

# STUDIO SOUND

AND BROADCAST ENGINEERING



## COMPRESSORS & LIMITERS NOISE REDUCTION



# Who Uses Soundtracs?



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Pete took his time, asked around and kept being referred back to the Soundtracs 8-16 series. After one day's evaluation Pete's decision was made — the Soundtracs 16-8-16.

— "the only mixer in the 16 track market designed with the musician in mind — either you people at Soundtracs are musicians or you've talked to a lot of people. I'd recommend this mixer to anyone — and tell them that I paid full retail price for the 16-8-16 I bought!"

Pete Townshend  
November 7th 1984



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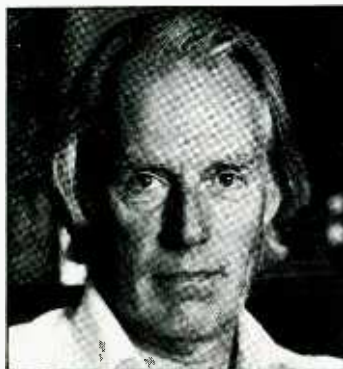
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# STUDIO SOUND

AND BROADCAST ENGINEERING

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 A LINK HOUSE PUBLICATION

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APRS for Studio Sound's  
Producer's Guide to APRS  
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# Graham Gouldman has recorded in the world's best studios.

(That's why he recorded his latest album at home)

Graham Gouldman, as a leading member of 10cc, has recorded in many world-famous studios, and certainly knows what makes a good recording, and also when he's achieved one. "But," he says, "I've always felt that the most creative recording environment is at home, in one's own space and in one's own time."

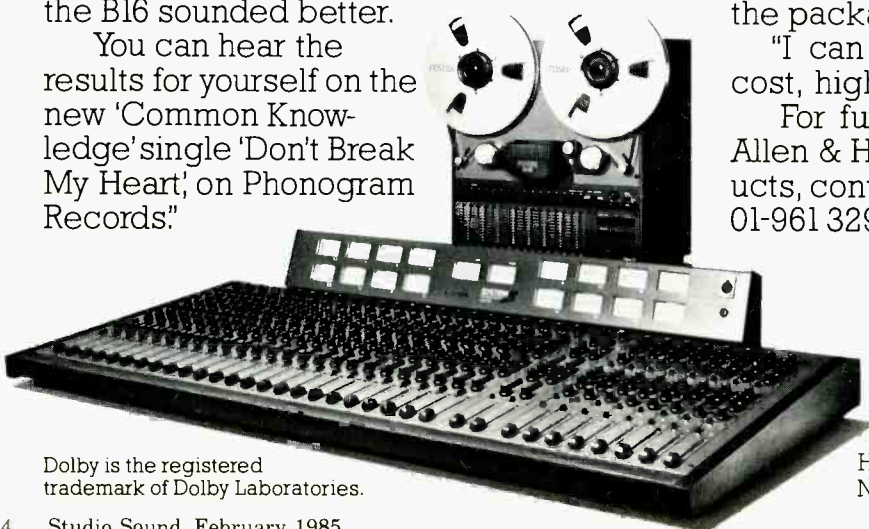
When he bought a Fostex B16 ½" 16-track recorder and an Allen & Heath System 8 16/16 mixer, he decided to put the system to the ultimate test and use it to record his current album. "Andrew Gold and I soon found that the sound quality far exceeded our wildest dreams," says Graham.

"The Allen & Heath mixer provided all the facilities I needed and produced quality to a standard beyond its price.

The Fostex B16, despite using ½" tape, was silent and accurate; the guys at Fostex really have mastered head technology, and the Dolby 'C' noise reduction really works a treat. All this for around £5000?!"

"For mixdown, we had anticipated having to transfer to 24-track – but when the time came, both Andrew and I agreed that the B16 sounded better.

You can hear the results for yourself on the new 'Common Knowledge' single 'Don't Break My Heart,' on Phonogram Records."



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# EDITORIAL

# EDITORIAL

This month's comment from Keith Spencer-Allen

## Flirting with the dynamic rangers and other stories

I have realised recently that I am the possessor of quite dichotomous attitudes to dynamic range. My gut feeling is for solid advocacy of the widest dynamic range possible within the chosen medium, noise floors and ceilings being such to allow this. For me, this is the great attraction of digital recording—whatever the true percentage of that 90 dB plus range effectively available for practical use.

On the other hand, I balance my idealism by a strong attachment to the compressor/limiter as one of the most creative tools available. Now with high level analogue tapes, better tape machines and general all-round improvements in headroom capabilities, there is less requirement to limit dynamic range purely to squeeze sound on tape. This stage was reached for rock multitrack work about 10 years ago with the arrival of the first effective noise reduction systems offering 30 dB noise reduction, and the multitrack that could be equalised truly flat. So aside from 'practical work-a-day' use on bass guitar hot-spots and vocal intelligibility at lower mix levels, the compressor has, in recording terms, become an effects device. In digital terms, however, work-a-day compressor use has often been less necessary as the digital equipment chain has expanded—and the real effects applications often sound too much like just that and need far more care.

So here I am—a defender of dynamics and a believer in the power of compression. It is true that my examples are largely from the mixdown process on one hand and multitrack recording on the other, however there is a contradiction which becomes even more ironic. One of the debates in progress at present is, of course, concerning the processing/remixing, etc, that should be applied to old recordings prior to re-release in the CD format. Many recordings from the early '60s, particularly those from the popular music catalogues, have very restricted dynamic ranges being made in a time when wide band, full-track compression was king. Meters reach a peak level and remain there until the fade, there being none of the subtle compression systems of these days. Producers such as Joe Meek raised compression to become an essential part of the music by making a virtue of the necessity to maximise signal levels on tape for noise reasons. If these recordings should have their dynamic range expanded, they would lose much of their simple appeal although it must be added that some recordings become quite unlistenable in the CD format if some treatment is not used. There is perhaps the further often said but debatable point that rock music needs a limited dynamic range to a degree to sound like rock music.

My final dichotomy continues the CD theme. If I choose to sit down and listen to a good CD recording, the dynamics can be very exciting and the experience may be very

pleasant. However, if one plays discs with wide dynamics and chooses *not* to concentrate, for instance as background music, the dynamic range will be a very annoying factor. I have tried some experiments using RMS sensing type compressors on the output of the CD player and this certainly reduces the psychologically tiring effects of dynamic range—the effect of being challenged to listen; this is even without the distraction of noisy surroundings. As an aside, I wonder whether a similar effect will be noticed by users of portable and in-car CD players who also may not be fully concentrating on the music.

I can remember the indignation I felt when I found out that one of the major producers of CDs publicly stated that they didn't feel there was any reason for putting a greater dynamic range on CD than they normally used on their standard black vinyl issue. I still feel that where the original material exceeds these limits, the CD should be dynamically wide open and the onus should be on the consumer to limit the dynamic range to his/her needs. So where are all these hi-fi compressor system units—or am I truly alone with my dichotomy?

## Other matters

Although I dislike the idea of the compulsory annual survey of the past year and enforced optimism about the next common in the media at this time of the year, there are a number of observations that I find encouraging for the industry as a whole.

As both exhibitor and attendee of seemingly vast numbers of exhibitions and conventions worldwide, I find the last six months has shown an upturn in equipment sales such that exhibitors at these events are still smiling on the final day of the exhibition *and* have a new piece of equipment to show—you can't buy it for another year yet but at least it is new where last year's new launch was often just a different front panel. On the studio bookings side, there was also a quite remarkable revival which appears to have been sustained, certainly in London.

As a final point, I would like to congratulate the AES on the very sensible plan for Conventions (see Diary, January). The alternating East/West Coast autumn show as from 1986 is the most satisfactory compromise all round considering that it is not possible to ignore decisions made previously and the way in which they have altered the relative importance of other shows to the recording industry. The current level of dialogue and communication must, however, be maintained on a regular basis so that if the situation should change in the future, it will not take so many years to reach a consensus of opinion of interested parties.

**STUDIO  
SOUND**  
AND BROADCAST ENGINEERING

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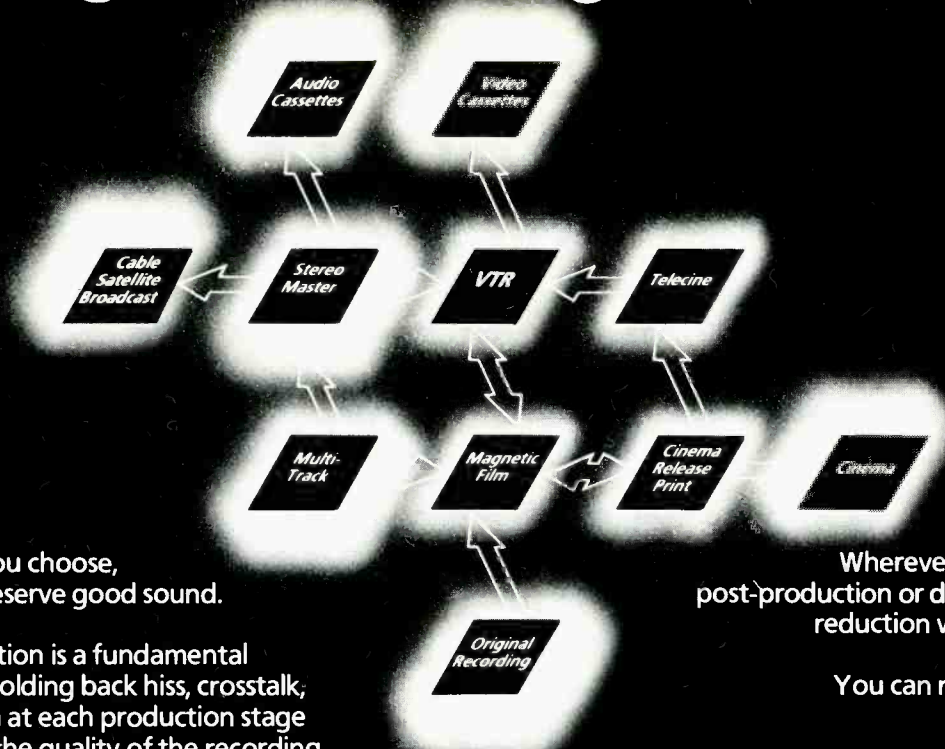
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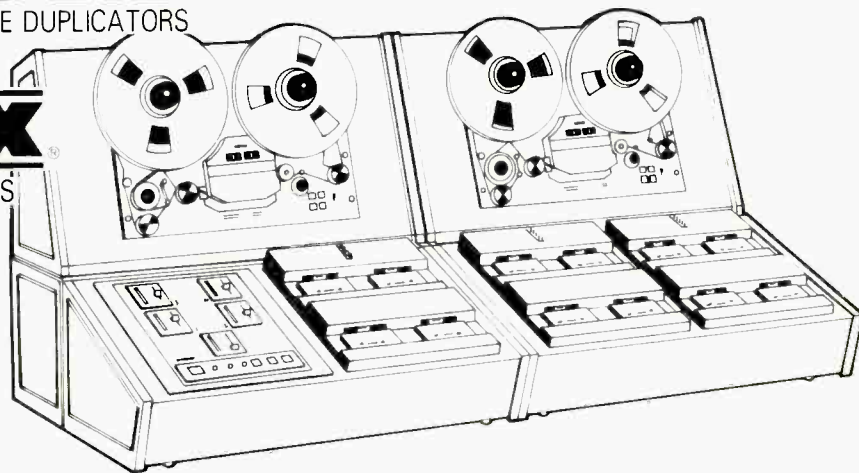
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**Studio Soundtracks** New commercial and video post production studio chooses the MTR series to ensure highest audio quality.

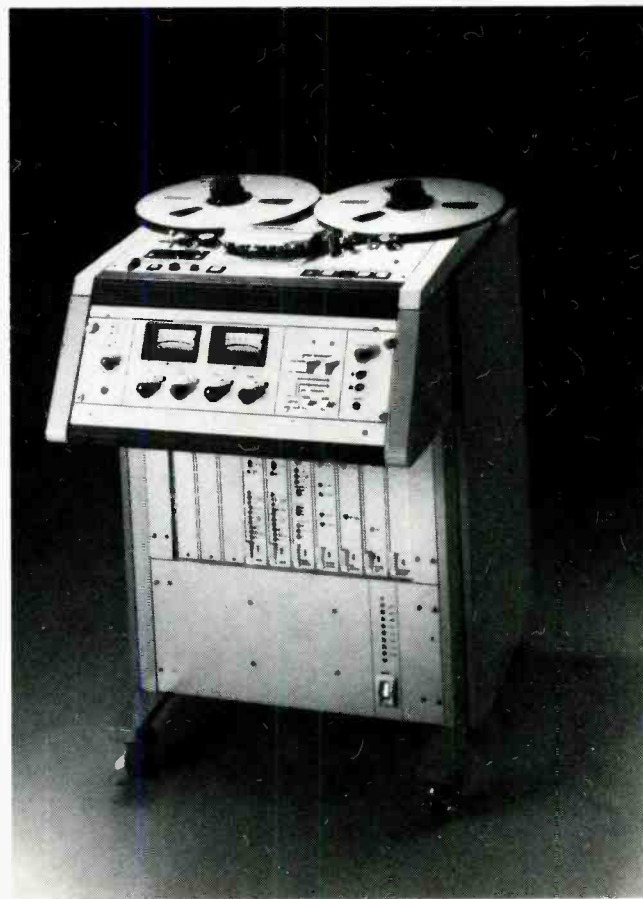
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**Drawmer** first appeared with an intelligent noise gate with sidechain processing. In the wake of its success their DL221 also became a sales leader as a result of extra facilities. The sidechain access for ducking or de-essing is featured. - with the capability to monitor this signal. A unique bi-directional LED display, offers level or gain reduction display in two colours.

Most recently a new compressor features an old component - the vacuum tube. The smooth overload characteristics are featured in a unique, equalised front end design. A unique 'round' sound for sale.



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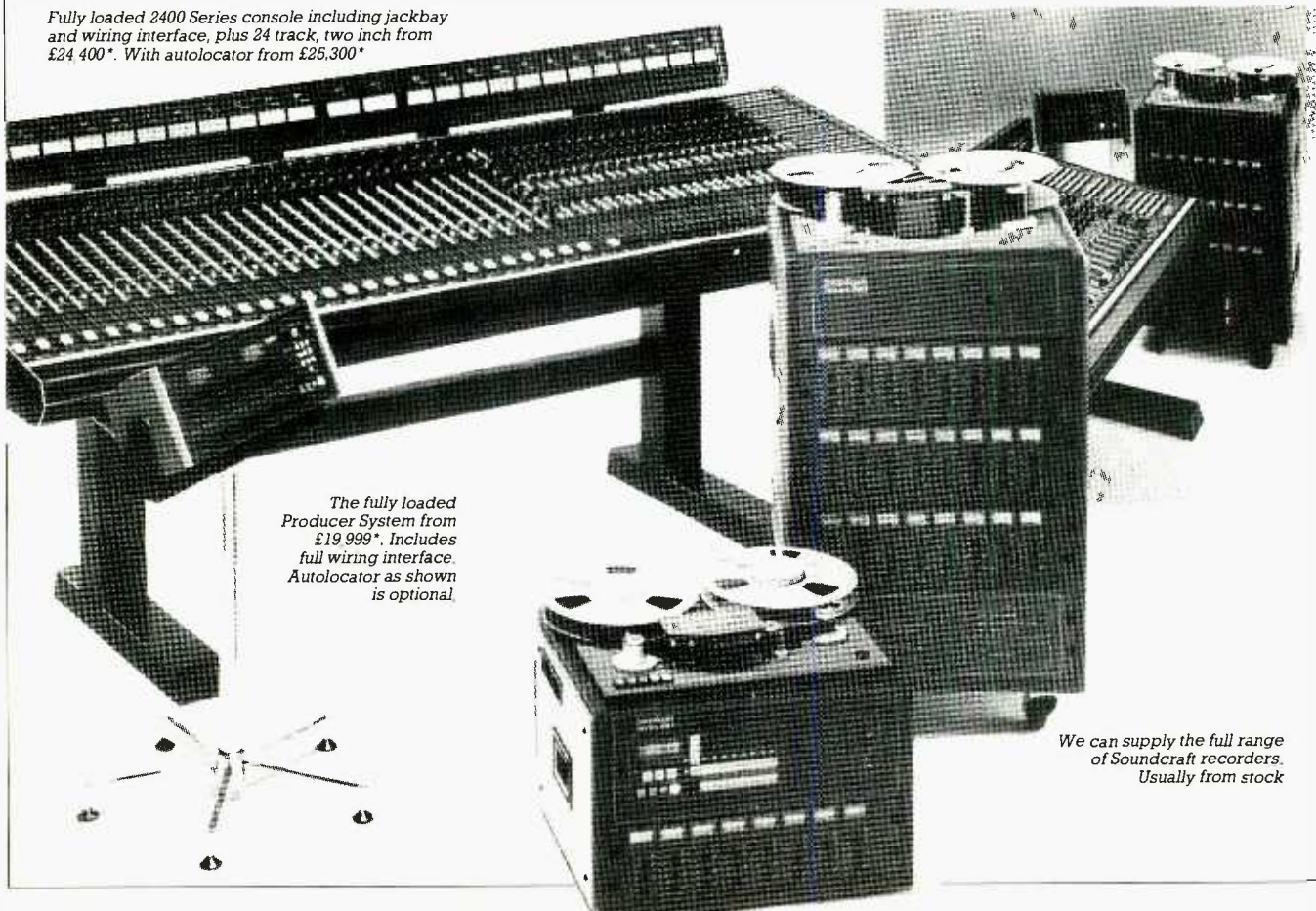
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It's over a year since those controversial advertisements appeared. At that time the proposed equation was between a PR99 and a SONY PCMF1 processor. The fact was, you had to add the price of a video recorder to arrive at a working system.

Sony's latest offering makes the challenge to analog recording a reality.

At a price, considerably less than half that of the original version, the new PCM-501ES processor truly offers the opportunity for digital stereo mastering to every studio.

Combined with a video recorder your cost can quite easily be as low as that of an analog stereo machine.

Standard connectors and minus ten levels, offer a simple interface. (zero level to order).

The quality fulfills everything expected from digital sound recording.

The PCM 501ES offers both 14 and 16 bit linear quantization selectable by the front panel 'resolution' switch. At the higher bit rate, dynamic range is more than 90dB and

harmonic distortion is below 0.005%.

Features include peak reading meters, auto playback mute, copy switching and record mute. A 'tracking' analysis function on the meter, allows you to trim your video recorder's alignment to tapes made on other machines. A further OVC (optimum video condition) indicators and control allows you to detect any dirty head or unstable tape transport conditions.

The Sony PCM 501ES is supplied complete with BNC terminated connecting leads, for simple interface to any video recorder.

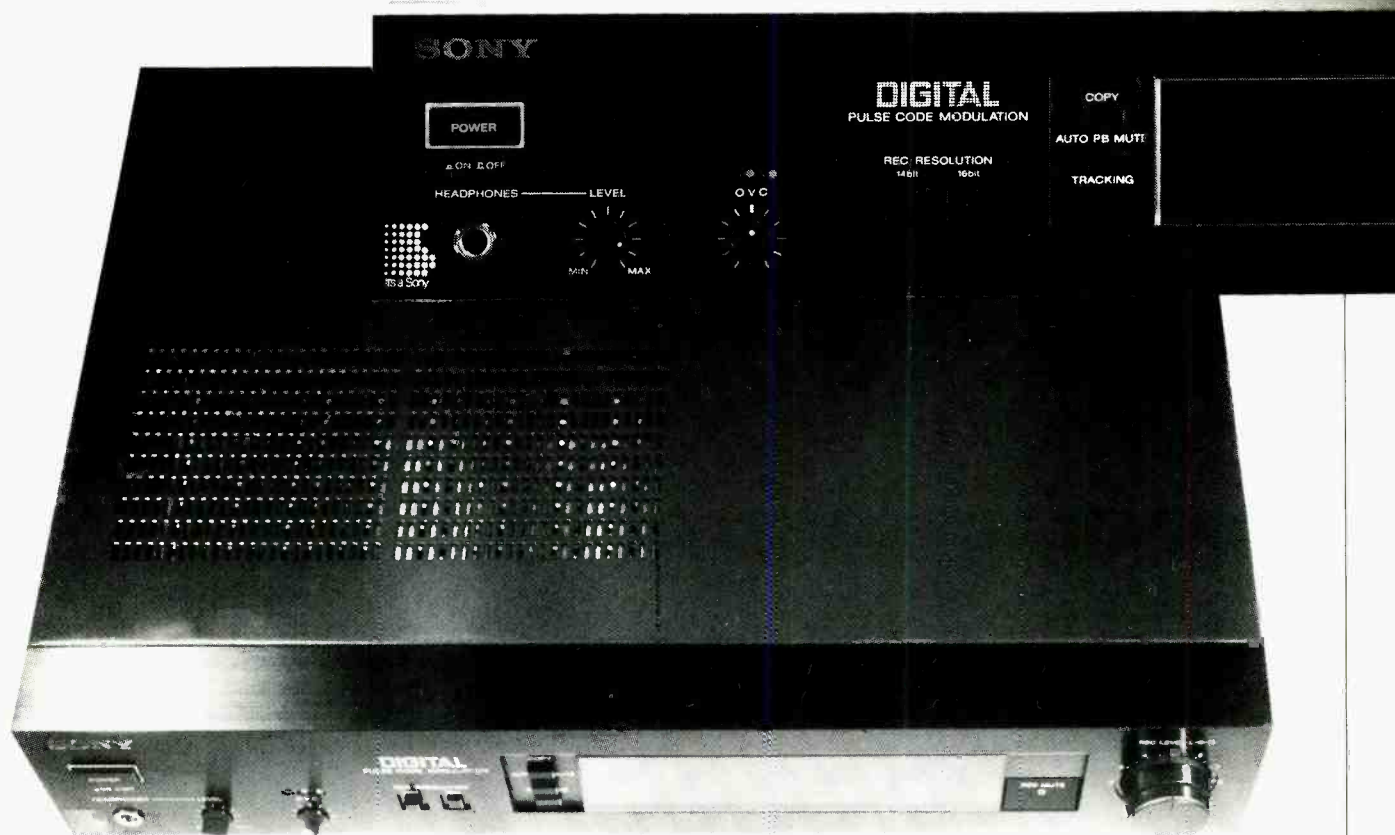
You will find that everything is included to make your introduction to digital mastering as smooth as possible.

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# THE BLACK & WHITE CONNECTION

The Black and White Connection makes interface simple. From **SYCOLOGIC** come connections to solve many of today's MIDI requirements.

**AMI.** Analog to MIDI Interface, can be used to breathe new life into Analog Keyboards or Sequencers, expanding their creative possibilities by linking with any MIDI-equipped instruments. Standard CV and Gate signals are converted into MIDI 'events' allowing control of Pitch, Dynamics, Modulation Parameters and even Sync Code.

## "M.I.D.I. INTERFACE MADE SIMPLE"

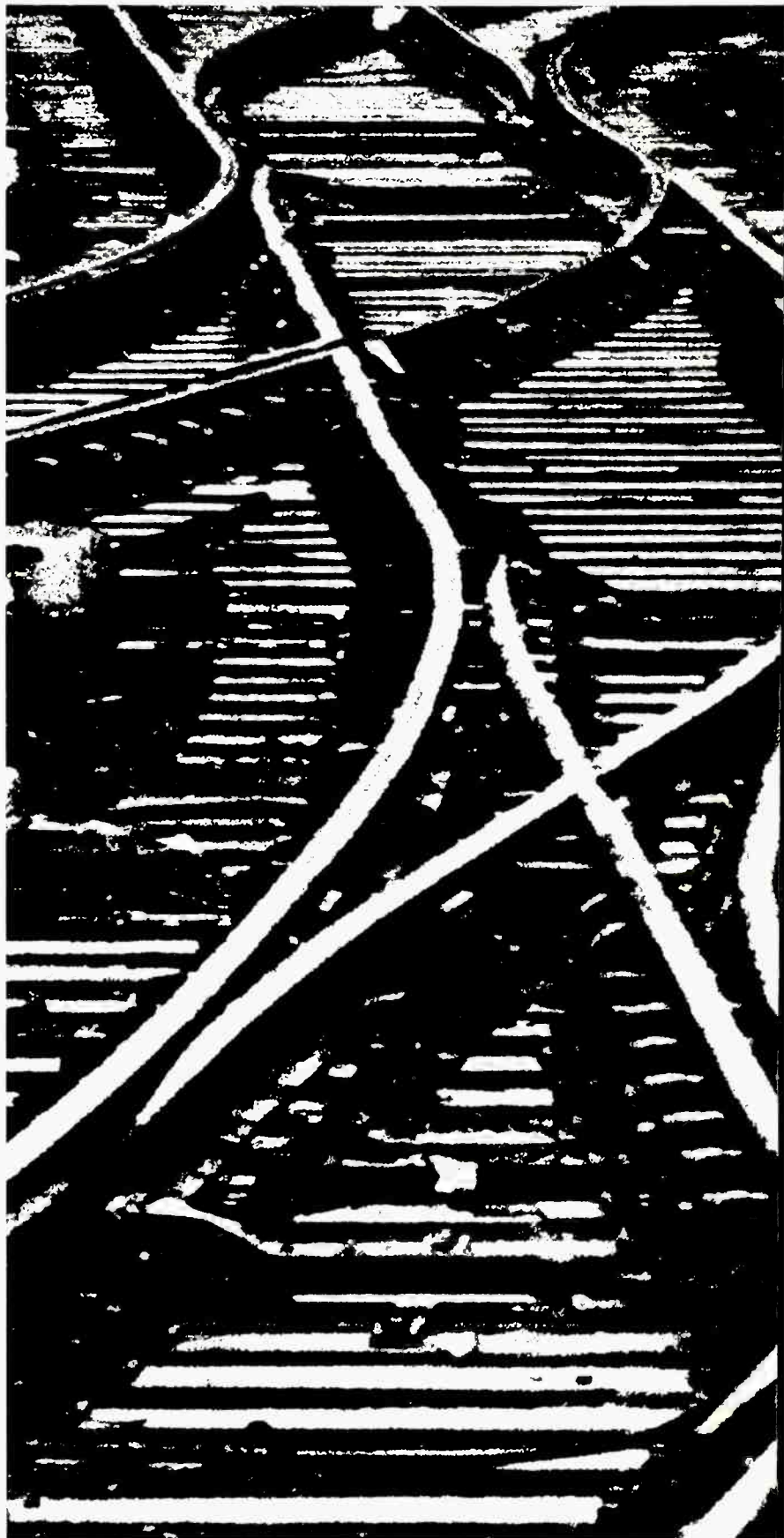
**PSP.** Percussion Signal Processor, represents a dramatic new step in electronic percussion technology. By connecting between playing surfaces and their sound-producing electronics, the PSP allows previously 'dumb' percussion synthesisers to talk MIDI – dynamically. Pads can be used to play MIDI instruments, or MIDI instruments used to play percussion synthesisers. Connect a MIDI Sequencer and you have the ability to record, in real-time, live drumming with all the dynamic inflections. Using the PSP's control panel a variety of parameters can be assigned to each playing surface, including Note value, Gate time and 'Feel'. These can then be recalled at the touch of a button from a number of stored patches.

**M14.** Quad MIDI Matrix, has been designed to simplify MIDI connections. Problems of constant lead-swapping, MIDI delays and the lack of a 'Thru' socket, are minimised using the M14. Up to 4 instruments can be connected, allowing any one machine to 'talk' while the others 'listen'. Connections are made by defining points on a matrix, displayed on the front panel. An optional infra-red transmitter allows patches to be made remotely.

**MX1.** Memory Expansion board for the Yamaha DX7, allows you to store and recall 128 Internal Voices, instead of the normal 32 – via the DX7's controls or via MIDI. In addition, several software enhancements have been added to expand the DX7's MIDI functions, including the ability to transmit on any channel. No modification is necessary to the DX7.

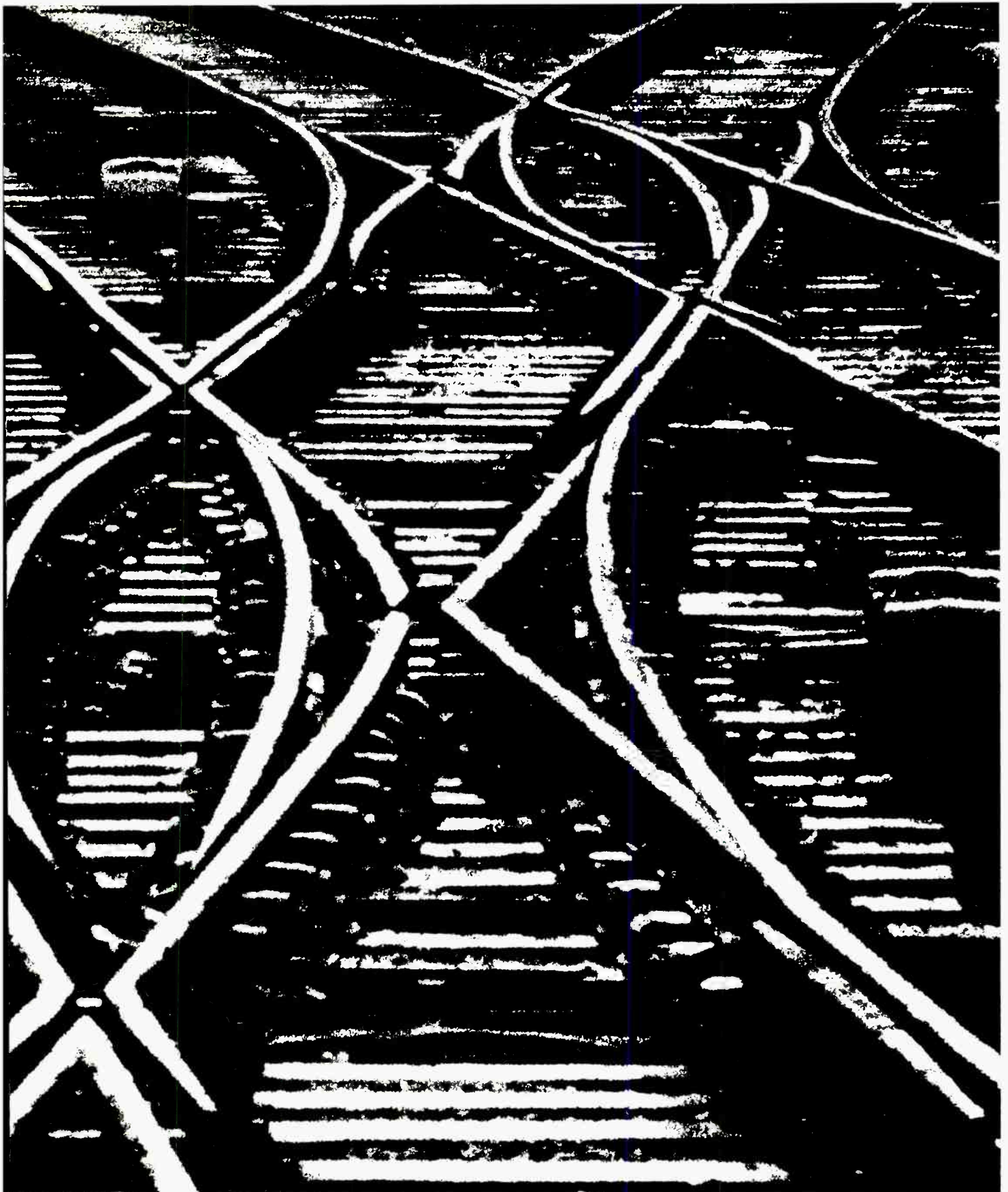
**SYCOLOGIC** – enhancing today's MIDI possibilities. The Black and White Connection.

Syco, 20 Conduit Place, London W2.  
Telephone 01-724 2451 for an appointment.  
Telex 22278 SYCO G, Fax 262 6081.



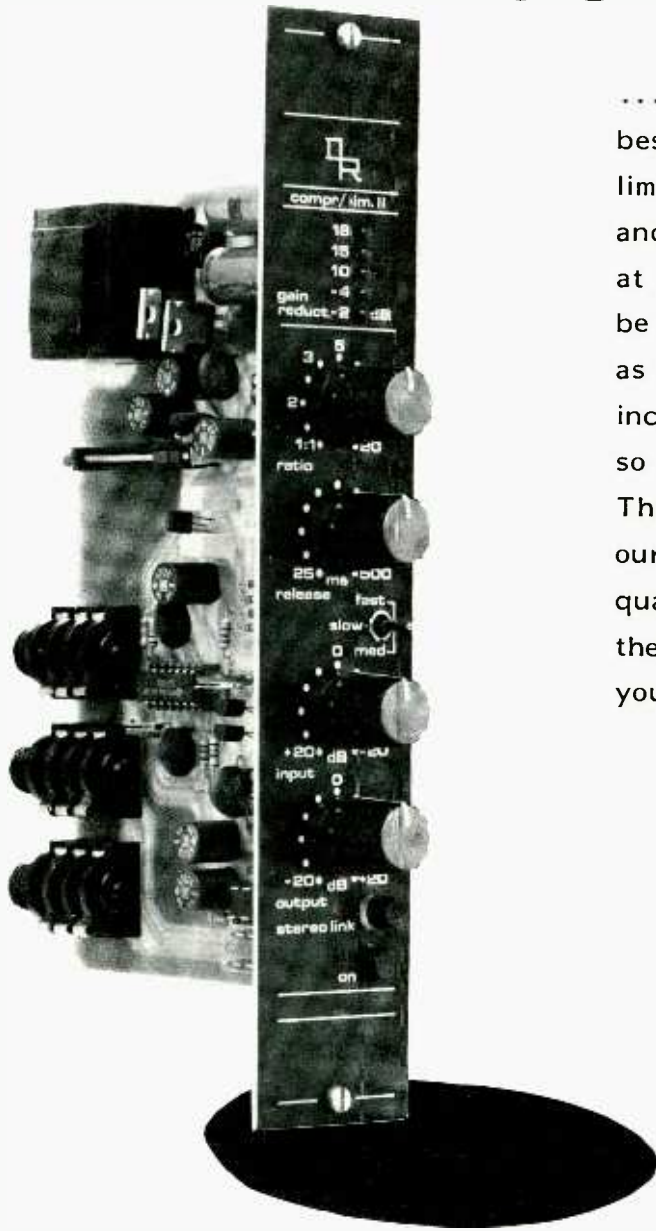


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- 15200 Lahti 089-1833813
- France/Mettler Audio Blvd. de Clichy 3-5
- 75009 Paris, 01-8782911
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# COMPUTER AUDIO

CompuSonics created the DSP-2002 for professional radio and television broadcasting service. Functionally, the DSP-2002 equals or exceeds conventional cartridge machines with the additional benefits of digital sound quality, random access and interactive editing. Recording time capacity ranges from 30 to 960 minutes in stereo, depending on the number of Storage Modules installed.



## Preliminary Specifications

- Resolution . . . . . 16 bits •
- Wow & Flutter . . . . . none •
- Signal to noise . . . . . 92 dB •
- Channel separation . . . . . 92 dB •
- Frequency response . . . . . 20 to 15,000 Hz •
- Dynamic range . . . . . better than 92 dB •
- Sample rate . . . . . 50,000 Hz (other rates optional) •
- Distortion at 1 kHz, 10V peak to peak . . . . . less than .01%, 3d Harmonic •



- Plain English menu; no computer training is required to operate the DSP-2002 •
  - Stereo or mono audio input and output are under software control •
  - Twelve inch video monitor with detached typewriter style keyboard •
  - Random access and playback in programmable sequence •
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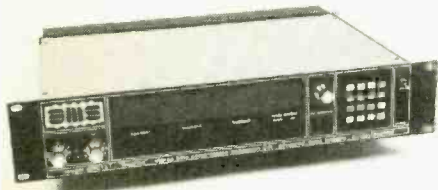
Illustrated here the MD 918. For full information on the Sennheiser range of microphones write to department SS, Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St. Peter, Bucks. SL9 9UG. Telephone: Gerrards Cross (0753) 888447.

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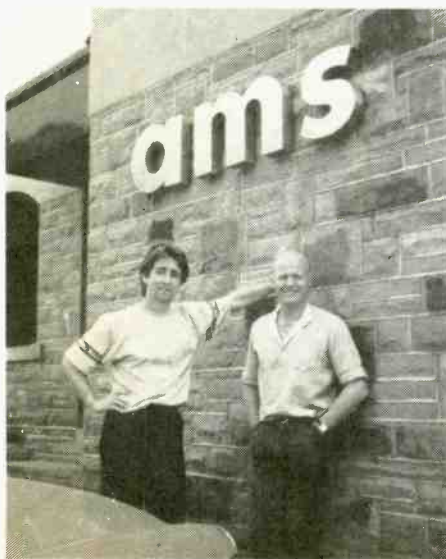
# ECHO TIMES

## TIMEFLEX SURFACES AT A E S NEW YORK



Timeflex is a modified and specialised version of the DMX 15-80S dedicated to time compression or expansion. Whenever audio, film or video is speeded up or slowed down the dual de-glitched intelligent pitch changers within Timeflex can restore the correct audio pitch. The system is housed in a 2 Unit high rack mount case and is capable of either stereo or dual channel operation. Timeflex also incorporates the possibility of programmable delay offsets should sound/vision

## THE HOLLIES DROP IN AT A.M.S.



synchronisation be required. Following the preview at AES New York and subsequent demonstration of the system at certain facilities immediately after the exhibition, A.M.S. received orders for the first 11 units for delivery in December '84. ■

### REVERB PROGRAMME BAR CODE UPDATE

The first issue of barcodes on laminated card for updating existing RMX 16 digital reverberators via their remote terminals were made available in mid October. This software update includes both new programmes and issues of programmes previously released, but not currently available on REV 3.0 version software. The initial list of programmes available includes: DELAY 8, DELAY 16, ROOM B1, FREEZE, ROOM A0 IMAGE P1, REVERSE 2, NONLIN 1, PLATE B1, HALL A1. Any three of these programmes may be stored at the same time in the soft programme locations, programmes 10, 11 and 12 in the RMX 16 mainframe. This first issue will be supplied free of charge to all RMX 16 owners when updating their remote terminals to accept bar code readers. ■

Tony Hicks and Bobby Elliot of the Hollies called in at A.M.S. to collect an RMX 16 and a DMX 15-80S which had been purchased by the band for both studio and live work. The Hollies had become familiar with A.M.S. equipment whilst working in studios both in England and America. ■

## KEYBOARD INTERFACES NOW BEING SHIPPED

The first batch of 50 keyboard interfaces were shipped during October following the demonstration of the first prototype unit at the APRS exhibition in London during mid June.

The keyboard interface is a 1 Unit high addition for any DMX 15-80S DDL Pitch Changer allowing control of various functions by means of any keyboard capable of providing a 1 Volt per octave control voltage and Gate. The unit has currently four major functions:

1. Control of either the A or B channel pitch changers over their 2 octave range by means of any compatible keyboard.
2. Control of Loop Edited Samples over the same range.
3. Rotating pot control of both A and B channel pitch changers.
4. A new programme called Chorus which when selected automatically randomly varies both pitch changers about the unity setting, the user having control of both speed and depth variation.

The general feeling amongst the first owners of this low priced add-on is that it provides a wealth of additional facilities, particularly in the realms of manipulation of stored sampled sound, for the already versatile DMX 15-80S. ■





## PEOPLE IN THE KNOW

"On Leave It I used a Linn and played that through an A.M.S. and delayed it for a full bar".

*Alan White, drummer with Yes talking about tracks on the Yes 90125 album with Andy Hughes of International Musician.*

☆☆☆

"Being a re-mix room and not a control room, the outboard selection is very special indeed. Offerings include the A.M.S. RMX 16 and 80S units which are almost becoming as essential as the new Dragonslayer Video-disc games!"

*Chris Everard, Editor of sound Engineer magazine.*

☆☆☆

"The thing that has been most exciting to me over the last few years has been the effect of a good reverberation units. I like the sound of the A.M.S. better than anything else. I got terrifically excited when I first tried that out because it's beautiful – one of the deepest and best reverbs I've ever heard. I always look for a unit that gives me that perspective back behind the speakers - the Lexicon does a bit, but the A.M.S. has got real depth to it."

*John Foxx in an interview to HSR magazine.*

☆☆☆

"The A.M.S. is God. That's all you need to know. Totally the single most

revolutionary thing I ever acquired was the A.M.S. digital delay. I've never had a session on my own stuff or anyone else's where my finger's off that button for more than half an hour."

*William Orbit of Torch Song in an interview with Sean Rothman.*

☆☆☆

"One of the things we need most where digital technology has really helped us, is to be able to put a voice in a room; considerable numbers of clients ask for the sound effect of an empty room. You tweak the old A.M.S., define a room of a certain size and suddenly - yes! - you've got a room. At first we were seriously concerned whether the cost of the unit would be recouped. Well now we've got four A.M.S. systems.

From the manager's point of view, the way to get the best employees is not only to pay good salaries; it's got a lot to do with the equipment the engineers are going to work with. I think it's absolutely certain that if an engineer was offered another job with a higher wage which meant switching from the latest good equipment to old rubbish, he wouldn't move. If they are working eight or nine hours a day in a studio the equipment is very important to keep the motivation high and maintain excitement and interest. If we had a staff meeting and said do we want five pounds a week more each or shall we buy a couple of A.M.S. harmonizers, another reverb unit or whatever

I honestly think there would be no contest. Staff prefer new equipment and are willing to make five pounds extra a week on overtime when we get more bookings. Modern, high technology equipment enables you to attract and keep the best engineers.

*Robbie Weston, M.D., Silk Sound - one of the U.K.'s four major companies in the field of audio for T.V. or Radio talking to Alvin Gold, International Broadcasting.*

## USA DEALERS IN THE KNOW

"A.M.S. is Hot: I've got a studio with three rooms who bought an RMX 16, they then bought another and they are used all the time. I even have a studio who've got all their existing outboard gear up for sale to finance the purchase of A.M.S. systems."

*Nigel Bramwell. Audio and Design/Calrec... A.M.S. dealer Washington State.*

☆☆☆

"A.M.S. products are proven products universally well received in the marketplace. Each customer's evaluation has turned into a purchase."

*Courtney Spencer. Martin Audio Video Corporation... A.M.S. dealer in New York City.*

☆☆☆

"We feel the A.M.S. product range offers our clients the sound quality and ▶



## THE FIXX

Pictured above are the Fixx whilst spending some time on the A.M.S. stand at the APRS exhibition in London. Being produced by Rupert Hine means they are no strangers to A.M.S. equipment and their time was valuably spent examining the keyboard interface for the DMX 15-80S. ■



## KEN TOWNSEND TESTS THE DRIVING SEAT.

Pictured above is Mr. Ken Townsend, studio manager of EMI Abbey Road studios in London during a recent visit to the A.M.S. factories. Not unused to the pressures of management Mr. Townsend is pictured here behind the desk of sales and marketing director of A.M.S. Mr. Stuart Nevison. It should be pointed out that Groucho Marx look-alike Mr. Nevison had opted to remain incognito during Ken Townsend's brief spell of duty at the helm! ■



performance they are looking for in digital audio processing. What more can we say? - They must be great as they are selling like hot cakes on a cold winter morning!"

*John Alderson. Studio Supply Company...  
A.M.S. dealers in Nashville.*

☆☆☆

"Everywhere I take A.M.S. equipment producers and engineers get

real excited when they get a chance to play with it... it really is fun to show!"

*Ron Timmons. A.I.C. Company...  
A.M.S. dealer in Northern California.*

☆☆☆

"A.M.S. units are the hottest thing in town! The reasons people are buying them is the quality of sound, their versatility - there is a lot more

to them than delay, pitch change and reverb - and of course their reliability factor. What's most exciting is we are really beginning to hear their effect on American productions as well as the European ones that they have dominated for so long."

*Harry Harris. Harris Sound. ... A.M.S. distributor and dealer for the Los Angeles area. ■*

*Humberto Gatica arrived in the U.S.A from Chile in 1968. Thirteen years ago he accidentally walked into a recording studio and knew that he wanted to be involved and by his own admission he has been very lucky and very successful. He has been involved in many projects including part of Michael Jackson's 'Thriller', and albums by Kenny Loggins, Fee Waybill, Dan Hardman, Kenny Rodgers and many more. Humberto enjoys his work and was able to confirm the rumour that he was recently spotted running between three control rooms at Sunset Sound studios in Hollywood - the simultaneous projects he was involved in at that time were Kenny Rogers, Kenny Loggins and Chicago!!*

**A.M.S.:** What was it that alerted you to A.M.S.?

**H.G.:** I listen to a lot of other people's records and I really am a big fan of 'The English Sound'. I've listened to a lot of English records and there was definitely a sound that I considered unique. For instance, there is an English band called The Fixx and they have a source of delay they use that I really love - and I know you'll tell me it's A.M.S.

**A.M.S.:** The Fixx are produced by one of England's most fanatical A.M.S. users - Rupert Hine.

**H.G.:** Exactly! The same sort of sound that he used on the recent Tina Turner album - and the best way I can describe it is 'unique'. So for three years I've been using A.M.S. units and there isn't a session when I don't use them in one way or another.

The most important thing I can say about A.M.S. is that the products are very musical. I can be recording a synthesizer and the musician will say - "Hey, what are you doing to the sound? It's fantastic! - I can't believe it!" - and my easiest explanation is - "Oh... just using a little A.M.S." There is always something in the recording process that if put through A.M.S. units makes it sound better. I recorded a Christmas album for Kenny Rogers and Dolly Parton where many of the A.M.S. effects used were very subtle - but, if you took the A.M.S. effects out even when used subtly you really

## HUMBERTO GATICA



could tell the difference.

**A.M.S.:** How do you like to use the RMX 16?

**H.G.:** I am fanatical over a drum sound. I will use 'Necam' to remove every drum back beat from a snare so all I am left with is the impact of that snare - now feed that to the RMX 16 reverb and the effect is awesome and well worth the time spent. I really like the brightness of the RMX 16 - take the Ambience programme, it's clean with lots of top end which means when you bring the music up in a mix it's still there - that's just not the case with all digital reverbs. I also like very much the Nonlin and Reverse programmes. I recently completed a new Chicago album and there were several cuts where I used the Reverse programme on the brass sound - and they loved it. It really added a new dimension to the sound. For the past 17 years their horn section has been a major part of the record and what do you do if somebody asks you to give a new sound? Somehow a short decay setting on the Reverse programme does!

**A.M.S.:** What about strings?

**H.G.:** I find it impossible to explain what I want from strings, but by

using the RMX 16 I can place the strings exactly where I feel they sound best. Taking an RMX 16 everywhere with me I can go into any studio and hardly worry about the room. I can make a big room sound small and a small room sound big! A.M.S. units are everything I need in a mix because they make it so easy to create depth and place for not only strings but everything. I believe it is important to make a record feel like everyone is there and playing at the same time and A.M.S. units are my biggest help in creating this feel whether it be delay, echo, pitch change or reverberation.

**A.M.S.:** And how about the DMX 15-80S pitch changers?

**H.G.:** A.M.S. have literally changed the whole business with their units. Everywhere I go I make fans for A.M.S. - Julio Inglesias is a very sensitive man and to him the vocals are the most important part of his recording. The last time we worked together it was in America and he just wasn't happy with the result because with American musicians he had been forced to sing right on top of the beat. He was very precise when recording but afterwards we could play around with the DMX 15-80S and program it so that each phrase he sang could be 'laid back' just sufficient for him to feel comfortable again with the end result. And he was right, it made a lot of difference. Julio fell in love with the A.M.S. and was looking for a unit to take everywhere with him!

**A.M.S.:** Do you use the Loop Editing System?

**H.G.:** There is so much you can do with A.M.S. units but there again there are many things I feel I haven't fully taken advantage of yet. I started work on Quincy Jones's new album and when we sat down to talk about it Quincy was very excited about getting very heavily involved with this new sound - and of course he's talking about A.M.S. sampling! I am a really big fan of A.M.S. and the best way I can put it is - A.M.S. makes recording fun. ■

# ELECTRIC LIGHT ORCHESTRA

*In the very early days of A.M.S. it was thought that the DM 2-20 Flanger, because of its stereo outputs and dual channel analog delay function, could successfully replace rotating speaker cabinets for use with electronic keyboards. E.L.O. were the first band approached and asked to consider the DM 2-20 as a valuable piece of equipment for their use. Both Jeff Lynne and Richard Tandy of E.L.O. are now both A.M.S. converts and carry their own units wherever they go.*

**A.M.S.:** After your introduction to A.M.S. when did you next come across any of our units?

**Richard Tandy:** Following our first meeting, which I do remember, I next encountered A.M.S. systems at Ridge Farm. What immediately excited me was the quality of the DMX 15-80S - particularly the bandwidth of the system.

**Jeff Lynne:** The quality just made it so difficult to use anything else. They are all fabulous, we really do just get so blasé and it's not unusual to hear a shout of "just put another 2 hours of delay on this for us!" - confident that that will not cause any problems.

**A.M.S.:** Between you what do you really make best use of when you are working with A.M.S. units?

**R.T.:** For me, I do work a lot with drum machines and when writing, the accuracy of the programmability of the DMX 15-80S has made it so easy for me to get the sound I want.

**J.L.:** I am a big fan of the RMX 16 reverb. I really do like the Ambience



programme if only because it is so obviously designed to have very little colour. I love either very short decay settings or very long ones.

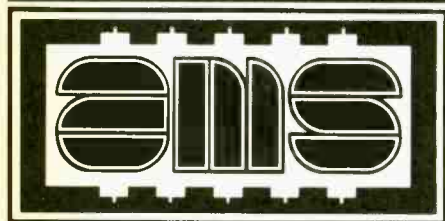
**A.M.S.:** We have talked to people who write tunes around pieces of equipment. Do you work like this or not?

**J.L.:** No, not really. I do write a song by trying to get a good tune first - that's the most important bit. What's really nice then is that I always find that A.M.S. comes into how the arrangement works and they really

are such a pleasure to work with at that very important level.

**A.M.S.:** So do you feel A.M.S. plays an important role for you?

**J.L.:** There is no question that A.M.S. really did change our lives! Sampling using the Loop Edit System is amazing. I've actually done a Christmas Record for my friends - it features my father and we really should send you a copy - it's brilliant. There really is no point explaining it to you now because you would never get away with publishing it in any respectable magazine!! ■



**Advanced Music Systems,  
Wallstreams Lane,  
Worsthorne, Burnley, England.  
Tel: (0282) 57011 Telex: 63108**

Australia: Audio Mix Systems (Int) Pty. Ltd, 5th Floor, 21 Pier Street, Haymarket, Sydney, NSW 2000. Tel: (02) 2646817. CONTACT: Iain Everington.  
Canada: Manta Electronics Group, 204 King Street East, Toronto, Ontario, M5A 1J7. Tel: (416) 868 0513. CONTACT: Andy Cox.  
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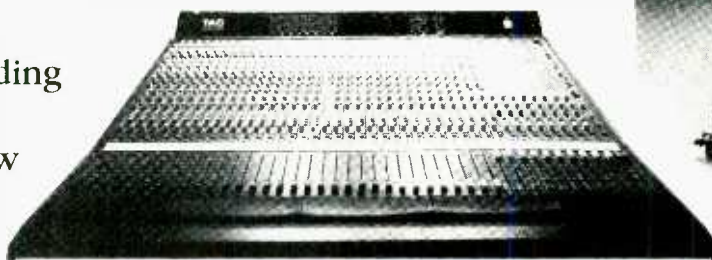
We never apologize for the fact that our product list is usually out of date. ITA's range of professional studio equipment is the envy of many other suppliers, but we are always updating it to make sure it stays that way.

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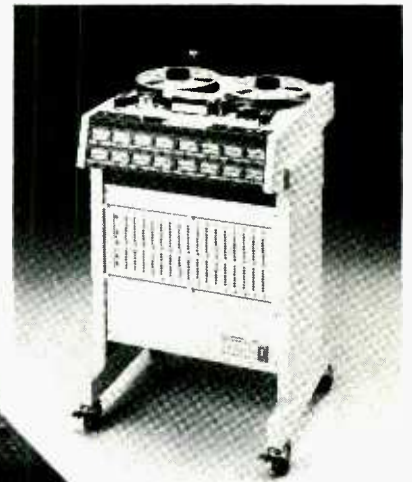
professional recording equipment yet. We show here just a few items recently added to our list.

The Otari MX70 is a brand new 1" 8 or 16-track recorder offering extremely advanced design at low cost. The TAC Scorpion is a new modular mixer system of an exceptional constructional standard giving equally high performance, and is available in a wide variety of formats. On



the outboards front, we have the best-sounding digital reverb under £2,000 – the Lexicon PCM60, the amazing Bel BD80 8 second delay line, and Yamaha's new D1500 MIDI-controllable programmable d.d.l.

All these are in stock NOW at ITA, along with many more new items. Remember, if it's worth hearing in 1985 – we'll probably have it.



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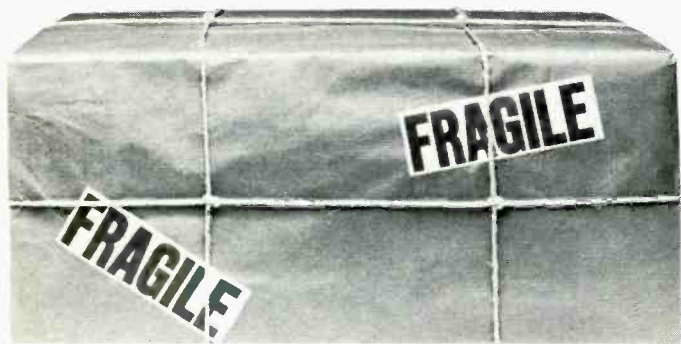


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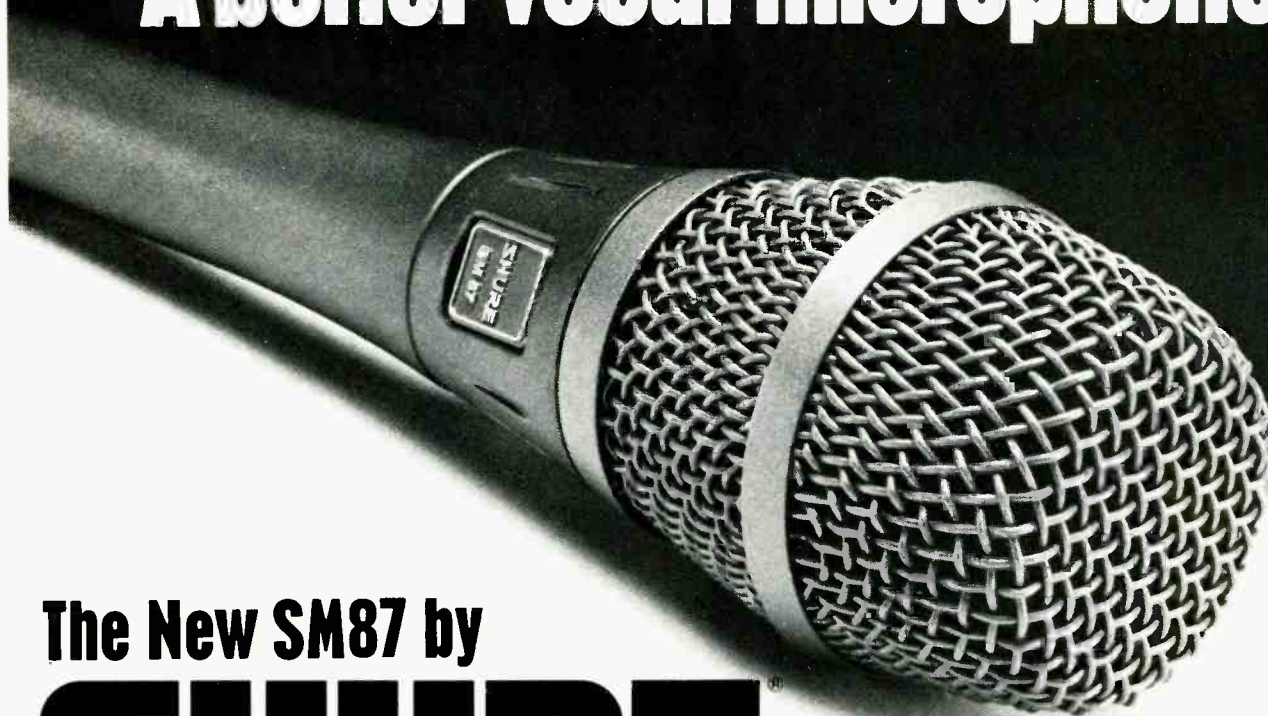
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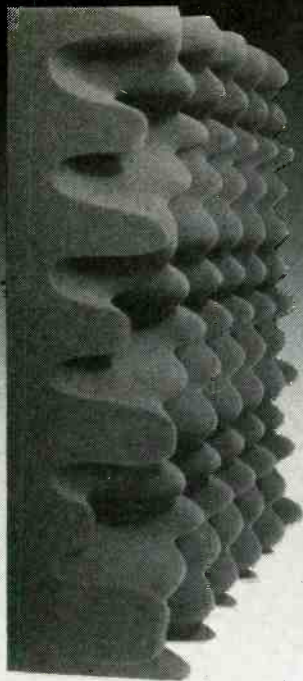
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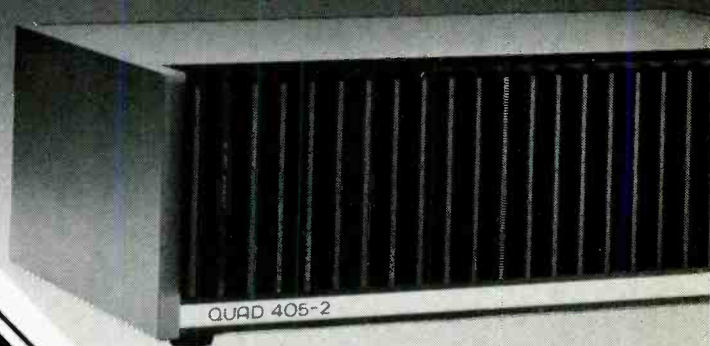
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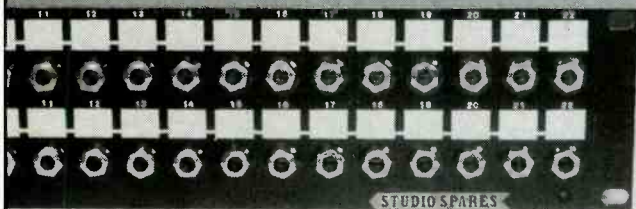
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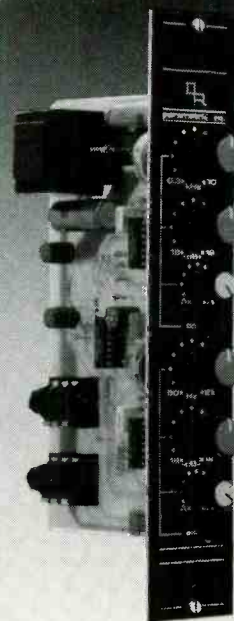
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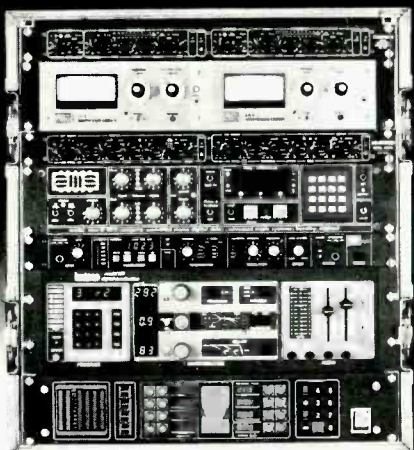
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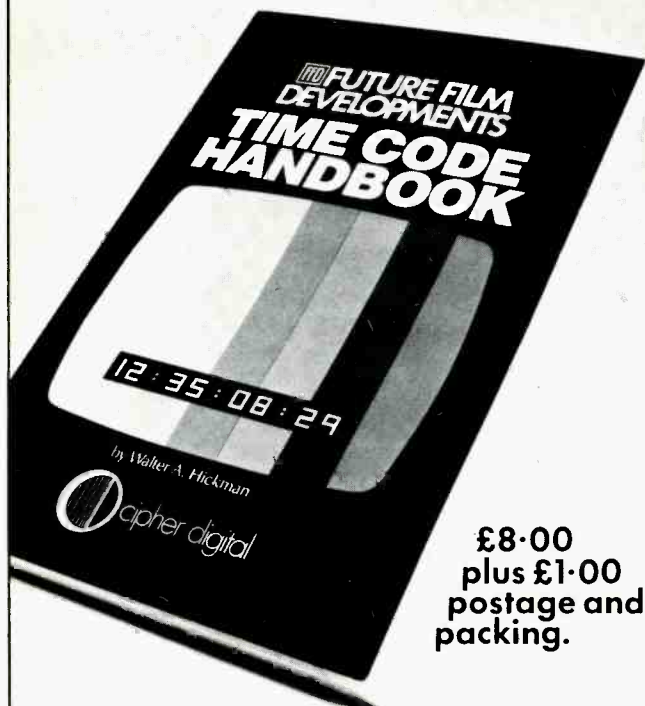
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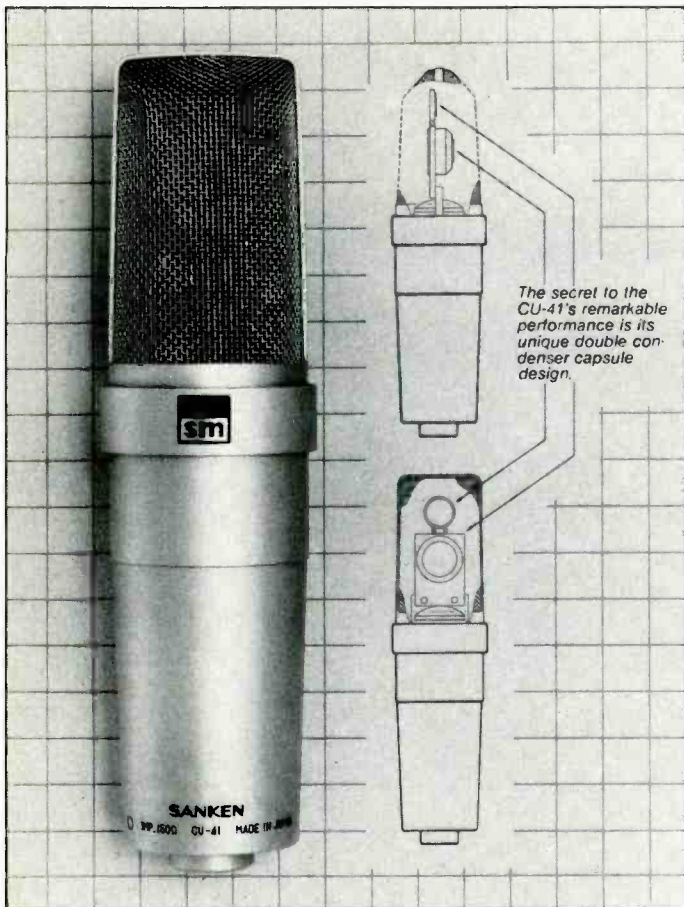
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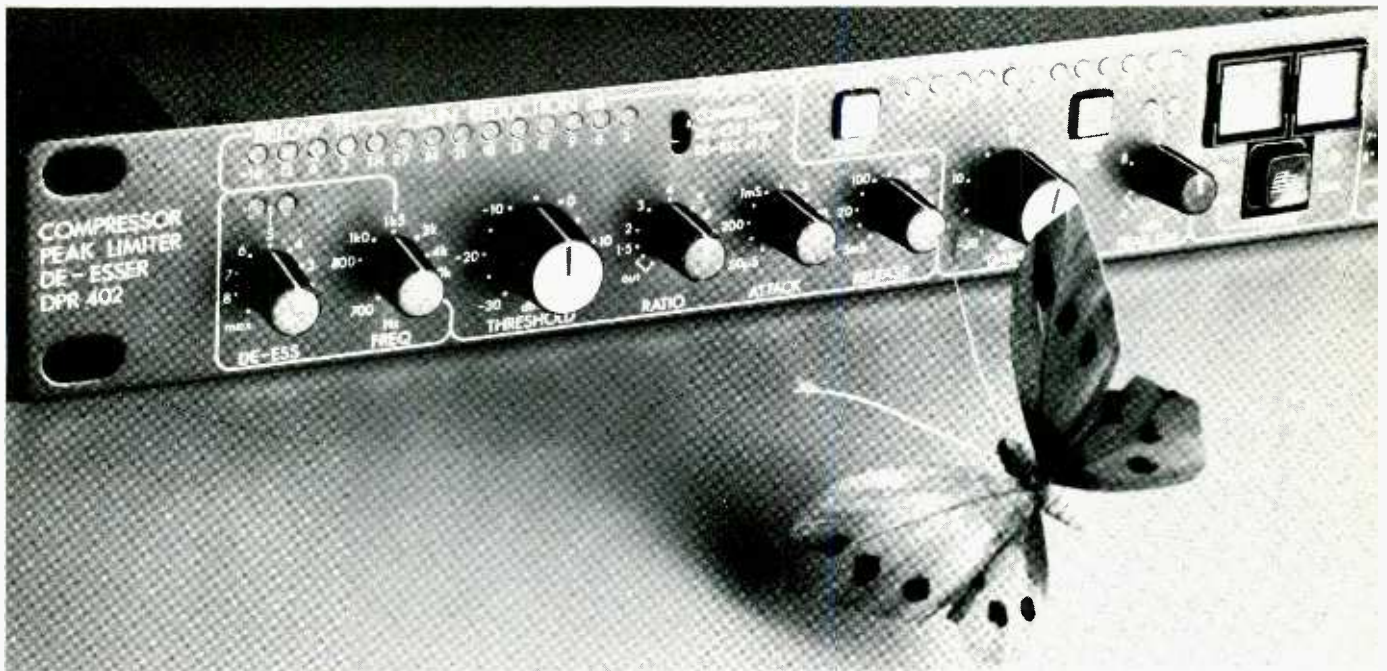
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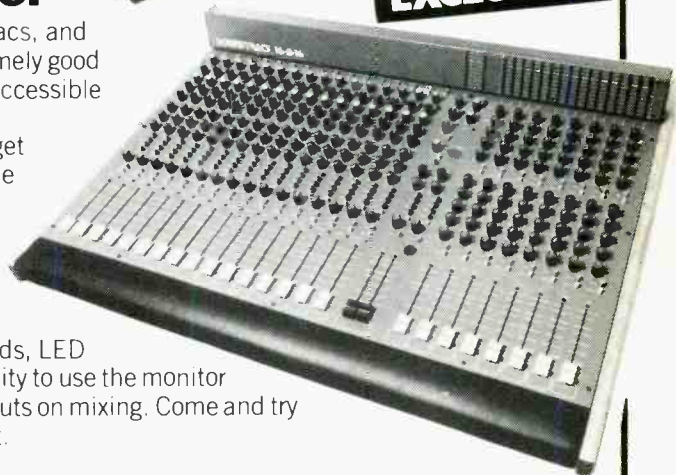
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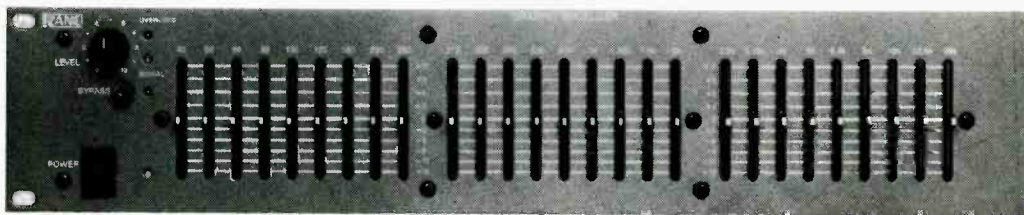
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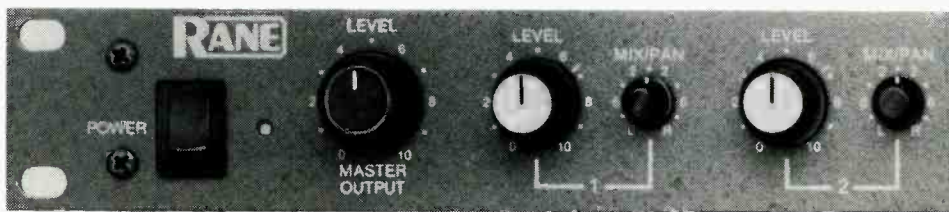
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# DIARY DIARY

Mergers, addresses, agreements

## Cadey info anyone?

We have recently had a number of enquiries about information on Cadey, a small UK company who used to manufacture multitrack tape machines. We believe that they are no longer in existence as a manufacturer and no longer have a current address for any part of the company. All our enquiries have also drawn a blank.

If any readers are able to help in any way with information, servicing details or spares, there are several

Cadey users who would very much like to hear from you. One of the enquirers has said that he would be quite prepared to run a Cadey 'users' club' to co-ordinate the available information should this prove necessary—however we all need the information to co-ordinate first. If you are able to provide any details please write to *Studio Sound* at the Croydon address on page 3 and we will forward any letters—hopefully to everyone's benefit.

## BPI-MU agreements

The BPI and Musicians' Union have renewed the procedures under their Agreements for the use of backing tracks and promotional videos. BPI members will have received explanatory literature, as the Agreements are only available to members.

One of the changes introduced is that a Standard Consent Form will have to be completed by all musicians and session singers not signed to a BPI member company appearing on records of BPI members. Before now it was only necessary to submit consent forms to the MU when

applications were made to use a backing track. It is required by law that producers obtain consent in writing from all performers (record company contracts with signed artists cover these).

The way this procedure will work is that the consent form serial number will be quoted in applications to the MU for the use of backing tracks or promotional videos, on TV programmes to which the Agreements apply.

Applications may be made on a standard application form whereas previously two separate forms were required.

## Address changes

● Sound Designs, sole distributor of the *DBS4 MKII* and *DBS5* loudspeaker kits have moved to East Barn, Thorpe Morieux, Bury St Edmunds, Suffolk IP30 0NW. Tel: (0284) 828926.

● Quad Eight/Westrex have moved into their new International headquarters.

The new location is at 225 Parkside Drive, San Fernando, CA 91340, USA. Tel: (818) 898-2341. The telex number remains the same: 662446.

## Sound Summit studio opens in Lake Geneva

Digital Entertainment Corp have supplied the Mitsubishi *X-80A* digital recorder to Wisconsin's new 48-track studio. Analogue machines installed include two Studer *A800s* and *A80* ½ in and ¼ in. The console is a Neve *8068* with *NECAM* automation. Sound Summit, Highway 50, Lake Geneva, WI, 53147. Tel: 414-248 7666.

## New headquarters for Modern Videofilm

Modern Videofilm has retained Jeff Cooper Architects to design and engineer its new corporate headquarters.

The 50,000 ft<sup>2</sup> building will be Hollywood's first video post-

production facility to be custom-built from scratch. It will house work areas for video editing, telecine transfer, tape duplicating and 24-track audio sweetening.

## New pro-audio for Scotland

Parsec Ltd is a new company set up to cater for the needs of Scotland's professional audio industry. Services include public address and disco installations, recording and broadcast installations, complete turnkey service, cassette manufacture and duplication as well as service

and sales operation with maintenance back-up.

The head office is at 73 Glasgow Road, Blanefield G63 9HY. Tel: 0360 70177.

Contact: John Turner. There is also a branch office situated at 20 Hawkhill Avenue, Ayr KA8 9JP. Tel: 0292 267400.

Contact: Jim Bryan.

## Bandive and Atlantex merger

It has been announced that Bandive and Atlantex have joined forces. Atlantex MD Bob Wilson joins the Bandive board of directors as sales director.

This merger has created the largest independently owned pro-audio wholesale/distributing company in the UK.

## Soundex goes to Allotrope

Allotrope Ltd is the new owner of Soundtrex Ltd. The new board of directors at Soundex will consist of Tim Blackham (chairman) and Stuart Young (managing director), and company secretary Bill Cooper. Further information from Allotrope, 114 Wardour Street, London W1V 3LP. Tel: 01-434 3344.

## Hudsons group take over Crow of Reading

Television broadcast engineering company Crow of Reading has been acquired by Hudsons Offshore Holdings Ltd. The takeover follows the contract which Crow recently obtained from the Ethiopian government, worth approximately £3.5 million, to re-equip substantially the

country's television system for colour.

Crow of Reading, with its subsidiaries MVC-CROW Ltd, Turnbull and Crow Ltd and Crow Broadcast Equipment-Singapore, will retain its present form, operating with the present management and workforce.

## End of the line for KT88

After 28 years continuous production the M-O Valve Company has decided to cease manufacture of the *Gold Lion KT88* in order to free resources and production capacity for new product lines

including integrated circuit packages. The *Gold Lion KT77* will also be phased out.

These valves have been used for many years in amplifiers including Marshall, Burman, Hi-Watt, Roost and White.

## Turnkey shop

The new Turnkey shop, opened in October last year, is claimed to be the first 'high street' retail store in the UK dedicated solely to personal multitrack and studio recording.

The shop will also feature training videos for all multitrack machines on offer. Turnkey Shop, 14 Percy Street, London W1P 9FD. Tel: 01-637 1701.

## RS over the counter

RS Components have opened two London centres for over the counter service. You can also phone through your order and collect later.

They are located at: Fairway Estate, Green Lane, Hounslow, Middx. Tel: 01-572 4225, and Old Ford Trading Centre, Maverton Road, London E3. Tel: 01-980 6513.

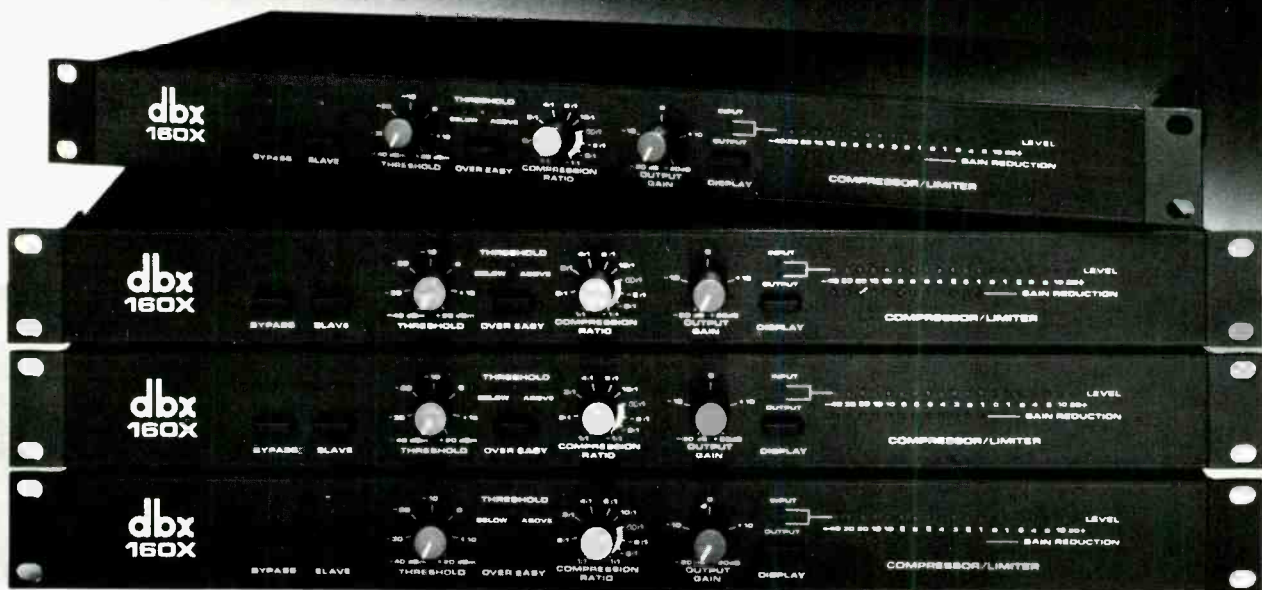


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but still there were a few areas  
you wanted improved; stereo linking,  
mounting, clearer meters, easier rack  
selectable compression characteristics.**

**We listened and the result is the 160X.**



Austria: Kain Ges.m.b.h. & Co. KG, dba/Stereo Center Kain, Muenchner Bundesstrasse 42, A-5020 Salzburg. Australia: Klarion Pty, Regent House, 63 Kingsway South, Melbourne 3205. Belgium/Luxembourg: Trans European Music SA, Koeiwyerstradt 105, B-1710 Dilbeek. Denmark: SLT, Helgesvej 9-11/DK-2000, Copenhagen. England: Scenic Sound Equipment, Unit 2, 10 William Road, London NW1 3EN. Finland: Studiotec Ky, Eljaksentie 9, 00370 Helsinki 37. France: Cineco, 72, des Champs-Elysees, 75008 Paris. Greece: Bon Studio Sound Systems, 14 Zaimi Str, Athens 48. Hong Kong: Philippines, South Korea, Thailand, People's Republic of China: Studer Revox (Far East) Ltd, 5th Floor, Parklane Bldg, 233-5 Queens Road, Central, Hong Kong. Italy: Scientel Audio SRL, Via Pietri 52 (or) Via Venturi 70, Modena 41100. Japan: BSR (Japan) Ltd, Tokyo 101. Netherlands: Special Audio Products B.V. Scheldeplein 18, 1078 GR Amsterdam. New Zealand: Videx Systems Ltd, Ellice Industrial Estate, P.O. Box 31-029, Auckland 10, 48 Ellice Road, Glenfield. Norway: Lydrommet, St Olavsgate 27, Oslo 1. Spain: Commercial Lavilla, Legatedad, 64066, Barcelona 24. Sweden: Tal & Ton AB, Kungsgatan 5, 411 19 Goeteborg. Switzerland: Audio Bauer A, CH-8064 Zurich, Bernerstrasse-Nord 182. West Germany: Audio Vertrieb, Bargweg 45b, 2000 Norderstedt.

# DIARY DIARY

Purchase, people, APRS news

## C-Tape purchase Cactus

C-Tape Developments have purchased Cactus, manufacturer of *Cactus Drums*—a digitally derived electronic percussion system. The company will be concentrating on generating equipment combining the benefits of both the *C-ducer*

and *Cactus* systems. C-Tape Developments Ltd, Transducer Laboratories, 73 High Street, Aldershot, Hants GU11 1BY. Tel: (0252) 319171. Telex: 858623. USA: C-Tape Developments Inc, PO Box 1069, Palatine, IL 60078. Tel: (312) 359-9240.

## People

- Turnkey Two have appointed Roger D'Arcy and Hugh Flynn to handle architectural building services.
- Peter Wandless has joined Solid State Logic as area sales manager for the UK. Peter's career as a recording engineer most recently involved employment at CTS Studios in Wembley where he was responsible for the acapella recordings of The Flying Pickets amongst other projects.
- Crown International Tecron Division has announced the appointment of D B (Don) Keele Jnr as manager of software development.

A member and fellow of the AES, Mr Keele has presented and published a number of papers on loudspeaker design and measurement methods, one of which won the AES Publication Award.

Previous positions have included JBL Inc, Klipsch & Associates and Electro-Voice.

- Manfred Koch, managing director of Electro-Voice Germany since 1975, has been appointed director of marketing of E-V Europe. He is now responsible for the German and Swiss sales company of E-V, as well as sales to the agents representing the American company in other European countries.

There have also been other appointments within the company. Andreas Schneider becomes director for operations of E-V in Europe; he will be responsible for manufacturing and related activities and Bruno Schürmann (previously head of finance of the Swiss company) has been appointed director of finance for Electro-Voice Europe.

Lars R Fransden, who is also director of international marketing for the parent company, Electro-Voice Inc, remains managing director of Electro-Voice Europe.

- Myriad Audio Visual Sales, London, have made three new appointments: Brian Bridgman becomes marketing and sales manager; Nigel Mann is the business development manager having come from Harman Audio; and Wayne Burke (ex Roundhouse Studios maintenance engineer) is the new AV technician.

- Crown International have announced the appointment of Bill Raventos as microphone product director. He will be responsible for microphone product definition, design input, field evaluations, and working with reps and end-users to determine microphone-related needs. He was previously director of technical services for Ringling Brothers Barnum & Bailey Circus at the Circus World theme park in Florida. He has also worked for Electro-Voice in marketing and new product development.

- Keith Worsley, previously with Lexicon, has joined Klark-Teknik Electronics Inc as national sales manager. Also at Klark-Teknik Research Ltd, Peter Tongue has been promoted to sales manager (worldwide sales).

- Philip J DeSantis has been appointed national sales manager of the professional audio division of the Sony Corporation of America. He was previously director of marketing and sales for pro-audio and broadcast product divisions of Lexicon.

- Colin Lane-Rowley has joined the Music Lab sales and marketing team, working on their QSC, Rane, ADA, Garfield and Klotz ranges.

- John Didlock has joined Marquee Electronics as sales engineer, with specific responsibility for Adams-Smith *System 2600* timecode and synchronisation equipment, for which the company has recently been appointed UK and Eire agent.

## APRS COLUMN

- Two of the major events in the pro-audio calendar, with which the APRS has a close and very active association, are again at hand.

Once more a contingent of UK manufacturers will be attending the AES, in Hamburg, with the greatest assistance from the APRS through its joint venture with the British Overseas Trade Board. The joint venture earns each participating exhibitor a subsidy from the BOTB, covering the total cost of hire of the site—less participation fees of 40% for first timers, 45% for second time exhibitors and 50% for others. The object of the exercise is to assist UK companies to win export orders, and the APRS has been able every year to date to report that the companies which attend under its auspices have fully justified that assistance. The rules of the scheme insist that the equipment exhibited should have been manufactured in the UK or Northern Ireland, and the APRS has a duty to offer participation in the scheme to any eligible company, whether association members or not.

The APRS take care of the joint venture paperwork after applying annually for the right to run the joint venture; it produces a catalogue and pays for translation into the language of the host country (and usually one other European language as well); it has a stand to which exhibitors can refer for advice and assistance during the show; through the offices of secretary Edward Masek it collects the individual reports of exhibitors and presents a full report to the BOTB; and it collects and distributes the BOTB subsidy. Without an efficient and energetic trade

association with which to liaise, the BOTB would not be able to give this help.

- Allocation of stand space for the 1985 APRS Exhibition at the Kensington Exhibition Centre has now been made—at the lively mid-January balloting meeting. This show, which plainly continues to grow in importance internationally (and in the number of would-be exhibitors) increased in floor area by about 20% in 1984. This year it will again be on two floors of the Exhibition Centre, but Masek has again managed to increase available floor area by 5%.

The APRS show is booked in about two years ahead, and so the 1985 dates were fixed before those of the Montreux show were announced. For the convenience of companies exhibiting at both, considerable effort was made to alter the APRS dates but this proved impossible. Despite this unfortunate clash of dates (with APRS running on immediately after Montreux) the association and most of the exhibitors are confident that there will be no adverse effect on the UK event. There is equal confidence that the number of visitors will again rise.

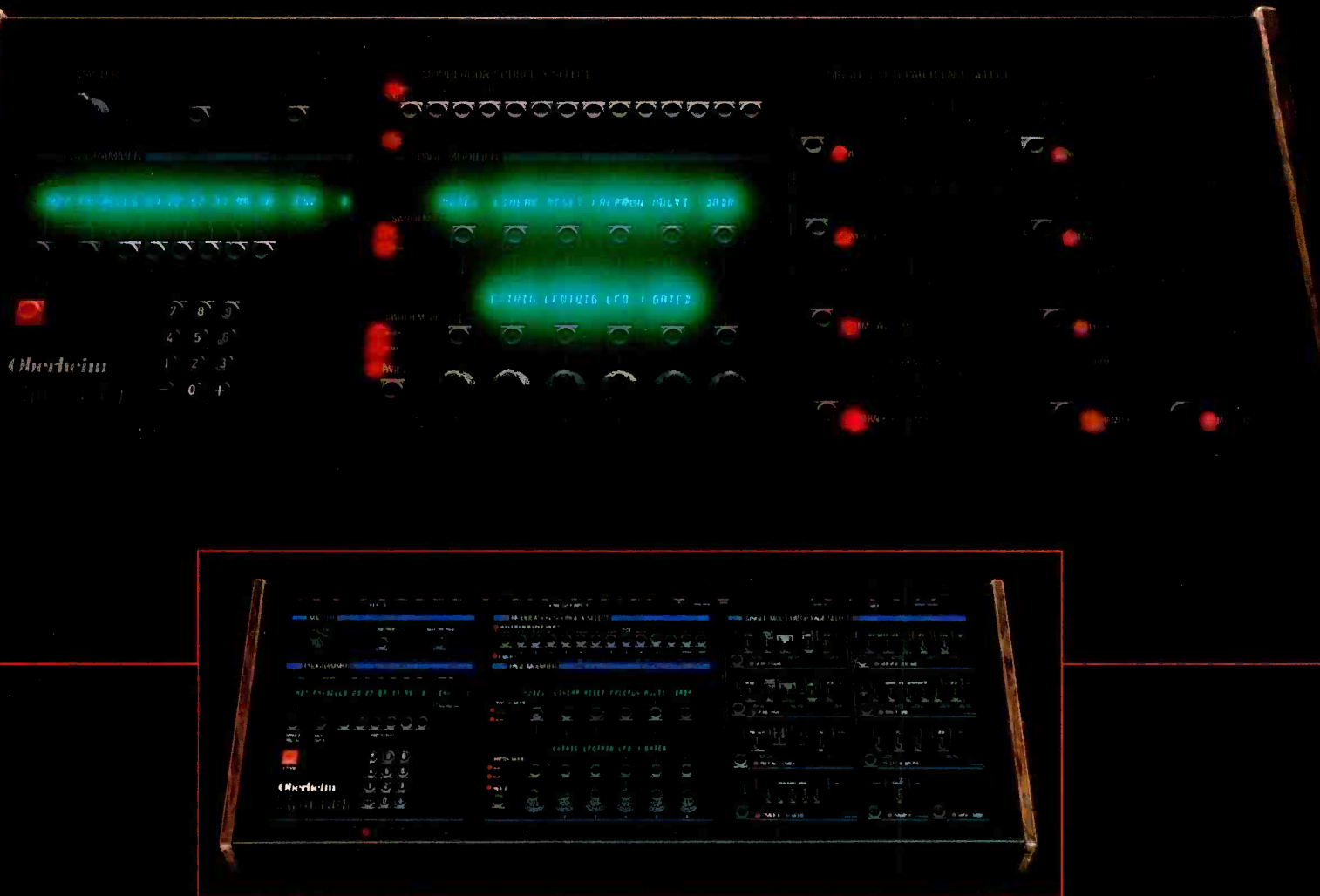
The cost of space has been held to £78/m<sup>2</sup>—maintaining the APRS Exhibition's position as the least expensive international show for manufacturers, while being one of the most successful. Its significance will again be underlined by the fact that the opening ceremony will be performed by a Government Minister.

- Plans are already being made for the 1985 APRS Engineers Course at Surrey University. Recent students' reports have been analysed, and as expected the increase in hands-on time was much liked and appreciated. The reports indicate that this year they would like even more practical sessions to accompany the lectures and seminars.

The Engineers Course was undoubtedly a success and the 1986 and 1987 courses are already booked in at Guildford.



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ers, MIDI and CVs simultaneously, and of course, the Oberheim System.

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Telex: 826967

# DIARY DIARY

Contracts, compressors, limiters

## Contracts

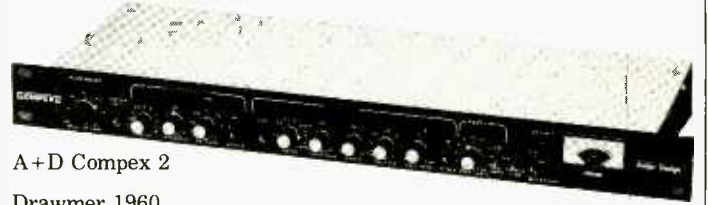
- Two new Neve consoles have been ordered by Abbey Road and Yellow 2 studios. Abbey Road has ordered an 8128 32-channel console for the Penthouse suite, replacing the 8108/56 which is now going to the USA.
- Yellow 2 studios in Stockport (alias Studio 2) have commissioned a custom 48-channel console. The studio is planning to be fully operational by the new year. The desk will be interfacing to a Sony PCM F1 and Q.Lock facility will enable professional video post production.
- Elliott Brothers have recently been awarded a contract to supply a mobile radio studio for the Falklands Islands by the British Forces Broadcast Service. The contract includes system design, project management and the complete installation in a container supplied by IAC, which will be fitted with helicopter lifting lugs.
- Audix Ltd, Altec's UK agent has supplied the new 515 G series speakers to London's Leicester Square Theatre and Odeon Leicester Square cinemas which have been incorporated into their existing Altec sound systems. The first batch arrived just in time for the opening of the dance film Beat Street.
- Micmix Audio Products Inc recently supplied several Dynafex noise reduction systems on the radio and television 'pool' coverage of the Republican National Convention. The systems were used during broadcast to reduce background noise at the Convention site.
- Neil Young has purchased two Sony PCM-3324 digital multitrack recorders and the Sony RM-3310 digital synchroniser/controller for his studio in Redwood City, California.
- Harrison Systems have recently supplied new modular PRO-7 consoles to NAVP (Nashville); Prism Productions (Dallas); Alpha Cine Laboratory (Seattle) and WSRE (Pensacola).
- George Massenburg Labs of West Los Angeles have installed the first of their moving-fader automation systems at Hollywood's Conway recorders. The

Conway system includes automated operation of 40 input faders, eight echo returns, six groups, all with automated muting.

- Neve Electronics have received their first dozen orders for the new NECAM 96 automation system. Orders have come from both new customers and existing NECAM users wishing to upgrade. In the broadcast field customers have included BBC Television (also the BBC film department), and Central Television in Birmingham. Others include Lucasfilm, Compact Video and Disney Productions, all in California.

Analogue business recently placed includes a £¼ million installation for NOS in Holland, and consoles for broadcasting authorities as far afield as Hong Kong, Finland, Jordan and Australia.

- The LA Record Plant, one of Los Angeles' largest recording operations, has purchased the Sony PCM-3324 digital multitrack recorder. The studio intends to use the machine for record projects, remote recording and film scoring.
- Otari have announced recent sales which include a 24-track MTR-90 to Capital Radio, London; an MTR-90 to Anglia Television, UK; an MTR-90 to the drama department of BBC Manchester, UK—the 12th delivered to the BBC; two MTR-90 24-tracks to Amazon Studios, Liverpool, UK; two MTR-90 machines to Advision Studios, London; 46 MTR-10 machines to the Australian Broadcasting Corporation; and a DP-80 high speed duplication system to Music Annex, Menlo Park, California.
- The Digital Entertainment Corporation has announced the delivery of the first Mitsubishi XE-1 electronic editing system in North America. The system is installed in Squires Productions, White Plains, NY and will be used with two X-80 recorders mainly for the editing of classical music.
- Turnkey Two's Andy Munro has recently completed the following design projects: The Townhouse 3, Jacob's update, Parkgates update, Sound Developments 3, Red Rooster Munich, Gimpy Dak Records and Music Works 2.



A+D Complex 2

Drawmer 1960



## Compressors and limiters

There are a large number of new compressors and limiters launched each year and 1984 was no exception. Possibly the most unusual compressor to have been launched recently is the Drawmer 1960. This is a 2-channel 2U high rack mount compressor that uses valve (tube) technology in addition to solid state electronics. The compression characteristic is 'soft knee' with variable threshold and switchable attack and release. There is provision for both mic and line inputs and the complete unit also incorporates a preamplifier and a basic EQ section. Drawmer are just about to start production and the range of features suggests that they envisage use outside the straight control room environment. It would be interesting to know if this will be the only compressor currently available to use valves in some capacity.

Another unit that is of particular interest is the Brooke Siren Systems DPR 402. This is two channels of compressor/limiter, de-esser and peak limiter in a single U, 19 in rack format. The unit has been designed so all these facilities may be used together or separately and there is provision for side chain insertion. The de-esser is frequency adjustable and there are fully adjustable controls for the majority of dynamics functions including separate LED metering for gain reduction and output level. Possibly one of the most densely packed front panels available.

Audio + Design have launched a new version of the *Complex: Complex 2*. This features a number of changes including an extension of

softer thresholds and ratios to -60 dB below normal operating levels, switchable LOG/LIN compressor release characteristics together with a slow AGC release, and a change to unity gain operation rather than variable.

EMT have recently been showing a new version of the EMT *Transient Limiter* known as the EMT 266X although exactly how it differs from the standard 266 will have to await the arrival of the literature in English.

At the lower cost end of the market, there have recently been new units from Shiino Vesta Fire, the SL-020 dual compressor/limiter with fully variable parameters with the threshold control arranged as two ranges, and with provision for side chain access; from Cathedral Sound in the form of the CSL2 stereo peak limiter built in a wrap round instrument case with four switchable threshold levels and fixed attack and release times; the Ashly SC-52 dual compressor/limiter with fully adjustable attack, release, gain reduction and output gain.

In the area of modular rack systems, D&R Electronica have launched *Series II* versions of the compressor/limiter and the stereo limiter. The first of these units has lower noise and distortion figures, faster attack times and precise tracking in stereo use. The stereo limiter also has improvements in the same areas but also adds three switchable attack times.

While on the subject of rack systems, Rebis have added the RA223 comp/limiter/gate to their rack series. This is covered in more detail in this month's new products. □



# IMPORTANT ANNOUNCEMENT

Sony PCMF1/SLF1



Sony PCM701ES/SLC9



To clear any confusion or misunderstanding about the above Sony Digital recording products, please be advised:

**1** The Sony PCMF1 is still in production in Japan, and is available from HHB. The Sony SLF1 video recorder has indeed ceased production, but HHB has managed to secure limited numbers of these desirable machines.

**2** It should also be borne in mind that an alternative system exists for applications where portability is not essential. This system comprises the Sony PCM701ES processor - identical in function and compatibility to the PCMF1 - and SLC9 video recorder.

**3** HHB are pleased to announce ex-stock availability of CLUE (Computer Logging Unit and Editor) which provides editing facilities for PCMF1 or PCM701ES/Betamax recording, as well as intelligent autolocation and logging.

Call now for more information about this exciting new product.



The No 1 name in Digital Audio.

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London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

# NEW PRODUCTS

# NEW PRODUCTS

Equipment, modifications, options, software

## Rebis units

Rebis Audio have just announced four additions to the *RA200 Series* rack system. The first is the *RA222 VCA* noise gate with adjustable sensitivity (-40 to +20 dBm), hold (20 ms to 1.6 s), release (40 ms to 1.7 s) and attack (50  $\mu$ s to 250 ms). Green and red LEDs indicate the gate action while there is front panel switching for gate bypass and selection of an external key. Maximum attenuation available is >85 dB.

The *RA223* is a compressor/limiter gate with the gate section (upper portion of the panel) having adjustable sensitivity (-40 to +20 dBm)

and release (40 ms to 1.7 s). Gate operation is indicated by a red LED while a 3-position in/key switch selects gate in, out or external keying. The attack may be switched 50  $\mu$ s or 2 ms. The comp/limiter section has adjustable gain (-20 to +20 dB) and release (40 ms to 1.7 s). Green and red LEDs indicate 2 dB and 10 dB of gain reduction respectively. Remaining features include an in/out switch and a lim/comp select altering the ratio between 20:1 and 2:1.

The *RA224* filter gate is a double width module which consists of a similar unit to the *RA222* noise gate with the addition of independent wide band HF and LF adjustable filters that may be inserted in the side chain or on the unit input. Further switches select duck, link, side chain monitor, external key and bypass modes.

The last of the new units is the *RA225* expander with adjustable sensitivity (-20 to +20 dBm), release (40 ms to 1.7 s/20 dB), attack (50  $\mu$ s to 250 ms/20 dB) and gain (0 to 30 dB). Four LEDs indicate the level of gain reduction and there are switches for bypass and external keying. The expansion range claimed is >40 dB.

**Rebis Audio Ltd, Kinver Street, Stourbridge, West Midlands DY8 5AB, UK. Tel: 0384 71865.**



## ElectroSpace Spanner

ElectroSpace Developments have announced the introduction of the *Spanner*, a unit they describe as an advanced and versatile stereo panning system. It will be available in two versions—mono input with stereo outputs and stereo input/stereo output.

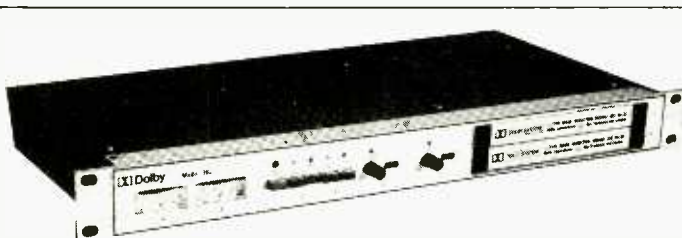
The *Spanner* is a single U, 19 in rack mount unit. Front panel facilities are: offset control which moves the image so that any effect centres around that point with four colour display showing stereo positioning; the auto system with auto depth, frequency and symmetry controls to tailor the pan; an entirely independent panning system that allows modulation and triggering of the stereo image by the input or an external source. This section also has a depth and damping control that will allow adjustment of the decay time of the

modulating signal. The clamp mode holds the image on one side, which side being determined by the trigger system which allows the unit to count a given number of external pulses and then move to the opposite polarity at a speed dependent upon the damping control.

All audio input and outputs are *XLR*-type balanced and the amplitude of the panned signal is claimed to be within  $\pm 0.5$  dB anywhere within the image. A frequency response of 20 Hz to 20 kHz  $\pm 1$  dB is quoted and the noise figure is -85 dBm across the same bandwidth.

**ElectroSpace Developments Ltd, Suite 3, 39/41 Newnham Street, Ely, Cambs CB7 4P, UK. Tel: 0353 61251.**

**UK: Britannia Row, 35 Britannia Row, London N1 8QH. Tel: 01-226 3377. Telex: 268279.**



## Dolby Model 362

Dolby have recently introduced a 2-channel A-type noise reduction unit. The *362* contains two independent *cat 22* cards within a single U height 19 in rack format with front panel switching of modes as well as remote operation. The *cat 22* cards are easily accessible from the front panel with all operational functions, ie meters, tone oscillators,

in/out functions, 'uncal' controls being in pairs.

**Dolby Laboratories Inc, 731 Sansome Street, San Francisco, CA 94111, USA. Tel: (415) 392 0300. Telex: 34409.**

**UK: Dolby Laboratories, 346 Clapham Road, London SW9 9AP. Tel: 01-720 1111. Telex: 91909.**

## Timecode TimeLink

*TimeLink* is a new addition to Audio Kinetics' range of timecode products. It can be used with various types of reference frequency, and is an electronic 'gearbox' designed to 'get you out of trouble', whether the problem is poor quality code, or incorrect standard.

*TimeLink* contains a timecode resampler which will reconstitute poor code, plus a 6-input electronic gearbox which can be set to produce an output reference frequency of a different standard from the input reference.

The inputs may be timecode, video syncs, FM, pulse, AC mains (internal) or internal crystal, and the output available as a field and frame-rate reference frequency, locked to the original. For

example, a timecode input of 30 frames/s may be used to generate a reference which will enable a timecode generator (such as that in the *Q.Lock*) to lock to the original source, but generate, say, 25 frames/s. Other applications include 50 to 60 Hz reference conversion or any ratio of the frequencies 48, 47.94, 49.94, 50, 59.94 and 60 Hz, which relate to 24, 25 and 30 frame/s and their drop frame equivalents.

**Audio Kinetics Ltd, Kinetic Centre, Theobald Street, Boreham Wood, Herts WD6 4PJ, UK. Tel: 01-953 8118. Telex: 299951.**

**USA: Audio Kinetics Inc, 4721 Laurel Canyon Blvd, Suite 209, North Hollywood, CA 91607. Tel: (213) 980-5717. Telex: 194781.**



# Satisfying, pure digital reverb at an affordable price.

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Size control — from a closet to the Taj Mahal — dramatically increasing the versatility of each program

Adjustable predelay and reverb time

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Remote control functions for stage performances

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Tel: 01-387 1262, 01-734 2812  
Telex: 27939 SCENIC G

# NEW PRODUCTS

# NEW PRODUCTS

Equipment, modifications, options, software

## Soundcraft consoles

Soundcraft have announced two new series of compact consoles, the *Series 600* and the *Series 500*. The *600* is designed specifically for the 16-track facility while both models feature a standard input module that has 8-output group routing. The *500* is intended for live performance use and has eight buses selectable in pairs, with six aux sends together with individual channel outputs. EQ is provided on the monitor/effects return section. The console includes control monitor outputs on the front and rear panel. The prefade aux send is link-selected before or after the EQ section and aux sends 3 to 6 may be link-selected pre or post fader. The console can be set for -10 or +4 dB operation with optional specialised effects return modules available for substitution in input channel

positions. All inputs and outputs except channel line out and inserts are balanced.

The *600* features eight output groups paralleled for 16-track use. It is available in 16, 24 and 32 input frames with the standard console having full 16-track monitoring with normalised returns. Each input channel also has direct outputs. Metering is LED as standard but it is selectable peak/VU. The console may also be set for -10 or +4 dB operation. Six aux sends are provided and stereo input modules are available for video/audio post production use.

**Soundcraft Electronics Ltd,**  
5/8 Great Sutton Street,  
London EC1V 0BX, UK.  
Tel: 01-251 3631.

**USA:** Soundcraft Electronics Inc, 1517 20th Street, Santa Monica, CA 90404. Tel: (213) 453-4591. Telex: 66423.



Soundcraft's Series 500 8-channel for live work

## Audio Kinetics film machine and B16 interfaces

New film machine interfaces from Audio Kinetics are for the *Q.Lock* synchroniser. *Inverse Unifilm* allows film (either projector or sound follower) transports to be used as the master machine without recording timecode on the stock, by taking the Bi-phase pulses (or tach + direction) and generating a pseudo-timecode within *Q.Lock* for the system to synchronise with. The new interface is supplied with a machine control cable to interface to the machine's transport

commands, so that full system control may be obtained from *Q.Lock*.

There is also a new *Q.Lock* interface for the Fostex *B16* tape machine. Full details are available from Audio Kinetics. **Audio Kinetics Ltd, Kinetic Centre, Theobald Street, Boreham Wood, Herts WD6 4PJ. Tel: 01-953 8118. Telex: 299951.**

**USA:** Audio Kinetics Inc, 4721 Laurel Canyon Blvd, Suite 209, North Hollywood, CA 91607. Tel: (213) 980-5717. Telex: 194781.

## Renkus-Heinz crossover and horn/adaptor

Three new products from Renkus-Heinz: *SWG 20-3* is a 3-way active crossover signal processor offering 18 dB/octave continuously variable crossover, thermal and displacement overload protection, EQ and time compensation. Crossover ranges are 250 to 2.5 kHz and 500 to 5 kHz. The new design is simple to use and gives continuous output at maximum safe levels.

The *CBH 500* constant beamwidth horn is the latest in a series of diecast aluminium horns. The 2 in throat (an adaptor is available

for 1 in) gives 60×40° constant beamwidth coverage above 500 Hz. Designed for long and mid throw applications it is suitable for cluster and system usage.

The *SSA 242* adaptor allows coupling of the 2.4 in throat of the *SSD 5600* to standard 2 in horns. It is capable of 100 W output and can be retrofitted into existing systems to increase SPL or used with a variety of R-H 2in exit horns.

**Renkus-Heinz Inc, 17851 AB Sky Park Circle, Irvine, CA 92714. Tel: (714) 250 0166. Telex: 705568.**

## DOD effects units

DOD Electronics launched three new products at the NY AES Convention. The *R-938* is a rack mount digital delay line offering 1.9 s of delay at 15 kHz bandwidth. A rear panel switch extends delay time up to 8 s with a decreased bandwidth available. The delay time is indicated by a 4-figure readout. Delay times are push button selected. There is provision for flanging and chorus effects in addition to a sync input allowing external triggering.

The *R-944 Chain Reaction* is a unit featuring four independent effects units in the same rack mount box. These are compressor/distortion, digital delay, flanger/chorus and parametric equaliser. A harmonic enhancement circuit is provided on the output. There

are additionally effects insert points on the rear panel with provision for a foot pedal control unit using a standard stereo cable that allows individual selection of the effects units, a bypass switch and a repeat hold for the digital delay.

The third unit is the *R-848* 6-spring mechanical reverb incorporating a variable pre-delay of 20 to 60 ms, a four preset EQ network and an additional parametric EQ for fine tuning of the reverb.

**DOD Electronics Corporation, 5639 South Riley Lane, Salt Lake City, UT 84107, USA. Tel: (801) 268-8400.**

**UK:** Atlantex Music Ltd, 3 Caldwell Lane, Hitchin, Herts SG4 0AG. Tel: 0462 31511 Telex: 826967.

## Smaller Tascam

Teac/Tascam have recently introduced the *Porta-One*, a new mini combined 4-channel mixer/cassette recorder in a smaller and more portable format than their previous models. Essentially the unit duplicates the facilities of the original *M144 Portastudio* but has the addition of dbx noise reduction, mains/battery operation and a tape speed of 1½ in/s.

**Teac Corp, 3-7-3 Naka-cho, Musashino, Tokyo. Tel: 0422 53-1111. Telex: 2822551.**  
**UK:** Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2

5DD. Tel: 0753 76911.  
**USA:** Teac Corp of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303. Telex: 677014.

## In brief

• Sennheiser have announced the reintroduction of the *MD 409* dynamic cardioid mic. This was the most popular Sennheiser mic after the *MD 421* during the '70s and found common use on drums, percussion and brass due to its high level sound handling capacity. □



# FOR TRIDENT STUDIOS, IT'S THE OTARI EDGE.

Trident Recording Studios number among those London studios which can be accurately called "World Class". Their latest endeavour, Studio Three, features facilities for audio post-production as well as music recording.

The Trident choice for multitrack recorders: two MTR-90 Series II twentyfour channel machines.

Trident selected the MTR-90 recorders for many of the same reasons you would: superb sound quality, easy interface with video editing systems and synchronisers, an advanced microprocessor-based tape transport, and a reputation for reliable performance.

While gently handling your Masters in the most reliable

manner, the MTR-90 will deliver the fastest transport operational modes of any 2" professional audio recorder made. The compact MTR-90 even fits easily into the smallest machine or sound control room. An equally compact Remote Session Controller comes standard and an optional full-function autolocator may be easily fitted.

Whether your work is in music, radio, multi-media, film or television audio production, there are many advantages to owning an Otari.

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To receive full technical information and a demonstration, please contact one of our authorised professional dealers or ring us at 0753-822381. Otari Electric (U.K.) Ltd, 22 Church Street, Slough, Berks., SL1 1PT, U.K. Telex: 849453 OTARI G.

Authorised Dealers:

**ITA**, 1 Felgate Mews, Studland Street, London W6 9JT 01 748 9009

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**Application:**

**The MTR-90 Multi-channel Master Recorder for Music Production**

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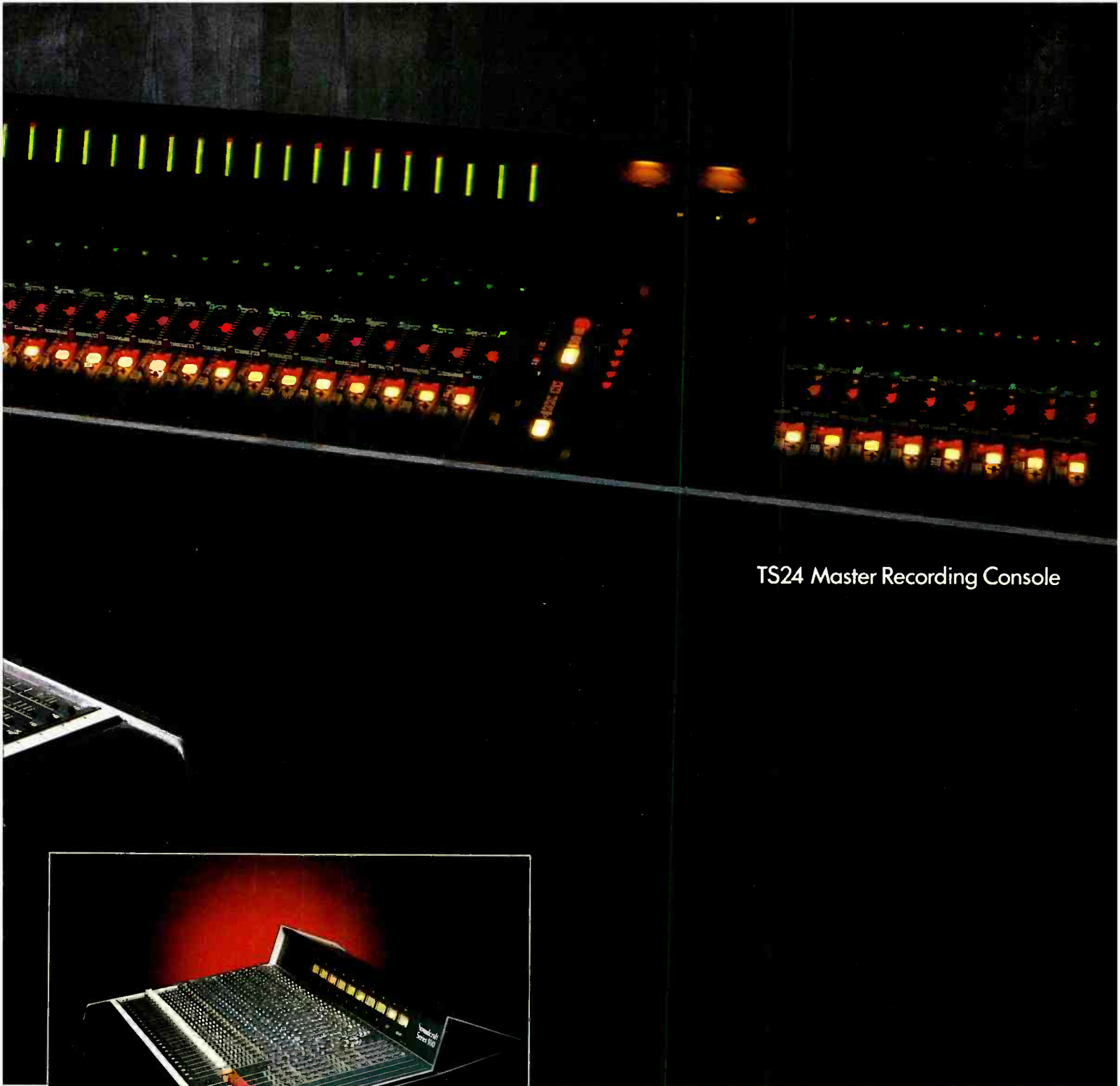
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# LETTERS LETTERS

Letters should be marked 'For Publication' and sent to the Editor at the Croydon address on page 3

## Bose theory

Dear Sir, Congratulations to Barry Fox on once again taking the bull (in both senses!) by the horns in his article on the Bose loudspeaker system (March 1984). I have always believed that Dr Bose's theory was based on the fact that his loudspeakers sounded better when you couldn't hear them very well, and we now have his own confirmation of this. I wonder if he has a 'mellow' switch on his amplifier?

Seriously, though, I must take issue with Mr Fox on his point about the stereo listening area. Listening to a good (Blumlein) stereo recording, you certainly do not hear mono everywhere except

between the two speakers. The fact that an acceptable stereo image can be heard over a wide area is one of the advantages which give the Blumlein system such an unarguable superiority over other stereo techniques. The soundfield produced by the loudspeakers was shown by Blumlein to have a precise mathematical relationship with that sampled by the microphones during the recording process. As the microphones are placed so as to capture the desired balance between direct and reflected sound in the concert hall or studio, it follows that any addition of reflected sound will not assist in reproducing a good stereo image; quite the reverse, in fact.

I suspect that Dr Bose's claim that his

loudspeakers produce a wider stereo listening area than conventional loudspeakers is based on recordings made using 'spaced mic' and 'panned mono' techniques, when additional reflected sound in the listening room is mistaken for the 'directional ambience' effect obtained with Blumlein 'coincident pair' recordings. It is remarkable how many professional audio people are still ignorant of the fundamental differences in both application and result between the two stereo techniques.

Dr Bose's theory can only hold good if the recording is made in an anechoic environment and the playback generates all the desired ambience in the listener's own room. This is patently nonsense unless the listener has a room suitable for live musical performances. In fact, it is the converse which is the case; the recording encompasses the complete sound in the performing environment and should preferably be reproduced in an anechoic room (as experiments in the anechoic chamber at EMI Hayes in the early 1960s showed) for an accurate reproduction of the sound in the studio or concert hall.

The success of Bose as a company is, I am sure, due to the manufacture of high-power, low-volume enclosures which are extremely successful for certain applications in theatres and A-V presentation, etc. The distinct paucity of Bose 901s in recording studio and broadcast control rooms is surely evidence enough that this design has not gained a reputation for sound quality or the excellence of its stereo image.

Yours faithfully, John L Andrews,  
Joint Managing Director, Stancoil Limited, 38 Alexandra Road, Windsor, Berks, UK.

## Barry Fox replies

My article was intended to provoke comment by conveying my understanding of Dr Bose's theories. I made it clear that I did not necessarily subscribe to them. Of course I agree that Blumlein recordings give an acceptable stereo image over a wide listening area. I only wish more recording engineers and record producers felt the same way. Perhaps it is significant that no one from CBS, EMI, PolyGram, etc, has picked up on this point.

## Please write

We would like to hear from you if you have an idea for an article—one-page, or even half-page, features are just as welcome as longer ones.

Please note that any written items submitted should be typed, double spaced, and any accompanying diagrams or photographs would be helpful.

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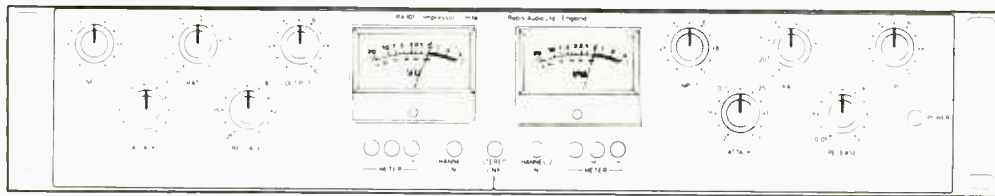
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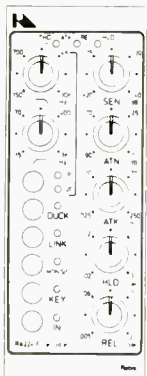
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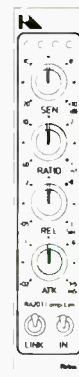
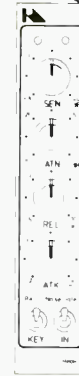
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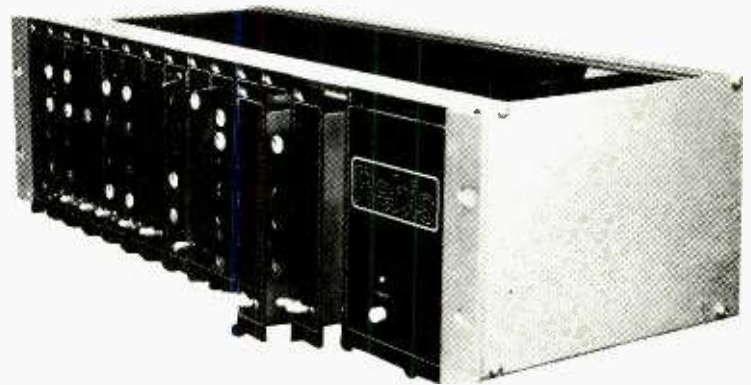
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# TELCOM C4 NOISE REDUCTION SYSTEM

**A** compander is a device which is used to reduce the influence of noise originating in transmission lines upon the signal which they carry. In this context, 'transmission lines' are the devices and links in the electrical transmission of an audio signal from the microphone to the monitor speaker including the storage media located between the signal source and the signal output.

What however are the properties of a compander system? In a paper presented at the 49th AES Convention on the design criteria for a compander system<sup>1</sup>, authors Duncan, Rosenberg and Hoffman mention 11 requirements which an ideal compander should fulfil.

- The reproduced signal should be audibly identical to the original
- Noise and distortion should be limited by the recording medium not by the electronics
- The system should not increase the probability of overload
- The system should be easily reproducible, stable with regard to temperature and time, trouble free and inexpensive
- The system ideally should not be sensitive to amplitude and phase errors in the recording medium
- Any overshoot during compression should not exceed the limit of the recording system
- The system should not increase any channel imbalances that may exist in the recording system
- The compressed signal should sound natural so that expansion upon playback is not required—this would make the system compatible with present equipment
- Noise reduction should enable the recording of the entire dynamic range of music without distortion or audible noise
- The noise reducer should not significantly cut the maximum playing time of the medium
- Finally it is highly desirable that any noise reduction

**The Telefunken company developed the telcom c4 noise reduction system in 1976. The system has both gained and suffered from being a late entrant into the noise reduction market—gaining from several years of industry noise reduction experience although having to compete with several other well established systems. However the telcom c4 system has been widely accepted in some areas with many of the continental European broadcast organisations having standardised on telcom for their noise reduction requirements, as have an increasing number of studios. Wolfgang Schneider of ANT\* covers the basic problems of compander design together with a description of the telcom c4 system itself**

system be universal, ie the same system should be employed with minor changes in parameters, to eliminate noise in discs, FM radio and tapes.

We will look closer at these comprehensive requirements for compander systems in audio equipment<sup>2</sup>, however, before doing so it is necessary to take a brief look at the basic principles of a compander.

## Compander principles

The complete compander consists of two components: a dynamic compressor and a dynamic expander. The compressor is located before the transmission lines and the

expander follows (Fig 1). The two components are complementary to each other, ie the signal to be 'transmitted' is processed—in this case termed the transfer function 'X'—and this must later be reversed by an exactly reciprocal function, the transfer function  $\frac{1}{X}$ . On the whole, a signal which passes through both components remains unchanged but if it passes through only one of the components, the signal is modified. For example, the noise signal, which superimposes itself on the useful signal in the transmission channel, only passes through the expander. Its intensity is reduced by the fact that the expander is capable of attenuating the

\*In 1983, following a reorganisation at AEG Telefunken, one of the companies that had been operating as part of the group was set up as a separate company under the name of ANT Nachrichtentechnik GmbH, telcom being one of their products

level of weak signals.

Naturally, the compander exerts no influence on interference which the signal contained before compression. Such interference runs through the compressor and expander in the same way as the useful signal and, in exactly the same way, remains unchanged. Ideally, compression should take place directly before the signal output.

## Variables in the tape machine

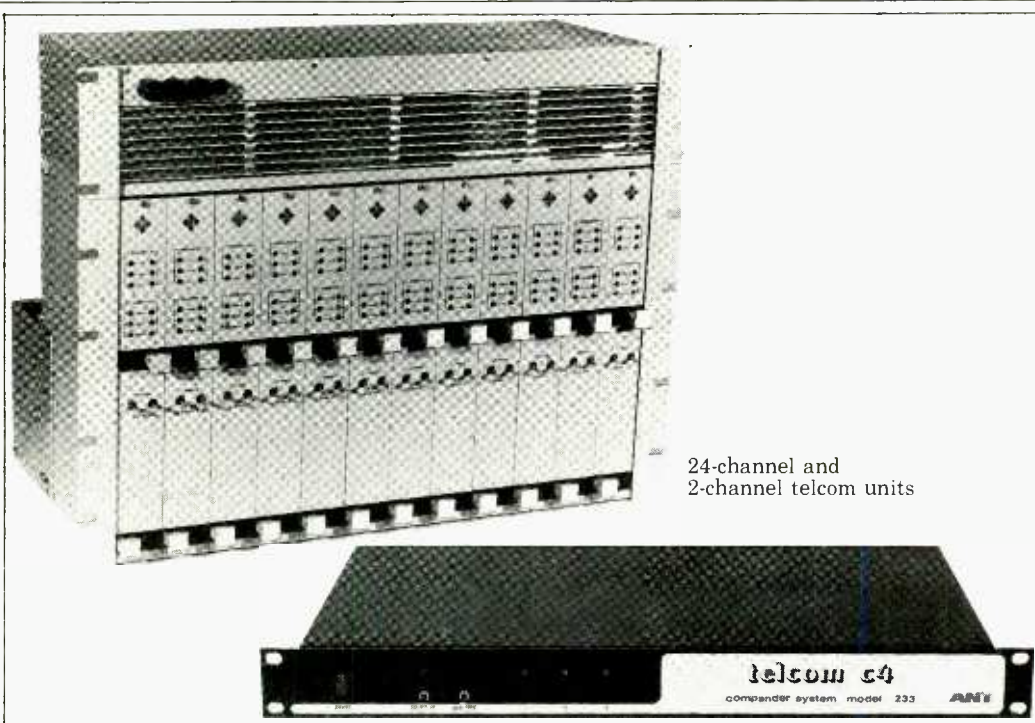
The basic principles of the compander are perfect but they can only be applied if the transmission lines have the transfer function of '1', ie are linear. Let us consider the noise variables in the transfer function of a tape machine which will influence the behaviour of the  $\frac{1}{X}$  circuit, ie the expander.

- Non-linearities at extremely high amplitudes
- Phase errors in the electronic circuitry and the tape itself
- Hum and noise voltages
- Tape dropouts, ie brief level fluctuations
- Amplitude variations in the frequency response

In order to approximate the ideal compander as nearly as possible, the influence exerted by the above mentioned noise variables on the transfer functions  $\frac{1}{X}$  must be kept as small as possible. I will now explain these points in detail.

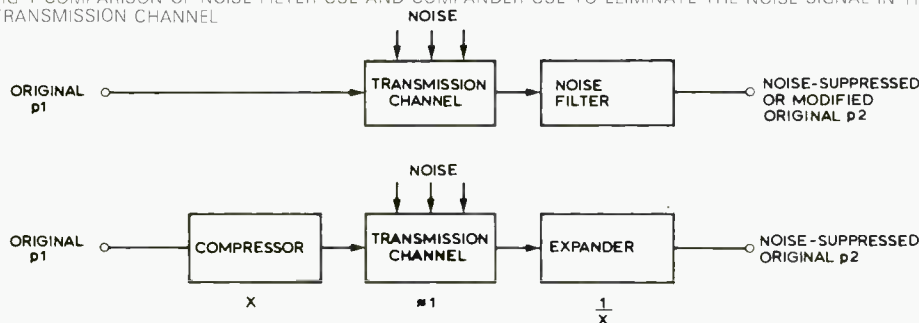
*Non-linearities at extremely high amplitudes.* At high amplitudes (above the nominal level), the tape is magnetised to saturation, which is equivalent to an amplitude limit. This disturbs the synchronisation between the compressor and expander, eg the rectifier which controls the  $\frac{1}{X}$  circuit contains a different signal to the rectifier for the X circuit. Thus the transfer function in the  $\frac{1}{X}$  expander is not complementary. In order to overcome this effect, high levels must have already been reduced in the X circuit. In addition, it must be ensured that the attack time of the control system is short for rapid response to level changes





24-channel and 2-channel telcom units

FIG 1 COMPARISON OF NOISE FILTER USE AND COMPANDER USE TO ELIMINATE THE NOISE SIGNAL IN THE TRANSMISSION CHANNEL



in order to prevent the above described effect from occurring.

*Phase errors of the tape machine.* A tape recorder, especially, produces a highly non-linear phase shift which changes the response curve of the audio signal feeding to the  $\frac{1}{2}$  circuit (expander) during playback. This is particularly significant for the rectifier circuit controlling expansion because this circuit is then no longer capable of exactly cancelling the compression of the X circuit. Therefore, the synchronisation of the compressor and expander is impaired resulting, among other things, in 'breathing' and 'dropout' of weak signals.

It is possible to design rectifiers in such a way that the produced signals correspond, for example, to the mean value, the RMS value or the peak value of the input signal. In this case, RMS value rectification is preferable as it is insensitive to phase shifts. However, such rectifiers are difficult to design and what is more (and this is important), they provide no protection against overshooting and thus distortion in the tape recorder occurs when recording signals

with high peak values. The pulse-shaped signal has a low RMS value and a high peak value. Distortion has a damaging effect on the transferred signal and this effect cannot be reversed by the  $\frac{1}{2}$  circuit. Therefore, a mixture of RMS and peak value rectification (depending on the character of the AF signal) is preferable in order to obtain the best compromise between synchronism of the control circuits ('tracking'), on the one hand, and distortion on the other, and thus between distortion and useful noise reduction in practical circumstances.

Naturally, the attack time of the compander also plays a role. Short times reduce the signal peaks of the compressor output level and thus distortion, but simultaneously increase the control tracking error mentioned above. Therefore, it seems impossible to obtain an optimum control voltage generator for the X and  $\frac{1}{2}$  circuits to suit all conditions. However, there is a way to solve this problem. Although the solution is more complex, the increased effort is justified by the benefits: the complete audio frequency band

is divided into several sub-bands with their own control voltage generators. Among other things this offers the following major advantage: the result of a multiband system is that it significantly reduces the influence of phase shift while the complete system has a simultaneous, extremely short 'relative attack time'.

To elucidate, imagine a tone of a certain amplitude which has an extremely high harmonic content. Depending on the phase relationship of the harmonics relative to the basic wave, this tone has differing peak values. If this tone is broken up into its basic wave and the individual harmonic waves, the same peak values are always obtained in the individual frequency bands, even if the phase relationships have changed. This can be explained quite simply by the fact that a signal occurs in each band which is measured independently of the other signal components.

*Hum and noise voltage; tape dropouts.* The audibility of tape noise after passing through the  $\frac{1}{2}$  circuit (expander), is determined by the recovery time. If, for

example, the recovery time, during which the gain of the expander drops, is greater than rapidly decaying signal levels, these signal levels will acquire an audible 'noise tail' of tape noise which will characteristically falsify reproduction. On the other hand a longer holding time is favourable as it reduces the audibility of 'dropouts' on the tape itself.

There are no optimum regulating times or rectifier circuits which are in practice capable of solving the above described problems during playback, eg tracking distortion, etc. At present, one of the two systems listed below is used:

- a) by means of filters, the audible frequency band is split up into sub-bands, each with its own compander, each compander operating independently of the others;
- b) the compander is provided with pronounced pre- and de-emphasis in the upper AF range.

Method (b) reduces the noise modulation of the expander originating from the tape noise by amplifying the effective upper AF level and thus also masking the noise in the range. The increased upper AF level must be limited before the rectifier of the compander by introducing a further upper AF pre-emphasis. This corresponds to a reduction in the effective expansion; that is to say, the compander gain is less. In contrast dividing the frequency band into several sub-bands accentuates expansion in the weak upper AF signals in that range, where the tape noise is mainly located, and also makes it possible to optimise the attack time in each frequency band, thus reducing tape distortion.

*Frequency response.* Nowadays, the amplitude response over the frequency bandwidth of studio tape recorders is very good. It amounts to a deviation from the desired value of approximately  $\pm 1$  dB. However, it must be remembered that the  $\frac{1}{2}$  circuit is controlled by this deviation, ie a transfer function with expanding character: the frequency response deviation of  $\pm 1$  dB is amplified to  $\pm 2$  dB by a compander with a compression ratio of 2:1. For this reason, we should strive to obtain a low compression ratio but in order to avoid impairing its noise suppression capabilities, this ratio should not be too low. It is also obvious that the use of a constant, low compression ratio over the complete level range is preferable instead of

using a higher compression ratio in only one part of this range. In addition, a further advantage of the constant compression ratio is that the reciprocal behaviour to the X circuit is maintained in the  $\frac{1}{X}$  circuit in the event of a level offset by the tape recorder (naturally this offset should be uniform throughout the frequency band).

## telcom c4 compander system

After this brief discussion of the general theory of companders, I will now look at a practical example namely the former Telefunken compander *telcom c4*<sup>3</sup> (*Telefunken compander*). In the same way as the Dolby A system (Fig 2), four frequency bands were chosen for the *telcom c4* compander system (Fig 3) which have completely independent control circuits. This provides an optimum relationship between the results and the effort required to obtain these results. The complementary behaviour of the *telcom c4* is achieved by division and multiplication.

# TELCOM C4 NOISE REDUCTION SYSTEM

The characteristics of all four sub-systems have the same pitch over the complete working range; they have a dB-linear slope. The compression slope characteristic is independent of the recording level and has a logarithmic value of 33%.

The compression ratio used in this system was designed to be the optimum compromise between the increase in signal-to-noise ratio, and the accuracy of reproduction of the original signal in case of faults in the transmission lines. Irrespective of the modulation level, the dynamic behaviour of the control system is also constant; that is to say, the change in gain as a function of time has a logarithmic progression. As a result of this, identical transient time constants are obtained for each operating point.

The great advantage of working with logarithmic characteristics (both in the

static and dynamic ranges) is that neither dynamic distortions nor changes in the frequency response occur in the event of gain deviations.

In the *telcom c4* system, gain is controlled with the aid of field effect transistors whose control characteristics are linearised electronically or with VCAs. This results in a complementary, dynamic behaviour which is upheld during expansion in the event of a modified reference level.

The problem of the control time constants is as follows; the attack time of the control must be so short that no overshoot occurs in the following systems in the event of a maximum surge level, even at the highest processed frequency. This means that the control process must last no longer than one quarter period of the upper frequency limit. Expressed in numbers, this means that the control time must be less than 12.5  $\mu$ s,

referred to 20 kHz. The recovery time is determined by the dynamic harmonic distortion which arises due to the temporary logarithmic amplitude changes of a sinusoidal oscillation. When referred to a harmonic distortion of 0.2% and a lower processed frequency of 30 Hz, the gain may not increase by more than approximately 6 dB per second. In the case of a control sweep of 30 dB, the total recovery time is approximately 5 s.

The extremely large ratio of recovery time to attack time of approximately 500,000:1 is reduced to approximately 5,000:1 by splitting up the overall frequency band into four separate bands. This is an order of magnitude which is very easy to implement in practice.

In summary, the benefits of this compander system are: (a) no overshoot of subsequent systems due to an extremely brief attack time and peak detector; (b) no 'breathing' tape noise due to four frequency bands; (c) harmonic distortion of less than 0.2% at low frequencies due to a matched recovery time; (d) the compressor and expander have a complementary behaviour due to the dB-linear characteristic — no level adjustment; (e) large gain in dynamic range.

The ANT compander was primarily conceived for use in professional sound studios. In this application, there are a number of practical advantages in the system, i.e. no level adjustment, a dynamic gain of approximately 30 dB with studio tape recorders and no breathing or pumping.

There is no need to make further mention of level adjustment, as the reduced workload and the exclusion of possible errors are obvious. In comparison with most conventional companders, the dynamic gain of 30 dB provides some advantages and new possibilities for use.

It should also be noted that use of a compander with tape recorders effectively increases crosstalk attenuation, pre- and post-echoes and distortion from the transmission line (tape). □

### References

- (1) Duncan M G, Rosenberg D, Hoffman G H. 'Design Criteria of a Universal Compander for the Elimination of Audible Noise in Tape, Disc and Broadcast Systems'. *Journal of the AES*, October 1975, pages 610-621.
- (2) Wermuth J, Senf F. 'Criteria for Compander Design and Their Realisation'. AES 56th Convention, Paris, March 1977.
- (3) Wermuth J. 'Compander System *telcom c4*'. *Fernseh- und Kino-Technik* No 3/1980, West Germany.

FIG 2 PRINCIPLE AND OPERATION OF THE DOLBY A SYSTEM

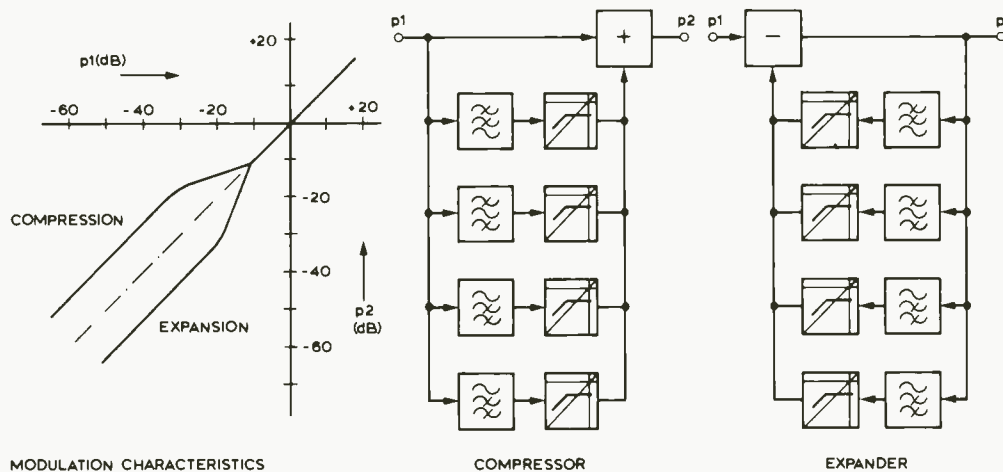
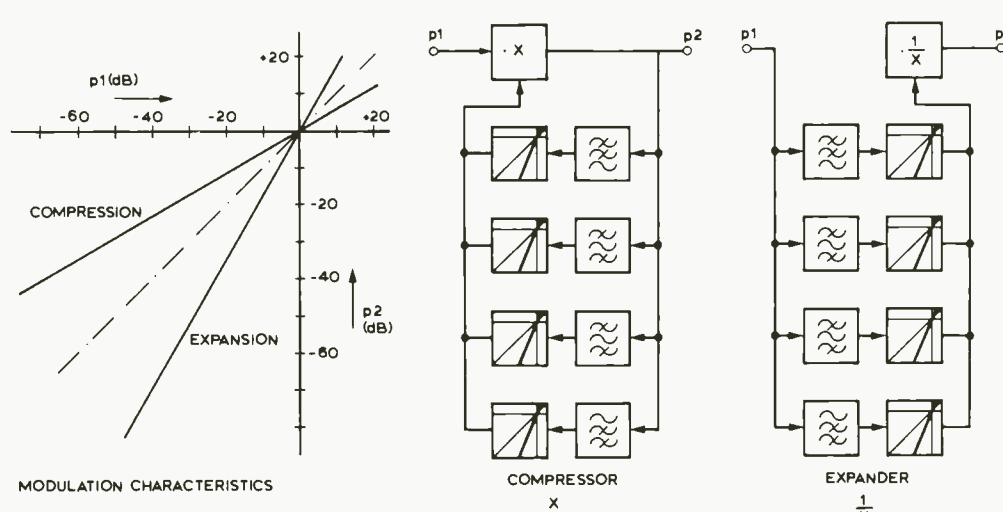


FIG 3 PRINCIPLE AND OPERATION OF THE ANT COMPANDER SYSTEM TELCOM c4





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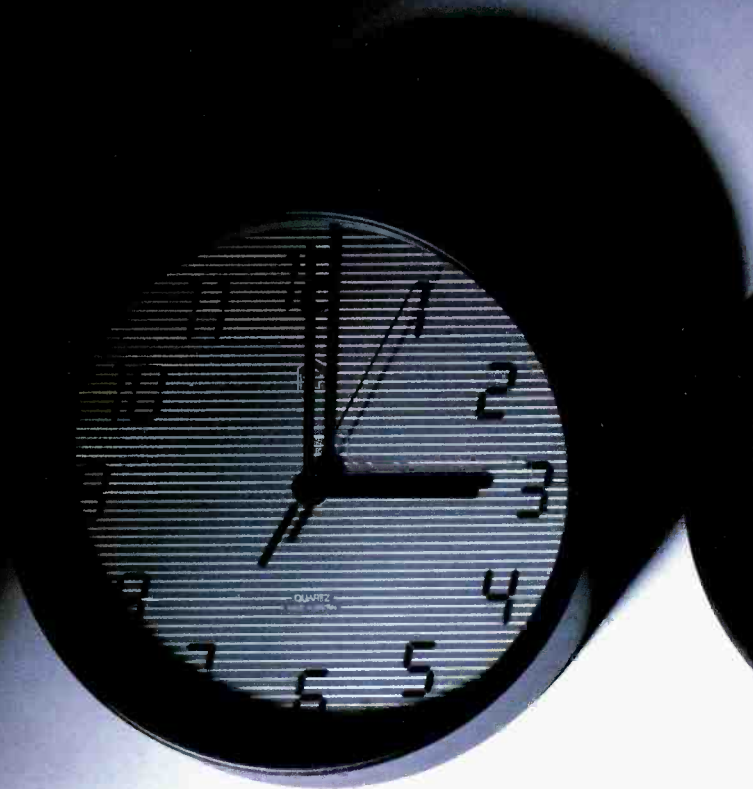
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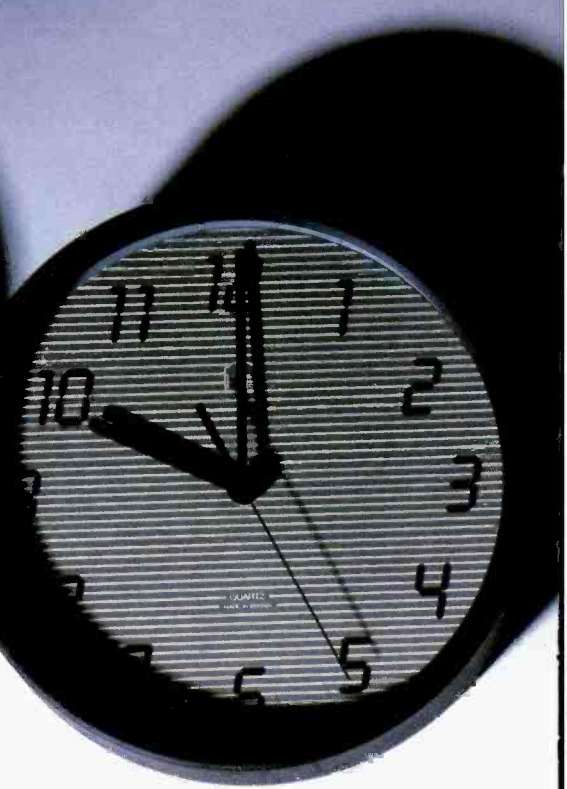
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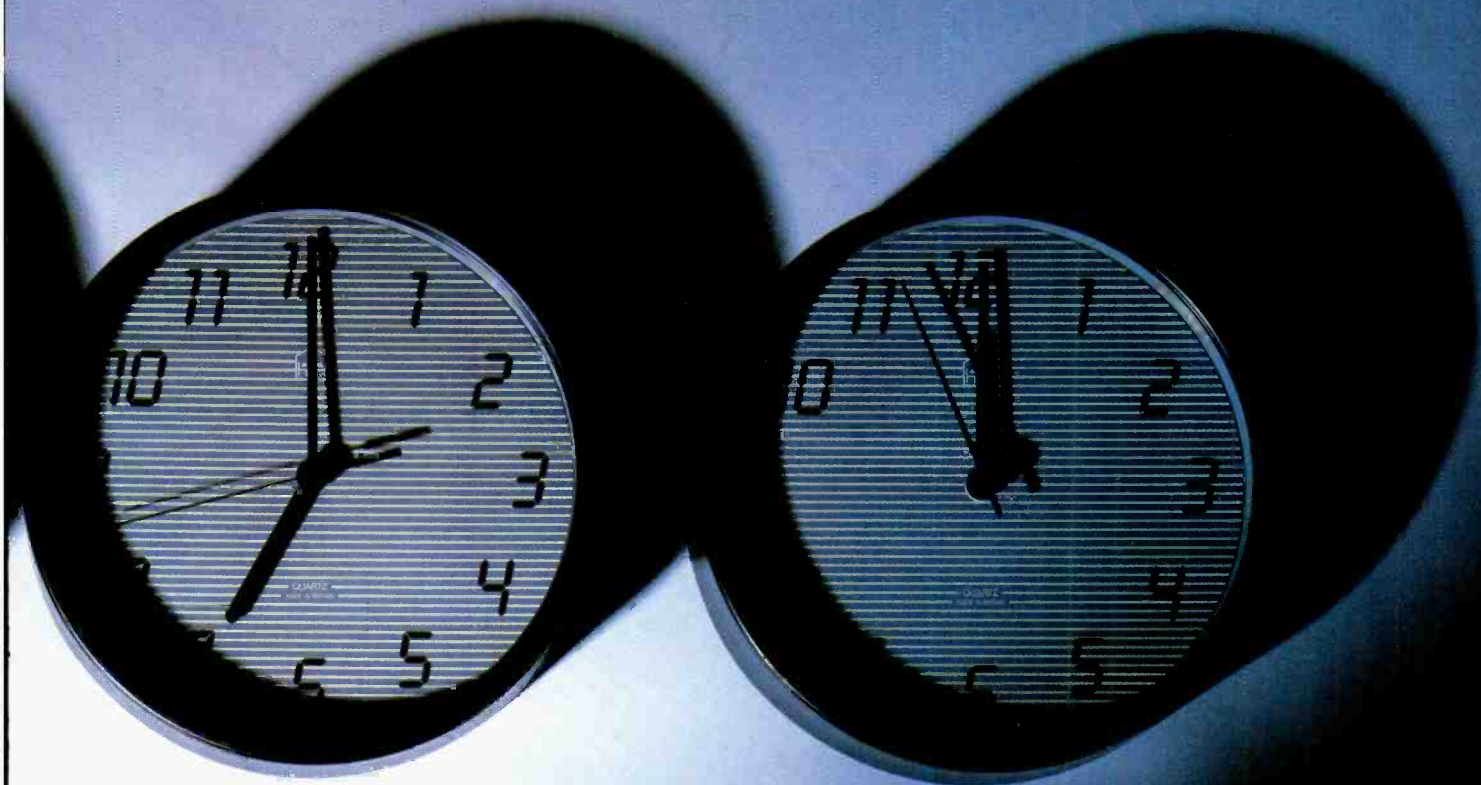
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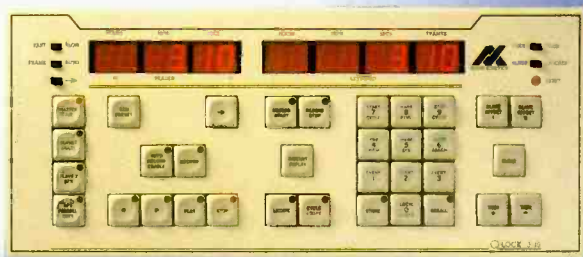


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# THE PRODUCER SERIES

# GEORGE MARTIN PART TWO

Concluding Ralph Denyer's interview. See January issue for part one



**B**roadly speaking, George Martin's 34 year career in the recording industry can be divided into two different periods, with his production of the Beatles spanning both.

He was an employee of Parlophone records for 13 years from 1952 to 1965 becoming head of the label in 1955 at the age of 29. The second period began in 1965 when George—together with John Burgess, Peter Sullivan and Ron Richards, three other very successful record producers—formed Associated Independent Record Production, London, known throughout the recording industry simply as Air.

Within a very short time, operating purely as a production company, they found themselves with an enviable problem: their expenses were low and their income quite huge. The logical answer was to invest in studios of their own and these opened during 1969. Air now consists of a parent with separate companies dealing with many aspects of the recording industry. The Chrysalis organisation invested substantially in Air during the mid '70s, at the same time bringing considerable business expertise to the Air group. In 1980 Air also opened a studio on the island of Montserrat. George is chairman of the group and of Air Studios and when not involved in record production, he becomes more involved with the business side of things but as he has been working with Paul McCartney for virtually the last three years that has placed considerable demands on his time. John Burgess is managing director of the Air Group with overall responsibility for the smooth running of the companies. Some time ago, accepting that it was difficult if not impossible to be responsible for the day-to-day running of a substantial group of companies and be a full time producer as well, John decided to concentrate on the business side of things. He does still produce on occasions, when projects can be fitted around business commitments.

During the '50s and early '60s George fulfilled both management and A&R functions. He was concerned with every aspect of the record business from signing acts, to producing them, to making sure the records got to the shops. In those days, all technical aspects of recording were strictly within the domain of the recording engineers who could be instantly recognised by their regulation white coats whereas the A&R men wore civvies. All males, artists included, wore a collar and tie and visitors were not permitted in the studios.

**S**tepping back 35 years, there is one point that should be straightened out. Though George is quite modest about his days as an oboist, just prior to starting his career in the record industry, he did play the instrument as a member of the orchestra at Sadlers Wells Opera. Not bad, considering that piano was his main instrument and composition his main subject.

The fact that George had to cope with a vast amount of different types of music and people, gave him a unique experience within a few short years. One important factor was

his unbiased attitude towards, and appreciation of, all kinds of music. Also he was able to combine a genuine interest in the people with whom he worked with finely honed diplomatic skills.

George recorded quite a lot of Scottish country dance music during the '50s. The most famous and popular of the acts was Jimmy Shand—George produced the band's most successful early recordings, including their biggest hit *Bluebell Polka*. Shand played the dances a little fast for the strict tempo purists but delighted the rest of Scotland with his vibrant playing.

"The way his fingers flew over

the keys. Most people don't realise how difficult a button accordion is to play. I used to watch him play and think: 'well, how the hell do you do it?' I couldn't do it."

During the same period George also recorded a lot of British jazz, ranging from traditional revivalists to the more musically adventurous Johnny Dankworth.

"I recorded an awful lot of material with John and Cleo Laine. Over different periods he had different bands starting off with the Johnny Dankworth Seven, then he went into big band stuff.

"Jack Parnell and Johnny Dankworth were part and parcel of that whole team, if you like to call it that, that included Humphrey Lyttleton, Graeme Bell and his Dixieland Jazz Band, Freddy Randall, and Joe Daniels and his Hot Shots. There were a whole lot of jazz people we used to record and every month we would put out a couple of jazz records."

On the classical side, George recalls making many recordings with the London Baroque Ensemble whose leader and conductor Doctor Karl Haas was an outstanding musicologist and authority on the music of the Baroque era.

"I am still proud of the recordings I made with the London Baroque Ensemble. They were all mono of course because they were made in the early '50s, recorded in the big studio at Abbey Road with the minimum of microphones. In particular there's a Dvorak *Serenade For Wind* and a piece by Dittersdorf, a concerto I seem to remember. Actually, all of those recordings with the London Baroque Ensemble were superb recordings not just because of the room but also because of the players. There were people in that ensemble that will probably never be equalled. People like Frederick Thurston on clarinet, Terrance McDonagh on oboe and Dennis Brain who was the horn player. Wonderful performers. Obviously you get marvellous performers today but there was something about those people that was really special. Those records have got a lovely sound to them, even though they are mono."

Through the London Baroque Ensemble, George met Peter Ustinov who is a great lover of classical music but it was with Ustinov that George produced his first comedy record in 1952. The record was quite a bold exercise for George as he moved into comedy while also experimenting with recording techniques. The two titles for the single were *Mock Mozart* and *Phoney Folk Lore*. For one of the tracks Ustinov sang several vocal parts which George could only record sound-on-sound as



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these were decidedly pre-multitrack days. The record was sufficiently successful to allow George to continue recording comedy, including the albums he recorded with Peter Sellers. The tracks included the legendary *Sellers Sings George Gershwin* as well as a sketch which George and Sellers liked which was originally intended for radio and written by two young comedy writers. The sketch was called *Balham, Gateway To The South* and the writers were Frank Muir and Dennis Norden.

In Britain before the advent of the Beatles, popular music was of a largely copyist nature.

"It was very influenced by America. I used to make records with Matt Monro for instance, and his records like *Portrait Of My Love* and *My Kind of Girl* had a kind of swinging thing and they were big records. But they owed an awful lot to Frank Sinatra. In those days film makers were also apeing Hollywood. It wasn't until the '60s that we established an identity of our own. I think that then America started to copy us, which was lovely for us."

By 1962 George had considerable success at Parlophone with the comedy records by Peter Ustinov, Flanders and Swann, Spike Milligan, Peter Sellers and Bernard Cribbins and he also consistently produced Top 10 records with artists such as Shirley Bassey, The Temperance Seven, Jim Dale and many others. But he was competitive and looking for what he called a strong 'fireproof' youth orientated act—over on EMI's Columbia label Norrie Paramor had been doing extremely well for some time producing Cliff Richard and the Shadows, the top UK recording act.

It was a despondent Brian Epstein who walked into the HMV record shop one day during April of 1962. He had trudged round just about all the record companies with the Beatles' demo tapes but nobody was interested in signing them. At that time anyone in the vicinity could walk into the large HMV shop in London's Oxford Street and get records cut from tapes for £1 10s (£1.50). Epstein thought that perhaps people would be more ready to listen to the group he managed if they could just slip a record on. So he went into the shop with that in mind. Ted Huntley, the man who actually cut the records, felt that the group had something to offer. He directed Epstein to Syd Colman who ran a publishing company on the floor above the shop, and Colman in turn put Epstein in touch with George.

At their first meeting George wasn't impressed by the demo tape he heard and though he found the novelty of two lead voices quite appealing, he mulled over the idea of making Paul the lead singer so as to model the group's image on that of Cliff and the Shadows. He also sensed an indefinable quality that told him the group might have something. After a recording test during September at Abbey Road when the group played some of their own songs (including *Love Me Do*, and *PS I Love You*) George felt he was going to have to find material for them to record. He went up to Liverpool to see what all the fuss was about at live Beatle dates. At the Cavern Club he saw the Beatles playing with what he called 'total

the creative scope made available to the record producer.

"Absolutely, because then you had a whole picture to paint from instead of a single spot, even though during the 4-track days we were limited by the amount of information we could put in different places. You know, with four tracks you can put something on each side, something in the centre and you've got one left over. In fact 4-track recording gave us a bit of inspiration because it meant we could use panning techniques a bit more. So if you had something on your fourth track and you wanted it to float around a bit, you could actually move it during your piece. That is how we got over our limited sources of information with 4-track. We spread the sounds

## Four-track recording gave us a bit of inspiration because it meant we could use panning techniques

commitment' and seeing the total empathy between the group and the young capacity audience realised the group was a force to be reckoned with. He was also impressed because what he was hearing and seeing, though obviously inspired by American rock'n'roll, was not a shallow imitation of Elvis and it was decidedly British.

In response to the success of the first singles George got them into the studio for their first album, *Please Please Me*. As is well documented, in 13 hours they recorded 13 songs and tagged on the title track which had already been released as a single.

The album was recorded on a twin-track tape machine and released in mono. Four-track arrived at Abbey Road in time for the second album *With The Beatles*. George relates some details of the early days of fledgling stereo.

"I generally put rhythm on one track, that is bass and drums together and sometimes even rhythm guitars. But more often than not, rhythm and lead guitars on a separate track. Then voices on a third track and then any extras on the fourth track. So with that amount of freedom—freedom he says, with four tracks!—we could actually make up a passable stereo."

George immediately loved working in stereo. Even when initially records were released in mono and stereo, and very few people had stereo record players, George was convinced of its importance in terms of widening

around, so we wouldn't keep everything static."

In his book, George had said that *Strawberry Fields Forever* was his all time favourite Beatle single. Does he still feel that way or was that a spur of the moment comment?

"No, I still think that was the best coupling (with *Penny Lane*) we ever issued because they were both fantastic tracks. I mentioned that because of the irony of the fact that it didn't go to No 1 the first week. It was very strange, though it did eventually get to No 1."

During the '60s, there were often wide discrepancies between charts in different publications. Also as the single was a double A-side, the sales were split in two in chart returns. Therefore, Engelbert Humperdinck only had to sell just over half the amount of *Release Me* singles to hold the No 1 spot. According to one chart the Beatles only made it to No 2, consequently interrupting what would have been a run of 18 consecutive No 1s, starting with *From Me To You* in 1963 and ending with *The Ballad Of John And Yoko* in 1969.

One particularly interesting point about *Strawberry Fields* is that the record is composed of two takes that were originally in different keys, a semitone apart. John Lennon liked the beginning of a basically acoustic version and the end of an electric version and left George to sort it out. There was a lot of debate at the time about where this famous 'join' came.

"Oh yes, it actually sticks out a mile to me now and I'm

amazed that people didn't see it. The obvious thing is that the second one has all the extra instruments on it, all the cellos, trumpets and things. There's a definite point at which you can hear the new one coming in. The rhythms are rather different. If we listened to it now I could show you the exact spot."

The musical development evident on the *Rubber Soul* and *Revolver* albums had created a huge interest in what the Beatles were going to do next. Instead of an expected minimum of three No 1 Beatles singles per year, in 1966 EMI had to be content with *Paperback Writer* and the coupling of two *Revolver* tracks, *Eleanor Rigby* and *Yellow Submarine*. Eventually George and the Beatles gave way to pressure and handed over the masters of *Penny Lane* and *Strawberry Fields Forever*, two songs that they really had intended to go on their next album, *Sgt Pepper's Lonely Hearts Club Band*.

"Those songs were the beginning of *Sgt Pepper*. And the reason we didn't put them on there was that we'd already issued them as a single. And we'd issued them as a single because we needed to keep the ball rolling. We had a policy of not putting out anything on our albums that had been issued as singles, unlike today when you must put your hit single on your album to sell it. In those days we were very self-righteous and said: 'No! People must have the best value for money and we mustn't dig up old singles for albums. That's quite wrong'."

And what about the end of *Strawberry Fields* when the Beatles come back sounding like a train and then disappear behind some backwards tape?

"That," said George with a smile, "was a kind of a joke. Again we had the fireman's bell thing clanging away. It wasn't my idea. We were going to do a fade and one of the boys—I can't remember who—said why don't we kid people and come back again after the fade. It was an incessant thing anyway and when you hear it coming back in again it almost adds another dimension. We all thought it worked terribly well."

I had been requested to ask George about the way in which the drums were recorded on *Sgt Pepper*, particularly for the reprise version of the title track, as it was one of the earliest dynamic drum sounds heard on record—as the cliché goes: 'jumping out of the speakers'. "Was I aware of it? Again, I can't claim credit for that. I can say that the Beatles opened my eyes to the possibilities of percussion and I guess I only



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became aware of the importance of the bass drum during the early days of the Beatles. And I then realised what a great sound it was, what a great root it was. I got very hooked on bass drums and tom-toms, as well as the snare drum, of course. And Ringo's drumming had such a characteristic sound that it was comparatively easy to get that over. So the kind of thing you mentioned—where it jumped out of the speakers at you—was something we all loved and that I thought was great. And of course, it satisfied Ringo enormously. There was almost a symphonic use of the drums sometimes. On *A Day In The Life* for instance. A lot of his tom work was almost like tympani work in a symphony orchestra. It was musical, not just a rhythmic thing. It was actually putting the right quotes in the right places. The ideas were suggested by us but it was Ringo who actually executed it, and a lot of his genius comes across in that song."

**Q** uite a few unfamiliar sounds could be heard on *Abbey Road*, particularly on *Here Comes The Sun* and *Maxwell's Silver Hammer*. On the latter, what sounds like a friendly little alien creeps in and wanders around the stereo picture, finally ending up dead centre. George confirmed that quite a few of the subtle sounds on the album were achieved with a synthesiser. "I did use a synth on that, a Moog *Series III*. I'd already done the 'course' if you like to call it that, in San Francisco with Bernie Krause and Paul Beaver and I bought one for our studios. But George had also bought the one that we used on *Maxwell's*

I like lyrics that in a way leave a lot for the imagination to fill in...it gives you a little bit more to play with

*Silver Hammer*. On that particular one, I suppose we were still influenced by real sounds and we were still trying to get sounds that were like instruments we knew, more than synthetic sounds but nevertheless, there was a floaty mystical thing about the sound on *Maxwell's Silver Hammer*."

And so it was the *Series III* that followed George Harrison's acoustic guitar on *Here Comes The Sun*?

"That's right. George helped quite a lot on *Maxwell's Silver Hammer* with the synth. It was his instrument and he liked the idea of imitating sounds too. I like imitating sounds, one instrument imitating another, maybe merging one thing into another. I don't know if you noticed on *Ballroom Dancing* (original version on McCartney's *Tug Of War* album) if you've heard that track there's a clarinet kind of glissando which is a bit like Gerswin's *Rhapsody in Blue*, and the clarinet swoops up from its bottom chalumeau register. It's much wider than the Gerswin one going through two octaves and in fact is almost impossible to do. Jack Brymer played it but at the very top it isn't a clarinet any more, it's a trumpet which finishes the phrase. It was difficult to get the

crossover point so that you couldn't really hear the join although we did manage it. But that's the kind of thing I love. Again, it's painting isn't it? A little bit of magic."

The most cost-effective instrument on *Sgt. Pepper* must have been the maracas, which at times mingled in and out with Ringo's partly open hi-hat.

"That again was probably done through limiting. We didn't have very sophisticated studio devices in those days. We didn't have Kepexes or noise gates of any sort and the compressors and limiters we had were fairly primitive. The only thing we could do was to compress one instrument into another. And that open hi-hat and maracas sound was—as I remember it—a question of the two being locked in together and the hi-hat allowing the maracas to come through when it wasn't playing. We used a Fairchild compressor, which we still use and is marvellous. They were the best of their day. Of course, in those days, we didn't have pitch shifters or digital delays or any of those tricks that we can use nowadays."

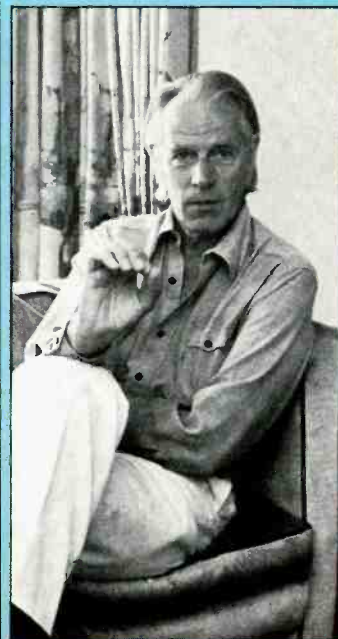
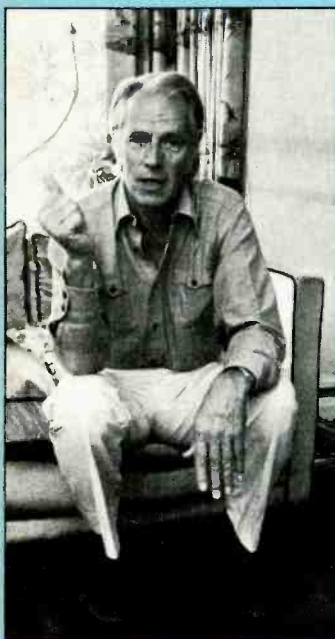
The Beatles' music and image was enigmatic. Despite the fact that Beatle literature has become a cottage industry, so

much still remains unexplained and hopefully will always leave room for imagination. Their often emotive lyrics were, like a Picasso, open to individual interpretation.

"I like lyrics that in a way leave a lot for the imagination to fill in and not to be too pat, not too definite. I like to leave a certain amount of room for imaginative movement in your mind. I think that's good, it gives you a little bit more to play with."

mentioned to George that quite a lot of people seem to share my view that he and Quincy Jones are regarded as being two—if not the two—major figures in modern record production.

"Well thank you," George responded adding with a smile, "I don't know what you want me to say about that except to be flattered by it. Nice to be linked with Quincy anyway, because he's such a great producer and a great musician. I guess the odd thing about having a lot of experience—and now it's 34 years since I started—is that one doesn't feel any different. Basically within myself I don't feel any different from the way I did in 1950. I know that I've got this ramshackle body which is gradually getting older by the day. But that's the curious thing about getting older. You don't think that you are any different and everybody else is just changing around you. The outlook basically doesn't change. My views on music haven't changed at all. I'm still interested in unusual things. I still like doing things for kicks, but we have to remind ourselves that we're not teenagers. Even with Paul—I reminded him the other day that I'd been in the



Photos: Ralph Denyer



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business for over 30 years and he's been in it for two thirds of that time. I told him: 'You've been in the business for 20 years. You're an old man now.'

"And when you think about it, my son who is 15 is now the public. By the way, he can be very scathing about some of my work. And when I get congratulations from him on a really good track, I know that I've succeeded with young people. It's an accolade."

We went on to talk about the use of techniques, such as backwards tape and playing instruments in unorthodox ways, to stimulate and develop ideas in the studio.

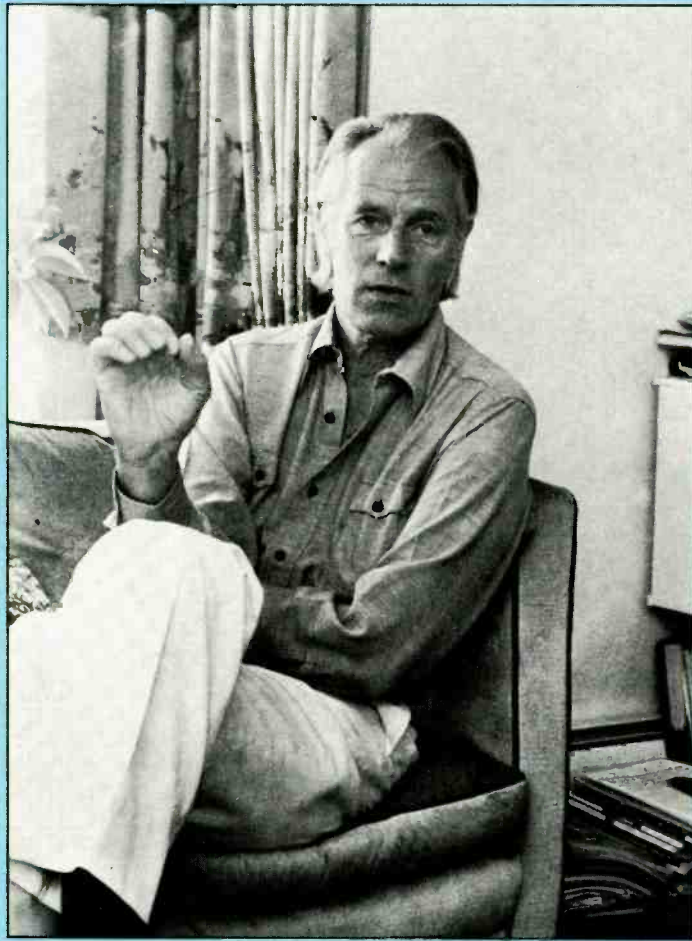
"It is exploring the possibilities of anything really. You can go too far out. I mean, you can do weird things with any instrument. For example, you can make an oboe play four notes at once. The only trouble is they are not very good notes but for a single note instrument to play four notes at all, is something of a miracle. But it's rather like a dog playing chess, it's a miracle that he can play at all, he doesn't have to play very well. So there's a limit to exploration. I suppose it does make you more aware of the possibilities. It's certainly fun to do and sometimes I tell myself I'm just like a child really, just indulging in my little play things. But through that comes something."

While interviewing record producers over the past year or so, I had gained the impression that they frequently employ new technology of the day to stimulate creativity but, in the final analysis, the technology only plays a small part in the successful development of the recording of a piece of music.

"It's his (the producer's) plaything though, it's his toy. And it doesn't make any difference to the worth of the thing in the end. For Vangelis' *Chariots of Fire* wasn't successful because it was synthesised, it could have been just as successful if it had been made with conventional instruments, I'm sure. The brilliance of that score was that the tunes were right, the concept was right and the rhythms were right. If you had taken away the main melody and just had synthesised music, it wouldn't have been so successful. The slow motion sequences and the wonderful synthesised rhythms he got fitted the film so beautifully."

It was such a successful marriage of images and sound that it is now impossible to see slow motion sequences of athletics without imagining Vangelis' score.

"That's right, any more than you can see a shark without thinking of the *Jaws* semitone



jumps. It's the linking of visual to aural images. This is going to come more and more in the future. We are no longer just an aural society, we are in a visual society and this is why in this country, and I think in the States, you have to have a video to accompany any single."

Good or bad, these are the times we live in.

"Yes. It's not enough to just have a great sound. So inevitably in the next five or 10 years, there will be records made which are video records, which are made from the outset as a combined affair. And that's what's got to happen and producers of the future have got to think in these terms. They've got to think of a visual-aural experience. It's no longer any good to think in terms of purely sound alone. That I find very exciting. The linking of vision to sound is wonderful."

We went on to talk about Paul McCartney's *Pipes Of Peace* and some of the details of how it was conceived and recorded. The visual concept of the wartime story video was not thought of originally.

"We wanted to try and convey the sound of as many pipes as possible. The pipe is such a universal folk instrument. From China through Afghanistan through to Ireland, you'll find pipes of one sort or another. So Paul's thought was: 'Can we

convey this, that we can actually unite the world with music, with the pipes of peace portraying that?'"

"We also wanted to combine that with the effect of innocence and children and in fact we got the Pestalozzi Children's Choir along to perform, thinking that they might add another dimension to it and they did. It was quite a nice touch but we still added a lot of backing voices with Linda and Eric Stewart. A lot of the pipes had to be synthesised, and for that we used a Fairlight. I used to play the oboe and on one phrase I wanted to use an oboe lick. I haven't played for about 20 years but I said, 'Rather than get an oboist in, I'll play it.' Arrogance itself. I got the oboe in and I was *terribly* depressed when I realised what sound I was producing. It was ghastly. My diaphragm was no longer what it was and nor was my lip control. I was able to produce one or two good notes but *only* one or two. I didn't have the dexterity and I suddenly realised how inferior my technique had become. So I said, 'What I'll have to do is play one good note, or several good notes and (laughs) put them on to the Fairlight and play the phrase I want on the keyboard.' It sounded perfectly all right so in the end I got my oboe phrase. That's an example of modern

technology helping someone who can't play.

"Then of course, we used a tabla to give a sort of oriental feel. When the tabla comes in, it lifts the track. Again, I thought we needed a real orchestra. Scoring the song for strings, brass and woodwind gave it another sort of dimension too. I think that without the orchestra, it wouldn't have become the classy record that it did. Sometimes I get attacked for using conventional instruments, a big sound like that. But I think it was absolutely necessary in *Pipes of Peace*.

"Oh, one thing about the song, when Paul wrote it, he wrote it in C. When I heard him sing it I said, 'You know, it's in the wrong key for you. You have to sing it awfully low.' When he sang it in another key, part of it sounded awfully high. Then I realised the range was over two octaves. A lot of writers—even the most experienced ones like Paul—don't think about how a song is going to affect their voice. They quite often write their songs so that their fingers feel comfortable with the instrument they're playing, forgetting that it may not be the best key for their voice. He was singing the opening lines so low that it sounded more like Paul Robeson. And yet in the same key the latter part, the main chorus was just right. I thought about it over the weekend and when he came in to the studio on the Monday I said, 'This is what you'll have to do.'

"I said he'd have to sing the first part of the song in one key and the second part in another. I put the first part in E and I'll have to play it on the piano to show you the difference."

George did exactly that and if you listen to the record you can hear the modulation from E to C and back into E. An interesting point is the lift the modulation from E to C gives to the song, solving the problem while at the same time enhancing the composition.

"When Paul heard it he said, 'Oh, that's great. I like it and it sounds much more interesting.' And I think that change helped enormously."

**T**here was a gap of over 10 years between the time Paul and he worked together on *Abbey Road* and McCartney's 1982 *Tug Of War* album and I asked George to talk

about their renewed relationship.

"We'd always been good friends. One of my worries in our starting to work together again was that he'd been a very successful producer in his own right for many years and there we were, coming back into a



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producer/artist relationship. I said, 'It will only work if you accept what I have to say as being valid, because there's no point in having a yes man. If you want a yes man, you can get somebody else. If you want somebody to agree with everything you do, that's destructive.'

"On the other hand, it's all too easy for the producer to get smart and start disagreeing with the artist so as to look big. That's fatal too. That's stupid and ridiculous. Yet honesty has got to prevail and if the producer really thinks the artist's song isn't good enough, he's got to say so unequivocally, and the artist has got to trust him. If you don't have that relationship, then you're done. If the artist thinks the producer is trying to make something out of it, when he himself thinks it's bloody good, then immediately you've broken down. And so you've got to have that trust and it's tough. I mean, Paul's probably the greatest living songwriter in the world and here I am, a producer who's never written a hit song in his life. So what temerity do I have to go to the guy and say the song is not good enough? It's a terrible thing to do but it's absolutely necessary. To give Paul his due he accepted my criticisms with remarkable bon homie and I guess it's only because we've worked together for so long that he could do it. Absolutely vital and necessary though."

At the end of a previous interview session, George had invited me to have a listen while they were mixing the up tempo 12 in single version of *No More Lonely Nights*. In the control room while Paul was enthusing about the fun of using AMS delay lines to record short sounds and being able to cue them in at ease during the mix, out in the studio some programmers were intently working away. Now I had the opportunity to ask George to describe what they had been doing.

"That's quite interesting. There are choral sounds that come in on the slow ballad version of *No More Lonely Nights*—slightly ethereal, floaty, slightly synthetic choral sounds. I built up a lot of backing vocals with Linda, Eric Stewart and Paul and created a lot of sort of complex harmonic washes. So I just dug those out, and they were in the same key, so I was able to use them actually fitting them into the new rhythms. All those vocals came from the other ballad and initially had nothing to do with the disco version at all. That kind of thing is quite nice to play with but again, it's playing with sound and *musique concrete* stuff really."

I went on to ask George about

various aspects of the *Broad Street* project.

"*Give My Regards To Broad Street* is a slightly dramatic story, a sort of day in the life of McCartney but it has a twist to it. It's a vehicle for his songs and from the moment you see him at the beginning of the picture to the end, there are 14 of them—10 are old songs and four are new. The old songs go back to the Beatle days—McCartney songs of the Beatle era—McCartney classics really and having 14 tracks on it, plus soundtrack material, it virtually becomes a greatest hits album but with four great new songs. It's a good package. I honestly believe that—some of the tracks we've done again—I actually prefer them to the originals.

"*Yesterday* is such a unique record, I prefer the original. But I prefer the new versions of *Silly Love Songs* and *The Long And Winding Road* which I think are both terrific tracks—much better than the originals. *The Long And Winding Road* starts off with a saxophone played by Dick Morrissey, then it goes into the vocal and we used a black gospel choir, the London Community Gospel Choir I think they call themselves, and it's just terrific. It's very much a live track. We had a live band in the studio with Herbie Flowers on bass,

with Paul and Trevor Barstow on keyboards. On *Silly Love Songs* we had most of Toto—Jeff Porcaro on drums, Steve Lukather on guitar and Louis Johnson on bass and it was terrific, really beautiful.

"We had so much material that it became a double album. We didn't want that because they're messy but the compact disc can cope with the length we had, which was over an hour. If we'd tried to put over an hour on an ordinary disc we'd have lost too much quality. So we kept the timing on the ordinary disc to 23 minutes a side but we got all 14 songs on it. The tape can run a bit longer and it is about 27 minutes a side and that has a lot of the extended versions of the songs on it. Finally the compact disc has the complete score."

**M**y final meeting with George was back at Air Studios in London for a short photo session. In his role as chairman, there are items which require his attention and Air managing director John Burgess was patiently waiting for us to finish, as George explained while I clicked away.

Although George is very

experienced in the business side of the recording industry, one gets the impression that he gains satisfaction more through creative, as opposed to entrepreneurial pursuits.

"Yeah, I used to be both, in fact I was more administrative than creative to start with. I've done both quite well. I don't know, as you get older—this is such a young business and there are some wonderful young producers, you know? After being the 'Fastest Gun In The West' you've got to learn when to hang up your holster. You're in competition still, with all these people.

"I'm not talking about going outside into the snow and never coming back like in Scott of the Antarctic. I think the most difficult thing, if you are successful, is to stay successful. And to keep coming back and keep doing good things, which I've always tried to do. All I'm saying is it gets harder, it doesn't get any easier. No, I shall just gradually slip away. The thing is, I still get asked to do an awful lot of work and I keep turning people down."

**K**nowing what kind of answer to expect by now but in order to get it in George's own words, I asked what his current criterion is for producing a record for someone.

"Whether it'll be fun to do or not. Whether I'll enjoy doing it."

In fact, that's what seems to emerge as a prime factor in his working with America—his longest producer-artist relationship outside of the Beatles.

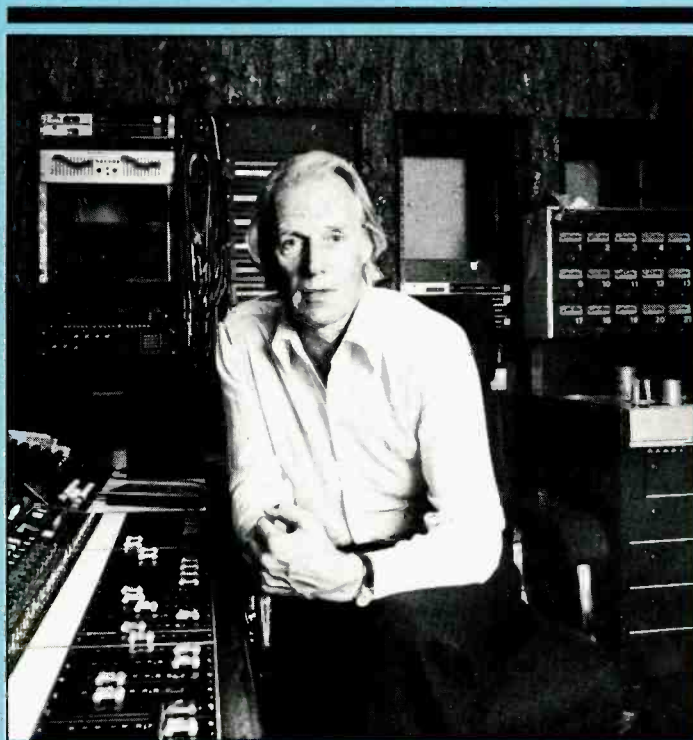
"That's right. Life is too short otherwise. There's no *earthly* point in my making a blockbuster of a record if I'm going to be miserable all the time I'm doing it. I just don't see the point in it."

It seems that even if George is asked to produce an artist with the potential to make a brilliant innovative record, if the personal side of things isn't right, he would politely decline.

"Yeah, I think it's more important than the music. To me it is, because it's life, and life is more important than music. I've been very lucky because all the great music I've done has been done in enjoyable circumstances. And the stuff that has emerged as being historically good was done with a great deal of warmth and love, which is marvellous. You're very lucky to have those combinations.

"All I'm saying is: if I go into a *new* relationship with someone and their music is great, unless I can relate to them and know that I'm going to enjoy working with them, I won't do it—someone else will anyway." □

I think the most difficult thing, if you are successful, is to stay successful





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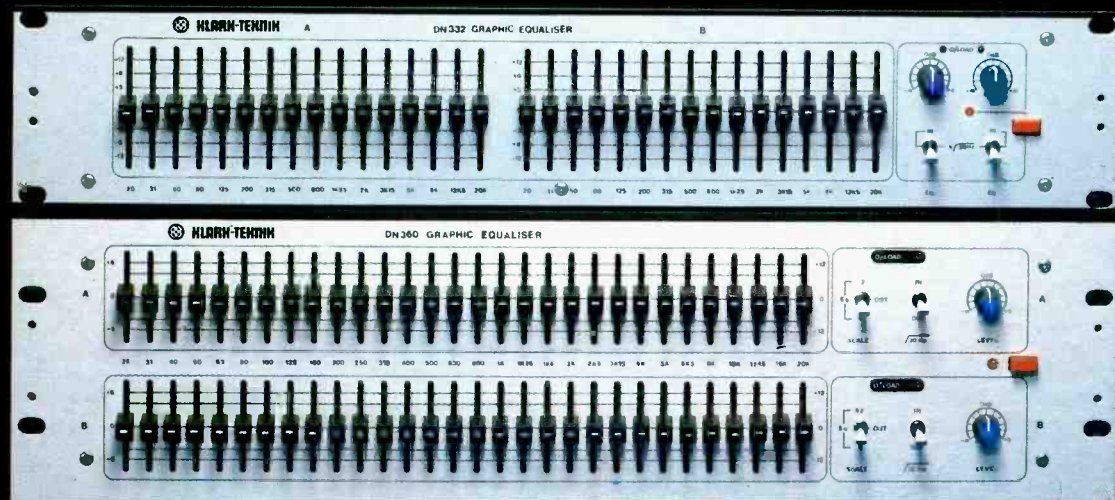
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# STUDIO FILE

# STUDIO FILE

The Workhouse was just that for about six months of 1984. Studio One has been completely rebuilt, undergoing an astonishing transformation from a dark and almost dingy place in the depths of The Workhouse premises, to a large bright, up-to-the-minute hi-tech studio. Studio Two has not been neglected either. It now boasts a newly installed 36-channel Solid State Logic 4000E console with *Total Recall*.

Situated in Peckham, London, The Workhouse lies unobtrusively at the side of the Old Kent Road—if you didn't know what you were looking for you could easily miss it altogether. Having found it, however, and successfully communicated with what you conclude must be the doorbell—held on with only one screw—uttering the secret password 'Studio Sound', you step into another world.

Enough romanticising! For those not already in the know, The Workhouse Studios are owned by Manfred Mann and Peter Hammond: Studio 1 is their joint property and Studio 2 belongs to Manfred and in addition to being his place of work (when bookings allow him in) it is also a popular commercial workplace—even more so now that the SSL is installed and working.

The new look Studio 1 all started when architect James Urquhart came to build the kitchen, and somehow the project overflowed into the recording area. Andy Munro advised on the acoustics and the result is, well, unusual.

The thing about the old studio was that the recording area was some 10 ft below control room level, leaving the musicians somewhat removed from the heart of the matter. The main criterion then was to bring the musicians up to the same level. To this end a balcony was installed, running down one side of the room, with an area approximately 8×14 ft at one end, directly in front of the control room's sliding glass doors. Stepping off this platform, you can then descend a rather grand wooden staircase into the original area which extends roughly 20 ft square. The area under the balcony along the side wall provides storage space for mic

## The Workhouse Studios, London

stands, etc, and under the platform at the far end, sliding glass doors make a conversion into an isolation room.

Once tucked away under the platform one would assume that all contact with the real world up in the control room has been lost forever. This is solved by means of a giant mirror mounted on the opposite end wall on a pivot which serves not only to show what each other is up to but is also quite handy for directing various brass instruments at for a bright sound.

The studio has a lot of light wood in it with parquet flooring, covered here and there with rugs to suit, the wooden staircase, the wooden balcony with white metal sides, and has a very bright feel—both visually and acoustically. The walls are covered in reversible panels, approximately 1 m wide which are cork on one side and treated with a live-sounding shiny paint on the other. The acoustics are thus quite variable. There are also a number of Turnkey sound absorbers lying around.

When you are standing downstairs, the ceiling stretches 20 ft above you, and Peter Hammond was particularly keen to retain the ambience that this creates in the new design.

The platform area serves a double purpose as recording/additional control room area and has extra seating for the latter. The studio's hi-tech appearance is

enhanced with lighting tracks which can provide four different moods of lighting, and what Peter describes as 'colourful trunking' (blue actually) running round the room and housing all the wiring and mic lines.

In Control Room 1 the Harrison *Series 32* in-line console with automation is at right angles to the sliding glass doors and, therefore, the studio. The console features built-in remotes for the Studer *A80* 24-track machine with Ready, Master Ready, Master Sync & Replay, Auto Line-in, and Auto Talkback (which may be overridden when not required). There are also remotes built in for the EMT *140* plate and the AKG *BX20* reverbs which are housed away in a storage room behind the isolation booth.

Original plans were to replace the Harrison with the SSL which has found its way into Studio 2. In the end they opted to keep the 32-channel Harrison because The Workhouse engineers, as well as a lot of their clients, are very fond of it, finding it a very musical desk to work with. Peter and assistant engineer Stuart Barry talked about this at length, and seemed to be enjoying the best of both worlds with their clasp firmly on the old favourite as well as the much sought after SSL. Stuart felt that the Harrison EQ in particular was a sound he preferred.

The tape machines are located at the front of the

control room behind the desk and as well as the *A80 MKIII* 24-track there are Studer *A80* and MCI *JH110* 2-track machines. Monitoring is on JBL *4341s* driven by Crown *DC300* and there are bass absorber (foam) panels on the wall behind these.

The walls are 'broken up' with the air conditioning installation and various housings for switches and wiring, etc. Other acoustic treatment includes Turnkey baffles on the back wall, the same reversible panelling found in the studio area, and bass absorbers in the ceiling towards the back of the room. The floor is again finished in a parquet covering, with a rug laid on top. The rug is assisted in its absorption process by a sofa along the back wall.

Racked auxiliary equipment sits tidily at the back of the room, and not only is the rack tie-lined to Studio 2, but it incorporates tie-lines to the desk for DI-ing—especially useful for musicians arriving with, for example, a *LinnDrum*; as Peter says, "it saves having all those wires all over the place. The musician can just put the Linn on a table at the back of the room and there are no wires to trip over all the time."

Outboard equipment is plentiful and includes Dolby A noise reduction systems (24- and 2-channel), Quantec *Room Simulator*, AMS *RMX16* digital reverb, Lexicon *224* (these two by arrangement with Studio 2), Orban De-esser, AMS *DMX15/80S* stereo delay (with 1.6 s and 400 ms and pitch change), Eventide *Harmonizers*, Klark-Teknik delay/chorus/flanger, Kepex and Drawmer *DS201* noise gates, UREI *1176* and Drawmer *DL221* and Pye compressors.

Reference monitoring is on various models, including Radio Spares *18LS* and Auratones.

They also have a Sony *F1* system, and an extensive collection of microphones. Having made Stuart dash all over the building checking model numbers, we are now in a position to inform you that these include Neumann *U87*, *U47* (valve) and *U64*; AKG *D12*, *C414*, *C451E*, *D202*, *D224*; Beyer *M260* (used on guitars or amps) and Shure

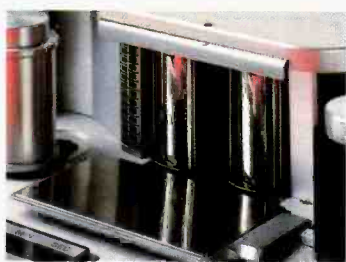
Peter Hammond behind Studio One's Harrison desk







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# STUDIO FILE

# STUDIO FILE

SM7 and SM2s. Headphones are by Beyer.

Daylight is admitted to Studio 1 through electrically controlled skylight windows above the tape recorders. These lend a light and airy atmosphere to the room, and they find it less tiring to work in.

This studio is where Lawrie Latham (producer of, amongst others, Paul Young) started life as a tape-op, and he is frequently to be seen returning to work here with various projects. Another regular visitor has been Anne Dudley (famous for her work with Trevor Horn) who has been involved recently on recordings with the Technos and April Showers.

Manfred Mann's Studio 2 also has a Turnkey ring to the design, and was built in 1982, originally intended only for his own use. It was not possible to take such a lingering look at this facility since engineer Jeremy Allom was busy setting up the desk for the day's session.

## The Workhouse continued

Acoustic treatment includes bass baffles in the ceiling behind the desk, with wood above the desk, bass absorbers on the back wall and strategically around the room, and carpeting on the floor. Once again there is daylight and potential fresh air.

Studio monitoring is on JBL 4430s driven by Studer A68 amp and reference monitoring is again on Radio Spares 18LS, and hovering in the vicinity of the right hand monitor is Jonathon Livingston (I presume) Seagull—a little far from home, but maybe he got lost.

The recording area is much smaller than Studio 1's, although there are plans afoot to purchase a piece of land which the room backs on to. It is roughly 20 ft<sup>2</sup> with one corner chopped off. The remaining corner at that end is therefore only practical for storage. Re-instating the missing corner should make a

considerable difference.

Along the angled wall there are four panels which open out to reveal a mirrored reflective surface for variable acoustics. The ceiling is slanted and wooden, with a small trap by the sliding doors communicating with the control room.

The effects rack is again wired to the desk for DI-ing of *LinnDrums*, etc, and houses an Electro-Harmonix *Super Replay 4* s digital sampler, an AMS *RMX16*, Lexicon *224*, AMS stereo delay (1.6 s and 800 ms), Eventide *Harmonizer*, Drawmer *Multitracker*, Survival Projects stereo panner, four Drawmer noise gates, UREI *1176* compressors and a TC Electronics *2240* parametric equaliser.

Tape machines include a newly purchased Otari *MTR 90* 24-track machine and Studer *B67* stereo machine and there is also a Sony *F1*.

Between the two studios

there is a small kitchen which was full of tape-op when we walked past, so we couldn't see much, but we have it on good authority that it provides sandwiches and fried snacks, etc (free!).

Apart from the reception area and offices that's about it for downstairs. Upstairs the building work was by no means over. Most of the area was being converted into a spacious apartment, possibly for studio use, possibly not. The remaining rooms include the maintenance workshop, a large TV and pool room and the tape stores.

By mid-day, what with accountants, builders, architects, clients, relations, the place was beginning to get a bit hectic and a timely leave-taking was in order. There has been a studio on The Workhouse site for over 10 years now—it must be here to stay.

**Janet Angus**  
**The Workhouse Studios,**  
**488-490 Old Kent Road,**  
**London SE1 5AG, UK.**  
**Tel: 01-237 1737/8.**

While Munich is undoubtedly the major recording centre in West Germany, with around 10 large studios and many smaller facilities, other German cities also have a sizable industry capable of supporting at least a couple of modern well-equipped studios. Among these are Hamburg, Frankfurt and Cologne.

The very size of Germany and the regional distribution of her radio and television system—similar to the British IBA structure—mean a substantial gathering of talent and technology at a number of centres, and this accounts in some measure for the spread of the recording industry across the country.

Cologne, apart from being the home of Westdeutscher Rundfunk, also has a 32-track digital recording studio—Studio 'N'. The studio takes its name, or rather initial, from Georgi Nedeltshev who founded the place 10 years ago. The studio, originally a cinema, is situated in a quiet residential street in a suburb of Cologne, Bickendorf, which is about 10 minutes' drive from the city centre and about 20 from the airport. Apart from the comfortable lounge

## Studio 'N', Cologne

and bar on the premises, there is an excellent restaurant and bar next door which serves substantial German fare and a good Stein of German beer.

When Herr Nedeltshev acquired the studio it was already in use for film post-production doing double duty as a cinema by the simple expedient of removing the chairs by day and putting them back in the evening. As one might expect from an ex-cinema, the studio is a goodly size. Oddly, however, it was found to be too dry, especially since much of the work involved recordings either for, or using musicians from the radio orchestras, who are used to natural acoustics. The carpet was replaced with parquet and the walls were treated to large wooden foil-covered wedges. The result is a room which is fashionably live and natural sounding. Large screens can be used for baffling where required, and these have foldback distribution boxes screwed on to them—a neat idea.

The theme of natural sound is one very close to the hearts

of the people at Studio 'N', extending from acoustics through to monitoring and to this end they use 32-track and 2-track digital Telefunken (Mitsubishi) machines. Speech recording, for example, will always show up a system which does not sound natural. Traditionally the studio had always recorded plays for radio and this forms part of the work, even today. In fact, there are Avant-Garde Hoerspiel directors who insist on the dynamic range offered by digital to capture subtle sounds on tape.

Although the main source of income from the studio is from pop music—Kraftwerk have recently mixed a single—a wide range of work is accepted from big bands and several private bands, to contemporary serious music or 'Neumusik'. These works are premiered at an annual festival in Witten, following which the music is recorded, usually straight to stereo, in the studio, with the room often crowded with multiple percussion and instruments of every size and shape. Much of this output is

used by the radio people.

Experimental techniques are not confined to this sort of music, however. The week after my visit an experiment in big band recording using a dummy head stereo microphone was scheduled to take place. The band would be arranged round the dummy head to determine the actual positions, then the rhythm track only recorded, followed by section for section overdubs. The idea is to allow performance to be optimised by allowing punching-in, but not to *cheat* by allowing EQ and reverb modifications to the sound. Time will tell if the result has all the excitement of a live performance.

Chief engineer at the studio is Günther Kaspar who has been with Nedeltshev from the outset. Günther very kindly showed me round the complex, which includes, in addition to the 32-track digital/24-track analogue (syncable) room, a 24-track overdub (API console) and a 24-track video post-production (MCI 400) facility. All analogue multitracks are 3M M79s.

The control room acoustics were designed by Jensen of



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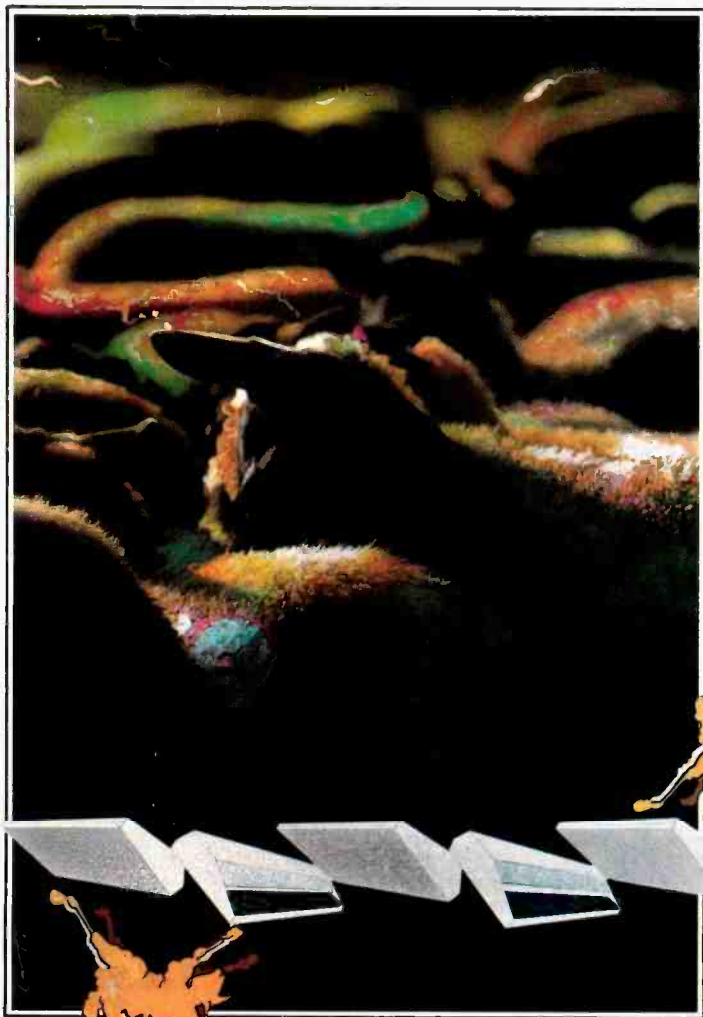
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# STUDIO FILE

# STUDIO FILE

Hamburg. The design features wooden side walls, broadening to the back of the room. There are vertical ports every metre or so with openings of around 10 cm, each port having different absorption characteristics to allow controlled broadband absorption of sound travelling along these walls on the way to the rear of the room. The back wall comprises the better known low frequency traps. The room is claimed to be free of standing waves, and certainly, the low end sounded tight but with a pleasing depth, while the diffusion of the mids and highs provided the resemblance to living-room acoustics which was the original design approach. Monitoring was recently changed from JBL 4-way bi-amped 4341s to UREI 813s with a modest amount of low end EQ using Klark-Teknik graphics.

After the studio had acquired the Telefunken MX800 digital machine, control room parameters were found to have become more stringent; less faults were masked by the recording process, and so Jensen was asked once again to do some revision to the room. Once this was done, the monitoring showed up other effects in the recording chain such as transient and phase distortion. This led to the decision to purchase a new console and after evaluating demonstration units from several manufacturers both in the workshops and actually patched directly into the recording chain, it was decided that the Solid State Logic 48-channel console offered performance which would not degrade that of the digital machine.

I asked Günther about digital: "Once you have used digital you can't go back to analogue. Apart from the absence of degradation, there are other advantages. For example, we often mix on to two tracks of the multitrack so that we can punch-in on the mix. The Telefunken will punch-in and out inaudibly in the middle of a note, if need be, and this makes life easier not only when overdubbing, but also when mixing. You don't have to worry about starting and stopping stereo

## Studio 'N' continued



Studio 'N' features an SSL SL4000E desk with automation, and Telefunken digital equipment

machines. Of course, you *can* mix onto tracks of an analogue multitrack but since you would need another generation to get the mix to the cutting room, there's little point. We make a copy, in the digital domain, from the mix on the multitrack on to our stereo Telefunken MX 80 (which, by the way, you can edit with a razor blade) and take the machine to the cutting room. The machine is portable—the transport and electronics separate and will fit in any estate car."

Unfortunately, what one cannot do with this system is re-mix subsequently using the mix and 2-tracks as the basic and make alterations to, for example, the voice by using the original vocal along with the already mixed vocal, which one might get away with using analogue. This is because the original vocal has been sampled once and the mixed vocal a second time. The inherent delay, albeit undetectable, in the sampling process causes phasing problems to occur between the two versions. You have to re-mix completely. I asked Günther about automated mixing: "It's rather like the digital experience—once you have used it you can't work without it. It changes your style—you're actually arranging while you're mixing and many composers now work with this in mind, all the way through the recording process."

Günther is no stranger to mix automation; the studio's previous console used the Allison programmer. However he likes the SSL automation. As he says, there are different ways to update segments to suit the particular need—rollback and pick-up (for small mistakes), automatic joining of front and back of a mix to a segment, off-line butt and insert edits of any two mixes (intro from one mix, middle from another and end from yet another), selective track joining (ie rhythm from one mix, synths from another), high speed winding in any direction while updating (alter the vocal backing in every chorus of a long disco mix without playing the whole track through) and so on.

The SSL *Total Recall* option is on order to retrofit. "The studio nearly always works round the clock in shifts and we can't afford lock-out simply because a client has the console set up for, say, rhythm tracks. We will be able to store the console settings from the day session, use the room in the evening without having to log the settings, which at best is inaccurate, especially with non-stepped parametric controls, and reset the console the next morning in about 10 minutes. You have to reset them by hand, but we are well aware that the only alternatives now, and in the foreseeable future, would be consoles with 20 VCAs in every channel or the vastly

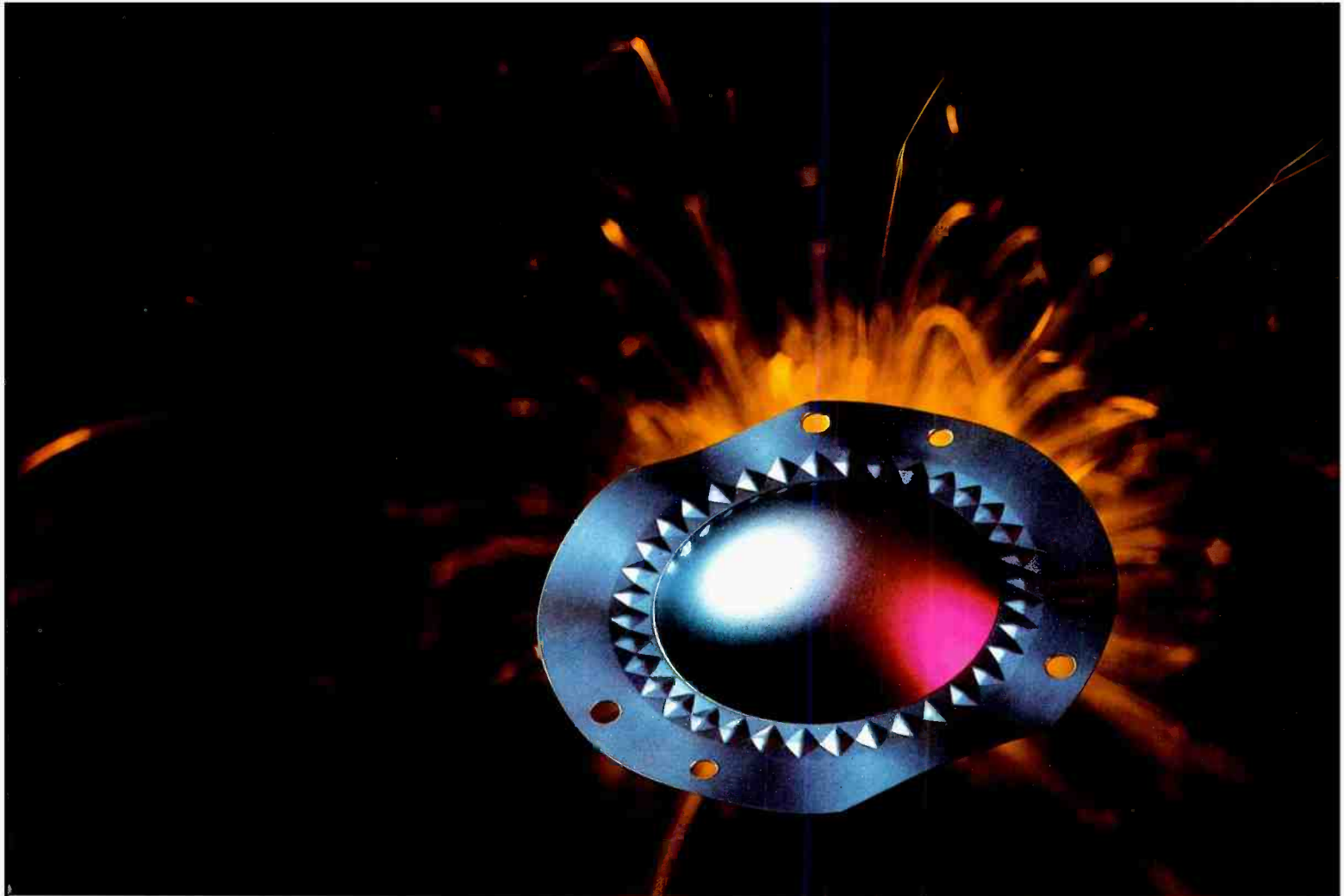
expensive digital consoles becoming available which, being 16-bit devices still can't match state-of-the-art analogue. Let's face it, analogue is at the peak of its development. Digital consoles are very much at the prototype stage."

German recordings have traditionally been characterised by their individual use of reverb and although this applies mainly to the more ethnic music forms these days, I was interested to hear Günther's views on digital versus plate reverb. I noticed a Lexicon 224, and Ursa Major and Quantec. Of these three only the Lexicon is currently house equipment—the Ursa Major belonged to the producer on the session and the Quantec was on approval. Günther is evaluating several devices with an AMS next in line. The studio has a couple of stereo EMT 140s, a 'Gold Foil' 240, and an AKG BX15. "When the Lexicon arrived I deserted the plates altogether for a while, but now I tend to use a mixture of both digital and analogue. Plates often sound better on percussive material, for example."

Outboard gear in the control room includes a comprehensive selection of delays, flangers, parametrics, compressors and expanders from all the leading makes. There is a hire facility which has all the favourite toys should you not find the one you want. The studio itself has a vast selection of instruments including a Steinway-B, Tack piano, Rhodes, RMI keyboard computer, Hohner *Cembalet* and Clavinet D6, string ensemble, ARP synth, marimba, vibes, timpani, percussion and Yamaha and Rogers drums. The studio also sports a bunch of amps including Fender and Marshall. Mics, like outboard gear is the selection one expects, including some valve Neumanns, and a couple of nice big booms for those fat sounding ambient mics on electric guitar and drums (the room has the height!).

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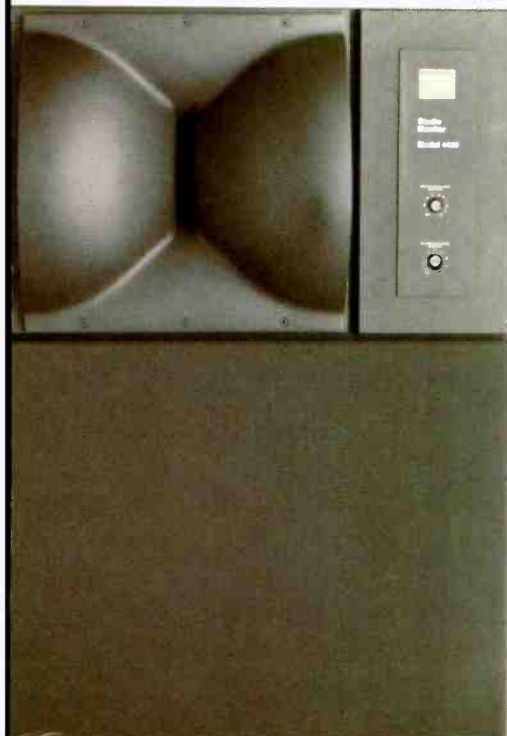
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# MULTITALENTED ASP

Is it possible for a single machine to take over all the functions of a recording studio, sound and music synthesiser, and film-sound editor? The answer is not only yes, it's inevitable, according to the 6-man team that comprises the Digital Audio Project at Lucasfilm, the California studio responsible for the *Star Wars* saga and the *Indiana Jones/Raiders* blockbusters. In fact, they have already built such a machine. The questions that remain now are how to interface it with human beings, and how to sell it to other studios. And they'll have those answers pretty soon.

The Lucasfilm *Audio Signal Processor* has been in operation since April 1982, and has been used, mostly as a sound effects processor, on the hit films *Return of the Jedi* and *Indiana Jones and the Temple of Doom*. When it's all done, completed and becomes commercially available somewhere around the end of 1985, it will combine the functions of a multitrack tape recorder, a mixing console, a sound editing desk, a multitude of signal processors, and a music and voice synthesiser. For those manufacturers and personnel who feel threatened by such a machine, it is only appropriate that the *Audio Signal Processor* is usually referred to by its acronym—the ASP.

The Lucasfilm Digital Audio Project, under the direction of James Anderson ('Andy') Moorer, has been developing the ASP since the early part of 1980. At last year's Digicon conference in Vancouver, Canada, Moorer almost offhandedly announced that the commercial version of the ASP would be ready by Christmas 1984, at a cost of \$750,000. As is common with radically new products, that schedule has not been met, and Moorer's price estimate was way off. Early in 1984, the company decided to delay the release of the system at least a year, because new technologies were becoming available, and Moorer wanted the product to reflect them.

An ordinary hardware company, with a tight delivery schedule to meet, would make such a decision only under extreme duress, and the cost of the new technology and the delay would most likely be passed on as a hefty increase in the price of the finished product. But Lucasfilm is not your ordinary hardware manufacturer—the company's success is hardly dependent on getting the ASP out the door on time; and the new design has a bonus: it's cheaper—much cheaper. The projected price for the basic beast with a single disk drive has been reduced to around \$150,000, 80% lower than first

**Lucasfilm's computer division is dedicated to improving all aspects of film and video production. Paul D Lehrman reports on their latest studio computer with programs for many and varied functions including film sound editing, effects and noise elimination**

announced. It will fit into a standard 19 in rack, standing about 4 ft high.

## Hardware

At the heart of the system is a Motorola 68000 32-bit microprocessor, equipped with 1 Mbyte of main memory, a Winchester hard disk drive, and a high resolution graphics display. This is the 'control' computer which, through a high speed Ethernet, can deal with up to eight digital signal processors (DSPs). Each of these is a custom dual bus 24-bit computer with an instruction set

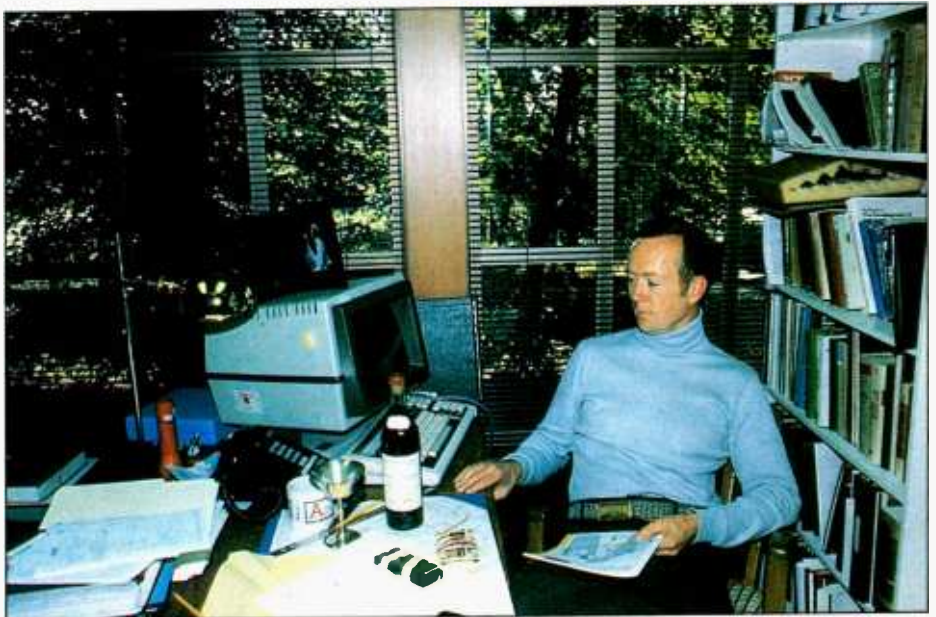
consisting of some 400 commands and an execute time of slightly over 50 ns. Each DSP also has two or more 128 kB memory banks associated with it, up to four of its own hard disk drives, and digital-to-analogue and analogue-to-digital converters.

The original design for the DSPs used Emitter-Coupled Logic (ECL), requiring about 1200 integrated circuits per unit, with another 900 ICs in the controller. But that's about to change. "ECL circuits are fast, power hungry, and expensive," explains Curtis Abbott, one of the original Digital Audio Project team. "We plan to implement the commercial version in TTL (Transistor-Transistor Logic) using new Motorola gate-array VLSIs that are now available. It's more efficient because there's more functionality on each chip. They're like 'custom' chips—they're the closest you can get to designing your own chip without actually building it.

"Six months ago, this would not have been possible, because the technology wasn't available," says Andy Moorer. "It's going to make the unit about 15% slower, but it should bring the cost down by a factor of four or more. Had we stayed the path we were on, we could have had several units out in the field by now but they would have been very expensive."

The four hard disks that can be hooked into each DSP under the current configuration each have a capacity of 350 Mbytes. Each disk can handle

'Andy' Moorer contemplates a design problem





40 min of mono sound, using a 50 kHz sampling rate. In the 6-track format which is standard with 70 mm film, that translates into less than 7 min per disk—and changing a hard disk pack is a little more complex than just flipping floppies. But the limitation is not as severe as it sounds. “We don’t store silence,” says Moorer. “Reel Two of *The Empire Strikes Back* had lots of silence, and didn’t use more than 50 min of individual mono tracks.” In addition, film sound does not normally use a full 20 kHz bandwidth, so the storage time of each disk can be increased somewhat by slowing down the sampling rate, which is done in the software.

Nonetheless, the team is looking at the new 800 Mbyte disks now being delivered by CDC, which can store 100 min of mono sound, and Moorer is considering using optical disks, such as the *OptiNem* made by Shugart, which can store 1.2 Gbytes on a 10 in platter, for archival sound storage.

## Is this trip necessary?

So what does this monster actually do? Being a high-speed, super-powerful dedicated sound processor, it has the potential to accomplish literally anything within the realm of audio. But there have to be interfaces for the human beings who use it, and software to mediate between the operators and the beast. The possibilities are infinite, but Lucasfilm’s resources are not thard as

this may be to believe) so implementations of the ASP have to be handled one at a time, and there are priorities. To see what these priorities are, it’s necessary to step back a little and look at why the project was started in the first place.

Andy Moorer has a wickedly dry sense of humour. He likes to start his public lectures on the ASP with a slide of a Moviola editor and the statement, “Gentlemen, we meet the enemy!” Film sound is an exacting and often frustrating science (*science? Ed*), made the more difficult by the fact that in the vast majority of productions, it takes a backseat to the visuals. A composer (who is usually brought in towards the end of the production schedule) can spend many weeks at home and many days in the 24-track studio getting his music to fit a particular film sequence, only to have the editor at the last minute add or excise or shift around three or 300 frames to change the visual pacing. The sound editors, who have each element of the sound mix—the dialogue, the sound effects, the background sound, and the music—on individual reels of sprocketed magnetic film (‘units’), then have to go back and recut each unit and then realign them. Often as not, by the time they are done, the film editor has made other changes.

“*Return of the Jedi* had 17 sound editors,” says Moorer, “as well as nine assistants, whose jobs consisted of carrying units back and forth and

keeping track of everything.”

Even before the editing process begins, the needs of film sound are extremely complex. A scene may have several tracks of production and replacement dialogue, several tracks of effects and several tracks of music. “A complicated scene can entail as many as 130 separate reels,” Moorer has written. Mixing boards with 72 inputs, run by four to 12 hands, are not uncommon. “Typically, they have no automation, so that level and filter settings must be ‘rehearsed’ like a musical performance,” says Moorer.

Added to all this are the unique skills necessary in such areas as sound-effects production and dialogue replacement, which are arts unto themselves. The actual sound of someone getting punched in the nose, for example, doesn’t translate well on to film tracks, so effects producers typically replace it with a combination of several sounds, like a pistol shot and a watermelon being dropped from a height. Dialogue recorded on a set is typically loaded with all sorts of extraneous noise, while voices in a studio are often lacking in ambience, so someone has to work with these to make them sound as if they’re all coming from the same acoustical environment.

And then there’s the problem of generation noise. In a typical film production, many elements have gone through six generations before they reach the final print.

“What we wish to do here at Lucasfilm,” Moorer says, “is to put a computer in the middle of all this.”

Chief technician Charlie Keagle and a few pieces of ASP



## What it does now

For now, the computer in the middle is being used mostly for audio processing, as a kind of super effects generator. *Indiana Jones* . . . was the first film in which it played a major role. The ASP was responsible for the heart-stopping airplane dives, the extended arrow ‘fly-bys’, the screams of torture victims, and the eerie Bernard Herrmann-esque violin music. The last is among the handful of demonstration programs that Moorer and his crew like to play for visitors. It uses real string sounds as a source, according to Peter Nye, a software engineer who joined the group last year, and lets individual faders on a small outboard panel control pitch, vibrato, reverb, and level. There are two faders remaining on the box, and Nye says that they could easily be programmed for stereo panning and Doppler shift.

Another demo was created by recording ▶

# MULTITALENTED ASP

and storing each of the 88 notes of a grand piano, and then playing them back in a particular order—in this case, the first prelude from the first book of Bach's *Well-Tempered Clavier*. The music is divided into five tracks, and the fader box controls the level of each. (There is also a serious musical mistake in the program—I hope that they straighten it out before they let too many outsiders hear it. . .).

Yet another demo program is the audio 'logo' for the *THX* speaker system—the cinema playback system designed for Lucas by Tomlinson Holman. It starts as an impossibly dense cluster of string-like tones which gradually sorts itself out into a majestic major chord. Around the lab, it's known as 'Deep Note'.

The most impressive *ASP* demo I heard starts with a line of dialogue from one of the *Star Wars* movies. Like most production dialogue, it's full of noise and clutter, and is difficult to understand. Moorer throws a switch, and a digital filter consisting of 256 linearly-spaced 94 Hz-wide bands, cuts in. The noise vanishes. "The algorithm for that one," explains Moorer, "was developed by the army for reducing noise on radio transmissions from the cockpit of an *F-15*. It's like Dolby, but with more bands. The expansion curve we're using gives better suppression on the low end. The gain is continuously variable, which is hard to do in the analogue domain. Dolby introduces a phase shift of about  $\pm 3^\circ$ . There's none here." Which is not to imply that Moorer looks down on Dolby. "We'd like to implement it in the system," he says, "in software. There'd be no need to constantly encode and decode."

## What it will do

Processing, however, is only a small part of what the team has in mind for the *ASP*. Already, there are several sophisticated control systems nearing completion. A sound editing program, with the cute name *EdiSon*, has been written by Alan Marr. It uses a graphics terminal with 1024x800 pixels, and a mouse with three buttons. *EdiSon* works in two parts: first is a sound file editor, which uses icons of scissors, eyeballs, and ears to collect and edit the sounds in the machine's library. A Fast Fourier Transform program, with visual readout, is also available, for getting down to the real nitty-gritty.

The file editor is followed by a cuesheet editor, which uses text and more icons to display individual sounds and place them on the screen according to when they occur, and on which track. The program displays eight tracks on the screen simultaneously, but up to 64 tracks can be dealt with, by scrolling the information horizontally across the screen, like a spreadsheet.

In one corner of the machine room at the Digital Audio Project is the first audio mixing console for the *ASP*, which

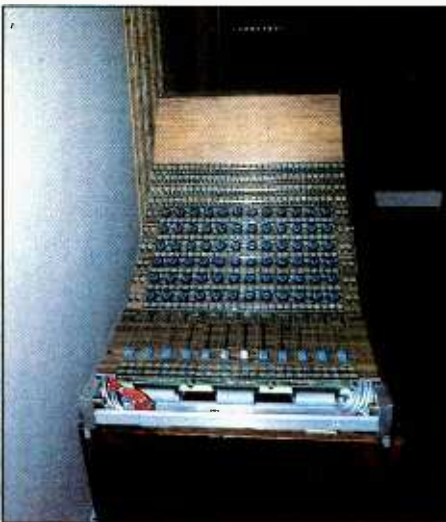
was designed by John Snell. There's nothing particularly unusual about it, until you realise that not only are there no meters, there are also no labels. Of course, that's because every knob and slider is software-assignable, and tiny LED alphanumeric displays are scattered all over the console. It's a prototype, and it is already obsolete, as members of the team work on reducing the number of controls to a bare minimum and letting a touch-sensitive graphics screen handle all of the function selection. "We want to get away from the forest of knobs," explains Peter Nye, "and have the graphics keep changing, so that you are only looking at what you need." One neat trick being considered is to use a half-silvered mirror to reflect the graphic images right on to the knobs themselves, so the mixer never has to look up to find out what it is he's about to adjust.

"For a while," says Nye, "I was working on a mixing station, while Alan was doing an editing station. The distinctions got kind of blurry, but we felt we had to make them so that the folks who are used to the old equipment could use them easily, so we treated them as two separate projects. Besides, mixers and editors are in separate unions." Recently, however, the group changed its collective mind. "We decided after all that it really didn't make sense to separate them," says Nye. "The people in the field that we talked to, think it would save a lot of time to have them together, so we are integrating editing and mixing into one package. Someone, therefore, can be doing an edit, and stop and do noise-reduction or a small mixdown on the cue he's working on."

"One person could do an entire film on the *ASP*," says Moorer, "but that's not necessarily how film people like to work. So two projects that we're looking at are a digital premix station and a full digital mixing theatre."

All of these programs will communicate with the *ASP* via a

John Snell's prototype mixing console



general-purpose control language that Curtis Abbott is developing. The language, written in C, calls up individual 'unit generators', which are packets of microcode in the software that describe sound sources, filters, scores, oscillators, wavetables, and inputs and outputs, and plugs them all together. It can deal with all the *ASP*'s functions, including editing, playback, processing, motion control, etc, and can read the knobs and sliders on whatever control boxes the group comes up with. Much of the work was done while Abbott was at IRCAM, the government-sponsored research facility in Paris. "The language I started with was ridiculous," says Abbott, "but I knew that when I wrote it. I'm working to improve it."

A future application for Abbott's language—one possible 'front end'—may well be a music-composition language. Because the *ASP* is totally software-controlled, any conceivable type of synthesis technique could be used to produce sound. "What's lacking now is a standard-notation graphics package, one that uses musical scores," Nye says. "But we should be able to do it when we're ready."

## What it all means

Andy Moorer hopes that the *ASP* will be the last major piece of audio equipment a studio will ever have to buy. "When they want to do something new," he says, "they don't have to rent a piece of hardware, they just buy a new program. Once the machine is done, we want to become a software house."

In addition, much of the research going on here will have applications elsewhere. Moorer has published an article in the *AES Journal* describing the work he has done in digital equalisation, and the mega-band noise reduction technique he has developed was presented in a paper at the last New York AES convention.

It's important to remember that the Digital Audio Project is but one part of Lucasfilm's computer division, which is dedicated to improving all aspects of film and video production. In addition to the *ASP* team, there is the video editing group, whose first commercial product, *EditDroid*, is being marketed by Convergence Corporation; a graphics division for developing techniques of computerised animation; a games division that is working with Atari; and a laser research group that is working on ways of letting computers 'write' and 'read' images directly to and from film, through bit-mapped graphics.

"If you commit to an all-digital world," says Moorer, "like combining the *EditDroid* and the *ASP*, there is a tremendous speedup in production. There's full random access to every element, and no generation noise. The bottom line for the studios who would use this will be how fast they can kick an episode of *Hardcastle and McCormack* out the door." □



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# IN P E R S P E C T I V E

# IN P E R S P E C T I V E

Comment from Martin Polon, our US columnist

As Flight 22 from London lands at the International Arrivals Building of Los Angeles International Airport, all passengers are herded to the new customs facility. John Smith, stylish and successful rock mixer, moves towards the green lane, having returned from a short trip to London to sweeten a made-for-television movie. Expected within the hour at his company's branch office in Hollywood, he is feeling at the top of his form. At the customs station, he is questioned by an unassuming inspector in baggy clothes. His declaration indicates little cash activity on his trip and John smugly expects no problems. The customs agent asks to see the inside of a grey, padded canvas case in which John's portable computer lives. Spotting the PC, the agent summarily calls for assistance. A senior agent asks John if he has a copy of a Carnet or the Shippers Export Declaration Form. John nervously jokes that he doesn't even have the racing form. Then and there John and his portable PC and his luggage leave the line. John emerges an hour and a half later without his portable PC, the custody of which is in temporary jeopardy and which may later require a sizeable fine to ransom.

Apologies to Graham Greene on several levels aside, the number of audio professionals transporting personal and portable computers has taken a quantum jump. The machines are used by popular groups and recording personnel with several electronic mail services available in the US and the UK. Some of these services offer customised programs for expense and information control while on recording projects and during record production. Many PCs are being used individually in audio to store book-keeping and planning information and to track business plans. In addition, the development of new systems for audio maintenance and process control as well as microprocessor based mixing and recording increasingly provide integration with personal computers. So it has become very natural for the audio traveller (like other business travellers) to carry a portable computer.

Our little airport scenario may be fictional but similar events have occurred according to senior customs officials. The moral of the story may seem to indicate the wisdom of not testing your bad jokes on customs inspectors on returning to or entering the United States; but it has more to do with a worldwide trend in regulating transportation of portable computers and micro-electronics based systems.

These machines have now become targets for an international maze of rules and regulations. This all adds to the lengthy list of problems that face audio travellers. For the he or she who carries a transportable or kneetop computer on international business or has

## Travelling with my Aunt's PC

microprocessor based equipment in the cargo hold, the presence of computer chips brings a new twist; the chills and thrills of international intrigue, customs officers and seizure. Computers and computer-based equipment, it seems, have finally been recognised officially by many countries as either a threat to their national security or as an economic resource to levy duties against; or as potential commodities to be smuggled in or out like untaxed cigarettes, hashish and cured pork sausage.

One government official at the US Department of Commerce, the agency charged with export rule interpretation in the United States, indicated annoyance at the ambiguity of the current situation. Perhaps remembering the potential results of animated dialogues with the press in an election year, he refused to identify himself. From this position of isolation, he opined, "that any user of a personal computer who carries the machine out of this country is asking for big trouble; although someone from abroad can bring it in easily enough.

"Despite the ying and yang pattern of previous enforcement in the US, there are so many mechanisms at work now in the United States and especially in the countries of destination, that you will have to have tremendous luck not to run into misfortune or worse. There are more holes in the system of enforcement than in Swiss cheese . . . going out. But . . . customs agents around the world and in the US await you with open arms upon your return or arrival."

The first area of concern for the audio traveller is getting the portable or computer-based electronics out of the country of residence. Although it is unlikely that a kneetop portable in your carry-on luggage will attract attention on departure, US customs teams conduct spot checks on selected international flights from the various American international airports. Under the current US Government interpretation of export regulations, the international passage of a personal computer or computerised equipment (albeit any computer) requires legal registration. This has to be done via a specific form with customs before leaving the country. Airport customs does not stock the requisite form. It must be obtained separately from the US Department of Commerce.

The second major set of problems will occur upon arrival at your country or countries of destination. On landing, you must deal with the local nation's customs. You must decide whether or not to declare the machine. If you leave the US, the declaration forms have no

validity anywhere else. If you do not declare and are stopped for a spot check, you and/or the computer could be in jeopardy (then or on your exit). For most travellers, the speed and easy convenience of the green lane/red lane system used in the US and by members and affiliated countries of the European Common Market, allows for real ignorance of the rules rather than evasion.

In many of these countries, their restriction on computers, etc, are more economic than geopolitical. Some business travellers in the know do use international freight forwarders or export brokers to prepare the necessary forms and the international 'Carnet' document that allows legal movement with computer electronics. Unfortunately, the Carnet has to be shown on entry and exit from each country visited and requires time consuming stops in the red (declaration) lanes. Compliance becomes an unfortunate burden for the travelling audio professional who is carrying a computer only as personal property to be returned to his or her home at the conclusion of the trip.

Third World countries can be especially taxing on the owner as well as the machine. An importer/exporter of records and cassettes who uses a Tandy 100 in his business for inventory, found Africa to be a place of considerable difficulty. "The machine became an issue while I was being searched by three agents amongst 100 passengers. There was a proper Carnet but I had to 'contribute' vigorously to be rid of the matter without losing the computer. But nobody knew a thing when I tried to protest. However, I was led to understand that my business in the country would not be successful if I persisted!"

Such stories are not unique to computers or Africa amongst travellers. One tired businessman opted that "the 3-2-1 rule (3 in, 2 for customs, 1 left for me; as with Scotch whisky) solves most problems in the Third World but obviously does not work with computers." Problems have occurred in some of the most civilised of countries. Any kind of problem could mean time and connections lost, extra duties or fines, the posting of a large bond or even possible confiscation of the computer or computerised equipment to be held 'safely?' until your departure.

One added problem for the legitimate traveller involves the complication of customs enforcement with 'normal' theft or other loss of a portable computer or other computerised audio hardware. Since most countries in the world, including all of the European Common Market members add duties and/or VAT (Value Added) taxes to the price of these machines when they are sold domestically, their regulations are designed to prevent these units from



# IN PERSPECTIVE IN PERSPECTIVE

entering without the collection of these tariffs. One crusty officer of Her Majesty's Customs in the UK put it thus: "The oldest trick in the book is for travellers to bring something in as though it is for their personal use and leave it or 'lose it'."

World airline travel adds another element of risk to the personal computer equation. The attendants at airport security stations can be confused by their X-ray viewer profiles of a portable computer or related electronics. Often, the presence of batteries and unfamiliar components will cause a lengthy hand search of the traveller and his or her luggage and even the partial disassembly of the machine. Worse still, foreign X-ray machines are not always operated at the low powers found in the US. Add to this the fact that some air carriers have decided that portables are not safe in the cabin (although most American carriers have finally concluded the units are safe). The act of flying with a portable adds new dimensions to the saying 'computer users, like blondes, have more fun'. The worst penalty of all in this situation can find the portable computer assigned to the tender ministrations of the cargo handlers and the aircraft's hold, where it will have the half life of a Ku-Klux Klan member with Mr 'T'.

Even the act of returning to the merciful shores of home does not solve the problem. In the US of A—land of freedom, home of the Brave, Mom and Apple Pie—constitutional protection of PCs is not as simple as it looks. Upon your return or entry, until you physically clear customs, you have much less of the protection you've taken for granted. Confiscation of your machine as part of official detention or seizure policies is not only not out of the question, but can occur for several reasons. One customs old timer opined "if you bring a computer with you, forget the proscuitto ham or anything worse since everything 'could' be seized." Current US enforcement of computer export controls seems to be following a hard line position, with the attitude of 'if we didn't get you on the way out; we'll get you on the way back'. This seems to be dictated in major part by the US Defense Department's concerns.

One answer to all of these world travel problems is to comply with all the regulations, use all of the mechanisms and file all of the forms, here, there and everywhere. Unfortunately, that is far from simple and is often so time consuming as to render the process virtually impossible to complete by departure; especially for last minute trips. It also does not address the jeopardy of customs enforcement in certain parts of the world formerly reserved for 'mad dogs and Englishmen'.

Perhaps it remains for the

manufacturers of portable computers to form a lobbying body to inform authorities worldwide of the innocence of their products. Certainly, the individual traveller cannot fight 'City Hall' on an international basis. These self-same manufacturers have done just that to simplify and protect their large-scale export position under the same regulations for sales outside the country of origin. In the United States, only world travellers are troubled with most of these concerns. In Europe, however, national borders are crossed as

frequently as state lines are in America. The market for computers in audio is forecast to grow at a prodigious pace all over the world. This is not to suggest that computer equipped audio workers (or anyone else for that matter) should leave their machines at home. But knowledge of the potentials for difficulty could make it easier in the future for anyone travelling with a computer. It's time to make it safer for portable computer owners than it was for refugees travelling fourth class on the Albanian national railways. □

## multimix

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# BUSINESS BUSINESS



Barry Fox investigates the facts behind the industry news

## Multichannel soundtrack

Dolby Labs has been keeping very quiet about its plans for a discrete multichannel optical film soundtrack. The gaff, however, is blown in a recent patent application filed right across Europe. Whereas American patent applications remain secret for years, European filings are promptly published. Inventors Ioan Allen and Craig Todd filed at the American Patent Office in March 1983 and in Europe a year later. Full details of their research work are now published in European application 119 101.

A Dolby stereo variable area (SVA) track crams two bilateral tracks, each 0.033 in wide and separated by a guard band of 0.01 in, into the 0.076 in mono track width. To get surround sound, and hold dialogue firm at centre front, the left, centre, right and surround channels are matrixed, using Todd's MP encoding. This spreads the centre channel in phase and 3 dB down between both tracks, with the surround also spread and 3 dB down, but out of phase between tracks ( $-90^\circ$  in the left and  $+90^\circ$  in the right). Logic, namely the Tate chip, improves separation but can never be as good as discrete recording for all kinds of signals. Hence the continued use of 6-track magnetic stripe on 70 mm prints.

Over recent years there have been plans for a new multitrack optical format, but it has not been compatible with Dolby SVA. In practice compatibility is now essential, because the industry is not going to embrace a new standard. The Dolby patent claims the idea of a 4- or 6-track optical format which is compatible with standard 2-track SVA. It's a long document, with pages of drawings, but the basic idea is simple.

Instead of matrixing the information electrically, as in a 4-2-4 chain, it is matrixed optically by dimension.

For a 6-track optical recording, three tracks are squeezed into the space normally taken by one stereo track. For the left channel, one of the three tracks carries only left channel information. Another track carries in-phase centre channel information and the third track carries out-of-phase surround information. The same happens for the right channel, with one track carrying pure right information, another carrying in-phase centre and the third carrying out-of-phase surround.

The crux of the idea is that the centre and surround tracks are 0.7 times the width of the pure left and right tracks. So the summed energy is compatible with a 4-2-4 matrix which electrically combines 0.7 centre and 0.7 surround with unity left or right. So the optically encoded track gives discrete 6-track information when read with 6-track light

cells, stereo when read with a 2-track light cell and mono when read with a single cell. Provided the system is set up accurately there can be clean separation between the discrete tracks but the film print is compatible with all existing cinema equipment. Obviously set up is the key factor and the patent goes on to discuss scanning laser techniques and buzz track line up tests.

The same technique can be used for 4-track recording, with just two tracks occupying the space normally used for each half of the stereo pair. In this case the signal sent to the four tracks is matrixed so that together they carry the same information as the normal stereo pair of a Dolby SVA print. With discrete replay, separation is improved. With normal replay there's normal stereo, or mono.

## A change of heart

CBS has been synonymous with close-miked multitrack: even when the company books Abbey Road Number One for an orchestral recording, it has been likely to shove microphones up the bells and into the bellies of anything in sight, record dry on 24 tracks and then add some unnatural ambience. All that, it seems, is changing. CBS has been recording the Berlin Philharmonic, with Daniel Barenboim, at the Philharmonie Hall in Berlin, using a very simple mic technique.

The Philharmonie, a beautiful modern hall rather like the Royal Festival Hall in London, has a good natural acoustic. I have several times been to concerts there and it would have been a pity to record there with close mics. The latest CBS batch (Schubert 2nd, 3rd, 5th and 8th plus Berlioz *Fantastique*) were made with a crossed pair in the front row and just a touch of lift on the woodwinds, with mix straight down to stereo on a much-modified Sony PCM system.

Watch out for releases early next year on the CBS Masterworks label. Watch out also for much political infighting inside CBS. There are more than a few people in the company who are desperately hoping that the recordings will get bad reviews.

## CD mono

Remember the BBC discovery that some compact disc players sound odd in mono? To recap briefly, it is because some players do not use a buffer to put the left and right channels back into step at the output. Instead the player squirts out chunks of the left and right channels; in sequence. Remember that the left and right channels of information have to be interleaved in the serial data stream coming off disc. Think of it as a hose-pipe carrying globs of oil, then water, then oil, then water and so on.

They emerge from a single nozzle as a rapid sequence, not as parallel jets of oil and water.

Compact disc players with a buffer put the left and right channel chunks back into synchronism. Un-buffered players create a lag of  $11.34 \mu\text{s}$  between left and right channels. In stereo this creates a slight phase shift, mainly at high frequencies. In mono there is inevitably some HF cancellation. Most people who buy compact disc players don't play them in mono. The BBC, however, has to worry about mono compatibility for its AM transmissions. Hence the BBC discovery of the  $11.34 \mu\text{s}$  lag.

There is in fact another very good reason for listening to compact discs in mono. If the digital master tape has been sourced from an analogue original, then any mis-match on azimuth between that analogue tape and the playback machine used for dubbing it on to digital cassette, will irrevocably lock phase errors on to the digital master. These errors will be accurately conveyed all the way down the chain on to the finished product CD. In some cases the phase errors from sloppy azimuth will be far more serious than those caused by the lag of an unbuffered player. If you don't believe me try borrowing a copy of the Taco RCA CD *After Eight*. Listen in stereo, then switch to mono. Roll up, roll up, hear the top end collapse before your very ears.

## Australians go MAC

Although the significance was missed by many, the really big news at IBC was the Australian broadcasters' decision to go MAC, with Dolby's Delta Link digital sound, rather than the packet switched PCM recommended by the EBU, and chosen by Britain. The Dolby delta system was originally developed for 8 mm video, but not adopted as the standard. It was then modified for DBS. Whereas PCM coding relies on digital words of fixed length, delta modulation uses steps of variable length. The big bonus is that it uses around one third the number of bits needed for PCM; per channel between 0.2 and 0.3 Mbits/s delta compared to 1 Mbit for PCM. The system is also far more resistant to errors. As the signal is degraded, for instance by rain or poor dish aerial alignment, the delta system produces sound like a gramophone with a fluffy stylus whereas a PCM system just cracks up.

I noted with interest that at IBC the excellent British Aerospace demonstration of DBS reception under difficult conditions was for pictures only. Also, although the BBC talks only about using PCM for its new terrestrial stereo TV, Kingswood Warren is looking again at delta mod. □



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# BASF



# A-1 AUDIO'S TWO-TRUCK TOUR

**R**eading stories about the technical and operational exploits of the crews that support the superstar music groups is always informative. According to conventional wisdom, articles in magazines and journals are the best source for keeping up with the practical applications of new products, and the development of innovative techniques that have been tested under actual operating conditions. Likewise, for the owner and user of more modest sound-reinforcement systems, an editorial glimpse of state-of-the-art installations provides a goal toward which to shoot when the financial flow reaches the point where investing large sums of money in an audio system is feasible.

Studying expensive system layouts, however, doesn't always provide information that is relevant to smaller setups. In fact, regardless of available cash, massive systems are just not right for every application. Because of varying factors such as the size of the venue, the intended decibel level of the show's musical content, and other similar considerations, groups relatively unconcerned about cost may find that smaller systems are actually better for them and their audiences. Yet ironically, the sound quality must be as good as any spare-no-expense system. Accurate sound reproduction at a concert or live show is essential for favourable reviews and repeat engagements. So given this 'Catch-22' situation, what's the answer?

California-based A-1 Audio Systems experienced this dilemma first hand, especially with regard to how it affected some of their regular clients. Many of the production-oriented artists—such as Shirley MacLaine, Engelbert Humperdinck, Paul Anka, Ann-Margret, etc—who were scheduled to take their shows on the road, found that they really didn't need scores of speaker cabinets and racks of amplifiers. They have reinforcement needs that call for ample power and accurate, even distribution throughout large venues; the system has, however, to be absolutely quiet and, for the most part, inconspicuous when used in smaller, more intimate atmospheres like nightclubs and show rooms, where

## Bob Anthony looks at the application of A-1 Audio's compact sound reinforcement system

house systems aren't always adequate.

Making use of their extensive research, development and manufacturing facilities (see June 1984 issue for a look at A-1's 20,000 ft<sup>2</sup> Los Angeles headquarters), A-1 Audio has developed a compact sound-reinforcement system that is easily capable of filling a 10,000 seat auditorium, (20,000 seat rooms have been covered with excellent results), yet can be packed, along with flying trusses and hoists, stage-production gear (risers, sets, rain curtain, dry-ice machines, etc), all the band equipment, a complete over-stage lighting system, spots, and a variety of merchandising items into two 18-wheel tractor-trailer trucks. "This is a completely self-contained touring system

## Background on A-1 Audio

Founded only 14 years ago in 1970 by Al Siniscal, A-1 Audio Systems today maintains offices and supply warehouses in four cities—Los Angeles (headquarters); Atlantic City, New Jersey; Las Vegas, Nevada; and the Reno/Lake Tahoe, Nevada area. In addition to music industry clients such as those mentioned in the article, the company provides custom audio systems to a variety of other businesses, which comprise a large percentage of the principal hotels and casinos in international live entertainment capitals like Las Vegas, the Bahamas, Mexico City, Atlantic City, etc; and complex audio/visual interfacing required to put on successful corporate/industrial presentations for clients like IBM, Yamaha, Cadillac, Mattel, etc. **A-1 Audio, 6322 De Longpre Avenue, Hollywood, CA 90028. Tel: (213) 465-1101.**

that is designed to be failsafe, and almost repair itself in the event that some minor breakdown does occur," says veteran sound engineer Al Siniscal, founder and president of A-1 Audio. "We call it a contemporary-style show system, which means it can travel with any artist who has sets, scenery, maybe some lasers or projectors or whatever. Otherwise, we could move the audio gear by itself in just one truck. The number of vehicles depends on how much production equipment the act wants to take around."

This compactness by no means indicates that the components are compromised in any way. The same bass bins, mid and high frequency horn cabinets, amplifiers, cabling methods and so on are actually the prime building blocks of A-1's larger, world class systems which have been sent on the road with headliners like Frank Sinatra, Barry Manilow and the Doobie Bros.

"Our design philosophy is to produce a highly efficient hornloaded sound system as opposed to one built around the bass-reflex concept," explains Al Siniscal. "That's one reason why we can get a lot of sound for the relatively few loudspeakers in our typical VIP stacks. They are big cabinets, but they're very loud, clean and accurate."

According to Siniscal (who is a registered electrical engineer in the state of California and has been a prime mover behind the designs of A-1's entire product line), a large compression driver and a radial horn provide more output (greater dB SPL) than a cone loudspeaker mounted in a baffle. A quick glance at the sensitivity of one of these units as listed in any JBL, Gauss or Altec catalogue will verify this statement immediately. A-1 Audio applies that fact to their advantage by manufacturing horn-loaded bass cabinets. "Some people prefer non-horn-loaded systems, because they're smaller," he concedes, "but the problem remains that you have to employ three or four of the smaller boxes to compensate for the efficiency you lose every time you don't use a horn."

The typical two truck audio system is composed of eight sets of two cabinets (a bass bin and a smaller second cabinet with the high- and mid-frequency components) arranged in clusters of four cabinets each. The two outside boxes are identical bass bins that stand about 7 ft high. The centre column comprises the two upper range cabinets stacked one on top of the other to approximate the same height as the two outside columns.

Generally, only four clusters are sent out with every tour, and they literally go on and off the truck ready to fly. A set of four cabinets is assembled into a cluster formation at the shop, and left that way for the duration of the tour. The two bass boxes and the top high/mid cabinet (centre stack) are stationary. The lower (location-wise) high/mid cabinet may be angled up or down for proper sound coverage once the system is brought into the given hall. Each cluster displays about a 90° dispersion pattern so that four of them in a semi-circle can easily cover the audience area of an arena.

Permanently affixed to the top of every cluster is a truss bar, and underneath are fastened large, heavy-duty castors. When the sets of cabinets are rolled off

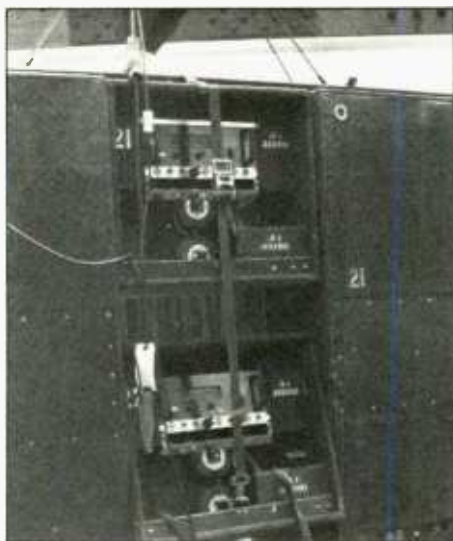


the truck, the crew simply roll them into the hall, hook them to the chain-hoists, and raise them into place.

Power amplifiers (BGW 750s), too, are built into the clusters for several reasons. The short speaker leads produce a high damping factor, which in turn provides clean, accurate sound output. In the event that one amp should malfunction, the affected speaker(s) can be patched in seconds to another amp channel via a short jump cable. But most importantly, because the amps are never disconnected for transporting, the chance of misconnection during setup is virtually eliminated.

The only connections (per cluster) that need to be made on site are the AC power cable, which plugs into one of two AC bayonet-type receptacles on the back of the central stack (one cable powers all the amplifiers); and a single audio cable that contains 11 pairs of lines assigned thus—1, 4, and 7: low, mid and high frequency signals respectively designated as Zone 1 and equalised for short throw, or the front floor area of the arena; 2, 5, and 8: low, mid and high frequency signals respectively, designated as Zone 2 and equalised for long throw, or the seats in the back central portion of the audience; 3, 6, and 9: low, mid, and high frequency signals respectively, designated as Zone 3 and equalised for the audience on either side of the stage; 10 is a composite or full range channel (low, mid and high frequencies) available for a rear fill system located in the back of the venue; 11 is a spare line.

One 11-pair VIP cable goes up to the first cluster, where a splitter box and a shorter 11-pair jump cable sends the audio to the adjacent set of cabinets. This process may be repeated to tie all the flown clusters together or individual cables can be run up from the ground. Because there are essentially four separate feeds in the snake any problems like hum, buzz or a dead line can be remedied by switching to another zone. A 3-way switch on the back of the cabinets selects which set of lines is 'hot' for a particular amp/speaker combination. Of course, the most important features of this arrangement are speed (all the amps and speakers in



VIP centre cluster—rear view (left) shows amp placement and tilting of HF boxes



the entire cluster are connected at one time), and the fact that the audio feeds cannot be attached incorrectly during a frenzied setup, because the 11-pair cable may be plugged in only one way. "Most of the other audio companies strap and unstrap their boxes for every gig," says Al Siniscal. "When we go into a hall or showroom, we just put the hook from the motor on the hook from the truss bar, and up goes the system. The multi-paired VIP cable and AC cables take about 2 s to plug in, and there is no speaker cabling to worry about, because it's never unplugged in the first place."

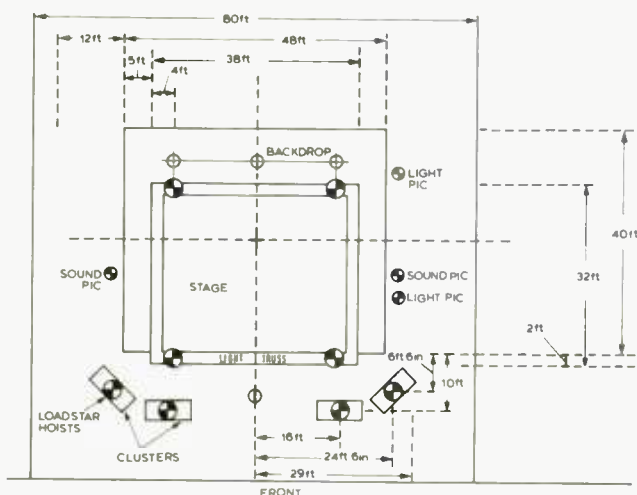
## House console

The house console, too, has been modified to save time during move-in. A-1's chief of maintenance and fabrication Lou Mannick, in association with Al Siniscal designed and built a hard-shell travelling case/stand for the Yamaha *PM-2000* consoles that are part of these sound reinforcement systems. Two double-action, off-road automobile shock absorbers permanently attach the board to the custom built case, which also supports the mixing desk at the show site. Mounted on either end of the console, the two shocks neutralise any

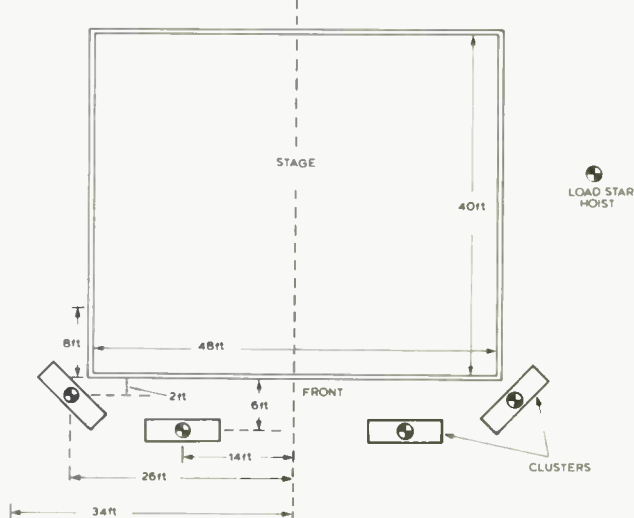
severe jolts during transit when the console is in the vertical position (the back is facing down) inside the case. With the case cover removed, the mixing board easily swings into the horizontal position for use by the engineer.

Extra space at the bottom of the case allows the cables to stay plugged in when the console is rotated vertically for travel. The input cables are all on pigtail connectors, or 'squids', which remain patched at all times and simply connect to the main snake lines during installation using military-type half turn screw connectors with gold flashed pins. Needless to say, the packing time and patching errors are reduced drastically (about 3 min to clear all the cables and fold up the console). "The *PM-2000* is a heavy board," says Siniscal, "and normally it's very difficult to get four busy stage hands during load-in to set up the console in the middle of the arena somewhere. You get two, and then one disappears while you're trying to find a third guy. That kind of foolishness wastes time and money. By using our case, two guys can lift off the lid, and just flip open the board with all the wiring ready to go. And the case becomes the stand—all in less than 4 minutes maximum."

DIAGRAM OF HANGING POINTS FOR CLUSTERS ABOVE STAGE AREA



WAYNE NEWTON SHOW 1983 - ARENA FLYING POINTS



# A-1 AUDIO'S TWO-TRUCK TOUR

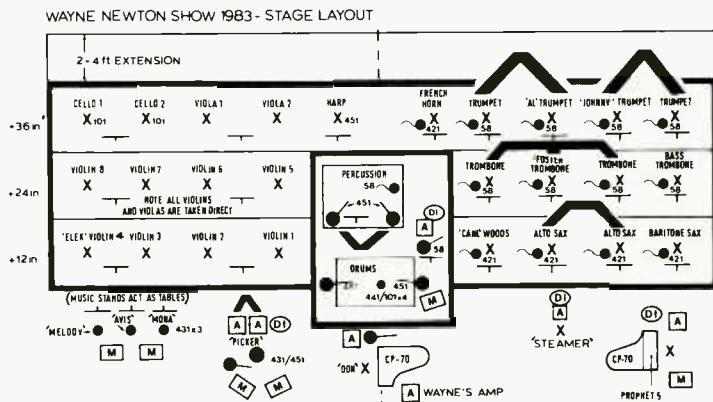
Jim Root, production manager and house audio engineer for Flying Eagle Productions (singer Wayne Newton's company), has been working with A-1's two-truck system for 10 years. Typical audience sizes range anywhere from 2,700 to 15,000 people, and the 4-cluster system, according to Root, has been more than sufficient in all applications. "Our normal load-in time is scheduled for 10 am, and we've always been set up and ready to go before the 4 hr union minimum is done at 2 pm. I'm usually ready to do a show by 1.30 in the afternoon. We save the promoters tons of money."

The audio crew, which is certainly not large, comprises only Root (production manager/house audio mixer), Michael Martin (monitor mixer/chief of the audio crew), and two assistants, Connie Fernstrom and Alan Richardson. At the site, the regular crew is augmented by two union rigging people. Two lighting men and two stage technicians complete the entire Flying Eagle road staff, not counting musicians and Newton himself. "The costs of touring keeps going up, and in order to keep costs down, we simplify everything so the artist can travel with a smaller crew. Most importantly, we don't need to have as many people from the hall, which lowers the stage hand bill. So many times clients argue about what the costs should be per night on a show. Yes, A-1 might charge \$500 more a night for the system but by making the system more efficient and easier to set up, we save them three times that in stage hand costs per night."

## Truck packing

Part of the time saving effort is dependent upon how the trucks are loaded and unloaded each night. Of the two, one is designated as the lighting truck and the other the audio truck. For those uninformed about trucking in general, the 10x7 ft area in the upper nose of the tractor—the first 10 ft of a tractor trailer that sits on the tractor rig, or what truckers refer to as the 'fifth wheel' is called the 'dance floor.' On the dance floor of the lighting truck are the stage risers. The lighting system follows, with all the rigging motors for sound, and the power distribution for both sound and lighting loaded last. That way the first thing to come off the truck is the power distribution systems and the rigging gear, so it can be up in the air by the time the sound equipment comes off the other truck. "Actually," explains Root, "the sound equipment (cabinets) does not necessarily have to come off next, and could come off last."

The second truck transports the audio



### THE WAYNE NEWTON AGGREGATION

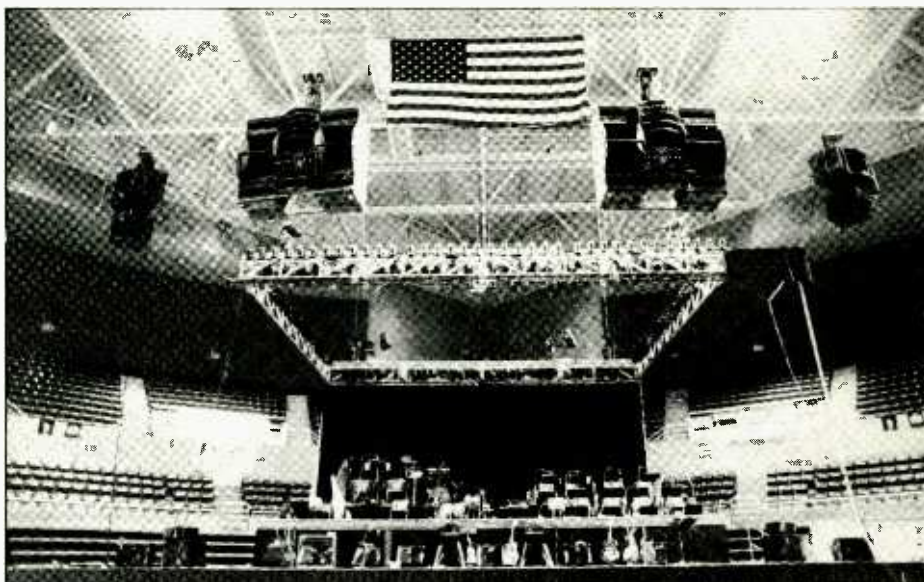
Musical director: Don Vincent  
Guitar, banjo, vocals: Mike 'Picker' Martsoff  
Lead guitar: John 'Steamer' Adams  
Percussion: Walfredo De Los Reyes  
Lead trumpet: Al Longo  
Trumpet: John Madrid  
Bass: Frank Fabio  
Drummer: Raphael Erardy  
Lead trombone: Foster Wilson  
Lead Saxophone: Carl Hosbond  
Harpist: Kimberly Sullivan  
French horn: Elizabeth Smith  
Synthesiser: Pat Caddick  
Lead violin: Elek Bacsik

KEY

- Mic stand
- Boom
- Goose 18 in
- Music stand
- Guitar amp
- Monitor speaker
- Direct box
- Player position

### MICROPHONES

Sennheiser MD421, MD431, MD441  
AKG C451  
Shure SM58  
Countryman 101  
Note: Monitor mix position is offstage right and occupies a 12 x 8 ft area



Wayne Newton Show stage layout with flown VIPs and stage and lighting trusses

gear with the band equipment stored on the dance floor. The house boards and related outboard gear get packed next, with the house speakers holding those components tightly in the trailer. Last are the stage or monitor speakers, such as floor monitors, side stage monitors and occasionally front fills. The production oriented components, such as rain curtain, dry ice machines, projectors lasers, and merchandising items, etc, are packed in their own road cases, which 'fill in the cracks', so to speak, to make a very snug, yet compact, touring package.

So for the artist or act that finds they don't need the sometimes overpowering prestige of a massive sound system, smaller, more efficient systems are possible that can save time and money during installation and possibly the ears of the audience who would otherwise be blasted out of a smaller venue with too many speakers and too many watts of power. □


## Flying Eagle production crew

**Audio:** Jim Root—production director/ chief engineer/house engineer; Michael Martin—chief of the audio crew/monitor mixer; Connie Fernstrom—assistant to Martin (A-1 employee); Alan Richardson—assistant to Fernstrom (A-1 employee).

**Stage technicians:** Leigh Parsons—stage manager; Mark Barbutti. (Except for Connie and Alan, all the rest are Flying Eagle employees.)

**Lighting:** Joe Hopkins—lighting director; Doug Gentile—assistant to Hopkins. (They handle all the lighting, including the Pan-spots and Morpheus lights. With the addition of two union riggers at the show site, the typical set-up time is 3½ hr for a 15,000 seat arena.)





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# INSIGHTS

# INSIGHTS

Recording industry observations by Richard Elen

## Music technology

A friend of mine runs an outfit called ESSP (Electronic Synthesizer Sound Projects) which specialises in supplying information on electronic instruments, and music using such instruments. When he comes over to visit, I expect something unusual.

Recently he brought along the usual bag full of unusual records and the odd compact disc. First thing I came across was the new Frankie Goes To Hollywood double album, *Pleasure Dome*. I was not about to buy this album, because it was due out on CD before Christmas and I do my best to avoid buying black vinyl unless there's no other way to get the music. It also happens that Island/ZTT plan to do something rather sensible—if unusual—with the album.

*Pleasure Dome* is a double album, which means that there could be up to 80 minutes of music on the album. In fact, this isn't the case: it's more like 60. But being about an hour means that it will reasonably transfer to a single compact disc instead of the rather wasteful and unnecessary two. The result is that this bound-to-be-best-selling album will be about the same price whether you buy it on little silver plastic things or wobbly old 12 in vinyl—only the pictures will be smaller in the former case. Good for them—I'll wait until they've done it.

In fact, you can get as much as about 80 minutes on a CD—in other words, a long double album's worth—the only limitation is that nobody yet makes an 80 min U-matic cassette for the 1610 master (hint!). (75 min from Sony soon—Ed.)

The advent of DASH machines will, of course, change all that: the 7½ in/s DASH format will accommodate virtually a full-length feature film soundtrack on one reel. But until then, 60-odd minutes is the CD limit for all practical purposes.

## The noise of art

Producer of Frankie Goes to Hollywood, Trevor Horn (also formerly of Yes among other things), has his own project, Art of Noise. I have the first Art of Noise 12 in single (or EP, or whatever you want to call a 12 in 45 rev/min thing with a difficult-to-count number of tracks). It's called *Into Battle with the Art of Noise* and is quite fascinating, especially if you like Fairlights and most of the other accoutrements of modern music technology. It, like most Zang Tumb Tuum records, has a cover embellished with a fair number of curious wordy statements which may or may not be of serious intent.

So, had my friend brought the new Art of Noise album over in his collection? Yes, he... no he hadn't. I picked up a 12 in cover which looked suspiciously like another in ZTT's Incidental Series, to wit, the album in question. I should

have looked harder. It indeed looked suspicious, but ZTT's or Trevor Horn's it wasn't.

On closer examination it turned out to be a 12 in single (or EP etc, etc) calling itself *Into Trouble with the Noise of Art*. By the looks of things, someone certainly is going to get into trouble with the Art of Horn. The 'Noise of Art' 12 in has a cover which is most definitely a take-off of most of the things that ZTT has turned out. There are the slightly odd titles, and the weird writings on the back.

It's on an almost-familiar record label, too: YYY (Ying Yang Yumm) Records, except they aren't in London's Basing Street, they are in Hemel Hempstead, Hertfordshire. And at the top of the rear cover are words which look suspiciously like they came from the Oxford English Dictionary:

'pre'tentious (-shus) *a* (Of person, book, speech, record, etc) making claim to great merit or importance; hence -LY *adv.*, -NESS *n.* (f. *F* *pretentieux* (as prec.; see -IOUS))

Oops. Has Trevor Horn seen this? Among other graffiti, the record indicates that it is dedicated to one Mrs Ethel Smith of Croydon. Hmmm...

I was obviously curious to listen to this piece of plastic, and lo and behold, it is exactly what one might have expected: the title track at least is a rather brilliant series of musical puns and jokes (some obvious, some less so), including material which is very much *a la mode d'Horn*. By the sound of it, it sails close enough to the wind to be only just on the OK side of Mr Horn's favourite musicologist. It's reminiscent both of Art of Noise and FGTH, and even includes a little sampled sound which was almost certainly sucked in from the 'Into Battle' disc. It's immense fun, and what is more, it is exceptionally well executed. I just hope Mr Horn has a good sense of humour.

What makes this record even more interesting is that it isn't done on a Fairlight with Page R: instead, it's performed on a little sound-sampling and sequencing card which stuffs into your Apple (or Apple-clone) computer and costs a mere £250. That's pretty hard to believe, and had I not heard of the card before—Mike Beecher discussed it in September's *Studio Sound*—I wouldn't have believed it either.

The card in question is the Greengate Electronics DS3, and according to the record cover, *everything* was done on it, by a remarkably computer-literate band by the name of Mainframe. *The Noise of Art* is basically a demo disc for the DS3 system, available by mail order.

There is now more software available for the system than there was when Mike Beecher wrote about it, and MIDI interfacing is due soon, along with other software updates which will offer even more possibilities. In the meantime, get

hold of the record one way or another and be impressed.

## Playing with DS3

Having heard such a great deal about the Greengate Electronics sequencing and sampling card DS3, I was unexpectedly able to have a play with one at Terry Lloyd's Computer Music Studios in London, where the DS3 was installed on an Apple-like computer.

In fact, it wasn't quite an Apple: it was a Taiwanese nearly-Apple called a Unitron 2200, which happens to be exactly the same machine as I use. Unfortunately, the DS3 seems to have a couple of complaints. One appears to be to do with the alphanumeric keyboard, which on a 2200 is quite sophisticated, with auto-repeat and n-key rollover. This means that one of the nice things you can do with the DS3 software—starting several sequences off at once by pressing the Control key plus some of the number keys under which sequences are stored—doesn't work, you only get the first one. This is hardly Greengate's fault, of course, but I am hoping that a little mod to the Unitron keyboard will put a stop to that.

There are some other things which are *not* Unitron's fault, however. For one thing, the card is slot-dependent. It has to sit in Apple slot 5.

Slot-dependent Apple add-ons tend to leave one with a certain anxiety. Over the years that Apples have been around, a standard protocol as regards what-goes-in-where in the Apple has developed. If you run CPM on the thing, you will tend to have an extra 16 K memory in Slot 0 (the 'language card'); a parallel printer card in Slot 1, serial (communications) card in Slot 2, 80-column video card in Slot 3, the first two disk drives in Slot 6, and a PAL colour card (if you live in Europe and like colour pictures) in Slot 7.

With so many slots spoken for, it makes sense for new cards to be as flexible as possible as far as where you put them is concerned, and this is exactly what most people do. If you have a Unitron, you get especially worried about slot-dependent devices, because many of the above assignments are *hard-wired* parts of the main board, and aren't in slots at all. Greengate have chosen one of the less-likely-to-be-used slots, but it is still a pity that there isn't a menu option offering the chance to change it. To be fair, the manual says that the system can be supplied for a different slot, but that isn't quite the same thing.

Another problem seems to be that the software crashes rather easily. This may well be due to my being unused to using the thing, of course, but it had me a bit worried.

Finally, the option to play a sequence takes you through a set of questions and answers with defaults: you can just press



# INSIGHTS

# INSIGHTS

the Return key and it will select the bracketed default. One of these questions asks you if you want to save a sequence or group of sequences, and under certain circumstances this can default to 'yes'—and given the filename of a real sequence file on the disc, you can merrily go and over-write a sequence file with a load of nothing. I know—I did it.

To be fair, though, I don't regard these things as particularly serious. A great deal of work has gone into the DS3 system, and you can't expect everything to be perfect on a brand new product that costs so little. In addition, Greengate are upgrading their software all the time, so these little quirks will probably have disappeared by the time I see a DS3 again—and this may be a few weeks away, as the company has been flooded out with orders for the system.

I still can't work out how they can store so many sound samples in 64 K of memory, with a good 15 kHz bandwidth.

## Apple MIDI

Apples seem to be pretty common as the basis of music systems. It's hardly surprising, as they are excellent machines with a lot of flexibility. Apart from the DS3, the Decillionix DX1 (a bit like the DS3, but monophonic and with less audio bandwidth) and the alphaSyntauri system, there are synths like the Passport Designs system. Passport also make a MIDI card, which is rather impossible to get hold of here in the UK.

This is a pity, because I came across some rather marvellous software that uses an Apple MIDI card, while in the States for the recent AES Convention. I went to a concert at the New York University School of Music, given by the local Syntauri Users' group.

At the concert I was introduced to Joy Weigel of Mimetics Corporation, and she gave me a couple of disks which they have developed which use a MIDI Apple card to talk to a Yamaha DX-7. As there are loads of people with DX-7s these days and a goodly number of Apples, too, they should do very well with these two programs.

Called *Data 7* and *Performance 7*, the two program suites use the Apple to store and manipulate DX-7 sounds via the MIDI interface. *Data 7* allows you to catalogue DX-7 sounds on-screen (rather than in that little window in the machine), and most excitingly, lets you develop new sounds on-screen with three pages of data displayed in a really accessible form, which makes modification of voice parameters really easy. In addition, you get the ability to throw sounds at the DX-7's memory in a couple of seconds.

*Performance 7* on the other hand is specifically designed to give you access to 288 DX-7 voices instantaneously, a great idea for live performance. You can also swap sounds around in the banks so that you can put them in sensible places. Each bank can be catalogued on-screen, too.

Another thing that came out of the NYU concert was the fact that I obtained some remarkable graphics

software for the Apple. A gentleman by the name of Don Slepian was doing marvellous visual accompaniments to the music with a homebrew video synthesiser which appeared to combine about four different systems, one of which was a heavily-modified Apple running some amazing pattern-generation software.

The software turned out to be a *Fire Organ*, a demo disk for a graphics system called Cee-Mac, from a company called Vagabondo Enterprises, configured as about 30 or so 'visual scores' deliberately designed to go with music. The disk is self-documenting and includes notes on the scores by their composers. And it's *fast*. I thought this was due to Don's accelerated Apple, but on getting the disk home, it seems to run virtually as fast on my machine. It's very impressive, especially in colour.

Don Slepian also provided one of the high points of the concert, when he left his video machinery to do an improvisatory set on a heavily-modified little Casio keyboard. The poor little Casio had had a perspex box tacked on the back with a remarkable number of controls which gave things like *n* types of fuzz, pitchbend, something akin to a demented arpeggiator, and a good deal else which would be impossible to describe. □

## Further information

ESSP (Electronic Synthesiser Sound Projects), The Sound House, PO Box 37b, East Molesey, Surrey KT8 9JB, UK. Tel: 01-979 9997.

*Into Battle with the Art of Noise*, ZTT Records, ZTIS 100.

*Who's Afraid of the Art of Noise*, ZTT Records, ZTTIQ2.

*Into Trouble with the Noise of Art*, YYY Records, YYY001, 24 Missden Drive, Hemel Hempstead, Hertfordshire HP3 8QR, UK. Tel: 0442 3496.

DS3 Apple-based sound-sampling and sequencing system by Greengate Electronics available from dealers.

*Data 7* and *Performance 7*, DX-7 programs for the Apple, Mimetics Corporation, PO Box 60238, STA 'A', Palo Alto, CA 94306, USA. Tel: (408) 741-0117.

Don Slepian, Music Video Services, PO Box 836, Edison, NJ 08818, USA. Tel: (201) 572-5088.

*Fire Organ*, Cee-Mac graphics demo disk for the Apple, Vagabondo Enterprises, Tel: (408) 662-0422 (USA).

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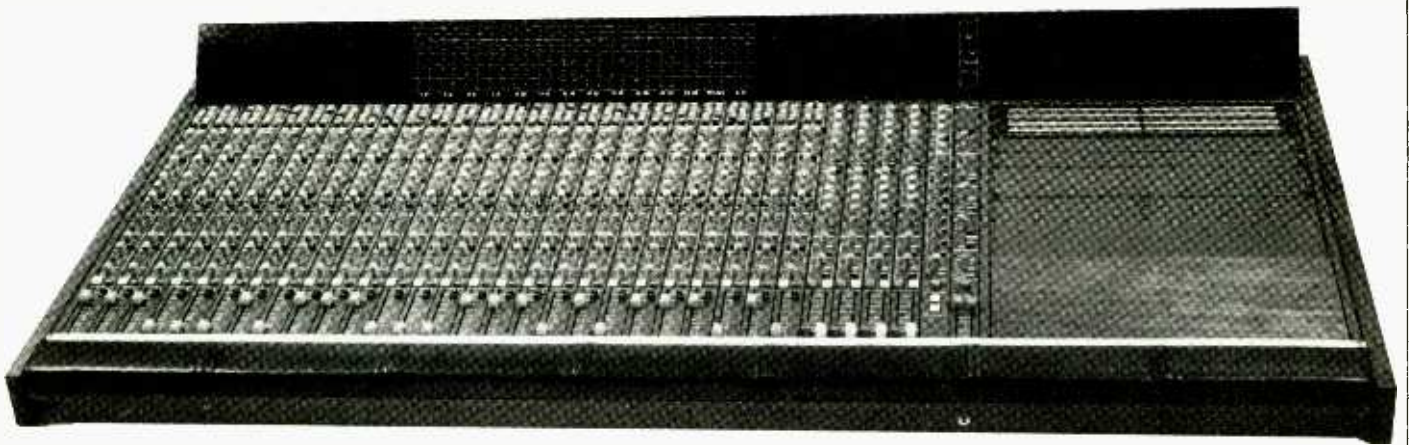
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# REVIEW REVIEW

Hugh Ford reviews a mixing console



# TAC MATCHLESS

**A**s standard the *Matchless* is a 26/24/8/2 in-line desk having eight auxiliary sends and returns. The mixer is based on four types of module: input/outputs, sub group/auxiliary sends, auxiliary master, and master monitor.

The construction is based on a heavy duty welded steel frame of box sections to which are welded the steel front, back and sides, etc. The modules plug into printed circuit connectors on a mother board in the base with some modules also having flying leads fitted with DIL and other connectors. A rack mounting power supply is separate and fixes to the desk with locking connectors, thus eliminating any AC signals from the desk.

The sides of the desk have a smart wooden trim with a leather arm rest hinging at the front. To the rear the metering bridge with its 28 bargraph meters and an annunciator panel, hinges backwards and is finished in dark perspex. These are normally secured by two screws each.

Modules are put into the frame by hinging back the meter bridge and the arm rest. Within the frame the rear of the modules is located by two pins and no further fixing is necessary.

## MANUFACTURER'S SPECIFICATION

**Mic input:** equivalent input noise with 200  $\Omega$  source, -126 dBV DIN; maximum input level without pad +1 dBV; CMRR at 40 dB gain typically better than 60 dBm 20 Hz to 20 kHz.  
**Line input:** noise at unity gain measured at insert send with EQ out of circuit, -93 dBV DIN.  
**Bus output noise, multitrack:** with no inputs assigned to the bus, -92 dBV DIN; with 24 inputs assigned to the bus, -78 dBV DIN.  
**Stereo bus output noise:** with 24 channels assigned to the stereo bus but with channel faders down, main faders set at '0' and stereo only assigned to main outputs (normal mixdown mode), -78 dBV DIN.  
**Overall performance with microphone input routed to stereo bus at 40 dB mic gain, and with an output level of +10 dBV.**  
**Frequency response:**  $\pm 1$  dB, 20 Hz to 20 kHz.  
**Distortion (THD):** better than 0.05% at 45 Hz, 1 kHz, and 10 kHz.  
**Crosstalk:** multitrack bus to bus, typically better than -64 dB at 10 kHz stereo bus typically better than 60 dB at 10 kHz.  
**Power supply unit:** 19 in rack mounting with console DC supply rails and +48 VDC phantom power rail; factory-set for 110, 220 or 240 VAC operation.  
**Dimensions:** (whd) 77 $\times$ 13 $\times$ 37 in/195.4 $\times$ 32 $\times$ 94.3 cm (height with stand 37 in/94 cm).  
**Weight:** 275 lb/125 kg; crate size, 91 $\times$ 46 $\times$ 23 in/230 $\times$ 118 $\times$ 59 cm.  
**Manufacturer:** Total Audio Concepts, Islington Mill, James Street, Salford M3 5HW, UK.  
**USA:** Amek Consoles Inc, 10815 Burbank Boulevard, North Hollywood, CA 91601.

As is conventional the 28 input/output modules are to the left, followed by the four sub group/auxiliary modules, the auxiliary master and master monitor modules. The remainder of the right hand side of the desk is formed into a 19 in rack space which has a comprehensive miniature jackbay and plenty of spare room.

Connections with the outside world are via two 90-way connectors for a 24-track tape machine having unbalanced outputs and balanced inputs. Five pairs of  $\frac{1}{4}$  in jack sockets on the frame connect to two stereo tape machines, two sets of monitor speakers and feed a monitor/cue mix. Other than a DIN connector for communications all other feeds come via the modules which have connectors accessible at the rear of the desk.

## Input/output modules

To the rear an *XLR* connector forms the balanced microphone input with the balanced line input being at a  $\frac{1}{4}$  in jack socket. A further jack provides the unbalanced insert send/return with the output being at a third jack. At the top of the module the bus routing is done with 13 locking pushbuttons, 12 of which select the buses from 1 to 12 or 13 to 24 according to the setting of the 13th switch. A further switch feeds the stereo



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# REVIEW REVIEW

bus directly. Within the input section there are separate microphone and line preamplifiers each with a gain trim having a 40 dB range. Next to these four pushbuttons select 48 V phantom powering, select mic/line, insert a nominal 20 dB pad in the microphone input, and phase reverse the microphone input.

In the middle of the panel is the equaliser section consisting of switched frequency high and low frequency equalisers, variable frequency mid-1 and mid-2 equalisers each with switched Q and a fixed frequency switched highpass filter.

There follows the monitor/cue section with three level controls and a panpot arranged as two mono and two stereo auxiliary sends.

Above the ALPS fader two mute group buttons allow the formation of two muting groups operated from the auxiliary master module. Above this are the illuminated channel mute button, channel panpot, prefade listen button and peak warning indicator in the form of a yellow LED.

## Sub-group/auxiliary send modules

Each of these four modules is a double channel module with the two group outputs at XLR connectors to the rear which also has four 1/4 in jack sockets. Two of these deal with the left and right group inserts with the other two being the left and right tape/tx inputs.

The top part of the panel includes two identical monitor/cue send sections. Each section has a mute and a prefade listen button plus a further button which connects the section to either the bus or the tape/tx jacks at the rear. Four level controls feed auxiliary buses 1 to 4 with the master level control having up to 10 dB gain and a panpot feeding the monitor/cue bus.

Each sub-group section is fed from the buses 1 to 8 on the input/output modules and has the same type of fader as the input/output modules. In addition each channel has an illuminated mute button, an after fade listen button feeding the post fade signal to the monitors and a stereo routing switch which feeds the stereo fade signal after the panpot into the stereo bus.

## Auxiliary master module

This module includes the oscillator which may be switched to 100 Hz, 1 kHz or 10 kHz. The output is available at a rear panel jack in addition to being fed to all 24 output buses and the stereo bus by a slate button.

There follow two assignable, 3-section, fixed frequency, equalisers with high, low and mid-frequency sections. One of these equalisers can be assigned to auxiliary buses 1 or 3 and the other to 2

or 4. Below are the eight auxiliary master send controls, each with a prefade listen (solo) button, the auxiliary outputs taking the form of jack sockets on the rear of the module. A microphone behind the front panel is within the talkback section which has a level control and three pushbuttons including the push to talk button. The others feed talkback to the 24 buses (slate) or to auxiliary outputs 3, 4, 7 and 8.

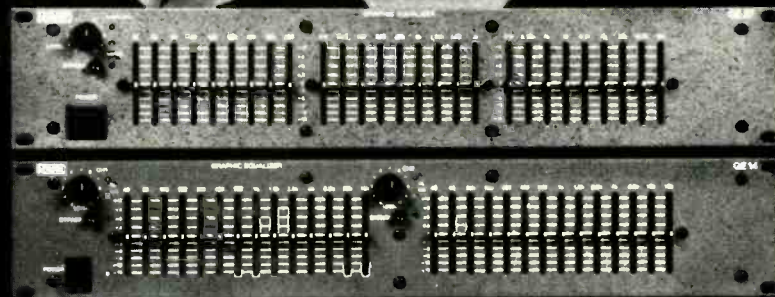
Finally there are the two group master mute buttons which work in conjunction with the mute master buttons on the input/output modules.

## Master module

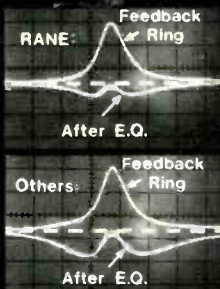
At the bottom of this module are the two master faders feeding the main outputs at XLR connectors to the rear of the module, there is also a master mute button. Prefade inserts are available for the two feeds at the rear. Next is the monitor/cue send section with its stereo level potentiometer and buttons for routing the stereo or monitor bus to the main outputs.

Proceeding up the panel is the control room monitor section which has pushbuttons for selecting the feed from

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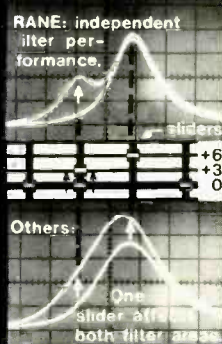
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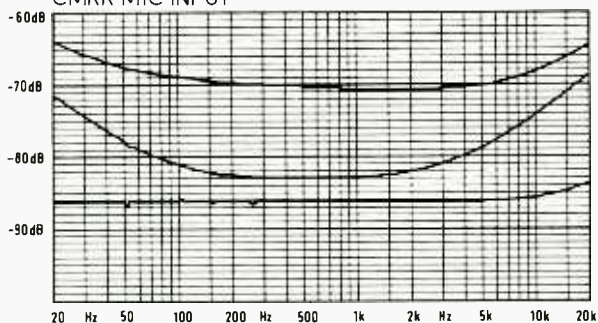
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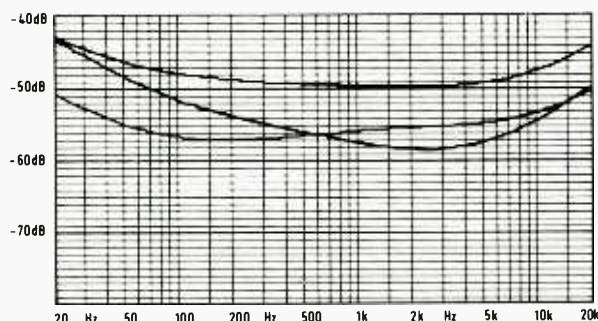
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# REVIEW REVIEW

FIG. 1  
TAC MATCHLESS  
CMRR MIC INPUT



(a) WITHOUT PAD



(b) WITH PAD

FIG. 2  
TAC MATCHLESS  
FREQUENCY RESPONSE-MIC INPUT TO CHANNEL OUTPUT

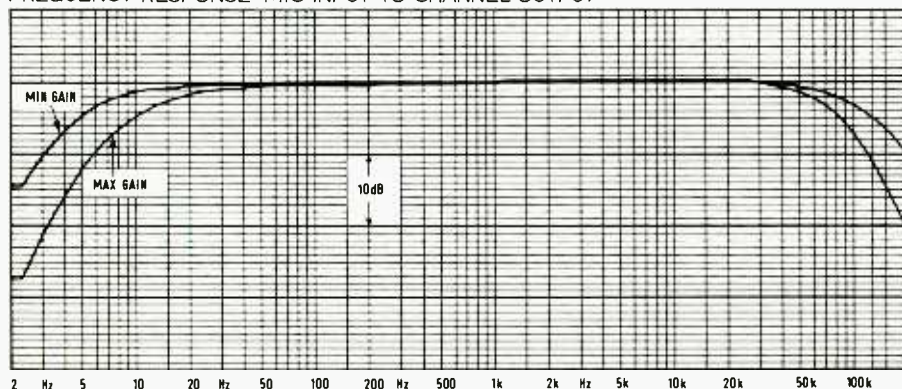
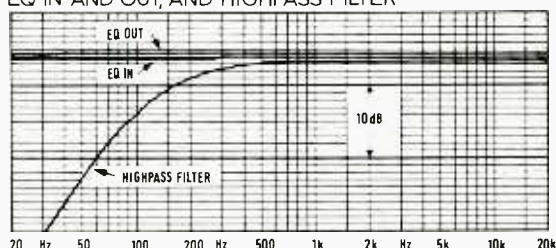


FIG. 3  
TAC MATCHLESS  
EQ IN AND OUT, AND HIGHPASS FILTER



either the monitor mix, the main output or from one of two stereo tape machines. The output can then be fed to two separate pairs of loudspeakers. A mute button and a 20 dB dim button are provided with separate level potentiometers for normal and prefade listening.

Other than a switch for selecting VU or PPM metering on all meters, all that remains are the auxiliary stereo input and output sections. The input section which has a level potentiometer with 10 dB available gain and a left/right balance control receives its input from the rear of the module. The output is fed directly to the stereo bus—mute and prefade listen facilities are provided. The auxiliary stereo output is also located at the rear of the module and has a level control plus pushbutton switches which derives its input from any combination of the stereo bus, the monitor mix output and the talkback output.

## Inputs and outputs

This completely transformerless desk works on the principle of low impedance unbalanced outputs together with medium impedance electronically balanced inputs, including the microphone inputs. The impedance at the microphone inputs was 1.2 k $\Omega$  without the nominal 20 dB pad irrespective of microphone gain, the actual attenuation of the pads being close to 21 dB with an input impedance of 1 k $\Omega$ . Common mode rejection at the microphone inputs varied quite widely from channel to channel but was satisfactory as shown in Fig 1a for three randomly selected channels. With the pads in circuit the common mode rejection decreased as shown in Fig 1b but this is normally of little significance.

Phantom powering offered a 46.8 VDC supply from the standard source impedance with the microphone gain trim having a 42 dB range. At maximum gain, the gain to the insert point was on average 63.5 dB under which conditions input overload occurred at 1 mV (-58 dBm), this increasing to just over 1 V (+2.2 dBm) at minimum gain without the pad in circuit. This corresponds to the 42 dB range of the gain trim.

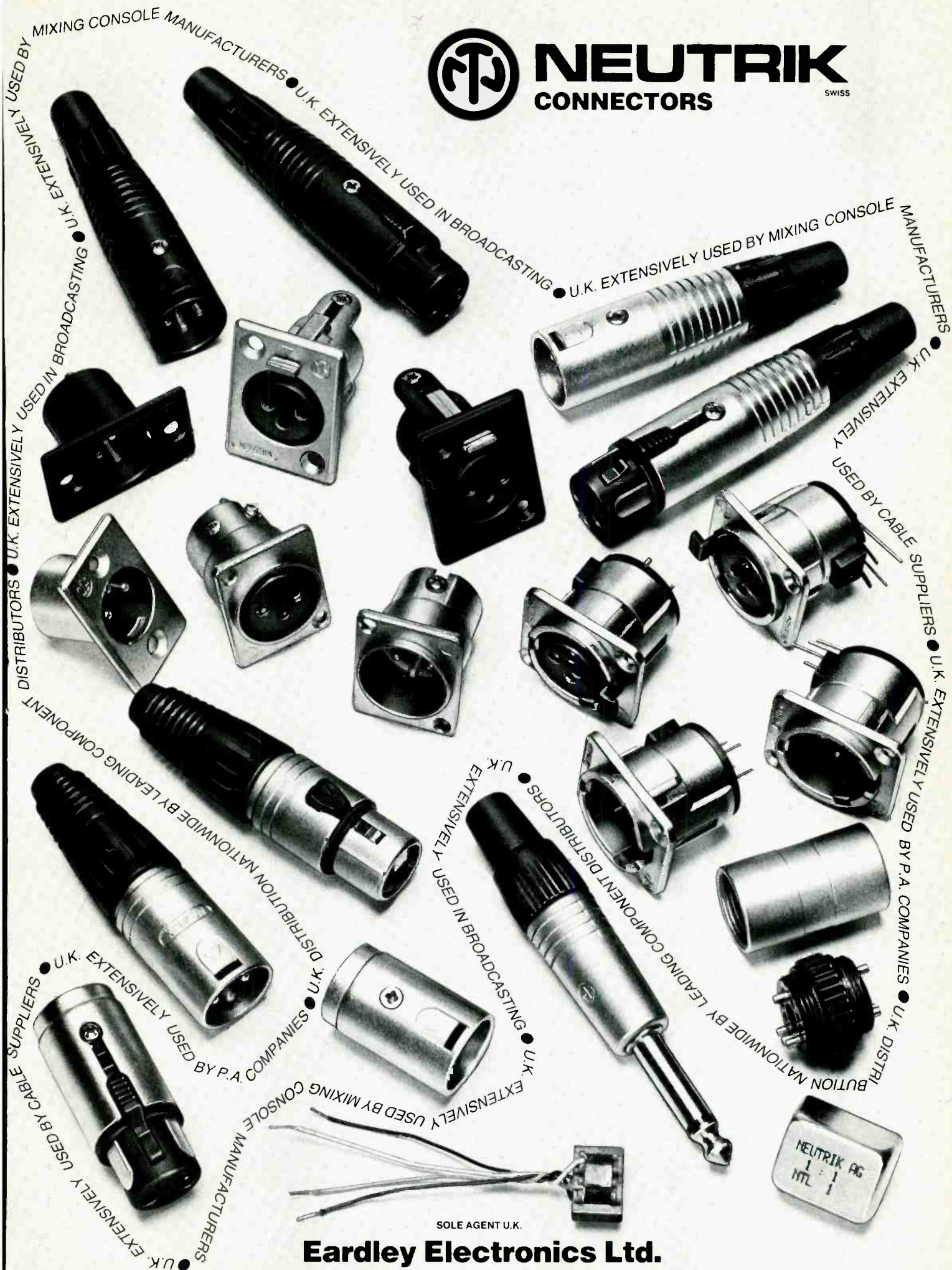
The balanced line inputs, like the other balanced high level inputs, had an impedance of 19.7 k $\Omega$  irrespective of gain. The latter had a range of +20.9 dB to -20.6 dB to the insert point with the corresponding overload points being 0.996 V (+2.2 dBm) and >10 V (+22.2 dBm). Common mode rejection at the line inputs varied between 48 dB and 55 dB remaining almost constant from 20 Hz to 20 kHz.

Gain from the insert inputs to the channel outputs was 6.6 dB with the insert point being an unbalanced 9.9 k $\Omega$  connection capable of handling 10.6 V (+22.7 dBm) at the onset of serious





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# REVIEW REVIEW

FIG. 4  
TAC MATCHLESS  
LF EQUALISER

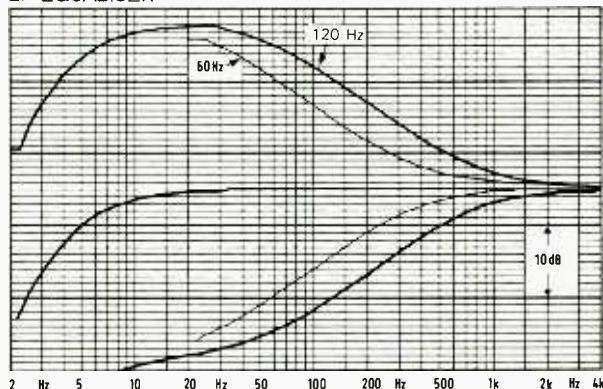


FIG. 5  
TAC MATCHLESS  
SWITCHED Q

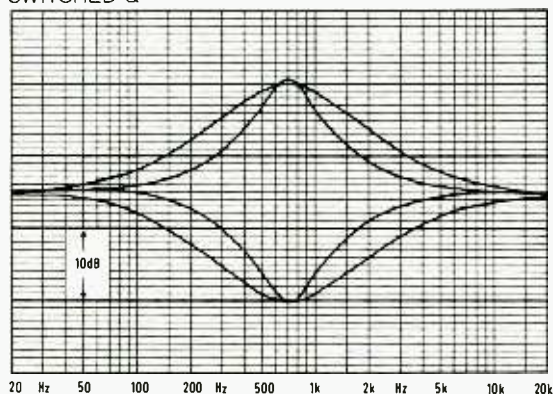
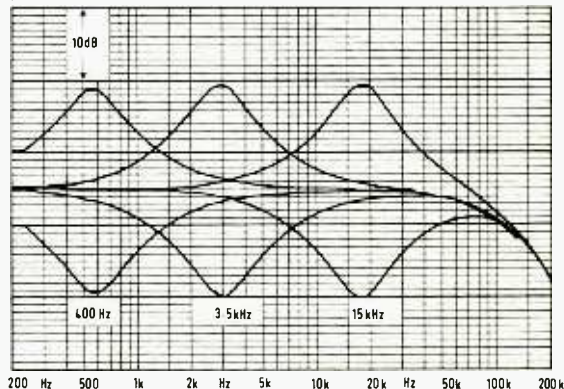
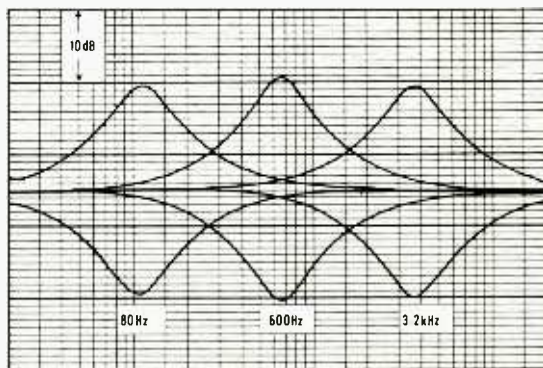


FIG. 6  
TAC MATCHLESS  
MID FREQUENCY EQUALISERS



(a) MID 1



(b) MID 2

distortion. The unbalanced insert point output, like most other outputs, had a source impedance of  $48 \Omega$  with a maximum drive capability of 7.58 V (+19.8 dBm).

All these connections are well contrived for interfacing with other professional equipment with levels and impedances being satisfactory.

## Frequency response

The frequency response at +10 dBm output at the channel output for minimum and maximum microphone gain is shown in Fig 2; response within the audio band remained flat and constant with the gain setting. Outside the audio band the response varied and it was felt that some form of lowpass filtering would be desirable to reduce possible RF interference. Insertion of the pad had no effect upon frequency response which also remained the same at lower input/output levels.

Fig 3 shows the effect of inserting the equalisers in their flat position upon the response from the line input to the channel output, this introducing a slight level shift only. Also shown is the characteristic of the highpass filter with

its 12 dB/octave attenuation below its  $-3$  dB point at 165 Hz which I feel is on the high side.

The characteristics of the low frequency equaliser at its extreme cut/boost settings are shown in Fig 4 for the 60 Hz and 120 Hz switched positions. The range of  $\pm 20$  dB seems to be excessive and unusable with the wide range making the control setting very sensitive. The two mid equalisers had identical shapes with the two available

switched Q performances being shown in Fig 5 which applies for any frequency setting.

The available range of cut/boost for the two mid equalisers was a conventional  $\pm 15$  dB as shown in Fig 6 for the MID 1 and MID 2 equalisers with their nominal frequency ranges continuously variable from 400 Hz to 15 kHz and 80 Hz to 3.2 kHz respectively.

In both cases the control laws were satisfactory in terms of frequency and

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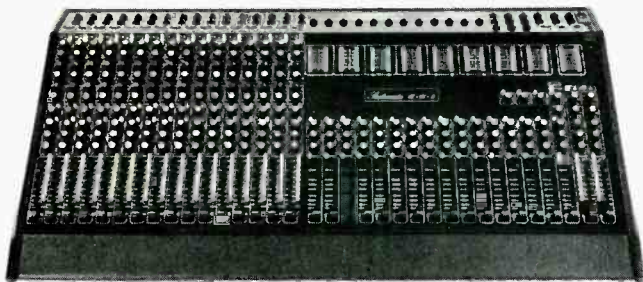
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# STUDIOMASTER

## 16-16-2



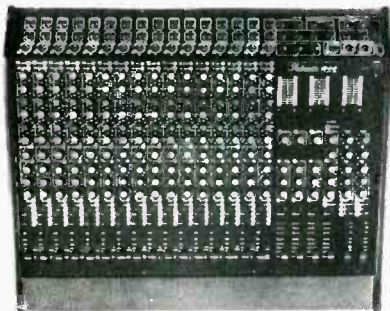
The 16/16/2 is designed to complement budget 16-track recorders. It features its own external P.S.U. which can supply even a fully expanded 16/16/2 (a 32/16/2!). All mic. channels have 48V Phantom Power, parametric E.Q. network, and 3 auxiliary sends. Full 16 channel monitoring is included in the 16/16/2 package. 12 segment 2 colour bargraphs are fitted to the 16 sub-mix stages and the master output which is also fitted with 3 band E.Q. As well as optional expander modules for the mic. channels, a double patch bay is available.

## 16-8-2



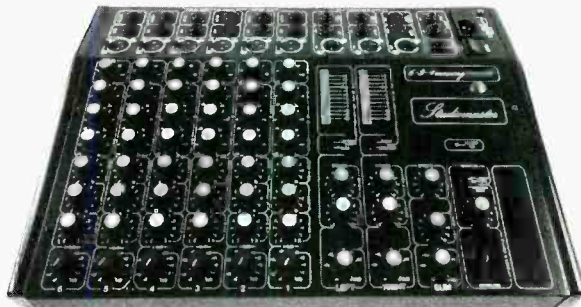
The 16/8/2 is compatible with 8-track recorders and has all the versatility of the 16/16/2, like optional expander modules for the mic. channels (an extra 16 mic. channels may be fitted without altering the unit's P.S.U.) and a double patch bay. Mic. channels feature 48V Phantom Power, parametric E.Q. network, 3 auxiliary sends and 90mm faders. Full monitor and foldback systems are included. Master outputs have 3-band E.Q. and 2 colour 12 segment bargraphs. These bargraphs are also fitted to the 8 sub-mix stages. Applications for the 16/8/2 include small 8-track studio mixing and live sound reinforcement.

## 16-4-2



The 16/4/2 is the mixer that the 16/8/2 and 16/16/2 developed from and consequently contains all their superb features. It is expandable to 32/4/2 on its existing P.S.U. and a patch bay is also available. Mic. channels have parametric E.Q. network, 48V Phantom Power, 3 auxiliary sends and 90mm faders. Full monitor and foldback systems, 3-band E.Q. on the master outputs and 2 colour 12 segment bargraphs are all supplied on the 16/4/2. Use of this mixer include live sound reinforcement and for use with 4 track recorders in small studios.

## 6-2-1



The STUDIOMASTER 6-2-1 mixing console offers features and performance normally obtainable from mixers costing twice the price. Mic. channels feature three band e.q., effects and monitor sends as well as the usual gain and pan controls. 2 colour, 12 segment bargraphs allow monitoring of channels, auxiliaries and both stereo and mono sum outputs. This outstanding specification makes the 6-2-1 ideal for sub-mixing, P.A. and recording.

## Mosfet 500



With distortion not exceeding 0.005% (1kHz sinewave at 200 watts/4ohms) this amplifier provides reliable amplification of outstanding fidelity in all applications. The extensive protection circuitry ensures failsafe protection against D.C., thermal overload and short circuit conditions. The front panel carries LED indication allowing instant monitoring of the amplifier's operational status. The Mosfet 500 is ideally suited to all professional applications requiring medium power, accurate reproduction.

## Mosfet 1000



This high power amplifier delivers twice the power of the MOSFET 500 with the same 0.005% distortion (1kHz sinewave at 400 watts/4 ohms). This amplifier has already proved itself under the most stressful of applications and is fast becoming the standard against which all other amplifiers are measured. The Mosfet 1000 delivers high power with total fidelity in all applications.

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# REVIEW REVIEW

cut/boost. The final equaliser is a high frequency shelving section with two switched frequencies, 6 kHz or 12 kHz. The characteristics of this at maximum cut/boost are shown in Fig 7 where a very large degree of equalisation is apparent; like the low frequency section this is rather excessive.

The overall frequency response was checked through a number of chains, for instance from the line input through the input and group modules to the main stereo output, and found to be within +0/-0.5 dB from 30 Hz to 20 kHz.

The response of the high, mid and low frequency equalisers in the auxiliary channels is shown in Fig 8 where the mid fixed frequency equaliser is sensibly centred to peak around 4.5 kHz. Both the high frequency and low frequency equalisers are of the shelving type with fixed frequencies.

## Noise

Noise referred to the microphone inputs was consistent from one channel to another with very good results. In the case of the line inputs noise was also at a low level but there was an approximately 2 dB difference between the channels.

Table 1 refers to the inputs with the microphone inputs terminated in 200  $\Omega$  and the line inputs in 600  $\Omega$  taking the average noise for the line inputs.

Noise at the output of the input modules naturally depended upon the equaliser settings and this was as might be predicted. Insertion of the equalisers in their flat position, however, significantly degraded the noise performance.

The noise at the channel outputs is  $\blacktriangleright$

TABLE 1

Measurement method	Noise referred to inputs	
	Microphone	Line
22 Hz to 22 kHz RMS band limited	-127.0 dBm	-96.5 dBm
A-weighted RMS	-128.7 dBm	-98.5 dBm
CCIR-weighted RMS	-120.0 dBm	-90.0 dBm
CCIR-weighted quasi-peak	-116.3 dBm	-85.8 dBm
CCIR-weighted ARM ref 2 kHz	-126.9 dBm	-96.4 dBm

FIG. 7  
TAC MATCHLESS  
HF EQUALISER

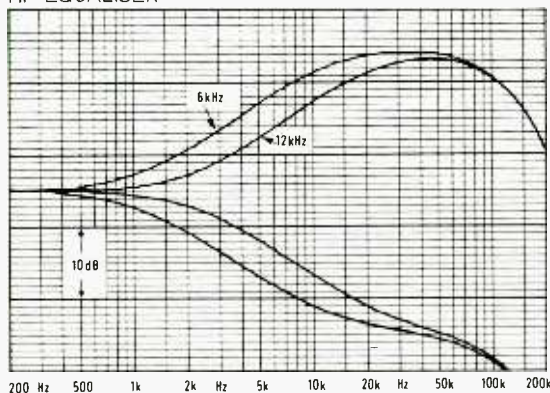
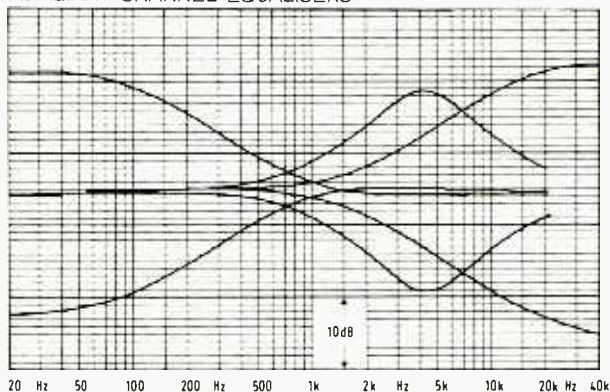


FIG. 8  
TAC MATCHLESS  
AUXILIARY CHANNEL EQUALISERS



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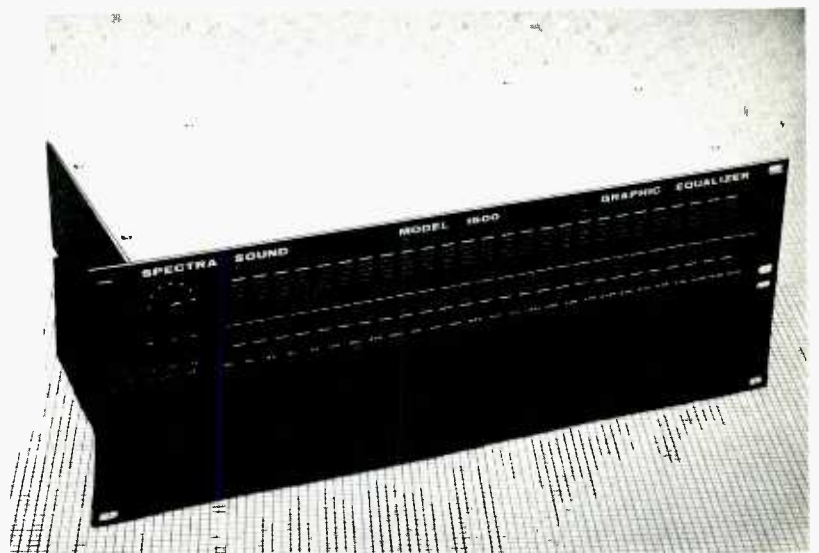
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# REVIEW REVIEW

TABLE 2

Measurement method  
22 Hz to 22 kHz RMS band limited  
A-weighted RMS  
CCIR-weighted RMS  
CCIR-weighted quasi-peak  
CCIR-weighted ARM ref 2 kHz

Noise at channel outputs

EQ out	EQ in
-87 dBm	-81 dBm
-89 dBm	-83 dBm
-81 dBm	-85 dBm
-76 dBm	-71 dBm
-89 dBm	-82 dBm

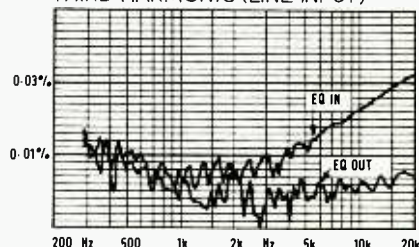
TABLE 3

Frequency  
1 kHz  
10 kHz

Oscillator harmonic distortion

Second	Third
0.5%	0.4%
0.35%	0.3%

FIG. 9  
TAC MATCHLESS  
THIRD HARMONIC (LINE INPUT)



shown in Table 2 with the line input selected at unity gain with the equaliser in/out in their flat setting. In other departments no problem was found with noise and as there are no power line signals within the desk there was a complete absence of power line hum.

## Distortion

Using the line inputs, harmonic distortion to any output was less than 0.01% from 20 Hz to 20 kHz at any level below clipping with the microphone inputs offering a similar performance except at maximum gain. Under the latter conditions the second harmonic rose above 0.01% at 4 kHz increasing to 0.03% at 12 kHz.

Insertion of the equalisers produced an increase in third harmonic as shown in Fig 9 for the equalisers in their flat position. This was relatively independent of level with equalisation having the predictable effect.

Intermodulation distortion to the CCIF twin tone method was very good, remaining below 0.01% up to 200 kHz at any level up to 6 dB below clipping above which there was an increase in high frequency intermodulation distortion. This applied under the conditions used for measuring harmonic distortion. A notable feature was that the squarewave performance was absolutely clean from any input to any output—there was a complete absence of overshoot or ringing. Clearly the lack of transformers helps achieve this clean performance.

## Crosstalk

Breakthrough from the microphone input into the line input and vice versa was excellent, generally remaining below -100 dB up to 3 kHz increasing to 85 dB at 20 kHz.

The mutes offered an isolation in excess of 80 dB up to 10 kHz with the channel faders having a similar performance. Channel to channel or bus to bus crosstalk appeared to be the same under many different conditions, being 100 dB at 200 Hz and rising at 6 dB/octave with increasing frequency.

## Metering and overload

The meters were aligned such that they gave the same indication in either the VU mode or the PPM mode with the first red segment (above 0 dB indication) becoming illuminated at +4 dBm output. All meters tracked each other satisfactorily with the calibrations being substantially correct, however the rectifier characteristic remained to the VU standard in either the VU or the peak modes. In the VU mode the 'dynamics' were correct so far as a LED bargraph can agree with the standard for VU meters with the correct rise and fall times. In the PPM mode the rise time to full steady state indications was fast at 4 ms and the fall time to -25 dB indication was 700 ms.

A matter which I find peculiar is the alignment of 0 dB indication being the same in the VU and PPM modes as +4 dBm output is correct in the VU mode (to common alignment standards) where the peaks are often 10 dB in excess of 0 VU.

The peak indicators in the channel modules were extremely fast in operation with a sensible hold to enhance visibility. However, being a post EQ level indicator they do not give proof against overload in the separate microphone and line input stages.

## Other matters

The nominal 1 kHz and 10 kHz

frequencies of the oscillator were reasonably close at 951 Hz and 9.987 kHz with the output level corresponding to +4.08 dBm and +4.13 dBm at the oscillator output jack. As is correct this showed zero level on the meters in the slate mode.

Harmonic distortion was perhaps on the high side as shown in Table 3.

## Summary

From a mechanical point of view this is a substantially constructed desk with a complex steel frame bearing a smart trim. Removal and insertion of the modules is relatively easy and the integrated circuits and faders are socketed for ease of servicing.

Whilst circuits are provided, not all the boards had component identifications and no layout diagrams were provided. Overall the standard of the electronics layout and assembly is satisfactory.

From the point of view of performance the only weakness seems to be the noise performance of the equalisers. In other respects the measured performance was good or very good with no serious complaints.

Although more relevant to a user report, I cannot refrain from expressing my dislike of the pushbutton switches. It was very difficult to see if they were depressed—a feature that can easily be put right by the use of two colour knobs. □

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**GAIN REDUCTION:** Shows gain of the VCA (0 to -25db). Shows the effect of any control but OUTPUT TRIM and DE-ESSER

**INPUT ATTENUATOR:** Adjusts drive to compressor/limiter, determining amount of G/R.

**ATTACK TIME:** Adjusts speed of response to input level increase. Fast: Peak limiter & compressor. Slow: Compressor only

**GATE THRESHOLD:** Determines the input level that causes "gating"; VCA gain then moves slowly to IDLE GAIN setting.

**OUTPUT TRIM:** Adjusts VCA gain to control or prevent clipping as required. Effect is seen on VCA LEVEL meter. Not an Output Attenuator (Output Attenuator is located on rear of unit)

**DE-ESSER OPERATE/DEFEAT:** Activates or defeats de-esser control circuitry.

**COUPLED/INDEPENDENT:** Couples A and B gain and gating circuits for accurate stereo tracking

**COMPRESSION RATIO:** Adjusts compressor from "looser" (2:1) to "tighter" ( $\infty$ :1).

**RELEASE SHAPE:** Linear: Compressor releases at constant rate. Exponential: Release starts slower, then accelerates.

**VCA LEVEL:** Shows peak operating level of VCA. Clipping occurs above approximately +2.

**IDLE GAIN:** Presets VCA gain when in gated condition or anytime unit is DEFEATED. Used for smoothing out transitions and for decreasing audible action of compressor.

**OPERATE/DEFEAT:** Activates or defeats gain control circuitry. Does not bypass any circuitry.

**DE-ESSER SENSITIVITY:** Adjusts threshold of de-essing. De-essing increases as control is turned clockwise.

Also available as a single-channel unit: Model 422A. Ask your dealer for a detailed brochure.

## Reviewed by others.

"In addition to the measured performance being very good the subjective impressions of the unit were excellent. This product has many novel and highly practical features all of which are quite simple to use but need not be used if simplified operation is required. Overall a very good compressor/limiter, well made and easy to service."

Hugh Ford, *Studio Sound* November, 1983

"Overall, the 422A/424A should prove to be a system of diverse capabilities, able to tackle the widest variety of material—once the user masters its operation. In addition, its solid construction and excellent service documentation should insure years of reliable operation. Such qualities are typical of timeless designs that tend to retain their value long after the accountants have depreciated them away."

John Monforte, *db Magazine* July-August 1983

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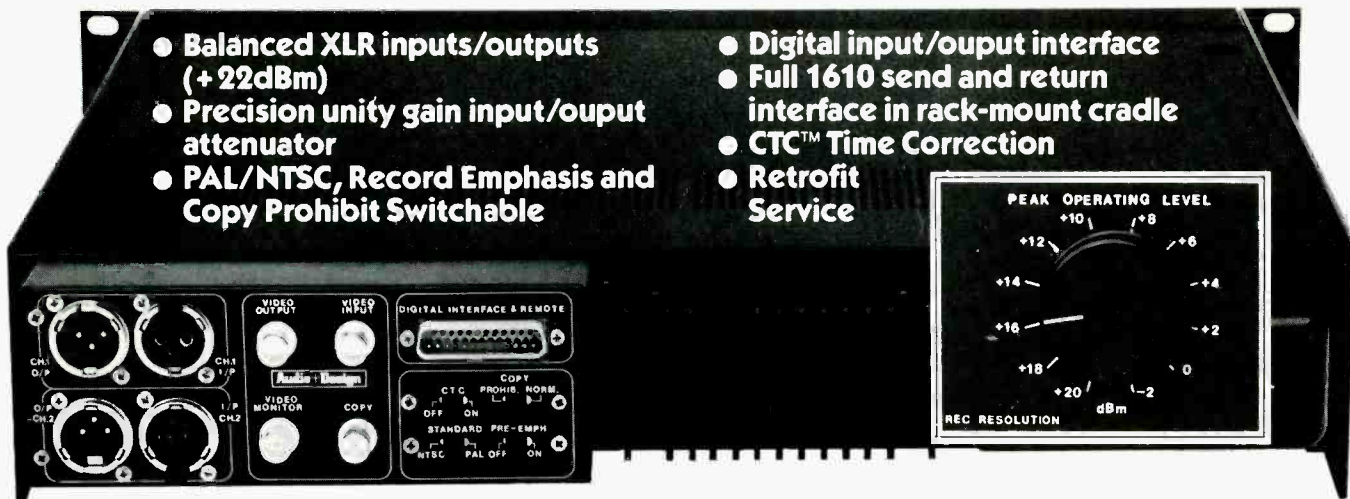
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