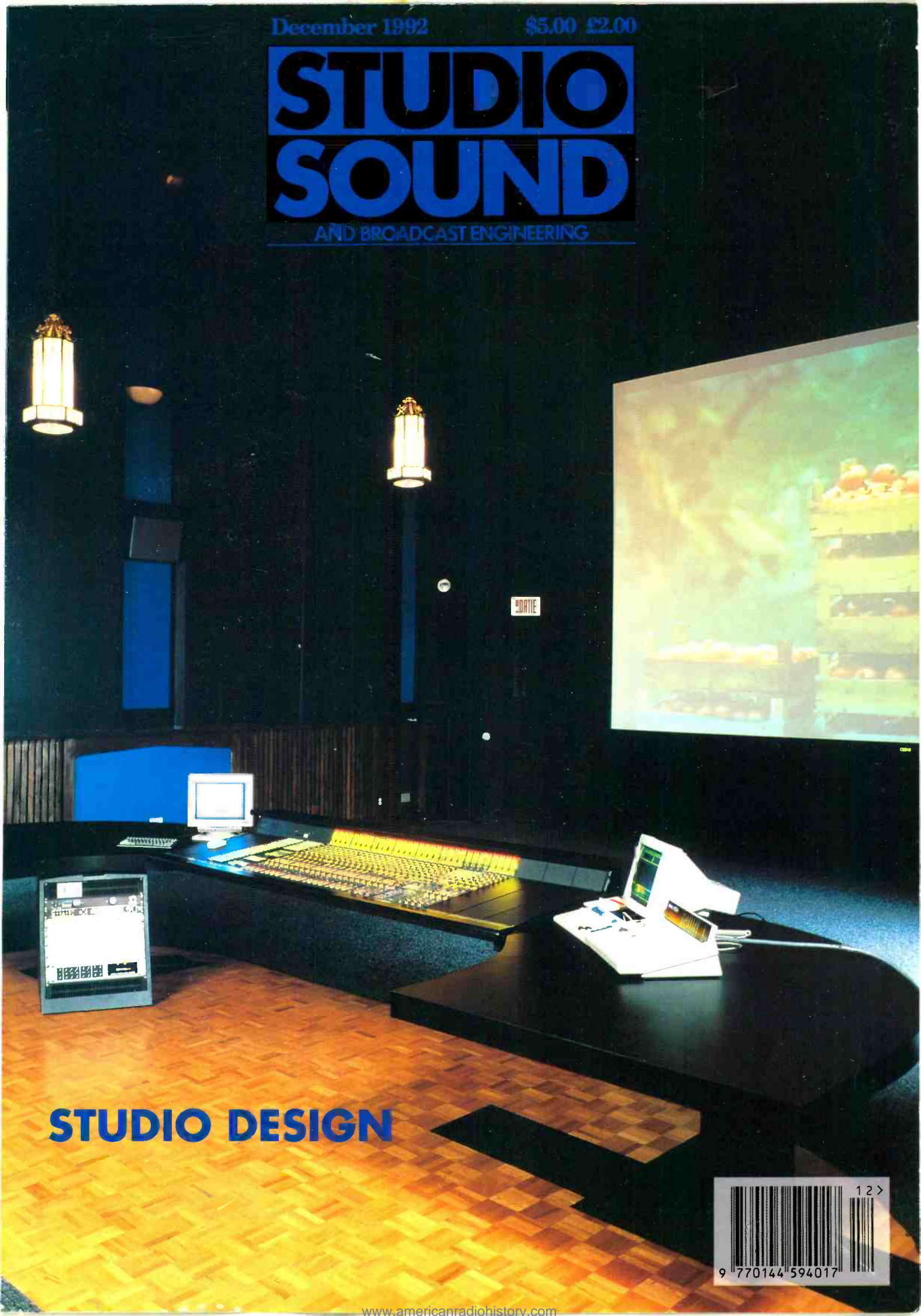


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EDITORIAL

Editor: Tim Goodyer
Assistant Editor: Julian Mitchell
Production Editor: Peter Stanbury
Secretary: Mary Walsh
Consultant: Sam Wise
Columnists: Barry Fox; Martin Polon;
Keith Spencer-Allen
Regular Contributors: James Betteridge;
Ben Duncan; Terry Nelson; Dave Foister;
Francis Rumsey; Yasmin Hashmi; Zenon Schoepe;
Mike Lethby; Patrick Stapley

ADVERTISEMENTS

Executive Ad Manager: Steve Grice
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CIRCULATION

Circulation and Development Manager:
Colin Enderson
Controlled Circulation Manager:
Maria Udy

Director: Doug Shuard
Publisher: Steve Haysom

EDITORIAL & ADVERTISEMENT OFFICES

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Designing for the Future

Two types of force control fundamental changes in the running of a commercial recording studio and the design philosophy behind it: the first is technological advance, the second is fashion.

As we extend our understanding of the physical world and the way in which we interact with it, our ability to take advantage of it is correspondingly extended. That much is easily understood. For example, maturing psychoacoustic studies and the slowly increasing use of 'surround sound' technology is creating a growing demand for suitably equipped mixing consoles, speaker arrays and, of course, for studio environments in which they can be accommodated. What is perhaps harder for the professional studio business to accept is that, for all its technical excellence and expertise, it is also at the mercy of the second force — popular taste.

Looking back a few years, we can see how simply and effectively the emergence of cassette-based 'personal' multitrack recorders destroyed the commercial 4-track business. In other words, it became fashionable to record at home before committing time, cash and music to a better-equipped recording facility. And, as we all know, the trend has continued — since the appearance of the Tascam 144, there has been a proliferation of musical and recording equipment which has progressively narrowed the gap between what can be achieved inside and outside of a purpose-designed recording facility. The 'secret' has been to get away from the use of microphones and to substitute line sound sources. In this way, many of the difficulties and associated expenses of controlled acoustic environments can be avoided.

While technically (and culturally) interesting, this devolution of recording has been understandably unpopular with those of us involved with struggling commercial studios. However, I suspect that there is a more encouraging trend now appearing.

In the absence of similar facilities being commercially available, musicians have had no option other than to set up their own studios based on this new technology — accepting with the responsibility, exclusive access and control. Yet all the traditional commercial considerations of finance, accommodation, maintenance and expertise in operation remain — with a few significant shifts in emphasis. The decision of commercial facilities to build in-house preproduction suites (often readily compatible with the studio's main rooms) is proving popular with those who would prefer to concentrate on the music and leave the technicalities to someone else.

In a recent interview, the Christians' Henry Priestman commented, 'With technology the way it is, you can do a hell of a lot in your bedroom and you can do a hell of a lot in a cheap studio. . . you don't need the most expensive facilities all the way down the line. As long as you mix somewhere good.'

The Christians have just completed an album which had been demoed and preproduced in the preproduction suite at Liverpool's Amazon studios, Joolz Holland's Helicon Mountain studio and Square One in Bury rather than in a studio of their own construction.

The influence that home-grown studios have exerted over commercial studio design has reflected the change in relative emphasis placed on the control room and live areas. Where the control room was once only required to accommodate the recording equipment and personnel involved in the recording, clients now often expect to be able to fill it with keyboards, samplers, drum machines and so on. In some cases, the only requirement for the live room is the vocals.

While the latest incarnation of the 'home' studio is not about to go away, the conditions which brought it into existence can now be regarded as being addressed by commercial facilities. And while it has not been an easy ride, they have presented valuable lessons along the way and are valid on all levels: conceptual, financial and musical. ■

Tim Goodyer

Cover: Marco Film, Montreal.

Designed by Patrick Bernsen

Radio star.



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The new PCM-7010 – a brilliant radio performer

Ideal for broadcast radio applications, the new PCM-7010 professional DAT recorder from Sony offers quick loading, instant start, fader start and simple remote or direct control. The recorder has four heads for simultaneous confidence monitoring and its modular architecture provides options for digital I/Os, memory start, timecode interface and an RS-232 interface option for PC control.

Like all Sony products, the PCM-7010 is robust, reliable and versatile and, like all DAT recorders, offers substantial cost and performance benefits compared with 1/4" analogue.

DAT is a well established and proven professional format, now being used across a wide range of broadcast and production applications.

Backed by the EBU recommendation of DAT as an exchange medium, broadcasters have been quick to realise its benefits.

Sony has pioneered DAT technology and in 1991, with the PCM-7000 series, launched its first DAT recorders designed purely for the professional. Since then over 1500 units have been delivered to customers in Europe alone, a clear sign of success.

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The end of an era: the Mitsubishi X880 digital multitrack

Mitsubishi leave Pro Audio

Sales of Mitsubishi digital recorders from the UK and European sales office in Hatfield will cease at the end of the year, as Mitsubishi begin the first stage of its phased withdrawal from the professional audio market.

Field Service Support and spares for machines will continue for the foreseeable future, with the familiar team of Mitsubishi digital engineers working out of Hatfield. The announcement is made 10 years after the introduction of the *Pro-Digi* format digital audio tape recorders at the 1982 AES.

Pointing to the current recessionary climate, Adrian Bailey (sales and marketing) explained the reasons behind the announcement, 'Like many manufacturers, Mitsubishi has been searching for viability in its operation in the pro-audio industry. Sadly, the continuing downturn of business has endorsed earlier decisions to withhold development and introduction of new products, but had accelerated the need to withdraw from this extremely slow-moving market.'

At the time of writing, it is not possible to confirm how the withdrawal will affect members of the Pro-Audio sales team. Mitsubishi Electric are currently exploring the

opportunities for redeployment elsewhere within the organisation.

Reborn classic

George Neumann GmbH has recently obtained sufficient quantities of authentic components and are about to produce a single special production run of Neumann U67 valve mics. The Special Promotion Neumann U67 comes in Nickel-Silver finish, complete with power supply, in a wood carrying case. A limited number of this Special Promotion model are being made available to the UK pro-audio market and orders are being taken now for delivery in time for Christmas.

Sennheiser UK Ltd.
Tel: 0628 850811.

Saki Magnetics launch relapping service

Saki Magnetics is to launch an international customer service programme to 'relap' magnetic recording heads. The programme includes audio record and master playback heads for high-speed and in-cassette duplicators as well as heads for broadcast and recording studios.

Saki is including any size, any

format, any material and any head manufactured by anybody in its relapping programme. The service, by phone appointment, includes a one-day turnaround delivery at no premium charge to customers in the US and a 'quick service' at no premium charge to international customers.

Saki Magnetics, 26600 Agoura Road, Calabass, CA 91302, USA.
Tel: +1 818 880 4054.
Fax: +1 818 880 6242

Contracts

● **Advision Studios** based in Brighton, UK, and owned by Geoff Downes of supergroup Asia, has become the first UK facility to install the Korg *SoundLink* random access digital audio multitrack system.

● At the July 1992 IBC, held in Amsterdam, Europe Audio Rent in Holland, were one of the first rental companies to order the new digital 24-track Sony *PCM 3342S*. The machine was delivered at end of September and is now available. Europe Audio Rent.
Tel: 03465 70670.

● UK artist, Rick Astley has recently purchased a Soundtracs *Quartz* console. He always had a great interest in recording equipment for his own home studio, and therefore is confident that he has got the best value for money when he opted for the Soundtracs *Quartz*.

● Cinevision, a Austrian television and video-production company have recently purchased a Solid State Logic *ScreenSound* digital audio editing system, which has proved to be very efficient and effective. This is

just one example, of how this system enables continuous and high-speed work within a short space of time.

● The Walters-Stork Design Group, Inc has been selected to design the new mastering facility for mastering legend Bob Ludwig. The new Portland, ME, facility will have two mastering suites completed by Jan. 1, with provisions for two more in the future. Walters-Stork will also design Peavey's new 50,000ft² media centre at its headquarters in Meridian, MS. Scheduled for a 1993 opening. The group will design and construct the new audio and video facilities at Five Towns College in Dix Hills, New York.

● One of London's newest musical imports, *Kiss of the Spider Woman*, is the latest West End show to feature a Cadac *J-Type* mixing console. The sound design is by Martin Levan who specified a 61-input version of the *J-Type* with 12 subgroups and 24 matrix outputs, plus five programmable routing modules.

● Recent DynaudioAcoustic monitoring sales through UK supplier Stirling Audio include *M2s* to the Pet Shop Boys; *M2s* to Trevor Horn and *M1s* to Eel Pie Studios, London.

● The Cutting Rooms at South Manchester College, have bought the *Uptown 990* moving fader automation system — installed in their Raindirk *Symphony* console.

● Skywalker Sound South, CA, has bought and installed its first Otari *ProDisk-464* hard disk recording-editing system.

● The Consortium, a postproduction facility in Shepperton Studios, London, has bought an *AUGAN 408 OMX* audio editing system. Other recent *OMX* sales include Warwick



A new Soundtracs Quartz for Rick Astley. But has his public given him up?

dubbing theatre; BFBS; BBC Outside Broadcast and Angell Sound Studios.

● Industrial Acoustics Company (IAC) of Staines, Middlx, UK has completed the installation of 12 custom-designed modular voice-over booths for French national TV broadcaster Television Francaise 1 (TF1) at its Paris studios.

● Fox Tape Division, Los Angeles, CA, has bought two SSL *Scenaria* digital audio-video production systems as well as a third *ScreenSound* digital audio editing system to expand its *SoundNet* digital audio network

● Recent sales of the Professional Monitor Company's products include UK console manufacturer Solid State Logic for their demo studios; the studios of The Royal College of Music in London; and The National Physical Laboratory in West London.

● Recent sales of Graham-Patten Systems *D-ESAM* series digital audio mixers include ABC Television, New York, which now owns a total of nine *D-ESAM 800* systems; Apocalypse Post, Sydney, Australia; Rushes, London; and Woodholly, Los Angeles

● Tannoy's Contractor series have been used as part of a \$100,000 sound installation for the new multimillion dollar Chinese Cultural Centre in Calgary.



Orinoco in full flow

Praise for QSound

There was a day when you reached for your Aural Exciter to add that indefinable sparkle to the mix, it made even cassette copies sound good. Now producers can go spatial for sound enhancement; *QSound*, Roland *RSS*, Perfect Pitch's *OM3D* system, and the *Spatializer* are a few of the current processors to promise placement and movement of sounds in 3D space using just two speakers.

In the rush to use such systems mistakes have inevitably produced questionable results and bad press.



Audiofile file: Mark St John (second left) and Airtio Moreira (right) with Fourth World and Silver Signature monitors from B&W

Sting and Madonna used *QSound* on albums and holes started to appear in the sound stages; there were mono compatibility questions and tonal changes were seen as an undesirable side effect.

However *QSound* is trying hard to prolong its appeal. The system is now available on a daily-rate basis and not as a percentage of the album sales as before, it is a third of its original size and now features joystick panning to SMPTE or MIDI time code. The system has just been used on all tracks of Praise's new album recorded at Orinoco Studios in South East London by engineer-producer Richard Burgess and engineer Julian Withers.

For Withers, 'A-B'ing between stereo and *QSound* was like flipping between mono and stereo. The results were great with a much fuller sound than usual. We made a conscious decision to use the effect sparingly because of possible phase cancellation problems and the holes you can get.'

The Orinoco sessions used the bulky original system and have the marks on the walls to prove it from manoeuvres into the Neve studio. The *Mark II* system comes in a much more manageable size with laptop computer on top of the rack. Miniaturisation will no doubt house *QSound* in a 1U rack space in the future.

What you also get when you hire

QSound is Keith Marlow who is the company's UK installer and consultant. He was present at most of the Praise sessions but was careful not to get in the way, Marlow: 'People usually want to shut themselves away with the system, so I just give them a 30-minute demo and let them get on with it. The joystick with the new system helps people get over the initial strangeness.'

QSound the company is now based in Los Angeles with the R&D staying in Canada. Marlow: 'At the moment the games-software people are being more adventurous than the studios, in fact we've been looking into producing chip sets for a certain manufacturer.'

The *QSound* sessions gave *Studio Sound* a chance to visit one of London's more durable recording studios. Orinoco is around five years old and made its name through recording Enya's hit album *Orinoco Flow*. The studio's decision a couple of years ago to buy a Neve VR was seen as a make-or-break one, as it turned out if the studio had not bought the desk they might not have survived. The situation was helped by the fact that the Orinoco building and most of the equipment is owned by the studio's founder Tom Astor.

Last year Orinoco opened their second room, The Toy Shop, a MIDI-based programming suite which recently helped The Shamen to

produce their hit singles and album. The studio also offers a video studio and OrinocoMix, a stable of producers and DJ remixers like Tommy D of Right Said Fred fame; Carl Cox; Lenny Dee and Steve Proctor. OrinocoMix is run by Alex Kerr-Wilson who has now relinquished all studio manager duties to concentrate on the artists management.

QSound Corp.
Tel: +1 213 876 6137.
Fax: +1 213 876 6721
UK: 0279 659808
Orinoco Studios.
Tel: 071 232 0008.
Fax: 071 237 6109

Audiofile recording at 145

Recording studio 145 Wardour Street in London's Soho was the site of a recent recording venture for B&W music, a subsidiary of B&W the speaker manufacturer. The band to be recorded was Fourth World featuring Brazilian percussion Airtio Moreira, Flora Purim, Jose Neto and Gary Meek. B&W Music was formed a couple of years ago to record mostly live jazz at festivals including Montreux — music that would appeal to the 'Audiofile' listener. ►

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The contention that drove the sessions at 145 was that this type of music, in this case predominately acoustic, should rely on the esoteric end of studio equipment that more reflects the esoteric hi-fi equipment that will replay it — B&W have donated a pair of their £4,000 *Silver Signatures* for monitoring purposes to press the point.

Mark St John, owner of the studio and a well known advocate of technology for the sake of music not for itself, produced the sessions and

used much equipment that was already owned by the studio. The recording used no digital but concentrated on Neumann and Sennheiser dummy heads and the Calrec SoundField recorded on an Otari MTR90. The tracks were mastered on a souped up 15 year old MCI analogue tape recorder with Saki heads and Dolby SR. The album is due out in the new year after a equally careful mastering process. **B&W Music Tel: +44 903 820415. Fax: +44 903 820419. ■**

In-Brief

● Spotlight Publications, publishers of *Studio Sound*, *Pro Sound News* and *Music Week* have bought The Gavin Report Inc, publisher of *The Gavin Report*, the San Francisco-based weekly magazine covering radio and music.

● In order to rebuff rumours to the contrary, Dave Wood, of Studer Revox UK, has stated that the *PR99 MkIII* professional tape recorder is still very much in production and will continue to be produced until at least the end of the century. Studer Revox.

Tel: 0635 876969.

● An APRS-organised joint venture for the AES exhibition to be held in Berlin next March is offering the chance of a DTI subsidy for all qualifying UK companies with products or services for the professional audio market. Contact the APRS. Tel: 0734 756216.

● Creation Technologies, makers of Anatek MIDI accessories for the MI market have announced the formation of the Anatek Professional Division, initially to market the *RADAR* random access digital audio recorder.

● A unique publication by music industry experts, *The Master Tape Book*, is now available from the APRS. The new book, a definitive guide to the creation and management of audio master tapes, is complete with photographs, illustrations and cartoons. APRS. Tel: 0734 756216.

● BBC Engineering and Thomson-CSF-Laboratories Electroniques de Rennes have recently demonstrated that it is possible to transmit at least one digital HDTV service in a standard television channel. The two organisations have collaborated using a novel, high spectral-efficiency modulation

technique.

● Mike Novak and Jon Trotter, longtime associates in Electromusic, and more recently Elliot Bros & Novak Electromusic, have formed a new company, Electracoustic Ltd, 1 Hoxton Square, London. N1 6NU. Tel: 071 613 0111.

Fax: 071 613 5266.

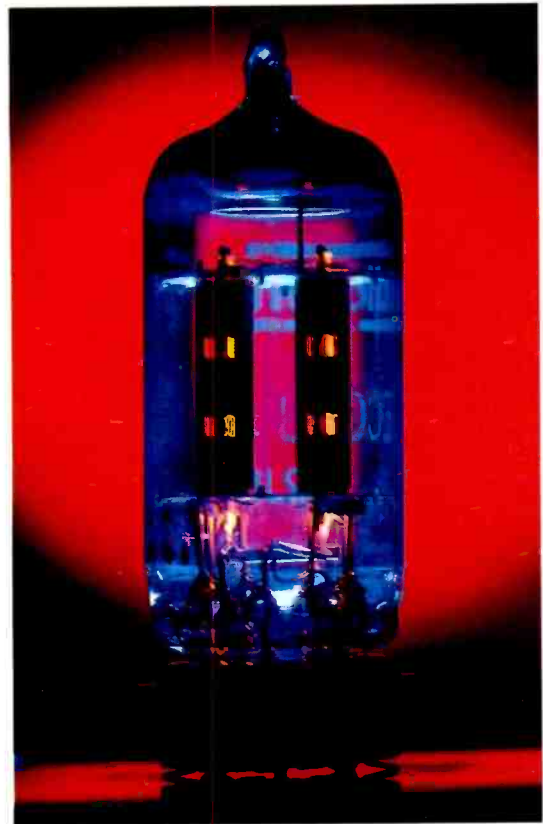
● UK AES Studio Design have been hit by bad debts and have had to close their studio division. Courtenay Nicholas' new company is Sound Design and is both consultancy and design. Recent work includes the new TV companies in Portugal TVI and SIC. Sound Design, 'Dundas', Chavey Down Road, Winkfield Row, Bracknell, RG12 6PB. Tel: 0344 883620

● Mingles Music, one of the UK's leading music production houses, have completed a £100,000 development programme including expansion of premises and investment in new studio facilities. Mingles have trebled their floor space providing a new client area with video viewing. A new recording studio is included featuring a separate section for keyboards

● Otari Corp have announced the formation of a new corporate division. The manufacturing facilities of the King Instruments, Division of Otari, Inc. in Westboro, MA, and Otari Console Group (formerly Sound Workshop) in Hauppauge, NY, have been merged into what will be known as Otari manufacturing Corp (OMC).

● dCS have announced a price cut in their stereo audio A-D convertor. They claim cost savings have been achieved through effective quality control during manufacture, reflecting the UK list price reduction to £2950. ■

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The Alcatel Space Theatre with its full-field dome screen

Expo '92

Universal Expositions are one of the traditional showcases for technological breakthroughs. And although it is difficult to tell without the benefit of hindsight the difference between a gimmick and a godsend, the 1992 Expo held in the Spanish city of Seville did not appear to feature anything with the life-changing significance — that of, say, the electric lighting that graced the 1888 Expo in Barcelona or the telephone that, along with ice cream soda, was the sensation of the Philadelphia Expo in 1876. I expect that there were those at the Barcelona exhibition, who boorishly explained that the cost of replacing gas lighting would ensure that light bulbs would never become cheap household items. I hesitate therefore to offer myself to the maw of historical ridicule by making pronouncements about the latest item of gee-whizzery which, in this case, would seem to be the IMAX SOLIDO featured at the Fujitsu Pavilion.

IMAX Corporation, the Toronto-based film company, were well represented at Seville and had four different systems on display. The French Pavilion had the standard IMAX giant screen mounted in a somewhat unconventional way; that is to say, horizontally at the bottom of a mirror lined 'well' (Le Puits d'Images). A fast-forward helicopter ride from Paris to Seville was one of the films shown there and it was possible to view it not only from within the Pavilion (queuing time three hours) but also from 'walkalators' which passed through the building above the well.

The Canadians celebrated the world premiere of 'Momentum', a dazzling tour of Canada shot and projected in the new IMAX HD format, high definition being achieved by a 48 frames-per-second rate. In common with the other formats, the IMAX frame size is 70mm — which is ten times bigger than the standard 35mm film — and it runs through the projector sideways instead of vertically.

The Spanish telecommunications company, Alcatel, sponsored both the Pavilion of the Universe, with its

dome-shaped digital planetarium, and the Space Theatre, where another three-hour queue regularly baked to see OMNIMAX. This system is projected through a 180° fish-eye lens onto a large dome screen which fills your field of vision. Scenes from the film *Eureka!*, which transport you to the heaving deck of Magellan's ship off the coast of Tierra del Fuego, are so involving that you may find yourself in danger of losing your popcorn. I did not manage to see the Rolling Stones feature *At the Max* and can, therefore, only wonder at the prospect of vertiginous close-ups of Mick Jagger.

The IMAX SOLIDO, presented by the Japanese computer giant Fujitsu, is also screened in a dome-shaped theatre but the big difference here is that the SOLIDO is three-dimensional. The effect is achieved by wearing special glasses which are a far cry from the cardboard-framed green and red celluloid items of yore. These glasses have electronic liquid crystal shutters which open and shut 96 times a second (48Hz for each eye). They are infrared synchronised to the film which alternately projects images for

each eye creating a stereoscopic image in full colour. Seemingly palpable images pass by you and, indeed, through you. Combined with a 4-way, 8-channel, CD-based sound system by SONICS the experience of travelling through blood, veins, and xylems in *Echoes of the Sun* can only be described as a mind-buck.

There is only one other SOLIDO (in Tokyo) and Kazuo Suzuki, the director of the Fujitsu Pavilion has doubts about its future.

'I have told IMAX this,' he says, 'so I don't mind telling you. IMAX do not know how to economise. They want the best at any cost. This system is so expensive that we will fail to commercialise it. IMAX will be defeated by the competition.'

And it is easy to imagine that competition not a million miles away from the North West Pacific is presumably waiting patiently in the wings for the IMAX patents to run out.

If the future of cinema does turn out to be dome-shaped then the implications for the audio world are far reaching — the prospect of a globular mixing studio cannot be too far away. ■ **Peter Ridsdale**

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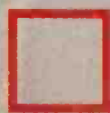
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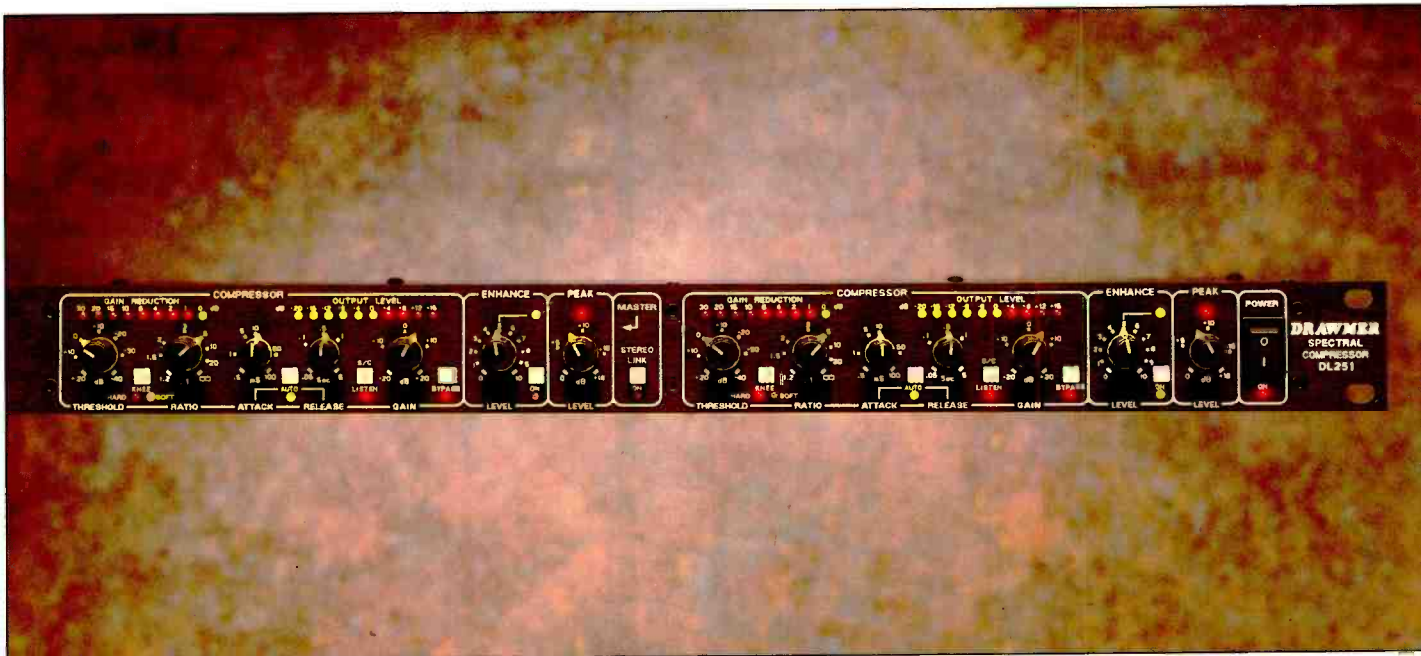
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Drawmer's DL251 — with 'Dynamic Spectral Enhancement'

Drawmer DL251

The *DL251* is a new, 1U stereo compressor-limiter from Drawmer. It is to run concurrently with the existing Drawmer *DL241* and offers a few significant differences from its stable mate. The most glamorous of these is the addition of the Dynamic Spectral Enhancement system, 'designed to compensate for the loss of transient detail that tends to occur during periods of heavy compression'. We will return to that enticing titbit shortly, but first let us deal with the 'meat and potatoes' of the unit.

The basic facilities are similar to the *DL241* and if you are used to operating the latter you will face no great learning curve in adapting to a new box. The basic compressor controls include the standard THRESHOLD, RATIO, ATTACK, RELEASE and GAIN knobs (see box for details) — there is no input level control which may bother certain of the old school. Both models have an AUTO button associated with the ATTACK AND RELEASE knob which disables manual control of these parameters, turning them over to the Drawmer's own sensing system; it tracks the rate of change of the input signal and adjusts accordingly — both attack and release times. Thus, all but the most vicious peaks and troughs are controlled without subjecting the legato programme to unnecessarily

fast slopes. Generally, it does work very well and, of course, greatly reduces the amount of earnest knob twiddling involved in quickly compressing something.

The *DL241* is available with ¼-inch jack connections or XLRs, whereas the *DL251* comes only with XLRs. The *DL251*'s rear panel also shows an extra stereo jack socket per channel providing access to the side chain for frequency-conscious compressing (commonly de-essing) and this can also be used with a mono jack for ducking where a mono external signal (related or unrelated to the audio passing through the device) can be used to trigger compression. This facility is notably missing from the *DL241*. Associated with this side chain access is the LISTEN button on the front panel which allows you to listen to the side chain signal you are using as a trigger to make sure you are attacking your programme in the way you want to attack it.

Returning to the rear panel, there is also an extra button on the *DL251* which determines whether the stereo linking of the channels is peak or average. The effect of this is most easily explained by saying that if a signal 10dB over threshold was applied to the left channel when peak was selected, both sides would apply

a fully 10dB reduction, whereas in the average mode it would apply only 5dB. Most people, then, would use average mode, although the option is there for special circumstances.

Another new facility over the *DL241* is the HARD KNEE/SOFT KNEE SELECTION button — the *DL241* was fixed on soft knee. The new model is also superior in terms of its stereo linking in that all parameters are governed from the left set of controls — in the case of the *DL241* the BYPASS buttons remain independent.

So what about the spectral enhancement? Missing from the front panel of the *DL251* is the simple expander-gate control present on each channel of the *DL241*. In its place is a knob inscribed ENHANCE. The facility compensates for the fact that with most types of programme a compressor will be triggered largely by the greater amount of energy present in the lower frequencies. This applies a general compression across

the spectrum reducing the relatively amount of high frequencies and so dulling the sound. As you increase the amount of enhancement the *DL251* allows more high frequencies to pass, progressively from around 2.5kHz upwards, thus brightening the sound. The difference in subjective effect from simply sticking on some top is increasingly apparent as you increase the amount of compression. In any event it is nice, in the heat of the moment, to have a knob on the compressor itself with which to quickly add some presence.

As with the *DL241*, the *DL251* offers quick and effective compression in a compact, inexpensive form. In my book the extras on the *DL251* more than make up for the loss of the simple one-knob gate found on the *DL241*. ■

Jim Betteridge

Drawmer Distribution.
Tel: 0924 378669.

MANUFACTURER'S SPECIFICATION

Controls

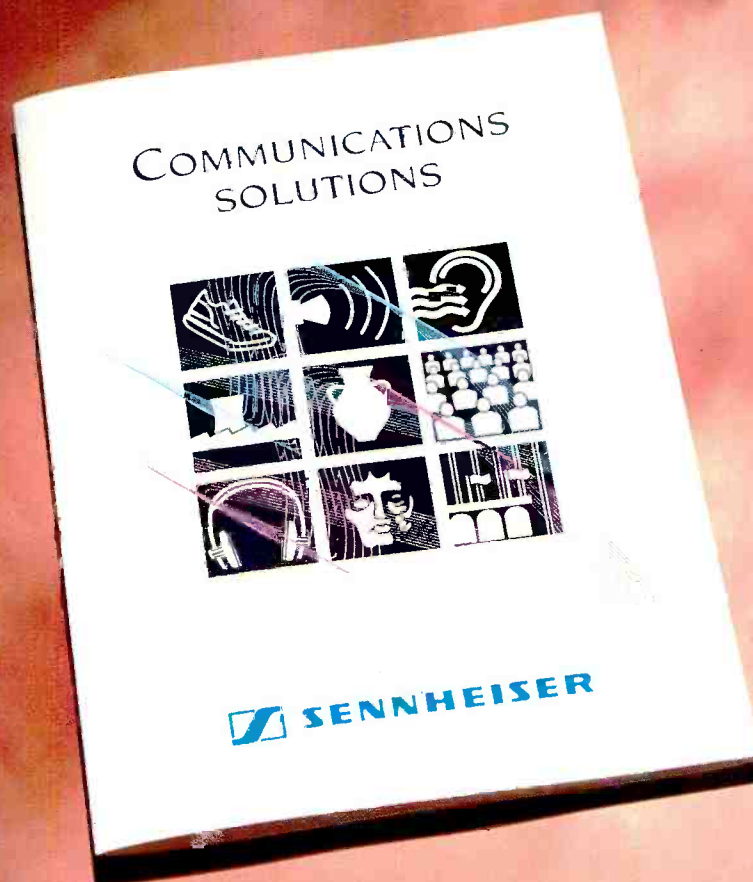
Power on-off	
Threshold:	+20dB to -40dB
Ratio:	1.2: 1 to infinity
Attack Time:	0.5ms to 100ms
Release Time:	0.05s to 5s
Gain:	-20dB to +20dB
Enhance:	0-10
ENHANCE ON-OFF button and LED	
Peak Limit: 0dB to +16dB and LED	
SOFT-HARD KNEE button + LED	
AUTO ATTACK-RELEASE button and LED	
SIDE CHAIN LISTEN button	

BYPASS button and LED
STEREO LINK ON-OFF button and LED
REAR PANEL PEAK-AVERAGE LINK button
Rear panel button for +4dB/-10dB operation

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 **SENNHEISER**

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In these days of the increasingly flexible and featured guitar preamp, it is refreshing to encounter a device that does not sport digital multieffects processing, LCDs and shift buttons. Manufacturers should bear in mind that while digital signal processing effects do have an application and appeal to guitarists, many six-string picker's driving concern is basic tone.

A look at any professional's rig will confirm the notion that time or modulation processing is generally regarded, and treated, as a separate event to the creation of a guitarist's sound. Elaborate multieffects rackmounts with in-built distortion circuitry are only partially used, and often when they are it is as part of a much larger sound jigsaw. All this leans ostensibly towards the age-old guitar setup of guitar-to-amp with effects boxes in between, giving a fundamental tone, that the player is happy with, which can be interfered

with at will.

The problem with many modern multieffects devices for guitarists is that they do not address this fundamental requirement for basic tone with the same vigour with which they chase the ability to provide 'barber-pole flanges' and 'mind-warp phasing' — an observation borne out by handing such a fully-featured unit to a player who has never encountered one before. Five or so minutes of sheer wonder are followed by a frenzy of preset button pressing and not, it seems, in the search for more digital delicacies but in an earnest quest for a plain tone with perhaps a hint of spring-type reverb through which to simply play the instrument.

Guitar multieffects units can prove to be very unsatisfying purchases with time. The majority of guitarists desire a straightforward timbre and a degree of built-in flexibility that can be controlled by the way they play. Given this, it is surprising at just how little attention many of the major manufacturers pay to stand-alone

guitar preamps without bells and whistles.

With this in mind Hughes & Kettner, who have had significant success with their thinking-player's range of guitar amps and the rather good *Red Box* speaker simulator, have released the *Tubeman* — billed as a 4-channel amp booster, recording amp and preamp.

Built out of metal like an oversized effects pedal, rotary control pots are located on the top with an on-off footswitch while the single instruments input and three outputs are placed on the back panel. *Tubeman* runs off a 12V mains adaptor which plugs badly into a loose socket on the back panel. This is unforgivable as only the lightest of tugs pulls it out.

Inside shock-isolated boards protect an ECC83 valve that does the business for the *Tubeman*, the principle of which is simple. A 4-way rotary switch selects one of four channels — JAZZ, FUNK, BLUES and ROCK — all of which share Bass, Mid and Treble EQ, Gain and Master

Gain pots plus a MID BOOST ON-OFF push button. You plug in and go.

A line output facilitates connection of the results straight to a power amp, a booster out does the same to a guitar amp input, while a recording out sources its signal through a speaker simulator for connecting straight to a mixing desk. All work well and are acceptably quiet.

The three tone controls are deceptively interactive and seem at their best when one is at an extreme at which point the others take on interestingly idiosyncratic properties. That being said the treble is best used delicately with something like a Strat because there is a lot on tap.

The MID BOOST button kicks in powerfully and acts most markedly on hotter tones, tending to confuse things on cleaner settings. While it can be operated by foot, being a black button on a black panel means its position is hard to decide from anything further than two feet away even in full light.

Tubeman's valve physiology is immediately apparent as soon you

AIWA HHB 1 PRO. PROFESSIONAL, PORTABLE DAT



The Aiwa HHB 1 Pro — well known as a "Best Buy" low cost professional portable DAT recorder — packs an uncompromising list of features into a rugged, compact design. Facilities like dry cell and rechargeable battery power, a multi-voltage power supply, AES/EBU digital I/O and a unique - non SCMS - copy prohibit-free SPDIF digital I/O, balanced mic./line inputs and illuminated LCD display, a wired remote control and full indexing facilities.

The HHB 1 Pro is supplied complete with an XLR splitter lead for the balanced XLR mic. input. For failsafe operation, a "Key Hold" switch disables front panel controls. Counter functions include "Program Time", "Absolute Time" and "Tape Counter". The unit can simultaneously accommodate ten dry cell batteries and a rechargeable battery, extending power-up time to up to 4 hours. The HHB 1 PRO is also available as part of "The Kit", along with Sony ECM979 microphone and accessories in a steel reinforced flight case.

A BATTERY OF FEATURES AND A CHOICE OF BATTERIES

plug in because of the sheer life of the notes. As would be expected, the JAZZ setting is the cleanest with a slight leaning towards bottom end while FUNK is brighter with a touch more honk. The BLUES tone crunches when shouted at while the ROCK tone shouts back at the slightest provocation. All are very usable once grasped and have significantly different characters that seem to suggest that we are talking about more than just one fundamental setting with four stages of gain.

If I had to pick holes, and I must, I would suggest that the Jazz channel could be slightly unpleasant even with a weak pick-up. Reducing the sensitivity would give even more flexibility to an otherwise very flexible channel. Funk on the other hand could be slightly heavier to give a little more of both extremes available on the input gain pot but its a corking rhythm channel anyway. Blues is pretty much as you would expect and very velocity sensitive, while Rock can be made to go on and on although it still has the capacity to



Hughes & Kettner Tubeman — the thinking player's effects unit

take over from where the Blues channel stops — albeit with touch more bottom end.

There is something very wholesome about a box this size that contains all you could need to get one sound that you are happy with. I say one sound because while Hughes & Kettner describe *Tubeman* as 4-channel, which it sort of is, there is no easy way of switching between them and even if there was I would

warrant that the disparity in the required settings would render any such switching ability useless. Regard *Tubeman* instead as a single channel device, which it certainly is, that has access to three other tone characters and which is excellent at creating one strong tone. In many instances this is all that is needed.

Strong, compact, portable, versatile and wonderfully accessible are words that describe *Tubeman* well. It also

sounds great and represents a sound building block on which to base a guitar rig. ■

UK: John Hornby Skewes, Salem House, Parkinson Approach, Garforth, Leeds LS25 2HR.
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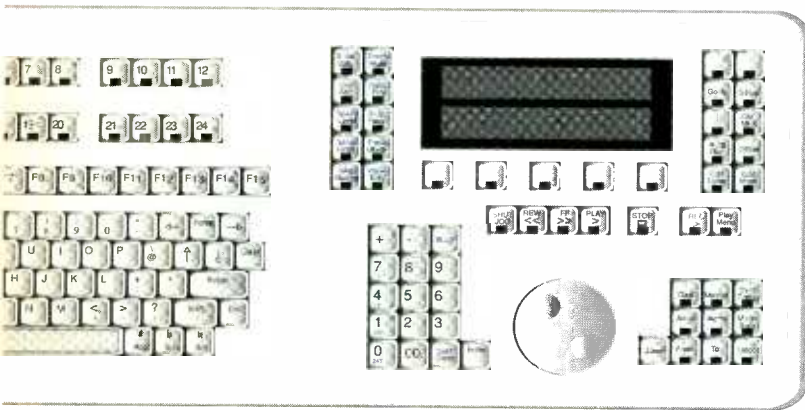
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Sonic Solutions

Sonic Solutions have announced two new additions to their workstation range; the *SonicStation II* and *Sonic Quattro*. The *SonicStation II* supersedes the original *SonicStation* offering increased performance and features which include the ability to edit high resolution audio formats from 16 to 24 bits, real-time playback of 12-16 channels of audio from a single hard disk (depending on configuration), automatic generation of project log sheets and level and panning automation. The system still includes background recording of audio to hard disk, real-time playback of edits and variable crossfades. The *Sonic Quattro* is similar to the *SonicStation II* but offers four channels of digital I-O and increased productivity from back unloading of audio from the hard disk. Both products are compatible with the new CD Printer from Sony-START Labs, a recordable CD unit capable of creating CD-Refs and PreMaster CDs at double speed.

Sonic Solutions & JL Cooper have announced their joint development of the *CS1000*, a high end moving fader controller for use with the Sonic Solutions workstations. The unit will consist of a single base module plus a number of expansion modules. Each base module will include nine Penny & Giles moving faders (eight input trims and one master), a jog-shuttle wheel, LED time code display and switches and knobs for transport, EQ and effects functions.

Sonic Solutions,
1891 E. San Francisco Blvd,
San Rafael, CA 94901.
Tel: +1 415 485 4800.
Fax: +1 415 485 4877.

UK: The Tyrell Corporation, 20 Great Chapel Street, London. W1V 3AQ.
Tel: 071 287 1515. Fax: 071 287 1464
AppleLink TYRELL.

DAWN II

Doremi Labs, manufacturers of the *DAWN* audio postproduction editor, have announced the *DAWN II*, a second generation hardware design. *DAWN* is now expandable from a basic 8-channel system to 48-channel system and features an analogue and digital input and output for every channel on the system. The new software (Version 3.6) also includes some major developments including Sony 9-pin machine control, CMX

autoconform and VT emulation. Doremi have also announced the imminent release of a hardware controller for the *DAWN*. The *SP-1* comprises faders, buttons, transport controls and a jog-shuttle wheel. The *SP-1* will be available from January.

Doremi Labs Inc,
4927 N. Glen Arden Ave, Covina,
CA 91724. Tel: +1 818 966 2454.
Fax: +1 818 966 6554.

UK: The Tyrell Corporation, 20 Great Chapel Street, London. W1V 3AQ.
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QSystem II

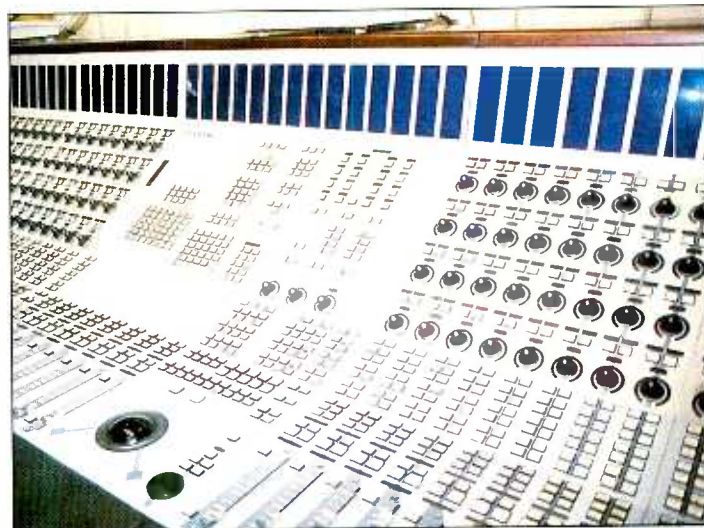
Los Angeles-based QSound Corporation have introduced *QSystem II*, a real-time multichannel digital signal processing system for localising sound and generating a more natural sound field than traditional stereo, using its patented *QSound* technology. An upgrade from QSound's previously available system, *QSystem II* is half the size and offers many features such as: MIDI compatible automated joystick panning to SMPTE-MTC and autopanning with adjustable shape, rate and triggering.

QSound Corporation.
Tel: +1 213 876 6137.
Fax: +1 213 876 6721.
UK: 0279 659808.

W&G

In a surprise move away from the test equipment with which they have previously been associated, Wandel & Goltermann have established a new division and previewed an all-new mixing console.

The console, called *Vision*, has been under development for around one-and-a-half years and will initially take the form of analogue signal paths under the digital control of the console surface. Control hardware utilises a GMX processor (running Unix) managing one or more DSP 96000 (dependent upon the number of channels) for the audio, and a SPARC Station for the three graphic displays. The displays are situated on top of the meter bridge and display independent of each other, showing details of the centre section and active areas of the left and right-hand channel strip areas. Although already fitted with P&G motorised faders, automation is currently of the snapshot variety.



W&G Vision console

The console will support a maximum of 128 channel strips and 256 audio channels. There are 40 assignable buses and the console is 'totally configurable' making it equally suitable for music recording and multichannel audio applications.

Vision made its debut at the recent Tonmeister show in Karlsruhe, Germany, but was not operational due to a hard disk crash at the start of the show. Project leader Stephan Schmitt was on hand, however, to explain that the digitally-controlled analogue format was to be followed by a completely digital system including total dynamic automation. As the system has been designed on a modular basis — control console, digital control and processing rack and analogue audio rack — 'going digital' will only involve replacing the analogue audio rack.

The analogue-snapshot version of *Vision* is expected to ship in January '93 and cost something over DM500,000. Schmitt also explained that the project was intended to be a viable commercial exercise and predicted a successful future for the console.

Wandel & Goltermann,
Frankfurter Allee 202, 0-1130
Berlin, Germany.

Musicfax

London-based Marada Music is marketing a new electronic interface — *Musicfax* — which allows recorded music to be sent anywhere in the world using nothing more complicated than a basic telephone.

Musicfax is also designed to receive prerecorded music over a telephone

line so that it can be played simultaneously on loudspeakers and recorded by the recipient.

Although the signal is sent and received in mono, this small box — no bigger than a packet of cigarettes — does away with the tedious process of holding a telephone handset up to a speaker which until now has been the usual method to give someone a basic idea of how a piece of music sounds.

Peter Knight of Marada Music is selling the US-designed unit for £70 and anticipates big demand from songwriters, producers, music publishers, composers, arrangers, copiers, pluggers — in fact anyone in the music business who needs to send and receive music on a regular basis.

He explains; 'The *Musicfax* works by connecting to a telephone between the handset and the base unit. Although standard BT phones don't disconnect at this point, it is possible to buy a Panasonic or Mercury-style phone which will allow you to use *Musicfax*.

'The unit doesn't need a separate power source and the sound quality is only affected by the quality of the connection between the two telephones. Ideally both parties should have a *Musicfax* fitted but it doesn't really matter if only one party has one.'

Knight points out that the main advantage of *Musicfax* is that a considerable amount of time and money can be saved — especially when music has to be sent abroad. Instead of having to send tapes by courier services it is now possible to send it by telephone.

He adds: 'This little box has input and output sockets so that you can ▶

plug straight into the music source if you want to send music, or plug it into a 2-channel recorder if you want to record. You can also link it up to your speakers if you only want to hear the music being sent to you. The unit doesn't have a volume control so this has to be set from the source, but it is possible to talk over the handset while listening to the music so you can have a discussion about what you are actually hearing.'

Marada Music is selling the units by mail order with all the necessary jacks included in the price.
Marada Music Ltd, 171 Southgate Road, London. N1 3LE.
Tel: 071 359 2974.

Prism DreamSeries

Prism Sound have released the *DreamSeries* (Dynamic Range Enhanced Audio Modulator) products with the launch of the *Dream AD-1*, an A-D convertor. As well as the normal linear output format, a selection of features are provided that use DSP techniques to produce enhanced output tailored for 16-bit media. Among these are Triangular Probability-Density Function (TPDF) dithering, noise-shaping and Prism Sound DRE processing.

PrismSound, William James House, Cowley Road, Cambridge. CB4 4WX. Tel: 0223 424988

Neve launch MADIX-2

Neve have responded to the need for format conversion between the digital multitrack recorder and the new generation of digital desks by

launching *MADIX-2*. *MADIX-2* is a self-contained, bidirectional convertor that translates between Sony and Mitsubishi digital formats and the MADI format, and can be fitted to any digital multitrack recorder.

It is synchronised to the studio reference via a standard AES-EBU reference signal. It also generates a square-wave word clock that can be used for synchronising the attendant multitrack machine. *MADIX-2* can also be used independently by coupling the MADI output to the MADI input, allowing direct translation between the Mitsubishi and Sony formats in either direction.
Neve Electronics, New Cambridge House, Bassingbourn Road, Litlington, Royston, Herts SG8 0QD. Tel: 0763 852222.

Fax: 0763 853500.
USA: Siemens Audio, Inc, 7 Parklawn Drive, Bethel, CT 06801. Tel: +1 203 744 6230.
Fax: +1 203 792 7863.

TOA-NHK desk

TOA in association with Japanese broadcasters NHK have developed a fully digital console, based on its *IX-9000* live sound desk. A design priority was operating ease, for which 4-colour LCD touch screens were built into the system. The console uses an assignable function that allows as few as 12 faders to control all of its input and output channels. The system incorporates AES-EBU input and output channels.

UK: TOA Electronics Ltd, Tallon Road, Hutton Industrial Estate, Brentwood, Essex. CM13 1TG. Tel: 0277 233882.

US: TOA Electronics, Inc, 601 Gateway Blvd, STE. 300, S. San Francisco, CA 940080. Tel: +1 415 588 2538.
Fax: +1 415 588 3349.

B&K adaptor kits

The newly founded Danish Pro Audio company have introduced two new adaptor kits for *B&K 4003* and *4006* omnidirectional microphones. The Acoustic Pressure Equalisation Adaptors are passive acoustic processors which employ diffraction technology to modify sound reception near the diaphragm acting both as spatial and spectral equalisers.

The range of adaptors offer a cost-effective method of altering the mic's frequency and polar response, but unlike electronic EQ methods, the

acoustic equalisation provided by these attachments changes the on-axis and off-axis responses without compromising the smooth off-axis response.

Bruel & Kjaer Pro Audio, 92 Uxbridge Road, Harrow, Middlx. HA3 6BZ, UK.
Tel: 081 954 2366.
Fax: 081 954 9504.
USA: B&K Instruments Inc, 185 Forest Str, Marlboro, MA 01752. Tel: +1 508 481 7000.
Fax: +1 508 485 0519. ■

In-Brief

- ASC have announced the availability in Europe of the *DAVE-2000 series II* digital editor. Specifically designed to record and edit voice and ENG information for news and other on-air uses. **ASC. Tel: +44 734 811000.**
- Tannoy have developed an unusually high-powered studio monitor; the new *Studio 10x12.2* used in tandem with the bass cabinet *Studio 12.3* delivers over 130dB with a frequency response of 40Hz to 21kHz. **Tannoy. Tel: 0236 420199.**
US: TGI, North America. Tel: +1 519 745 1158.
- Otari have announced the impending release of version 4.0 software upgrade for the *ProDisk (PD-464)* digital recording-editing system. Version 4.0 introduces Otari's new Guide screen operating system and visual display. **UK: Tel: 0753 580777.**
US: +1 415 341 5900.
- Timeline have introduced the new *Lynx* and *Gearbox* processors designed to enhance the Timeline

machine control system by synchronising mixed time code types at both fixed and variable rates.

- UK: Stirling Audio. Tel: 081 624 6000.**
- US: Timeline Inc. Tel: +1 619 727 3300**
- Allen & Heath have introduced a software update for their *GS3* series Studio consoles. *TOTAL CONTROL* is the latest development of console-to-MIDI integration where the console's mute automation key functions are accessible to external devices in real time via MIDI. **UK: Harman Audio. Tel: 0753 576911.**
US: Allen & Heath. Tel: +1 801 268 8400.
- Total Systems have restyled and used the latest semiconductor technology for their *DBM-3* AES-EBU digital audio meter. The meter has peak segments, overload indicators, display bright-up, and remote reset for the peak and overload memories. Total Systems report a steadily growing market for digital metering as the AES-EBU format becomes more widespread. **Total Systems. Tel: 0256 54786. ■**

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Minnesota Sound Gallery's Studio A

THE GRAND DESIGN

All recording and production facilities have common requirements for sound isolation from the outside world and sound containment within the assigned space. Whether the facility is a top-line professional studio or a private studio, many of

the obstacles remain the same. One of the easiest methods of overcoming them is to engage — and pay for — the services of a professional design company. The only alternative is to 'go it alone' and risk the consequences of inexperience and poor judgment. Or is it?

Many people believe that design companies either want to take complete control of a project or have no involvement at all. In fact, many are happy to step in as required and offer anything from a little advice to major structural work. All you need to know is when best to call.



US-based Lakeside Associates' projects include CBS Records' New York and LA studios and private studios for Donna Summer and Eddie Murphy. President Carl Yanchar gives an insight into studio design and the role of the design company

proximity of high-level, low-frequency sources demand a level of isolation that, in most instances, exceeds those of any potential external sources. The degree of sound isolation attained is dependent upon three factors: the mass of the enclosing walls, ceiling and floor; airtight sealing of all penetrations for doors, windows, cables, and air ducts; and physical separation from the enclosing structure.

After doors and windows, a studio's air-conditioning ducting represents the most significant penetration of an enclosure. Careful sealing and structural decoupling of these penetrations is crucial.^{1,2} Eliminating even the smallest crack in an otherwise adequate partition has been proven to be important. Air-conditioning noise, especially low-frequency rumble, presents one of the most difficult challenges to providing a low noise floor. Conventional techniques, such as fibrous duct lining and passive silencers, can be effective above 250Hz. In lower octave bands, duct lining — as conventionally employed — is less effective. Passive silencers of sufficient length place severe static pressure restrictions on air-handling units.

A recent study has suggested that placing the duct lining in such a way that the fibres are normal to the duct axis can nearly double the

attenuation at low frequencies, compared to that to the conventional orientation.³

Large cable ducts and conduits provide very efficient transmission paths for sound. These must be sealed airtight, yet be able to accommodate future changes. A good solution, especially when cable trays must be used, is to use products such as Crouse-Hinds' Thru-Wall Barrier sealing systems. These, and similar devices, consist of mounting frames of various sizes, with elastomeric sealing blocks that form a tight seal around cables and conduits.

Active noise control systems are quickly becoming a valuable method of solving low-frequency attenuation problems. First patented in 1934, these systems consist of a microphone that detects the noise as it propagates down the duct. A DSP controller processes this signal, determines a cancelling waveform and introduces this signal through a loudspeaker. A second microphone located just beyond the speaker provides error-correction feedback. Attenuation is 12–20dB between 40Hz and 160Hz.⁴

Since costs typically increase geometrically with lower noise levels, it is important to determine the specific requirements for each situation. A common, albeit crude, guideline for ►

The first step is to assess the suitability of the location of your proposed studio. Beginning with the sound isolation of a single-room facility, location is the primary determining factor here. Proximity to other buildings, transportation centres and other fixed noise sources will dictate the amount of required isolation. In choosing a site, be sure to evaluate it fully — traffic, railway and manufacturing plant schedules may be quite different on weekends and weekdays. Air traffic patterns might also be altered due to weather conditions, placing an otherwise quiet site under a busy flight path.

In a multiple-room facility, however, the

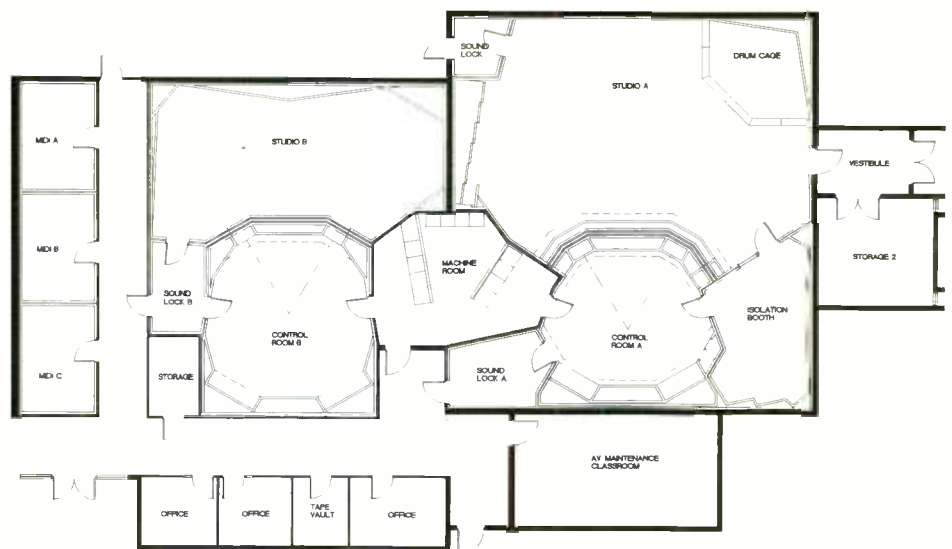


Fig.1: Floor plan of a proposed two-room recording complex for Citrus College of Recording Technology, CA. A central machine room is accessible from either control room and recording areas. Windows leading directly off the control rooms provide visual communications into the machine room, to confirm transport status



Redesigned Studio A mixdown room for The Plant, Sausalito, CA. The narrow room dimensions, and wide SSL console, meant that the acoustic design had to cover a wide mix location, with a wide subtended monitor angle

determining this is the Noise Criterion Curves.^{5,6} Traditionally, recording and broadcast studios were recommended to follow NC 15–20 curves, and television studios the NC 25 curve. Studies have questioned the appropriateness of these recommendation, in light of recent advances in recording technology.⁷

Introduced in 1957 by Leo Beranek, the NC curves are based upon a survey of office workers, concerning the effect of noise on productivity and speech communication. Although less than ideal for determining noise audibility in critical recording and production environments, most published data is based upon this system. It is also a system that some architects and construction professionals understand.

If there is one aspect of the evolution of recording technologies of the past decade that has changed the design criteria for contemporary recording and production facilities it is the advent of digital technology. This enhanced analogue recording processes has dramatically expanded the dynamic range of recording. Consequently, we need to reduce the acoustic noise floor in recording environments. The addition of a 20-40Hz octave in the reproduction chain has also placed further LF demands on the combined electronic and acoustic monitoring system.

Concurrently, the cooling requirements of high-density digital electronics has initiated a trend to relocating these devices away from the control room. An additional benefit of this topology is that, during the transition towards a digital installation, analogue and digital reel-to-reel, hard disk, and other storage formats can be easily routed to multiple control rooms.

Once external noise is under control, we must deal with noise generated within our studio — from sources such as lights, dimmers, fans and air-conditioning.

Internal sound control

After external and internal noise sources have been addressed, the next step is to sculpture the 'sound' of the room. This process entails controlling the build up and decay of a room's sound field. The sound field can be controlled by absorption with porous materials, diaphragms and resonators, reflection management and diffusion. All of these techniques are, to varying degrees, non-linear. Porous absorbers become ineffective between 250-500Hz, depending upon their thickness. Diaphragmatic and resonant absorbers can be extremely frequency sensitive. Reflective surfaces become absorptive, usually with increasing frequency; at some point they can also become diaphragmatic. Diffusive surfaces not only vary with frequency, but can also be dependent upon orientation. In addition, they also usually become absorptive and diaphragmatic at certain frequencies.

At frequencies below 250Hz, conventional techniques require a depth of porous absorber or a cavity equal to one quarter of the wavelength of the lowest frequency to be absorbed. At 40Hz this dimension is approximately seven feet; at 20Hz it is over 14 feet. Such materials eats up a lot of real estate but the improvement in low-frequency transient response is amazing. Recent work at ►

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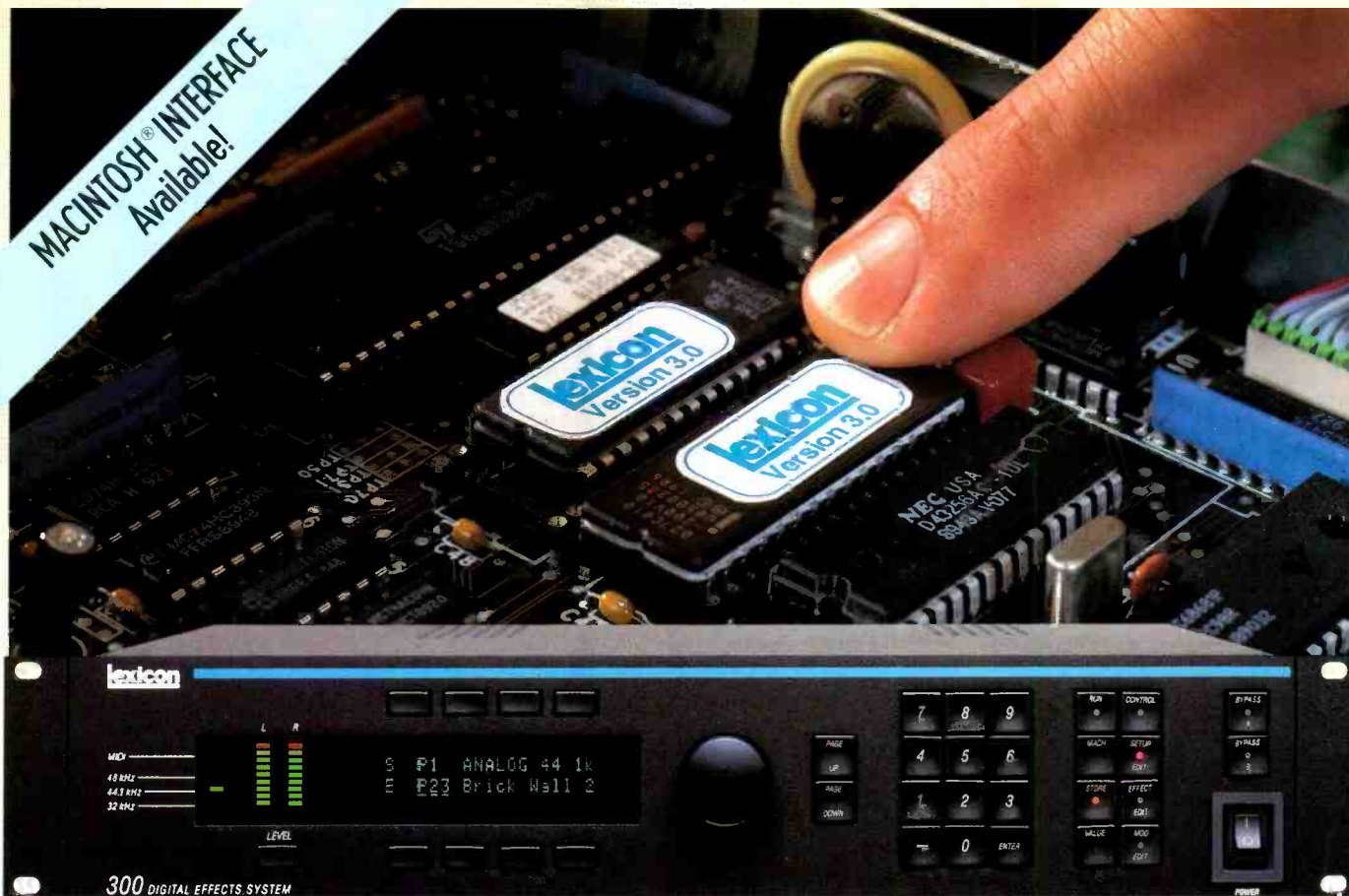
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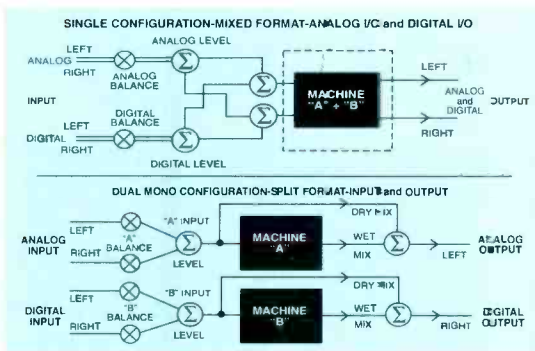
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the US Army Construction Engineering Research Lab has developed low-frequency absorbers with normal incidence absorption coefficients approaching 1, with a thickness less than 10% of a wavelength.⁸

In control rooms, another goal is monitoring linearity. The best way to accomplish this is to start with a linear monitor, selecting dispersion to complement the room's geometry and use. In most cases, some degree of high-frequency roll off is preferred to a ruler-flat response beyond 20kHz.

Audio-for-video rooms

In the cost-conscious '90s, recording and production environments must be more flexible than ever to serve an expanding client base. The most prevalent diversification is towards audio-for-video sessions.

In the studio, we are faced with the conflicting requirement for an acoustically dead space to accommodate ADR and Foley work, as opposed to a more moderate-sounding space for most music recording. Budget permitting, both uses can be serviced by providing some degree of variability, utilising heavy curtains or more sophisticated methods.

In the control room, the physical conflicts between a dedicated centrally located audio monitor for surround mixing, a video monitor at something less than neck-straining height and a panoramic window into the studio presents a dilemma. Dolby Laboratories recommend that for optimum imaging the centre monitor match the left and right speakers, and be placed at the same height. The optimum viewing distance for video displays is given in.⁹

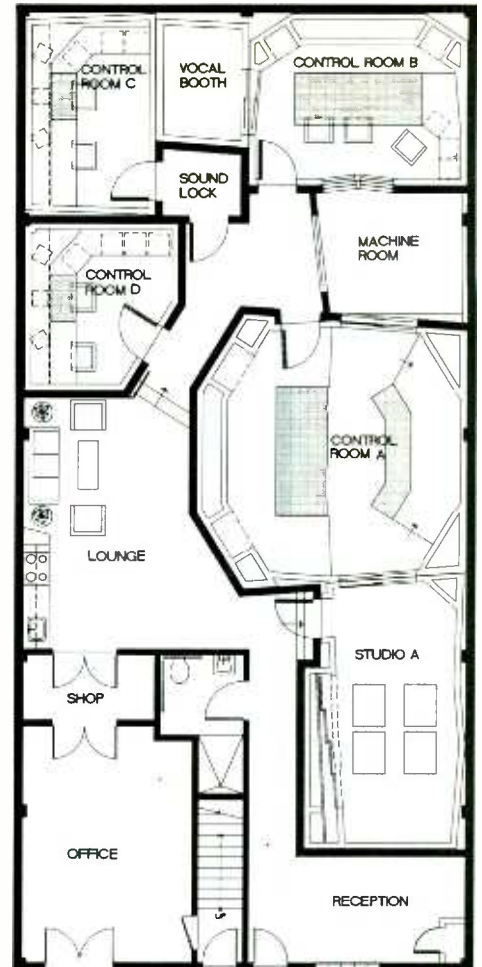
Some compromise must be made, depending upon the relative importance of each element to the user of the facility. One alternative that has worked in several situations is to place the viewing window to one side.

The trend to have a central equipment room as opposed to dedicated equipment in each control room, can become a problem in a multi-room facility, especially when space is restricted. The criteria are that clients and talent should be able to access the studio and control room, independently of engineers' access to the machine room. And there is still a desire for the engineer to have visual contact with reel-to-reel machines.

Figs 1, and 2 illustrate two possible solutions, accomplishing the intended goals to varying degrees.



Dual mix-to-picture and sweetening rooms for Editel-Chicago were designed to operate with a central machine room that houses analogue-digital ATRs and a wide selection of video machines



Multiple-room facilities

From a technical, power and signal interfacing standpoint, a single-room facility is relatively straightforward. However, all these systems take on added complexity in a multiple-room facility. Inattention to detail can result in facilities where each room functions internally but the interface between rooms may be erratic, or even impossible. This severely limits a facility's potential usefulness.

Of paramount consideration is a well-planned and executed earthing scheme. For AC power, two earthing (grounding) concepts predominate: a true 'star earth' with every outlet having a separate earth wire linked back to the central earth point, and a devolved earth, in which each major room has a central earth point, and these points connect back to the central technical earth for the entire facility.

Of these methods, the star earth is, by far, the more effective method.

All third-pin earths from socket outlets should be brought to a buss bar connected to the central earth point. All receptacles must be the isolated-earth type, usually identifiable by their orange colour or green triangle. All power should be completely shielded in steel conduit and raceways. Non-metallic, sheathed cable should never be used.

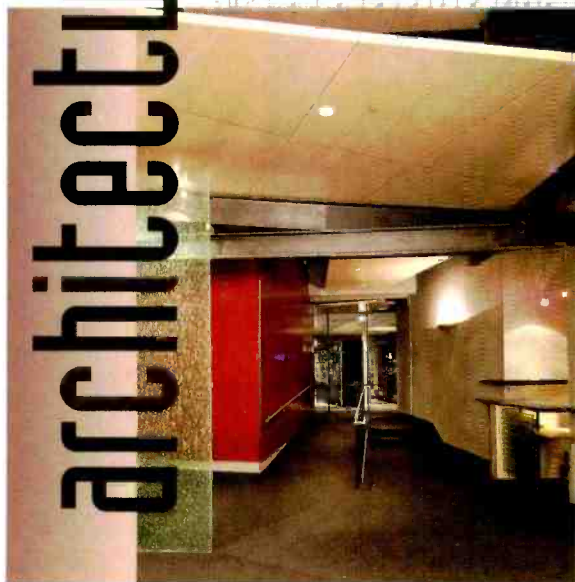
Conduits must be earthed. They must not be mechanically connected to conduits for any other power system, nor to anything else metallic, such as water or sprinkler systems. Technical power should never be used for any other function (such as photocopiers, kitchen equipment, air-conditioning, or nonproduction equipment). ►

Left. Fig.2: Floor plan for Focused Audio, San Francisco, where four, interlinked video-production control rooms are coupled to a shared machine room

architecture for acoustics/media

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The facility design for Focused Audio, San Francisco, called for four separate mix-to-picture control rooms and a companion audio-video machine room squeezed into just 5,600ft² of floor space

Only when all of these conditions exist can an interface system be developed that is consistent and trouble free.

All equipment should have only one connection to the earth system. The most convenient connection is the third wire in the mains power lead. According to the US National Electrical Code (NEC) and other International codes this wire must be used for safety. Some facilities prefer to run a separate earth wire to each piece of equipment; this precaution is not usually necessary, and can be very inconvenient in cases where equipment has to be moved from room to

room.

Obviously, if you leave the mains lead earth wire intact, in order to avoid earth loops, any other signal connection between equipment must not complete an earth loop. In other words, all signal shields must connect at one end only. Various methods exist for achieving this goal, including complex schemes involving shields cut just about everywhere and bussed earths on patch bays. Actually, most of these schemes can be made to work, as long as the cardinal rule of earthing is applied — do it consistently.

However, any scheme involving earth bussing

can create different earth 'nodes', with varying impedance to true technical earth. In a multi-room installation, this can create certain patches or equipment configurations that never seem to work totally hum and buzz free.

The simplest method is simply to carry all shields through any and all interconnects and patch bay normals, and simply lift the shield at one end. The most prevalent choice is to connect any shield at its source, and lift it at its destination. Lifting should be done at the equipment end of the connection, and not at an intermediate I/O connector or patch bay. Most equipment has some sort of captive cabling allowing easy disconnect and establishing a connector 'standard' such as XLR to ELCO for multitrack machines. All input earth lifting is now performed in this equipment-specific cable and not in any trunk or tie line. This technique greatly simplifies installation, because all bulk wiring is done in one simple way, with all shields intact. ■

Lakeside Associates Inc, 9272 Jeronimo Road, Suite 123c, Irvine, CA 92718, USA. Tel: +1 714 770 6601. Fax: +1 714 770 6575.

ROOM EVALUATION

Before buying or leasing any facility, a prospective owner should minimise investment risk by conducting an initial walk-through, preferably with the architect, designer, and contractor. These are some of the items to be assessed:

- Control room shell, 600–900ft².
- Studio shell, usually 2,000ft² minimum.
- Support space, as required
- Room for expansion
- Clear height of 15 feet, minimum
- Column spacing 25 feet, or greater
- Flooring loading capability of 150–200lbs/ft²
- Existing mechanical system capacity (heating ventilation, air-conditioning)
- Electrical service (including ease of upgrade, and power conditioning required)
- Structural system and exterior wall composition
- Ability of roof to accept additional loads for isolation construction and HVAC
- Roof condition
- Air traffic paths
- Nearby rail routes
- Automobile, truck and motorcycle, routes
- Local road condition (potholes, etc.)
- Soil type
- Proximity to TV & radio transmitters

On the basis of this on-site research and other information, you should be able to determine the suitability of an existing structure. Some idea of the extent of changes required for transition from this structure to the new should also be developed. Assess the scope of these changes as they affect both the interior and exterior of the building. Example of some specific considerations would include zoning requirements, building codes, required upgrades to an older building, disabled access, additional parking, earthquake or wind reinforcement, and fire codes.

Some general contractors offer preconstruction services, such as value engineering, that can save time and money, and minimise surprise and headaches later on in the project. ■

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SOLO MIDI. A recording console available in 16, 24 and 32 input frame sizes (36, 52, 68 in remix). Automated MIDI muting on all channel inputs, monitor inputs, group outputs, stereo effect returns and auxiliary masters. Four band EQ with two swept Mids, assignable to monitor inputs. Six auxiliary sends – four assignable to monitor inputs. Four stereo effect returns with two band EQ, balance and level controls. Raised meterbridge.

SOLO LIVE. A sound reinforcement console available with 16, 24 or 32 inputs. Four independent sub-groups, right/left master and mono sum output. Four band EQ with two swept Mids. Six auxiliary sends. Balanced inputs and outputs. Four stereo effect returns. 48V phantom powering for all mic inputs. Raised meterbridge.

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Director of
Sony Classical
Productions in
New York,
reveals some
of the
background to
Super Bit
Mapping and
the 20-bit
recording of
Don Carlo

New York's Manhattan Center squats on the island of Manhattan astride the intersection of 34th Street and 8th Avenue. Originally built as the Manhattan Opera House in 1906 by Oscar Hammerstein I, one of its purposes was to break the Metropolitan Opera's stranglehold on the operatic life of New York. Some 25 years later, the Masons built a ballroom seven stories above the opera house. Although the opera house was later gutted by fire — never to fulfil its objective — the ballroom has become one of New York's most esteemed classical music recording venues. Over the years it has produced much of the most treasured classical music recorded in this city — you might say that it is the Abbey Road Studio A of New York. Ironically then, one of its most frequent occupants, the occupant as we write, is the Metropolitan Opera.

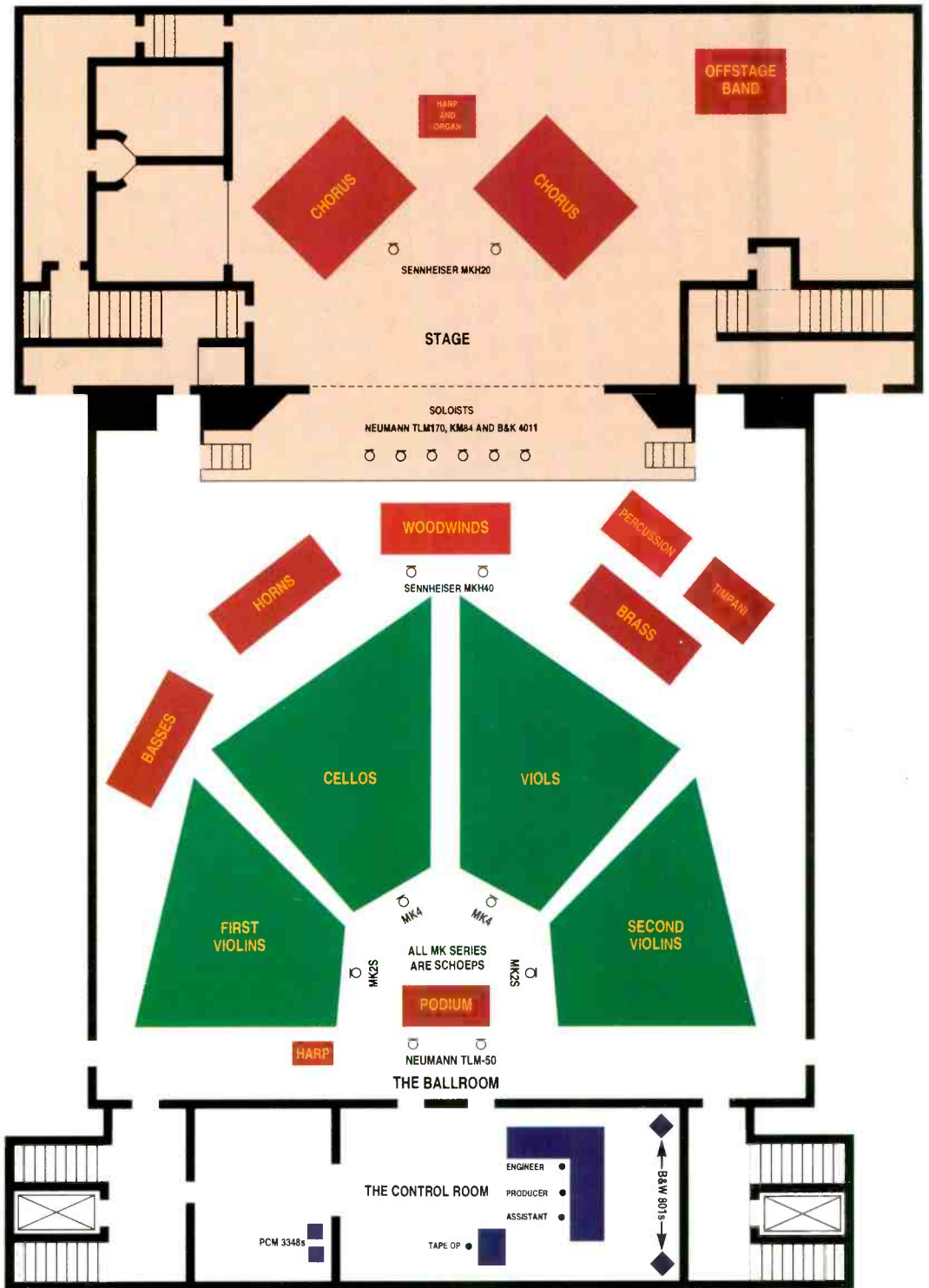
Meanwhile, the compact disc celebrated its 10th birthday this year and looks set to be around in its present form for some time to come. Superior signal conversion and signal-processing technology played a large part in the evolution of the CD player, and the same factors look set to benefit the recording end of the chain — which is likely to be continually refined, well past the end

of the decade. In fact, the sonic potential of the compact disc has yet to be fulfilled as the recent precision (20-bit) recording of Giuseppe Verdi's opera *Don Carlo* by Sony Classical demonstrates.

The project

As the Manhattan Opera's ballroom evolved into a large studio, the permutations of the orchestral setup have varied widely, eventually settling on

the orchestra being set up on the floor facing the rear of the hall. *Don Carlo* was an ambitious operatic project, covering not only the orchestra and soloists but also a full chorus, a small brass band, an offstage chorus, and a harp — all of which perform together during certain passages. Maestro James Levine conducts the orchestra from the rear of the hall facing the stage, upon the apron of which stand the soloists. The chorus was placed behind the soloists on risers forming a



The Manhattan Center set up for recording Verdi's opera *Don Carlo*

SONY CLASSICAL'S DON

leaky 'wall'. Behind this wall, a small brass band plays in an attempt to sonically distance itself from the main microphones, thereby giving an impression of distance that the score requires. Michel Glotz, one of Europe's last great impresarios is producing; engineering responsibilities are handled by Christian Constantinov, Sony Classical's vice president.

Without engaging in a detailed discussion of responsibility, it should be stated that the overall balance of the final recording was determined by several people on both sides of the glass. The ability to make slight changes in balance argues in favour of multitrack as opposed to live 2-track recording. An argument could also be made that the conductor's frame of reference changes from the time of the recording session, to the period following the actual recording. In a recording of this complexity, again, the ability to gently rebalance takes on significant importance.

All of which is not to imply that this was a multimicrophone recording, because it was not; Sony Classical's *Don Carlo* is effectively a 2-microphone recording. We selected Neumann *TLM-50s*, the stunning recreation of the original *M-50*, aluminium diaphragms and all. Soloists are treated to Neumann *TLM-170s* and the occasional spot mic appears only to be used very sparingly. Spot mics have been a fixture of 2 and 3-microphone recordings for much of the history of classical recording during the past 40 years, only to be 'cracked' when necessary, sometimes at the request of the conductor. Obviously, the potential for abuse exists.

It should be emphasised, however, that the *TLM-50s* located above and behind the conductor's head served as the principal pick-up, with little or no blending of the spots at all. Mention of this is made for the sake of candour. The great majority of '2-microphone' recordings issued today on

compact disc actually use five or more mics. There are, of course, those 'golden ears' capable of judging which recordings use only two, or three, mics. If the extent of their judgmental accuracy was ever revealed, however, it would quickly become obvious that this is a very difficult exercise to engage in, and that 2-microphone recordings are rare indeed.

Preamplification of microphone signals is handled on a selective basis. Critical signals (that is orchestral pick-up and soloists) are routed through outboard devices, and then on to their respective A-D convertors. The commercially favoured preamp is Deane Jensen's *Twin Servo*, a device that should not be confused not with a similar unit made by other companies with similar components. The trail of mic preamps we have evaluated stretches through devices made by George Massenburg, Focusrite, Benchmark, and Neve. Soon to be tried are units being supplied by FM Acoustics of Switzerland; Creation Electronics, Oxford; and Esoteric Audio Research

To emphasise the importance placed on this interface, the label's engineering divisions in New York and Hamburg have developed prototype devices that are being evaluated during selected sessions. One of these devices is a transformerless valve-unit. The other is a discrete, solid-state unit that is coupled down to direct current, thereby successfully eliminating the large coupling capacitors necessary to accommodate phantom power.

Several Studer 962 consoles provide the remainder of the mic preamplification, while simultaneously serving as monitor mixers driving the combination of a Mark Levinson 23 power amplifier and the ubiquitous B&W 801 *Matrix IIs*. It is a little known fact that Studer are the world's largest manufacturer of mixing consoles, and that the firm's portable mixers have been a mainstay of

classical recording, dating back to the original discrete 069 *Series*. Known for their sound quality, reliability, and their effective immunity from RF pick-up, Studer consoles have been a favourite of classical recordists for many years. A cursory examination of their schematic reveals that the mic preamplifier is a patented low-distortion design. The results of pick-ups fed from a Studer mixer rival those from esoteric, expensive outboard devices.

Extended precision digital audio

It would be wise at this juncture to explain that when the precision or dynamic range of digital audio is extended, the noise floor is lowered, allowing the recording of lower-level information with greater detail. It is only a matter of degree before we incur the consequences of monitoring this low-level pick-up, these consequences being electrical, acoustical, and performance related. As a check on low-level information, electrostatic headphones are used in conjunction with the B&W 801s during low-level passages.

As mentioned earlier, the primary microphone pair connect to outboard preamps that, in turn, feed 20-bit A-D convertors. The channels fed by these convertors remain in Input or Repro on the tape machine, thereby forming the basis of a monitoring signal. This latter is converted back into the analogue domain using discrete, laser-trimmed 20-bit Ultra Analog D-A. (The same brand of convertors is also used in Sony's A-D convertors.) Although the signal output of these convertors will not wind up on the finished disc, their low-level accuracy, allows accurate acoustical checking of the signal's low-level integrity. ▶



Conductor James Levine confers with producer Michael Glotz during the recording of *Don Carlo*

Large performance spaces almost always include assorted extraneous noise sources that require varying measures of suppression, especially in light of the low-level capability. The Manhattan Centre is no exception to this rule. Doors adjoining the main ballroom are covered from the outside with tarpaulins. The hallways leading up to doors are similarly lined, forming large acoustic attenuators. As is usually the case, the air conditioning is operated up to the start of the session and disabled somewhat before. This action both eliminates the attendant low-frequency rumble, and also allows the air to settle with respect to both kinetic energy and thermal gradients.

The performance aspect of defining a low-level pick-up relates to the conduct of the orchestra-conductor combination. Here, the Met Orchestra under James Levine sets an outstanding example. To begin with, the orchestra is very well disciplined, responding quickly to all of the requests and instructions emanating from the podium with a minimum of noise. Maestro Levine quiets the orchestra for 20 to 30 seconds prior to a downbeat, and keeps the orchestra absolutely silent for the same period of time at the conclusion of a passage, allowing for the appropriate background or enabling an edit to work if necessary.

Sitting in session with this orchestra and conductor, and taking the time during these silences to set one's ears to take in the actual dynamic range, is a most unnerving experience that completely justifies this electroacoustical exercise. (It also leads one to the conclusion that we will never get this on tape — ever.)

Recording formats

Before proceeding, we should refer back to 1989, and the Toronto AES Digital Audio Conference. During the Conference, Roger Lagadec told the audience in Japanese that there was no free lunch, alluding to the fact that a 20-bit permutation of the DASH-M format had been developed. Known as DASH-X, the physical embodiment of this format is an extensively modified 16-bit PCM-3402 open reel machine that sacrifices some of the redundancy of 15ips DASH-M (Twin-DASH), in exchange for the ability to record the extra bits — hence the lack of the free lunch.

DASH-X tapes are not compatible with stock DASH-M tapes; the machine also requires a 20-bit outboard A-D plus D-A convertor package. The results of such a pairing is a most impressive dynamic range capability exceeding 105dB, plus a sonic footprint characterised by excellent low-level resolution and an almost total absence of the artifacts most often cited by critics of digital audio. Although *Don Carlo* will be mixed to this format, because the production sessions are multitrack, this transport is not in evidence. While DASH-X machines are commercially available on a limited basis, their cost reflects their complexity and, while they will probably not proliferate, they serve well as developmental platforms for future technology.

First shown at the New York AES Convention in October 1991, and now being delivered, an early member of Sony's future family of digital products is the *DAF-4000* (Digital Audio Frame.) The *DAF-4000* is a powered, self-contained chassis housing up to 16 channels of either 20-bit A-D or 20-bit D-A conversion. That an A-D convertor is capable of accurately quantising audio over a range of 250,000 discrete levels, as measurements will verify, attests to its extreme precision, — although the bill for this 'lunch' comes due in the form of increased complexity and cost.

The multitrack machine used on the *Don Carlo* sessions was an industry-standard PCM-3348, well known for its utility, reliability, and sound quality. Yet when one records the most significant 16 bits from a 20-bit A-D convertor on a machine that is already sonically superb, the results define the edge of the 'envelope' in terms of 16-bit multitrack performance. As with the outboard microphone preamplifiers, these outboard convertors are used for the recording of critical signals, most notably the orchestral pick-up and soloists.

Because Sony Classical's recording of the Metropolitan Opera appears to be an annual event (going back to 1990), last year's recording of *Luisa Miller* and *Il Trovatore* inspired Sony's engineering departments to attempt prototype digital interfaces that would enable recording of the entire 20-bit word from an A-D convertor on a 16-bit machine, by splitting the word so as to occupy more than one track. During replay, the two parts are reassembled to form a single 20-bit word that is then latched into a 20 bit D-A, or

output digitally to some form of digital console. This year's recording saw the first use of this interface, combined with selected 20-bit outboard convertors capable of dynamic ranges approaching 110dB. While it is too early to judge, a number of eyebrows are already raised.

The above description is of a highly-optimised digital recording process which attempts to deal with the constraints imposed upon it by the complexity of the art form and the sheer breadth of the project. No mention has been made nor can be made of the postproduction phase, as it is beyond the scope of the present discussion. Suffice it to say that in this case, beauty is in the ear of the listener.

Obviously, no recording session is an absolute success and, as always, there are lessons to be learned for future sessions. In the case of *Don Carlo*, these lessons relate to reducing the number of mics by grouping the soloists, or possibly recording all of them with a single pair of microphones. Another thought would have been to place the soloists at a greater distance from the orchestra's brass section to allow less leakage. Electronically, the ability to pick up and preamplify the main pick-up, and quantise to below 18-bits without the requisite penalties paid in the currency of electrical noise, may well lead to more detailed compact discs, by virtue of the more effective use of some of the signal processing (described in the accompanying sidebar).

It should be clear by this time that the nascent technology we have touched upon here, extended-precision 20-bit digital audio, is merely a powerful tool to be applied in the service of further improving the sonic quality of compact disc replay. In comparisons with two-track, half-inch, analogue machines, the most skilled ears in New York's best known popular music recording facility were unable to find fault with 20-bit DASH-X. However; more than a few manufacturers of 16-bit hardware have simply tacked four additional bits onto the end of their 16-bit words and proclaimed themselves disciples of the 20-bit grail.

The bottom line

This may well prompt the aged to yearn for times past, where one or two valve microphones, a small console, and a high-speed valve tape machine were all that was necessary to make superlative recordings. This is probably still the case, as ►

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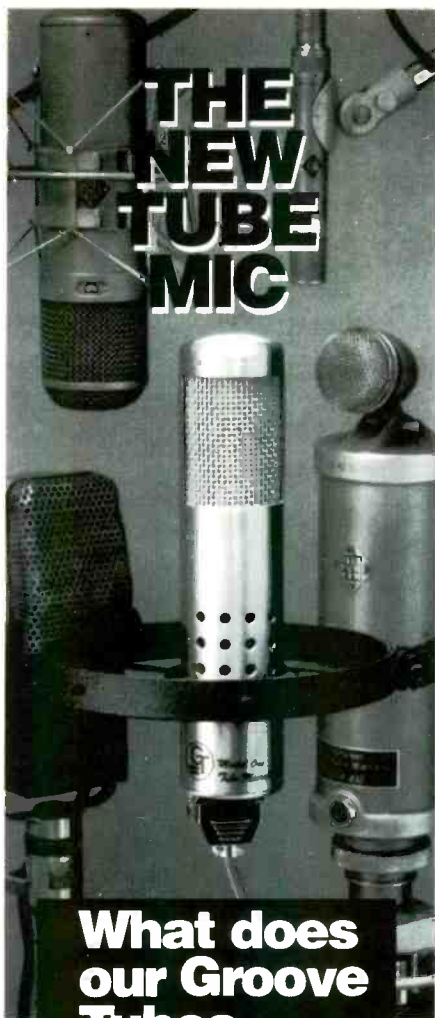
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can be proven by some recent recordings that are appearing now in both CD and LP form simultaneously — although attentive listening to the two-track 20-bit orchestral pick-up from *Don Carlo* reveals it is most impressive by any standard, modern or past.

Finally, with respect to the wayward compact disc, the uphill battle to seek the last smidgen of sonic quality from it is still in progress and will

remain so for the foreseeable future. If the jury is out on the sound of CD it will probably remain out — for a couple of years at least. ■

The US release date for the four-CD collection of Verdi's *Don Carlo* is set for March 1993. No European release date has yet been set. Matrix #S4K-52500.

20-BIT: FACT OR FANTASY?

Extended-precision 20-bit digital audio is one of the more salient examples of the adage 'a chain is only as strong as its weakest link.' As the ante is upped in terms of dynamic range, the weak links reveal themselves very quickly. Most recording engineers that have heard a dynamic 20-bit recording, compared with the same signal quantised to 16-bits, will tell you that extended-precision digital audio is neither fiction nor fantasy. Those who understand the technology, however, will correctly argue that it is not fact.

Current machines are capable of storing either the whole 20-bit word, or the 20-bit word plus four auxiliary-bits specified in the AES-EBU serial-bitstream. As is well known, however, storage is not the problem; analogue-to-digital conversion is the bottleneck. A student of digital audio will explain that a 20-bit recording would have a dynamic range of some 119dB, yet our measured results rarely exceed 110dB — and that is on a good day. Put simply, although we are capable of storing 20-bits, the two least significant-bits (LSBs) or more are usually lost in the analogue noise of the convertor's front end. In reality, our 20-bit recordings are far closer to 18-bits. Which is not to say that these two additional-bits are unimportant: they convey an additional 12dB of dynamic range beyond the existing 16-bit signal. The ability to make use of these bits, however, requires an understanding of the amount of noise generated by multiple microphones and mixing buses.

Extended precision digital recording

The first of three arguments in favour of extended precision digital recording was initially broached in 'Maintaining Digital Audio Quality' by Francis Rumsey, *Studio Sound*, February 1991. In his article, Rumsey explained that the additional headroom could obviate the practice of recording near the very top of the digital meter scale, thereby decreasing the likelihood of an over level. That a mastering format should have greater dynamic range than the derived release formats has been a fundamental tenet of analogue working since its inception, due to degradation caused by signal processing and copying through successive generations. While it is probably sacrilegious to raise the subject of the effects of multiple digital generations, the effects of requantisation and jitter may well argue for original recordings to be made with the most precise data word possible.

The second rationale stems from the original 20-bit developmental engineering carried out during 1988 by Sony Corporation's Audio Products Division. Explaining that 20-bit convertors were capable of quantising to more than 250,000 discrete levels and were therefore very accurate, measurements and listening tests revealed that data words made up of the 16 MSBs of a 20-bit convertor conveyed greater low-level

detail with greater accuracy than the data words output from the best 16-bit convertors generally manufactured. Experts in IC process technology and convertor design attribute the limitations in low-level 16-bit convertor performance to the silicon processes used, or the circuit topologies found in commercially-produced convertors — processes that appear not to be used for 20-bit devices. In simpler terms, compact discs made from 20-bit recordings come far closer to achieving true 16-bit resolution than discs made from 16-bit recordings, owing to the fact that a 20-bit convertor will not suffer from similar inaccuracies until bit 17 or 18.

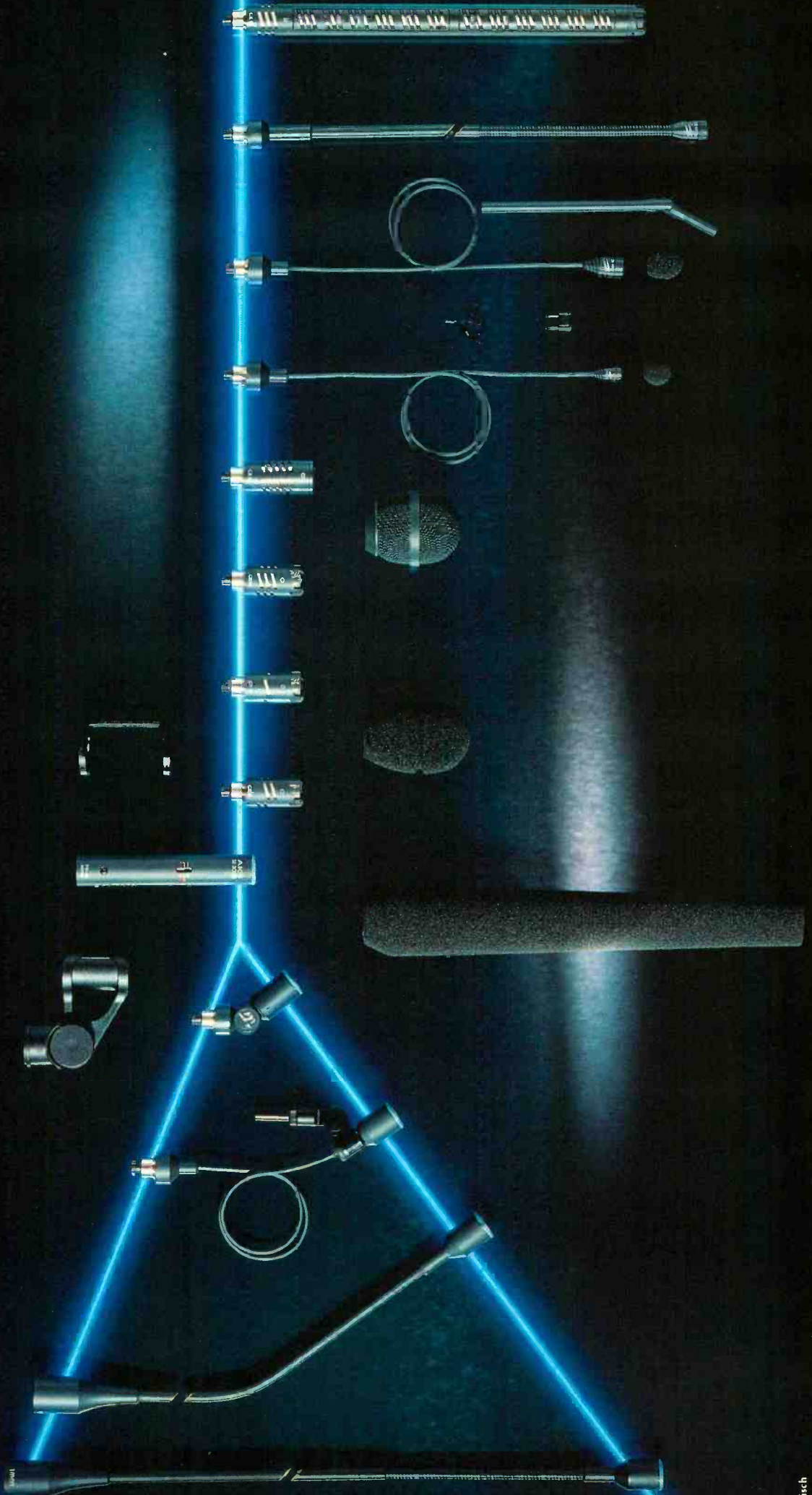
The final reason for extended precision quantisation relates more to the future potential of the sound of the compact disc than the preceding two. Digital signal processing can be used to requantise the 20-bit output of the master tape machine into the 16-bit word that is recorded on the disc. Advances in large-scale IC fabrication techniques have placed tremendous DSP capability within the reach of commercial digital audio equipment manufacturers. Such processing can utilise the intelligent information below bit 16 of a 20-bit master, and hence improve the resolution of information of the 16-bit word on a finished CD.

Noise-shaping techniques

Sophisticated noise-shaping schemes have been used in D-A convertors to redistribute the power of the quantisation noise floor. This information can be rendered either lower or less audible within the audio pass band, while raising its power above the audible pass band. The 20-bit A-D conversion process is becoming a beneficiary of a similar process. One of the current algorithms employs 50th order noise shaping to lower the noise floor across the audible pass band, while a more sophisticated, patented algorithm is actually distributing the noise power based on the low-level psychoacoustical properties of the ear. The end result is a lowering of the noise floor where the ear is most able to discern its presence. Remembering that much of this processing is based on the usable information contained in the least significant four bits of a 20-bit recording, it follows that improved convertors and recording techniques — plus the development of improved algorithms — will result in these processes becoming more effective.

Even the most casual of observers of CD-player technology cannot help but notice the rate of progress in terms of playback performance, the pace of this improvement being far faster and more extensive than the pace of record performance improvements. Although a fairly recent innovation, 20-bit recording would appear to be one of the most significant advances in digital record performance in the 10-year history of the compact disc, a history that will hopefully be added to further into the decade. ■

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TRIDENT 90

Patrick Stapley reviews Trident's latest mid-market analogue console

Last month (November) saw the release of Trident's new mid-price analogue console, the *Series 90*. Although the *90* directly replaces the ten-year-old *Series 80*, there are few similarities between these consoles, and many new facilities — including machine control and Trident's first automation system — have been incorporated. The *90*, in fact, bears a far greater resemblance to the *Vector*, and it appears that we are now seeing a new family of consoles emerging from the company. In view of the recent management buy-out, this would seem highly appropriate.

I-O Module

To try and cut down on descriptive text, a line drawing of the module is included much of which is self-explanatory, but where necessary comment has been added. I hope this approach will help to relay information in a more immediate and intuitive way.

A design priority of the *90* has been to offer a large number of inputs while keeping the console relatively compact; this has been achieved by choosing an in-line design that provides three independently controllable signal paths per I-O module. Thus a 40-way console (2553mm long x 1137mm deep) can control 120 inputs during mixdown, plus an additional eight effects returns. The largest frame size will be a 56-module console.

The three inputs are Mic, Line 1 and Line 2. As with conventional in-line consoles the mic and line inputs can feed either the channel or monitor path dependent on local or global switching. However, the *90* offers an additional line input that can

either be selected in place of Line 1, combined with it, or used as a totally independent signal path. In the latter case (Line 2 to Mix) this is achieved by replacing the normal feed to Auxiliary 9-10 with the post EQ Line 2 signal. From here the signal will be redirected to the mix bus via the Aux. 9-10 level and pan controls.

The equaliser section has been designed to split three ways. The midfrequency bands on the 4-band equaliser can be switched between the channel and monitor paths. An additional 2-band fixed EQ (10k and 100k based on Trident's *TSM* range) may be switched between the monitor and Line 2 path. This arrangement provides independent EQ for each path, and can be configured in a variety of ways (see chart below). The filter section always remains in the channel path.

As with EQ, the three paths have separate access to the auxiliary sends. The 10 sends (six

mono and two stereo) all have paired Chan-Mon switching but Aux. 5 and 6 also have the ability to source Line 2. The send from Aux. 5 and 6 can be disconnected from the aux bus to the group bus, providing Line 2 with access to the routing matrix — that is Aux. 5 feeds odd numbers and Aux. 6 even numbers. This facility also extends the auxiliary capability by allowing the groups to be used as additional auxiliary buses.

The triple signal path arrangement of the I-O module permits the desk to be configured in a variety of ways with simple switching. Although on the face of it the arrangement may seem a little complicated, in reality it is surprisingly easy to operate. A helpful touch has been to colour all Line 2 switches in a prominent dark grey.

Central facilities

This section of the console is also illustrated, and again many of the functions will be self-explanatory. Another aspect that can be seen here is the colour scheme — the familiar black and neutral shades of grey have been replaced by a resplendent peacock blue. It is a bold choice, and regardless of whether you love it or hate it, it does give the console a distinct identity.

Towards the top of the centre section are two stereo foldback circuits with source selection ►

CHANNEL	MONITOR	LINE 2
HF/HMF/LMF/LF	HF*/LF*	NO EQ
HF/HMF/LMF/LF	NO EQ	HF*/LF*
HF/LF	HF*/HMF/LMF/LF*	NO EQ
HF/LF	HMF/LMF	HF*/LF*

* denotes fixed-band EQ

from auxiliary pairs, stereo bus, studio playback sends, and each other. As sourcing is additive, headphone balances can be quickly assembled without having to set up individual mixes channel by channel. Talkback facilities are comprehensive, featuring discrete level adjustable sends, and two compressor protected Listen Mic returns which output onto the Alt 1 speaker circuit. Also included is Auto TB which automatically switches two-way talkback once the multitrack has stopped or is in wind-rewind.

The default solo condition for both long and short faders is AFL; this can be changed via global switching to either PFL or SIP (Solo In Place). If the destructive SIP mode is selected, the Link facility becomes available which causes both long and short fader mutes to respond together. Additionally, if Line 2 To Mix has been selected (see earlier), the Aux. 9-10 mutes will also be activated. The SOLO SAFE buttons would be necessary for each of the three signal paths.

Each I-O module has 12 automated switches — AUX. CUTS, FADER CUTS, INSERT IN, AND CHANNEL EQ IN. All these switches, along with the AUXILIARY MASTER CUTS and EFFECTS RETURN CUTS, can be assigned to 16 switch groups, allowing global or selective snapshots or be stored and recalled. The GROUP MASTER buttons are also automated, and during mixdown the computer treats them as any other automated switch. Switch groups can be copied to each other either singly or in blocks and new data will be overlaid on top of any existing data. The switch master panel and the keyboard itself are virtually identical to the *Vector* — also included are ten smart keys (F1-10) enabling regularly used commands to be stored.

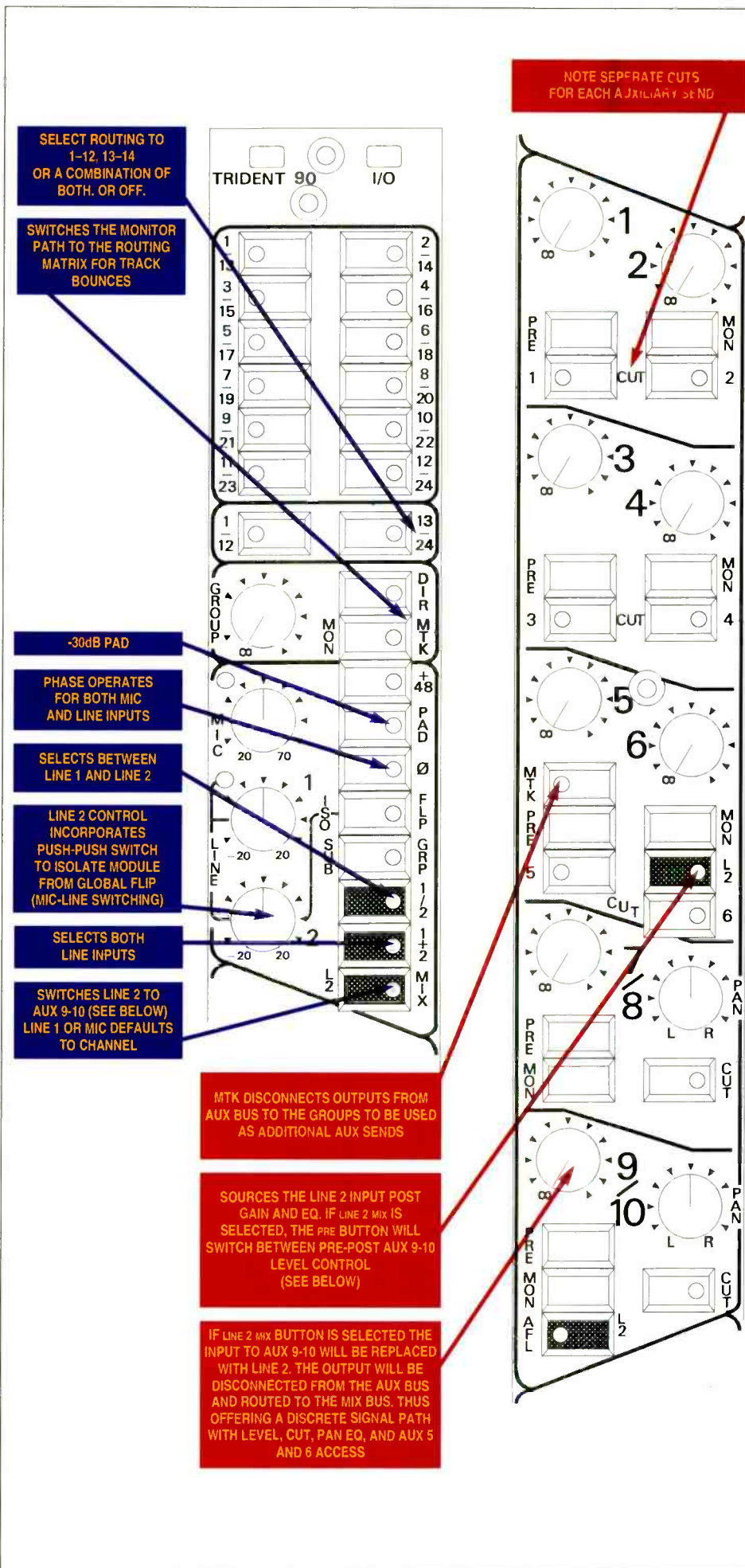
The console is fitted with 32-segment, software-controlled bar graph meters for each I-O module and the stereo bus. There are an additional pair of mechanical VUs for the stereo output, plus a pair of auxiliary bar graphs that may be switched between various sources. All bar graphs are VU-PPM selectable, and a Peak Hold facility is available with either manual or auto reset. Bar graphs can also display VCA levels by dividing the meter so that the top half shows the short fader, and the bottom half the long. The I-O meters can be sourced from either the channel of monitor paths, pre or post EQ, but when selected to Monitor Pre, they will follow Group-Tape switching. The default condition is VU-Post Chan. A centrally-placed phase meter is an option.

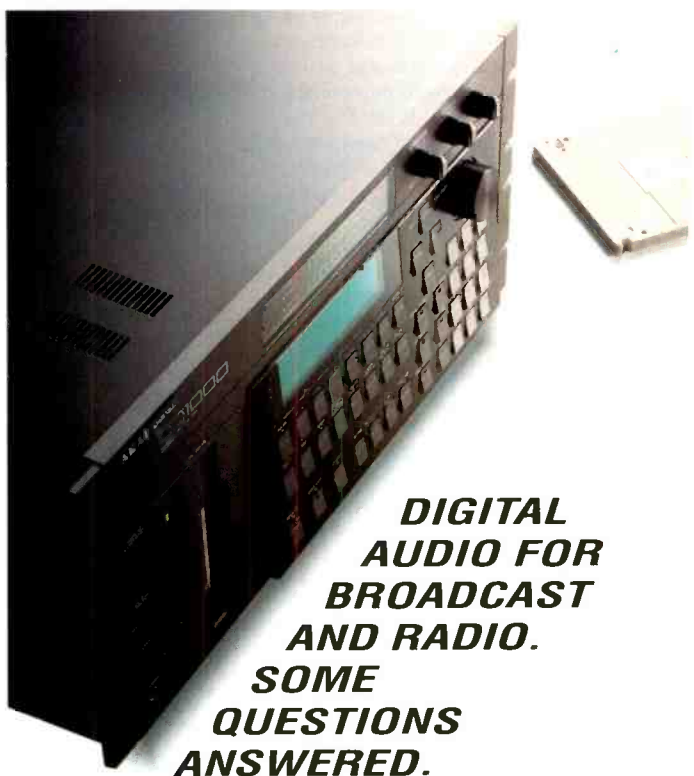
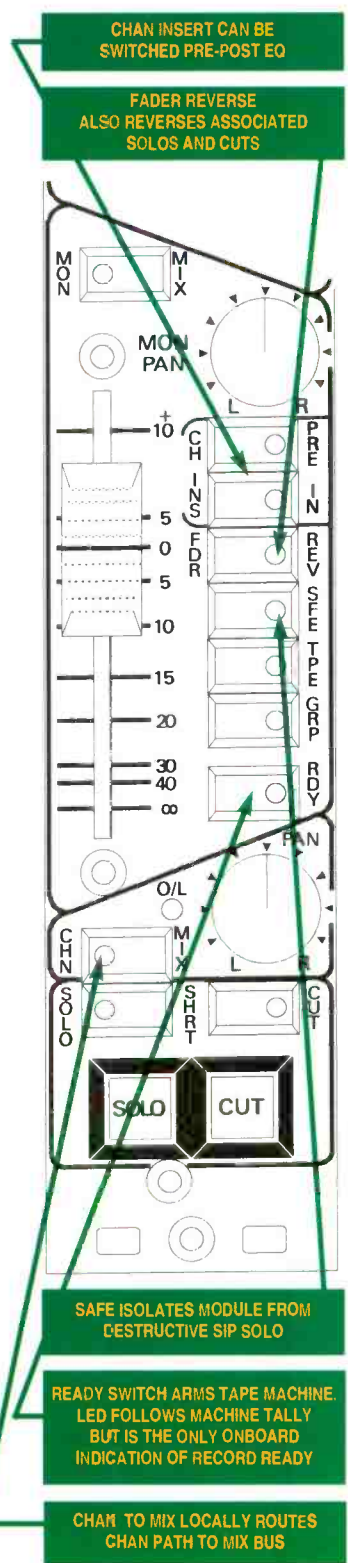
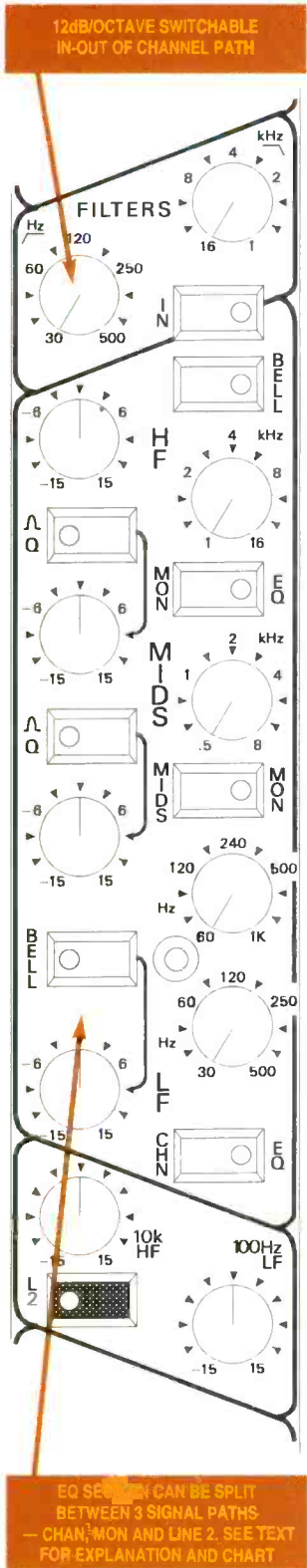
Machine control

Machine control is closely integrated with automation, and provides a powerful but simple to manage facility. There are two main screens displayed by the *Series 90* computer — Machine Control and Automation.

The Machine Control Screen includes a Cue List and a separate Tape Position box which scrolls through cues as the tape plays. Using the trackball, cues can be accessed from the Cue List and located; alternatively GoTo commands can be entered from the keyboard, in a similar fashion to SSL. Four further boxes show the GoTo point and End point for cycle times, and the Drop-In/Out points for automatic recording. Cues can be entered on the fly or off-line, and may be edited to subframe accuracy. To help speed-up the naming of cues, quick keys have been included — for example keying-in GS inserts Guitar Solo.

Also incorporated on the screen is a 176-track tracklist! The list has been designed to function as either a straightforward tracksheet or as an input list — hence the number (3 x 56 Inputs + FX ▶





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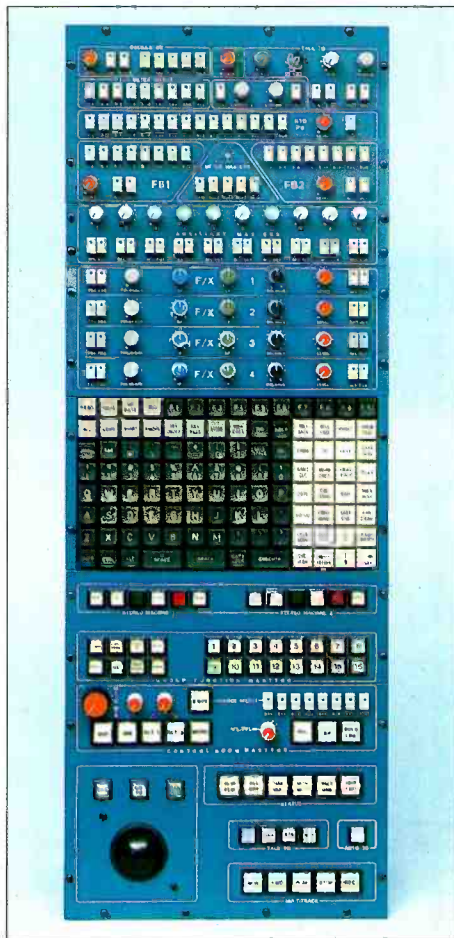


Returns = 176). An option being considered for the future is a cross-patch menu to cater for track to input repatching. Names can be copied, so if there are eight tracks of backing vocals for example, it only requires typing-in once — in fact the whole procedure of entering text is word processor based. There is also a Solo Track Sheet mode, which causes the selected track to solo on the console, providing a method of centralised soloing.

The Machine Control Menu is accessed from this screen and shows the machines connected and whether they are on or off line. A comprehensive list of machines is provided, and the system will automatically adjust control parameters to suit the selected transport. Full control and synchronisation is provided for a Master, Slave and MIDI 'virtual machine' — because the system generates MIDI song pointers and MIDI time code, a sequencer is treated like a tape machine. At present the console is being supplied with an Adams Smith Zeta 3 synchroniser, but future software updates will allow for TimeLine, Fostex, and Audio Kinetics products. Two features worthy of mention are: the ability to run the time code generator backwards and thus extend time code in reverse; and the ability to control an offset slave without the master connected — this is done by calculating the offset between master and slave, and regenerating new code in place of master time code.

Automation

As mentioned in the introduction, this is the first proprietary automation system from Trident and it is fitted as standard; the company do, however, have an OEM agreement with Audiomotion to fit *Uptown* as an option. At the time of seeing the



Centre section

console there were still some details to be finalised, so what follows is a general overview rather than an in-depth description.

The system controls both long and short faders, the 12 automated switches per I-O module, the cuts for the auxiliary masters and effects returns, plus the switch group masters. Faders can either be all VCA or a mixture of long moving faders and short VCA faders. When the automation is switched off, all VCAs are automatically bypassed.

The system runs on a 386 or 486 PC, depending on requirements, with between 2Mb and 4Mb of RAM. A 40Mb hard disk is standard, but again larger disks can be supplied. Both 3.5-inch and 5.25-inch floppy disk drives are part of the package, along with the RGB monitor. Separate status buttons and LEDs for long and short faders are built into the top of the long fader.

The Mix Screen includes some of the information from the Machine Control Screen, including time code readouts and a cue box which will either display scrolling cues or, if the trackball is moved up-down, the Cue List. Above these are 32 bar graphs which, depending on mode selection, represent either long faders or short faders; they can also be arranged in pairs of long and short faders for each channel, in which case the screen will be displaying 16 rather than 32 channels. Up to 96 channels can be controlled, and a left-right movement on the trackball will scroll the display. Below each bar graph are two boxes: the first displays the channel number and indicates automation status by colour, the lower shows group information. A further screen displays the 12 switches laid out in module strips, and shows their status and on-off condition.

The familiar Read, Write, Update and Isolate statuses apply to both faders and switches



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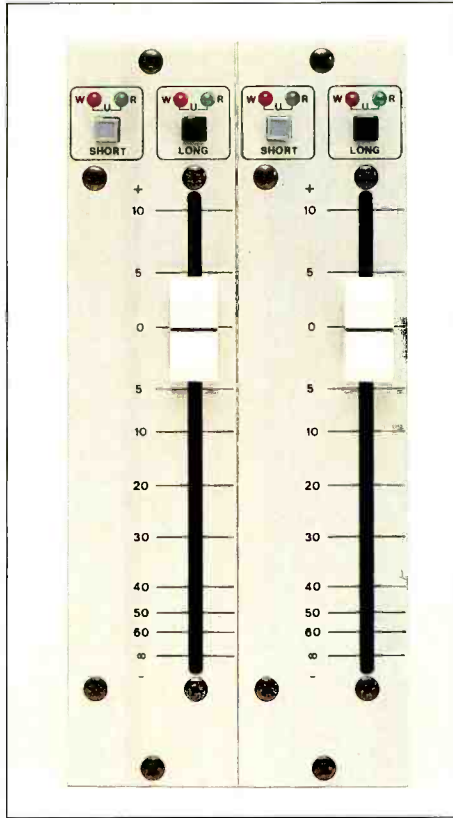
C L O S E R T O T H E

individually. In addition to the bar graph display fader status is also indicated by the local Status LEDs, and can be set locally or globally — status sequence will vary depending on Setup Menu selection. Once set, status remains intact until changed by the user; although an automatic reset from Write to Update after the first pass is being considered as a setup option. Write status can be set to function either in an extended manner — that is if the pass stops before the end of the mix, fader and switch values are written through to the end; or in a localised manner where new data is only written as far as the stop point.

The system operates with two mixes in RAM (Current and Previous) allowing rollback updates. Each bar graph display splits vertically to show the two levels, and to provide a visible null indication — the Status LEDs also act as nulling indicators and the system will include an autotakeover facility. Mixes can be saved automatically or manually depending on the Setup Menu: Auto Saving will literally save all passes unless they are aborted, while manual saving requires the user to keep, abort or update the pass once the tape has stopped — if the tape is rewound rather than stopped the computer assumes the intention is to update.

Off-line functions include merging and joining mixes with the ability to select individual faders and switches. Fader and switches may be trimmed, and data can be copied and swapped both within I-O module and between modules. Additionally, it is possible to manipulate switch data in banks, that is all Aux. 1 Cut information can be copied to Aux. 2.

MIDI files are stored under a Project File, which also contains the cue list, track list, notes, machines control information, setup information



and so on, all of which can be printed-out. Each Project file can hold 360 mixes.

Function related Help pages are included within the system, but Trident are also introducing a remote technical back up facility via modem. This rather novel idea will allow files to

be downloaded to a PC at the other end of the phone line where a qualified technical engineer will be able to control the system and troubleshoot for faults. This method could also be used for instant loading of new software.

Trident will be releasing a Virtual Dynamics software package for the console early next year. This optional feature utilises existing VCAs (extra VCAs are supplied for moving fader systems), and will provide full dynamic processing on all channels, monitors and main outputs. The system will be screen based.

Conclusion

The Trident *Series 90* manages to pack a lot of features into a small space. Much thought has gone into maximising signal path flexibility, without over complicating or restricting operation, and its large input capability should satisfy the most input-hungry of clients. The built-in machine control and automation are definite plus points, and appear well conceived, but it must be stressed that we were unable to fully test them.

Although the console has evolved significantly and bears little similarity to its predecessor, it retains the Trident stamp for both quality engineering and sonic performance. The *Series 90* represents excellent value for money (exchange rates permitting), and will prove a formidable contender in the mid-price console market. ■

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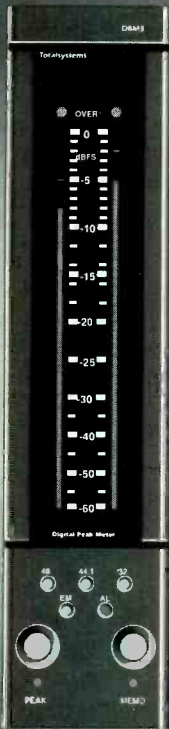


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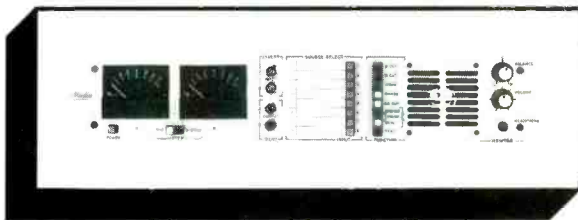


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AT4033

STUDIO CONDENSER MICROPHONE

“ Audio Technica is still in its infancy in the professional market, and not having encountered it before, the 4033 Transfomerless Capacitor Studio Microphone came as a very pleasant surprise. Its styling is distinctive and elegant, the finish is excellent, and the cat's cradle, again supplied as standard, is simple and effective and balances the microphone very well. Everything about the microphone looks and feels sturdy and professional. Once again the facilities are simple; the only switches are for the high pass filter and the pad, and the polar pattern is cardioid.



AT4033 shown with optional shock mount AT8441

But the biggest surprise was the sound. On everything I tried – including a Steinway grand – the output was virtually indistinguishable from that of the 414 – open, transparent and clean, quiet and free of colouration. The main difference was in the sensitivity – the 4033 is few dB more sensitive than the 414. If this is an example of what Audio Technica has to offer, I await further developments with interest. A variable-pattern microphone with the sound of the 4033 would be a very useful addition to the arsenal indeed. As it stands, I can't imagine it will be long before this microphone is a much more familiar sight.”

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ATM-002

Korg's direct-to-disk workstation also incorporates MIDI sequencing facilities.

Yasmin Hashmi investigates the integration

When multitrack tapeless systems were first introduced, you could have expected to pay in excess of £50,000 for an 8-channel system without digital mixing or EQ. Although a couple of relatively low-cost multitrack systems had been available for some time, they were generally considered as providing an inferior performance in terms of DSP, functionality and synchronisation — in other words, they did not provide the features which make a tapeless system particularly useful for heavy-duty postproduction applications. However, times are changing. The middle ground, in terms of pricing, is slowly being populated with systems which provide features often associated with the top end, and this promises to make the technology useful to a much wider market.

Based in Japan, Korg are perhaps best known for their synthesisers and samplers. Celebrating their 30th anniversary this year, they can boast a fair degree of experience when it comes to synthesis, sampling, sequencing and MIDI since, among others, Dave Smith (widely credited with inventing MIDI) works for the company.

Korg have also been producing digital signal processors for some time, but one of their most successful products to date has been the *M1* 'workstation' keyboard. This performs both sampling and synthesis and its popularity no doubt encouraged Korg towards the development of a workstation. As a result *SoundLink* was officially launched early this year and is designed to integrate disk-based recording with sequencing and DSP functions.

SoundLink's hardware is housed in two racks — the main unit and the storage unit. The main unit provides all inputs, outputs and interfaces. It sports eight independent XLR analogue inputs, ten analogue outputs (including two for a mix output), a Sony 9-pin port for external machine control, BNC connectors for video sync and VITC, LTC in and out, an RS422 input (not yet implemented) and a metronome output. It also provides SPDIF and AES-EBU interfaces and two MIDI buses — one for MTC and the other for MIDI events.

The storage unit houses a 680Mb hard disk which supports 8-channel replay and provides four hours of recording time at 44.1kHz. There is room for another two drives, but these will only



SOUNDLINK

increase storage time, not the number of channels. Furthermore, an extension unit can be connected which supports another three drives for yet more recording time. The storage unit also houses the integrated *Exabyte* tape streamer for archiving purposes.

User interface

Physically, the user is presented with a console containing mixer and editing sections. Across the back of the console is an upright meter bridge which displays eight individual channels as well as left and right master meters. The mixer section has eight faders with mute and solo switches, one master fader and a MIDI fader for controlling the volume of an external device. Above the faders are track select keys, bus-routing buttons (for internal digital bouncing) and channel select keys (for monitoring the input or output from the disk). Above these are 16 buttons for arming, routing and muting MIDI channels from the system's internal MIDI sequencer.

The editing section sports transport controls, a multifunction wheel, numeric keys, edit function keys, a key for selecting local or external machine control, an LED locator display, various mode

select keys and a small LCD display. On the back of the console are connectors for optional RGB or composite monitors and an alphanumeric keyboard.

Recording and editing

The system supports sampling rates of 44.1kHz and 48kHz and allows simultaneous recording of up to eight analogue or two digital inputs. Each input has a fixed routing to a track, such that Input 1 is routed to Track 1, Input 2 to Track 2 and so on. The desired tracks for recording are armed and transport controls used to start recording. The LCD shows eight tracks as vertical strips and while recording is taking place, the strips are filled with blocks representing the audio. Once recording is over, the take is automatically given a number, name (which can be changed) and is stored with relevant information in a take list. This lists cues and takes alphabetically only, but allows them to be auditioned.

The system cannot perform manual punch-ins, but does allow nondestructive automated ▶

punch-ins, with in and out times being set. In addition, it will perform punch-ins while in a loop and will stack successive takes so that the preferred take can be selected for replacing the original. Multiple takes can also be stacked across the eight tracks for quick comparison purposes.

For cut-and-paste-type editing, the track display is used which has a fixed time base of 35s. Editing can be single-track-based, across all eight tracks or across pairs of tracks (Tracks 1 and 2 or 3 and 4). Marks can be made on the fly and the system will work to a range of resolutions for location purposes including marks, frames, seconds, minutes, cues, beats, measures and sub-beats (or ticks). For locating purposes using audio scrubbing, a waveform is displayed which can be zoomed in and out, with the scrub resolution changing accordingly.

For events list editing, the display will list cues and their event times for a selected track. This display can be used to offset a cue (reference its event time to a point within the cue rather than the in point), change the in and out ramps of a cue and/or the crossfade. Crossfades can be up to 250ms in duration, logarithmic or linear and are non-real-time.

MIDI

SoundLink has an internal 16-track MIDI sequencer and up to 20 songs can be created in a session. Basic cut-and-paste-type song editing is provided as well as features such as the ability to automatically calculate control events with a chosen curve between two given points. This feature could be useful for controlling an effect between two events in a picture for example. In addition, if a section of audio has been time

compressed-expanded, the tempo of the corresponding MIDI sequence will also be compressed-expanded.

Other features which can be useful when working to picture, particularly for scoring, include fade out or slow down between two given points and automatic MIDI tempo map generation (by defining in and out points and number of bars). The latter can also be useful for working out the tempo of an old recording which is to be remixed, but for which the tempo is unknown. This is achieved by marking the beginning of the recording, then marking an appropriate measure (after four bars for example) and finally marking the end of the song — the system will then calculate the tempo.

Sync and external control

SoundLink chase locks to time code and values can be grabbed and used to place cues. The system synchronises to LTC, VITC, video sync, word clock and MTC and can reshape or regenerate incoming time code. One-way communication with external devices is supported with control over functions such as jog, shuttle and looping (with a preroll of up to 60s on the *SoundLink*'s audio if required).

The system can also control the volume of external devices via the MIDI fader and can control MIDI programme changes of external devices. In return, programme data from such devices can be transferred back to the system for storage with the session.

The system supports level control, mute, solo, EQ, reverb and internal bouncing. Each track has an associated fader for level control and the

displays shows a real-time dynamic representation of each track's level. Each fader can control around 1000 steps of level and fader movements can be automated. Level information can also be overwritten by 'capturing' the current level and taking it up or down with the direction starting from above or below the captured level.

Mutes and solos are performed by pressing their respective buttons which light up if active. They can also be automated and can be located to specific points in the same way as edit points are found — by scrubbing or locating to a particular resolution. All automation chases the audio such that if the audio is being scrubbed, the MUTE and SOLO buttons will light up accordingly.

Each track can have its own limiter, reverb (with 14 editable parameters) and three-band EQ — each with 200-frame snapshot automation. Although automation is not cue-based (it is not tied to a cue such that if the cue is moved the automation follows it), it can be made to follow the cue in two stages. This is because all automation information can be listed and edited. Therefore, if the first step is to move the cue, the second step would be to cut and paste the associated automation to the new location of the cue.

Each track also has its own software-based PHASE switch, high-pass filter, pan setting, noise gate (with threshold and release), EQ BYPASS switch and pre or post-fader switch. In addition, tracks can be internally bounced to create a new recording which will also reflect any automation used.

SoundLink's DSP capabilities include sample rate conversion between its two sampling rates, non-real-time compression-expansion (from 50% to 200% with three algorithms to choose from) and the ability to varispeed plus or minus 6% with a

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constant sampling. The medium used for archiving (as well as loading a new operating system) is *Exabyte* tape streamer.

All data and audio required for a session can be archived to tape at three times faster than real time. The user can select whether to backup or upload individual sessions or all sessions resident on disk-tape and any takes-cues which were not used in any sessions are automatically marked in the cue list and can be selected for deletion. If cues are deleted, the disk is automatically defragmented (or shuffled) in order to eliminate 'holes' and provide a contiguous space for further recording.

The software under review was version 2 and, Korg plan to respond to customer feedback by providing an enhanced operating system every six months. Software upgrades are currently free of charge. Korg are also looking at MO applications.

Conclusion

The middle ground for tapeless systems is an area which is particularly open to competition — from both above and below. At the lower end, for example, there is increasing pressure from very low-cost tape-based systems which provide both the number of tracks required and digital quality, but not random access. The potential purchaser must weigh up the benefits of cost against functionality. From the higher end, the pressure comes not only from the features available, but the ease with which the system is operated — from past studies, this is often of paramount importance in the choice of system.

SoundLink is a good all-rounder and provides all the basic features required of a multitrack tapeless system as well as features such as digital



mixing and EQ, MIDI sequencing, sample rate conversion and machine control. For the price, apart from the random access editing side of the system, it would be difficult enough to equal its performance using a tape-based system in conjunction with a mixing console and peripherals. As far as competition from other tapeless systems is concerned, *SoundLink* offers many features often associated with the higher end. In its favour, it provides an operating surface with comprehensive tactile control. However, the very nature of comprehensive tapeless editing

often means that the user is obliged to rely on visual information as much as on hearing the results and this is where *SoundLink* is at its weakest. Nonetheless, Korg have already expressed their intention to regularly update the system's operational software which no doubt will result in increased use of the optional monitor with more refined displays. ■

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One German recording studio has gone into multichannel audio in a big way —the design considerations are explained by the project consultant and the designer

The Touchdown recording complex is situated amongst the hills, fields and forest land that is to be found some 25 kilometres north of Munich. The complex is a convenient 15-minute drive from the new Munich International airport, and welcomes its clients with an outdoor heated swimming pool and jacuzzi — alongside its two studio control rooms, 85-m² live room, MIDI suite and off-line postproduction editing suite. It also boasts a Foley stage in the live room and one of the largest sound effects libraries in the world. (This has been made available for third-party use and currently supports both the NED *Synclavier* and SSL *Screensound* libraries.) Most recently, Touchdown has seen the reconstruction of its Studio 2 to accommodate a 15-enclosure monitoring system capable of supporting stereo, Dolby Stereo (LCRS) and Ambisonic productions.

Touchdown is owned by New York entrepreneur Terry Drivas who is the ex-MD of various successful computer majors. The facility currently caters for a wide range of clients and enjoys a roughly equal spread of work from music recording and audio for video. Business on the postproduction side has grown steadily with two projects under way at the time of writing — *The Cement Garden*, a joint UK-German feature, and the HDTV *Phantom of the Diamond King* for Steiner Films-ORF-Beta Taurus.

The technical design of the studios was to cater for both analogue and digital recording media and also for synchronised machine control. Communication between all rooms is facilitated by a central patch bay matrix and central synchronisation is via a customised Motionworkers *AKES-III* system. All rooms have access to analogue and synchronised digital distribution lines and can route audio signals to and from some 96 plus recording channels. Data lines are similarly accurately matrixed.

Because of the demands of the picture-orientated clientele, Touchdown has 'outgrown' standard stereo audio requirements and the requirement for what was originally called 'the virtual room' started to become clear. Thus it was decided to make a 'reasonable departure' from conventional audio.



PHOTO: ROGER QUESTED

The resultant Studio 2 is equipped with a sophisticated Sony HDTV (*HDIR-550*) video projection system, an octagon of Quested audio monitoring in the conventional plane plus an overhead channel for vertically-placed signal content. The room caters for Dolby Stereo with the front three channels providing Left-Centre-Rear placement and the rear left and right providing the surround channel. The additional mid-left,

mid-right and centre-rear monitors complete the hexagon and cater for other surround formats such as Ambisonics.

Signal placement is facilitated by the use of a sophisticated digital surround-sound processor encoder-decoder and 16-channel vector-positioning unit. This unit was developed by UK-based AGM Digital Arts and employs multiple AGM *TMS-320c30*-based, 4-channel in-out, 32-bit ►



Touchdown Studio 2 showing equipment and monitor installation

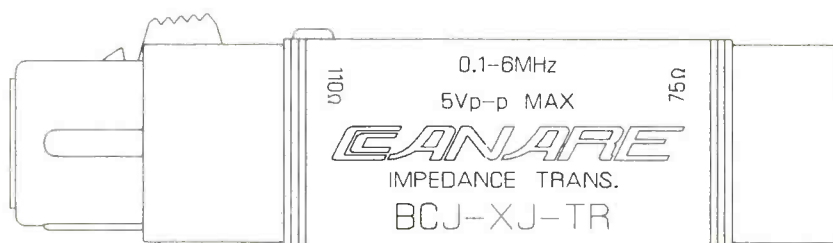
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People keep asking me which I think will win the war between DCC and MiniDisc? I must honestly say I do not know which format will win — it is still too early to say. What I do know is that both Philips and Sony are getting very touchy, and whenever the press write anything critical we can expect to get our ears bent by one side or the other. Or both. Perhaps the best thing would be for the press just to report that both DCC and MD are perfect and that everyone should buy both — two additional sets of hardware and four versions of every new music title (CD, Compact Cassette, DCC and MiniDisc). Alternatively, you could opt to throw away your Walkman and dispense with the cassette version. What better way to highlight, without fear of complaint, the stupidity of the mess which Philips and Sony have gotten us into?

The other topical concern is the Alan Blumlein biography and the archive material concerning the man who 'invented stereo' collected over the last 20 years by Francis Thomson.

There is some interesting news. Early in 1991, Francis Thomson once again asked magazines and journals to publish appeals for yet more biographical material. Those editors who knew that Thomson has begun collecting papers in 1972 treated his request with suspicion. Others published fresh appeals. Later (23rd January 1992) *Nature*, the science professional's journal of record, took the unprecedented step of publishing a note warning readers that it had 'since come to light that Mr Thomson is unable to produce evidence of work on such a book, that he has declined to make the material already collected available to others and that readers would be ill advised to accede to his request for biographical material.'

In the meantime (May 1991), knowing that third-party attempts at guaranteeing the long-term security of Thomson's collected papers had failed, I formally requested that the IEE investigate the biographer's behaviour. I drew attention to his use of IEE membership when publishing appeals for material and made it very clear that my motive in asking the IEE to investigate the activities of one of its members was to safeguard the material already collected.

It took the IEE over a year and much nagging from me to come to a decision (in late June 1992). By coincidence, this came shortly after the 50th anniversary of Blumlein's death (7th June 1942), when the Halifax bomber being used to test his H2S radar system crashed near the river Wye at Goodrich in Hertfordshire. Neatly summing up what the lack of a Blumlein biography means, *The Times* report of the memorial ceremony commemorating the crash in honour of all those who worked on wartime radar, did not even mention Alan Blumlein by name.

The IEE's decision was to take no action. The reasons given were marked 'confidential' and the IEE have refused my requests to lift the restriction. They have, however, stated, without a seal of confidence, that 'the investigating panel received assurances from Mr Thomson that the archival material he has collected will be safeguarded and [the panel] has no reason to doubt this assurance.'

Because I had previously raised the question of

Barry Fox

Photo CD blanks under wraps while Alan Blumlein's self-appointed biographer plays hard to get

the Blumlein archive with them, I asked the Royal Society if they had any news. Although my first letter and enclosures went mysteriously astray, I did finally hear from the Society's librarian, Sheila Edwards, on the very morning of a memorial seminar at the IEE on the 26th of October.

'I am happy to confirm that I have been in correspondence with Mr Thomson,' wrote Ms Edwards, 'and that the Officers of the Society have agreed to accept Mr Thomson's generous offer to donate his collection of Blumlein papers to the Society.' So when will this be, and when will bona fide researchers be able to read through the Blumlein archives in the Royal Society library?

The good news is that the archive, when available, will be subject to the Royal Society's normal rules. These are such that the papers are kept secret until 40 years after the death of the subject. And as Alan Blumlein died over 50 years ago, this means the papers will be available as soon as the Society has them.

So when will that be? When will bona fide researchers be able to read through the Blumlein archives in the Royal Society's library, perhaps getting a closer insight into those early experiments on disc and film stereo recording carried out at EMI in the early 1930s? Here, I fear, comes the bad news.

Ms Edwards admitted that a lot of people are interested in the papers but that the Society is 'still negotiating with Mr Thomson.' How will the Royal Society let people know when the papers arrive? An announcement will be made in the Society's own journal but no decision has been taken yet. Should I phone and enquire on behalf of the majority who do not see the journal — in three months, perhaps? 'It is likely to take longer than three months.'

Well, how long?

'There is no time scale yet. Please do not phone.'

In the absence of any more constructive suggestions from the Royal Society, I can only suggest that those of you who are concerned should

Do Kodak think I am going to start up an unlicensed Photo CD centre in my garden shed?

call the Royal Society and ask for yourselves.

This suggestion did not, however, appeal to the IEE. The Institution's Assistant Secretary, Philip Secker, rose from the audience at the Savoy Place meeting and warned the audience that to make such approaches would be 'counterproductive' because 'negotiations are at a delicate stage.'

Without further explanation, which has not been offered, it is hard to know what this means. It is even harder to reconcile this warning with the IEE's assurance that it had received assurances 'which it had no reason to doubt.'

After the IEE seminar, Thorn EMI hosted a buffet. The company which had employed Blumlein noted in their invitation that, 'it is surprising to note the lack of public awareness surrounding him.' Even inside T-EMI, it seems — the invitation referred to Blumlein's achievements as 'including 78 patents.'

It was 128.

Taiyo Yuden asked me to meet the head man from Japan, Mr Sudo, to talk about blank CD-R pricing. Unfortunately, Mr Sudo fell ill and his trip to Europe was cancelled. I await rescheduling with great interest.

Although the press have not yet seen inside Taiyo Yuden's production plant in Japan, engineers who have been there tell how closely it resembles a conventional CD pressing plant. The blanks are pressed, like ordinary CDs, with a control groove which guides the laser optics in the recorder and provides a time reference signal. Then a few drops of dye polymer coating material are applied to the surface, and the disc is spun to spread the coating evenly. This adds only cents to the material cost.

The only other extra cost is in high-level quality control necessary because any blemish in the spun coating mix will unfocus the laser both on recording and playback. This would introduce a higher risk of uncorrectable errors. None of this justifies the huge price difference between CD-R audio blanks and *Photo CD* blanks (which retail at £5 inc. VAT in the UK).

Kodak have flatly refused to let me have a blank *Photo CD* to try in an audio CD recorder, and thereby confirm or deny the trade rumour that PCD blanks are pregrooved with a control track which only a *Photo CD* recorder can read. Kodak's reason is transparent nonsense; they claim it would 'compromise their *Photo CD* licensing agreements with wholesale photofinishers.' What do Kodak think I am going to do with one blank — start up an unlicensed *Photo CD* centre in my garden shed with home-made equipment?

This kind of nonsense is unlikely to engender sympathy for Kodak's predicament over *Photo CD*. To me, it looks certain to fail commercially as a stand-alone domestic format but likely to be taken up with enthusiasm by professionals such as picture libraries. If this happens, Kodak will be stuck selling a professional product at a domestic price, much as Sony were with DAT.

If *Photo CD* rides into the home, it is most likely to be on the back of CD-I, because a CD-I player will also play *Photo CD*s. A PCD player will not play CD-I discs and is thus a confusing irrelevance, doomed to disappear in a high-street sale. Taiyo's high pricing structure seems doomed to disappear too — and the sooner, the better. ■

WHY



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ABOUT

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When you consider the prevalence in America today of the NIMBY Philosophy (Not In My Back Yard), you can better understand the attitude displayed in suburbia and exurbia to the appearance of a recording studio. A recording studio may be more desirable than, say, a toxic waste reprocessing facility or nuclear power station, but only slightly so. Of course, these 'civilians' have visions of musicians driving decaying VW vans and smoking dope on their front lawns — not to mention the prospect of heavy metal recording sessions making sleep impossible five nights a week. The prospect of 'presentable' musos driving Cadillacs and taking herbal tea is not always understood by Mr. and Mrs. America. Neither is acoustical structural integrity and insulation. It is a major role reversal to accept that the recording studio is not the bad neighbour. In fact, a number of studio owners have discovered that good neighbours may be more important than just about any other factor in a studio's success.

'Studio A' was a project studio in a three-unit apartment building; it was a way for two young men to achieve some success with the music they both loved. The studio had been improved recently with some digital equipment and DAT machines. The men had both worked at other jobs to save the \$50,000 dollars they had lavished on their studio and they were convinced that they could move to a larger space in just a few months. The owner of the building ran some kind of small business out of his apartment and did nothing to interfere with our entrepreneurs — until the Drug Enforcement Administration showed up. A recording session was going on when four young drug agents wearing flack vests and carrying M16 automatic rifles entered the studio for the purposes of search and seizure. Although there were no drugs found, the landlord's neighbourhood cocaine trade caused the entire building and all of the contents to be forfeit to the US Government for 'the duration'.

Unfortunately, problems with a studio's neighbours can arise with unforeseen and with terrifying consequences. There are, however, some simple rules that can help prevent such calamities from befalling those operating mainstream, personal and project recording studios.

Monitoring external noise levels at a prospective site over seven days, 24 hours per day is an obvious, yet frequently neglected precaution. What many site selection managers do for businesses other than audio recording studios is to install a computerised automatic dosimeter that will deliver a detailed analysis of any extreme noise levels encountered during the time frame in question. If any sharp peaks are registered, the specific time will be logged and a personal visit to the site and it's environs can be made to track down the source of the noise. Too many studios spend millions of dollars on equipment and new buildings yet shortcut on the \$500 this service typically costs.

Sometimes, properly identifying a source of noise prior to taking occupancy can be a positive tool in negotiating a lower lease with a landlord. For example, if catering trucks load up next door and are on the road by 7am and return quietly after 5pm, there may not be anything more serious than

Martin Polon

Cautionary words on choosing a location for your studio

a scheduling problem for a studio with an unusual neighbour. Monitor internal noise levels at a prospective site over seven days, 24 hours per day. The same principle applies when leasing space in an existing building.

Conducting a walking 'tour' of the neighbourhood at various hours for several weeks is another useful procedure. The information gathered through careful observation can have a variety of ramifications. Physical safety in a neighbourhood is a real issue in the 1990s. Some studios are managing to beat the real estate escalation in the big cities by moving into so-called 'emerging' neighbourhoods. The problem with this is that the neighbourhood has frequently not emerged sufficiently to separate the 'neighbour' from 'the boys in the hood'. Clients are generally unresponsive to having their cars stolen or vandalised, or being mugged at the end of a late session. And security may not be the answer as it can be frustrating for clients not be able to walk to dinner or for a smoke during a break. It is unfortunate that the three centres of American recording — New York, Nashville and Los Angeles — have experienced the same kind of high rise activity and contrasting inner city decay that forces studios to either cope with a central location or else settle for relocation to the safety of the suburbs.

Learning all that you can about your immediate neighbours' business activities is another good move. It is likely to be useful to understand the social and economic impact of those businesses and other organisations that could effect studio operations.

One studio owner described his experiences at eyeballing a potential neighbourhood with some amusement. 'There was a seemingly quiet little Chinese restaurant on one side of us and an apparently unused Italian-American social club on the other. By walking around at night, I discovered that there was no on-street parking available on either Friday or Saturday nights and that the noise level from both establishments would disturb our recording activities. The Italian group met in their club on Friday and although I had no proof that they had anything to do with the Mother's And Father's Italian Association and you may abbreviate that. . . I did not relish the thought of trying to get people to quiet down and-or move their big black Cadillacs.

'Ditto the Chinese who were drawn on Saturday night for an all you can eat menu of obscure eels and shellfish. Most of these folks did not speak much English. So I decided not to locate there. But it sure was an interesting neighbourhood.'

Make sure you know as much about your landlord as your landlord knows about you. The same rule holds true for tenants, if the studio is the owner and-or landlord. Needless to say, it is very, very, very important to determine whether someone is selling drugs from your property or whose drug-selling activities could place your entire investment in jeopardy to the drug-hunting constables of Uncle Fed. This issue is especially important since the laws of enforced confiscation are virtually immutable when drug dealing is involved and the Drug Enforcement Administration (DEA) has already seized a number of studios and project facilities in similar circumstances from innocent and not-so innocent studio operators.

Hiring a reputable environmental inspection firm to eyeball a prospective site and/or facility makes a lot of sense. We have already established that the cost of an acoustical analysis of a potential site is small in relation to the total cost of building or acquiring a studio. The same can be said for an environmental analysis by a firm certified by the local authorities. In many cases, banks and finance companies require such environmental assurances before lending money. Too many sites have been polluted in the past with asbestos or formaldehyde-based insulation in the walls. Such past contamination can continue to leak into studios and control rooms for years after the initial installation.

Contact may be made with the local power authority to get an accurate 'power snapshot' of your prospective neighbourhood. This kind of information on your business neighbours can also prevent a costly mistake — one facility settled in to do post-production only to discover that their neighbour was involved in chrome plating auto parts and had a small substation with large SCR's to provide very high amperage DC plating current. The recording console in the studio was at the back wall and no more than 25 feet from the electrical and RF noise generated. Although the problem was eventually solved by a conscientious effort on the part of both parties and the power utility, it cost the studio in question big bucks.

The immediate effort of a studio to ingratiate itself to it's neighbours has paid many dividends to those facilities who have made the effort. Of course, the home studio can face the reverse of this in trying to keep secret the operation of what is essentially a business in a residential neighbourhood. But even here, the application of a positive and cooperative attitude to your neighbours has helped scores of home studio operations to succeed.

The bottom line here is to use common sense and spend a small portion of the total capital committed to a new studio facility for research. The old saying that 'an ounce of prevention is worth a pound of cure' has never been more true than in pre-empting potential problems with a new studio facility. It is curious to note that all of the principles mentioned above have just as much impact on the personal and project studios as they do for larger facilities. If anything, the small studio owner-operator has to be even more vigilant about these issues. ■

switch on the AD-500.

The internal clock slaves to these sources with a 'flywheel' effect, reducing clock jitter while maintaining synchronisation. The AD-500 will lock to signals from below 32kHz to 54kHz, allowing for a $\pm 12\%$ varispeed operation at either 44.1 or 48kHz sampling rates. Low jitter is a main feature that Apogee are selling in the AD-500 and DA-1000. Jitter is the timing error between digital audio samples. Even minor jitter can cause degradation in the audio output, starting at high frequencies. The initial audible result of clock jitter is poor stereo imaging. The Apogee converters are said to reduce jitter to less than 30 picoseconds, which we do not have equipment to measure.

Timing

The internal crystal has a specified accuracy of ± 10 PPM, giving frame accuracy over a two-hour period. In addition, the AD-500 includes Apogee's '1.001' circuitry which ensures tracking between video and audio systems to maintain lip sync. This for example allows 44.1kHz sampling to lock to a 44.056 NTSC video system. Another application allows for the generation of 47.952kHz for use in conjunction with some HDTV applications, again using the 1.001 circuitry.

Even when using external word sync inputs, the divide by 1.001 and x 1.001 selections can be used to correct timing when the wrong clock has been recorded on the source. This unit is undoubtedly very flexible in terms of time and synchronisation, providing an eye opener to the potential problems of interfacing digital audio systems.

The only problem with some of these operational features is that the front-panel switch position is unlabelled. This is apparently due in part to the fact that software has been upgraded, providing additional functionality from unused control switch positions, and in part due to difficulty in explaining what is going on without the manual. One word labels will not help. Squares and circles on the Sync Source switch indicate when similarly marked functions on the SAMPLE RATE switch are functional.

The only way we can see to improve on the situation would be to include an alphanumeric display to indicate clearly the relationship between all settings. This would, however, increase cost and size.

Finally, the DA-1000 provides a correction called EIAJ delay, which is a half-word digital delay used to restore absolute alignment between outputs when used with F1 recording systems.

Copy protection

Like synchronisation, this is another can of worms, opened by the purveyors of recordings worried about theft of their artist's originals. Fortunately for us, digital recordings do not get much worse as more generations of copies are made, so efforts to prevent multiple generations became very important - delaying the sale of DAT recorders to the domestic market for several years.

MANUFACTURER'S SPECIFICATION

AD-500

Quantisation	18 bits/sample
Operating Levels	+4dBu nominal, +28dBu max (balanced), +24dBu max (unbalanced)
Frequency Response	20Hz-10kHz. ± 0.025 dB 10kHz-20kHz. $+0.025$ dB/-0.1dB
Total Harmonic Distortion	-94dB Typical at 1kHz Plus Noise (at 48kHz sampling; 0.1dB below full scale) Typically 95.5dB
Signal-to-noise ratio	Typically better than 90dB at 1kHz
Crosstalk	50uS/15uS, switchable, Green LED indicator
Emphasis	1.5dB below digital full scale, switchable on-off
Soft Limit Threshold	12dB below digital full scale, switchable on-off
Soft Saturate Threshold	Red indicates 1.5dB below full scale
Metering Thresholds	Amber indicates 12dB below full scale
Common Mode Rejection	Typically better than 90dB at 100Hz Typically better than 70dB at 10kHz
External Sampling Rate Range	Any frequency from 32kHz to 54kHz via external sync input
Internal Sampling Rate	32kHz, 44.056kHz, 44.1kHz or 48kHz
Internal Sampling Rate Accuracy	± 10 PPM

DA-1000

Quantisation — Converter	20 bits/sample, 8 times oversampling
Quantisation — Input	16 bits/sample
Frequency Response	20Hz-10kHz. ± 0.025 dB 10kHz-20kHz. $+0.05$ -0.2dB
Total Harmonic Distortion	-94dB Typical at 1kHz (any sampling rate, 0.1dB below full scale)
Signal-to-Noise Ratio	Typically 106dB flat Typically 108.5dB (A Weighted)
Crosstalk	Typically 110dB, 20 to 20kHz
De-emphasis	50uS/15uS
Input Sampling Rate Range	32kHz to 54kHz via all digital inputs

Both units

Internal Clock Jitter	Typically 30picoseconds RMS
Nominal DC Power Input	12Vdc at 1200mA
Input Voltage Range	11.5 to 15V DC
Weight	1.3kg (just under 3lbs)
Dimensions(LxWxH)	273 x 142 x 39.6mm
Operating Temperature	0°C to 40°C (32°F to 104°F)

APOGEE Portable Reference Standard A-D and D-A Convertors

The chosen method (SCMS) is designed to confuse the unknowing, but seems to have confused the equipment manufacturers as well. Needless to say, the standard is not followed very well, so what will happen when copy control digital codes are sent or received is marginally unreliable. Apogee are shipping the AD-500 and DA-500 in a mode intended to circumvent the rules for professional (and only honest) reasons, but allow the daring owner to tweak the results by removing or adding surface-mounted links internal to the units.

A warning. Do not get into this without a time buffer zone available to try things out.

Earthing

Just last week I once again faced up to mixed (earthing) grounding criteria and WON! By plugging a phono plug into an unused socket on one device and wedging the outer between cover and chassis on another device. Apogee provide a battery ground, chassis ground and analogue ground which you can mix around until your setup works best. Could someone with wonderful brains dream up a way to finally resolve audio grounding? Surely a cheap, balanced domestic connector and audio IC with built-in balancing characteristics could prove cost-effective enough in volume.

AD-500 input

The inputs on the AD-500 have passive RF filters

(soon to be required by EMC regulations), followed by electronically balanced input circuitry with a rated impedance of 20k Ω (balanced) or 10k Ω (balanced). Common mode rejection ratio is excellent and to specifications as shown in Fig. 1.

Manual control

The AD-500 is provided with two level controls on each channel. One is a front panel user adjustment, the other a through-the-panel preset. Normally these are configured such that the preset adjusts the maximum gain available on the front panel knob, calibrating the maximum level position. However, internal links and circuitry allow these to control two independent analogue inputs on each channel should that be required. The range of control is large. The input circuitry overloads at an input level just below +30dBu, adequate for any need. Internal jumpers can be used to set the unit up for use with unbalanced professional or domestic operating levels. The labelling on the front panel adjustment knobs does not have any calibration markings.

On the DA-1000, output level of digital full scale is controlled by a through-the-panel preset for each channel, plus internal jumpers to set the basic operating mode.

Dynamic control

The AD-500 provides two forms of programme level control, Soft Limit and Soft Saturate. Soft limit is just that, a 10:1 limiter which activates ►

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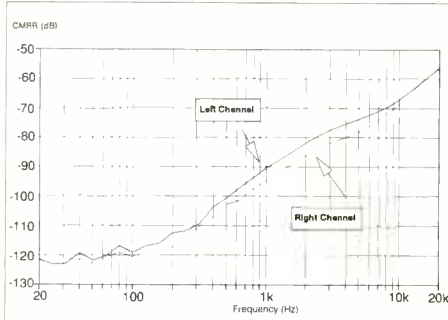
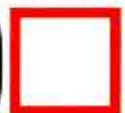


Fig. 1: Input common mode rejection ratio. A good performance

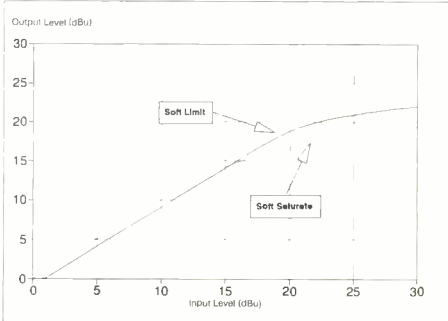


Fig. 2: Action of dynamics control on AD 500

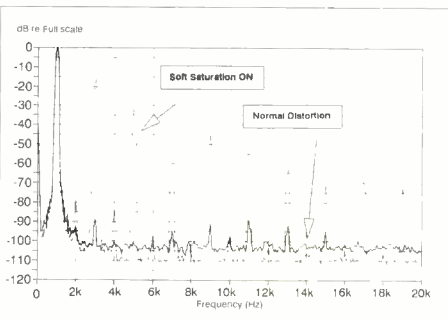


Fig. 3: Distortion products with and without Soft Saturation

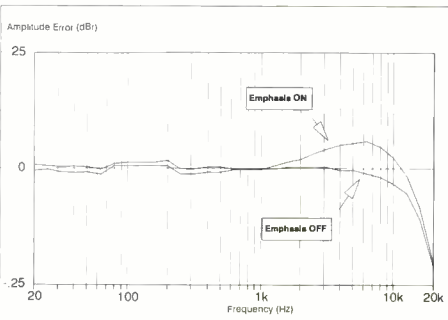


Fig. 4: Frequency response at 0.1dB below full scale, emphasis OFF and ON AD-500 plus DA 1000

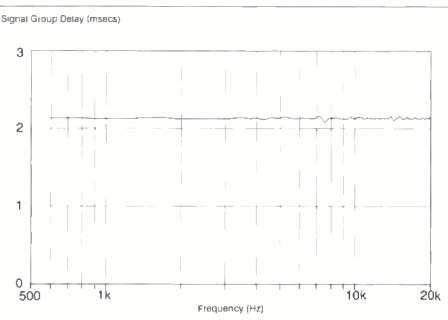


Fig. 5: Group delay of signal via AD 500 and DA 1000. The delay is virtually constant with frequency indicating truly linear phase characteristics

about 2dB below the digital clip point. This is provided to allow more level onto the digital tape, while preventing hard clipping — producing in Apogee's words 'a hotter CD'. Soft saturate seems to use this limiter brought into action at a lower level, with the same ultimate slope. It is compared by Apogee with analogue tape saturation. The limiter action is said to produce distortion products similar to analogue tape, warming the sound.

Fig. 2 shows the amplitude control effects of these two dynamic level settings. In Fig. 3 the effect of soft saturation on harmonic distortion is shown, this being a rather radical increase in distortion amplitude. The audible effect of this is pleasant on some types of material and almost unnoticeable on others. Apogee recommend that soft saturation is used only while tracking, and not in mixdown or transfer operations.

Amplitude and phase

With emphasis OFF, the amplitude versus frequency response of the units is nearly flawless. Analogue in to analogue out of back-to-back units is within 0.03dB from 20Hz to 10kHz, and only -0.22dB at 20kHz. Similar results are obtained with the individual units. Emphasis ON is nearly as good, giving a worst case error of +0.06dB at 6kHz referenced to 1kHz. See Fig. 4 for details.

Plugging the units back-to-back results in a virtually unmeasurable interchannel phase difference, with a maximum error of 0.2.

The AD-500 and DA-1000 are publicised as having linear phase filters. These were quickly checked by connecting the units back-to-back and running a phase versus frequency test. This does indeed give a virtually linear response — a straight line of phase change versus frequency. Since converters have an intrinsic delay characteristic, resulting from the sampling interval, they will have a resulting linear phase change with frequency, not usually linear, though this is the ideal. A linear characteristic of phase versus frequency is equivalent to a pure delay, that is all frequencies are delayed by the same amount of time. Fig. 5 shows the group delay resulting from the AD-500 to DA-1000 link, which is indeed the same at all frequencies — indicating linear phase. This is the best result we have seen.

One problem which occurred seems to indicate either a labelling or software error on the one of the units. Selecting Emphasis ON on the AD-500 did not consistently activate de-emphasis on the DA-1000, though our test equipment indicated that the correct codes were being passed.

Noise and distortion

The noise spectrum, shown in Fig. 6 gives no cause for concern, with a very smooth characteristic and low overall level. Table 1 gives wide-band noise measurements which meet the manufacturer's vague specifications if they are intended to be 'A' weighted RMS or CCIR-ARM standards. In any case performance is good for a 16-bit system.

As is evident from Fig. 3, there is little distortion when signals are below clipping and soft saturation is off. Measuring back-to-back units at 0.1 dB below clipping, THD+N is typically about 0.003% or -90dB RMS over a 30kHz bandwidth. The DA-1000 alone produces a THD+N of about -92dB. Neither of these matches the specified ▶

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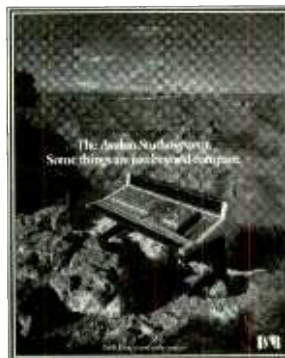
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TABLE 1

Measurement Type	22-22kHz RMS	400-kHz RMS	CCIR Unwid	CCIR Wtd	A wtd RMS	CCIR-ARM
Left Ch	-93.5	-93.5	-90	-83.5	-96.8	-95.5
Right Ch	-93.5	-93.5	-90	-83.5	-96.8	-95.3

Wide-band noise measured from AD-500 balanced input to DA-1000 balanced output. dB referenced to Full Scale. Inputs terminated 50Ω

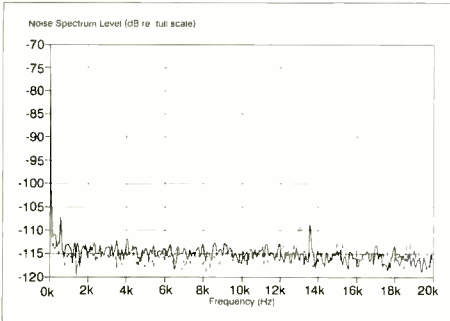


Fig.6: Noise spectrum of AD-500 plus DA-1000 with inputs terminated in 50Ω

-94dB, but never-the-less is a good performance.

Similarly SMPTE and CCIF twin-tone tests produce a good performance, as does DIM-30 for transient distortion characteristics.

Modulation noise on the right channel is excellent, while the left channel is not as good. The modulation noise is indicated by the space between curves shown in Fig. 6. Notice that one curve is out of line with the rest. This 'glitch' is unlikely to be audible since it occurs at an intermediate rather than low signal level, and will therefore be masked.

Quantisation distortion, shown in Fig. 7, confirms the cause of the above with an obvious wiggle in the curve. Otherwise quantisation distortion is consistently good.

Wide-band noise measured from AD-500 balanced input to DA-1000 balanced output. Measured in dB referenced to Full Scale. Inputs terminated 50Ω.

Linearity

Much of our testing of digital audio products involves characterising their A-D and D-A convertor systems, though there are usually other features for which the product is advertised. Since the AD-500 and DA-1000 are specifically designed to maximise convertor performance — in amplitude, phase and timing accuracy — they were examined even more closely in these respects.

Placing the two units back-to-back should give us the worst case linearity performance. In several cases, products which included both A-D and D-A functions within one package have looked good back-to-back, but not so good when the intermediate digital signal was examined. We believe that this may be due to production test procedures which optimise analogue in to analogue out performance but do not necessarily optimise each convertor stage independently.

In the Apogee case, the AD-500 and DA-1000 stand alone, so should be individually optimised.

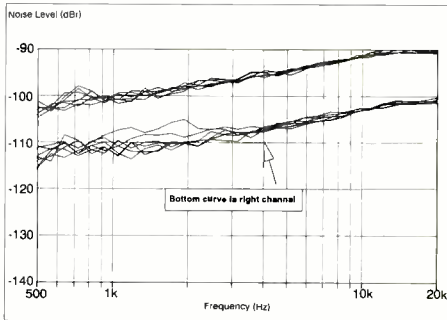


Fig.7: Modulation is indicated by the spread of the curves — a changing noise level. Curves are offset for clarity. Left channel performance is very good, right shows some deficiency

In our tests, analogue in to analogue out linearity is the best we have seen to date. See Fig.8.

However, in testing the DA-1000 alone, we found some deviation at the bottom end on the right channel which seems to be accompanied by noise. The DA-1000 specifications are a bit ambiguous, stating convertor resolution of 20 bits and input resolution of 16 bits. Using the AES-EBU input and setting our digital generator at 20 bit resolution with dither on produces an unacceptable result, while with 16-bit resolution, there is some error (1dB) at low levels in the right channel. The left channel is superb. We therefore assume that the true resolution of the unit overall is 16 bits. Testing the AD-500 alone produced an excellent linearity performance on both channels.

Metering

The meters on the unit are rudimentary, it being intended that the source device will provide most of the metering required. Two LEDs on each channel give an indication of recording level, operating in the analogue domain rather than the resulting digital level. The first, amber, LED illuminates when signals are within 12dB of clipping, while the second, red, led indicates 2dB of headroom before clipping.

Crosstalk

As with most other matters, crosstalk is excellent, as confirmed by Fig.10. This exceeds the specifications, and is outstanding in the DA-1000.

Conclusion

The Apogee AD-500 and DA-1000 are excellent products, both as add-in convertor systems and as potential correction devices for timing problems. Everything about them shows considerable thought and good engineering practice. While our listening facility is too limited to provide a conclusive basis for comment, to me they sounded very transparent and dynamic. A clean sound by anyone's standard. ■

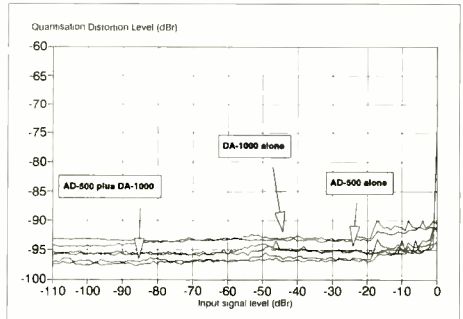


Fig.8: Quantisation distortion level versus signal amplitude. Deviations in level indicate convertor inaccuracies

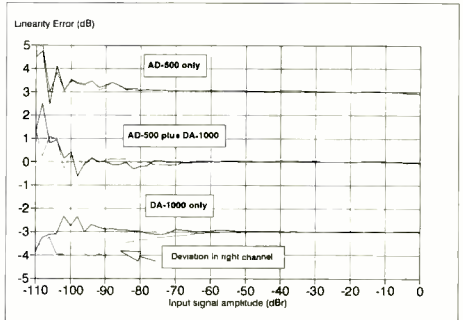


Fig.9: Linearity error versus input signal level. Signals are offset for clarity — only variation is relevant

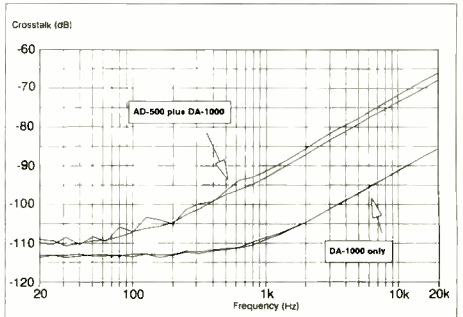
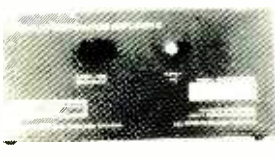


Fig.10: Crosstalk versus frequency. Performance of the combined units is good but DA-1000 alone is excellent

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Bits on the Bottleneck

Dear sir, with reference to 'The Bit Bottleneck', *Studio Sound*, October 1992, especially the Sony Super Bit Mapping chapter, I would like to make the following remarks.

The new technique which Sony dubs 'Super Bit Mapping' (SBM) is a 'simple' dithering process. The input word length being 20 bits, the output 16 bits. Of course, dithering has been used for years by many of us. The new thing about Sony's SBM is the noise shaping which is modelled after the human hearing curve (E-weighting curve), that is a dip at 4kHz etc.

Well, the use of noise shaping in dithering processes is by no means as new as the article may suggest: Stanley P. Lipshitz, John Vanderkooy and Robert A. Wannamaker have published the basic framework on noise shaped dither (E-curve based as well as others) at the 88th AES Convention in Montreux, March 1990.

At the same AES Convention the company Harmonia mundi Acustica introduced their new redithering module for their *bw102* mastering system. This new module was already based on the algorithms of Mr Lipshitz et al. The *bw102* redithering module accepts input word lengths as wide as 24 bits and has a selectable output word length from 16 to 20 bits. Many mastering studios have already used this module for some time, so chances are, you already have a 'Super' CD on your shelf.

A second remark. To benefit from the noise shaping introduced by the dithering process, the consumer's CD player has to have a very good D-A convertor. Very good means, that the precision in which the analogue voltages are

generated at the D-A's output has to be, independent of the convertors resolution, about 20 bits! If the D-A convertor fails to be that precise, the beautiful hearing curve gets 'filled up' with noise from the poor D-A convertor. So it would be good advice to test any 'Super' CD on a known, good D-A convertor.

**Daniel Weiss, Daniel Weiss Engineering Ltd
Florastrasse 10, 8610 Uster, Switzerland**

Dear sir, in Francis Rumsey's interesting article 'The Bit Bottleneck', *Studio Sound*, October 1992, he mentioned the 'recently introduced *Nagra-D* machine which is designed more for portable use with pictures and has four audio channels.'

In many respects that is an over-simplification of the *Nagra-D* attributes no doubt caused by us hiding our light under a bushel. We feel that the *Nagra-D* offers benefits to the sound recording industry as a whole by virtue of it being a precision built 4-track machine offering full 20-bit recording quality.

The machine was designed from the outset to use reel-to-reel format to give visual confidence of operation, and the use of conventional oxide tape offers outstanding stability and longevity even with recordings made in adverse conditions. Another small but important point is that time code is recorded linearly, to enable reading at high as well as low speeds.

However, we would be the first to acknowledge that technology in tape recording is all well and good, but how does it actually sound? We have exposed the *Nagra-D* to a series of subjective listening tests with respected recording engineers who have no allegiance to Nagra. The verdict so far is that it provides the best sound quality currently available — in any format.

**John Rudling, Nagra Kudelski (GB) Ltd, 13U
Long Spring, Porters Wood, St Albans, Herts
AL3 6EN.**

Digital Meter

Dear sir, 'Products', *Studio Sound*, October 92, carries an item describing what is claimed to be 'the world's first digital true peak programme meter', from the Danish company NTP.

This is a rather strange claim, for as far back as 1985, my company has been designing and selling digital true peak programme meters, starting with the Sony compatible *DBM-1* to the new AES-EBU compatible *DBM-3*. All our digital meters have zero integration time, and read true peak values even for one sample of signal. In actual fact, we were the first on the market with digital metering, ahead of both RTW, Sony, and more recently NTP, and have been selling and developing successfully to the present day. Our digital meters have sold into Japan, USA, France, Germany, Switzerland, Belgium, Holland, and throughout the UK.

While the NTP meter in question is no doubt an ingenious design that attempts to mix analogue and digital needs into the one product, its claim as the world's first true peak programme meter is misleading, and a correction should be sought.

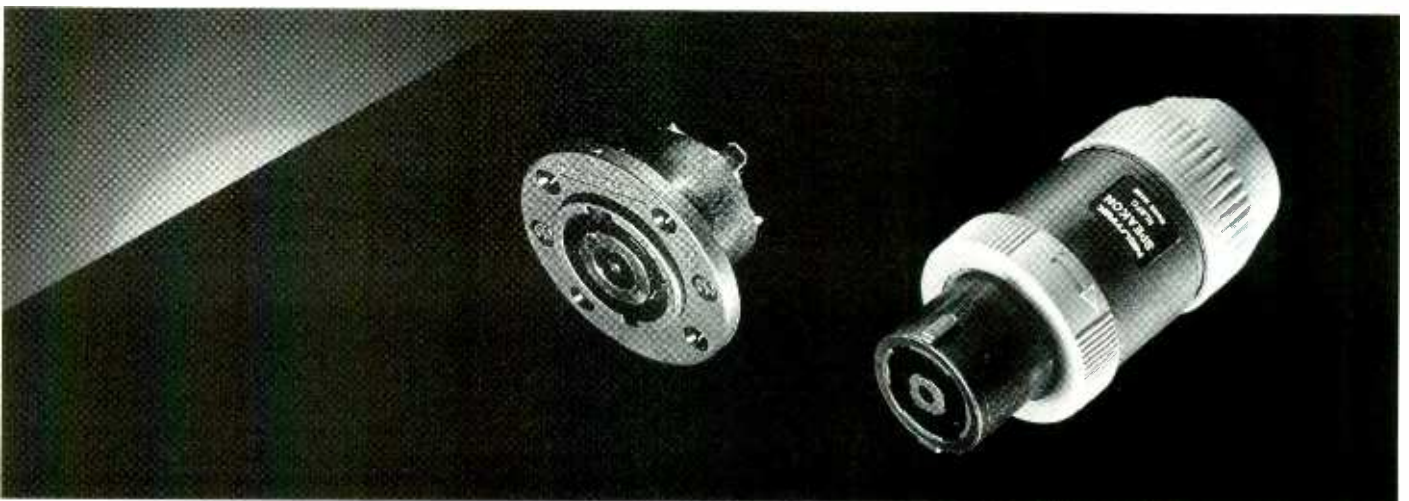
**Rod Duggan, Managing Director, Total
Systems, 59 Hatch Lane, Old Basingstoke,
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Letters should be addressed to:
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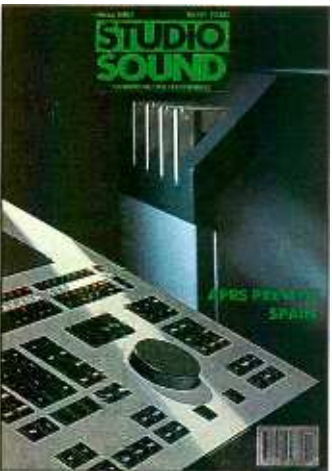
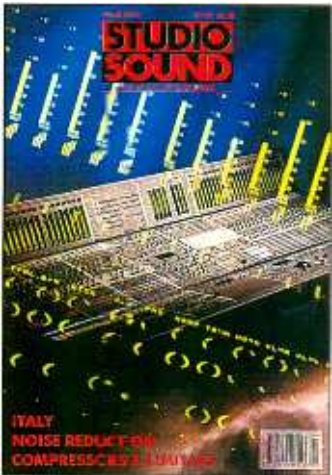
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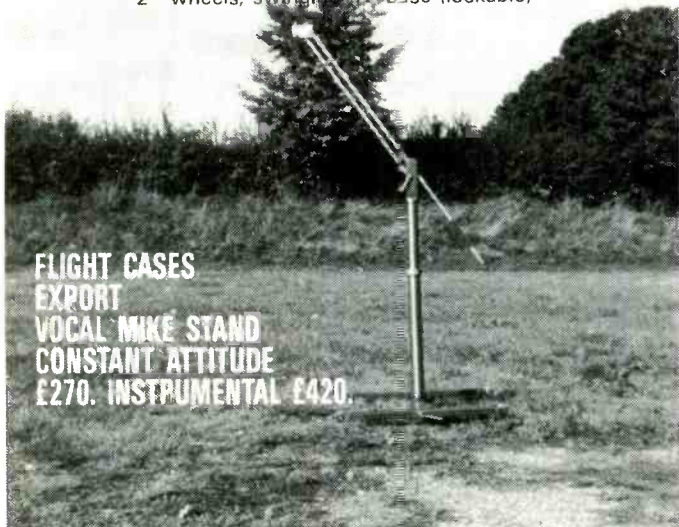
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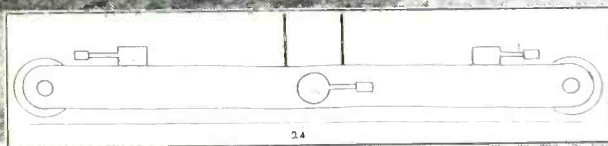
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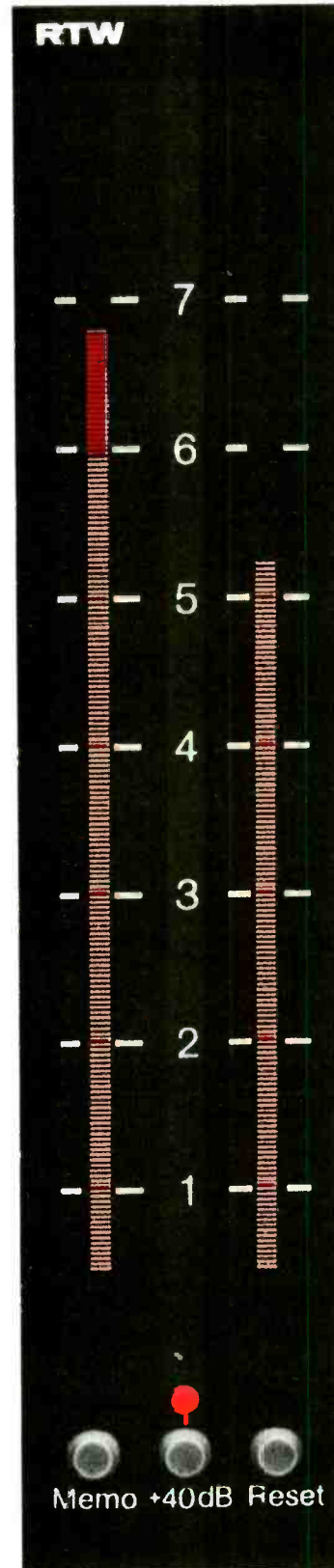


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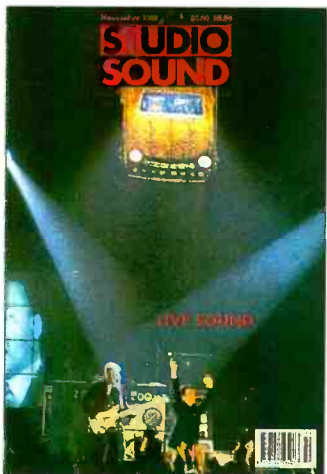
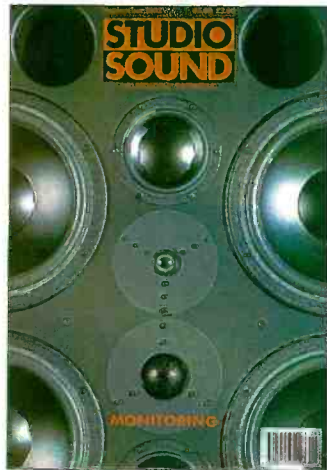
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One of the techniques that an experienced engineer picks up is the ability to diagnose the most likely source of a problem in an audio signal. Years of listening make the different distortion types and other abnormalities quite identifiable — something which impresses the hell out of those with, as yet, less attuned ears.

However, for most engineers there are certain times when you just can not put your finger on what the precise problem is — only that the sound is not everything that it should be. It is rare that you have the time to get to the bottom of the real problem and it is usually necessary to work around it for the rest of the session.

There are a number of problem areas that fall within this 'difficult' category. Sometimes it can be the sound source itself; a microphone has the ability to hear aspects of the sound that are not immediately obvious unless you can place your ear at precisely the same position as the mic and even then the combination of your ear and brain might be filtering the problem anyway. Good case examples are the hinges of a grand piano and sympathetic resonance from a light fitting. Difficult to detect.

Sometimes it may be the environment: temperature or humidity having considerable effect as it can on many sound sources. On occasions it can be the fault of a gradual deterioration in performance that has now become noticeable. Examples include drift in alignment and, more worryingly difficult to detect, the limited life span of valves. Renewing valves is one of those jobs which cannot be left until failure but precisely how you monitor the operating hours before replacement is difficult to arrange — especially for a valve mic (a point for discussion). I used to have access to some valve mic-line amps and the results of revalving were a constant source of surprise.

There is also the possibility that the problem is within yourself. In my case a head cold always causes problems with my hearing. My ears give a harsh unpleasant edge to the mid range and seem to reduce ambience. I have learnt to live with this by confirming with someone else that a sound really is still okay. Tiredness is another hazard, as is working at those times of the day when your body clock is telling your hearing to function in a manner that



Keith Spencer-Allen

on the skill of studio diagnostics

is at odds with your current activity. I am advised that one's hearing reaches a peak of acuteness around 3am and I have known considerable problems to result from tiny aberrations that are completely inaudible in the cold light of morning.

One potential problem area that has frequently proven unpredictable is that of poor electrical contact. A broken connection is easily detectable, as is a dirty fader or potentiometer. Patch fields are a frequently less obvious problem. Some socket types have sufficient resistance to insertion of the plug to clean the contacts every time the plug is used; other types need frequent cleaning. It is often the patches that are normally left in place that give the most trouble. The difficult signs to detect are drops in level and a gradual increase in distortion — some odd tricks of poor contact that seem impossible to explain yet can happen.

The best solution is to regularly vacuum a patch bay even if no problems are present — in fact, this is the best time to do it. Plugs that remain static in the bay should be periodically removed and reinserted rapidly to clean the contacts. Despite these concerns, a manual patch bay is something that the wise keep a wary eye upon.

Another area of constant concern is microphone cable. There are obvious stresses and strains upon leads and connectors — cables being pulled round corners, straining against their connectors, run over by flight cases and deformed under instruments. The main concern, of course, is a break in the conductors but this is easy to diagnose. Regular cable checking and inspection of connector junctions can help reduce obvious problems, but not all faults can be discovered so easily.

Far more insidious is the gradual deterioration in cabling, this is very hard to detect. Some conductors seem to undergo a weakening and oxidation near soldered connections, particularly if within the crowded confines of a plug where no sleeving has been used. Gradually the thin strands of the conductor fracture giving increasingly poor contact. Similarly, there can be fractures in conductors within the cable itself. Frequently these will not manifest themselves until the cable is bent so as to part the fracture. An unsound joint will only become worse and can add a most difficult to detect distortion if subjected to vibration. A level peak can mask the distortion itself but give a quite unpleasant edge to the sound that easily goes

undetected.

Recently, I came across a microphone where there was a fracture in one of the internal leads between the electronics and the output socket. This took a great deal of time to find as the effect was intermittent and, even at its worst, sounded more like distortion. When the mic was disassembled, the faulty connecting wire was in a slightly different position, giving a better connection and no sign of bad conductivity.

Expanding the regular cable check to include the cable shaking test mentioned in October's 'Craft' — with the cable connected to a condenser mic and phantom powered from the console with a high gain setting — should make any problems within the cable clearly audible as crackles.

Poor electrical contact can have many unpredictable effects. The oddest for me was the case of the singing jack socket. While monitoring mics from the studio area during an overdub, there was a clearly audible foldback signal as if a pair of headphones were plugged in but unworn. Checking around the studio revealed that this was not the case. The sound was coming from a die-cast box that only contained two jack sockets and the wires leading to them. Yet there was a clear audible signal coming from the case. It was easily cleared by unscrewing the case, a swift internal clean and reassembly, never to occur again. Subsequently I have never been surprised by the effects of poor electrical contact and if I come across unusual problems the idea of checking all the contact areas of the signal path has gradually risen in relative importance.

As a footnote, consider the role of changing technology in evoking new terms and phrases. Digital audio has ushered in new words, as has hard-disk recording, and we can expect the language surrounding disc cutting to gradually slip into the realms of the archaic. But why does the terminology change when the described process is still current?

While looking through some reference books from the mid '70s I came across several examples of this change. The term 'windgag', while descriptive, has given way to the more pleasant sounding 'windshield'. But what has happened to the recording that was 'stretched' and the process once known as 'reduction'?

Any suggestions? ■

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