a choice of mono or stereo programmes each running for a full hour. Nimbus has shown the way here, by making 8 hour mono background music discs for Rediffusion, using the CDI Level B standard. This uses 4 bit ADPCM (adaptive delta) sampled at 37.8 kHz to give an audio bandwidth of 18 kHz and S/N ratio of 60 dB—FM radio quality and quite good enough for a noisy aircraft cabin. The Nimbus breakthrough was making the number-crunching circuits needed to convert 16 bit PCM recordings into Level B ADPCM in realtime.

The challenge to DAT and CD comes from systems that build on the old Sony FI system of recording digital audio on video tape, in this case either VHS or 8 mm, rather than Beta. Hughes,

Matsushita, Avicom (owned by Lockheed), Sony and others in the game are all developing tape-based systems, which interleave several stereo or mono pairs of digital recordings on a video tape deck with bolt-on digital processor. The system has the obvious advantage of using the same basic hardware as video entertainment systems.

Meanwhile Matsushita has developed a solid state recorder, without any moving parts, that gives instant access to 256 'fasten your belt' messages and up to 2 hours of that horrid 'soothing' music airlines think we need when the plane is taking off or landing. The Matsushita SSSV (Solid State Stored Voice) system points the way to likely developments in jingle storage.

A unit that looks like a large domestic toaster has two circuit boards, each carrying 60, 1 Mbit EPROM chips. EPROM memory stores digital code even when disconnected from a power supply. Stored data can only be erased, and the chip re-used, if the chip is exposed to powerful ultraviolet light. So messages once stored are secure.

Normally even telephone quality speech requires 64 kbit of storage space for every second of sound. Matsushita engineers are cagey about the coding tricks used to squeeze 2 hours of sound into the 120 Mbit memory store. The original sound is chopped up or 'sampled' at 8 kHz and converted into a telephone quality 64 kbit/s stream of 8 bit words. Each word is then compared with those coming before and after. The system encodes only the changes of sound sampled, not an accurate full description of each sample. This technique reduces the digital data rate by a factor of four, to 16 kbit/s.

Despite the low data rate, the quality of sound is remarkably good and is virtually indistinguishable from tape announcements. Japan Airlines is already installing the equipment and if passengers notice the difference it will be because there is none of the wow and flutter that makes taped take-off music normally sound so bad.

I travelled recently on one of the new high speed 'bullet' trains in Japan, complete with aircraft seats, a smartly dressed 'stewardess' handing out hot towels, onboard telephones and everything spotlessly clean. British Rail will never get there.

But there is one idea on the new bullets even BR could learn from.

Each seat has a small switch and socket in the arm rest. The socket takes the plug for a pair of stereo headphones. The switch selects between nine channels of audio entertainment.

Passengers can either plug their own personal stereo headphones into the standard size socket or borrow or hire a pair of headphones from staff employed to sell refreshments on the train.

The clever part is that the rail company has not had to go to the expense of installing tape playing equipment of the type used by airlines. Neither is there any need to provide continually updated entertainment tapes. The train has a radio aerial on the roof that picks up all the FM stereo stations in whatever region it is passing through. These stations are then tuned in by a central receiver, amplified and fed to the armrest sockets. So passengers get the chance to hear music of their choice, or news, live, off-air as they travel. □

The pale green car had been parked at the corner since before lunchtime. The two men sitting in the car had the look of LAPD detectives. Metro squad. Their car looked tired, their clothes were tired and brother, did they ever feel tired. You'd look tired too if all you did was sit in a car watching people through a rear view mirror. A cop's life is a lot more dull than TV would have us believe. John Egan had put in 19 years of sitting in cars and watching people and had become very old, very quickly. He had fired his gun in anger three times in those 19 years but he hadn't killed anybody. Probably never would. Busted a few heads, though.

The gun was part of the problem: nothing to do with LAPD was terribly classy. Effective? yes—Classy?—no way, José. The gun was a blued Smith and Wesson .38 calibre revolver. The standard issue weapon. Yes, sure the department was switching over to 9 mm autos like the army but John didn't trust an auto. What did you do if it got wet or all those teeny-weeny parts jammed. He at least felt he could trust his 'wheel' gun. But boy, wouldn't a shiny new stainless steel Smith model 66 wheel gun chambered in .357 magnum K frame with Pachmyer rubber grips be sweet. He wished he had the \$500 to buy a new gun.

Thinking about a new gun reminded him of dinner. Bought on the run. Again. Yet another trip to the Fatburger on Ventura Boulevard for a double order of chilli fries with grated cheddar cheese. Gawd, how he loved that thick beefy spicy chilli covered with melted cheese on top of french fried potatoes. Burp. It was running down his tie. My God, he thought, it's time I bought a can of that stuff you spray on your tie to prevent food from staining. \$3.50 to clean a tie. Lousy Mexican dry cleaner. Here I am, a cop for almost 20 years and I drive a beat up old Ford pickup truck and my dry cleaner drives a BMW. My god, a 'beemer' like all the 'yuppies'. That's it, my dry cleaner is a Mexican 'yuppie'. Probably eats duck breast tacos and drinks Perrier water instead of Dos Equis. More's the pity.

Just then, a brown Chrysler minivan pulled into the driveway at 1212 Sattoy Street. He could see the six people climb out in the side view mirror. Five guys with one chick. All looked like a bunch of hippies but it's hard to see in the mirror. He jabbed his dozing partner in the ribs and woke him from his reverie. He faced his partner. "They're here, you 'bleeping' pig. I told you not to order a triple Fatburger with chilli, egg, cheese, sautéed onions and tomatoes. You ate enough food to sink a battleship. And, as always, you dozed off."

His partner glared indignantly at him and then reached for the radio. "2014. 2014."

The radio blared back so loudly, "This is control," that John dived for the volume button.

"This is 2014. Roll the SWAT truck."

John turned to his partner. "How long do you guess?"

His partner showed 10 fingers to signify 10 minutes.

The SWAT truck parked around the corner and the officers came out on the double. Paramilitarily

## Martin Polon

### The case of HARP and the home studio. Comment from our US columnist

uniformed in flat black, wearing turned around baseball caps, they were a fearsome entourage if ever there was one. Two men were snipers and carried match aligned M14s, now known as M1As. "Those big 308 Winchester rounds would do a lot of damage," though John. The rest carried either stock LAPD issue pump shotguns with seven rounds of double ought buckshot in the chamber, or else the M16-2 that had been upgraded initially for the Marines. John didn't care much for the M16. It had jammed on him in 'Nam and he was not in love with that gun. "Give me an Israeli Galil assault rifle every time," he thought.

The team quickly assumed appropriate positions around the house. It was just another non-descript San Fernando valley home. Built around 1946 to house the cascade of employees flooding the LA aircraft plants. "The California dream," John thought. Just a simple remodelled ranch-style abode. With a complete 24-track recording studio in the garage. That's why their cars were always parked out front. A dead giveaway. And that was a no-no in LA because the zoning people didn't like the violation. Two of the SWAT team members jumped from the SWAT truck with a large battering ram and ran for the front door of the house. Black and white squad cars blocked off the entrances to the block.

"It's showtime," thought John.

The team moved with a flawlessness that made John think of opera. Why opera he couldn't say—it should have been ballet. Never mind, they hit that house like a ton of bricks. OPG (Official Police Garage) tow trucks pulled away the van and the four other cars parked in the driveway. The battering ram crew hit the front door. In went the assault unit. Out came the artists recording and the studio staff. "Another victory for the zoning boys," he thought. He started to salivate, thinking about a large double order of chilli fries with cheese and a fried egg on top.

Well, guys and girls of the recording world, is it really 'showtime?' The above fictional enactment of a police raid in Los Angeles is relatively accurate but hopefully things there in LaLa land have not progressed to the point of armed confrontations. Unfortunately, it has come very close to that. Some of the regular studios in the LA area have taken to asking the city and/or country to enforce zoning regulations against so-called home studios that are actively engaged in soliciting recording work in residential neighbourhoods. The question that has not been asked or answered yet is "Will this internecine warfare spread to other cities and climes and is

there any room for compromise available?"

One of the phenomena of the '80s that is sure to become an issue of the '90s is the home studio. So entrenched has the home studio become that no less august a publication than *New Yorker* has featured a home studio/production facility as part of its recent 'weekend work' feature. The home studio as New York chic. Where does this all go? Perhaps a scent for men. A fragrance called Reels or perhaps Après Audio with the strong smell of burning recorder brakes and shredding plastic tape. Fashion aside, the home studio is a growth phenomenon that shows little sign of abating in the near future.

A Los Angeles professional studio owner had this to say about the 'home' recording scene: "Let's face the facts. The idea of the home studio was inevitable. The Japanese wanted into the pro-studio business. They studied it and studied it and could not find a way to profit in their usual style with the top ticket items. So they reverse engineered the top ticket items and produced comparable units at 20% of the cost with some trade-offs. But not so many as you might think for the price. This was coupled with the development of the dedicated computerised synthesiser and the MIDI explosion among all the instruments and you have the environment for the revolution. Couple that with the recent interest in the glamour of recording and you have a whole batch of home 'vanity' studios. Take the popularity of electronic musical instruments and synthesisers, add a record album production budget, shake well but do not stir and you have the recipe for every group in creation owning their own dedicated home studio. Why rehearse in someone else's space when you can create your own with the rehearsal budget you get from the record company."

"*Au contraire*," responds a London home studio operator. "Why always pick on us. The home studio has allowed the musician and composer the creative access to have music played and recorded in studio with virtually unlimited musical 'voices'. No need for the unbearable expense of a union call with 23 musicians. I can do it all in my facility. Only the very wealthy could afford that before; now it has become the province of everyone. As long as I use MIDI, the quality is so close to the big studio that I don't need the big studio. And now I can get affordable digital mixers, equalisers, reverb units, 2-track DAT machines and 12-track digital multitrackers. So what do I need someone else for, at least until the end of the project."

To understand the specific problem it is first necessary to understand Los Angeles and the so-called home recording scene. Los Angeles is by definition (of at the least the *New Yorker* magazine) the home of periodic sieges of what some pundits refer to as 'shake and bake.' That is to say that the metropolitan area, comprised so heavily of young mountains and low desert is regularly subjected to fire and mud slides/rock slides. All that plus the occasional Richter 7-plus killer earthquake and the more numerous Richter 5-plus mangle earthquakes. What that means is that all structures are considered somewhat impermanent and that remodelling and/or new

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construction is a wave of if not a way of life. The net result is that the building of a home studio is just one more aspect of the remodelling scene that dominates LA housing.

The city's (LA is a collective of cities after all) inspection units are weak, understaffed and not above accepting the odd gratuity. There are so many people working in the electronic entertainment industry in LA that the addition of the home studio has become like the addition of a swimming pool—a 'must have'. It is fascinating to note that LA area real estate agents have added some studio abbreviations to their own colourful shorthand. It is not out of order to see a housing ad in the Sunday *LA Times*, or more chi chi in the *Daily Variety*, with the notation '24 Tk Hm Std' or 'Dig Post Rm' next to the nomenclature for an indoor/outdoor swimming pool or a redwood hot tub with jacuzzi.

Neighbouring residents as a rule do not interfere with the lifestyles or remodelling plans of those they abut. So there is rarely a case of neighbours turning in other neighbours for zoning violations. People in Los Angeles tend to live somewhat isolated lifestyles and at the same time tolerate behaviour that would be viewed as aberrant in other climes. Not to mention that the number of registered and illicit owners of automatic weaponry in the late great State of California is estimated to be about equal to the rest of the United States according to some Federal officials. So your neighbour may be keeping children in cages, hiding illegal aliens, manufacturing PCP or distributing cocaine. Would you intrude? Certainly not for something as sublime by comparison as a home studio!

This writer's life was unmeasurably enriched some years ago by living across the street from the Osmond family complex on Manning Avenue in West Los Angeles, near the quintessential yupdom (as in yuppie; to yup) Westwood Village. Despite years of working with youth in my academic visage at UCLA, I never ceased to be swayed by the sound of 55 teenage girls perched in our shrubbery sighing "OOhhhhhh Donnnee" at 3.30 in the morning. The Osmond's had bought a sturdy three-storey LA neo-gothic-greek-romanesque apartment building and converted it into family living quarters and a recording studio facility to serve the pubescent Donnie and his beautiful singing sister Marie. Ten years ago, their 'home' studio had the same professional consoles, tape machines, peripherals and monitors found in the major studios on Sunset Boulevard. The term 'home' really meant more the location. Eventually, the neighbours' complaints seemed to be one of the issues that caused the family to return to Utah. I always felt it was the surfeit of overweight, acne-riddled screaming teenage females waiting for a glimpse of Donny, who were the culprits rather than the studio. Despite the fact that my bedroom window was no more than 15 ft from one of the studio walls, I never heard a thing.

At any rate, having digressed somewhat, let us return to the issues raised by HARP. What has happened is that a group of regular studio owners in LA, according to some non-members, have

banded together to take advantage of the various and sundry municipal and regional zoning and home use ordinances in order to reduce what they see as unfair competition. The group uses the acronym HARP, to stand for Hollywood Association of Recording Professionals. Ostensibly, according to HARP members, the group exists to deal with unfair competition from illegally zoned studios, to fight the 'hot-pin-two/hot-pin-three' battle of the Peloponnesian wars yet again with manufacturers, to do some group buying, to obtain medical insurance coverage, to communicate stolen equipment lists, to create staff training programmes and to exchange relevant business information.

Those who have been closed down by the pertinent zoning enforcement agencies are crying foul. They are hiring attorneys and public relations gurus to turn the coin over and point the finger at the large studios operating in commercially zoned areas. They accuse the large studios of being big and greedy. The large studios in turn insist that they are not focusing on practising musicians who use their home studios for 'creative purposes'. Instead they say, the focus has been on home facilities that are actively soliciting sessions and charging money for that studio time.

Legally, the whole thing takes on an unclear and perhaps fuzzy glow. According to a local professor familiar with the issues, the zoning violations on one hand are matched by a possible constraint of trade on another. "It's all a judgement call," he posited. "The zoning violations are real but extant in such large numbers that the authorities do not have the necessary horses in the stables to deal with it. Do you have any idea how many home studios there are in LA? I sympathise with the large studios but in practice there is danger in their position. Remember that in Los Angeles, there are more attorneys than ambulances and they all have to earn a comfortable living. The attorneys I mean."

Tax-wise, the home recordists are probably in greater jeopardy from city, county, state and national taxes than from any other source of regulation. In fact, according to a certified public accountant whose practice is limited to entertainment areas, the home studios are really in danger of audit by the IRS. "The Internal Revenue Service giveth—the IRS taketh away. The home studio guys forget that it was their tax men who showed them how to shield excessive income in the building of a home studio and to continue to operate the facility at an attractive level of loss. Once you start to get aggressive and turn a profit, you throw out the window all the tax saving at the time and possibly invalidate some of the computations used to assemble the studio in the first place. Worse still, a lot of these nincompoop home studio owners are pocketing the hourly fee in cash. Some even give a discount to encourage cash payments. Not smart at all."

In addition, for an example of local taxes, Los Angeles County collects a property tax from home owners. The home studio frequently adds \$100,000 or more to the price tag of a home. That can translate into hundreds, perhaps thousands of dollars more tax payments each year. So many home studios try to hide the existence of the

facility from the assessor.

Since the spread of home studio technology shows no sign of reversal, the two sides are going to have to reach compromise at some time. Firstly, commercial studios (and I think we have to use the definition of operation in a commercially zoned neighbourhood) face the delicate task of avoiding offending certain producers who quite literally might be working both sides of the street. Secondly, the home studios have to concede that the commercial studios paid their dues and have earned the right to provide a range of services that the home studio can only dream about. The home studio that really succeeds is going to have to expand out of a residential setting anyway. Co-operation can benefit both sides.

Anyway, it is important to keep the whole issue from reaching the flaring point. Bad blood in Los Angeles can reach some startling ends in the entertainment industry. Recent mob-like assassinations of owners of a popular chain of record stores and the kidnap-murder trial of those suspected of the dispatch of a sometimes movie and record producer peripherally involved with the making of the movie *Cotton Club*, indicate how far West Coast record and movie industry hostility can go. None of this is positive. The news media smears the recording industry across the tabloid pages. Lawyers cop rich fees. Better the recording industry in LA and elsewhere works together through organisations like SPARS and APRS to legitimise the home studios. Those home studio owners who really want to expand and solicit outside business should be able to get help in receiving bank loans to expand into true commercial quarters. Competing unfairly from the economic protection of residential quarters is not really competing at all and that is probably the point HARP is emphasising.

If there is a conclusion here, it is that the home recording studios are getting off the expense hook virtually scot free. The home studios are not paying for land, a roof over their heads, business insurance for the facility/equipment/employees/liability, business rates for utility hookups and telephone services, taxes on business functions, etc. They are also reaping the home office deduction on their national and state income taxes, plus deductions over a short term for the purchase of new equipment. A commercial venture is able to amortise equipment only over a much longer time frame. The list goes on and on. The bottom line is that the home studio should be an adjunct to one's professional life rather than a professional way of life itself. There is no question that the home studio revolution has hurt the major studios. Some analysts feel that the number of professional studios has dropped by half in the last 10 years with the home studios filling the gap. But it is important to remember that part of the home studio revolution has been the acceptance of electronic and/or synthesised music and instruments. Only a commercial studio can provide the kind of large spaces and engineered acoustics necessary to do justice to vocals and acoustic instruments. The current swing back in that direction may end the controversy before it really gets started. □

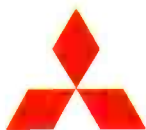


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# Technics SV-260

## A technical report by Sam Wise on Technics SV-260 portable DAT player

The Technics SV-260 comes as standard in a black leather-look cover—similar in appearance to a clergyman's Bible, though it weighs a bit more—and has a well-built feel to it. The carrying strap latches reliably onto metal studs at the sides of the recorder. The strap is just long enough to reach across the average shoulder for secure carriage. Anyone larger will need to obtain a longer one. The strap's shoulder pad combined with the small size of the recorder makes it extremely comfortable to carry.

With the cover closed, the battery compartment and digital output are accessible at the rear. The mic/line switchable XLR input sockets, gold-plated phono line out sockets, pad limit switch and DC input socket appear at an aperture on the right side.

The case cover is retained by four stud fasteners and is removed easily. There is no convenient way to store the cover, so the first time you need it in case of rain it will either have been left in the car, or be lost. Other than that, the cover is well designed, including high density foam in its front edge, providing ample protection to the otherwise vulnerable RECORD LEVEL and PHONES LEVEL controls. The front panel pushbuttons are sensibly designed, having lips at their sides to prevent accidental operation.

A quick look inside reveals a transport mechanism more akin to a camera than a piece of professional audio equipment, consisting of a collection of highly miniaturised mouldings, stampings and springs. To save space the head drum diameter has been reduced from the DAT standard 30 mm (1 1/8 inch) with 90° wrap down to 15 mm (5/8 inch) with a 180° wrap. This will, in theory, place additional stress on the tape and therefore increase the likelihood of digital drop-

outs. The tape seems at this point to be the weak link in the DAT system anyway but a mini machine like this is not likely to be used for multiple replays (unless it is used as a superior personal stereo).

Removing the remainder of the carrying case reveals no further controls or connectors, but does show up broad shock-absorbing rubber feet that cover most of the bottom and rear surfaces. This

Japanese manufacturers, an excellent service manual is available. Using this as a guide, the machine was dismantled to the level necessary for routine repairs. The process is easy and took only about 10 min. The first machine we were sent for review had a fault in one microphone input. Disassembling the input section of the machine is not so easy, things seem to have changed a bit since the manual was written. Technics were themselves unable to effect a quick repair, so a new unit was supplied, which was 100%.

## Basic operation

The important operational controls are on the accessible edge when the machine is strapped to the shoulder, though a bit fiddly to operate on the bench due to its small size. Operation is largely self-explanatory. Most of the pushbuttons contain



is typical of the good design detail evident on this machine.

Just like analogue machines, digital recorders will need routine servicing—principally to replace heads and clean/replace the pinchwheel assemblies. JVC, for example, recommend that the head cylinder is replaced after 1,000 hours, equating to a year's use for a reporter's machine so ease of servicing is important. As with other

built in LED function indicators. Pressing RECORD by itself puts the machine into RECORD PAUSE mode. Punching PLAY from this mode enters RECORD in about 1 sec—quick-start for a DAT machine. Pressing FF or REW from PLAY produces a slow wind without any monitoring. From STOP these controls fast wind at about half the rate of larger DAT machines, completely rewinding a 120 min tape in 2 min. Pressing REW a second time speeds things up to normal DAT standards, rewinding in 1 min.

The ON/OFF switch is a 'soft' switch, enabling the machine to switch itself into standby after 10 min, then off automatically after 30 min of disuse. This also happens if the machine is left in PAUSE mode overlong.

Aside from the main transport controls, the front edge contains a custom liquid crystal display, counter reset button, REC LEVEL dual concentric controls and a 6.35 mm gold-plated headphone jack with level control.

Subsidiary transport function controls are located near the front edge on the top of the machine. The LIGHT switch activates backlighting on the LCD, permanently when mains powered and for 20 sec when battery powered. Programme

## Manufacturer's specification

### Sampling frequencies

**Recording:** fixed at 48 kHz

**Playback:** 44.1 kHz or 48 kHz, automatically switched

### Audio

**Frequency response:** 10 Hz to 22 kHz, +0.5/-1.5 dB

**Dynamic range:** >87 dB

**Signal to noise ratio:** >88 dB

**THD+N:** <0.05%, input +4 dBm, output -14 dB

**Wow and flutter:** unmeasurable

### Input/output

**Line in:** +4 dB attenuator on. -10 dB attenuator off. Impedance >10 kΩ, balanced, transformerless

**Mic in:** -60 dB attenuator on. -74 dB attenuator off. Impedance >10 kΩ, balanced, transformerless

**Line output:** -14 dB. Impedance 1.2 kΩ, unbalanced

**Headphone output:** 20 mW, 16 Ω load

**Digital output:** coaxial 75 Ω

### General

**Power supply:** switchable 110 to 120/220 to 240 V, 50/60 Hz, 20 W

**Battery operation:** approximately 2.2 hr.

Recharge time 8 hr

**Size:** 228×44×137 mm/9×1 3/4×5 1/2 inches (whd)

**Weight:** 1.45 kg/3 lb 2 oz (approx) with battery

**Editor's Note:** The Technics SV-260 is a machine we believe to be between Panasonic's US models SV-250 and SV-255 in specification.

numbers can be added automatically during recording by the use of the AUTO PNO pushbutton. This is used to trigger a new programme number whenever the signal falls below the selected threshold of -40 dB or -60 dB for longer than about 1 sec. According to the operating manual, programme numbers must be entered manually when using a microphone, presumably because the recorded level is unlikely to drop low enough for automatic detection. Programme numbers are entered manually during recording each time the machine is switched from stop or pause to record by pressing the PLAY button. Reporters keeping a notebook can later use the machine's programme numbers to create a random programme playback sequence for quick transfer of material in the required order to an editing machine. The machine also has a useful set of skip functions allowing the rapid location of specific portions of recorded material, as well as END SEARCH, which takes the tape right up to the end of the recorded material. The cassette loading tray and EJECT button are also on the top of the machine.

The LCD display contains a stereo meter roughly calibrated in dB below 100% modulation. It has a fast attack and slow decay characteristic. This serves as a useful guide but the ballistics are to no known standard. Overload level is indicated but not clearly, a pair of bright red LEDs would be better. The remaining information displayed on the LCD is the current index number, the next programmed index number, a tape counter (not in realtime), battery condition indicator and mode indication for auto programme numbering.

The mains power adaptor is completely separate, plugging into a special socket on the side of the machine. Unlike the Sony TCD-D10, the batteries remain in the machine and are automatically recharged when the mains adaptor is active. Spare batteries can be installed in about 10 sec if required.

The digital output socket is a 3.5 mm jack rather than the more standard gold-plated phono but an adapter lead is supplied with the machine. The digital port was not tested due to the lack of a suitable facility on the test equipment. There is no digital input facility.

My usual endurance test for portables—which consists of slinging the machine over my shoulder and running around my 1 acre garden until exhausted while speaking into it—brought no problems. It was as if sitting on the bench. Once again the size, shape and weight of the unit brought forth less than the usual cries of pain.

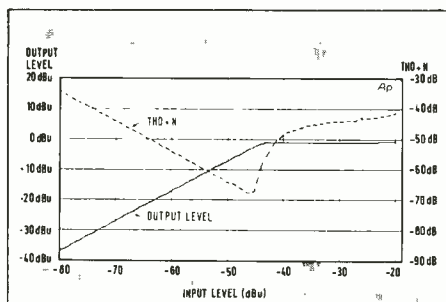
## Input performance

Microphone and line inputs share the same XLR input connectors and are selected by a MIC/LINE switch. In addition, there is a three-position OFF/PAD/MIC/LIM switch. The PAD position has a nominal 14 dB of attenuation, which measurements showed was very close at 14.1 dB.

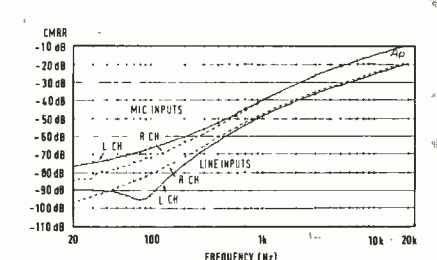
Though the machine has a peculiar mix of professional and domestic operating specifications, it was tested at professional levels where possible

since most *Studio Sound* readers will be using it that way.

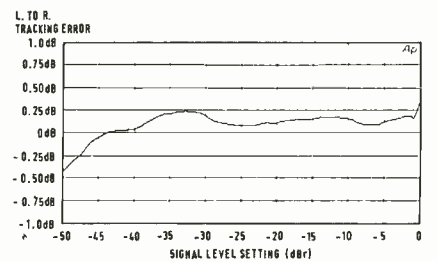
With the REC LEVEL control at maximum and PAD OFF, a line input level of +5.25 dBu trips the overload indicator. The corresponding microphone input level is -53.4 dBu. These represent the maximum sensitivity of the unit for full output.



**FIG 1: Demonstration of microphone limiter action**  
**Note the hard limiting that occurs just below an output level of 0 dBu**  
**Note also the intrinsic distortion of the limiter down to a level where noise predominates. For input levels below the knee, the THD+N figure gives the S/N ratio**



**FIG 2: Input common mode rejection ratio**  
**Input level is -2 dBu**



**FIG 3: Interchannel pot tracking error**

In line mode, there is only about 1 dB between the overload trigger and the 1% distortion level, while in mic mode, the margin is nearly 4 dB. With PAD OFF it is possible to overload the front end of the unit, but once PAD is in, reduction of the REC LEVEL control enables the SV-260 to cope with input levels of over +30 dB in line mode, and nearly 0 dBu in mic mode.

As shown in Fig 1, the limiter has a good hard knee preventing overload. Its distortion (THD+N)

performance of about 0.7% when limiting is not impressive but a lot better than the 10% to 75% that would occur at high levels without it. Tracking of the limiters between left and right channels is excellent within about ±0.1 dB. The limiter attack time is about 3 ms and release is about 15 ms. This makes it a bit slow on the attack for a peak limiter but it will still minimise audible overloads.

Turning up the headphones level control produces distortion in the headphone amplifier, which is reflected into the main outputs at a noticeable level, this with 50 Ω headphones connected. The manufacturer specifies operation into 16 Ω headphones but be careful if they are being driven hard.

Fig 2 shows the common mode rejection ratio of the mic and line inputs. Performance is quite good at low frequencies but decreases with frequency to a poor 10 dB at 20 kHz on the mic input. When using this machine, stay away from sources of high frequency interference.

The stereo REC LEVEL control has excellent tracking as shown in Fig 3. Certainly this stereo level control has the best matching we have seen in a long time.

Input impedance measures 18.2 kΩ on the line inputs—an acceptable performance—and 23.3 kΩ on mic inputs, much higher than normal.

Maximum microphone gain is 55.1 dB, which is a bit low but should be adequate for most uses. The mic inputs were found to be very sensitive to radiated noise from a nearby monochrome computer monitor, verifying the poor measured CMRR at higher frequencies.

The line inputs have a maximum gain of 0 dB. This is suitable for direct line transfer between professional machines but not for transfer from domestic sources if the ultimate output will be fed to professional machines. It seems as if Technics intend the mic input to be used with the PAD IN when additional line gain is required. The microphone input impedance, being higher than normal, makes it suitable for use as a line input.

## Outputs

Using a digitally generated test tape, performance of the replay chain and D/A converters was checked. Replay of digitally generated 100% modulation gives a maximum output level of +4.6 dBu into a 100 kΩ load, not really a professional output level but high enough for transfer to a professional machine for editing. Reducing the load to 600 Ω reduces the maximum output level to -13.4 dBu—this is clearly not a professional line driving output. Use of the mains power supply does not affect performance.

Line output impedance measures approximately 1.4 kΩ, certainly far higher than is normal for professional equipment and above most domestic equipment as well. This means that even a professional line input at 10 kΩ will produce some loading effects and long cables should not be used. Of course, if transfers are done using the digital output then all the above is irrelevant.

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The headphone output is a genuine line drive stage, which will deliver 17 mW into 16 Ω. This should be adequate for both casual listeners and reporters while not necessarily removing one's eardrums. The frequency response of the headphone output with this load dropped 2 dB at 20 Hz and 1.2 dB at 20 kHz. This is certainly adequate for the purpose.

## Monitoring

In all other DAT machines tested to date, when in record mode, the input signal passes through the A/D and D/A converters on the way to the output sockets, so one is monitoring the whole recording and replay chain except for the tape. In the SV-260, the record monitor chain goes directly from the input amplifiers to the output amplifiers, bypassing the converters. This seems a disadvantage, reducing the operator's quality assurance.

This monitor chain also prevented group delay measurements using the equipment available.

## Frequency and phase response

The record to replay frequency response from both mic and line inputs is good at about ±0.2 dB over the audio band. Stereo matching is superb, with left and right curves being directly overlaid as shown in Fig 4. The replay only response is very similar.

Fig 5 shows the effect of the input anti-aliasing and output reconstruction filters. As can be seen, the response is virtually flat out to 22 kHz and then dives 85 dB by about 25 kHz. There should be no high frequency aliasing problems here.

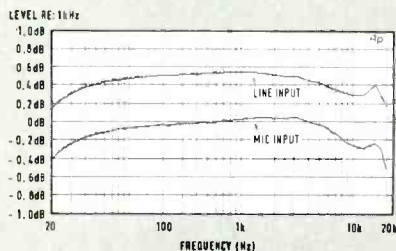
Though other areas of stereo matching are excellent, Fig 6 shows that the phase difference between left and right outputs is not so good, rising to about 38° at 20 kHz. This can be bettered on a well aligned analogue machine but they tend to drift with use, and phase varies with tape weave. On the SV-260, the phase difference is due to sharing one D/A converter on the output and will remain constant with time.

## Stereo separation

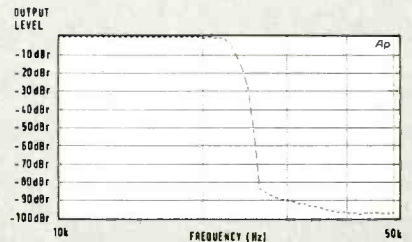
Record to replay stereo separation is good, being better than 80 dB in either direction up to 2 kHz. The replay only separation is very similar, indicating that any limitations are due to the output circuitry. Details are shown in Fig 7.

## Distortion, linearity and noise

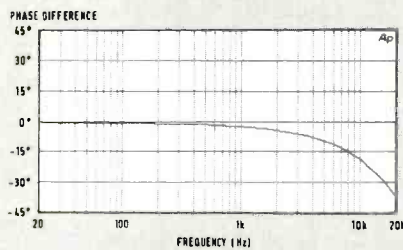
Replay-only noise measured RMS, unweighted, over a 22 to 22 kHz bandwidth is -89 dB below the 100% modulation level, much better than



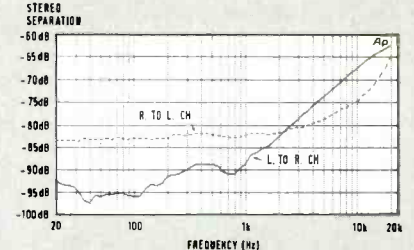
**FIG 4: Record to replay frequency response**  
Left and right channels are precisely matched: curves are offset for clarity  
Input level is 2 dB below clipping



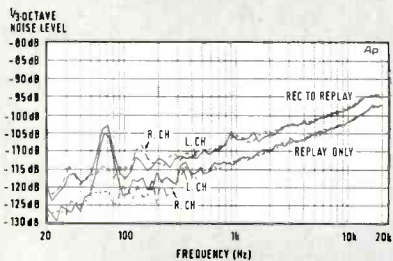
**FIG 5: Record to replay frequency response of anti-aliasing filters**  
Right channel and left channel directly overlay  
Input level is 2 dB below clipping



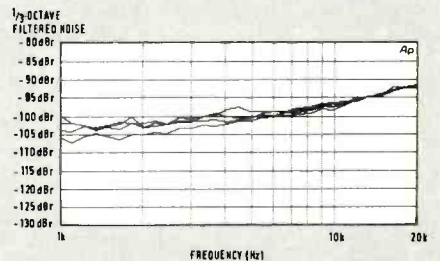
**FIG 6: Record to replay interchannel phase difference**



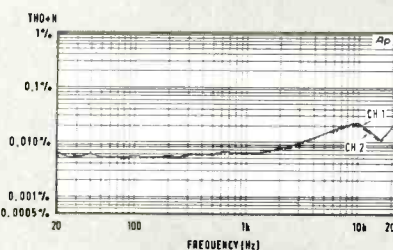
**FIG 7: Stereo separation**  
Curves show record to replay; replay only is similar  
Input level is -2 dB



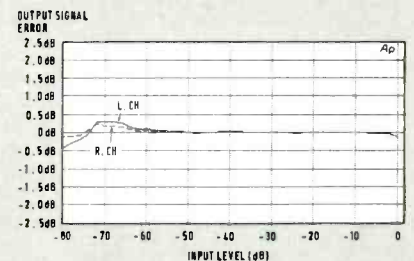
**FIG 8: 1/2-octave noise spectrum**  
Noise level ref maximum level—RMS  
Rs=50 Ω



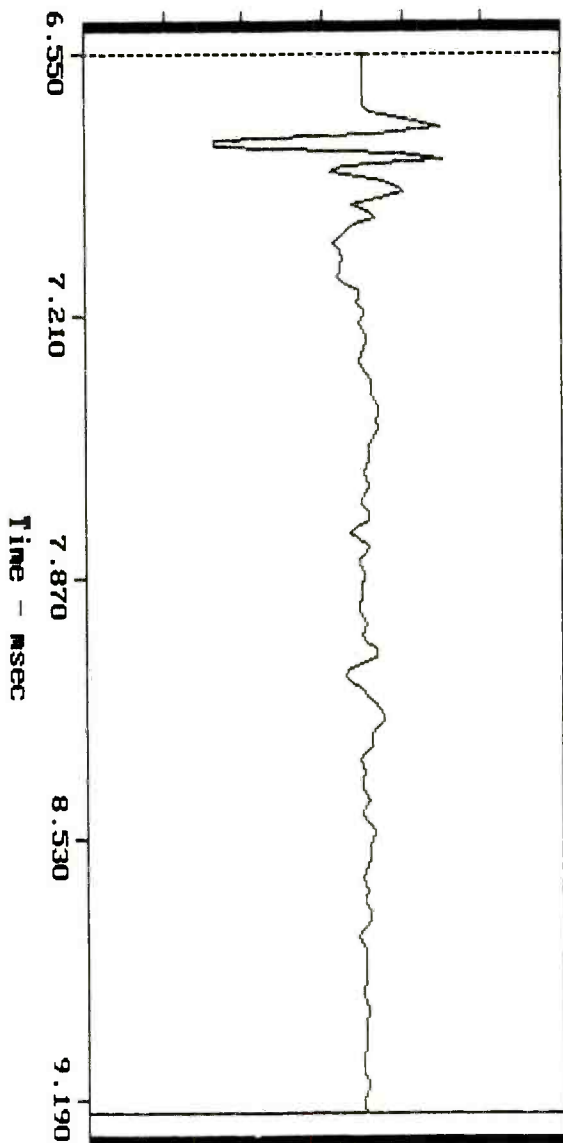
**FIG 9: Record to replay modulation noise**  
Right channel, input and noise level ref maximum input level  
Noise caused by modulation is the difference between curves



**FIG 10: Total harmonic distortion plus noise of the replay chain only—digitally generated test tape (JAS CD-1)**  
Maximum level (+4.61 dBu)



**FIG 11: Record to replay deviation from linearity**  
Distortion and level shown referred to maximum input level (1% THD+N at 1 kHz)



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analogue, of course, but 2 to 4 dB worse than other portable recorders measured to date. It does, however, meet the manufacturer's specifications. The lower curve of Fig 8 shows the replay only 1/2-octave noise spectrum of a digital zero signal with dither. Except for an inaudible noise pickup on the left channel at a frequency of 66 Hz plus its harmonics, the noise is almost perfectly white. The upper curve is the record to replay noise with the line input terminated in 50 Ω and gain set to unity. Note that the noise is degraded by about 5 dB when recording. This is due to performance limitations in the anti-aliasing and A/D converter sections. Fig 9 shows that the modulation noise is about 5 dB, this being the space between the upper and lower curves.

Table 1 gives the noise performance for the microphone inputs. This is a bit disappointing, giving an equivalent input noise of about -117 dB for a gain of 50 dB. An external mixer should better this by 8 to 10 dB. Noise is not reduced much as the gain is turned down.

The noise performance using the line inputs is also shown in Table 1. The maximum gain is unity (0 dB) on line inputs. This gain was used and the measurements are referred to a 0 dBu output level. While monitoring, the noise is virtually constant at all gain settings, with the limiter in or not. Note that for both mic and line inputs, the right channel has significantly more noise than the left.

Replay only distortion at maximum replay level is shown in Fig 10. This is a good THD+N performance, being below 0.006% up to 1 kHz, rising to 0.02% at 10 kHz. The record to replay results are similar but degraded by the increased noise. At low frequencies most of the THD+N is noise, with true distortion only appearing above about 3 kHz. SMPTE, DIM and CCIF distortion measurements give a similar result.

As shown in Fig 11, converter linearity was excellent down to a level of -60 dB referenced to 100% modulation. Below this performance is still very good, deviating from an ideal response by less than 0.5 dB.

## Summary

The Technics SV-260 has some compromises in its design, probably forced by the combined constraints of size, power consumption and price. But, after the initial problem of a noisy input amplifier, it performed consistently and well. It has bettered all others in its stereo matching, with the exception of phase difference. This is most likely the benefit and cost of using a shared D/A converter stage.

The outputs, though not meeting the usual professional driving capabilities are at least honestly fitted with phono sockets—of a very high quality I might add. For best results in a professional environment, either use the digital outputs, or use an interface box to transform the outputs to the correct level and impedance.

Given that DAT tape is reliable enough to withstand the increased stress caused by the

**TABLE 1 Broadband Noise Performance**  
dB reference 100% modulation level

		22 Hz to 22 kHz		400 Hz to 22 kHz		CCIR-468-3	CCIR-468-3
		L	RMS	L	RMS	Unwtd	Wtd
Mic input 55 dB gain	L	-68.5	-68.6	-64.3	-64.3	-58.1	-58.4
	R	-64.4	-64.3	-61.3	-61.3	-58.4	-58.4
Line input 0 dB gain	L	-89.5	-89.5	-85.5	-85.5	-79.1	-79.1
	R	-85.4	-85.4	-81.8	-81.8	-78.7	-78.7

smaller drum, the machine should prove reliable in use. It is certainly well made.

As an acoustic data recorder it is definitely good enough and the right size, shape and price. As a reporter's machine, or for recording wild effects, it

is certainly up to scratch. If the ultimate in performance and professional compatibility are your priorities, or you need timecode, then there are better machines but at a cost which includes luggability. □



### ProBox 1™

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

### ProBox 2™

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

### ProBox 3™

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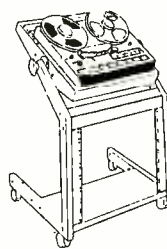
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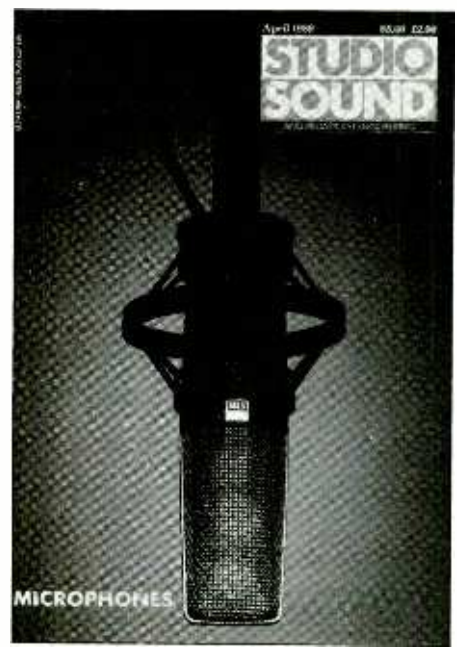
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## Software that solves audio production problems.

A family of programs for IBM AT compatibles that automate many of the record keeping chores of audio production work, especially for film and video post production.

### Sound & Music Cataloging

- Organize Tapes, Samples, CDs, DATs, Film & Records
- Enter your own data or use our free catalog listings of CD sound & music libraries
- Search with multiple words using "and" "or" & "not"
- Control CDs via interface to Sony CDK-006 jukebox

### Effects Spotting

- Manage spotting lists referenced to reel, scene, timecode or feet/frame
- Search, copy & paste from effects catalog to spotting lists

### Cue Sheet Printing

- Prints standard re-recording cue sheets in feet/frames or timecode on any size paper
- Shows title, description, ID number, position, fades, handles & internal events
- Allows 96 tracks per premix
- Extensive conformation functions facilitate picture changes
- Multiple fonts & colors

### ADR Printouts

- Simply enter basic spotting information once to print standard cue/line sheets as well as a variety of other forms
- Sort and refine before printing to create specific printouts by character or reel
- Transfer spotting information into Cue Sheet program for easy Cue Sheet printing

### Leonardo Software

10378 Holman Avenue  
Los Angeles, CA 90024  
Phone (213) 277-5161  
Fax (213) 277-9086

AKG CAP 340 M	6/29	Hybrid Cases Rack Bag	1/16	Soundtracs Tracmix fader automation system	1/15
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AKG D90S and D95S	2/30	Industrial Research System 41	2/24	Stellavox Stelladart	9/16
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Allen & Heath SC Plus	11/21	JRF CTTC for Ampex	12/22	Studer D820-48 48-track DASH	12/22
Alpha Audio BOSS/2	1/15	Kelsey Acoustics BNC Patchpanels	9/21	Studer 990 mixing console	7/16
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# SPOILT FOR CHOICE

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

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

## The Features

### A820 - The Flagship Model

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

### A827 - The Cost-Effective Model

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

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

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