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STUDIO SOUND

AND BROADCAST ENGINEERING

INTERNATIONAL PRO AUDIO AND POSTPRODUCTION MAGAZINE

STUDIO DESIGN

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The Remodelling of Portugal's Namouche Studio

Network Control

New Concepts in Equipment Control

Amplifier Bench Tests

Russian Neve Audio and British MC² Power Amps

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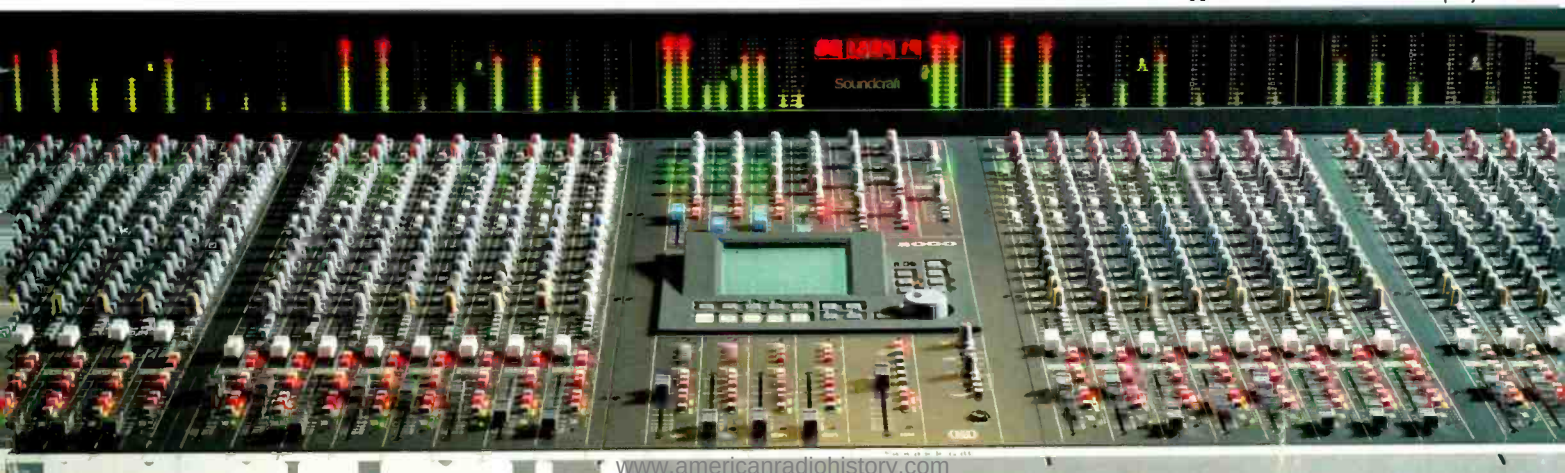

STUDIO SOUND
AND BROADCAST ENGINEERING

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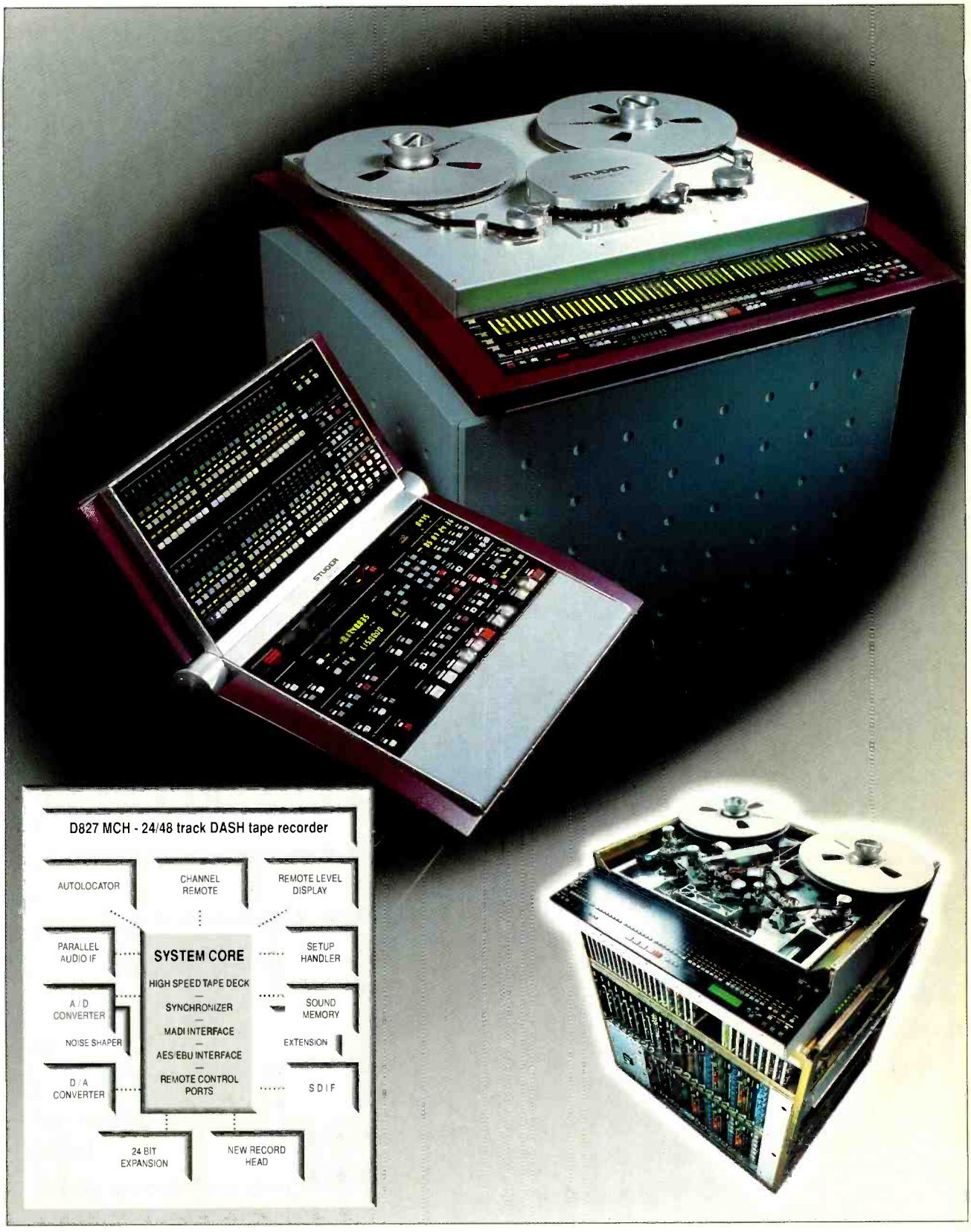

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France: +33 1 48 76 11 44
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U.K.: +44 81 953 35 33
Canada: +1 416 510 13 47
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Studer UK, Cranborne House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JN, UK
Tel: *44 (0) 1707 665000. Fax: *44 (0) 1707 665723

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AND BROADCAST ENGINEERING

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EDITORIAL
Editor: Tim Goodyer
Production Editor: Peter Stanbury
Editorial Secretary: Deborah Harris
Consultants: John Watkinson; Sam Wise
Columnists: Barry Fox; Kevin Hilton; Martin Polon
Regular Contributors: James Betteridge; Simon Croft; James Douglas; Ben Duncan; Tim Frost; Philip Newell; Terry Nelson; Dave Foister; Francis Rumsey; Yasmin Hashmi; Zenon Schoepe; Patrick Stapley

ADVERTISEMENTS
Executive Ad Manager: Steve Grice
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PA to the Publisher: Lianne Davey

CIRCULATION
Assistant Circulation Manager: Diana Rabôt

Managing Director: Doug Shuard
Publisher: Steve Haysom

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The Soap Barrier

I've just got back from the San Francisco AES show. It was one of the most positive shows I have been involved in for some years: there was lots to see, plenty of people to talk to and it was guaranteed to leave all attendees suffering from exhaustion—and many of them suffering from jet lag. Unlike the rest of the showgoers, however, I was given an invaluable piece of advice on my return: you need a rest, it went, have a third of a *Mars* bar.

I left the advice and took the joke because it epitomised one particular element of international communication that has been troubling me for some time and was to come up in conversation several times in San Francisco.

Let's back track. *Mars* is a chocolate bar sold for years with the slogan 'a *Mars* a day helps you work, rest and play'. A third of a *Mars* was, therefore, supposed to provide me with rest. Take it or leave it if you are already familiar with *Mars* and the slogan—if these elements are missing from your culture, however, your options are more restricted.

The point is this: an international community—such as pro-audio—relies on common points of reference to communicate. On the technical side these are relatively common, and so discussions concerning sampling rates, THD or data reduction can be conducted with relative ease. Small talk and humour translate rather less well.

So what?

So nothing, if all you need to communicate are technical specs, operational procedures and sales stories. But even with the luxury of a generally accepted language, producing a magazine that is as entertaining as it is informative is quite simply impossible. Which is not to say that *Studio Sound* should be any more dry than necessary; we did, with the welcome cooperation of Penny & Giles and Cadac, run quite a successful 'April Fool's' story earlier this year—and next year's observance of this particular old custom is already comfortably in hand. But it should be readily understood that there are genuinely few opportunities to extract a smile from readers in Ottawa without confusing or perplexing those in Osaka.

It may be that help is at hand, however. Not content with home-grown soap operas such as *Coronation Street*, *Eastenders* and *Brookside*, the British broadcasters have treated their viewers to ever increasing numbers of imported soaps. It began with American soaps such as *Cheers* (not forgetting *Soap*) and more recently has embraced more Australian soaps than anyone dare count. At the same time, British soaps have been finding their way abroad—*Eastenders*, for example has turned up in both America and Australia. With the press in general becoming increasingly seduced by soap opera references for their levity, we seem poised to establish a set of international 'soap references'—ready-made solutions to the levity barrier.

Once these are agreed and implemented, we will be able to tour trade show bars cynically discussing the good old days of soap-free journalism.

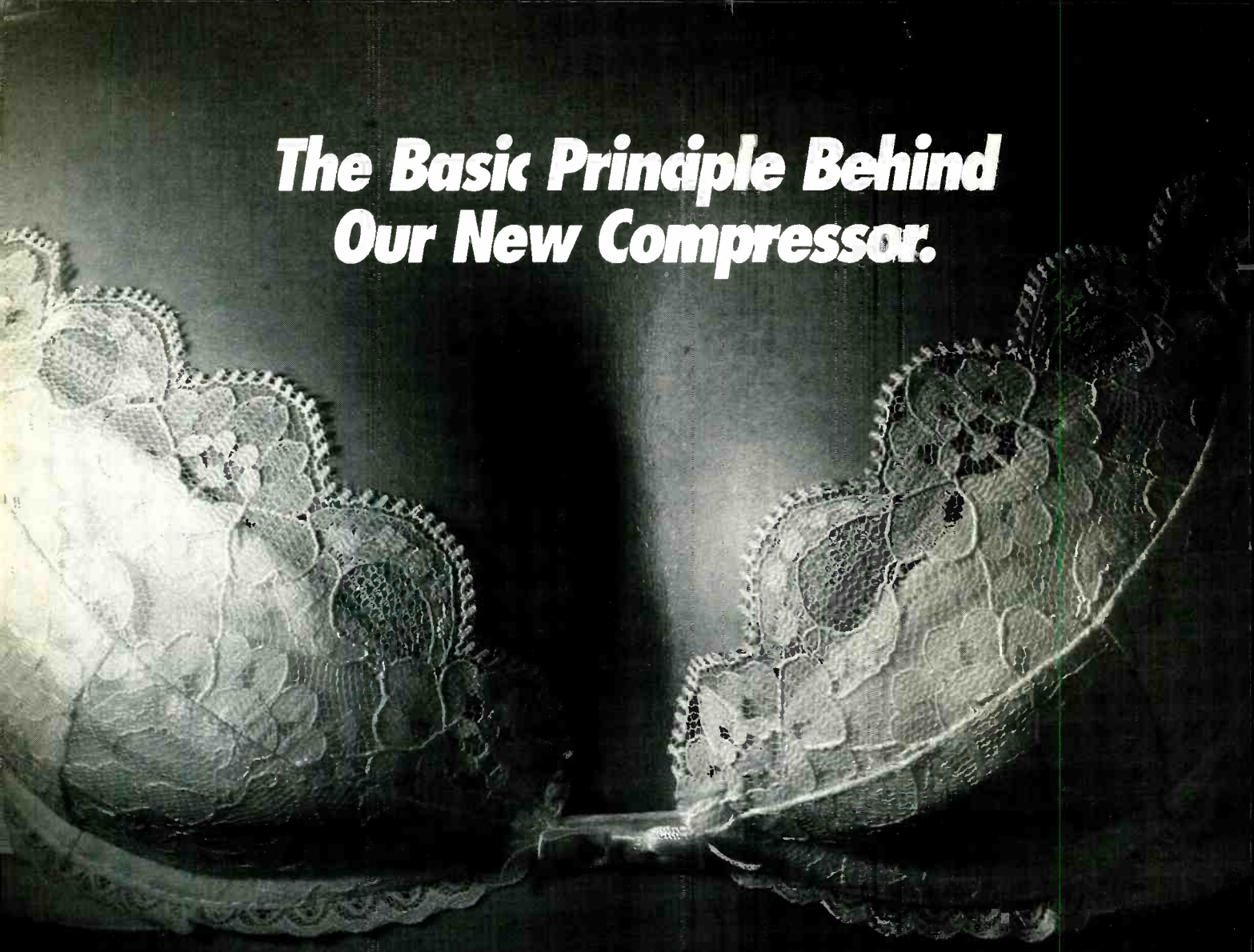
On another tack, you will see that this issue contains an index to 1994's articles and reviews—as we have run in previous years. Again, this facility appears in direct response to the many readers who retain Studio Sound for future reference.

Finally, it simply remains for me to say Happy Christmas, Joyeux Noël, Season's Greetings, Felices Fiestas, Frohe Feiertage... ■

Tim Goodyer

Cover: Hitokuchi-Zaka Studio, Tokyo. Design by Harris Grant Associates

The Basic Principle Behind Our New Compressor.



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December 1994

● December 1st–4th, **13th International AES Conference**, Dallas, Texas, USA. ● December 4th–7th, **5th World CD-i and Video-CD Conference**, Düsseldorf, Germany. ● December 13th, **UK AES Lecture: PA Systems—Do They Get a Fair Hearing?** Imperial College, London, UK.

January 1995

● January 5th–7th, **Showbiz Expo East**, New York Hilton and Towers, New York, USA. ● January 24th–27th, **ITA Information SuperHighway '95 Conference and Exhibition**, Santa Clara Convention Center, USA. ● January 27th–29th, **JTS Conference: Preserving Our A-V Heritage**, NFT, London, UK. ● January 30th–February 3rd, **Midem**, Palais des Festivals, Cannes, France.

February 1995

● February 7th–9th, **ISDN User Show**, Olympia 2, London, UK. ● February 12th–15th, **Siel 95** and **Theatrical Services Exhibition**, Porte de Versailles, Paris, France. ● February 15th, **Conference: Still Protecting the Media**, Le Meriden Hotel, London, UK. ● February 20th–23rd, **Communications World 95**, Hong Kong Convention and Exhibition Centre, Hong Kong. ● February 23rd–24th, **Conference: Video on Demand**, Langham Hilton, London, UK. ● February 25th– 28th, **98th AES Convention**, Palais de Congrés, Paris, France.

March 1995

● March 8th–12th, **Frankfurt Pro Light and Sound**, Messe Frankfurt, Frankfurt, Germany. ● March 8th–12th, **ITA Seminar: The Converging World of Entertainment, Information and Delivery Systems**, Westin Mission Hills Resort, Rancho Mirage, California, USA. ● March 25th–27th, **The Pro Audio Show**, Karachi, Pakistan. ● March 29th–April 2nd, **Audiovideo 95**, Lenexpo Exhibition Complex, St Petersburg, Russia.

April 1995

● April 4th–6th, **REPLItech Europe**, Austria Center, Vienna, Austria. ● April 4th–7th, **Communications Tokyo Exhibition**, Tokyo International Trade Fairgrounds, Tokyo, Japan. ● April 9th–13th, **NAB 95 Symposia**, Las Vegas Convention Center, Las Vegas, USA. ● April 10th–13th, **NAB 95**, Las Vegas Convention Center, Las Vegas, USA. ● April 26th–29th, **Broadcast Technology Indonesia**, Jakarta, Indonesia. ● April 26th–28th, **5th Australian Regional AES Convention**, Sydney Exhibition Centre, Sydney, Australia.

May 1995

● May 5th–7th, **Theatre World**, Business Design Centre, London, UK. ● May 23rd–25th, **Midem Asia**, Hong Kong. ● May 9th–12th, **Pro Audio, Light and Music China 95**, Beijing Exhibition Centre, People's Republic of China. ● May 30th–31st, **Leipziger MedienMesse Hörfunk**, Leipziger Messe, Leipzeig, Germany.

June 1995

● June 8th–10th, **Second Annual South American Pro Audio Expo**, Centro de Extension, Santiago, Chile. ● June 8th–13th, **International Television Symposium**, Montreux, Switzerland. ● June 10th–12th, **12th ShowBiz Expo**, Los Angeles, USA. ● June 13th–15th, **REPLItech International**, Santa Clara Convention Center, Santa Clara, USA. ● June 21st–23th, **Audio Technology 95 (formerly APRS)**, National Hall, Olympia, London, UK.

July 1995

● July 12th–14th, **Pro Audio and Light 95**, World Trade Centre, Singapore. ● July 17th–19th, **WCA 95 (Wireless Cable Association Show)**, Washington Convention Center, Washington, USA.

August 1995

● August 25th–28th, **Beijing International Radio and TV Broadcasting Equipment Exhibition 95**, World Trade Centre, Beijing, People's Republic of China.

September 1995

● September 14th–18th, **IBC 95**, RAI Centre, Amsterdam, Holland. ● September 21st–24th, **Nordic Sound Symposium XVII**, Bolkesjø Mountain Hotel, Norway

October 1995

● October 5th–8th, **99th AES Convention**, Jacob K Javits Center, New York, USA. ● October 17th–19th, **Vision 95**, Olympia, London, UK. ● October 24th–26th, **REPLItech Asia**, Singapore International Convention and Exhibition Centre, Singapore. ● October 25th–28th, **Broadcast Cable and Satellite India 95**, Pragati Maidan, New Delhi, India.

November 1995

● November 2nd–4th, **Broadcast India 95**, World Trade Centre, Bombay, India. ● November 7th–9th, **Wireless World Expo 95**, Moscone Center, San Francisco, USA.

December 1995

● December 5th–9th, **Expo Comm China South 95**, Guangzhou Foreign Trade Exhibition Centre, Guangzhou, China.

CONFERENCE REPORT

Reproduced Sound 10

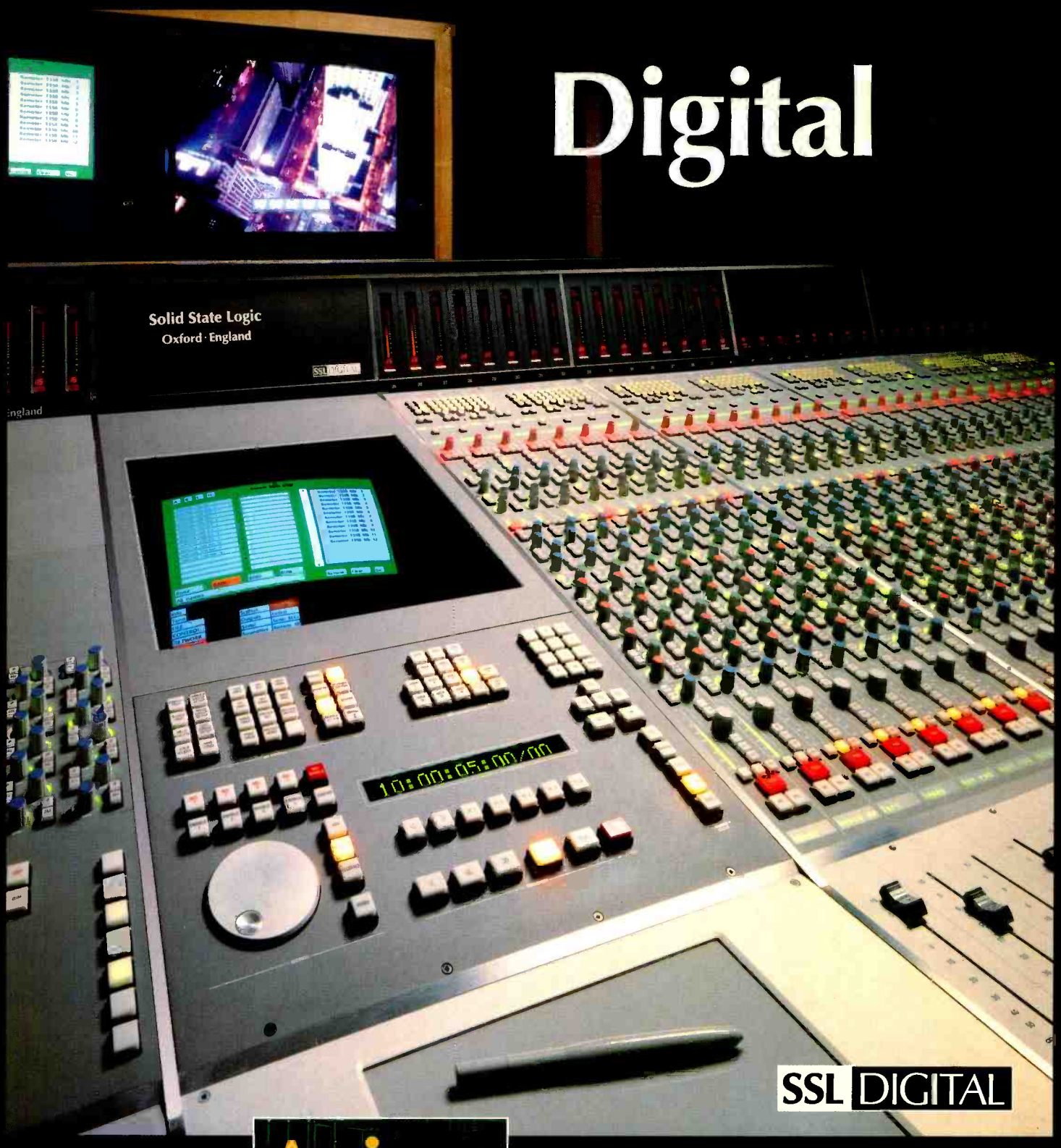
For the tenth year running, the Institute of Acoustics' annual conference on 'Reproduced Sound' was held at the Hydro Hotel, overlooking Bowness on Windermere, a town astride England's largest lake. As usual the conference ran from 9am on Friday through to noon on Sunday. This year, the programme was split into three sessions running partly in parallel. First, an acoustics training course for sound engineers. Second, a *tranche* of papers on Network Control. Third, other papers, covering diverse topics, including loudspeaker developments, amplifier tests, room acoustics, and speech intelligibility.

Ten presentations were all broadly about networked controlling of audio-video-other devices via computers. These were overviewed by Allen Mornington-West's description of the host of existing protocols. Propositions included the computer-network control of major live shows, and presentations ranged from the European beta users experiences (at Blackpool) before and after Crest's *NexSys*, to design considerations for network controller ICs. The parallel open session included my own own presentation on realistic power amplifier test procedures and an eye-opening illustration on the graphical results of conducted EMC tests on seven state-of-the-art, high power amplifiers. In an ironic twist, the amplifiers guilty of conducting the most RF onto the mains supply included all of those with conventional power supplies. In the speaker developments session, Johns Woodgate and Bowsher discussed developments of compact 'bipolar' and higher order gradient speakers with LF directivity. Paul Mills continued the saga of Tannoy's current-driven drive-unit to-be, with a look at current-driving power amplifier topologies. James Angus presented a development for speaker designers, namely figuring into the design the inevitable acoustic effects of the nearest of the six walls with which most speakers interface. After some papers by EAW's Chamness and BOSE's Cliff Hendricksen, relevant to large installed systems, John Watkinson took up 'The future of digital recording'.

The conference ended with seven papers under the heading 'Sound in Spaces', including studies of early reflections in control rooms, and work with diffusers and active absorbers. It was in this final session that I found the most interesting paper, by Phil Newell, Tom Hidley and Keith Holland about a new approach to optimum control room design. The starting point is a new approach to room treatment, to vanquish inconsistencies between similar rooms with similar monitors, and allow main monitors to once again take the place of nearfield monitors as the ideal reference. This is achieved by having little reverberation, the so-called Non Environment—while avoiding the unpleasant psychological effects of overly anechoic spaces.■

Ben Duncan

Copies of the papers are available in two books (*Vol 16a* and *Vol16b*, Part 4) from: Institute of Acoustics, PO Box 320, St.Albans, Herts AL1 1PZ, UK.
Tel: +44 1 727 848195.



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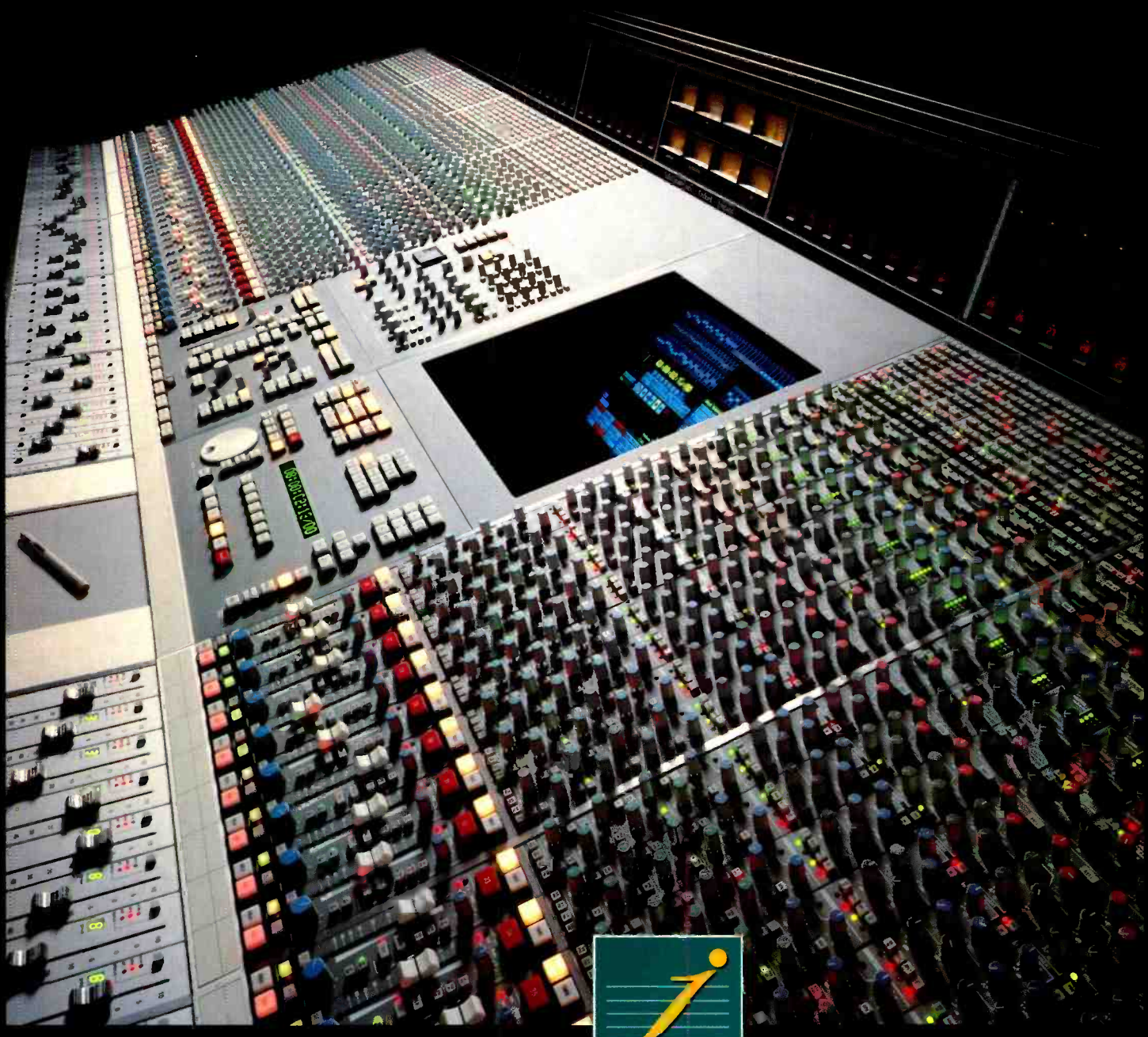

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International News

In-brief

● **Synclavier-Fostex alliance**

Healed wounds between The Synclavier Company and the development team at FXR have allowed the two companies to make attractive overtures to the postpro industry. Fostex will now feature The Synclavier Co's *S/Link* file conversion and *EditView* software in the OS of their *Foundation 2000* nonlinear recorder-editor. The SF AES Convention provided the launch platform for the alliance and saw both parties demonstrating *S/Link* v2.0, illustrating their joint commitment to becoming serious contenders in the hotly-contested nonlinear competition.

Synclavier Co. Tel: +1 603 448 8887.
Fostex R&D. Tel: +1 603 643 9811.

● **Avid and Yamaha strengthen links**

At AES, Avid Technology and Yamaha announced enhanced hardware and software integration between Avid audio products and the Yamaha *DMC1000* digital mixing console. Avid also announced support for direct interface with Yamaha A–D and D–A convertors. News of the improved links with Yamaha accompanied details of v3.0 for *AudioVision* and *AudioStation*, giving 16 channels of audio playback with picture from a single disk, and the expanded family of products built around the *AudioVision* and *AudioStation* systems.

Avid Technology Inc.
Tel: +1 508 640 3103.
Avid Technology Europe Ltd.
Tel: +44 1753 655999.
Avid Japan KK.
Tel: +81 33 505 7937.

● **4000 Audio Precision *System Ones***

Audio Precision have delivered their 4000th *System One* PC-based audio test and measurement system to the Moonwha Broadcasting Corporation of Seoul, Korea. The new System, which is a Dual Domain version providing for generation and analysis of both analogue and digital domain signals, is the third to be purchased by the network, and will by used by MBC's engineering staff for maintenance and repair of all audio components in the network's television transmission chain. The first *System One* was shipped to MBC in August 1985.

Audio Precision.
Tel: +1 503 627 0832.

● **Panasonic *ADAT***

As if in response to the recent Tascam-Sony *DA-88* digital multitrack tie-up, Alesis and Panasonic have struck a deal giving the Japanese giant license to support the Alesis *ADAT* linear digital recording format. Announced at the San Francisco AES Convention, this strategic alignment ensures future ADAT-based machines from Panasonic intended for the pro-audio and postproduction market.

Alesis Corp. Tel: +1 310 558 4530

Lightwave Fibox systems in action

Several recent events have made use of Lightwave Systems' Fibre Optic Digital Audio Link, which is claimed to have a 2½-mile transmission distance and 108dB dynamic range. The July 4th Boston Pops Esplanade Concert's audio broadcast was transmitted using the system, carrying signals from the stage to the WCRB mixing-announcing booth about 400m away and eliminating the hum and other noise which had been encountered at previous concert broadcasts.

Crossroads Audio used the system at the Freedom Festival in Austin, Texas, featuring a concert by (among others) Fleetwood Mac and REO Speedwagon. The signal was sent from a crossover at the console to a delay tower 200 feet away; 'since the delay system was powered by a separate generator, there could have been power phase and ground problems, but with Fibox we had no problem at all', explains Chief Engineer Pete Stauber, who also uses the system in large-scale fireworks displays where wiring runs are frequently of the order of thousands of feet and multiple power sources are in use.

Finally, Morgan Sound used two Fibox systems at the Mount Hood Jazz Festival. which took place in an athletics stadium. Three mixes were multiplexed on to a single 1,000-foot cable run to feed the main left-right signal to the stage and signals to four delay positions, again using multiple power sources.

Lightwave Systems Inc.
Tel: +1 214 741 5142.

APRS: new name, new venue

The Association of Professional Recording Services (APRS) is announcing a new name and a new venue for the 1995 exhibition. Taking place from 21st–23rd June 1995, Audio Technology '95 is to be held in the National Hall at Olympia, London, where the show aims to reflect every facet of today's professional audio industry.

Now in its 28th year, the APRS exhibition continues to be the only event of its kind in Britain, attracting a very strong UK and international following from visitors and exhibiting companies. Exhibition organiser Philip Vaughn explains the rationale behind the new plans for 1995: 'We enjoyed a very successful show in 1994, with enthusiastic reception of both the *Briefings* sessions and our broader exhibitor base. Building on this firm foundation, we wanted to look for new ways to give the event added value. It was with this in mind that we researched an improved venue for 1995. Our goal was to house the exhibition in one main area, providing an even more dynamic atmosphere, and responding to our exhibitors' requests. The National Hall does exactly that, providing us with an extremely prestigious location equipped with excellent exhibitor and visitor facilities.

'The scope of the APRS Show has also widened dramatically in recent years, in response to our evolving industry. The event genuinely encompasses audio technology in its widest sense, and hence we also decided to address the issue of the show's name. Audio Technology '95, coupled with The APRS Show, encapsulates the whole story—the long-standing tradition of the APRS Show is visibly aligned with the dynamics of today's audio environment, perfectly defining the event that is unique for both the UK and the wider international marketplace.'

Over 30 British companies will be attending the forthcoming Paris AES Convention with the assistance of a subsidy from the Department of Trade and Industry. Coordinated through the APRS body, the subsidy offers up to 50% of the stand costs in the interests of stimulating British exports and has been awarded to Focusrite, DDA, Calrec, Crookwood, the Professional Monitor Company and Tannoy among others.

APRS. Tel: +44 1734 756218.

Valves return to RS catalogue. The worldwide market for thermionic valves (or vacuum tubes) is still thought to be worth around $3bn. By introducing a range of valves UK component giants RS Components aim to address the particular needs of the audio industry. RS are offering eight audio amplifier valves, including two matched pairs, from National Electronics, one of the few remaining specialised valve manufacturers. Supplied to RS by Richardson Electronics, the parent company of National Electronics, the valves feature familiar part markings and comprise a range including preamplifiers, drivers and output valves suitable for power outputs of up to 70W.
RS Components. Tel: +44 1536 201234

Mark IV take Shuttlesound. THE SF AES Convention set the scene for UK distributor Shuttlesound to sign over to the Swiss Mark IV group. Set against a background of extensive discussion, the arrangement is reckoned by both parties to offer benefits all round—Mark IV have addressed a 'key country' previously denied their own distribution, while Shuttlesound are expected to retain day-to-day running and ensure added security.
Shuttlesound. Tel: +44 181 640 9600

Russian showing

Audiovideo '95 is the third international pro-audio and video exhibition to be held at the Lenexpo complex in St Peterburg. The main themes of the show are expected to be pro-audio and video, PA systems, broadcast and A-V services. This year's show (1994) demonstrated the increasing interest of Western companies in the former Eastern bloc through such exhibitors as Avid and Reflexion Arts.
Greet Co. Tel: +7 812 119 6245.

BGW license Lab Gruppen

BGW Systems and Lab Gruppen have announced the signing of an exclusive technology-licensing agreement concerning the design of the established Lab Gruppen model *2000C* power amplifier. The *2000C* uses patented signal-tracking switching technology, allowing a linear amplifier to operate highly efficiently at all load impedances. The lightweight switching power supply is the key to the *2000C*'s weight of only 10kg; impedance matching load-selector switches enable the amplifier to deliver a kilowatt per channel or more into 8Ω, 4Ω, 2Ω and 1.5Ω.

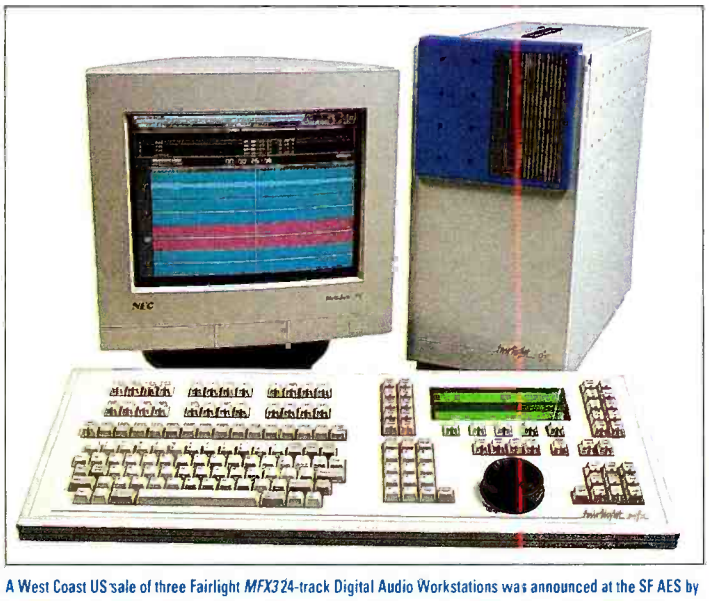
BGW, renowned amplifier manufacturers for over 23 years, plan to incorporate the technology of the Lab Gruppen design in the *Performance Series Model 10*, and to further improve the product by working closely with key touring companies in the US.

Meanwhile the new *Performance Series 3* is a 2U-high 450W per channel amplifier capable of delivering 1000W into a bridged 8Ω load, and featuring a switch selectable clipping eliminator to prevent speaker damage.
BGW Systems Inc.
Tel: +1 310 973 8090.

Dolby *Fax* features in films

Among the growing Dolby *Fax*-user list are several major film studios, including Disney's Buena Vista Studios in Glendale, California, Twickenham Film Studios in London, Howard Schwartz in New York, Warner Bros in Los Angeles, Film House in Toronto and Sound One in New York. Use of the system allows actors to work on soundtracks for one production while remaining on location for another, and film soundtrack mixes can be evaluated in real time by directors who are hundreds or thousands of miles away from the dubbing theatre.
Dolby Laboratories.
Tel +1 415 558 0200.
UK: Dolby Laboratories.
Tel: +44 1793 842100.

A second Studer *Dyaxis II* system has been taken by the British Central Office of Information for its Overseas Radio Services studio. Serving government offices and agencies, the COI will use *Dyaxis II* mainly in the production of foreign language programmes for distribution to overseas radio and TV broadcasters worldwide. Seated with the *Dyaxis II* is COI Studio Manager Derek Thomas



A West Coast US sale of three Fairlight *MFX3* 24-track Digital Audio Workstations was announced at the SF AES by Fairlight Director of Operations and Tamara Rogers—COO of Hollywood-based Waves Sound Recorders. The 5-room postproduction facility opted for the *MFX3*s after surveying competing systems. Ms Rogers commented, 'the only Digital Audio Workstation that met our criteria was the Fairlight'. The Waves installation joins a recent sale of a further *MFX3* to EFX Systems, a Burbank-based postpro facility, and the seven Japanese orders taken during October. These include a Mini system for national broadcaster NHK, and MFX3s for Tokyo 109, Sony PCL and Crow Studios. Other worldwide orders include Icon Post and Best Results in Australia, Zoo Postpro in London, and Moscow's REN TV and Triarios Corporation. Fairlight ESP Pty. Tel: +61 2 975 1230. Fairlight US. Tel: +1 213 460 4884.

Contracts

● *Solitaire* in good company

Soundtracs' *Solitaire* production console has recently found favour with a number of facilities worldwide. Among the many takers are France's Tralala Music and Triangle Productions, California's Levitan Studios, Israel's Merlin's Cave, Holland's Studio 88, Italy's Dynamo Sound Studio, Britain's Trident 2, Belgium's Chain Gang Studios and Japan's Rock On Company.
Production of the *Solitaire* is now meeting the demand of one console every 48 hours. A Soundtracs Jade console with full dynamics has been ordered by the Dutch Broadcast Corporation (NOB) for their Studio 2 broadcast facility in Hurth, Germany. NOB already have a Soundtracs *In Line* console installed at Studio Rembrandt, Hilversum.
Soundtracs. Tel: +44 181 399 3392.

● API in Frisco

API President Paul Wolff used the San Francisco AES Convention to announce the sale of a *Legacy Series* console to the Salyer Music Group in Fremont. The console is a 48-input *Legacy* fitted with *Uptown 990* fader automation and is scheduled for January installation.
API Consoles. Tel: +1 708 653 4544.

● Capricorn sighted in NYC

The first placement of AMS Neve's *Capricorn* console in New York has gone to RightTrack Studio. Featuring 72 faders, 180 inputs, 288 paths and 160 channels of EQ-dynamics, the sale was the cause of celebration for those concerned at the SF AES.
AMS Neve. Tel: +441282 457011.
RightTrack. Tel: +1 212 944 5770.

● Boxers knock 'em dead

As The Discrete Research Group announces the creation of Coastal Acoustics Ltd to handle the Boxer range of monitors, comes news of Boxer sales. New York's, Battery Studios and Sony Music have taken delivery of *T5* systems, while Tokyo-based Hitokuchi-Zaka Studios (see cover) have a *Boxer Four* system as part of Control Room 3. Nittozaka Studios, also in Tokyo, have a T5 system, while Revolver Studios in New Zealand have bought *Boxer Four*.
Coastal Acoustics Ltd.
Tel: +44 1753 631022.

● Middle East's largest studio installs *Motionworker*

DB Studios of Tel Aviv have installed their own *Motionworker* system. *Motionworker* is being used to control DB's analogue Studer machines, with its four Sony serial ports controlling *ADAT*s and other serial machines. This allows various combinations of analogue and digital formats, and also enables a hard disk recorder such as Cubase Audio to be run directly from DB's SSL computer.
Motionworks. Tel: +44 1865 865355.

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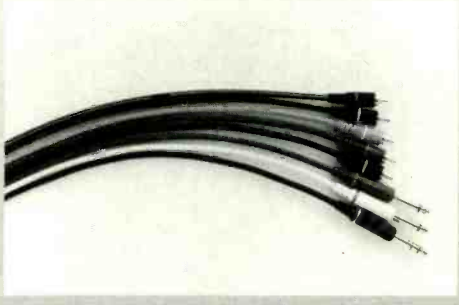

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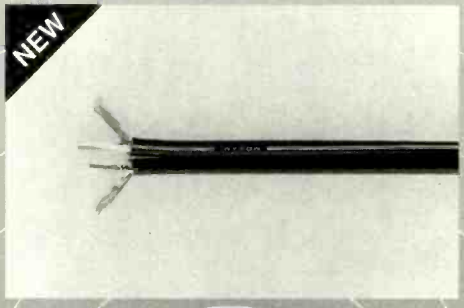

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NEW

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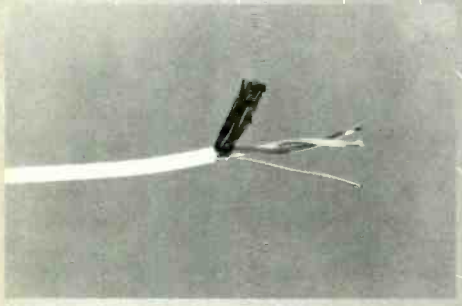

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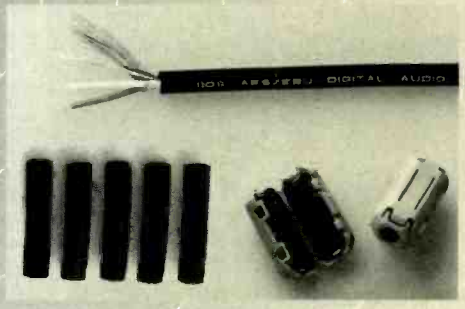
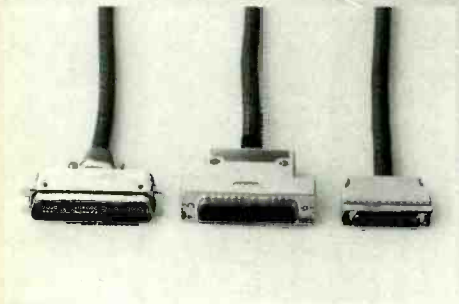


AES/EBU 110Ω DIGITAL AUDIO CABLE



SCSI -II SINGLE ENDED A CABLE

NEW

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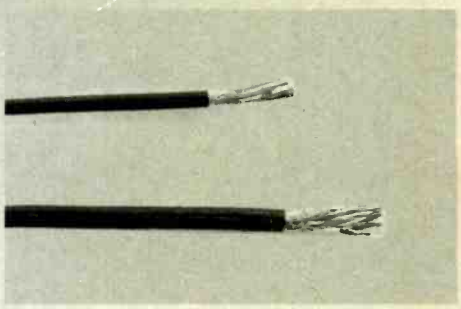

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Ultra-Harmonizer upgrade

Perfect harmony—v2.00 software for the *DSP4000*

Eventide's flagship *DSP4000 Ultra-Harmonizer* recently received an AES upgrade in the form of v2.00 software. Internal processing and program loading are faster under the new software, and 40 new patchable modules—along with extensive modification to the Patch Editor—have been added.

The user-interface has also been improved, reducing keystrokes and making operation 'more intuitive', and a Compare function allows switching between an existing program and an edit of it. The operating system now supports larger memory cards (up to 4Mb S-RAM). Shipping is planned for January 1995.

Eventide. Tel: +1 201 641 1200.

In the Bag

The SF AES Convention saw the surprise launch of a new close-field studio monitor system from Bag End—the *Studio System*. The *Studio System A* incorporates prematched *MM-8* close-field along with the *D10E-S* subwoofer system and the *ELF-1* integrator, while the *Studio System B* combines *MM-8*s and *D10E-S*s,and the lower cost *ELF-M*.

The *MM-8* monitors use an 8-inch, 2-way, dual-concentric, time-aligned driver, have a frequency response of 100Hz–200kHz and are optimised for use with 100W amplification (at 8Ω). The *D10E-S* carries dual 10-inch drivers with 400W power handling (4Ω) and extends the system response down to 18Hz (100Hz crossover).

Bag End. Tel: +1 708 529 6231.

Apogee *DA-800*

Apogee Sound have entered a new market with the *DA-800*, claimed to be the world's first professional power amplifier expressly designed for microprocessor control, planned from its inception to work in Lone Wolf's *MediaLink* network environment and offering features not found on any other computer-controlled amplifier.

The 800W/channel amplifier features large backlit LCDs on the front panel which selectively display attenuation level, output voltage, load impedance, true output Wattage, operating temperature and AC mains voltage. In a computer-network environment all these parameters are simultaneously available for monitoring by a host computer.

The *DA-800* avoids the problem of physical controls not matching remotely-set levels by performing all level adjustments with continuous-turn shaft encoders which are then displayed accurately on the LCD in 0.5dB steps. Each channel may be adjusted independently, or the channels may be linked, providing precision tracking with up to 31dB of offset; level controls may be disabled with a lockout switch.

Level control uses the *MTA 1567* VCA, and the power stage delivers over 800W/per channel into 4Ω at less than 0.005% THD (at 1kHz) in a 2U-high package. The *DA-800* is available both as a 'straight' power amplifier or with internal processing cards for the various models of Apogee loudspeakers. The processor models may be specified in a Permanent version with all input and output connections on the rear, or a Road version with connectors on the front panel.

Apogee Sound Inc.
Tel: +1 707 778 8887.


AES debut: Bag End's first close-field studio monitor system

Gotham cables

Alongside their recently-introduced specialised digital audio cables, Gotham have launched some new microphone and analogue audio cables. *GAC-1* is a sophisticated unbalanced cable, using multiple layers of screening and insulation around a central 48mm x 0.07mm conductor. Together with Gotham's exclusive double-Reussen shield as featured on most of their cables, *GAC-1* incorporates a viscose separation between jacket and shield, and a conductive plastic layer around the centre conductor to ground static energy developed by moving the cables.

Similar construction is used in the *GAC-2* balanced cable, but without the viscose separation or the conductive plastic. Two 48 x 0.07mm conductors are individually insulated, surrounded by an overall ▶

In brief

● **Capricorn enhanced**

First showing of v2.3 software for the AMS Neve *Capricorn* console took place at the recent SF AES Convention and included VCA-style groups, allowing any number of slave faders to be controlled by a single group master; meter read-outs to reflect selected analogue levels; individual setting of word length and dither; direct monitoring of external audio sources and real-time merging of automation mix passes.

AMS Neve. Tel: +44 1282 457011.

● **Apogee *UV22* goes soft**

MasterTools is Apogee Electronics' TDM plug-in version of the *UV22* Super CD Encoding system. Allowing redithering of 20-bit masters to the 16-bit CD standard, *MasterTools* offers simultaneous peak and average, Smart Meter Ballistics and Over Indication metering options among its features.

Apogee Electronics.
Tel: +1 310 915 1000.

● **beyerdynamic push back the boundaries**

The new *MPC65* from beyerdynamic is a low-profile, small footprint Boundary-Effect condenser microphone. Its polar pattern is semicardioid, rejecting sound from the rear, which with its unobtrusive design makes it ideal for theatre use. It features a flat frequency response between 65Hz and 18kHz, with a low-cut filter on the separate preamplifier-adaptor.

beyerdynamic (GB) Ltd.
Tel: +44 1273 479411.

● **Yamaha quadruple-speed CD recorders**

Already incorporated in a *Pentium* PC package from CD Revolution, the Yamaha *CDE100* and *CDR100* are quadruple-speed CD recorders, in external and internal formats respectively. The models feature a newly developed exclusive optical head, spindle motor, high-speed signal-processing LSI and control unit, and incorporate the *Orange Book* (Part 2 incremental writing) 3-mode record feature, with Disk-at-once, Track-at-once and Multisession modes. The external version is available with a hard drive fitted internally, and both models are fully compatible with CD-DA, CD-ROM, CD-ROM/XA and CD-I.

Yamaha Corporation of America.
Tel: +1 714 522 9011.
Yamaha-Kemble Music.
Tel: +44 1908 366700.

● **Quested *HQ410U***

Quested Monitoring Systems ▶

chose the SF AES Convention as the launch platform for their new *HQ410U* multiformat studio monitors, versatile units which can be configured in three ways: as a 3-way passive monitor, split in half and bi-amped to give a 2-way active with passive crossover between mid and high frequencies, or as a full 3-way active monitor. The loudspeaker can be mounted vertically or horizontally, with a rotation of the sub-baffle which carries the HF and MF drivers, and features four 10-inch, high-excursion LF drivers with double rear suspension, a 3-inch soft-dome MF driver and a 1⅛-inch ferrofluid-cooled soft-dome tweeter.

Quested Monitoring Systems. Tel: +44 171 731 7434

● **CCS *cdqPRIMA***

CCS Europe showed their new *cdqPRIMA*, which they describe as the world's first intelligent full-duplex audio codec, at the SF AES and German Tonmeistertagung. The *cdqPRIMA* features ISO MPEG Layer II (MUSICAM), G.722, up to eight contact closures, one RS485 and three RS232 interfaces, and separation and then enclosed in the double-Reussen shield, giving screening effective up to 25MHz and 95dB noise attenuation at 25kHz.

A smaller version is also available: *GAC-2/1* cable forms the basis of Gotham's multipair series and retains the double-Reussen shield in a simplified overall configuration.

Gotham AG. Tel: +41 1 840 0144.

Lexicon *PCM-80*

New from Lexicon is the *PCM-80* signal processor, a true-stereo effects unit offering balanced analogue outputs, digital I-O, multivoice delay and reverb effects, and RAM or ROM storage with a PCMCIA data card. The data-card slot enables effects to be carried between studios, as well as allowing additional memory or algorithms to be added and upgraded as they become available.

Two hundred preset programs cover a wide range of applications including music, both in performance and in production, and a range of effects specifically designed for video postproduction and dance remixing. Redesigned versions of some of the *PCM-70* effects are also included, such as Concert Hall and Tiled Room presets. New algorithms rejoice in intriguing names like Glide>Hall and Res 1/2>Plate, and another unique feature is the Dynamic Patching matrix, which makes it possible to map data from any of 143 possible control sources to any effects parameter. Also included in the *PCM-80* is a pair of 'dynamic spatialisation processors' which enable effects to be placed virtually anywhere—between the speakers or even beyond them.

Lexicon Inc. Tel: +1 617 736 0300. Fax: +1 617 891 0340.

Autoplay II

Maddox Broadcast, broadcast-and-software systems specialists, have introduced *Autoplay II*, a system placing transmission control under *Windows* computer control. *Autoplay II* consists of *Windows* workstations, which can be in any number of different locations, controlling a scheduler control 'engine'. Commands are sent from any of the workstations to the control engine via an ethernet LAN.

The system is modular design, allowing for quick and cost-effective customisation. Modules available within *Autoplay II* allow for matrix and VTR control, a tape library, ad insertion, GPI switching for auxiliary equipment and an automated scheduler. This last module lists the status of past, current and future events, enabling schedules and schedule information to be inserted, deleted or amended.

One module that is unique to *Autoplay II* is the Group Event Library, which enables the software to use a unique tree structure allowing for the preparation of event batches for later insertion into the transmission schedule. With the system's multitasking environment, modules can be run simultaneously and more than one copy can be used

either on a single workstation or across a network. All information is shared and all status screens are updated in real time. Full support of all system functions can be given remotely via a modem.
Maddox Broadcast Ltd.
Tel: +44 1293 542275.

Get *Real-Q*

The San Francisco AES Convention provided a suitable and popular platform for the release of the Sabine *Real-Q* Practical Adaptive Equaliser. Aimed primarily at live events, the *Real-Q* is a DSP-based equaliser capable of continually monitoring the response of a performance hall and maintaining a predefined curve.

Unashamedly pitched at more elaborate and less automated systems, the *Real-Q* includes pink and white noise generators, real-time analyser, 31-band digital master and adaptive equalisers, inputs for two reference mics, digital input and output, 10 memory locations and MIDI.

SF AES surprise—Sabine's *Real-Q*

Sabine. Tel: +1 904 371 3829.

Sanken shotgun

On show from Sanken at AES was the new *CSS-5* compact shotgun microphone with switchable mono-stereo functions. Developed in conjunction with NHK, the 5-capsule *CSS-5* is already in use for television dramas in Japan, and is also intended for use on location film-video documentaries and major broadcast events.

The design combines directional capsules to create a line microphone with a second-order pressure-gradient effect, and the claimed result is precision directionality and accurate frequency response even below 2kHz in a microphone only 30cm in length. Three switchable modes of operation are provided: Mono for sharp shotgun directivity and maximum low-frequency definition; Normal for directional hypercardioid focus with accurate stereo localisation; and Wide, with expanded 140° stereo image for cinematic ambience and SFX. Sanken claim that the sonic characteristics of the frontal sound remain unchanged even when switching from mono to stereo.
Audio Intervisual Design.
Tel: +1 213 845 1155.

modularity in terms of network interfaces. The synchronisation of up to six ISDN B channels is performed according to the ITU-TJ.52 recommendation, so that bit rates between 56 and 384kbps can be transmitted without any additional ISDN equipment. The unit can realise complete systems, such as DAB, ADR, point-to-multipoint for advertisement distribution or satellite backup.
CCS Audio Products.
Tel: +1 908 946 3800.
CCS Europe GmbH.
Tel: +49 8 11 55 160.

● **SADiE scores**

Version 2 (free) software release for the popular *SADiE* reorder-editor include SCSI CD-R, DDP 8mm CD mastering format (*Red* or *Orange* Book standard), backup to Exabyte, 16, 20, 24-bit editing and a hardware controller interface. In SA&V's latest accounts, the company claim 560 systems installed during 1994 and identify 45% of systems sold being for export from the UK.
SA&V. Tel: +44 1353 648888

ADT Serial Digital Analyser

New from Audio Digital Technology (ADT) is a piece of test equipment that no studio or broadcaster using digital audio can afford to be without—particularly considering the remarkably low price. The unit is a hand-held, serial digital analyser (SDA) which can be used to display the states of a selection of non-audio bits carried over standard digital-audio interfaces, edit them and then retransmit the data. As studios increasingly use all-digital signal chains and need to copy recordings digitally between devices, the problems of incompatibility become more obvious. It is not uncommon for two digital-audio devices to refuse to talk to each other because of a difference in implementation of their digital interfaces, even when this difference appears to be small. One needs to be able to look at the state of the data bits most likely to cause a problem and attempt to establish communication by careful editing.

The SDA works with either AES-EBU (professional) or SPDIF (consumer) digital interfaces, and has inputs and outputs in both formats. BNC connectors on the side of the SDA allow it to be connected to an oscilloscope so that the input data waveform can be displayed. These consist of connectors which tap off both sides of the AES-EBU balanced line and one which carries an extracted word clock signal for synchronising the scope trigger. Waveform or eye-pattern display allows a user to see whether the audio signal is in good condition, and to see how it has been affected by being carried over long cables or poor quality electrical paths.

The input can be terminated in either 110Ω or 75Ω, or left unterminated, in order to match the input impedance to that required by the standard in use. The effect of changing termination can be seen on the external waveform display.

The SDA incorporates a D–A convertor for monitoring the incoming audio signal, either over a small internal loudspeaker, which can be switched to monitor either channel, or using stereo headphones.

The front panel consists of a number of LEDs representing the states of some of the most important channel-status bits in the digital-interface signal. It also has a section of the display which shows the sampling frequency of the incoming signal. The accuracy of the sampling frequency can be measured, and LEDs indicate whether the received frequency is within either 400ppm, 4% or out of range of the internal reference. This can be particularly useful because there may arise occasions on which the sampling frequency is either wrongly indicated in channel status, when the sampling frequencies of two devices are different, or when the frequency tolerance is too great for the receiver to lock, resulting in non-communication between devices.

A final series of LEDs indicate the presence of line errors in the digital signal, including indications of 'no lock' (inability to lock to the incoming data), biphase errors, parity errors, channel status CRC errors (a typical fault when devices don't transmit CRC), validity flag errors and a 'confidence' light (which shows that the incoming signal is of poor electrical quality).

The SDA is extremely easy to use and is well finished as a product. It uses either an internal rechargeable battery or an external 9V power supply, and there is a Low Battery LED to show that recharging is needed.

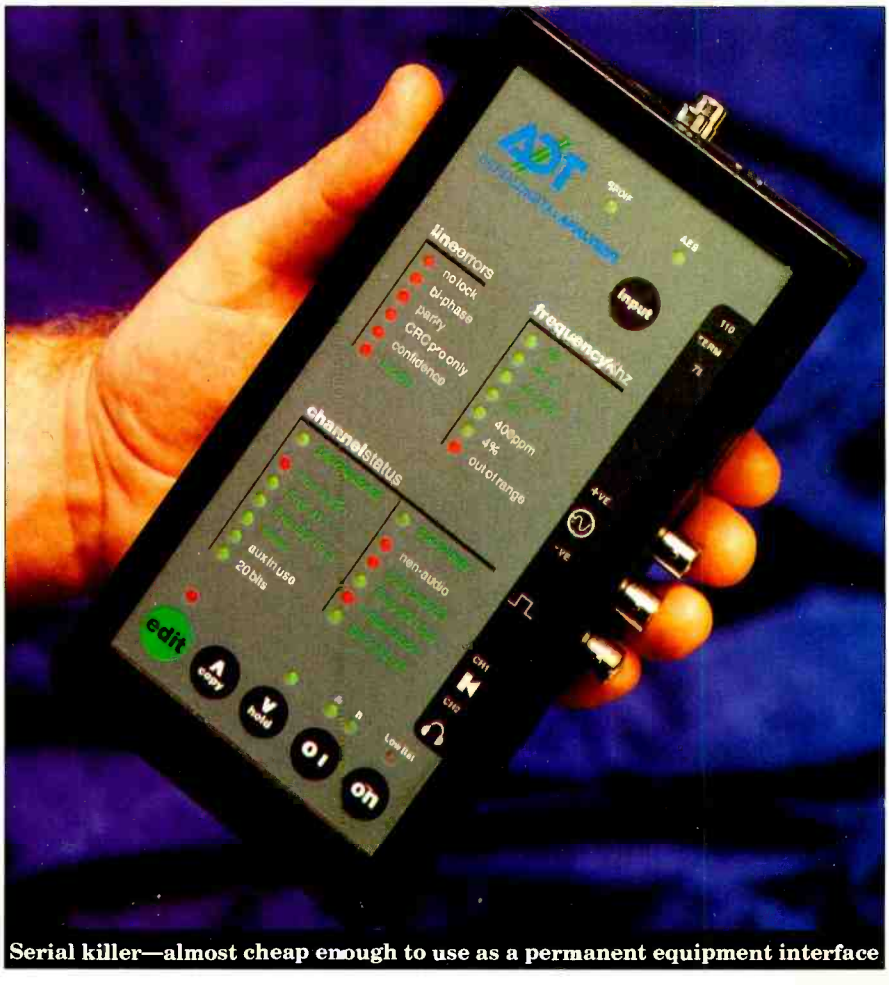
The channel-status display allows the user to see whether the incoming data is in either consumer or professional format, and then correctly displays the meanings of certain bits in the appropriate format. For example, the consumer section includes display of the presence of a pre-emphasis flag, the copyright assertion flag and the SCMS copy generation. The professional section shows two different types of pre-emphasis, the stereo mode flag, a LED to show that the audio signal is flagged as having 20-bit resolution, and another showing that the aux bits are used for up to 24-bit audio words. All this, of course, depends on the manufacturer of the source device having implemented the flags correctly (or at all).

An Error Hold mode is possible, allowing any received changes from the initial state of bits to be latched and displayed. Consequently it would be possible to go away and leave the SDA in circuit during a transfer and allow it to store any interface errors that occurred during the transfer.

The Edit mode of the SDA allows certain channel-status bits and the validity bit to be inverted at the retransmitted output. When the outputs are enabled they both carry whatever input data is selected, therefore the professional interface can be made to transmit consumer data and vice versa. The edit functions therefore allow audio data to be retransmitted over either type of electrical interface with modified non-audio bits, making it possible for the user to establish communication between two otherwise incompatible systems. The consumer mode allows modification of the copy-protection status and SCMS generation for cases when legitimate digital copies need to be made between two consumer devices. The SDA is almost cheap enough to be left in circuit between two incompatible devices as an interface adaptor.■

Francis Rumsey

Audio Digital Technology,
178 High Street, Teddington,
Middlesex TW11 8HU, UK.
Tel: +44 181 977 4546.
Fax: +44 181 943 1545.



Serial killer—almost cheap enough to use as a permanent equipment interface

SPL Optimizer

Many manufacturers put out products identified simply by a model number of variable arbitrariness, safe in the knowledge that audio people love talking in code. Everyone knows a *414* from a *441*, a *DA-30* from a *DA-88*, and an LNE from an XLR, and the bandying about of such impenetrable jargon signifies fully paid-up membership of the club. It is possible to come a cropper, however, and other manufacturers know the value of a memorable, informative name. Few know which model of Mercedes-Benz or BMW is which, but give a car a name like *Mondeo* or *Clio* and it sticks. Aphex, for instance, love names, with products which sound like the bad guys in a comic strip, and after a shaky start during which the most bizarre products carried the most mundane numbers, SPL decided to follow the same path. Thus the *Vitalizer* suggests its half-and-half role of EQ and enhancement, and the *Optimizer* suggests—what? FM broadcast processing perhaps, or at least some form of dynamic control? Wrong; the *Optimizer* is no more or less than an extremely adventurous equaliser. But at least we will remember its name.

The *Optimizer* provides four bands of versatile EQ and filtering, usable as a single 4-band path or two 2-band channels. Each band is identical, offering full parametric EQ or high-pass, low-pass, band-pass or notch filtering, all with frequency adjustable from 10Hz to 23kHz in four broadly-overlapping ranges. The four bands can all be set to different functions, giving an enormous range of possibilities.

There are, as there would have to be, a fair number of controls on each band, and their functions are obvious when in Parametric mode. The FREQUENCY control is uncalibrated, marked simply from Low to High, with limits set by the various combinations of two push buttons. The available ranges have a considerable overlap; the lowest is 10Hz–2.4kHz while the highest is 112Hz–23kHz, a range which should cover most needs all by itself. The disadvantage is the resulting low resolution of the FREQUENCY control, with small movements making, perhaps too big, a difference for easy critical adjustment. Q is calibrated from 1.5–0.2, and the final control provides 12dB of boost or cut. This is on the modest side for a dedicated parametric, and is complicated by the fact that the *Optimizer* uses what SPL call 'proportional Q' filters which reduce the centre-frequency gain as the bandwidth increases so as to maintain a more constant subjective level. This means that with the Q at its widest, the equaliser will only give 5dB of boost or cut at the centre frequency, which sounds limiting but in practice appears not to be. It does have the desired musical effect of keeping the perceived loudness steady and reducing the need for gain adjustments as the EQ is changed. If the gain does need to be altered, each band has its own output level control ranging from -80 to +5dB.

Things become slightly less intuitive when the unit was switched to one of its basic filter modes: Band Pass, High Pass or Low Pass. Selection of centre or cutoff frequency uses the same controls as the parametric, but the BOOST-CUT control is now used for the steepness of the filter slope. Fully anti clockwise it is marked Gentle while clockwise is Steep, and although the characteristics are not specified the slopes are usefully distinct. The surprise is that in its central position it nulls the signal almost completely, giving rise to the curious situation that a device apparently set flat can be giving no output at all. The situation is made less comprehensible by the fact that the intermediate positions appear to do little other than make the same setting quieter —the slope and the perceived filter characteristics remain about the same. A simple STEEP-GENTLE switch would have done the job for me, and avoided any possible confusion. That said, the results the filters produce are very usable, further helped by the Q control which in HP and LP modes adds a variable boost just before the cutoff frequency.

The final mode for each band is Notch, which provides a deep notch of variable width at a centre frequency chosen in the usual way. At its narrowest it beats the quoted spec of 60dB rejection without too much effect on the surrounding signal, and at its widest it provides well over 70dB of cut, albeit with significant loss of the surrounding frequencies.

The combination of four of these very flexible equaliser-filter bands is powerful indeed. In Mono mode the possibilities of a 4-band parametric, two bands of parametric with flexible high and low-pass filters, one parametric with filters and a notch and so on should deal with most eventualities, while dual-channel mode still provides a useful range of combinations. I particularly like the idea of using the *Optimizer* in a gate or compressor side-chain, where the ability to fine-tune such a bank of filters should allow treatment of problems most gates' own filters would be stumped by.

All too often, a product which attempts to be all things to all men ends up disappearing up its own output socket. Proof that a jack of all trades is rarely master of any of them, it's often the last thing you'd use to do any of the jobs it thinks it can do. Not so the *Optimizer*; it manages to offer all the filtering functions anyone is ever likely to want and carry them all out not just adequately, but interestingly and musically. It is operationally quirky and it looks a bit utilitarian, but none of that should matter to the professional beside the fact that it is an unusually powerful, useful tool which does its job well. Remember the name. ■

Dave Foister

SPL, Hauptstrasse 59A, D-41372, Niederkrüchten 1, West Germany.
Tel: +49 21 63 9834-0.
Fax: +49 21 63 9834-20.
UK: The Home Service, 178 High Street, Teddington, Middlesex TW11 8HU. Tel: +44 181 943 4949. Fax: +44 181 943 5155.

SPL *Optimizer* – interesting, musical and flexible

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Old time, step time meets MIDI manageability in the *MAQ 16/3*

Doepfer Musikelektronik *MAQ16/3*

It is strange the way some things come full circle. I can remember a time when I had my hand in my pocket ready to buy a stand-alone step sequencer for my Korg *MS20* monophonic CV synth convinced, that this would revolutionise compositional creativity. Fortunately—or unfortunately depending on just how rose-tinted my memory glasses are —the salesman mentioned carelessly that this 'new MIDI business' was making it possible to run far more sophisticated sequencers from toy computers. A fleeting period of consideration had me backing out of the shop (hand still firmly in pocket) not fully understanding but wondering whether such a piece of software would allow me to duplicate those step-sequencer effects that I so wanted. Of course, I got sidetracked along with the rest of a generation and never really bothered. But everything comes around.

The *MAQ16/3* from Doepfer Musikelektronik is described as a MIDI analogue sequencer and does everything those early sequencers did—but it does it over MIDI and with a little more panache. The *DEQ* was originally developed for electronic music pioneers Kraftwerk, but has since found homes with New Order, The Human League and Pascal Gabriel.

The sequencer is a 3U-high rackmount with an external PSU and MIDI Out and MIDI In (sequences can be influenced by incoming MIDI data) on the back panel. On the front panel there are three rows of 16 knobs each with an associated LED which flashes when a particular event is triggered, a rudimentary (although large) LED display, eight function buttons each with its own LED, plus an noncontinuous dial for parameter entry. Complete configurations of the 48 knobs can be saved in four preset memory locations.

Each row of knobs can be programmed to emit different types of MIDI event such as note on and off, velocity, continuous controller data, pitch bend, patch changes and mono and poly aftertouch on a specified MIDI channel. Advanced features add dynamic channel-switching from one row of knobs into another, and similarly note addition and transposition. All these functions are entered from the EVENT button and follow a method of data entry that is shared by all other function modes —press the relevant button, its LED lights and the display shows the parameter. The parameter display flashes alternately with a dot indicating which of the three rows you are currently adjusting. Subsequent pressing of the appropriate function button scrolls through parameter access for the three rows.

Each row sequence can be reduced in length by adjusting the first and last step, and the timing of the rows relative to each other can be adjusted in units of MIDI clock to give syncopated feels or different tempos altogether. A MODE button changes the running order of a row's sequence between Forward, Reverse, Pendulum and Random settings. The device will sync to an external source and dump its presets via MIDI.

The SINGLE STEP function button allows the parameter dial to step through a column of three steps one at a time with a numerical display given for any one of the three pots when turned. Without this, precise programming of sequences with notes, pauses and other data becomes a very frustrating affair as you are constantly trying to catch up with the sequence. However, the more haphazard approach does prompt up the occasional attack of inspiration.

The dial is a touch notchy and tricky to adjust finely, and also requires autonulling in order to pick up a parameter. Similarly, the octave span when on its widest setting (the range is 1–5 octaves in octave steps) is difficult to set accurately from the knobs and it is sensible to limit ranges if you want to work quickly with multiple rows. The knobs are not continuous and have physical octave end-stops. Each row is monophonic, so the full compositional might of the *MAQ* amounts to 3-note polyphony. If this bothers you then you are missing the point.

In use

I can still get a buzz from complex, short-step sequences played back at high speed but I realise that I'm a bit strange like that. The significant thing about the *MAQ* is that you can also develop a sequence with a splash of continuous controller data to alter the timbre, change velocities, aftertouch and all that jazz to spice it up, and make the sequence evolve. You can also transpose rows from an external keyboard and you can slip and groove the three rows relative to each other without any headache to make even the most banal collection of clips sound meaningful.

Perhaps most surprisingly, this unit has a lot of scope for real-time live adjustment and experimentation (loosely in the vein of the *Zyklus* machine), providing that you do not cut out note-off commands.

The *MAQ* lends itself well to integration into a MIDI system where it can be made to work musically as a bass-line generator, a musical feature or for general underpinning. The dance brigade will love it as will ambient artists.

The most distressing thing is the flashing alternate display for parameter value and row selection as this definitely slows progress and I find it hard to believe that the two could not have been combined on the same display.

The variability is incredible and far exceeds what you would expect to be able to achieve with such a basic concept. It does justice to those old analogue step-sequencers that the *MAQ* is based on particularly as you can use it to drive modern tone modules.

This is a wonderful piece of kit that is a lot of fun. It is also great to see an old-style principle implemented so intelligently and with such added value. ■

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CAD IN STUDIO DESIGN

Stuart Litobarski assesses the place of computer-aided design in the recording studio

Studio designers are quite a computer literate lot on the whole—if the findings of a recent survey carried out for *Studio Sound*, and around which this article is based, are to be believed. Virtually all designers use a CAD package in their work. And with the use of software in studio design growing, acoustic applications are expected to become an increasingly important, tool in the acoustician's armoury. One important difference in studio design—as opposed to concert hall design—is the difficulty in defining the acoustic characteristics of a small room, especially at low frequencies. While you could easily get a result for a bare rectangular space, the act of adding just one mixing desk will radically alter the modes, and can seriously affect the room response. So how adequate is the current generation of acoustic application software at handling studio design tasks?

CAD

The overwhelming majority of studio consulting firms use *Autocad*. The fact that many architects use this package must have played at least a small part in this decision. Another factor when choosing professional software is the level of technical support to which you will have access.

Real World's main recording room was an almost entirely CAD project

It seems that designing on paper will continue to be with us for the time being, because, on smaller projects at least, it is felt to be most time efficient to put sketches and even drawings on paper. Once the architectural paper design is complete, it must be demonstrated to clients. With the typical committee or decision maker being generally untrained at visualising a finished building from a paper design, this task generally falls to an architect or designer, who can reveal and explain the various features. Traditionally, scale models have been used at the competition stage.

Computer visualisation techniques now include animated rendering of 3-D CAD drawings, and video graphics. In rendering, the 3-D CAD wire-frame drawing is 'coloured in' with representative surface textures and colours, and lighting effects are added using ray-tracing routines. This allows that classic moon-lit, walk-through effect to be achieved, giving the viewer a strong impression of being in the building. The result is an image that looks uncannily like an architectural photograph. Virtual reality techniques can be expected to extend this illusion in the future. ACM used *Pointline* architectural CAD from Switzerland, that can make video animations directly.

Many add-on application programs are available for *Autocad*. They will access the actual *Autocad* data to produce calculations on things such as piping, HV&AC, quantity estimating, and other building services. To date there seems to be no system that will do this for acoustic calculations, although at least one firm of consultants have produced their own software to translate *Autocad* data into input for Odeon. This represents a major saving in time, as one of the difficult things pointed out was actual time that it takes to input data into all the different design programs. Many designers reported that they were using ray-trace or mirror image modelling software for acoustic prediction.

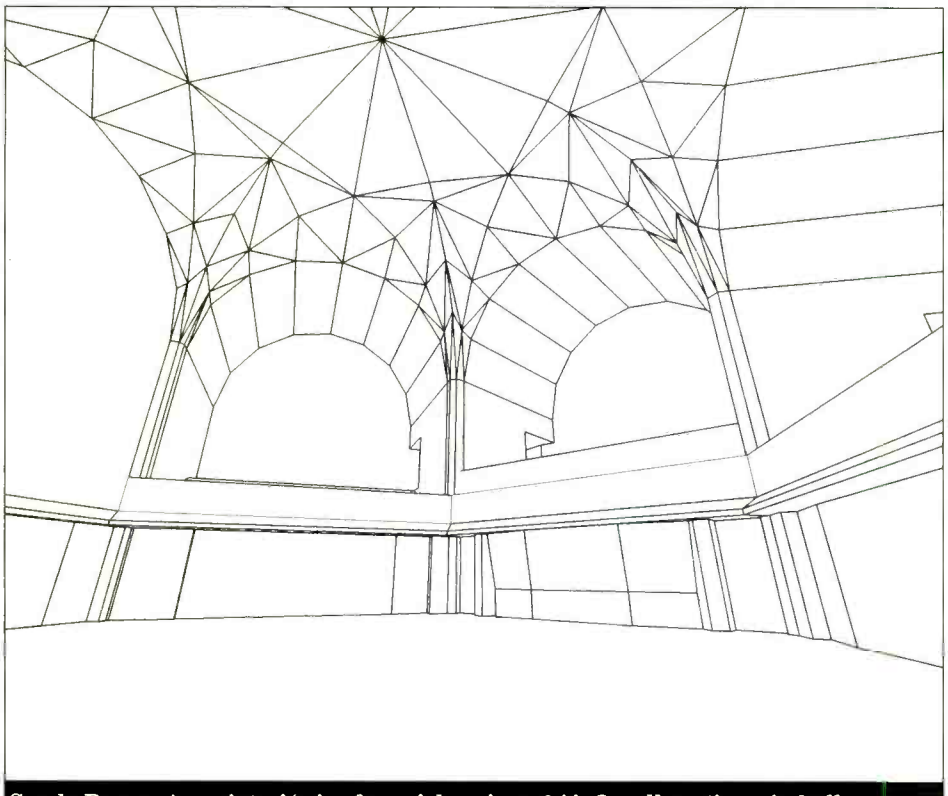
Many studio designers needed to use separate acoustic design packages for their work. There is a problem with data exchange between the various programs. The problem in getting data exchange software to solve the problem seems to be one of market demand. The replies received suggest that data import-export may be a major bottleneck to interdisciplinary design teams working over the electronic media.

Acoustic application software

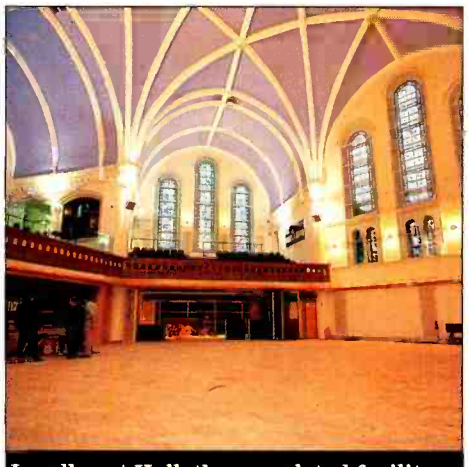
Almost all designers used a spreadsheet in some version. The ease with which calculations may be set up and modified makes this a major asset in the day to day calculations that are the workload of the engineering consultant. As time goes by, sets of spreadsheet templates are built up which can be used again. Spreadsheets have the advantage that the output can be easily printed in graphical form, and readily incorporated into reports.

Many designers used DOS as well as *Windows*-based programs. This is not surprising. In an area such as acoustic data processing, that takes up much processing power, the processing overheads of the *Windows* GUI can be a definite restriction.

Specialist acousticians such as Mike Barron have become skilled in acoustic measurement techniques based on scale



Sandy Brown Associates' 'wire frame' drawing of Air Lyndhurst's main hall



Lyndhurst Hall: the completed facility

models, to predict the acoustics of a proposed scheme. New computer techniques, whereby a block of plastic can be sculpted using laser beams that are driven by 3-D CAD software, means that scale models may continue to play this in the future. However, computer programs that use ray-trace or mirror-image techniques are starting to assume this acoustic prediction role.

Acoustic measurement systems

Once the design—be it paper or CAD-based—has been realised, some method of measuring and fine tuning the finished product must be used. Test data is used to plug updated parameters, such as the room surface absorption characteristics, back into the design software. The result is a more accurate design prediction the next time around. Several systems are currently available to tackle the task of these acoustic measurements, different designers and consultants naturally favouring different systems.

The simplest method is just a measurement of sound pressure levels. A white-noise source is played through each monitor, in the case of a control room, and the level in third-octave frequency bands is recorded at the listening position. RT60 measurements may be made by stepping off the test signal and measuring the decay time.

This method is essentially frequency domain, and has its limitations, but is nevertheless useful in measuring the steady-state room response at the listening position. Moving the measurement mic around will normally reveal great differences in response to the modal pattern in the room, and this can be an indicator of the diffusion properties of the room. Many measurement systems can do this test, including hand-held sound-level meters, when used with the appropriate noise source, which can even be a CD.

The B&K *2012 Audio Analyser* works by producing a swept sine signal. In a manner reminiscent of the sonar chirp signal, the bandwidth of the signal determines spatial accuracy. Because the signal never stays long on any one frequency, it effectively acts as a pulse at that frequency, thereby allowing anechoic measurements to be taken when the received ▶

THE DESIGNERS

Andy Munro, Munro Associates, London

'We use the CAD programs quite often, partly for receiving and exchanging files. Amongst ourselves, we tend to use some PC-orientated, *Windows*-based CAD systems, mainly because they're quicker for doing simple 3-D and even 2-D stuff. Most of the other software we've used off and on. We use *Mathcad*. I've used some of the modelling programs, but I don't find them very suitable for studio design In terms of use of computer and CAD systems, in general we don't do anything else—we don't have pens in the office any more. The last time I saw the drawing board I think it was piled high with magazines. We're totally CAD based.

'MLSSA was a fairly simple concept when it first came out. The minute I first saw it in the *AES Journal* I jumped on it. Now, four years down the line it's an extremely powerful software tool—but it took four years to get there. I don't think anybody comes out with the perfect system in this line, because there is so much development time involved. We've developed quite a strong user base as far as MLSSA is concerned, I think we've got about 200 users in the UK now. And they are fairly interactive in their own ways. A lot of them are loudspeaker manufacturers and a lot of them are systems designers. They obviously work quite well together and constantly send each other measurements asking, 'well this is what we get, so what happens if we change that?

'The only way you can really get a complete answer, that would virtually guarantee a result would be to use finite element analysis. But, that kind of modelling, a, uses up a lot of computer, and b, actually is fairly complex to program in the first place. You're talking about a finite analysis system coupled to a fair amount of input by people such as ourselves, to actually make it do the acoustic modelling. But that is the way to go —that's where you'll see the greatest advances in the next couple of years.'

ACM, Germany

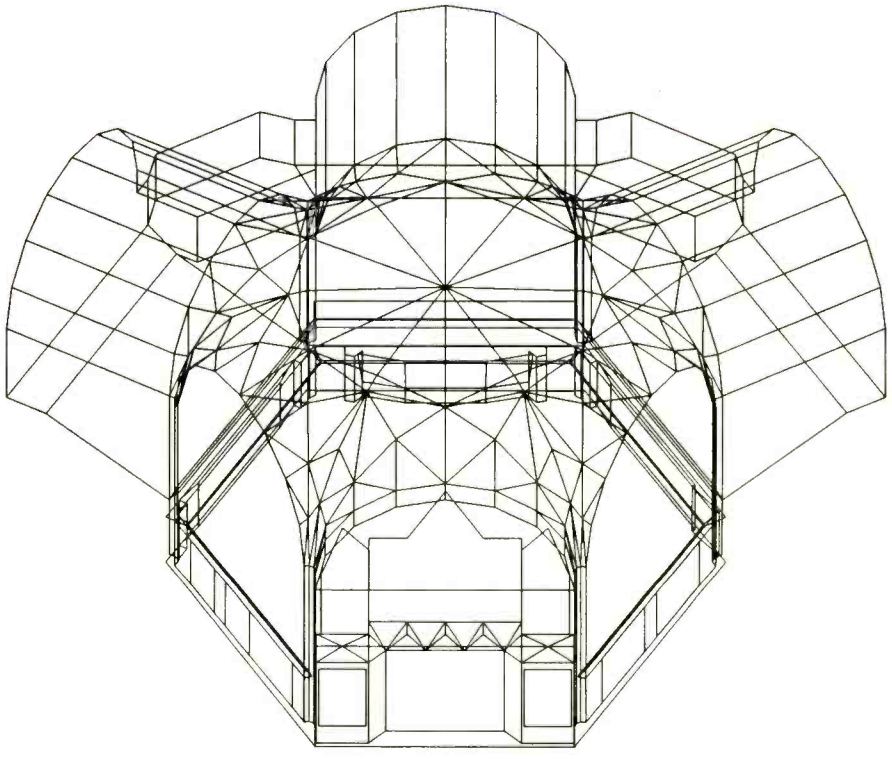
'Ray-tracing software and auralisation, whilst wisely used in large rooms, are to be handled as a tool like other tools. Decisions should not be based on their results alone. Calculations and experience must come into play too. We use these new sound tools with the same approach to calculations as we did before. The only difference is the ability to handle a bigger amount of data in less time, which improves our work in the sense of being more detailed and more exact. Furthermore, we have the possibility to try 'what if' solutions, which would not be possible with a manual system.

'If these software tools are used in the right manner, the predictions are confirmed by the measurements, of course. Unfortunately, a lot of people believe that computer programs are prophets, which can do all the calculations without any knowledge of the scientific basics. In several cases, we were called in to repair rooms that were designed by other persons whose calculations were based on software simulations. The users had completely ignored the fundamental acoustical relationships.' ▶

ARO, Adelaide, Australia
'We've got *Autocad LT*, which is fine for doing plans, but that doesn't have any acoustical features, of course. I think certain people are working on it, so hopefully they will come up with something good. Finite element analysis would be the way to go. I've found that MLSSA is not quite so accurate as TEF for straight acoustical work. We're working on remote testing using MLSSA.'

Neil Grant, Harris Grant Associates, UK
'As in other industries, CAD is no substitute for prior knowledge, it just makes it quicker, providing insights into mechanisms that might otherwise be obscure. Exceedingly powerful software is being used in the automotive and other industries. These provide a level of sophistication not commonly found in our own industry, although many companies use their own bespoke packages and notebooks that are proprietary and useful.
'Much work is being done on re-defining the performance in 4π} space of acoustical materials, in formats suitable for use in acoustic design programs, but they are all hardware limited. The DISC project [Dr. Peter D' Antonio in the States, Mendel Kleiner in Europe] is working on standardising this format, although their prime aim is auralisation. Currently, all of these packages are simplistic, but good sales tools.'

David Hawkins, Eastlake, London
'I've noted that any idea that is not the architects own is difficult to communicate to them. CAD's most beneficial use to ourselves was, and still is, in the preparation of cutting drawings for when we order-up the components for 9-element window systems of extremely complicated geometry. We are probably a little different from other outfits in that we are a design-and-build operation and a great deal of our work is overseas. People say to us, "I want to put up a studio in Athens, or Nigeria or wherever, would you design it, and would you prefabricate it as far as possible, and would you send out all the people to assemble it on site?". And that is our market niche. It also happens to be the area that we've got more expertise in than almost anybody else. I suppose we've built about 340 rooms in about 36 countries now.
'At the end of the day, it's garbage-in garbage-out. Anyone who thinks that *Autocad 12* is going to make a good draughtsman out of somebody who is not basically disciplined to think, and to create, like a draughtsman, is going to wait an awfully long time for drawings to start pouring out. I work with drawings every day of my life, and I'm amazed that 99% of the population that doesn't work with drawings have a mental block on making a composite mental 3-dimensional drawing out of a couple of 2-dimensional ones. CAD is useful for that, and for being able to turn things round on an axis and so forth, but we often find that our commissioning clients need to see the simplest representation of whatever they are discussing with us, rather that a more complex and versatile model.' ▶



A further 'wire frame' model of Air Lyndhurst

signal is gated. Although the system is expensive, high accuracy of frequency discrimination is claimed down to quite low frequencies, when the test procedures devised by B&K are carried out. It is useful for locating narrow-band resonances, and edge diffraction effects in loudspeakers. Data may be down-loaded into a computer for subsequent analysis.

TEF is a variation of the B&K system. It uses software to produce waterfall time-energy-frequency plots of the sound decay within a room, hence TEF. The well-known TEF plots show the room decay at each frequency over a period of time. This type of plot is very useful, for example, in detecting low-frequency modal effects or in identifying the location of a single reflecting room surface. Again, data may be downloaded into a computer.

MLSSA is much favoured by loudspeaker manufacturers and system designers, who make many frequency response measurements. A quasi-random noise-test signal is used that gives an improved signal-to-noise-ratio over previous systems. The synthetic test signal is quite unique, and easily discriminated against background noise. This allows all sorts of clever things to be done, such as taking test measurements from a sound system, while music is being played through the loudspeakers at the same time. Later versions incorporate many of the features of TEF.

Many consultants use their own proprietary systems, usually based around data acquisition by a computer. This allows software to be tailored to the individual workload of the consultant. Indeed, several consultants code their own computer programs. This allows a complete say in the mathematical algorithms that will be used. Virtually all acoustic application programs make major assumptions in their algorithms, in order to simplify the calculations and produce a result in a reasonable time. Very few software houses reveal all their algorithms to the end user. Users are often in the dark regarding the validity of results, when the software is used in different situations. Coding your own algorithms gives you a much greater say in how your data will be crunched. Consultants SAI do much work in DSP, so they make extensive use of *Mathcad*. They use *Mathcad* to transform the filter coefficients, and to simulate and verify DSP results before a design is put into practice.

Auralisation

Auralisation is a new design technique. A 3-D CAD model of a room is analysed using ray-trace or mirror-image techniques, to produce an impulse response based on the dimensions and surface coefficients of the room. This impulse response is slotted into a digital filter, that is used to filter an anechoic recording according to the predicted room response. The result is that the filtered recording will sound similar to the way that real sound would when reproduced in the physical room. Auralisation allows comparisons of the effects of design changes in ▶

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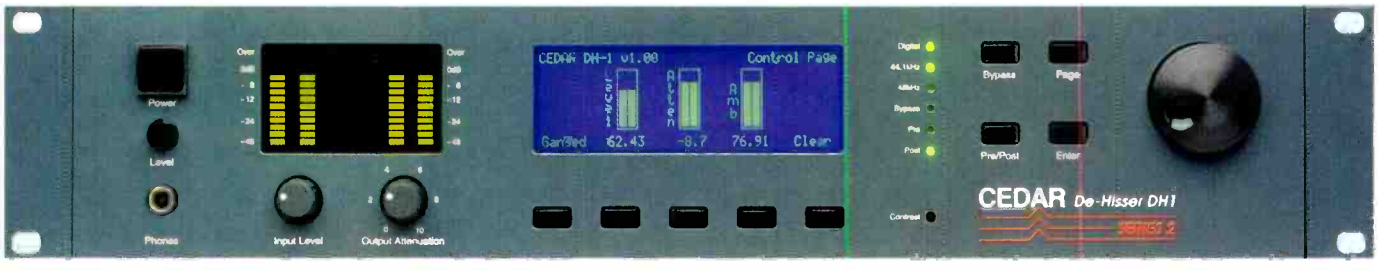

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Jack Metcalfe, Sydney, Australia

'We find that we still need paper drawings at this stage. Using TEF allows one to refine the models. Our models are still reasonably crude, but they are slowly evolving. We are interested in direct connection between CAD and materials data lists, using quantity survey programs, estimation and costing software. We would like to see, and are working towards, connection with numerically controlled cutting equipment, through CAD output files.'

Sam Berkow, SIA Acoustics, New York, USA

'I use *Autocad* for drafting and 3-D drawing. I use a wide range of acoustic design software, much of which I have been forced to write. The reason we wrote our own is that when I worked at Artec there just wasn't a commercial package. There's also the point that a number of manufacturers don't tell you what calculations they're doing. We put all of our time in the calculation functions and not into the user interface, because we don't sell software. So, as typically half the development time is spent on the user-interface, we were able to spend much more time on just getting the calculations right. SAI acoustic is a leader in the field of audible simulation

'I have used *Mathcad* for many years and have developed many spreadsheets for specific applications. Many consultants are unaware of the assumptions built into several of the leading packages, creating a false sense of security. This point should be made clear to *Studio Sound* readers, small rooms and large rooms are acoustically different! Small rooms are much harder to model, because of the modal nature of small rooms

'Scale models are very very useful. Very few people can really look at a drawing and "see" a 3-D room. Lastly, I think that the hand drawing, sketching process is very important to creating successful designs.

'The challenge for people doing acoustical computer modelling is to remember that ultimately, what the rooms sounds like is more important than the mathematics. But, it's my experience that getting the mathematics right yields the most reliable and reasonable result.'

Sean Davies, Wembley, UK

'After 35 years in the business I find I can often walk into a room and tell the client what the characteristics of his room are without hearing anything. I look at the spaces, look at the surfaces, the angles, and say, 'right, you'll get a phase shift at so much, that is about a wavelength at 40Hz, you're going to get a build-up of bass on the back wall, you're stereo image is going to be pretty poor, you're pans pots are going to work left, right, and nothing much else in the middle,' and they look sort of opened mouthed, and say, 'well how can you say that because you haven't heard anything.' I don't need to hear anything, it's pretty obvious in the layout of the room. If I can do that in probably five minutes dead, why should I sit at the computer for half an hour? ▶

the various acoustic parameters, such as shape, to be easily and economically made. A healthy market response to auralisation should drive the ingenuity of the software designers in coding improved algorithms. Although, to gain widespread acceptance, it looks as though auralisation will probably have to be linked in to a set of subjective acoustic values.

The auralisation technique is expected to improve as more feedback from measured field data is gained. That depends on the willingness of acoustics designers to work with the new medium, and to generate results. Comments received suggest that the AES work into loudspeaker data libraries, and the DISC surface project, will prove essential. SAI Acoustics and CATT are just two of the firms who are world pioneers in auralisation.

Advantages of CAD

Most designers agree that more work is due on a method for data exchange between *Autocad* and the various acoustic design packages. The need for a detailed and comprehensive library of surface data was commented on frequently. *CADCAM* is being used or actively investigated in several cases. Eastlake Audio use it to produce cutting data for complex acoustic windows. Generally, the building industry is not perceived as being very hi-tech.

Several who were contacted agreed that ray-trace modelling software had been found to give good correlation with measurements in larger rooms, even when these were quite complex in shape. When kept to the task of designing reflection-free control rooms, results in small rooms could also be excellent too. Poor accuracy in small rooms at low-frequency was felt to be the major drawback to this kind of software. Existing loudspeaker data was felt to be insufficient in many cases.

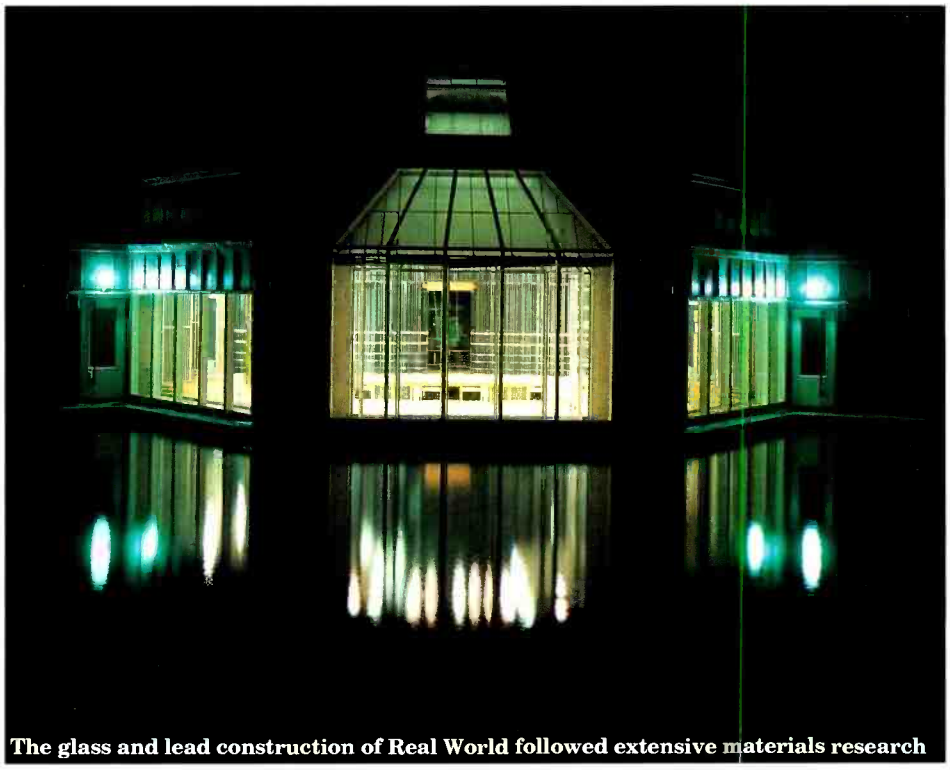
Internet and E-mail are already being used to transmit data between the different disciplines that are involved in designing a major studio. Sandy Brown Associates have been doing TV studios for the Olympics, where they use NBC's E-mail network. Andy Munro has used E-mail with Disney.

Many thought that visualisation, and auralisation, are excellent selling points. The majority agreed that virtual reality would be used to create novel designs in the future. Although, the general consensus was that it will be a long time coming.

Disadvantages of CAD

None of the existing CAD modelling software used was adequate at predicting the low-frequency performance of small rooms. Studies by CATT Acoustic at Chalmers University in Sweden using FE and BE analysis showed that even these techniques could fall off dramatically in accuracy, if the rooms were very small or absorbent. Nevertheless, German consultants ACM say they would like to see FE analysis programs available for use in their work. In the meantime, one answer may be to stick with proven models, or else a minimum room size, when working on critical listening designs for small spaces. Unfortunately, this was rarely feasible.

Designers who used a lot of acoustic design and modelling software often comment on the lack of suitable acoustic data to plug into the models. When a design system was used over a period of ▶



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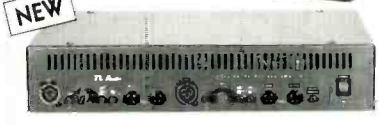

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'The thing about studio designs is that you get a lot of strange shapes for acoustic reasons, and the average draftsman doesn't normally meet these shapes, but the *Autocad* is useful in describing these. I've also got spreadsheets and *Mathcad* in the computer. The problem with acoustics design programs is that they all make assumptions, and they don't relate to subjective values, which is what much of acoustics is about. I see the acoustic consultant as the person who can take the wishes of the client and turn them into specifications for materials, angles, and construction and so on. and I don't think the computer can do that because it has to have the input about what it is supposed to produce.'

Schu S. Yamaguchi, Acoustic Design Group, Japan

'Paper drawings are used for the basic design. We use both TEF and MLSSA, and we have found the results of reverberation time calculations, using predictive modelling software, to be shorter that the actual measurement results. We would like to see acoustic design software included with CAD, and combined with a virtual reality system.'

Nick Whitacker, London

'We use TEF systems for acoustics analysis, and Norsonic and CEL for environmental work. Spreadsheets are used for cost analysis. We have done some work with EASE-Hypersignal predictive(a ray-tracer) software for large spaces. Apart from these computer based items I do not really use architectural CAD systems myself, although I continue to evaluate their development.'

Richard Galbraith, Sandy Brown Associates, London

'Almost all the drawings and calculations that we do are in computer programs of one sort or another. We don't have any drawing boards in the office anymore. We use *Odeon* software for modelling, although we all know what the disadvantages of modelling are. One of the problems traditionally has been the difficulty of inputting data, but we have written our own linking software now, so that we can take *Autocad* models and inject them into *Odeon*. They thought it couldn't be done. The model shown of Air studios basically contains about as much data as *Odeon* can hold. I would say it is almost impossible to input that data on a point-by-point basis into *Odeon* by hand, it would just be a ridiculous amount of work.

'Every time I see a piece of acoustics software it always has this problem. It seems to me that one of the things that is required is to link with standard CAD programs whether it be *Autocad*, or others using DXF file formats or something like that. It is no good having a half-dozen different acoustics programs in which you have to input your co-ordinate data in different ways. *Odeon* and others have tried to get round this by creating their own little CAD system within the program. But, we would never contemplate getting people skilled in more that one type of CAD drawing, because it's just too expensive.' ■

Real World's diffusing wall was one of the first to be modelled by computer

time it was possible to build up an acoustic database, which would be used to train the system to better accuracy.

The future of CAD in audio

Multimedia computers are routinely fitted with a sound card of 16-bit or better accuracy. This means that many home computers already contain a powerful audio DSP system, featuring near CD-sound quality. Few designers admit to using these cards in their work. However, the sheer scale of a 700 million plus potential market means that something must inevitably happen in this area. What that will be, and whether it will put any studio designers and acoustic consultants out of work, remains to be seen. ■

Stuart Litobarski is an Acoustic Consultant whose main interest is in the acoustic design of recording studios. He still finds time to play bass with Bristol acid-jazz band Hi Jinx. A freelance contributor to several magazines, he is listed in *Who's Who in the World*.

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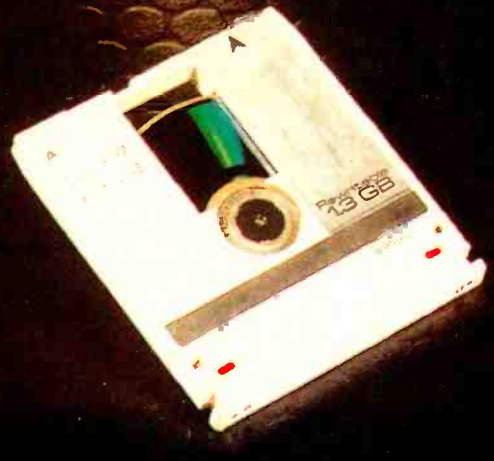

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DD1500

The various elements of the *DD1500* system-processor, A-D convertor, disk drive, remote and monitor

Akai's latest nonlinear recorder-editor further demonstrates the company's ability to marry functional power with ease of operation. Preview by Jim Betteridge

The *DD1500* is a new 16-track, hard-disk recorder-editor from Akai, with v1.0 software not scheduled for release until mid-December. What follows is intended as a brief overview of the system and its features; an in-depth review will follow in a later issue.

Though its name may suggest a vaguely linear progression, the *DD1500* could not be more different from Akai's existing *DD1000*, and is operationally streets ahead of it in virtually all respects. The system is entirely purpose-built with not a mouse or drop-down menu in sight. It comprises five basic sections:

The remote controller—which can be sited up to 400 metres away—is linked by a single, lightweight Ethernet cable, leaving the possibility of networking open for the future.

The 3U-high rackmount main processor which includes up to six stereo pairs of AES-EBU digital inputs and eight outputs, the time-code input and output and the many and various clock, sync and control connections that allow accommodation of, or into, virtually any standard audio, film or video system.

The 2U-high rackmount A–D convertor unit providing up to 12 analogue inputs and 20 analogue outputs on balanced XLRs.

The 2U-high rackmount box containing a hard disk of up to 4Gb and the optional optical disc-drive. Further suitable drives can be attached via SCSI as usual.

The standard VGA colour monitor which connects directly to the controller (no extra hardware required). This is assisted by a 40 x 6 character LCD set into the controller, below which are six soft keys. Here menus and options are displayed, the VGA monitor being mainly for track-waveform display and metering. If desired, however, the contents of the LCD can be shown on the monitor. In addition most people will want to get hold of a standard PC-style QWERTY keyboard from which all naming can be executed.

The user-interface itself is 19-inch rackmount although it can also be used desktop style. It is covered with generally large, easily targeted buttons bearing clear and familiar legends that will bring comfort to the mouse-weary operator. The most familiar of these are the transport controls: PLAY, STOP, REWIND, FAST FORWARD and RECORD. You can decide how fast the wind speeds are (up to five times play), and if you hit ▶

a WIND button while holding down PLAY it sounds just like a tape recorder shuttling in Edit mode —not a digital glitch to be heard. Indeed, the *DD1500* can be used in Record mode very much like a tape machine.

Eight illuminated buttons plus a 1–8/9–16 button arm the 16 tracks, while a second row of eight buttons mute individual tracks on replay. You arm a track, hit PLAY and RECORD and an extending red line on each track selected tells you are recording. You can also set in and out points for auto drop in and out, and check them before committing using the Rehearse mode. Hit STOP and you instantly have the waveform on the screen ready to be edited. Notice there are no changing modes, pages or screens; everything on the *DD1500* is accessed from the one screen thereby cutting down significantly on key strokes and general palaver. With all 16 tracks in view you cannot see any detail, but hit the ZOOM key a few times and you can get down to basic details instantly. The zoom range is currently not that great—about six seconds across the width of the screen—and more useful for fine editing is the JOG-SHUTTLE wheel which is among the smoothest and most accurate I have laid my hand on. Dropping in and out, manually or automatically, is gapless and silent. You can also overdub just as you would with tape.

There are no changing modes, pages or screens; everything on the *DD1500* is accessed from one screen thereby cutting down significantly on key strokes

Editing one or more tracks is generally very quick and intuitive. In, Sync and Out points are marked by punching large keys of the same names. The Sync point can be used to mark a reference point that is neither the in nor out point—say, to align a timp roll in bar 13 with a door slam in vision. For each project opened on the *DD1500* there are 100 numbered locate memories to jump directly to, plus 100 grab points (hit the big button marked GRAB to set one) which can be sequenced through at the touch of a button. COPY, CUT, ERASE, PASTE, INSERT, TRIM and DISCARD keys, plus a fill command, give a fairly clear picture of the basic tools available. For those oft repeated key stroke sequences a MACRO button allows six sets of key commands to be stored and recalled at the touch of a soft key. You can Cut, Copy and Paste to and from the library or the ten clipboard memories, with the latter being available for audition before you past them in. Above the transport keys are a set of play buttons marked LAST, IN-OUT, TO, OVER and FROM. Having made your incision, these buttons allow you to audition it in various useful ways. The LAST key will simply repeat what ever your last set of play commands were—very handy. If you do not like what you hear, there are 20 levels of undo and, as the tide turns again, redo. After all, the clients indecision is final.

The system locks to incoming time code extremely well and even shuttles with audio when following incoming LTC from a VTR in shuttle —backward or forward. It will also follow VITC and resolve to video sync or word clock. Unlike the *DD1000*, it actually resolves bit for bit to incoming LTC and hence a video sync source may not be necessary. RS422 Master mode allows full transport and jog control of other equipment from the *DD*'s remote.

The general smoothness and speed of the system is due to the use of three LSI chips developed by Akai.

The main DSP allows up to 32 events to happen simultaneously—say 16 tracks each with a simultaneous butt edit which can have a short crossfade to avoid clicks. It is also responsible for the beautifully glitch-free scrubbing in shuttle.

The mixer chip currently facilitates basic mixing whereby you can set a static level and pan value for selected tracks and set fade-in and fade-out times at the top and tail of each section of a track together with a level for that section. In the second half of next year a fuller software implementation will provide fully dynamic fader and mute automation (16:4) controllable from any suitable MIDI controller or Akai's own *MT8* mixer pad which has been designed as a semi pro device for use with the *DR8*—a less sophisticated 8-track hard-disk recorder. You will also be able to use the single fader and pan pot on the remote itself. In addition, the mixer will offer real-time EQ on a track basis. By the end of March there will also be real-time rate conversion on *playback*. This means you can record digitally at the sample rate as the source, include files of any rate in the same project, even on the same track, and the *DD1500* will convert them to a standard rate on playback. In this way 'bit transparency' is apparently maintained.

The graphics chip allows perfectly smooth, continuous graphics with no delays, jumps or screen redraws to contend with.

To the right of the LCD screen is a good size LED time-code display, and below this is a 3½-inch floppy drive. By the end of March 1995, this will allow EDLs from various major video edit suites to be inserted for autoconforming. There is currently no DSP active, even though the hardware and the basic software (inherited ▶

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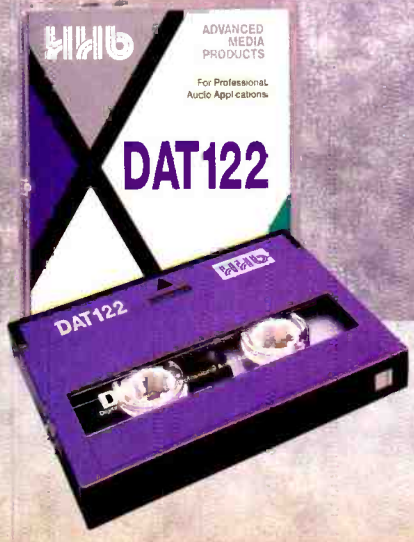

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from the *DD1000*) is in place. By the end of March 1995 this too should have been activated to provide time stretch, pitch shifting, varispeed, EQ and reverse. All the above improvements are included in the original price of the *DD1500*.

In terms of choice of storage, the *DD1500* offers 16-tracks from a hard disk or eight from one of the newer (faster) models of 1.3Gb removable magneto-optical drives. The limited number of tracks in the latter case is due entirely to disc speed and, assuming that they meet their intended spec, a new breed of 2.6Gb optical drive due out in Summer will be fast enough to provide a full complement of 16 tracks.

By March 1995 the *DD1500* will be able to recognise files from Akai's current digital recorder-editor, the *DD1000*, which is based around the slower 650Mb M-O drive. The removable discs are physically identical and are accepted directly by the *DD1500*'s drive. If you have a stand-alone 650Mb drive you will be able to use it to record, playback and edit with the *DD1500*, although it will provide only four tracks. These can be four independent mono tracks, as opposed to the two stereo pairs offered by the *DD1000*. In all cases, the number of tracks stated includes any being used for recording. Thus, if you are recording a stereo pair onto the 8-track-capable 1.3Gb optical drive, you will only be able play back six tracks.

The DD1500 offers 16-tracks from a hard disk or eight from one of the newer (faster) models of 1.3Gb removable magneto-optical drives

Archiving to Exabyte will be available by the end of January. Meanwhile, you can archive to any other SCSI device, such as an M-O drive, and the archiving can be made selective so that if you a stream of 30 different footsteps from a CD and ended up using only three of them, only the sections of the recording used would be archived thereby saving space.

In terms of cost, then, the basic system is positioned towards the top end of the mid-priced, computer-based systems, of which there are many. There is no doubt that the list of features offered by a number of PC or *Mac*-based systems is extremely impressive. To date, however, the likes of AMS, DAR, Lexicon and Fairlight have rested relatively easy in the knowledge that, although the bang-for-buck calculation may have seemed against them on paper, the mouse-and-menu interface is deemed too involved for some time-conscious, high pressure, professional, postpro facility houses. With this in mind, the *DD1500* with its unusually direct, straightforward user-interface and fast, unfaltering operation seems to be something of a breakthrough. Reliability is also a major factor for those working under the impatient gaze of clients. If the *DD1500* is anything like the *DD1000*, there should not be any problems there either. ■

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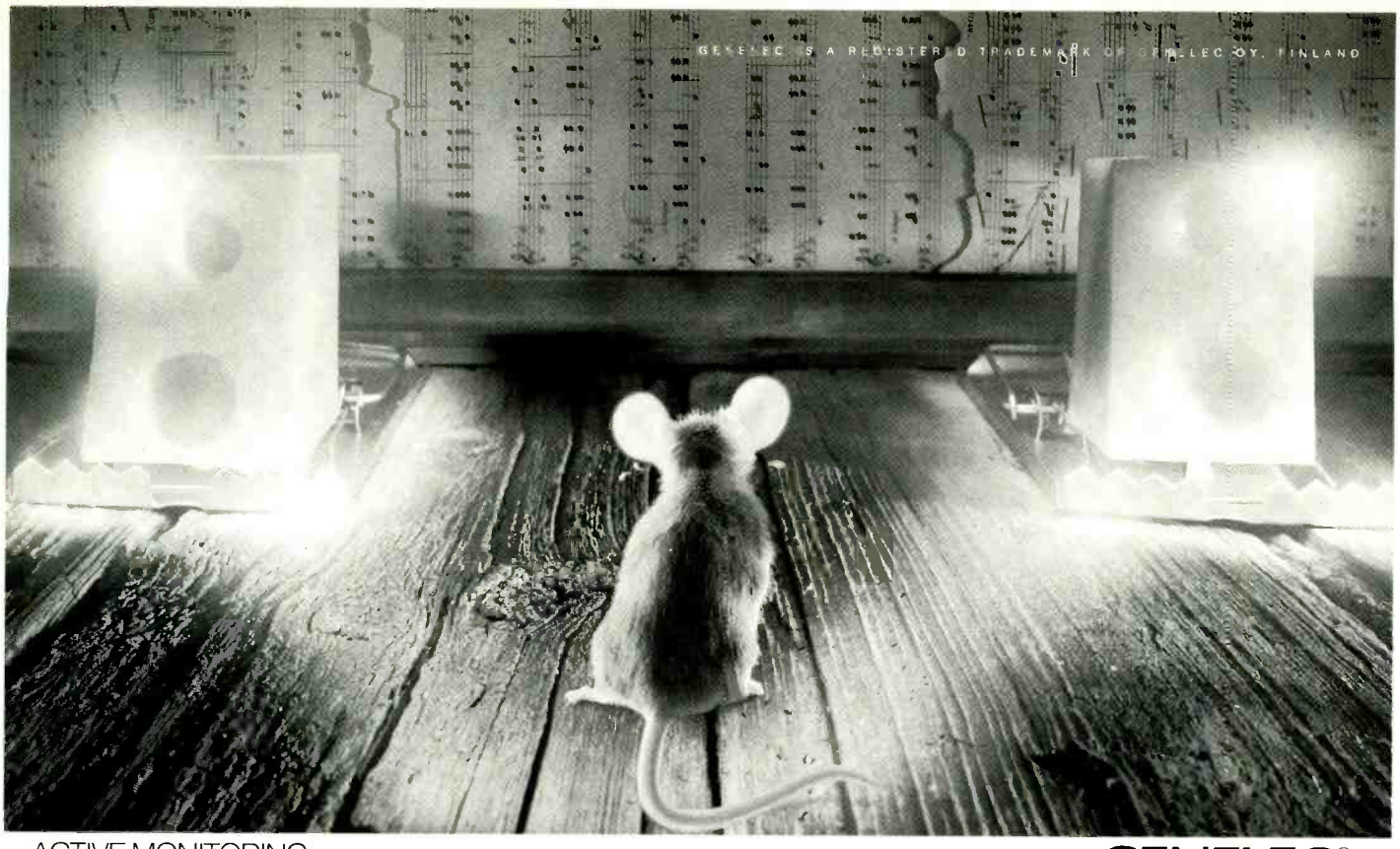

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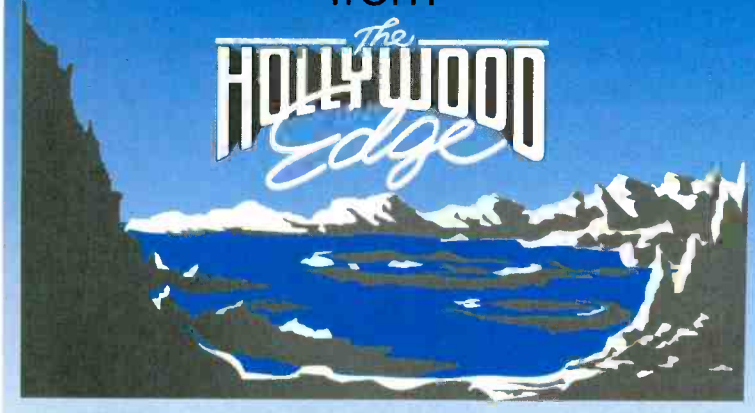

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NETWORK CONTROL

Allen Mornington-West outlines technologies and sets out some of the criteria for the future of network control systems

The obvious uses for a uniform control protocol are in large PA rigs, musicals, leisure centres and theme parks. To these can be added night clubs, smaller theatres, video suites, broadcast environments, small-scale live performance and virtual-reality sound systems. For audio equipment the provision of the facility is likely to be a complicating luxury in systems with less than five power amplifiers and associated equipment but an increasing necessity in systems where the number of audio units approaches 100.

But it is almost impossible to countenance a single network technology—or, more importantly, a single network protocol—being used uniformly throughout the world of professional audio, video and lighting control industries (PAVI). Since current design technologies for signal processing are converging, future for product differentiation will focus on the man-machine interface (MMI). These considerations suggest some level of protocol at which all aspects of PAVI activity could be drawn together.

At the present time, nearly all of the previously accepted methods of remote control in the world of the entertaining electron are up for change. The lighting industry settled on the DMX512 technology only a few years back and yet we are witnessing moves to provide something significantly better. Even the widespread and much abused MIDI is witnessing a new approach on its home territory of musical instrument control by the ZIPI and eXtended MIDI proposals.[1]

What seems strange is the grip which many manufacturers attempt to retain on their control protocols. This would be understandable if there were some doubt as to the stability of the interface involved, but it is more likely that the manufacturer perceives the loss of some proprietary control over the product. Yet 'open' protocols have witnessed most widespread use, and this openness has powered third-party application developers to extend the utility of equipment. Consider Ethernet, GPIB, AES3-EBU and MIDI, or the widespread use of the C language.

We need network control and monitoring because equipment is increasingly seldom close to hand —because productions are increasingly complex, because the public are increasingly discerning and because we have environmental issues to reckon with.

Characteristics

There is an inanity in the human psyche which leads an otherwise rational person to specify a £2m audio installation and then try to save a few pounds buying a cheap PC clone to drive it. While accountants may have a great deal to learn about engineering, there may be some virtue in engineers looking at life from the other side —occasionally. When it comes to something such as network control, it is no surprise to learn that the incremental component cost is intended to be below £10 ($16). For MIDI this cost can be below £5 ($8) but, as we will see, it is not a serious contender for the role of network technology.

For practical reasons it is useful if the combination of signalling rate and signalling distance can be optimised and an often quoted target is 125kB/s over 500m. At this rate it is only control and monitoring signals which are being considered; audio or video programmes require data rates beyond 123MB/s and there are emerging technologies which will facilitate this (such as ATM).

At the present time, the use of glass-cored fibre is likely to be appreciated most when the bandwidth of the medium is used to carry programme material at the same time. The apparent limit of 125kB/s and 500m reflect the need to be able to determine within a 1-bit signalling period that the control signal is correctly available to equipment nodes attached to the bus.

The issue here is one of latency and determinacy. Determinacy expresses the possibility of being able to operate the network so that an attempt to transmit information results in the network being in a known state. Latency expresses the time delay between the requirement to transmit a message and the time when the message is correctly delivered. For time-bounded systems it is important that latency is both bounded—that is, it can be guaranteed not to exceed a stated value and that the actual time is short. For the sake of a quick yardstick the reference for being on time could be taken to be within one SMPTE-EBU frame. Equipment such as repeaters and gateways modify the anticipation of latency greatly and, a gateway between a determinate bounded latency network and Ethernet will, in principle, result in loss of determinacy and bounded latency.

We will consider a true network protocol as being able to support both peer-to-peer operation and master-to-minion working. The earlier PA422 system predicates a master controller and in this scheme it is one of the tasks of the master equipment to poll attached equipment in order to update, for example, temperature or acoustic noise level values. Another feature of true networking is that is should be possible to design and implement bridges, repeaters, routers and gateways. Each of these necessary networking accessories will need to be intelligent principally because of the need to maintain some bound to the latency. From a system designers point of view, a network technology must offer galvanic isolation, low EMC emissions and susceptibility, and in-built transmission error–detection.

ISO OSI model

The Open Systems Interconnection (OSI) 7-layer model is a useful guideline by which we can judge the degree to which we have an acceptable network protocol design. Each layer can be envisaged as receiving and passing on messages to adjacent layers while it carries out a set of duties:

1. The physical layer is concerned with the unstructured bitstream over some physical medium. It is concerned with mechanical connections, pin numbering, cable, fibre and radio methods of bearing the bit stream and for establishing and maintaining access to the medium.

2. The data–link layer is concerned with reliable data transfer across the link. At this level, the data is organised into data frames, sync bits and stuffing bits are added and usually a Cyclic Redundancy Check is computed and appended to the bitstream. Finally, ▶

the data may be subject to channel coding such as NRZ, MFM or MLT3.

3. The network layer handles the consequences of collisions having been detected as a consequence it has some part to play in maintaining the link. The role is extended to provide continuity for successive frames which form part of a longer message.

4. The transport layer handles full blocks of data and the flow control associated with this.It will normally monitor any errors in the received data and act accordingly.

5. The session layer authorises access to the higher layers for the communication channel. Strings of packets which have been collated can be presented to the next higher layer as a set of checked data.

6. The presentation layer deals with reorganising data by converting it (between EBCDIC and ASCII for example) or decrypting it in order to present it to the next layer.

7. The application layer here is not the final use application layer; that is one of the next few layers with which the OSI model is not concerned. This layer handles the interface to the operating system of the host machine such as its filing system or storing away local variable values. It would be feasible to model the local maintenance of time code for example in this layer.

It is probably clear that the easy bit is in the first two, maybe three, layers. These are concerned with physical signalling and transport activities and, as an example, you might visualise how to place a large amount of MIDI operation into just three layers. MIDI, like DMX512, might be modelled as skipping all of the other layers and relating itself directly to the user's main program. What makes the design process a challenge is the need to design the messaging for these middle layers. The target is to achieve this in such a manner that the resulting protocol can be carried on almost any reasonable transport system. This should ensure that it will be possible to design a gateway between the various transport technologies.

Setting standards

It is the content of these middle layers which may be responsible for some engineers thinking that things have become far too complicated. They may only have wanted to change the gain on a power amplifier and adjust a graphic equaliser, but the equipment which our industry has designed is capable of greater functionality. The functionality can also be modified on-the-fly as is the cast with almost any equipment based on DSP. And, because we have no ideas what tomorrow's equipment designs will be, we need to design a protocol capable of learning what the equipment it is connected to is capable of. More than this, it should be possible to teach controlling equipment the rules of control. Thus the targets for the protocol require us to agree a data model for a generic entertainment equipment such that however it is internally organised, sufficiently intelligent learner equipment will be able to control the available functions.

This all implies standards, and that is where the AES SC10 has been active. This subcommittee recognised that there was a valid divide between the lower and upper layers of the OSI networking model and so it organised two subcommittees to bring forth standards respective standards. There are a number of candidates for the physical layer but not all of them are open or licence free. Indeed, for some of them there is no firm technical information at all. Some that are open are costly to implement while others have chosen to encapsulate all OSI layers within a proprietary closed technology. Because the AES SC10 is attempting to produce an open standard which has the acceptance of the main part of industry, it is clearly not in a position to settle the issue for some time. It may have difficulty doing this until the upper layers have been settled. Truly a chicken and egg situation.

Progress on the higher layers stalled for a short while though it looks to be freed now that meetings at the recent AES Convention agreed to publish the first nine sections of the committee's AES24 ID as a definition of the data model to which the protocols should relate. The issues which remain to be resolved include those of implementing automatic recognition of new equipment (possibly by way of a teacher-learner protocol), devising hooks for bridges and repeaters, understanding the problems of time code in a network environment and handling morphological dynamism in equipment attached to this work.

The issues which remain to be resolved include recognition of the new equipment, hooks for bridges and repeaters, time code and handling morphological dynamism

Meanwhile it is all too easy to focus on the physical layers for at least they can be assumed to exist . We'll look at some candidates for the task of transport bearer and at a later time, possibly after the AES Paris convention, we may be able to review the issues involved in the higher layers more thoroughly.

Simple architectures

The main network architectures are grouped according to their physical and logical arrangement. In most cases these reflect the signalling means and the way in which the signalling medium is accessed. The principal physical groups are:

Bus or spine: the connecting cable, or fibre passes by each equipment node and a connection to the equipment is achieved with a tap or T joint. There are usually constraints on the length of the tail attached to the T joint. It is usual for this scheme to implement one of the CSMA types of medium access by the Arcnet method breaks from this by using a token passing scheme based on equipment node identities. A straight bus is usually easier to lay out the cable for but, unless care is taken with the algorithm for medium access, access can not always be guaranteed. This means that efficiency, approximately the ratio between the practically achieved data-transmission rate and the maximum possible signally bandwidth, can be poor.

Ring: each unit is connected to the next in the ring by a cable or fibre. This format is usually associated with the token-passing method of determining medium access. The benefits of token-passing schemes include the determinable latency and the potential for using several segments of the ring at the same time in order to increase the use of the medium.

Star: a central hub is used to connect each unit individually. Though this could be realised as one large junction box, it is often handled as a logical ring in which each connection is handled in turn by some controller. The need to visit each of the nodes in turn means that for much of the time the equipment connection may be idle, but this does not bring the advantage that disconnection of any equipment does not break the network.

There are a few major methods by which signalling proceeds, more or less orderly, between consenting equipment.

Time Slot: this may be one of the more orderly approaches to controlling access to the communications medium but setting it up and maintaining timing may be a problem especially if it is a requirement that equipments be allowed to come and go arbitrarily.

Master Polled: this certainly requires the continued presence of the master controller in order to stay up. Where feedback from remote equipment is required, it is necessary to set up a poll, or request, in a fixed regular basis and in the approach would look rather like a form of master-driven time slot. Sending a group broadcast is an unwieldy activity as it means sending an individual message to each equipment node. But provided that the maximum message length of any packet is constrained to a known size the worst-case latency can be determined. This approach to accessing the medium is usually associated with physical star installation and this can lend itself well to installing an intelligent hub in the base of a rack with relatively short individual feeds to each item of equipment ▶

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under network control.

Token passing: instead of allowing a fixed time for each equipment to occupy the network medium regardless of whether there is any information to convey a node holds a token which allows it access to the bus if it has anything to say. When it has finished its turn it passes the token to the next equipment node. Two main forms of this exist physically. In the first the physical arrangements is actually a ring and the token is passed sequentially round. In an enhancement of this approach it is possible to use the fact that the ring is broken at each equipment node and that this isolates each segment of the ring and it is possible to have several message transactions occurring at the same time. The second format is physically a linear bus in which the token is passed to the equipment with the next valid equipment identity. This latter approach is taken by *Arcnet*. One minor drawback of the simple implementation of a ring topology is that in a large system it can be some time before the token is passed through the full round of addresses and thus latency, though determinate and bounded, can become rather large. One obvious way to circumvent this is to age the equipment addresses even to the point where, having not been actively involved in sending or receiving data for a number of periods, the equipment node effectively becomes dormant. When it is time to wake up it must negotiate for its existence to be recognised and for a fresh instance of its node alias to be determined.

CSMACD group: Carrier Sense Medium Access Collision Detection. The principle is that in a collection of a number of nodes it may become increasingly impossible to determine which is the node which will require access to the medium next. Accordingly there can be a free-for-all and the first stage in averting calamity is that before attempting to gain access to the medium a node shall monitor the bus activity until it has determined that it is clear to transmit. It is quite likely that, where is a large number of potential intercommunicants, other nodes might also take the same time to declare their hand. Each node is required to monitor the medium and to decode its own transmissions and where it determines that what it can receive is not what it sent it must assume some kind of fault. The interfering nodes are required to be silent before they attempt to gain access once more and they hold off trying for a random time. As collisions increase the length of this backing off, this delay is increased. This is the basis of the medium-access protocol used in Ethernet but it gives rise to the problem that the latency is potentially unbounded and indeterminate. Proposals to use the Ethernet transport system for PAVI signalling have suggested ways around this problem and one of them requires that the peak traffic is held to below a rate of 2MB/s, some 20% of the potential peak rate. This is a fair penalty to pay for the privilege of being able to use the standard hubs and repeaters used throughout the computing industry.

One principle variation on the CSMACD approach is taken by one of the industrial process control protocols known as CAN. In this scheme the signals placed on the medium (fibre or copper, for example) are monitored but the first part of the CAN packet is actually a priority code and this is used to determine that the highest priority equipment node has command of the bus. Because the determination of this is carried out on a bit-by-bit basis, it is known as Non-Destructive Bitwise Arbitration. The overall process is known as CSMA/CD/NDBA. CAN appears to have other interesting features which might suit transport methods for PAVI equipment.

There is one more characteristic which will need settling and that is the matter of the medium. There is a small field from which to choose:

Twisted pair: this is available in shielded and unshielded versions. Experience in high EMC environments indicates that it is the quality of the balancing which has most effect and the shield tidies up the EMC aspect, adds to the strength and the fun in terminating it. There's a wide choice of potential candidate cables.[2]

Coaxial: the conventional thin-net form of Ethernet uses coaxial cabling but this is often an expensive option.

Optical fibre: there is choice here since short-haul connections may use plastic fibre and cheap optical transceivers. Longer distances are best covered using single-mode fibre and these do provide greater bandwidth capable of exceeding 250MHz using a 1300nm LED, for example. One problem with the optical approach applied to a bus or ring topology is that each node has to remain powered or else the network will fall over.

These are typical physical and electronic arrangements for networking structures along with some of the commoner medium access methods in use. Technologies which can not implement a network approach are not covered here, which leaves MIDI and DMX512 out in the cold because they do not provide peer-to-peer working and because the scope of the definition of available commands means that every extension of the control protocol is an exception.

Physical transports

We should retain a distinction between the transmission of programme materials and control information. There are technologies which can be used to carry both types of information such as B-ISDN, ATM, 100VGAnyLan, but it might be preferable to consider them as simply bearers rather than the network itself. There is no reason why the two information streams have to be related and, besides, there remains the need to provide a reverse-signalling channel for all of the monitoring data to be sent back from wherever.

There are a large number of potential candidates and, with only slight stretch of perspective, over 20 may be available. This is not to say that others in use in professional-audio systems do not exist, but that details are not to hand at the present time. These include the Crown IQ, Crest NexSys, QSC QLink and the Lone Wolf MediaLink systems. All of these are proprietary systems and it has been indicated that is a full protocol standard should arise that their owners will attempt to carry the standard within their signalling technology.

We will look at examples of their electrical ▶

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waveform, as it is a means of showing their structure and their electrical driving and timing characteristics, in a second article. For the present, as a rough measure of their potency, we will estimate their messaging speed in terms of the greatest rate at which they can send a single byte payload and, as a measure of their ability to carry longer messages we will try a first estimate on the length of time which would be taken to transfer 1MB (125Byte).

Speedy message?

There is a point of view—not necessarily shared by all—that in a PAVI-based network control the type of messages transmitted will comprise mainly of short messages. These will be something like change gain to X, temperature is X, gang together A and B, Powerdown X, move X, acknowledge message, drop connection and so on. This, it could be argued, leaves other technologies to perform a better job shifting pages of text. Messages in long strings will however occur and two circumstances come to mind. The first occurs during the initiation phase of the network when various equipments set out to learn about each other. This process has been described as a Teacher-Learner Protocol (TLP).[3] The second arises when arrays or lists of values internal to a unit have to be sent—this might include a complete EDL, the complete set of coefficients for a DSP system and the complete channel settings for an audio mixing desk or lighting-control panel.

In a practical network, Ethernet would be hard pushed to reach 40% of bus utilisation and the messaging and transfer figures would be some 30% lower. An Arcnet system with a large number of nodes would spend a great amount of the network resource simply passing the tok (sic) round as each instance of token passing involves the equivalent of an 8-byte packet. The Echellon system was modelled using the standard differential mode in which there appears to be a lengthy waiting period at the end of each packet. It is this which appears to slow down the overall performance. The estimate for CAN assumes that the protocol in use is loosely based on the DevideNet.[4]

A summary here is invidious because each of the transport systems referred to could be considered an optimum solution for a particular use in which performance in one or other of the apparently key characteristics of a PAVI network has to be compromised in order to capitalise on other benefits. This focuses attention on the AES SC10 target to achieve a messaging protocol which can be carried on a variety of suitable transports. Thus one might use an Ethernet transport to shift a large amount of data, between a master controller and a standby controller, on an almost point-to-point basis. You might consider wiring a large site with an Echellon-based system because all of the systems components are available to the installer. It might be appropriate to arrange for a group of video playback machines to share a token ring–system hub. And CAN might see use as the final control protocol at individual equipment level because of its cost–effectiveness. At present there is no clear winner and it appears there will remain a variety for some time to come. ■

References:

1 A new network and communications protocol for electronic musical devices was published in the ICMC proceedings 1994. More information is obtainable from Keith McMillen, e-mail mcmillen@cnmat.berkeley.edu.
More information on eXtended MIDI from Digital Design & Development, 18A Godshuis Street, 1861 Belgium. Compuserve 73261,530

2 *DMX512, A Guide for Users and Installers*, Adam Bennette, PLASA, 7 Highlight House, MN21 3UH, UK. In addition to a concise description of DMX512 operation this text contains a useful list of cable types which might be considered

3 *Some Principles for Control of Entertainment Electronics by Networks*, Allen Mornington-West, proceeding of the Reproduced Sound conference RS10, Windermere 1994.E-mail 100044.1157@compuserve.com

4 *The DeviceNet specification*, Alolen Bradley Co, 747 Alpha Drive, Highland Heights, OH 44 143, USA. This sets out the full DeviceNet protocol for PAVI and it is worth considering adapting many of the measures rather than using them outright.

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Steve Levitt, Front of House Engineer, 28th Montreux Jazz Festival, Lisa Stansfield, Level 42

Photo: Montreux Jazz Festival main system (left).

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NAMOUCHE STUDIOS

When the Portuguese Namouche Studios decided to refit, they discovered a wealth of classic equipment earmarked for destruction. Philip Newell reports on a marriage of old equipment and new studio design

Namouche studios began life as Radio Triunfo in the early 1970s. Radio Triunfo was not as the name suggests, a radio station, but a record company owned by Rogerio Leal, and a church organisation. In April 1969, they commissioned the studio design from acoustician and Thermal Insulation-Isolation Engineer Andre Ledentu from Le Cannet. The studio was built as an extension to the rear ground floor and basement of an apartment building in Estrada da Luz, the road leading to the famous Benfica football stadium, Estadio da Luz.

Serious attention to equipping the studio seems to have begun in the mid-1970s, with a new Neve 16:4 *8014* console. Around 1978, a Neve *Series 80* console was purchased from Decca in London. This had been extended at some point to a 30-input 24-output format, though it is unclear whether Decca did the modification, or console electronics prior to shipment. Subsequently, the Neve console found its way to Polysom, another studio owned by Jose Serafim and Arnaldo Trindade. In 1982, Polysom bought Radio Triunfo, complete with all its equipment.

Running parallel to this operation was the Namouche production company (owned by Guilherme Inez and Ze da Ponte) whose main work was music for advertising, though the owners were also respected musical performers in their own rights. In May 1985, Namouche bought Polysom and within six months, also bought Radio Triunfo, so by the beginning of 1986, both studios were again under common ownership. The names of both were changed to Namouche. Three years later, Namouche sold the old Polysom studios, which are now known as Xangrila (Shangri-la), and at the time of the sale, virtually all of the ex-Polysom equipment was transferred to the former Radio Triunfo studio, which brought together under one roof a quite exquisite selection of classic recording equipment, including the two Neve consoles. These were believed to be the only two Neves in Portugal, except possibly for one which reputedly remains boxed and unused in a television studio. The 12.5m x 14m studio at Radio Triunfo, with its 6m-high ceiling, was one of the only studio rooms of its size in Portugal, so despite the winding down of the operation, the studios continued to find work. The former isolation rooms downstairs (below the main control room) were converted into control rooms for radio recording and jingle production, which provided a workable income for the whole; but despite the sporadic upgrading of equipment, the problems involved in finding spare parts in Portugal for much of the more esoteric equipment, meant that more of it was being put into storage. By 1993, it was clear that the situation could not continue indefinitely.

Inez and Ze da Ponte sold a large share-holding back to Jose Serafim, from whom they had bought the studios in 1985. Serafim now had his own very successful record label, plus CD and cassette production plants, but was without studio facilities. By the beginning of 1994, it was necessary either to re build or to close down the studio.

The 'old' control room showing stacked monitors and original Neve console

Aladdin's cave

Visiting Namouche in early 1993, I found an Aladdin's Cave of classic audio-recording equipment. The general state of repair was not good, partly as a result of sales reps being more interested in selling equipment than providing back up, and partly because finding alternative back up is no easy task. The equipment list included, however, many items unique in Portugal including around two dozen Neumann microphones, half of which were types such as *U67*s and *M49*s. Many people had told the owners that the equipment was beyond repair, as spare parts were no longer available yet I was able to find boxes of unused AC701 acorn valves for the *M49*s in a drawer of odds and ends. Downstairs, an Ampex *AG440* 8-track machine was being used as an interim 2-track for making radio programmes, replacing a 'dead' *ATR102*. This had been lying idle for four years after suffering a broken glass tacho-disc. The studio had been told locally that spares for these machines were no longer available—untrue, yet we did not need to search farther than a drawer in the workshop to locate a replacement disc. Such was the disarray.

'Good, modern equipment' such as Tascam, Fostex or Yamaha was being suggested for refitting the studio—the sonic quality of which falls far short of that of the dying equipment in Namouche.

Recognising my obvious enthusiasm, the owners arranged a period of four days for my son Julius and myself to see just what we could revitalise. We began with the 24-track Neve console, which was little over half functioning. Under the

The redesigned studio control room with Reflexion Arts *236* monitors and 'combined' Neve console

watchful and interested gaze of Namouche staff, we rectified fault after fault, and it soon become obvious to all that there was life in the console. At the end of the period, I was asked if I wanted to re design and re build the whole studio. The answer was an unequivocal 'Yes'.

Acoustics

Big changes were needed in order to bring the Namouche into line with current expectations. The studio itself has a floor area of about 175m², with almost 6m of headroom up to the first false ceiling. The general acoustic was somewhat strange, yet for most things perfectly workable. The ambience, however, was uninspiring and dated—before my visit, I was told that it was reminiscent of the old Pye Studio in Marble Arch, London. When I saw Namouche, I could see why: elevated control rooms, the general 'mid-browness' of the place, and the acoustic architecture which largely consisted of surface treatments. I chose to brighten the place up both visually and acoustically.

Namouche had not only managed to hold on to their classic equipment, but also to the paperwork. The explanatory plan of Andre Ledentu's original design was still held in the files after 25 years—it called for skylights, but being close to one of the flight paths into Lisbon airport, Ledentu recommended the idea not be implemented. Further, he called for a 15-inch soft-earth overlayer on the slab roof to deaden airborne noise, considered at that time to be around 90dB outside. Noise levels are by no means so high these days, as efficient high-bypass turbofan engines are significantly quieter than the *Concorde* style turbojet engines of the late-1960s. Certainly there was no aircraft noise apparent in Namouche, so Ledentu's isolation recommendations appear to have done their job well.

The walls consisted of alternate hard and soft surfaces of 12 sections of full-height wood panelling, about 80cm wide, interspaced with sections of fabric over a sort of Hessian-faced compressed glass fibre. The false ceiling was made of compressed glass-fibre tiles, but was unfortunately punctuated with perspex sheets to allow through the light of 48 fluorescent tubes. The entire lower section of the walls, from about 1.5m down, was covered in a perforated board, something like pegboard but from sheet wood, fixed over a glass-fibre backing. The entire wall adjacent to the booths and control room was covered in perforated wood, with sharp-angled protuberances to break up the uniformity of the surface. The floor was a fully-floated concrete slab with carpet on its surface. According to Ledentu's spec, the short pile carpet was laid to reduce the noise of feet and general movement. The specification called for 'a studio usable for a wide range of recording' of which drama would be a distinct possibility as the plan refers much to the intelligibility of speech and for which purpose, a general reverb time of around half a second had been the aim. Acoustic variability was to be effected solely by the use of around a dozen acoustic partitions which were hard on one side and soft on the other, and could be wheeled around. In general, the sound was lacklustre.

The original specification was written entirely in terms of room volume, absorption units, decibels of isolation and other technicalities. Not one word in the 20-odd page document referred to a musical instrument. Such was largely the accepted practice in those days, but as I pointed out at length (see 'Out of Control', *Studio Sound*, December 1993) what is specified technically and what is perceived musically are often only tenuously linked.

As there were many good points to the original design, I chose to modify rather than totally rebuild. Also, the late-1960s ambience of the design was not entirely without character. There are still a number of dated studios in Lisbon, but these will soon go leaving the 'new' Namouche quite ▶

The live area before renovation

distinctive in years to come.

It was decided to lay a light-coloured wooden floor partly to add more immediate brightness to the sound. Certainly the grand piano—a huge Czechoslovak Petrov concert grand—took on a significantly richer character after the new floor was down. To help to compensate the overall acoustic for this additional 175m² of reflective surface, about 70m² or 80m² of wall surface was treated with Noisetec *PKB2*, a deadsheet and felt barrier mat. This was then covered with a light beige 'stretch' material which cut down significantly the reverb time of the room as a whole. The movable screens were also made to be much more absorbent on their 'dead' sides, before being covered in the same fabric as the walls; a huge improvement on the original finish of a dark green, plastic garden mesh. Finally, the fluorescent lights were relegated to cleaning and maintenance duties and hidden behind a reduced number of perspex panels. Four 500m halogen floodlights were extended from the walls and ceiling (two from each) and now flood the ceiling from below, throwing a warm light down into the room. These can be further augmented by various par spotlights.

The old control room, in use until February 1994, was an unqualified disaster. It was too live, resonant, unsymmetrical, badly laid out, and had a wooden wall with small perforations less than two feet behind the engineer's head. The pan controls on the mixing desk were not used because little effect could be heard. I was told that the centre on the pan pots were not reliable so nobody would use them, yet when I checked them out electrically, I failed to find one faulty pan pot on the whole desk.

The main monitoring consisted of a pair of JBL *4430*s, and a pair of Altec *9844A*s (the Altecs standing on top of the JBLs) wired in parallel for each side of the 'stereo'. The Carver amplifier was distorting at low levels on one side, and radiating hum into all adjacent wiring. The only saving grace was a pair of Genelec *530NF*s on top of the console, but even these suffered from the bounce off the hard back wall behind the engineer.

There were a total of eight pairs of monitors around the place—the legacy of a history of monitoring problems. In one room, there were even four Altec *604E*s lying on the floor, from where they came I have no clue.

The old control room was far too live, and with parallel walls the resonant modes were particularly noticeable. It was decided to concentrate on internal acoustics, general aesthetics, and monitoring. The room was roughly 7m square, with the entrances behind a pillar at centre rear. The main restriction was only having about 2.6m in ceiling height. In order to break up the parallel nature of the room, it was decided to make the walls and ceiling as diaphragmatic as possible over a wide frequency range. To the inside of Ledentu's original sound isolation ceiling was affixed 6cm of *Arkobel*, a high-density reconstituted foam. Glued to the undersurface of this was a layer of *PKB2*, 5Kg/m² deadsheet with a 2cm layer of heavy felt bonded to one side, which pointed into the room. Below this was a stretch-fabric ceiling which support the lights.

The new walls were assembled inside the old room, and consisted of wooden frames covered in alternate layers of felt and deadsheet. Along each side wall was then hung a free hanging, maximum-sized, low-frequency absorber panel. A further lightweight frame was fixed inside, and covered in the same stretch fabric as the ceiling. The floor was re laid using a pre-finished wood strip. Despite the relatively low internal ceiling height of around 2.3m, the light colours on all surfaces, and well distributed lighting, dimmable by variac, now give a impression of air and space.

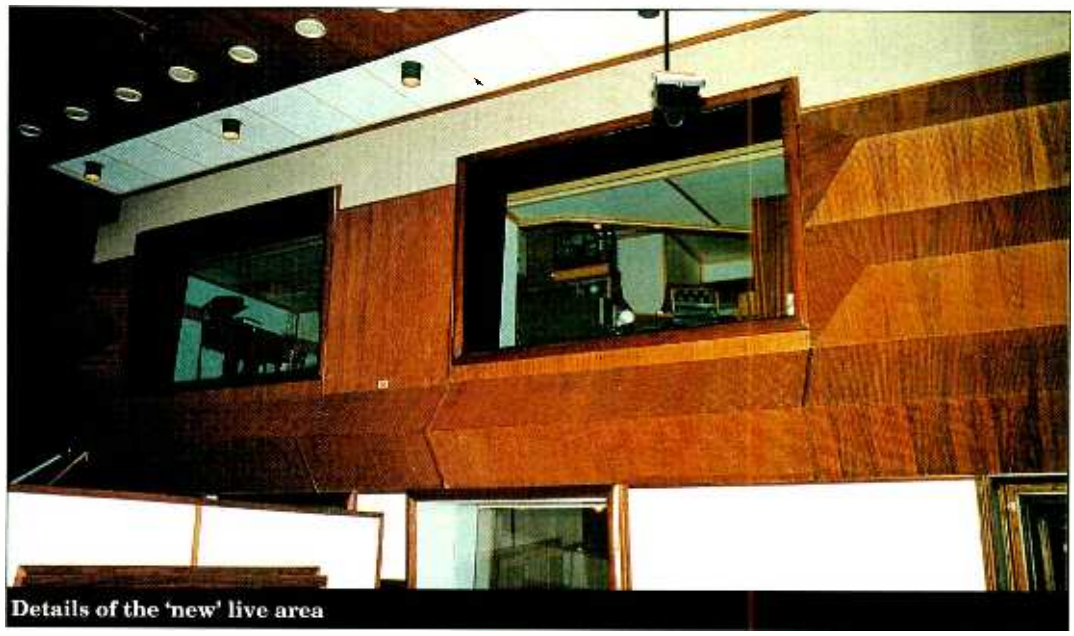
Apart from a central structural pillar, the front wall from 1.3m down consisted of two large windows looking down into the main studio area. For reasons of safety and acoustic deadness, the inner windows were replaced with 12mm laminated glass. There was no alternative but

to position the main monitoring system in new overbridge between the top of the window and the ceiling. The problem with overbridge mounting is that there is no surface in which to mount the loudspeakers in such a way that there is a continuous, plane surface against which the sound wave from the bass drivers can 'push'. Getting a clean incident wave without phase confusion is usually difficult. In this instance, the diaphragmatic ceiling helped to reduce reflections from above, while the underside of the bridge was itself made of diaphragmatic deadsheet in order to reduce the resonant nature of the cavity created below the dead soffit. I later chose to leave the mixing console close to the loudspeakers, as it could have played havoc with the room acoustics if its back is allowed to 'see' the loudspeakers. The rear and bottom panels were left off the console partially in order to let the sound 'breathe' through the console, and partly to remove the tendency for the panels to rattle, which is noticeable with high-level transients from the monitor system in a room of such low reverberation time.

The main monitoring system was a pair of Reflexion Arts *236*s, driven by the new Neva Audio *5002BG* amplifiers made in St Petersburg, Russia (see bench test in this issue). For the small monitor system, I decided to continue to use the Genelec *S30*s, as they provided a good contrast to the *RA236*s, yet agreed with them well in terms of overall musical balance. These days, I generally do not like to use large and small monitor systems from the same manufacturer. A second respected point of view is usually beneficial to balanced decision making.

Equipment

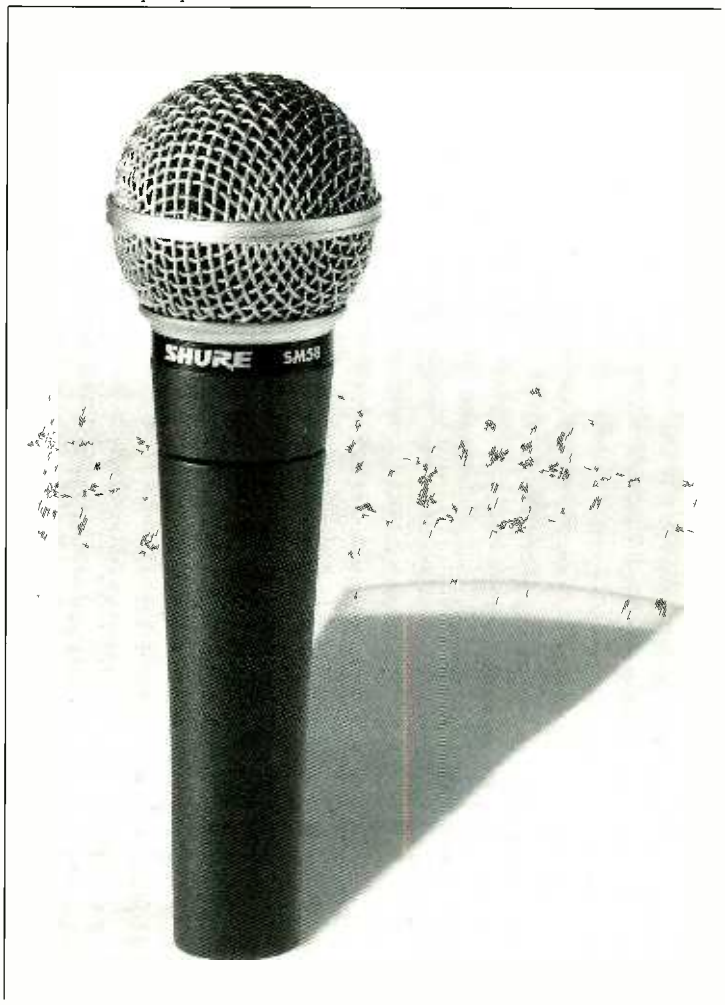
I had found a wonderful Chilton mixing desk in a cardboard box, and knew it was sonically first class and capable of substituting for the Neve in the radio-jingle control room. This made it possible to combine the two Neves, yielding a 46-channel mixer with 18 additional effects returns channels. I had few worries about this, as I had done a similar job when the Manor Mobile bought the Pye Recording Studios Mobile in 1974. That composite console was subsequently sold to Genesis in the early 1980s. Largely assisting Julius, I had also reworked the ex-EMI Amsterdam Neve console, of similar vintage, when Building the Pink Museum in Liverpool in 1988. In the event, Julius undertook the console refit, and Cyril Selinger, Jerry Crockford and Ken Atwood (former employees of Ampex, Neve and Dolby respectively) came out for various spells to utilise their wide ranging experience on the more intransigent problems.



Details of the 'new' live area

The composite console was fitted with 48 channels of *Necam 96* automation, providing commonality of spare parts and experience of use with the only other Necam system in Portugal at Discossete. In these far-flung parts, equipment needs to be chosen for ruggedness and repairability, as well as performance.

Once I had been given the go-ahead for the rebuild, I had the equipment re arranged in the room, more in the fashion of the layout which I was proposing. Definite courses of events had led to the previous layout, yet it had forced virtually all the equipment into one corner of the room, with a large area behind the monitor loudspeakers for setting a Fairlight and various other instruments. This necessitated a fourth set of monitors, this time for the musicians, but still in the same reflective room. After I had repositioned the equipment, we played a game with the pan pots—I would mark a position on the front wall, then ask somebody to tell me when the sound appeared to be coming from that position. The pan pots were marked with a centre 0 then 1–5 left and 1–5 right. I would then ask the listener to tell me in what position he or she would expect the pan pot to be for the position heard. We only played the game four times, and after four precisely correct answers, I heard no further mention of inaccurate pan pots. ▶




The live area before...


...and after renovation

People said that the new equipment layout was obvious, yet for some reason, despite all the time and problems, nobody had done the obvious. Sometimes a large part of a studio designer's job is giving people the confidence to follow their own judgment. In this case I think that many things had become established, even after the initial reasons for doing had vanished, and temporary fixes had become permanent.

The pre-February 1994 control room consisted of two former rooms with their dividing partition removed. Except for the doors and large windows, all the wall surfaces consisted of the same perforated wooden panels as were used in the studios. The false ceiling was of compressed glass-fibre tiles, and the floor was covered with short-pile carpet, from which the static shocks were almost lethal. It appears to be absolutely normal in Portugal, and I have spoken to qualified electricians on the subject, to wire three phases to one extension board. For example, if an effects rack is fed by a 12-way distribution board into which to plug the effects. It is not unusual for one phase to be connected to each group of four sockets. Even in live work, I have found three phases feeding one amplifier rack. One reason for this would appear to be the lack of current available on any one phase, not the mention the lack of current generally. The total power into the whole Namouche complex is less than that supplied to many British houses, but the uprating of a supply can be bureaucratic, time consuming, expensive, and not without risks. There is a problem with many corrupt 'officials' in Portugal, and people often worry that to invite somebody in to assess a situation for upgrade, is also an invitation for them to discover a missing approval, authorisation, or other piece of paper, which unless somebody is bribed, will surely see you closed down. The Namouche complex had a 3-phase feed of 30A per phase; luckily there was a spare 30A single-phase feed to the offices. We doubled up on this phase, to give 60A for the audio supplies of the entire building, which left us one 30A feed for air conditioning, and another for the lights and the supplies to the office and hallway. At several points in the design, power efficiency was a great factor to be considered. Electricity is not cheap here, either.


Restored multitrack machines

The new studio

Where does all this leave us? With classic recording equipment, extensively overhauled, and laid out in a space more suited to current recording practices placed in an up-to-date monitoring environment without having lost the feel of the 'grand old studios' from which it evolved. Now that Namouche have been put into contact with the appropriate sources of spare parts and experienced personnel, the previous degeneration of the equipment need not recur.

Interestingly, so many experienced persons from countries to the north and east have expressed delight in such a facility becoming available, yet the local Portuguese response is disappointing. It is remarkable just how deep the Fostex-Tascam mentality goes. Appearances seem to be all important over here, and consequently many will shy away from things unusual—and unusual Namouche certainly is. The big studio room is already in demand with owners of other studios bringing along their own *ADAT* setups to use the recording space, microphones and mixing console, then scurrying off back to their own studio for any overdubbing, editing and mixing.

The studio have just recruited one British recording engineer, while one of their existing engineers has gone to Abbey Road to witness operations there for a few weeks. A third engineer is so involved in jingle recordings that he rarely seems to lift his head for long enough to realise that anything has changed since last year. He does seem appreciative, however, that it is no longer necessary to spend time routeing around problems. In July 1994, a British maintenance person was also added to the full-time staff.

Namouche has provided Portugal with a window into the world of 'real' recording, where engineering skills can be put to the test with a sonically beautiful recording chain, the only possible item which I would consider lacking being 48 channels of Dolby *SR*, but who knows what the near future may bring. ■

Namouche Studios 1-3: Estrada da Luz, 26B-1600 Lisboa, Portugal. Tel: +351 1 726 5575.
Namouche Studio 3: Rua de Campolide, 103C-1000 Lisboa. Tel: +351 1 68 18 66.

What do you like best about your DA-88?

"Built-in headroom. It makes a big difference when you're trying to track quickly."

"MIDI synching is so easy and clean. It's hard to know where the virtual recording ends and the taped recording begins."

"It sounds great. Especially in the upper frequencies."

"Bouncing. I can bounce forever, it seems. The DA-88 just doesn't distort like other digital decks."

"We really like the convenience of the Hi8 format. You don't get tape stretch, you get much more time per tape, and it's really cost-effective."

"The Hi8 format is a superior recording medium, and it's a TASCAM."

"I can't help but notice the difference in the sound. Unbelievable."

"It locks up a helluva lot faster than our other digital multi-track recorder."

"It's trouble-free. All I have to do is clean the heads. I'd call it the stress-free modular digital multitrack!"

"I needed over an hour of recording time. The DA-88 is the only digital recorder to offer that."

"The frame accuracy is so fantastic, I can edit voice-overs and guitar parts as small as two frames using the Absolute Time capability."

"Punching in and out is so simple. That fact alone made it worth buying a DA-88."

"The punches are very clean and accurate. A dream."

"I've been on the DA-88 nonstop for three weeks now. The transport is phenomenal."

"I like the size, the editing capabilities, and the price. I even like the way it looks."

"I just finished scoring two movies on it. Unbelievable machine."

"Two things. First, the DA-88 gives me a full one-hour and thirteen minutes of record time. Second, the wind times are so wonderfully tight and quick... it takes my other digital recorder a day and a half to rewind."

"The TASCAM unit is clearly more dependable."

"I've had a lot of experience with TASCAM... the dependability and the value. It was a no-risk investment for us."

"The sync card has built-in SMPTE, video sync and Sony 9-pin. Perfect for our video house."

"I like the auto-locator and rehearsal modes, and of course we're doing our next album on it."

"I like having the A/D and D/A converters on an interface card because you can drop in a new card without having to disassemble the whole machine."

"With the sync card it's so easy to synchronize our audio both to video and other audio source, including our DAT."

"The seventy minutes of recording time means we can do something we never could before — get an entire performance on a single piece of tape."

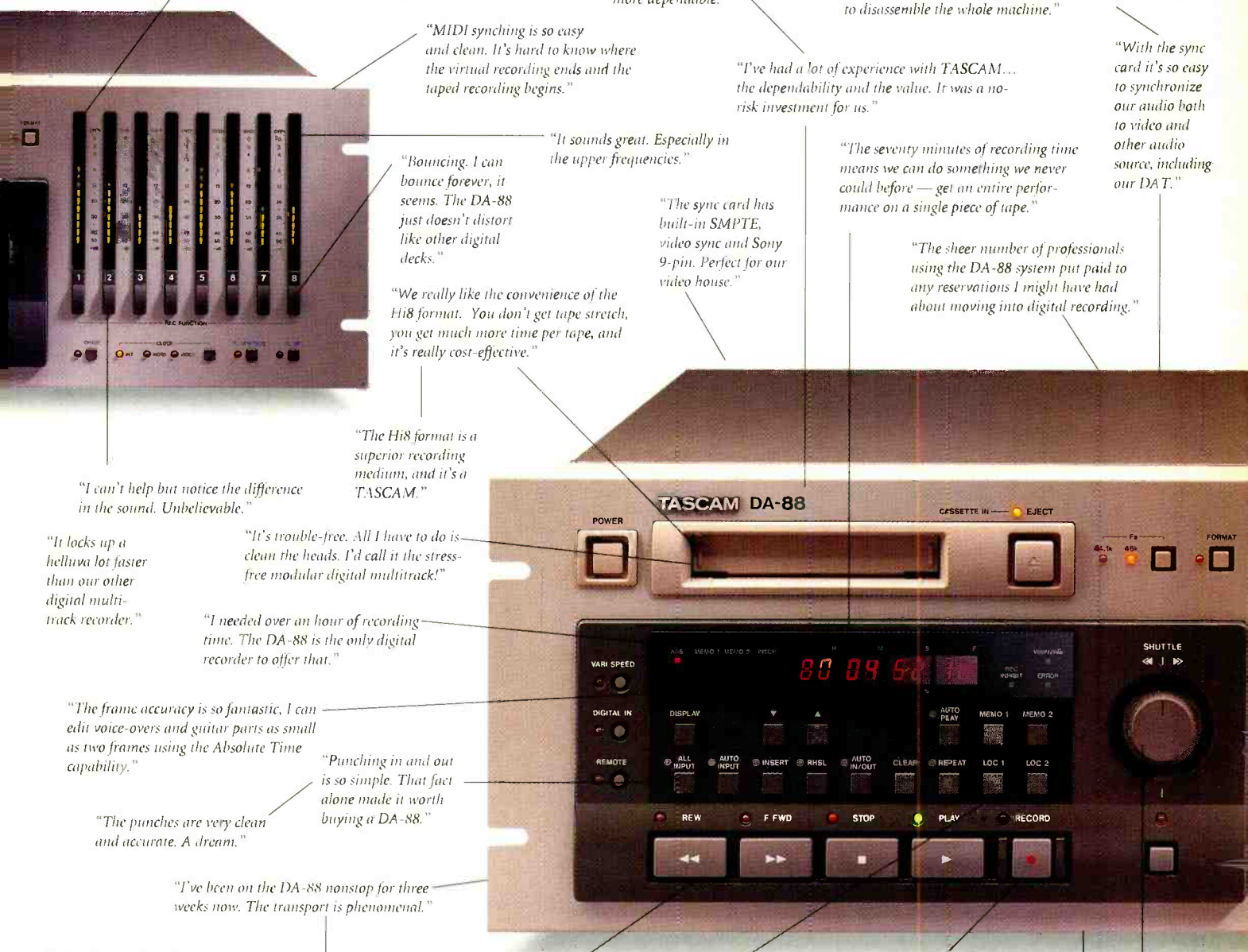
"The sheer number of professionals using the DA-88 system put paid to any reservations I might have had about moving into digital recording."

"I can now offer my customers digital recording at analogue prices."

"It's just faster. Speed counts. Time is money."

"It just feels better than any other recorder in its price range."

"We love the jog/shuttle wheel. It's working out great."



No wonder the DA-88 is the preferred digital multitrack.

It features the latest generation in digital multitrack recording technology. According to users, it's the best-sounding, best-built, most functional and affordable digital multitrack on the market. You're going to love the DA-88. Get to your dealer now and see why!

"It's the name. They make the best recording equipment, period."

"I can lock it to video and my analogue machines with no hassle. Life is so easy now that I have my DA-88."

"I wanted the serious machine for music production. That's TASCAM."

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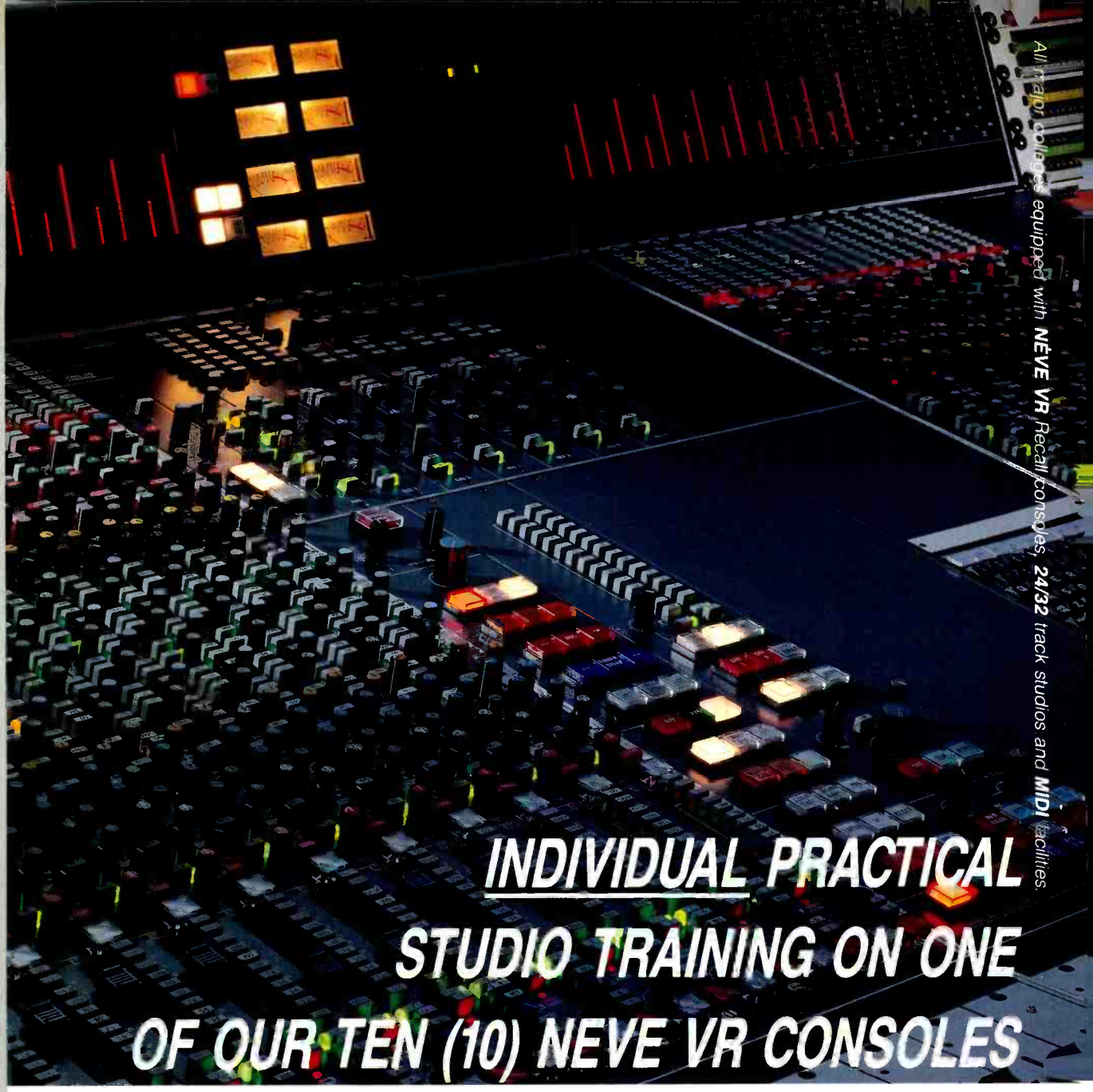

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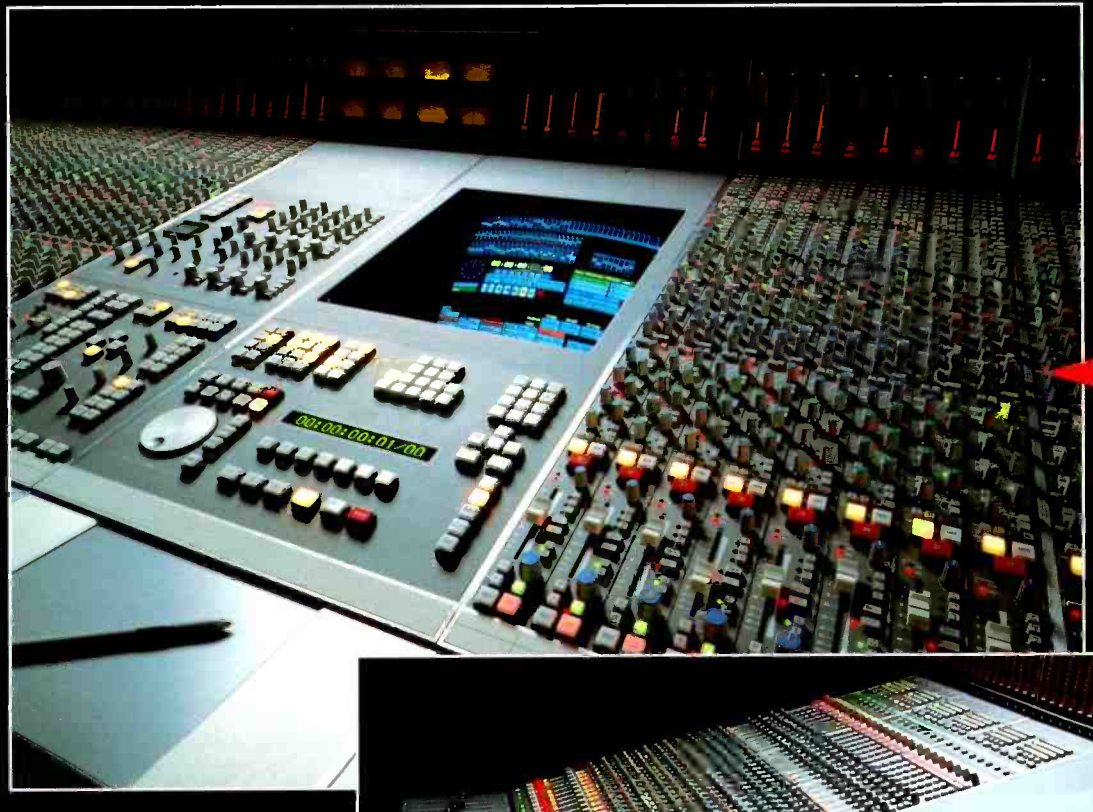
AUTUMN 94 **Solid State Logic**

Into The Future...

Major New Products from SSL Launched at AES



SL 9000 J-SERIES

TOTAL STUDIO SYSTEM

High Quality Audio

Advanced Automation

Optional Digital Storage and Editing

Axiom

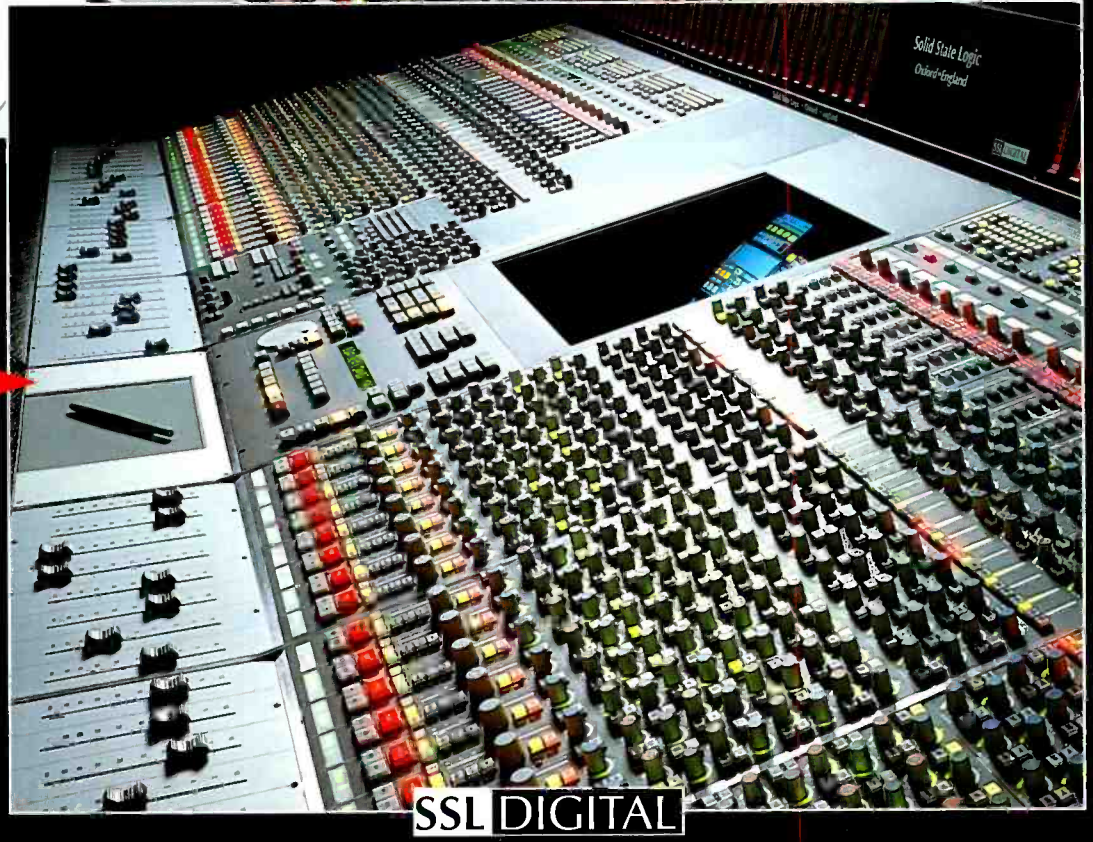
SSL DIGITAL

DIGITAL PRODUCTION SYSTEM

Fully Digital

Total Automation/Reset

Integral Digital Storage and Editing



Solid State Logic

Into The Future...

Solid State Logic Announces New Products at AES

In a period of unprecedented technological change, there are several issues of overriding concern to studios around the world. At the AES Convention in San Francisco, Solid State Logic defined the way ahead with a range of revolutionary new products which follow concepts first seen in Scenaria and OmniMix.

Resource Management

At the core of SSL's product philosophy is the realisation of a tapeless, non-linear working environment – for all its quality and efficiency reasons – with the provision for either an analogue or digital control surface. Both systems benefit from random access recording and the shared resources provided by SSL's DiskTrack system.

DiskTrack™ Recording/Editing & Resource Management System

- Instant access, non-linear working environment
- Provides multi-console access to central I/O and hard disk resources
- Up to 95 channels of concurrent access hard disk audio storage/editing
- All 95 channels may simultaneously be in record and playback, effectively doubling the number of useful channels
- Non-destructive drop-in/out
- Offline concurrent backup
- Integral part of Axiom and option for SL 9000 J Series consoles

Analogue Audio

SSL has continually advanced its analogue console designs. Years of experience have culminated in an entirely new console, the SL 9000 J Series Total Studio System, which we confidently dub the 'ultimate analogue console'.

The SL 9000 J Series provides a familiar control surface, while its high quality circuitry gives it an unrivalled noise performance plus enhanced versions of SSL's legendary signal processing capabilities.

The SL 9000 boasts a new, fast automation computer, based on the proven control technology of SSL's award-winning family of digital products. The majority of console switches are now automated, in addition to the small faders. Automated panning is also a feature.

Most remarkably, the SL 9000 provides the option of having SSL's DiskTrack hard disk multitrack recorder/editor integrated with its automation system. The addition of DiskTrack enables an analogue console to benefit from in-built digital recording and editing resources for the first time.

Digital Audio

The Axiom Digital Production System provides automated gain, pan, equalisation, filters, dynamics and the most commonly used effects processing, such as reverberation.

Axiom is a single system capable of multitrack recording, non-destructive drop-ins, editing, sequencing and playback, all with the same high quality. Only by the use of SSL's award-winning, proprietary technology has this been achievable.

The Future

Solid State Logic revolutionised audio production when it created the first fully-featured, in-line console with a dedicated automation computer. A similar revolution has taken place as a result of Scenaria and OmniMix, which were the first products to combine recording and editing with digital video.

The SL 9000 J Series and Axiom Digital Production System are the latest innovations in SSL's strategy for integration – making studios' dreams for the future attainable today.

SL 9000 J Series Total Studio System

- Audiophile sound quality
- 48-track routing
- Main LCRS bus, plus 4 additional stereo busses
- Switchable E/G eq in each channel
- 6 mono, one stereo aux send per channel
- Automation of master fader, large fader, small fader, channel switches, cuts and group solos, left/right, front/back panning
- 32 software groups
- Soft grouping of channel switches
- 8 master control groups
- Integral digital storage/editing option

Axiom Digital Production System

- Fully digital, fully automated mixing console
- Systemwide or selective reset
- Console frame sizes from 48 to 96 channels
- Configurable for a wide range of applications
- Integral hard disk storage/editing – up to 95 channels of concurrent access hard disk audio storage
- Resource management system, giving shared access to:
  – Comprehensive analogue and digital inputs/outputs
  – Hard disk resources

SSL DIGITAL

SSL Digital and 'The Lion King'

Latest Disney Blockbuster Dubbed on OmniMix

▲ *The mixing team: (L-R) Brian Christiansen, his father (and owner of Sun Studio) Svend and brother Bennie*

Solid State Logic digital systems played a key role in the creation of the soundtrack of the latest animated feature film from Walt Disney, *The Lion King*. ScreenSound, Scenaria and OmniMix systems have all been used, both on the original soundtrack and many foreign language versions.

Weddington Studios, in Hollywood, worked on the original English-language dialogue. With it's ScreenSound system, Weddington was able to edit and sequence the project with the aid of the system's comprehensive track laying functions. Co-owner of Weddington, Steve Flick, comments: "It's a great system to work on. ScreenSound allows an editor to become more involved in sound design."

New Wave Entertainment, in Burbank, put the film's promotional trailers together. Within its recently-opened facility, New Wave houses two Scenaria systems and SoundNet.

"Speed is essential for us," comments David Cantu, Editor/Mixer. "The Scenarias let us make quick editorial and mix changes in response to Disney's requests."

London-based **Saunders and Gordon,** a leading post-production studio, used Scenaria for dialogue recording on the film. Saunders and Gordon's Scenaria-equipped Studio One was linked by ISDN lines to Disney producers and directors in California, enabling them to respond instantly to lines spoken by actors Jeremy Irons and Rowan Atkinson.

Work on the Scandinavian-language versions of *The Lion King* was conducted by **Werne Studios** in Finland and Sun Studio in Denmark. Werne Studios is one of Finland's leading film and video post-production facilities and is equipped with three ScreenSound V5s, two VisionTracks, SoundNet and an SL 4040 G Series with film panning. ScreenSound V5, with its networking features, enabled Werne to considerably speed up the post-production process, so that changes made by Disney could easily be accommodated.

Sun Studio in Copenhagen has recently installed Denmark's first OmniMix in an all-new THX-approved dubbing theatre, plus a standalone ScreenSound V5 with VisionTrack for dialogue editing. Sun worked on the mixes for the Swedish, Norwegian, Finnish and Icelandic versions of *The Lion King*, whilst also carrying out the full voice recording and mixing of the Danish version.

Criteria Expands With G Plus

"SSL was the Natural Choice"

▲ *Joel Levy, owner/president at the SL4000 G Plus console in Studio B at Criteria, Miami*

Miami's Criteria Recording Studios re-opened it's premier mixing suite, Studio B, with a 96-channel SL 4000 G Plus console from Solid State Logic, equipped with the Ultimation moving fader system and Total Recall.

"We upgraded to the larger console because a lot of our international clients need to work on a board of this size," says Joel Levy, owner and president of Criteria since 1988. "They require the additional capabilities for returns, effects and simply more tracks. For instance, some people like to lock three 24-track machines together - that's 72 channels right there."

The 37 year-old studio has a lengthy history of prestigious clients and recording successes, with work spanning the careers of James Brown, the Eagles and the Bee Gees, through to Gloria Estefan and Lenny Kravitz.

"SSL was the natural choice for this expansion. It's reputation, support and mixing qualities are all unsurpassed in the industry," commented Levy. "A lot of artists and producers also want SSL's automation, which is why we selected both the Ultimation and Total Recall options."

The new 96-channel SL 4000 G Plus console in Studio B joins the facility's complement of SSL consoles, which includes a 48-channel SL 6000 in the large tracking room and an SL 6048 in Studio D, which is used primarily for voice-over and commercial work.

In recent months, Criteria has hosted an impressive client list, including REM who returned for their second visit. The studio has also continued to gain popularity among leading Latin and South American artists such as Jose Luis Rodriguez, Raul DiBlasio and Mexico's Juan Gabriel.

SSL DIGITAL

Solid State Logic

Warner Bros. Installs Two SL 8000 Film Consoles

"Tailor-made to Suit the Way We Work"

Warner Bros Studios Post-Production Facility has installed two custom SL 8000 Film consoles as part of a major renovation of the Burbank facility. The consoles will be used on the feature film dubbing stages.

Each of the 80-channel SL 8000 Film consoles has been customised with special features that include split mix busses for three-man operation, three 48-input pre-dub mixers, three 8-channel reassigns for each mixer, joystick panners and two graphic EQs for each mixer.

"SSL offered us the flexibility of customising the SL 8000 consoles," says Chief Engineer Claus Wiedemann. "Now our consoles are tailor-made to suit the particular way in which we need to work."

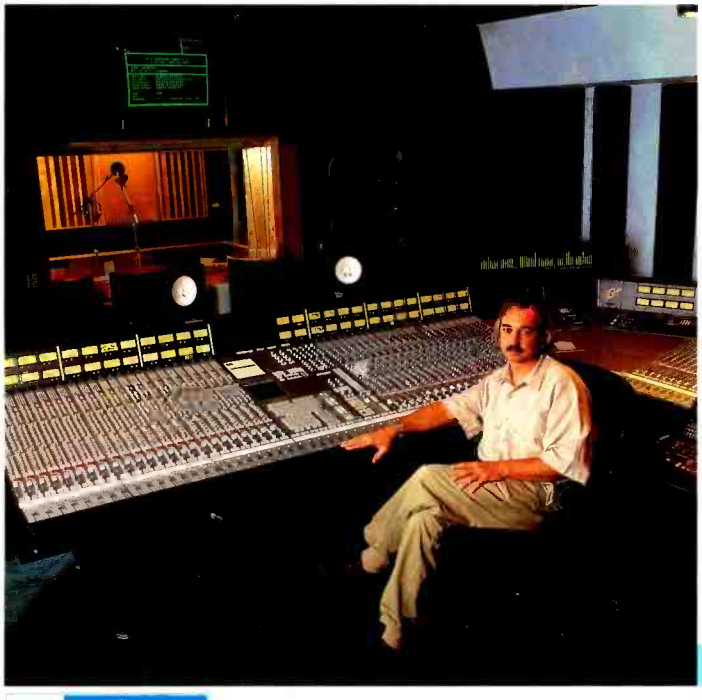
Warner Bros Studios Post-Production Facility offers a full-range of services, including production sound, film editing, digital sound editing, telecine and transfer, ADR/Foley stages, two scoring stages, as well as five re-recording stages which accommodate all film and video formats.

"Warner Bros is committed to having an in-house facility which is in-line with the highest industry standards," says Don Rodgers, Senior VP of Post-Production at Warner Bros, "Our facility is technologically competitive with other studios and post-houses for both in-house work and work for outside clients."

▲ *(L-R) John Reitz, David Campbell, Gregg Rudloff : The re-recording mixer team with one of the custom SL 8000 Film Consoles installed at Warner Bros. Burbank Studios*

Warner Bros Studios Post-Production Facility has worked on a number of recent feature film successes, including: *Unforgiven*, *Demolition Man* and *Perfect World*, and television programmes such as *Brisco County Jr.* and *Lois & Clark: The New Adventures of Superman*.

SL 8000 G Plus to Crescent Moon Studio



"The Best Console for Film and Surround Sound"

Miami-based Crescent Moon Studios, owned by Estefan Enterprises, has installed a 72-input L-shaped SL 8000 G Plus console with Ultimation and Total Recall in its Studio C.

"I particularly like the additional routing capabilities that the SL 8000 affords," explains Chief Engineer and facility designer Eric Shilling. "It is extremely flexible and allows me to work in more than one medium. Crescent Moon is becoming increasingly involved with music-for-film and surround sound projects, for which the SL 8000 is undoubtedly the best console."

Recent projects undertaken at Crescent Moon include nine tracks for the forthcoming Sylvester Stallone movie *The Specialist*, and work on a new album for Gloria Estefan. In addition, Phil Ramone completed mixes for a second Frank Sinatra *Duets* project on the SL 8000 G Plus, having also used the facility for the first *Duets* album.

Initially, Crescent Moon Studios was built as a private recording facility for Gloria Estefan and her husband, Emilio, but in 1990 opened it's doors to other artists, including Whitney Houston, Aretha Franklin, INXS, Pink Floyd and Bette Midler.

◀ *Eric Shilling with the SL 8000 G Plus at Crescent Moon, Miami*

Scenaria Around The World

Post-production companies around the world are increasingly specifying Scenaria and OmniMix. Among the latest installations are:

Fox Tape, Hollywood, the audio/video post-production facility which handles on-air promotions work for the Fox Broadcasting Company, has installed a third and fourth Scenaria. "Scenaria's integrated design makes it a one-person operation; a hands-on editing and mixing environment in one package," comments VP of Engineering Tony Ciesniewski.

Tape Gallery, London, an audio post-production facility specialising in commercials, has purchased its second Scenaria, and upgraded both to OmniMix specification. "With the increased level of business on our first system, we needed a second within a year." explains MD Lloyd Billing.

East Side, New York, has the first OmniMix system in New York. The OmniMix joins six ScreenSounds which are linked via SoundNet, three SL 4000 consoles and two SL 6000 consoles. "The great advantage of OmniMix is the combination of digital audio and video storage," explains Project Design Engineer, Jim Sorensen. "With instant access to picture, there's no rewind time."

Saunders & Gordon, London, was the first audio post-production house in London to install a Scenaria system. Following the popularity of the system with its clients, Saunders & Gordon has now installed a second system.

Post Perfect, New York, a major video and special effects facility in New York, has installed three Scenaria systems in it's audio post facility, Mixed Nuts. "We can offer our clients amazing speed with Scenaria," comments Dean Winkler, VP and Director of Creative Services. "It's a whole new way of approaching audio post-production."

The Post Group, Los Angeles, handles a wide range of sound editing, mix-to-picture, and music editing on their Scenaria. "We needed an automated system, but were limited by the space available," explains Rick Wilson, audio engineering supervisor. "Scenaria solves both problems now that recording, editing and mixing can be carried out in a compact surface and in the digital domain."

NOB, Holland, is the largest post-production facility in the country. "We wanted to have the most technologically advanced system," comments Fritz Paeper, Production Manager at NOB. "Scenaria is the first system to combine the advantages of digital audio production with digital video."

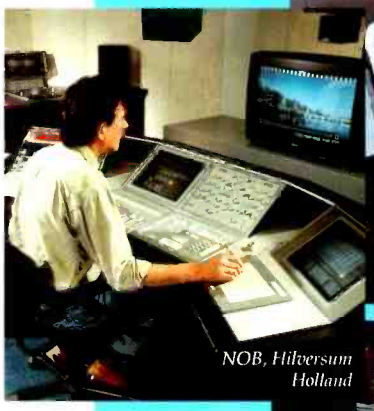
Soundtrack, New York, has recently taken delivery of it's first Scenaria, to accompany the seven ScreenSound digital audio editors, two SL 4000 G Series consoles and three SL 6000 G Series consoles already installed at the studio.

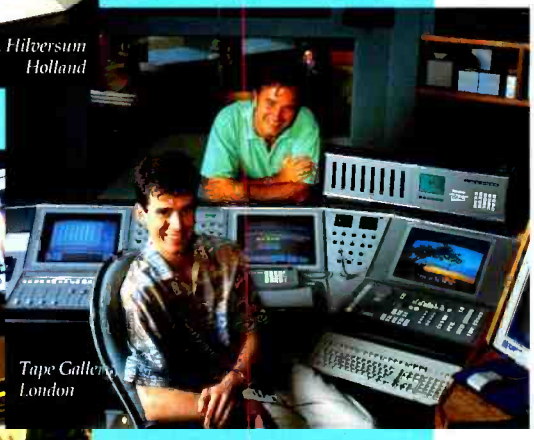
USA Networks, Jersey City, as part of a major relocation and expansion programme, has installed its first Scenaria. "Scenaria allows for quick storage and recall of information, as well as switching between various versions of a project," says Senior Sound Mixer, Andy Allen.

New Wave Entertainment, Burbank, has two Scenaria systems and a SoundNet. "The Scenarias let us make quick editorial and mix changes in response to requests," comments David Cantu, Editor/Mixer.

Orbit, Rome, Italy, the world's first fully digital, multi-channel, multi-lingual, direct-to-home satellite television broadcaster has installed two Scenarias. "We are delighted with Scenaria. It is especially helpful to producers who can easily understand this state of the art equipment," says Phil Braden, General Manager.


Fox Tape, Hollywood,


NOB, Hilversum Holland


Tape Gallery, London


US Networks, Jersey City


Soundtrack New York


Post Perfect, New York


East Side, New York


Post Group, Los Angeles

Solid State Logic

Broadcasters Worldwide Install

Solid State Logic mixing consoles and digital products are increasingly being specified by many of the world's leading broadcasters. Latest installations include:

USA - NFL Films has purchased an SL 8048 G Plus console with Ultimation™ and Total Recall™. **Unitel** has taken delivery of an SL 8040 GB On-Air Production console. **ESPN**, sports cable network, purchased an SL 5548 broadcast console. **CBS** has added an SL 8056 GB On-Air Production console for use in its New York facility, and an SL 6064 G Plus for use in its Los Angeles Television City headquarters. **Fox Tape** added third and fourth Scenaria systems to make them amongst the world's largest Scenaria users. **NPR**, the first non-commercial, satellite-delivered radio system in the US, has installed an SL 4048 G Plus console with Ultimation and Total Recall.

United Arab Emirates – UA Radio has installed a 40-channel SL 4000, the first SSL console in the country.

Kuwait - KBS, Kuwait Broadcasting Service has up-graded it's facilities with an SL 4048 G Plus console.

Australia - ABC TV has installed a 48-channel SL 4000 G Plus console as part of a major refurbishment.

Austria - National broadcaster, **ORF** has upgraded its Scenaria to full OmniMix standard for future Surround Sound projects.

Sweden - SR, the Swedish Broadcasting Corporation has purchased a further four SL 4000 G Plus consoles; three for use in OB vehicles.

Italy - Orbit, the world's first fully digital, multi-channel, multi-lingual, direct-to-home satellite television broadcaster has bought two Scenarias for it's new Rome-based facility.

Taiwan - TTV purchased an SL 4040 G Plus console. **CTS**, currently relocating into a purpose-built complex in Taipei, has purchased an SL 4024 and an SL 8048 G Plus console.

Japan - National Broadcaster, NHK has installed six Scenaria systems. These are located at their headquarters and at regional stations in Sendai, Nagoro, Matsuyama, Hiroshima and Sapporo.

▲ *KBS, Kuwait*

◀ *ORF, Austria*

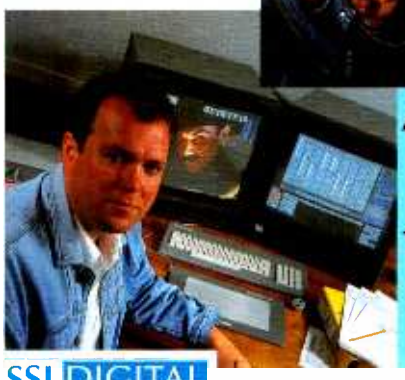
SSL Scores in Film and Episodic TV

SSL Digital Speeds Up Audio Post

Audio post-production for some of the world's most successful television programmes and films is regularly being carried out with SSL Digital products.

In the UK the popular series *Jeeves and Wooster*, starring Stephen Fry and Hugh Laurie is one of **Snaptrax's** many prestigious projects. Barely a year after opening at Denham Studios, London, Snaptrax now also works on the internationally acclaimed television series *Poirot*, starring David Suchet.

Current projects, including a new Hugh Laurie comedy drama series entitled *All or Nothing At All*, have resulted in the need for a further Version 5 system. Snaptrax's two existing systems will also be upgraded to V5 standard.



▲ *Richard Lambert of M2 Facilities with the studio's ScreenSound*

◀ *Colin Richie, working on 'Poirot' with one of Snaptrax's three ScreenSounds*

Hanna Barbera's *Daisy Mead Maizie* and *Doctor Seuss* are amongst the recent projects carried out at London's **M2 Facilities Group**. The studio's two ScreenSound V5s, with VisionTrack and SoundNet, have been used predominantly on post-production of programmes for the BBC and independent television, including *Dispatches*, *Time Watch* and *The South Bank Show*.

Audio post on the film *True Lies* was carried out using ScreenSound by James Cameron's **Lightstorm Entertainment** in Santa Monica.

Hollywood Digital in the US, dedicate over 50% of their sessions to episodic TV and drama series, and as such require a speedy work turnaround. With audio production of the series *Harts of the West*, *Movies-of-the-Week* and the hugely popular *Larry Sanders Show*, the fully integrated post-production approach of their two Scenaria OmniMix systems allows for speed, accuracy and flexibility.

Working on a variety of animation dialogue projects for Warner Bros, MGM, Hanna Barbera, Universal, and Disney's *The Lion King*, has led to **Howard Schwartz Recording** expanding it's ScreenSound facility, with a total of five systems linked via SoundNet. The New York-based studio recently worked on the feature film *I Love Trouble*, starring Nick Nolte and Julia Roberts, as well as *The Simpsons* TV series and promotional trailers for CBS Sports.

▲ *Andre Perreault working on OmniMix at Hollywood Digital*

◀ *John Arrias, owner, B&J Recording, Los Angeles*

ADR work for the television series *Robocop*, and promotional work for *Married .....With Children* and *Seinfeld* are amongst projects undertaken by Los Angeles-based **B & J Recording**. Having recently installed their first ScreenSound V5, the post-production facility is now heavily involved with writing and post-producing *American Gladiators* and *Gladiators 2000*.

Eastern Europe Goes Digital

Broadcasters Install ScreenSound

Throughout the former Communist states of Eastern Europe, post-production and broadcast companies are installing Solid State Logic digital audio-for-video systems. Installations have most recently taken place in Russia, the Czech Republic and Romania.

Romania - Romanian TV has installed a ScreenSound system at it's headquarters in Bucharest. The public television station will use the ScreenSound to handle the post-production of the country's main TV programmes and films.

The Czech Republic - S-Pro Alfa in Prague is a new post-production facility. The company has recently installed a Screen-Sound system to handle post-production for television and radio advertisement spots.

Russia - Premier SV has installed an ScreenSound V5 with SoundNet and Vision-Track. Premier is one of the leading advertising agencies in Russia, which has also bought the rights for a number of popular western television series, including *Return to Eden, Twin Peaks, Wild Rose* and *The Streets of San Francisco.*

◀ *S-Pro Alfa, Prague*

▲ *Omnibus, Japan*

SSL Shows Eastern Promise

Music studios, post-production facilities and broadcasters in the Far East are increasingly demanding SSL consoles and digital products.

Wonder Station, Japan has upgraded to a new SL 4064 G Plus. Joe Hisaishi, successful musician and studio owner, was so impressed with the new console that he immediately re-recorded his new album on the G Plus.

Omnibus, Japan, are so pleased with the changes that Scenaria has brought, that it is now up-dating to OmniMix specification. Omnibus has clients who now insist on Scenaria, refusing to use any other system.

In Taiwan, **Platinum Studios,** which already has four roomsequipped , SL 4000 G Plus console has purchased a Scenaria for audio post-production on video and TV projects.

CTS in Taiwan has installed an SL 8048 G Plus console, and an SL 4024 G Plus console in new purpose-built premises in Taipei.

TTV, also located in Taipei, has installed an SL 4040 G Plus console for use on variety show productions.

Music Factory in Hong Kong has installed an SL 4056 G Plus, console, fitted with Total Recall and Ultimation.

◀ *Music Factory, Hong Kong*

G Plus Sets Standard for World-Class Studios

Music recording studios around the world increasingly refer to Solid State Logic consoles as the industry's standard for excellence.

London-based **Westpoint Studios** has installed an SL 4048 G Plus console. The private studio, co-owned by Simply Red drummer, Gota Yashiki, works on a large variety of music projects, including Japanese productions.

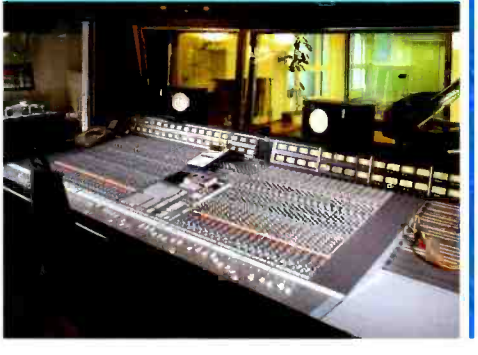
Based on the Caribbean island of Martinique, **Hibiscus,** a ten-year old music production company, has just installed an SL 4048 G Plus console with Ultimation and Total Recall. This is the first G Plus console to be installed in the French Caribbean.

Hardstudios in Switzerland has installed an SL 4000 G Plus console to be used predominately on Swiss projects. The studio selected the G Plus console because of it's reliability and outstanding reputation within the industry.

Record-breaking songwriter and producer, **Mike Stock** has purchased an SL 4000 G Plus console for his new £3 million two-room complex in London. Mike, who produced hits for Rick Astley, Kylie Minogue and Jason Donovan as part of Stock, Aitken and Waterman, chose the console because of it's global reputation for quality.

▲ *Gota Yashiki and Dave Tyler at Westpoint Studios*

▼ *Hardstudios, Switzerland*



NY's 'Room With a View'

Room With a View, a Manhattan-based studio where the control room enjoys stunning views of the Empire State Building, has installed an SL 4064 G Plus with Ultimation and Total Recall.

"We felt that the installation of an SSL would allow us to open up commercially," explains owner Alessandro Cecconi. "We have the ability to handle film and video post-production projects and we specialise in working with European clients. We are one of the few facilities in the USA that can lock up to PAL and NTSC."

▼ *Room With a View, New York*

Solid State Logic

From the Desk of... *Humberto Gatica*

Twenty years ago, when Humberto Gatica first walked into a recording studio, he realised instantly that this was the industry he wanted to be involved in. Now, as a highly respected producer and engineer working with artists such as Gloria Estefan, Barbra Streisand, Michael Jackson and Tina Turner, Gatica spends the majority of his time in the studio.

"It's very important for me that the studio is just right in terms of technical quality and atmosphere, as I could be spending anywhere from ten hours to six months there. I take a systems approach, so that everything works together, using pieces of equipment that come as close as possible to what I would call "real" sound.

"I first discovered the SL 4000 console at a studio called Ground Control in Santa Monica. I realised that, finally, there was a way for me to make music the way I wanted to hear it. Over the years many sonic improvements have been made and I would say that there's now almost a warmth to the SSL sound. About 85% of the equalisation that you hear on my records comes from what the console alone provides me with.

"The SSL automation system is an aspect I love! It's fast and user-friendly, and so incredibly accurate. If I create an atmosphere that touches you emotionally, then I feel I have accomplished my job. I go for quality every time, and that's where the reliability and functionality of the equipment I use really comes into play.

"I'm the most unbelievably self-critical human being, and when I finish a mix, it's a great accomplishment to be able to feel it in your heart and hear it in your brain. That's the feeling I'm always in pursuit of in my work."

SSL's Studios

With the finest range of consoles and digital post-production products in the world, SSL places a high priority on providing demonstration facilities of an equally high standard. At SSL's worldwide headquarters, near Oxford, there are a range of studios fully equipped for their application, whether that be music recording, broadcast or film and video post-production. The company also has its own lecture room for structured presentations to larger groups.

The main mixing rooms are home to an SL 8000 G Plus console, SL 9000 J Series and Axiom Digital Production System. There is also a digital post-production floor with rooms housing OmniMix, Scenaria, ScreenSound, VisionTrack, SoundNet and WorldNet systems. In addition to SSL equipment, there is also a range of industry-standard outboard equipment, plus digital and analogue multitrack recorders.

◀ *SSL worldwide headquarters near Oxford, where the demonstration studios are situated*

Each of these rooms is in almost constant use, providing a critical environment for clients to learn about SSL systems. Regular training courses are also held, both for operators and service personnel. Further demonstration facilities are located at SSL's New York, Los Angeles and Tokyo offices.

If you would like to learn more about any SSL system, just contact your nearest SSL office or agent.

Award-Winning SSL

Consoles and Digital Products Are The Industry Choice

Solid State Logic has recently won prestigious industry awards for both its G Plus console range and the Scenaria OmniMix Digital Audio/Video System.

At the Third Annual Professional's Choice Awards Ceremony, held at NAB '94, the G Plus Console System was named Audio Console of the Year.

The awards ceremony honoured the best post-production and production equipment of the year, as voted by the readers of *Post* and *Producer* magazines.

Offering greatly enhanced sound quality, with oxygen-free cable and new op and mix amps, as well as entirely new operational features, G Plus represents the updating of the entire G Series console range, to set new, even higher standards in performance specification.

Scenaria OmniMix Digital Surround Sound Audio/Video System has received the 1994 Excellence in Engineering Award for audio. The award, sponsored by *Television Broadcast* (TVB) magazine, honours innovative and landmark products in the broadcast marketplace. TVB's broadcast consultants nominate products, which are then voted on by the readership.

"The Excellence in Engineering Award seeks to identify those products that our readers feel are so innovative that they are 'classics' — that set new standards in a product category for the broadcast industry," explains Ron Merrell, TVB editor.

SSL Worldwide

International Headquarters

Solid State Logic, Begbroke, Oxford, OX5 1RU, England • Tel: (0865) 842300 • Fax: (0865) 842118

France
1 rue Michael Faraday
78180 Montigny le Bretonneux
Tel: (1) 3460 4666
Fax: (1) 3460 9522

Italy
Via Pirandello 17
20099 Sesto San Giovanni
Milan
Tel: (2) 262 24956
Fax: (2) 262 24938

Japan
3-55-14 Sendagaya
Shibuya-Ku
Tokyo 151
Tel: (03) 5474 1144
Fax: (03) 5474 1147

USA (Headquarters)
320 West 46th Street
New York
NY 10036-8398
Tel: (212) 315 1111
Fax: (212) 315 0251

USA (Western Region)
6255 Sunset Boulevard
Los Angeles
CA 90028-7411
Tel: (213) 463 4444
Fax: (213) 463 6568

Sales and Service Agents: **Canada:** Acura Technology Group; (905) 886 6960: **China, Hong Kong,** Advanced Communication Equipment 424 0387: **Singapore, Malaysia, Indonesia:** Advanced Communication Equipment (Singapore) 741 5328: **Taiwan:** Advancetek (2) 719 2388: **Austria, Croatia, Slovenia, Bosnia, Hungary:** Audiosales (Austria) (22) 36 26 123: **Norway:** Siv. Ing. Benum A/S (2) 145 460: **South Korea:** Daesan International Inc. (2) 379 8442: **Switzerland:** DR W.A. Günther (1) 910 4141: **Kuwait:** International Music Centre 264 5635: **Argentina:** ITV Intervideo Professional (1) 362 0754: **Spain:** Levon SA (3) 203 4804: **Denmark:** Provideo Equipment A-S (42) 64 78 00: **Southern Africa:** Questek Marketing CC (11) 789 1832: **Brazil:** Savana Comunicacoes Ltda (21) 274 5009: **Finland:** Studiotec (0) 592 055: **Australia:** Syntec International PTY (2) 417 4700 **Colombia:** Sonygraf Ltda (1) 256 2519: **Venezuela:** Sonex de Venezuela (2) 358 082: **Belgium, Luxembourg:** Trans European Music (2) 466 5010: **The Netherlands:** TM Audio (30) 414 070: **Chile:** Intervideo (235) 2668: **Czech Republic:** Audio Sales S.R.O. (2) 54 4173: **Egypt:** EKO Sound (360) 3566: **Russian Federation:** Elbor Ltd (0628) 668485: **Slovakia:** Audiosales (7722) 249

SSL DIGITAL

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Martin Polon

Only steal from those you love—or those in the biz

Need a valve compressor made in Finland on a chromed stainless steel chassis modelled on the old Pultec models but cannot afford it? Not to worry—just schedule a session in a 'big' studio and check out their gear. Then return some dark night and make your selection via 'Midnight Audio Supply'. Alternatively, book another session using the same alias as before. Send the house technician out for booze with an extra bottle in it for him; back the truck up to the studio's rear door and go on a 'shopping' spree. Yet another method is to 'enlist' the help of a technician at the 'target' studio in question who will, at the end of the session, assist in moving as much of the studio's equipment into your truck as is humanly possible.

There are numerous ways in which studios are defrauded or burgled—according to law enforcement sources, the proliferation of project studios has not done what many in the professional recording industry had hoped—to dilute the demand for illicit professional equipment. Instead, according to one insurance company executive, 'the ability of hundreds of thousands of young recording aficionados to gain experience with inexpensive recording hardware has only seemed to whet their appetite for the stuff found in professional recording studios. Fortunately, very few translate their equipment lust into felonious assault on the recording studio industry.'

Crimes against professional recording studios usually take one of the following forms:

The inside job: one law enforcement source estimates that at least 50% of all break-ins have some component of an 'inside job.' This is not to say that studio staff are involved in all cases but that someone has been able to 'case' the studio to assess its equipment, paths of entry and exit, security features and staffing times. It would, be naive to assume that all former studio staff all exhibit the same loyalty as Queen Elizabeth's Household Guard... especially where there has been bad feelings on both sides. And current staff, if not properly compensated by their perception (not yours), will on occasion consider a 15% 'fingers fee' on a $250,000 equipment 'lift'—a suitable nest egg for their old age!

Clients: it would be nice to assume that all studio clients come to your facility to take advantage of your fabulous sound. But this may be a bit short of the mark. There will be the occasional client who will be 'shopping' your facilities for after hours action. The correct response is not to assume any level of paranoia towards any customer —especially since you will never know who is there to 'shop' you.

Freelancers: the problem of controlling equipment shrinkage must also include the regular passage of freelance engineers and other part-time help brought in by or at the request of your clients. Again, the vast majority of such freelancers are as reliable as your own staff. But there are the occasional 'bad apple' who will attempt to add some of your test equipment or microphones or the odd power amplifier to his collection after the last session.

Organised crime: this is a really tough issue with a lot of history for the record business. There has been in the distant past documented links between organised crime 'families' and record companies. These relationships included 'protection' for specific studios from any kind of undesirable 'problems'. That was then and this is now, but there has been suggestions of 'rings' that specialise in the theft of audio and video studio equipment. There is no way to combat such organisations other than to use the best possible security aids. But it may be wise to forgo the usual round of incredulity when such stories circulate at industry events. There are crime 'families' and they are people you would really rather not know.

Scams: not all studio thieves come at night or physically break-into the facilities. There has been the odd instance of individuals dressed in uniforms, appearing at studios to pick up this piece of equipment or that for 'repair'. This scam works especially well when everyone save the receptionist has worked until four-in-the-morning on a session.

Solutions to 'equipment shrinkage' problems include the use of computer and equipment anchors. These are commercially available, virtually indestructible plastic 'connectors' that attach to the unit in question via epoxy adhesive. The plastic unit can then be 'passed through' with a chain or cable and padlocked to a large piece of furniture or other surface.

Security screws on equipment placed in relay racks, in conjunction with cement or lead weights attached to the bottom of the relay racks are another option. These screws can be removed only with a special screwdriver, unavailable through the usual hardware retail channels. The screws were originally invented for use in penal institutions and mental 'hospitals,' and cannot be removed with power screwdrivers—the 'tool' of choice of break-in artists.

Alternatively, the use of cement filled steel pipes of large diameter in conjunction with 'one way' tire shredders at loading dock entrances can be considered. This allows total control of loading areas after hours.

Roller-style door closures over the loading dock doors and any other access portals large enough to allow equipment removal or unauthorised egress are a further option. Some studios use welded bars and removable gates to control all studio openings.

Tools may be engraved to identify the ownership of specific units as well as at the component level such as microphones and speaker drivers; welded chains will limit movement of recording console frames by connection to welded steel anchors placed permanently into the cement of the studio floor while off-duty police officers can be paid to patrol the premises on certain nights (if not all nights and weekends) and during recording sessions and for 'suspect' groups.

Hired guard services or (as they are euphemistically called US) 'rent-a-cops' can provide parking lot security during sessions, to check the studio perimeters regularly and to respond to studio 'silent alarms.'

Designation of one or more staff members as 'security coordinator' is one way of focusing attention on the problem, as is the use of hidden cameras and-or microphones to record activities inside the studio complex during off-hours. These practices have become standard items in some facilities as have well placed and visible TV cameras covering the parking and loading areas as well as all entrances.

Keeping a complete and up-to-date inventory of all equipment in the studio coupled with a 'going-on' and a 'going-out' check of studio facilities after each session or at the least on a weekly basis can help identify problem areas, and while background checks of current staff are controversial, some studios are now having to make them. Other studio owners feel such a procedure is especially important for evaluating prospective new staff.

Alarm systems that work via sonic, ultra sonic, infrared or motion sensors and-or a combination of all the above are particularly effective. Burglar alarm systems of varying sophistication certainly have become standard equipment at many facilities as has the periodic changing of all locks. The use of high-quality electronic combination locks provides both adequate security and allows for instant reprogramming of the lock in-house. Key locks should be changed every six months or more often if necessary.

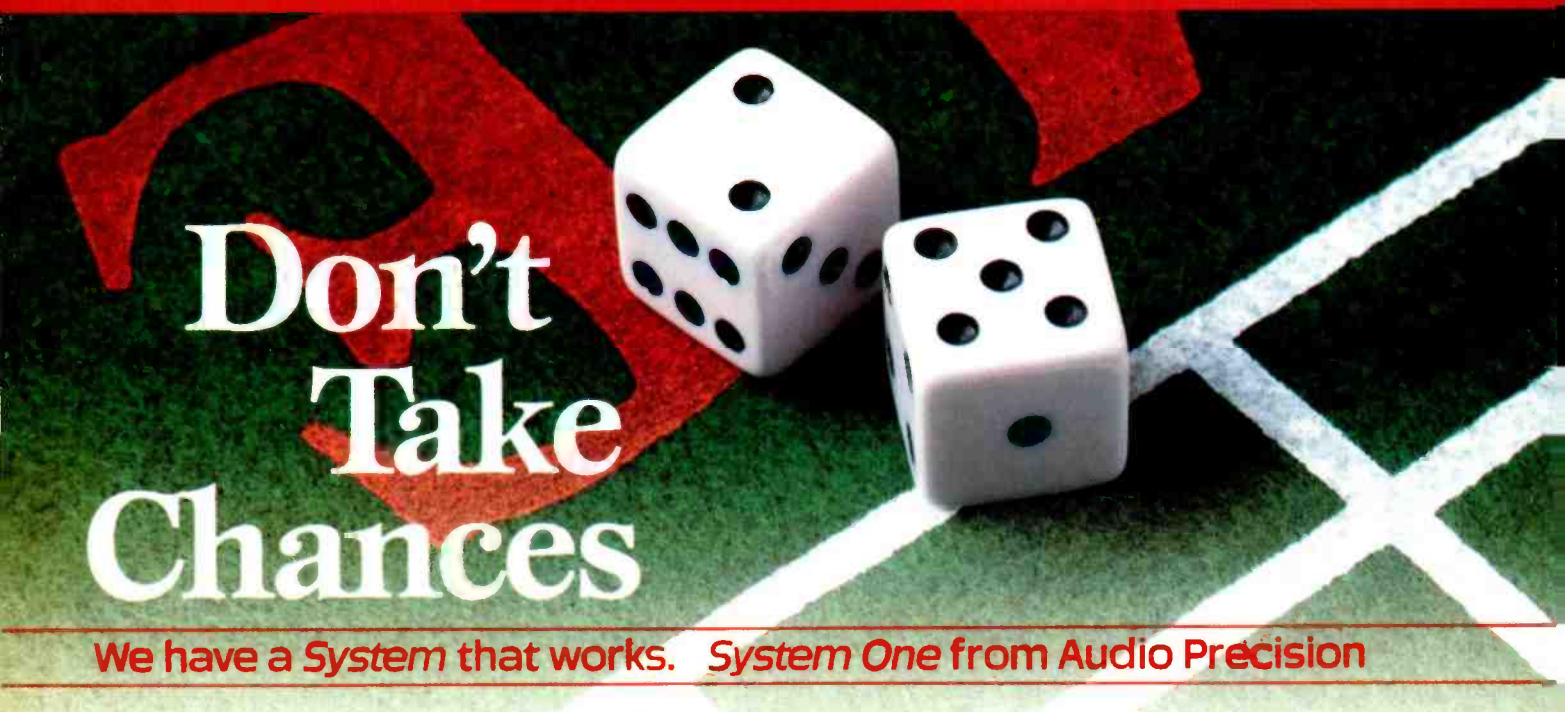
The fact that every television station in the US has an adequate perimeter fence and security personnel while precious few recording or postproduction studio complexes do is a function of more than Federal mandates on broadcast facilities. For example, every recording complex and post facility on 'movie' studio lots has the same protective modes. But most studio owners refuse to take necessary precautions for a number of reasons—despite the fact the there are a significant number of studios in the US (and elsewhere) with equipment investments as large as that of many TV stations not to mention client bases of significant notoriety.

The reasons for ignoring what has become a growing threat to studio facilities generally falls into four categories.

First is cost—most studio operators who cite this factor ignore their initial investment in equipment which is always in the six figures and frequently exceeds that. The savings on insurance alone can often pay for security improvements. Police details at night can be built into the studio charges for evening services. Second is customer reaction. Yet in the 1990s, clients frequently welcome adequate security especially for artists who are easily recognisable. Third is the fear that security precautions will make it harder to resell equipment as the studio 'trades up' to newer gear. The fourth is a concern over the loss of in-studio flexibility.

The bottom line is that a relatively minor investment could sustain a much larger success in your studio. ■

Dual Domain Audio Testing



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Kevin Hilton

IBC and the latest on DAB

To vaguely quote Quentin Tarantino, what was I talking about? Oh right, DAB. The evolution of digital transmission technology for radio and television has been pretty much a parallel phenomenon, maybe with the pictureless medium out front in the early days. At this year's IBC, digital was everywhere on the main exhibition floor, but it was largely all for television—compression, Pay-Per-View, Near Instant Video on Demand.

Those who wanted the latest on digital audio broadcasting had to wander round the upper reaches of the RAI Centre, following signs of increasing illogicality, until they eventually came across a small, almost apologetic section called the New Technologies Display. Pushed right to the back of this was the BBC Research and Development stand, showing the latest work by the Eureka 147 Project, a consortium of broadcasters and consumer electronics manufacturers endorsed by the European Broadcasting and International Telecommunications Unions.

If the name sounds familiar, that is because it uses the same prefix as another EU-backed venture, the failed, almost notorious Eureka 95 Project to develop a universal system for high definition television. While that has metamorphosed into the 1187 ADTT (Advanced Digital Television Technologies) programme, 147 looks like becoming reality, with broadcasters, regulators and governments talking about the end of next year as a likely start date.

The IBC display was based on a theoretically typical configuration, showing the transmission chain from source to receiver. Using a CD player as the starting point, the signal is fed into a Musicam coding unit, where the compression bit-rates for the various services are selected, fed to a power amplifier, transmitted and then received by specialist domestic units.

The heart of DAB, the multiplex process, allows varying, multiple channels to be carried on a single frequency. Working on a bandwidth of approximately 1.5MHz and an overall transport bit-rate of 2.4Mbit/s, broadcasters can select audio bit-rates between 384kbit/s and 32kbit/s, depending on the amount of error protection required and the type of service concerned. Rough estimates foresee a typical single-multiplex configuration of six high-quality stereo channels, and up to 20 restricted quality stereo-mono stations.

Such a system is being hailed as supremely spectrum and power efficient, something that all broadcasters and regulatory bodies are looking for given that FM is becoming a crowded and precious commodity. DAB also has other attractions: it can bury data within the carrying signal, allowing functional information, like dynamic range control, and added extras, for example song lyrics for visual display, to be included in the service.

This extra capacity means that the operators will be able to precisely dictate the format of the different services. 'There is some intelligence to it,' explains the BBC's Humphrey Lau. 'We can assign different bit-rates to different channels, as well as specifying the protection needed for that channel. With error protection on the subchannels, we can make sure that services won't drop out if there is a bit-error.'

Joining the BBC in this pan-European initiative are an impressive list of broadcasters, telecoms authorities and manufacturers (trade and domestic), including Robert Bosch, Deutsche Bundespost Telekom, Grundig, Philips, Thomson, and the CCETT. These have been joined in later months by other companies that must have realised that DAB is not only going to happen but is going to be big: the European Space Agency, Rohde & Schwarz, Teracom Svensk Rundradio of Sweden, Delco from the USA, Finland's Nokia, and a large Japanese contingent, including Sony, Clarion and Pioneer.

These technologies combine computation, measurement and communications—which H-P call MC²—and are being brought to the broadcast market through joint ventures; the company are canny enough to realise that they are still a newcomer to this market. 'We thought that a large company just plunging in wouldn't make a lot of sense,' says Jim Olson, General Manager of H-P's Video Communications division, based in Santa Clara, California.

To date, these associations include software management designer Louth, routeing and automation manufacturer Pro-Bel, and graphics specialist Pinnacle Systems. H-P are also building up close ties with established broadcast distributors, including Delta System in Germany, which also handles Pro-Bel, and a number of TV operators: Channel 13 (KOLD-TV) in Arizona, which went on air in October, were the first, followed by Munich-based RTL2, now rated as one of Germany's big four private stations.

Jim Olson says that H-P intend to build their broadcast market share by 300 to 400% come next year, although he admits that it is still a small part of the company's overall business. 'But we see it as a key market in the future,' he says, 'and so do other leading computer firms. Oracle and Microsoft are all producing video-related products and it's for several reasons. This whole move of analogue to digital is playing to the strengths of big companies like Microsoft and H-P.'

This was borne out on the floor of the RAI; with the obvious exceptions of Sony and Panasonic, many of the traditional broadcast hardware manufacturers were dwarfed by the size and splendour of the stands showing equipment from companies that, a few years ago, would have never contemplated attending something like IBC. The flags heralded IBM, Silicon Graphics, NEC, and Soft-Image/Microsoft, as well as H-P, while the launches reflected current interests and concerns: MPEG-based compression, desktop editing for news suites (IBM having teamed up with Independent Television News to produce the world's first stored digital video 'news on demand' service), serial storage, magneto-optical discs, and solid-state audio filing.

As was to be expected, some worries have been voiced over this invasion by the pocket-protector brigade, and it's not necessarily just broadcast veterans afraid of a little competition. One of the more vocal during the Show was Paul Bamborough, Chairman of film-editing-systems maker Lightworks, who used his company's press reception to say: 'The computer industry is not like the video industry. The film-video industry says what will happen when it says it—the computer industry is a lot more optimistic.'

Bamborough was originally a founder of SSL, before moving on, forming Lightworks in 1990, concentrating on nonlinear editors for the film industry. He is now partly looking back to audio for the way ahead, promising a second generation nonlinear system with full networking, integrated sound mixing and lossless compression by the second-half of 1995.

The first move to this can be seen on the *Heavyworks One*, which includes an integrated console, the *Fader Box*, delivering live audio mixing, assignable channels to faders groups, mute and solo buttons, four different modes (Playback, Record, Trim and Update), eight fully-assignable fader groups, fully-motorised faders and eight camera buttons for so-called 'on-the-fly' vision editing. Such a move is part of the increasing attempts to bring together the once disparate areas of sound and vision in postproduction, a dichotomy that many see as unsuitable in these days of multimedia.

While Bamborough's current company prepares to spread itself in the traditional audio-visual market, the one that he helped found is moving further from its core business to embrace technologies that have been adopted from the computer and telecommunications sectors. SSL have built upon their studio networking systems to produce *WorldNet*, a 2-level concept based on the Integrated Services Digital Network (ISDN). The high-end, complete bodies of work involving either real-time performances, or entire *ScreenSound* or *Scenaria* multitrack programmes being passed between compatible facilities in different locations, is catered for by *WorldNet Project*. Voice-over work and other simpler jobs are intended for *WorldNet Audio*.

SSL's Marketing Director, Colin Pringle, explained, 'We can transfer multitrack projects bit-for-bit. Instead of backing up onto a tape streamer, engineers could back up onto somebody else's system using the net. *WorldNet Audio* is for daily use by voice-over people, but it would be sensible for most operators to have both.'

Which, more or less, brings IBC '94 to a close. The worrying thought is that, before we're ready for it, the whole business will start again because of the move to annual status, which also means that it will come along just as we think we have got rid of the ITS. Perhaps we should spare a thought for the staff of the IBC, who had been used to a year off before even having to think about the next exhibition; now they are going to have to go straight from one to the other. Welcome to the real world, guys. ■

MIDEM

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POWER AMPLIFIER

MC² MC-650

Ben Duncan assesses the *MC-650*, one of a new range of British power amplifiers with microprocessor control

The *MC-650* (and its junior cousin, the *MC-450*) comes from MC², a new name in power amplifier manufacturing. Still, the design is no upstart, having had an exceptional gestation period of almost 20 years, for the man behind MC² is Terry Clarke, founder and ex-owner of Klark-Teknik. Since the 1970s, he has spent many hours thinking about power amplifier design, received technical input from Jeff Byers of Midas, and examined other manufacturer's work. But while at KT he never got around to it–in fact, the MC² project only began in earnest three years ago after Clarke sold KT to Mark IV. The end result was partly launched this year, and dozens are already in use, both in multiple fixed installs, and also in Opus Audio Developments' PA rigs—which are manufactured down the road from MC². As the design progressed, Opus provided useful critical input

Description

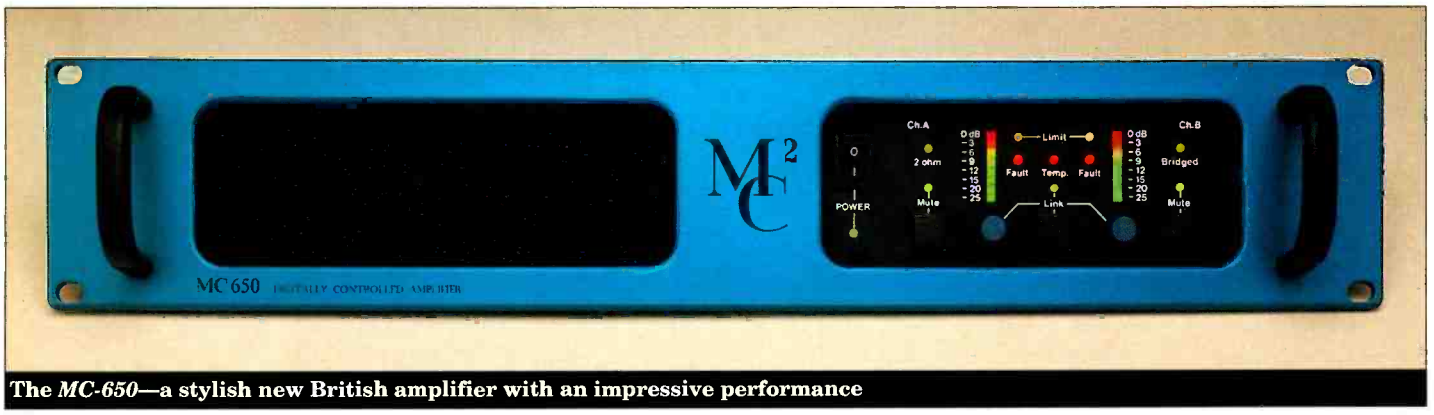
Visually, the most striking element of the *MC-650* is its bright blue, anodised front panel. And the sculpted profile, with the edges of the fan filter media tucked behind the nearly ¼-inch thick front plate. This is practical stuff, as the filter pad is about as accessible as you can get, but will not flop or fall out (unlike a similar but more elongated approach by a major US amp manufacturer) and does not rely on tacky self-adhesive aids. Turning to the controls and indicators, the gain controls are 'shaft encoders', meaning they are 'digitally-abled' and have no end-stops. Each channel also has touch MUTE buttons, signal bar-LED metering (with true clip referral), limit and fault LEDs. The bar LEDs show the gain setting as soon as the associated gain control (strictly attenuator) knob is turned, even slightly. For example, when the knob is cranked up to the maximum gain setting (strictly minimum attenuation), the bar meter lights up fully, to 0dB.

A touch button can be set to link the channels, indicated by the central Link LED. Further LEDs indicate Bridge mode, and '2Ω' operation, where both channels' power supplies are reconfigured for a more optimum current-voltage ratio into 2Ω loads in stereo or 4Ω when bridged. Another, single LED lights if either channel overheats. The mains cable is hard wired and changing it, while reasonably straightforward, would require destruction of the permanent cable clamp. Incoming supply fusing (an overall 10A for 240V AC) is accessible on the panel. There are another seven, fully documented fuses inside.

Inputs are conventionally wired female XLRs, but with no male 'link outs'. No user has had a problem thus far, but MC² say they can soon supply units with this facility if needed for a reasonable, minimum number of ten units. Outputs are conventionally wired Speakons—half the terminals (2+, 2-) are unused. There are additionally binding-posts-cum-4mm-sockets with special side shrouding to help meet the soon-to-be compulsory EC LVD regulations. Slide switches set Stereo or Bridge (mono) modes, and a minimum nominal load impedance of 4Ω or 2Ω. The review amplifier (and all current production models) was supplied with blanked-off provision for a D-connector, marked Remote. It is easy to take all the front-panel information and monitor and control the amplifier from an external computer, and this has been tested. However MC²—like almost everyone else—is waiting for a, indeed *the*, protocol to emerge—having seen enough money to buy houses being poured by one large pro-audio company after another into perfecting equipment for a networking 'standard' that is yet to be. Clarke cites the Lone Wolf network as the best seen so far, except the custom hardware as unrealistically pricey. Whatever, all amplifiers will be updatable with a remote card when a sensible, global protocol emerges.

Internal affairs

The inside of the amp is simpler than most: there is a limited amount of sturdy, pluggable wiring loom, with all latching connectors, hooked up to three circuit cards and two amplifier modules, the latter combining drive circuitry, the M-DAC, heat sinks and fans. One PCB contains the power-supply fusing and ▶



The *MC-650*—a stylish new British amplifier with an impressive performance

reservoir capacitors, the protective ntc thermistors, control relays and auxiliary circuitry. A second PCB holds the front-panel controls and LEDs. The third board carries a microprocessor and temperature-reading A–D convertor —the source of the amplifier's intelligence. The remaining interior space is filled by a single toroid with multiple windings.

For those who still feel that the type of output transistor says anything significant about the way an amplifier sounds or survives, they are bipolar, modern, plastic and made by Toshiba. The heat sinks are 'live' but are insulated from the case by rugged plastic tape. The omission of individual transistor insulators (mica) aids device junction cooling and also simplifies and speeds up transistor replacements, which is also streamlined by the transistors being soldered straight-legged, at the PCB edge. Cooling employs an exceptional two fans per heat sink—four in all. The fans' noise is pleasingly discreet; in a quiet space, from a distance of ten feet, it sounds like the faint traffic roar of a motorway five miles away. The fans blast directly and orthogonally against the fins—an approach rarely seen, though I first used it myself to good effect over a decade ago. The *MC-650*'s heat sinks are certainly surprisingly small considering the power throughput. Later, Terry Clarke revealed that the design had been optimised with the aid of a student who had expertise in using a thermal CAD program.

SW6 and SW7 operate together, they determine the operating mode and release time of the limiter as follows:-

SW6	SW7	Function
OFF	OFF	Release time = slow
OFF	ON	Release time = fast
ON	OFF	Automatic Gain

Control mode. (Once the level has been reduced it will remain at that level until changed manually).

ON	ON	Limiter disabled.

SW8 (normally ON) This sets the attack time of the limiter.
ON=Fast
OFF = Slow

Fig. 9–Tabulation of DIP header options

The driver stage—described by the maker as floating—is relatively unusual for being reduced to just a dual op-amp IC, and having power supplies that follow the output swing, so that the drive signal can be higher than the output section. This avoids the waste heat that the more common 1V to 10V (at clip) of output 'saturation voltage' implies, when hard driving with a compressed programme. As the output transistors are bipolar, the question of abuse protection arises. This is a joint effort. As well as current sharing, it involves avoiding saturation at high frequencies, and with a minimum number of four transistors, abrupt limiting above 20A had its part to play —even with the power devices being jointly rated at 60A at room temperature.

Also hidden inside is a versatile limiter, elegantly utilising the same M-DAC as the gain controls. Mode (limiter or agc), thresholds (0dB, -1dB, -2dB or -3dB below true clip) and dynamics can be set by a DIP header inside (see **Fig.9**). The 'agc' setting offers poetic justice at last: it can be used to punish DJs who abuse a PA system or risk the hirer being fined for sound level excesses—as any gain reduction is permanent until reset by switching off. The unit was tested with the default settings—limit just below clip.

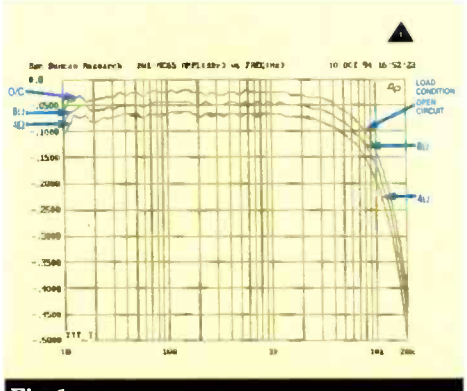


Fig. 1

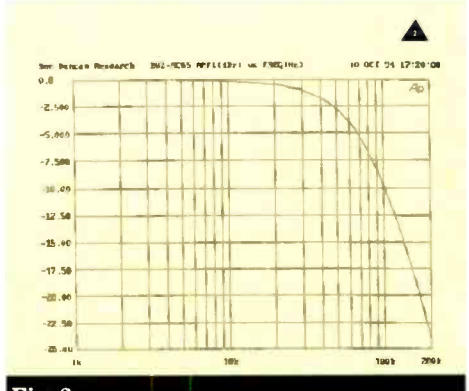


Fig. 2

Bench test

Fig.1 shows the bandwidth for three load conditions, driven 1dB below clip, over the fine range of 0dB to -0.5dB. The response is healthy, just approaching -0.5dB at 20kHz with a 4Ω (minimum) load, or slightly less. The slight difference in the amplitude of the 4Ω and 8Ω load plots expresses the output impedance, which is constant from 10Hz to above 5kHz. The inter plot gap of about 0.02dB works out as an unusually low 9mΩ at the output terminals. Alas, only those able to place the amp within a yard or less of the boxes (PA) or monitors (studio) will be able to make direct use of this. At least it indicates some uniformity in the application of feedback. **Fig.2** repeats the bandwidth sweep up to low RF realms, with a 4Ω load. There were no signs (nor smells) of stress, and the -25dB of rejection at 1MHz is quite good. **Fig.3** plots CMR, residue measured at the output, with a CM signal of +18dBu for a high CM residue-to-noise ratio (CMRNR). LF rejection is excellent, slightly different but both in excess of -90dB at 100Hz, degrading to still better than -50dB at 50kHz.

Fig.4 shows the noise spectra, with little if anything to bother the ear at the usual 50Hz, 100Hz and 150Hz hum frequencies. When weighted for audible annoyance, the frequencies either side of 3.5kHz will drop away steeply. Even at this most sensitive point, the indicated noise, -123dB below full output, will be all but inaudible in all but the quietest rooms with highly sensitive midrange drivers. There's also no pickup (at 32kHz and harmonics) from the test set's computer monitor—a sign of some RF immunity, considering my Audio Precision's dedicated PC monitor has a uniform position with respect to tested equipment, and that a number of other PA amplifiers have showed sizeable 32kHz spikes.

In **Fig.5**, %THD into a 4Ω load has been plotted with both wide (upper) and narrow bandwidth. Wide means 10Hz to 500kHz; narrow is 400Hz to 22kHz. These are corner frequencies and plotting is confined to narrower limits of half the uppermost frequency, and about double the lowermost, hence 1kHz to 10kHz for the narrow-band plot. The similarity in percentage THD for the wide and narrow plots demonstrates that most of the distortion registered at 1kHz is real harmonics, not superimposed hum and-or hiss.

Fig.6 shows percentage THD versus frequency with a standard, 'honest' 80kHz bandwidth (which still only includes up to the 4th harmonic at 20kHz), into different loads: an open circuit, 8Ω and 4Ω resistive loads, and a simulated 4Ω, 15-inch driver (Simulated Loud Speaker or SLS) load. Above 200Hz, the three loaded curves are very similar up to 3kHz, with only slight differences on up to 50kHz. This suggests that the distortion seen in this, the mid range, is dominantly the driver or some earlier stage—the output stage is ▶

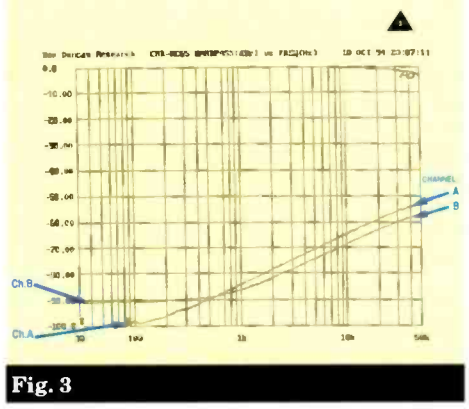


Fig. 3

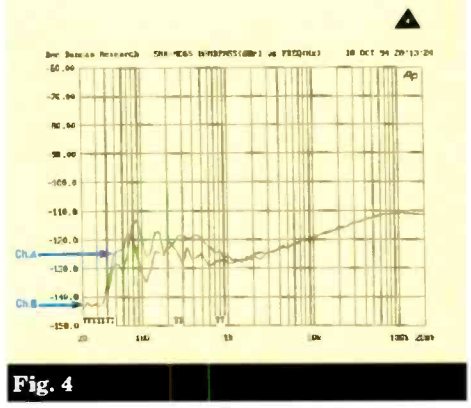


Fig. 4

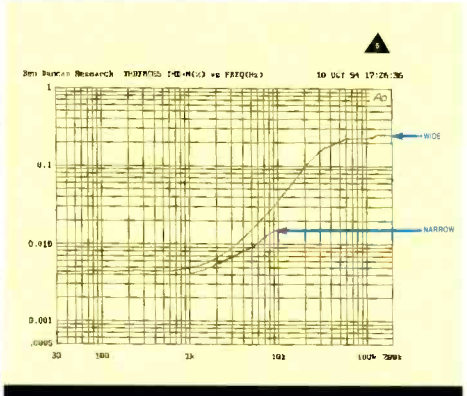


Fig. 5

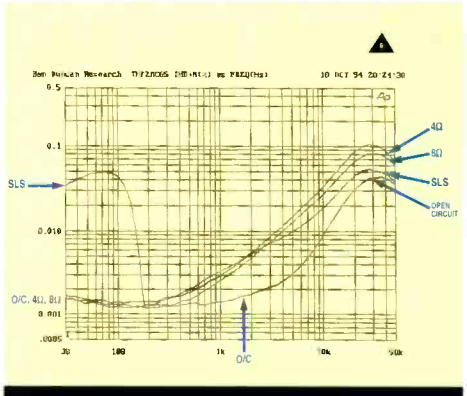


Fig. 6

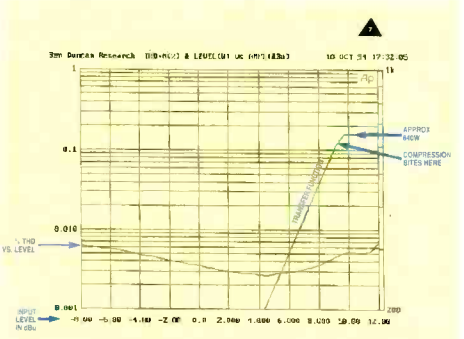


Fig. 7

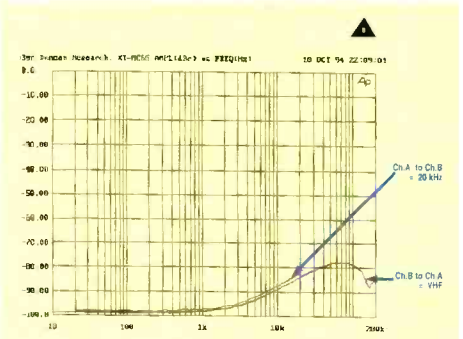


Fig. 8

'blameless'. Below 200Hz, the same applies except the SLS shows a steep rise in percentage THD, where the simulated drive-unit's stressful capacitative loading regime begins. A similarly abrupt rise in percentage THD is typical of most power amplifiers tested so far with this new, more apposite audio test condition. As the average ear is increasingly unfussy about harmonics totalling above 1% at low bass, the effect in occurring mostly below 100Hz, is less significant than it appears, but is still food for thought about what resistive load tests do not reveal. (This test may seem unfair to the maker, but new tests have to start somewhere).

Fig.7 illustrates the transfer function and maximum output. Distortion, here measured narrow-band, initially falls as usual with increasing drive. But instead of abruptly rising at clip, normally occurring where the output power stops rising (on the transfer function plot), the *MC-650*'s anticlip limiting action prevents any significant rise, at least up to the +12dBu drive level shown, or about 2.5dB past where clip would have occurred. Meanwhile, the power output is still clamped as if clipped, in this case to 640W, referenced to 4Ω. The unusually low distortion of such a 'hard' limiter effect is apparently accounted for by the use of the gain-controlling M-DAC as the attenuative element. Finally, **Fig.8** demonstrates good, low crosstalk in both directions, up to the most perfectionist recording studio requirements. The uppermost, Channel A to Channel B plot was plotted with a narrow 20kHz bandwidth to illustrate that some broad and-or major out-of-band noise was not affecting the results.

Further 'real world' testing revealed that the *MC-650* was in the top category, one of a handful of amplifiers that sailed through and survived tortures that included (in turn) 1 hour of cooking with a worst-case signal; driving hard until 'an event' with all the air vents taped-up; and connecting Channel 1 output full-bore up Channel 2 input. Beyond these, while checking mains operating range, I discovered one niche of unwelcome behaviour, unlikely to be encountered often, but still possible. This was the way in which a momentary (half a second) dip in supply below 205V AC (re. 240V setting) irrevocably triggered a complete shutdown sequence. This latter condition, involving total loss of output, and even the fans and all LEDs, is only intended to occur if the amplifier or rack ▶

Even at this most sensitive point, the indicated noise, -123dB below full output, will be all but inaudible

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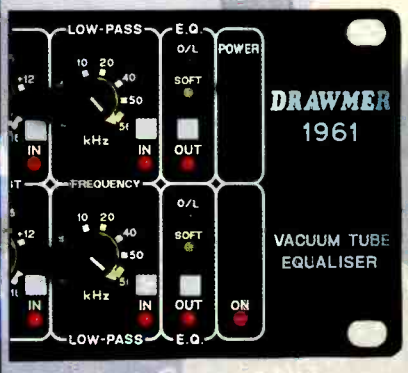

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Studio Sound

Overall sonic quality of the *MC-650* was assessed in the top class

catches (or is overcome by) fire. Fortunately, the maker was able to fix this problem, which was an oversight after early changes, by mailing a revised program IC (PROM). Fitting the new IC was an unusually easy operation, requiring little other than removing the lid and unclicking a few connectors. With the new PROM, the amplifier withstood prolonged supply dips to below 160V AC without hiccups. One feature I at first disliked was the way that having made a gain adjustment, a subjectively lengthy and irritating dead time elapsed. Anyone who has been saddled with computer that 'thinks' slower than they do knows how this feels... It was frustrating because during the dead time, you cannot see the effect that your adjustment had had on metered levels. This is important in a big PA, where an adjustment cannot be heard by the knob turner, and only be done 'by numbers', and because the wait time will add up if you have 100 units to adjust. Thankfully, this too was fixed 'overnight in the post', with further revised 'PROMware' which speeded up the LED bar's reset back to signal-metering after encoder turning had ceased, to be well under a second. These are examples of where the ease of changing and upgrading software can be unexpectedly helpful to everyone concerned.

Conclusion

After bench tests, the *MC-650* was 'environmentally assessed' in sweaty anger in a Nottingham dance-house music club, where it was driven to just below clip with a 70Hz bass-heavy full-range signal for six hours. There were no problems, and the sound quality was noted much improved over the older PA amp (that shall be nameless) that it replaced. Only the *MC-650*'s weight was criticised by my hosts, who had to lug the amp up and (even worst after six hours of sweating) down three flights of stairs. While the *MC-650* is only averagely weighty considering its output rating and 50-60Hz power supply, MC² are sufficiently aware of weight-sensitive users to already be working on the higher power but lighter-weight model, with a switch-mode supply.

Listening tests were then carried out in a controlled setup, where the room content, layout and the top-class-core-audio system components (including 15-inch Tannoy *DMT-II* monitors) have changed only sparsely and mostly incrementally over many months. Even furniture has not moved more than a couple of inches in this time. What was most impressive about the *MC-650*'s sonic quality was that it sounded so natural at all levels right up to clip; there was nothing strident or 'shouty' about the mids, and no audible exaggeration in any other band. In a few highly testing areas, such as the sense of air and precision surrounding a vocal line that is itself surrounded by a mayhemic backing track, it was also good—even if it was felt that the planned future model with a switch-mode power supply would likely sound even better. Still, overall sonic quality of the *MC-650* was assessed in the top class.

All round, a very solid unit, highly original, light (elegant) in places, with muscle applied in the right, other places. The *MC-650* should open ears in all kinds of pro-audio realms, and also one of the limited number of powerful pro amplifiers suited to a small studio, having unobtrusive cooling fans. ■

MC² Audio Ltd, Unit 6, Kingsgate, Heathpark Industrial Estate, Honiton, Devon EX14 8YD. Tel: +44 1 404 44633. Fax: +44 1404 44660.

References

1. *Realistic Amplifier Testing—Procedures for Touring PA*. For further information and availability see P.189–204 of 'Proc. IOA, Reproduced Sound 10', and in 'Events' on page 7.

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NEVA AUDIO PA-5002BG

With the trade borders opening, pro-audio equipment from the former Eastern Bloc is beginning to make its way into the West —with surprising results. Sam Wise bench tests the NevaAudio professional power amplifier

This may be the first review of a piece of Russian professional audio equipment in the West. It certainly surprised me when the editor asked me to have a look at 'the Russian power amplifier under my desk'. On second thoughts, why should surprise be my reaction? Russia has proved over many years able to master technology which matches that in the West, and even to produce good results when hampered by trade embargoes on various products, some of them still in force today.

Truthfully, the stimulus for this review was really the very competitive price offered for this amplifier. If it works well, European and US manufacturers watch out.

In the manufacture of a power amplifier there are four main cost areas: metalwork, output devices, transformer and labour. My thoughts were that this amplifier probably contained Russian parts for all except the output devices—these being somewhat high-tech and specialised for a country without an historic hi-fi market. But here I was wrong. The amplifier is Russian through and through, and is quite revealing regarding technology which is probably either unavailable or very high cost in the local market. But, ways have been found to construct an amplifier which is mechanically well thought out and nearly up to our best standards in quality.

Internal construction

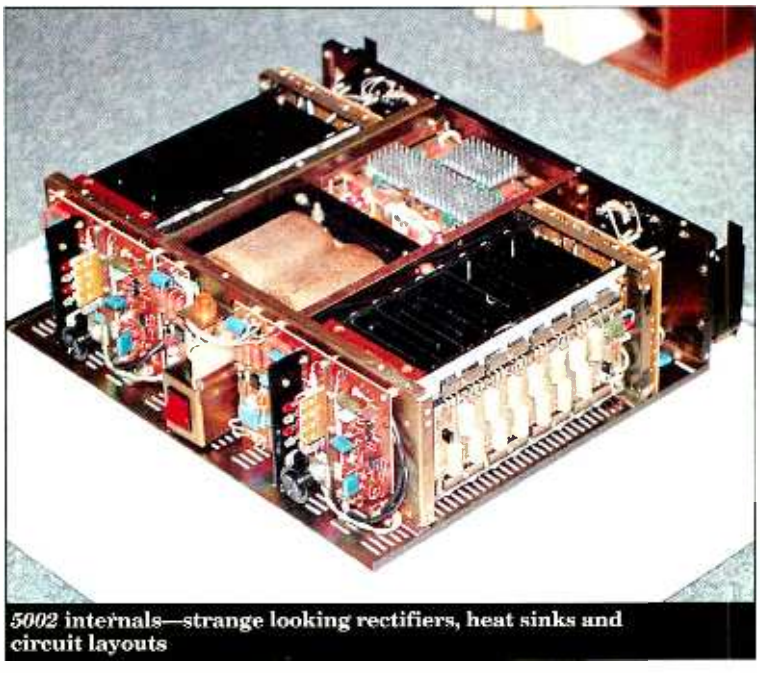
The chassis is all steel with what looks like a cadmium-passivated finish. This consists mainly of two robust frames which run from front to rear secured at the front to a sub-frame panel and held together at the rear with a metal frame containing power supply rectifiers, regulators and capacitors. Access is obtained by removing top and bottom covers. The front and rear panels can then be easily removed, leaving the two main heat sink assemblies with their output devices accessible for repair. Except for the four doubled-sided glass-fibre PCBs used to mount the 16 pairs of output transistors per channel, all PCBs are single-sided and made of paxolin or its Russian equivalent.

Most of the wiring is hand soldered in place with apparently no internal plug and socket connections. Wires are bundled using hand-tied looms —reminiscent of high-quality audio equipment of 30 years ago. Many of the components are also about double the size of those currently in use in the West, and there are indications that component voltage and current limits are lower. For example, the very large count of 32 output transistors for a 500W-4Ω output stage, and the large number of relatively low value capacitors in evidence in the power supply. It is said that 'where there is a will, there is a way'. The designer of this amplifier was not going to be put off by a limited range of components.

The upside of this design is that each parallelled component is subjected to a reduced stress—so long as none of the parallelled devices have failed. But the downside is the well known electronics reliability axiom that failures are directly proportional to component count.

On arrival, everything seemed well, except that two internal hold-downs for the heat-sink assemblies had sheared, being made of machined paxolin. In addition, there are a lot of internal screws which, though fitted with shakeproof washers, would be prone to loosening if the equipment travelled a lot. Those factors, added to the rack space required (when venting is accounted for) probably mean that this amplifier would live better in a fixed installation rather than a flightcase rack.

All wiring, components and PCBs appear well made and carefully ▶



5002 internals—strange looking rectifiers, heat sinks and circuit layouts

MANUFACTURER'S SPECIFICATION

Power Output
W (per channel)
Continous Average Output
Power both channels driven.
8Ω 1kHz 1%THD 350W
4Ω 1kHz 1%THD 500W
Bridged mono operation
8Ω 1kHz 1%THD 1000W
Total Harmonic Distortion
0.003%
(1kHz,-10dB re: rated output)
0.1% (20Hz to 20kHz)
Frequency Range
5Hz to 60kHz (-3dB, Pout=1W)
20Hz to 20kHz, +0, 0.3dB
Signal-to-Noise Ratio
106dB (A-weighted)
Slew Rate 35V/μS
Input Sensitivity
1.25V RMS for rated 8Ω output
Gain 32dB
Damping Factor
400:1 (400Hz, 8Ω)
Output Circuit Type
fully complementary, two-level
Output Devices (Total)
64 output transistors
Cooling passive
Connections: Input
¼-inch phone jack or XLR, balanced and unbalanced
Output 30 A terminals
Dimensions (WxHxD)
438mm x 132mm x 435mm
(19 inches x 5¼inches x 17⅛ inches)
Weight 19kg (41.8lbs)
Power Supply
220V ac, 50-60Hz (actually probably 240V)
Protection
DC protect: 1Hz or DC at 4.5V
Thermal 95°C
Current Voltage limiting

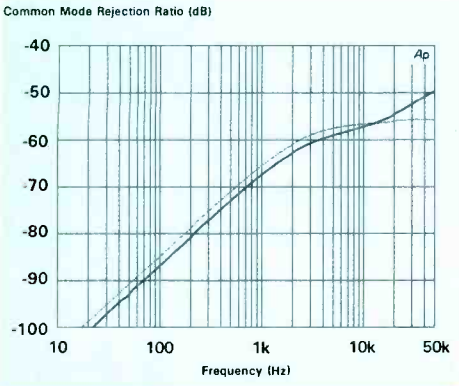


Fig.1: Common Mode Rejection Ratio of channels A and B. Both are loaded with 8 Ω and driven simultaneously at 350W/channel

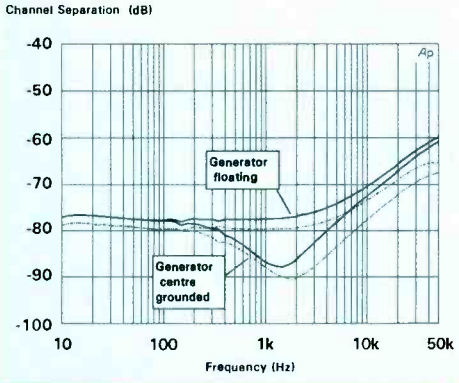


Fig.2: Channel separation (X-talk) in dB. Both channels loaded with 8 Ω, driven alternatively at 350 W/channel

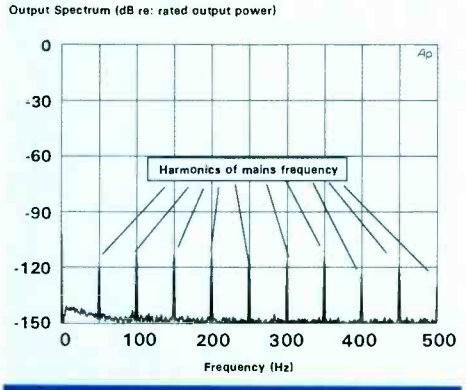


Fig.3: Low frequency spectrum of output signal with both channels loaded with 4 Ω. Referenced to rated output power (500W/ch into 4 Ω). No input signal

assembled, including the heat sinks which, rather than being the extrusions we have grown to expect, are constructed of 16 formed fins screwed to a pair of thick aluminium main plates. Ventilation is by convection—there is not a fan in sight. Rack spaces above and below are likely to be essential to reliable operation. During testing the amplifier was stood on the bench on its relatively small rubber feet. It worked reliably but would have run cooler with better airflow beneath.

TABLE 1

Noise Measurement type	Channel A	Channel B
Unweighted 22Hz–22kHz RMS	-97.5dB	-102.3dB
A-Weighted RMS	-105.0dB	-107.0dB
A-weighted Average	-106.1dB	-108.3dB
CCIR-468 Unweighted	-93.6dB	-96.9dB
CCIR-468-3 Weighted	-94.8dB	-95.1dB

Panels and controls

The front panel is made of black-painted aluminium, with large cast-aluminium handles for carrying the unit and protecting the controls, which are themselves recessed. Each channel has a nondetented rotary volume control, calibrated 0–10. These were found to match reasonably well between channels—typical accuracy 0.6dB channel-to-channel when set to visually the same position—good enough. Each has three LEDs mounted above it: red Protect—giving warning of short circuits or over-temperature shut-down, green Signal (which gets brighter as the signal level increases beginning at about 30dB below clipping) and red Clip (which illuminates at almost exactly the point the amplifier begins to clip under any operational conditions). In the centre is a red, illuminated, ON-OFF switch.

On the rear is a large-diameter captive mains cable complete with the correct internal colours for the UK. The mains fuse is internally mounted beneath the top cover, so, if a fuse blows due to ageing and could be safely replaced you are nonetheless out of luck in less than 20 minutes work. Inputs are on Neutrik-type XLR connectors (not Russian) and a parallelled three-pole 6.35mm jack. Outputs are sensibly only on 30A rated 5-way binding posts. There is room for a Speakon or two here. Lastly are three slide switches—two combine to select Stereo, Dual Mono (Channel A input routes to both channels), and Bridge modes. The last lifts the chassis ground from the signal ground. There are two brackets fitted to provide rear of rack support. The weight of the unit is quite well balanced and toward the front—good design.

Bench tests

The first testing problem is that the amplifier has been supplied labelled for 220V operation, and with a continental-type mains plug. While this is not usually a problem with signal-processing equipment, the 10% over voltage provided by British power supplies can be enough to consign a power amp to the great graveyard in the sky. Here, my Chinese-made variac (variable voltage transformer) was put to good use after several years of neglect. A voltage monitor was permanently tied to the output of the transformer to ensure that full voltage was maintained under load.

Following completion of the bench tests, the unit was tried on 240V and found to deliver the rated power instead of something a bit less. Obviously the builders put in a 240V-rated transformer but neglected to relabel the housing.

Inputs and outputs

The input is electronically balanced, having an input impedance of about 16kΩ, suitably high. Input common-mode-rejection ratio is shown in **Fig.1**—an acceptable performance. Channel separation is good as shown in **Fig.2**. Input sensitivity measures +3dBu for full output into 4Ω, or 1.1V.

Output source impedance is about 0.05Ω, giving a damping factor into 8Ω of 160, an adequate performance but less than the 400 specified. Power was initially measured below specification using the specified 220V mains supply. However, at 240V the unit met specification at 350W into 8Ω and 500W into 4Ω both channels driven. These rose to 415W into 8Ω and 630W into 4Ω with a single channel driven at the 1% distortion level. Bridged mono delivered 1000W into 8Ω.

Frequency response is as specified being -3dB at 5Hz and 60kHz. Audio band flatness is within 0.2dB. The response is almost totally constant with output level. ▶

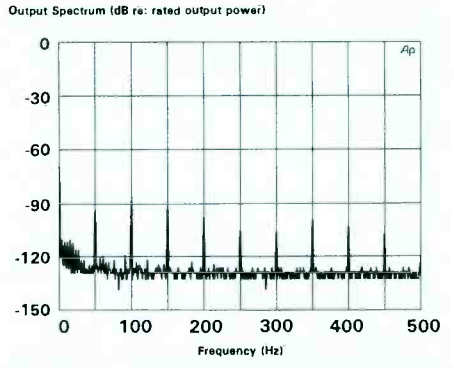


Fig.4: Low frequency spectrum of output signal with both channels loaded with 4 Ω. Referenced to rated output power (500W/ch into 4 Ω). Note overall increase in level from Fig.3. With 1 kHz tone generating 350 W rated output power

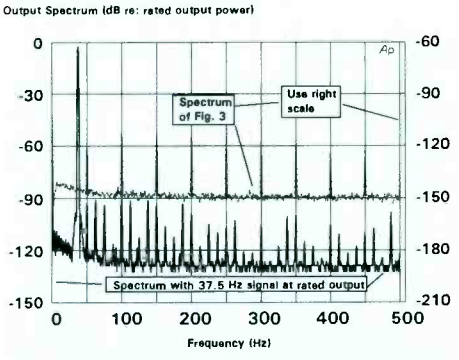
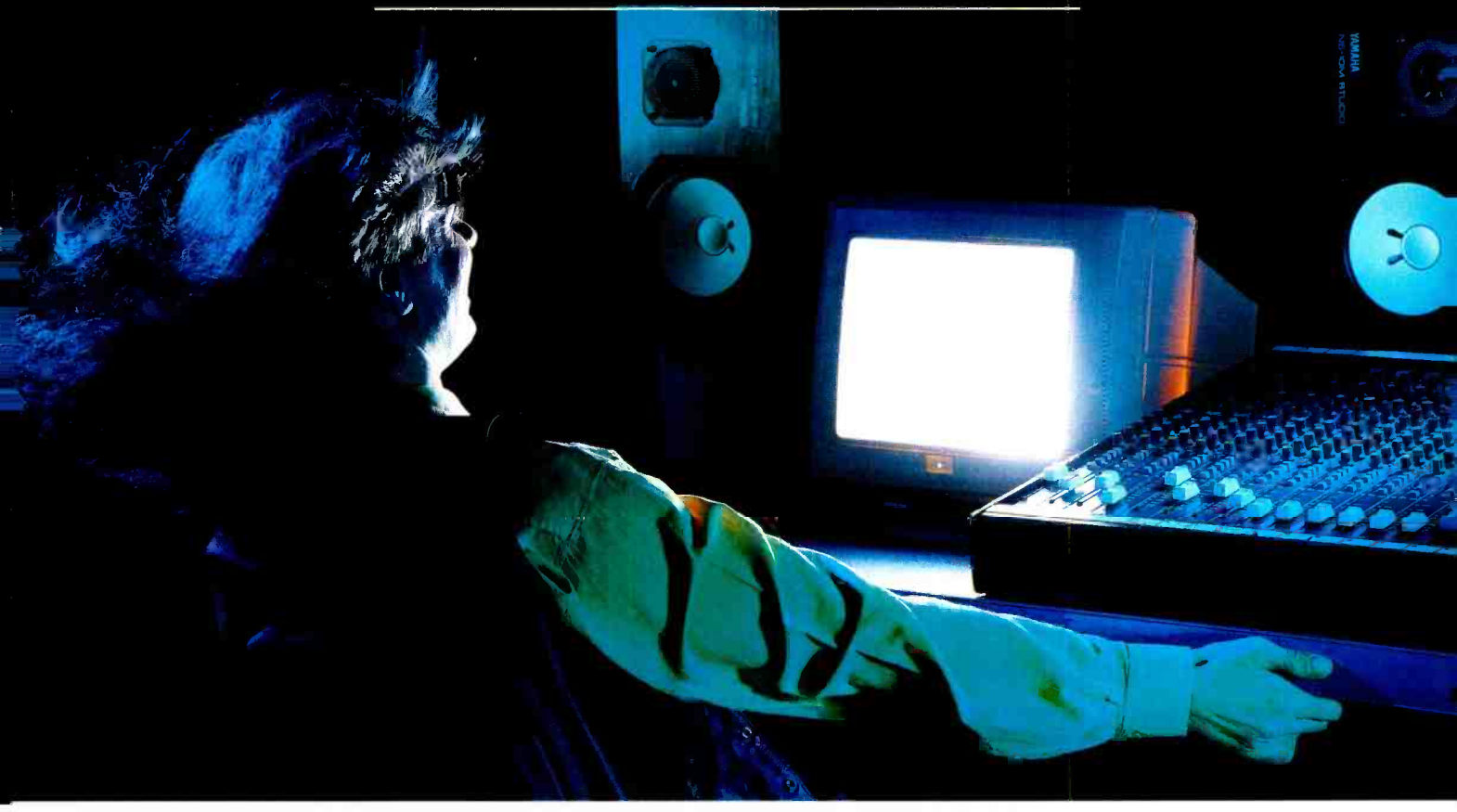


Fig.5: Low frequency spectrum of output signal with both channels loaded with 4 Ω. Referenced to rated output power (500W/ch into 4 Ω). Comparison of spectrum with no signal, and spectrum with full rated output at 37.5 Hz



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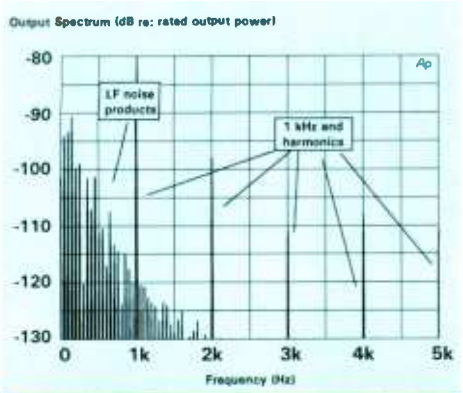

Fig.6: This is the same data as shown in Fig.4, but with a wider frequency spectrum displayed

Noise and distortion

Wideband noise measurements are given in Table 1, meeting specification. This again is a good, though not startling performance.

The biggest weakness of the amplifier's design seems to stem from the power supply. This is due, I would guess, to component availability, a large number of fairly small value capacitors are used to build up to the required value. One of the main sources of low to mid-frequency noise in a power amplifier is the wiring between the rectifiers and the capacitors. This has a continuous stream of short-duration high-current pulses in it as the transformer lead-outs and rectifiers supply current to charge up the capacitors on each peak of the mains cycle. If this wiring is spread out, or not carefully and consistently dressed with respect to input wiring and preamplifiers, then noise can result. While it is clear that noise as a whole is kept under good control, the noise and other artefacts produced by these mains pulses is not so well controlled.

Figs.3–6 are an interesting series of spectral noise plots, showing the noise and distortion caused by the power supply system. **Fig.3** shows the noise spectrum up to 500Hz when the amplifier is loaded with 4Ω, but with no input signal. The lines every 50Hz are harmonics of the mains current. The levels are relatively low, but they do extend upward in frequency a good way, indications of a likely source in the power supply system wiring. At first glance **Fig.4** looks the same, but note that the levels are now at least 20dB higher, This plot was taken when the amplifier was delivering 300W per channel of 1kHz sine wave into 4Ω.

Next look at **Fig.5**. This combines the plot of **Fig.3** (top, dotted—use right-side legend) and a plot which is nearly the same as **Fig.4**. Instead of 1kHz the tone is at 37.5Hz—very near mains frequency but selected to produce intermediate lines if any interaction results. The 50Hz harmonics have remained at the same level, but they are joined by a series of intermodulation products at 12.5Hz intervals. The cause here is some modulation of the power supply due to the less than zero perfect impedance that it has.

In **Fig.6**, we back out to a wider frequency view up to 5kHz. This is actually the same result as **Fig.4**. The hash on the left is the mains spectrum without the intermodulation caused by the 37.5Hz tone. The line at 1kHz is the sine-wave test signal. The lines at multiples of 1kHz are its harmonic distortion products.

For comparison, the THD+n plot versus level at 1kHz is shown in **Fig.7**. The point at which the amplifier switches power supply modes is evident at about -6dB output level, as is the point at which the amplifier begins to clip just below 0dB. The apparent rise of distortion to the left is largely due to noise. **Fig.8** shows how THD+n changes with level (individual curves) and frequency. The

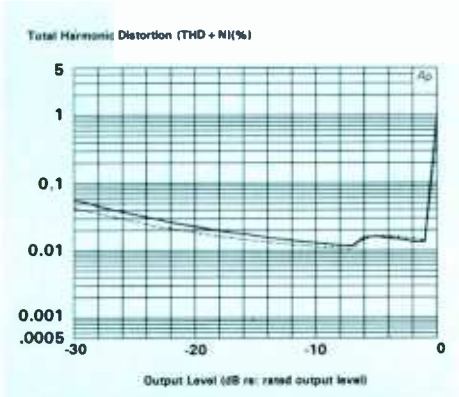

Fig.7: THD+N (%) versus Output Amplitude (dBr). Levels referenced to rated output level. Both channels driven at 1 kHz

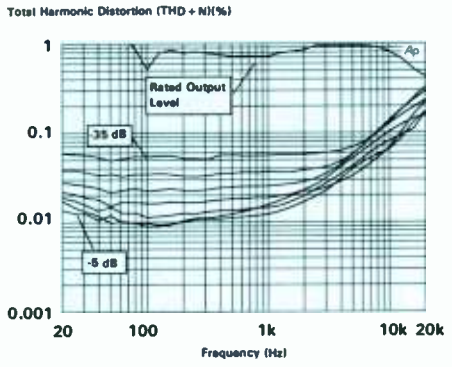

Fig.8: Change of THD+N with output level and frequency. Load is 4 Ω, both channels driven

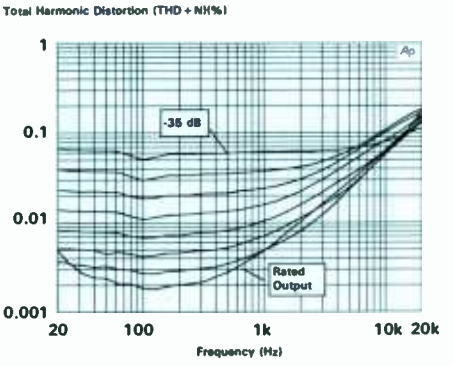

Fig.9: Hill Chameleon – shown for comparison. Change of THD+N with output level and frequency. Load is 4 Ω, both channels driven

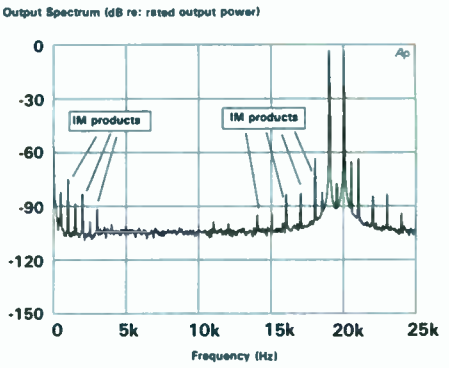

Fig.10: FFT Spectrum with tone tones of 19 kHz and 20 kHz. Level is set at 285 W into 4 Ω, both channels driven. Graph shows intermodulation distortion products (IM)

distortion does not drop below 0.01 % on Channel A, but does meet spec on Channel B (not shown). The difference is almost entirely low frequency related. For comparison, **Fig.9** shows the equivalent distortion curves for the recently-reviewed Chameleon. Can you hear this combination of harmonic and intermodulation distortion? I think so, but it is not blatant at these levels.

Fig.10 is interesting from the intermodulation perspective. Here there are two tones injected at the same level—19kHz and 20kHz, designed to stress any sluggishness in the amplifier. There are high-order distortion products surrounding the two tones, and a cluster of lower order products mixed up with the power supply noise at the low frequency end of the spectrum.

When tested with a square-wave signal and-or a capacitive load, the amplifier behaved impeccably.

Power efficiency

The amplifier operating instructions make the point that the amplifier is power efficient, particularly on standby and at low levels of signal—that is, most of the time. **Fig.11** confirms a low quiescent state, consuming only about 86W for a 1000W amplifier. At about 1W output, the current begins to rise, going sharply upward at 100W output where it is 25% efficient. At full power, about 1,800W are consumed for an output of 1000W total average power or about 55% efficiency. Bear in mind that at this level the amplifier is dissipating 800W internally, so begins to warm up nicely.

Lastly, in **Fig.12**, the 'turn-on' transient is shown reaching a peak of over 30A for one mains cycle. There is no attempt at a soft start on this amplifier.

Listening test

To get an idea of the audibility of some of what was measured, the amplifier was taken home to power up my JBL *Control 5*s with subs. Compared to the Technics amplifier which is in normal use, the Neva sounded slightly cloudier with a mite of harshness on vocals—subtle, but present none the less. For some reason—possibly nothing to do with the amp—the stereo imaging seemed to be better. All in all it was quite pleasant though I was pleased to hook the other amp back up again. ▶

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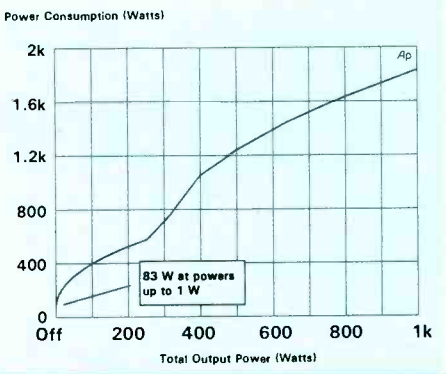

Fig.11: Power Consumption (W) versus Output Power (W). Both channels driven and loaded with 4 Ω. Output power shown is total of both channels

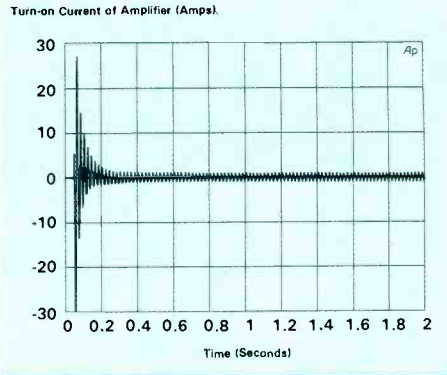

Fig.12: Time record of turn-on current of amplifier. Note maximum current is over 30 amps. There is no soft-start circuit on this amplifier

Conclusion

The NevaAudio PA-5002BG is, in many ways, a good power amplifier. It handles long-duration high-level signals well, never going into heat protection mode or showing any signs of distress during testing. That is more than can be said for some amplifiers recently tested. It has some constructional weaknesses which the manufacturer could readily overcome. Ventilation space must be kept around the amplifier, so do not assume that the 3U height is real from a rack space perspective. For the very interesting price, it may be hard to beat for fixed installations in many applications such as clubs, sound reinforcement and so on. For studio monitoring in a high performance environment, another model may be preferred.

Congratulations to the designers of the NevaAudio amplifier for overcoming obstacles to produce a good product from (probably) limited resources. It is a sign of good things to come. ■

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FIELD REPORT

I encountered the Neva 5002 while investigating proposed work in Russia. I had some amplifiers shipped to Lisbon, where I was redesigning Namouche studios (see article in this issue). Nobody knew what to expect but when the amplifiers emerged, there was a 'business' appearance to them which set a lot of heads nodding in approval.

After unpacking, everything came apart out of a burning curiosity as to whether all inside would be marked in the Cyrillic alphabet, and if Russian components would look any different to Eastern and Western ones. To everybody's delight, there were strange looking rectifiers and heat sinks, circuit layouts untypical of more familiar products, and I saw the use of Paxolin insulators for the first time in decades.

In October 1994, I was visiting St Petersburg for the Audio Video '94 exhibition. While there, I was invited to the Neva 'factory' and it immediately became apparent why the amplifiers are such good performers. The people at Neva, including their designers Feodor Kurouzbaver and Vladimir Rataev, were people of great intelligence, competence and humility. There was no sales hype, no arrogance about the superiority of their designs; only a remarkable degree of openness, honesty, and the courtesy that comes from a good upbringing and education.

Neva use multiple reservoir capacitors because large single capacitors of adequate reliability are hard to get hold of from Russian or ex-USSR sources. The capacitors which they use (24 per amplifier) are Russian military-grade capacitors with which they feel comfortable. They have now made over 2500 amplifiers over the last five years and they have no service stations. It would seem that to the best of their knowledge, they have had no reservoir failures. The rectifiers are peculiar flat things, which are unlike anything else which I have seen and are mounted between some strange 'bed on nails' heat sinks. The choice seems to have been dictated by availability and reliability.

I pumped them further, trying to find the weak spots. Apparently only two faults are likely to occur: a blown mains fuse suggests the failure of an output device. The cure being to check the resistance between the transistor legs one by one in situ, one of which will show a resistance around 1Ω less than the others. Change that, and you are back in business. The other likely fault is a driver transistor failure. 'Not enough gold in Russian transistors!', I was told. On rare occasions, an amplifier will exhibit asymmetric clipping, which occurs if a driver goes open circuit at the base-emitter junction—the fix is only a 15-minute repair. The amps do not seem to go wrong often. It appears, however, that the amplifiers are absolutely incapable of going DC on the output —sensor circuits crowbar the PSU at the slightest sign of a dangerous output, so in the very rare event of an output device failure, precious cones and diaphragms suffer no ill effects.

There is no doubt that these people know that they are doing. I came away with the impression that the people, and their products, can be implicitly trusted. Neva are working on a 2kW/channel model, which I look forward to testing as I am sure it will be something to be reckoned with. ■

Philip Newell

INDEX TO 1994

A guide to features and reviews published in *Studio Sound*, Volume 36.
The right-hand column gives the month of publication and the page number

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Amek Mozart 40 frame, supertrue..... £37,000
Amek Mozart RN 56 frame, 34 fitted..... £55,000
Langly Recall 40/8/2, 8 VCA's, etc..... £20,000
TAC SR 6000 40/8/2..... £18,500
TAC Matchless 2 available..... from £3,500
APT 48 German high end console..... £40,000
Yamaha DMC 1000 18 months, excellent, 2 available..... £16,000
Trident 65 Series 24/16, excellent..... £3,500
Mackie 8 buss 24/8/2 as new..... £2,500
Studiomaster Proline 24/8/16 MIDI..... £1,150
Soundcraft Spirit Live 8/3, excellent..... £495

DIGITAL RECORDERS:

DAR Soundstation 2 8 channel..... £12,500
AMS Audiophile v.7; 2 in 8 out; 1hr..... £4,500
AMS Audiophile head ideal for sharing 2 rooms with 1 Audiophile..... £1,500
Digidesign Pro Tools with accelerator..... £ call
Alesis ADAT few hours use..... £1,500
Sony 2500 pro DAT..... £875

ANALOGUE TAPE MACHINES:

Otari MTR 90 Mk2 low hours, with overbridge, remote..... £11,500
Otari MTR 90 spares, loads..... £ call
Otari EC 101 synchronizer for MTR 90..... £250
Otari MX 80 rem/loc, low usage..... £9,000
Studer A 800 Mk 3 very low hours..... £ call
Studer A 80 Mk2 good runner..... £4,950
Studer A 80 Mk2 16/24 frame, rem. loc..... £3,000
Fostex G 16 MINT, hardly used..... £2,500
Sony 5000 ¼" CTC, excellent cond..... £950
Ampex ATR 102 ½" refurbished, warranty..... £3,500
Otari MTR 12 ½" + ¼"..... £2,750
Studer A80 ¼"..... £575
Studer B67 trolley, excellent..... £575
Dolby MT 24 SR automated, 18 cards..... £9,000
Dolby XP Rack empty..... £650
Dolby SP 24A 24 channels, Dobley A..... £1,250

OUTBOARD:

Neve/Amek 9098 in stock, on demo and sounding wonderful! ..... £ call
Neve 2254a pair racked and refurbished by Shep..... £1,600
Neve 1002 discreet class A..... £ call
Neve 33135 Vintage Eq's pair, racked..... £995
Neve 33608 psudeo stereo..... £150
Neve spares psu, modules etc, loads..... £ call
Neve V rack 8 eq, 2 dynamics, MINT..... £4,500
Amek PM 01 rare classic 2520 eq, 4 in rack..... £ call
Urei 1176 2 available..... £750
Urei LA 4 pair, racked, silver..... £750
Urei 546 parametric eq..... £425
TubeTech LCA 2B as new, recent..... £1,695
TubeTech PE1B valve eq, perfect..... £795
TubeTech CL1A valve compresser, perfect..... £895
Summit DCL2000 mint, stereo limiter..... £1,695
Audio and Design E 560-RS stereo limiter..... £425
Drawmmer DL 221 compresser..... £275
Drawmmer DS 201 dual gate..... £250
DBX 162 stereo version of 160..... £550
DBX 166 quantity available..... £330
BSS DPR 502 dual MIDI gate..... £350
Orban de-essers 1 left..... £250
Valley Keepex 2 10 in rack..... £1,500
Valley Gatex quad gate..... £175
Klark Teknik DN 60 RTA with mic..... £1,200
Klark Teknik DN 510 dual MIDI gate..... £425
Klark Teknik DN 322..... £350
BBE 822 sonic maximiser..... £275
Rebis gates & compressors..... £ call
Symetrix 511A noise gate, expander..... £175

FX:

Quantec QRS immaculate..... £2,250
Lexicon 224XL with LARC v 8.2..... £3,500
Lexicon 224 just serviced..... £1,250
Lexicon 200 224 in a box..... £1,200
Lexicon Super Prime Time 97..... £750
AMS RMX 16 remote..... £250
AMS DMX 15 80S several, various spec..... £1,300
Eventide H 3000S 2 available..... £1,600
Eventide H 910..... £275
Klark Teknik DN 780 reverb, excellent..... £895
Roland SDE 3000 2 available..... £395
Bel BDE 3200 24 second delay, sample..... £550
Bel BD 80 recent brown model..... £275
EMT 444 digital delay, 1 in 6 out, cheap!..... £150
Sony R7 reverb & remote..... £675
Yamaha SPX 90..... £275
Yamaha R 1000 crusty!..... £120
Electrospace Time Matrix..... £450
Electrospace spanner..... £295

MICROPHONES:

Neumann SM 2 stereo valve, serviced..... £1,250
Neumann U 87 2 available with shocks..... £750
Neumann KM 84i average condition..... £225
Neumann SM 69 Fet, stereo, MINT..... £950
AKG C12B 3 mics off 1 psu..... £2,000 lot
AKG The Tube complete kit..... £1,150
EAR The Tube rare, stunning..... £1,100
EAR Mic pre's..... £ call
B&K 4007 6 available..... £450
B&K 3529 stereo kit, 4003 + pre amps..... £2,500
Sennheiser 415T boxed, rifle..... £225
Sennheiser MD 421 2 available..... £150
Shure SM 87..... £150

MONITORING:

Dynaudio M2 with stands and amp..... £ call
ATC SCM 100A..... £2,750
ATC SCM 20..... £750
Tannoy Little Golds excellent condition..... £450
FW 801A the ultimate!..... £1,500
BGW 750C studio use only..... £395
Quad 521 BBC Spec..... £450
Quad 520f excellent..... £350
Quad 405..... £175

VARIOUS:

Sony DAE 1100, 1610 complete system..... £13,000
Fostex 4030/4035 sync + remote..... £650
RTW PPMs BBC spec..... £200
Audio Kinetics Pacer & Pad..... £750
Function Junction MIDI matrix..... £350
GPO patch bays..... from £5

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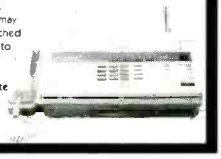

USED GEAR WANTED

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Barry Fox

Are all our 16-bit masters already obsolete? Is there a workable alternative to currently available M-O mastering systems?

What a shame that US audio pioneer Bert Whyte did not live to see and hear the new batch of Sony Classical CDs which have been sourced from the Everest archives.

In the late 1950s and early 1960s, Whyte put together the best stereo recording equipment he could lay his hands on, and took it to the best halls he could find, to record the top orchestras of the day for the Everest label. The first batch of five CDs include performances by Sir Adrian Boult, Sir Malcolm Sargent, Malcolm Arnold (now Sir), and Walter Susskind, at Walthamstow Assembly Hall in London and Heinz Hall, Pitsburg.

The microphones used were three Neumann *U-47* valve condensers, modified by Frank Church. The high-voltage DC power source was a photoflash battery. There were no line amplifiers; the signal just went through one triode before recording and one triode for playback.

Instead of 1/4-inch tape, Whyte used 35mm movie technology. The film studios were using Westrex 3-channel film recorders, to keep dialogue, music and effects separate for multilingual release. Whyte used the same machines, with three mics, for stereo.

The sprocketed 35mm acetate film was coated over its full width with magnetic oxide. So each of the three tracks was 7mm wide. Recording speed was the film industry standard, 90ft per minute or 18-inch per second. The high recording speed and wide tracks provided Whyte with a very low noise floor and a very wide bandwidth. This, of course, was in the days before Dolby and dbx. So the signal was completely unprocessed. The thick acetate base meant that there was no print through after recording.

But Everest then made and worked from 1/4-inch tape copies, releasing on vinyl pressings of variable quality.

Last year Seymour Solomon, President of Omega Records and founder of the Vanguard classic label, found a hundred of the original Everest 35mm masters in a vault in California. They had not been played since they were dubbed onto tape. Solomon worked with Sony to modify a more modern Westrex film recorder to match the original equalisation curves.

The signal was transferred to Sony's 20-bit *PCM 9000* system and then mastered down to 16 bits for CD release, with SBM (Super Bit Mapping). The film cans had not been opened for 30 years and when the lids came off the acetate fumes started allergic skin reactions for everyone involved.

Without doubt the results sound great. But inevitably the questions arise. Why do you need 20-bit transfers and SBM processing to deliver an analogue recording which, however good, still has a noise floor well above 16-bit levels? Any analogue recording, however quiet, will be self dithering, with the noise floor continually toggling the least significant bits.

Whether the use of SBM to convert the 20-bit disc transfers to 16-bit masters is of real benefit, remains open to question. But David Smith, of Sony's Classical Recording Division, who supervised the project, argues convincingly that there is very real value in 'freezing' the film original in 20-bit, rather than 16-bit code.

'What it is doing', says Smith, 'is more accurately capturing the noise. There is good reason to believe that there is useful information below the noise floor in an analogue recording. And it's detail that's worth retrieving. I want to hear the reverberation tails of the hall, I want to hear the space round the orchestra and the air round the oboe.

'It's a fact too, that the upper 16 bits of a 20-bit system are probably more accurate than the 16 bits of a 16-bit system.

'I was there at the transfers, and I know that what we are getting is low-level accuracy. People who buy the CDs now get to hear the quality of the masters.'

Food for thought—as, if the only way to capture an analogue recording accurately is to record the low-level background noise accurately, then the last ten years of 16-bit transfers are obsolete. Which, of course, is excellent news for the record companies, who can now remaster and reissue all their previous CD reissues.

Meanwhile, back in Britain, Decca continue to go their own way. Not out of perversity, but conviction.

In the late 1970s Nippon Columbia in Japan, Soundstream in the US and Decca in the UK, lead the studio world into digital audio recording. All used their own proprietary equipment. Decca modified the warhorse reel-to-reel video recorders which were then made by IVC, the International Video Corporation of San Francisco. These were so rugged that the military adopted them as standard. So did the British Government's GCHQ listening post at Cheltenham.

Naval frigates used IVC recorders, too. When one went down in the Falklands, it took the world's stock of the nonstandard tape reels with it.

IVC went out of business years ago, but Decca have kept their 45 recorders going since the late 1970s, by buying up every available secondhand machine, and cannibalising them for spares. Scanner drums have been refurbished by coating with Teflon.

It would have been far easier for Decca to buy Sony U-matics and *PCM 1600* convertors. But Tony Griffiths was never satisfied with the error rates, so Decca just kept on using the IVCs. This has saved Decca a fortune in capital investment over the last 15 years.

'We have spent nothing on new machines in 15 years', says Griffiths, 'while most studios have had to upgrade their U-matic and PCM processors several times over'.

Decca are now upgrading to an optical disc recorder—but not Sony's *PCM 9000*. Instead, they are making their own at a rate of eight a month —not for sale, only for use inside the PolyGram group.

Why not buy off the shelf from Sony? Decca's point is that the *PCM 9000* is based on MiniDisc technology and thus a nonstandard magneto-optical disc. Decca's recorder used a 5 1/4-inch magneto-optical disc of ISO standard, as used by the computer industry. So the company can pick and choose its source of disc, and upgrade to longer playing times as the computer industry upgrades the standard capacity.

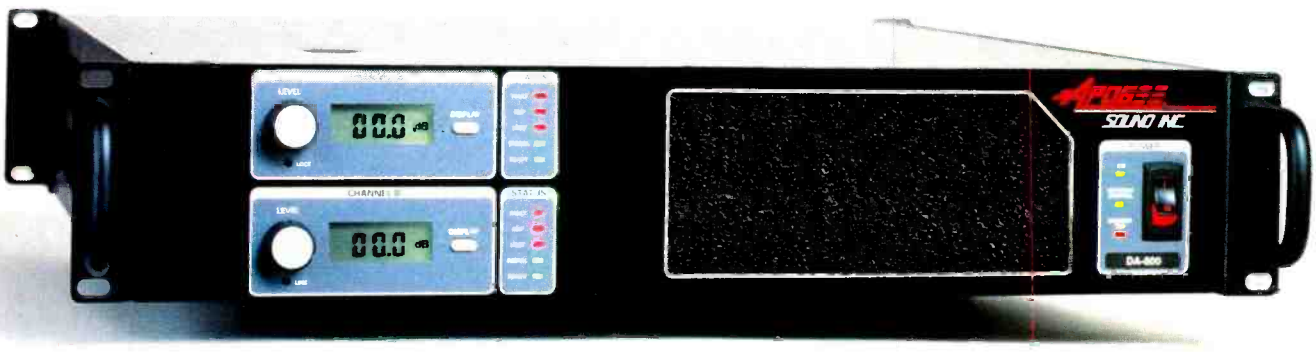
The current recorder has a 1.3Gb capacity. With 'lossless compression' of around 2.1 this gives around 72 minutes unbroken playing time with a 20-bit recording. Bought in bulk, disc prices are around half the price of tape.

Lossless compression itself is meaningless. What is being referred to here is 'lossless reduction'—which sounds like a contradiction in terms. All reduction involves throwing some information away but lossless reduction, whether for text, pictures or audio, means throwing away redundant information, for instance gaps between words, blank areas of picture, straight repetition or silence. The principles are similar to those used on personal computers, to double the effective capacity of a hard disc drive.

When you think about it, common sense tells that computer disk compression must be lossless —otherwise programs would fail to run, word processed text would read differently and bank statements would no longer add up. ■

ILLUSTRATION: CARL FLINT

Digital Power.



The DA-800 Digitally Controlled Power Amplifier.

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The DA-800 offers a lot more than just advanced digital control; at the heart of the design is an ultra-quiet, low distortion, very high power linear amplifier, expertly engineered for reliability and sonic purity.

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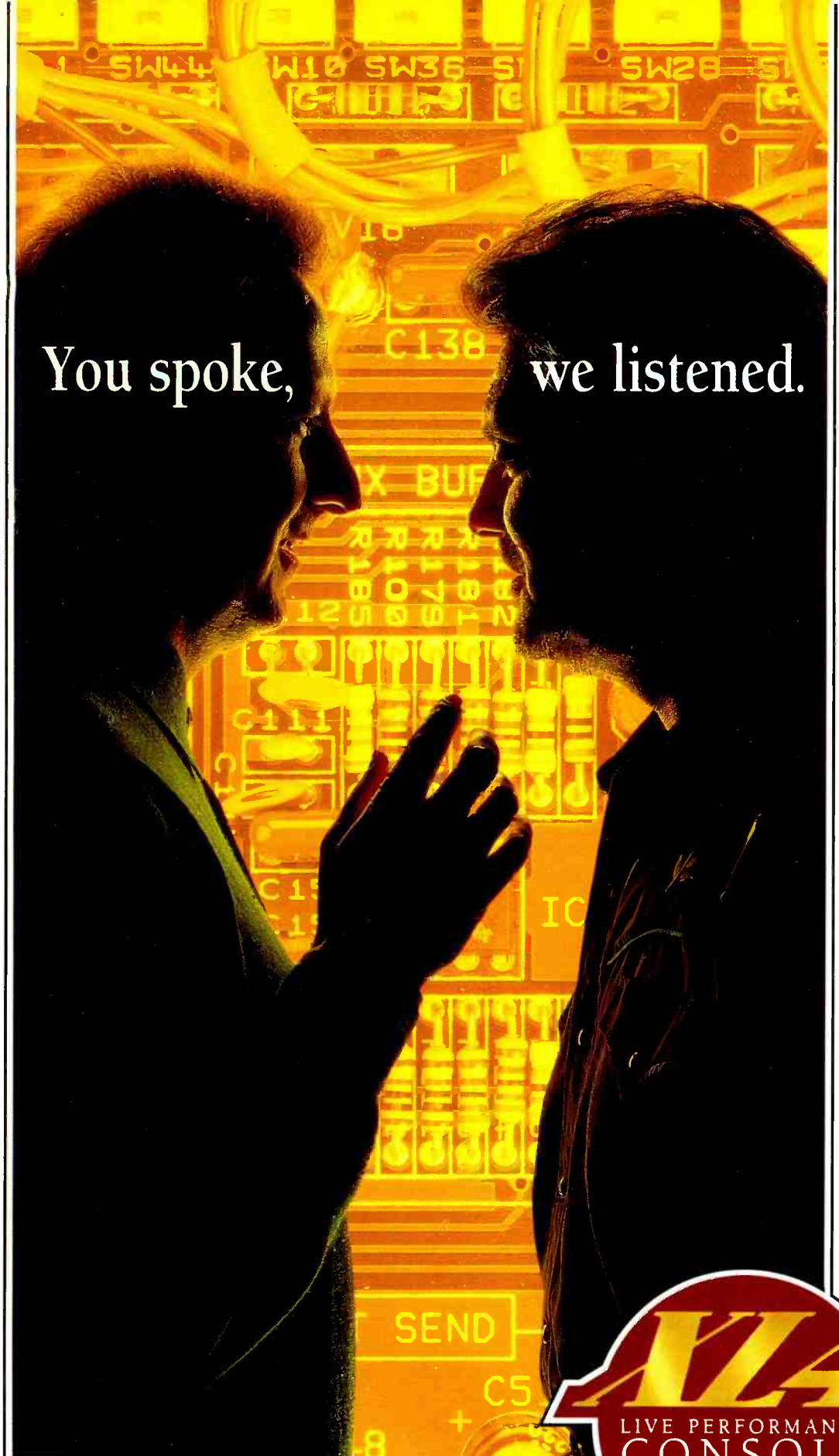

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