

March 1989

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A LINK PUBLICATION

STUDIO SOUND

AND BROADCAST ENGINEERING



**AES HAMBURG
PREVIEW**

For a 16 or 24 track studio owner, the future looks very good.

With MIDI systems and digital outboard, you can already achieve extremely sophisticated productions.

But it's very hard to find a recording console to match that standard, without spending a small fortune.

That's why we've developed the new Series 6000. An evolutionary design that demonstrates how far Soundcraft are thinking ahead.

Behind the classic layout is a revelation in performance and facilities.

For a start, it's equipped with enough buses and routing options to make adventurous production a pleasure, rather than a chore.

It's a full 16 or 24 bus console, plus six



auxiliary sends per channel. Each of the tape returns has EQ, which with its 'split' format naturally means they'll double as extra inputs.

We've also provided each input with push-button routing, EQ by-pass and programmable electronic muting that gives you none of the clicks ordinary switches produce.

There's even true solo-in-place, sadly lacking on many more expensive desks.

But it's the 6000's sonic performance which really puts the competition in the shade.

Take our revolutionary input design: 2dB to 70dB gain without a pad, with nearly unmeasurable distortion, crosstalk and noise.

Our new grounding system yields superb

hum immunity and a routing isolation of 110dB (1kHz), and our active panpot comes close to theoretical perfection, improving on our competitors' performance by a full 25dB.

So nothing will change your sound, except our acclaimed, four-band sweep EQ.

In a word, purity.

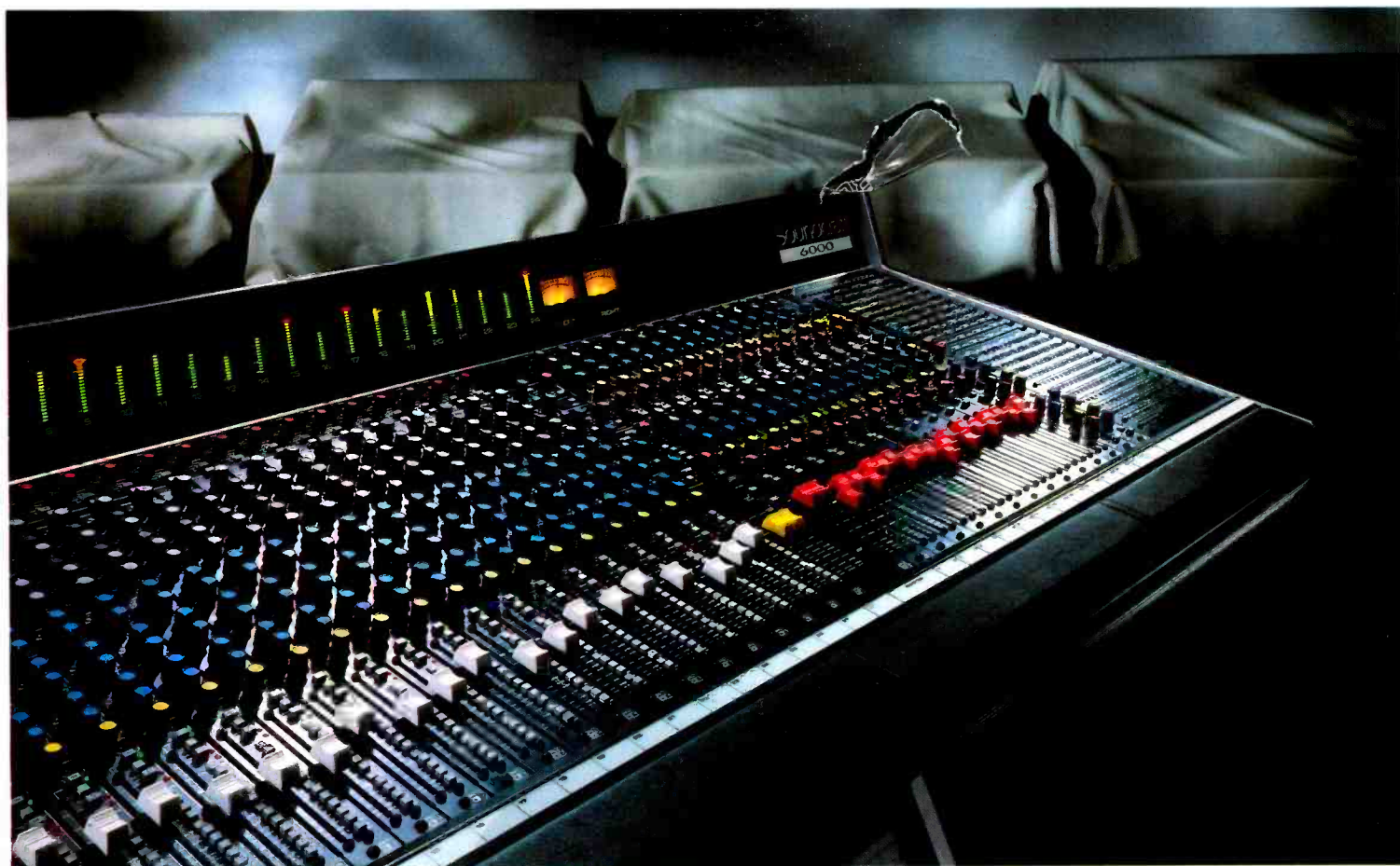
And with options including 16 to 44 channels, a stereo input module and built-in patchbay, you'll find it an affordable slice of progress. No matter what budget you're working to.

The Series 6000 is simply the most comprehensive production console in its class.

Call us today for full information, and the address of your nearest dealer.

Soundcraft
6000

If only more expensive desks performed as well.



STUDIO SOUND

AND BROADCAST ENGINEERING



The studio at CBS/Sony, Hong Kong

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THE SATURN 824 MULTITRACK. ITS NEW SPECIFICATION IS JUST OUR FIRST ACHIEVEMENT.



The Saturn 824 with Auto Alignment is a major enhancement of a highly successful multitrack.

Its new specification provides many features as standard which on other machines are expensive options. Proven reliability and superb audio performance make its price even more of an achievement.

The enhancements include Auto Alignment as standard, saving valuable studio time, along with full size meters and a Tape Management panel to complement those on the unique Total Remote unit.

We've added a parallel interface for synchronisation; and a noise reduction interface for Dolby SR, resulting in a sonic performance that many consider superior to digital.

Durability is something else that has benefited, with the introduction of a new head design incorporating long life 'Recovac' composite alloy.

Reliability is also intrinsic to the precision-engineered 'Calculated Open Loop Tension' transport system and the fully modular tape path design. Twin high-torque motors and 'intelligent' sensing maintain perfect tape tension even at an exceptionally fast 600ips – the best spooling performance of any multitrack.

All proving that the new Saturn 824 is a more powerful and even more reliable long-term proposition than ever.

To put our new specifications to the test, call us for full details and a demonstration session.

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AND BROADCAST ENGINEERING

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BUREAU OF CIRCULATIONS

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(ABC audited)

Cover: Mitsubishi X-880 32-track digital
recorder

Watcha gonna do about it?

We all have a tendency to be wary of the unknown. But there are of course relative degrees of the unknown and therefore, I suppose, there must be relative wariness. For instance, I don't know exactly how many 24-track recording studios there are in the world and nobody else does either. I am not wary of this fact but I would be wary of placing any form of money on the figure (if there were any way that the true figure could be found). I don't know the true value of the recording industry in terms of equipment sales and in reality nobody does. At *Studio Sound* we get many calls about facts and figures such as this and we also see many quoted in business plans and they all seem to differ wildly. We, of course, have our estimates of the number of studios in different territories around the world but they are simply estimates. Because of the nature of *Studio Sound's* circulation they are probably some of the most accurate figures available but they are still quite simply estimates. We are, however, only wary of our lack of definitive figures when there is the need to make precise projections from such imprecise ground data.

Another unknown—how many revolutions does a 14 inch reel of tape make when playing fully from one end to the other? I haven't counted it and I really don't have the inclination to calculate it. Outside of a question here it has very little importance. And the world will not be a different place if we never know.

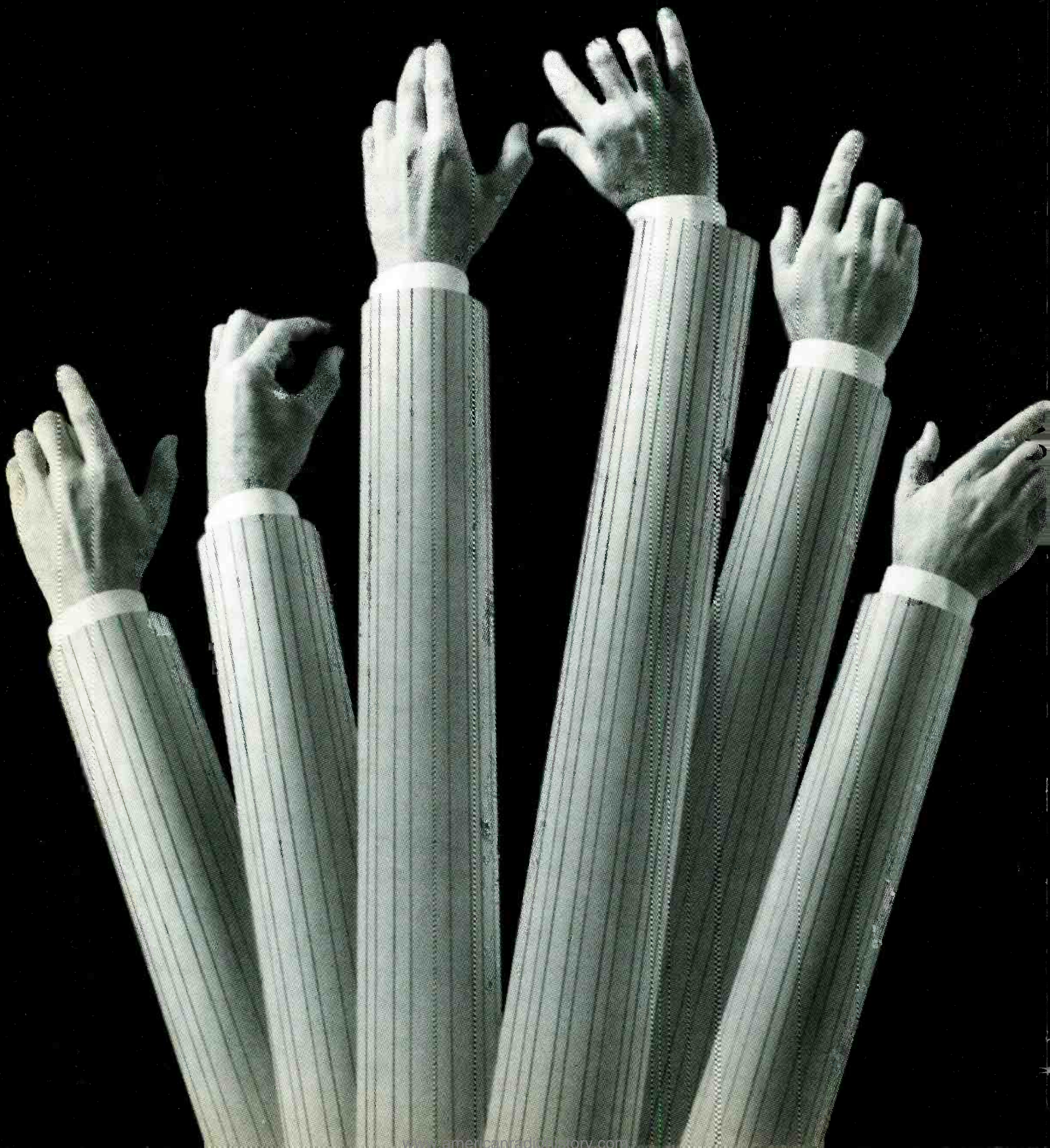
There are some things, however, that we would definitely like to know and the best source for such information would be you, our readership. We would like to know if there is a relationship between the changing formats in home entertainment and the type or amount of sessions booked for recording. For instance we have seen a dramatic decline in the fortunes of the 7 inch single (with one small UK record company launching the single-sided disc to cut costs), the appearance of the CD single with its 20 minutes playing time suggested as a replacement, the decline in vinyl album sales with significant growth in cassette and CD albums all with considerably longer potential playing times. Has this affected sales of studio time, or will it? With the average vinyl album having a playing time of just under 40 minutes and the CD easily achieving over 72 minutes are we going to see an increase in session time or will that not happen until the CD becomes a larger force than the other formats (ie you will record a CD rather than an album with the vinyl becoming just a 'sample' for the 'proper' recording on the CD) or will this not have any effect at all?

If I were looking to start or expand a studio these are just some of the factors that I would wish to research. There are probably no answers to this as yet and if there is any effect it is probably masked by pre-programming and home studio preparation that is far more common at the moment. But in the long term these factors must influence.

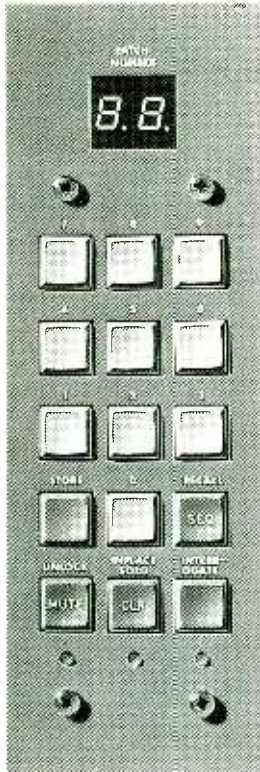
If you are already in business then you can adapt to the changing face of your revenue sources. If you are about to invest untold amounts in a facility then the way in which the type of work you hope to be are getting will change could become that final twist on top of 'Just what hardware should I commit myself too?' that finally makes you scream 'No more!'

Or do you simply jump with two feet confidently into the unknown. I'm probably right behind you.

Keith Spencer-Allen



THE CMX GIVES YOU A FEW HELPING HANDS.



ARMED WITH A SOUNDTRACS CMX YOU CAN CREATE AND REPEAT WORKS OF GREATER COMPLEXITY THAN ONE PAIR OF HANDS COULD NORMALLY HANDLE.

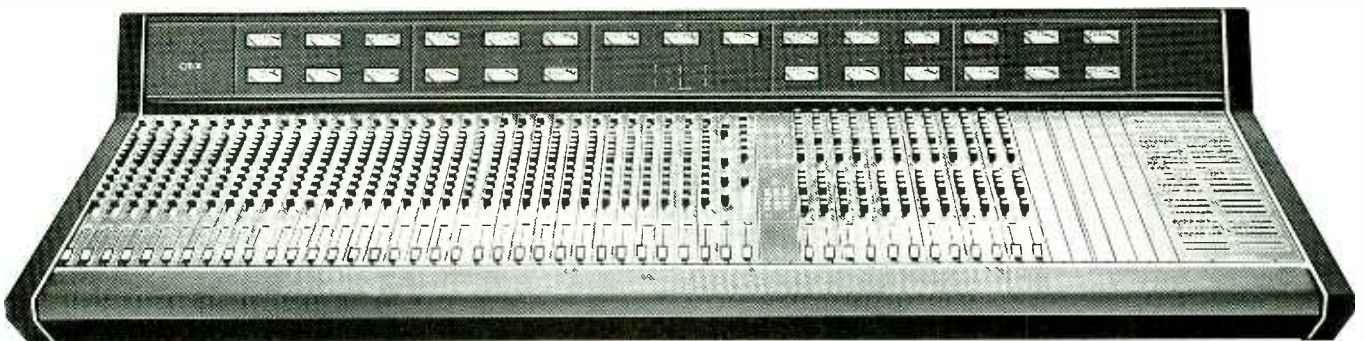
THIS IS BECAUSE THE MICROPROCESSOR INSTALLED AS STANDARD EQUIPMENT IN THE CMX GIVES YOU DIGITAL CONTROL OF THE ROUTING (AND THEREFORE MUTING) FUNCTIONS WHICH ARE EASILY ACCESSED THROUGH A SIMPLE KEYPAD.

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SO IF YOU COULD USE A HAND TO GET AHEAD, GET A CMX.



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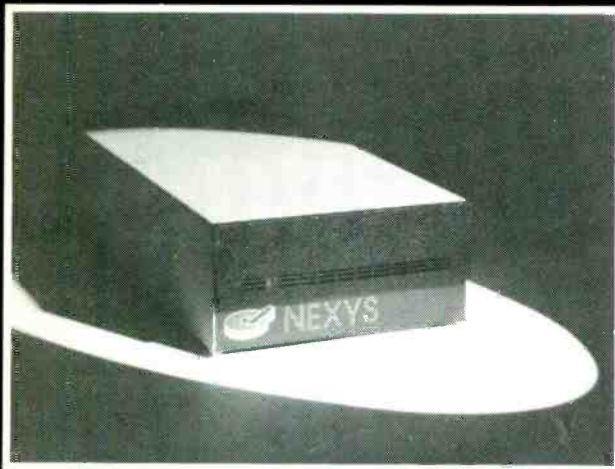
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Nexys SL-60 M
Nexys IM-60
Nexys IM-60 M

External hard disk with Apple Macintosh formatting software
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Put your sampler into overdrive with the Nexys SL-60

SCSI, the only interface fast enough for real-time digital audio, is now available for samplers with the introduction of the SL-60. The 64 Megabyte capacity means it can store at least 80 3.5 inch floppy disks. Instead of groping for floppies, simply load sound after sound in just a few seconds. Imagine loading an Emax sound bank in only 4 seconds!

Compatibility

The SL-60 communicates with samplers through its SCSI-port. More and more samplers and computers feature SCSI interfaces, including:

- * Akai S-950
- * Akai S-1000
- * Dyaxis
- * Emu Emax
- * Emu Emulator 3
- * Ensoniq EPS
- * Roland S-550
- * Sequential Studio 440
- * Sequential Prophet 3000

For even more storage, the optional daisy-chain cable can be used to connect up to 7 SL-60's for instant access to a giant 448 Mb!

SL-60 Features include:

- * Auto-parking Safeguards against damage during transport
- * Changeable SCSI-ID Allows flexible SCSI-setup with all samplers
- * 64 Mb storage Stores about 80 sound banks on a 1 Mb sampler
- * SCSI-port Industry-standard high-speed interface (100 X MIDI speed)
- * Daisy-chain Connect up to 7 SL-60's for more storage
- * Remote MIDI-control Load any sound with a program change command

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FOR THOSE OF YOU WITHOUT AN AMR24, THIS IS WHAT LOW NOISE SOUNDS LIKE.

No matter how sensitive your ear, the noise floor of the AMR24 is so low that you simply can't hear it.

And neither, of course, can a digital multi-track.

Our design engineers recognised some time ago that the conventional solutions to deal with noise and crosstalk, which are fine for analogue tape, are simply not good enough when working with the precision of digital.

To achieve this degree of sonic integrity it's necessary to innovate. So, for instance, as well as balancing all inputs and outputs, we use fully

balanced buses to virtually eliminate crosstalk and provide a high level of immunity to external fields. And every stage is automatically by-passed when it's not in use to maintain the shortest and cleanest possible signal path.

Cracking the noise problem has allowed us to endow the AMR24 with an EQ section of exceptional musicality.

Although it may appear at first glance to be a normal four band set up, we designed the peaking mode of the low frequency equalizer using a unique system where the Q automatically increases as the frequency decreases.

This, as you can imagine, allows you to handle the bass spectrum in a way that is both more precise and far more musical.

If you haven't heard the AMR24 and you'd like to put it to the test, call the appropriate number below to receive a copy of our brochure and to arrange a demonstration. It's bound to prove, dare we say it, music to your ear.



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S-950 XE-8

S-1000



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BETTER EXCUSE FOR SLEEPLESS NIGHTS

AYou could lose a lot of sleep deciding which sampling system to buy. You could lose a lot of sleep setting up and learning how to use the system you do buy. Or you could choose from the brilliant new family of Akai samplers and lose a lot of sleep doing nothing but make music.

The S-950 is Akai's successor to the remarkable S-900. Incredibly, it offers a whole range of extra features — at a lower price! An expandable memory. Superb 48kHz sampling frequency. The ability to load information whilst playing. Full compatibility with the massive S-900 and S-1000 sound libraries. Time stretch, cross-fade looping and pre-trigger recording facilities, a filter envelope and much more. All for the astonishing price of £1,399. Optional boards for hard disk and digital input make the S-950 a uniquely versatile machine.

The S-1000 is the new 16-bit sampling standard. It produces the cleanest, clearest stereo samples you've ever heard, with the ease and immediacy which have made Akai famous. 2Mb of memory, expandable to a staggering 8Mb. A maximum sampling rate of 48kHz. 16 voices, with easy layer, multiple looping and cross-fade capabilities. A large 40x8 LCD display makes editing incredibly simple and the use of a separate monitor unnecessary. For its sheer power, intelligence and accessibility — at a cost of only £2,899 — the S-1000 is unequalled.

And to complete the picture, Akai have developed the S-1000PB 16 bit sample playback machine, priced at £2,199, and the S-1000HD with built-in hard disk, providing a generous 40Mb of storage: at £3,999 nothing else even comes close.

If it's quality drum sounds you want, check out the XE-8. Coming complete with two memory cards, the XE-8 provides a wide variety of excellent 16 bit drum samples in a compact 1U rack unit. Choose from individual or mix outputs. Used with MIDI drum machine or sequencer — such as our ASQ-10 — you can edit and store your own sounds to give the crisp, clear dynamic attacks of real or electronic percussion, for an unbelievable £499.

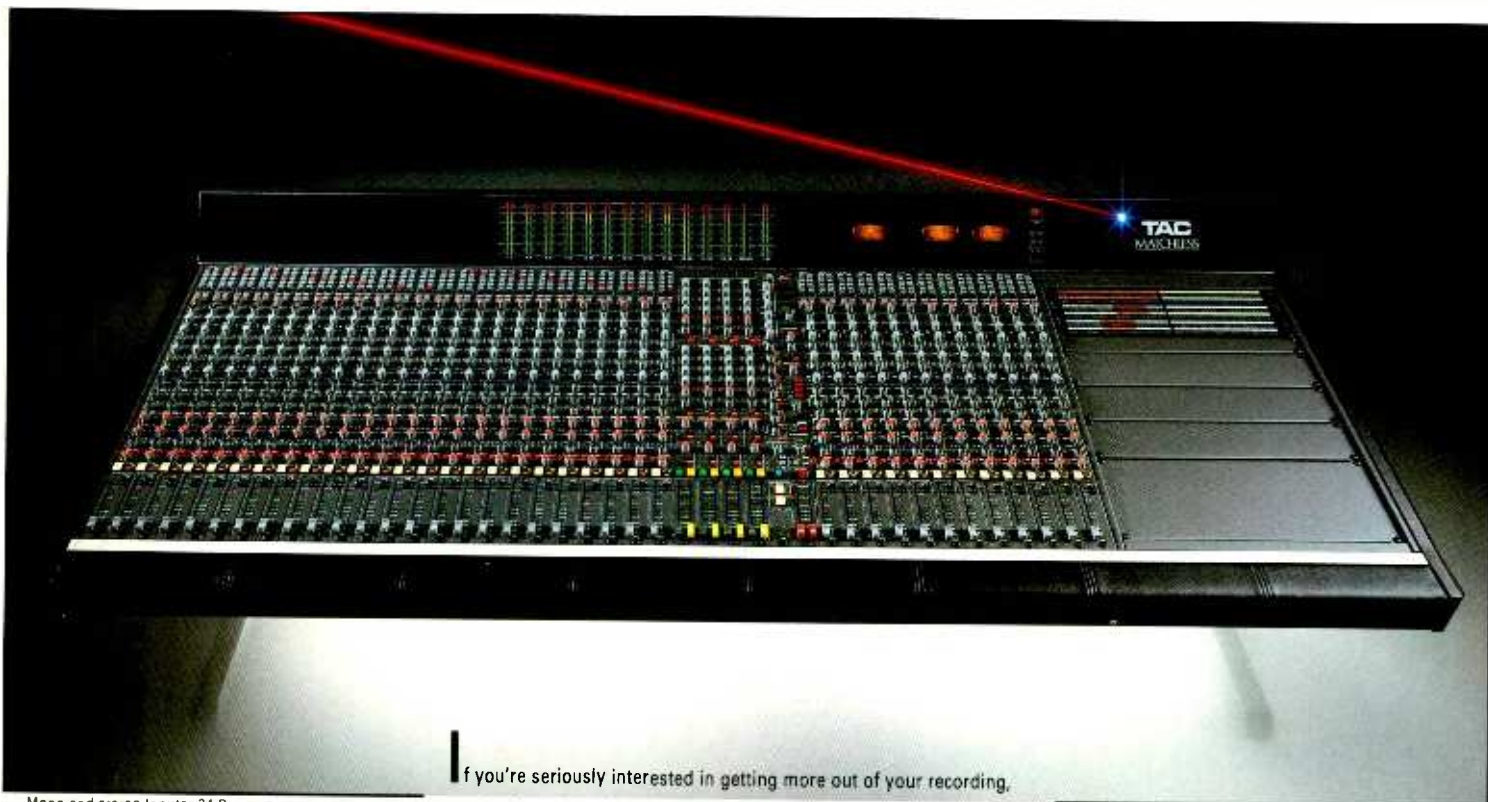
When a system's as good as the sum of its parts, you know it's Akai. Sleep on it.



AKAI

professional

MATCHLESS? STILL MATCHLESS!



Mono and stereo Inputs: 24 Busses:
8 Aux Send Busses: In-Line Monitoring:
8 Subgroups: 8 FX Returns:
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MATCHLESS will help you to get more out of your other equipment.

MATCHLESS wears a ridiculously reasonable price tag and will help you get a return on your investment more quickly.

MATCHLESS is a pleasure to use and sounds utterly splendid.

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MATCHLESS can now be fitted with a variety of automation packages.

We like the MATCHLESS so much, we've made over 400 of them so far. We haven't been able to keep any of them back for ourselves.

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TAC
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1 SM48 Dynamic

Perfect for vocalists on the way up. Many of the outstanding performance features, similar appearance, and ruggedness of the world-standard SM58, at a most affordable price. Delivers the famous Shure sound, and features the uniform cardioid polar pattern and distinctively enhanced upper mid-range of the SM58. Rugged, reliable and dependable.



4 SM7 Dynamic

The SM7 is among the finest studio professional dynamic microphones in use today. It features a wide range, very smooth frequency response with graphic response-tailoring switches to allow the choice of four different mic response curves. It has an accurate, symmetrical cardioid pick-up pattern, uniform with frequency and provides maximum rejection of unwanted background noise.



2

SM85 Condenser

The SM85 is ideal for the most demanding live applications as well as broadcasting and studio requirements. It exhibits remarkably low distortion (right up to overload point) over the entire audio spectrum, considerably less than other more expensive condensers. Controlled low frequency, roll-off, tailored mid-range and clean, scintillating high frequencies set this mic in a class of its own.

**So you
thought Shure
only made
one vocal
mic**



5 SM87 Condenser

The SM87 is a studio-quality supercardioid condenser with Shure's legendary road mic ruggedness. New cartridge element and highly directional polar pattern enable the SM87 to reject unwanted sounds and produce high gain before feedback. Its vocal-contoured response provides tremendous flexibility at the mixing board and a warm, smooth, naturally rich sound. High SPL levels are handled effortlessly.

3 SM96 Condenser

This vocalist's microphone has features usually found in much more expensive condenser units. Smooth response has a controlled low-end roll-off to correct for proximity effect, and a slight presence rise to enhance vocals. Efficient 3-leg capsule suspension system minimizes handling noise. Optimized output level to control overloading. Steel-shielded against hum and RF pickup. Operates off phantom power, plus the convenience of automatic battery switchover.

6 869 Condenser

An economically priced electret condenser mic, the 869 is an outstanding performer for general sound reinforcement and music applications. The 869's controlled upper mid-range presence rise and low frequency roll-off give optimal clarity and crispness to voices. It's as rugged and reliable as you'd expect from Shure and can be phantom powered or uses a 1.5 volt AA battery.



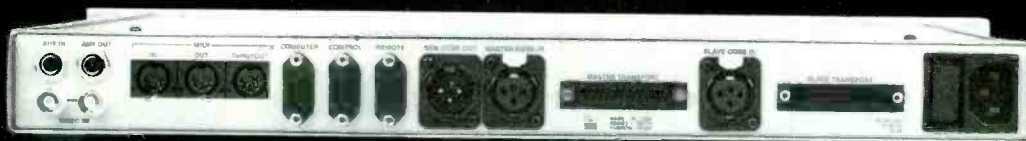
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No matter which way you look at it,
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And the ZETA-THREE has the professional features you expect from the world's leading manufacturer of audio-for-video synchronizers—features such as time code generation and re-generation with true SMPTE/EBU—spec "soft" code edges for less cross-talk,

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When compromise is not part of the studio specification.

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Brüel & Kjær Type 4011

Like any other microphone, the Brüel & Kjær Type 4011 cardioid has its limitations. Amongst them are:

A dynamic range of 138 dB.

A flat frequency response from 40 Hz to 20 kHz.

Maximum 0.5% total harmonic distortion at 110 dB SPL.

Type 4011 — a microphone with impressive limitations.

Write to us for a Type 4011 colour poster.

Brüel & Kjær 

Brüel & Kjær (UK) Ltd

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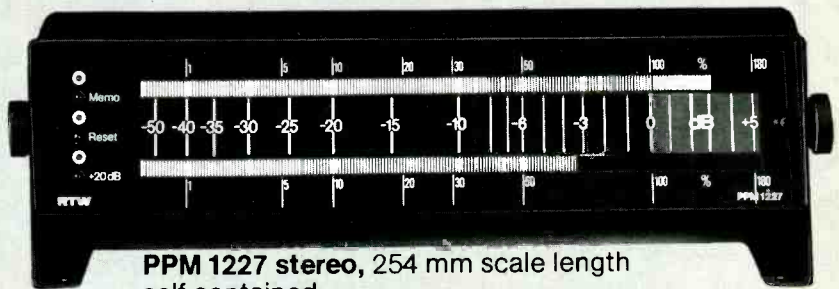
89-017

RTW Peak Programme Meter



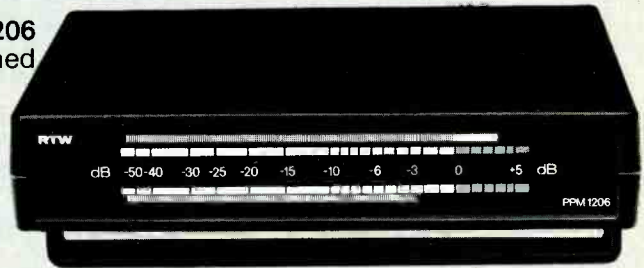
PPM 1109 stereo
Analog + Digital
Audio Peakmeter

AES HAMBURG
BOOTH No. 5-23



PPM 1227 stereo, 254 mm scale length
self contained

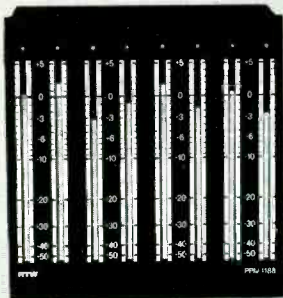
Model 1206
self contained



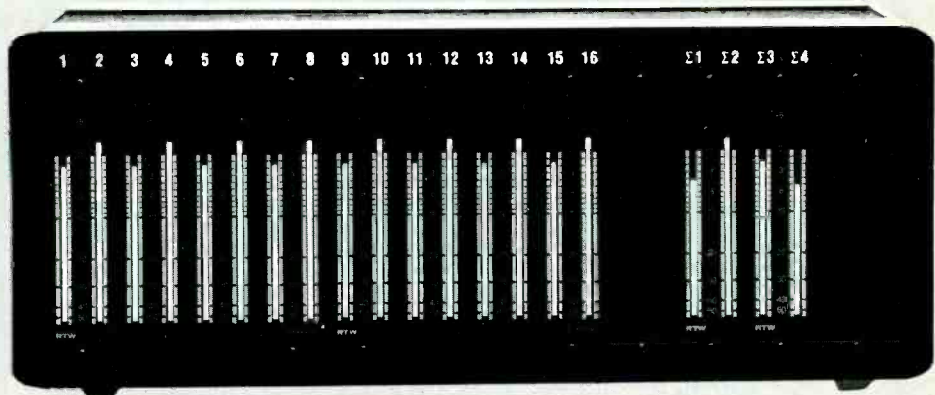
Peak programme meters
for monitoring the peak level
in analog and digital audio



PPM 1118
2-Channel
Module



PPM 1188
8-Channel
Module

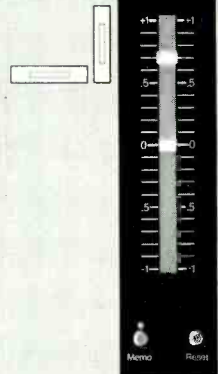


Multi-Channel Unit 16-4 and 24-4

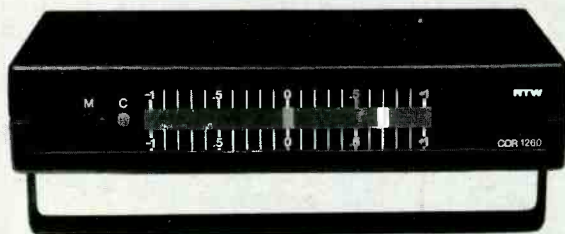
RTW Correlator

Compatibility meter
displays the phase correlation
of stereo recordings

Correlator Model 1170



Correlator Model 1160



Correlator Model 1260
self contained

RTW

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Neve delivers USSR's first DSP

Neve have supplied a *DSP* Digital Audio system to Gostelradio in Moscow. The sale, processed through Siemens in Austria, required approval from the Department of Trade and Industry before Neve were able to accept the order.

The console is to be delivered to the Gostelradio concert hall in August, for installation by the broadcast company's own engineers. It will be used both for live broadcasting and multitrack recording in conjunction with a Sony 24-track 3324 digital recorder. The purchase has been made as a result of Gostelradio's desire to experience and acquire skills in the latest Western technology. During the Spring of 1988, three delegates visited West German Radio in Cologne, which has two Neve *DSP* consoles, for a week of operational training. This was followed by a 2-day visit to the factory in England and the sale was concluded the following September.

This will be the first digital mixing console behind the iron curtain. Siemens Austria, who made this sale, represent all Neve sales into the Comecon territories, of which the Soviet Union is currently generating the most business. Several Neve consoles have already been supplied, eg for the Kremlin Palace in Moscow and several OB units, although as these sales were not made under today's Glasnost and Perestroika, they are not sure of the consoles' exact locations or even applications.

Last year saw a tremendous increase in sales to the Soviet Union but Siemens' pro-audio group sales and marketing manager Norbert Kindermann prefers to take a conservative view. The effects of the Soviet Union's recent disasters in Chernobyl and Armenia may be felt for many years from an investment point of view, but nevertheless the market is looking attractive.

Exhibitions and conventions

March 7th to 10th 86th AES Convention, Congress Centre, Hamburg (CCH), AM Dammtor, D-2000 Hamburg, West Germany.

April 28th to May 2nd NB, Las Vegas, USA.

June 7th to 9th APRS 89, Olympia 2, London, UK. Contact: APRS Secretariat. Tel: 0923 772907.

June 17th to 23rd ITS Montreux, Switzerland.

September 18th to 21st Media Visie 89, RAI International Exhibition Centre, Amsterdam, The

Netherlands. Contact: RAI, Europaplein, 1078 GZ Amsterdam. Tel: (0) 20-549 12 12. Fax: (0) 20-461006.

October 3rd to 9th World Broadcasting Symposium, Geneva, Switzerland.

October 25th to 28th Broadcast 89, Frankfurt, West Germany.

October 19th to 22nd AES 87th Convention, New York, USA. Contact: AES, USA. Tel: (212) 661-8528.

In brief

• **Harrison Information Technology Ltd** have purchased an additional factory in Cambridge, UK, for the manufacture of their *Xi-Series* amplifiers and newly introduced Modular Mixer.

• **DDA** is offering special versions of their *S* and *D* series mixers for mastering and duplication applications with special modules to handle multiple stereo source switching and routing.

News from the AES

Our next lecture will be on Tuesday March 14th when Richard Cabot of Audio Precision (USA) will talk about **Testing Digital Audio Devices in the Digital Domain**.

"A measurement system will be described that allows testing of digital audio devices in the digital domain, analogue domain or a combination of the two. By generating and analysing the test signals digitally, the need for a reference standard A/D or D/A converter is eliminated. By combining the digital generation and analysis hardware with analogue measurement hardware, the system is capable of measuring A/D converters, D/A converters or conversion sections of complete products. The entire system is controlled by a personal computer, allowing fast and thorough testing for engineering or production applications. The techniques employed and the hardware used to implement the system will be described. Measurements of commercial digital equipment will be used to illustrate the measurement techniques."

Subjects to be covered later in the year will include **Acoustic Modelling, Mixing Consoles, Design of Pipe Organs, Studio Acoustics and Analogue Digital Converters**.

Following the successful Sound with Pictures conference held in 1988, the UK section of the AES is pleased to announce that **Sound Reinforcement Engineering** is the title of a conference to be held at the IBA, Brompton Road, London on May 23rd and 24th, 1989. Under

the chairmanship of Peter Mapp, a comprehensive array of papers will be presented by leading industry figures covering all aspects of sound reinforcement technology. The other major event in the calendar is the **86th Convention** in Hamburg, 7th to 10th March 1989.

TIPS for 1992: In preparation for the open market in 1992, all EEC governments are currently rationalising vocational training qualifications throughout all industries. Most industries already have training schemes and assessment boards, and in most cases their qualifications are accepted by the National Council for Vocational Qualifications.

Traditionally the audio industry has been so diverse and informal that little exists in the way of recognised qualifications. This problem has been addressed by the formation of the Training Initiative for Professional Sound (TIPS). Chairman of the Initiative is Paul Turner elected by representatives of interested organisations, including the AES, SCIF, APRS and IOA. Negotiations are underway between TIPS and NCVQ leading to TIPS recognition as a lead industry body. On an urgent basis research will then be conducted to establish what qualifications currently exist and what needs to be provided.

For further details on any of the above or information on joining the AES, please contact: **Heather Lane, AES British Section, Lent Rise Road, Burnham, Slough, Berks SL1 7NY, UK. Tel: 06286 63725.**

People

• **Bruel & Kjaer's** Pro-Audio Group international manager Adrian Weidmann has moved to Bruel & Kjaer Instruments, Marlborough, MA, USA. He will spend a year rationalising Bruel & Kjaer's US dealer network by co-ordinating a series of seminars and presentations throughout the USA. Weidmann will, however, continue to oversee international operations.

• **Telex Communications** of Minneapolis, USA, have named Jeffery S Wetherell president and chief operating officer. Wetherell transferred to Telex Communications in 1987 and worked previously in

Tokyo, Paris, Frankfurt, London and Kinshasa in Zaire. He comes from a sales and marketing background.

• **Sifam** of Torquay, UK, have appointed John Tamsitt as sales manager. Tamsitt joined Sifam in 1966 as a sales representative and was export sales manager from 1983.

• **Trish Ashton** has joined **Executive Audio** of Surrey, UK, as product range co-ordinator. Ashton previously worked for Paul Farrah Sound and Hayden Laboratories and her new role will make her responsible for products including Anchor, Samson, Gauss, C Audio and EAW.

“Neve Je t’aime!”

Polygone Studios has received a design award for their new purpose built studio complex. The studio was “Number One” in France for the number of hits recorded in 1987. “The biggest hit of the studio has been the Neve V series.”

Jacques Bally Studio Owner.

“Neve V series Je t’aime!”

Jacques Hermer Chief Engineer.

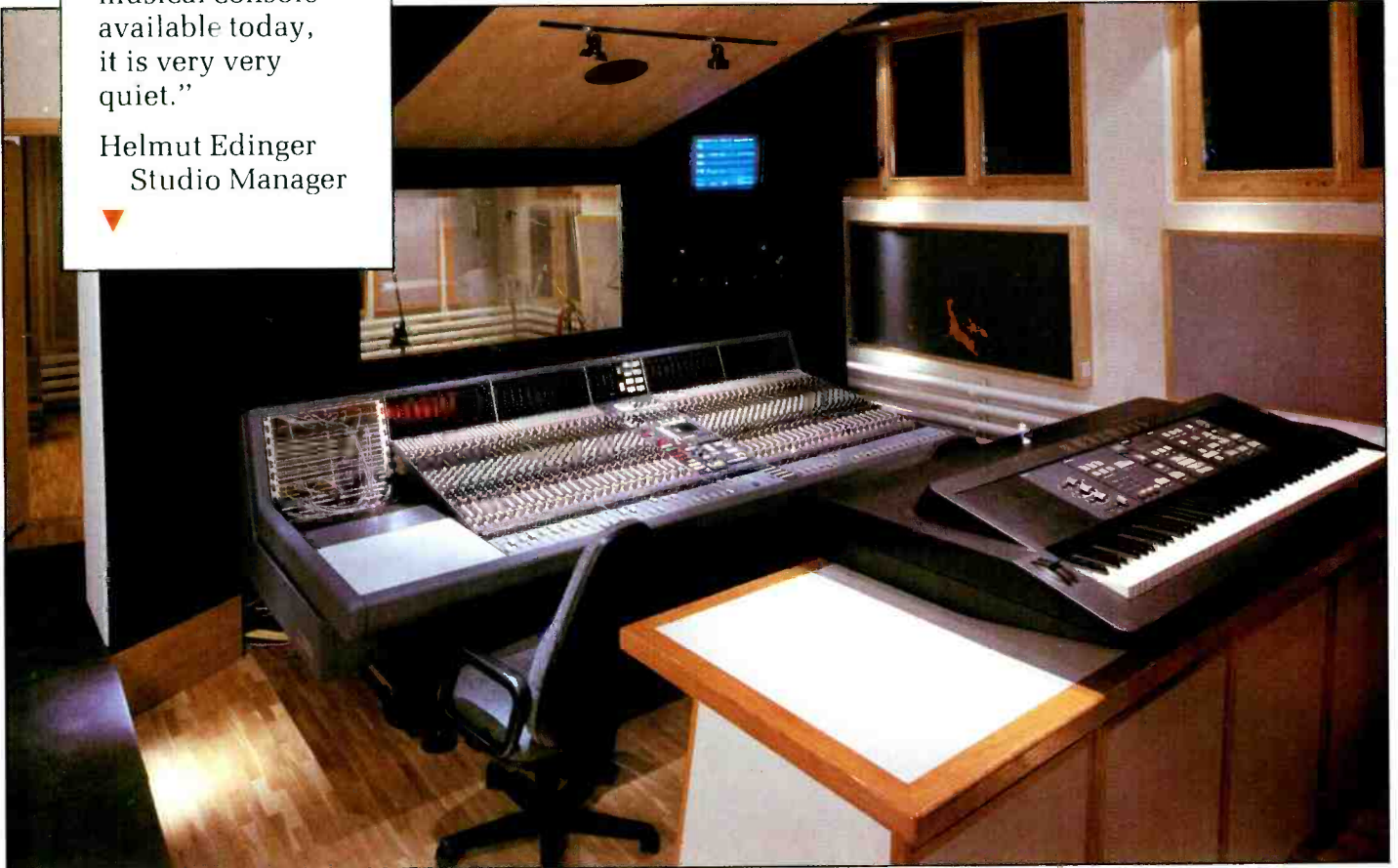


POLYGONE STUDIOS – TOULOUSE – FRANCE ▲

Blackwood Studios uses the Neve V series for music recording and for live broadcasts from the nearby music club.

“It is in our opinion the most musical console available today, it is very very quiet.”

Helmut Edinger
Studio Manager



BLACKWOOD STUDIOS – BASEL – SWITZERLAND ▲

 **Neve**
A Siemens Company

NEVE ELECTRONICS INTERNATIONAL LIMITED, MELBOURN, ROYSTON, HERTS SG8 6AU, ENGLAND
TELEPHONE: ROYSTON (0763) 60776. TELEX: 81381. CABLES: NEVE CAMBRIDGE. FACSIMILE: (0763) 61886

www.americanradiohistory.com

We are sailing . . .

The UK Professional Audio Sailing Trophy (PASTY) will be competed for by a fleet of 10 sailing boats in a charity weekend of racing by members of the audio industry. A certain amount of nautical skill will be required, however, on the weekend of April 15th to 16th, as the boats take part in a series of three races out of Southampton and into Cowes on the Isle of Wight.

There will also be various events during the weekend involving quantities of food and drink. Visitors

will be welcome—accommodation is available in Southampton and there will be additional craft for those not actually taking part in the sailing but wishing to witness events at first hand. You are encouraged to sponsor competitors in order to boost the fund raising. All profits will be donated to the 1989 charity nominated by DEAF.

The organisers are Tim Chapman (0273 693610), Mike Novak (01-253 9410) and Ian Wilson (01-226 1226).

Dolby SR—popularity increases

Rattle and Hum: The Movie, concert film of U2, was the first film to be released where all stereo prints are Dolby SR encoded and *Scrooged*, UIP's recent release, was the first to be released with Dolby Stereo SR as the sole distribution format for most

countries.

Cinemas in many countries are now being equipped to play films that are encoded with SR and which have used SR during recording and post-production, and three cinemas in Iceland recently installed SR.

In brief

- The BASF Studio Masters Award for Excellence for August has gone to John Eden of Brook House Studios, Suffolk, UK, for his recording of the Corradi album *Yanahena* on BASF 911 tape.
- Vector Marketing in London have joined with audio consultant Paul Trew to form **Smart Acoustics Ltd**, which has been created to provide a comprehensive service to potential users of the IVIE range of professional sound measurement products including the spectrum analysers *IE-10* and *IE-30*.
- Strongroom Studios in London, have announced the opening of their new multitrack studio Strongroom 2.

It will complement the existing Amek G2520-based studio but will house a new Amek A2 console. The room is purpose designed for MIDI programming and track laying and includes a large control room featuring natural light, overdub and isolation booths and comprehensive MIDI equipment.

• **New England Digital** and Lucasfilm's Sprocket Systems Division have entered into a joint development agreement to produce new film and video sound editing products. The companies will develop new hardware, software and communications protocol for the new editing systems.

Courses and seminars

March 20th New advances in Optical Recording Technology, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL. Tel: 01-240 1871.
March 20th to 22nd Digital Audio Technology. Contact: ISVR Conference Secretary, University of Southampton. Tel: 0703 592310.
April 11th to 13th Digital Audio Signal Processing. Contact ISVR Conference Secretary, University of Southampton. Tel: 0703 592310.
April 11th Acoustic modelling. Contact: AES (British Section), tel:

06286 63725.
May 9th Pulling all the stops out. Contact: AES (British Section), tel: 06286 63725.
May 23rd to 24th Sound reinforcement engineering conference. Contact: AES (British Section), tel: 06286 63725.
June 13th Studio Acoustics. Contact: AES (British Section), tel: 06286 63725.
July 11th High resolution ADC. Contact: AES (British Section), tel: 06286 63725.

Address changes

• **Audio Marketing Group** are now located at The Workshop, Camelsdale Road, Haslemere Road, Haslemere, Surrey GU27 3RJ. Tel: 0428 58775.

• **WaveFrame** have moved to new offices 2511 55th Street, Boulder,

CO 80301. Phone and fax numbers remain the same: (303) 447-1572 and (303) 447-2351 respectively.

• **RTS Systems** of Burbank, CA, have a new telephone number: (818) 566-6700.

Letter: Amateurs in pro-audio

Dear Sir, I was interested and perturbed to read the editorial in the January edition of *Studio Sound*.

It has been generally agreed for some years in our industry that the proliferation of 'cardboard boxes' with LEDs and batteries inside purporting to be 'a revolutionary digital/audio system available at £55 in three months' must stop.

You claim that recent exhibitions have seen a more realistic attitude taken by the manufacturers!

However, all this 'realism' has achieved is statements with longer delivery times. My point is that most of these miraculous products will never appear at all: every major pro-audio show has one or two new hardware/software products, which quietly fade into the sunset, as in some cases do the companies behind them.

I am not in any way opposed to small start up situations, they should be encouraged, to keep our industry buoyant and competitive. What I am opposed to is such companies which are run by enthusiastic amateurs with zero business skills.

In the 80s the product concept is the least important item. Every week our company receives two or

three R+D ideas to look at for investment. What these companies lack is marketing, production skills and most importantly financial management.

If our enthusiasts are prepared to form a consortium with business partners then the sky's the limit. However, in the normal scenario (launch the product, take a deposit, fail to deliver the product, go into liquidation) the products and companies are doomed to failure.

I categorically object to the number of amateurs in our industry because they merely confuse the ultimate customer.

Perhaps I shouldn't be so vocal and let *caveat emptor* prevail! However, I do feel very strongly about studio owners being misled, putting up hard earned (or borrowed) money as deposits and then being totally disillusioned, compounded by financial embarrassment or ruin.

It is really about time the customer started to ask for the balance sheets of the manufacturers they wish to purchase product from.

Yours faithfully, Todd Wells,
Chairman and Managing Director, Soundtracs plc, 91 Ewell Road, Surbiton, Surrey KT6 6AH, UK.

Literature received

- The *Audio Electronics Reference Book*, edited by Ian R Sinclair has been published by Blackwell Scientific Publications Ltd. Contributors include Donald Aldous, Dave Berriman, Barry Fox, Alvin Gold, Jimmy Hughes, Mark Jenkins, Stan Kelly, John Linsley Hood, Peter Mapp and Dr W Tempest. The text covers the whole spectrum of audio electronic equipment including studio and control acoustics.
- Schafer Library, North Carolina, have published an *Audio Manufacturer's Address Book* with over 1,100 cross-referenced listings.

Further information from PO Box 1241, Concord, NC 28026, USA. Tel: (704) 786-3009.

• McGraw-Hill, UK, have published *Magnetic Recording Volume III: Video, Audio and Instrumentation Recording*, edited by C Denis Mee and Eric D Daniel. Tel: 0628 23431/2 for more information.

• The third edition of Finn Jorgensen's *Complete Handbook of Magnetic Recording* has been published by TAB Professional and Reference Books, PO Box 40, Blue Ridge Summit, PA 17294-0850, USA. Tel: (717) 794-2191.



Take a fresh look at the industry standard for DAT mastering.

Amongst audio professionals, the Sony DTC-1000ES is now widely recognised as the DAT standard. It's officially supplied by HHB – Sony's leading independent distributor. That means genuine service and spares support, as well as expert advice.

Second generation DAT hardware incorporates rationalised integrated circuitry and single A to D conversion. This may make DAT more accessible to consumers, but it's bad news for the audio professional. That's why we've talked to Sony and secured an extended production run for the DTC 1000ES.

Along with twin A-D conversion, all DTC 1000ES recorders from HHB are now specially adapted to record at 44.1kHz as well as 48 kHz. A modification that's impossible to implement in most



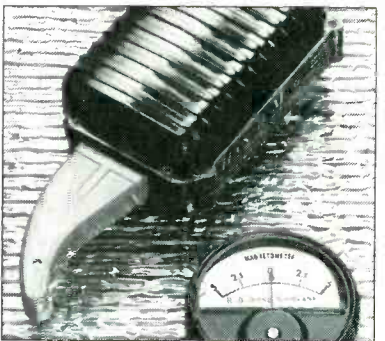
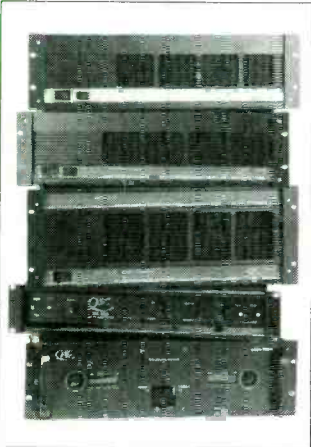
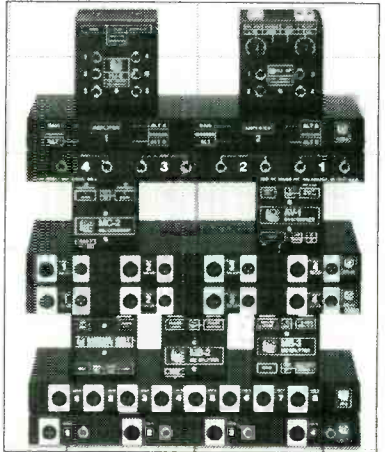
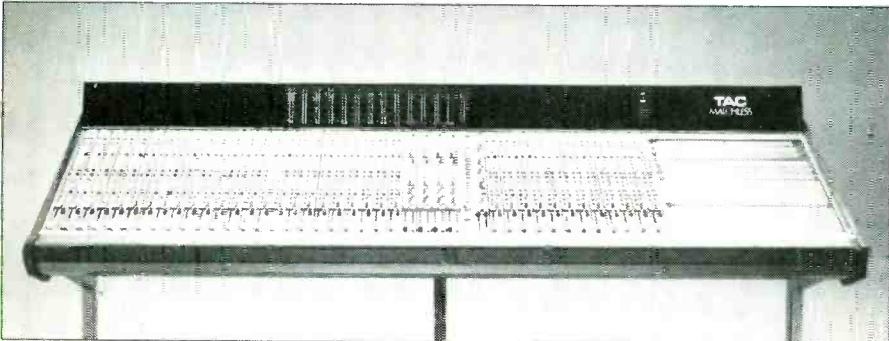
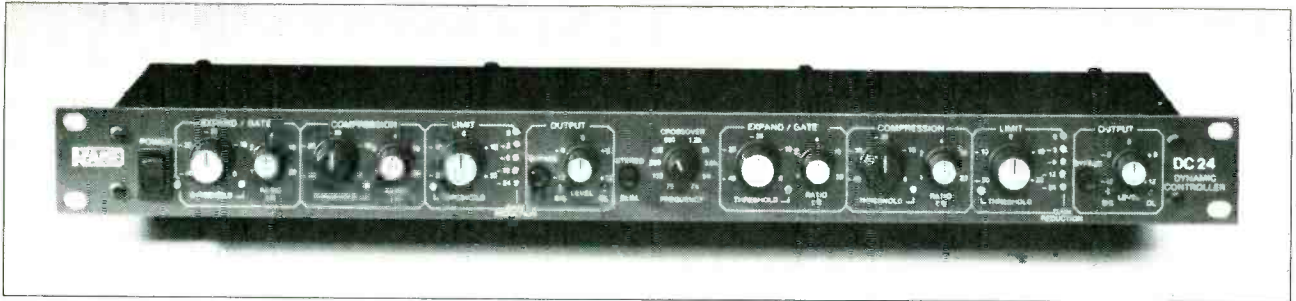
second generation devices. For additional professional convenience, we've even designed an optional 19" rack tray.



If you're thinking about a secure future with highly-affordable DAT mastering, take a fresh look at the new DTC-1000ES package from HHB. It's just one member of a powerful family of DAT equipment available from the industry's most experienced supplier of digital recording hardware.



AMPEX, ANNIS, NEOTEK, PRO CO, QSC, RANE, STUDIO MAGNETICS, TAC, TASCAM & MUCH MORE



Thoughts on ergonomics

OK so what's new? Mother Nature has been laying down 'rock' for 405 million years. 404,995,500 years after the 'Big Bang' Man swung out of the trees to make his contribution. A few thousand years later he'd managed to minimise his activities, in the laying down of rock, not to just flicking a plectrum across six strings but merely lifting 78.09 atomic weight atoms into a chip. The result, another Big Bang, which instead of creating a vast Universe, enabled the rapid shrinking of every conceivable piece of electronic equipment.

However, while 'surfing' on the 80-year wave that took him from wire recording to DAT, he somehow forgot that it also took the previous 404,995,553 years to evolve his own physique. Designed, by survival, primarily to run, swing, eat and fornicate (and all those other activities essential to the 'rock' laying business).

While progress in healthcare, food production, and environmental issues combine to nurture a *homo sapiens* now averaging 6 ft *erectus* as opposed to 5 ft at the turn of the century, the technology boom is churning out equipment more ergonomically suited

to medieval minstrels.

Firstly, the present day mixing console necessitates that an engineer must spend 75% of his working day with his body bent at right angles. All hail the old BBC 'Type B' with its *erectus*-friendly panel and big black rotary knobs. At least you could hang on to them with sweaty hands while the PPMs were hitting the back stop.

Apparently, it would be too expensive to produce *erectus* PCBs and anyway, the low level aspect not only allows easy viewing through the partition window but also interferes less with the monitoring acoustics.

Perhaps nearfield monitoring, console-mounted VDUs and other revolutionary recording techniques will see the end of my aching back.

After all, if Sound Stage in Nashville can do away with the glass, and the partition, completely, then surely that throws the low-level philosophy out of any glass remaining.

Now, let us turn to the rack. That fiendish torture device that lurks behind, to the right, to the left, beneath, above, every console driving seat. Let us 'turn' indeed; through

90°, 130°, 180°. To work at some of them you need at least 10 years experience of yoga. And as many arms as Shiva.

Early rackmounted devices, such as compressors, limiters and gates had few parameters and were quickly adjusted. A present day device, such as *TX81Z*, for instance, has more adjustments to make in one 'flick' of a parameter button than a whole rack full of '70s equipment. Put it in 'Performance' mode and that figure may be multiplied by eight.

No problem if your *TX* is mounted 6 inches in front of your nose while sitting at the console. Few racks are. The *TX* is now, typical of most rackmounted equipment.

Consequently, unless he has overcome the problem, the engineer must spend a lot of time with his body twisted, his head down, his back bent forward, on his knees, squatting, stretching upwards. . .

Is there a solution?

No, not bring it all up on to the VDU with a pet mouse. Then you'll just spend all day watching the box, while bending over the console adjusting the EQ.

To bring the recording studio into

line with man's correct evolutionary status perhaps the rack could be 100 yards away from the console, involving a hefty sprint every time a program change was required. It could be positioned 10 ft off the floor with a rope ladder for getting there and a vine for swinging back. . .

The sequencer, on the other hand, presents an entirely different set of problems. More akin to brainwashing than physical torture.

It has often been said, that it takes 10 times longer to realise an idea on a sequencer than it does to just open your mouth and sing it.

Solution: Think, Write, Play, Stop, and then think again. For Christ's sake don't put it into the Repeat mode. You'll forget, not only where you started but where you wanted to go. It was often the problem with multitrack recording. To hear too much of it. You just had to, Get Away.

Optimistically, present-day recording technology has made every process so quick and idiot-proof that there is little need to 'twist' the night away. Unless you wish to burn off some carbohydrate. Or bend and squat, for that matter.

David Hastilow

Contracts

- The new Disney/MGM studio at Lake Buena Vista, FL, USA, has equipped its soundstage with a **Sony APR-5003V** analogue 2-track recorder/reproducer for use in video post-production, film audio production and musical recording. All the soundstages are fitted with **Sony ECM-55** lavalier mics. The studio also has five **Sony DVR-10 D-2** digital VTRs Sony have sponsored an A/V theatre at a new theme park to be constructed at the studio site. The theatre will be installed with **MXP-2016** and **MXP-3036VF** mixing consoles and **PCM-3324A** digital multitrack recorders.

- Rainhill Tape Specialists, based in Merseyside, UK, have added a further **Lyrec** twin slave unit to their **P-2000** high-speed duplication system.

- **JBL's** professional division at Harman UK recently devised a 'dance system' for Stock, Aitken and Waterman's **PWL** 'tracking' studio in London. The system incorporates two

JBL 4851 Concert Series cabinets and two **JBL 4785** sub-bass units. The **4851** units comprise two **2204** 12 inch speakers, one **2445 HF** compression driver on a **2380A** horn and **2404** tweeters. The sub-bass unit is a double-ported, 3-chamber reflex box usable down to 30 Hz designed and built by JBL International in Denmark. **PWL's** 4-way active system is controlled by **JBL 5235** crossovers.

- The BBC have purchased four **Akai MG14D** multitrack recorders from Raper & Wayman in London to help in the promotion of their **RDS Radio Data System**—a means by which information can be broadcast automatically over compatible radio receivers while they are tuned to another station. The **Akai MG14Ds** are 14-track machines which use special ½ inch cassettes (similar to Betamax) as their tape medium.

- **Twickenham Film Studios** in the UK have recently equipped with **Dolby SR**. The studios already have **Dolby A**-type noise reduction and

have now purchased 72 channels in three **Dolby XP24SR** multichannel units so either noise reduction is available in both **Twickenham's** mixing studios.

- **Bruel & Kjaer**, Middx., UK, have supplied the BBC with over 30 microphones. **BBC Broadcasting House** in London has taken delivery of 16 **4011** cardioids which will be allocated to the **BBC Concert Hall**, **Studios One and Two** at Maida Vale, London, and the **BBC OB** division. **BBC Bristol** and **Leeds** have received **4006s** and **BBC Cardiff** and **Manchester** with **4011s**.

- **Mitsubishi Pro Audio**, Herts, UK, have announced recent sales of their **X-86HS** and **X-86C** 2-track digital recorders. **X-86HS** machines have gone to **Conway Recording Studios**, **Design FX Audio**, **Bernie Grundman Mastering** and **Tim Jordan Rentals**, all based in Los Angeles. An **X-86C** has been supplied to **Masterfonics** in Memphis, TN, USA.

- A second **Saturn Research Saturn** 24-track tape machine has been supplied to **NRK**, the Norwegian state broadcasting company. The first machine was bought by **Radio 2's** music production studio and is in use with a **Soundcraft TS24** 48-channel mixer equipped with **MasterMix** console automation.

- **Peter Gabriel** has ordered two **Studer A820** 24-track machines for use at **Realworld Studios** near Bath, UK. A recent software update, now fitted to all **A820** multitrack machines, improves drop-in/out times, according to **Studer**.

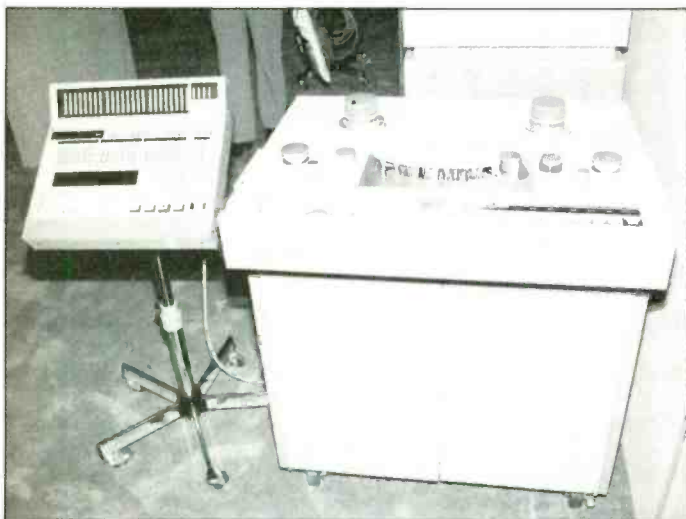
- A **Soundcraft TS12** in-line console has been purchased by **Neil Schon**, guitar player with rock group **Journey**. The 36-input console has been installed in **Schon's** personal studio in **Oakland, CA, USA**. Other recent **TS12** installations include **The Sound Department** in **Portland, OR**, and **Logos Productions**, **Clayton, OH, USA**.

Tascam new products

The *DA-800-24* is a 24-track digital recorder in the DASH format and is fully compatible with the Sony *PCM-3324/3324A*. The transport features a specially-developed pinchroller drive system for high tape handling precision and stability. A dump edit function is also included for cut-and-splice editing. The electronics incorporate Tascam's new ZD circuitry in the A/D and D/A converters, which improves performance by suppressing distortion in low level signals. Other features include sampling frequencies of 48, 44.1 and 44.056 kHz, SDIF-2 digital I/O, optional AES/EBU digital I/O, 20-segment LED peak level meters for each channel, setup memories for channel, setup data,

a variety of programming and control functions, including a shuttle wheel for search functions (frame accurate), an auto cue function, event play, link play and pitch control. A RAM buffer is also available as an option for immediate startup from ready mode and continuous looping between two cue points. Other features include ZD circuitry, standard and single CD compatibility, fader start and headphone amplifiers.

The *MSR-16* is a 16-track ½ inch tape recorder and features completely new heads, 2-speed transport and plug-in electronics together with switchable dbx type I noise reduction. Advanced facilities include gapless auto drop-in/drop-out with rehearsal functions, spot erase, built-in



four channel group memories, shuttle wheel and $\pm 12.5\%$ pitch control.

The *DA-50* is a DAT recorder for professional applications and employs ZD circuitry to reduce distortion and noise to extremely low levels. High quality componentry and boards are used, together with Van den Hul matched crystal wiring, and the chassis is built for superior vibration and resonance rejection. Sampling frequencies for record/play are 48 and 32 kHz with 44.1 kHz play only. Inputs and outputs are both balanced (*XLRs*) and unbalanced (*RCA phono*) together with digital audio interface format I/Os switchable between coaxial and optical connectors.

The *CD-701/RC-701* is a professional CD player/control unit for broadcast and audio production applications. The *RC-701* can control up to four *CD-701* players and offers

autolocator and parallel and serial interfaces for external *SMPTE/EBU* synchronisers or *RS-232/Tascam MIDI-IZER*.

Tascam accessories include the *MTS-1000 MIDI-IZER* synchroniser/controller that offers MIDI to timecode and tape transport synchronisation/control capability, the *MTS-30* MIDI tape synchroniser for MIDI sequencers, etc, with advanced error correction and the *ES-50/ES-51* tape synchroniser and controller for timecode sync between *ATRs* and/or *VTRs* plus locator, event and timecode generator functions.

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

USA: Teac Corporation of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726 0303.

Lexicon CP-1 Dolby Pro-Logic surround sound system

The Lexicon *CP-1* Dolby Pro-Logic Digital environmental processor processes ambience, reverberation and panorama to synthesise rooms of different sizes and acoustics besides producing Dolby surround sound. Lexicon claim several advantages over other surround decoders because the *CP-1* is all digital, allowing some elements of processing that can only be done in the digital domain, such as auto input balance and auto azimuth error correction which are claimed to produce superior steering

and perfectly centred dialogue. Primarily intended for the home entertainment market, the unit is supplied with an I-R remote and has 12 preset programs and 12 user stores.

Lexicon Inc, 100 Beaver Street, Waltham, MA 02154-8425, USA. Tel: (617) 891-6790.

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

Harrison mixing consoles

Harrison have introduced two new consoles that incorporate features developed for the *SeriesTen*, the *MR-20* recording console and the *AP-100* on-air broadcast console.

The *MR-20* is externally almost identical to the previous *MR-2* console with the exception of black cosmetics but much of the internal circuitry has been revised to include many of the advantages offered by the *SeriesTen* development programme. Harrison Systems claim the "*MR-20* is sonically superior to the *MR-2* while still offering all of the facilities that made the *MR-2* popular".

The *AP-100* on-air console uses DCA technology and provides a cost effective 'off the shelf' mixer for live broadcast. Standard configuration is 12 stereo line input channels (plus two microphone preamplifiers) routing to stereo programme—stereo auxiliary and mono clean feed

outputs, in a 16-input frame. An input expansion kit of four input channels is available on option as are microphone preamplifiers. Also optional is a master programme and master auxiliary fader package.

Main features of the *AP-100* include programmable console configurations into non-volatile RAM via the front panel keyboard, stereo A and B sources to each channel, full variety of logic interfaces (eg for use with video switchers in A/V suites), built-in presettable timer with up and down count capabilities and smart cue system that automatically switches from momentary to latching.

Harrison Systems Inc, PO Box 290157, Nashville, TN 37229-0157, USA. Tel: (615) 834-1184. Fax: (615) 834-1365.

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



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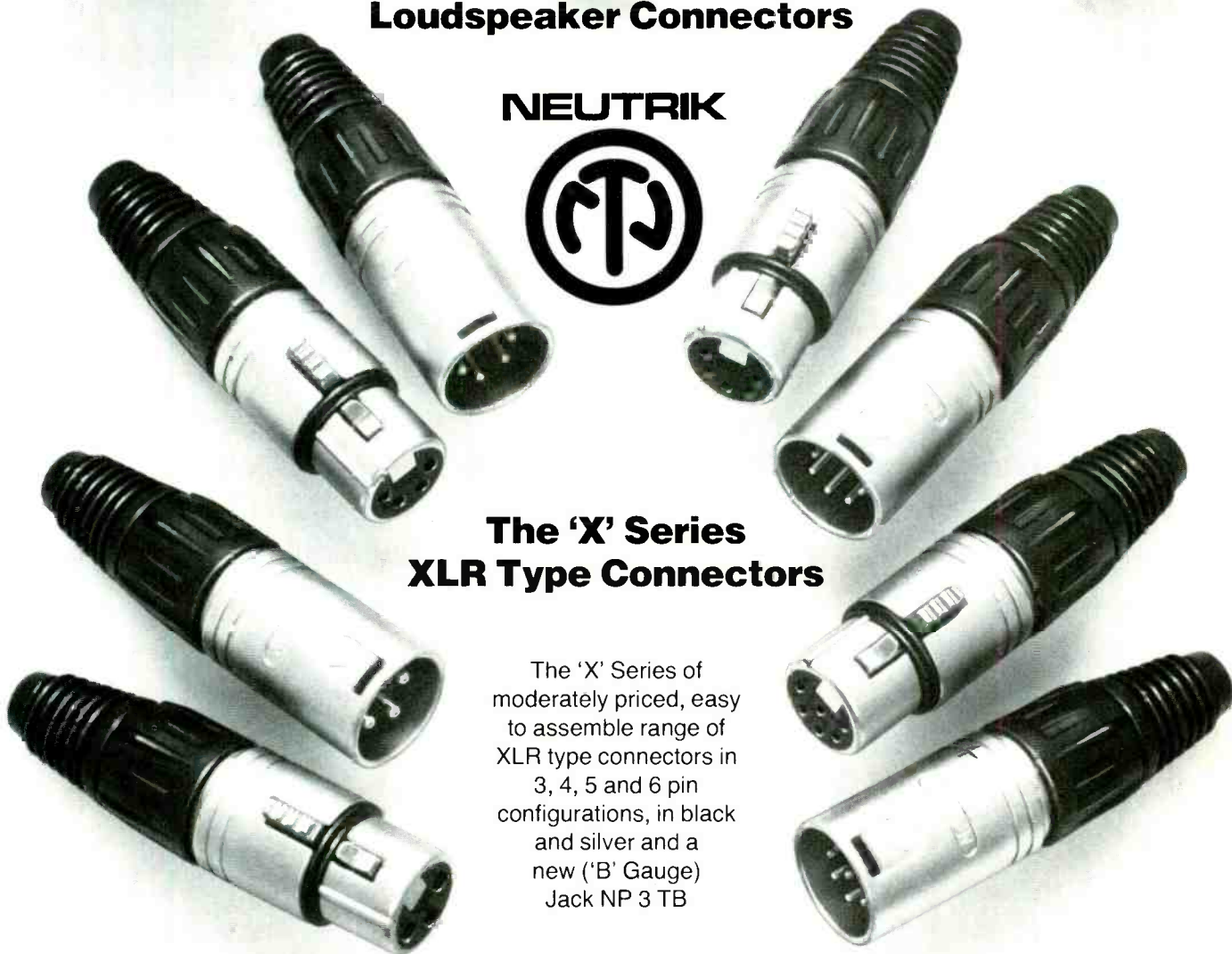
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Telephone: 01-221 0606/01-727 0711 Telex: 23894 Telefax: 01-727 9556

Studer Revox new products

Studer Revox have introduced a variety of new products including the A827 multitrack recorder, the Revox C270 series of recorders, the A764 FM monitor tuner, the A723 active studio loudspeaker and A729 CD controller.

The A827 is a 24-track analogue recorder using the same transport as the A820/24 and much of the microprocessor technology. Features include 14 inch reel capacity, three speeds with integrated varispeed, phase compensated audio electronics NAB/CCIR/AES equalisation switchable controlled amplifiers and switchable Dolby HX-Pro. An optional internal synchroniser is also offered as well as a remote control unit with shuttle wheel for cueing, editing, etc. Integration into system (eg: A/V production) is facilitated by the provision of RS-232/422 parallel and serial ports. Microprocessor control of the transport and audio electronics with automatic alignment data recall offers two alignments per tape speed.

The C270 series of recorders comprises the C270 2-track (¼ inch) machine, C274 4-track (¼ inch) and the C278 8-track (½ inch). Features common to all machines include three tape speeds, varispeed, internal monitor speaker/headphone output, autolocator and one-hand cueing in edit mode, fader start circuitry, RS-232 serial port for all machine functions, modular electronics for easy service, gapless drop-in/drop-out and rackmount side panels. Both the C278 and C274 can be synchronised via SMPTE timecode and the two machines also come in low speed versions for logging applications.

The A764 is a professional FM monitor tuner with RDS/ARI multifunction decoder. The unit satisfies the two essential quality requirements of low noise and large signal immunity by being fitted with two complete high-dynamic RF input stages with single/double selection;

the IF filters are also switchable between wide and narrow.

Other features include computer-rated LC toroid bandpass filters, microcomputer system with two microprocessors, RS-232 interface, alphanumeric dot matrix display with 20 characters, ARI/RDS decoder module, 60 memory locations, balanced/unbalanced outputs and two switchable antenna inputs.

The A723 is an active 3-way monitor speaker with a 100 W amplifier for each driver. Special features of the amplifier design include negative output impedance to improve accuracy and all-pass filters for each band with analogue delays to ensure proper phase coherency. The group delay of the crossover filters is also compensated for in order to stabilise the directional lobes at the crossover points, thus contributing to stable stereo imaging. Other features include balanced input, highpass filter and switchable bass response and stepped input attenuator. Dimensions are 580×325×405 mm (22¾×12¾×16 inches).

The A729 is a modular CD system controller for complex post-production and creative programme design applications. The unit can control up to four CD players via their ES interface and has a built-in recognition facility of up to 100 CDs. A cue wheel allows cue points to be programmed as required and an automatic program run of up to three sequences can be programmed for each player.

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf, Switzerland. Tel: 01 840.29.60. Fax: 01 840.47.37.

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

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

Oak racks

Oak of Cambridge have developed a new racking system in standard and RFI shielded versions. The RFI version is a response to increasing demand from the computer and telecoms industries for shielding, and is supplied assembled and welded. The standard version is supplied in knock-down self-assembly form, with

the emphasis on simple assembly—no jigs are required. Oak see the advantages as being greater flexibility, reduced cost and reduced storage requirements for distributors. **Oak, Denny End Industrial Estate, Waterbeach, Cambridge CB5 9PB, UK. Tel: 0223 441144.**



Studer A827

Dod increase Digitech and Audio Logic ranges

Digitech have released the *DSP-128 Plus* with 20 Hz to 20 kHz bandwidth, a redesigned front panel and 20 bit VLSI processing; the *IPS-33 Smart Shift*, which adds one or two "crystal clear" harmony notes to vocal and instrumental lines, the *IPS* lines being user-defined from a library of 41 different scales; and the *GSP-5*, which provides effects plus features such as MIDI control, 99 user memory locations and the possibility to use up to five effects simultaneously.

In the Audio Logic range is the *SC 131* digital delay and *SC610/SC611* mixer/expander.

The *SC 131* is a cut-only graphic equaliser with 31 ISO centres. The attenuation ranges are switchable between -10/-20 dB and the unit also features variable high- and lowpass filters, ±12 dB overall gain and balanced/unbalanced input/output on *XLRs*, ¼ inch jacks and barrier strip.

The *RIDI* is a single-input/single-

output 16 bit digital delay with a delay range to 320 ms in 5 ms increments. Input and output are balanced and unbalanced with screwdriver adjustable presets. A security cover for the delay adjust DIP switch is also provided.

The *SC610* is a 1U 6/1 mixer and is complemented by the *SC611* 6-input expansion module. Each unit features four microphone inputs and two mic/line inputs, each with low cut filter switch, screwdriver adjustable gain trim pot and clip LED. The *SC610* also has an auxiliary stereo input (summed to mono), master bass, treble control and output level controls, mix bus clip LED and 6-segment headroom indicator. All inputs and outputs balanced/unbalanced.

Dod Electronics Corp, 5639 South Riley Lane, Salt Lake City, UT 84107, USA. Tel: (801) 268-8400. Fax: (801) 262-4966.
UK: John Hornby Skewes Co Ltd, Salem House, Garforth, Leeds LS25 1PX. Tel: 0532 865381.



"OF COURSE THE TECHNICS SV-260 PORTABLE DAT RECORDERS ARE JUST AS GOOD FOR CLASSICAL MUSIC, I ONLY MENTIONED REGGAE IN PASSING" PLEADED REG!!!



EVEN CYRILS TOGGLE COULD NOT PROTECT HIM, THE STRANGER WAS DETERMINED TO HEAR THE SONY APR 24 ANALOGUE RECORDERS SUPERB SOUND QUALITY FOR HIMSELF.

PERCY AND CLIVE SO LOVED THEIR YAMAHA DMP 7D THEY WERE SURE GONNA USE ITS OPTIONAL DIGITAL INPUTS AND OUTPUTS AT EVERY GIVEN OPPORTUNITY.



NOT EVEN THE EVENTIDE H3000 THE ULTRA HARMONIZERS 16 BIT 44.1 KHz SAMPLING 5Hz -20 KHz ON ALL EFFECTS COULD COME BETWEEN FORTESCUE AND HIS DANCE PARTNER TEMPEBE.

COLIN KNEW THIS WAS THE ONLY WAY TO PROVE TO THE DOUBTING THOMAS BROTHERS THAT THE NEW DOLBY SR/A NOISE REDUCTION UNIT WAS OBTAINABLE EVEN FOR THEM!!



ROLAND WAS TICKLED PINK TO FIND THE NEW ROLAND DIGITAL REVERB WITH GRAPHIC DISPLAY REMOTE WAS NAMED AFTER HIM.... THE R880?!



BEVERLY WAS BOTH UNHORSED AND UNNERVED BY THE AMAZING STOCKS OF TAPE BEFORE HER.



Neve Flying Faders

The *Flying Faders* moving fader console automation system has been designed in collaboration with Martinsound Technologies to give great flexibility together with ease of operation. Pressing the RUN button puts *Flying Faders* into working mode and from then on it can be forgotten about.

The faders are Penny & Giles conductive plastic fitted with a high torque motor assembly having no gears or clutch and they are capable of very fast moves. All fader movements are stored into scratch memory and any pass can be recalled as required before putting final mix decisions onto disk. Other features include automatic matching (or nulling), 0.1 dB accuracy, 1/4 frame accurate muting, Link function with single fader update, VCA-style grouping and free-grouping, overall Trim mode, stereo faders and auto

calibration.

Series consoles have the added advantage of the channel/monitor mute, EQ in and insert in buttons being interfaced directly to the *Flying Faders* system, together with commands such as fader start, track enable, events, etc.

The *Flying Faders* package can be retrofitted to most consoles to a maximum of 256 channels. The design is modular to allow updating with new software. Neve also plan to release an instructional video on the system in the 'near future'.

Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU, UK. Tel: 0763-60776. Fax: 0763-61886.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Fax: (203) 792-7863.

API 550b equaliser and 512b mic preamps

API have added two new modules to their range, the *550b* equaliser and the *512b* microphone preamplifier.

The *550b* features the same circuit design as the *550a* but miniaturisation of components has enabled a fourth band to be added for a total of 28 selectable frequencies. The high and low bands can be switched between peaking and shelving and the unit features discrete circuitry throughout. Wiring and power requirements are as the *550a*.

The *512b* mic preamp features front or rear microphone inputs with a Jensen transformer plus an unbalanced 1/4 inch jack input for low level instruments. The output is transformer-balanced. Panel controls

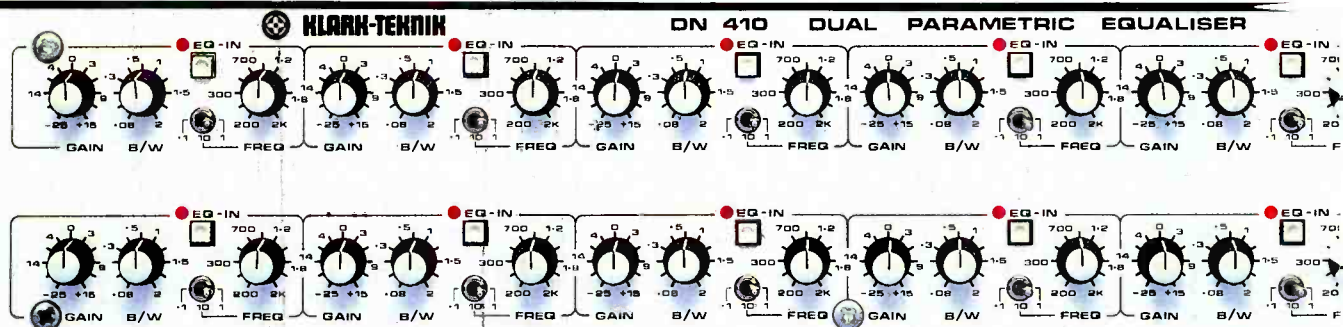
include switches for 48 V phantom—20 dB pad—mic/unbal input, gain pot and LED vu meter. An added feature is remote control of the gain (on option) for special applications.

API previewed the *525b* passive compressor/limiter at the Los Angeles AES. This uses a motorised pot for gain reduction instead of VCAs. Potential users were invited to test the unit and pass on their comments to API.

API Audio Products, Inc, 7951 Twist Lane, Springfield, VA 22153, USA. Tel: (703) 455-8188. Fax: (703) 455-4240.

UK: Syco Systems Ltd, 20 Conduit Place, London W2. Tel: 01-724 2451. Fax: 01-262 6081.

Parametric Equalisation



Klark-Teknik Research Limited Klark Industrial Park, Walter Nash Road, Kidderminster, Worcestershire DY11 7HJ, England. Tel: (0562) 741515 Telex: 339821 KLARTK G Fax No: (0562) 745371

Head dummy head

The Head Measurement and Recording System is an advanced dummy head recording system that has applications for high quality music recording and noise analysis and consists of a dummy head, a record processor and reproduce unit.

It represents a statistically 'average' human head, complete with felt hair and shoulders. The head is fitted with two Bruel & Kjaer 4165 condenser microphones and the necessary preamplifiers and line drivers. Due to the wide variations of ear canal characteristics in people, the microphones are placed 4 mm inside the 'ear'.

The Record Processor is a modular housing containing the head freefield equalisers, power supply modules (AC or AC/battery) and interface modules to the recording or analysis equipment. The Reproduce Unit has

the same housing but with equaliser modules, input modules (for A-B comparisons) and amplifier modules for driving up to two pairs of Stax SR-Lambda professional headphones.

Unlike most binaural systems, the Head system provides excellent playback results with loudspeakers and has a dynamic range of 136 dB. 1 V RMS can be obtained from four SPL settings—94, 104, 114 and 124 dB—and a test generator produces 94 dB at 240 Hz for calibration and reference purposes.

Head Acoustics GmbH,
Julicherstrasse 336, D-5100
Aachen, West Germany. Tel:
0241-1822-181. Fax: 0241-1822-100.
USA: Head Acoustics North America,
114A Washington Street, Norwalk,
CT 06854. Tel: (203) 838-4167. Fax:
(203) 854-5703.



Cue Systems have announced the *Cuedos* real-time control system for up to four Yamaha *DMP-7* consoles and peripheral MIDI-controlled processors. Desk configurations include 16/4 surround sound or 32/2 stereo. Host computer for *Cuedos* is an Atari *ST* (1 Mbyte minimum) and for ease of operation in a live environment three screens are offered: realtime, preset, offset. Realtime mode is direct control of mixing functions and outboard MIDI equipment, preset allows the creation/editing of programs (without disturbing a live mix) and offset allows the introduction of general parameter changes, eg EQ, before a performance.


...DN410— The Universal Equaliser

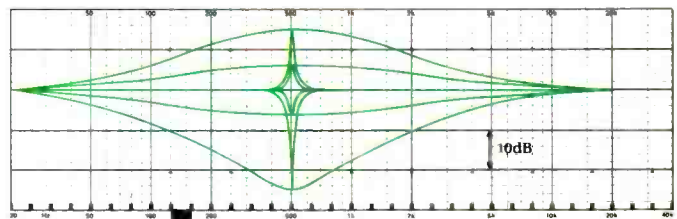
Unprecedented control – with ten *universal* parametric filters, each capable of performing the full range of notch filter and broadband functions anywhere 20Hz to 20kHz.


Outstanding audio quality – carefully designed for minimal distortion and lowest noise, the DN410 re-affirms Klark-Teknik's reputation for sonic excellence.

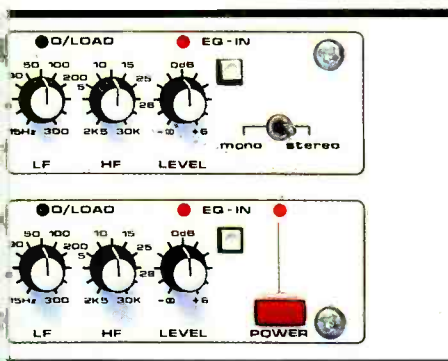
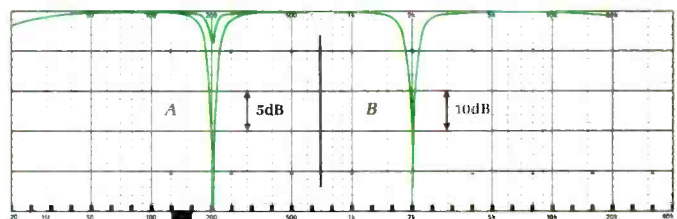
Professional features – with low and high cut filters, dual/mono mode select, fail-safe bypass and a choice of termination standards, the DN410 is thoroughly engineered – to suit your application.

Klark-Teknik reliability – designed-in from initial concept, the Series 400 parametrics feature quality assurance in the best traditions of Klark-Teknik.








 Parametric

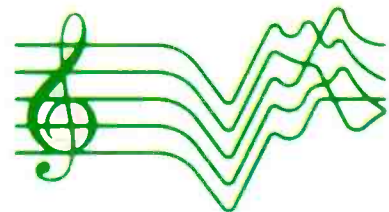


 Notching
 A. Single filter
 B. Two filters



The DN410...Specifications

	Frequency response (20Hz-20kHz)	± 0.5dB
	Distortion @ +4dBm	< 0.01% @ 1kHz
	Equivalent input noise (20Hz-20kHz unweighted)	< -90dBm
	Channel separation	> 75dB @ 1kHz
	Filter bandwidth	Variable from 1/2 to 2 octaves
	Maximum boost/cut	+15 to -25dB
	Maximum output level	+22dBm

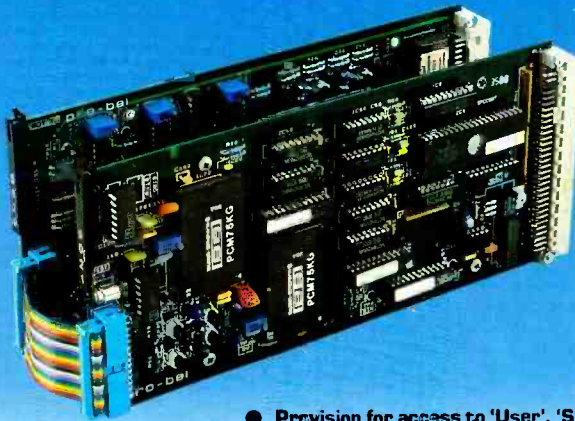


EQUALISATION

MORE BITS FOR YOUR DIGITAL STUDIO

Digital Studio and Transmission Systems both demand routing and distribution equipment with performance in excess of 16 bits. Pro-Bel's latest line-up of digital audio products meets this criteria whilst offering total transparency to the full AES/EBU digital code. Our new AES/EBU converters feature

18/20 bit resolution resulting in an impressive system specification comparable with that achievable from standard analogue equipment. Match this with our TDM digital audio router's unique capability to ROUTE and MIX AES/EBU signals in the digital domain and you've realised true system flexibility.



5020/1 ADC Converter

- 105dB dynamic range
- Two outputs to AES/EBU standard using all 20 programme audio bits
- Output locked to local reference
- Line test facility

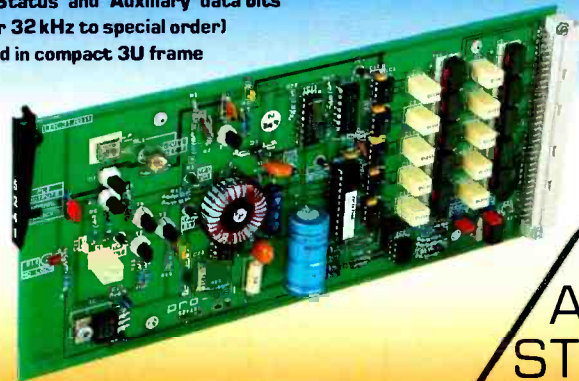
5030/1 DAC Converter

- Performance in excess of 18 bit by use of over sampling and gain ranging
- Two inputs and line-up check facility
- Invalid or non-synchronous input indication
- Optimised for 16, 18 or 20 bit coded input

- Provision for access to 'User', 'Status' and 'Auxiliary' data bits
- 48 kHz standard (44.1 kHz or 32 kHz to special order)
- Up to 5 converters housed in compact 3U frame

5241 AES/EBU Distribution Amplifier

- Input and output interfaces conform to AES/EBU specification
- Ten outputs with individual buffers
- Selectable input cable equaliser
- Selectable clock regenerator
- Direct replacement for our 6241 analogue DA permitting economic upgrade from analogue 'mono' to digital 'stereo' using same cable circuits



5012 Digital Audio Waveform Generator

- Switchable 48 kHz or 44.1 kHz
- Independent left and right channel controls of frequency, amplitude and waveform
- Master oscillator lockable to an external AES/EBU bitstream or TTL compatible reference
- U, V & C bits may be set in any static pattern
- RDAT compatible



pro-bel PROFESSIONAL DIGITAL AUDIO

Klark-Teknik signal processors

Klark-Teknik have released a new range of dynamics processors and two new digital delay units.

The *DN500* is a dual-channel compressor/limiter/expander for dual-channel mono or stereo operation and features front panel controls for all parameters. The limiter section includes in/out switches for limit and clipper functions. The unit is built into a 1U chassis and features electronically-balanced inputs and outputs (transformer balancing optional) as well as separate sidechain inputs for the compressor and expander sections. Performance is quoted at less than 0.05% distortion over 20 Hz to 20 kHz with a S/N ratio better than -94 dBm.

The *DN510* is a dual noise gate with advanced control characteristics to provide optimum performance with very low noise (-104 dBm for -90 dB attenuation). The 1U unit has a wide variety of controls for four parameter groups, which include the gate section, filter section (wide range high- and lowpass filters), trigger control section including masking and the envelope section for ducking and MIDI control. The DC inputs require +5 V to open the gate, while the output has a +5 V trigger when the gate opens. The MIDI output features both after-envelope delay sends and after-hold period sends. The audio inputs and outputs are electronically-balanced and transformer balancing is optional.

The *DN514* fits four noise gates

into a 1U chassis with each channel having two 'automatic' attack settings—percussive and normal. Hold time is automatically scaled to the release setting and a unique sync function allows the user to synchronise signals by interlocking the release times of the four gates. The unit also features wide range high- and lowpass filters, external triggering and electronically-balanced inputs and outputs (transformer balancing optional).

The *DN726* is a 16 bit stereo delay line with in-phase outputs and has applications in satellite broadcasting where left/right channels must be perfectly in-phase to avoid cancellations. The unit features a frequency response of 20 Hz to 20 kHz and is adjustable from 0 to 1.3 secs in 20 μ s increments. Battery backup is provided for all memory settings.

The *DN775* is a stereo preview delay for mastering applications with a frequency response of 20 Hz to 25 kHz, a delay range of 0 to 5.55 secs in 16 μ s increments and a dynamic range greater than 90 dBm. **Klark-Teknik Research Ltd, Klark Industrial Park, Walter Nash Road West, Kidderminster, Worcs DY11 7HJ, UK. Tel: 0562 741515. Fax: 0562 745371.**

USA: Klark-Teknik Electronics Inc, 30B Banfi Plaza North, Farmingdale, NY 11735. Tel: (516) 249-3660. Fax: (516) 420-1863.

In brief

• The *Alesis Quadraverb* 16 bit digital effects processor features 20 kHz bandwidth, true stereo operation, a wide range of effects (including stereo reverb, delay, chorus, pitch shift) and EQ programs. Up to four effects can be mixed simultaneously. Other features include MIDI IN/OUT sockets together with realtime MIDI control of parameters, LCD readout and 100 memory locations and 90 factory preset programs. **Alesis, CA, USA. Tel: (213) 467-8000. Fax: (213) 836-9192. UK: Sound Technology, Herts. Tel: 0462 480000. Fax: 0462 480800.**

• **BSS Audio** have introduced the *FDS-310* electronic crossover especially for the American market. The unit can operate as a stereo 2-way crossover or as a mono 3-way with extra full range output. Crossover frequencies are sweepable and each band features 24 dB/octave Linkwitz/Riley filter characteristics, polarity reverse switch, mute switch, level control and signal LEDs. All inputs and outputs are balanced and the unit includes the facility of internal links allowing user configurations for use with constant directivity horns, summed LF output

and sub-woofer output(s). **BSS Audio Ltd, Herts, UK. Tel: 0727 45242. USA: Edge Distribution Corp. Tel: (914) 567-1400.**

• **Crest Audio** have released two new power amplifiers, the *CC300* and *CC301*. Both amplifiers are convection cooled and are designed for studio monitoring and high quality fixed installation applications. Power ratings are 500 W/channel into 4 Ω (FTC) and 1100 W peak with THD less than 0.025% at 500 W into 4 Ω at 1 kHz. Inputs are balanced and the only difference between the two models is that the *CC300* has 20-segment LED displays and the *CC301* has bi-colour active/clip indicators. **Crest Audio, NJ, USA. Tel: (201) 423-1300. Fax: (201) 423-2977.**

• **Milab** have released a new dynamic microphone, the *D-37*. Constructed of solid brass, the microphone features a shock-mounted capsule, frequency response of 50 Hz to 20 kHz with presence boost. **Milab Microphone Laboratories, Billesholm, Sweden. UK: Klark-Teknik Research Ltd, Worcs. Tel: 0562 741515. USA: Klark-Teknik Electronics Inc, NY. Tel: (516) 249-3660. Fax: (516) 420-1863.**

In brief

• The *Gold Line 30M8* is a battery-operated (rechargeable Gel Cell) realtime analyser offering 30 filter bands and eight memories. The unit will accept either microphone or line sources and has three frequency response functions—flat, C-weighting, A-weighting. The display consists of a 300 LED matrix and each column is calibrated in vu-style scaling, ie -20 dB to +3 dB. For measurements using pink noise an external generator such as the *Gold Line PN2* will be required.

The *PBM-1* boundary microphone features a capsule mounted in a solid brass truncated pyramid and features a very even frequency response across the 20 Hz to 20 kHz range and

high SPL handling characteristics (150 dB/SPL). Powering is 12 V phantom. **Gold Line, CT, USA. Tel: (203) 938-2588. Fax: (203) 938-8740.**

• **Dolby Laboratories** have introduced the Model 363 incorporating two channels of switchable A-type noise reduction or *SR Spectral Recording* into a 1U package. Features include electronically-balanced inputs and outputs, easy calibration, input/output monitor switch and local or remote control. **Dolby Laboratories Inc, CA, USA. Tel: (415) 558-0200. Fax: (415) 863-1373. Dolby Laboratories, London, UK. Tel: 01-720 1111. Fax: 01-720 4118.**



The Muse from Audio Automation is an automated digital console for CD mastering and digital editing. Features include 24 to 56 bit realtime processing, full automation of all parameters and digital inputs and outputs (AES/EBU, SDIF-2, RS-232). Input and output levels are adjusted either via optical pots or 'drawn in' on the high resolution colour monitor. The EQ section is 5-band fully parametric with the dynamics section providing control over ratio, threshold, attack and release settings. The Muse can accept sampling rates of 30 Hz to 100 kHz, thus allowing for future developments.

GCG D-10/20/110/ MT-32 editor and manager

Joining the ranks of software synthesiser editor packages for the Atari *ST* is an editor and manager for the Roland *LA* machines from G C Geerdes. The package provides on-screen voice editing for the *D-10/20/110* family and the *MT-32* in a mouse-driven graphic environment, and runs on hi-res mono monitors

only, since it displays large amounts of information at a time. Part of the package is a database with search functions for stored voices and it also includes a 24-track sequencer.

G C Geerdes, Bismarckstrasse 84, 1000 Berlin 12, West Germany. Tel: 030-31 67.79.

PA Decoder voice card volume III

PA Decoder's Memory Card Volume III for the Roland *D50* offers 128 sounds with all secondary functions such as pitch bend and modulation catered for, and uses both sides of the ROM card to provide two banks of sound. This card features a multi-layer technology, and comes with top-quality gold-plated contacts, a sound

contents list, and a 'no-quibble' guarantee.

PA Decoder, Osterseldstrasse 1, D4520, Melle 9, West Germany. Tel: 05429 1853/54. Fax: 05429 1470. UK: Executive Audio, 159 Park Road, Kingston-upon-Thames, Surrey KT2 6BX. Tel: 01-541 0180. Fax: 01-549 2858.

Tascam MTS-30 MIDI/FSK translator

Tascam have just scheduled the release of their new *MTS-30* MIDI/FSK translator, which is designed to synchronise MIDI equipment with multitrack recorders.

This unit offers a more reliable form of MIDI/FSK conversion which includes MIDI song position pointers to allow synchronised playback from any point within a composition.

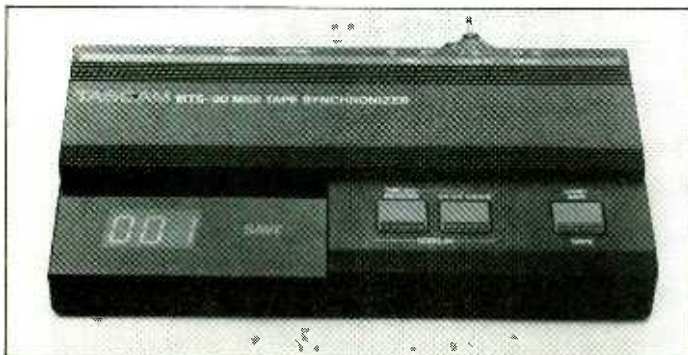
Improvements over the more usual MIDI/FSK converters found in many sequencers and drum machines include powerful error correction circuitry to guard against conversion errors, and a MIDI Out/Thru socket,

which will allow the operator to drive the drum machine while recording the sync tone from sequencer to tape, and to drive both the drum machine and sequencer on playback, without repatching.

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

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

USA: Teac Corp of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303.



Savant Editing Software

Savant Audio have announced the release of their *EDIT-DSS*, a visual editing software program for the Korg *DSS-1* sampler, which runs on Atari *ST* or *Mega* computers with a minimum requirement of 1 Mbyte of RAM installed in the computer. The software will support colour or monochrome displays and uses an intuitive mouse and menu interface, with high-speed graphics routines.

The main features are as follows: The software allows for complete waveform editing—cut, copy, paste, mix, draw, optimise, reverse, compress, invert, crossfade, undo, etc.

The samples may be played back

through the Atari's internal speaker so you can hear the edits immediately.

The complete *DSS-1* system is held in RAM, so that up to 16 multi-sounds, 256 samples and 64 programs are instantly available.

The software allows you to edit all the *DSS-1* parameters, hold two banks of patches in RAM, create libraries of patches, and generate new patches, all on-screen rather than using the tiny *DSS-1* display. Savant Audio, 2140 Bellmore Ave, Bellmore, NY 11710, USA. Tel: (516) 826-6336.

Marion Systems MS-9C

The *MS-9C* is a 16 bit upgrade for the Akai *S900* sampler. It has newly designed circuitry and replaces the audio voice board while still allowing you to use existing 12-bit *S900* sample libraries.

The quality of the input section of the *S900* has been improved using low-noise filters and a 16 bit D/A converter. The output is passed through a 16 bit D/A converter, and again through the low-noise filter to provide an 85 dB signal to noise ratio between the input and the output.

A special data compression technique is used to allow for 16 or 12 bit operation. In 16 bit mode, 16 bit samples from the A/D converter are passed through a digital data compression circuit which converts each sample to 12 bit format. These compressed 12 bit samples can then be stored in the *S900* sample memory or on disk, just like normal samples, with no reduction in available sampling time. When the samples are played back, the data compression circuitry exactly reverses the process, taking 12 bit samples from memory and converting them to true 16 bit

samples for playback.

In the 12 bit mode, the data compression circuitry is disabled. As samples are generated by the A/D converter, the four least significant bits are discarded, and the remainder of the sample is stored in linear 12 bit format. During playback, these new 12 bit samples, or any existing 'old' *S900* 12 bit samples, are put back through the output circuitry as 12 bit samples. In many cases, the manufacturer claims, original 12 bit samples will sound better when played back through the *MS-9C*'s high-quality circuitry.

The default mode following power-up is defined by the positioning of a jumper on the *MS-9C* board. A special floppy disk is supplied with the *MS-9C* to toggle this mode setting in a matter of a few seconds, after the initial installation.

The basic operation of the *S900* is left unchanged, and the upgraded circuitry will be compatible with all versions of the *S900* software.

Synton Electronics BV, Computerweg 1, NL 3606 AV Maarsse, The Netherlands. Tel: 03465 67424.

EMR music software

ElectroMusic Research have just launched their *STUDIO 24 Plus* recording system for the Acorn *Archimedes* computer. EMR call the program "a unique MIDI and internal sound controller".

EMR have also launched *SCOREWRITER* Professional Music Typesetter for the *Archimedes*.

SCOREWRITER PMS is a music publishing system aimed at professional users, and carrying a professional-user price tag. This system works with a Postscript-compatible laser printer.

EMR Ltd, 14 Mount Close, Wickford, Essex SS11 8HG, UK. Tel: 0702 335747.

AKG
ACOUSTICS

ADVANCED MICROPHONE TECHNOLOGY

The C451 preamplifier and CK Series capsules, together form the AKG CMS microphone series, long regarded as the most comprehensive and versatile modular microphone system available.

Many hundreds of CMS Systems are in use worldwide in A/V and recording studios, conference centres, and training establishments. For truly professional sound in every location, the AKG CMS is unsurpassed.



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



Valley DSP dynamic sibilance processor:
removes sibilance while maintaining the full frequency response.

Dynamics processing from Valley. It's so natural, you'll be lucky to hear it.

The Valley 610 dual compressor/expander.
And the Valley DSP dynamic sibilance processor.

Two processors which provide exceptionally precise signal control and creative potential – without the usual trade-off in undesirable extras you don't want to hear.

Both of them from the company that created the original, classic, Kepex noise gate.

The 610 features unique interactive electronics to combine dramatic dynamic range control with complete freedom from 'pumping' effects.

The VCA is our own patented design.
Its Linear Integration Detection system

maintains musically correct dynamics – adding to sonic 'naturalness' with none of the squashed or strained sound most compressor/expanders create in low-level passages.

And with the DSP you can (at last) remove sibilance without colouring the tonal balance. Even in a complete mix.

These are just two examples from the Valley range, which also includes gates, limiters, levellers and parametric EQ.

It's the most natural sounding solution you can find. And naturally, we suggest you audition it immediately.

For more details of these products and the complete range, call Stirling today.



Valley 610 Dual compressor/expander:
dramatic dynamic range control: uniquely natural sound.



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to perform well in a multitude of applications. The A10, A80, A200, and A240 subwoofer come, with mounting facilities for support systems.

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SONY

Broadcast, Recording Studio and
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Sony Broadcast
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European Headquarters:
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United Kingdom

Dear Reader

Re: New analogue multi-track

Sony are proud to announce the introduction of a new 24 track analogue audio tape recorder as a replacement for the JH-24, which over the years has become something of an industry standard.

The new machine, the APR-24, is eminently suitable for recording studios and audio/video post production. It has been designed to meet the widest range of audio recording requirements, in particular the fast and accurate synchronisation of audio with video.

Featuring comprehensive microprocessor control of both transport and audio electronics, along with versatile remote control facilities for ease of use, the APR-24 represents a major step forward in the world of cost effective analogue recording.

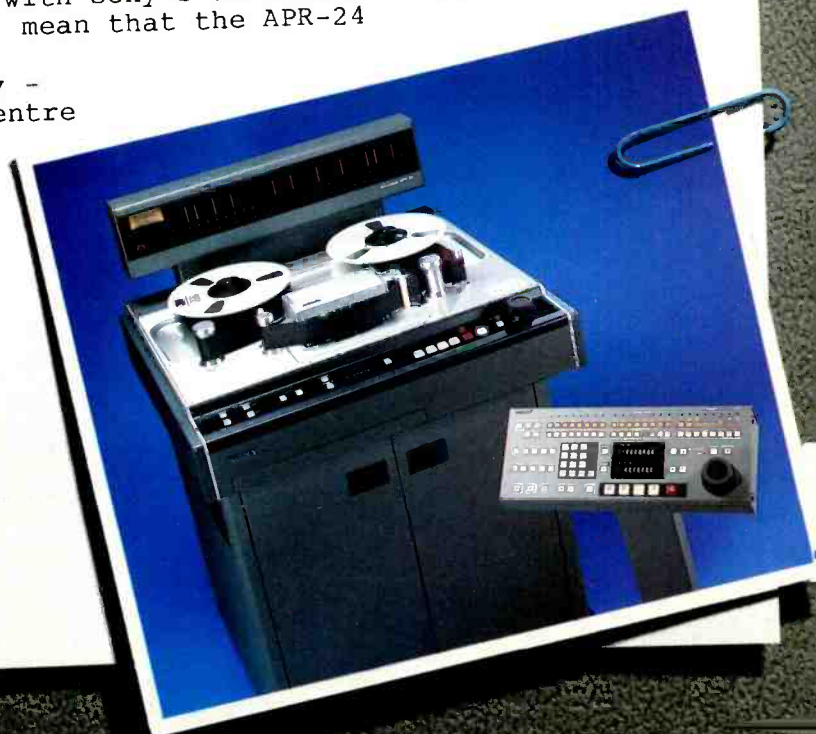
The APR-24 has an internal synchroniser, which being part of the machine's software, gives substantial advantages in terms of cost, space and ease of interconnection for external machine control. It also features a built-in all format timecode generator, giving versatile tape striping without the need for a separate timecode generator. In addition a multi-function metering system is included plus triggered edit synchronisation as an alternative to controlling drop-ins from an external synchroniser or studio computer.

State-of-the-art audio circuits and components ensure superb sound quality and microprocessor assisted alignment provides the user with accurate and repeatable control over machine line-up.

All these features, coupled with Sony's unrivalled reputation for quality and reliability, mean that the APR-24 is the solution to your audio problems. Don't delay - Contact your nearest Sony centre to find out more. You'll not be disappointed.

Sincerely

SONY



For further information contact:

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An improvement on the MTR 90 Mk2? Who on earth could have managed that?



Many an envious glance has been cast in the direction of an MTR-90 Mk.2.

No wonder. With its pinch-rollerless transport, its user-friendly control and its faultless reliability, the MTR-90 Mk.2 has been known as the king of 2-inch multitrack.

But now, it shares its crown with a newcomer. A machine with all its advantages, plus faster wind and rewind, auto alignment on record and repro and frame-accurate mini-locator.

A machine that offers even better audio quality than the MTR-90 Mk.2, but retains all its vital portability.

A machine that even features an optional inboard Dolby* Rack, ready to accept your choice of SR cards or Otari's unique, switchable A/SR combination cards. As well as a host of detail features aimed at helping the skilled engineer to do a better, faster job.

The name of this marvel is the MTR-100A. And if you're still in the dark as to its maker, wonder no more.

Because there's only one machine that can top an Otari. Another Otari.



MTR-100A. The master of masters.

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Otari Electric Co Ltd, 4-29-18 Minami-Ogikubo, Suginami-ku, Tokyo 167. Telephone: (03) 333-9631. Telefax: (03) 331-5802

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Otari Electric Deutschland GmbH, Rudolf Diesel Strasse 12, D-4005 Meerbusch 2, West Germany. Telephone: 010 49/2159/50-861-862 or -863. Telefax: 010 49 2159 1778

AES CONVENTION PREVIEW

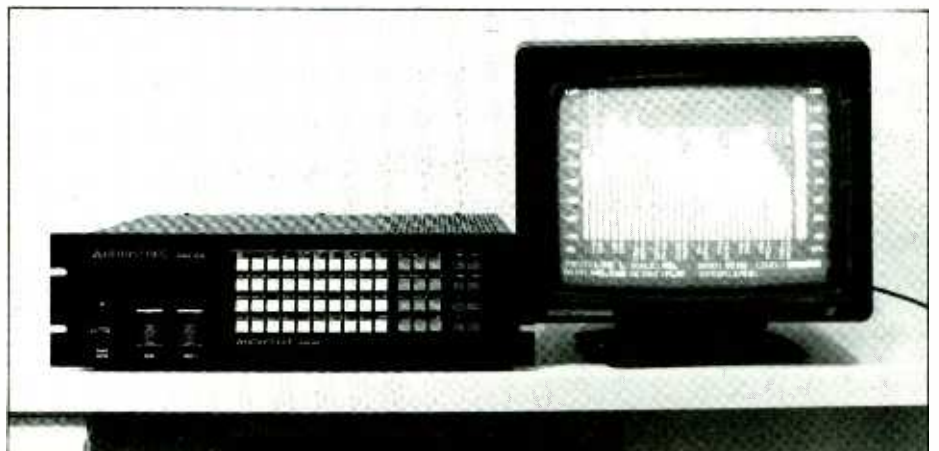
The 86th Convention of the Audio Engineering Society will be held at the Congress Centrum, Am Dammtor, Hamburg, March 7th to 10th, 1989. As usual the Convention will consist of a wide range of technical papers with an associated exhibition. We have compiled this preview from details available to us at the time of writing

A

● **ABAC Rustin:** digitally controlled console with latest system updates. ● **Acoustics Design Group:** details of past and future studio design projects with full information on their services. ● **Adams-Smith:** of synchronising products and software updates. ● **AEG:** range of analogue tape machines from ¼ inch to multitrack, as well as peripheral equipment. ● **AEQ:** range of mixing consoles and ancillary equipment. ● **AGAP:** *Balecan* computerised library system handling DAT and Video 8 cassettes with automatic handling and up to four record/playback machines designed to user requirements; *Datac* computer interface to remote all functions up to eight of Sony *PCM-2500* or *DTC-1000* DAT machines; *SYGAR* automatic management system for radio broadcasting network with software adapted to customer needs; *SUSAN* system allowing simultaneous data broadcasting in analogue programme; and *GAEL* computerised system to manage and broadcast commercial breaks. ● **Agfa-Gevaert:** audio, video and duplicating tape and cassette products. ● **Akai:** the *DR-1200* digital multitrack, the range of digital samplers and other digital processing equipment. ● **AKG:** full range of products including microphones, headphones, reverberation units and signal processing equipment. ● **Allen & Heath:** range of mixing consoles. ● **Alpermann:** range of timecode-related products. ● **Alphaton:** full range of transformers and transformer-based products. ● **Altec Lansing:** as well as the established range of sound reinforcement products Altec will be showing the *9442A* with accessories, the *14712* limiter and a new family of *Mantaray* horns. ● **AMB:** professional audio measurement tools and featuring a new dB meter. ● **Amek:** featured will be the *Mozart* mixing console derived from the *APC1000* using an all-input approach initially available in a 56-input frame with 32 buses and 12 stereo aux sends. An automation system has been developed in conjunction with Steinberg but others may be used. Also the *APC1000*, *G2520*, *Classic*, and the *BCII* with *ESM32* serial interface. ● **Ampetronic:** two new products: the *ILD4* induction loop amplifier driving up to 4 A into a loop covering up to 100 m²; and the *Powertrac* MOSFET power amplifier offering 600 W/channel from a 2U rack. ● **Ampex:** a full line of professional audio tape products including *456 Grand Master*, *467* digital open reel and cassettes, *478* low print mastering tape for broadcasting and the new *472* series of studio mastering cassettes.

In commemoration of Ampex's 30th audio tape anniversary there will be a historical display and a live demonstration on a vintage Ampex *351* tape machine of a 30-year-old Billie Holiday recording. ● **Amptown:** no information available. ● **AMS/Calrec:** demonstrating Version 8 software for the *AudioFile* providing major operational enhancements, the *Logic 1* digital audio mixer with *AudioFile*, the range of digitally controlled assignable consoles, the *UA8000* music recording console, and the range of microphones relaunched with updated design. Also the existing range of signal processing products. ● **Analog Digital Synergy:** an operational version of the Synergy One in-line digital console with full four band EQ, filters, headroom indicator etc with full automation and reset. ● **Anchor/ROH:** new products include the *Phantom Hailer*, the *Ensign* and the new *Liberty* system. ● **ANT:** full range of pro audio products with featured new products including the *telcom c4 AC27* compander card for fitting in the audio card slot of a Sony *BVH 2000/2500* VTR; the *PETRA* cluster design programme, which avoids the distortions of spherical mapping using a globe; and the *Soundwich* loudspeaker—a new loudspeaker design method that varies the thickness of the diaphragm with improved performance. Other products will include the *TRS 800* custom mixing consoles with VCA faders, the *telmos 900* PA system, PA loudspeaker series *L950/L955* and the *telcom c4* noise reduction system in all versions. ● **Apex:** range of audio cassette labelling and printing systems for use in duplication facilities. ● **Aphex:** four new products

including the *Type III* version of the *Aural Exciter*; the *Feel Factory* algorithmic feel composer; the *Studio Clock*, a SMPTE to MIDI converter with the ability to map tempo changes from human drummer, keyboard player or complete mix; and the *Impulse* 12-input analogue-to-MIDI trigger system for percussion. ● **Applied Research & Technology:** full range of signal processors including a device that is claimed to have twice the capacity of the *MultiVerb*. ● **ARX Systems:** sound reinforcement systems including speakers, power amplifiers and signal processors. ● **ASL:** intercom systems, interfaces and accessories. ● **ATB:** details of their audio and video cassette components for the duplicating industry. ● **Asona:** range of duplicating equipment and accessories including winders and slave units. ● **Audio Design:** the *SoundMaestro* digital recording and editing system coupled with the *Level Mode-Defier*, which is fully dithered digital fader for EBU lines; the *Pro-Box* digital toolbox providing format conversion—SP/EBU, EBU/SP and CD to EBU/SP; an EBU to *F1* converter; the *ScampMaestro* budget digital editor running on a standard Atari *ST* computer providing a stereo editing system; the *PRO-DAT* range of modified DAT machines; the *F601* Superdynamic transmitter limiter and the *Compex 2*. Audio Design will also be showing signal processing products from SPL. ● **Audio Developments:** portable mixers, portable processors and a digitally based editing system. ● **Audio Digital:** range of audio delay lines. ● **Audio Export:** no information available. ● **Audio Kinetics:** featured will be the *ES Penta*—an ESbus controller/autolocator capable of controlling up to five machines with ESbus synchronisers. Also featured will be the *ES 1.11* ESbus synchroniser, the *ES Eclipse 16* machine ESbus controller and the *ES SSU* system services unit. Other products include *Wiper* for visual cues in AD; *Pacer* and *Pacer Pad 2*, *Striper*, *Gearbox*, *MasterMix* and the *Q.Lock*. ● **Audio Precision:** first showing of the DSP capability of *System One* in production form with capabilities such as high resolution spectrum analysis, individual harmonic measurement, waveform display on the PC screen and the digital I/O allows measurements in the digital domain. Also the full line of *System One* testing products. ● **Audio Technica:** microphones, radio mics and microphone accessories. ● **Audiomatic:** Concept Design products including the *DAAD* solid state duplication master. ● **Audiomatica:** computerised systems for the control of audio including a mix system and a parametric EQ system. ● **Audiopak:** no information available. ● **Audioscope:** the model *9000* modular audio

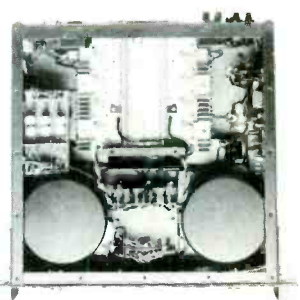


Audioscope 9000 modular audio measurement set

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POWER OUTPUT	10Hz–20KHz < 0.1% THD	@ 1KHz 1% THD	MAX.
8 Ω Stereo	325W + 325W	340W + 340W	600W + 600W
4 Ω Stereo	550W + 550W	600W + 600W	950W + 950W
2 Ω Stereo	750W + 750W	900W + 900W	1,500W + 1,500W
8 Ω Mono	925W	1,000W	1,220W
4 Ω Mono	1,150W	1,300W	2,000W

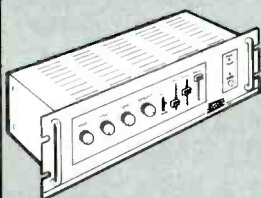


Interior view of A.80 showing extra large toroidal transformers

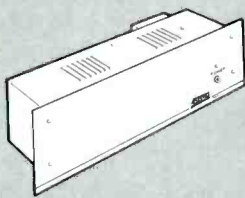
HUM & NOISE LEVEL: Better than 106dB below full rated output, A weighted.

POWER BANDWIDTH: 20Hz–50KHz. ± 1 dB @ 1W to full rated output power.

SIZE & WEIGHT: 19" x 16½" x 5¾". 75 lbs. TRADE PRICE: £608.00 (+ V.A.T.).

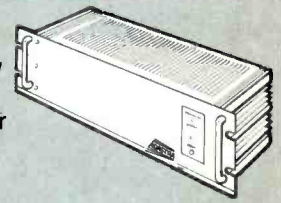
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MODELS A.84 and A.85
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THE ADVANTAGES OF A STUDIO CONDENSER WITHOUT A SOUND OF ITS OWN



For all of its virtues, the typical studio condenser imparts a definite character to any recording. These impositions are often considered inevitable technical imperfections: accepted, ignored or tolerated by audio engineers.

Characteristic anomalies of condenser performance such as exaggerated high end response or distortion have even been rationalized as compensation for the high frequency losses inherent in typical analog formats. Nowadays, however, they are increasingly viewed as unnecessary intrusions in critical analog and digital recording situations.

A Condenser For The Digital Era: The Difference is Nothing. The increased dynamic range of digital recording is perfectly complemented by the self-effacing nature of the MC 740. The microphone is virtually inaudible. No coloration, no self-noise — no sonic footprint, not even a fingerprint. All

five of its pickup patterns are equally uniform, identically transparent. We feel your prior experience with large diaphragm condensers will confirm this as a unique achievement.

An Atypical Approach To Condenser Sound. Beyer has never relied on conventional technical solutions. A manifestation of this kind of thinking, the MC 740 eliminates the icy, strident quality typical of most condensers to reproduce voices and instruments with warmth and intimacy. It's no coincidence that these are characteristics often ascribed to our ribbon microphones.

The MC 740's freedom from exaggerated sibilance or graininess and its greatly reduced distortion are immediately apparent to critical listeners. European and American engineers have already commented on the startling accuracy of the 740, and the way it reveals the subtle differences between instru-

ments and ambient environments.

Accuracy And Versatility Without Compromise. Uniform (< 2 dB: from actual machine specs, not just published specs) frequency response curves for all five polar patterns may seem a remarkable breakthrough. To Beyer, this is simply a design criterion for the microphone. Similarly, there is no contradiction in the fact that the 740 is exceptionally sensitive, yet also withstands extreme SPLs (up to 144 dB with the 10 dB attenuator in circuit).

Hear What You Could Be Missing. The MC 740's unconventional design offers a clear alternative. The best way to evaluate the difference the MC 740 can make is to work with it in your studio. To arrange a hands-on audition of this remarkable new audio instrument, contact your Beyer dealer or write us: beyerdynamic, Ltd., Unit 14, Cliffe Industrial Estate Lewes, Sussex BN85JL

ACCURACY IN AUDIO

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Estemac TMC torque meter

measurement set which uses a video monitor to display 1/3-octave spectrum analyser, pink/white noise generator, ppm/vu audio levels up to 96 channels and automation level indicator.

● **Audiotronics:** broadcast and broadcast production consoles. ● **Audix:** new products include a digital adaptive telephone hybrid using digital signal processing techniques, the new Radio Continuity Consoles, a working version of the AAT audio console with multitracking facilities incorporated and a range of rackmounting amplifier modules.

B

● **BASF:** professional audio and video tapes, cassettes, and calibration test tapes. ● **Bel Marketing:** noise reduction and signal processing products. ● **Beyer Dynamic:** new products include *SEH 186* wireless mic with the antenna integrated into the mic shaft, and the *TS 109* pocket transmitter; the *SHM 10* condenser gooseneck mic; a MOSFET power amplifier rated at 350 W/channel into 4 ohms; and a 12-channel mobile wireless system. ● **BGW Systems:** power amplifiers including the latest version of the *750* series. ● **BNS:** studio monitor systems including active systems. ● **Bose:** sound contracting and small scale live sound products. ● **Brahler:** wide range of conferencing products. ● **Broadcast Electronics:** range of broadcast products including on-air console and cart machines. ● **Bruel & Kjaer Instrumentation:** audio test and measurement equipment. ● **Bruel & Kjaer Pro Audio:** series *4000* microphones together with the most recent addition, the *4011* cardioid pattern mic, plus stereo microphone sets and accessories for the *4000* series. There will also be a preview of a new binaural head and torso recording system designed for studio and live performance applications. ● **BSS Audio:** frequency dividers *MCS200* and *FDS360*, the *DPR402* compressor/de-esser, the *DPR502* MIDI controllable noise gate, and the *AR* series of DI boxes, lead and phase checkers. New for the show will be the *AR416*, a 4-channel 1U rackmount mains powered DI box and the *DPR504* 4-channel noise gate based on the *DPR502*. ● **Burr-Brown:** IC sets including digital converters.

C

● **Cadac:** examples from the range of mixing console systems. ● **Cambridge:** no information available. ● **Camco:** power amplifier products. ● **Canford Audio:** new products include several heavy duty polyurethane jacketed cables, new studio clock systems, journalist's cassette

machine, *SoundTech* mixing consoles, the *CA944* broadcast turntables, the full range of *TecPro* intercom systems and many small studio accessories. ● **C Audio:** launching the *RA* series of MOSFET power amplifiers. There are three models ranging from 250 to 625 W/channel into 4 Ω. Within a 2U rack format. Also new will be the *MA400* 400 W mono power amplifier, which features five multifunction input channels, balanced low or high impedance, with separate gains, 2-band EQ, effects send and delay send with a built-in digital delay. ● **Cetec-Gauss:** series *2400* high-speed cassette duplicating system the new *2480* combined master and loopbin that operates at up to 480 in/s will be featured. New line of test equipment series *1100* consisting of a composite generator and tape system analyser used for duplicating system alignment and QC testing. ● **Cetec-Vega:** no information available.

● **Clarity:** enhanced *XLV* effects interface to enable full automation of Lexicon *224XL* and *480L* and the *AMS rmx.16* digital reverberation systems. The new software automates all of page and machine changes available in the *LARC* controller in addition to existing automation of fader moves. Clarity will also demonstrate new software for the *rmx.16* digital reverber.

● **Clearcom:** wide range of intercom systems.

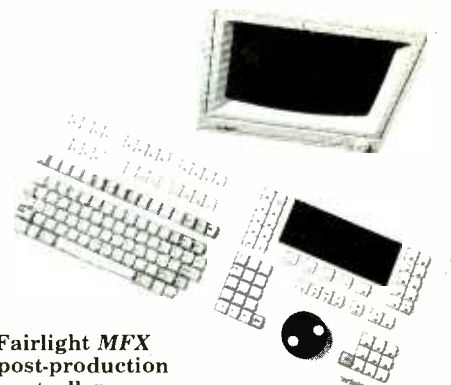
● **Community:** range of speaker systems and drive units for live sound applications.

● **Connectronics:** cable reels and patchbays, stagelink systems and assemblies. ● **Crest:** introducing models *6001* and *4801*, additions to the *Professional* series which are electrically identical to the *7001* and the *8001* but less powerful. Common features include IGM impedance sensing, auto ramp signal control and RMS slip limiting. Both units are fully modular.

● **Crown:** introducing a stereo recording microphone system known as *SASS*, Stereo Ambient Sampling System. Two versions will be shown—one using B&K mics in a boundary configuration and the other using *PZMs*. A major part of the booth will be dedicated to information and demonstrations of this system. ● **CST Manufacturing:** products for cassette tape duplication including printers and labellers.

D

● **DAS Audio:** no information available. ● **D&B:** sound reinforcement systems with full electronic control systems. ● **dbx:** showing the full range of *dbx* products. Featured will be the latest additions for the *RTA* system and the digital 18-20 bit converters. ● **DDA:** full line of mixing consoles and crossover systems. Featured will be the *DCM 232* console fitted with the new *VCA* fader automation and the *CAT* switch automation; and the *AMR 24* console. Also on show will be the new theatre/live sound console with eight *VCA* and auto mute subgroups; and the *Q*, *S* and *D* series of consoles. ● **DIC:** no information available. ● **DOD:** Audio Logic *SC 131* room equaliser, the *SC610* mixer and the *R1D1* room delay. From *DigiTech* will be shown the *DSPS-128* plus digital effects unit and the *IPS-33* intelligent pitch transposer. ● **Digital Audio Research:** for the first time at a European AES *DAR* will be demonstrating the *SoundStation II* with full 8-channel operation and the optical disk backup subsystem. The optical disk provides high speed backup of audio data and edit decisions to 800 Mbyte ISO standard *WORM* disks. ● **Digital Audio Technologies:** will be showing the *Stellavox* range of tape machines and featuring the enhanced *TD88*. ● **Digitec:** equipment for the



Fairlight MFX post-production controller

digital studio—the *DS-C 16* AES/EBU converter, the *DS-M 16*×16 switching matrix and the *DSP* digital audio processing unit. Analogue products include mixers, tape machines, amplifiers and a computer controlled audio switching system based on the *TRESOR* local area network. ● **Dolby:** products for music recording, film and TV post-production, cassette duplication and transmission systems. ● **Dorrough:** audio processors for AM, FM stereo, shortwave and TV sound applications. A new model, the *610-B*, will be introduced. Also LED meters for audio level control that display average and peak simultaneously on the same scale. Also new will be the stereo Signal Test Set Model *1200* offering the ability to measure stereo programme levels in L/R and sum/diff formats.

● **Drake Electronics:** new digital distribution equipment based on the AES/EBU format and including A/D and D/A converters. Also a new analogue range of audio distribution amps using the same Euro card format as the digital range.

● **Drawer:** the full range of signal processors. Featured products will include the *M500* dynamics processor with its multiple processing capability and two new products—the *DF320* universal noise filter which is a single-ended noise reduction system using a programme dependent noise filter with an auto attack expander, and the *LA12* distribution amplifier which is a low noise high bandwidth design offering one stereo inputs and 12 stereo outputs having been developed specifically for realtime cassette duplication.

● **D&R:** range of mixing consoles and signal processing equipment. ● **Dwight Cavendish:** no information received. ● **Dynaudio:** free standing speaker systems.

E

● **EAA:** high powered amplifiers and portable mixers. ● **EAW:** live sound speaker systems featuring the new *KF300* and *KF600*. ● **Eela Audio:** broadcast mixers and ancillary equipment. ● **Electro Sound:** showing the *8000* series cassette duplications systems. ● **Electro-Voice:** products from their wide range of loudspeaker units, microphones, monitors and signal processors. ● **Elektro Akustik:** no information available. ● **EMT:** Multioutput-Mix system *MMC* which is the latest version of the *EMT* modular mixing console system using *VCA* control; the *EMT 632* Multilevel meter offering 32-channel display, 1/3-octave realtime analyser and a *DC* multichannel display together with a range of new plug-in functions. ● **Estemac:** featuring two new products, the *TMC* torque meter for audio cassettes which allows the measurement of

friction within any size audio cassette; and the *DOC 110/1* dropout counter which is a 19 inch rackmount unit developed for video tape applications but apparently finding use in the evaluation of tape used for digital audio recording. ● **Estudios Gema**: no information available. ● **Eventide**: full range of sound processing products featuring the *H3000* and *H3000B UltraHarmonizers*.

F

● **Fairlight**: alternating audio demonstrations of the traditional Fairlight *Series III* with the CAPS 80-track polyphonic sequencer; and the post-production capabilities of the system using the *MFX* controller. Both will feature the *Waveform Supervisor* system management computer and the features it allows—8-track recording on a single 360 Mbyte hard disk and the use of an 800 Mbyte WORM disk for voice/FX library storage and programme archiving. ● **Ferrograph**: main exhibit will be the *9500* digital random access recorder/reproducer. Recordings are stored on magnetic disk cartridges which can hold up to 18 mins of stereo audio. Operation is from front panel of via a *Macintosh* computer running dedicated editing software. Also on show will be the *9000* optical recorder, the Ferrograph range of analogue tape machines, the *RTS2* and *ATU1* audio test measuring system and the Ferrograph range of defluxers. ● **Fidelipac**: demonstrations of the complete line of broadcast studio products including the Dynamax *CTR100*, *CTR10* and *CTR30* series cartridge recorders and players, *ESD10* eraser/splicer detector, Dynamax *Cobalt*, *Master Cart*, *300* and *350* NAB tape cartridge racks, test tapes and accessories. ● **FM Acoustics**: featured will be the range of *Forceline* high-energy transfer cables for use between amplifier and speaker. Designed specifically as speaker cables they have very low resistance and high power handling capability. Also the *FM* range of power amplifiers, electronic crossovers and line level interface. ● **Focusrite**: on show for the first time is the *ISA131* dynamics processor module which is a dual channel version of the *ISA130* with the same specifications. The full range of existing *ISA110* and *ISA115* input signal amplifiers, the remote controlled mic preamp *ISA116* and the *ISA* dynamics processor will also be shown. Channel strips from the *Forté* series on consoles will be displayed. ● **For.A**: *Sirius-100* digital audio memory designed for radio station applications. Capable of up to eight channels of audio from up to eight hard disk drives and possible use of recording time extension with bandwidth reduction in speech recording mode. Up to eight user stations on the same system possible. ● **Fostex**: examples from the full range of Fostex products. Featured will be the new professional DAT machine with timecode synchronisation ability. ● **France Cables**: no information available. ● **Full Sail**: details of the Full Sail Center for the Recording Arts including the specialist and general training courses offered.

G

● **Genelec**: full range of active studio monitoring systems from compact biamped nearfield to the large main control room monitor *1035*. ● **Ghielmetti**: matrix programming equipment for routing/switching audio and video signals. ● **Giese**: range of synchronisation and timecode equipment. ● **Gorgy Timing**: timing and display

clocks. ● **Gotham**: professional audio cables featuring the new *GAC-2* 2-conductor cable with double layer Reussen shielding and PVC tube separating conductors and the shields. ● **Graff**: featured will be the *Crystal* high-speed copier in mono and stereo with 8x or 16x normal speed options, and the heavy duty bulk eraser. Also the *Diamond* in updated form and other established Graff products. ● **GTC**: featured will be *Edicom II*, a new ADR system succeeding the *Edicom* but based on a completely new technology and incorporates a simple user interface. Offers graphic representation of a take, prompting by means of wipe bars, A/B mode with two VTRs for fast take sequencing and control of one or more synchronised ATRs for ready to mix sound recordings. Also the *Digiton*, a hard disk recording system with special workstation for ADR, and *CARL* which is a remote control for the Quantec *QRS/XL* audio processor.

H

● **Harmonia Mundi**: digital interface and processing module. ● **Harrison Systems**: *SeriesTen* totally automated console system with the new *Macintosh II*-based hard disk automation system; the new *AP-100* broadcast console series in both tabletop and rackmount versions, the new *MR-20* in-line multitrack recording console with GML moving fader automation, the *TV-4* stereo broadcast console, the *AIR-790* on-air broadcast console and the *PRO-790* broadcast console series. ● **Haufe**: no information available. ● **Head Acoustics**: the new *Aachen Head* with ID equalisation (independent of direction) which makes speaker/binaural compatible recordings. The system consists of a head and shoulder simulation and electronics unit. ● **Heino Ilsemann**: labelling, sorting, packaging and foil wrapping machines for audio cassettes, packaging and foil wrapping machines for video cassettes and packaging machines and handling systems for compact discs. ● **HES**: the *Engineering* series of modules which includes full range of modules for broadcast applications allowing the building of a complete studio system in a 19 inch 3U rack. ● **Heyna**: range of duplication equipment. ● **HHB Hire & Sales**: DAT machines from Sony and Technics with modified versions for specialised applications, digital multitracks from Sony and Akai, a selection of Sony Broadcast video equipment, the Audio Kinetics EBus system, and also wide range of signal processing, microphones, monitors and peripheral products. ● **HH Electronic**: range of power amplifiers with power outputs from 50 to 1200 W. Shown for the first time will be the *TA* series of professional loudspeakers which initially comprises the *TA2* full frequency system in a 2-way compact enclosure, the *TA3* full frequency 4-way system; the *TAS1* compact sub bass unit that can be used to extend *TA* series response below 40 Hz, and the *CI* system controller that performs frequency response alignment, crossover and limiter functions for the *TA* series. ● **Hill Audio**: first European showing of the *LC* series of power amplifiers comprising four models from 200 to 800 W/channel with variable speed fan and new protection circuitry in 2U format. Also the expanded range of modular consoles, the *Remix* console and the '000' range of power amplifiers. ● **Hilton Sound**: details of their Europe-wide hire services with offices in London and Paris. On show will be the PDASH digital format conversion system. Hilton has recently added two Sony *PCM-3348* multitracks, two Mitsubishi *X880*

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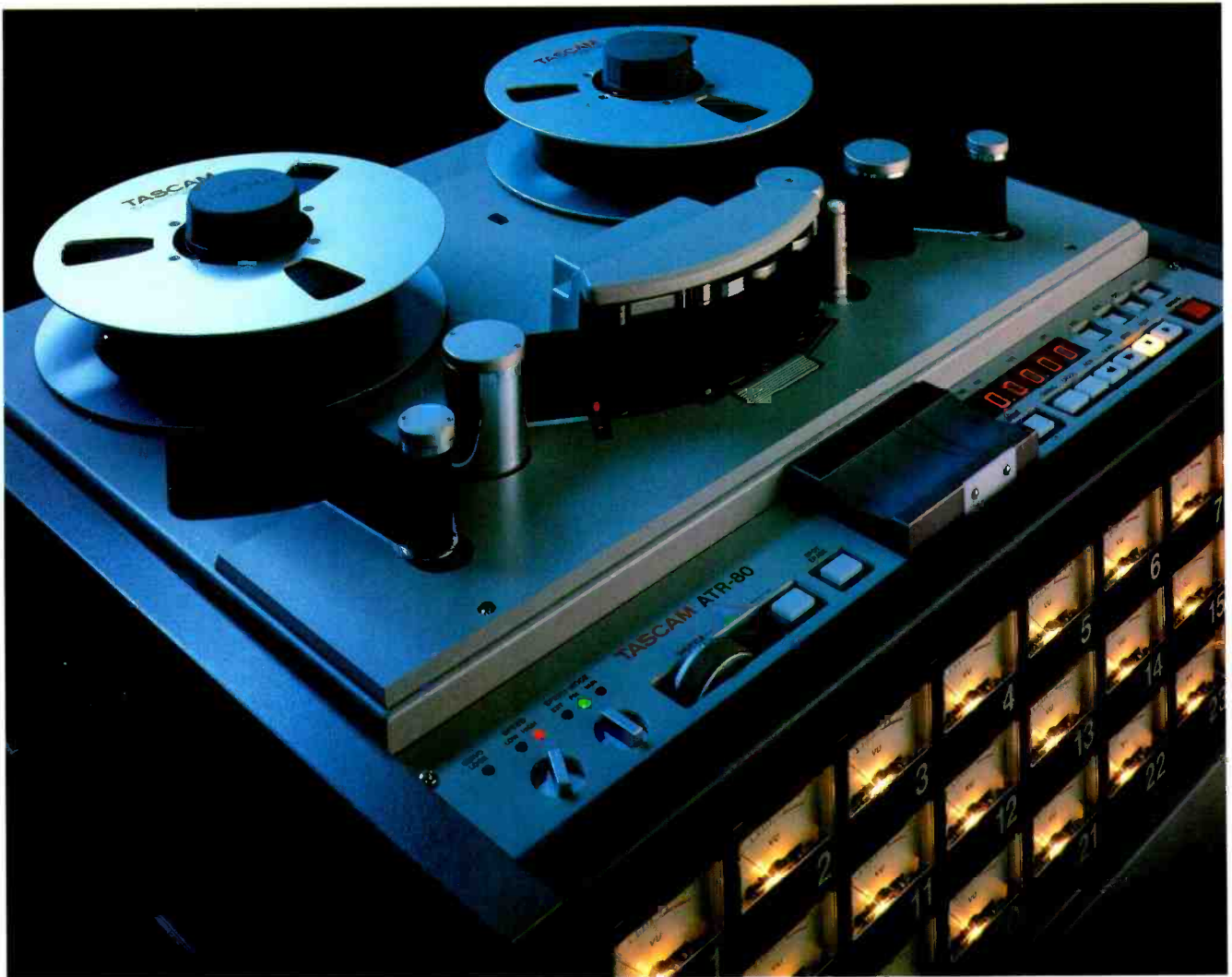
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You may think you know which 24 track recorder gives you the most advanced technology and design. However, you're probably in for a surprise.

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The ATR-80 is an engineer's dream. It has features that make track-laying and mastering faster and easier than it's ever been in a 2-inch 24 track format.

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

multitracks and a further *AudioFile* to their hire stock. ● **HME:** 700 series of cabled intercom products including the *RP733* 2-channel power station, *BH720* single-channel belt pac and the *BH721* dual channel belt pac with the first European showing of the *RP743* 4-channel power station, the *RP753* 4-channel matrix power station, and the *RP735/RP755* which add headset-free operation. Also series 50 wireless mic system.

I

● **ICM:** C-0 shells including coloured and transparent sonic welded, screwed coloured and transparent, and standard or transparent library cases. Also details of CD production capabilities. ● **ITC:** broadcast cartridge systems. ● **Ivo Lola Ribar:** products include the *LA 1300* mixing console for 8-track broadcast production, music recording and sound reinforcement with solid construction, mono or stereo input modules and choice of vu or ppm metering. Also the *LA 1100* series console, power amplifiers *LA 2210* MkII and *LA2111A* MkII, distribution amplifier system *LA 2700*, graphic equaliser *LA 3201*, active monitor *LA 6602*, warning system amplifier *LA 4900*, PA speakers *LA 6700* and a range of installation components.

J

● **Jackson Music:** details of their second hand equipment and sales services. ● **JBL/UREI:** new *Sound Power* series of loudspeaker systems and electronic racks designed for temporary and permanent installation. Also on view will be the *2450* lightweight Neodymium compression driver and the newest members of the *JBL Control* series the *Control 12SR* and *Control 10*, as well as white and grey variants on the *Control 1* and *5*. For cinema applications the Lucasfilm *THX Monitor 3714 Panel* and the *JBL* bi-radial horn-mounting assemblies will be featured. ● **Jellinghaus:** computer-controlled automation systems.

K

● **Keith Monks:** wide range of ancillary products. ● **King:** showing an R-DAT cassette loader and a

fully automated audio cassette loader. ● **Kintek:** range of stereo converters. ● **Klark-Teknik:** series 300 range of graphic equalisers, the *DN60* realtime spectrum analyser, the series 700 digital delay lines with the new *DN726* stereo broadcast delay, *DN773* broadcast profanity delay and the *DN775* disc cutting delay, the *DN780* digital reverberation system, series 400 parametric equalisers and the new series 500 dynamic processors. Klark Acoustic's *Jade* active monitors and the new *Jade 2* high powered nearfield monitors. From Midas will be shown the latest *XL2* auditorium console. ● **Klein+Hummel:** self-powered monitors, equaliser products and a headphone amplifier. ● **Klotz:** studio/broadcast cables including multicores, loudspeaker, microphone and single screen cables, as well as selection of their interface products. ● **Koch:** CD production equipment.

L

● **Lawo:** broadcast mixing console products. ● **Lexicon:** *Opus* random access digital audio workstation, the model *2400*, the *480L* digital effects system with *Version 3.00* new software, which includes digital stereo parametric equaliser, enhanced sampling and MIDI control, etc; the *PCM-70*, *LXP-1* multi effects processing module and the *MRC* MIDI remote module. ● **Lyrec:** full product range including the *TR-533* analogue multitrack recorder now with the *Dolby HX Pro* options; the new *P-4409* duplication system master running at 480 in/s with three preset speed ratios and newly developed loopbin with increased capacity; and a new version of the *FRED* portable editing deck for handling tape wound oxide out.

M

● **MBI:** broadcast mixers and ancillary equipment will be on display along with details of MBI services for design, installation and commissioning of complete radio studio products. ● **Media Touch Systems:** broadcast production products. ● **Meyer:** sound reinforcement systems and studio monitors. ● **Milab:** will feature two new mics: the *BM-75* is a condenser design with switchable 10 and 20 dB pads plus highpass filter with applications principally for stage use. The

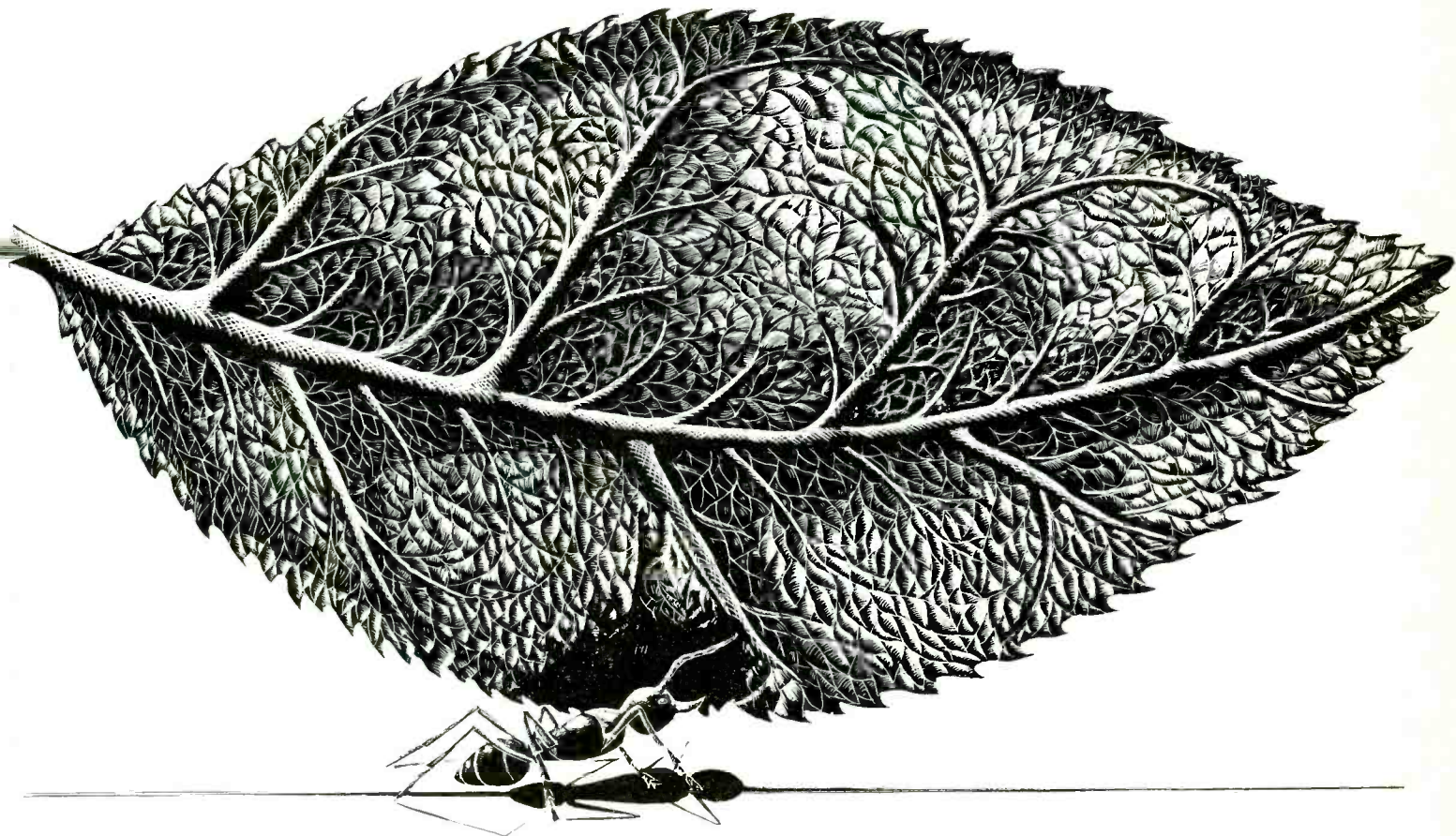
D-37 is a dynamic mic with an 'open and broad sound' quality, a solid brass body and soft capsule suspension. ● **Minim:** range of presenters' clocks, studio clock systems and Ambisonic decoding equipment. ● **Mitsubishi:** new will be the *X-880* 32-track digital multitrack and the *CS-1* chase synchroniser. The *X-880* is fully compatible with the *X-850* but greater use of LSI's allows it to be smaller and lighter, as well as easier to operate and service. Other products will include the *X-86HS* and *X-86C* 2-track recorders, *X-E2* digital editor, *X-850*, *X-400* and *X-86*, and the *Westar* range of consoles. ● **Mondial:** featured will be the editing tape machine *5001 ME* design for replay and ease of editing with internal speaker and amplifier for external speakers. Also the new *5002 ME* broadcast tape machine design for high quality applications. ● **Mosses & Mitchell:** jack patchfield systems and jack plugs. ● **Music Produktiv:** no information available. ● **Musicbox:** C-0 shells, library cases, boxes and blank cassette tapes.

N

● **NTP:** featured will be the series 525 digital communication switcher featuring 24 kHz sampling frequency and 12-bit resolution. Also ppm meters, compressor/limiters, telephone hybrids and special purpose instruments. ● **Nagra Kudelski:** portable professional audio and video tape recorders. The new version of the *Nagra T-Audio*, the *TA.3 TCR* will be demonstrated. It features a new keyboard with numeric keypad with Sony and Ampex protocol enabling it to communicate with most editing systems via its RS422 port. ● **Neumann:** studio condenser mics including the long and short shotguns, the new stereo shotgun and the newly developed *KM 100* miniature condenser mic system. In the area of mixing consoles the *N 20* and *N 40* series as well as automated microprocessor controlled systems for faders, EQ and mic amps and the new *N 5000* series for storage of dynamic and static console information. Also the range of lacquer and DMM cutting systems. ● **Neutrik:** audio connectors featuring the new *Pro Fi* which has a spring mechanism allowing earth-before-signal contact; the *Audiograph 3300* modular measuring system with the first showing of the *3317* bargraph module which is used with the input module *3312* as an analogue meter to display measurement results; the new *Infomatic Systems* modular digital sound recorder product line acquired from Kinovox; the audio transmission test set *TT402* with the new *TS02* software package; and the launch of the audio test system *A1*. This is a standalone test instrument based on the technology incorporated in the *3337* analyser module from the *Audiograph* system. ● **Neve:** featured will be a completely new moving fader automation system known as *Flying Faders*. Developed in co-operation with Martinsound Technologies, the system includes expanded 12-bit resolution to provide a total of 4096 digital steps and features including a total mix memory of all moves—not just the last pass, hard disk storage and 3.5 inch floppy drive. The system will be shown incorporated into the latest version of the *V* series console. Also on show will be the *66* series of broadcast consoles. ● **New England Digital:** digital audio workstations and *Direct-To-Disk* hard disk recording system in all its various versions. ● **Nexo:** featured will be the *SI1000* and *SI2000* integrated systems which have evolved from the *SI* system; and the *SI TD* controller which adds realtime control of voice coil



Milab range of microphones



POWERFUL DOESN'T ALWAYS MEAN BIG

The leafcutter ant perfectly demonstrates the design philosophy behind Carver amplifiers—to pack the most power into the lightest, smallest package. The latest addition to the range weighs in at only 10lbs with an output of 465 Watts RMS per channel into 8 ohms. Tested – and proven – on some of the biggest and toughest tours ever to go on the road, 108 Carver units were used by Clair Brothers

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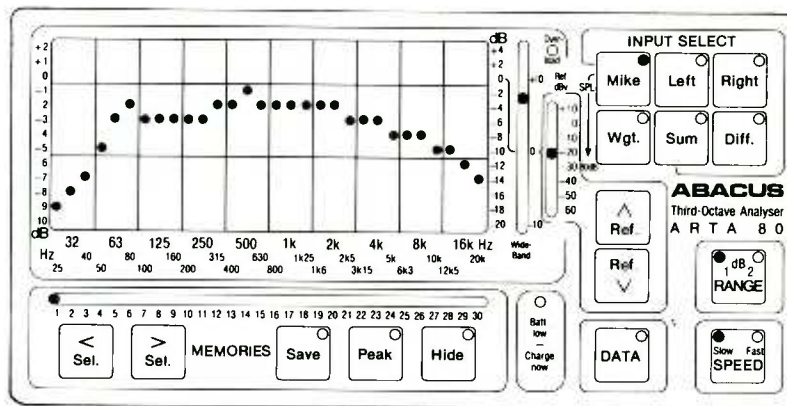
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For exacting engineers, a precise instrument, the **ARTA 80** third-octave audio analyser.

- Incorporates precision pink-noise generator.
- Ultra-bright LEDs for clear display and battery power saving.
- Thirty non-volatile memories. View any memory simultaneously with "live" display.
- RS232 serial port for down-loading memory data to a personal computer.



Battery portable – size 24 x 16 x 8 cms. weighs only 1.5 kg.

Microphone plus two line inputs.

Parallel printer port for plotting spectrum graphs directly on dot-matrix printers.

12dB or 24dB display range, fast or slow response.

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SONY 701....

A small retrofit board for the Sony PCM 701 digital recorder, giving a digital output conforming to the AES/EBU/SPDIF standard. The kit allows transfers to the Sony 2500, 2800 and other R-DAT machines to be kept in the digital domain. Fitting can be undertaken in less than an hour by anyone competent with a soldering iron. A version for the PCM F1, which leaves the battery compartment free will soon be available. **Price £195.95**

MIDI ANALYST....

The Midi Analyst is a data analyser, test and filter set for MIDI. Arranged as a 1U rackmount, self-powered unit, it will monitor ALL types of MIDI data in either interpreted mode (Note ON G4 Velocity 64 Channel 1) or as raw data in HEX or Decimal base. The unit includes a Midi Time Code reader, MIDI clock tempo analyser, a set of filters with channel solo/mute function to allow troublesome data to be removed from the stream, and a memory buffer to review data for step-time output. The Analyst is essential for MIDI based studios, live set-ups, R&D departments, and for education. **Price £299.00**

AKAI S1000....

A rack-mount hard disc addition for the Akai S1000 sampler giving direct access to up to 80 Meg. Also a removable hard disc system using 42 Meg cartridges. Each hard disc includes an 8 Meg original Sample library prepared by Tom McLaughlin.

Yamaha C1....

The new Yamaha lap-top computer features a fast 80286 processor with 20 Meg Hard disc as standard, full IBM PC compatibility, with the additions of Timecode IN and OUT, 2 x MIDI IN, and 8 independent MIDI OUT ports. **Voyetra's Sequencer Plus MKIII** (ver 2.0) makes this the most convenient and powerful computer based MIDI sequencing system available.

Computer
MUSIC Systems

6 Manor Road, Teddington, Middx. TW11 8BG. Tel: 01 977 4546. Fax: 01 943 1545

temperature and cone displacement while improving system response. An area of the booth will be used to demonstrate Nexa CAAD software—a PC-based program allowing 3D modelling of speaker placement effects.

O

- **Optical Disc Corp:** optical disc mastering products.
- **Optical Disc Mastering:** company produces mastering equipment based on photo-resist process, which, together with related equipment, allows users to make glass masters for *LaserVision* and all CD applications. Various masters will be shown with information on the mastering sequence. Also the CD-ROM data formatter *LHH 3200* will be featured, which allows mastering facilities to format incoming user data to the specified standard for CD-ROM.
- **Optifile:** retrofit console automation system.
- **Orban:** new products include the *9105A OptiMod-HF* audio processing system designed for international shortwave broadcast with 3 to 4 dB more loudness than *Optimod-AM*; and the *764B* programmable parametric equaliser/notch filter, a stereo unit capable of storing 99 full sets of control settings for instant recall. Also full range of broadcast and studio processing products on display.
- **Otari:** featured will be the *DTR900-B* 32-track PD format digital multitrack. The *B* is a development of the earlier model with extensive use of VLSI technology. Existing products on show include *MTR-90/II*, *MX-80*, *MX-70*, *BTR-5*, *MX-55T*, *MX-50*, *MX5050 MkIII/8*, *TMD* display, *T-320* and *T-650*.

P

- **Pacific Recorders:** no information available.
- **Pastega:** no information available.
- **Pearl:** microphones for studio, stage, broadcast, TV, film and installation. Featured will be the stereo condenser mics *MS 2* and *MS 8* which are transformerless with internal MS matrix in *MS 2* mic. New for the AES is the *CC 30* cardioid transformerless rectangular double membrane condenser mic designed for studio application.
- **Penny & Giles:** controllers using conductive plastic tracks and precious metal wipers. Featured will be the new motorised rotary fader based on the *RFII* series rotary pots. System has wide range of customer options including touch sensing ability and special laws. Also Mosses and Mitchell range of jack sockets and jackfields.
- **Prefer:** no information available.
- **Pro Bel:** new products include high quality 18 and 20-bit DAC converters to AES/EBU specification, 10-output AES/EBU distribution amplifier, 64x64 analogue audio routing switcher and *TDM* digital audio router with optional audio fader module. Also on display will be the established Pro-Bel products.
- **ProSound News:** pro-audio news magazine.
- **Productiv Sound Hire:** no information available.
- **Publison:** signal processing systems featuring the *IM90* with latest hardware and software updates.
- **Pyral:** range of magnetic tape products.

Q

- **Quad Electroacoustics:** power amplifiers and electrostatic speakers suitable for classical monitoring.
- **Quantec:** signal processing systems.

R

- **Raindirk:** featured will be the *Symphony* multitrack recording console.
- **Rane:** wide range of analogue signal processing systems.
- **R Barth:** signal processing devices.
- **RCF:** introducing several new drive units including the *L6L380* laboratory series carbon fibre, the *L10CX1A* 10 inch coaxial system, the *L15P801* professional series speaker, the *L15L600* laboratory series high power speaker, *L18P751* high efficiency 18 inch and the *N482* laboratory series compression driver.
- **Real World Research:** *Audio Tablet* random access audio editor designed for use in a variety of professional audio applications including dialogue and music editing, CD and 12 inch mastering. A 2-channel system encoding audio in 16-bit format at 48, 44.1 or 32 kHz with a capacity of up to seven hours of stereo. Based around a pressure sensitive screen.
- **RE Instruments:** examples from their range of test and measurement equipment including the *RE201* dual-channel audio analyser, the *RE108* synthesised signal generator, the *RE501* programmable stereo generator and the *RE530* RDS generator. From their broadcast range will be the *RE531* RDS coder and the *RE521* FM stereo coder which will be shown for the first time.
- **Rood:** new stereo encoder model *SC 2000* built around a specially designed ASIC and improved specification over the existing models.

Also bandwidth extenders, stereo decoders line of SCA receivers.

- **RTS:** new will be the *BP325* programmable intercom user station and the *2528* dual-channel remote control mic preamp. Featured will be the *BP317* portable single-channel headset user station, the *848A* 24x24 programmable matrix intercom station and the *DC848* data concentrator for the *848A* intercom system. Other products on display will include the series *800* intercom and the *TW* intercom system.
- **RTW:** new ppm model *1119* with integrated phase meter and designed for panel mounting; the new programme time model *1195* which records programme time data under manual control or by modulation with take listings being output to an external printer; and a 24-channel remote metering system for the Sony *PCM-3324* known as the *1190 DMS*; and the portable location mixer *MkIV* manufactured by NP-Electroakustik of Denmark with four input channels, MS matrix, phase correlation meter, limiters, phantom power, etc.

S

- **SAJE:** mixing console products. Featured will be the *Memory* digitally controlled analogue console with most recent software enhancements.
- **Saki:** line of long life ferrite heads for Ampex, MCI, Otari, Scully, Sony and Studer.
- **Samson:** wireless mic systems. Featured will be the *Stage*

GREAT NOW-MAKE



IDEA IT-WORK

The Summit Audio concept of hybrid signal processors was developed out of the demand from recording engineers and producers for original vacuum tube based equipment of more than a decade ago and has been put to work in a range of five products.

Refreshingly uncomplicated to operate, the Summit range offers the best sonic attributes of tube technology together with solid state dependability.

Contact Autograph Sales for information on the complete range of Summit Audio signal processors and discover how to make the idea work in your studio.



EQP-100
Mono Tube Equaliser

TLA-100A
Tube Compressor Limiter

TPA-200
Tube Microphone Pre-Amplifier

Also available but not shown, the *EQP-200* Dual Tube Equaliser and the new *WI-200* Warm Interface.



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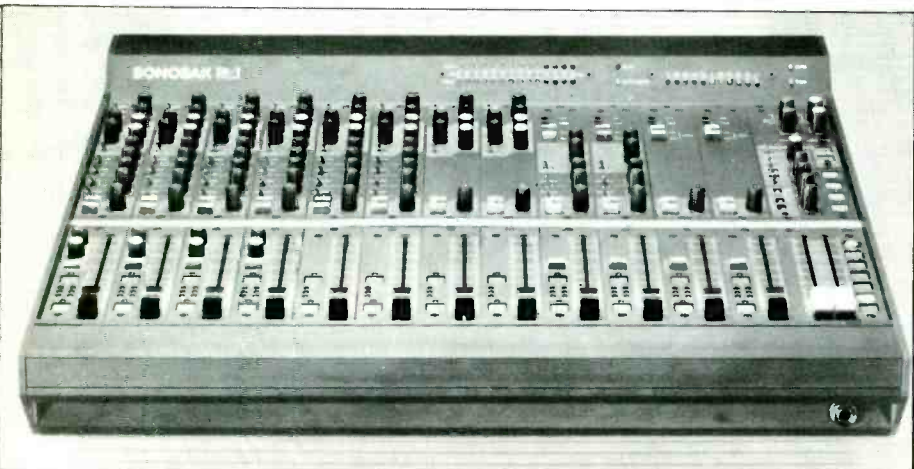
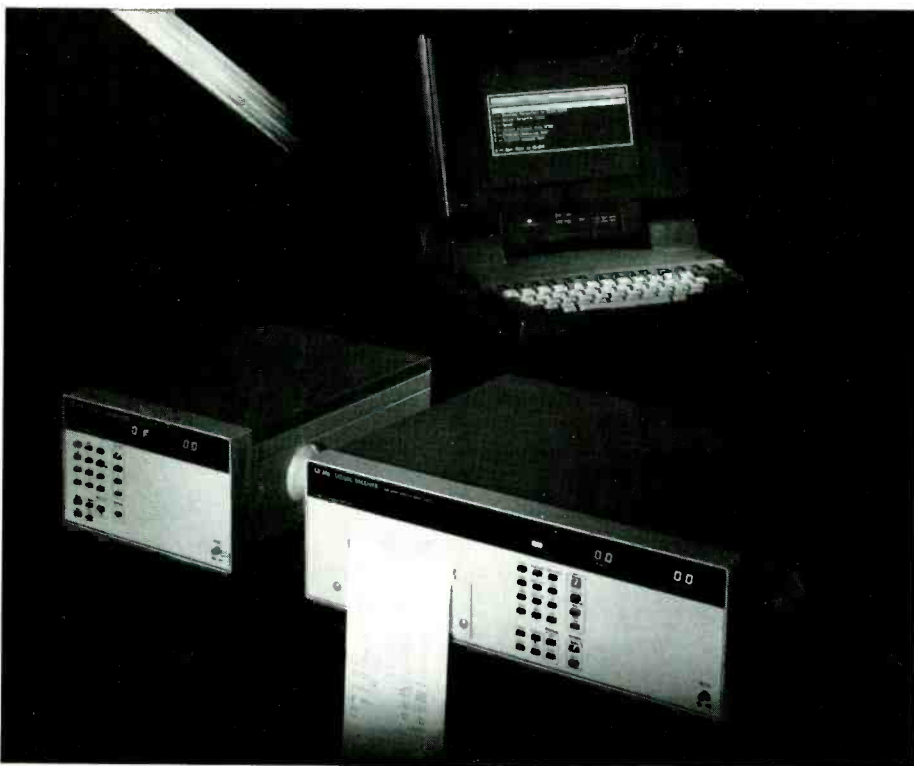


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(Above) Sanken CU-44X. (Below) Schmid SiatNet test system

22 true diversity wireless mic system from the Stage series. ● **Sanken**: first European AES showing of the CU-44X and CMS-9 mics. The CU-44X is a transformerless version of the CU-41 dual capsule design with low noise and high SPL. The CMS-9 is a cardioid pattern stereo mic designed for use with a handgrip in portable use. ● **Saturn Research**: featured will be the Saturn 824 analogue multitrack with autoalignment and features including noise reduction interface, a tape management panel, a new meter bridge and a parallel interface. ● **Schmid**: a revolutionary test system that measures the transmission parameter of broadcast networks automatically. SiatNet measures, evaluates and records all transmission parameters of monophonic and stereophonic networks automatically. All aspects of the system are controlled by one central PC. ● **Schoeps**: microphones for recording applications. ● **SCV**: signal processing equipment and interfacing accessories. ● **Seem**: new will be the VE-503-21, a microprocessor-controlled programme selector designed to expand the input capabilities of audio consoles where the number of sources has exceeded the inputs available. Also the new VCA input modules for the SEESAM 2 audio mixer, and the Studio Clock System which



Sonosax SX-T

consists of a master unit and one or more slave units with a numeric keypad for each unit. ● **Sellmark**: range of console faders. ● **Sennheiser**: condenser, pre-polarised condenser and dynamic microphones, wireless mic systems for any number of channels, headphones, infra-red systems and portable mixing consoles. ● **Sescom**: accessory and interconnection boxes. Featured will be the Rack Signal Processing line containing 15 separate processors. ● **Shure**: several new mics including the Beta series—dynamic models designed for vocal and instrumental applications. The new SM99 miniature gooseneck condenser with supercardioid pattern will be shown. Live display of the full line of mics for user sound checks as well as the Automatic Microphone System, the Wireless Microphone System, the teleconferencing system and the BC series of broadcast phono cartridges. ● **Siemens**: broadcast audio products. ● **Sonifex**: selection of broadcast NAB cartridge machines and featuring four new products: the Micro HS X series stereo broadcast machines with digital timer, noise reduction, headphone monitoring etc; a new NAB cartridge known as the Sapphire which offers full compatibility with existing carts but with improved specs; an automatic telephone balance unit HY02 available as a free-standing or rackmount; and the Micro DS, an FSK data system for storage and retrieval of information each time a cartridge is played. ● **Sonosax**: featured will be the SX-PR, a portable mixer available with 2, 4 or 6 inputs and designed for ENG/EFP work. Also new is the SX-V portable mixer for TV and video applications and the capability of handling up to 10 inputs, with established products SX-S and the SX-T on display. ● **Sony**: PCM-3348 48-track digital multitrack, APR-24 analogue multitrack, MXP-3056 56-channel version of the XMP-3000 series, SDP-1000 signal processing station, TC-D10 pro portable DAT machine with a new mic, ECM-M55, for portable stereo use, plus software enhancements for existing systems. ● **Sound Engineer**: sound recording magazine. ● **Soundcraft**: the launch of the 3200 32-bus multitrack recording console in a split configuration with 36 inputs and a range of innovative facilities and features. Other products will include the series 6000 recording console, TS12, in-line console, series 8000 sound reinforcement console, series 200 BVE with VSA 24 serial interface and the SAC 200 on-air console. ● **Soundtracs**: a selection of products including the ERIC production console offered with three levels of automation; the ILA36 with Tracmix VCA fader automation; and two new consoles to be launched at the AES: a new PA console aimed at sophisticated installations and rental companies; and the FM broadcast console intended as an 'on air' console for community and local radio use. ● **SSL**: featured will be the ScreenSound digital audio editing, mixing and recording system for video and film post-production, and for audio for video applications. ScreenSound interfaces with VTRs and film reproducers for off-line editing. Also the SL 4000 G, SL 5000 M series consoles, the 01 digital production centre, and the range of SSL dedicated control computers. ● **Stage Accompany**: monitor and speaker for stage and studio with automated control and procession systems. ● **Stanton Magnetics**: featured will be the 890AL DJ Pro record cartridge with a suspension system designed for back cueing and scratch mixing; and the 500AL-MP and 690EL-MP which are matched pairs of disco application cartridges so two turntables can be fully matched. ● **Stax**: high

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Westec LT3020 console

quality headphone products. ● **Steenbeck**: film-related audio products. ● **Steinberg**: latest computer-related audio products. Featured will be the *Topaz* hard disk recording/editing system.

● **STK**: no information available. ● **Strand Magnetics**: audio and video cassette products. ● **Struieven**: low cost automation system. ● **Studer**: first European showing of the A827 analogue multitrack based on the A820 transport but at a lower cost. In the digital area will be the *DE4003* digital audio editor. Also 990 series of mixers, A729 CD Systems Controller, 3-way active studio monitor A723 and a professional FM monitor tuner A764 with RDS decoder. ● **Studio Equipment Distribution**: Court *Signature* series of monitors comprising three acoustically compatible systems from 2-way passive to bi-amped 2-way, passive 2-way. Also on show will be the *Stand Easy* range of studio furniture. ● **Studio**: studio news magazine. ● **Sunkyoung**: audio duplicating cassette tapes including *UCR* pure chrome, *SKX* super ferric and *SH* standard ferric. ● **Switchcraft**: examples from the very wide range of interconnection products. ● **Syrinx**: digitally controlled mixing system.

T

● **TAC**: first showing of the *Bullet* compact format console housed in a free-standing chassis

with the ability to rackmount. Basic configuration is 10/4/2 with 4-band EQ, mic/line inputs, phase reverse and phantom power, etc. *Matchless* with *JMS C Mix* PC fader and mute automation, *Scorpion* and *SR9000* live sound console. ● **TAM**: disc cutting supplies. ● **Tannoy**: featured will be the new nearfield monitor *NFM-8* using a new 8 inch dual concentric drive unit. Also *TPI* reference A/V monitor, and *Super Gold* series of monitors including the *SGM10B*, *LGM*, *SGM 12X*, *SGM 1000*, *SGM 3000*, *FSM* and *FSMu*. ● **Tape Automation**: tape duplicating equipment including master transports, slaves and loaders. ● **Tapematic**: audio and video loading equipment featuring a new video loader with a conveyor system; *SAM* (Static Audio Master) for high-speed 128:1 audio duplication and slaves, and a production/service data control system. ● **Tascam**: first European showing of the *DA-800-24* DASH digital 24-track and the *CD-701/RC-701* compact disc system with one controller and four players. Also featured will be the *M-700* 40-channel inline console together with the *ATR-80-24* analogue 24-track, *ATR-80-32* analogue 32-track, *ES-50/51* synchroniser and controller, *MTS-1000* SMPTE to MIDI synchroniser, *DA-50* DAT recorder, *ATR-60-16* 16-track analogue machine with built-in dbx, *ATR-60-2* 2-track with centre track timecode, and a selection of pro cassette machines and low cost mixing consoles. ● **TC Electronic**: signal processing equipment. ● **TFT**: solid state



Total Audio Concepts
Bullet console

microwave link products. ● **3M**: wide range of magnetic media products and details of optical mastering services. ● **360 Systems**: signal processing products. ● **THT**: no information received. ● **Timeline**: the *Lynx* timecode synchroniser modules and the new system controller. ● **Toa**: Wide range of products from mics to speaker systems. ● **Trident Audio**: entire line of multitrack, production and post-production consoles. New products include the series *80E* 48-track routing and monitoring multitrack recording console; the newly restyled *Di-An* digitally controlled analogue console running under *AUTOmate II* giving automated dynamic control of all console parameters with PSS, D-Link and D-Copy features, and the updated versions of the *16* and *24* small studio consoles. ● **Turbosound**: the *TXD* series has been added to the range of enclosures designed for wide dispersion from a small cabinet with the use of specially designed transducers. The *TMW* series of floor monitors has been extended with the *TMW-210* comprising two 10 inch units with a HF driver in a small cabinet. The new *TSE-112* comprises a 10 inch TurboMid device with a V-2 HF unit.

V

● **Valley International**: signal processing equipment. ● **Vector Marketing**: sound reinforcement products from Renkus-Heinz.

W

● **Wellard Research**: introducing a 200 m powered co-axial monitor, and for the first time an electronic product, a domestic/professional interface. Also the *Middle Monitor* range of active studio monitoring systems. ● **Westec**: a new console, the *LT3020* with full second fader automation, hard disk data storage now 40 Mbytes, electronic track display on each channel, optional 2.4 second 16-bit digital delay on each channel which will enable later versions to have sampling capability on each channel, a new bargraph system designed in conjunction with RTW and expanded aux section. ● **WH Brady**: adhesive and splicing tapes for magnetic tape recording and applications. ● **Windmill Munro Design**: details of past and present studio projects together with their range of studio monitor systems. ● **Woelke**: professional audio heads and test equipment.

Y/Z

● **Yamaha**: full range of signal processors, mixers, amplifiers, speakers and microphones. ● **Zonal**: the full range of magnetic tape and film products. New is the *830* series broadcast tape designed to meet European Broadcast standards and features improved distortion, noise and HF characteristics. Also new is a range of voice logging cassette tapes.

Studio Sound will be based on stand 3-98 where we will be exhibiting copies of the latest issue together with our sister publications *One to One* and *Broadcast Systems Engineering*. Editorial and advertising staff will be in attendance at the stand or around the convention and we look forward to meeting anyone who wishes to drop by.

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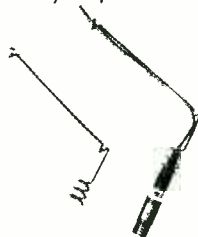


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SATURN MULTITRACK

Patrick Stapley gives an operational report
on the 24-track Saturn tape machine

Saturn Research has been an independent company since August 1988. It was formed as a result of the management buy-out of Soundcraft Magnetics and is currently concerned with the continuing manufacture and development of the *Saturn* multitrack.

The machine has created considerable interest since it first appeared in the latter part of 1986, and has proved a prime contender in the top end of the analogue market, successfully shaking off the 'cheap and cheerful' label that was associated with earlier Soundcraft machines.

The *Saturn* being manufactured at the moment is identical to the Soundcraft machine although features originally considered options, like auto-alignment, the meter overbridge and the deck tape management panel, are now standard.

The *Saturn* offers a comprehensive array of microprocessor-controlled operational facilities, which are all accessible from the remote console. The *Total Remote*, as it is appropriately called, consists of two panels that can be angled individually to suit the user. Broadly speaking the remote is split into four operational areas: at the top are 24 vu meters which follow monitor switching, below this is the tape management section controlling parameters such as speed, equalisation curve, alignment, etc, and contains a 16-character LCD displaying menus, parameters, etc. Next is the track monitoring matrix and record ready selectors, and from here down the remote is taken up with transport related controls and displays. All the keys are of the sealed membrane type incorporating LEDs and produce a satisfying touch contact.

The great advantage of having this degree of remote control is that once the machine has been laced up it can be forgotten about, and chores like alignment are reduced to a few button presses from the comfort of one's chair, rather than the normal tedious performance with a screwdriver.

The tape management section has switching for 7½, 15 and 30 in/s and selection here will automatically set the previously selected EQ curve. Each of the nine combinations of speed and EQ have a full alignment memory, and some of the more unlikely combinations, for example 30 NAB, can be used as stores for different fluxivity levels, say +6 rather than +4. Tape alignment on the replay/sync side is carried out by selecting a parameter (gain, LF, HF) and adjusting it using the Up/Down keys, which replace conventional trim pots. This can be done on individual channels or all 24 can be adjusted at once.

The record side can also be lined up manually

but the auto-align system will complete a full 24-track, 5-parameter alignment in approximately 10 minutes. This is achieved with the help of an internal 112-frequency oscillator with a range of 31 Hz to 31 kHz, which, at the end of an auto-align run, will continually sweep over its range providing the user with a useful visual check.

Auto alignment can be performed on any tracks that are switched to ready, and with individual parameters. In addition to the nine alignment memories mentioned, there are a further four memories per combination for different record setups, enabling instant alignment between different tapes. Existing alignments are protected from inadvertent alteration by a lock out feature, which disables associated keys until a special key sequence is entered.

The monitoring matrix provides individual or total switching between replay, sync and line. It also offers a solo facility whereby all the tracks mute apart from those selected. Record/ready switches have green and red LEDs and there is a Recall key that returns all tracks to safe. When in fast wind/rewind the monitoring is automatically muted but if one wishes to hear the tape spooling for cue purposes, it can be reinstated using the Mute Defeat key. Any setup on the matrix can be stored in one of four monitor memories allowing, for example, a setup of record ready buttons to be recalled.

The transport keys are large and well-illuminated when active; record can be either a single or double key operation depending on user preference, and spooling speeds can be changed from the factory setting of 300 in/s to a whole range of speeds up to a maximum 600 in/s, using the Varispool facility. Varispeed is provided with a ±50% range, and is displayed as in/s in the tape management display. The RTZ key (Return To Zero) will do just that when pressed once, a double press causes the machine to locate to the point where the tape last went into play. A 10-position autolocator is supplied with cycling and offset facilities, it also includes a key labelled Until, which instructs the machine to play up to a location point and then stop. There are two digital readouts one associated with the tape position and the other with the autolocator; a local zero point can be introduced to aid location without losing the true tape position. The *Saturn* will be supplied very shortly with its own timecode reader/generator and both displays are currently equipped to show frames.

An interesting facility is the inclusion of three programmable function keys. These can each hold up to 32 key presses from functions connected

with the autolocator, transport controls and the monitor/record section: so a sequence could be programmed to play the tape to a certain locate position, drop a selection of tracks into record, continue through to another locate point, drop out and wind back ready to repeat the sequence. This is a simple example when you consider that the three function keys can be linked together to memorise over 90 key presses.

Other features include Reverse Play, which puts the tape into an accurate backwards play speed, with cycling and varispeed capabilities. Timing Defeat, which produces a much quicker drop in response but at the expense of ramped 'gapless' drop-ins; drop-outs remain unaffected. As the tape comes to the end in fast wind/rewind it will stop within a few turns of the end, or it will slow down and spool off slowly if the wind/rewind key has been pressed twice.

The machine itself has a sturdy uncluttered appearance with pleasing simple lines. Special attention has been given to internal access, with doors back and front and a lifting deck. Inside, the various cards and parts are all easily accessible, and the use of modular design in a number of cases has made the job of maintenance a much simpler one. The deck will accommodate spools up to 14 inches but because of the COLT system (Calculated Open Loop Tension) both spools must be the same size. COLT constantly recalculates the tape position by means of information received from spool and tape motion sensors; this is then used by the CPU to control the high torque bi-directional motors giving exact tension requirements and maximum efficiency. The system requires no physical braking and even in the event of a power failure will produce a controlled stop.

The deck has been angled to facilitate tape loading and the tape path is guided entirely by rollers. Headblocks can be exchanged to convert the machine into a 16-track; in this event a PCB within the headblock passes information to the microprocessor, automatically altering parameters to suit 16-track operation.

Audio in/out's are via a choice of ELCO multicores or *XLR*s; various interfaces are available for connection to noise reduction, synchronisers, consoles, etc, and a special mini remote is presently under development that will offer basic functions and be suited for use in situations like mobile recording where space is at a premium. □

Saturn Research Ltd, Unit 3a, 6-24 Southgate Road, London N1 3JJ, UK.

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Main studio control room

Hong Kong is a bewildering bedlam of high technology and the symbols of Western capitalist society confusingly contrasting with extreme poverty. This hectic gateway to the East conceals beneath its glittering romantic veneer a lifestyle of severe hardship and values that are a curious mixture of East and West. Although undeniably Chinese in origin, the Hong Kongese are an established British colony demonstrating a unique blend of oriental Englishness.

Until 1978 no self-respecting overseas record company had considered coming within a mile of the place; after all it was virtually an open invitation to throw money down the piracy drain. Once this had been curbed the way was paved for international companies to bring their music to the Hong Kong market. WEA and CBS/Sony were among those to move in. A

known to be a certain amount of pirate product finding its way from there into mainland China.)

Once the CBS/Sony plant was up and running there followed the design and installation of recording studios and disc cutting facilities in the company's new offices in central Kowloon. This took place during the early 1980s and was a mammoth project. Anyone who has visited Hong Kong more than once will know that buildings go up and down at an alarming rate. What seemed to be relatively new buildings a year ago have been torn down and replaced with even bigger and more startling ones. The structure of the Acme building in Nanking Street, where CBS/Sony had set up their operation, proved insufficient to take the loads of the necessary floating floors. The building, erected in 1981, first had to be reinforced and since the studios required 2-storey height (6 m) the third floor had to be removed.

Considering the diminutive size of the market, the company pay an astonishingly high rent for its five storeys. Nothing in Hong Kong is at as high a premium as space. It therefore has to be paid for dearly to the tune of HK\$1m per annum (approx £71,500). It doesn't take much imagination to realise how cut-throat the studio market is. Unfortunately this has had a similar effect to that witnessed in London in recent years. There are approximately 10 24-track recording studios in Hong Kong and although demand is greater than supply, competition has brought studio rates down to an all time low. CBS/Sony operate at an amazing HK\$400/hour—less than £30.

This of course curtails investment in new technology and facilities. Not surprising then is the total absence of digital multitrack machines. Hong Kong does not have a single one, nor is likely to be getting any either. On the other hand the Sony 1610 is popular as a mastering machine.

The studios are built to a Tom Hidley design, the implementation of which was supervised by the Takana Company of Japan, the ergonomics regulated by engineers from the parent company. Such close ties with CBS/Sony Japan have been very beneficial throughout the growth of the Hong Kong operation. With all new technology, the ability to import not only a lot of second hand equipment from the studios in Japan, but also the knowledge and expertise that competing Hong Kongese companies could learn only by trial and error have proved invaluable.

On the second floor there is a recording studio and a mixing suite with an additional shared isolation room, which has tielines to both control rooms. The studio was the first to be completed back in 1983, this was followed by the arrival of

CBS/SONY

Janet Angus reports from the hustle and bustle of Hong Kong

joint venture company was set up between CBS/Sony Japan and the already well-established Fook Yuen distribution company (which continues to operate today). During the course of the next decade record sales increased twentyfold. CBS/Sony have seen their monthly turnover spiral up from HK\$50,000 (approx £3,600) per month to a much more respectable HK\$5m and then HK\$10m, and it continues to grow. Fook Yuen and CBS/Sony share managing director Peter Chiu, the former company now being responsible for handling all Sony hardware and software in Hong Kong.

In addition to the record marketing operation, the new company set up a fully fledged record pressing plant and high speed cassette duplication facility catering for the Hong Kong/Kowloon market as well as to some extent the Portuguese colony of Macau. (Macau has its problems, however, as there is

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◁ second hand disc cutting equipment from Japan which was temporarily set up in what is now the mix suite in '84. In '86 a custom cutting suite was constructed on the fifth floor and the mixing facilities were finally installed in the freed area on the second floor. The arrival of local disc cutting was significant as prior to that tapes had to be sent to Japan for cutting. Today there is still only one competitor, record company Panasia; CBS/Sony claim an impressive 75% to 80% of the business.

The two second floor control rooms are by Tom Hidley, the cutting room by studio manager Joe Chu on similar lines. They are typical Hidley rooms from the late '70s featuring a preponderance of wood, rock, velvet curtains and brown fabric. There is a seating area at the back of the room with machine recesses on either side. Behind the wood and fabric wall finishes are a combination of baffles and traps while the rear ceiling section is bass trapped. The only real differences between the second floor rooms is size. Largest is the recording studio at 43 m² (approx 460 yd²); the mix room is slightly smaller. Upstairs, although visually very similar, the cutting room is considerably different as it is crammed into one storey height (3 m).

Monitoring throughout is by TAD speakers, with Auratones for nearfield listening. Mixing consoles are Sony/MCI 600 series with Sony/MCI JH24 24-track and JH10 plus Studer A820 2-track (with Dolby) tape machines. For digital mastering there are Sony 1610s.

There is plenty of outboard in both rooms including Roland SDE2400 and SDE3000 delays; Audio+Design Panscan; Sony MU-R201 digital reverb; Aphex Compellor and Aural Exciter; Orban sibilance controller; four Valley People Kepex II; Inovonics 201 limiters; UREI compressor; AMS rmx.16 and dmx.1580; Sony DRE2000 reverb; Quantec QRS room simulator; Korg DRV2000; Klark-Teknik spectrum analyser. In addition to all this the studio control room also has an Akai MIDI patchbay, S1000 stereo digital sampler; Boss CE300 Super Chorus; Roland D-550 linear synth, DDR-30 digital drums and

MKS-100 digital sampler; Sony MU-R201 digital reverb; UREI compressor/limiter and an E-mu SP-12. MIDI-based instruments caught on in a big way two or three years ago but are not so popular now. There are also 24 tracks of Dolby A available.

The recording area is a fair size at 61 m² (approx 660 yd²) and features the traditional Hidley piano, drum and iso booths; velvet curtains, mirrors and wooden floor. In the middle of the room there is a structural pillar that had to be incorporated. This has been clad in rope, which effectively isolates it from interfering with the room's sound. An economical solution, which actually looks quite attractive.

Adjacent to the control room is the shared iso room, which is approximately 6 m² (65 yd²). All the recording areas are linked to both control rooms by video cameras and tielines. Adjoining the mix room is a small overdub booth of about 7½ m² (approx 81 yd²) with acoustics variable by implementing curtains and carpets as required.

In spite of competition the studios are working virtually round the clock with bookings registered many weeks and even months in advance. A lot of non-CBS projects come in specifically for mixing, representing 40% of the work.

Considering the size and unique nature of the market these studios serve, the facilities are of a surprisingly high standard. The obvious reason for this is their close association with parent company CBS/Sony Japan. The corporate policy of pursuing quality is no less prevalent here than in any other country. Professionally run, these studios are regularly maintained and are prepared to stick to their guns over rates in order to continue to do so. The same goes for record pressing and tape duplication where although slightly more expensive than the competition, quality always comes first. In fact, CBS/Sony is an unusually sane haven in what must be one of the most chaotic cities in the world.

CBS/Sony Hong Kong Ltd, 4th Floor, Acme Building, 22-28 Nanking Street, Yaumati, Kowloon, Hong Kong. Tel: 3-7714391. Fax: 3-7803152.

The market

The most apparent and obvious way in which Hong Kong shares similarities with the West is its world renowned shopping centre offering goods—genuine and imitation—from all the top designer names. Indeed many travellers' only experience of Hong Kong is the never-ending Nathan Road on Kowloon with its clothes and jewellery, and Stanley Market on Hong Kong Island where you can buy almost anything under the sun for a few pounds, or even pence.

The fact that the majority of Hong Kongese consumers can count a television as well as hi-fi equipment, personal stereos and, increasingly, compact disc players among their Western chattels belies the living conditions under which most of them exist—situations that would be intolerable to the average European or American. A cursory glance into China will immediately explain why these living conditions are not only tolerated but appreciated as really rather good. The Chinese Hong Kong community is made up of those who escaped from Communist mainland China in the years prior to the 1950s. These people and their descendants have grown to value, very highly, Western society and its associated culture that exists side by side with their native own.

The music industry here has been very much lead by the US and UK. In fact, as recently as 10 years ago the market was totally dominated by overseas product; any local artists sang in English. It was only 10 years ago that their first Cantonese album was released, marking the birth of an industry that is booming today. More than 90% of this local market is for Chinese pop, although there is still some traditional Chinese opera and classical Chinese music. The majority of the record buying public is predictably the 15 to 25-year-old age group so presumably pop music will continue to dominate.

Although the population figure currently stands at approximately 6 million, with the 1997 reversion to Communist rule now on the horizon, the people are emigrating in droves—some 50 to 60,000 a month. They didn't risk their lives escaping only to be handed back again a few decades on. Similarly it is a very rash overseas company that is prepared to invest in new projects at this stage. Nobody is quite sure how much trust to place in the Communists' pledge to retain the territory as it is for the next 50 years; after all they have no experience of governing an essentially Western society. This unique city therefore finds itself in a 'Catch 22' situation. Once the epitome of swiftly changing society, Hong Kong has reached an impasse and lies waiting in the balance.

Nevertheless the 6 million who remain are crammed into an incredible

1,000 km² (approx 386 miles²) including the sparsely populated outlying islands. The majority are stacked skywards on Hong Kong Island and Kowloon, surrounded by all the glitter and razzamatazz of a city as fast moving as New York, with the added romance of one of the busiest natural harbours in the world.

As is the case the world over, the Hong Kong record industry is buoyant. The vinyl LP, however, is predictably in a slow decline. While compact disc sales are increasing it is for imports only, the local market finding its strength on cassette. This society, which from a distance seems to offer all our high technology at duty-free bargain basement prices, has been slow to embrace DAT. Taking their lead from the US and UK they accept that if Copycode presents a problem to those societies, so it does here. DAT has only really caught on in the area of mastering for duplication. There is no software in the shops at all.

Two years ago a liaison project was set up with China to promote Hong Kongese artists on the mainland. The success of these projects is, however, tempered by the language barrier: Hong Kongese speak Cantonese; the Chinese, for the most part, speak various forms of Mandarin (as do the Taiwanese and Singaporeans who are therefore better placed to exploit this new vast market). There have been recent experiments overdubbing Mandarin vocals on a few albums but nobody seems to be very excited by the idea.

Hong Kong's population figure, similar to those of the Scandinavian territories, makes for the same kind of profitability problems. Having said that, the Hong Kongese are pretty good consumers; a typical Hong Kong hit record sells around 40 or 50,000 (best seller figures of 300,000 have been quoted). Two fifths of these will be on vinyl LP, the rest on cassette. A gold record requires sales of 25,000, platinum 50,000. Imported classical, jazz and pop music sells extremely well on CD but presumably a lot of that is also going to the tourist trade. There are several unofficial charts but official chart compilation is done by the two radio stations: the pirate Commercial Radio and government-owned Radio Hong Kong.

A common misconception about the free Hong Kong market is that it exports much of its underpriced product. As far as music media is concerned this is totally unfounded. There was a time when piracy was rife but these days the industry is very tightly controlled. Government legislation introduced in 1978 provided heavy punishments and implemented large fines for those caught dealing in pirate goods.

S 240



The EELA AUDIO S 240 is a mixer designed for the professional broadcaster in the 1990's. With DC Control of faders, and liberal use of electronic switching, combined with dedicated logic circuits. Developed together with engineers and presenters to provide the facilities, and the flexibility to enable the latest modes of operation to be

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DIGITAL AUDIO EDITORS

While at the AES Convention in Los Angeles, Sid Price took stock of the disk-based systems on show

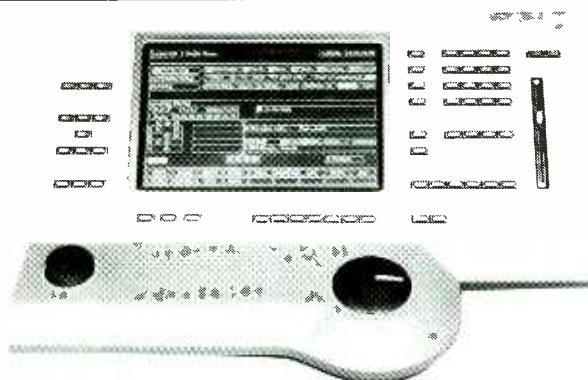
The processing of audio in the digital domain has to be the major growth area in our industry, and in particular the race is on to secure a portion of the rapidly developing market for editors. As the convention/exhibition environment is hardly the ideal place to evaluate equipment—the major constraint being one of time available, both from the exhibitor and attendees point of view—what follows must be taken on an 'as-seen' basis. In the time available one can only assume that the features shown and talked about are real and deliverable. At the end of the day the only way to decide between apparently equal facility equipment is to sit down in a known environment, with known source material and try to work with the device. With the cautions out of the way let's proceed with the round-up; the companies are dealt with in alphabetical order.

Advanced Music Systems

The *AudioFile* is one of the more established products on offer, with a claimed customer base of over 200 it continues to be developed by the company. Recent developments include extensive cut and paste facilities, transport control of an external video tape machine and optional 'Pods' for packaging the system. There are several forms of Pod available, a simple workstation with an author's desk for documents, etc, a Sub Mix Pod with the desk replaced by an 8/2 sub-mixer and a Mini Mixer Pod that incorporates Calrec *Mini Mixer* complete with equalisation. The most recent development is the integration of the *AudioFile* and the AMS/Calrec *Logic 1* digital mixing console. This combination will provide a fully automated post-production system. Mix data from the console being integrated into the data



The complete *Dyaxis* system from IMS



DAR's *SoundStation II*

for the cues stored on the hard disk, a very powerful feature.

Digital Audio Research

The *SoundStation II* was shown with several new features and configuration options. *SoundStation* may now be configured as a 2-, 4-, or 8-track record, edit, playback device. It features input and output in either AES/EBU digital interface, Sony 1610/1630 digital interface, or analogue using 18 bit A/D and D/A converters. Introduced at the show was the optical write once, read many times (WORM) disk drive. This provides an easily removable media for digital audio backup and storage, a feature that more and more users are becoming more aware of as they build their libraries of effects and source material. Other new hardware to provide the facility to lock the sample clock to various external sources, such as PAL and NTSC video, and longitudinal timecode, was also introduced.

On the software front DAR was demonstrating Stereo TimeWarp, for high-quality time compression and expansion of audio, without pitch change. The program is non-realtime, which means *SoundStation* has to think about it for a while and prepare the data to control reproduction. The program can alter the duration of the audio from 50% to 200%. Punch-in recording now provides multiple passes through a loop without loss of previously recorded material.

Integrated Media Systems

Dyaxis is a disk-based, audio recording, editing, and playback system that provides 2-track editor

designed to work with and be controlled through a *Macintosh* computer. The modular system consists of the Audio Processor, Mass Storage System, and the MIDI Timecode Interface.

The audio processor uses stereo 16 bit A/D and D/A converters, sampling at 48 kHz, 44.1 kHz, or any of 200 user-selectable frequencies. Input and output may also be done digitally in either AES/EBU, SDIF, SPDIF, or Sony 601 format. The digital interface is claimed to be easily adaptable to new standards as they emerge.

The mass storage system offers hard disk drives of either 102 or 320 Mbyte, housed in a sub-assembly, which can contain one or two full-height drives. In addition to a pair of hard disk drives an additional removable media hard disk or tape streamer backup device may be installed in the mass storage system.

The third hardware element of the system, the MIDI Timecode Interface, converts SMPTE timecode to MIDI timecode and feeds this to the *Macintosh*. This permits the software on the *Macintosh* to control the reproduction of audio by the audio processor referred to timecode. Additional features of the timecode interface are two MIDI-Out ports for control of external sequencers, etc, and a jam sync mode that sends SMPTE out in sync with the SMPTE input.

Several software packages are available for use with *Dyaxis*, the basic system comes with *MacMix*, a digital editing program. This provides for the marking of source, scrub-editing, cross-fade editing, sound file mixing, panning, looping and assembly of source material into finished tracks.

Two optional packages *Alchemy* and *SoundDesigner II* (from Digidesign), offer sample editing and waveform manipulation facilities. For those who like to perform editing using CMX-style decision lists, Digidesign offer *Q-Sheet A/V* and for those users who wish to manage their sound files using database techniques a further package is available from Soundsmiths called



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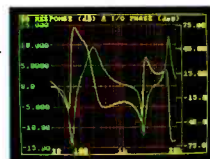
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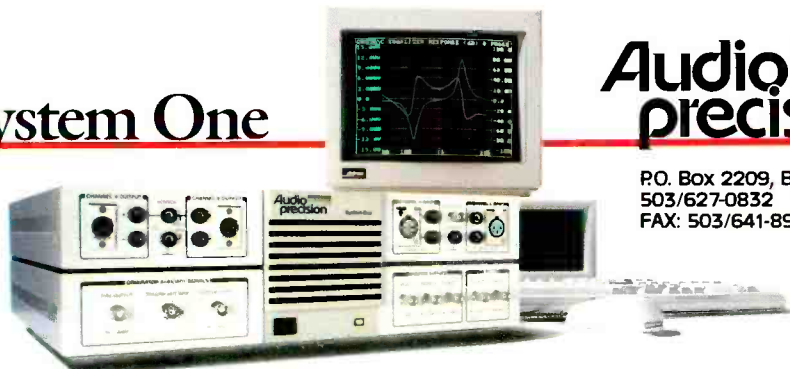
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◁ *SoundBase*. It allows sorting, cataloguing, and interrogation of sound files stored on the system.

Lexicon

The *Opus* offers an integrated editor and mixing console system. It provides facilities for editing, crossfades, slip sync of material and loop creation. Up to eight hours of sound effects or other source material can be on-line, additional storage of libraries is possible using optical disks. *Opus* is capable of playing and recording on a total of eight tracks simultaneously, emulating an 8-track tape machine. The sample clock may be locked to one of a number of external references such as timecode, video, or even film dubbers.

Opus mixes up to 12 channels of digital audio, each channel includes a dual 200-segment plasma level meter, input trim, phase invert, four aux sends, record, pan, mute, solo and fader. When equalisation is added this will be controlled by an assignable control strip with four independent 20 Hz to 20 kHz sweep range filters. Each section may be assigned a different filter characteristic, either parametric notch, high shelf, low shelf, highpass, or lowpass. Assignment of the control strip to a particular channel is by operation of an 'access' key on each channel strip. When a

channel is accessed its current settings are displayed using LED bargraphs on the EQ module. The future promises full automation of dynamics, mix and equalisation.

New England Digital

NED presented two new systems and enhancements to other parts of their product range. The *Synclavier 9600* digital audio system features configurations that may include up to 96 polyphonic stereo voices, 96 Mbytes of memory and approaching 3 Gbytes of on-line sound storage. A choice of user interfaces is available including a customised *Macintosh II* graphics workstation or the new Controller/Editor/Locator system also presented at the show. The *9600* features plug compatibility with NED's *Direct-to-Disk* digital multitrack editing system.

The *3200* digital audio system is a smaller modular computer workstation providing up to 32 monophonic voices, 32 Mbytes of memory and up to 720 Mbytes of on-line hard disk storage. The *Macintosh II* is used as the standard front end, although the *3200* will interface to any MIDI keyboard.



Lexicon's *Opus* digital audio production system in operation



NED's family of digital audio workstations

The Controller/Editor/Locator (CEL) mentioned previously may be used as the front end for any of the NED products including the *Direct-To-Disk* system. It offers motion control, track arming and soloing, autolocator functions and scrub editing.

Software enhancements to the *PostPro*, the 8-track *Direct-To-Disk* system, were also announced. The new features are Time Compression, Direct Digital Transfer, VITC/LTC synchronisation and CMX Edit List Conversion. Time Compression offers two algorithms, one for dialogue and one for music, which permit compression or expansion of audio without pitch change. The expansion/compression is available over a range of 50% to 200% of realtime. Digital Transfer permits the user to load audio data to and from Sony, Mitsubishi and AES/EBU format recorders without leaving the digital domain.

Real World Research

The *Audio Tablet* is a dedicated stereo editing device, although future versions are promised customised for other application areas. The control interface is a touch screen and graphics display combination. The touch screen is pressure sensitive and operation of on-screen buttons is accompanied by a 'clunk' from a solenoid inside the control surface. The hardware consists of three parts: the control surface, the processor rack and the peripheral rack. The peripheral rack holds the mass storage devices, which at the present time are Winchester hard disk devices. Up to seven peripheral racks may be connected to a single processor rack. Each processor rack is capable of handling up to four channels of digital and analogue audio. Future system expansion is made possible by adding further processor racks.

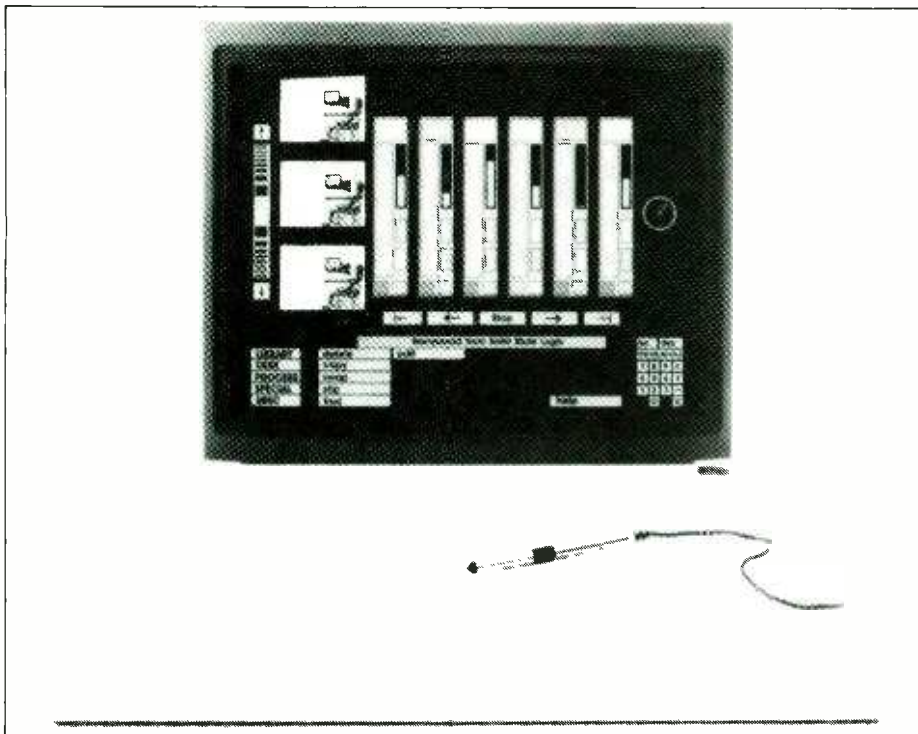
Facilities provided are geared specifically towards stereo editing of music with five screens or panels provided. These panels are the recorder, the cut and splice editor, the fine editor, the labels panel and the set splice panel.

The recorder panel configures and presents the tablet as a conventional tape recorder and is used to store input audio on the hard disk system. Cut and splice, as the name suggests, is the editing panel for the tablet with the fine edit panel providing control over crossfades, overlaps and gains across the edits. The labels panel permits editing of labels in segments created with the recorder panel. The final panel is the set splice panel, which permits editing of the default parameters for the various 'built-in' splice types.

Solid State Logic

SSL had two distinct approaches to digital audio editing on display. The *HarrySound* system was developed in co-operation with SSL's sister company in the UEI group, Quantel. The operational concepts of *HarrySound* and *Harry*, the Quantel video editor, are shared. Indeed it is possible to control both systems from the same integrated control point. The operator interface consists of a video monitor and control tablet with pen for input. When the two systems are integrated *HarrySound* appears as an additional set of menus on the usual *Harry* screen. *Harry* may also be operated in standalone mode. Mass storage is provided on *Harry* by a 330 Mbyte hard disk, which holds 50 minutes of mono audio. The system may be expanded with additional 690 and 840 Mbyte drives, with backup provided by an 8 mm tape drive system. Facilities are cut and





SSL Harrysound



SSL 01 digital production centre

splice, mixing of tracks, time offset of tracks and crossfade control. Up to six tracks of edited sound files may be cut together, played back and mixed simultaneously. A mixed track may be sent to the outputs of *Harry* or used as a source track for further editing.

The second system on display was the 01 digital production centre, a system comprising the digital equivalent of an 8-channel mixer, three stereo tape machines, and an edit controller. In use the 01 has been designed to be as close as possible to the conventional three tape machine editing controller with conventional console attached. The console section provides a 4-band parametric equaliser, separate high and lowpass filters, dynamics section with limiting, compression, expansion, and gating. All rotary controls have rings of LEDs that show the current settings.

Sonic Solutions

The *Sonic System* is what Sonic Solutions call a *Macintosh II*-based system, which provides a

number of interesting features. The hardware makes use of the graphics capability of the *Macintosh II* for its user interface. A card, the Sonic Solutions Processor (SSP) is fitted to the *Macintosh* to perform the realtime digital audio processing. The SSP has four signal processors, which may be configured to handle multiple simultaneous tasks. Also provided are four digital input/output channels in either AES/EBU or Sony Digital Interface formats. The hardware is capable of supporting sampling rates up to 60 kHz.

The *Sonic System* is intended to be configured and operated by a number of application software packages. These packages, called *Audio Desktops*, permit specific tasks to be performed. The first package released is the *CD PreMastering Desktop*, which provides for editing, automated mixing, processing and sequencing tracks on a master tape.

Sonic Solutions also intend to offer a version of their *NoNOISE* system to run on the *Sonic System*. *NoNOISE* was developed to process old recordings to remove clicks and noise from such

recordings. The removals are made using sophisticated DSP techniques, which, in the case of click removal, reconstruct the audio for the segment cut out.

Steinberg

Topaz is a digital audio recorder from Steinberg that, once again, makes use of the *Macintosh II*'s user interface. It uses a 360 Mbyte drive for audio storage with backup provided by a tape streamer. The processor, mass storage and tape backup device are housed in a 19 inch rackmounting case. A single *Topaz* unit may be configured as two mono channels or one stereo channel. Up to eight rack units may be combined to give a maximum configuration of a 16-channel, multitrack recorder. An AES/EBU interface provides for digital input/output, while 16 bit linear A/D and D/A converters are fitted as standard for analogue I/O.

The processing unit is controlled from the *Macintosh II* using a high speed RS 422 link.

Features available include editing, mixing, equalisation using a 3-band parametric equaliser, variable playback speed without pitch change, pitch shifting and 'event list' controlled playback of material.

WaveFrame Corporation

The *AudioFrame* system from WaveFrame Corporation is based upon their Digital Audio Bus: a 64-channel digital patchbay that permits the user to plug in an array of modules that perform sampling, recording and editing, signal processing and mixing. The operator interface is a graphics display with mouse pointing device.

Just introduced at the AES show is the *Universal Digital Interface Module (UDI-4)*. It enables the *AudioFrame* to directly receive and send digital audio data in a variety of formats and sampling rates. The *UDI-4* plugs into the *AudioFrame*'s Digital Audio Rack and provides transfer using AES/EBU, Sony/Philips consumer, SDIF-1, SDIF-2, Mitsubishi PD and Mitsubishi DUB 2-track format. Each module is configured with two stereo input/output sections, each section may be either an input or an output. Sample rates between 30 kHz and 50 kHz may be used.

Texture is a software release made by WaveFrame, which is a MIDI music sequencer that runs on the *AudioFrame*. It uses the familiar modular recording architecture of songs, patterns and tracks. Each pattern may contain up to 32 tracks and up to 96 patterns may be recorded for linking and editing into a complete composition. Comprehensive editing facilities are provided that may be applied to individual links in the composition to achieve realtime muting, transposition and tempo changes during playback.

Summary

It seems that many of the products seen at the show have been around for some time, indeed the feeling gained from walking the floor is that manufacturers are beginning to fulfil the promises made for their equipment. Several systems not previously deliverable now seem to be finding their way to first users. Others, in the market for some time, are gaining acceptance and facilities at an encouraging rate. Which to buy? Not an easy decision; remember the opening remarks and try it for yourself. It is the only way. □

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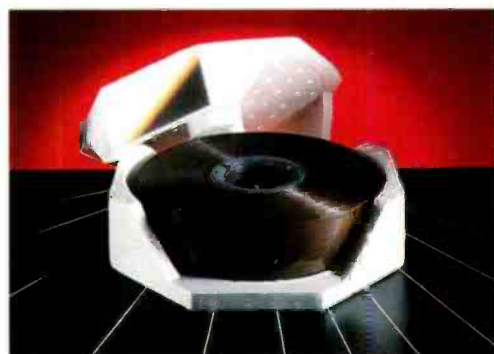
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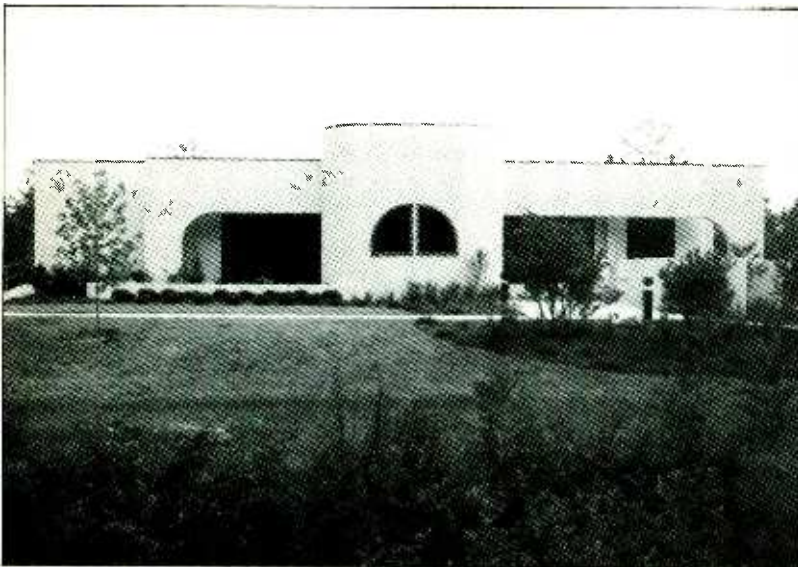
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The Pegasus exterior

PEGASUS

Pegasus is a 2-studio complex based in Florida, USA geared towards serving the record, film and video industries. Gregory A DeTogne talks to owner Butch Trucks about the background and construction of the facility

Situated in the dense woodlands that rise from the rolling hills of Northern Florida's Panhandle, Pegasus Studios lie just outside of Tallahassee at the intersection of Interstate 10 and Highway 90. Having opened its doors recently as an 11,000 ft² full service facility capable of tackling projects ranging from record production and film scoring to video post-production, \$3.5 million was required to bring the project to completion, which includes construction costs of \$1.3 million for the structure itself.

Outfitted with two amply-equipped studios, Studio A is the largest. Beneath its towering 22 ft ceiling, the room's 2,400 ft² main floor can easily play host to a 115-piece symphony orchestra. Conversely, Studio B, which occupies a portion of the 2-storey building's second floor, is a modern post-production room ideally suited for dialogue replacement, sound effects, video scoring and mixing.

The road that took Pegasus from their conceptual stages to their present form was carefully negotiated by owner Butch Trucks. Trucks, who is probably most widely recognised for his role as a drummer with The Allman Brothers Band, first conceived the idea of owning his own studio as a way to change his career's direction.

"I spent a number of years on the road with the Allman Brothers, and at one point, I had had enough of Holiday Inns and airports," he admits. "The music was always fun but after four or five times around the world, it got tiring. I wanted to settle down with my wife and kids, and becoming involved in the production end of the business seemed to offer me that opportunity. I didn't want to live in New York, LA, or

Nashville, however, so my only other option was to build my own studio."

As Trucks laid plans for the studio, he developed a marketing strategy based around the dramatic upturn Florida has seen in film and television production: "Before breaking ground, I looked around the entire state and didn't see anyone else with adequate facilities to handle scoring work for film and video," he recalls. "Producers were coming down here to shoot, and then flying back to New York or LA to take care of post-production. Based upon what I saw I decided to build a studio that would meet the needs of the record business and the film and video industries."

After securing the necessary funding, Trucks set out to select a site for his facility. He settled upon a location in his native Northern Florida where he would become the anchor tenant in a 550 acre development project called Gadsden Station, which is being built exclusively for the entertainment industry by the Talquin Development Company. A subsidiary of the Florida Progress Corporation, Talquin, like Trucks, felt that the Tallahassee area offered a host of advantages for the studio owner.

"In addition to the burgeoning film and video post-production markets which can be taken advantage of in Florida, the greater Tallahassee area offers a wealth of local talent and a natural environment conducive to the creative process," Talquin spokesman Dave Williams eagerly points out. "The resources of Tallahassee-based Florida State University's arts division are all at your disposal—equipment, props and talent for example—plus their symphony orchestra, which expects to play a major role in Pegasus' film scoring work. The area is also quiet and free of the usual big city distractions, yet is only 12 minutes away from Tallahassee's airport, which is served by a number of national carriers. Those utilising Pegasus or any of the facilities scheduled to be built at Gadsden Station also have the benefit of taking advantage of the abundant recreational opportunities nearby. Of the 550 acres on the premises, only about a quarter of the land is earmarked for development. The rest will remain in its natural state, offering bass fishing on a private lake and access to the nearby Ochlockonee River. Those with other water sports in mind can travel a short distance to the Gulf of Mexico, where we have some of the finest white sand beaches in the region. As a final complement, all of this is set in a region with a climate which is warm all year round."

Outwardly, Pegasus Studios is a stark grey structure built into a steep hill and surrounded by woodlands. Clean and modern with many curving lines and flying buttresses, the exterior is a finished concrete surface. It is equally opulent on the inside with a huge marble-floored entry, spacious administrative offices and lounge areas displaying colourful, larger-than-life paintings done by Trucks' wife Melinda. The original blueprints were drawn in 1981 by George L Augspurger but construction didn't begin until February 1987. To bring the original plans up-to-date, Trucks relied upon architect Rolando Gutierrez of Tallahassee-based Clemons, Rutherford and Associates, and David Engelke, who served as technical adviser and on-site engineer. A key figure in many facets of Pegasus' construction, Engelke is also responsible for building the monstrous custom monitors that reside in Studio A's control room and is the owner of Studio B and all its MIDI toys.

Trucks and Engelke freely admit that the Pegasus story is one of excess when it comes to isolation, grounding and wiring configurations, to name just a few areas. Throughout the building, many things were done that most studios always dream of but can never afford because of the expense. According to Trucks, provided you already owned the land, it would cost around \$15 million to build the same facility in New York City. But in Florida it was possible to remain competitive and the results are sometimes startling.

Even a casual glance at the blueprints would reveal the excess. From the outside, the first layer of wall material measures 12 inches thick and is made from steel-reinforced concrete, which was poured in place to form a giant slab from the ground up. Talquin Development's construction crew poured the walls and footers first, and then poured the bottom slab on which the studio floats from the same material. To improve isolation inside the outer walls, traditional 2x4 inch wall framing was rejected in favour of a significantly heavier 2x10 inch design. Throughout the building, the 10 inch gap in

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◁ the wall framing was filled with glass fibre insulation, and then given a 3-layer thick coating of sealed Sheetrock on both sides. Every interior wall is also floated off the bottom slab with ½ inch Neoprene rubber, which was applied to each wall's top and sides as well. In sections of the interior where one room's wall abuts another, a 1 inch airtight gap was left in between, creating divisions 23 inches thick with 12 layers of Sheetrock. With this much concern being given to isolation, it's only natural that Pegasus is amazingly free of extraneous noise. Strict attention was given, however, to ensure that aesthetically the place appears no different from a structure using ordinary construction techniques. Isolation was further enhanced by locating all of the most sensitive audio areas in the portion of the building that resides underground.

With isolation more than adequately taken care of, careful consideration was given to providing a quality recording environment built expressly for digital. Whereas with analogue, slightly noisy air conditioning units, creaky floors, and plumbing aren't as crucial, these things were treated in an almost overkill fashion by on-site engineer Engelke, who painstakingly helped scour a variety of sources for the perfect noise-free cooling system, made sure that the water pipes were routed well away from the recording areas and took care of countless other noise-related details.

Given its size, Studio A has a unique live sound. To facilitate situations where the room needs to be deadened, movable absorption panels were supplied by Augspurger that enable the room's acoustics to be changed to whatever a client desires. Studio A's floor is made from ¾ inch flat wood glued together to form a single piece, which floats on ½ inch of styrofoam. For film scoring, a full-size motion picture screen graces the east wall, which can be retracted into the ceiling when not in use. To round out Studio A's production capabilities, a stage is also at hand, along with theatrical lighting and a fully-automated Strand mixing palette that can turn the room's walls any colour.

Laid out in a geometric shape, which ensures proper presentation of the custom *E IV/D* monitors built by Engelke's company, E-Systems Technologies, the Studio A control room extends 35 ft from front to back. Special soffits enable the monitors to be hung in a much lower position than is usually possible, which also allows the room to be equipped with a one-of-a-kind, 180° panoramic plate glass window with 1 inch thick laminated plates of glass separated by an airspace. With the central portion of the window weighing 1200 lb (544 kg), each of the plates is suspended in rubber airtight gaskets. Angled to provide proper sound deflection, the airspace between the plates of glass rises from 20 inches (51 cm) across at the bottom to 3 ft (91 cm) across at the top.

Studio A's equipment centres around an SSL 4056G console equipped with *Total Recall* and the latest SSL EQs. Tape machines are 32-track digital Mitsubishi *X-850*, and Mitsubishi *X-86* 2-track for mastering. An array of outboard gear present includes a Quantec *QRS XL* Room Simulator, an Eventide *H-3000 Harmonizer*, a Lexicon *PCM 70* and *480L*, a Yamaha *REV-5* and *SPX 90 II*, and four Valley People *Kepex IIs*. Besides ample techno-gadgetry the basics are available as well, including a vintage collection of microphones.

A proprietary set of 4-way loudspeakers, which stand 45 inches (114 cm) tall and weigh 600 lb (272 kg) a piece, Engelke's *E IV/D* monitors are highly geometric in shape with many angular planes. Based around Community Light & Sound's *M4* midrange compression driver, power for the cabinets comes from five Crown amplifiers, while the crossover network was provided by Nashville's Creative Electronics.

"In my opinion, the midrange is too often ignored when choosing components for a monitoring system," Engelke believes. "As a result, what you get from some monitors isn't an accurate representation of sound, especially with snare drums and the male vocal range. To maintain accuracy in the midrange spectrum, the *M4*'s response is optimally designed to perform between the frequencies of 200 and 2,000 Hz."

To most effectively fit into Engelke's *E IV/D* plans, the *M4*s were modified slightly to accept a custom horn by removing the front of the loudspeaker and exposing the diaphragm. The custom horn was coupled directly to what was now a 7 inch exit area on the *M4*, resulting in a 1:1 design, which lowers the pressure per area and reduces distortion to an extremely low level.



Studio B control room



Studio A

At the bottom-end of each *E IV/D* cabinet, signals up to 120 Hz are directed to an 18 inch JBL driver, which has no mass ring on its voice coil. In selecting this component, Engelke was once again going for maximum accuracy. By powering each of these JBL loudspeakers with their own Crown *Delta Omega* amplifier a situation was created where the amps sense the position of the voice coils, effect more control, and thereby increase accuracy.

A Crown *Micro-Tech 1200LX* powers twin TAD 15 inch woofers in each cabinet, which handle frequencies from 120 to 400 Hz. At 400 Hz, signals crossover into the *M4*s, which are driven by a Crown *PSA 2*. The *M4*s carry the signals up to 1.6 kHz, at which point they crossover into a TAD *4001* coupled with a Community *SH864* horn, which can carry them up to a theoretical 22 kHz with the aid of a Crown *PS 400* amplifier.

Phase coherency in Engelke's *E IV/D*s was achieved by physically adjusting the drivers in each cabinet. At the centre of each enclosure lies the tweeter and its Community *SH864* horn. The *M4* and its custom horn reside beneath the tweeter, and to position the two as close together as possible, both devices' horns were bonded together with a wood emulsion. The three low-end transducers are situated side-by-side at the very top of the angular cabinet, with the single 18 inch element located between the two 15 inch woofers.

"The monitors complement the room real well," Studio A chief engineer Ralph Moss reports. "They disperse sound equally throughout the room so you don't have to worry about finding the ideal engineering position. You can sit back and get a good representation of sound anywhere."

In addition to the physical properties of the monitors themselves, the control room's configuration plays a large part ▷

◁ in providing an accurate representation of what's happening on the other side of the glass. "The properties of our monitors required certain design parameters to be established for Control Room A," Engelke added. "Placing high-powered monitors capable of producing 130 dB in a room that occupies less than 1,000 ft² left us with a dilemma where we had to artificially create a large environment to handle the acoustical power. To compensate, we built a trap in the floor to soak up the resonant waves in the bass region, placed baffles in the ceiling for absorption, built critical angles into the walls, glass, and ceiling to re-direct sound, and as a final measure, placed diffusion grading in the rear of the room. The diffusion grading directs sound back at the engineer in a fashion that artificially makes the wall seem like it's not really there. The idea behind everything we did is that when you listen to the speakers, what you hear is as close to what's going on out in the studio as possible, given the limits of two monitors producing a flat stereo image in a psychoacoustically-built room."

Unlike RPG diffuser systems, which are about 16 inches (41 cm) thick, the diffusers used on the rear wall of Studio A's control room are about 8 inches (20 cm) thick, which saves

valuable space. Custom-fabricated by Engelke, he explains that although his diffusers are half the width of an RPG panel, they sacrifice only a minor amount of absorption and possess better diffusion resolution in terms of bandwidth because they employ a narrower slit width.

Smaller in size at 20x24 ft (wd) (6.1x7.3 m), Studio B's control room is located directly above Studio A's. Housing an SSL 6056E with a G Series computer and *Total Recall*, the main tape machine is a Studer A820 24-track with Dolby SR noise reduction. Ideally suited for projects calling for a more intimate environment, it is used for mixing and film and video post-production.

Studio B has over 300 tracks of MIDI sequencing available, along with music publishing abilities, computerised scoring and arranging aids, and full video capabilities backed by a Sony ¼ inch SP system locked into the audio system via *Lynx* timecode modules capable of going from a dead stop to full lock-up in under 3 seconds. A wide array of audio monitors is available, and for video, everything runs through a 35 inch (89 cm) digital monitor, which makes its home directly in front of the console.

To handle virtually any kind of post-work as well as myriad other video operations, Studio B contains a Sony BVE editor with A/B roll, variable wipe, a character generator, dual timebase correctors, and special effects capabilities. Videotape players are also present, along with enough synthesisers and samplers to duplicate the orchestras used for film scoring on Studio A's main floor. Upon request, a *Synclavier* digital music system with 32-voice polyphonic sampling is also available, which can be wired into Studio A as well.

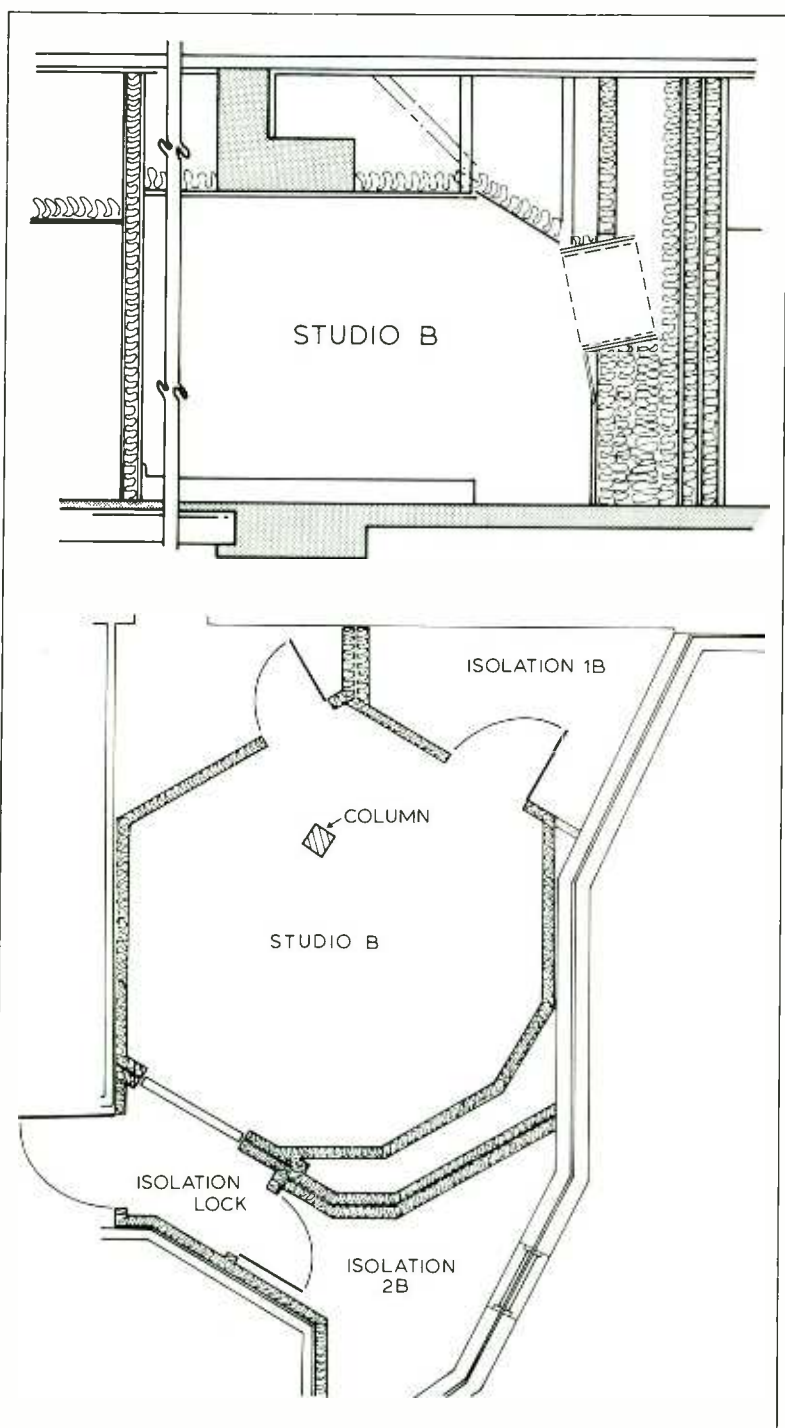
Managed and stored by Leonardo effects software, over 10,000 sound effects are on file in Studio B. With the Leonardo system, clients can conduct interactive searches by describing to the engineer what they want to hear. Once the engineer has a general idea of what the client wants, he uses a database wordsearch system that turns up a variety of CD-stored examples of the effect almost instantaneously.

Wiring for the structure was divided into two distinct circuits. One handles the infrastructure (office lights, hallway receptacles, etc) while the other does nothing but serve the receptacles in the main studio and control rooms. A 3-wire configuration is used at each receptacle in the studio areas, which consists of hot, cold and a third independent wire running all the way back to a grounding stake made from a copperclad iron pipe measuring 4½ inches (11.43 cm) in diameter and buried 87 ft (26.52 m) into the ground. Throughout the facility, multi-cable Canare wiring with its own shielding was used, which was wrapped further with an additional coating of aluminium shielding before being run through the conduit. Audio, video, cue and house sync lines all run through separate conduits, and conforming with international standards, pin 2 is high on all Pegasus' 3-pin connectors. Steel conduit of 4 inch (10.16 cm) diameter and ½ inch (1.27 cm) thick shield-grounded back to the grounding stake is used on all audio feeds. Completely sealed with Neoprene and then sealed again in concrete for maximum isolation, these pieces of conduit converge at one point directly beneath the consoles, where they are bonded together with strapping wire and tied to the studio's technical ground to insure that no groundloops are formed in the conduit.

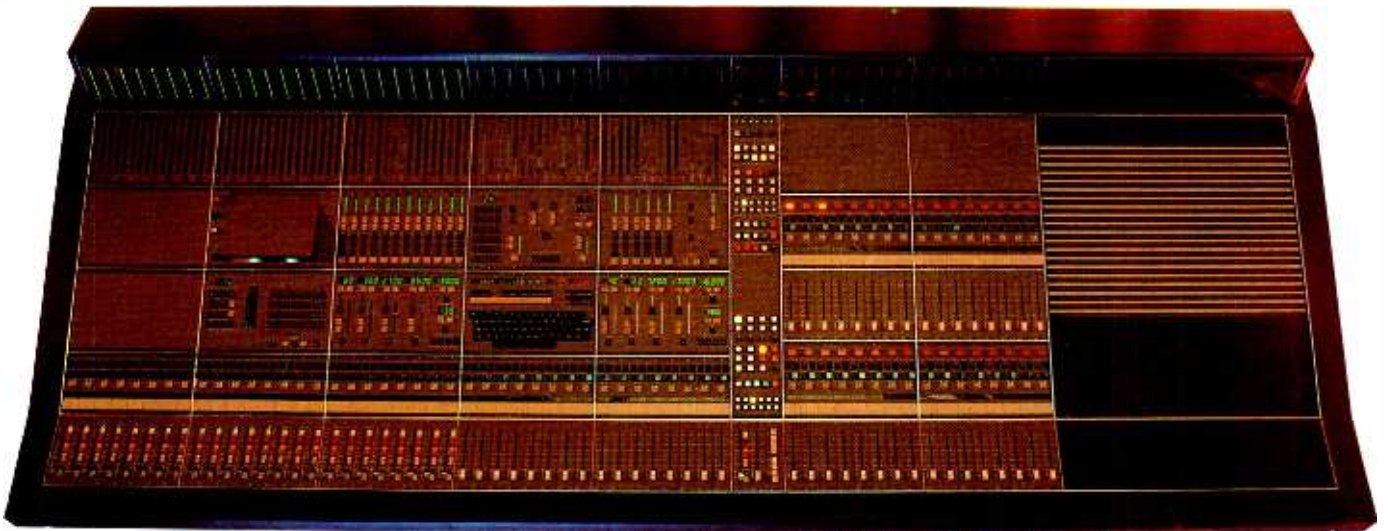
In the event of an interruption in power, an entire wall in Pegasus' mechanical room was devoted to an emergency battery power supply—a necessity given the use of the Mitsubishi tape deck, which has the capability of ruining a tape irreversibly in the event of a power failure. With the battery packs, engineers have a 40 minute time frame to turn the tape machines off without glitching. Any other type of important memory storage device is also connected to this power source, along with the SSL consoles.

As of this writing, talent in session at Pegasus include former Allman Brothers lead guitarist Dickey Betts, who is at work with his own band on an upcoming Epic release, and a promising new artist named T-Ray, who is 60% complete on a new album contract with a major label, which will be promoted in part by a music video which has been post-produced in Studio B. □

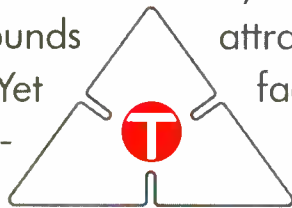
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AUTO TEST AND ALIGNMENT

Bob Metzler of Audio Precision describes a method of automated alignment of Studer analogue tape machines using the System One Audio Test Set

In most studios and broadcast operations, aligning analogue tape machines consumes the largest amount of maintenance engineer time. In addition to being time-consuming, alignment must be very carefully done if it is to provide consistent performance results. With the increasing scarcity of experienced maintenance engineers, any method of assistance in this process will be valuable to engineers and managers alike.

The Studer A820, A812, A810, A807 series of tape recorders has been designed with all level, bias, and equalisation controls electronically accessible for adjustment via an RS-232 port, from an external computer.

Audio Precision has developed a program that controls the *System One* audio test and measurement set plus the transport and adjustments of these Studer machines to produce automatic alignment. Operator co-operation is required only to load the reference and blank tapes and to perform azimuth alignment of the heads. Standard reference tapes may be used. Reproduce section alignment is performed in 2 to 3 minutes per tape speed, depending mostly on the operator's performance in loading the tape and making the azimuth alignment. Record section alignment requires 3 to 4 minutes per speed but the record section can be aligned for four speeds in about 10 minutes since the tape is loaded only once and record head alignment is

done at only one speed. A complete sequence of alignment, full performance verification to factory or user specifications, and printing of a 3-page performance report, takes 7 to 10 minutes per speed—and the operator can be working on other projects during most of that time.

Fig 1 is a block diagram of the connections between an IBM-compatible personal computer, *System One*, and the Studer machine. *System One* is controlled via its normal digital interface card plugged into the computer, while the PC serial port controls the Studer.

The operator is presented with an on-screen menu at the beginning of the process. Fig 2 shows the initial menu for the reproduce alignment. The various choices initially displayed (type of reference tape, machine model number, reference fluxivity, etc) will be the selections retained from the last time the program was run. The first character of each major item is intensified on the computer screen. To change selections, the operator presses the corresponding key on the computer keyboard. Pressing the R for reference tape, for example, produces a subsidiary menu such as Fig 3. The operator may then use the keyboard arrow keys to move the selection cursor to choose another reference tape. Some items, such as reference fluxivity, are numeric keyboard entries with a wide range of values permitted.

When the operator indicates that the selections

are satisfactory, the program prompts him to spool the reference tape to the start of the first tone and reset the machine counter. This provides the necessary synchronisation for the program, which will then locate all necessary tones relative to this point. The reproduce section alignment then proceeds automatically in this sequence:

Adjust line output level (both channels simultaneously); 3 to 5 seconds

Locate (automatically) to the azimuth alignment section of reference tape; 4 to 6 seconds

Display analogue to bargraphs of level and phase and prompt operator to adjust repro head azimuth for maximum level and zero phase. The operator may now move to other tasks (such as drinking coffee)

Locate back to reference tone and re-adjust line output levels; 8 to 10 seconds

Locate to the HF tone nearest to Studer's recommended frequency for treble level adjustment. Adjust both channels simultaneously; 15 to 25 seconds

Repro alignment is now complete. If the 'align plus full performance verification' mode is in use, the program will then locate each frequency on the tape, measure amplitude of both channels, and thus proceed through a full reproduce frequency response measurement; 1 to 2 minutes. Measurements are compared to factory limits at mid-band and above (bass repro level has not been adjusted yet). If any point is out of limit, the operator is given the choice of repeating the measurement, stopping the procedure, or proceeding to the next step

Record section alignment presents a similar menu to the operator, as shown in Fig 4. The key selections include the type of blank tape being used, equalisation and selection of speeds to be aligned. Selection of a tape type from the tape menu then displays the recommended values of overbias on the main menu for that tape formulation. If the user has his own opinions on overbias values, he may press the B key (for bias) and substitute his judgement. Fig 5 is a partial list of tapes presently supported; the entire list occupies more than one screen. When all selections are to the operator's satisfaction, the record alignment sequence is as follows:

Adjust bias (both channels simultaneously) for the specified value of overbias; 20 to 30 seconds

Adjust line output levels; 3 to 5 seconds

Display a phase vs frequency graph while *System One* performs a fast 4-point 1 kHz to 15 kHz frequency sweep in a continuously repeating cycle of about 1 second per sweep. The operator is prompted to adjust record head azimuth for a flat line (zero phase at all frequencies). Fig 6 shows a typical screen with superimposed graphs for two incorrect azimuth adjustments (curved upwards and downwards) plus the correct flat line

Display a crosstalk vs frequency graph, alternating the L-R and R-L crosstalk measurements, while the operator is prompted to adjust the crosstalk control in the head assembly for optimally-low crosstalk in both directions. The operator's assistance is now no longer needed (and the coffee shouldn't be cold yet)

Re-adjust bias for specified overbias; 20 to 30 seconds

Re-adjust line output levels; 3 to 5 seconds

Adjust treble levels; 5 to 8 seconds

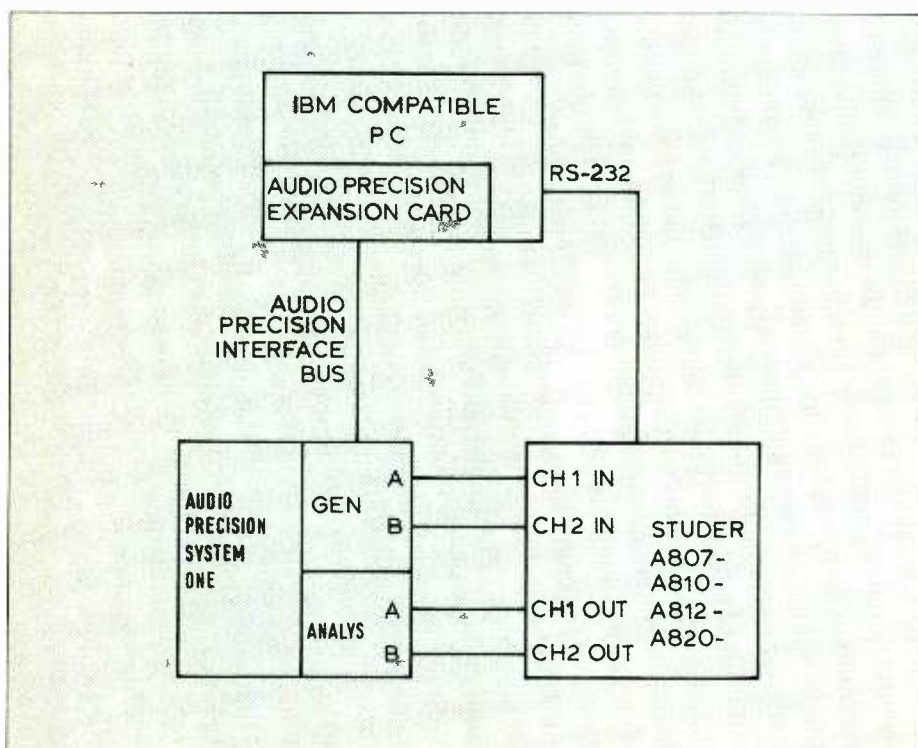


Fig 1

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Studer Professional Tape Machine Reproduce Alignment

The following details are assumed by the alignment procedure

Operating Level - L RANGE: 4/10 dBm
Reference Tape - Magnetic Reference Lab Catalog 21J205
Speed - 300 mm/s (15 in/s)
Equalization - NAB
Transition Frequencies - 50 & 3150 Hz
Reference Fluxivity - 250 nWb/m
Desired Reference Fluxivity - 250 nWb/m
Model Number - A887-2/2 UU
Equalization - Standard Equalization for Standard 1/4 inch heads
Tape Sort - A
Power Line - 100/120 V 60 Hz

Press <Enter> to accept or first letter of item to change

```

Fig 2

```

Reference Tape Selection Menu
Make your selection with the up and down arrow keys
When desired selection is highlighted, press <Enter>

1. Magnetic Reference Lab Catalog 21T204, Speed - 190 mm/s (7.5 in/s)
   EQ - NAB, Ft - 50 & 3150 Hz, Ref Fluxivity - 250 nWb/m
2. Magnetic Reference Lab Catalog 21J205, Speed - 300 mm/s (15 in/s)
   EQ - NAB, Ft - 50 & 3150 Hz, Ref Fluxivity - 250 nWb/m
3. Magnetic Reference Lab Catalog 21L221, Speed - 760 mm/s (30 in/s)
   EQ - AES, Ft - 0 & 9800 Hz, Ref Fluxivity - 250 nWb/m
4. BASF Catalog 711312, Speed - 95.25 mm/s (3.75 in/s)
   EQ - CCIR, Ft - 50 & 1800 Hz, Ref Fluxivity - 250 nWb/m
5. BASF Catalog 614107, Speed - 190 mm/s (7.5 in/s)
   EQ - CCIR, Ft - 0 & 2240 Hz, Ref Fluxivity - 320 nWb/m
6. BASF Catalog 710035, Speed - 300 mm/s (15 in/s)
   EQ - CCIR, Ft - 0 & 4500 Hz, Ref Fluxivity - 320 nWb/m
7. Magnetic Reference Lab Catalog 21T104, Speed - 190 mm/s (7.5 in/s)
   EQ - NAB, Ft - 50 & 3150 Hz, Ref Fluxivity - 200 nWb/m

```

Fig 3

```

Studer Professional Tape Machine Record Alignment

The following defaults are assumed by the alignment procedure

Operating Level - L RANGE: 4/10 dBm
Alignment Tape - SCOTCH (3M) 226
Bias -
  3.75 IPS - 6 dB
  7.5 IPS - 6 dB
  15 IPS - 3.5 dB
  30 IPS - 1.5 dB
Speed(s) - 3.75 (9.5) 7.50 (19.0) 15.00 (38.0) ips (cm/s)
Model Number - A887-2/2 UU
Equalization - NAB
Tape Sort - A

Press <Enter> to accept or first letter of item to change

```

Fig 4

```

Alignment Tape Selection Menu
Make your selection with the up and down arrow keys
When desired selection is highlighted, press <Enter>

1. Agfa PEM 468
2. Agfa PEM 469
3. Agfa PER 525
4. Agfa PER 528
5. Ampex 406
6. Ampex 466 GRAND MASTER
7. BASF LGR 30P
8. BASF LGR 50P
9. BASF LGR 50LH/50LHL
10. BASF STUDIO MASTER 510
11. EMI 816/817
12. PYRAL CJ90

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Fig 5

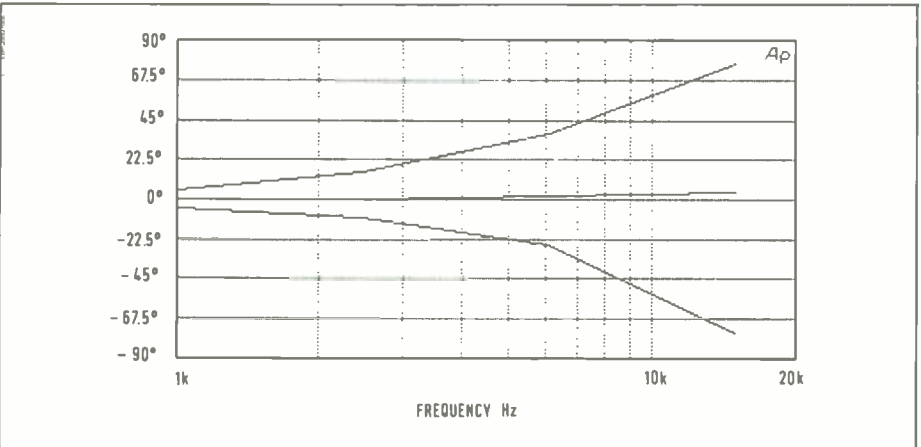


Fig 6 Correct and incorrect azimuth adjustment

◁ Adjust bass repro level (which cannot normally be done with a reference tape due to LF magnetic fringing effects): 2 to 3 seconds

Record low, mid-band, and high frequencies for sync section alignment: 20 seconds

Rewind and adjust sync level, sync treble level and sync bass level; 25 seconds

Record section alignment is now complete. If the full performance measurement mode is invoked, the program goes on to automatically measure each of the following parameters and compare it to factory specs:

- Line output level
- Third harmonic distortion
- Full-range record-repro frequency response
- Stereo separation (crosstalk)
- Wow and flutter; records 3.15 kHz tone, rewinds to start of tone and measures, makes 2 \approx computation and compares result to limits

Depth of erasure; records 1 kHz at 0 VU, returns to start of tone and records over it with no signal, measuring repro level with selective filter to permit measurements below wide-band noise level

Phase accuracy at 10 kHz
Weighted and unweighted S/N ratio. For this measurement, the program locates ahead to a point which should be virgin or bulk-erased tape

Rewind the tape

Print a 3-page performance report in the format specified by the Studer factory. The print-out includes the final hexadecimal value of each adjustment in the machine for each tape speed. Time for performance verification and report printout is 2 to 3 minutes

Results of this automated process are extremely consistent. Five consecutive alignments of an A820 were made and the resulting record-repro frequency responses graphically overlaid for comparison. Response flatness was well within 1.0 dB across the entire spectrum. The maximum deviation between any of the measurements at any one frequency was 0.3 dB, which occurred at 18 kHz.

Users may add reference tapes not presently supported. They must first, time the various tones on the tape, then create a new text file containing data in a tabular format. Any PC text editor such as a word processor or *System One's* own editor may be used. The table consists of the frequency, amplitude with respect to reference fluxivity, starting time and duration of each tone segment on the tape. The reference fluxivity value, tape model number, speed, and equalisation are also entered. The tape file is then added to the reference tape selection menu, again using any text editor. New blank tape formulations are even easier to add, requiring only the tape designation plus overbias values for the four speeds.

Even though the software program for alignment of these Studer machines is purpose-written and thus highly specialised, *System One* and the *PC* are fully usable for alignment and performance verification of tape machines requiring manual alignment, using existing reference tapes. Analogue indications are displayed for all adjustments. Bias adjustment is supported by the overbias method, minimum distortion method, or modulation noise minimisation method. Record EQ is easily set by toggling the generator between midband and any arbitrary high frequency while adjusting for constant output. Performance measurements are graphed in realtime, on screen. *System One* also performs complete audio testing of mixing consoles, equalisers, digital recorders and processors, microphones and virtually all other audio devices. □

About Dolby SR...

Guy Charbonneau

producer and owner of Le Mobile, Hollywood

It gives one the sound as if it's not on tape, that it's the live performance

Pro Sound News, April 1987

John Cutler

producer for Grateful Dead

SR could save the analog business for many years. It is transparent...

Mix, July 1987

William Hoekstra

recording engineer, Saint Louis Symphony Orchestra

In some ways, SR is better than digital... the 15ips Dolby actually has a better capability for handling peaks

Pro Sound News, April 1987

Brian Masterson

director, Windmill Lane, Dublin

We have bought 76 channels of Dolby SR which is terrific

Eq, June 1988

Hugh Padgham

producer

I'm quite happy with a good analogue machine and Dolby SR

Sound on Sound, May 1988

Simon Phillips

drummer and studio owner

I've done an album with it and I think it's brilliant

Studio Sound, May 1988

Pete Townshend

musician, The Who

Dolby SR has lengthened the life of analog by 10 years

Pro Sound News, August 1988

John Williams

guitarist

Wherever possible I will do all my recordings with Dolby SR

HI Fi News and Record Review, May 1988

...unsolicited statements, in print

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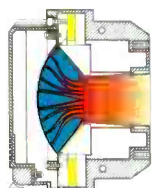
Dolby Laboratories, Inc., 346 Clapham Road, London SW6 9AP, tel 01-720-1111, itx 919109, fax 01-720-4118, 100 Potrero Avenue, San Francisco, Ca 94103-4813, tel 415-558-0200, itx 34409, fax 415-863-1373. Dolby and the Double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. © Dolby Laboratories, Inc. 1988 S89/8537.

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JBL's 2450J Neodymium Compression Driver with Coherent Wave™ phasing plug provides in-phase combining of sound waves for extended high frequency performance. JBL's patented diamond surround titanium diaphragm with new embossed dome greatly reduces distortion and damage at high SPL.

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2450J

The 2450's smaller size translates to tighter spacing of horn arc arrays, more even and precise coverage and greatly reduced requirements for delay. Plus, the 2450 nets out at a mere 4.8 kg (10.5 lb). The benefits of this dramatic weight reduction include lower shipping costs to the site or on the road and significantly less load bearing requirements for both structures and rigging. With built-in mounting points, the 2450 will take much less time to install.

Yes, it took more than a little neodymium to change the face of driver technology. But we're confident you will find the breakthrough results were certainly well worth the wait and the effort.



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WHICH AMPLIFIER TECHNOLOGY PART FOUR

Ben Duncan concludes the series with a look at the different kinds of power supplies found in modern amplifiers; and presents an overview of the complete series

In relating the different kinds of power amplifier technology, I've presumed for simplicity that DC power is *fait accompli*. But of course, in a real amplifier, before anything useful happens, a power supply, its component parts probably taking up over half the volume of the box, has to convert the AC 'line juice' into a suitable DC voltage. In common with the output stages we've looked at, practical power supplies are less than 100% efficient. It's a law of nature. The efficiency of the power supply (PSU) will be of particular interest to us, set alongside the output stage (OPS). An amplifier's overall efficiency is the product of the two:

$$\% \text{ overall} = \% \text{ OPS} \times \% \text{ PSU}$$

Because neither are more than 100%, each contributes to reducing the nett figure. For example, if both were 50% efficient, nett efficiency drops to 25% ($0.5^2 = 0.25$).

Power factors

To discover either the overall efficiency of a power amplifier, or just that of its PSU, we first need to measure the current drawn off the AC supply when driving a known number of watts into a defined load. Almost regardless of the power conversion technique(s) employed, practical amplifier PSUs always involve reactive components in varying degrees, for safety isolation, AC voltage scaling and energy storage. The outcome is that most (if not all) power supplies present a reactive load to the AC power line; the periodic AC current generally leads the AC voltage. Most PSUs using 'smart' electronic techniques also present a non linear load.

For these reasons alone, power input requires careful definition, to screen out the effects of non-unity Power Factor (PF) (a perfectly resistive load has a power factor of 1.0; for many amplifiers, PF is around 0.8) and associated high peak currents. The latter aggravate I²R losses in cables, leading to voltage droop, hence power and efficiency losses. For the most part, these effects are essentially external to the amplifier. They're also liable to be significant only if the incoming line power cabling has too high a resistance; or the socketry in line is dirty or loose. With high peak currents, the cable gauge needed may be many times that suggested on the basis of safe current rating alone. The essential point is that the efficiency comparisons that follow assume a

competent, low resistance installation. Accurate power input measurements also need to take account of auxiliary circuitry, subtracting the power drawn by fans, lamps, LEDs and relays.

Intention to supply

Three main classes of PSU are to be found in today's power amplifiers. By far the oldest and still universal, is the familiar one shown in Fig 1. Significant waste heat is dissipated by every major part: in the transformer (T1), the rectifier bridge (BR) and the reservoir capacitors (RES). In the textbooks, the 'Bi-phase bridge' (as it's known) has an efficiency of 81%. In practice, a typical high power amplifier containing a generously rated ('stiff') supply of the kind illustrated, yields 70 to 78%, depending on loading. Efficiency rises if the amplifier is driven hard into a low impedance load—for a variety of reasons.

The circuit in Fig 1 also pulls a peak current that's typically 3½× greater than the RMS current consumption. That's because charge transfer is bundled up into the small period when the incoming voltage at the bridge exceeds the voltage on the reservoir capacitors. If the windings are rated to handle the peak current, then rather like a Class A or A-B amplifier OPS handling music, the transformer's capacity to supply power is under utilised for the remaining 80 to 90% of the time. If the transformer is made small to save on size and weight, I²R losses rise and efficiency suffers. Smelt any good varnish, recently?

Beset with a circuit that's 30 to 50 years old (in various guises), amplifier designers are left to score small gains in efficiency by adopting refined 'C' core or toroidal transformers, and by taking steps to keep down the ESR (internal DC resistance) of the capacitors. Dissipation can be reduced by suitable uprating. In turn, PSU component temperatures are reduced, particularly when the amplifier is driven hard, so enhancing reliability. However, beyond a point, it's pyrrhic, as weight, size and cost are also uprated, generally ahead of any reasonable budget. On the other hand, this species of power supply is at least simple and reliable. It needs no elaborate cooling aids, while interference (EMI) radiation is restricted to low frequency magnetic harmonics.

The users of audio power amplifiers aren't the only people embarrassed by the sheer weight, space, cost and inefficiency of 'stone-age' power supplies. Many techniques exist to shrink these

parameters but only a handful are readily suited, or developed enough, to comfortably supply the voltages and currents needed for audio power. Few manufacturers have been affluent or confident enough to support the necessary development effort, and fewer still have succeeded. Who are they and what's their approach?

Pulse-width power (PWM)

In part 3 (*Studio Sound*, February), we encountered Carver's application of Class G technique but his review of amplifier efficiency was farsighted (for 1979) and brave enough to embrace the PSU as well. The power supply technology in Carver's amplifiers (up to and including the *PM-350*) is a development and refinement of the 'Phase-controlled back-slope' power supply that's well established in industrial electronics and TV sets.

The essence of Carver's scheme is to control the mains transformer's duty cycle, by switching with a triac (Fig 2). The triac's switching rate is constant but the period over which the triac remains energised is controlled (in part) by the incoming audio signal. The resulting pulse width is small under standby conditions but increases progressively in line with the immediate power requirements. There's a slight lag in duty-cycle adjustment (Carver's patent cites 200 μs), which is bridged by small reservoir capacitors. Large capacitors aren't necessary because the energy stored in the transformer's magnetic flux (and in a subsidiary resonant inductor, Carver's 'Magnetic Field Coil') is available between pulses, to bridge the gap.

This is where Carver's phrase 'Magnetic Field Amplifier' comes close to being truly descriptive: in effect, full use is being made of magnetic energy (-L di/dt) stored in the transformer, that would normally be dissipated as I²R losses in the primary. The outcome is that a 50 VA transformer (in the *M400A* 'Cube' for example) can provide over 1 kVA for short periods, enough to generate up to 750 W of audio burst power. The phase-controlled back slope PSU also exhibits regulation: the DC output voltage remains steady in spite of sag or surge on the AC power line.

The main snag with this approach is environmental. As with the conventional PSU in Fig 1, Carver's PSU in Fig 2 draws high peak currents. But the mechanism is subtly different and the effect potentially worse, because each time the transformer is pulsed on, it has to be charged with flux from scratch. Remember the way the lights dim when a traditional high power amplifier with a toroidal mains transformer is first energised? Now imagine this kind of *inrush current* recurring twice every mains cycle. In practice, the peak current draw is dependent upon the mains supply impedance.

When one channel of Carver's *PM 1.5* for example, is driven into clip with a pink noise signal into 4 Ω, the peak current rises from 10 A (just below clip) to 60 A. For currents of this magnitude, if the supply wiring resistance isn't low enough, the mains voltage waveform has 'chunks' taken out of it. Owing to the regulation inherent in Carver's amplifiers, they should be largely unaffected by the resulting sag in the RMS mains voltage. The same can't be said for ordinary power amplifiers (with unregulated supplies) sharing the same supply, as in many PA systems. In the studio, this kind of behaviour

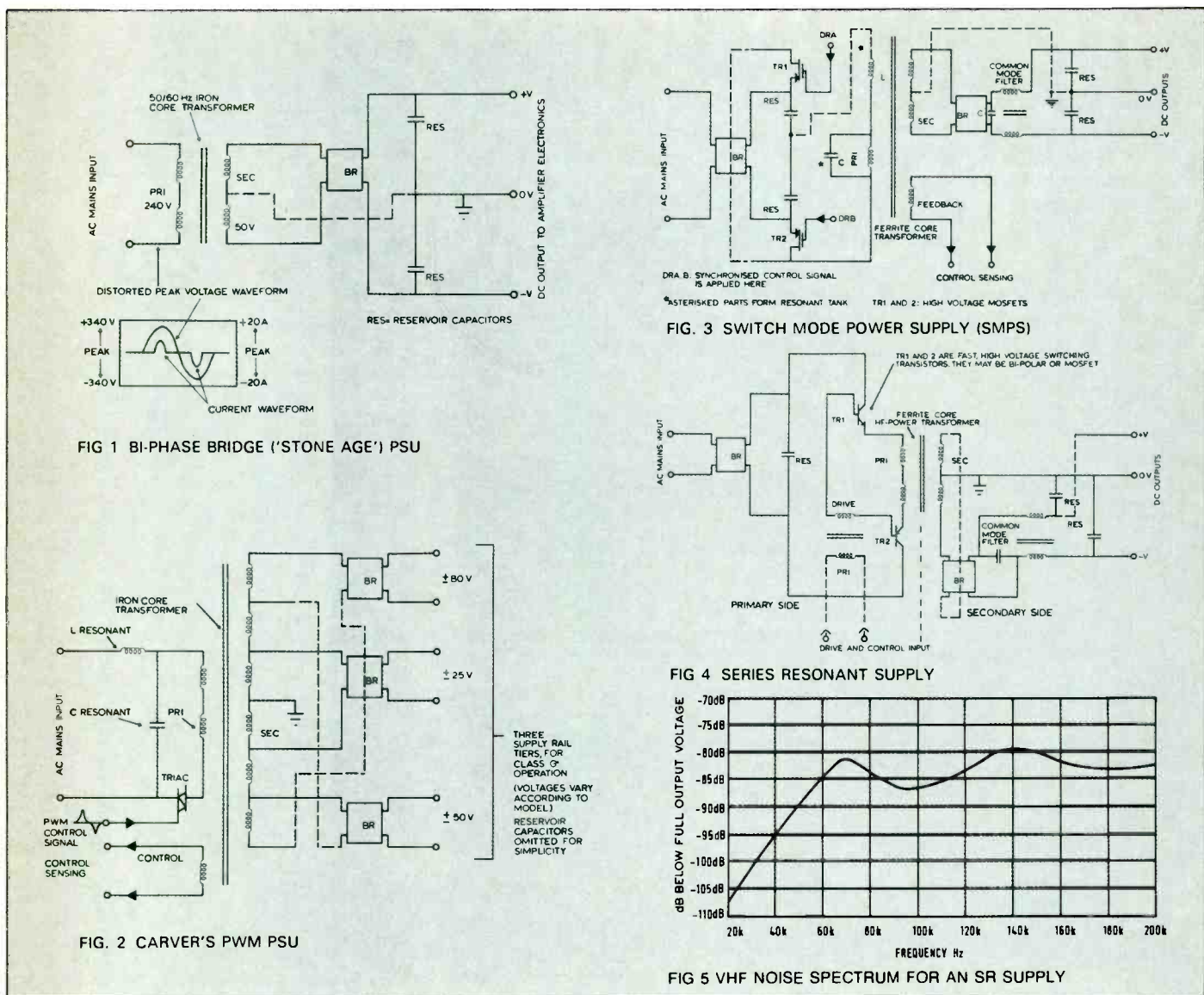


FIG 1 BI-PHASE BRIDGE ('STONE AGE') PSU

FIG 2 CARVER'S PWM PSU

FIG 3 SWITCH MODE POWER SUPPLY (SMPS)

FIG 4 SERIES RESONANT SUPPLY

FIG 5 VHF NOISE SPECTRUM FOR AN SR SUPPLY

◁ needs putting into perspective. First, the majority of studios manage with two or three stereo amplifiers at most. Second, the majority of sensitive line-level equipment operates from tightly regulated supplies. Third, heavy-duty digital equipment already present in the studio is likely to use similar power conversion techniques, equally capable of distorting the mains voltage waveform. In any event, it's good control room practice to derive any amplifier(s) mains supply from an isolated, low impedance spur.

Carver's approach has also been subject to purely circumstantial criticism (referring to the current models listed in Table 1) because the potential for weight and size reduction in the PSU has been pushed to its limits. In common with the Class G OPS heatsinking, the PSU is rated to cope with the power requirements of full range and substantially uncompressed music programme. Recalling the occasions when music programme's PMR approached that of a continuous sine wave (see part 3), whenever Carver's present models are seen in large-scale PA systems, they're usually driving only the mid and HF sections. At the same time, while small and light, Carver's PSU is actually less efficient than a stone-age PSU. My measurements indicated around 56%, rising slightly when driven hard.

On a positive note, Carver's PWM supply uses fewer and simpler parts than its counterparts, while the triac used for switching is also

inherently more 'blow-out proof' than any transistor. This bodes well for field reliability.

Switchers (SMPS)

The PWM switching technique illustrated in Fig 3 has long been used to provide DC power for hungry computers. With variations, it's featured in Yamaha's PD2500, in Carver's M2.0, and in Peavey's DECA 1200.

The AC mains is rectified and the peak voltage stored in reservoir capacitors. The high voltage DC is then 'chopped' by high speed switching transistors, so it appears on the transformer's primary as an HF squarewave. Because the switching frequency is 100 to 5,000x higher than 50/60 Hz, proportionally fewer turns of wire are needed to transfer a given VA product, all kinds of losses in the transformer are generally reduced, and the transformer shrinks. The waveform emerging from the transformer's secondary is again rectified and smoothed, or rather, filtered. At first sight, large or bulky components shouldn't be required, again because the fundamental switching frequency is so much higher than usual.

The design hurdles are threefold. First, the power factor is no better than the stone-age PSU, because the current flow into the reservoir capacitor(s) is again restricted to the peak period of the AC voltage waveform. In fact, considering

the absence of a transformer and the current-limiting effect of its winding resistance, the peak current is potentially higher; unless the maker has bothered to fit a thermistor. Second, while 'chopping' or switching DC to create AC is superficially attractive providing dissipation in the switching devices can be kept low, it's messy. The whole power supply is bathed in and liable to radiate, a mish-mash of harmonics and RF spurs ranging up to 10 MHz and above. At frequencies where capacitors become inductive, nice solid grounds can't be relied upon, and PCB track lengths above 1 mm act as aerials, the ensuing noise isn't mopped up easily.

Practical efficiencies range from 85% (Peavey's DECA series) to 60% (Carver's PM-2.0). Much depends on the switching frequency, and whether size or efficiency have been given ultimate precedence at the design stage. Despite transformer shrinkage, it's sobering to recall that switching supplies require twice as many reservoir capacitors. And that primary electrolytics rated at >375 VDC (to suit 240 VAC juice) aren't small—even when they're made in Japan. To cap it all, switching supplies depend on a string of relatively exotic (hence expensive) components, such as high current VHF filter chokes, 1 kV switching transistors, and high speed secondary bridge rectifiers, needed to rectify >20 kHz pulses with any kind of efficiency. At the same time, with the increasing use of SMPS in global electronics, the price of suitable parts is ▷

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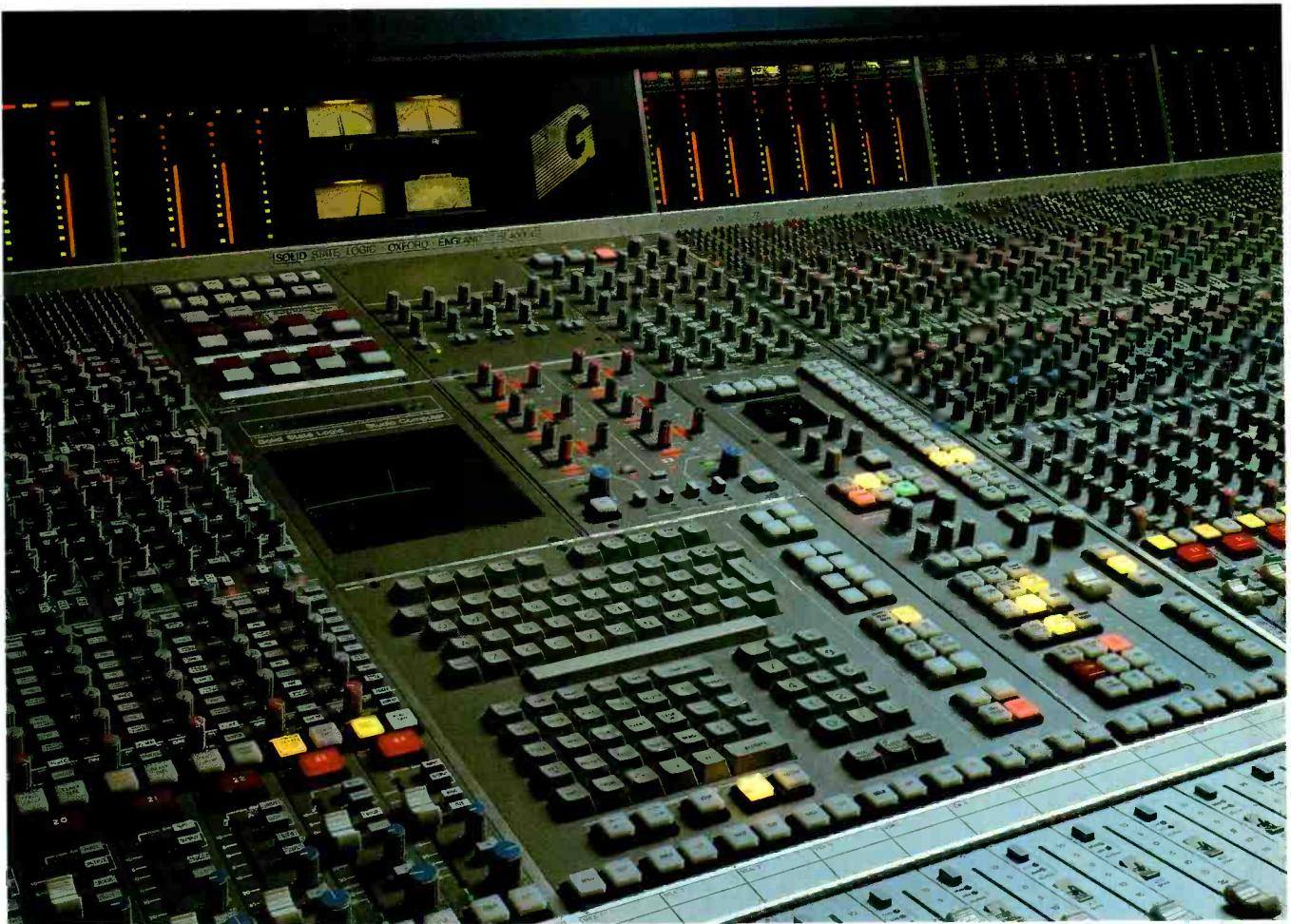
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◁ reducing, as time passes.

Tesla's dream (SR)

The primary attraction of SMPS is to switch at the highest feasible frequency, to push down the size of the transformer and output filtration components. Early SMPS operated below 16 kHz. As high voltage bi-polar switching transistors improved, and then MOSFETs arrived, switching frequencies in industrial SMPS have been pushed

beyond 100 kHz. At this point, diminishing returns set in: even with the latest semiconductors, switching losses rise and the devices start to run hot. Bigger and bigger heatsinks are called for, in turn defeating the goal of reducing size and weight! Meanwhile, as the switching frequency increases, the levels of RFI begin to get embarrassing.

Meanwhile, imagine a PA rental company being bothered to measure the current draw on the cables supplying the PA wings, with the PA being driven at full whack with pink noise. Then

imagine they uprated the cable's cross-sectional area to drop less than (say) 2% of the RMS line voltage (measured at the last amplifier along the line). Considering the peak currents drawn by certain amplifier models, they'd probably find that the weight and volume occupied by the wing supply cables would largely offset the savings achieved by choosing compact, lightweight amplifiers. Or put another way, small improvements in the power/weight ratio of amplifiers are easily thrown away if they don't deliver their rated power, because the usual 10 mm² (68 A) cable causes the line voltage to sag.

Series-resonance has been developed as a cleaner, more efficient way to convert power at high frequencies. It involves the production of a sinusoidal current waveform, which is switched (by careful synchronisation) at the point of zero current. Whereas PWM and SMPS PSUs employ a fixed period with a variable 'on' time, SR PSUs' 'on' time is fixed, while the period varies. Fig 4 shows a typical series-resonant topology; there are several configurations. Note the main circuit elements are identical to the SMPS in Fig 3, except for the middle, where the primary DC voltage is switched in conjunction with a resonant tank circuit.

This section of the circuit is similar in essence to a Class C RF amplifier, which is efficient because it operates without bias and doesn't try to be linear, instead relying on L-C resonance to tidy up the waveshape. Series resonance is also efficient because zero-current switching sync cuts dissipation in the MOSFETs, to around 1% of the output power.

Table 2 summarises typical losses, producing a nett efficiency of around 92%. Because the switching MOSFETs run so cool, long term reliability should prove far in advance of identical devices sweating it out inside a conventional SMPS. The knock-on benefit is global: the cooler any part of an amplifier runs, the cooler it all runs. And the cooler you keep the device, the longer it lives. Series-resonance is cleaner too. Since the AC in the transformer approaches a pure sine-wave, and thanks to zero-current switching, fewer components and less headscratching is required to keep RFI/EMI leakage to within tight limits (eg to accord with West Germany's VDE-871B). The graph in Fig 5 plots the VHF noise spectrum at the output terminals, referred to full output (0 dVR), for Rauch's DVT300s, the first amplifier to employ a series-resonant PSU.

SR operating frequency can be as high as 200 kHz, though somewhat lower frequencies are preferred, before reverse switching, ringing and parasitic losses rise disproportionately. At this juncture, efficiency (and the avoidance of heat) directly conflicts with the reduction of transformer size and weight. Even so, series-resonant PSUs offer a quadrupling of power density, typically 25 W/in³ compared to 6 W/in³ for traditional SMPS PSUs.

Just as significant to large scale installers and PA users, the peak current draw of a properly engineered SR PSU is lower than that of any other of the PSU types illustrated (Fig 1), essentially because the input reservoir capacitors aren't significantly drained during each half-cycle. It's typically equal to the peak current drawn by a conventional Type 1 amplifier (see Table 1), of half the power rating. The immediate audible benefit is in the bass end: music with components that are time related to the mains frequency and its harmonics aren't syncopated any longer by the supply. Finally, SR PSUs employ parts similar to ▷

TABLE 1 Amplifier summary—50 popular stage and studio power amplifiers categorised

Classification efficiency	OPS		PSU		Overall
Type 1	Standard		Standard		Average
Type 2	High efficiency		Standard		Above average
Type 3	Standard		High efficiency		Above average
Type 4	High efficiency		High efficiency		High
Manufacturer	Model	Type	OPS description	PSU description	
BGW	750D	1	Bipolar Class A-B		
	GTA, GTB	1	Bipolar Class A-B		
Boulder	500	1	Bipolar Class A-B		
BSS	EPC-780	4	MOSFET Class G*	SR*	
Carver	PM-1.5	4	Bipolar Class G	PWM	
	PM-175	4	Bipolar Class G	PWM	
	PM-350	4	Bipolar Class G	PWM	
	PM-2.0	4	Bipolar Class G	SMPS	
C-Audio	SR series	1	MOSFET Class A-B		
Citronic	PPX series	1	MOSFET Class A-B		
Crest	3001	1	Bipolar Class A-B		
	4001	1	Bipolar Class A-B		
	7001	2(4)	Bipolar Class G	SMPS future option	
	8001	2	Bipolar Class G		
Crown/Amcron	DC-300	1	Bipolar Class A-B		
	MT-600	2	Bipolar Class A-B*		
	MT-1200	2	Bipolar Class A-B*		
	PSA-2X	2	Bipolar Class A-B		
Dynamic Precision	No. 1	1	MOSFET Class A-B		
FM Acoustics	FM series	1	Bipolar Class A-B		
Hill	DX series	1	Bipolar Class A, sliding bias		
HIT	Xi series	1	MOSFET Class A-B		
	DSA series	2	MOSFET Class D		
JBL/UREI	6200 series	1	Bipolar Class A-B		
Lab Gruppen	SS 1300	3	Bipolar Class A-B	SMPS	
Meyer	MS-1000-A	1	Bipolar Class A-B		
	AMP-2**	1	MOSFET Class A-B		
Otis	Power Station	1	Bipolar Class A-B		
Peavey	CS series	1	Bipolar Class A-B		
	M series	1	Bipolar Class A-B		
	DECA 424	2	MOSFET Class D		
	DECA 528	4	MOSFET Class D*	SMPS*	
	DECA 724	2	MOSFET Class D		
	DECA 1200	4	MOSFET Class D*	SMPS*	
Quad	All models	1	Bipolar Class A-B		
QSC	Series I	1	Bipolar Class A-B		
	Series III	2	Bipolar Class G*		
Ramsa	WP series	1	Bipolar Class A-B		
Rauch Precision	DVT 50S	1	MOSFET Class A-B		
	DVT 250S	1	MOSFET Class A-B		
	DVT 300S	3	MOSFET Class A-B	SR*	
Tannoy	SR840	1	MOSFET Class A-B		
TOA	P series	1	Bipolar Class A-B		
Turner	B series	1	Bipolar Class A-B		
Yamaha	P2075	1	Bipolar Class A-B		
	P2150, 2250	1	Bipolar Class A-B		
	PC5002M	2	Bipolar Class G		
	PD2500	3	Bipolar Class A-B	SMPS	

* Amplifiers and power supplies that have higher efficiency than others within their class, and generally incorporate the most recent innovation in this area
 ** An in-house code name for a new model, due to appear in 1989

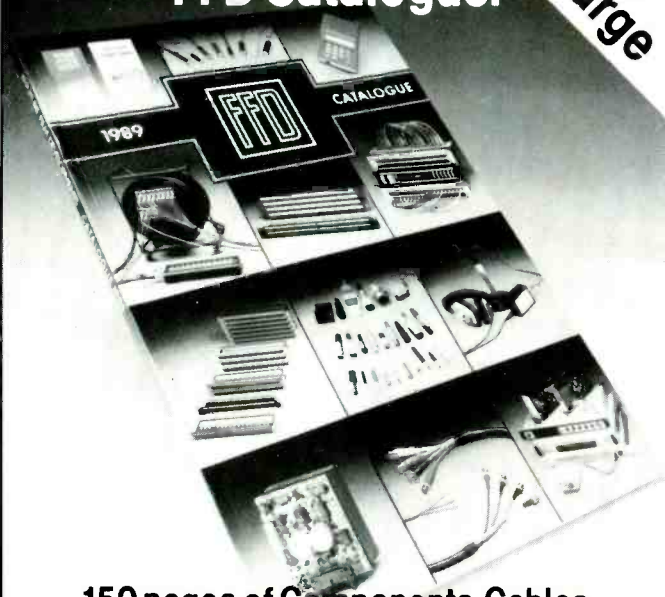
TABLE 2 Losses in an SR PSU analysed

Circuit area	Loss
Primary bridge	16 W
Resonant LC tank	8 W
MOSFET switches	40 W
Transformer	13 W
Secondary bridge	32 W
Total loss:	109 W
Total output power:	1300 W
% efficiency:	92.2%

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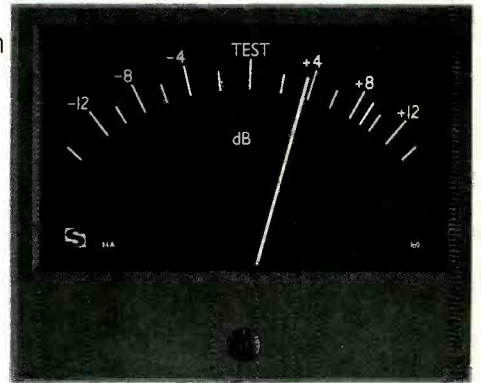
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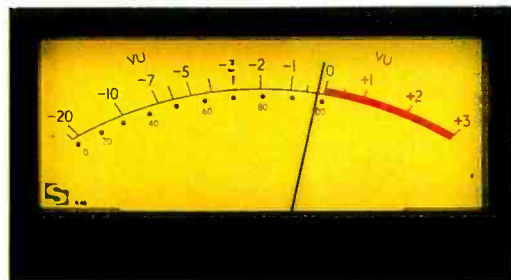
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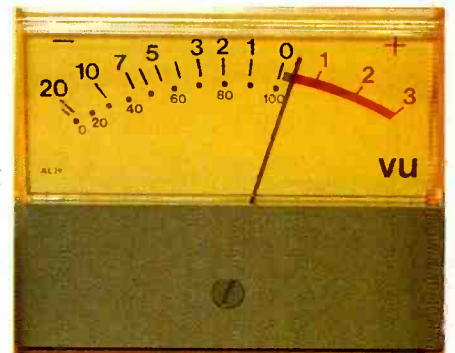
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Abbreviations and technical definitions

EMI: Electro Magnetic Interference
OPS: (audio) Output Stage
PMR: Peak to Mean Ratio (also known as Crest Factor)
PSU: Power Supply
RFI: Radio Frequency Garbage
VHF: For audio, any frequency >20 kHz

◁ those in conventional SMPSs, except there are fewer of them.

Tradeoffs

All the 'smart electronic' techniques described above depend on fast, high repetition-rate switching to provide improved efficiency and/or reductions in weight and size of the transformer. And each in turn, generates VHF noise, to varying degrees. At best, the results are visible as a thickening on the scope trace at the amplifier's output, and an occasional spike, typically a few microseconds wide. It looks bad, it inevitably contributes to a worsening of HF intermodulation figures, and it might be audible as HF distortion and 'veiling'. If you're unlucky (or untidy) the noise radiates from/is conducted by the mains cable and gets inside all the adjacent equipment you care to probe. Although noise is suppressed by design to reasonable limits by all the reputable amplifier makers with smart PSUs, only one component intolerance or loose earth connection is needed to turn any individual amplifier into a

powerful RF noise generator. So for amplifiers employing anything other than a 'stone-age' PSU, it's doubly valuable to make a 'goods inward' inspection of RF levels present at the outputs and around the mains lead before installation.

The higher parts count in 'smart' power supplies potentially reduces MTBF (reliability) figures. Then there's the speed with which overstressed small components can expire. In real life, most audio output devices continue to blow with a short between their main terminals. Often, a shorted speaker cable is the culprit. It follows that to be properly protected a 'smart' PSU needs to be able to cope with a direct short across its outputs.

On the one hand, overloaded 'stone-age' PSUs do at least give off a warning buzz and some interesting smells, and more often than not, a fuse blows before any real damage is done. Also 'stone-age' supplies exhibit a soft 'somewhere around here' current limit, whereas 'smart' supplies have definite hard-knee limits that can never be safely exceeded, however momentarily. On the other hand, 'smart' PSUs open the way to sophisticated protection. For example, an SR PSU can be powered down within a fraction of a millisecond, should its life be threatened.

Summary

Each class of amplifier has a broad optimum power/volume ratio (W/in^3 , or W/mm^3). Although fuel and truck rental can be saved by using the smallest and lightest amplifier available, all is not what it seems: efficiency suffers when size and weight are reduced below nature's intrinsic scale, and there may be tradeoffs to the kind of programme that can be handled, as well as higher

operating temperatures and environmental side-effects.

At the bottom line, high efficiency in audio power amplifiers means a high ratio between output power and wasted power. It's not synonymous with small size and levity, although it may contribute to both. On this basis, the coolest-running, most efficient power amplifiers are made (at the time of writing) by Peavey in the USA and BSS in the UK.

Beyond this, there are combinations of power, size, weight, reliability and sonic quality to suit most purposes. It remains for amplifier users to define exactly what they need, and to thoroughly evaluate shortlisted models under real operating conditions before purchase. Table 1 sums up the series, detailing the technology used in over 50 amplifier models that are either widely used by UK studios and PA rental companies, or are technically notable. *Caveat Emptor*... □

Acknowledgements

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PIONEERS IN AUDIO ACCESSIBILITY

Well, students of the recording scene, here we have the first annual *Studio Sound* 'Perspective' audio industry exam. Read these

informative little 'squibs' and decide which of these several items are true and which ones are false. See if you can decide which of these pieces will signal changes in the audio industry and appear in print again and again. At the end of this test, you will be able to quantify your audio awareness score. Remember, no cheating. There is a proctor hiding behind page 83 who will slap your knuckles with a ruler if you do cheat.

● 1 As of the Winter 1988-89 edition of the Schwann music media catalogue, there were exactly fifty-five (55) pre-recorded digital audio tape (DAT) releases extant in the United States. These 55 tapes—from suppliers Delta Music, DMP and GRP—represent the total catalogue of DAT tapes available. The announced availability of in-car DAT players as part of the sound systems packages for luxury 1989 cars from several major automakers, means that a 1989 consumer market for DAT music tapes does exist. Major record companies have declined to make available any music from their respective catalogues for automotive DAT replication and distribution. This means these DAT sound systems in the 1989 luxury cars are a lot like the proverbial gun without bullets. It would appear that there are going to be a lot of drivers getting very tired of the same fifty-five (55) recordings.

● 2 Consumer audio industry sources estimate the 1989 market for LP turntables and cartridges to be in the range of 1 million units in the United States and Canada. United Kingdom figures should reach 200,000 units within the same time frame. Considering virtual saturation of LP record players in homes (in excess of 90% ownership), the turntable sales figures represent a modest 'turn' of replacement turntables plus some new entrants to the LP marketplace. Considering that in the United States, new CD players sold in 1988 will total only about 5 million units, the sales velocity of a mature technology, the LP, remains surprisingly strong.

● 3 Record industry sources confirmed that 1988 would be a banner year for the sales of recorded music in the United States on compact discs. It was expected that the final tally would show sales figures in excess of those for black vinyl (LP) and approaching tape (cassettes) conclusively for the first time. The unit sales achieved will also eclipse the all time sales figures last set in the late 1970s (1978) during rock's (and the record industry's) golden era. The same sources also indicated that the sales figures justified the current high retail prices for CD releases. Contrary to criticism from those calling for wider distribution at a lower price, these sources felt that the record industry could sell all the music it (the industry) was willing to produce at the current price level. CD dollar volume was expected to surpass easily the \$2 billion level.

● 4 Analysts announced that if the current rate of decline continued and the record companies continued to make good on their plans for the elimination of black vinyl, the LP will disappear from the catalogue of major labels by the end of

Martin Polon

A little of DIS and a little of DAT. A quiz to test your knowledge of events likely or not. Comment from our US columnist

1991. LPs declined by nearly 25% in terms of unit sales from the majors' catalogues in 1988. Some observers expect that smaller labels will pick up the demand for LP pressings but other experts say that the record stores want to eliminate the LP as much as the major labels do. Greater CD profitability and the excess space needed for LPs in-store are cited as two main reasons for the anti-LP retail position. It is felt in some quarters, however, that record companies will honour an LP embargo about as well as OPEC members sustain oil price squeezes. The prospect of controlling the LP market may turn some record company heads around on the topic of black vinyl.

● 5 A major multimedia duplicator in the United States, has ceased its CD pressing operations. The halt was apparently mandated by creditors of the parent operation. The parent company is in Chapter 11 of Federal bankruptcy proceedings. Many of the assets of the parent are for sale but no buyer has been found for the CD pressing facility and the facility cannot be kept operating at a profit due to reduced sales volume and low industry-wide prices for CD pressing. The facility will be auctioned if a buyer is not found early into 1989. It is common knowledge that pressing for large orders can be contracted at close to a dollar a disc in certain facilities. A 'buck a bang' is a price that can bankrupt many CD plants built with high interest money at the beginning of the 1980s, profitability being dependent upon pressing at two dollars per disc or better. Several observers were fearful that other CD facilities in the Western World could also be in similar jeopardy.

● 6 An important Japanese audio and video maker, a major affiliate of and partially held by an arm of one of the world's largest trading companies, will withdraw from the lucrative and important United States audio marketplace in 1989. This unprecedented move will be mandated by a significant loss over a given time period, due primarily to the US marketplace confusion over product pricing and the effects of yen revaluation. The move signals an honest statement that this company cannot make money in the cut-throat US audio marketplace anymore selling quality products built in Japan. The company had entered the US market with open reel audio tape recorders in the early 1960s.

● 7 Speaking of open reel audio tape recorders, a look back into the history of the audio industry finds the introduction of open reel audio tape recorders greeted with mixed emotions.

Enthusiasts in the 1950s were thrilled with the 7½ in/s recording speed for 7 inch reels of Scotch 111 recording tape. But representatives of the world's record companies were determined to halt the proliferation of these home recording machines. In statements to the press, these record industry mouthpieces called for an abolition of home tape recorders as 'stealing recordings', 'putting the recording studio into every home', 'capable of stealing profit from every record extent', etc. A call was made for legal protection and the payment of a royalty to every record label for each tape recorder bought and each reel of blank tape purchased.

● 8 Digital audio tape recorders (DAT) are being withheld from the consumer marketplace in the US and Europe until a technical analytical organ of the US Government completes its study on illicit copying of recorded music and its concomitant impact on record company profit. The study supposed to be released in the Spring of 1989 is meant to provide a definitive look at copying and its true impact on record company claims of copy damages to record sales.

Meanwhile, despite a large war chest for impacted companies, the world's electronic giants and the not-so-giant are still avoiding the introduction of DAT due to the threat of music industry 'killer-shark' lawyers brandishing nuisance law suits. DAT products will not join the audio-video marketplace until either a software supplier-hardware supplier agreement is codified or until the world's audio hardware suppliers decide to force the issue. No body of law would be interested in sitting for either a continued legal stalemate or by the calendar presence of nuisance law suits.

● 9 The board of a major record industry representative organisation has called for a unified opposition to the technology of optical recording on 'compact disc'. Specifically, CD-R for 'Write-Once' and CD-E for 'Erasable', are defined as representing an even greater potential threat to copyright owners of music as intellectual property than the much deprecated DAT. It is felt that CD-R could be on the market by the end of 1989 while CD-E could take several more years in development. In a press statement, the record organisation states that while the new developments in technology are always greeted warmly, those developments that obviously threaten to inhibit the creativity of the artist, the performer and the producer must be opposed strongly. Electronics industry analysts point out that a strong position against recording optical disk could pit the approximately \$4 billion record industry against the \$200 billion plus computer industry.

● 10 Having lost the equivalent of two years selling exposure for the DAT system in the United States and Europe. DAT manufacturers face 1989 having only agreed to talk again with the software makers. Despite an upbeat meeting in London at the close of 1988 with record company representatives, the *status quo* is

virtually unchanged in terms of the log jam over DAT. Despite the willingness of some hardware makers to consider the incorporation of a one-time copy governor in DAT recorders, the two sides could not find enough middle ground to reach an agreement. The governor would make use of digital information tracks on the CD and on the DAT tape to prevent multiple copies from being

or even a product category may also have to change. People do not buy what they do not understand or cannot perceive.

● 13 Japanese attitudes at retail are at the root of the conflict over DAT and other new technologies, record company sources indicate. In Japan, there are over 5,000 shops in the business of renting records (CDs, LPs, cassettes, etc.). These

and the water temperature for spraying at the rear of the individual who is seated on the 'throne'. The Japanese envision the toilet becoming a place to visit, a place to wind down from the cares and stress of the day, a place to relax and enjoy.

In a typical application, the user sits on a sanitised seat that is preheated to the ideal temperature *vis-a-vis* outside air temperature. The user performs whatever bodily functions are necessary and then pushes a button on the command module. A mechanical arm bearing rotating water jets is extended and the spray is extended upwards. From the command module, control of water temperature, pressure and angle are in the hands of the user. Perfumed mist follows blasts of heated air and the process is finished. That is unless medical information is needed by the family physician. Blood pressure, temperature, haemorrhoidal status, urine or stool condition can all be ascertained by the toilet and then transmitted via phone line to the doctor's computer. There will in all likelihood be a phone line as part of the installation anyway since the fax phone would need the line as well as the digital audio link for downloaded music of the user's choice.

“In fact, this test is great fun because it has allowed us to present some of the current trends in our industry to you in a relatively painless way. But let me make a point. There is nothing painless about the conflict going on in our business that is preventing new technology from emerging.”

made tape-to-tape. Most attendees at the London gathering and most outside observers feel that the record companies' insistence in involving legislative and other government authorities, conforms to their existing position on the need for royalties to the music copyright holders—namely the record companies themselves.

● 11 Industry trade group complains that duplication quality is the greatest threat to consumer confidence in audio and visual releases. Despite nearly a 20% rise in consumer purchases of pre-recorded cassettes, the quality problem has never been worse in this decade, according to some sources. The virtually non-linear behaviour of many portable and automotive audio tape players, which constitute a majority of the market, means that most consumers cannot easily detect sloppy replication. The attitude that 'what the consumer can't hear, will not hurt him' is far too prevalent in the industry, according to several long-time observers. Even the CD, which has had very low rates of consumer return as opposed to other forms of recorded music, is beginning to experience much higher levels of defects. This is due to a combination of cost cutting measures by both CD suppliers and the record companies themselves. The lack of adherence to the 'bluebook' of CD standards set up by Philips and Sony is another problem. The high quality reputation of the CD system could be endangered if quality control measures are not restored. Some sources feel that the CD reject rate has risen to 6% or 7% from a low of 1% to 2%.

● 12 A recent study by an American university research group indicates that only about 5% to 7% of the adult population could be called technically literate. Nearly 60% of those questioned did not know that the earth revolves around the sun. The implication for the audio industry involves the perception of technical quality in the compact disc and whether the majority of the population recognises this quality inherently. Another concurrent issue is the inability of large segments of the audio consuming population to deal with complex and elaborate audio components; especially those units that require user skill to achieve maximum performance. The concept of what represents saturation for a specific product

rental shops allow consumers to take recordings home for copying and return them the next day. Blank cassettes in Japan sell at the 600 million unit level per year, while recorded cassettes only sell at the 50 million tape point. Record industry analysts feel that if the Japanese home market was attuned to a 'higher morality' when it comes to unauthorised copying, the problem of coming to terms over DAT, etc. would be easier to resolve.

● 14 A new blue-light laser has been developed by a major Japanese electronics maker. The laser could be the key in the long term to doubling compact disc capacity or allowing a half-size disc (60 mm) to take the place of a standard diameter disc (120 mm) in terms of recorded content. In addition, the blue laser could be the key to reading and recording CD compatible optical disks using dye coatings that can be written at low power. The heart of the new modular laser package is the doubling of conventional laser frequency producing a substantial light output in the blue region. Although the laser module is still considered a prototype, it will be available for application testing well before the end of 1989.

● 15 Much dialogue is being undertaken in Japan to identify new and more profitable markets to be exploited by the major Japanese consumer products giants. The audio market has become something of a disappointment for Japan. Growth is very slow, with the entire category assuming the mantle of a mature business. In Japan, for example, 1989 audio sales are expected to increase by slightly more than 3%. In Japan CD sales, on the other hand, will decrease by slightly more than 3% as well. In the United States, 1989 growth in audio products is expected to be in the range of 2 to 3%. Hot product lines like fax, electronic games and smart calculators, computers and directories have primarily benefited smaller firms. The 'big boys' in Japan are currently investigating 'paperless toilets' or 'automatic bottom sanitising facilities'. They don't want to miss the boat on this one. Excrementally speaking, these toilet 'systems' are designed to provide the ultimate in service to the user. A microprocessor control system makes decisions pertaining to gender of the user, water temperature desired while one is 'on' the facility

Well, there you are. Now, let's just check your scores. All the choices presented above are true. Every single one. It means we are labouring in a very interesting business, indeed. Now, it is encouraging if you scored 12-15 on this test. That would mean you are well on your way to being qualified as an audio industry executive. If you scored 10-11, then you certainly could find yourself running a top flight recording studio. If you scored 7-9, then you could well qualify for a job as a sound engineer. If your score was 4-6, and you voted for Margaret Thatcher or Ronald Reagan, then you should consider government service in audio. If you had a score of 3 or less, then you would be qualified to write this column but don't call us—we'll call you!

In fact, this test is great fun because it has allowed us to present some of the current trends in our industry to you in a relatively painless way. But let me make a point. There is nothing painless about the conflict going on in our business that is preventing new technology from emerging. Whatever my attitudes towards the record companies may seem in print, in fact I support their right to appropriate and fair compensation—the words appropriate and fair being the key. The hardware people cannot continue to tolerate the *status quo* because the result has been the loss of velocity throughout the industry. Fewer recording sessions, less professional equipment sold, mature status for consumer audio, etc. are all ramifications of freezing out new technology. And I am only half joking when I say this. If the audio industry does not regain its technology initiative soon, the Japanese electronic giants may indeed turn their energies to producing computerised super toilets. We can continue with our *status quo* by recording 'fifties rock to flush by' or 'great themes to ponder on the hi-tech john'. □



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Cinema sound engineers took a walk down memory lane recently at the Warner West End in Leicester Square, London.

Bose had hired it to launch a sound system that, we were told, "could have a dramatic effect on the future of cinema sound in the UK".

The Bose system is a 2-way configuration based on three stacks of Bose 802s behind the screen handling 125 Hz upwards, a pair of Bose low frequency 'cannon' drivers on the floor near the screen pumping out 25 to 125 Hz, and a gang of Bose 102 speakers around the cinema to give full range surround-sound. The Bose stacks take up less space, and are cheaper than the THX/JBL system, which major cinemas are now installing.

The Bose, however, sound is not as good as you get from a well-tailored JBL system, but, in its favour, it's still a marked improvement on the 50-year-old horn speakers, which some cinemas are still using.

Behind the scenes Bose have been negotiating with Dolby Labs to 'bless' the Bose cinema system for reproducing Dolby Stereo and Surround films. There are now over 1,700 cinema films in Dolby stereo format and although over 11,000 cinemas have revamped their sound system to cope with Dolby tracks, that still leaves an awful lot more cinemas round the world that have not yet converted. Hence Bose's desire to get Dolby's nod of approval.

The main sticking point so far has been that Dolby stereo films are mixed and dubbed in studios that don't use Bose monitors. So inevitably they will sound different when reproduced on a Bose cinema system. This leaves Dolby on the horns of a dilemma.

Vetoing the Bose system will deter cinemas with limited space and funds from upgrading to Dolby stereo and surround; but approving the Bose system may upset sound mixers, directors and producers who want to hear in the dubbing room how their mix will sound in a cinema.

Negotiations between Bose and Dolby recently reached a delicate stage.

To the surprise of the press (and to the surprise person) we found when we arrived at the Warner West End that the event was in fact a joint venture between Bose and another Mass company Kintek, who had invited cinema industry engineers.

There followed a lengthy screening of reels from feature films, with spiel from American representatives of both Kintek and Bose. Many of those present knew how history tells there is absolutely no love lost between Dolby and Kintek.

Throughout the '70s, Dolby Labs poured many tens (probably hundreds) of millions of dollars into persuading the film industry to use studio A-type noise reduction to improve the quality of film soundtracks, split the conventional mono track into a stereo pair and employ quadrasonic matrix coding techniques to give surround-sound. The watershed came when George Lucas and Steven Spielberg used Dolby Stereo for *Star Wars* and *Close Encounters* 35 mm release prints.

Suddenly film makers were anxious to release in Dolby Stereo and cinema managers wanted to

Barry Fox

Bose and Kintek have a system which they believe challenges the stereo cinema sound of 'you know who'. But does it?

put Dolby Stereo up in lights.

Prior to that, British engineer John Mosely had devised the bizarre 'quintophonic' surround-sound system used for The Who's film *Tommy*. It mixed optical and magnetic tracks. Quintophonics sank without trace and the film went out in Dolby Stereo.

In July 1979 Mosely represented Kintek when he lectured the British Kinematograph Sound and Television Society in London on a new sound system to rival Dolby. The Mosely-Kintek system split the optical soundtrack into seven tracks, instead of the normal two halves for stereo. This gave multiple surround-sound. dbx noise reduced hiss. Although clever, the seven track system was too complicated and too late—and it too sank without trace.

A year later, Kintek tried again with a system called *Cinesonics*, which was claimed to offer "the next dimension in movie sound". Kintek's sales pitch to the cinema industry promised "realistic surround" with "special circuitry to eliminate almost all of the noise" and more circuitry which "electronically expands the dynamic range of every film to restore it to the original sound levels".

Through 1980 and 1981 I repeatedly asked Kintek to explain how their system worked. To cut a long story short, it used dbx decoders to mimic Dolby circuitry.

Some cinemas in America and Japan have installed Kintek decoders and use them to screen Dolby Stereo films. The circuitry steers clear of any Dolby patents which are still in force, so Dolby Labs can do nothing to prevent the sale or use of Kintek decoders—just as Dolby Labs can do nothing to stop a hi-fi firm building a noise reduction decoder which mimics the performance of a Dolby B or C chip.

But what Dolby can do, and most definitely does do, is use its trademarks to stop the makers of mimic circuits describing them as Dolby-compatible. This is what drove all the Japanese pseudo-Dolby cassette decks off the market. When someone buys a tape recorder, they want one with Dolby B or C, not an un-named circuit which can be used to decode recordings made in a "well-known noise reduction system" which the

manufacturer cannot mention in adverts, instruction books or control panel labelling.

Likewise cinema owners who install Kintek decoders cannot advertise a presentation as being "in Dolby stereo".

So bedding down with Kintek was hardly the best way for Bose to score Brownie points with Dolby!

Engineers and journalists at the Bose/Kintek demonstration (billed outside as Kintek/Bose, incidentally) watched and listened bemused and amused, as the double act marketing team from America announced their intention to launch a sales campaign in Europe for Kintek/Bose cinema systems. They referred to Tom Holman, who designed the THX system of JBL speakers used by cinemas like Warner as having "limited acoustical knowledge" and described the Kintek circuit as "cloning" Dolby equipment.

And according to Kintek, not only does the Kintek decoder mimic Dolby A noise reduction for stereo tracks, it also "clones" the Dolby *Spectral Recording* system as well. SR was developed for recording studios but is now being used on some feature films.

"Our SR cloning circuits are much more competitive," said Kintek blithely, "they do the same job but without the complexity."

At this stage, the audience, who well know Dolby's attitude to cloning, drew a sharp intake of breath. Engineers then hammered Kintek and Bose for their unscientific approach.

The scientific approach would have been to demonstrate the conventional Dolby system installed in the Warner cinema with the existing THX/JBL system, then demonstrate the Dolby decoder with Bose loudspeakers, then demonstrate the Kintek decoder with the existing THX/JBL sound system, and finally demonstrate Kintek with Bose. Instead they just played Kintek through Bose, leaving no point of reference.

"You don't change two variables at the same time when comparing sound equipment," complained a frustrated engineer. "You change one variable at a time."

Dolby Labs look like having the last laugh. The company admits that it cannot do anything to stop Kintek cloning its circuitry but it most certainly can and will police its trademarks. Dolby has already produced a leaflet, which lays down the legal ground rules for cinema managers.

"They can use what equipment they like to screen films," says Dolby, "providing they don't use our name or logo. The moment they mention Dolby, we will pounce."

So if you see any cinemas advertising films in stereo by 'you know who' you will know why they are doing it.

A week after the public bed-in Bose tried some damage control. In a 'have-our-cake-and-eat-it' statement Alan Kilford, managing director of Bose UK, 'pointed out' that although a Kintek sound processor was used, Bose has "no preference for any one manufacturer's processor" and "demonstrations to this effect will be available in the near future".

Which is a bit like saying I know we were campaigning for the Labour party last week, but we will be lobbying for the Tories next week. □

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PEAVEY DIGITAL ENERGY CONVERSION AMPLIFIERS

DATA EXCHANGE

Continuing our series on understanding computer technology Francis Rumsey explains how data is exchanged between microprocessors

Data, whether it is digital audio data or other information, is a fact of life these days. Most audio equipment now incorporates at least one microprocessor, and microprocessors rely on data for operation; they also need to talk to other microprocessors at times and the data that results from system operations will often need to be stored somewhere for future use. Everyday examples of this in the studio are not hard to find; a MIDI sequencer telling synths and samplers what to do, or a console automation system controlling a set of faders.

Data basics

Everyone talks about digital data being just 'ones and noughts' but what does this mean in practice? In order to send ones and noughts down a piece of wire they may be represented by differing voltages; to transmit them over a telephone line they may be converted into changes in frequency of a tone within the telephone bandwidth; to transmit them over the air they may be used to modulate a radio frequency carrier. There is also the question of how many digits to send at once because data messages are usually made up of words consisting of a number of ones and noughts (bits), often eight (called a byte).

Parallel or serial?

The most simple distinction to be made here is between parallel and serial communication. In essence, parallel communication involves the transmission of a number of bits together while serial communication involves the transmission of one bit after the other. In terms of pieces of wire linking two pieces of equipment, the parallel interface will usually require more wires than a serial interface. If an 8-bit message is to be sent from one place to another directly over wire, the parallel interface would use one wire per data bit (eight wires) while the serial interface might only need one wire, although in practice this is not always the case because of the need for additional 'housekeeping' circuits.

The parallel interface will usually be more cumbersome to implement externally to a system (say for communicating between two synthesisers) because of the large number of wires, larger connectors, and bulky cable, whereas the serial interface is often more suitable here due to the possibility of using simple connectors and cable. It will also be appreciated that the cost of cabling any considerable distance in parallel fashion might prove prohibitive and that to communicate

over telephone lines or by radio using parallel links would be impractical, as one would need as many channels as bits in the data word.

Internally, within a microprocessor-controlled system, parallel communications make more sense, since the distances are small and one needs the speed advantages that are inherent in a parallel system. Often the parallel links are printed on circuit boards or are wired as backplanes between circuit boards. The collection of wires that make up the parallel interface is called a bus.

There are a number of well-known serial and parallel interface standards, all of which will be found on various desktop computers for connecting printers, modems, networks, and so on. They are also appearing more on computerised audio and video equipment for remote controllers, edit list dumps, and so forth. RS-232, 422, 423 and Ethernet are all serial standards, while Centronics, IEEE and SCSI are all parallel standards. Commonly, parallel interfaces will represent a one or a nought by a high or low voltage on the relevant piece of wire, and the pattern of high and low voltages on the wires will match the bits of the digital word. The high voltage will often be around 5 V, while the low will lie around 0 V. The low voltage will represent the 'true' state or a binary 'one'.

Often, a serial interface will also represent bit states by changes in voltage but in this case each bit has a specific time slot as the bits of a word are sent one after the other down a single link. Exactly how many bits of wire this corresponds to depends on the interface standard in use, as some are electrically balanced lines (like RS-422), while others are simply a single wire and an earth for the data line (like RS-232). RS-232 is a bit special in this respect, because the true standard requires a 25-way D-type connector, each pin having a specific function to do with the organisation of



Fig 1b: Serial
Eight cats have to queue to jump through one cat-flap

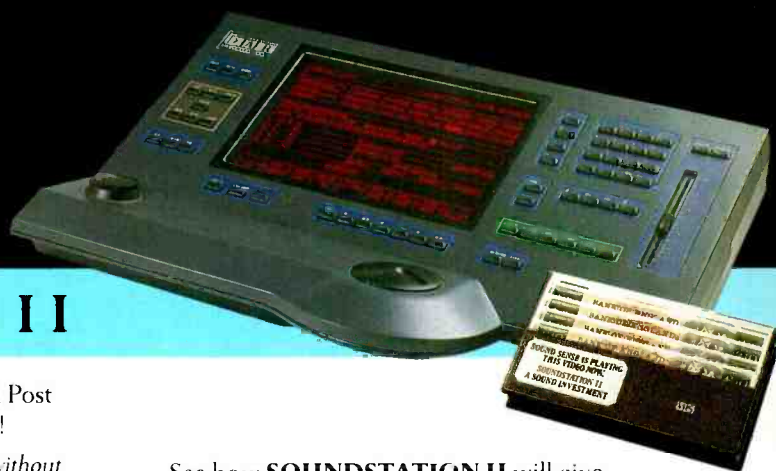
data flow, as RS-232 is used widely with modems, which transmit and receive data over telephone lines. Of the 25 lines in an RS-232 connector, only one carries transmit data (pin 2), one carries receive data (pin 3), and a third is earth (pin 7). The TX and RX lines swing between ± 15 V. All the others are to do with housekeeping, so often all that is required for simple communication is two or three wires plus the shorting of some of the others together to fool the computer into accepting and transmitting data without the relevant control lines from a modem.

Speed of transmission

It may already be appreciated that the serial interface will have some limitations on the speed at which a message can be transmitted, due to the need for each bit of a word to be sent sequentially. It takes longer for eight cats to go through one cat-flap than if they each have their own cat-flap and all go out together (Fig 1). In the case of the parallel bus, all the bits of a word can be simultaneously placed on separate wires and they will all register at the receiver together.

The speed at which bits are transmitted serially varies greatly between systems. The requirements for speed are based on the urgency with which a system requires data to operate correctly, and can be as low as a few hundred bits per second to many million. An RS-232 interface will usually operate at rates up to 19.2 kbit/s and it is vital that the transmitting and receiving devices are operating at the same rate otherwise the result will be garbled data. This data rate in bits/s is often referred to as the baud rate of an interface, and there are a number of standard baud rates in use. The higher the baud rate, the more data can be sent in a given period of time but high baud rates require wide bandwidth and are more susceptible to errors and interference. A relatively low baud rate would be adequate for most dot matrix printers, as they can only print characters at a limited speed, so it would be pointless to

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send them any faster unless the printer had a large memory to store letters until they could be printed. Conversely, a high baud rate would be preferable if one wished to link two computers serially for the exchange of data files, as it would be annoying to have to wait when the computers were both capable of working faster. In this case a fast network standard like Ethernet would be better than RS-232.

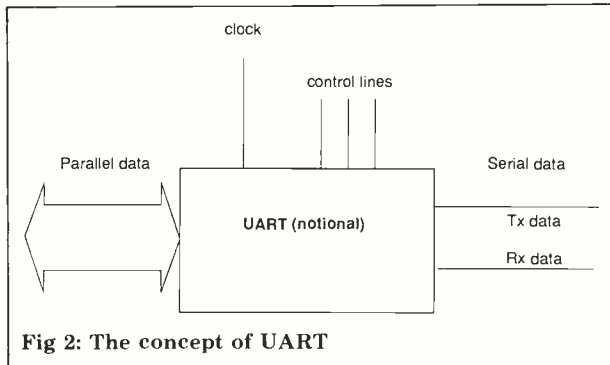


Fig 2: The concept of UART

It is not normal to use the term baud rate when talking about parallel communications.

MIDI is an example of a serial standard that operates at a rate of 31.25 kbaud. This relatively high data rate is necessary because it is important that information about musical notes to be played arrives at instruments at precisely the right time otherwise the musical timing would be thrown out and chords would be staggered. In the MIDI world, an eight-note chord sent from one instrument to another must be transmitted serially, that is one note after another, making it vital that there is not a perceptible delay between the first and last notes of a chord arriving at the receiving end.

A digital tape recorder sending digital audio data to another machine when copying a tape will often use a serial interface like the AES/EBU standard. This uses a very high data transmission rate as it has to carry digital audio samples in realtime, such that a stereo sample is sent in the original sample period, so we're talking about Mbits/s here, which requires the adoption of a modulation method known as bi-phase mark (like that used for timecode) to limit the bandwidth required.

Serial interfaces make use of a device known as a UART, which takes in and transmits serial data and converts it to and from the parallel format required by most microprocessors. The letters stand for Universal Asynchronous Receiver/Transmitter. All MIDI instruments have a UART in them to take in serial information to the microprocessor from the MIDI IN, and to send serial information from the MIDI OUT (Fig 2).

Synchronous and asynchronous interfaces

Simple serial communications involving a single pair of wires for transmission require that the clock rates of the transmitting and receiving UARTs are running at the same frequency, with very small tolerances. If they aren't, it becomes difficult for the receiver to decide which bit is in which time slot and errors can occur. It's rather as if you've been told that one letter will come through your letter box on each hour, and each letter is to be put in a box labelled with the hour on which it arrived but in fact the letters arrive

every three quarters of an hour, making it very difficult to decide which box the letters arriving on the half hours should be put in. In an asynchronous interface the messages can arrive at any time with gaps between them, so the receiver must be ready to convert them at the right rate as soon as they arrive. A byte will be preceded by a start bit and succeeded by one or two stop bits to signal the beginning and end of the data. The

receiving UART will use the leading and trailing edges of the start bit to adjust its phase lock for correct reception of data. Often a parity bit will also be sent, which can be used by the receiver to check for errors in the transmitted data due to interference on the line. The parity bit is set to make the number of ones in the word either odd or even (depending on whether odd or even parity is in use), and if this is not still the case at the receiving end

the receiver will know to request that the word be sent again.

A synchronous interface will usually send a clock signal along with the data signal on a separate wire, and this will be used to synchronise the clock at the receiving end such that it is at the same frequency and phase as the transmitter. Data is sent on the data line in synchronism with this clock and everybody is happy. The transmitter can change its clock frequency within limits and the receiver is automatically locked. This is impractical over phone lines and other such long distance links, as already outlined.

Handshaking

Computer people talk a lot about handshaking but perhaps they're very sociable people. Handshaking between computers is not always necessary but it's a means of formalising the liaison so that everyone knows where they stand: it prevents confusion and is essential when complicated communications are going on.

A system such as MIDI doesn't employ any handshaking: one synthesiser sends a message to any others who care to listen and if no one listens, well, nobody much cares. MIDI is very laid back. In more complicated systems where it is vital to know that another machine is ready to receive your message and to know that it has received it satisfactorily, handshaking is used. Often, there are some additional 'housekeeping' wires on an interface bus, serial or parallel, and these control the flow of data between devices. In a simple situation there might be a wire from the transmitter to the receiver to say 'I've got something to tell you', and a wire back from the receiver to say 'OK then, sock it to me'. The transmitter wouldn't send the message until the 'OK then, sock it to me' line went true. There might be other lines to request things like a retransmission in case of errors, and so forth. Handshaking might slow things down a little bit but it makes for more reliable communications, especially when a lot of devices are present.

There is a very simple serial data exchange protocol known as Kermit which doesn't require any additional housekeeping lines and will work with a simple RS-232 TX and RX pair. Data is sent in packets on the TX line and the receiver sends messages back to the transmitter over the other line to say whether it has received each

packet correctly or not. If there has been an error the packet is sent again until it is received correctly. This protocol is very useful over a modern link where interference is rife on telephone lines because it ensures that no duff data is accepted.

Complex parallel buses like the IEEE-488 (or GP-IB) can address a considerable number of different devices, all connected to the same bus. Each device on the bus has its own unique address and will only respond to messages intended for it. Such addressing can also be achieved over high speed serial buses like the ESBUS or Ethernet by using methods such as the token ring, which involves the passing of an address 'token' around the network until a device accepts it.

Some real examples

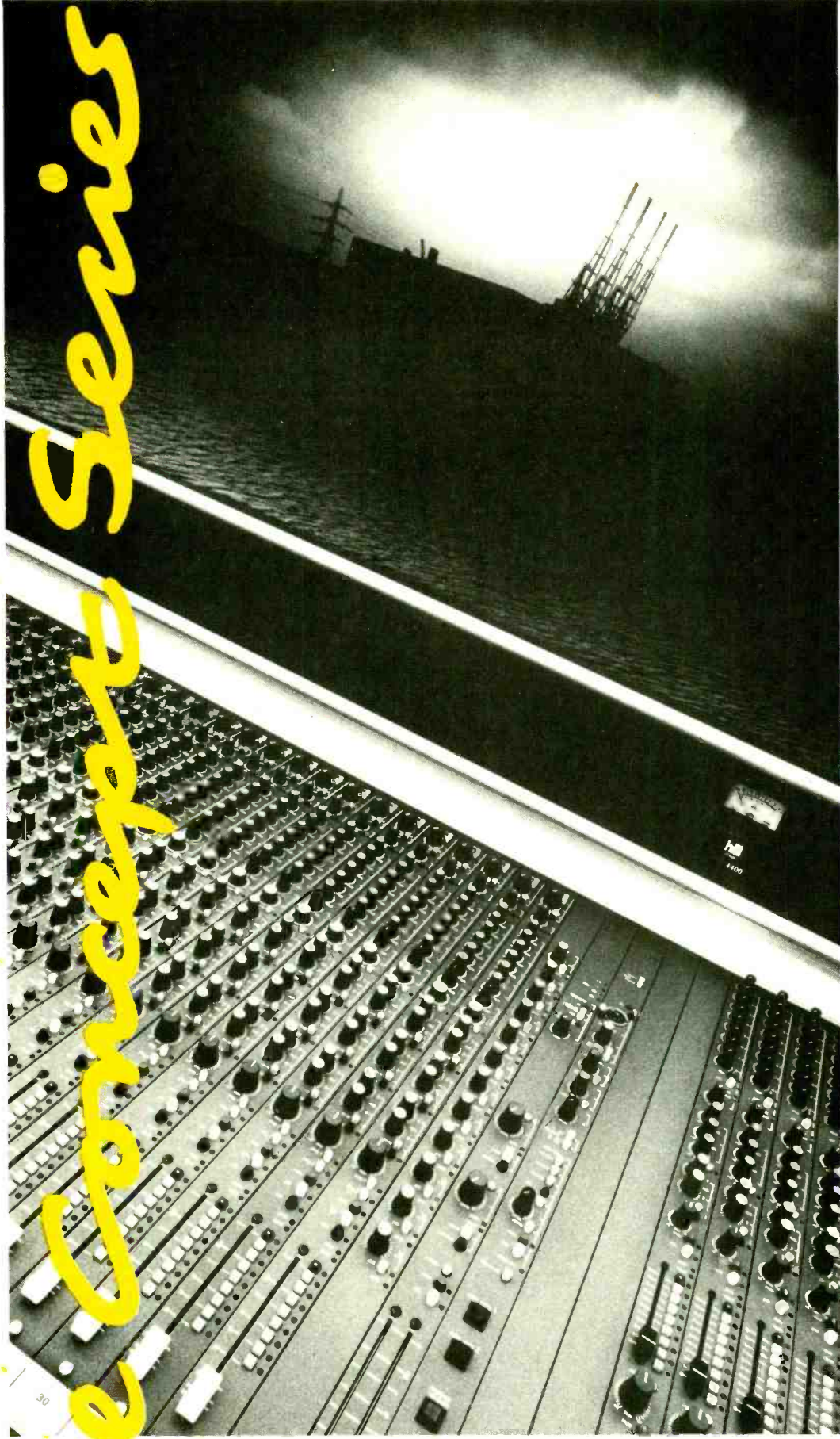
As mentioned above, serial and parallel communications are rife in the modern recording studio where microprocessor-controlled equipment is taking over. A console automation system will often have a serial communication link between the keypad and the main processor to carry the information about which keys were pressed, and parallel buses to other parts of the system such as the automated faders. A parallel bus would be important for the faders because a lot of information has to be carried in a short time to represent continuous movements of a large number of faders at once, whereas the serial link to the keyboard is appropriate because keys are pressed relatively infrequently and a small, light cable is preferable for a remote keypad.

Remote controls to video and audio machines are often serial RS-422 links and this is being standardised slowly using the ESBUS, which is a serial RS-422 communications network using a standard machine control language. People often imagine that standards like RS-232 and 422 define the messages that are sent over an interface and the format of the data but in fact all that they specify is the electro-mechanical interface, giving such things as the connector types and the voltages in use. It is up to the individual manufacturer to decide exactly what format the data transmitted over the interface will have but the ESBUS is an attempt to have all machines talking the same language, so that the same data message will cause an Otari MTR-90 to stop as causes a Studer A820 to stop.

The future

It is already possible to download MIDI voice data and sample dumps from computer 'bulletin boards' using a modem and an RS-232 interface to your Macintosh or Atari desktop computer. Many studios already have installed serial networks in the form of MIDI links around the control room and studio, and it may not be long before a serial network is installed for machine control.

One can imagine the day when perhaps a number of people are working in different rooms on terminals to a central random access recording, synthesis and editing system, all linked by a high speed serial network to carry the information to and from the workstation. A similar thing already happens in some broadcast centres where a central machine room has perhaps 10 C-format VTRs, and the RS-422 control of these can be assigned to various edit suites and transmission suites as required using a programmable assignment matrix. □



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Sony TCD-D10

A technical report by Sam Wise on the Sony TCD-D10 portable DAT recorder

The world of quality recorders for portable use has been dominated by machines made by Nagra and Stellavox. Many reporters use the Uher, which is a bit larger but less expensive. Where audio quality is less important, portable cassette machines have been widely used. But with the Sony *TCD-D10*, it is now possible to achieve the performance of a studio master recorder combined with the size and ease of use of a cassette recorder. However, there is a practical problem common to compact cassette and DAT cassette-based systems—difficulty in editing the raw recorded material and editing is required 100% of the time.

First impressions

The *D10* comes nicely packaged in a leather look (and feel) carrying case. The front flap is held closed by *Velcro* but unfortunately not held open by anything, although it can be tucked back against the body. When the case is closed, the mic and line input connectors on the side of the unit are exposed to the elements but since some of them will usually be in use anyway, this is somewhat unavoidable. A further aperture at the back allows batteries to be changed without removing the case. All operational controls are located on the front edge or front of the top edge for easy access in the field. The *D10* itself appears well made and is certainly visually attractive.

The stereo mic provided with the *D10* includes remote control buttons for PLAY, RECORD, STOP and PAUSE. The PAUSE control is designed for use with thumb or forefinger and is all that is needed 'on

the run'. A lock prevents accidental pause if required. In my limited experience pretending to be a reporter in a local town, this mic and remote worked well but with the remote in use and case cover shut, it is impossible to see meter or mode indicators. An aperture in the case flap making these visible while protecting everything else would be useful.

Controls and operation

When the machine is slung over the shoulder for field use, the front edge is uppermost; this is described first. At the left end is a volume control for the in-built loudspeaker or headset

monitoring. Centrally, an LCD display shows elapsed or remaining time and index number, which can be switched to show the time or date as well. This also has a red/green LED ppm-type meter and indicators for play, record and pause modes. The LCD display is back-lit for 10 seconds whenever the LIGHT button is pressed; very convenient.

To the right of these displays are the DISPLAY and SEARCH controls. The display controls are described above. The search controls allow the tape to be fast-forwarded or rewound to the next



Start ID. Associated with them is a SCAN button, which allows an automatic search of the tape to be made in either direction. Each time a Start ID is found, the tape stops and plays 10 seconds of the recorded material for reference. This is a very handy feature, speeding up the location and transfer of material recorded in the panic of the moment.

Finally at the right-hand end is a dual-concentric knob set used for setting Record Level and a Limiter On/Off switch. The record level knobs are very tightly coupled mechanically since the recorder is designed for stereo use and there is very little chance of accidental slippage.

The main transport controls are located on the front edge of the top panel and consist of the normal REWIND, STOP, PLAY, FAST FORWARD, RECORD and PAUSE. When Rewind and Fast Forward are used in play mode, they allow the tape to be auditioned at several times normal speed for cueing. At the far right is a HOLD switch, which disables all transport controls and the power switch. It is designed to allow the transport to be locked into an operating mode that cannot be altered accidentally during any kind of rough handling. When RECORD is pressed, a Start ID—or in *D10* terms Index—is written on the tape, allowing the rapid location of recorded sections using the scan functions built-in to this and other DAT machines.

Further to the rear is the cassette loading door, which has two levels in order to protect the relatively fragile digital tape and rotary head mechanism. Loading is quick and easy. Also under here are the controls to set the time and date, which are battery backed independently of the main battery.

At the rear, the main battery is located under a protective sliding door and once again is easy to

Manufacturer's specification

Recording system: Rotary head digital audio tape

D/A conversion: 16 bit linear

Frequency response: 20 Hz to 22 kHz, ± 1 dB

Signal-to-noise ratio: < 85 dB

Dynamic range: > 90 dB (at 1 kHz)

Total harmonic distortion: $> 0.008\%$ (at 1 kHz)

Wow and Flutter: below measurable limit

Inputs: line in—unbalanced, 50 k Ω input impedance, min input level 35 mV; mic in—unbalanced, for low impedance microphone, min input level 0.3 mV

Outputs: line out—unbalanced, 470 Ω source impedance for load > 10 k Ω , rated output 0.25 V; headphones—stereo, 150 Ω source impedance for load > 32 Ω , 0 to 18 mV rated output

Battery life: approximately 2 hr continuous with supplied NP-22H battery pack

Power consumption: 6.5 W

Dimensions: (w/h/d) 253 \times 55 \times 191 mm/
10 \times 2 $\frac{1}{4}$ \times 7 $\frac{5}{8}$ in

Weight: approximately 1.5 kg/4 lb including battery

Microphone: Stereo electret condenser type

Angle between capsules: variable 90° to 120°

Output impedance: 550 Ω $\pm 20\%$, recommended

load > 3 k Ω

Output level: -68 dB ± 3 dB, where

0 dB = 1 V $\sqrt{\text{bar}}$ at 1 kHz

Battery life: approximately 2500 hours

continuous

Noise level: S/N > 49 dB at 1 kHz, 1/3 bar

inherent noise < 25 dB SPL (0 dB

SPL = 2×10^{-4} μbar)

Maximum sound pressure level: > 117 dB SPL

Dynamic range: > 92 dB

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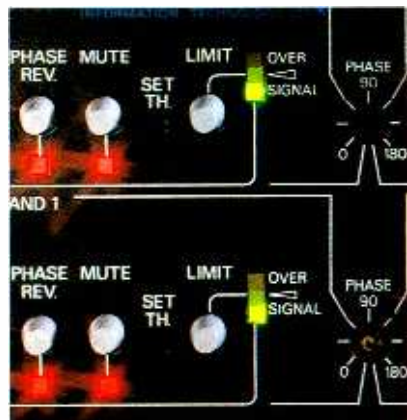
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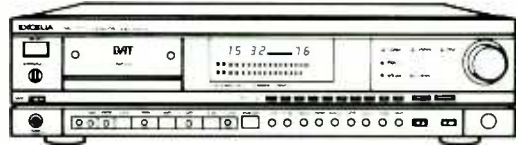
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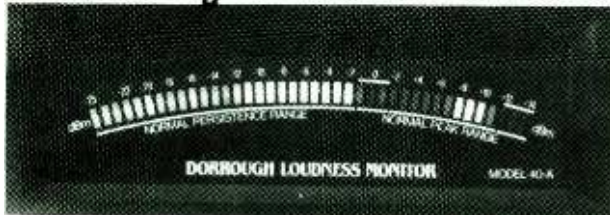
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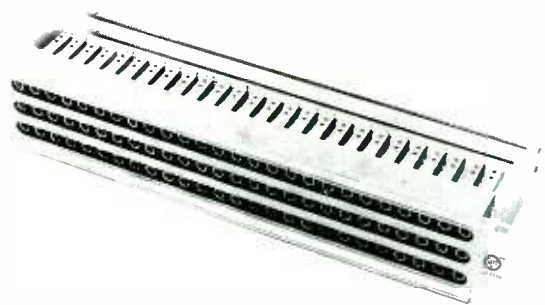
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install or release. In order to operate from mains power, the mains adapter unit is plugged into the battery slot instead. Recharging the battery is accomplished by coupling it to the mains adapter using a plastic coupler supplied with the *D10*. One disadvantage of this charging system is that it is necessary to purchase an additional mains adapter if it is desired to power the *D10* from the mains while recharging the battery. Recharging time is said to be 2 hours with the standard adapter but it was not possible to confirm this.

Lastly, on the right edge of the machine are four gold-plated phono (cinch) connectors for line inputs and outputs, two gold-plated unbalanced 6.35 mm jack connectors for the microphone inputs, one 6.35 mm stereo headphone connector, the remote control socket and the mic attenuator switch.

Inputs and outputs

The RECORD LEVEL controls track beautifully over the first 40 dB of attenuation, giving a worst case L-R channel level difference of only 0.5 dB. These also have a reasonable range, with Line In matching Line Out at halfway or position 5 on the dial. Mic input level for clipping ranges from -50.5 dBu at maximum recording level, to -8.0 dBu at position 1 (almost off). The built-in mic attenuator switch appears to be located elsewhere than at the input since, though it has a nominal 20 dB of loss, it still allows the input to overload at levels above -8 dBu. A glance at the circuit drawing confirms that it is not really an attenuator but instead alters the mic amp gain. Never mind, -8 dBu is a reasonably high level and the mic is not likely to end up inside a bass drum. Mic input impedance is about 10 k Ω .

In attempting to measure the equivalent input noise for the microphone input, it became obvious that the mains adapter is a considerable source of hum into the mic input. With a gain of about 55 dB, the hum degrades the noise measurement by 10 to 20 dB according to what earthing scheme is used in attempting to reduce it. With the battery in place the performance for 55 dB of gain over a 22 Hz to 22 kHz bandwidth with 200 Ω source impedance is good at -126.5 dB.

Line input level for peak recorded level varied from -10 dBu with the record level full up to a maximum of +30 dBu, no problems here. There is no hum audible on the line inputs. Line input impedance measures about 50 k Ω , confirming the manufacturer's specification.

The built-in limiter has no effect until the signal comes within 6 dB of clipping, then acts as a hard peak limiter. This works well on most real-life input signals but since the limiter precedes the pre-emphasis circuitry, it is still possible for signals with a large high frequency content to reach clipping. Fig 1 shows the relative clipping level versus frequency, demonstrating headroom reduction of 10 dB at high frequencies. The limiter works well over a 15 dB input range from 5 dB below clip to about 10 dB above clipping, having at these levels a distortion of about 0.3%. At higher levels it still works but with rising distortion. The attack time is short

enough to easily catch the peaks of a 1 kHz sinewave. In short, using the limiter is a lot better than having digital clipping.

Both mic and line inputs and outputs are unbalanced. Again, this is not a problem in the normal type of application with a handheld mic but lab tests indicate susceptibility to things like colour video monitors when longer leads are used on the mic input. For the costs involved, balancing the mic inputs would provide a more versatile product. Maximum output level into a high impedance is 1.732 V (+7 dBu) from a source impedance of just over 600 Ω .

The microphone supplied is a stereo type and works well, giving a good stereo impression from moving traffic and the like. With the windshield on, the mic is very P-proof but it is sensitive to handling noise—not vibration but the sound of the hand scraping on the microphone barrel or on the holder/remote control. The mic is an electret type with internal battery, including a battery warning light on the ON/OFF switch and it is lightweight, which would be an advantage on a long day.

To test the *D10* in a realistic simulation of a reporter's life—recording while riding a horse in the Grand National—the unit was placed in record mode and vigorously swung around, bounced against the body, etc. It is with pleasure I say, there was no audible sign of distress: the *D10* behaved just as if it were sitting quietly on the bench.

Frequency response, phase and crosstalk

The replay only, and record/replay frequency responses are shown in Fig 2. These are certainly superior to the analogue machines with which the *D10* competes. Either could be specified by Sony as ± 0.25 dB from 20 Hz to 20 kHz. The remaining error is due to the emphasis/de-emphasis filters. Fig 3 shows the phase error between left and right outputs. In this case it is substantial, reaching 18° at 10 kHz but still well within broadcaster's specifications.

Crosstalk versus frequency is shown in Fig 4. On replay (lower curves) these results are excellent, while record/replay is still better than 20 dB below that required by IBA specifications.

Noise and distortion

Looking more deeply into the *D10*, differences between it and the *DTC-1000* tabletop model become apparent. As stated above, the microphone equivalent input noise is good, so long as the cables are short or you are sitting in a screened room. Basic dynamic range is also good, reaching just over 93 dB. A look at the swept 1/8-octave bandwidth noise of Fig 5 taken with the mains adapter in use reveals the hum, which shows up so clearly on the mic input. These curves are

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taken record/replay from Line In to Line Out (upper curve) and replay only using an infinity zero digitally generated test tape (lower curve). The hum is acceptably low for a stereo machine on line in but still is 25 dB above the basic noise floor. General broadband noise measurements are given in Table 1.

Fig 6 is a detailed plot of modulation noise. These curves are made by inputting a low frequency tone, in this case 60 Hz. The fundamental and its low order harmonics are filtered out, leaving noise from 1 kHz up. This remaining noise is then plotted by sweeping the

TABLE 1 Broadband noise measurements

Right and left channel measurements were identical except on microphone inputs, where right is degraded by hum when run from the AC power adapter.

Measurements are from Line In to Line Out dB below peak level	
22 Hz to 22 kHz, RMS	-93.3
400 Hz to 22 kHz, RMS	-94.2
CCIR unwt'd, Q-Pk	-89.4
CCIR wtd, Q-Pk	-83.3

1/2-octave filter. After each plot, the input signal level is increased by 10 dB. The 60 Hz tone stimulates the switches in the A/D and D/A converters, which are the primary cause of the noise. We are not looking at the absolute levels, rather the difference between the curves, indicating an increase in noise caused by the conversion process itself. Note that at low frequencies the modulation noise is about 12 dB, decreasing at higher frequencies to 5 dB or less due to the beneficial effect of the replay de-emphasis roll-off. This indicates that it is the A/D converter causing the noise, which is significantly

FIG.1 COMPARISON OF RELATIVE MAXIMUM INPUT LEVEL VERSUS FREQUENCY. 0dB REPRESENTS THE LOW FREQUENCY OVERLOAD POINT

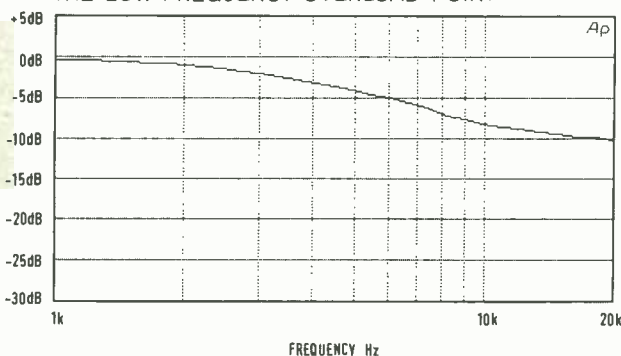


FIG.2 PLAYBACK ONLY FREQUENCY RESPONSE USING CBS CD-1 DIGITALLY GENERATED TEST TAPE RECORD/REPLAY LINE IN TO LINE OUT

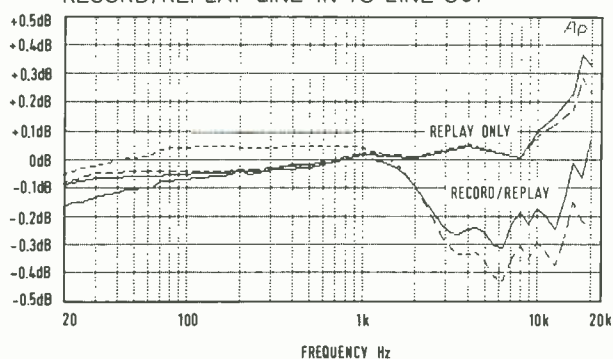


FIG.3 PHASE ERROR BETWEEN LEFT AND RIGHT CHANNELS VERSUS FREQUENCY. RECORD/REPLAY

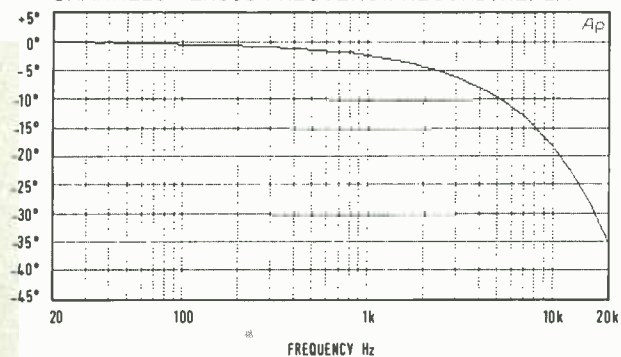


FIG.4 REPLAY ONLY CROSSTALK FROM DIGITALLY GENERATED TEST TAPE RECORD/REPLAY CROSSTALK FROM LINE IN TO LINE OUT

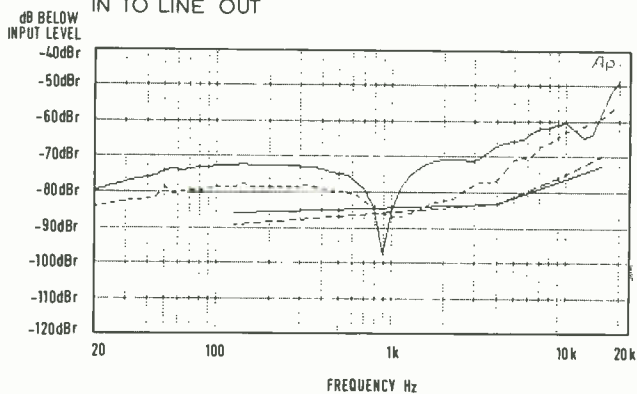


FIG.5 1/3-OCTAVE FREQUENCY SPECTRA (dB REF MAXIMUM OUTPUT) LEFT CHANNEL ONLY LOWER CURVE (AT 1kHz) OUTPUT STAGE ONLY (INFINITE O) UPPER CURVE (AT 1kHz) INPUT AND OUTPUT (Rs = 25 Ω)

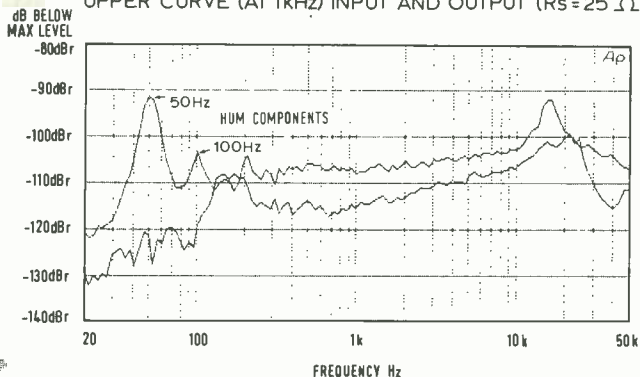


FIG.6 MODULATION NOISE SPECTRUM (dB REF MAXIMUM OUTPUT) 60 Hz TONE -20, -30, -40, -50, -60, -70, -80 dB RIGHT CHANNEL

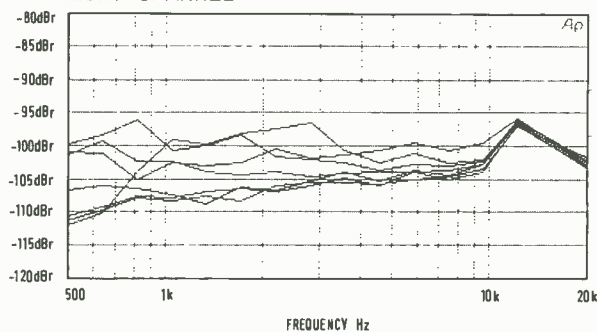


FIG.7 QUANTISATION DISTORTION (dB REF MAXIMUM OUTPUT)

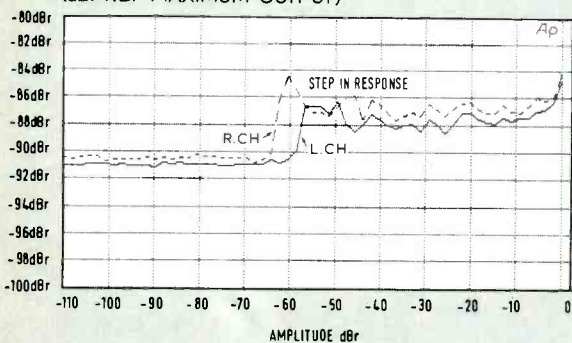


FIG.8 INPUT-OUTPUT LINEARITY, R-DAT, 200 Hz

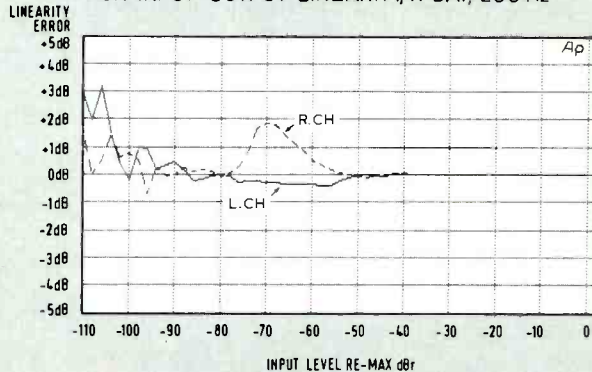


FIG.9 THD+NOISE REPLAY ONLY AT MAX OUTPUT LEVEL FROM DIGITALLY GENERATED TEST TAPE RECORD/REPLAY AT 12 dB BELOW MAXIMUM OUTPUT LEVEL RECORD/REPLAY IS NOISE LIMITED AT LOWER FREQUENCIES DISTORTION APPEARS TO BE PRINCIPALLY GENERATED BY D/A AND DIGITAL FILTERING CIRCUITS

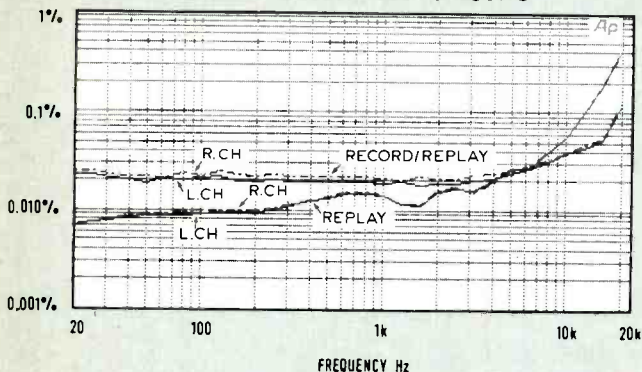
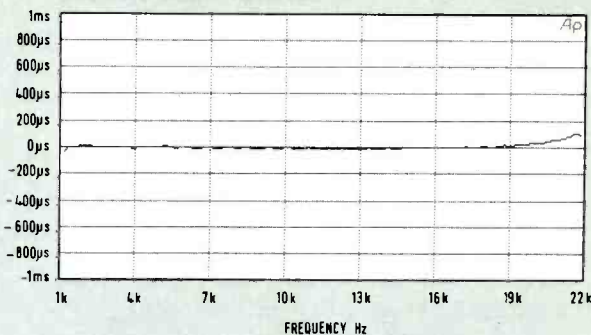


FIG.10 GROUP DELAY CAUSED BY THE FILTERING WITHIN THE UNIT. FIXED DELAY DUE TO DIGITAL ACQUISITION AND PROCESSING IS FIXED AT 600µs AND HAS BEEN REMOVED



higher than found in other Sony DAT products.

Fig 7 shows quantisation distortion. In this plot, once again we are not looking at the absolute levels but rather at the steps in the response. As the input level drops, steps in the curve indicate that a converter bit which is in error or particularly noisy is no longer activated by the signal. Thus on these curves at about 60 dB below 100% modulation, a bit is in error. This corresponds well with the modulation noise curves where the noise increases substantially at about the same level. With pure tone inputs, these effects are audible.

Linearity errors are shown in Fig 8, an excellent result with the left channel exhibiting an almost error-free amplitude encode/decode cycle.

Distortion measurements of all types revealed the expected rise in distortion with frequency above about 5 kHz. Fig 9 shows both replay only and record/replay THD+N. The replay curve is a result of using a digitally generated test tape. Since both curves exhibit similar characteristics,

this indicates that this distortion is primarily a result of the D/A conversion and filtering process. Note that the record/replay results are noise limited at the lower frequencies. These results are of course outstandingly better than an analogue recorder.

Other matters

As a reference, the group delay distortion due to the conversion process and filtering was measured. The fixed delay is approximately 600 µs, while the frequency-dependent delay is shown in Fig 10.

This curve also represents the actual frequency-dependent delay on the Sony DTC-1000ES and PCM-2500, the curve in Fig 15 of the review in the October 1988 issue was improperly processed and is in error.

Unlike the Sony desktop models however, the TCD-D10 has an interchannel delay difference that shows up on the phase response of Fig 3.

Summary

The Sony TCD-D10 offers a good value portable recorder particularly suitable for use by radio reporters (or for sound effects and samples collection—Ed). Lack of a sync system limits its use for film or television, though it would be possible to use one of the stereo tracks to record a synchronising signal. There is at least one acoustic consultant who uses a D10 for on-site recording of frequency response and reverb decay of rooms for later processing. It seems tough enough to stand up to considerable abuse, and appears to be more immune to vibration than any portable reel-to-reel machines I have used. Audio performance, while showing some weaknesses compared to tabletop DAT machines, is nonetheless excellent compared to conventional machines. But for the quick and nasty record/edit/broadcast cycle, the need to transfer before editing is a limitation that remains with the DAT format until editing DAT machines become available. □

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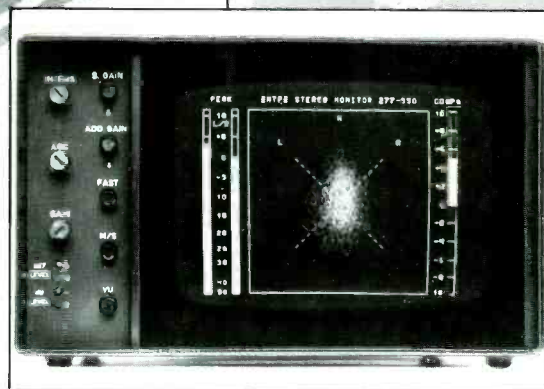
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Soundcraft TS12

Patrick Stapley looks at this console and its associated FAME automation and find there's more to it than meets the eye

Before seeing the *TS12* for the first time, I must confess I expected to find a scaled down, cheaper version of the *TS24*. Cheaper it certainly is but, apart from the same in-line philosophy and some technical similarities, it is very much a new design.

The brief for the *TS12* seems to have been to manufacture an affordable, compact console offering the technical specifications and facilities of more expensive desks. The spec is impressive for a 'budget' console and is borne out in its clean, quiet operation.

The mixer comes in two standard input sizes, 24 and 36, feeding through to 12 groups. There is the option of an additional eight inputs or four quad FX return modules, and the choice between a 9 or a 19 inch patchbay. The smallest frame length is 68 inches (1722 mm) and the largest 103.5 inches (2627 mm).

I/O module

Looking from the top there are three buttons that switch: phantom powering, a 20 dB mic pad and the mic/line selection. One gliding gain pot is shared between mic and line inputs, providing ranges of +22 to +70 dB and -10 to +14 dB. There is a fixed 80 Hz, 20 dB/octave highpass filter, which, although not ideal for every application, provides a good overall facility. Next to this is a phase reversal button that follows mic/line selection.

The EQ is 4-band semi-parametric with ± 15 dB control. The high and low frequencies have a

shelving characteristic and are switchable between 8/10 kHz and 50/100 Hz. The two mid frequency bands are sweepable from 600 Hz to 9 kHz and 120 Hz to 1.9 kHz—they both have a wide/narrow Q selector. EQ can be switched between the channel/mix paths and the EQ in/out button does not affect the HPF. There is no LPF. From a sound point of view, the EQ worked well producing a pleasing natural sound, especially at the high end.

Below the EQ section are the six auxiliaries arranged in pairs. Each pair is normally fed from the mix path but aux 1-4 can be switched. Aux 1+2 are primarily designed to feed the foldback circuits from a pre-fade, pre-cut mix source. This is intended to isolate the headphones from any interference by the engineer. There is a CH button for switching the source and if the channel fader itself has been 'flipped', the source will become mix postfade.

Aux 3+4 provide a postfade mix send but if their FOLLOW button is pressed, they will duplicate the selection of aux 1+2. It is then up to the user to decide, by means of internal jumpers, whether the source to aux 3+4 should be pre- or post-aux 1+2. If it is post, then any level changes made on 1+2 will directly affect 3+4. One use for this, although I am slightly sceptical, is for sending to reverbs, etc, that are purely intended for a headphone balance, and therefore follow foldback sends.

Aux 5+6 simply remain in the mix path with a pre/post selector. The channel fader, as with the *TS24*, is a rotary control with associated cut, PFL and pan. Whether or not you like a fader in the form of a pot, is a matter of taste. Personally, I

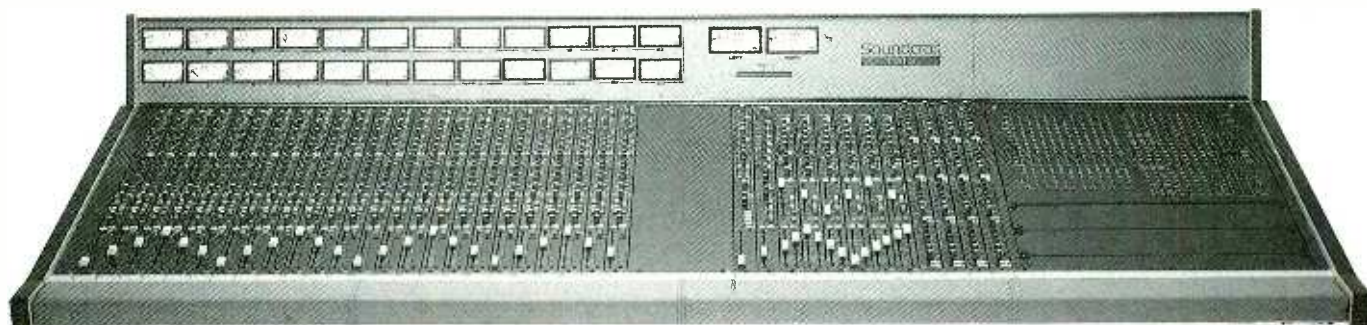
find faders give a clearer visual indication of levels and relationships as well as being easier to operate. Of course with the *TS12* there are 12 group faders but they don't help if the signal is being routed direct.

The channel fader can be used in three different ways: firstly in the conventional sense to set level to tape, secondly as an FX return in mixdown and thirdly as an extra post-fade stereo aux send. These choices are accessed from the buttons below.

There are three buttons governing signal flow through the module and nine dealing with routing. In a normal recording situation, I would route to the multitrack either with the DIRECT button or via the 12 groups. The six group assign buttons route in pairs using the pan to provide odd/even numbers. Tracks 13-24 are paralleled from groups 1-12, so group 1 will send to both tracks 1+13. If I am sending direct, the group send will be disconnected and this allows me to record on all 24 tracks without duplication. I can also route directly to the mix bus by pressing MIX. To monitor line in and line out on the mix fader the TAPE button is used and must be pressed in to hear tape. The button marked FADER (FDR) inputs the mix signal into the channel path making the channel fader an aux send via the group matrix. If FDR and DIRECT are selected, a prefade channel signal will go direct to the track.

The BOUNCE button will switch the mix signal back to the routing matrix, allowing levels and pans created in a monitor mix to be mixed down, whilst disconnecting the channel fader. If FDR and BOUNCE are pressed together, the routing matrix becomes split so that groups 1-8 are fed from the mix fader, and groups 9-12 plus the MIX bus are fed from the channel fader. This provides the user with an optimum choice of mono/stereo auxiliaries and subgroups. There is indication next to the group matrix as to how this facility splits.

Connected with the tape buttons is a ± 8 dB trim pot and below this are the mix panpot, solo and cut buttons. The solo can be either PFL or SIP dependent on central switching. Also governed centrally are the A+B cut buttons, which provide group muting for the mix faders. The fader itself is a long throw 100 mm linear fader, with a cut-off point greater than 90 dB.



The LEDs on the I/O module indicate switching for the HPF, EQ in/out, EQ mix/channel, aux in/out, the various solos and cuts, and bounce. It might have been an idea to include an LED for the DIRECT button, as this has a destructive action on the group send that could easily catch people out. Situated at the top right of the fader is a peak LED, which will flash on at 5 dB below clipping for both channel and mix paths. It has a fast transient response and measures the signal at three separate points through the module.

The standard metering is via mechanical vus although bargraphs with internal vu/ppm switching are available. The 24-track meters follow the TAPE button, either reading the send or return from the multitrack. Apart from the track

meters there are main left/right output meters and a phase meter. There is the option of fitting six aux send meters.

Group and FX return module

Six of these modules are supplied and each controls two groups and a stereo FX return. The two group faders, with their characteristic red heads, are situated at the bottom of the module where they have been sensibly spaced for ease of mono and stereo operation. Each group has a PFL button (post insert) and each pair has a subgroup

button, which will re-route the output in mono or stereo to the mix bus.

The rest of the module is taken up with the FX return. This is quite a comprehensive facility offering a long throw stereo fader, input switching, EQ, auxs and routing.

The input selection at the top of the module consists of two buttons marked LEFT and RIGHT, with a level control. If both buttons are out, a stereo input is catered for; if either LEFT or RIGHT buttons are selected the respective input will be paralleled on to both sides, and with both buttons pressed, the input becomes summed mono. The stereo EQ section provides a 100 Hz 12 dB/octave HPF, which, like the I/O module, can be switched in and out independently of the EQ. There are fixed bands of EQ operating at 10 k, 3.2 k, 320 and 100 Hz, with a range of 15 dB.

The six auxs are arranged on three buttons in pairs, with two pots governing overall odd and even sends. The source can be mono or stereo, dependent on internal jumper switches, and can be switched as a whole pre- or post-fade.

Next to the fader are the GROUP and MIX ROUTING buttons, which share a stereo balance control. Above these are PFL and CUT buttons.

Auxiliary/echo return module

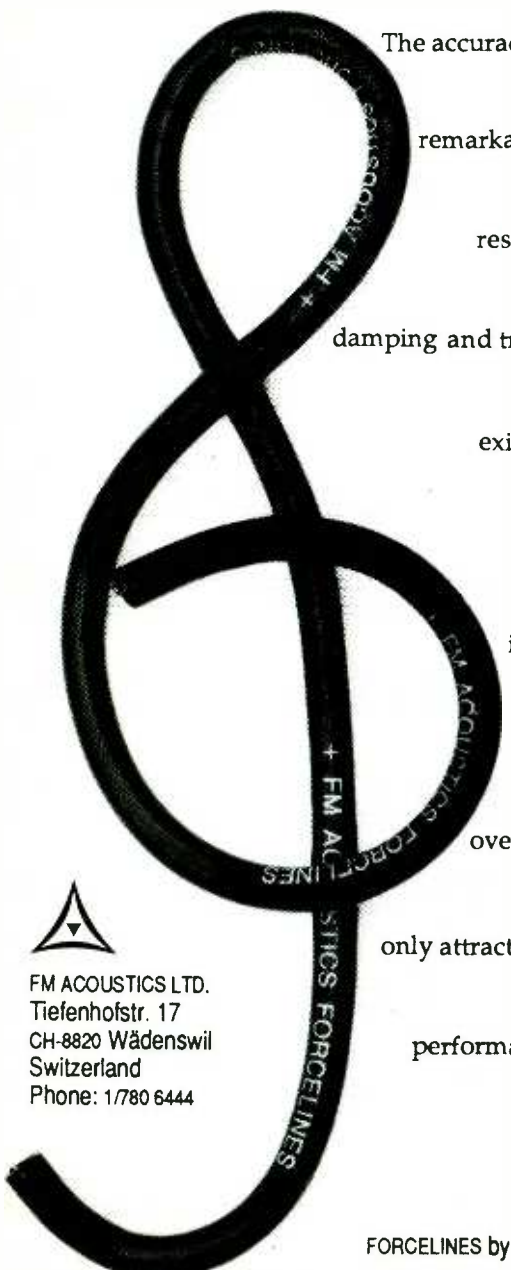
Just one of these modules is sandwiched between the Monitor Master section and the Group/FX section. It houses the master sends for the six auxs and includes an AFL button for each. It also has a stereo echo return, which is similar in layout to the FX return previously described. The differences are that there is no left/right input selector and the EQ is fixed 2-band. At the top of the module is a 20 to 20 kHz oscillator with two buttons routing it to groups/mix and a patchbay output.

Monitor master module

There are two sections at the top of this module—Phones 1 and Phones 2. Each section incorporates a master level control and three source pots, which are responsible for mixing together foldback from Aux 1, Aux 2 and a stereo signal derived from the studio loudspeaker source buttons. The introduction of the studio selector into the headphones makes it possible to run two different stereo mixes without using any more than two auxs. This is done by inputting the monitor mix from the studio selector to both headphone circuits while emphasising various components using aux 1+2. The only drawback here is that any changes made in the control room will also affect the cans.

The STUDIO and PHONES SOURCE buttons are arranged in a column comprising the mix output, three stereo tape returns, and two stereo external sources (these are obviously wired to suit the user's requirements). Directly above is a pot that drives the studio speaker level and to the right is

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an identical arrangement of buttons that select the control room monitor source.

The SOLO MASTER button switches between AFL (permanent LED) and SIP (flashing LED). SIP will cut all non-selected channels, leaving echo and FX returns open. The PFL circuit has a master trim control allowing the user to set a solo that corresponds with the listening level. The master buttons for A+B muting are situated on this module, as are the talkback controls. Talkback is from a built-in electret mic with a gain pot, which supplies separate communication to the headphones, studio and tape. The module finishes at the bottom with the main stereo mix fader.

Quad FX module

The Quad FX modules are optional and there is room for four of them to the right of the Group/FX section if this is not used for extra input channels. Each module splits into four mono FX returns with an input and output pot, panning, 2-band EQ and sends to aux 1+2. The auxs can be jumper selected to be pre- or post-

Each return is permanently routed through to the mix bus and has PFL and muting buttons. As with the standard FX and echo return modules, it would be usual to normal outboard equipment to these inputs, so saving on patchcords. If the option of the four Quad FX modules is taken up, the console would offer 16 mono and seven stereo returns.

Patchbay

Depending on the size of the console, the quality consciousness of the user, or the overall cost, Soundcraft will fit two types of patchbay. The 9 inch bay uses plastic bantams, which take up considerably less space than the better quality (Mosses & Mitchell) all metal sockets used in the 19 inch bay. Both patchbays offer a good selection of break-in and insert points on all modules, as well as access to stereo machines, outboard, phones, speakers, oscillators, etc. There is also provision made for paralleling and phase reversing signals. The larger patchbay has an extra 40 tie lines and caters for desks with up to

44 inputs. The 19 inch patchbay can be removed and rackmounted, in which case the space could be filled with additional I/O modules.

Conclusion

There is a lot more to the TS12 than one would imagine at first glance. The various signal path possibilities have been maximised to provide the user with a versatile, if not sometimes complex, routing system. The ability to create extra auxiliaries and returns are all plus points. It's also nice to see designated FX returns with channel-type facilities.

The compact design of the console is noticeable, both from a size point of view and the way in which certain controls double up in their function, ie the source buttons for phones and studio speakers and the 12 groups feeding 24 tracks.

As far as the user is concerned it is a console that can be operated at various levels of complexity depending on individual style or job requirement. For the price the TS12 is a good sounding desk with plenty of facilities. □

FAME

FAME is an acronym for Faders, Auxiliaries, Mutes and Equalisation—these being the functions controlled by the computer. In the case of the auxiliaries and the EQ, only the in/out buttons are automated. The system was designated specifically for the TS12 by Optimix in conjunction with Soundcraft.

There are three main areas in the system—the keyboard, the VDU and the processor/disk drive. The keyboard is sited in the central part of the desk within easy reach of the engineer but can be positioned below the patchbay or supplied as a free-standing remote. The high resolution VDU (not part of the package) is placed somewhere close to the user and the 16 bit 68000 microprocessor with its 3½ inch disk drive is housed in a 2U, 19 inch rack unit.

Each disk is formatted to hold a maximum of 10 mixes. The working mix is continually modified in 512 K of RAM and need only be saved to disk for backup or archiving purposes.

Keyboard

The keyboard is arranged in two distinct sections: one is a rectangle of 15 buttons, containing a numeric keypad and five function keys; the other is a cross of five buttons, comprising the ENTER key surrounded by north, south, east and west cursor keys. The function keys in the rectangular section are the SAFE key, which locks all automated functions in a MASTER READ status; the TRIM key, which disables SAFE mode and allows status selection from the VDU; and the RECORD key, which drops statuses in and out of WRITE. SAFE and RECORD can be used in conjunction to produce a 'Master Read/Record Ready' mode

whereby the TRIM key switches preselected functions and status into RECORD.

The VDU can only display 24 channels at once, so a SCROLL button is fitted, which gives access to the extra channels on larger consoles. The last function button in this section is the FLIP key (↔), which behaves like an escape button, and is frequently used to move the cursor back to the status windows on the VDU.

Screen

The system has two main working displays—the desk page and the menu page. The desk page is a graphic representation of 24 faders with their mutes, auxs and EQ buttons, arranged in channel strips. To the right of this are the function windows, which fall into three sections: the top window gives access to the menu page; the next block is responsible for status selection of the switches; and the bottom block of windows controls status selection as well as VCA subgrouping for the faders. The menu page accesses the various operational screens concerned with the disk, timecode and merging.

At the bottom of the desk page are a number of displays showing computer prompts SAFE and RECORD windows, the present timecode reading from tape, the percentage of used RAM, and the last mix number the computer has dealt with.

First steps

The very first stage is to boot the computer into life by inserting a formatted disk which loads the program. This same disk can then be used as a data disk. When the system is installed, a master program disk is supplied and acts as the mother for all subsequent formatted copies. Formatting takes about two minutes per disk and the procedure is accessed via the menu page.

Once the program has been successfully loaded, the desk page appears on the screen. At this point there may be a couple of parameters that require changing—these are the number of inputs and the type of code being used. The maximum number of inputs the computer can handle is 64 and there are two types of timecode it will read/generate—SMPTE (NDF) or EBU. Once the code has been decided upon, it is recorded on the multitrack.

The next step is to 'Initiate' the mix by giving it start and end times. This is done by inputting the times from the keypad (no need for punctuation). The maximum recommended length for any one mix is 35 minutes, and timecode during a mix should never go over the 24 hour point.

Mixing

When the system is first set up, all the faders and switches will adopt WRITE status. W will appear on the desk display beneath each fader and on each switch. The console is now set to REHEARSE WRITE mode and it is not until the RECORD key is pressed that data will be written. So to start mixing, I run the tape from the top and hit the RECORD key. As the tape passes through the initiated start point, a red block will appear at the bottom of the screen, telling me the tape is within the mix zone.

I can now write my first moves on both faders and switches. The faders are displayed as green bargraphs and the switches have on/off indicators that follow the LED colours on the desk. Once I have made my first pass and stopped the tape, the computer will prompt 'To keep these modifications press enter'. If there had not been anything worth keeping, the RECORD key would be pressed.

I now have the first stage of my mix, in RAM, and will have to remove WRITE status from certain areas of the console to play it back. To do this, the cursor must be on the fader or switch

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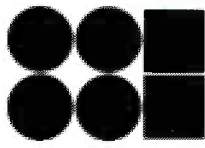
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function windows where it can change over from WRITE to READ. As this is done, the cursor automatically flicks over to the associated part of the desk display, allowing selection of faders or switches. Faders can be status switched as a whole or individually and switches can be changed en masse, by function, by module or individually. Once I have changed the status, I can then go for another pass, or perhaps just run over a small section.

As the mix builds, it should be backed-up by saving it to disk. SAVE, LOAD and DELETE operations are implemented via the menu page. There is a catalogue showing the number of the mix (0-9), the amount of memory it has used and the total disk memory available. It is left to the user to keep written notes concerning mix ID.

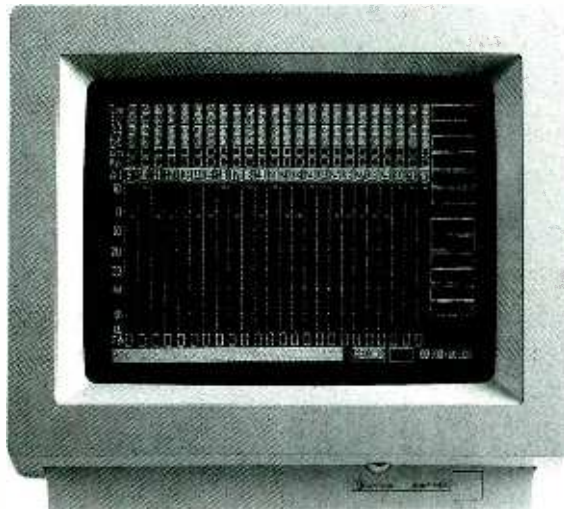
When a mix is played back, the fader display shows two bargraphs, one green, the other red. The green bargraph indicates current fader setting and the red shows the previous kept levels. These two displays, apart from giving a clear picture of fader movement, offer a very easy method of nulling or level matching. There are two fader statuses where this comes into its own—AUTOWRITE and UPDATE. AUTOWRITE will automatically switch a fader from READ to WRITE as it moves through the null point and UPDATE provides a relative trim. UPDATE is accessed by hitting TRIM when in READ: the green bargraph will show the new level and the level offset is the difference between the red and green displays.

The switches can be cut or uncut, either from the desk or from the screen. The bottom two switch function windows are labelled ON and CUT. Once a function has been entered, switches can be selected and collectively toggled using the ENTER key. Because the automated switching on the console is electronic, rather than mechanical, the switches never end up out of phase between console and screen.

Mixes that have been saved on the disk can be merged with each other, as long as their timecode values are identical. There are two methods of merging, either two mixes can be 'Joined', whereby A is joined to B at a specified point, or one mix can be 'Inserted' into another between two specified points. There is no crossfade or vector facility, so if any miss-matches in level exist, the merge will bump just like a tape edit. If this is not intentional, the level can quite easily be smoothed over with the help of the fader bargraphs and a little bit of updating.

Subgrouping

The system can create up to nine VCA fader groups (switches are not included). Each group is set up by moving the cursor to the Group Window and pressing ENTER. The group number is chosen between 1 and 9 and the faders selected. I now have to choose a group master fader, which needn't be one of the faders in the group. This is done from the Master Window using the same operational sequence. A group master fader must be above -40 dB, otherwise it will not connect—this guards against the eventuality of faders shooting through their 'end stops'.



The FAME screen and keyboard

Once a group has been created, each fader will display the group number, and the group master will identify itself with an inverse display. If at any time I need to adjust the position of the group master against the group without affecting levels, I can use the Local function.

Groups cannot exist within groups, so, for example if I wanted to group all the VCA faders in order to fade the track, I would have to do it prior to setting up other groups or after I had finished writing group data. An easier solution, in this case, might be to provide automation on the main mix fader.

Groups are disconnected by repeating the setup procedure but using 0 as the group number.

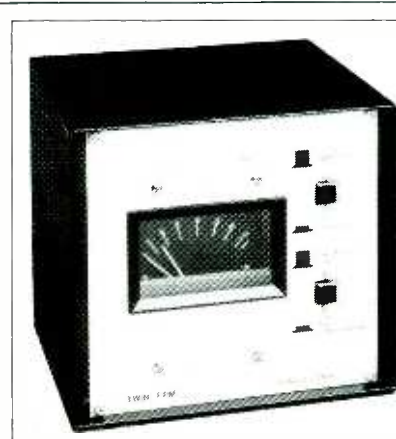
The user

To start with, the system seems a bit fiddly. There is a lot of to-ing and fro-ing between the

desk display and the function windows, selecting and de-selecting statuses, etc. I think it is slower in its initial operation than a system with function switching built into each fader. Like a great deal of equipment, however, the operational speed is proportional to user familiarity. The desk display provides the user with a good reference to what is going on in the mix but I did find pinpointing individual switches confusing at times.

Functions such as merging, saving and loading mixes, initiating etc were all straightforward and reasonably quick to perform. The grouping facility was more involved to set up than other systems but worked well.

The important factor with FAME is that it has not been designed as a competitor in the SSL, Massenburg, NECAM marketplace but as a companion to the TS12 where it provides an excellent facility at a reasonable price. □



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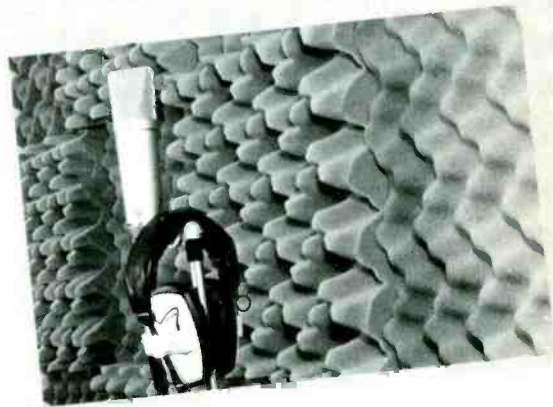
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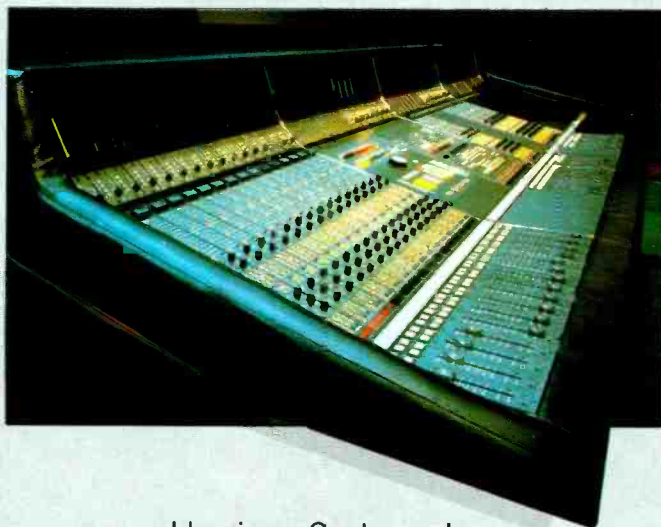
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