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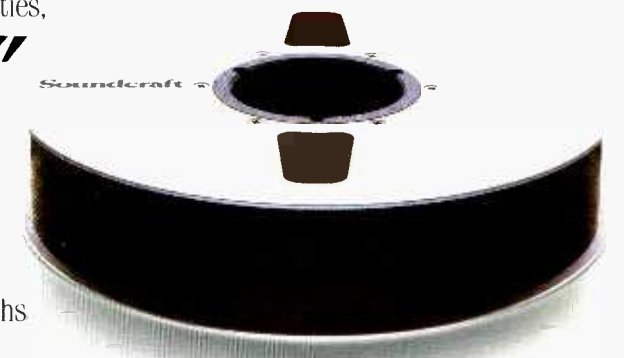
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1"



2"



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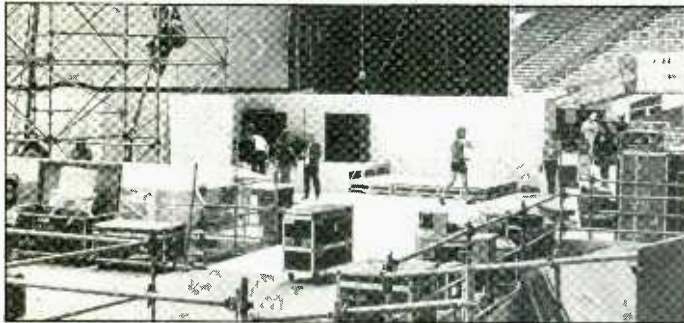
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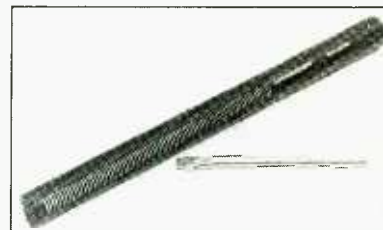
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Editor:
Keith Spencer-Allen
Assistant Editor:
Carl Anthony Snape
Production Editor:
Ann Horan
Production Assistant:
Beverly Hudec
Consultant:
Hugh Ford
US Commentator:
Martin Polon
Contributing Editor:
Richard Elen
Secretary:
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Advertisement Manager:
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Japan and Far East Agent:
Media Sales Japan Inc, Tamuracho
Bldg 3 3 14, Shimbashi Minato-Ku
Tokyo, Japan
US West Coast Agent:
Herb Schiff, 1408 Santa Monica Mall
Suite 200, Santa Monica
CA 90401 USA

COMMERCIAL MANAGER
Phil Guy



Editorial and advertising offices:
LINK HOUSE, DINGWALL
AVENUE, CROYDON CR9 2TA,
GREAT BRITAIN
Phone: 01-686 2599
International: +44 1 686 2599
Telex: 947709

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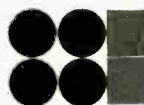
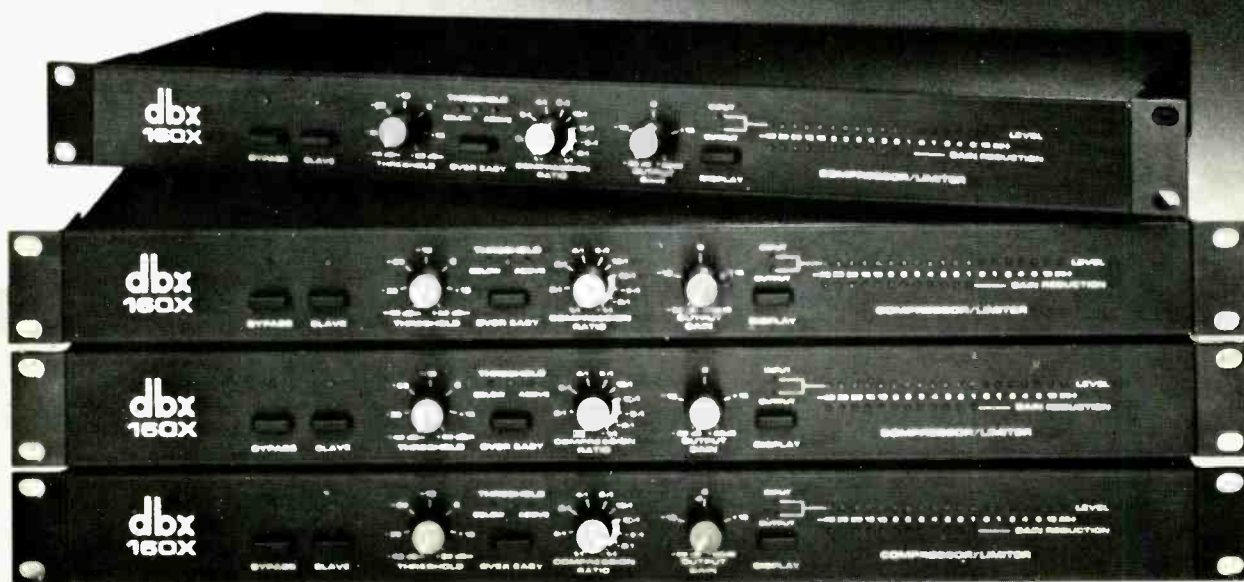
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EDITORIAL

EDITORIAL

This month's comment from Keith Spencer-Allen

Malicious rumours incorporated

It appears that the analogue tape machine may not live out the natural life that its current achieved standard of performance would suggest as 'right'.

'What future for the analogue tape recorder?'—this is the second most commonly asked question of us at the present time. Usually the question is worded in an inverse manner: 'How long before I have to commit myself to buying a digital multitrack/mastering machine?'. I am very glad that my continued commercial existence does not at this time depend on my ability to chance a figure. There are far too many unknowns that may have an effect.

CD has become firmly established and is perhaps giving digital electronics in all its aspects a kind of omnipresence that is creating a high pressure situation making studios feel they have to make a decision very soon or they will have lost their edge. At this point in time nobody should feel pressurised into purchasing any form of digital multitrack, unless the specific market that your clientele represents is asking for it and is prepared to continue asking when you charge a rate that reflects the true capital outlay involved.

Let us look, however, at the hardware reality currently in the market place—firstly digital multitracks—just two incompatible choices currently available and both difficult to edit on (no matter what improvements the manufacturers claim in format robustness we are still splicing video tape). On the mastering side, U-matics and 1610/1630 have a predominance, together with the *F1* format although there are a whole host of others available and waiting.

Viewed in this not totally inaccurate manner, the future of the analogue tape machine looks assured for some time yet. Even if we look at the major new influence upon digital audio at present the CD, it has to be said that few can easily distinguish the difference between a CD whose coding is ADD rather than DDD as long as the engineering aspects have been kept to a high level.

So what is the state of play on the analogue front if looked at in a similar manner. The largely compatible standards remain and the 1 in/2 in debate has settled down. The latest machines have audible improvements and the all round design has improved.

Both areas have their current market shortcomings but the analogue situation seems quite healthy in comparison.

We have, however, lost a number of major analogue manufacturers in recent years and there is arguably now only two manufacturers in large scale production of multitracks although there are a host of smaller regional manufacturers. Both of the two major analogue manufacturers are involved in digital audio—one to the stage of producing digital machines later this year.

The new generation of analogue mastering machines are very high performers—the *A820*, the *MTR20* and the *APR5000* have much to offer in improved performance but the negative factor is that this has been achieved at a large rise in the costings. In fact at a cost that might lead many to wonder if a full digital mastering system might not be a better investment. There are also a number of studios that will probably never go digital with any machines bearing the current cost structure. These will continue to rely on analogue machines and probably cease to exist when the eventual end of the analogue machine arrives—how long can you run a machine with no available spares back up?

Lastly I have heard rumblings from a certain tape manufacturer that there is little money in professional tape products and that they run them as a flagship type operation. They are obviously keenly looking forward to the days when we are all recording on video tape and life is just the one product type.

What I have tried to suggest here is that there are a number of factors—declining numbers of manufacturers who have an increasing interest in digital, rising costs of the new generation of mastering machines, pressure from clients and the record companies and lastly these murmurs from the tape manufacturers mentioned earlier. Well engineered analogue multitracks are very good and difficult to distinguish from fully digital recordings with care, particularly when current fashionable practice appears to be to record rhythm tracks on an analogue machine for that saturation sound and then transfer to digital multitrack. The digital multitrack is a powerful tool but there is still plenty of life in the analogue equivalent and it would be unfortunate if market forces brought about its premature demise well before its performance standard would suggest as right—and the resulting confusion within the industry would leave us all the poorer. □

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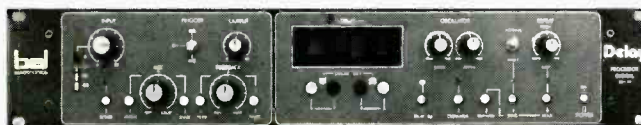
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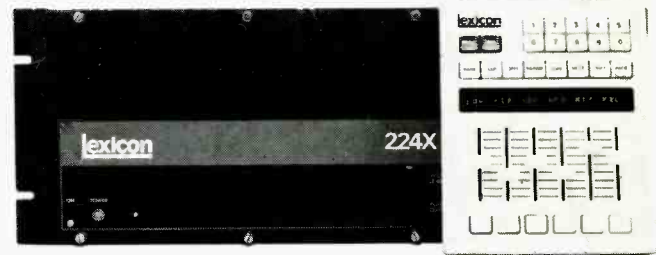
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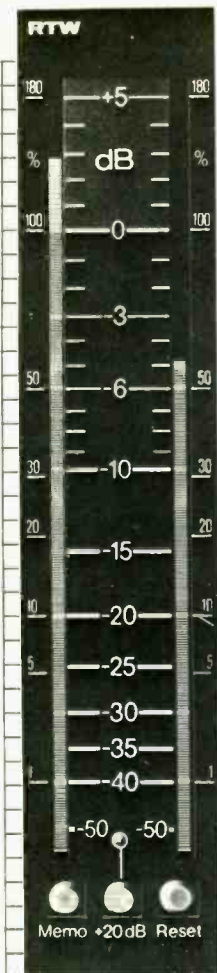
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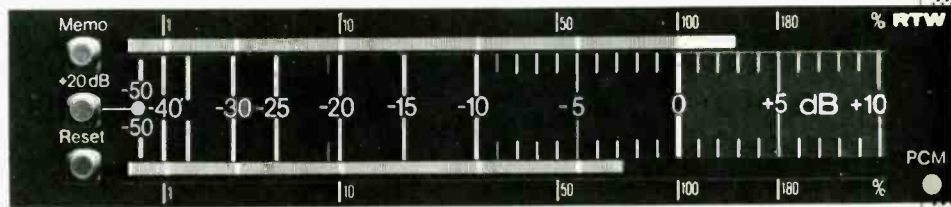


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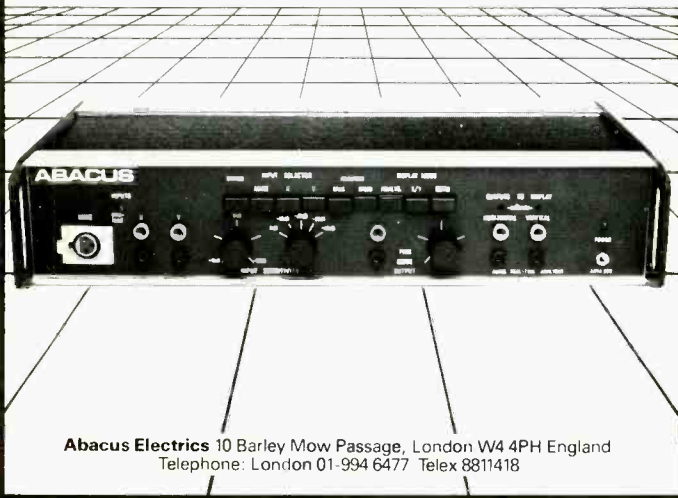
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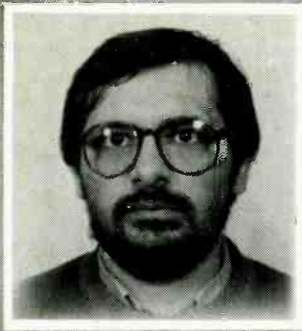
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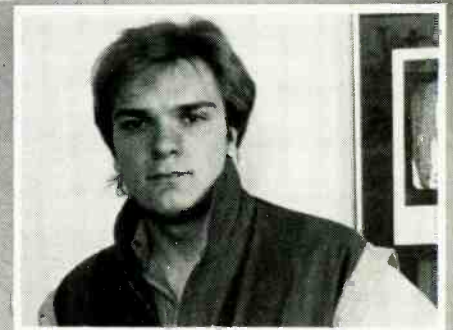
I buy my gear almost exclusively from Studio Spares in England on my Visa Card because of their efficiency and very friendly service which by far exceeds the ordinary.

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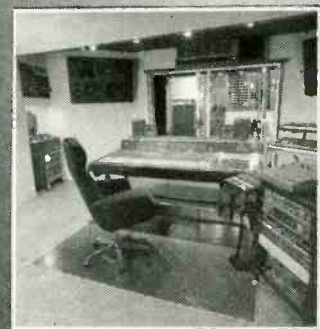


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We simply need a supply service to match our ever changing requirements. Fast and friendly everytime - Studio Spares is the answer

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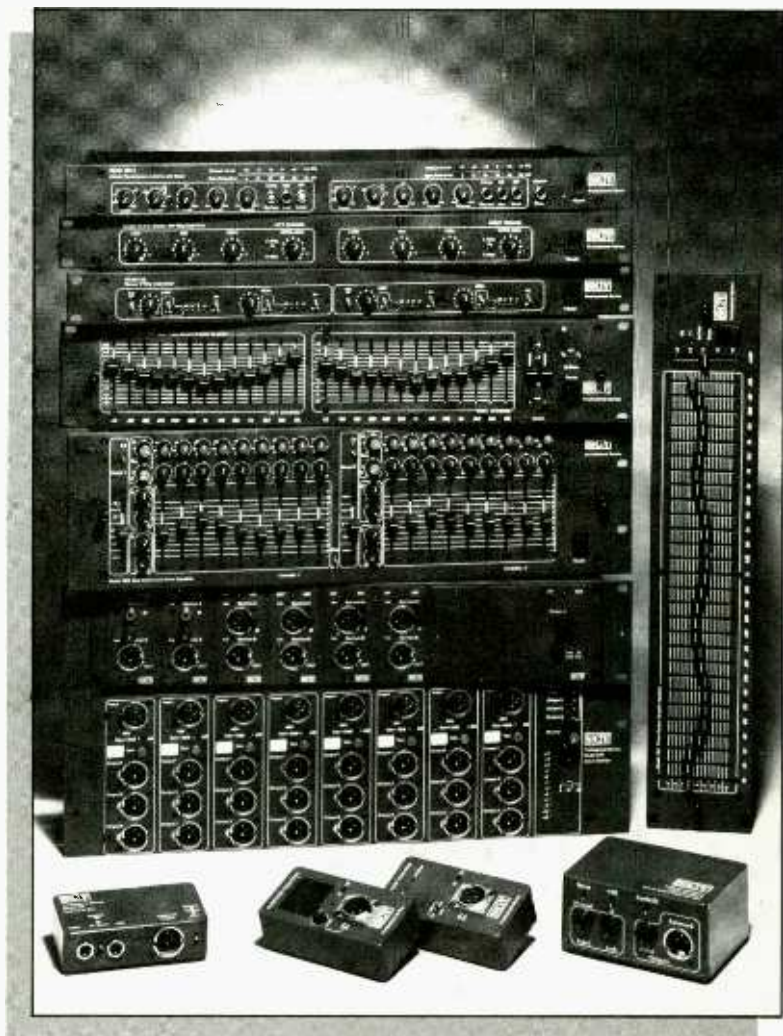
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More effects from HHB.

Introducing the amazing Yamaha REV 7 digital reverb + effects processor.

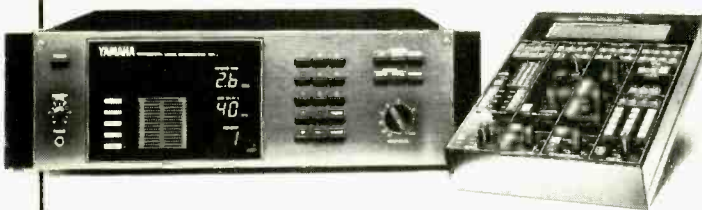


At last, a professional quality, programmable digital reverb, with the sounds and features you want, at a price so low you won't believe it.

Here are a few of the REV 7's features

- True or simulated stereo
- 30 factory presets and up to 60 user stores.
- Hall, Plate & Room reverb programs.
- Reverb available with gating, reverse, flanging...
- Early reflection programs.
- L/R delay and stereo echo.
- Stereo phasing and flanging.
- MIDI interface.
- Remote control.
- 16 bit @ 31.25 kHz sampling giving 20-12kHz response
- 3 band parametric EQ.

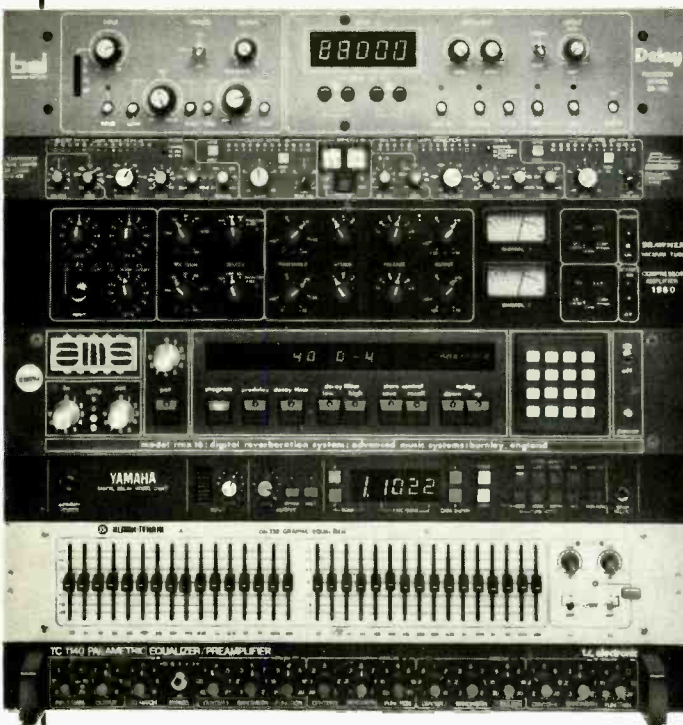
£1040



For the more demanding user, don't forget Yamaha's original REV 1 digital reverb with its full function remote control at £6595.

At £1040 the REV 7 must be the year's best buy, send now for colour brochure.

In addition to the REV 7, here are some more gadgets from HHB's effects collection:



We also keep toys from Lexicon, Urei, ElectroSpace, dbx, Eventide and many more. Our demo room is ready for you to try before you buy, or take advantage of our mail order service for best prices and free delivery.

Access, Barclaycard/Visa, American Express. Finance arranged. (All prices exclude VAT and are correct at time of going to press)

The newest from the BEL stable, the BD320 gives all the functions of the popular BD80, but with up to 32 (yes 32) seconds of delay. BD80 £695 (2 secs) + £200 per extra 2 secs. BD320 £1200 (8 secs) + £500 per extra 8 secs.

The BSS DPR402 is an all in one dynamics processor, providing compression, peak limiting, de-essing and expansion, all with frequency keying all in a lu package £615.

For that authentic 60's sound, DRAWMER's 1960 valve compressor/pre-amp is a must. "Soft knee" compression, microphone inputs, side chain operation etc £750. (Don't forget the DL221 @ £325, and DS201 @ £275)

The AMS RMX16 shown here is the state-of-the-art in programmable reverb. We also try to keep the DMX 15-80 DDL/pitch transposer, but demand is high so order now. RMX16 £4680. DMX15-80 £POA.

The YAMAHA D1500 is a low-cost, high-value programmable DDL with MIDI interface; it gives up to 1 sec delay, with 16 user memories. Our price is so low that we don't dare print it! £POA.

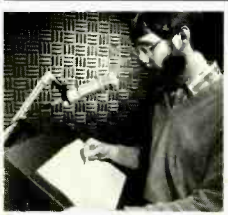
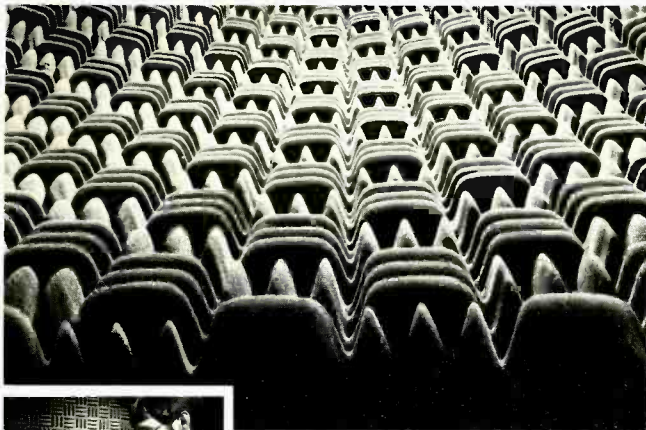
KLARKTEKNIK's range of equalisers should need no introduction: they are simply the industry standard for graphics. We also stock other Klark-Teknik products, such as their excellent digital reverb and the DN60 analyser. DN332 (shown here) £525. DN360 £980. DN60 (analyser) £1650. DN780 reverb £3580.

TC ELECTRONICS TC2240/1140 are stereo/mono 4 band fully parametric equalisers offering 20dB of cut and boost. We think they are the best value and best sounding outboard EQ's around. TC2240 £330. TC1140 £195.



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DS:3

the Midi connection



Based on the APPLE II series of computers (II, II+, EuroPlus and IIe) the DS:3 produces sparkling quality sound samples with editing and looping facilities available only to those systems costing twenty and fifty times as much. The use of a proven, reliable, work-horse computer (The Grandad of all personal machines!) allows continuous updating of the system performance both in powerful software and complementary electronic additions.

At the time of writing, looping and keyboard splitting are current facilities which were offered to our installed base on time and on spec. A full MIDI interface will be available; 10 second sampling follows; step-time sequencer to complement the existing real-time function and duration recording software complete the '85 offerings for the system itself.

But the most interesting update of all is the DS:4...

For a *very* modest price the DS:3 owner will be able to avail himself of the sound quality and dynamic range of CD—and with the extra voices and sample length expected from the very best 16-bit systems of the genre. Existing DS:3 owners will be offered this first since it is Greengate policy to look after its own...

Please send me information on the DS:3 Digital Sound Sampling Sequencer and its peripheral devices:

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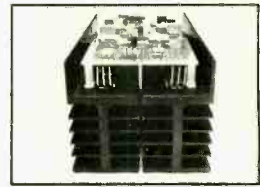
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High accuracy differential circuitry. This advanced design ensures the very lowest THD and IMD levels as well as producing extremely low levels of dynamic distortion.



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NAGRA IV-S TC



Post another advance in recording technology for NAGRA! The new NAGRA IV-S TC incorporates unique Time Code circuitry which permits time code record/playback (via switch selection) of the five film or video SMPTE/EBU standards.

What's more, there's an eleven key, slide-out, mini keyboard to enter or read data and check system operation, plus a seven segment eight digit LCD readout.

Of course, the recording quality, the functionality, are what you've come to expect from NAGRA just this side of perfect

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The Amcron tradition of peerless performance was established with the introduction of the legendary DC300 series in 1967. Now, in 1985, on the back of modern technology and two decades of experience, Amcron bring you the Micro-Tech 1000 amplifier.

The Micro-Tech 1000 is the amp we've all been waiting for - lightweight, compact, and with more than enough punch to suit the increased power requirements of the digital age. These are the facts:

- 400 watts RMS per channel into 4 ohms.
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- Safe operation at high power to 1 ohm.

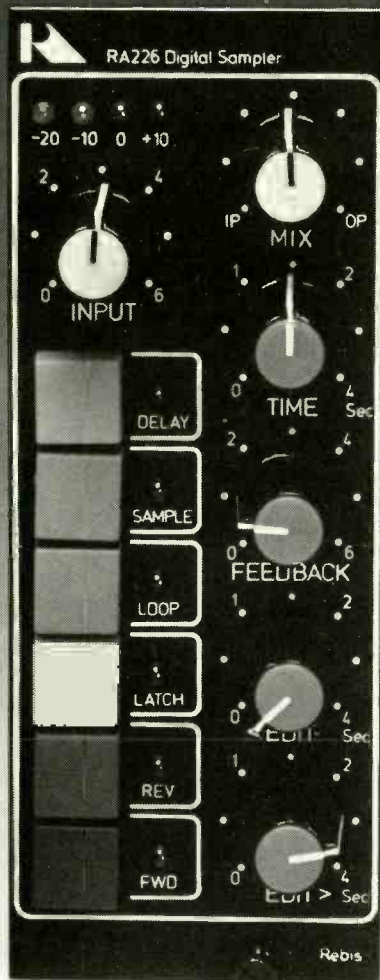
- Reversible forced-air cooling.
- Amcron performance in 3½" rack space.

We believe that these facts, coupled with Amcron's reputation speak for themselves. But if you wish to know more about the Micro-Tech 1000 and how it can solve your headroom problems, call HHB Hire & Sales at: Unit F, New Crescent Works, Nicoll Rd, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.



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The RA226 Sampler represents a price breakthrough in digital audio technology.

Using innovative techniques in software driven processing this new Rebis module gives you 8 seconds record/playback, expandable to 32 seconds on board, maintaining 12 kHz bandwidth.

Auto trip makes recording simple.

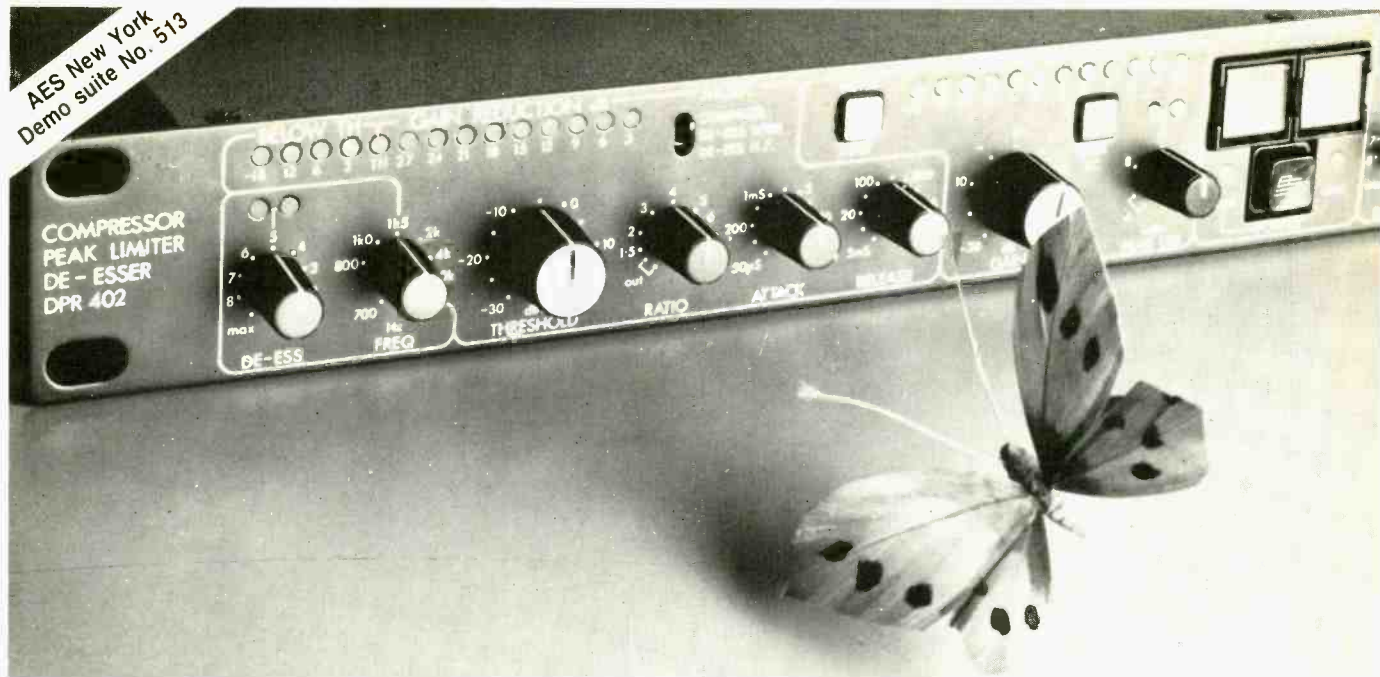
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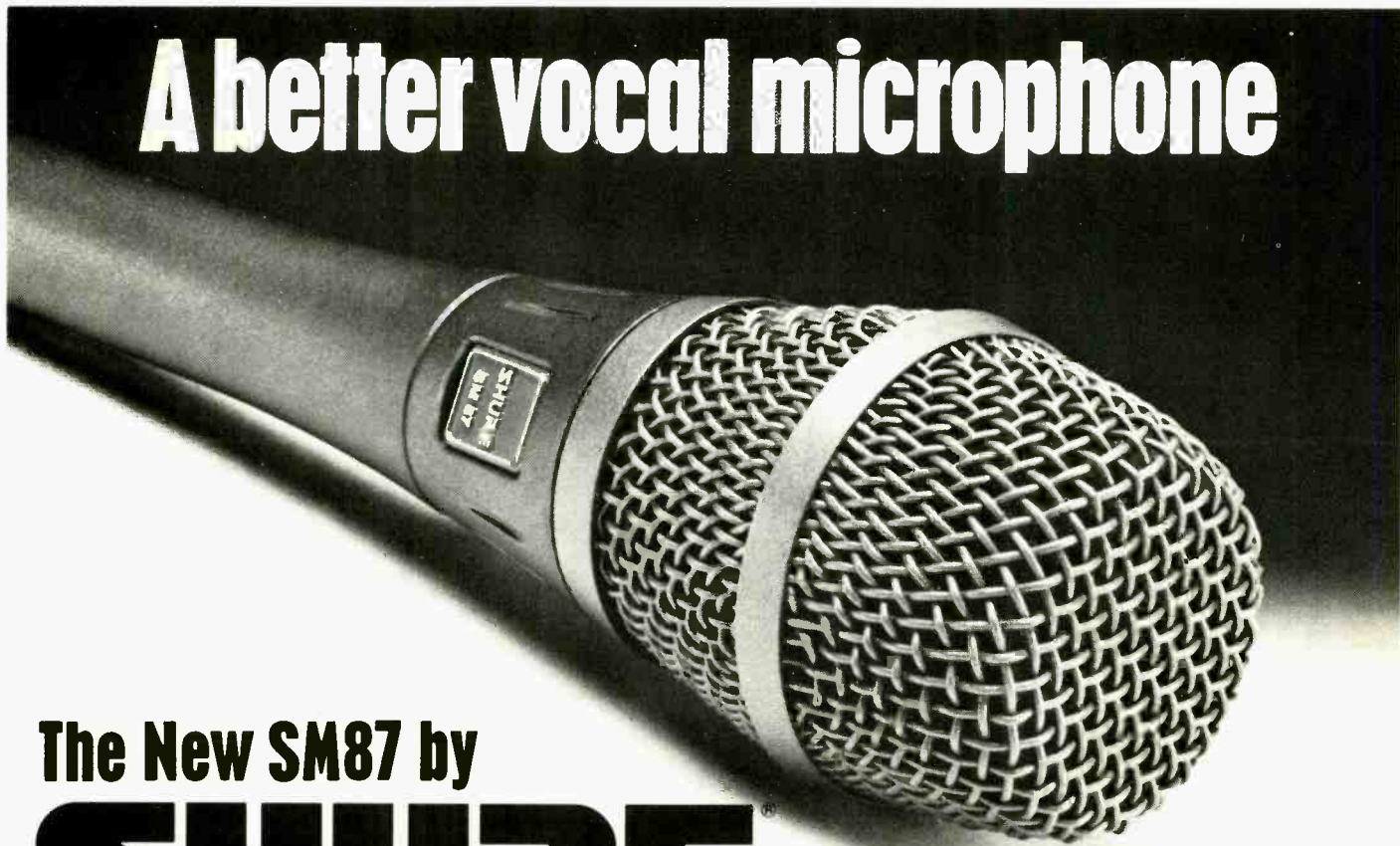
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A better vocal microphone



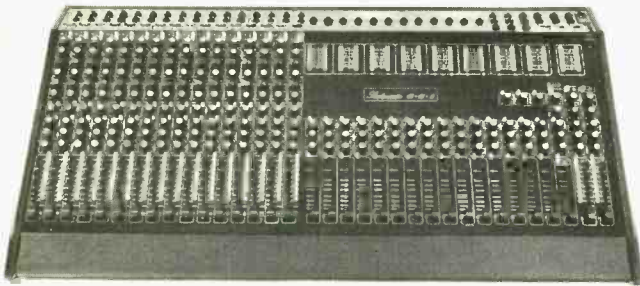
The New SM87 by

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HW International
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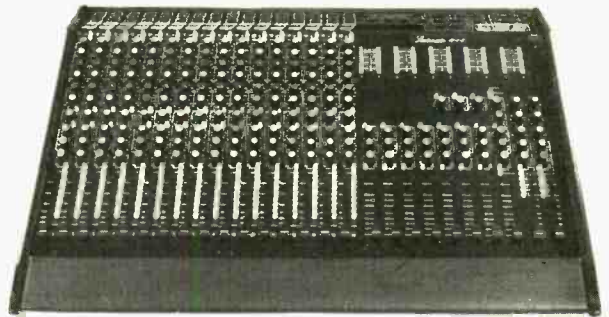
STUDIOMASTER

16-16-2



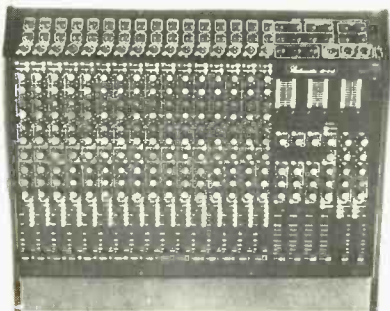
The 16/16/2 is designed to complement budget 16-track recorders. It features its own external P.S.U. which can supply even a fully expanded 16/16/2 (a 32/16/2!). All mic. channels have 48V Phantom Power, parametric E.Q. network, and 3 auxiliary sends. Full 16 channel monitoring is included in the 16/16/2 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



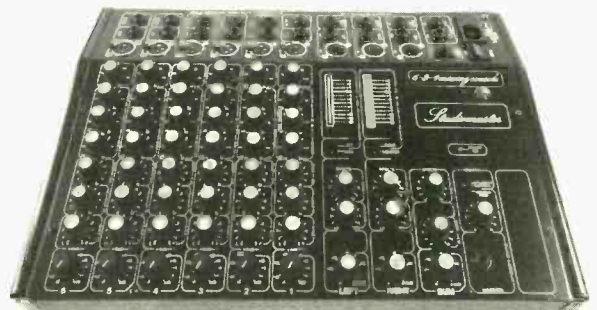
The 16/8/2 is compatible with 8-track recorders and has all the versatility of the 16/16/2, like optional expander modules for the mic. channels (an extra 16 mic. channels may be fitted without altering the unit's P.S.U.) and a double patch bay. Mic. channels feature 48V Phantom Power, parametric E.Q. 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.

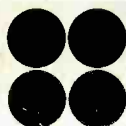
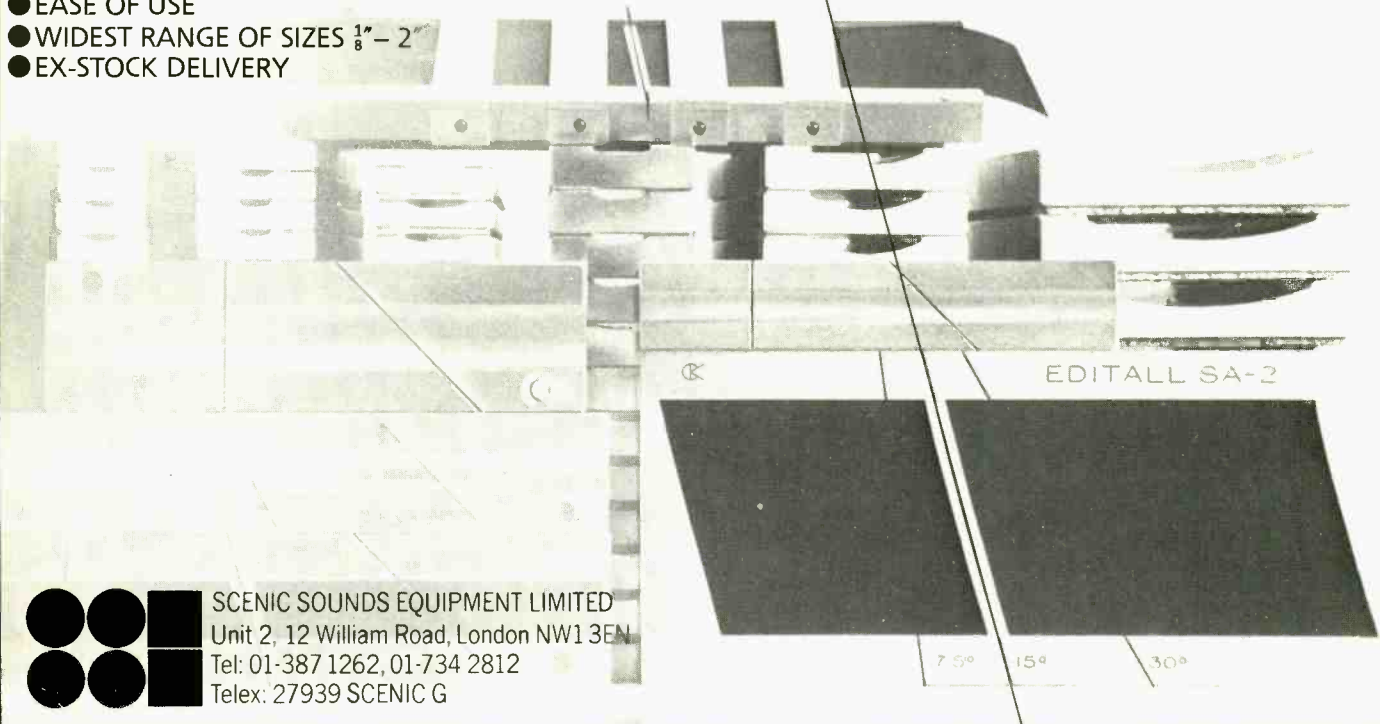
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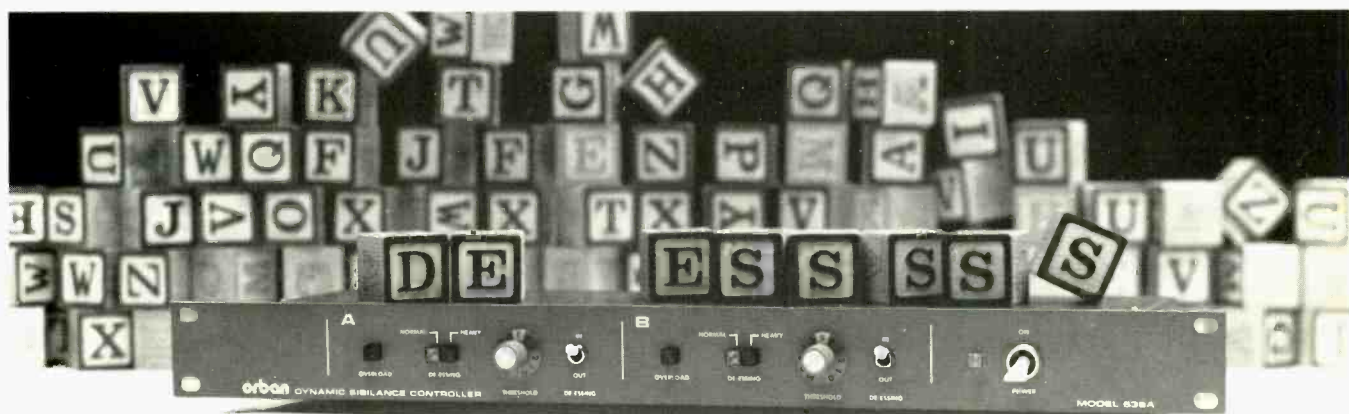
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The ABC's of de-essing.



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You know they're out there—those nasty "S" sounds that stymie the pursuit for quality in your vocal productions. That's why we've perfected our 536A Dynamic Sibilance Controller which subtly and effectively controls harsh "S" sounds while you mind your P's and Q's.

The 536A is a single purpose, two-channel de-esser which allows your vocal tracks to have the presence and sparkle you demand without the abrasive, distracting sibilance which can be an unexpected by-product. The 536A also allows for constant de-essing regardless of changes in input levels.

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Orban Associates Inc. 645 Bryant St.
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 Telex: 17-1480

NEW PRODUCTS

NEW PRODUCTS

Equipment, modifications, options, software

JBL 4425 bi-radial monitor

JBL's 4425 bi-radial loudspeaker is a medium-sized studio monitor designed to fill the gap between bookshelf and large monitor type designs. The 4425 is designed to offer the same characteristics as the larger 4430 without the size and bulk. Applications include studios, dubbing rooms and critical listening environments that do not require extremely high listening levels.

The bi-radial horn used is a completely new design incorporating a pure titanium diaphragm with edge-wound aluminium-ribbon voice coil, copper-plated pole piece, a diamond pattern diaphragm suspension and a computer machined phasing plug.

The horn is a scaled-down version of the 2344 made of acoustically inert high impact structural foam. The 300 mm (12 in) low frequency driver is also a new unit and incorporates a 76 mm (3 in) voice and JBL symmetrical

field geometry (SFG) magnet structure for low distortion.

The 4425 is claimed to have a smooth, accurate response from 40 Hz to 16 kHz. Sensitivity is 91 dB SPL for 1 W at 1 m and maximum power handling is 200 W continuous programme. The speakers include a mid and HF control and are manufactured in mirror image pairs in order to retain a symmetrical soundfield. As with the larger bi-radial monitor the 4425 system is claimed to provide a precisely aligned phase response over a 40° wide arc in the horizontal plane. The preferred listening arc in the vertical plane is between zero (on-axis) and 10° up.

JBL Inc, 8500 Balboa Boulevard, PO Box 2200, Northridge, CA 91329, USA. Tel: (213) 893-8411.

UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD. Tel: (0753) 76911.



Summit Audio valve compressor/limiter

Summit Audio have developed a compressor/limiter that they say combines the desirable qualities of earlier valve (tube) devices with the improved performance of modern circuitry. Offering ease of operation, 'warm sound' and 'soft knee' characteristics, the unit has two switchable attack and release settings with

access to the side chain. Stereo coupling is possible and the unit comes with a balanced input and a '990' balanced output stage. Jensen transformers can be supplied as a customer option.

Summit Audio Inc, PO Box 1678, Los Gatos, CA 95031, USA. Tel: (408) 395-2448.

IMS series 200 switcher

IMS has developed a new series of intelligent audio switchers/mixers for production and post production applications. The *Smart Switcher 200* series combines audio signals before routing them and can contain up to 256 summing cross points which can also be configured in groups of eight. Four on-board memories permit presetting of matrixes. The 200 series will interface with

any outboard studio device via its RS422 port thus adding computer control capability and access to synchronisers, sequencers and video editors. A MIDI port is optional.

A larger more versatile version of the 200 series—the 400—is also available and can deal with between 256 and 16,000 crosspoints. **IMS Inc, 1552 Laurel Street, San Carlos, CA 94070, USA. Tel: (415) 592-8055.**



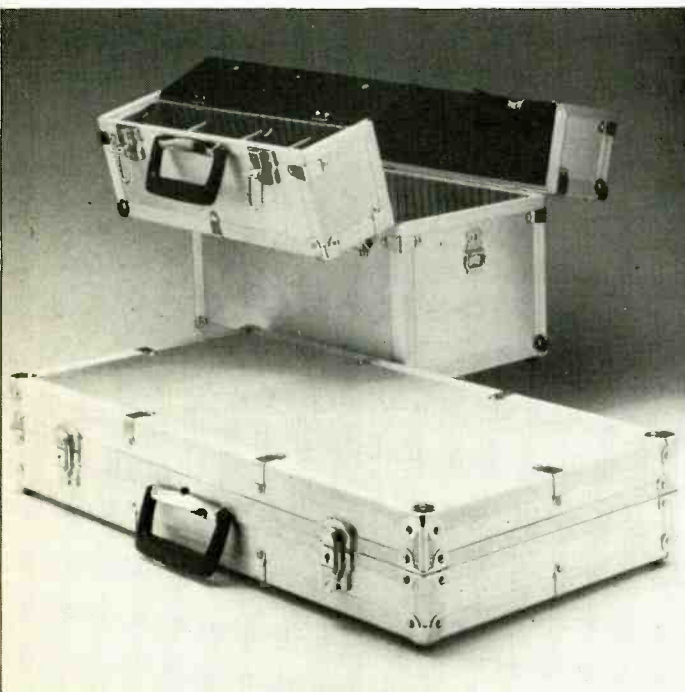
VCL Audio digital console

A new console from France breaks with the traditional console look. At the time of writing details are scant but the SSDV (Senseur Statique Digital Visualisable—Visual Digital Static Sensor) command desk uses 196 mm grooves instead of faders for level control. These can be ordered with either 32 or 64 discrete levels. The grooves are set into a translucent block making the console

surface impervious to dust, dirt and even liquids.

A VDU display and command processor complete the system package. The command processor using 3 or 5 in floppy disks with 64 k memory extendable to 256 k.

VCL Audio, Place du Moulin, Cidex 1924-Valleque, F-31290 Villefranche de Lauragais, France. Tel: (0033) 61 16 92.



AKG flight cases

AKG has introduced two strong lightweight flight cases designed for transporting microphones and valuable sound equipment. The cases which are lockable are made of silver-faced laminated ply panels with aluminium framing and reinforced

corners. The larger case (70×39×14 cm) has serrated infills which can be cut to match specific equipment. The smaller case (25×41×33 cm) has a double opening lid with eight inbuilt compartments and comes complete with a shoulder strap.

PROCESSOR KEYBOARD FD



16 bit Processor Keyboard Floppy Disk — but very piano.

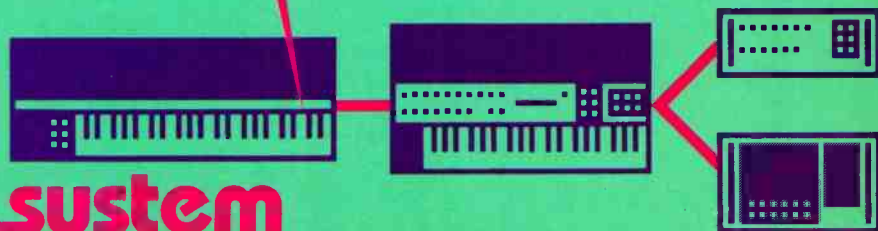
The Processor Keyboard FD is the creative component of the PPG Music Computer System. Its engineering creates your music: 72 high quality weighted wooden keys for dynamic touch playing, just like on an acoustic piano. 16 bit processor for perfect reproduction. Every nuance in touch is enhanced through individual selection of 8 combinable parameters for volume, filter, pitch, attack etc., each adjustable on 8 levels. Simultaneous triggering of PPG WAVE 2.3 and Expansion Voice Unit, even with differential dynamic values. Floppy disk for loading more than 500 PPG Sample Sounds, sequences and MIDI programs — 25 sound disks provided with the PRK FD. Fast loading of complete keyboard arrangements for multifaceted use on stage. Realtime sequencer for quick and exact composition. Songmode for putting together sequences to complete songs. As MIDI master keyboard dividable in up to 16 Midi split ranges. Actuation of up to 16 synthesizers, each self contained in dynamic, pitch, modulation and program selection. New, state of the art "realtime arpeggiator" for control of connected units. For more information about the PRK FD, the complete PPG System, the PPG Sound Library and the PPG Demo Cassette contact your local music dealer.

turnkey

Brent View Road, London NW9 7EL.
Telephone: 01-202 4366. Telex 25769.

PPG

system



NEW PRODUCTS NEW PRODUCTS

Equipment, modifications, options, software

Marshall AES-357 ambience effects system

Marshall's Ambience Effects System is essentially three separate processors—a stereo synthesiser/processor; a stereo post reverb processor and a stereo room simulator and ambience generator.

As a stereo synthesiser the *AES-357* offers 10 mono compatible types including: Stereo Field Conversion (generation of a stereo field by non-harmonic combing); Stereo Imaging Synthesis (stereo image created by multiple delay taps); and Stereo Ambience Generation, a binaural image construction utilising psycho-acoustic processing for front and rear dimension. In all a total of 1,000 programs are possible in this section of the system.

In the Stereo Post Reverb mode the *357* can be attached to the output of an existing reverb unit and it will multiply the echo density by two to 1,200 times. Additionally, it adds to the digital-based algorithms of digital reverbs the power-based algorithms of room simulation. From this it then constructs the room response and characteristic reflections. A thousand programs also exist in this mode.

The Stereo Simulator and Ambience Generator work on the principle that real rooms respond to the power of sound, not the voltage of a signal. Using true power functions and a variable delay matrix that allows multiple input, as well as output taps, room shape, size and ambience are all independently controllable. Another 1,000 programs are available in this section.

Specifications for the *357* show a dynamic range greater than 95 dB and a frequency response from 20 Hz to 20 kHz. All functions are remotable either by a direct control unit or via a computer interface. In the latter case a complete graphics oriented control program package—the *SG4*—is available.

Including the Rear option the *357* has 22 primary outputs each of which are decoded independently. The Rear option itself is not a derived or phase inverted output, but is an independent set of full stereo image corrected rear reflections which increase the tap matrix by 50% and the memory by a 100%.

According to Marshall this technology has been developed to overcome the limitations of conventional digital systems where all output taps (usually six to 12) share the same DAC which severely limits any specialised processing on any one tap. For convincing room simulation each reflection needs to be synthesised separately and accurately.

In order to make the *357* easy to read, large rear projected displays are used which can easily be read from across the studio or stage. The front display changes with function thus avoiding a cluttered and confusing front panel.

Marshall Electronic, United States Audio Inc, Box 438, Brooklandville, MD 21022, USA. Tel: (301) 484-2220. UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314.

Penny & Giles fader

A new motorised fader from Penny & Giles will enable console manufacturers to incorporate moving fader automation at reasonable cost without degrading the operating feel of the fader.

The new fader can be mounted in a channel width of less than 25 mm and the slider travel is 104 mm, compatible with P & G's existing range of manually operated faders. Full scale travel can be achieved in less than 100 ms and the fader

can incorporate mono or stereo taper potentiometer elements in addition to the linear control element.

Penny & Giles Conductive Plastics Ltd, Industrial Estate, Pontllanfraith, Blackwood, Gwent, South Wales NP2 2YD, UK. Tel: 0495 223771.

USA: Penny & Giles Conductive Plastics, 1640 Fifth Street, Santa Monica, CA 90401. Tel: (213) 393-0014.

Tannoy FSM & DTM-8 monitors

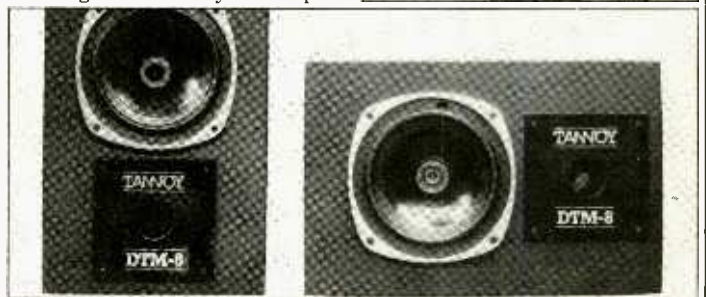
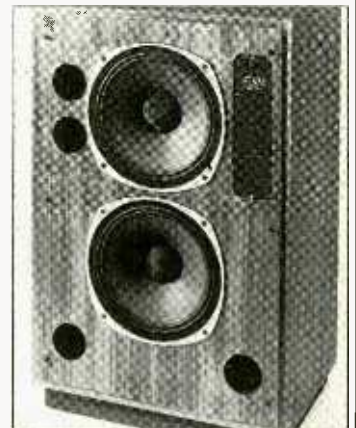
Two more studio monitors have been developed by Tannoy. New to the *SRM* series is the *FSM*. Internally the loudspeaker is divided into two totally separate enclosures with a 15 in dual concentric in the upper chamber and a 15 in bass unit in the lower. Gold-plated links on the crossover panel (adjustable from the front of the loudspeaker) provide frequency response adjustments, a slave input for passive operation and a LF Window In/Out option. The LF Window is designed to match the *FSM* to different room acoustics, particularly those with difficult bass characteristics. With the LF Window in operation the highpass filter to the dual concentric is bypassed so that both drive units operate in parallel with a subsequent 3 dB increase in low frequency energy.

Overall frequency response is quoted at 40 Hz to 20 kHz with a 2π sensitivity of 97 dB. The *FSM* weighs 80 kg (175 lb), measures 1050×720×535 mm, and is recommended for use with amplifiers up to 500 W/channel RMS into 8 Ω.

Using the recently developed

8 in Dual Concentric, the *DTM-8* has been primarily designed for use as a desk top monitor. The speaker has a black textured finish and is supplied without a grille although these are available as an optional extra.

Frequency response of the *DTM-8* is 55 Hz to 20 kHz ±3 dB. Sensitivity is 92 dB (2π) and the nominal impedance is 8 Ω. Overall dimensions are 460×300×200 mm and the *DTM-8* weighs 11 kg. **Tannoy Ltd, The Bilton Centre, Coronation Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3SB, UK. Tel 0494 450606.**



TMK CL100 AU cable length/fault detector

A unique instrument has been announced by TMK for measuring cable length and locating the position of breaks. Additionally the *CL 100 AU* cable break position locator will also indicate cross connections, short circuits and poor insulation in 2-core and coaxial cable. The unit can be used for identifying cable lengths from 1 m to 5 km. Free accessories include all test leads, battery, manual

and case with neck harness for 'hands-free' measurements. A battery operated signal tracer is also available as an optional extra which can be used in conjunction with the *CL100 AU*'s 1 kHz test tone.

Tachikawa Radio Manufacturing Co Ltd, Tokyo.

UK: Harris Electronics (London), 138 Grays Inn Road, London WC1X 8AX. Tel: 01-837 7937.

Low-cost digital audio comes of age.

The Sony PCM series has now been available for several years. In this time recording and broadcast organisations, government, educational and industrial establishments, as well as individual users have all acknowledged the unique value of these units, and made them a new standard. It is the superlative quality of Sony PCM digital, coupled with extremely low cost that has brought about this professional acceptance of the range. This is borne out by the number of new ancilliary products from other manufacturers, that have further increased the flexibility and versatility of the range. Examples of these products are the 'CLUE' logging and editing system from HHB, as well as various interfaces which allow digital communication with the PCM 1610.

Sony has acknowledged that this acceptance by professional users necessitates a change of

policy towards these products. Accordingly they have upgraded them from the domestic catalogue, and, realising the need for professional support and all that that entails, have appointed HHB as specialist dealers to represent them in the pro-audio market.

We are proud to announce this appointment, and happy to assure our customers of continued availability of the PCM range. The re-instatement of the PCM production line has been very largely due to pressure from end-users, who are after all the motivating force in the audio world. So if you are involved with audio recording and are still unfamiliar with Sony digital, then you owe it to yourself to call HHB - the No. 1 name in Digital Audio.

SONY FROM **HHB**

HHB HIRE & SALES, UNIT F, NEW CRESCENT WORKS, NICOLL ROAD, LONDON NW10 9AX. TELEPHONE: 01-961 3295. TELEX: 923393.

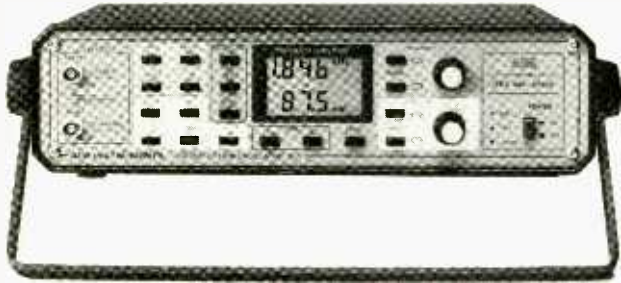


THE SONY PCM71 AND PCM701ES DIGITAL AUDIO PROCESSORS.

NEW PRODUCTS

NEW PRODUCTS

Equipment, modifications, options, software



Aim 501 oscillator

A low distortion oscillator with a built-in computer interface has been released by Aim Instruments. The 501 provides simultaneous display of frequency and amplitude, the latter available in volts or dBm referenced to several standard impedances and corrected to allow for several loading conditions. A normalised amplitude facility is also provided giving the reading as a dB ratio to any pre-selected level. Remote control, memory operation, bus address, reference impedance and load are also indicated on

the LCD display.

Basic specifications for the 501 include a frequency response of 9 Hz to 330 kHz, output up to 7 VRMS with less than 0.01% distortion in the audio frequency range. A non-volatile memory system provides access to 10 stored output configurations and the oscillator can be programmed via its RS232 or IEEE 488 interface.

Aim Instruments, Burrell Road Industrial Estate, St Ives, Huntingdon, Cambs PE17 4NF, UK. Tel: 0480 62225. Telex: 32303.

Sony CD mastering system

Sony has recently announced a second generation compact disc mastering system. The new equipment includes a more compact PCM-1630 digital audio processor and the DMR-4000 digital master recorder. Also available is the DTA-2000 digital tape analyser.

The PCM-1630 is a refined version of the PCM-1610 with newly developed digital and analogue filters and a 33-segment peak reading meter with hold facility. Optional boards include Read After Read (RAR) for use in conjunction with the new DMR-4000 recorder and a digital input/output board for compatibility with AES/EBU standards. The 1630 is fully compatible with the 1610.

The DMR-4000 is a U-matic digital master recorder offering simultaneous playback during recording and the Read After Read facility whereby a second head (the Confidence Reproducer) provides a second composite digital output, both of which can be connected to the PCM-1630 for increased reproduction reliability. The DMR-4000 also features a built-in head cleaner, timecode

generator and reader and easier connections when in use with the PCM-1630 and DAE-1100.

Sony has also released the DTA-2000, a digital tape analyser used to check the integrity of master tapes. Measured items include CRC, average, hold, mute, parity, timecode discontinuity, emphasis on/off and sampling frequency 44.1 or 44.056 kHz. Timecode is displayed in hours, minutes, seconds and frames. Using a Centronics interface the DTA-2000 can be coupled to a printer and all error status indications can be printed against the relevant timecode.

Sony Corp, PO Box 10, Tokyo Airport, 149, Japan. Tel: 03 448-2111. Telex: 22262.

UK: Sony Broadcast Ltd, City Wall House, Basing View, Basingstoke, Hants RG21 2LA. Tel: 0256 55011. Telex: 858424.

USA: Sony Corporation of America, Professional Audio Products Division, 9 West 57th Street, New York, NY 10019. Tel: (212) 371-5800. Telex: 424595.

Tascam new models

Tascam has recently announced several new additions to their range of audio products. In the final stage of development is the ATR 60 recorder. This is a 1/4 in stereo machine with a centre-track SMPTE facility all built into the same head. Based on the M16 transport, the ATR 60 is designed for stereo mastering and is specifically aimed at the musician, pro-audio and video market.

The MS-16 is a 1 in 16-track multitrack recorder with a new, extra heavy duty chassis designed to cope with extended periods of high speed, stop/start shuttling during editing sessions. The machine offers full SMPTE timecode lock-up facilities and +4 dBm balanced and -10 dBV unbalanced inputs and outputs. Options available include a remote control unit, autolocator, dbx units and reel clamps.

The new 388 Portastudio is the first complete 8-channel recording system consisting of a full function 8/8/2 mixer and a full servo-controlled 8-track 1/4 in reel-to-reel recorder. The mixer section includes eight PGM output busses, L/R stereo busses, aux and effects buss, two effects return systems and

a monitor section.

The tape transport employs 1/4 in tape on 7 in reels with a new three motor full servo controlled mechanism. Other features include a real-time tape counter, SMPTE compatibility and dbx noise reduction. A remote punch in/out switch, autolocator and remote transport control are available as optional extras.

Also new is a range of tape duplicators. Known as the T-2600 series, copying is 8x normal speed and the system can provide duplication for up to 21 copies. There are two master decks in the series each with its own slave system. The T2620/MS will duplicate both sides of a mono tape simultaneously. A stereo version the T2640/MS is also available.

The T-2600 series duplicators have built-in monitoring, longlife ferrite heads and ±3% pitch controls.

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. □



The new Sony mic and its pen friends



Sony Lavalier microphones have a long established reputation for quality, performance, serviceability and reliability throughout the broadcasting and entertainment industry.

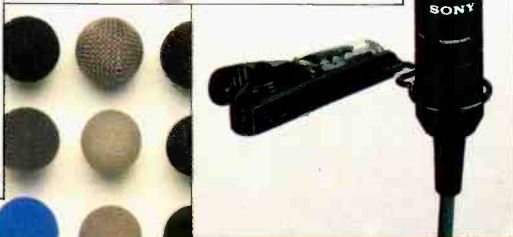
And now, that reputation will be enhanced by the introduction of a new generation of Lavalier microphones providing superior performance and a wider range of applications.

Of special importance is the new ECM-77. This unit is so small (only 5.6mm in diameter), and lightweight (only 1.5 grams), that it will fit snugly into the pocket using a standard size pen clip. Despite its size it has a frequency response from 40Hz to 20KHz.

Further, the wide range of accessories ensures that these microphones are the most versatile, compact and easy to use units available.

The Range

- ECM-77** Available in silver and black. Ultra compact and lightweight. Omni-directional.
- ECM-66** Available in silver and black. Uni-directional.
- ECM-55** Available in silver and black. Omni-directional.
- ECM-44** Available in silver and black. Omni-directional.



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Sony Pro-Audio

MUSIC PAGE

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Synthesis for the studio

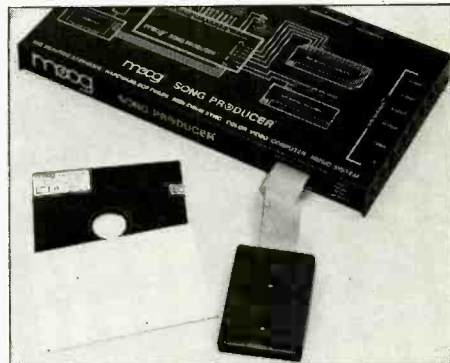
Moog Song Writer

The new Moog corporation has introduced the *Song Writer*, a MIDI real-time/step mode computer music system. The *Song Writer* interface links the Commodore C-64, SX-64 or C-128 into the MIDI system. It is a software/hardware package and does not use the SID chip within the Commodore. The interface includes MIDI input,

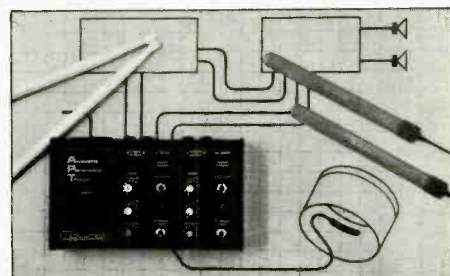
Thru, and four MIDI outputs. There are also eight outputs for triggering non-MIDI devices, a Clock In/Out, Clock Disable In/Out plus two footswitch inputs.

The software side includes several disks for easy updating of the system. These currently include MIDI Command, Songstepper and Sync Command. All software is menu driven with colourful graphics that let you see and edit what you hear. Additional software is under development.

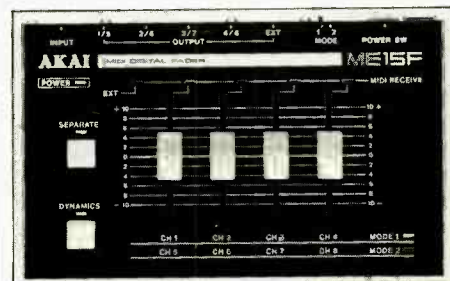
Moog Electronics Inc, 2500 Walden Avenue, Buffalo, NY 14225, USA.



Moog Song Producer with Song Writer



C-ducer APT from C-tape (see facing page)



ME15F MIDI fader from Akai

'000' series power amplifiers

*3000 watts in 5 1/4 inches

- **HIGH EFFICIENCY** dual power supplies from **TOROIDAL** transformer and computer grade capacitors.
- **FULLY PROTECTED** against damage to either load or amplifier.
- **SPACE SAVING** occupies only 3 units (5 1/4") of 19" rack space.
- **RELIABLE** output devices can handle 6 times rated power.
- **UNIQUE** ultra linear transformer coupled driver stage.

dx1000	1000W into 8, mono
	600W into 4, per channel
	300W into 8, per channel
dx1000A	1500W into 8, mono
	800W into 4, per channel
	450W into 8, per channel
dx2000	2000W into 4, mono
	1200W into 8, mono
	1000W into 2, per channel
	600W into 4, per channel
	300W into 8, per channel
dx3000	3000W into 4, mono
	1600W into 8, mono
	1500W into 2, per channel
	800W into 4, per channel
	450W into 8, per channel



*dx3000 bridged mono



Hill Audio, Inc., 231 Marquis Court, Lilburn, GA 30247 USA (404) 923-3193 TLX 293827 HLAB
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 Hill Audio, Ltd., Hollingbourne House, Hollingbourne, Kent ME17 1QJ, England (062 780) 555 TLX 966641 HILL

Tel: (716) 681-7200.

UK: Moog Music, 11 Forth Wynd, Port Seton, East Lothian, Scotland. Tel: 0875 812033.

Europe: Ruud Van Der Matten, p/a Waalhaven ZZ 48, 3088 HJ Rotterdam, Holland. Tel: (31) 10.29.0181.

Akai digital products

Akai have introduced three interesting digital products. Claimed to be the first of its kind in the world, the *ME10D* digital delay offers pure digital sound free from any analogue conversion. The unit is MIDI compatible and can provide delays up to 1000 ms.

The *ME15F* is a MIDI parallel box providing one input and five outputs linked via individual faders.

The Akai Digital Arpeggiator enables the user to automatically create arpeggios from MIDI keyboards or other related instruments. The *ME20A* can also be used as a polyphonic sequencer with step by step input. Three arpeggio patterns are available which include: up, down and sequence. The sequence will

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hold 128 notes and will also memorise harmonics and rests.

UK: Akai (UK) Ltd, Haslemere Heathrow Estate, Silver Jubilee Way, Parkway, Hounslow, Middlesex TW4 6NF. Tel: 01-897 6388.

USA: Akai America Ltd, 800 West Artesia Boulevard, PO Box 6010, Compton, CA 90220. Tel: (213) 537-3880.

C-Tape acoustic trigger

The *C-ducer APT* (Acoustic Percussion Trigger) is aimed at drummers wanting to mix electronic sounds with the acoustic sound of their kit. The *APT* is triggered from kit mounted *C-ducer* mics using signal processing that provides both audio and simultaneous trigger pulses. Separate audio outputs allow the real and triggered sounds to be mixed in any proportion and the *APT* will allow overdubbing of triggered voices from real drum tracks.

The system is available in a 2- or 5-channel format and includes the appropriate number of *C-ducer* mics. **C-Tape Developments Ltd, Transducer Laboratories, Unit 19, Holder Road, Aldershot, Hampshire GU12 4RH, UK. Tel: 0252 319171.** **USA:** C-Tape Developments Inc, PO Box 1069, Palatine, IL60078. Tel: (312) 359-9240.

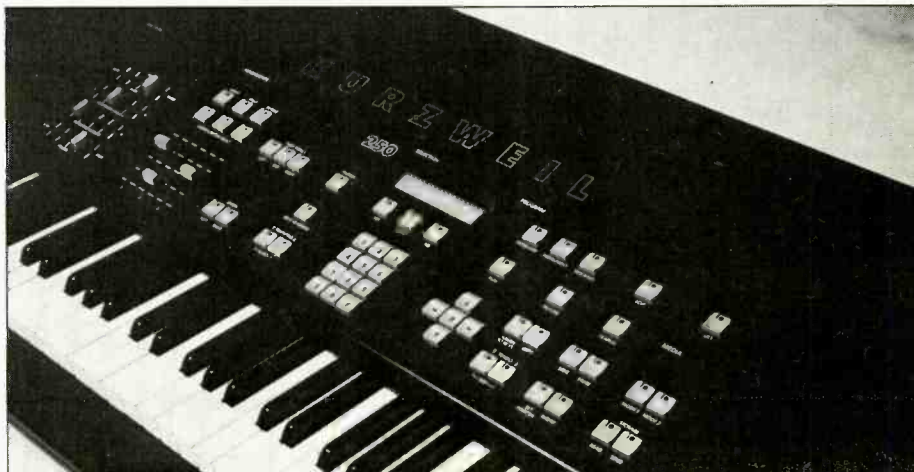
Kurzweil 250 updates

Kurzweil products, have recently unveiled new hardware and software options for the 250. The *Version 2* software improves user programmability and allows stereo delay effect to be programmed as part of the keyboard set up. Also available are variable brightness and five modes of transposition. The 250's sequencer now benefits from comprehensive editing facilities, error correction and looping while in the record mode.

The *Sound Modelling* sampling option offers 20 s of sample time at 25 kHz with 12 bit resolution. Samples may be trimmed, looped and adjusted for pitch.

Also new is the *Macattach* communications package which links the 250 with an Apple *Macintosh* computer. Software currently available provides off line storage for sequences, keyboard arrangements and samples taken using the *Sound Modelling* Program. The new *Sound Block* is also available which will add 84 voices to those already resident in the 250. Among those available are full choir, flute, oboe, clarinet, harp and bass guitar played in a variety of styles.

Kurzweil Music Systems, 411 Waverly Oaks Way, Waltham, MA 02154, USA. **UK:** Syco Systems Ltd, 20 Conduit Place, London W2. Tel: 01-724 2451. □



Kurzweil 250

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DIARY DIARY

Abbey Road subcode editing

Following the refurbishment of Studios One and Two London's Abbey Road Studios have recently upgraded its successful compact disc preparation room with the addition of a Philips LH-04425 PQ subcode editor—one of the first in the UK. With the new editor Abbey Road will now be able to offer very accurate track and index number data

to Sony 1610 digital master tapes destined for CD production.

With the addition of the PQ editing Abbey Road can now take any high quality master tape (analogue or digital) and produce a CD tape master which will need no further processing before being laser mastered at the CD plant to produce the final discs.

BPI first quarter figures

The BPI have recently released the 1985 first quarter record industry sales figures. In the period January to March unit sales were up 16.6% with sales valued at £69.5M compared with £59.6M in 1984. Early indications suggest the second quarter will also do well. Despite the upward trend the BPI note that in real terms the sale of recorded music has declined by

2% over the past four years and is 27% down on levels 10 years ago. Compared with last year LPs declined by 3.1% whilst CDs showed a 379% increase representing 532,000 units worth £3.3M. According to the BPI only shortages in manufacturing capacity and the proliferation of the CD rental business will prevent sales of CDs reaching 3 million units in 1985.

BKSTS award

CTS Studios in Wembley, north-west London, and Neve Electronics have been jointly awarded the Charles Parkhouse 1985 Award by the British Kinematograph Sound

& Television Society (BKSTS) for the development and production of the world's first comprehensive all-digital console.

EMI compact disc plant

EMI have announced their intention to open a CD manufacturing plant earlier next year. The factory, which will be based in Swindon alongside the current Thorn EMI VHD disc plant, is expected to have an annual capacity of between eight and 10 million compact discs.

Although Swindon was chosen because of the availability of high quality

factory facilities and services EMI Manufacturing and Distribution Services at Hayes will continue to distribute CDs throughout the UK and will be eventually involved in distributing UK-manufactured CDs on an international basis. EMIMADS' current commitment to offering record and tape manufacturing and distribution services will continue unaffected.

SSL far east office

Solid State Logic has announced the opening of a far east office in Hong Kong. It will serve clients in China, Singapore, the Philippines, Malaysia, Indonesia and Thailand with a staff of six operating under SSL Far East managing director Bingo Tso. A primary reason for the new office is to support the growing

Chinese recording industry to which SSL have already supplied six consoles.

Solid State Logic Far East, Austin Tower, Suite 301, 22 Austin Avenue, Tsimshatsui, Kowloon Hong Kong. Tel: (852 3) 721-2162. Telex: 47580 SSLFE.

Agencies

● FM Acoustics have appointed Britannia Row of London as their exclusive UK Distributor for all professional FM Acoustics' products.

● The Dutch and West German-based manufacturer of the SA PPE-2400 programmable equaliser, Stage Accompany, has announced that SED are to be their UK distributors.

● BAB Audio Services Southern Ltd, Greater London distributors for Millbank Electronics and Toa Electric has recently been appointed distributors in Herts, Berkshire and Middlesex.

● From November the distribution of Fuji magnetic tape products in the UK will be undertaken directly by Fuji Photo Film (UK) Ltd, and no

longer by Bell & Howell A-V Ltd.

● Amek Systems and controls Ltd and Total Audio Concepts Ltd have appointed Frank Hinton as their new exclusive distributor for Australia. Frank Hinton, Creative Audio Pty Ltd, 189 Melville Road, Pascoe Vale South, Victoria 3044, Australia. Tel: (03) 354 3987.

● Cherry Lane Technologies of Port Chester, New York has become the exclusive North American distributor for the Jellinghaus Musik Systems' MIDI-based software.

● Allen & Heath Brenell has announced that they are now distributing on a worldwide basis the complete range of Ashworth Transducers and Atlas Systems stands.

Address changes

● Audio and broadcasting consultant Jeff Gibson has formed Broadcast Engineering Consultants. BEC carries in-house facilities for the preparation of all drawings, installation diagrams and schedules and is also able to produce specialist equipment and control panels through its own manufacturing company. Broadcast Engineering Consultants, 3 Church Street, Frome, Somerset BA11 1PW, UK. Tel: 0373 67666.

● Sound and lighting consultants, Leisureplan Services have moved to Studio

12, 47 Wharfedale Road, London N1 9SE, UK. Tel: 01-833 5959.

● Genelec OY has moved to a new factory and can be contacted at: Genelec OY, Tehtaantie 17, SF-74100 Iisalmi, Finland. Tel: (358) 77 133 11. The previous PO Box address remains unchanged.

● Alangrove Associates, studio designers and builders, have moved to larger premises allowing them to bring wiring and air conditioning services in house. New address is 84 Uxbridge Road, London W12 8LR, UK. Tel: 01-749 3535.

CBS move into film and TV

London's CBS Studios are nearly moving into the recording of audio tracks for films and TV programmes. With the recent installation of synchronised audio-visual facilities a number of major soundtracks have already been recorded at the studio. These include *Legend*, Sylvester Stallone's *Rambo*, *Key to Rebecca* and *Starchaser*, an animated 3-D movie. Studio

manager Rodger Bain feels the studio's central London location, the wide range of recording facilities and the studio's experience in recording everything from rock to classical music and spoken word are the main reasons they are attracting people to the studio.

CBS Studios, 31 Whitfield Street, London W1P 5RE, UK. Tel: 01-636 3434.

Error correction

We have been asked to point out that the Valley People 440 Processor featured in the New Products section of the August issue is not distributed by Scenic Sounds Equipment in

the UK as was stated. Valley People products are handled in the UK by Atlantex Music although Scenic Sounds do market the OEM VCA and the Transistor Array products.

DIARY DIARY

Hollywood vaults

A new film and tape storage facility is under construction at 742 North Seward Street, Hollywood which when completed will provide temperature and humidity controlled, secure storage space for film, tape and computer data. The vault will feature 24 hr self-service access using a sophisticated

security system. The facility, which is constructed entirely from non-combustible materials, will be monitored 24 hr a day for smoke, fire, flooding and intruders and will use a night-time security patrol service.

Office: 1482 East Valley Road, Suite 625, Santa Barbara, CA 93108. Tel: (805) 969-5775.

Recording industry job centre

Recording engineers and producers looking for work in the US may find I Contact of interest. The company represents a diverse and growing list of freelance engineers who are available for both live and/or recording work. In addition to finding work I Contact provides engineers with exposure, studio and musician referrals, computerised list of recording credits and biography,

scheduling and archive tape library maintenance. Optional services include billing, negotiating, 24 hr answering service and staff positions.

I Contact claim to have booked their engineers for album projects with all the major US labels and is currently expanding the range of services they provide.

I Contact, 474 Greenwich Street, New York, NY 10013 USA. Tel: (212) 935-2962.

Space Logic design

Space Logic are a design consultancy based in London's St John's Wood and although their work spans everything from transport to domestic appliances their main area of specialisation is in designs for the audio industry.

The company is run by Dave Sherrif and Andy Leggo and they can provide everything from a conceptual sketch through to full production drawings and model mock ups. Exclusive to Space Logic is CAPA (Computer Aided Panel Artwork) an IBM mainframe-based system which enables camera ready artwork to be

prepared directly from the computer. Linked with a 2d CAD program both component drawings and graphic layouts can be overlaid on screen giving a virtually instant representation of the product.

Other services include logo designs, costings, technical manuals and promotional literature. Among Space Logic's clients are Bandive, Brooke Siren Systems, C-Tape Developments, Fostex, Martin Audio, Midas, Quark and Trident Audio Developments.

Space Logic Studio, 11A Cochrane Mews, London NW8 6NY, UK. Tel: 01-722 2566.

Contracts

- Scenic Sounds have supplied a Kurzweil 250 complete with the Sound Modelling option to Spandau Ballet.

- Marquee are the first UK studio to order the new

Harrison series 10. The totally automated 80-input console will be delivered in March 1986 as part of the Marquee's extensive rebuilding and expansion programme.

Up the JACOBS DIGITAL ladder another rung

1st UK studio with MITSUBISHI 32 track digital

Bookings (0252) 723518 Telex 85862/858393

JACOBS'S

STUDIOS



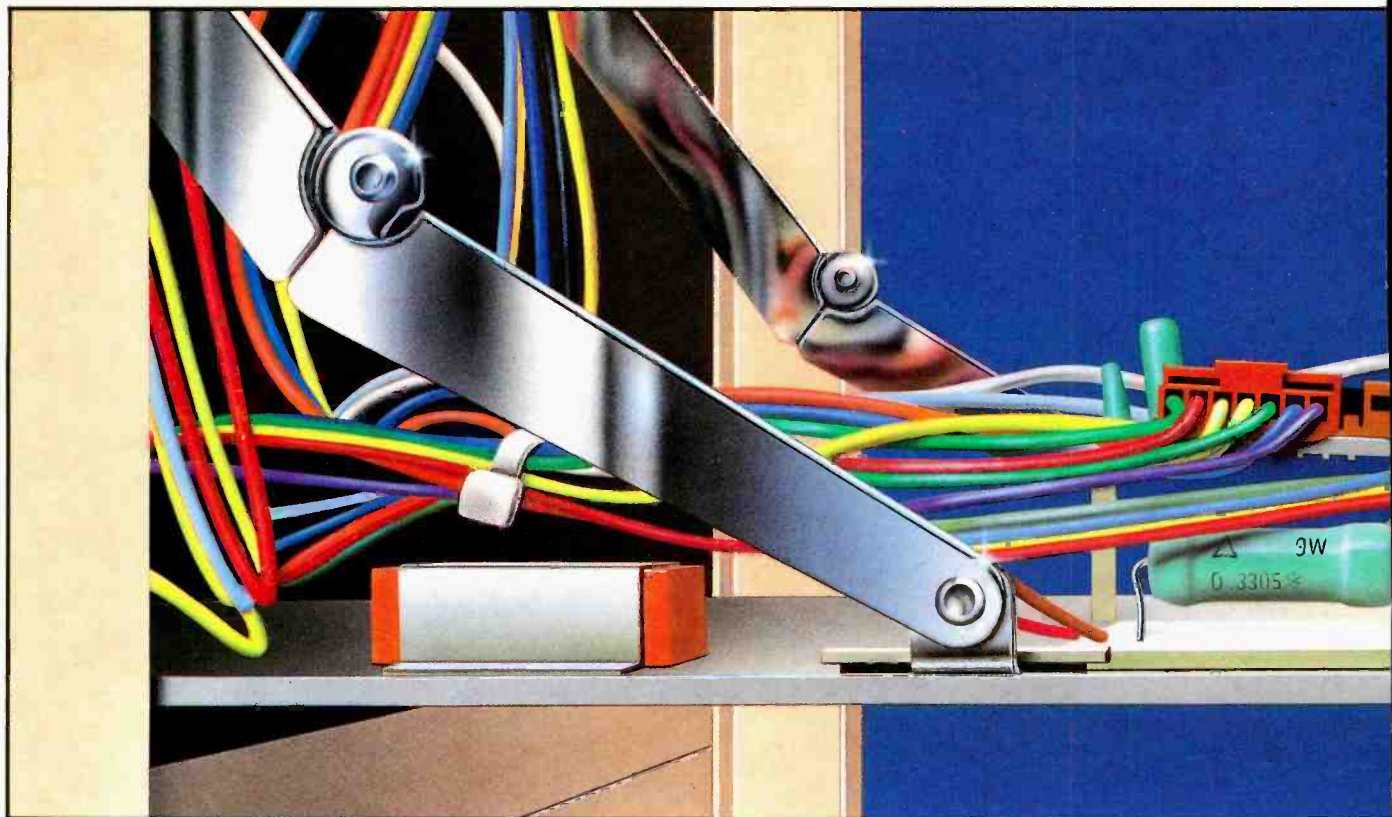
PERFECTONE PRODUCTS SA

MINIMAG Professional portable cassette recorder with pilot tone and SMPTE/EBU time code, in synchronism with film and TV camera.

Type of cassette: BASF UNISLETTE CR T 372 AM
 Tape type: BASF 6, 25mm; 1/4"
 Audio tracks: Two independent tracks of 2mm each (2 x mono or stereo)
 Duration: 24 min. (with tape 22µm)
 Tape speed: 9.5cm/sec.
 Dimensions: 176 x 240 x 90mm
 Weight: 3.6kg with batteries



PERFECTONE PRODUCTS SA, 2560 NIDAU, SWITZERLAND. TEL: (032) 51 12 12 TX. 34383 Perbi CH



**IT MAY SEEM JUST
A DETAIL TO YOU,
BUT OUR REPUTATION
HINGES ON IT.**

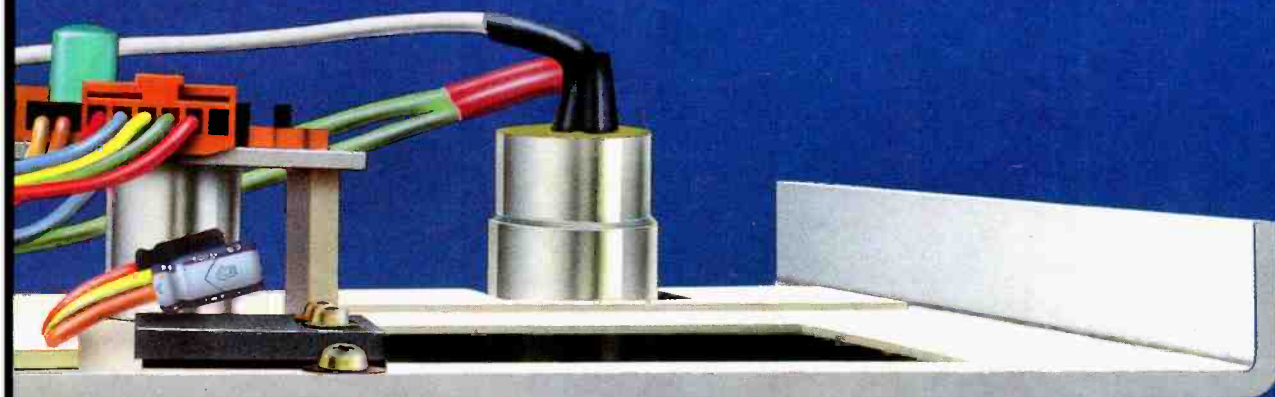
Otari Corporation
2 Davis Drive,
Belmont, California 94002
Telephone: (415) 592-8311
Telefax: (415) 591-3377
Telex: 910-376-4890 OTARICORP BLMT

Otari Electric Co. Ltd.
4-29-18 Minami-Ogikubo,
Suginami-ku,
Tokyo 167
Telephone: (03) 333-9631
Telefax: (03) 331-5802
Telex: J26604 OTRDENKI

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07-05 Aljunied Ind.,
Complex Singapore 1438
Telephone: 743-7711
Telefax: (743) 6430
Telex: RS36935 OTARI

Otari Electric Deutschland GmbH
Gielen Strasse 9,
4040 Nuess 1
Telephone: 02101-274011
Telefax: (02101) 222478
Telex: 8517691 OTELD

Otari Electric (UK) Ltd.
22 Church Street,
Slough,
SL1 1PT
Berkshire
Telephone: (0753) 822381
Telefax: (0753) 823707
Telex: 849453 OTARIG



This panel protects the mother board at the heart of the Otari MTR 12. And it's hinged to allow easier access.

The MTR 12's power supply is fully modular, too, for fast diagnosis and repair.

Even the transport assembly is hinged, for total accessibility.

In fact, every area of the MTR 12 shows that Otari did more than design a recorder with superlative performance. They also made it easier for you to keep it that way.

All of which goes some way towards explaining what makes the MTR 12 the most professional of 1/4" or 1/2" two-track mastering and production recorders.

Otari's advantage can be summed up in one word.

Detail.

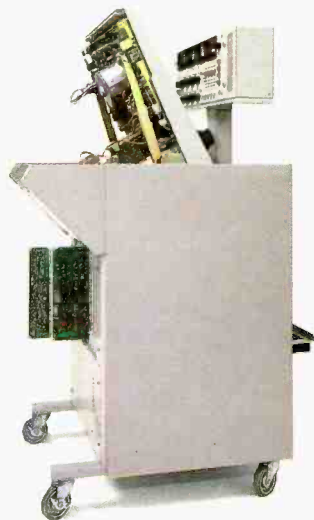
A passionate attention to those things that make a professional's life that little bit easier.

Naturally, because it's Otari, the technology is true state-of-the-art. It's the only recorder of its type to offer 7.5, 15 and 30 i.p.s. And the only design that lets you incorporate IEC format centre-track timecode, with the capacity to resolve mono and stereo pilotones, all in the same machine.

Other than these features, you'll find very few options on the MTR 12. For the very simple reason that the MTR 12's standard specification makes it one of the most complete professional recorders you can buy.

But Otari's attitude can best be shown by the way they build a 24-hour a day mastering recorder to the utmost standards of reliability. And then make it as accessible as they can, for maintenance.

After all, Otari reason, just because they have bent over backwards to make the MTR 12 more reliable, there's no reason why you should have to do the same to keep it that way.



OTARI®

For more information on the MTR 12 or other Otari products, contact
 Turnkey Studio Systems, Brent View Road, London NW9 7EL. Telephone: 01-202-4366.
 Industrial Tape Applications, 1 Felgate Mews, Studland Street, London W6 9JT. Telephone: 01-748 9009.

EXHIBITION PREVIEW

AES 79TH CONVENTION NEW YORK

The 79th AES Convention will be held at the New York Hilton Hotel, Avenue of the Americas, New York from the 12th to the 16th October. The convention will comprise the presentation of a wide range of technical papers on the 12th, and the exhibition will commence on the 13th. We have compiled a preview based on available information at the time of going to press

A

● **Acoustilog Inc:** Range of acoustic test equipment including reverberation timer, Impulser and time delay spectrometry equipment. ● **Adams-Smith:** Synchronising products for audio and audio for video editing systems. ● **ADC Telecommunications Inc:** No details available. ● **Advanced Music Systems:** Range of digital audio processing products including the DMX 15-80S, the RMX16 digital reverb, AV Sync Audio/Video delay compensator and Timeflex time compression. Currently under development is the 16 bit hard disk AudioFile digital recording and playback system. ● **AEG-Telefunken Corp:** Full range of professional tape recording equipment including master recorders, QC machines and high speed duplication equipment. ● **Agfa-Gevaert Inc:** Complete range of professional tape from PEM 469 studio tape to PEM 297D digital 1/4in tape. Also available video and duplicating tape. ● **Akai/IMC:** Range of products including the MG1212 12-channel recording system S612 sampler and other MIDI products. ● **AKG Acoustics Inc:** Microphones, stands, headphones, reverb systems and accessories. Current products include 'ultra-linear' CK61-ULS and CK62-ULS capsules, the fly lead CK1X, CK2X and CK3X and the TDU 8000 delay line. ● **Allen and Heath Brenell USA Ltd:** Range of recording consoles including the CMC and SR Series. ● **Alpha Audio:** Sonex and Sound-Tex acoustic treatment and the Boss production and post production editor. ● **Amek Consoles Inc:** Various mixing consoles including the new range of TAC modular PA and recording desks, improved Matchless with more flexibility. Within the Amek range is the M2500 and Angela recording consoles and the BC01 series II broadcast and production mixer with 'remote trigger' interface. ● **AMI/Concept Design:** No details available. ● **Ampex**

Corporation, Magnetic Tape Div: Full range of professional mastering, duplicating tape and cassettes. ● **Ampeco Sound Lab BV:** ASL intercom system with light and/or sound signal. ● **Amtel Systems Inc:** No details available. ● **ANT Telecommunications/Solway Inc:** telcom c4 noise reduction systems for studios, broadcasting and satellite transmissions. ● **Anvil Cases Inc:** Comprehensive range of flight cases for the recording and entertainment industry. ● **API Audio Products:** No details available. ● **ART Applied Research & Technology:** Various signal processors and equalisers including the new DR1 and DR2 units and the latest software updates. ● **Audico Inc:** Audio and video cassette loaders, winders, labels and accessories for the duplicating and professional market. ● **Audio Developments:** Range of compact mixers including the AD062 Multimixer, the AD145 Pico and the semi-modular AD160. ● **Audio/Digital Inc:** Range of digitally related equipment. ● **Audio Kinetics:** New products include the *Elipse* editor for controlling 32 machines (SMPTE) with full transport and record control on each machine. The *Q.Lock 4.10* synchroniser has been extended with an accessory card slot. Other equipment includes *MasterMix* console automation and the *Timelink* electronic gearbox. ● **Audio Precision:** Range of audio test equipment designed for testing analogue or 16 bit digital systems. ● **Audio Technica US Inc:** Unipoint broadcast and recording microphones, headphones, cartridges and accessories. ● **Audiotechniques Inc:** Details of the company's sales, rental and service operations. ● **Audio Video Consultants:** Magnetic tape duplication systems, audio and video tape loaders, labelling and insertion equipment. ● **AXE:** Various studio products including the *KT-1000* programmable digital metronome/synchroniser, headphone amplifier and studio DI boxes. ▶

Akai (UK) Limited-Electronic Music Division, Haslemere Heathrow Estate, Silver Jubilee Way, Parkway, Hounslow, Middlesex TW4 6NF.
Telephone: 01-897 6388
Telex: 892555 AKAIUK G.

Stockists:

Aberdeen

Bruce Miller, 363 Union Street, Aberdeen, Scotland.

Cambridge

Cambridge Rock, 8 Burleigh St, Cambridge, Cambs.

Cardiff

Music Land, 148-152 North Road, Cardiff, S. Wales.

Chelmsford

Future Music, 10 Baddow Road, Chelmsford, Essex.

Eastbourne

Peter Bonner Musical, 12a Grove Road, Eastbourne, E. Sussex.

Edinburgh

Gordon Simpson Ltd, 6 Stafford Street, Edinburgh, Scotland.

Fleet

Kingfisher Music Co, 20 Kings Road, Fleet, Hampshire.

Glasgow

McCormacks Music, 29-33 Bath Street, Glasgow, Scotland.

Liverpool

Hesseys Music Centre, 62 Stanley Street, Liverpool.

London

Freedmans, 627-631 High Street, Leytonstone, London E11.

London Rock Shops, 26 Chalk Farm Road, London NW1.

Turnkey, 14 Percy Street, London W1.

Syco Systems, 20 Conduit Place, London, W2.

Chromatix, 12 Oak Road, Ealing Broadway Centre, London W5.

Rod Argent Keyboards, 20 Denmark Street, London WC2.

Gig Sounds, 86-88 Mitchum Lane, London SW16.

Maidstone

E & S Electronics, 2 Upper Fant Road, Maidstone, Kent.

Manchester

A1 Music Centre, 88 Oxford Street, Manchester.

Newcastle-upon-Tyne

Rock City Music Ltd, 10 Moseley Street, Newcastle-upon-Tyne.

North Mansfield

Carlsbro Sound Centres, 182-184 Chesterfield Road, North Mansfield, Notts.

Romford

Monkey Business, 66 Victoria Road, Romford, Essex.

Swindon

John Holmes Music, 21-23 Faringdon Road, Swindon, Wilts.

AKAI

A new world of sound creation



NOW AN INCREDIBLE EXPERIENCE IN SOUND CREATION...

THE MG1212 RECORDER/MIXER

If you're looking for a complete recording system – combining multitrack recorder and mixer into one – then look no further. You've found it in the AKAI MG1212.

Imagine a unique 1/2" cassette tape – the first of its kind – offering no less than 12 audio tracks (with dbx noise reduction) plus special sync and internal control tracks, with the ease and simplicity of a home video recorder. A sophisticated on-board autolocator with pinpoint accuracy. And much more. It's already exciting.

Now imagine a full-function 12-channel multitrack mixing console with professional-standard controls and flexibility. 3-band sweep EQ. LED bargraph metering. XLR mix inputs. Insert points. And a unique centralised push-button routing matrix. It's all there: just what you'd expect from a company like AKAI.

But now imagine both these units – 1/2" 12-track recorder and mixer – together in the same machine. The result is a unique, compact, integrated package that no-one else can match. Its all-in-one concept eliminates tiresome multitrack wiring looms and brings you flexibility, versatility, ease of use and sensational sounds.

It's that special combination of versatility and ease of use that gives the MG1212, and the whole AKAI Micro Studio System, the edge. If you're looking for a new creative experience, AKAI's got your sound.

For stockists see facing page.

AKAI

A new world of sound creation

EXHIBITION PREVIEW

B

- **Kenneth A Bacon Associates:** No details available.
- **Barcus Berry Electronics:** Extensive range of contact transducer microphones and accessories.
- **BASF Systems Corporation:** Complete range of professional audio and video tapes including test and calibration tapes, *Studio 910*, *Digital Master 930* and *Loop Master 920*.
- **Beyer Dynamic Inc:** Among the new products on show will be the *MC740* condenser microphone offering five polar patterns, switchable or remote controlled. Other items include the *HM 560* headmic, the *M380* dynamic mic, a modular condenser system and additions to the wireless microphone system.
- **BGW Systems Inc:** Professional amplifier range for studio, stage and broadcasting.
- **Biamp Systems Inc:** Full range of small mixing consoles and signal processing equipment.
- **Bosendorfer Piano Co:** concert and recording pianos.
- **Brooke Siren Systems:** full range of electronic crossovers, including the first showing of the new *FDS 360*, DI boxes, phase checkers and testers plus the *DPR402* dynamic processing range.
- **Bruel & Kjaer Instruments Inc:** Extensive range of test and calibration equipment and music recording microphones.
- **Bryston Ltd:** Range of power amplifiers.

C

- **Calzone Case Co:** Flight cases for touring and recording equipment.
- **Cetec Gauss:** High speed duplicating systems, studio monitors and drive units.
- **Cetec Ivie:** Complete line of audio analysis, pink and white noise generators, microphones, amplifiers and preamplifiers including the *5000* series modular system.
- **Cetec Vega:** Wireless microphones and intercom systems.
- **Cipher Digital Inc:** Microprocessor controlled timecode readers, generators and character inserters.
- **Community Light & Sound Inc:** Range of sound reinforcement equipment.
- **Connectronics Corp:** Large range of cable, connectors and ready-made leads up to 32-pair multiway available.
- **Countryman Associates Inc:** Precision electret microphones including the *Isomax 11*, *Isomax 11H* and *Isomax 1V* systems.
- **Crest Audio:** Range of

power amplifiers including the *2501A*, *1501A*, *2001A* and *1001A*.

- **Crown International:** Full range of PZM mics, professional amplifiers including the *Delta Omega 2000* also and the Microtech and *TEF* measuring system.

D

- **David Hafler Co:** Amplifiers—both pre- and power—including the *P220* and *P505*.
- **DCS Audio Products:** No details available.
- **Direct Design Sound Inc:** Range of loudspeaker systems for sound reinforcement. Products include the *DRF-1* flush mounting radial horn and the *DVB-1* bass reflex enclosure.
- **DOD Electronics:** Wide variety of rack-mounted sound processing equipment including parametric equalisers, delay lines and graphic equalisers.
- **Dolby Laboratories Inc:** Professional noise reduction systems for studio, broadcast, duplicating and video use.
- **D+R Electronica BV:** Series *2000* and *4000* recording consoles, *Discom* mixers, automation ready *4000* and *8000* consoles and *SCORE* computer remix.

E

- **Eastern Acoustic Works Inc:** No details available.
- **Electronic Systems Laboratories Inc:** No details available.
- **Electro Sound Inc:** High speed duplicating systems including Dolby *HX* system.
- **Emilar:** Extensive range of loudspeaker drive units.
- **Estudios Gema SL:** No details available.
- **Eventide Inc:** Signal Processing equipment including the new 16 bit *H969 ProPitch Harmonizer*, the *SP2016* effects processor/reverb unit with *Generation II* software, the *H949 Harmonizer*, *JJ193* delay line and the *APX252* RTA.

F

- **Fairlight Instruments:** The *CMI* digital synthesiser system including the new series *III*.
- **Five Towns College:** No details available.
- **FM Acoustics Ltd:** New version of the *FM 236* linear-phase electronic crossover plus existing range of amplifiers and the new high energy transfer cables, *Forceline*.
- **Fostex Corporation of America:** Full range of Fostex products including

multitrack and mastering machines, mics, speakers and signal processing equipment.

G

- **Goldline:** Low cost acoustic measurement systems including spectrum analysers and noise level meters.
- **Gotham Audio Corporation:** Wide range of professional products from various manufacturers including Neumann and EMT. Other products include NTP level meters, TTM/Fabec noise reduction frames, Klein+Hummel monitor loudspeakers and Gotham audio cable.

H

- **Harrison Systems Inc:** Wide range of consoles including the *HM4*, *MX-8* and the new totally automated *series 10*.
- **Heino Ilseman GmbH:** Automatic cassette loading and labelling systems.
- **HM Electronics Inc:** Various radio mics and receivers, transit cases and accessories.

I

- **ICM Ltd:** Audio cassette labels, *CO* shells and cassette boxes.
- **Innovative Electronic Designs Inc:** Computer and digital audio control systems.

J

- **JBL Incorporated:** Professional loudspeaker products and associated equipment.
- **JRF Magnetic Sciences:** Magnetic recording heads servicing and sales for studios and duplicators.
- **JVC Corp of America:** Digitally related equipment, equipment for PA applications and signal processing systems.

K

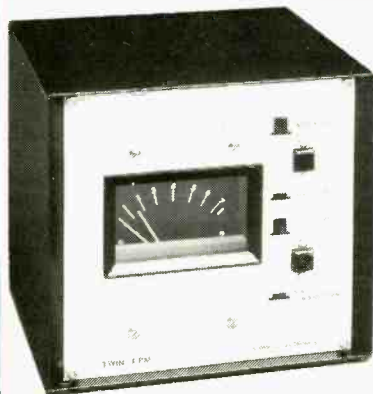
- **King Instrument Corp:** Video and audio cassette loaders with fully automatic operation.
- **Klark-Teknik Electronics Inc:** Full range of signal processing equipment including the series *300* graphic equaliser, series *700* digital delay line and the *DN60* real-time spectrum analyser. New updated software for the *DN780* added density digital reverberator/processor.
- **Kurzweil Music Systems Inc:** The Kurzweil *250* digital synthesiser system.

L

- **Lexicon Inc:** Digital signal processing products including the *224XL* digital reverb with *8.2* software, the *PCM60* and model *200*. Also on display will be a variety of digital delay lines.
- **Lumitrol Corp:** No details available.

M

- **Magnifax International:** Auto tape degaussers and tape duplication systems.
- **Marshall Electronics:** Full range of Marshall signal processing devices including the *Time Modulator*, *Tape Eliminator* and the new *AES 357* Ambience Effects System.
- **Martin Audio Video Corporation:** Selection



TWIN PPM BOX

High quality Ernest Turner TWIN movement in a mains-powered unit. The illuminated coaxially-mounted pointers of the TWIN offer an unrivalled method of monitoring stereo left and right or sum and difference controlled by a front panel switch. Meets IEC65-2, BS415 safety.

Ring or write for full specification of this or:

- ★ PPM2 and PPM3 drive circuits
- ★ PPM5 20-pin DIL hybrid
- ★ Ernest Turner movements 640, 642, 643 and TWIN with flush-mounting adaptors and illumination kits
- ★ Peak Deviation Meter
- ★ Programme and Deviation Chart Recorders
- ★ Stereo Disc Amplifier 3 and 5
- ★ Moving Coil Preamplifier
- ★ 10 Outlet Distribution Amplifier
- ★ Stabilizer
- ★ Fixed Shift Circuit Boards
- ★ Broadcast Monitor Receiver 150kHz-30MHz
- ★ Stereo Microphone Amplifier
- ★ Advanced Active Aerial

SURREY ELECTRONICS LTD.

The Forge, Lucks Green,
Cranleigh, Surrey GU6 7BG.
Tel. 0483 275997

EXHIBITION PREVIEW



The CU-32 microphone

from their wide range of products.

• **Meyer Sound Laboratories:** Acoustic analysis techniques (*SIM*), professional loudspeaker systems and *CP-10* parametric equaliser. • **Micro-Point Inc:** Leading supplier of cutting styli and associated disc cutting products. • **Mitsubishi Pro Audio Group:** Range of Mitsubishi digital recorders including the new *X-850* 32-track digital recorder plus Quad-Eight consoles and Westrex products. • **Monster Cable Inc:** Wide range of specialist cable products and interconnects.

N

• **Nagra Magnetic Recorders Inc:** Comprehensive range of professional ¼ in portable recorders for production and post-production work including the *T-Audio* twin capstan multi-format recorder and the *IV-s* SMPTE/EBU stereo recorder. • **Nakamichi USA Corporation:** Range of products featuring cassette decks. • **Neotek Corporation:** Audio consoles for recording, broadcast and sound reinforcement including the latest *ELITE* series. • **New England Digital:** *Synclavier* digital synthesiser system.

O

• **Orban Associates Inc:** Range of signal processors including stereo synthesiser, parametric equalisers, de-essers, compressor/limiters and accessories. • **Otari Corporation:** Range of professional mastering, duplicating and multitrack machines.

P

• **Paktec Automation:** No details available. • **Panasonic Industrial Co:** Ramsa mixing consoles, horns, speakers and microphones. • **Peavey Electronics Corp:** Professional power amplifiers and a wide range of sound reinforcement equipment including mixers, speaker systems, monitors and microphones. • **Penny & Giles:** Range of faders including the new Motorised Studio Fader. • **Pioneer Electronics USA Inc:**

No details available. • **Polyform Inc:** No details available. • **Pro Co Sound:** Wide range of professional single and multipair cables and connectors.

• **Publison America:** Range of signal processors including the *Infernal Machine 90* with up to 5 min of time delay and RS232, MIDI and SMPTE interfaces.

Q

• **QSC Audio Products Inc:** Range of power amplifiers. • **Quantec Tonstudioteknik GmbH:** Computer technology-based digital room simulators.

R

• **RCA Records:** Open reel and cassette test and alignment tapes. • **Red Acoustics (USA) Ltd/Pro. Sound Ltd:** Professional monitor loudspeaker systems. • **Rhone-Poulenc Systemes/Pyral:** Disc cutting laquers and magnetic tape products. • **Roadie Products Inc (Hybrid Cases):** No details available. • **Roland Corp US:** The Roland rack system and recently introduced synthesiser and ancillary devices. • **RPQ Diffusor Systems Inc:** Acoustic diffusers for scattering sound over a broad range of frequencies with uniform wide angle coverage. • **RSEC:** No details available. • **Rupert Neve Incorporated:** Range of broadcast and recording consoles. Details available on the DSP digital consoles and NECAM 96 moving fader automation system.

S

• **Saki Magnetics Inc:** A wide variety of replacement heads for the most professional multitrack and mastering machines. • **Samson Products:** Range of wireless microphone systems and accessories. • **Sanken Microphone Co Ltd:** Range of high quality microphones and associated accessories. Four new microphones will be launched—the *CU-31* and *CU-32* cardioids, the *CMS-2* and *CMS-6* MS stereo mics. • **Sansui Electronic:** No details available. • **Schoeps/Posthorn Recordings:** The full range of Schoeps microphones and accessories. • **SCV Audio:** Signal processing equipment including noise gates, equalisers, compressors and cross-over units. • **Selco/Sifam:** Extensive range of panel meters and accessories. • **Sennheiser Electronic Corp:** Full range of microphones, radio mic systems, headphones and accessories. • **Shure Brothers Incorporated:** Microphones, cartridges and sound reinforcement equipment and ancillary products. • **Sierra Audio Acoustics:** Phase-coherent studio designs and variable acoustic systems. • **Solid State Logic:** On demonstration the new *SL 5000 M* series audio production system for stereo television and general broadcast use. Also on demonstration will be the *SL 6000 E* console and on view the *SL 4000 E*. New options include a programmable parametric equaliser with two channels of dynamic stereo panning ▶

Prefer



20 years experience...

.....and turnover.

MPR-1425

Line of products includes:

full range of back electret & dynamic microphones; mike mixers, disco-mixers, mike cable + multi cable, headphones

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Production & Distribution

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p.o. box 1002, 6160 BA Geleen
Tel. (04494)-47373
telex: 36008
The Netherlands

EXHIBITION PREVIEW



Soundcraft Series 200B

and the SSL Integral Synchroniser and Master Transport Selector. ● **Sontron Instruments Pty Ltd:** No details available. ● **Sony Corporation of America:** Wide range of professional microphones, recording consoles, digital and analogue tape machines and CD mastering equipment items on show for the first time include *DMR 200* digital master recorder and the *1630* PCM processor. ● **Soundcraft Electronics Inc:** Will demonstrate a large selection from their extensive range including the new *TV24* broadcast console and the new series *200B* portable desks. Other consoles include the series *600*, *500*, *2400*, *1600*, *800B* and *4*. Also on display will be the series *760*, 24-track machine and the series *20* 2-track master recorder. ● **Sound Ideas/Sound Effects Library:** Library recordings of sound effects. ● **Sound Technology Inc:** Test equipment including microprocessor controlled tape recorder test set and distortion measuring equipment. ● **Soundtracs:** Main exhibit will be the Commodore *64* linked *CM4400* console. Also new is the *M-R* series 16-track console and the *T* series range. The established range of *16/8* and *24/8/16* consoles will also be on display. ● **Sound Workshop:** Diskmix

automation system and recording consoles. ● **Stanton Magnetics Inc:** Wide range of phono cartridges, headphones and record care products. ● **Steinway & Sons:** Musical instrument manufacturer. ● **Studer Revox America Inc:** Wide range of products including consoles, digital and analogue recorders for mastering, multitrack and duplicating, the *TLS 4000* synchroniser and the *A725* professional CD player. ● **Sunkyoung International Inc:** Manufacturer of magnetic tape products. ● **Symetrix Inc:** Wide range of equipment including amplifiers, compressor/limiters and signal processors, etc.

T

● **Tandberg:** Full range of professional products including *TCD910* master cassette recorder and the *TD50* series ¼ in 2-track tape recorders. ● **Tannoy North America Inc:** Various studio monitor loudspeakers for broadcast and recording. ● **Tascam:** Extensive range of consoles, tape machines and accessories. ● **Technics:** No details available. ● **Tektronix Inc:** Test equipment including the *SG5010* and *AA5001* programmable units. ● **Telex**

Communications Inc: No details available. ● **3M—Magnetic A/V Products Division:** Analogue and digital recording tape for the professional recording, broadcast and video industry. ● **Timeline Inc:** *LYNX* SMPTE timecode module. ● **Toa Electronics Inc:** Large range of products including amplifiers, loudspeakers, microphones, mixing desks, sound reinforcement and signal processing equipment. ● **Trident (USA) Inc:** Recording consoles including the new series *75*, the portable series *65* and the *TIL* series. ● **Troisi Engineering & Design Co:** No details available. ● **TTL USA Inc:** Automated cassette loading systems. ● **Turbosound Inc:** Range of sound reinforcement loudspeakers, sub woofers and floor monitors and the new *StarGate 626*.

U

● **Ursa Major Inc:** Variety of digital reverberation systems and stereo processors including the *StarGate 323*, *Space Station* and the *MSP-126* multi-tap stereo processor.

V

● **Valley Audio:** Design consultants, Boxer monitoring systems and pro audio distributors. ● **Valley People Inc:** Signal processors including the *440* limiter/compressor/dynamic sibilance processor, model *430* dynamics processor, *610* compressor/expander and the *800* series signal processors. ● **Viking Cases:** No details available.

W

● **Whirlwind Music Dist Inc:** Interface and cable products for the professional user. ● **Wireworks Corporation:** Full range of professional cables and connectors.

X

● **Xedit Corporation:** Test equipment and the complete range of *Editall* splicing blocks.

Y

● **Yamaha International Corp—Pro Products Division:** Wide range of consoles, power amplifiers and signal processing equipment. Featured will be *REV-7* digital reverb.

Z

● **Zonal Ltd:** Professional recording tape including *675* for mastering applications and *610* for broadcast.

● **Studio Sound:** Both editorial and advertising staff from *Studio Sound* will be in attendance at the convention. Copies of *Studio Sound* and our sister publication *Broadcast Systems Engineering* will be available from our booth 411A. Please feel free to come along and have a chat. □

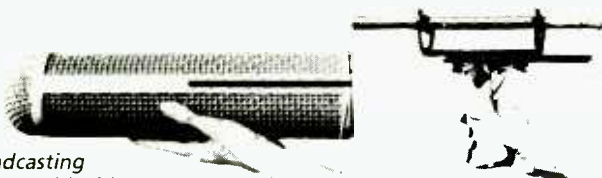
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ECHO TIMES

EMI:AMS

At a recent studio managers' conference held at EMI Abbey Road Studios in London it was unanimously agreed that pieces of AMS outboard equipment would be made available for every control room in all EMI recording studios worldwide. The delegates represented studios from EMI's international network including Japan, Australia, New Zealand, U.S.A., Germany, Sweden, South Africa, France, Holland and the U.K.



NEW·NEW DMX 15-80S Two Channel Sampling

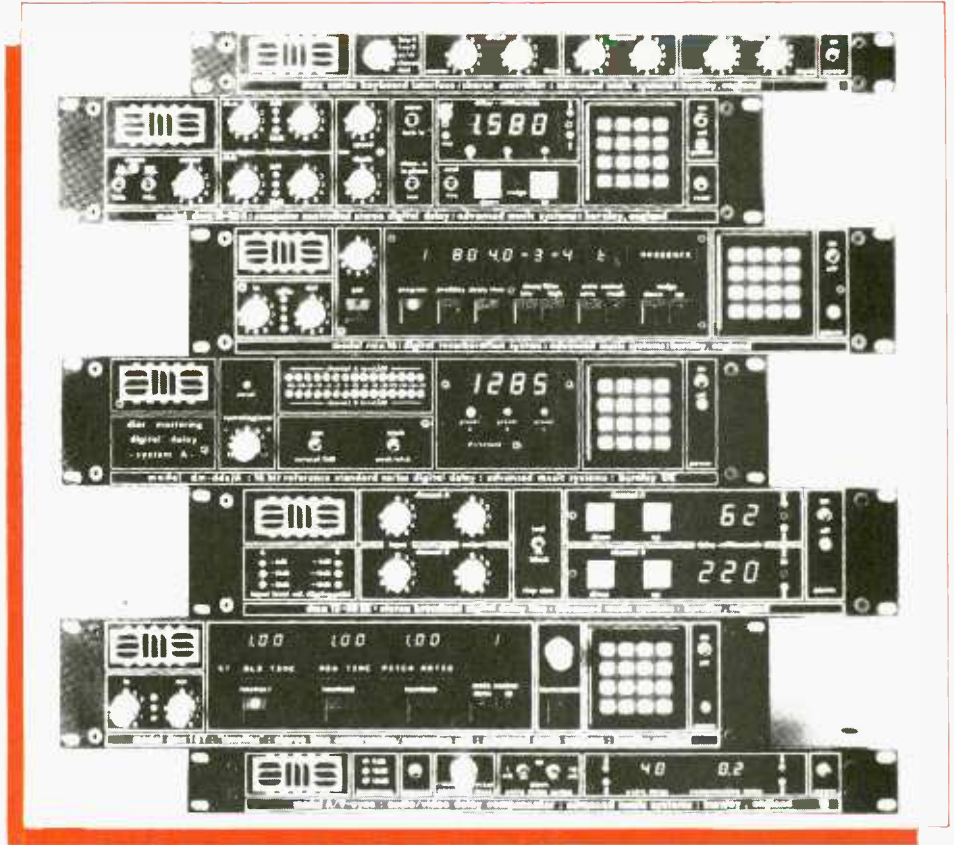
A new update has now been introduced for the DMX 15-80S giving users the option of sampling and triggering two independent pieces of information.

Each of these samples is controllable as with the original single loop – continuously looped, manually single triggered or triggered by audio input. In the case of audio triggering, audio input sufficient to illuminate either the channel A or channel B input LEDs will result in triggering of the sample stored on that channel of the unit.



NEW·NEW RMX 16 Memory Expansion

The RMX 16 can now be supplied with memory expansion to increase the number of factory set programmes from 9 to a number capable of accommodating



all AMS factory set programmes available at any one time. New programmes for the RMX 16 will still be made available on bar code allowing those owners with remote terminals and wands to immediately take advantage of new software issued.



NEW·NEW TIMEFLEX

AMS Timeflex has continued to prove its popularity with audio, video and film post production facilities by providing very high quality audio time compression. Timeflex is capable of operating in mono, dual channel or stereo modes and for this reason contains additional circuitry to that offered with standard AMS pitch changers to ensure complete phase matching of channels when used on a stereo signal.

A new interface card for AMS Timeflex is now available providing communications to external audio, video or film machines. The two standards

currently offered are RS 422 and 9K6/19K2 tacho signals. These interfaces allow Timeflex to automatically correct audio pitch should the machine to which it is interfaced be vari-speeded.

Alternatively, again using this interface, Timeflex can behave as master simply allowing the user to enter a new play time and accordingly Timeflex will accurately alter the machine speed and correct the audio pitch.

TIMES SIX

The popularity of "Echo Times", particularly in the U.S.A., as a medium for keeping owners, users and potential owners of A.M.S. equipment up to date with the latest developments has not gone unnoticed. We have received many requests to supply back-issues and accordingly reprints of all previous issues have been made and complete sets are now available on request.

The following people were interviewed in issues 1 to 5, all discussing their uses and applications for A.M.S. units: Martin Rushent, Kevin Peak, Air Studios, Hilton Sound Rental Company, Tom Bailey (of the Thompson Twins), Phil Collins, Humberto Gatica, Jeff Lynne of ELO, Paul McCartney and Hugh Padgham.

People in the know

"The AMS DDL is used to provide variation on the various rhythms, especially the bass drum rhythms. Effects used on 19 were setting the delay to a semi quaver's length so that instead of a steady four on the bass drum you get sixteenth notes in succession. A reverb with a long delay time could then be added to the original bass drum but omitted from the echoes for extra effect. Another effect that was used was to make the echo fall on an existing beat such that phase elimination would occur.

Also sometimes I add a bit of white noise to the snare by playing it onto a track from a synth, just to make it sound bigger. And I've found ways of using the AMS to make the sound much bigger."

Paul Hardcastle talking in an interview with Richard Walmsley in Electronic Soundmaker and Computer Music magazine.

"It is generally felt in digital circles that hard-disc editing is the way of the future, and with AudioFile, AMS has beaten many of its larger competitors. The software possibly needs a little refinement, but I for one am looking forward to the day when I can install one of these devices in Tape One."

Bill Foster of Tape One studios talking in Music Week.

"One of the stars of APRS 85 was AudioFile from AMS."

Jim Evans of Music Week.

"On Mag element A there was an LCR band mix, mag B contained Sting's vocal on track one, and the girl backup vocals on tracks two and three, and on the last three-track mag element there was bass and stereo audience. AMS digital effects were summed onto selected tracks during this mixdown: "AMS mania" according to Aaron."

Brad Aaron talking to Larry Blake of Recording Engineer/Producer magazine about "The Police Synchronicity Concert" film.

"After all, recording in 1985 is not like recording even in 1982. A little bit of the modern technology had kind of passed them by while the band was regrouping (after Lionel Richie went solo). They saw the AMS gear lined up in the outboard rack, and they couldn't believe it. We were sampling drums: we'd have a guy come in, but we wouldn't use him playing - we'd just sample his kit. Then we would have the track

programmed on a Linn and we'd replace the machine bass drum or snare with sampled sounds.

It took the making of this album for the band to embrace the new technology."

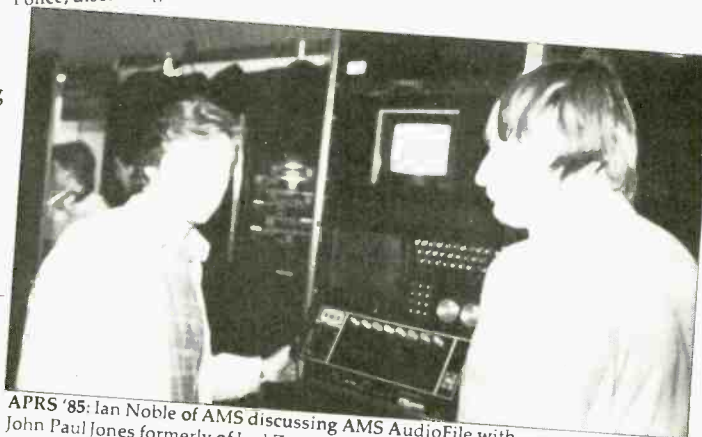
Dennis Lambert talking about the making of the Commodores "Nightshift" album in an interview with Mel Lambert and Ralph Jones of Recording Engineer/Producer magazine.

"If we're doing the cymbal parts separately, I'll use an AMS stereo timeprocessor with no delay using pitch changer on A channel reading 1.005 and on B channel reading 0.995 (1.000 is normal pitch). If you send the left hand cymbal track to the B channel of the AMS which returns on the right hand side, and send the right hand cymbal track to the A channel of the AMS which returns on the left hand side, this gives a nice zingy spread to the cymbals without being too splashy."

Producer Steve Brown talking to Janet Angus about his work with Wham, ABC and many others in HSR magazine.



APRS '85: Stuart Nevison of AMS with Stewart Copeland of the Police, discussing AMS AudioFile.



APRS '85: Ian Noble of AMS discussing AMS AudioFile with John Paul Jones formerly of Led Zeppelin.

"Is there any outboard equipment you particularly like?"

"Well I really like our AMS reverb, it gets used on nearly everything."

Muff Murfin, studio owner talking to Paul White of HSR magazine.

"One thing we did was to take the kit out into the live foyer, record the snare onto digital, pick up a good sounding hit and dump it into the AMS digital memory. Then in the mix we triggered it from the normal snare and added it to the overall sound to give a bigger Ambiance."

Producer Chris Kimsey discussing the track Kayleigh by Marillion with Jim Betteridge in International Musician and Recording World.

"When I mix I like to have a couple of AMS delay lines, minimum, an AMS reverb, as many Pultec (valve) equalisers as there are in the world because I love to record drums through them."

Chris Tsangerides talking about studio work with such bands as Thin Lizzy with Peter Buick of Sound Engineer magazine.

"Outboard equipment is also comprehensive with AMS 1850S and RMX16 units, a Yamaha Rev 1 and the Lexicon 224. Nick also has thoughts for the future in this area, "I would dearly

like to get the AMS Audiofile. It would be absolutely super - both for our audio clients and straight audio use".

Nick Turnbull talking to sound engineer

"On the Go West album we only had the MSQ 700, which was our lifeline. Now we've got the SXB, which links up really well with the TR 909. It's great for programming, triggering the AMS and stuff like that.

"For the Radar album we used the SRC - I like to have that facility because you can change the drum patterns if new ideas come up. On some of the tracks we had to pull out whole bass lines and relocate them with the AMS. It's like painting pictures - you can just rub a bit out and move it.

It might take two hours but I'll pick out a couple of things I can use somewhere else and it sounds really whacky."

Go West producer Gary Stevenson talking to Peter Buick of Sound Engineer magazine.



Ray Parker Jr.

Ray Parker Jr. is one of those people who never cease to amaze you as to how many projects they have been involved in or even how many successful songs they have written. Although not particularly big in England, Ghostbusters gave Ray three separate attacks at the British charts – firstly on the singles release, secondly on the release of the Ghostbusters film and finally it climbed the charts again as a 12" mix.

A.M.S.: *Briefly, what is your history?*

R.P.J.: The first 5 or 6 years of my career I worked as a studio musician and got involved in a series of different projects ranging from Marvin Gaye and Stevie Wonder to the Rolling Stones and Boz Skaggs. Then I got into writing songs and had success with things for Barry White, Rufus, Chaka Kahn and of course my own stuff – Ghostbusters was obviously a big break.

A.M.S.: *Is there anything you consider distinctive in the way you work?*

R.P.J.: I don't know about everyone else but I write to sounds. I have to go into the studio and hear the drums just like they are going to be on the record – I've got to hear the synthesizers, again just as they are going to sound on the record. Once I've got a framework I can formulate other things around that – I can't just sit down with a Linn like some people do. I have to have the sound EQ'd with reverb and effects added which is why AMS is so important.

A.M.S.: *What other reverb units do you use?*

R.P.J.: Let me see, I've had a AKG spring for 9 years. I have a Lexicon 224 and the 224X and a big EMT but I've never really got into that. I like things where I can reach them and just punch buttons which is one reason why I decided to add the RMX 16. I love the sound of the A.M.S. reverb and the sounds I really like I can get quickly and easily. For that reason it's the system I use most of all – that and probably the 224.

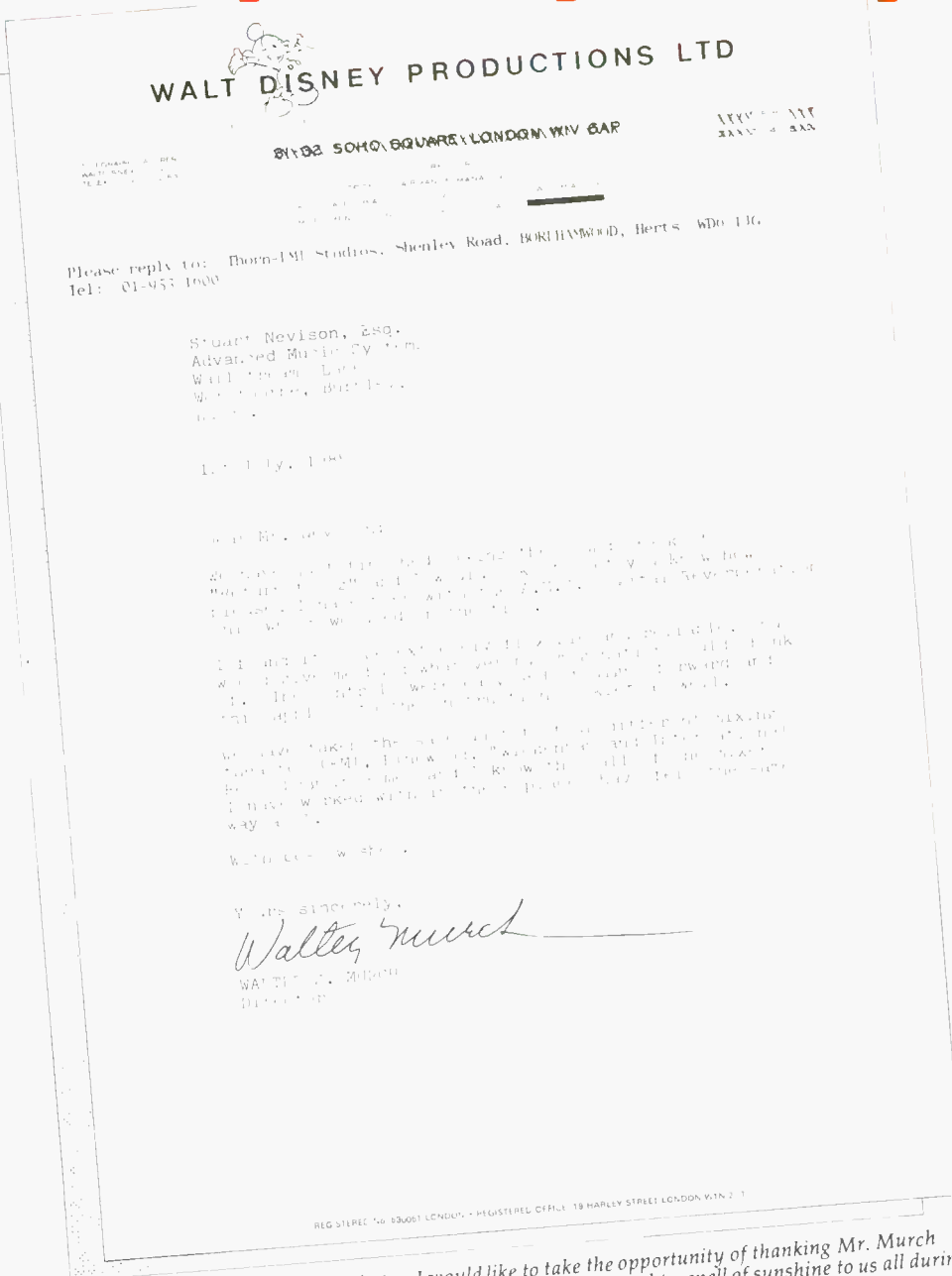
A.M.S.: *Do you have any favourite programmes?*

R.P.J.: All the programmes sound real good but my favourite is the AMS Nonlin. It's so different – it's unique – yeh! AMS Nonlin I really love that one. The Reverse programme is nice too. I guess a plate or a plate programme will get people to say well that's reverberation – but these special effects programmes are real nice.

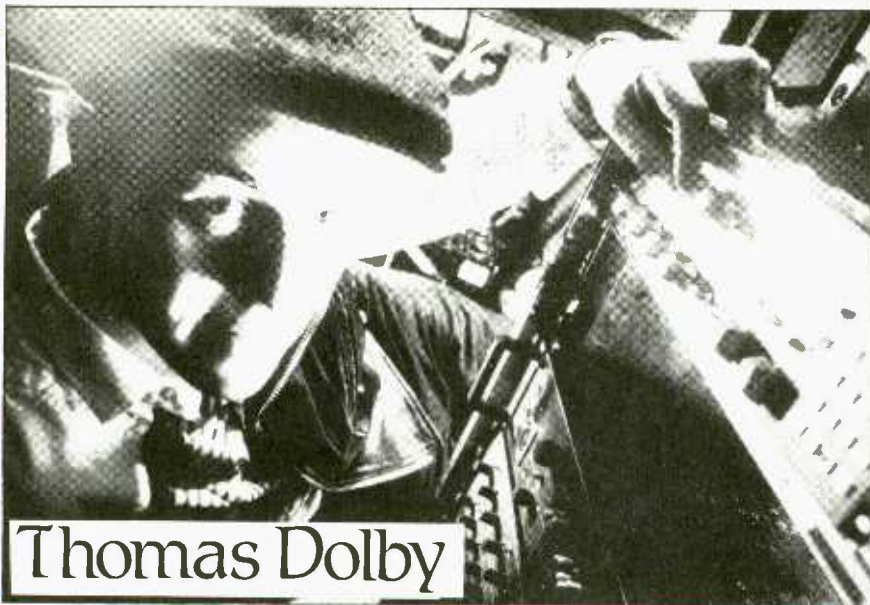
A.M.S.: *So what's next for you?*

R.P.J.: I enjoy being a solo artist/engineer and all I want to do is get in there and play with more buttons and gadgets and just experiment. I've heard a lot about DMX 15-80S DDL pitch changer and it sounds real interesting – I don't own one yet but my studios here are just choosing some new gear so who knows! Don't forget to listen out for my new album and 45 you'll definitely hear lots of AMS on them. ●

Disney • Disney • Disney



Following receipt of the above letter, I would like to take the opportunity of thanking Mr. Murch on behalf of all the staff and workforce at AMS. His letter brought a spell of sunshine to us all during what must be one of the coldest and wettest English summers on record!



Thomas Dolby

Thomas Dolby seemed to appear from nowhere at a time when totally synthesizer based bands such as the Human League were enjoying the peak of their success. Unlike quite a few of the "totally electronic" bands, Thomas Dolby has survived and gone on to further develop his individual style. AMS caught up with him during a three month stay in Los Angeles where, amongst other things, he was completing work on a project with Joni Mitchell.

A.M.S.: *So here we are in the Hollywood Hills!*

T.D.: Yeh! I've rented this house whilst working here. The best thing about the house is not that it originally belonged to Jenny Agutter but that Steve McQueen's 50's pick-up truck is down in the garage in absolutely showroom condition.

A.M.S.: *How did your career develop?*

T.D.: When I was 14 I used to write the odd song on the piano but with not having lessons there was never any discipline to get good at it. Because of that I moved to synthesizers. People had just got past the long blond hair and cape stage and instead of individual bravado on a Minimoog, people like Brian Eno exploring different textures created by a synthesiser were beginning to influence popular music. Living alone in London during the Punk era meant that even though I'd got very good at writing and arranging quite sophisticated songs on the Portastudio that had just come out, I really wanted to play in a band. So I managed to get some session work with bands including Bruce Woolley, Lene

Lovitch and Foreigner.

A.M.S.: *So how did the first album surface?*

T.D.: Doing sessions got me a bit of a reputation as a player which did open a few A & R men's doors. The first album was really just making a 24 track version of my demo material which I think caused it to suffer a bit as there were some things I just couldn't recreate. There is a lot going on in my songs and the fact that I write and direct my own videos gives me an opportunity to explain them better. The coverage given to the music and videos by MTV and cable here in the States gave me the break and it happened here in America before anywhere else.

A.M.S.: *Did you approach the second album differently?*

T.D.: Very much so, I don't think I was ever a part of the totally electronic sounding cult, but, people that liked those sort of bands would at least give me a listen and hopefully find something else in there. By this time I had used the DMX 15-80S as a sophisticated delay line, it was the first system with a good sound and character that meant you could match tape echo. Peter Gabriel and Kate Bush had just been through Townhouse studios using the Fairlight and at the same time "sampling" was everywhere and really hip.

A.M.S.: *So sampling and the Fairlight played an important role on your second album?*

T.D.: Yes they did and so did A.M.S. I write mainly on the Fairlight – however the Fairlight, as it stands now, seems to

have the potential that the more you build – the smaller it gets if you know what I mean. So once I've done my arrangement I go back to the original sounds that I've sampled, store and edit them in the 15-80S and then trigger them from the Fairlight. That gives me far superior sound quality and perspective, longer samples and also very importantly more accurate control by being able to offset the triggered samples to get the right feel to the piece.

A.M.S.: *You aren't the first person I've heard mention perspective. How important is that to your music?*

T.D.: Perspective has been an enormous breakthrough. The creative energy in England that continues to build up seems to have gone into production rather than the raw commodity, but there are a group of English producers that are 2 or 3 years ahead of the rest of the world – and I think it's because of their use of perspective. When all you had was an echo plate the information you got was how far away you were from an instrument. Now with delay lines and units such as the RMX 16 you can create atmospheres and your instruments can come from anything from a small room to an empty lonely canyon.

A.M.S.: *Do you create these perspectives during recording?*

T.D.: Yes, my approach is very cinematic, I tend to use the RMX 16 during the recording process to build up the song as I don't like leaving everything to the mix. You can make mistakes this way introducing perspectives to a single track that don't work when taken with the whole song. In an ideal world I would have a huge rack of multiple everything such that the mix would be vocals from the multitrack and everything else running live.

A.M.S.: *Does that mean something like AMS AudioFile interests you?*

T.D.: AudioFile is very exciting, I could quite happily do away with my multitrack tape recorder because AudioFile would allow me to drop in and out of record, edit within a track and repeat phrases. It's fascinating and given it's my own view of the way things are going to go I think AudioFile is the first serious device to arrive and I'm sure it will have a big influence.

A.M.S.: *A final question. Is there any function on any piece of A.M.S. equipment you would miss most if you lost it?*

T.D.: No. I'd miss them all! ●



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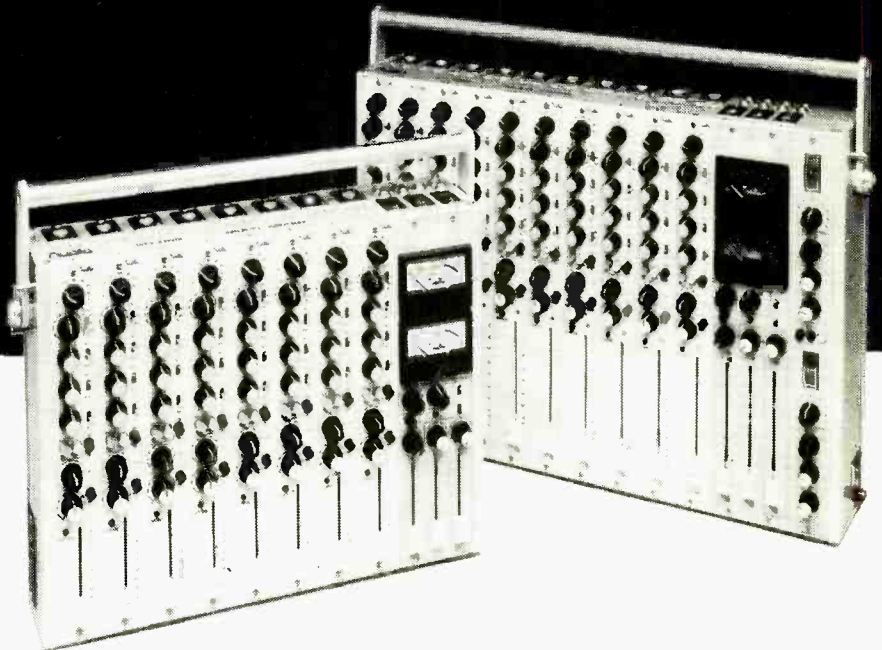


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LIVE AID

The hundreds of people who gave their time to put Live Aid together, created an unforgettable experience. It was a very emotional day and most important of all, it created a consciousness hitherto unmatched of the distress of Africa, and the terrible plight of its inhabitants.

The day started out in Wembley, led by Status Quo with their appropriate *Rocking All Over The World*. The performances went on to include the Style Council, Boomtown Rats, Ultravox, Spandau Ballet, Elvis Costello, Nik Kershaw, Sade, Sting (with his solo version of Roxanne), Phil Collins, Howard Jones, Bryan Ferry, Paul Young and Alison Moyet. This took the show up to 5 pm. At this point the American satellite went into operation and the acts were then alternated between the US and the UK: Bryan Adams, U2, the Beach Boys (who received a standing ovation at Wembley Arena where they were viewed on video screens whilst also receiving a standing ovation in Philadelphia), Dire Straits,

July 13th 1985 was a memorable day in Wembley, London. To see so many people working with a vast amount of hurriedly assembled technology on a truly global scale for such a worthy cause is little short of miraculous. We decided to record as much about the event and the people involved at the London end of the event. We have several reports, some will overlap; some even contradict but that really only goes to show the scale of the event.

In the first part we have reports from Janet Angus on the radio production and Richard Lamont on the TV and the telecommunications

Queen (who had Wembley screaming and singing throughout their appearance). This was followed by the video of *Dancing in the Street* by Bowie and Jagger then Simple Minds, the Pretenders, The Who, Santana, Elton John,

Kool and the Gang, Madonna, and the Wembley Finale led by Paul McCartney. This was by no means the end of the story since Philadelphia were now on their own. There followed Tom Petty, The Cars, Neil Young, Power Station,

Eric Clapton, Phil Collins, Robert Plant, Jimmy Page, Duran Duran, Madonna, Patti Labelle, Hall & Oates, The Temptations, Mick Jagger, Tina Turner and, finally, Bob Dylan.

The technical element of the event was extremely complex with so many different acts and instrumental line-ups involved. The BBC sound recording crew consisted of engineers Mike Robinson and Dave Dade, and producers Jeff Griffin and Chris Lycett. Jeff Griffin and Mike Robinson have, over the years been involved in many simultaneous radio/television broadcasts and their experience was tested to the limits at Live Aid.

How does the BBC set about tackling such a mammoth project? Jeff was involved in a lot of the preparation and planning work.

"The technical side of the stage preparation wasn't discussed as fully in our presence as was preferable. The BBC had a hell of a responsibility getting the show from Wembley out to the rest of the world—it was very complicated and very far reaching. But it was fascinating. One of the most

The two concerts were seen around the world by a billion people or more, and by the audiences at Wembley and Philadelphia on giant Diamond Vision screens. The operation at John F. Kennedy Stadium was handled by ABC and at Wembley by the BBC. Most countries were fed by 525-line NTSC pictures from ABC, the exception being Europe where a 625-line PAL feed was available from the BBC.

The BBC used two outside broadcast vehicles at Wembley. London 1 is a large colour mobile control room which was used to provide the concert coverage and to provide the feed to the US. Eight cameras fed into this truck. Four of them were large LDK5 types: two of them were on a runway directly in front of the stage, one was at the PA mixing platform and the fourth was on a hoist behind the rear of the stadium



Camera checks for the opening act Status Quo

overlooking the roof. This was used to provide a standard long shot for users to 'opt in' or 'opt out' of Wembley.

Very high sound pressure levels from the PA posed serious problems. Tom Concoran, one of the Wembley directors, says that horizontal banding on one of the LDK5 cameras was caused by microphony. "At times the PA was so loud and to get the shot I was asking for the cameraman very bravely

pulled right back to in front of the PA stack. The sound pressure level was literally vibrating the internal works of the camera. It wasn't a fault but it was a problem: the cameraman couldn't hear the talkback too well and we got this banding. We were having to make a choice a lot of the time between not getting the shot we wanted or getting it with stripes all over it."

The other four cameras were lightweights. Three were on

stage—two handheld, and one on a Hothead remote control mounting over the centre of the stage, operated by a cameraman behind the PA stack. The fourth lightweight camera was on the Goodyear airship to provide aerial shots.

London 22, the second vehicle, provided the feed for European networks and the BBC's own domestic networks. This took the concert coverage from London 1, and added all the outside sources. The main source, of course, was the Philadelphia coverage from ABC. There were also contributions from Australia, Japan, Holland, Austria, Yugoslavia, the USSR and West Germany. There were contributions in sound only from an Ethiopian famine relief camp, and from Concorde as it carried Phil Collins from his Wembley appearance to his Philadelphia one.

London 22 had two lightweight cameras of its

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fascinating technical meetings I have ever been to was discussing the lines, satellites and feeds—and I'm not a technical man.

"Bringing the picture in from Philadelphia via satellite with mono sound is easy in itself—you just have to convert from the American standard to the British. But the stereo sound had to go on another satellite for the necessary broader bandwidth. When the signal goes through the converter it is delayed, so they had to build in a slight delay into the stereo sound because it doesn't need converting since sound is sound. There were so many fine little details to be taken care of."

The Wembley stage's most unusual feature was a circular section which was divided into three and rotated through the sections to speed setting up and dismantling of stage sets.

"When we realised how complicated it was going to be from the stage point of view and the frequency of the band changeovers, our original thought that we could cope with one recording van became less and less attractive."

What finally made up their minds was the fact that the first three acts were to follow in as quick succession as possible since all three sections of the stage could be set up beforehand.

"There was no way we could change from one band to another—one of the changes

was only five minutes. You can't change the desk in five minutes." The decision was taken to bring in another van. The van Jeff and Mike work out of is equipped with a 40-channel SSL 4000E console and they needed a second van to match. The BBC own four of these but resources were already stretched for a number of reasons and after a lot of consideration a van from Scotland was brought down. "This also meant that we required more room at the site, but we had to do it because some of the changeovers were just impossible."

The vans' equipment complement is almost identical—the only difference being in the multitrack machines—one being a Studer A800 and the other Lyrec. They each had a few ancillary effects units including two pitch shifters, AMS digital reverb and digital delay lines which they made use of although there were many more pressing requirements which took priority over the engineers' efforts and attention.

Monitoring was on the traditional Rogers LS5/8s. Mike had originally hoped to be able to use Kef 104.2 speakers but it was decided that they had not been field tested for such a heavy duty event and that it would be better to play safe. In addition to the two recording vans, they also had an MRV (mobile recording vehicle) which housed multitrack and digital machines. More of this later.

The sound crew was quite



BBC mobile stereo sound facility



Live Aid sound check

own, which were used in the Wembley Stadium commentary box to provide teletext material, links and chat for UK consumption. An animated 'sting', consisting of a rotating Live Aid logo and Radio One type jingle, was used as a cue to European networks to opt out of the UK-only material. This sting was played in from a 1 in videotape machine in a VT truck provided by Trillion Video.

One of the London 22 cameras could be moved to a backstage position for interviews with performers as they came off stage. The Trillion truck had the capability to record, edit and replay these interviews using a further two 1 in machines. There were also standby videos on tape.

There were two other OB units in use, feeding back to Wembley. One was a single camera unit at Heathrow Airport to cover the departure of Concorde. The other unit

was a three-camera unit at the Legends night club, to provide material for Europe in the gaps between sets at Philadelphia, after the end of the Wembley gig.

All the outside contributions went into BBC Television Centre first. Norman Taylor, a BBC engineer who specialises in major international 'link up' programmes, explained the routing. "The United States was coming into us on Brightstar from 1330 to 0400 BST (British Summer Time). That was being converted in the BBC from NTSC to PAL. It was going into Studio Four Television Centre, to a Quantel 5000. We didn't use the studio—just the control room and the Quantel."

The Quantel was used to provide an effect for moving from one location to another: the outgoing picture would shrink into a quarter of the frame and the new picture would zoom in from the opposite quarter to fill the whole screen.

The feed from the US also went into Studio B, which was used as a switching point for contributions before being fed on a link to London 22.

Norman Taylor says some of the contributions used a satellite circuit for vision and a terrestrial link for sound. "The problem then was that we had to make absolutely sure that all the delays were correct. First of all I guaranteed to the rest of the world that any signals coming out of Television Centre would be totally synchronised in terms of sound against vision. Secondly, we realised that within the UK, there would be a lot of people who would be listening to Radio One in stereo but watching TV.

"We had to correct for two things. One was satellite (vision) against terrestrial (sound), the other was video going through synchronisers and the Quantel 5000."

The stereo sound feed was provided by BBC Radio as described in this issue.

Television took exactly the same mix, and made a mono feed by adding left and right. London 1's sound desk was used to provide three different audio feeds—for the US, for Europe and for the UK.

Six radio links were used for video between Wembley and Television Centre. Three were for the outgoing signals. One was for incoming contributions, and two were to and from the Quantel. Audio and communications channels, between Wembley Stadium and both Television Centre and BBC Radio at Broadcasting House, were provided on British Telecom balanced pairs: 50 circuits were used in all.

The signal from Japan arrived as NTSC. Norman Taylor says this was converted to PAL and fed to Studio Four, for the Quantel, and via Studio B to London 22. "The

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small considering the size of the task before them. "We had two teams of our own SMs" (studio managers, ie engineers) "in conjunction with OB engineers who were looking after the technical running of the vans and the run of lines, etc. These teams were led by Mike Robinson and Dave Dade who were assisted by Mike Shilling and Mike Engels respectively, checking microphones between numbers and checking the lines for each band."

The divided stage was furnished with two main stage boxes—one going to each van. There were three people stationed on the stage throughout the day, whose sole function was to test the mics and look after the stage set up generally: James Birtwhistle, Mark Farrar and Mike Walters. Between numbers Jeff and Chris checked backstage with the artists that they hadn't changed anything in their line-up and that the stage set up was as everyone was expecting.

"We decided right at the beginning that it would be better if we all stuck to the things we did best. So Radio One did all the sound for both television and radio. Television would look after the commentaries and link-ins which was great, because



Goodyear airship circles above Wembley

when our bands were not on stage, we could get ready for the next one.

"Television had a sound desk in the Master Scanner (mobile) with John Caulfield at the mixing point, acting as continuity, taking the sound from the sound mobiles and linking in from backstage or in the gantries or wherever else. We had said right at the beginning that there was no way we could do television and radio sound separately—it was far too complicated."

A lot of preparatory work was put in, although there were so many changes that some of it proved to be a waste of time. Mike Robinson endeavoured to compile charts for each of the performances he was going to be responsible for so that he could get the van ready reliably. "I had sort of worked out a programme for it but most of the information came in at the eleventh hour and it

was pointless then."

Preparations wise, apart from all the technical planning, the sound team had to somehow acquaint themselves with an enormous quantity of music and musician line ups. Mike and Jeff attended as many rehearsals as possible including The Who, Elton John, Bryan Ferry, David Bowie and Queen, absorbing the feel of the bands and watching the way they worked. Mike: "We were



One of two Diamond Vision screens installed at Wembley

feed from the USA was separately converted in Television Centre and handled in the same way—Quantel and Studio B. Then we had Australia, plus all the European contributions, put via a synchroniser to the Quantel. It went to Studio B pre-sync, because we had synchronisers at Wembley and we didn't want to have double synchronisation because that would aggravate the delay problem. The sources on that feed were Australia, Austria, Holland, Yugoslavia, USSR, Germany and Holland again. "Australia and Japan came

in on the Indian Ocean satellite. The European contributions came over the normal European (terrestrial microwave) circuits. I'm pretty sure that the Soviet Union's contribution came in via Eurovision as well: Moscow to Helsinki then down the normal route. We couldn't get time on the satellite out of the Soviet Union, which is a far cheaper and better way of doing it."

There was a voice report from Ethiopia, which came in by telephone. The BBC had wanted to set up a link using an Inmarsat circuit but it

proved impossible to sort out the paperwork in time.

The contribution from Concorde came in on British Airways' normal long-distance system—a single sideband short wave link. British Airways fed the signal from their terminal station at Heathrow to the BBC over a 4-wire telephone line.

The BBC had 4-wire talkback circuits to nearly everywhere. "We put people on and took them off according to the timing of their contributions. We had a 4-wire all the time to the USA, from London 22. We had a separate 4-wire from London 22 to Studio Four so that the director could control the Quantel. We had another one from London 22 which went into a conference unit in the International Control Room (Television Centre). At various times it went to Japan, Holland, Germany, Austria, Yugoslavia and the USSR. We only put them on about half an hour before their contribution was due. When they had done their contribution we would take them off again. So the director

was presented with his next contribution about 20 min before it was due. Also, the 2-wire output from London 22, which the producer was on, went to most of the destination countries. He could tell them how long the next opt-out was going to be and what he was going to do next."

Live Aid was not the largest outside broadcast of all time in terms of numbers of cameras, etc, but there were several factors which made it a pretty hairy operation. One was the short time in which to plan it. Another was the widespread use of stereo sound on the international TV links. Another was the constant switching between different countries. There were a number of problems on the day but considering the extremely difficult operational circumstances, it's not surprising. Anyway, when covering something so worthwhile and so poignant, the gremlins really don't seem to matter. □

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looking at instrumental line-ups and listening to the music. I didn't hear most of the music until the actual week of the event, and even then I didn't get a chance to hear all the bands that we did. It is very hard to memorise all those songs and also, we didn't always know the line-up of the bands before the morning of the event." Even knowing who to listen to was not always as straightforward as it may seem; Mike did spend some time learning Ultravox songs only to find that the other van ended up with that band.

Thursday 11th July, and the

BBC moved into Wembley. Even then, the panic hadn't seemed to have set in. There was merely a buzz of excitement and people hurtled around trying to sort the complex mass of cables out. Whenever it did become hectic, however, things were generally calmed with the sentiment that their current problems were nothing compared to the reasons they were all there in the first place.

"In the last week the running order must have changed five or six times—minor alterations such as the insert from Russia and Yugoslavia which affected the timing of the whole day's proceedings. On Friday it was

all systems go. After lunch we were theoretically running the first three bands as they would be on Saturday, but it took three and a half hours to rehearse the first three bands—fortunately the same thing didn't happen on the day.

"On the Friday we also rehearsed Spandau Ballet since their performance would be the first time the stage had gone full circle but this threw up huge problems. All the PA and BBC people were there until 10 o'clock that night talking through their mutual problems."

Plug-in charts had been issued by Malcolm Hill (PA) but although they were very carefully worked out beforehand, actually getting all the people involved to adhere to them caused a few problems. "On the day there was some difficulty in sticking to the original plugging diagrams. Everybody had to have a standard plug-in list, whereas it is usual for everybody to do things their own way. It was decided that that would be unworkable with so many different things going on. In a situation like this with 18 different acts, there was no time for such luxuries."

Mike: "Come the rotation of the stage and somehow things came unsorted. There was that much ironmongery flying around that we couldn't double mic it so we took feeds from the PA mics. The choice of microphones was left mainly up to the PA.

"There were two splitter boxes on stage: one to the stage which was performing and one to the stage which was setting up and about to become live. If everything had gone smoothly and according to plan we could have had five minutes calm, when all the mics had been tested and everything, just to sit back and think about little touches and refinements that we could have made to the sound. But it didn't work out like that and I wish it had. When the stage rotated, something seemed to happen to the mics, even the spare mics sometimes!"

Most of the artists were surprisingly, although quite understandably, very nervous so checking things through with them before they went on stage therefore, required a great deal of diplomacy. "I had to make a quick check to make sure there had been no last minute changes in line up or microphones. Some of the bands we just hadn't been able to see or hear at all beforehand, for instance U2. We would check everything

was OK, and they'd say, "yes yes," and then they went on stage and *did* do things differently! We very much didn't want anything to go wrong."

Contrary to popular belief, the concert was recorded by the BBC for possible later transmission, video or simulcast, although nothing has been decided about it. Jeff: "Quite early on at the planning stage I asked Bob Geldof if he wanted to have the show recorded. He said yes, although there is no likelihood of issuing records of the performances. There wasn't time beforehand to negotiate recording rights with all the individual artists, so nobody had agreed to it but it would have been criminal not to record it.

"The BBC acknowledges that it has no rights with the recordings, neither does the Live Aid Trust. There has to be some trust in this world—nothing will be done with the tapes without the artists' agreement. The BBC has lots of recordings that they have no rights over and will never use unless agreement is negotiated. Each of the Live Aid performances had a life of 24 hours (taking into consideration the time differences across the world), and that's it as far as I'm concerned until somebody says differently."

So here was another complication for the sound engineers. Mike: "I was trying to do a live mix but at the same time trying to do some sort of multitrack routing. It was very important to know the exact microphone line up and which lines they were using. From the multitrack point of view it was convenient to organise the routing and plugging so there was as much in line stuff as possible. I had a big pile of charts for the desk, and I wanted to have it all prepared long before the day but the information came in too late for that. One of the great problems on the day was that things were not appearing where they ought to have been. A lot of the time between and during performances was spent trying to find out where they were."

Jeff: "In the heat of the moment and the occasion, mistakes were made—odd things appearing in different places. On Saturday, ironically during the third set, the hero of the hour, Bob Geldof, got a bit carried away with his lead vocal mic as he jumped down

Richard Lamont



BBC OB vans outside Wembley Stadium

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BBC Television's mobile control room

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to the front of the stage; the lead was wrapped around something and he pulled it out of the stage box.

Unfortunately he didn't just damage the lead but also the entrance to line 28 into the stage box, which was one of the main three vocal mic allocations. Mike Robinson had already worked out all his setting and things and on a couple of occasions we found ourselves with the vocal not working just before the artist went on stage. "Bryan Ferry finished up with two microphones on stage. The PA and monitors had the feed of one mic but we hadn't so somebody thrust one of the spare vocal mics into his hand just as he went on stage and he stood there with both of them all the way through his set, not knowing why but fortunately professional enough to just go ahead and do it. It was a bit

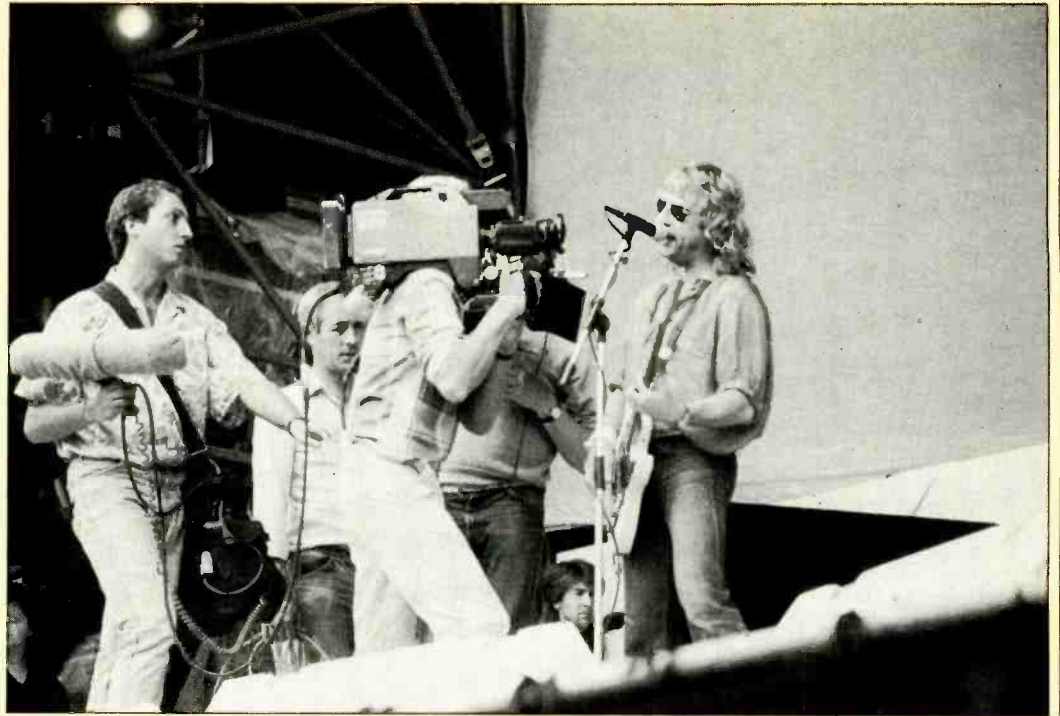
embarrassing for us and it is very bad practice to do something like that nowadays—it's the sort of thing we had to ask people to do 15 years ago.

"Anyway, we then decided to allocate line 3 for vocals; then somebody altered it. So Malcolm Hill went and sorted it out and after that everything remained pretty standard.

Power was lost twice by the BBC. Originally all the television vans were being fed from one particular sub-station in Wembley. The first time it turned out that the 500 A fuse had blown—why, nobody knows. Jeff: "It was just before Bowie went on stage. We switched immediately to the generator and it only took one minute but it threw people. Mike was still selecting everything on the desk as Bowie walked on to the stage.

"After that everything was OK until The Who. Less than one minute after they came on stage and he was just singing *Why don't you all fade away*, which I think is quite funny really because it was just at that point that the generator failed!

"Fortunately, by this time, the 500 A fuse had been replaced. Nobody knew why it had blown, so we went back and all the vans switched off all the ancillary equipment that they weren't using or felt that they could manage without, and in our case it



Smile please—you're on TV

included the cooling system—I don't know if you can remember the temperature on that day but it was very hot, and it wasn't just us that needed cooling, it was the equipment as well. So it was a bit of a gamble but it was OK. We were off-air for a total of five and a half minutes during The Who. Then we came back in as soon as we were sorted out and we started transmitting again immediately.

"Meanwhile, at Television Centre, however, they weren't really sure what was going on. We started transmitting direct sound as soon as we had it, while the pictures that TV Centre were putting out were being picked up off the satellite after they had been to Philadelphia and back, and that is why, when The Who came back on again, we were out of sync with the picture!"

It was a great shame that when Paul McCartney came on stage his vocal mic was not working. It is one of the many unsolved mysteries that happened that day. Both that microphone and the spare had been tested and found to be working just a few minutes before. "Why it didn't work I don't know. We had a spare vocal mic which we had used with Bryan Ferry but we had to check it was still working before we gave it to Paul McCartney because it would have just looked even worse if that one didn't work either. It didn't. By the time they did manage to find one that was working, he was half-way through *Let It Be*."

Meanwhile, the microphone testers were hard at work trying to make sure that all the radio mics were going to work in the grand finale when several different artists were to sing verses from the Band Aid song *Do They Know It's Christmas*. Out in the mobile Dave was desperately trying to find McCartney's vocal and faders were being pushed up all over the place hoping it would turn up somewhere. What was found, however, was James Birtwhistle testing a radio mic. As Jeff says, "Fortunately, I had insisted that they were not to use any bad language all day, just in case something like that did happen! We were using radio communication all the way through and all the people there were using all different kinds of frequencies for the different kinds of talkback as well as the radio mics on stage, so it was quite likely that something would be picked up somewhere along the line. And that's why the world heard James saying 'testing, testing' over the airwaves. Fortunately we did get all those microphones identified and when they started the finale everything was working and we got all the singers, which was very difficult because we had no idea who was going to sing which verse."

The finale was the most complex of all, not only because of the different artists involved but also because McCartney was using Elton John's piano and vocal mics which were set up in front of

the stage. These mics were going into the Scottish van to Dave Dade who was then feeding them into the London van who were receiving feeds from the circular stage with the Boomtown Rats backline with additional drum kit played by Police's Stewart Copeland.

Bristol television's OB unit also played a large role; initially they were stationed at Heathrow to see Phil Collins off on his Concorde trip to Philadelphia. Afterwards they went and set up at Legends night club where the UK links were conducted after Wembley finished and the US bands were on their own.

As the tired and happy crowd wended their way out of Wembley, rushing home to watch as much as they could of the remainder of the show the sound recording crew packed up and went home to bed.

Jeff: "We were emotionally and physically exhausted. A lot of the people involved there had been going all day and they were under tremendous pressure. It raised a lot of money and drew attention to the plight of Africa in a way that has never happened before and won't be forgotten for a long time.

"It was wonderful and I feel immensely privileged to have been allowed to be part of it and I think we all felt the same way. I would be quite happy to do it again and get more of it right!" □



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IN STEP

For many years the film industry relied on mechanical linkages to provide the synchronisation between picture and sound. However, the pilotone Nagra was probably one of the first widely available electronic synchronising systems, so it is no great surprise that timecode synchronisers are finding their way into the film dubbing process.

Eco in Cardiff was set up by film people who had previously worked at HTV, the ITV station serving Wales and the west of England, and does mainly audio post-production work for S4C (Channel Four Wales) and other local national TV stations. John Cross, one of the partners, says, "We work on programmes in two languages: one is the mother tongue, Welsh, and the other is English."

Much of the equipment at Eco is film oriented, including about £130,000 (\$170,000) worth of electronically interlocked Perfectone *Rapimag* 16mm sepomag transports. Another Perfectone transport provides the pictures by way of telecine; and it is quite simple to replace this with a U-matic VCR if the edited programme is on VT. One of the projects Eco is involved in is a 26-part serial called *Chateau Vallon*, a sort of French *Dallas*, shot in France on 1 in VT and revoiced at Eco with Welsh dialogue for S4C.

Dialogue replacement was once done using separate loops of film for each individual line of dialogue so the artist could do several takes in quick succession to get the lip sync as close as possible. Modern equipment creates loops by shuttling between two cue points as often as required. A rapid repeat is achieved by running all the transports back *in sync* at 30 times normal speed; 16 mm film runs at 19 cm/s (7½ in/s) so the top speed is just short of 6 m/s.

Eco uses *Q.Lock* to run a Studer 16-track in sync with the film transports so each artist's lines can be recorded on a separate track. From the multitrack tape the dubbing mixer prepares A and B rolls with alternate lines of dialogue on 16 mm sepomag. These are then taken to a film dubbing editor who can 'fine sync' the dialogue by physically adjusting sections of either track to be one or two frames earlier or later.

For the pictures Eco has a GTC *Editon* synchroniser which can slave a U-matic to the editor's Steenbeck. This is quite unusual as video equipment prefers to be

Tim Leigh Smith delves into the world of film and video to investigate the use of synchronisers

the master. A small sprocketed wheel is literally stuck on the Steenbeck to generate pulses which indicate the speed and direction of the sepomag tracks. Once a start mark has been set and locked the *Editon* relates the Steenbeck pulses to timecode from the U-matic cassette.

Things could get a little complicated when the editor is inching the tracks to locate an edit point as longitudinal timecode (LTC), like any audio signal, becomes unreadable at very low speeds. The solution is vertical interval timecode (VITC) recorded on two of the field blanking lines at the top of each video picture. The *Editon* timecode reader accepts VITC from still frame up to 50 times normal speed as well as LTC and, if all else fails, control track pulses from the U-matic.

Eco use a JVC U-matic designed for video editing and therefore intended to inch gently backwards and forwards when locating edit points. Nevertheless the sight of a video picture stepping slowly from frame to frame in response to the movements of a film editing table is disconcerting. The *Editon* unit is very unobtrusive as, in this application, just two buttons are required to set the start

When we dub video with the Editon we're using the same controls as when we're dubbing a film... we can go from film to video and sometimes the producer doesn't even notice

mark and lock it. This is one of the things that attracted Eco to this system as John Cross explains:

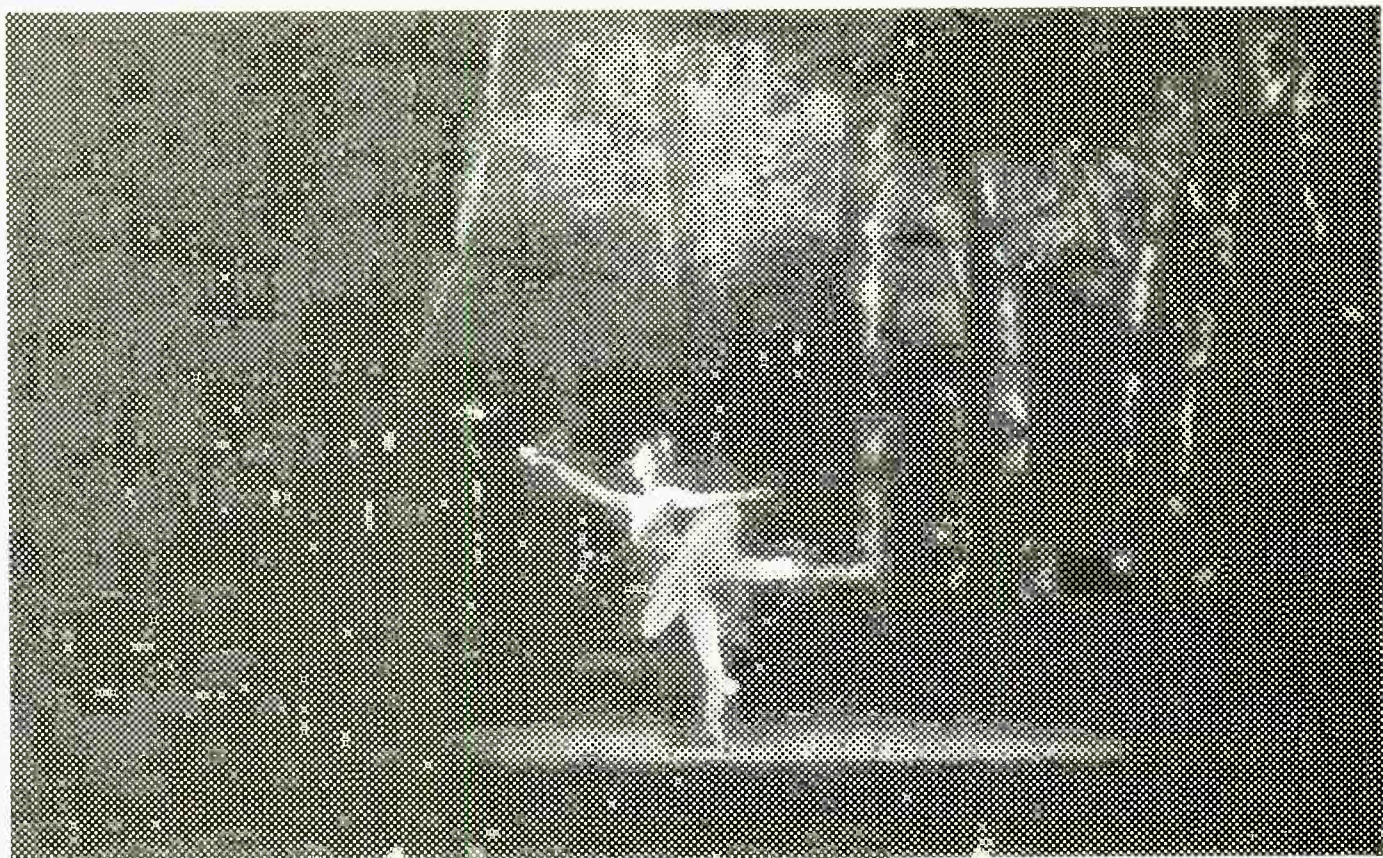
"It's very good because it takes out the number crunching that you get in video editing, or if you're using something like the *Q.Lock*. You're number crunching and what you're there to do is the sound. When we dub video with the *Editon* we're using exactly the same controls as when we're dubbing a film because we're using the same sepomag machines. We can go from film to video and sometimes the producer doesn't even notice the difference. The only difference is that the U-matic won't rock and roll quite as fast, it won't go 30 times speed as our film equipment will."

The simplicity of the *Editon* means that it doesn't have all the bells and whistles of some other synchronisers. Its control unit has 12 pushbuttons to provide remote control and timecode offset for a single slave. The claimed interlock accuracy of ±½ frame (about 20 ms) may seem out of place alongside the ±50 µs claimed by others, but it is the accepted accuracy of 16 mm sepomag editing with only one sprocket hole per frame.

John Cross acknowledges that sepomag machines are no substitute for tape when it comes to multitrack music where the precise phase relationship matters but he points out that it is a very cost effective way of tracklaying dialogue, effects and mixed-down music for video dubbing. One day with a dubbing editor can cost about the same as one hour in a multitrack studio.

Some of the earliest video audio post-production done by the BBC involved several 2 in quadruplex VT machines running in sync as sound sources. This was a rather expensive game. In 1974 the BBC's first video dubbing suite was opened at Television Centre. It was called Sypher which stood for SYNchronous Post-dub with Helical-scan and Eight-track Recorder. The helical-scan bit meant a U-matic VCR and that original Sypher suite is still equipped with an 8-track Studer. 1980 saw the opening of Sypher 2 with a 24-track and an 8-track recorder. This set the pattern for video dubbing suites opened in the past couple of years at BBC Enterprises, BBC Birmingham, and so on.

The Sypher suites are used on major



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drama and light entertainment productions. A lot of less complex audio post-production is carried out, as it always has been, in the VT areas with the aid of ¼ in twin-track (2 mm guard band) machines mounted on trolleys with a simple audio mixer and synchroniser. The soundtrack up to and beyond an edit point can be laid off on one track, with timecode at low level on the other. When the video edit is performed the soundtrack preceding the edit, re-laid from ¼ in, can be mixed with the soundtrack of the following section.

Most of the synchronisers used are designed by BBC Engineering Designs Department which has been developing synchronisers for over 10 years. Ray Taylor of Designs Department explained that the basic philosophy is to use a separate synchroniser and control unit for each slave machine. This is more expensive than multi-machine control systems; but it is much more flexible, allowing any number of machines to be linked as required.

The latest versions, *Maxim* and *Fasor*, are the first of a new generation of microprocessor controlled synchronisers. Like the many other units these have a *pulse lock* option using timecode from the master machine to establish sync and then switching to house sync pulses to avoid any problems with discontinuities in the master timecode. More unusual is the Resync button which can be used to switch control back to master timecode, on either a tight or a soft lock, if picture and sound become separated.

Almost all the areas using synchronisers are equipped with Studers of various shapes and sizes, each of which requires a different interface. The *Maxim* and *Fasor* include interfaces for Studer B67, A80 (MkII & MkIII) and A800. These are brought out to different pins on the connectors so that each type of machine sees the appropriate interface. Variations are possible to suit other machines.

The *Maxim* synchroniser is intended for video dubbing suites and the *Fasor* has the slightly different facilities required for locking tape machines to film transports in film dubbing areas. *Maxim* offers 100 timecode memories for events; starting or stopping playback machines; inserting or bypassing EQ and other audio effects. The *Fasor* was originally requested with just 10 timecode memories but already the users are asking for more. Hardly surprising as the rule seems to be: You can never have too many event stars.

Some of the Studer B67 and A80 twin-track machines are being converted for centre-track timecode using a BBC designed modification (0.8 mm track) which pre-dates the Studer A810 (0.38 mm track). This indicates the growing demand for stereo sound on television programmes for sale abroad, for issue on videograms and eventually, we trust, for transmission in Britain.

Dennis Weinreich had considerable experience as a recording engineer and producer when he decided to set up his own studio. Instead of just another multitrack studio he offered record industry know-how to video producers

IN STEP

Audio post-production is a new field so there aren't any accepted limitations

under the name Videosonics. He went in search of reliable synchronisers and surveying the larger market in his native America he saw a lot of btx *Shadows* in use.

The *Shadow* is a basic synchroniser for locking two machines together. Its optional control unit has a few additional functions such as timecode calculator, nine memories, display and remote control. What Dennis Weinreich had in mind was something more like a video editor, storing lots of cues and controlling several machines. Others were thinking this way and in due course btx offered the *Softouch* audio editing system.

Softouch can control up to three slave machines, each interfaced with its own *Shadow* synchroniser, and one btx *Cypher* LTC and VITC generator, high speed reader, character inserter and event controller which can handle most things. Each of the two control rooms at Videosonics has its own *Softouch* and *Cypher* and they share six *Shadows* which can interface with a pair of Otari *MTR-90* and one MCI *JH-24* multitrack, plus a pair of Studer *A810* twin-track with centre timecode track and a similar MCI *JH-110C-3-TC*.

Up to 100 sequences can be stored in the memories: not just basic timecodes but complete sets of in and out points with any offsets, event triggers and so on. Record in and out point for loops can be keyed in or picked up on the fly and *Softouch* will add the required pre-roll and post-roll. If the recording machine uses ramped bias the in and out points can be offset to allow for this delay. As well as running single loops in preview or record, once or as a cycle, the controller will assemble a succession of loops from the memories.

Quite complex sequences of key operations can be stored on each of 16 programmable softkeys. For example one key can set up all the parameters involved in a change from a 1 in master to a U-matic master. At present it is still necessary to unplug the first machine and plug in the second. As well as locking two or more machines in sync the controller offers full remote control of any slave that is not locked. Thus it is possible to locate a later sequence on a free slave while the locked machines are

transferring the present one.

Like most synchronisers btx has a choice of lock modes. *Frame lock* insists on the exact timecode address frame for frame, and indeed subframe (1/1000 frame) for subframe, which can be embarrassing if the master wows like a U-matic or if the master timecode has been edited. *Phase lock* relates only to the sync pulse element and *Auto lock* begins tight as frame lock and then relaxes into phase lock. The lock up speed is impressive as the *Shadows* 'learn' the dynamics of their transports and refine their control.

Dennis Weinreich is almost happy with *Softouch*: "It's pretty comprehensive. We don't find anything major wrong with it—it just doesn't do enough. We always want to do more. We're never really fully happy with just about anything. The thing about audio post-production is it's a new field so there aren't any accepted limitations. At the beginning of a programme you never know what's going to come up. When a guy walks in for a music session you pretty much know what you're going to be doing that day.

"For some time we've wanted something that communicates with assorted chasers and synchronisers via RS232 or RS422. What with Otari coming out with their synchroniser which is a plug in box for their multitrack machine and Sony MCI making a 2-track machine with its own chaser in it, and the Studer 4000 box, you're starting to get in a situation where all the tape machine manufacturers are making the ideal chase box for their transport. That's kind of interesting. First of all there are cost advantages of having the Otari synchroniser—it's a lot cheaper than a *Shadow* or an Adams-Smith module—also the synchroniser becomes part of the machine. So we thought it would be good to have a computer which communicated with all the various chase boxes.

"Alpha Automation have a device they call *The Boss*. They showed a version of it at the APRS this year. People came by and looked at it but I don't think anybody really knew what it was all about. The thing looks just like a video editor. It's a central computer for audio post-production purposes. One of our regular problems is: a guy shoots an hour programme over four nights, plus insert shots and all that. He edits his pictures: a shot from here and a shot from there—the close up was Thursday night and the long shot's Wednesday night. Then he walks in with his edited master and 18 reels of 2 in tape and says, 'Can you take my multitracks and make a match?'

"Now we've said that we want *The Boss* to be able to take the formatted disk from the CMX video with all the numbers on it and give us access to all those numbers so it eliminates the number crunching. It'll be more complicated than that even though CMX formatting is sort of an industry standard. There's a lot of unravelling that needs to be done. We have a lot of confidence in the people that are doing it and the main reason is that they're in the same business as we are. They have an audio post-production company in Richmond, Virginia. They also have

computer programming people and we think that they're doing a real good box.

"It gets away from the concept that machines slave to a master. Everything's got timecode on it so why not just sync everything to a central timecode generator? As soon as there is an RS232/422 protocol established we expect that where we'll have our edge is that we'll be able to use the synchroniser which best suits the machine that we're working with."

Interesting developments have been taking place at a former boathouse on the banks of the Thames, now a multitrack recording studio owned by Pete Townshend and named after Eel Pie Island two miles up river. The studio here is separated from the control room by a corridor so CCTV is used to link the two areas.

Last November a complete video control room was installed alongside the audio facilities. This is equipped with Sony VT machines—a 1 in C-format *BVH-2000*, two *BVU-800* and one *BVU-820* high band U-matics, a couple of low band U-matic—and a *BVE-800* three machine video editor. The vision mixer is a Cox *T16* with triple mix-effects and special effects are created by a Fairlight *Computer Video Instrument*. The video control room has its own 24-track Otari *MTR-90* and an Amek audio mixer with eight mono and four stereo channels taking in mic lines from the studio, split feeds from the main SSL desk and stereo line inputs. Five Sony *M3* lightweight colour cameras with remote controlled zoom and focus are installed in the studio and a Rank Strand *Tempus* 24-channel console offers up to 48 kW of lighting.

Some of the time the video control room does its own thing: video editing, audio laybacks, and such. But when certain sessions are taking place in the audio studio it's all lights, cameras and action! Two of the cameras are fixed on performers with immobile instruments, like the drummer and the keyboard player, while the other three swivel around on remote controlled pan and tilt heads. What's it all about? Video engineer Dave Edwards:

"For example, a lot of Pete Townshend's work is done on an overdub basis because people just aren't all available at the same time. So if Pete's recording with just a basic band to start with, while they're laying down their tracks we'll be putting it down on to U-matic as well. We may have the drummer on one tape, the bassist on another tape... whatever. Then when musicians come in at a later date and they run the 24-track tapes, we can run the videos in sync because we put the 24-track timecode onto one of the audio tracks when we were shooting.

"Not only can the guy hear what's been recorded but he can have monitors in front of him and he can actually see Pete on one monitor and the drummer on another... it's almost as if they're in an isolation booth in another part of the building, and it's easier for the musicians to get into the feel of the music."

This arrangement is creating a sort of *Who's Who's Who in Pop Music*. It has already provided material for promos,

and documentaries for Home Box Office in America and London Weekend Television's *South Bank Show*. Eel Pie's Roger Knapp devised a computer program to ensure that the video recording of every single multitrack take would not interfere with the all important audio recording. One pushbutton in the audio control room puts the video machines to stand-by and a second button starts VT and multitrack recording. The microcomputer starts the video recording with a 5 s count down from a Cox VT clock and logs the timecode start point and time of day.

Each of the two Studer *A800* multitrack recorders in the audio control room is provided with its own synchroniser and a shared high speed timecode reader from the Adams-Smith modular *System 2600* so that both can be slaved to the VT machines as well as one

another. The basic Adams-Smith synchroniser module is a complete unit for locking one transport to another and its own microprocessor lets it play with a wide variety of machines using different types of timecode, sync pulse, pilotone or tach pulses.

These variations can be set on the individual units but when they gather together with high speed timecode readers and the rest, they can talk to one another as required on a data bus, or via the vital RS232/422 serial interface module they can communicate with the microcomputer and the world. Thus the computer can provide each synchroniser with the data it needs to be able to interface with any of the transports. Roger Knapp is very pleased with the flexibility of these units, especially as they make less of a dent in the company wallet than many other synchronisers. □

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STUDIO FILE

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As well as housing a large complex of restaurants, bars, shops and boutiques, the basement area of the Palais des Congrès provides a home for the largest studio complex in Paris—and probably in France.

Les Studios de la Grande Armée would probably bring a smile of satisfaction to the Emperor himself and though you will hardly find a troupe of grognards, you will find a modern complex of recording studios with two complete Studios, A and B, and a mixdown room, Studio C.

Access to the studios is by an inconspicuous door on the lower level of the Palais des Congrès which leads in to a large reception/lounge area. This in turn becomes a large corridor with the entrances to the three studios on the right and various store and maintenance rooms on the left. The corridor also serves as a handy storage area for unused instruments or flight cases and there is still enough room for people to pass through. Double loading doors at the end of the corridor lead directly to the road outside minimising unloading problems. Space is no problem for the Grande Armée and there is plenty of room to expand should they wish to do so. One direction in which the studio has already expanded, has been the wiring of the studio through to the various stages in the Palais des Congrès for recording shows or sending up music and effects from the studio, either recorded or live. For maximum flexibility, there are 54 tie lines between each studio and 54 lines up to the stages. There is also a video link so that action on stage can be followed in the studio.

For a complex as large as the Grande Armée a permanent maintenance engineer is a must. Daniel Golléty comes from a varied background and has worked in studios and for suppliers as an installation engineer. This also means that he is often very much in demand elsewhere—when time permits!

“Though I can understand the economic problems that can face many studios, not having one’s own maintenance engineer can be a dangerous economy. Here it is a full time job to make sure that

Studios de la Grande Armée, Paris



Studio A

everything is kept in peak operating condition and there are times when I have to insist that the studio be cleared for an hour or two in order to do maintenance work between heavy sessions. After all, if something breaks down or fails, you can have maybe eight or nine people hanging around while you try to fix the fault and that can be a bad situation for the studio and its reputation.”

All three studios of the Grande Armée have been designed and built by Eastlake Audio, with Eastlake *TM-3* monitors being used throughout. The design of the three control rooms has been kept similar in order to provide a certain consistency between rooms and this works out well. “If clients or engineers have to change

rooms during production for any reason they soon get used to the new one. Though each studio has its own characteristics, there is a certain uniformity that makes it easy to work from one room to another without losing the basic reference point.”

The largest room is Studio A with a floor area of 200 m² and can hold up to 80 musicians. The studio is divided into two main areas, one fairly lively and the other more absorbent. There is heavy trapping around the walls and in the ceiling which leaves the room as dead as possible for maximum separation. The area in front of the control room features a marble floor and the ceiling is a mixture of open trap and wood panelling. There are pull drapes at various points around the



Control Room A

studio in order to change the absorbent characteristics. The far end of the studio has a small isolation room and large drum cage, though the drums are more often than not recorded out on the marble floor.

The studios contain a grand piano (Steinway, of course), tuned percussion, etc, but do not go wild over their selection of musical instruments. They prefer to work hand-in-hand with a Parisian instrument rental company who can ‘provide anything at an hour’s notice’ rather than buy a large selection of instruments only to find that the one a musician wants is the only one they don’t have!

“We are of the opinion that a studio provides the means to record and that it is logical for musicians to provide their own instruments. Of course, they may want to use a certain instrument for just one track and for that reason we co-ordinate all rentals from the studio as part of the service. We would much rather invest in the studio proper than buy a whole range of instruments that may rarely get used. This has to be reflected in the rates we charge.”

The microphone assortment is what one would expect from a top class studio and can be summed up as: you want it, they’ve got it! Access to the studio is via large doors from the main corridor or by the sliding double glass doors underneath the monitor bridge of the control room. In the same way there is a separate entrance to the control room, also from the corridor. The centrepiece of Room A is an SSL 4000 series console with 44 input channels in a 48 frame, complete with *Total Recall* and an Adams-Smith synchroniser.

La Grand Armée was one of the first French studios to go digital and is equipped throughout with 3M machines. The control room, however, is also equipped with a 3M M79 24-track analogue machine complete with Dolby as well as a 3M 32-track digital. Mastering is on a 3M 4-track digital with editor and/or Studer A80/RC stereo machines, one equipped with Dolby. There is also a Revox to remind us of our origins!

Somebody once said ‘you can

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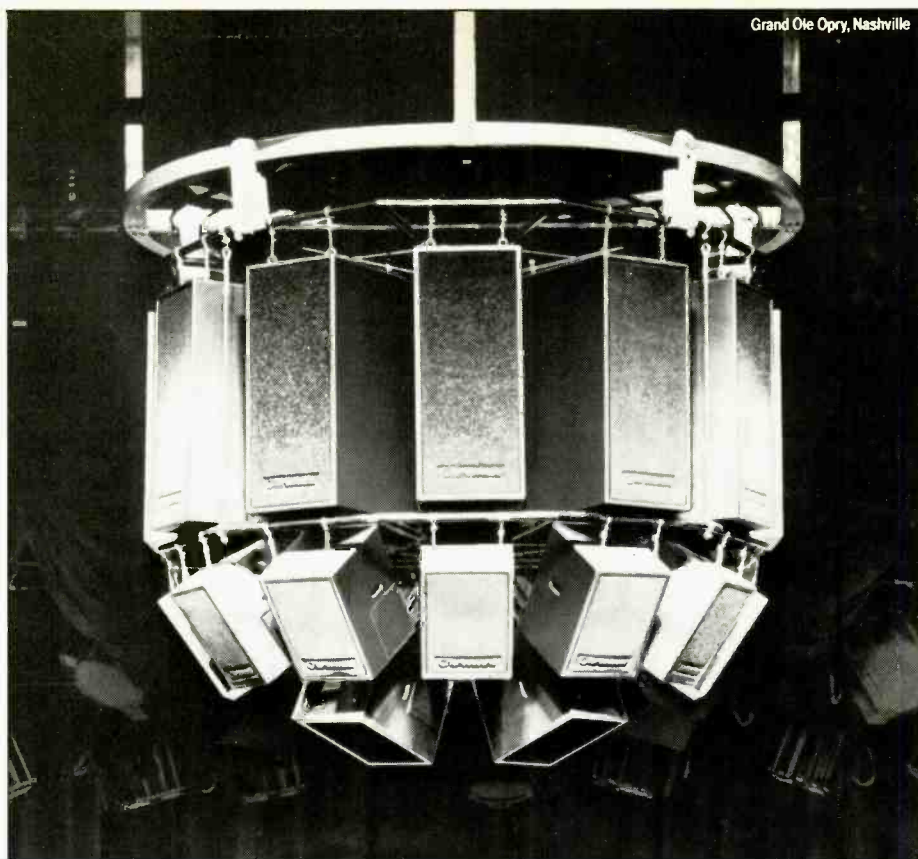
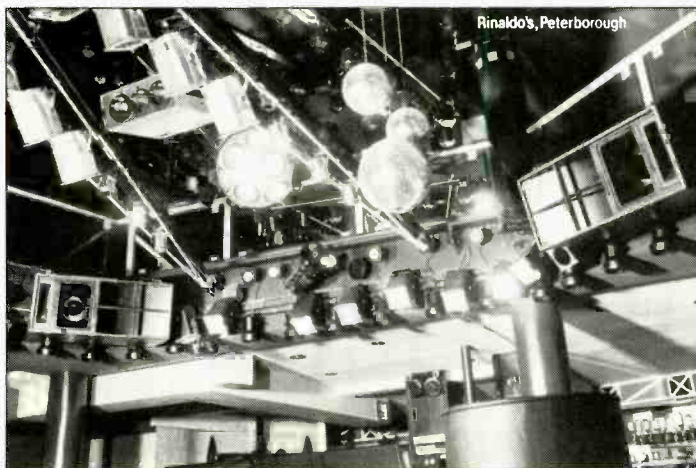
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STUDIO FILE

STUDIO FILE

never have enough reverb units'. However, Control Room A is not doing too badly with a Sony *DRE 2000*, *EMT 244* and *140*, *AMS RMX16* reverbs, as well as other time domain devices in the form of *AMS DMX15-80S* delay and *DM2-20* flanger, *Eventide H949 Harmonizer*, *DeltaLab DL-1* delay, *Lexicon Prime Time*, and *Marshall Time Modulator*. Gain reduction equipment includes two dbx *160* compressors, two *UREI LA-4*, *Orban 526A* de-esser and an *Audio+Design Vocal Stresser*. Other A+D equipment includes *Scamp S23* autopan and *S24 ADT*. The remaining ancillary equipment consists of a cassette recorder and turntable—not to mention a magnificent hat and coat stand! (Well, it is the first time I have seen the latter actually in a control room.)

At the time of my visit a mixdown of French artist Michel Sardou's latest single was going on so I was able to get an idea of the sound. Certainly very clear and full, with an even distribution along the console. Monitoring ranged from the *TM-3s* to desk mounted *Auraton*s and 'imported' *E-V Link* hi-fi speakers. "We have the facility to quickly instal any nearfield monitors or speakers that an engineer may bring, depending on the current fashion," explained Daniel. A plus of Control Room A is its size, which may have explained the very relaxed manner of Sardou's engineer.

Studio B has an area 50 m² with a capacity of 25 musicians. The design is fairly similar to A though the floor is entirely carpeted, together with an open-trapped ceiling, various drapes can be pulled down to modify the sound and there is a large drum cage with hardwood panelling. In spite of the large amount of trapping, the room has a very 'open' quality in the acoustics and though the reverberation time is fairly short—as one would expect—the sound is not at all damped. According to Daniel Studio B is very popular for rhythm tracks and the like as a good 'group feel' is easily obtained. "Musicians do not feel oppressed in here and we have had some long sessions without people complaining about fatigue.

Grande Armée continued



Studio B

They like to record in this room and whereas we may do some alterations to Studio A in order to liven it up a bit, we are certainly not going to touch Studio B."

Construction of the control room is virtually identical to Control Room A although it is not as big. The equipment roster is almost the same with the console having 40 input channels and an *Eventide 1745M DDL* replacing the *DeltaLabs*, plus an *Ursa Major Space Station* instead of the *Sony* reverb. The cassette recorder is an *Alpage AL 80*.

Access to Studio and Control Room B is via individual doors from the central corridor. Next to Control Room B is a 'cubbyhole' housing the various computer/power supply racks for the consoles as well as the racks which house the *Amcron* amplifiers for the foldback lines to the two studios.

"Having everything centralised helps with the maintenance and I don't have to go into the control rooms at all if there is a problem to be sorted out," said Daniel. Another advantage is that should a computer go out on a mixdown—and it's never happened yet—I can always use one of the others as it is rarely the case that all three rooms are mixing at once. Having them all here together means that I can simply crossplug and we're back in business again."

Studio C is the mixdown room. This is like Control

Room A in size and provides a comfortable working area. The interests of uniformity have been continued here with the installation of a false control room window in order to simulate the characteristics of the other rooms.

Mixing centres once again around an *SSL 4000* console with 56 inputs and *Total Recall*. Tape machines are 3M 32-track digital, 4-track digital with editor, *M79* 24-track with *Dolby* (the room is wired for 48 channels of *Dolby*), *Studer A80 ½* in high speed stereo recorder and two *Otari MTR 10* stereo machines. Two channels of *Dolby* can be patched in as required and a *Revox B77* brings up the rear. Effects gear is similar to the other two rooms and consists of *Lexicon 224* reverb, *Sony DRE 2000*, *AMS RMX16*, *DMX 15-80S* and *DM2-20*, *Publison HM80*, *Lexicon DDL*, *Orban 526A* de-esser, *DeltaLab DL1*, *MicMix* spring reverb, *Audio+Design Panscan*, two *Alpage AL80* cassette recorders and a turntable.

Like all the control rooms, the monitoring is powered by *Amcron* amplifiers and corrected by *White ½*-octave equalisers. Studio C features a bevy of *D150A* amplifiers with a *PSA-2* for the low end. Standard monitoring is again *TM-3s* and *Auraton*s but 'personal monitors' can be interfaced easily. One novel feature of the monitoring is a dual set of *White* equalisers—Daniel explains:

"There have been times

when visiting engineers wanted to re-EQ the room. We obviously weren't too happy about that so we decided to install a second set of equalisers that they could play with if they felt the need. The changeover is effected by a key operated switch—and I have the key! This way they have to ask me for it and I know that the house curve is not being used. This can avoid unpleasant surprises like someone not saying that they have changed the EQ."

La Grande Armée have a varied clientèle, ranging from established French artists such as *Michel Sardou* to names such as *Phil Collins*, *The Pretenders* and *Lalo Schiffrin* (who was mixing for a film in Studio C). The studios also do the music for many of the shows in Paris (the *Paris Lido* among others) and had done all the music for the *Chantal Goya* Christmas production which had been playing at the *Palais des Congrès*.

"With our system of tie lines, we can work with any of the stages with any of the studios, either for live recording or sending up programme material. Another facility is that any control room can work with any studio—or they can work in tandem. If need be, during a heavy mixing session a lot of effects from the other rooms can be patched through and thus avoid unplugging and carting equipment around."

Les Studios de la Grande Armée can certainly be classed not only as one of the front line studios in France but also on the international front. They are the only commercial studio in Europe to have three rooms equipped with digital and *SSL* consoles and are also doing very nicely, thank you. Though used by top artists, the studios encourage custom from young hopefuls and lesser known acts as these are the stars of tomorrow. Future plans include a jingles and demo studio where sophisticated techniques are not required but form a good part of the market. After all, *groggnards* have to start somewhere! **Terry Nelson**

Studios de la Grande Armée,
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WHO'S USING SOUNDTRACS CM4400?

Steve Glen chose the CM4400 for his studio 'The Chateau'. Some of the artists which benefitted from his songs and productions are: Hot Chocolate, Sad Cafe, Suzi Quatro, Phil Fearon & Galaxy, Bucks Fizz and Roger Daltry. Steve's experience in recording led him to the obvious choice, the CM4400.

SAV Studios using the CM4400 in a commercial situation, Tony Frossard and Marc Lacomme use the 'O' Lock Events Controller to trigger the 30 routing patches of the CM4400 speeding up complicated mixes often used in their type of work.

Richard Harvey owner of the Snake Ranch Studios. Richard chose the CM4400 for his own private studio. He found the internal computer which can be used to route and mute the equalized section of the monitors, as well as the channels, into the mix made the CM4400 the most advanced console available even at 3 times the price.

Blue Weaver As a member of the Bee Gees, Blue has recorded in studios all around the world and definitely knows what he wants from a mixing console. Blue uses a Fairlight Computer Synthesizer and finds the CM4400 not only complements his electronic instruments but also has a great sounding E.Q. for the vocal overdubs.

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SERIES III FAIRLIGHT CMI

Advance information on the Series III Fairlight CMI has raised a lot of interest. In this article Kim Ryrrie and Peter Vogel describe the system development.*

Since Fairlight launched the first commercial *Computer Musical Instrument* over six years ago, the world of the musician and producer has become filled with talk of hardware and software, bits and bytes, floppy and hard disks, and all the other buzzwords previously associated only with bespectacled engineers poring over endless sheets of computer printout. In the modern studio, the VDU is becoming almost as common as an equaliser and floppy disks as well as tapes are piled high on any box which doesn't produce magnetic fields.

The major breakthrough of the CMI was its ability to sample any sound and then replay it at the pitch corresponding to the keys pressed on a music keyboard. Naturally, once the principle was established, many other sound sampling instruments appeared on the market. Each of these has its own advantages and disadvantages, the objective of most manufacturers being to produce the best compromise at the lowest possible price. Fairlight has taken the alternative approach of catering for the needs of the professional market, where the cost of providing a largely integrated production system can be justified in terms of ease of use, reliability and most important, capability.

Most CMI owners have taken advantage of Fairlight's 'upgrades' which can be fitted to the CMI to increase its capabilities. Upgrades have usually taken the form of

improved software on floppy disk, giving the instrument new capabilities.

The most popular recent software upgrade has been the 'real-time sequencer', which in Fairlight parlance is called 'Page R'. (The software functions of the CMI are divided up into manageable chunks called 'pages', where each page corresponds to a certain 'page' of information on the video display.) Page R is a real-time composition tool. It allows the musician to build up a multivoice piece by recording live from the keyboard and then editing, or by inputting the notes using a light-pen to position them on the video display. Page R is like a musical word-processor. Notes, patterns (bars) and sections can be deleted, inserted, re-arranged, duplicated or changed in different ways. Notes can be edited while the music is playing and importantly, the notes, patterns and sections can be followed visually on the graphics monitor.

Hardware upgrades have included an improved 'channel card', with increased dynamic range and generally improved audio characteristics, and a revamped central processor system, which increased programme memory from 64k to 256k and updated from 6800 to 6809 micros. This meant that more complex programmes could be run, and speed of operation increased by virtue of the 6809's 16-bit capabilities and more advanced instruction set.

The last three to four years have been spent researching and developing the next generation of CMI. The new

system is called *Series III* and some of its fundamental system design goals were:

- Capability of industry-standard (16-bit, 44.1 kHz or 48 kHz) sampling as well as optional synthesis and data compression sampling with adequate real-time timbre and amplitude control.
- Open-ended software-based design.
- Massive common waveform RAM to allow long sample time.
- Stereo recording and playback to hard disk.
- Full flexibility to partition and automatically allocate waveform RAM to allow multiple waveform options per voice.
- Hierarchy to allow numerous independently controllable 'voices' to make up each 'instrument', and numerous 'sub-voices' (waveforms) to be available for each voice.
- High-resolution sound analysis and re-synthesis.
- 16-note polyphony—or 16 different sounds—expandable to 80 voices.
- Individual voice outputs or programmable grouping to any of 16 outputs (per 16 voices).
- Multiple independently configurable MIDI inputs and outputs.
- Full standard SMPTE read/write to composer/sequencer/event generator.
- An integrated 'Page R' style SMPTE based composer/

sequencer with full 'orchestration' composition capability, ie 80 polyphonic channels.

- Capacity for real-time computation and special effects such as reverb, flanging multiple channel DDL, etc.

Series III features

Although the *Series III* represents a radical step forward in terms of musical and acoustic capabilities, Fairlight does not claim it as 'revolutionary' in concept. The *Series III* builds on the already proven principles of the existing model. The emphasis is still strongly on the ability to deal with natural sounds and real-time composition, arrangement and production. There are significant improvements offered by the *Series III* beyond the *Series IIX CMI* as follows.

Sixteen voice channels: (increased from eight) This is the total number of sounds that can be produced simultaneously. One voice may be played with 16-note polyphony, 16 different voices played monophonically, or any combination totalling 16.

Eighty-channel sequencer: The *Series III* equivalent of 'Page R' can program up to 80 'lines' of music to be played simultaneously. While 16 of these can be played on the CMI's own voices, the rest can

Fairlight CMI Series III



This article was written while the Series III was still in development and specifications are therefore subject to change.

*Kim Ryrrie and Peter Vogel are managing director and R & D director respectively of Fairlight Instruments.

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SERIES III FAIRLIGHT CMI

be sent via MIDI to other synthesizers, or through additional Fairlight 'slave voice' racks. An 80-voice system can contain 70 Mbytes of waveform RAM.

Sixteen-bit stereo sampling: A stereo A/D converter provides 16-bit digital audio quality. Sampling rate is variable, up to 100 kHz mono to 50 kHz for stereo. Maximum playback sample rate to 200 kHz.

Long sample time: All 16 channels share common waveform memory, which is expandable up to 14 Mbytes for each group of 16 voices. The waveform RAM can be used in both 8- and 16-bit mode. Over 2 min of full bandwidth 16-bit sound can be sampled and stored in random access waveform memory, or conversely, if using 8-bit mode and 44 kHz sampling rate, about five minutes of sampled sounds are available, providing extensive multi-note sampling capability. In 8-bit mode, sounds are sampled in 16-bit then digitally compressed to 8 bits. Dynamics can then be

synthesised or reconstituted from the original sample.

A 60 Mbyte hard disk is provided in the standard configuration. Programme material can be recorded or played back in mono or stereo. The 60 Mbyte drive provides a recording time of about 7 min in stereo at 44.1 kHz in 16-bit mode.

Architecture

The compact *Series III* is housed in the same size chassis as the current *CMI*. The main physical changes from *Series IIX* are an expanded motherboard, to hold the extra waveform memories, a 500 W switch mode power supply and a 150 W analogue supply. We have also introduced a small high-resolution X-Y Graphics Tablet in place of the lightpen. Electronically, the dual 6809 computer remains much the same as it was, while the sound generating section is totally new, incorporating an additional 10 microprocessors for each group of 16 voices. The motherboard contains up to 28 8x8 in circuit cards of which seven are 2 Mbyte RAM cards (using 256 k chips), eight are dual-channel voice cards, two are the waveform processor (68000) and support card, one is the SMPTE/MIDI

and general interface card (68000) and the remainder the dual processor system (2x6809s), peripheral controllers, DMA/SCSI interface, floppy controller, dual processor RAM (500 kbytes) and a few spare slots. The 16 D/As, digitally controlled filters and amps and audio mix matrix is located on the rear panel on three large multilayer PCBs. The stereo A/D is located in a small sealed metal box inside the rear panel.

The operation of the voice generation hardware is shown in simplified form in Fig 1.

Each channel card contains two channels of voice generation hardware. Each card has its own on-board 6809 which controls a high-speed address and pitch generator. The address of the next word of waveform to be output is calculated at every sample time, at a rate determined by the required pitch. A variable sample rate playback system is employed to keep pitched sampling noise harmonically related to the note played.

Data from the waveform memory is fed to a 16-bit D/A converter, reconstructing the audio waveform which is passed through a digitally-controlled lowpass filter and then VCA for each voice to the instrument's output matrix mixer. The filter and VCA are both controlled by the processor on the channel card and can be used for amplitude enveloping or filtering effects. The filter removes unwanted aliasing components which would otherwise appear if the pitch of a note, and hence the sampling rate used for 'playback', dropped down into the audible spectrum.

The waveform processor is a

peripheral processor dedicated to manipulation of the 16-bit waveform memory data. It uses a 10 MHz 68000 processor and local cache memory. It is used for functions such as number-crunching (for Fourier analysis, etc) and highspeed data movement, such as when writing sampled audio to disk in real-time. It is also the port through which data from the A/D converter is transferred to waveform memory. This processor is not required in the normal process of performing sounds by reading from memory and so is available for 'real-time' waveform computation and special effects.

All functions are supervised by the computer section which provides the 'musician interface' to the sound generating hardware. Data from one or more music keyboards is received by the general interface which uses another 68000 to control four channels of MIDI input and four output as well as SMPTE-standard timecode (used to synchronise the sequencer). The user communicates with the computer via video display unit and alphanumeric keyboard. The X-Y tablet, built into the alpha-keyboard, is used as another input device. This is a small drawing surface from which the computer can read the coordinates of a stylus placed on the surface. It is used to enter graphical information, such as sound waveforms or envelopes, and also to select functions from menus displayed on the screen. Most of the CMI's functions can be accessed using this technique, so poor typing skill does not slow down operation.

The Graphics Tablet replaces the light-pen of the previous *CMI*, the main advantages being greater accuracy, ability to draw on black areas of the screen, and elimination of fatigue. Fig 2 shows the complete system.

FIG 1

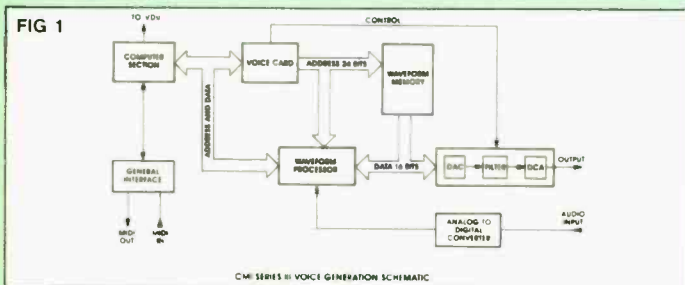
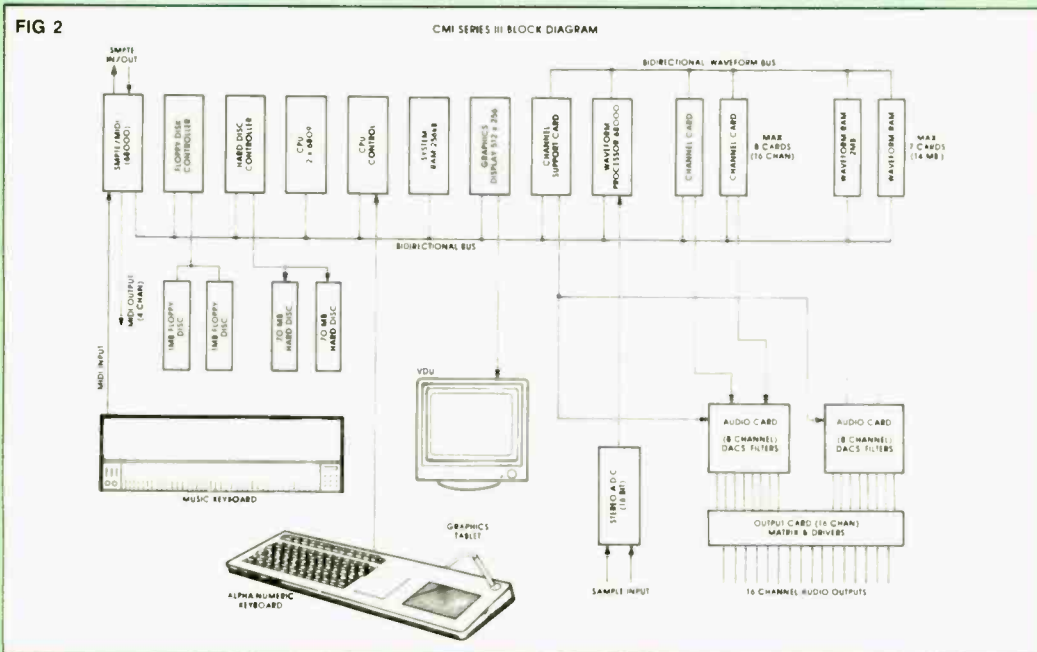


FIG 2



Software

Like its ancestors, the *Series III* has been designed to be as open ended as possible, from both a hardware and software point of view. With benefit of hindsight, the software has been designed for maximum friendliness. In general terms, the new software is extremely tolerant of operator error, the objective being to minimise the number of instructions the musician needs to enter to achieve the desired results. This has been achieved without relying on short but cryptic commands which are

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SERIES III FAIRLIGHT CMI

difficult to understand and easy to forget. Another important feature is that the software is as helpful as possible, so that if the computer cannot make sense of an instruction, it tells the user *why* it can't.

The other general software feature which has been finely honed as a result of previous experience is the sensible use of defaults. The idea behind defaults is that although the CMI is extremely flexible, allowing vast scope to control hundreds of parameters, much of the time the musician uses common settings, especially when starting from scratch to develop new sounds and compositions. For this reason, sensible defaults are automatically selected, which can be over-ridden if desired. Over the years, the most useful defaults have emerged and been incorporated into CMI software. These benefits are reflected in the *Series III* software which, while being much more powerful than the *Series II*, is also much simpler to learn and use.

A new software feature is the provision of 'windows'. This is a software concept which allows multiple areas of interest to be visible on the screen at once. Whereas in the *Series II* the musician had to change pages to view, for example, a sound waveform while working on a composition, it is now possible to have a window appear on the sequencer display, through which the desired waveform information can be viewed. The musician can therefore request various combinations of information to be displayed at once.

CAPS

CAPS—the Composer/Arranger/Performer/Sequencer—is similar in concept to 'Page R' in *Series II*, but vastly expanded in capacity and with many new facilities.

The main advance has been the increase in 'tracks' from eight monophonic to 80 polyphonic. As mentioned previously, 16 of these can be played by the standard configuration CMI internal voices but the remaining 64 can be fed to slave CMI voice racks via the high speed SCSI bus or other synthesisers via

the four MIDI output ports. MIDI stands for Musical Instrument Digital Interface and is a standard used by most synthesiser manufacturers. It is the digital equivalent of the volts/octave standard of analogue synthesisers. Using MIDI, musical data is transmitted serially. To avoid audible delays, the speed of the data has to be rather high. While this is not a problem electrically, it can be a problem for the microprocessor at the receiving end which has the task of unscrambling the data and playing music. For this reason, the *Series III* uses a 68000 microprocessor as a peripheral processor to handle MIDI data. The 68000 is about 10 times faster than the 8 bit micros usually used in synthesisers, allowing it to cope with four independent channels of MIDI input and output simultaneously.

SMPTE

SMPTE synchronising is the key to the ultimate power of CAPS, which can be used to directly control an array of audio and video-tape machines. This provides a central control for the production of film and video sound tracks for which purpose CAPS is ideally suited.

The 68000 also has the task of reading and writing SMPTE time code and synchronising CAPS to it. A tape recording can be started at any point in a composition, cueing and synchronising CAPS with it. This allows dropping in sections of compositions on to tape, and also for cueing sound effects for film and video.

Compositions can be programmed by playing in real-time from a music keyboard or other controller, entering notes using the Graphic Tablet, or a combination of both. An important feature of the *Series III* sequencer is the ability to load sounds from disk without interrupting playing of a composition, so that a vast number of different sounds can be used in the one composition, provided only sixteen of them are to play at any given time.

Sound creation

The natural sounds sampling capability remains the central feature of the *Series III*. Whereas the *Series II* sound sampling was of limited fidelity and sample time was only a couple of seconds, the *Series III* can sample several minutes of sound into Random

Access Memory, using the professional standard of 16-bits, at up to 100 kHz. This makes it suitable for any application requiring a totally flexible, random access, sound storage and retrieval system, as well as for music performance and compositional uses.

Once sampled, sounds can be manipulated in various ways. For example, a Fourier analysis can be performed on the whole sound, yielding complex harmonic functions which can be seen as a 'three dimensional' display of amplitude, time and pitch. The reverse process, Fourier synthesis, can be used to create sounds from harmonic curves entered using the Graphics Tablet. Several options are available for easy manipulation of sounds both off-line and in real-time.

Various techniques are available which allow a sound to be constructed using a natural sound as the starting point, or synthesising from scratch. The provision of digitally controlled filters and digitally controlled amplifiers for each channel allow complex modulations to be performed in real-time.

MIDI

To be consistent with industry practice, we have implemented the MIDI specification throughout the system, except where speed or resolution specifications would be restrictive, such as where waveform data would need transferring in which case the SCSI standard is used.

Some CMI users hardly ever use a keyboard and would prefer to use devices such as the *SynthAxe* guitar controller and *Fairlight Voicetracker*. With this in mind, *Series III* will have a 'live control box' option which contains several incremental pots each with its own description and value

readout which will augment real-time control of specified parameters.

The MIDI control page can allow one manufacturer's specific MIDI input to be converted to another's which can then be output to other MIDI devices. The MIDI ports can also be programmed through CAPS to control onboard mixing and effects devices.

Hard disk

To realise the full benefits of *Series III*'s sound sampling capabilities, hard disk is required. Suitable drives are now available in small packages with high-density, good reliability and low cost. One of our main concerns regarding hard disks was their roadworthiness (CMIs tend to be moved from place to place). The new generation medium density drives seem to be much improved in this regard and we have chosen a drive in the 60 Mbyte (formatted) region which is shock mounted in the standard CMI portable chassis. One or two 8 in floppy drives are also fitted and extra hard disk drives, tape cartridge backup, removable hard disk backup and laser disk drives can all be connected externally via the standard SCSI interface.

The SCSI interface is a generally accepted standard for high-speed data transfer between small computers and peripherals. It provides virtually unlimited access to data intensive peripheral controllers, allowing low cost expansion of hard disk memory. It can also be used to connect extra CMI 16-voice slave racks, the addition of which does not dilute the waveform memory or processor power available to existing voices. The slave voice racks contain their own waveform RAM (to 14 Mbytes each) and processors. □

Peter Vogel (left) and Kim Ryrrie



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NEW DESIGN.

Conventional in-line consoles suffer from the limitations of one long travel fader and one equaliser being shared by two signal paths. With the engineer fader reversing and moving the equaliser back and forth throughout the recording, overdubbing and mixing process to optimise the situation.

The TS24 eliminates these shortcomings, thanks to its logical design. The long travel fader is in the section called MIX, which is the signal path for both monitoring and mixing. The equaliser moves between the MIX and CHANNEL

signal paths automatically by use of the master status switches. 'Soft' switches may locally move EQ and AUX sends between the two signal paths but are also automatically reset.

When mixing, the Channel sections become available as additional inputs or effects sends without the limitations imposed by more conventional designs.

DROP-IN. BOUNCE.

Drop-ins are made easy by the use of the TAPE and GROUP button (T & G). Tape and Group enables you and the musician to monitor the original track and the overdub simultaneously.

The Bounce button facility enables you to take any combination of channels with their fader and pan settings directly to the routing matrix giving you instant bounce down.

SOUND AND VISION.

To create perfect sound, you also need perfect vision. With the TS24, that's exactly what you get. Separate scribble strips are provided instead of the usual confusing double one, and the Mix and Channel controls are in clearly defined areas for easier use.

AUTOMATION.

Soundcraft have developed a unique interface to the disc based MASTER MIX automation system, which enhances its operational flexibility by totally integrating the full extent of the console muting.

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JUST ONE TOUCH.



CONSTANT Q

Although all $\frac{1}{3}$ -octave equalisers provide filters centred at $\frac{1}{3}$ -octave intervals throughout the audio spectrum, most are not comprised of $\frac{1}{3}$ -octave filters. The user must beware of the differences between 'true' $\frac{1}{3}$ -octave equalisers and conventional devices. There is a world of difference between the two and thorough examination is warranted.

In semantic terms, a $\frac{1}{3}$ -octave equaliser is a device which can change the relative amplitude of each $\frac{1}{3}$ -octave individually, throughout the audio spectrum. It is therefore logical that any device which changes the amplitude of a frequency area of more than $\frac{1}{3}$ -octave at a time is not a $\frac{1}{3}$ -octave equaliser. By the same logic I suggest there are only two or three $\frac{1}{3}$ -octave equalisers currently available on the commercial market.

The bandwidth of a filter is defined as the distance, in frequency, between the -3 dB points of the filter's response curve, relative to the filter's peak amplitude. This can be defined in Hz (frequency), Q (quality factor) or in terms of octaves. We tend to specify graphic equalisers in octaves, so therefore the $\frac{1}{3}$ -octave filter should have -3 dB points at frequencies equal to $.89$ and 1.12 times the frequency at which the filter peaks. This should always be independent of the level control for each band. If this is not true, it is not a $\frac{1}{3}$ -octave filter.

Real-time analysers used for the purpose of ascertaining the combined loudspeaker/acoustic response of an environment all use true $\frac{1}{3}$ -octave filters to discriminate between bands. Using an equalising device which is not designed to complement the response of the analyser can impose some severe difficulties. The first thing one notices when trying to correct an improper response with a wide bandwidth

**Constant Q is just one
of the aspects of
equaliser performance
that are currently
raising much interest.**

**In this article
Terry Pennington of
Rane Corporation
looks at several areas
of graphic equaliser
performance related to
bandwidth and puts a
forceful case for the
virtues of narrow
bandwidth constant Q
designs**

equaliser is that changing the response of one band will directly affect the response of the neighbouring bands as well. Adjacent bands must therefore be compensated somewhat to make up for the action of the first band. This leads to equalising the equaliser, which adds considerable unnecessary manipulation to the audio being processed.

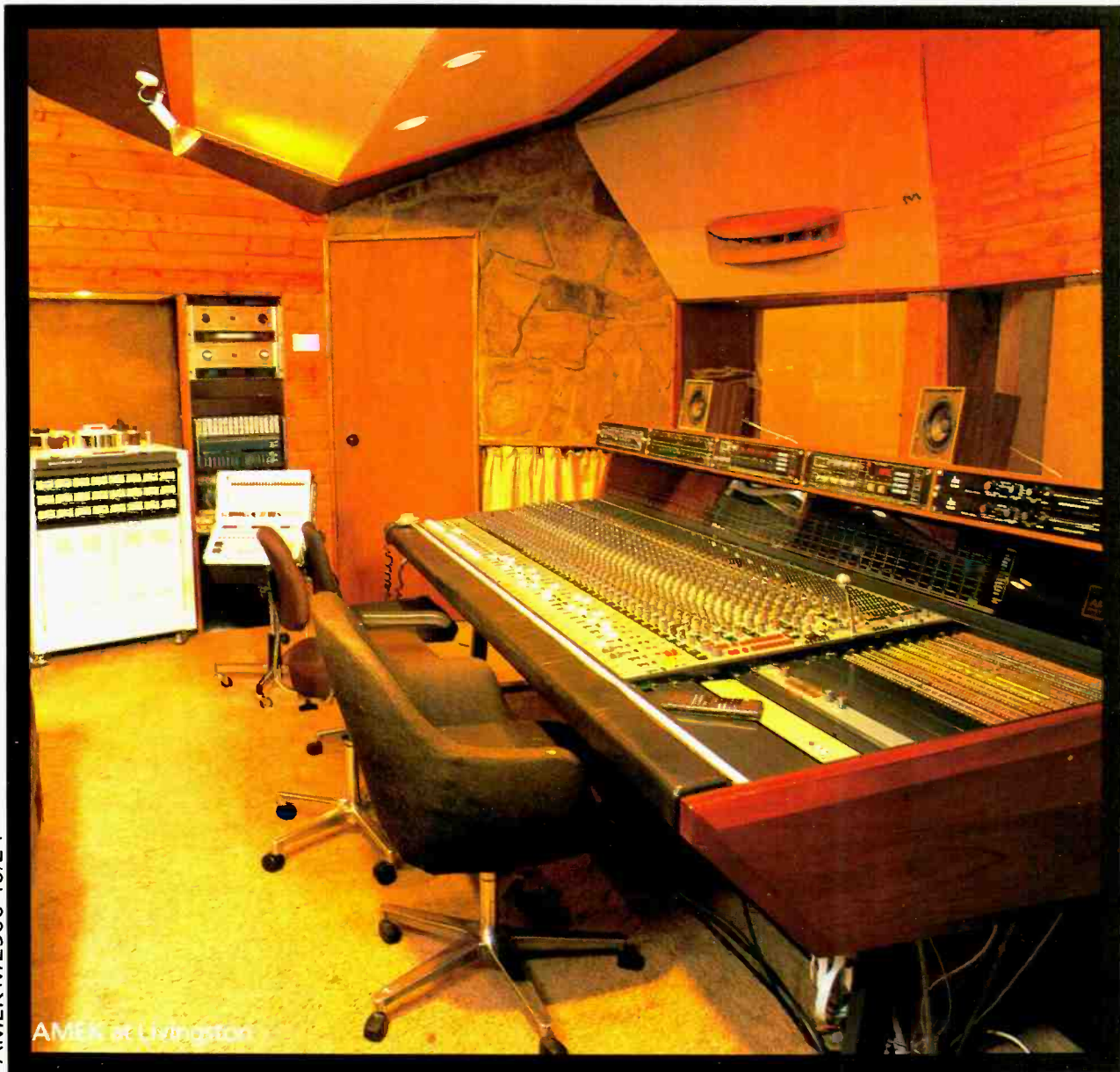
An examination of history is necessary to fully understand the reasons why traditional equalisers behave as they do. A conventional equaliser employs either filters comprised of inductors and capacitors connected to variable resistors; or synthetic inductors, known as gyrators, also connected to variable resistors. The variable resistors are used

to control the impact of the filters on the passband of the device, thereby controlling the EQ at the centre frequency of the filters. The problem with this scheme is that the variable resistor changes the damping and thereby the Q of the filter. As the resistor is changed, so is the bandwidth. In the early days of such devices, this was deemed acceptable since the alternative would require a very large collection of valves to construct the active filters needed to prevent this from happening. By the time that integrated circuits became readily available and affordable making the job of properly doing this easier, the above trade-off was continued, mostly out of habit.

The alternative to the conventional design is an equalisation device which employs a discrete bandpass filter for each band of the equaliser; each of these filter's outputs then selectively applied through variable resistors to either a 'boost bus' or a 'cut bus'. The variable resistors used in this application cannot affect the response of the individual filters since they are connected to the least sensitive node of the filter; its low impedance output. This is the simple mechanism which prevents bandwidth changes from occurring when front panel controls are manipulated.

For as long as there have been graphic equalisers there have been engineers striving to reduce the 'ripple' between adjacent and non-adjacent bands for all possible combinations of front panel settings. The evaluation of the amount of ripple is always performed using a sinewave sweep of the audio spectrum, this input passing only through the electronics and not through any acoustic transmission. It is true that there is less ripple observed when looking at the traditional equaliser as opposed to the constant bandwidth variety when only moderate amounts of boost or cut are

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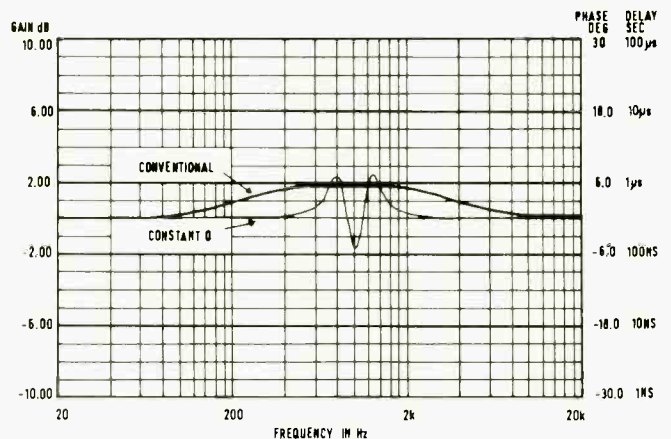
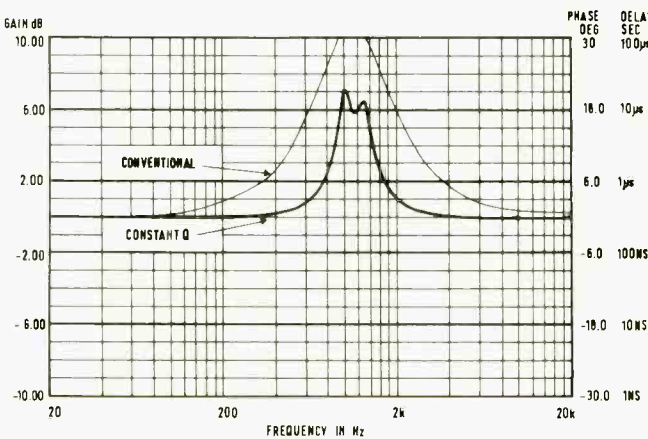
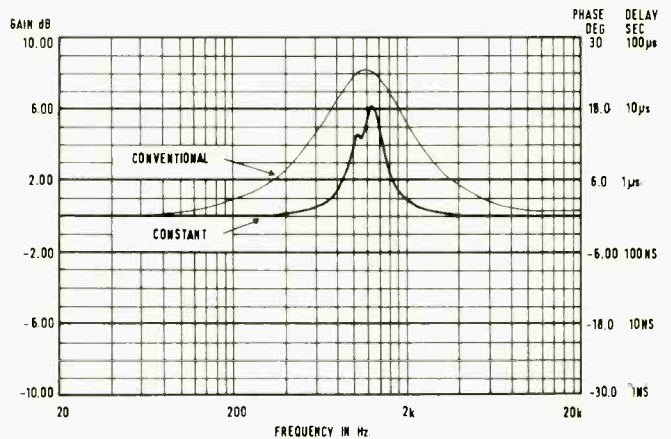
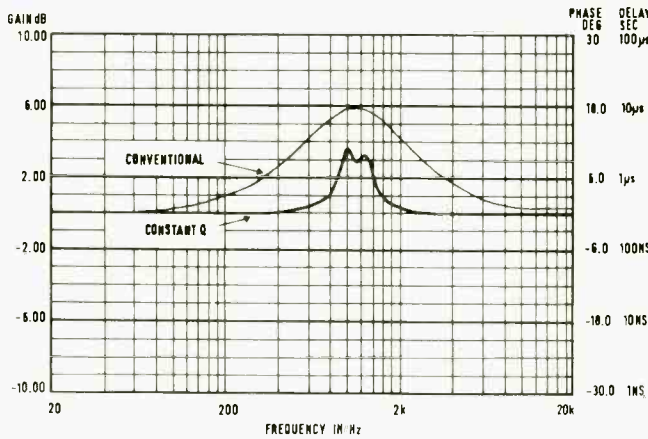
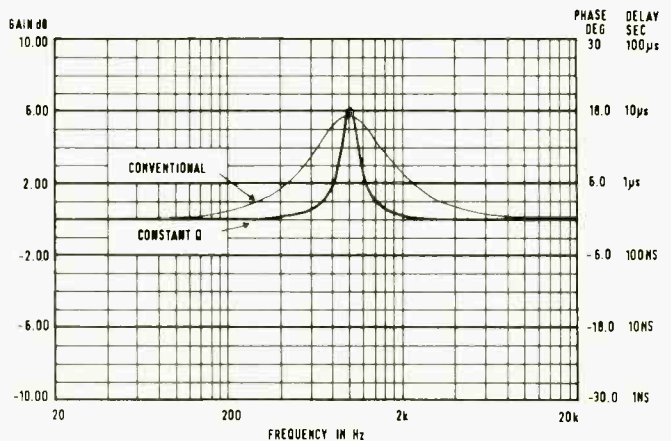
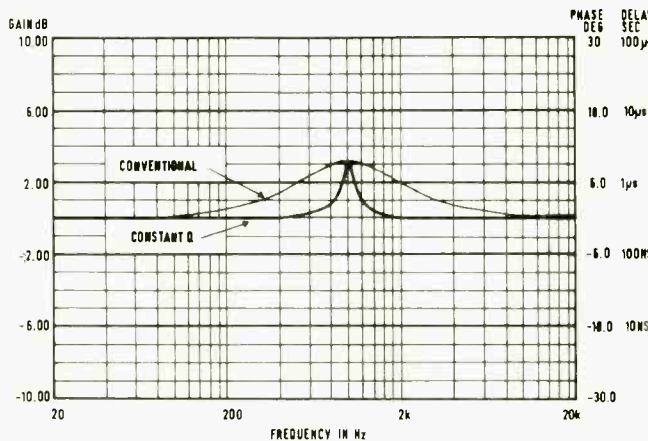
CONSTANT Q

required (usually less than ± 9 dB). The reason for this is due to the fact that the bandwidth of the filters of the traditional equalisers varies between one and two octaves at these levels. Each filter of a constant bandwidth equaliser will provide the specified $\frac{1}{3}$ -octave regardless of slider position. There will be, therefore, some ripple between bands, maybe as much as 1 dB at settings where the conventional equalisers have

none. Again, this will be observed when a sine wave sweep is run on the device and will have no impact on the sonic virtues of the system. Is it not more desirable to achieve the $\frac{1}{3}$ -octave capability than to produce a visually pleasing smooth curve of little or no value to audio reproduction?

Some critics of the constant bandwidth equaliser state that the ripple observed between boosted or cut bands of this type

of equaliser are attributed to improper design of combining circuitry. This is not true. There is no possible way to eliminate such ripple in a true $\frac{1}{3}$ -octave equaliser, properly designed or not. When a conventional equaliser is boosted or cut to the point where its variable bandwidth becomes $\frac{1}{3}$ -octave it will produce the very same ripple as the fixed $\frac{1}{3}$ -octave type. The only reason the ripple is not evident in the conventional



equaliser at other settings is solely due to its very wide bandwidth and filter overlap.

To directly quote one highly respected manufacturer of high-grade equalisers, 'The bandwidth of the filters were carefully selected to be as narrow as possible, yet broad enough to provide optimum summation.' Unfortunately, optimum summation is not the necessary parameter for proper room equalisation. It is this general misconception which causes the sound engineer some of his greatest problems. It is this lack of regard for true $\frac{1}{3}$ -octave equalisation on the part of most designers which makes it imperative that the end-user understands what is really required. True $\frac{1}{3}$ -octave equalisation is not possible when 'optimum summation' or 'ripple' is given too much precedence over performance.

Another contention of proponents of the conventional equaliser is the fact that the so-called 'combining' equaliser has a more pleasing phase response. Not true. The phase response of all equalisation devices is essentially the same. Providing frequency dependent amplitude deviations requires a fixed amount of phase shift for a given peak amplitude. As a rule of thumb, the resultant phase shift is 10° peak per 3 dB of frequency dependent change. It doesn't matter whether you use a conventional graphic, a constant-Q graphic, a parametric, passive, active, or the tone controls on the most inexpensive stereo receiver you can find. The phase contribution will always be the same. Fortunately, the acoustic phase created when a dip or peak in a response curve is present is exactly opposite of the electronic phase shift present in an equalisation device. Mother nature has saved us the trouble of trying to explain why we have to mess about with the timing of an audio signal just to provide a little EQ.

One encounters another serious drawback when using a conventional filter set. The enormous amount of boost or cut which may be inadvertently applied to a sound system when adjacent slide controls are moved in the same direction. As an example, setting two sliders to +6 dB will not result in only a +6 dB response across two one-thirds of an octave; it will, instead, result in one large peaking response of about +10 to +12 dB across an area over an octave wide. The constant bandwidth approach eliminates this danger since the contribution imposed from one filter on another can only be on the order of 1 to 2 dB.

A further major drawback of the conventional variable bandwidth approach is the inability to control the response of a $\frac{1}{3}$ -octave band centred between two adjacent bands which are both boosted or cut. As with the above case, the two bands will combine to produce a very high peaking response, even though there is a band in between them which is not set in the same direction. If, for instance, one were to

boost one band to, say, +6 dB, the next to -3 dB, and the next to +6 dB, the result would be a curve that goes up to +6 or 8 dB, continue on this course for another octave or so and then decrease back down to zero. The slider set for negative response would have no effect other than to decrease the peak amplitude of the boosted filters. The constant bandwidth design will allow one filter to work between two others, regardless of the setting of its neighbours. This is not to say that there is an absolute freedom from interaction with the constant bandwidth design. In the preceding example, the peak amplitudes will be in the order of 1 dB

less, in both the positive and negative directions, than the controls would lead one to expect. There will be, however, a positive and a negative correction applied to the system, not just a positive one.

The choice between 'true' $\frac{1}{3}$ -octave equalisation or something that simulates the real thing becomes really quite simple once the differences are understood. The only benefit in using a conventional equaliser is the smooth curves that may be achieved with moderate control settings. These curves are only of value when listening to a sinewave sweep in an anechoic chamber. A very unlikely application at best. \square

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UNIQUE RECORDING OCEAN WAY

The owner of Ocean Way and the man responsible for its direction is engineer Alan Sides, a man who appears to have committed his whole life to date to audio. And could there ever have been any doubt in the minds of those who knew the young Sides that he was destined some day to be a sound engineer?

Even by his mid teens a part time job in a friend's father's hi-fi store saw him taking full advantage of the wide access that his position gave him to the tools of his future trade, and although he wasn't technically too knowledgeable at that stage, his instinct was already strong. Alan:

"The owner was really a great guy, he used to let me borrow almost anything I liked, and so I was able to play around with a lot of different equipment. I always knew in my head what I wanted to hear, and although I didn't know too much else at that time, I found that simply by really knowing what I was aiming for, I was somehow able to turn it around and get the system sounding good."

Alan's aural facilities were partnered by an equally well-honed business acumen and an untempered willingness to go to extremes. This tendency toward the extravagant was keenly demonstrated to his long suffering parents when the local cinema, forced by lack of business into closure, found itself with no further use for a sound system. Alan takes up the tale:

"Luckily my father was away, and so I hired a crane, got all my friends to help me, and by taking out the second storey window, managed to get these two massive theatre speakers loaded into my bedroom.

"These cabinets were huge—about 7 ft high with two 15 in bass speakers and a single radial horn loading two compression drivers. Then on top of that as a super tweeter

Ocean Way is one of the more successful recording studios in Los Angeles. It is renowned for its unconventional 'ultra hi-fi' approach to recording and a long and impressive list of clients spanning Frank Sinatra to Michael Jackson. We asked Jim Betteridge to find out why the studio developed as it has; to look at the background of owner Alan Sides and leave open ended whether such a refreshing attitude would be business outside of LA



Control Room A

I had an original Altec 802C driver on an 811B horn. It was a very unusual system for a bedroom and over the next few months I experimented with various combinations of components and loadings. Some things worked, some didn't, and so I learned."

At the age of 17, in exchange for the installation of a nightclub PA system, Alan negotiated a six month

lease for the club's 5,000 sq ft basement area which subsequently became his own 2-track studio and his experimental base for over three years.

One of Alan's most consuming passions is old tube mics, and today he has an extensive and unique collection that is very much part of the Ocean Way hi-fi sound. It all started back in

these early days when he answered a 'For Sale' advertisement in the local paper:

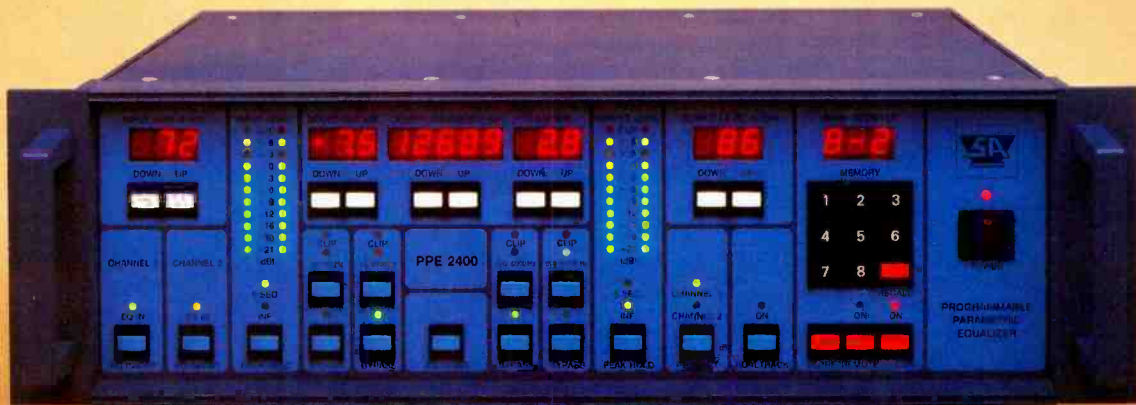
"I went down there and they had about 18 AKG C60 microphones for \$20.00 apiece, and a bunch of Telefunken CM-61 s for \$10.00 apiece. I bought some Schoeps and some Synchrons too, and a whole bunch of 421 s, all unbelievably cheap. I didn't have a great deal of money, and so I bought all I could get my hands on, went off and sold them, and then came back with the profits to buy more; I did that about five or six times. And so I had a large range of condenser mics in that first studio for almost nothing.

"I used to go up into the beer bar of the club and talk the groups into doing demos in my studio. At the time I was doing it all for free, I just wanted the chance to experiment. In fact it was quite a while before I started making money with the recording, I was more interested in playing around and making tapes for myself than in doing commercial recordings. The money in those days basically came through dealing. I've always been a wheeler-dealer, and even now I still regularly buy out studios, cherry-pick the items that I want and sell the rest. I buy about one a year, they come and they go, and I've made some big deals and a lot of money doing that. In that way I've always been able to finance everything with cash, I've never had to take a loan, and so my overheads have always been lower than other studios."

After the basement studio, Alan, who was now attending college, took a partnership in a 4-track studio in the valley:

"We were using an old Ampex MR70, which is still one of my all-time favourite

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UNIQUE RECORDING OCEAN WAY

machines. It was incredibly quiet and flat to 25 k but it was so mechanically nightmarish and unreliable that Ampex would prefer not to talk about it today. My console was made of JBL stereo hi-fi preamps which had great mic amps with incredible sounding bass and treble controls. I had six of these preamps giving me 12 basic inputs which were all tied together with 10 k resistors and Fairchild 662 line amps so that I could select output buses. Then I came out of the record outputs to a bunch of Shure M67 mixers for echo sends. I also had a couple of Ampex tube mixers for additional inputs. Another real asset was a 90x40 ft echo chamber with two *Voice of the Theatre* speakers and a couple of C-60 tube mics; that sounded very good."

Amazingly enough Alan still has most of this gear stashed away for posterity behind the walls of Ocean Way.

Around 1974 he rented a large garage space by the beach in West Los Angeles where he set up his first 16-track using an Ampex M1000 machine with a 24-input tube console taken from Studio One of Western Studios, and still with the original 7 ft high speakers arrays, though by this time with a number of modifications. It was around now that all Alan's hard-earned experience as an engineer started to pull in some money.

"A couple of producers who I'd done hi-fi's for heard some of my tapes and I started getting calls from clients to come down. They were punch freaks and so they loved the impact of the drum and bass sounds I was getting, and so I started working with various producers and was getting around \$75.00 an hour for myself and the studio. By '76 that had gone up to \$100.00 an hour, which was quite a bit of money in those days especially with low overheads, and I was working as much as I could work. In fact, to be honest, after I'd gone so called 'big time' and moved into the back room here on Sunset (Ocean Way's present site), the overheads went up so much that it took a good while before I was able to make the same kind of profits. Now it's

a little different, last month we did 730 hours between the two rooms, which is a lot of hours by any standard."

Alan moved his operation to its present position on Sunset Boulevard in 1978. The site was originally the home of United Studios—the United part of the famous United Western Studios—designed by the equally famous Bill Putnam back in the mid-'50s. Initially he took over only Studio B and taking over Studio A a couple of years later, he now owns the whole building.

Studio B retains basically the original form and acoustical treatment given to it by Putnam in the United days, although the control room was completely redesigned a couple of years ago, and now contains 48-channels of Massenburg (GML) automation in a custom console designed very much with hi-fidelity in mind. The equalisers built into the console are in-house designed, 3-band, 15-frequency and are what Alan terms 'free', in that use of them doesn't introduce any more active circuitry.

Alan explained, "When you mix down in Studio B, you're only using two amps per channel—a line amp and a bus amp, plus a passive mix network. The equaliser is inserted in the feedback loop of the line amp so that when you switch it in there is actually no additional active circuitry involved." There are also 52 API 550A equalisers available in auxiliary racks, which can be very easily switched into line. These were also chosen for their sparing use of amplifiers and their resultant sonic purity. Alan underlined how sparingly amplifiers had been used in the desk's design:

"In a typical situation, 'microphone in' to 'bus out' in our console, the signal will go through five amplifiers including the EQ; only three if the 550A (EQ) is punched out. In an SSL it's typical with the EQ punched in to go through 16 or more amplifiers, and you pay a price for that.

What does Alan look for in control room response? "I like to see it quite flat down to about 40 Hz and up to around 2.5 k. Then at 5 k it should be



Studio A



Control Room A

down by about ½ dB; at 10 about 1 dB and then 1½ dB down at 18 k. It should be noted that this curve I have found to be quite effective in a moderately dead control room. In a very live control room the same curve could be harsh and on the bright side."

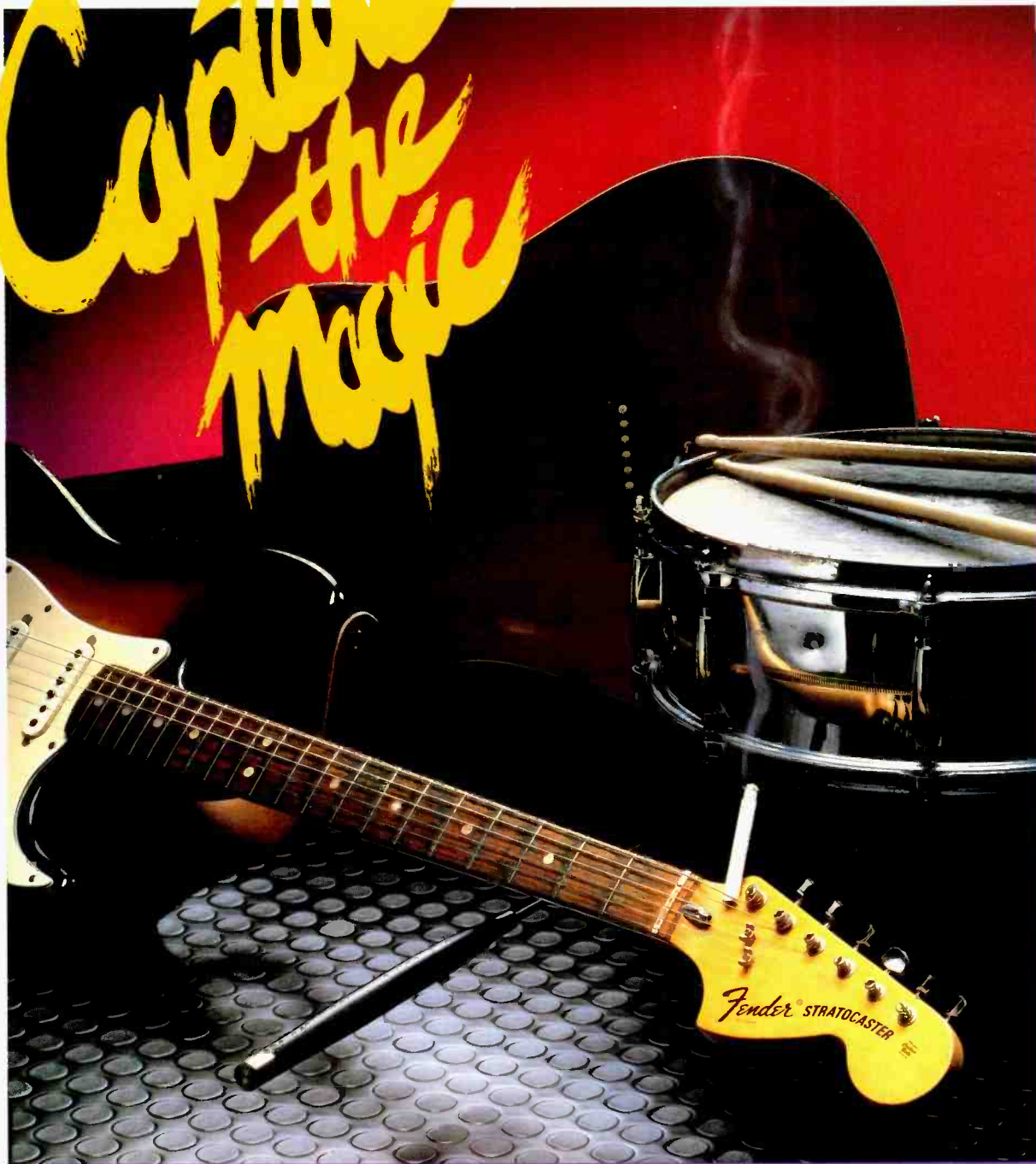
Is this really representative of a normal hi-fi? "Surprisingly, yes it is. Most hi-fi's have accentuated top and accentuated bottom and a dip in the mids. A lot of the recordings I do are direct to stereo or direct to disc for audiophiles, and I've done a lot of successful records for that camp. If you have a mix that is clear and well defined, it'll sound good on a car radio or a hi-fi. If you EQ for a specific type of system you're going to screw someone else. The important thing is to make it clear."

The Studio B floor area measures approximately 45x33 ft with a very high ceiling, a lino-covered concrete

floor, and a mixture of acoustic tiling, assorted modular box absorbers and wood panelling on the walls resulting in a controlled low frequency response, but a generally very live feel. Alan commented, "the ambience in this room is very clear and very musical; it's a huge plus. The liveness has a very uniform decay, there's no slap back, so when you get a snare in here the room really adds to the sound, and any spill you get between instruments is an enhancement, rather than something you want to get away from."

Adjoining to one side, and running the whole length of the studio and control room is what is modestly termed the isolation booth featuring a similarly high ceiling and live acoustic. Measuring 60x20 ft, however, it is actually comparable in area with the main room, and can be made to include, by means of sliding glass doors, a couple of other

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smaller booths. Thus a large orchestra including strings, brass, backline, vocalists and kit can be easily accommodated with adequate separation.

Including the control room, Studio A covers an area approximately 75x50 ft and is one of the most popular sites in town for large orchestral sessions. Once again it is an original 1950's

Putman design with parquee flooring, a lot of basic peg board treatment, a high ceiling and a generally live feel, not to mention a number of colourful and exotic murals. In Alan's own words, "The rooms sound great, so we don't mess around with them." And indeed, a long and impressive list of clients would seem to agree with him. Lionel Ritchie's highly acclaimed *Can't Slow Down* was recorded in 'A' and at the time of this interview he was busy there working on his next album. Other albums emerging from Ocean Way include those by Count Basie, Kim Carnes, Neil Diamond, Kenny Loggins, Olivia Newton-John, Kenny Rogers, Ry Cooder and Supertramp with other significant contributions being tracks for the likes of Barbra Streisand plus work on Michael Jackson's *Thriller*.

The size of the studio, a video interlock capability and the facility to mix directly to a specially hot-rodged 3-track 35 mm magnetic recorder (apparently "as flat as a mother to 25 k") thus avoiding generation loss in transfer, make Ocean Way a popular venue for film work. Recent features including *Alamo Bay*, *Brooster's Millions* and *Paris Texas*.

Studio A's control room sits in one corner of the big studio area and is largely as it was when Alan took it over save for a reinforced monitor enclosure and alterations to the rear wall trapping to suit the response of the new monitors. It's a large space ideally suited for multi-synthesiser overdubs.

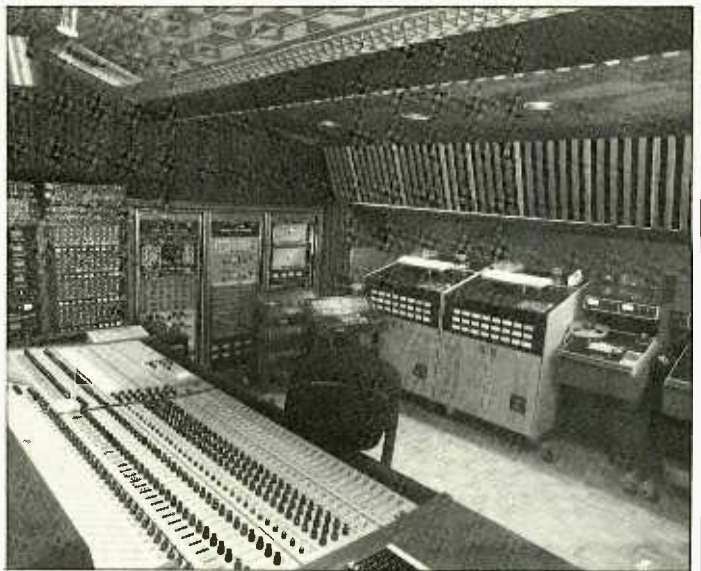
The mixing console is a custom split design with a 32-channel monitor section. The main channel input side of the board has 48 channels of Massenburg automation, and the same API 3-band

15-frequency 550A equalisers available in the rack in Studio B. As stated, the 550As were chosen, with sonic purity in mind but even so the console has been designed so that when the EQ bypass buttons are depressed, the EQ sections are completely out of circuit, unlike the standard API console design where the line amps are apparently still in line even in bypass mode.

Four separate stereo foldback sends, each with selectable source, are available on all main input and monitor channels. Should it be necessary to use the monitor section for extra inputs during mixdown, the solos/PFLs can be linked with those of the main channels. There are additional effects sends plus eight effects returns each with an API 550A equaliser, any of which can be sent to any of the foldback buses via an 8x8 matrix.

In both studios Ampex ATR124 24-tracks are used, and Alan wasn't pulling any punches concerning why he'd decided against Studer: "The ATR124 has the best low frequency response at 30 in/s of any machine, partly because they came up with a whole new type of head design; and they achieve this without a lot of low frequency compensation on playback. What Studer does with the A800, is to rely on substantially more LF boost to compensate for poor low frequency response in the head, and so you end up with very mushy bottom."

Alan now swears by the Ampex machines but to get to that point of satisfaction his engineers had had to make some modifications, one of which was to the wind speed. Alan: "The ATR is capable of winding a reel of 2 in tape from top to bottom in about 30 s but that's a little on the dangerous side! But if you want to set the speed up to where you'd like it to be, their power supply isn't quite up to it, so we had to make some changes there. The transport is now about 50% faster than an A800, top to bottom of reel. Then we changed all the buttons: there were these \$100.00 pieces of equipment that went bad after about six



Control Room B

weeks in service. Then there were other things we had to correct, like bumps on drop-ins and little snaps going from mode to mode; we also simplified the audio circuits—there were some unnecessary amps in there so we removed those... other than that, the machines are pretty stock!

"We also have 16-track heads for them which we use a lot for tracking. Supertramp, for instance, used a 16-track and a couple of 24-tracks locked together. That kind of multi-machine situation is nothing unusual, Kenny Loggins had I think a total of seven 24-tracks, and what he had to do was make combines: he'd have a background slave, a guitar synthesiser slave, a percussion slave, and so on, and then he had to make composites on to a 32-track 3M because it got so complicated."

Auxiliary gear is virtually unlimited and includes old and new equalisers and limiters such as Fairchild, GML, ITI, Lang and Pultec, plus a full range of most of the current digital and analogue processors. If you aren't satisfied by the array of EMT plates or the various digital reverb systems, the real thing is available from three large echo chambers each with a very different characteristic.

The monitor systems are an in-house design and Alan was reticent to go into too much detail although each custom-designed cabinet is tri-amped using modified Phase Linear 800 W solid state amps to drive a pair of 15 in bass speakers via a short length of 8-gauge welding wire. These are crossed over at 600 Hz to a pair of (unspecified custom) mid-range compression drivers loaded with a single 90° radial horn which in turn is crossed over at 10 kHz to a direct radiating dome tweeter using

a 1 mm aluminium dome, a mylar surround and an 18,500 gauss magnet. Both mid- and high-frequency drivers are powered by rather rare 80 W Marantz 9 valve amps. As far as time alignment is concerned, Alan is not prepared to suffer the losses of the analogue circuitry involved in electronic correction but he has endeavoured to align his drivers physically, and apart from a very minor discrepancy at the high end, claims to have succeeded. The cabinets are heavily braced 1 in marine ply and press board which he finds to be quite solid enough. The monitors are equalised sparingly using modified Whites that are minus much of their line amplification and their standard lowpass filters. Not much escapes without some component reduction.

Regarding acoustic design and the claims of certain well known organisations regarding guaranteed control room response specifications, Alan had some reservations. "It really depends on what window we're talking about; it has to be OK for at least three people, otherwise how is the producer going to work with the engineer? There are a number of studios in this town where you have what they call a 'head holder'. They lock you in 'right here', and it's 'don't move, that's perfect'—it can't work. It's important that the artist hears the same sound that I hear at the console. As an engineer, I'm happy when the musicians walk in and say, 'That's great!', if they don't, if they say nothing, I just feel terrible.

"As a studio owner, I work very hard to try to maintain the standard of what comes out of here but I can only go

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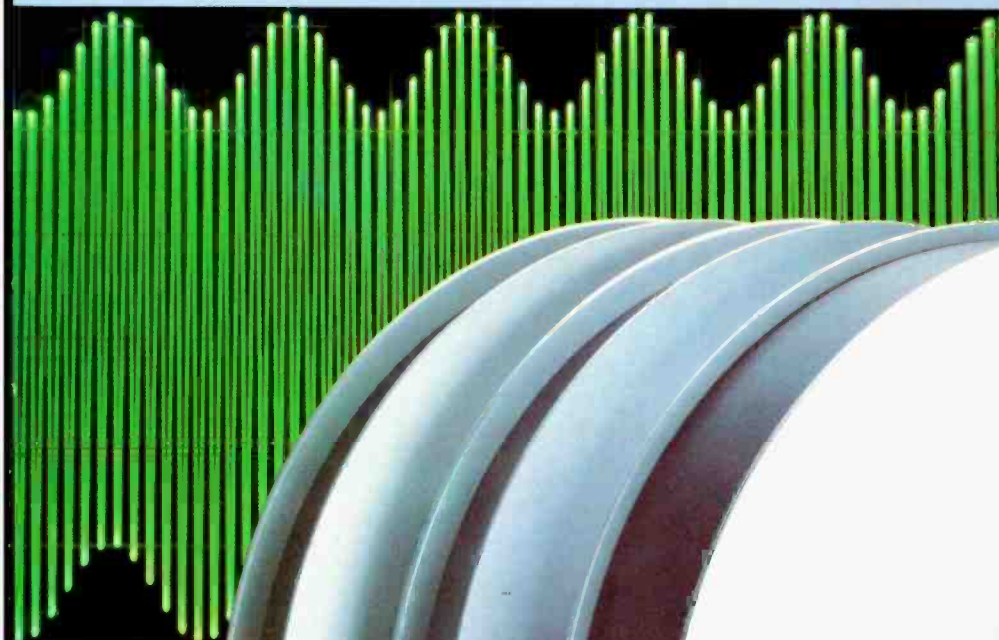
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so far in guiding engineers who might not be used to the set up. We have one well known engineer who comes here and he'll set all his EQs before he'll pull the faders. And then if it doesn't sound right, he'll patch in additional EQs to correct for what he did in the first place! Then of course there are other engineers who get a great sound."

What about in-house balance engineering staff?

"In Los Angeles, at least, the day of the staff engineer is kind of over. I know that in London a lot of studios include the engineer as part of the rate but here—almost never. Most engineers are independent, and an average hourly rate for a good engineer would be about \$50.00, although some are getting more like \$75.00. Our studio rate is usually based, without engineer but it does include almost all the outboard gear. We have a minimum of 3 hr and an extra charge if they want to do a video or 2-machine lock up.

But I have two or three guys who work here all the time, and whenever a date comes in without an engineer usually I will recommend one of them because of their familiarity with the room.

"A guy who's worked with me really since I opened the place, and is now quite an engineer himself, is Mark Ettel. For about six years we worked together all the time real intensely, and now he and I are very similar. We used to work it so that I'd do the tracking, he'd do the overdubs and then I'd mix it. Now Mark does a lot of stuff on his own and if I give Mark a date, he'll make them very happy."

Was Alan a keen participant in the digital revolution?

"I get very little demand for digital and personally I don't care for the way it sounds (it sounds, because what comes out is definitely not what goes in). There are lots of theoretical arguments for and against but what I'm talking about is very audibly obvious: a loss of low level high frequency ambient material



Studio B

and reverb, plus added harshness. The first time you listen back to a recording on a Sony 1610 you can hear a difference, it has this extra presence at around 7 or 8 kHz which can sound initially impressive but the real highs have gone and after a few digital copies the sound gets progressively harsher. I must say that a lot of the losses in the D to D's are due to the performance of the U-matic transport, and you don't get that trouble with the Sony 24-track. The Sony is quite a reasonable sounding machine.

"Some of the reasons for the losses are insufficient

sampling at high frequencies, especially at low levels and severe phase shift caused by the sharp analogue filtering. Also some manufacturers have a ridiculous and totally unnecessary amount of analogue stages in the input and output sections which further degrade the signal. A system was devised recently to correct for this phase shift. Unfortunately, the degradation caused by the correction system is far worse than the original problem! I've done about 33 digital albums (two of which were nominated for Grammys for sound) and when I'm getting my sounds, I

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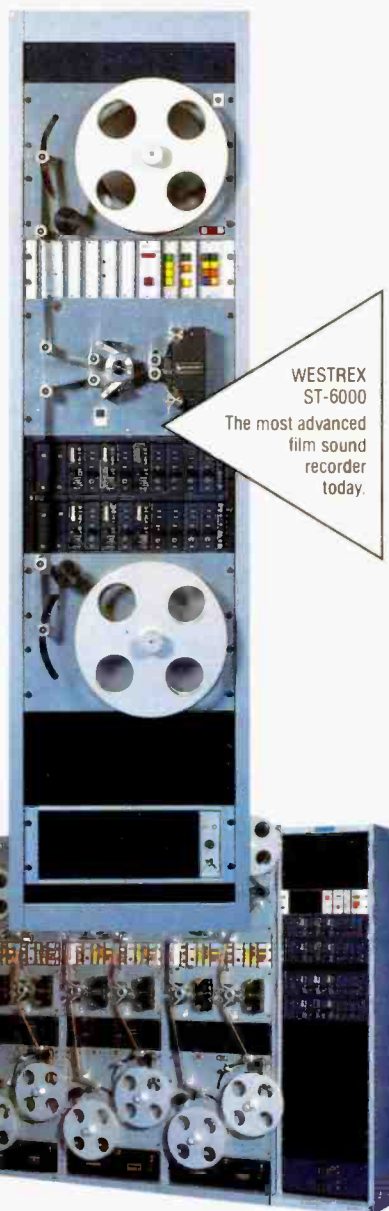
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always have to listen through the digital system so that I can effect adjustments to make it sound the way I want it to. If I listen to the bus on record, on playback I'll be upset. For instance, recording a sax, when you play it back sounds a little more narrow and a bit harsher. So I move the mic further back, add a 100 Hz shelf and a little 15 k to try and bring the air back in, and then what I hear is what I get.

"I'm not against digital all together, not at all; we're using a Synclavier digital synth a lot on Olivia Newton-John's album, and it sounds great. All the kick and snare sounds on the album are samples we've made with the Synclavier and it's very high quality, very hi-fi indeed. I think it's too bad that the industry has settled on such a mediocre standard—especially 44.1 for CD, it's not good. I've been over at Soundstream when they've been transferring some classical digital recordings, some of

which are very very good, through the Studer box: 50 k to 44.1, and there's a dramatic loss. I mean it's not a subtle difference, and apparently all the numbers were right. Basically you're losing a lot of information. On the Synclavier you can change the sampling rate, and it definitely gets audibly worse as it comes down. There was a point in one of Olivia's tracks where we accidentally erased part of a word, and so we just took a note from another section and manufactured it using the Synclavier. This was a ballad with the vocal loud, up-front, and it sounded great. They're coming out with 100 k sampling soon, and we can't wait to get our hands on it."

As a self-confessed punch freak, did Alan's technique involve compressors?

"I use limiters for effects mostly. I very rarely use them when I'm recording tracks, although I may run across a situation where I'll need a tad of limiting to maintain a good apparent level in a mix. With



Control Room B

Olivia I'm using an dbx 165 on the 'auto' setting, and I've set the gain range so that her loudest peak will probably hit a +1 or 1½ on the VU meter. Her mic technique is good but it's not fantastic, so I'll do a fair amount of gain riding in order to get the quiet things to come up. So I usually have a lyric sheet and go through it a few times to try to get it in my head but you have to be careful, you can make the mixing a nightmare if you don't do it right. But I'd rather do that than over-compress."

Finally, is being a studio owner in LA still generally a profitable business:

"There are meant to be around 400 studios in Los Angeles, and I would say that only a few do really well. It's not an easy business."

Easy or not, in the few months since our visit Alan has opened a third studio, Ocean Way Two. It's situated just a little further east on Sunset and actually larger than either of his two current studios. Some people manage to make it look easy. □

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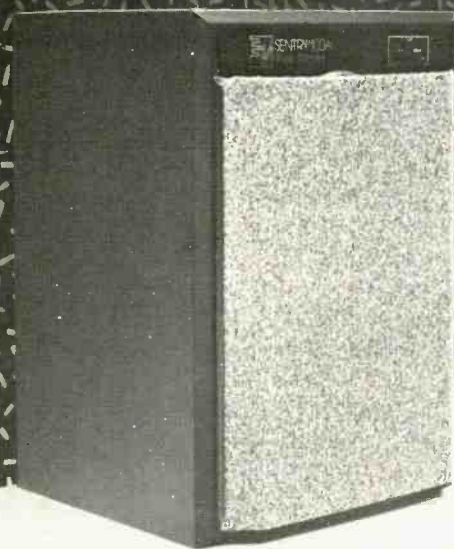


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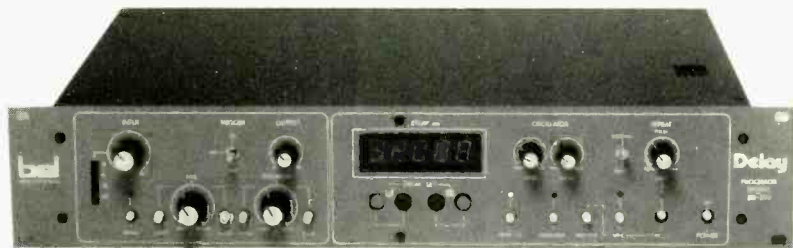
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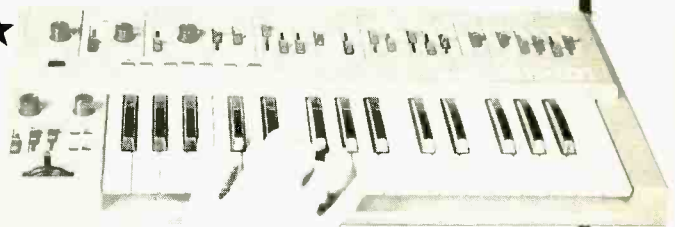


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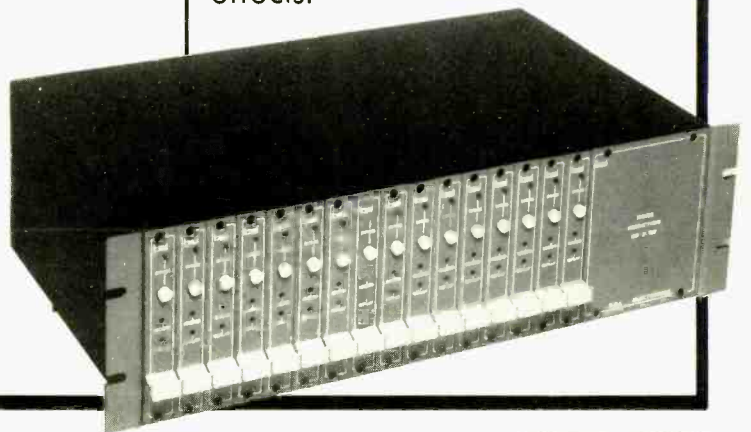
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THE RIBBON MICROPHONE

Examining the design of the 4038 microphone in more detail we see that the materials used and the spatial layout of the microphone as a whole are even more important than usual.

We should pay tribute to the BBC engineers involved in the exploratory research leading to this microphone. Experiments were conducted to optimise major parameters such as the aspect ratio of the ribbon, the detailed shape of the poles (in plan and elevation) the thickness, mechanical temper and the form and depth of the ribbon corrugations, the spacing and acoustic impedance of the damping gauzes, etc. The form of the case and lining gauzes help optimise the response, particularly at high frequencies.

To optimise the flux distribution in the gap, large-scale models of the pole section with different chamfer angles, etc., were made and the distribution of the lines of force explored with an electrostatic pole face probe. Exhaustive experiments were also carried out involving many different models to confirm the best ribbon shape and form. Motional impedance bridge measurements to optimise the ribbon damping will be considered later. A relatively high flux density in a wide gap (1/4 in, 6 mm) is needed to give a high output and hence a good noise clearance at line inputs (30 Ω or 200/300 Ω). A flux density of about 5,000 gauss is required in the gap. To obtain this, a fairly long and wide magnet is required and the poles have to be swelled out at the bottom to take the magnet.

Because of the wide gap and the relatively small pole piece section at the top which is required to obtain the necessary small distance 'd' around the poles, to give a good high frequency response, a large amount of magnetic leakage is inevitable. To reduce leakage, high permeability cobalt iron investment castings are used for the poles together with a toroidal 'doughnut ring' preferred direction modern alloy magnet. The magnet is the main contributor to the overall size of the microphone. Research is proceeding to see if the more recent rare earth magnets can be incorporated into a wide gap structure such as this. If this is possible a smaller microphone could result.

The short ribbon (1 in, 25 mm) means that the cosine polar response is maintained without narrowing at high frequencies in the vertical plane. The connections to the ribbon are taken out from the top end by four conductors arranged symmetrically about the ribbon. These bars are connected together at the bottom. Twisted leads are taken from these and the bottom of the ribbon down to the shielded toroidal transformer in the base of the microphone. Flexible leads are used because the microphone is pivoted on the base to allow for orientation in the vertical plane. The 3-pin connector is secured with a spring clip but three hawser-securing loops are provided for safe suspension, the microphone being

PART TWO

Michael Gayford
concludes his two part
article on ribbon
microphones with a
closer look at the 4038

balanced so as to hang well.

The polar response is shown in Fig 1 and the frequency response in Fig 2. The response is level and well-maintained from about 40 Hz to 15 kHz, the roll-off outside these frequencies being smooth and gradual. Some users extend the response at each end by a small amount of electrical equalisation. The ribbon is very light (0.2 mg) made from beaten aluminium foil of good purity. This has to be checked carefully for evenness and freedom from faults before cutting and corrugating. Inspection over a strong light reveals any thin areas. The mass of the ribbon is about 1/100 of that of most

moving parts of coil microphones and is less than that of many condenser mics. Low mass combined with critical damping ensures a very good transient attack. The proportioning of the case and the acoustic impedance of case perforations and of the various screening gauzes have all been selected to help maintain the response as flat as possible. The motional impedance method of checking ribbon damping is a useful development tool. The microphone is driven electrically with a small signal from a special bridge. This is balanced for the purely electrical impedance of the ribbon and leads over the frequency range by temporally immersing the ribbon in a volatile insulating fluid. A recorder connected in the bridge detector position then shows if the ribbon motional impedance is correctly damped. (Refer back to Fig 1, part one in the September issue.) Once this has been established, by the use of precision wire gauzes and sieving types of durable fabric fine bolting cloths, etc, the results on production microphones are consistently maintained. It is seen that gauze 'halos' are mounted around the poles and in the magnet centre hole. This is done to give a small controlled rise at

FIG 1
THE POLAR RESPONSE OF A 4038 MICROPHONE

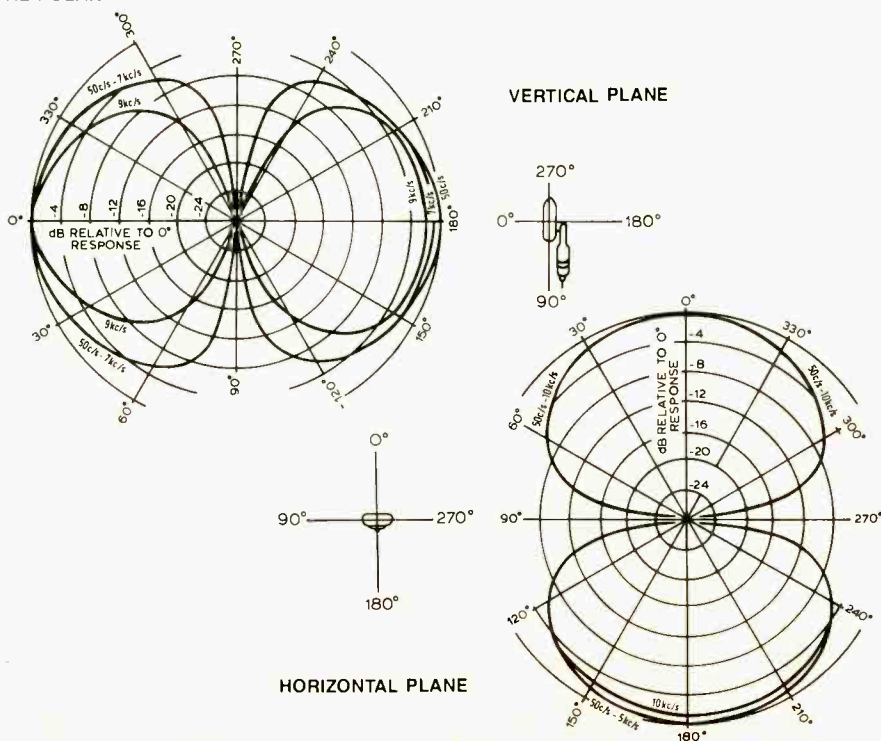
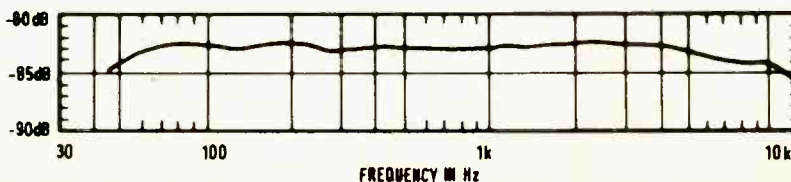


FIG. 2
THE FAR FIELD FREQUENCY RESPONSE
OF A 4038 MICROPHONE ON THE 0° AXIS



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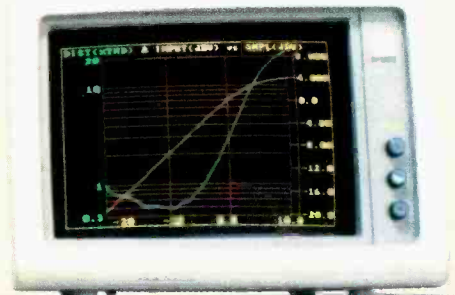
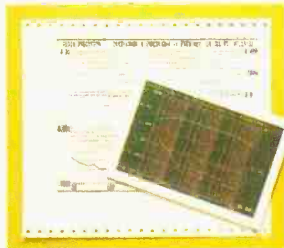
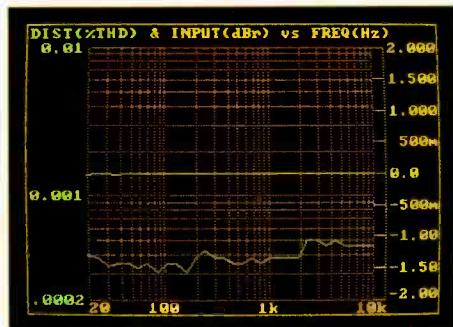
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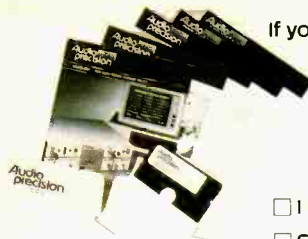
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THE RIBBON MICROPHONE

the lower frequencies to compensate for the fact that the ribbon becomes resistance-controlled rather than purely mass-controlled at the lower frequencies where the fundamental resonance of the ribbon has to be critically damped.

Operating precautions and mounting arrangements

Mass-controlled systems with light diaphragms or ribbons open to the air are sensitive to vibrations which affect the body of the microphone. The air load tends to keep the ribbon stationary, causing an electrical output. Flexible mountings for the 4038 must be of low stiffness, so that the resonance of the microphone on the mounting is at very low (sub-sonic) frequency and preferably damped, if the effects of footfalls, traffic rumble, etc. are to be minimised. Similarly, ribbon microphones are sensitive to draughts, wind and 'plosive' breath noises. The 4038 case and lining gives some windshielding but in adverse conditions, a large gauze-covered windshield is desirable for enclosing the microphone.

A boom mounted suspension for a 4038 was developed which exemplifies most of these desirable features. The microphone and suspension yoke is mounted on the

centre boss of a flexible rubber diaphragm type of shock mount. The microphone base is fixed in a large spherical gauze-lined wind shield which, in turn, is suspended from the yoke arms via four rubber shear mountings (the front hemisphere of the windshield has been removed in the illustration). The size of a windshield is an index of its effectiveness. Partly, a windshield may be considered as a lowpass filter, the air flow meeting a series impedance at the outside and a shunt acoustical capacitance in the air volume enclosed. In addition, turbulences caused as the air flow is diverted around the outside of the windshield are further removed from the microphone at the centre, when the windshield is relatively large. Proximity effect means that the turbulent noise should be as far as possible from the ribbon. The acoustic impedance of the windshield boundaries must not cause excessive high frequency loss or the setting up of standing waves inside the windshield. The gauze, etc. must be firmly supported, as any movement can cause non-linear response.

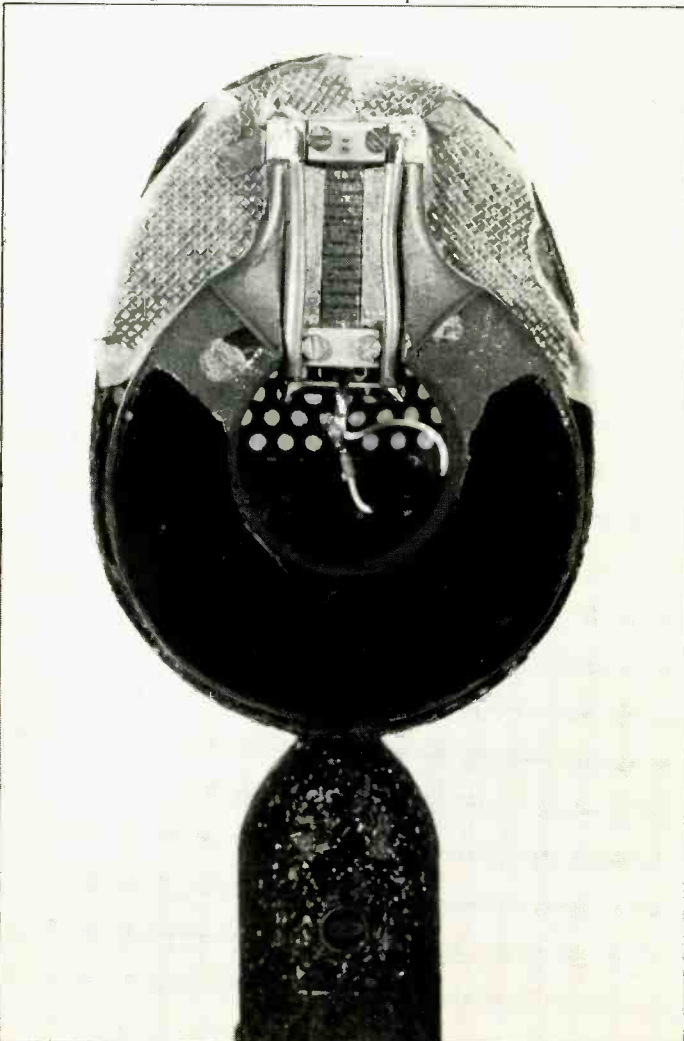
The commentator's ribbon mic

The general outline of the noise reducing close-talking or lip microphones have

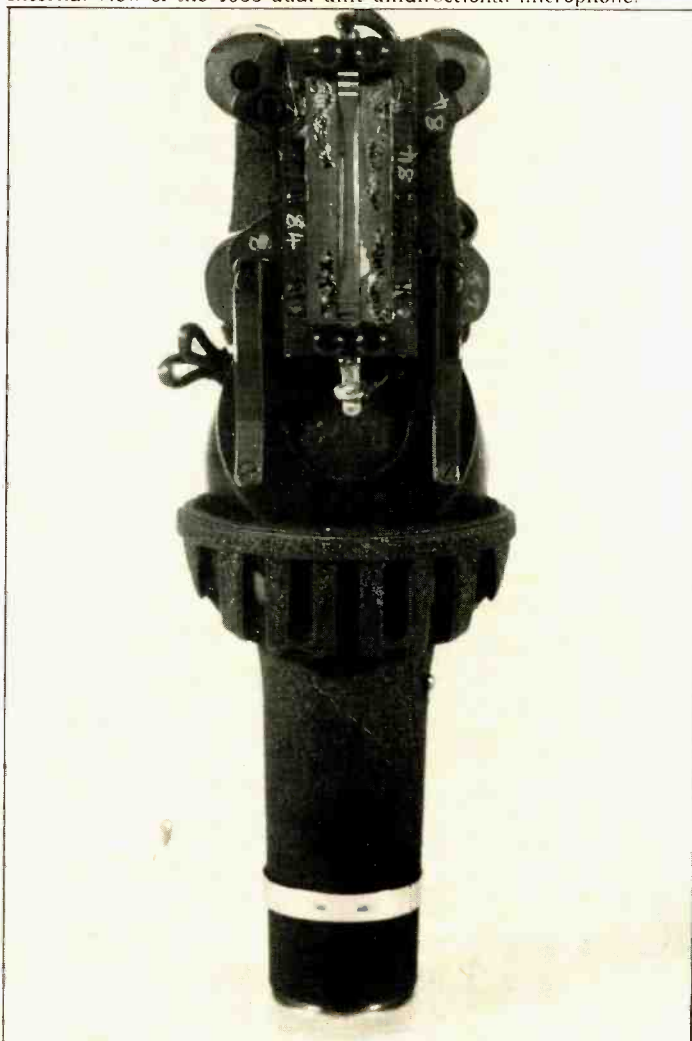
been given as well as some of the salient principles of its operation. To reduce the size and weight to suitable proportions for holding in the hand, the gap width and magnet size was reduced as far as possible. The ribbon width was reduced to 0.1 in (2.5 mm). The resulting loss of sensitivity is easily made up by the very close controlled talking 2 in distance. Small 'U' shaped magnets are used on plain polepieces. The magnet enclosure resonates broadly at the higher frequencies, which is actually an advantage, compensating for some deficiencies in close speech. The null plane of the ribbon is arranged parallel to the front of the microphone and thus at 90° to the mouth source. The nose source is off-axis but well clear of the dead axis. It is important to reproduce nasal sounds in order to obtain natural speech quality. With the case lining gauzes and the close mesh damping screens on each side of the ribbon, the windshields are very effective in eliminating 'plosive' sounds or blasting from the speech.

The ribbon is made of the same material with similar corrugations as in the 4038. Similar hum-reducing wiring is taken from the ribbon to a small shielded line transformer in the handle. It is necessary to minimise electromagnetic pick-up as a microphone may well be used in areas where mains-operated equipment—lights, TV monitors—may radiate hum frequencies as well as higher frequencies. □

Internal arrangement of the 4038 microphone.



Internal view of the 4033 dual unit unidirectional microphone.



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Barry Fox investigates the facts behind the industry news

More on tape levy

Warning: the Government's plans for a levy on blank tape could well cover open reel tape as well as cassettes. The Green Paper isn't specific. Most people have assumed it was aimed only at cassettes for domestic use. When you look closer, however, you realise that the writers have used some vague catch-all phrases like 'tape intended for domestic users'.

What about a semi-pro musician, or a pro musician or engineer with a home studio, or a small pro studio using Fostex, Tascam/Teac equipment? Are they domestic users? If not, how will they get tax-free tape? Will they have to pay the tax and then re-claim it? The obvious way out of course would be to tax only cassettes bought retail and leave all open reel tape tax-free. But that isn't the way the government is thinking. It's something that needs to be raised now, ahead of any levy that may be imposed.

The giveaway on the Government's current thinking is buried in an innocent looking letter from the Department of Trade and Industry which was sent to the Royal Photographic Society. In the very last line, after discussing exemptions, the Government official adds 'other tape formats such as reel-to-reel may also justify exemption'.

What this phrase means is that open reel tapes *will* be taxed unless someone lobbies for exemption and wins. So if you are using narrow gauge multitrack and you don't want to be trapped into proving that you are a non-domestic user, you had better get lobbying now before it is too late.

Black magic, cooking and chemistry

Before compact disc was launched, the industry thought mainly of CD as the ideal medium for releasing new digital recordings. Some people, notably John Borwick of *The Gramophone*, astutely observed that CD would make the ideal medium for re-releasing old, classic recordings. This, of course, is now happening. Sometimes the results are happy, other times not. I wince when I listen to the CD re-issue of some original George Benson jazz tracks. By comparison three vinyl LPs, digitally re-mastered from 50 year old jazz recordings by the Australian Broadcasting Corporation, sound remarkably clean. Robert Parker dubbed direct from original 78 RPM disc on to Sony *PCM F1*, so avoiding any analogue

tape generation.

Was analogue tape really that bad? According to Ampex, modern analogue tape has improved even over the last 10 years, although a straight comparison of the performance figures is misleading. Ten years ago S/N was around 72 dB, with total harmonic distortion of 3%. Ampex *Grand Master 456* raised S/N to 77 dB. But, says Ampex, the real improvement was in noise character. This was all down to the tape production process.

Tape factories are traditionally very secretive about how they make tape. Coating technology is a curious mix of black magic, cooking and pure chemistry. Production engineers duck any question that puts a finger on specifics. Video factories now often make all their tape in the same way, but batch-sample the result. The best batches go out labelled as 'high grade' and sell at a premium!

According to Ampex, modern tape sounds better because the noise is not so spikey as it was. The lubricant which must be incorporated in any tape coating, allowing ease of movement over the recording heads and guides, used to exude tiny droplets—especially in cold weather. These caused dropouts and spikey noise peaks.

There was also a tendency for the magnetic particles to clump together. This was the cause of noise modulation, with the background pumping along with a bass guitar line. Straight S/N figures don't show these improvements.

Even the best old tapes tend to shed oxide after a decade or more of storage. When the tape is taken off the shelf and played to make a new digital master, either for LP or CD release, the oxide starts to clog the heads. As it builds up, high frequencies fall off. Then in cyclic fashion some of the oxide clears away and HF response picks up temporarily, until more oxide builds up again. Of course cleaning the tape before transfer helps, but it is not the full answer. It is not generally known that Decca gets round this problem when mastering CDs, by stopping and starting the analogue tape deck every few minutes or so to clean the heads. Decca also starts and stops the analogue machine at every splice on the original. This is necessary because the old analogue recordings in Decca's vaults are original, cut master tapes.

Decca policy has always been to use relatively few mics in the studio, and where possible mix down straight into stereo. This original stereo tape is then edited, to avoid generation loss. So the Decca library copy is an original first generation master, with splices. Over the years these tend to open out slightly and even ooze goo, which will of course help clog the playback heads. Also, where an edit splice crosses different sessions, there may well be a gain, or ambience

difference. This was often masked by the original analogue LP medium, but stands out like a sore thumb on CD.

By stopping and starting the playback machine whenever the heads need cleaning and at every suspect join, Decca effectively disassembles the recording at the stage when it is transferred to digital tape. Reassembly is by Decca's digital editor, which can match gain where necessary. The digital joins are thus often cleaner and smoother than the original analogue joins. As many of the Decca engineers who did the original recordings are still around, they can now supervise the transfers. As longstanding policy, they have a frequency sweep on the beginning of each tape. So the transfer machine can be accurately lined up to match the original recorder. It's a time consuming business, and there are between 60,000 and 70,000 reels of tape in the Decca store. But once a tape has been transferred onto digital tape, it should be good for the next few hundred years. (Hopefully. Ed.)

Polygram, although obviously tied through Philips to Decca, has some different ideas on re-issues. Whereas Decca tends to capitalise on old recordings, by re-issuing them in improved form, Polygram's policy is that the image of CD is one of new, high fidelity digital technology. It doesn't match this image to routinely release old analogue masters on CD. That's why most Polygram releases are new digital recordings. But there are exceptions, like old analogue best sellers.

Like Decca, Philips has often recorded straight down into stereo, and cut the original master tape with a frequency sweep on the front end. But Philips engineers at Baarn don't disassemble the performance in the same way as Decca. Instead they check all joints on the original tape and physically re-make any which are showing signs of drying out.

Other record companies, of course, often just pull an old tape off the shelf and master for CD. The result often sounds like it! Everyone involved in the business of re-issue that I have spoken with, agrees on one thing. There is no magic digital technology which will make a silk purse out of a sow's ear. Any attempt at automatically cleaning up old recordings usually makes things worse—except for pop and rock, where noise gates were probably used in the studio. Anyway, it is far better to leave background tape hiss alone. The human ear and brain do a wonderful job filtering out hiss, by simply ignoring it after a short period of listening.

The old Australian jazz re-issues sound good because there is no analogue tape stage at all. Robert Parker dubs direct from disc because he believes analogue tape degradation is particularly obnoxious on material with limited high frequency content. □

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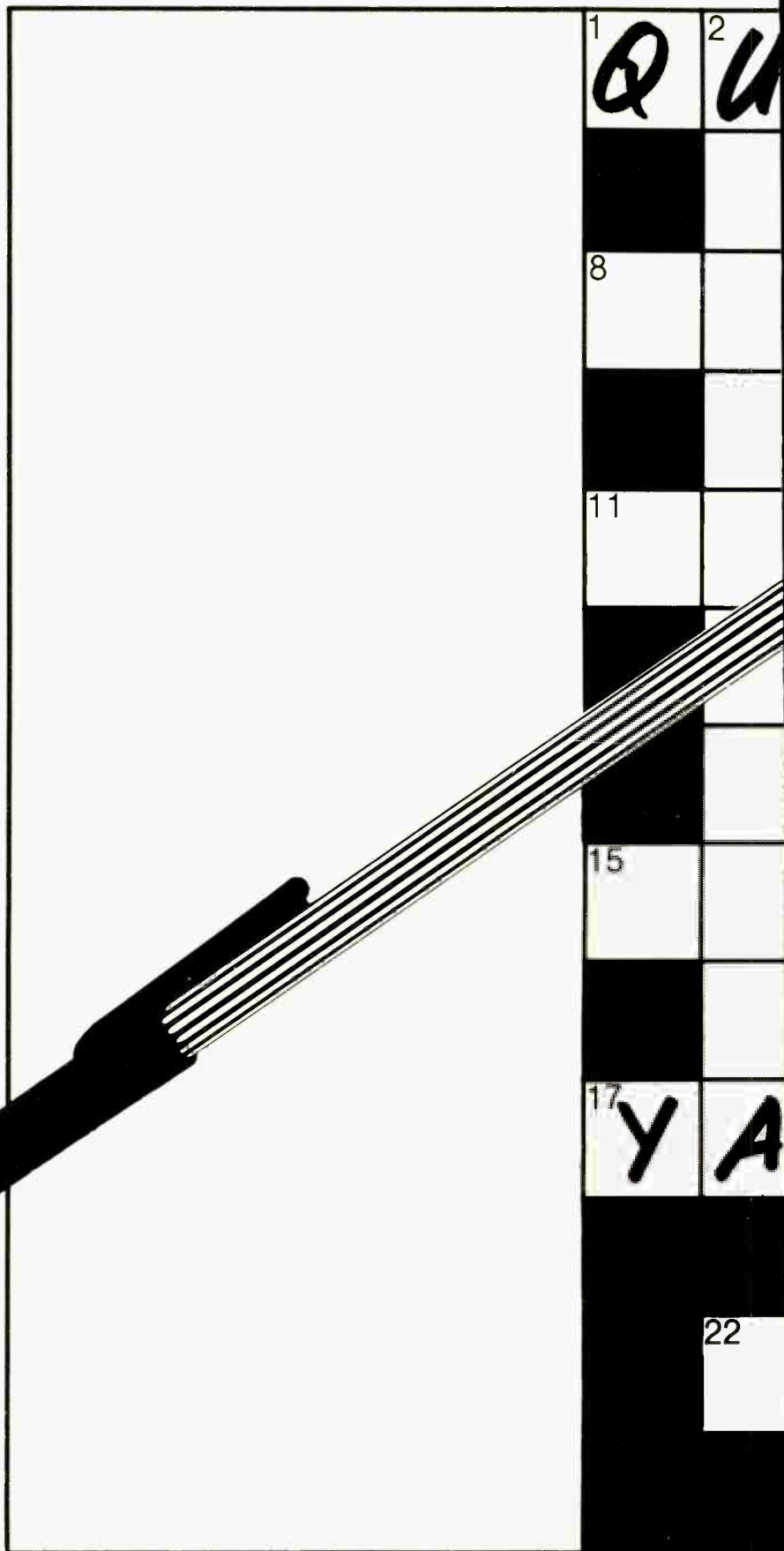
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REVIEW REVIEW

MICROPHONES

There are always problems in a mixed microphone review such as this where there is no common theme running through the selection of review models. The measured results and observed performance details need to be considered with reference to their intended application. These factors should be considered when looking at the published results as should the fact that apart from the two Sennheisers all the mics are intended for totally different uses and so the results should not be used to order the mics in any form of merit. We hope that we will be able to include factors such as these in the near future.

M easurements were divided into laboratory measurements and measurements taken under anechoic conditions in an anechoic chamber. A Bruel & Kjaer 4165 1/2 in high output microphone calibrated for sensitivity with a Bruel & Kjaer 4420 pistonphone was used as a reference for the sensitivity and frequency response measurements.

The frequency response of the samples was assessed with the sample and reference microphones placed 1 m from a Bowers & Wilkins 801 loudspeaker in the anechoic chamber. The reference

microphone was used to drive the compressor in the sweep oscillator in order to obtain a constant 94 dB sound pressure level.

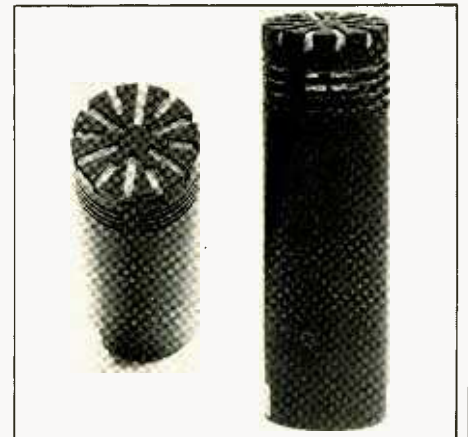
In order to plot the true response a pen speed of 100 dB/s with a plotting speed of 16.7 s/decade was used. This is faster than many manufacturers' plots which hide parts of uneven responses.

The polar responses were plotted under similar conditions with the sound pressure being set to make the front outputs coincide on the plots—normal practice. The polar responses were plotted at 125 Hz, 1 kHz, 10 kHz and 16 kHz whilst using a 1/3-octave filter to eliminate the effects of turntable noise.

Because loading can effect frequency response if long cables are used the approximate output impedance of the microphones was determined by measuring the output whilst applying 1/3-octave noise with the microphones feeding the standard phantom powering network and then loaded with 300 Ω. The voltage drop when loaded was used to determine the approximate output impedance at 125 Hz, 1 kHz and 10 kHz.

The final measurement was to determine the sensitivity to external magnetic fields such as those from power cables. Each microphone was 'searched' by a coil with a calculated 1 Oe 50 Hz magnetic field at its centre and the resulting 50 Hz output related to the equivalent sound pressure level that would cause the same output level.

The tabulated results for handling and wind noise and also pop sensitivity are purely subjective results without the use of wind shields.



MANUFACTURER'S SPECIFICATIONS

	ACO ACM48UP	Milab BM-73	PMB PMB-Q	Sennheiser MKH 406	Sennheiser MKH 416
Pattern	Cardioid	Cardioid	Cardioid or omni	Cardioid	Super- cardioid
Sensitivity (mV/Pa)	16.0	5.0	8.0	20.0	25.0
Maximum SPL	134 dB	144 dB	124 dB	131 dB	128 dB
Noise A-weighted	18 dB	20 dB	—	—	—
Dynamic range	76 dB	74 dB	74 dB	72 dB	72 dB
Frequency response (Hz)	30-16 k +/- 3 dB	30-20 k no limits	20-20 k no limits	40-20 k curve supplied	40-20 k
Impedance (Ω)	1 k	200	200	10	10
Minimum load Ω	—	—	1000	1000	400
Powering: Voltage	48/9 V	48 V	48 V	48 V	48 V
Current	—	1.2 mA	2 mA	2 mA	2 mA
Connector	wires	XLR-3	XLR-3	XLR-3 or DIN	XLR-3 or DIN
Weight	—	325 g	360 g	120 g	160 g
Finish	Black chrome	Black chrome	—	Black or satin	Black or satin

MEASURED RESULTS

	ACO ACM48UP	Milab BM-73	PMB PMB-Q	Sennheiser MKH 406	Sennheiser MKH 416
Sensitivity (mV Pa)	12.1/12.5	5.5	5.8/6.2	19.0	22.0
Self noise	—	—	—	—	—
A-weighted RMS	24 dBA	21 dBA	26 dBA	20 dBA	20 dBA
CCIR-weighted peak	34 dB	28 dB	30 dB	26 dB	28 dB
CCIR-weighted RMS	30 dB	25 dB	28 dB	22 dB	24 dB
Impedance (Ω)	—	—	—	—	—
100 Hz	14	160	280	35	30
1 kHz	14	115	185	30	15
10 kHz	14	130	280	10	15
Current at 48 V	0 mA	0.98 mA	2.4 mA	1.99 mA	1.95 mA
Output for 1 Oe equivalent SPL	<35 dB	89 dB	<40 dB	115 dB	113 dB
Wind noise	Very poor	Medium	Poor	Very poor	Poor
Handling noise	Medium	Good	Medium	Medium	Medium
Pop sensitivity	Very poor	Good	Very poor	Poor	Medium
Weight	50 g	320 g	310 g	140 g	170 g

Manufacturers and agents

ACO: ACO Pacific Inc, 2604 Read Avenue, Belmont, CA 94002, USA.

UK: Audio Video Marketing Ltd, Unit 20/21 Royal Industrial Estate, Jarrow, Tyne & Wear NE32 3HR.

Milab: Creative Trade Ctab AB, Knutsgatan 6, S-26500 Aastorp, Sweden.

USA: Camera Mart Inc, 245 West 54th Street, New York, NY 10019.

PMB: MB-Electronic GMBH, Postfach 60, Neckarstrasse 20, D-6951 Oberrhein, West Germany.

UK: Libra Electronics Limited, Bentfield Road, Stanstead, Essex CM24 8HS.

Sennheiser: Sennheiser Electronic KG, D-3002 Wedemark, West Germany.

UK: Hayden Laboratories Ltd, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG.

USA: Sennheiser Electronic Corporation (NY), 10 West 37th Street, New York, NY 10018.

ACO ACM48UP

Not very well known in the UK, ACO manufacture a number of measuring microphones very similar to the Bruel & Kjaer products in addition to studio microphones. The ACM48UP is a special microphone intended for volume and user applications and is available with a 13 in gooseneck finished in black chrome like the microphone itself.

The capsule which screws on to the preamplifier is 3/4 in diameter with a single wire connecting it to the preamplifier which is in a 3/4 in diameter by 1 11/16 in long tube internally threaded in its base. A 21 in long 4-way screened cable emerges from the preamplifier's base with one core and the shield being the ground connections, a second core the nominal 48 VDC polarisation voltage taking no current and the third core a +9 VDC supply measured at 2.28/1.70 mA for the preamplifier supply for the two samples provided.

The fourth core is the audio output which floats at +4 VDC and presents a very low source impedance at all frequencies. The sensitivity of the two

REVIEW REVIEW

samples was very closely matched to within 0.3 dB with the frequency response of the two samples being effectively identical with a rather large deviation in the 8 kHz area as shown in the frequency response plot.

Plotting the polar response showed the microphone to have a mild cardioid pattern with a well balanced frequency response over $\pm 90^\circ$ to the front.

The noise performance was average with the microphone being very sensitive to wind noise and prone to 'popping' on speech.



Milab BM-73

As standard this microphone is supplied with a stand adaptor, windshield and microphone cable. The microphone itself which is surprisingly heavy has an exceedingly strong grille to the front with an XLR-3 plug built into the base, the complete unit being finished in a slightly shiny black chrome.

A slide switch in the body, which can be operated manually, inserts a low frequency filter to compensate for the proximity effect with powering being by means of the standard +48 VDC phantom system at 0.98 mA.

The grille screws on to the microphone body for access to the capacitor capsule or replacement of the grille in the unlikely event that it be damaged—so strong is this microphone that it could be used as a hammer!

Reference to the polar plot shows a good cardioid characteristic with a well balanced front response at 10 kHz and below with the 16 kHz output falling off rather rapidly off axis.

The two frequency response plots show the effect of the highpass filter and the intentional peaking around 5 kHz which the manufacturer claims '... adds crispness where full harmonic detail is needed'.

This was a very quiet microphone with a typical sensitivity for a capacitor microphone and an adequately low output impedance. Whilst without its

rather tight fitting windshield it was sensitive to wind noise, fitting the windshield cured this and having good handling noise and pop sensitivity parameters this appears to be a very good hand microphone which is extremely robust but rather heavy.

PMB PMB-Q

The *PMB-Q* is an unusual microphone employing four capacitor capsules in a variable configuration intended for stereo recording using normal or MS techniques.

The review sample was supplied in a strong carrying case with foam filling to hold the microphone, its connecting unit and accessories. These include an excellent anti-vibration mount, a special stand adaptor for vertical mounting, and a massive windshield. In addition there are 2.5 m and 7.5 m connecting cables with 6-pin Tuchel locking connectors for interconnecting the microphone and its connecting unit plus four colour coded XLR leads for interconnecting the connecting unit to the desk.

Further accessories include four XLR to jack adaptors, four colour coded small

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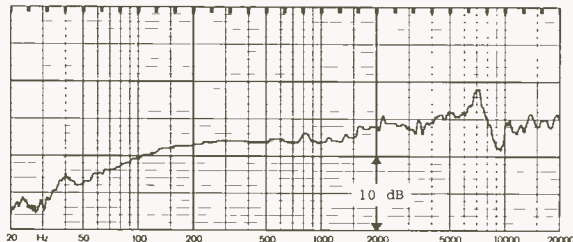
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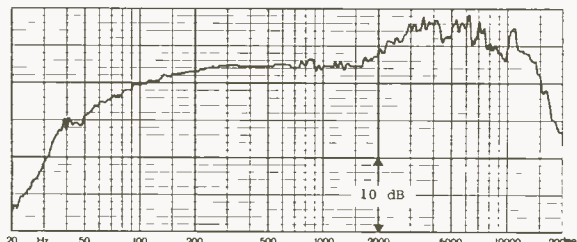
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FREQUENCY RESPONSE PLOTS

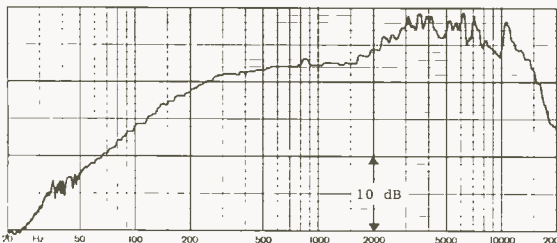
ACO ACM48UP



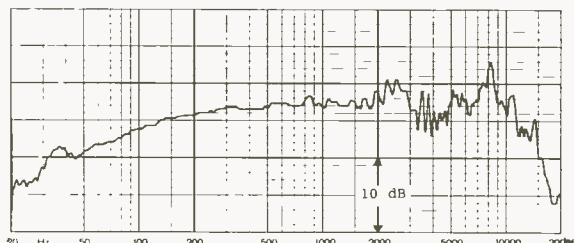
MILAB BM-73 FLAT



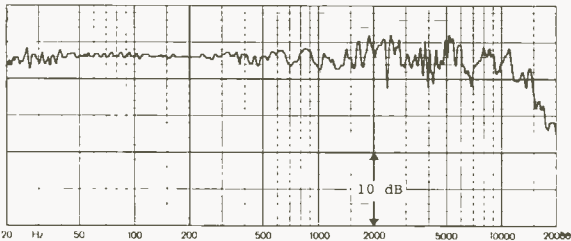
MILAB BM-73 WITH BASS CUT



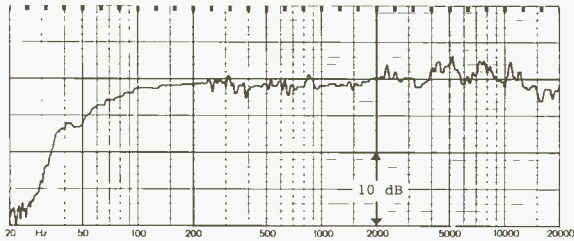
PMB PMB-Q CARDIOID



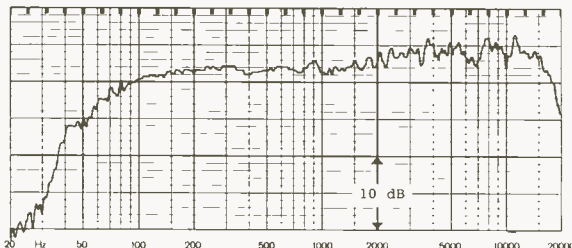
PMB PMB-Q OMNI



SENNHEISER 406



SENNHEISER 416



windshields, batteries and a desk stand.

Reverting to the microphone, the body is a 1/4 in diameter by 5 1/2 in long tube with a 6-pin Tuchel plug in its base. An approximately 3/4 in stalk extends from the top of the tube with two microphone capsules (colour coded red and yellow) being mounted back to back at right angles to the stalk.

Two further microphones (colour coded blue and green) are again mounted back to back at 90° to the first pair on an extension to the stalk with this pair being rotatable ±30° with spring loaded detents.

This system for four microphones mounted at 90° to each other feeds the connecting unit which has a 6-pin Tuchel socket at the rear to accept the microphone outputs which are then made available at four colour coded XLR



sockets. To the front of the connecting unit are two self illuminating type locking pushbutton switches and a potentiometer calibrated 0 to 10.

One switch selects the powering between external phantom +48 VDC powering at 2.4 mA or internal battery powering by means of two 22.5 V, PP3 dimension batteries which fit into the side of the connection unit. The second switch changes between XY operation when the four microphones are electrically independent or MS operation where the outputs are available at the red and blue outputs. In this mode of operation the potentiometer changes the base width electrically.

The standard four capsules have a cardioid polar diagram as shown in the polar plot, the performance being very good over a wide angle. The four

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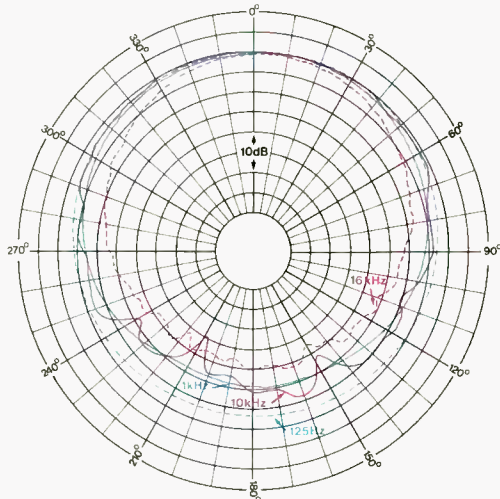


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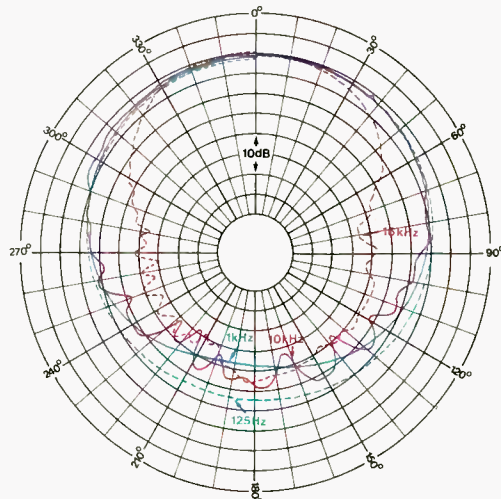
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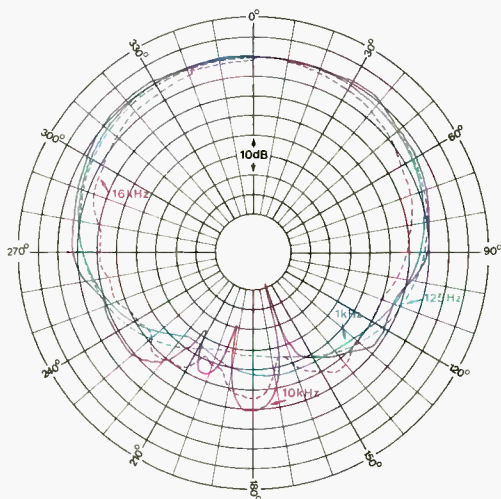
POLAR RESPONSE PLOTS



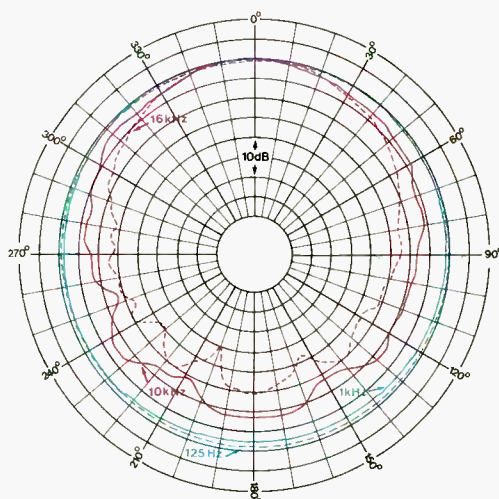
ACO ACM48UP



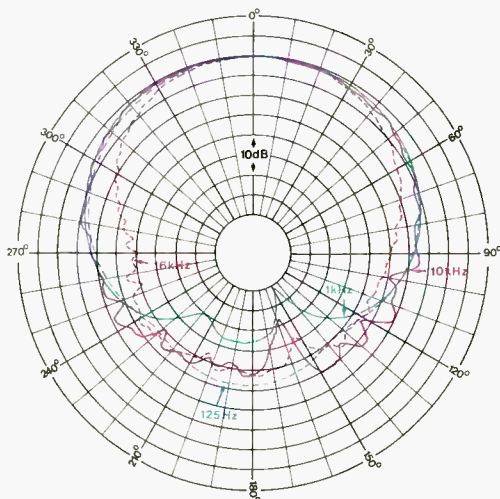
MILAB BM-73



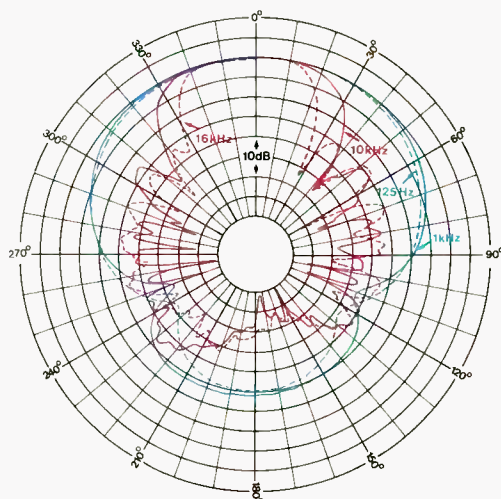
PMB PMB-Q CARDIOID



PMB PMB-Q OMNI



SENNHEISER 406



SENNHEISER 416

REVIEW REVIEW

capsules supplied were closely matched in polar response and frequency response on axis which as shown in the plot was rather disappointing at high frequencies with a rapid roll-off above 15 kHz.

In view of the form of construction of the microphone the lack of flatness at 3 kHz and above is not surprising with both the cardioid capsules and the optional omnidirectional capsule supplied, the latter having a better low frequency response than the cardioid capsules but a disappointing polar diagram.

The four cardioid capsules were closely matched in sensitivity (within 0.6 dB) as tabulated with the omnidirectional capsule being less sensitive at 4.7 mV/Pa. This was also reflected in the noise performance which was not outstanding.

For most applications the use of windshields will be mandatory, particularly in one suggested application as a table top 'conference' microphone.

Certainly this is an interesting microphone offering many possibilities with the positioning of the capsules and their polar diagrams being variables. The capsules and the microphone body being finished in slightly shiny black together with the relatively small size make this an unobtrusive unit.



Sennheiser MKH 406 and MKH 416

The two types finished in black are of similar construction: ¾ in diameter tubes with the XLR (optionally DIN) plug at one end and a heavy duty machined grille at the other end. The less directional MKH 406 has a few side ports at the working end with the ports

in the more directional MKH 416 extending most of the length of the tube.

Both types are 48 VDC phantom powered and use the Sennheiser RF microphone technology where only a low voltage at around 8 MHz is placed across the capacity of the capsule. A very low output impedance makes these microphones insensitive to loading with the high sensitivity dictating some caution as mixer inputs could be easily overloaded.

The microphones had a good noise performance; the MKH 406 had a flat on-axis frequency response, the MKH 416 a

slight mid-frequency boost with the response falling off above 15 kHz. These characteristics agreed with the plots supplied with the microphones.

Reference to the polar plots shows both microphones to have fairly classic characteristics for the type of microphone. The MKH 406 was very sensitive to wind noise making the use of a windshield essential for outdoor applications. In studio applications the microphones were rather sensitive to external magnetic fields making some caution necessary to avoid power cables. □

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REVIEW REVIEW

A technical report by Hugh Ford



SONY APR-5000

The Sony *APR-5000* series of tape recorders is one of the new generation of machines making liberal use of microprocessors not only for the tape transport control but also for alignment of the audio functions.

Three types are available for a choice of mounting. In addition to the desktop mounting version reviewed, there is a version for mounting in a console similar to the Ampex *ATR-100* allowing the machine to be tilted in the console and one for 19 in rack mounting.

Basically this is a 4-speed machine which can operate at any sequential

three speeds in the range 3¼ in/s to 30 in/s. Currently there are ¼ in mono, stereo or 2-track, and ½ in 2-track versions available but later this year one with centre-track timecode operating at the three higher speeds only will be introduced. This will have an inbuilt timecode generator covering EBU timecode plus SMPTE timecode with and without drop frame. At the moment its final configuration is not known but it will have a single timecode head with internal re-generation of the timecode so it will be capable of advancing or retarding the timecode. This will not only enable the machine to compensate

for the timecode head position but also allow it to dynamically insert timecode offsets either manually or from internally stored offsets with a resolution of 1/80 of one timecode frame.

Existing options are a remote control unit handling the transport and locator functions plus record ready and editing scissors for the ¼ in version (a factory-installed option).

The design of the tape transport is a new departure for the MCI/Sony stable as it is based on a ribbed alloy casting relatively light in weight. This is attached to the sheet steel sides and base, the sides having a charcoal-coloured alloy trim which contains two hinged carrying handles at either side.

All tape transport components are secured to machined reference faces on the top surface of the casting making machining of the casting straightforward as all important reference faces are at the top. They are not however all at the same height.

Direct drive is used for the DC reel motors which can accommodate a maximum of 12 ½ in reels, the spindles being designed for cine-type spools. For NAB spools a 1.02 mm flexible plastic conductive shim is used to compensate for the different spool width with collet fixing adaptors of good quality providing good positioning of NAB spools. (My calculations suggest that this shim is too thick.) An adaptor for European-type spools is also available.

The reel motors and the DC capstan motor are secured to the bottom of a plate which in turn is secured by three Allen screws to the top of the casting, making removal very easy. Each reel motor is fitted with a solenoid-operated band brake and a Hall-effect sensor for detecting speed, the latter each having two adjusting potentiometers.

From the pay-off reel the tape passes over a fairly large diameter guide, which like the other rotating guides is fitted with miniature ball races. Following this is a ceramic spring loaded tension sensing arm which is similarly equipped with a Hall-effect sensor before the tape timer roller which has a further sensor with two adjustments.

Next, the headblock is of very solid construction based on a 9.2 mm thick alloy plate which is supported by three hollow stainless steel posts. The latter fit over stainless steel pins secured to the reference face of the casting and are secured to these pins by three captive screws. The connections are via a loosely mounted 78-way 'D' connector.

A maximum of four heads are slung below the headblock plate, heavily spring loaded against a small plate secured to the block plate. The small plate is secured by a single screw with a screwdriver-operated cam for wrap adjustment. Allen screws fitted into the small plates and accessed through holes in the main plate provide adjustment of

MANUFACTURER'S SPECIFICATION

Frequency response:

Record/reproduce (with wide profile head option)

30 in/s, AES 40 Hz to 28 kHz +0.75/-2 dB

15 in/s, NAB 30 Hz to 24 kHz +0.75/-2 dB

7½ in/s, NAB 30 Hz to 20 kHz +0.75/-1.5 dB

Record/sync (with wide profile head option)

30 in/s, AES 40 Hz to 20 kHz +0.75/-2 dB

15 in/s, NAB 30 Hz to 20 kHz +0.75/-2 dB

7½ in/s, NAB 30 Hz to 10 kHz +0.75/-2 dB

Signal to noise ratio: (Record/reproduce, ref to 510 nWb/m; unweighted 20 Hz to 20 kHz)

	Mono	2-track	Timecode
30 in/s, AES	70 dB	65 dB	65 dB
15 in/s, NAB	68 dB	62 dB	62 dB
7½ in/s, NAB	67 dB	62 dB	62 dB

Weighted dB (A)

30 in/s, AES 74 dB 70 dB 70 dB

15 in/s, NAB 70 dB 67 dB 67 dB

7½ in/s, NAB 70 dB 67 dB 67 dB

Distortion: harmonic distortion: 510 nWb/m,

1 kHz fundamental 3rd harmonic: 30 in/s AES

<0.35%; 15 in/s NAB <0.52%; 7½ in/s NAB <1.6%

2nd harmonic: 30 in/s AES <0.10%; 15 in/s NAB

<0.10%; 7½ in/s NAB <0.10%. 3% 3rd harmonic:

30 in/s AES 1040 nWb/m. Fluxivity level: 15 in/s

NAB 1020 nWb/m; 7½ in/s NAB 1,000 nWb/m.

Distortion is primarily a function of tape

formulation and bias setting used. All

specifications are typical and may vary.

Bias frequency: 400 kHz.

Erase frequency: 100 kHz.

Depth of erasure (ref 250 nWb/m): At 1 kHz better than 80 dB.

Amplifier electronics: Input impedance 10 kΩ balanced; output impedance 120Ω balanced; output clipping 24 dBm.

Speeds: Fixed 3¼, 7½ and 15 in/s or 7½, 15 and 30 in/s; variable ±50% around fixed speeds.

Configuration: ¼ in 2-track NAB; ¼ in 2-track

DIN; ¼ in IEC centre-track timecode.

Reel sizes: Available with NAB A, 3½ or 7 in;

NAB B, 10½ in; DIN 1000 m, 11½ in; NAB type

12½ in.

Tension: 5½ oz ±¼ at all play speeds, beginning

to end of reel.

Long term speed stability: Better than 0.02%.

Wow and flutter: 30 in/s <0.025% DIN 45507

weighted; 15 in/s <0.035% DIN 45507 weighted;

7½ in/s <0.055% DIN 45507 weighted.

Start time: To 0.1% DIN 45507 flutter; 10½ in

reels: 30 in/s 900 ms, 15 in/s 500 ms, 7½ in/s

500 ms.

Rewind time: 2,400 ft—110 s, 4,800 ft—170 s.

System weight: 85 lb.

Dimensions (whd): Table type OA—480×410×

520 mm; stand type OA—560×1,090×520 mm.

Manufacturer: Sony Corporation, PO Box 10,

Tokyo Airport, 149, Japan.

UK: Sony Broadcast Limited, City Wall House,

Basing View, Basingstoke, Hants RG21 2LA.

USA: Sony Corporation of America, Professional

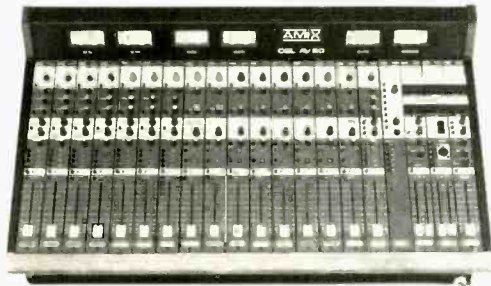
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- Monitor module

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azimuth, zenith and height. The access holes are normally covered with a trim to discourage knob twiddlers.

At the entry to and exit from this substantial assembly, fixed stainless steel guides are fitted beneath the main headblock plate the first head location being for the timecode head—no dummy head is needed if this is not fitted. Then follows the staggered twin-track stereo erase head and the metal stereo record head before the needle-bearing flutter roller and the metal replay head.

Whilst the finish of some parts could be improved, this is a well-engineered headblock which is very quickly and easily changed. Separate headblocks will be available optimised for the high or low speed combinations and different track formats. A clever idea is that each headblock contains an 8-way DIL switch which tells the electronics if it is a high or low speed block and if it is mono, 2-track or 3-track, and has three switches for identifying up to eight different blocks. The functions of these switches are printed on to the trim below the headblock, this trim and the trim over the reel motors being very easily removed for maintenance.

Below the headblock twin tape lifters are solenoid-operated with a second air-damped solenoid operating the twin hum shields located over the record (sync) and replay heads.

From the exit guide in the block the tape is passed via an optical tape presence sensor to the 12.60 mm diameter ceramic capstan which operates on the base film side of the tape. The large diameter rubber pinch roller is self-aligning and is operated by a very clever linkage which not only allows the use of an unusually small solenoid but also allows very simple tension adjustment just by moving a small spring.

The final component in the tape path is a small diameter roller guide close to the capstan. All that is needed to convert the machine to ½ in operation is a change of headblock, two roller guides and the tachometer roller. The operation takes seconds as the rollers are spring loaded within the screw-on caps on to the reference faces.

The electronics are on a number of high quality printed circuit boards and mainly interconnected by ribbon cables with insulation displacement connectors. All components are clearly identified and most integrated circuits socketed.

The record and erase heads are fed to a screened box on the top surface of the transport casting, containing matching transformers and components plus record/sync switching relays.

Folding down the front panel of the recorder reveals a screened card cage on the left. This contains the audio master printed circuit board and one board for each of the possible three channels (stereo plus timecode). An extender board (the review one had a wiring error) is

provided for servicing these boards which have two potentiometers on the master board and five on each audio board. The master board multitrans set master bias and erase levels with one potentiometer on the audio board adjusting 0 VU and the remainder unconnected with normal machine alignment.

All normal alignment functions are done via the central processing unit which feeds digital information to 8 bit D/A converters on the audio boards. Eight bits allow 256 possible settings which in terms of a conventional potentiometer is a resolution in the order of 1°.

The alignment keyboard is on the folded down section of the front of the machine—I will come to the alignment functions and the tape control functions later. The latter are to the bottom right of the transport with the central processing unit under the panel and the power supplies to the right of the audio card frame.

A printed circuit board on the top surface of the transport in between the reel motors provides drive for the solenoids and deals with tachometer signals. This board has four potentiometers. Removing two screws, which are not captive, and hinging down the rear panel reveals the reel drive board fitted to a heatsink on the rear panel, this board also has four potentiometers, for gain and tension adjustment. These are the only manual alignment facilities the rest being controlled by computer.

A second printed circuit on the rear panel, behind which there is another board secured vertically to the transport casting, provides digital interfacing and remote control functions. Normal remote control functions are at a 50-way 'D' connector on the rear panel which sends and receives TTL levels with the exception of the three outputs for driving external VU meters.

The remote connector includes all tape movement functions, tape lifter, fader start, tape direction, capstan reference in/out, record ready, erase and bias indicators, tachometer output, other information and two +5 VDC lines at 0.5 A.

Twin paralleled 9-pin 'D' connectors provide an RS-422 serial computer interface working to the proposed SMPTE/EBU protocol with an internal DIL switch setting the machine's address. Details of this interface were not available at the time of writing.

Other communications with the outside world at the rear panel include XLR connectors for three audio channels (stereo plus timecode track) and for the timecode input and output, a 9-pin 'D' connector for noise reduction, record/replay switching and an IEC power connector and supply fuse.

Two BNC connectors form an input and output for calibration

instrumentation, the connectors being switched automatically between the left and right channels or both (the outputs being summed) during the calibration procedure.

The final part of the machine is the meter bridge which is supported on a stalk at the rear of the machine. The box of the meter bridge can be tilted for the best viewing angle. The bridge optionally has a monitor loudspeaker section to the right which has a volume control and two illuminated pushbutton switches for selecting either or both tracks.

Up to three metering sections may be included, the audio track metering sections having an illuminated VU meter and six momentary pushbutton switches with inbuilt LEDs. Three switches select input, replay or sync as sources and the fourth is a record ready switch. The remaining switches located next to potentiometers select calibrated or uncalibrated input and output levels.

In each metering section there are red LEDs for bias and erase indication and a yellow LED identified 'ALN' giving warning that the alignment procedure is in action.

Within the tape movement control section the conventional illuminated fast wind, play, stop and shielded record controls are at the bottom together with an edit switch. The latter is inoperative in all but the stop and play modes. Normally in the stop mode tape tension is maintained at 100 g with the reel brakes off permitting rock and roll edit location, however, pressing the edit button releases the tape tension and the start button then performs a dump edit.

The running tape tension in the run and fast modes is also maintained at a steady 100 g at the pinch roller with the takeup tension when accelerating in the fast modes being around 200 g—all sensible tensions for standard play tape. The fast winding speed wound a full 2,500 ft reel of tape in just under 2 min giving a quite good (but not first class) wind quality with matt-backed tape.

Above the movement buttons is a lightly centre sprung roller identified 'MVC' (Manual and Velocity Control) which performs two functions. Normally moving this control in either direction will shuttle the tape at varying speed, according to how far the control is moved, in either direction whilst illuminating the green MVC LED next to the control. Touching the MVC control when in the fast wind modes gives a storage wind mode where the tape is wound at a reduced speed of about 75 in/s to give an improved wind for archiving.

Seven momentary pushbuttons with inbuilt LEDs to the left of the panel perform the following functions. Tape speed is selected by sequentially pressing one button with green LEDs indicating 'high', 'medium' or 'low' speed; the actual speeds are selected by the DIL

REVIEW REVIEW

switch in the headblock. Two further switches when pressed inhibit the tape lifters or the headshield—these illuminate when activated and remain in operation until pressed a second time.

Two buttons grouped together select local or network (bus controlled) operation with another activating the timecode generator when fitted. Finally in this area there is a spot erase button. This flashes when activated waiting for a channel to be put into the ready to record state and the record button pressed. The record button is then illuminated and the spot button steadily illuminated. Spot erasure can then be done by moving the tape by hand—touching any other control will revert the machine to the normal state.

The remaining control functions are associated with two time displays indicating up to ± 23 hr, 59 min, 59 s plus frames in the timecode mode and a 0-9 numeric keyboard with \pm , STORE and RECALL keys. Next to the tape time and the locate time displays are individual reset buttons and buttons which transfer either display to the other.

These all work in conjunction with the varispeed, locate and repeat buttons. When the varispeed button is pressed its LED flashes and the lower (locate time) display shows the percentage speed deviation from the nominal tape speed over the range $\pm 50\%$ in 0.1% increments without altering the current tape speed. The speed display may then be edited using the keyboard with any numbers in excess of $\pm 50\%$ being eventually interpreted as 50%.

Pressing the varispeed button a second time puts the machine into the varispeed mode and steadily illuminates the button. In this condition the locate time display continues to indicate the speed variation and moving the MVC control increments or decrements the speed at a rate from about 0.1%/s upwards, depending upon how far it is moved in either direction. This facility can be used with or without the tape moving in record or replay.

The numeric keyboard always enters the locate display, after which pressing the locate button locates this time on tape, the tape movement being very well controlled with rapid action without any overshoot or hunting.

Up to 30 tape times can be stored by entering the time into the locate display from the keyboard and then pressing the store button followed by the store number. Recalling the stores into the locate display is done by first entering the store number (0 to 29) and then pressing the recall button. After a 5 s delay the time appears in the locate display.

To use the repeat function, which can only operate in the replay mode, the start time is entered in store 28 and the end time in store 29. Pressing repeat then cycles over this section of tape

using the play and fast rewind functions. Whilst the repeat function operates on negative tape times it does nothing if the entered start time is after the entered end time.

All these facilities are very simple to use but confusion can be caused as store numbers less than 10 must be entered with a zero as a prefix. The 5 s delay between entering the store number and the appearance of its contents was irritating and could be far shorter. With the exception of an unduly noisy cooling fan in the recorder it was quiet in operation but engaging the pinch roller made a fairly loud acoustic click.

As previously mentioned the alignment controls are on the fold down front panel which is hinged at the bottom and secured in its closed position with two spring clips. Ribbon cables connect the alignment section to the other electronics and I feel that they should be protected where they pass over the hinge.

As stated earlier there are no potentiometers in the alignment section with all normal alignment controls being replaced by 8 bit D/A converters which are driven from internal digital memories loaded from the alignment section. Each tape speed has three sets of memories for all parameters with each of



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up to eight DIL switch-coded headblocks having its own set of nine memories (three speeds by the three memories per speed) giving a total of 72 complete sets of alignment data. The machine also takes note of the type of headblock (mono, stereo, timecode) such that in practice there are at least 108 separate sets of alignment data. This data is stored in battery-backed memory so the data is not lost when power is removed.

Examination of the alignment section reveals a number of white momentary pushbuttons with internal yellow LEDs and a 2-digit hexadecimal (0 to 9 then A, B, C, D, E & F) display.

As in normal calibration procedure, the first operation is to select the desired tape speed which is done with one of three speed buttons. After that the desired track is selected by two buttons. One selects all tracks and the other sequentially selects the fitted tracks 1 to 3.

Next the desired equalisation standard is selected by three buttons giving NAB equalisation, IEC equalisation or timecode equalisation. For setting the audio equalisation all tracks must be selected so that the tracks must have the same equalisation and at 30 in/s the IEC standard is the only available setting corresponding to the 15 μ s AES standard.

Having got this far the buttons are in familiar groups of individual level, low frequency and high frequency buttons for the play and sync modes plus bias, high frequency and level controls for the record section. These 'controls' are set by pressing the desired track and function. The status display then indicates the current setting in hexadecimal with increment or decrement buttons increasing or decreasing the setting and the display.

A worthwhile feature is that after pressing the increment or decrement buttons the display continues to count up or down slowly until the button is again pressed. Simultaneously pressing control and increment, or control and decrement, increases the counting speed to assist

rapid alignment. With the above parameters the display range is 00 to FF (256 settings).

Unlike most recorders there are four unusual adjustments for each tape speed which are set for all tracks together. These are selected by pressing a control key together with one of the level keys or record HF key which are marked with secondary functions in a rather unclear blue.

The first two secondary functions provide replay and sync head gap compensation which is particularly useful at low tape speeds and at high frequencies. The second two functions relate to feedforward and feedback compensation in the record amplifiers. These functions, which optimise the frequency response of the record amplifiers, have only eight settings for feedforward and 16 settings for the others.

During alignment the rear panel calibration input and output may be used as an alternative to the normal audio connections.

Storing the alignment data is very simple. Firstly the control and store buttons must be pressed simultaneously as a safety feature. One of the three preset store buttons is then pressed and all alignment data is stored in that memory—simple!

These preset buttons are used to select which of the three alignment settings is used at a particular tape speed. First the tape speed is selected and then the desired preset button pressed, after which the recorder remembers the last preset selected for each tape speed. Special labels are provided with the recorder and fit next to the preset and tape speed buttons/indicators to show the current settings as illustrated in Fig 1.

Inputs and outputs

The electronically balanced inputs could accept in excess of +22 dBm into a constant input impedance of 13.5 k Ω with the common mode rejection from 200 Hz

to 200 kHz shown in Fig 2 which is not corrected for the high frequency roll-off which exists above 40 kHz.

At the unbalanced rear panel calibrate input the sensitivity was identical to the balanced inputs with the input accepting a maximum of +22 dBm into a load impedance of 22 k Ω . The unbalanced calibrate output could deliver +22 dB.7V when driven by both channels of 6 dB lower from single channels when the output level was 6 dB below the main audio output. The impedance of this calibrate output was very low but the current drive capability was also low so it is important to avoid loading this output by instruments with a low input impedance such as a 600 Ω termination.

Replaying a fluxivity of 320 nWb/m showed that the output level range was about -12 dB.7V to +15 dB.7V from either the sync or replay heads with the adjustment at mid range being to within 0.1 dB, rather better than is normally possible with adjustment potentiometers.

The input monitor level settings had a more than adequate range with between -10 dBm and +16 dBm input being required for an indication of 0 VU. However, whilst control of the record level had an adequate range it could benefit from more gain as between -7 dBm and -20 dBm was required to record a fluxivity of 320 nWb/m on 3M 226 tape, meaning that the setting was rather near the minimum gain.

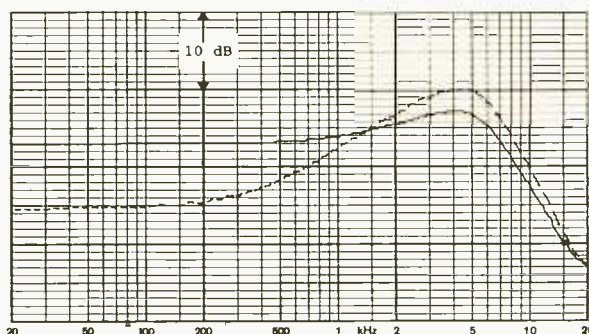
The internal monitor loudspeaker, which is muted when headphones are inserted into the jack socket at the front of the recorder, had plenty of gain with the maximum output to the headphones being 11.5 VRMS from a very low impedance suitable for driving low or high impedance headphones.

Of the more interesting outputs at the 50-way 'D' connector the external metering outputs followed the VU meters with +4 dBm corresponding to 0 VU from a very low source impedance. The capstan reference output was a 8.72 μ s pulse from +0.1 to +3.7 V with a repetition frequency of 19.21679 kHz at a

FIG 1
PRESET STORE IDENTIFICATION

STORE	PRESET 1	PRESET 2	PRESET 3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
HI-SPEED	TAPE TYPE 456 FLUXIVITY 510 nWb/m EQ STD AES OVERBIAS 3 dB@ 20 kHz	TAPE TYPE 226 FLUXIVITY 320 nWb/m EQ STD AES OVERBIAS 2 dB@ 10 kHz	TAPE TYPE SP8 50 FLUXIVITY 320 nWb/m EQ STD AES OVERBIAS 3.5 dB@ 20 kHz
MID-SPEED	TAPE TYPE 456 FLUXIVITY 510 nWb/m EQ STD IEC OVERBIAS 3.5 dB@ 10 kHz	TAPE TYPE 456 FLUXIVITY 510 nWb/m EQ STD NAB OVERBIAS 3 dB@ 5 kHz	TAPE TYPE PEM FLUXIVITY 510 nWb/m EQ STD IEC OVERBIAS 2.5 dB@ 15 kHz
LOW-SPEED	TAPE TYPE 207 FLUXIVITY 320 nWb/m EQ STD IEC OVERBIAS 3 dB@ 5 kHz	TAPE TYPE _____ FLUXIVITY _____ nWb/m EQ STD _____ OVERBIAS _____ dB@ _____ kHz	TAPE TYPE _____ FLUXIVITY _____ nWb/m EQ STD _____ OVERBIAS _____ dB@ _____ kHz

FIG 2
COMMON MODE REJECTION
——— RIGHT CHANNEL
- - - - - LEFT CHANNEL
MULTIPLY FREQUENCY SCALE BY 10



LPS 5500

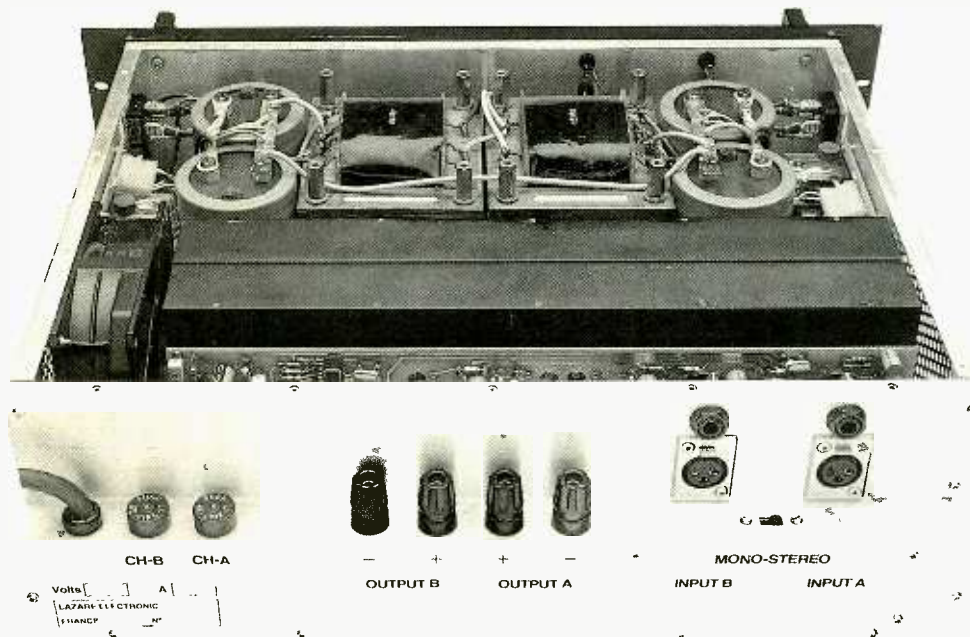
THE POWER WITHOUT COMPROMISE

First of all: the power: 500 watts continuous average output power per channel into 4 ohms, thanks to the use of a double power supply largely under-run (35 amp/400 volt rectifier bridges, 30 000 mFd filtering capacitors per channel).

But the LPS 5500 is not only that!

It is also modular designed which makes easier an eventual service, use of 175 W/200 volts/16 amps/8 MHz power transistors, rugged 2 mm thick hardened steel chassis, which guarantees a perfect rigidity for the best reliability, paralleled balanced or unbalanced inputs on male and female XLRs, efficient protections (line, DC, thermal), a power-on steadying circuit, lateral mounted cooling fans and 30 amps output terminals.

Frequent tests during the manufacture process enables reliability and regularity of the specs. Consequently, we offer a warranty for a 3 year period covering spare parts and workmanship, on all possible manufacture defects.



SPECIFICATIONS

Power output per channel (8 ohms, 20-20 000 Hz, THD 0,1 %): 325 W
(4 ohms, 20-20 000 Hz, THD 0,1 %): 500 W
Bridged (8 ohms, 20-20 000 Hz, THD 0,1 %): 1 000 W

Total harmonic distortion (rated output, 20-20 000 Hz): 0,1%

SMPTE-IMD (rated output): 0,1%

Frequency response (rated output): 20 Hz to 20 kHz + 0 — 0,5 dB

Damping factor: 200/1 (8 ohms)

Hum and noise: 100 dB below rated output

Input sensitivity: 1 V, rated power into 8 ohms

Input impedance: 14 k ohm/symmetrical, 9 k ohm/unsymmetrical

Crosstalk: 75 dB

Weight: 27 kg

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tape speed of 30 in/s and pro-rata at the lower speeds.

The tachometer output signal was also proportional to tape speed giving a rather jittery signal at 240.003 Hz at 15 in/s with an amplitude from 0 to +4 V. The tally signal had a similar amplitude.

Frequency response

The frequency response from the inputs to the outputs in the input monitor setting was very flat as shown in Fig 3

with a good high frequency roll-off above 30 kHz.

It was easy to set the replay equalisation to the 30 in/s AES 17.5 μ s standard and to the NAB and IEC standards at 15 and 7½ in/s to great accuracy. Using BASF and MRL calibration tapes the response could be set to within ± 0.5 dB reference 1 kHz for all tones on the tapes in the replay mode.

This also applied to the sync mode at 30 in/s above 63 Hz but as is to be expected, high frequency performance

fell at lower tape speeds.

The overall record/replay frequency response using 3M 226 tape over-biased by 2 dB at 10 kHz at 7½ and 15 in/s or 1.5 dB at 30 in/s is shown in Fig 4 for the three tape speeds. These show a very good performance at all tape speeds using the manufacturers' recommended setting for the replay gap compensation and record feedback and feedforward. Given time and trouble these frequency response plots I believe can be improved.

Commonly the sync reproduce frequency response is rather lacking in recorders but reference to Fig 5 shows that the performance of this machine is quite outstanding.

The full range of all equalisation type settings was examined at 30 in/s and 7½ in/s. There are nine equalisation type settings for each tape speed. So I have not included plots of all the enormous number of measurements made. Where I mention wide ranges, do bear in mind that each adjustment has a resolution of 1 in 256 (with three exceptions) such that fine adjustment was always simple.

Within the replay and sync chains the low frequency equalisers had a 10 dB range at 50 Hz with plenty of margin for adjusting to the NAB or IEC low frequency requirements. The high frequency equaliser was similarly well appointed with a 20 dB range at 10 kHz capable of aligning to any high frequency time constants.

A feature not found on many recorders is the secondary gap correction which has the possibility of 16 'settings' starting to have effect at 10 kHz with a 6 dB range at 20 kHz.

Using the aforementioned bias with 3M 226 tape, the record high frequency equalisers by themselves had a limited range of 6 dB at 20 kHz, however, the feedforward and feedback facilities which have 16 steps and eight steps respectively, considerably increase this range. In order to show the full frequency range of these the response was plotted at 30 in/s with Fig 6 showing the mid-high effect of the feedback equaliser and Fig 7 the

FIG 3
INPUT MONITOR FREQUENCY RESPONSE

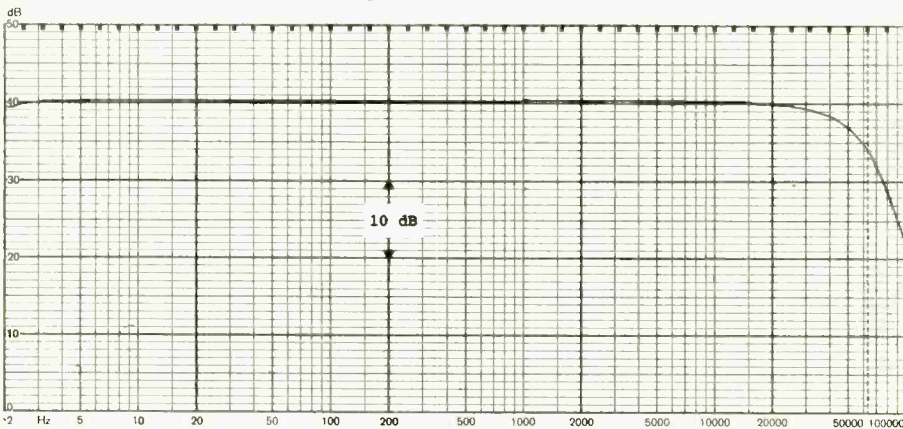


FIG 4A
RECORD/REPLAY FREQUENCY RESPONSE AES 30 IN/S

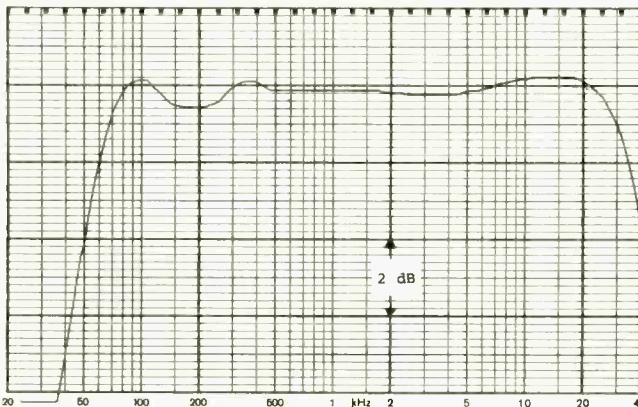


FIG 4B
RECORD/REPLAY FREQUENCY RESPONSE NAB 15 N/S

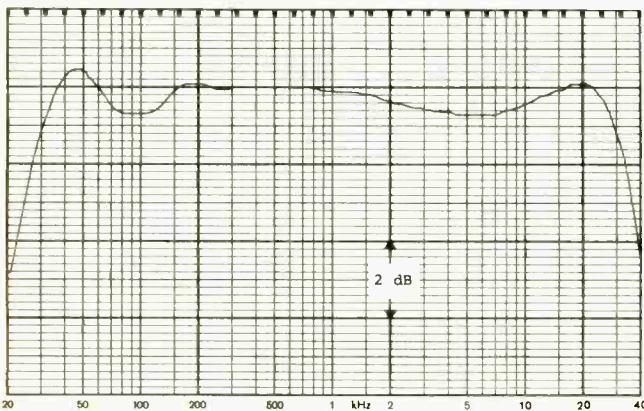
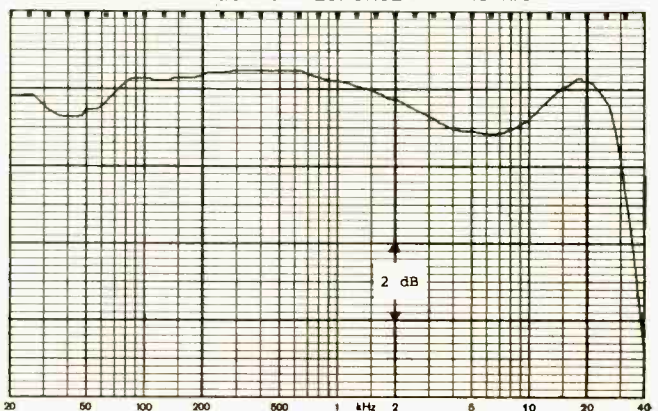


FIG 4C
RECORD/REPLAY FREQUENCY RESPONSE NAB 7½ IN/S



REVIEW REVIEW

FIG 5A
SYNC REPRODUCE FREQUENCY RESPONSE AES 30 IN/S

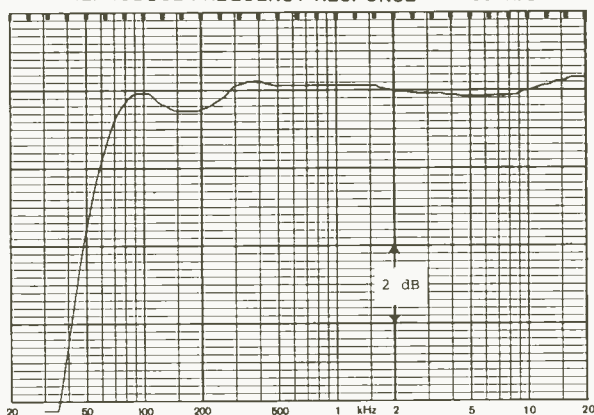


FIG 5B
SYNC REPRODUCE FREQUENCY RESPONSE NAB 15 IN/S

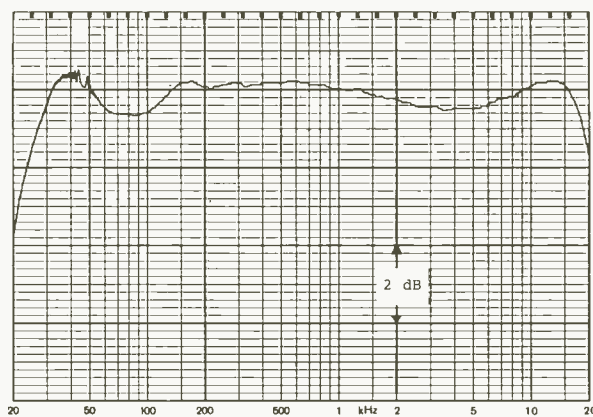


FIG 5C
SYNC REPRODUCE FREQUENCY RESPONSE NAB 7½ IN/S

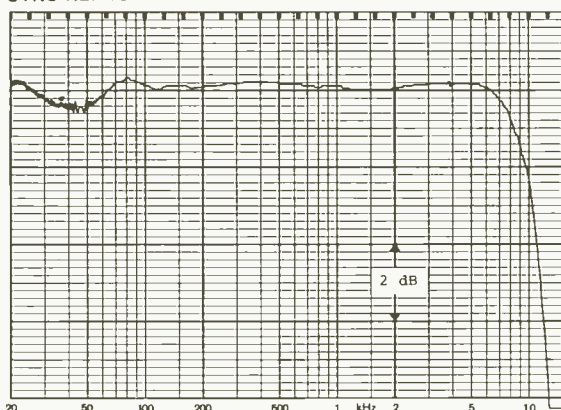


FIG 6
FEEDBACK EQUALISER AT 30IN/S
MULTIPLY FREQUENCY SCALE BY 10

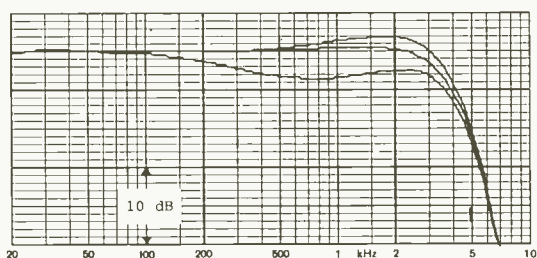


FIG 7
FEEDFORWARD EQUALISER AT 30 IN/S
MULTIPLY FREQUENCY SCALE BY 10

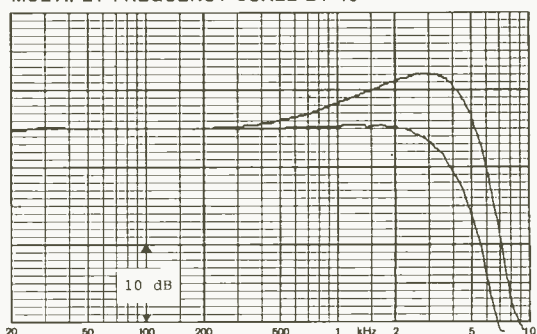


TABLE 1a Machine only

Measurement method	Reference level (320 nWb/m) to noise		
	30 in/s	15 in/s	7½ in/s
22 Hz to 22 kHz RMS	70 dB	68 dB	69 dB
A-weighted RMS	78 dB	78 dB	76 dB
CCIR-weighted RMS	72 dB	71 dB	70 dB
CCIR-weighted quasi-peak	68 dB	68 dB	66 dB
CCIR-ARM ref 2 kHz	79 dB	78 dB	76 dB

TABLE 1b Machine with tape

Measurement method	Reference level (320 nWb/m) to noise		
	30 in/s	15 in/s	7½ in/s
22 Hz to 22 kHz RMS	64 dB	63 dB	63 dB
A-weighted RMS	68 dB	66 dB	65 dB
CCIR-weighted RMS	59 dB	58 dB	58 dB
CCIR-weighted quasi-peak	55 dB	53 dB	53 dB
CCIR-ARM ref 2 kHz	65 dB	64 dB	64 dB

high frequency effect of the feedforward equaliser.

Noise

Output noise in both channels was measured with respect to a fluxivity of 320 nWb/m in the replay and sync modes, in the edit mode without moving tape and with machine erased 3M 226. The differences between the two-channels and between normal or sync replay were unusually consistent with differences at any tape speed being less than 0.5 dB.

In view of these consistent results Table 1 does not show separate tabulations for the two channels or the sync and replay modes, the tabulated figures refer to AES equalisation at

30 in/s and IEC equalisation at the lower speeds.

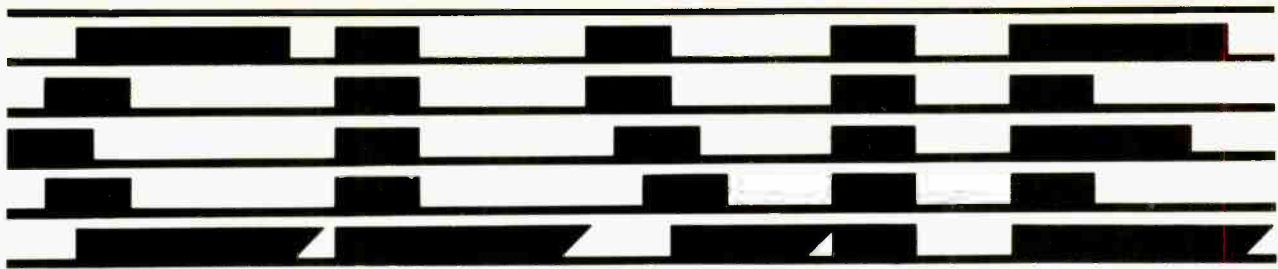
Noise in the muted mode was very low, however, when using the outputs in the unbalanced mode whilst the output noise remained low it depended very much upon the precise output configuration. It was preferable to ground the low side of the output for minimum noise, then the gain that the high side did not rise by precisely 6 dB as it would with a true balanced output.

With or without the head hum shields in position the mains frequency components in the outputs were minimal and well below noise, and no other unwanted tones were noted in the outputs.

Distortion

Clipping of the replay amplifiers occurred at a level 17.5 dB above 320 nWb/m giving a satisfactory margin for all current types of tape with the record amplifier being capable of driving a level +25 dB above that required to record a fluxivity of 320 nWb/m on 3M 226—a very good margin here.

Using 3M 226 biased as previously described, the maximum output level (MOL) for 3% 1 kHz third harmonic distortion reference 320 nWb/m was +10.2 dB at the two higher tape speeds or +7.5 dB at 7½ in/s. At the MOL the second harmonic distortion was very low with both forms of distortion being below



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REVIEW REVIEW

0.25% at all three tape speeds 10 dB below 320 nWb/m which would commonly correspond to 0 VU.

Wow, flutter and speed

Wow and flutter was measured to the IEC peak weighted standard at the beginning, middle and end of a reel of standard play tape and found to be consistent within each tape speed.

At 30 and 15 in/s the wow and flutter was well within specification at 0.16% and 0.025% respectively, agreeing with the manufacturers' test data. However, at 7½ in/s the wow and flutter at 0.05% was on specification and far above the original test data of 0.015%. It was noted that there was some instability in the capstan servo system, particularly at this speed. Sony have subsequently told me that modifications have been made to the capstan servo. These, I am informed, improve the lock-in rate as well as improving wow and flutter and temperature stability.

Recording and replaying a 10 kHz tone at 15 in/s whilst doing a 3.16 Hz bandwidth spectrum analysis of the output produced **Fig 8** demonstrating a very clean performance which was confirmed by the clean sound of the recorder.

Checking the tape speed from end to end of an NAB reel of standard play tape showed a speed drift less than 0.01% at 15 in/s with the relation between the

three speeds being within better than 0.02%.

Entering the varispeed mode with no intended speed variation (0% varispeed) produced a speed change of 0.45% which was reflected as an error at all varispeed settings otherwise the accuracy of the speed variation was within the resolution of the display.

Other matters

The depth of erasure of a 1 kHz tone was found to be 80/85 dB for the two tracks at 30 in/s increasing to 85/90 dB at 15 in/s—both quite satisfactory.

Crosstalk between the two channels when recording one channel with signal, the other with bias alone, and then replaying the unrecorded channel is shown to be very good at high frequencies in **Fig 9** for 15 in/s. A very similar performance was found in the sync replay mode. When recording one channel and replaying the other in sync the performance was also good as seen in **Fig 10** for 15 in/s.

Recording 20 kHz on one track at 15 in/s and subsequently erasing the adjacent track failed to produce any measurable erasure of the 20 kHz tone showing negligible leakage from the erase head to the adjacent track.

At 30 in/s the recording and reproduction of a 1 kHz squarewave was good as shown in **Fig 11** irrespective of output loading.

Track to track phase jitter at 15 in/s at

10 kHz is shown in **Fig 12** to be about $\pm 5^\circ$ peak when using a sample of 3M 226 tape, this factor being rather tape dependent.

Finally the VU meters were tested to the ASA standard and found to have the correct rectifier characteristics and ballistics.

Summary

The Sony *APR-5000* would not readily be recognised as a machine from the MCI stable because its mechanical and electronic design is radically different from earlier MCI machines.

The use of an alloy casting with machined reference faces on the top surface makes the machine very easy to service with the absolute minimum of mechanical and conventional electronic adjustments. Both mechanically and electrically the standard of construction and finish is very good.

Certainly the digital storage of alignment data is a very nice feature which has many advantages over alignment with conventional potentiometers, but it is rather time consuming.

In almost all respects this is an excellent machine which will find applications in a studio as well as in portable use. I have noted a few complaints in the text of this review but being at a production prototype stage I'm sure that note will be taken of any user comments at this stage. □

FIG 8
OUTPUT SPECTRUM ANALYSIS 1 mm = 2 Hz

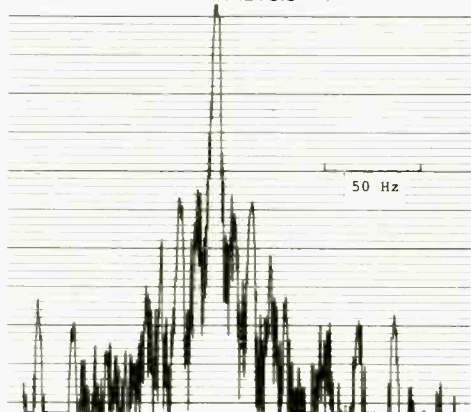


FIG 10
RECORD/SYNC CROSSTALK AT 15 IN/S

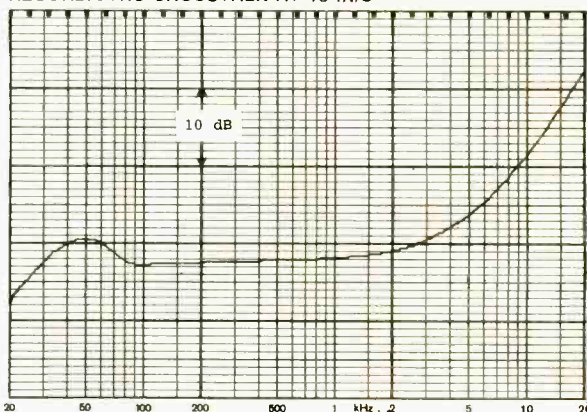


FIG 9
RECORD/REPLAY CROSSTALK AT 15 IN/S

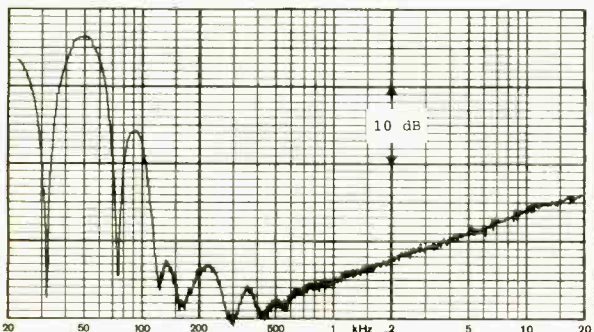


FIG 11
RECORDING AND REPRODUCTION OF A 1 kHz SQUAREWAVE AT 30 IN/S

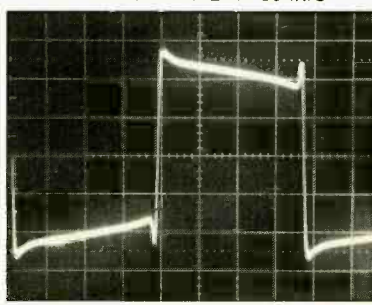
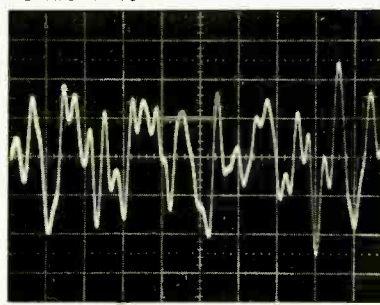


FIG 12
TRACK TO TRACK PHASE JITTER AT 15 IN/S AT 10 kHz



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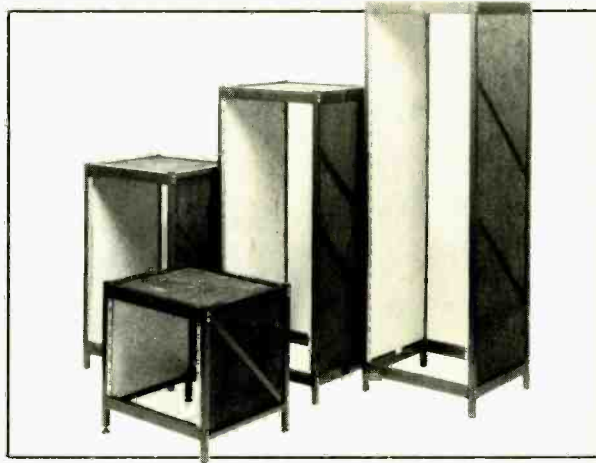
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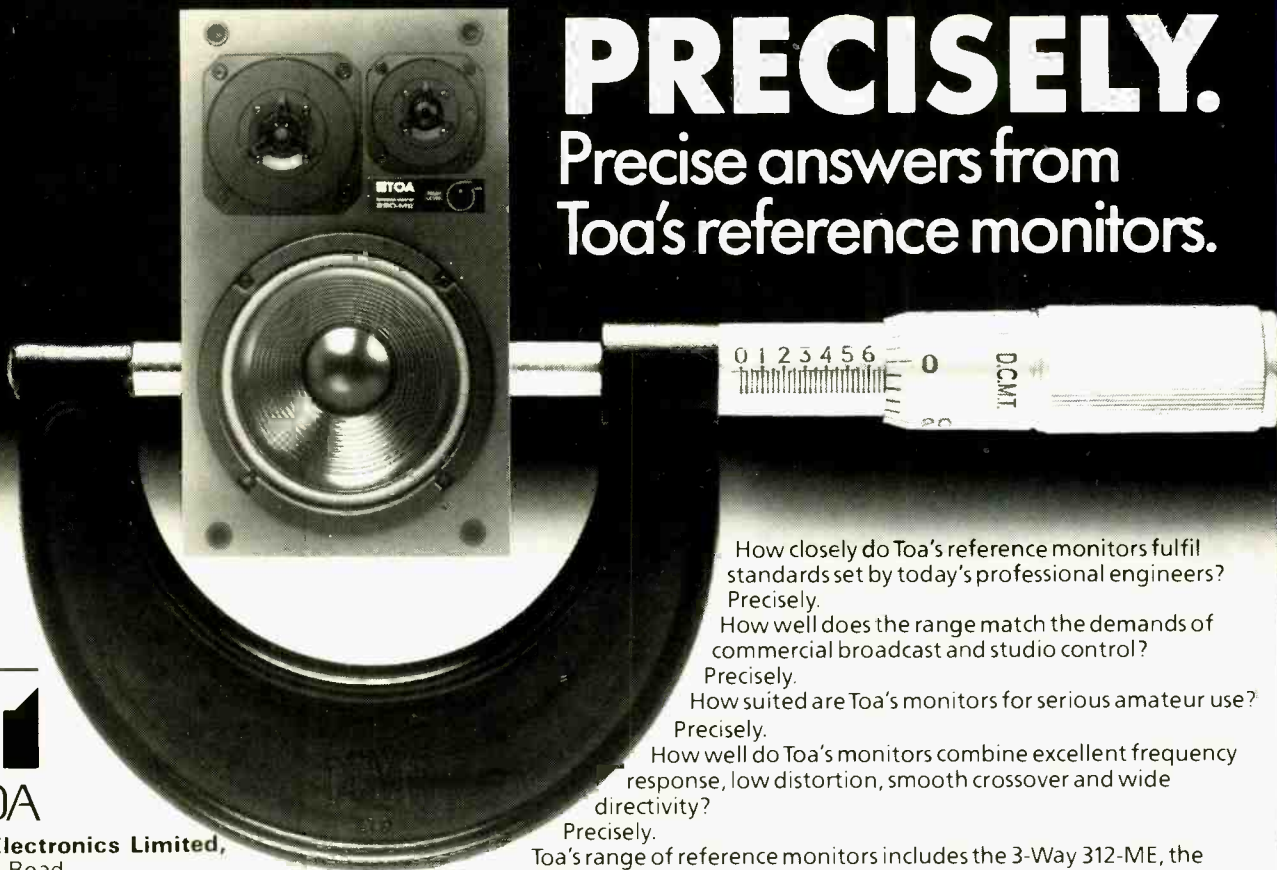
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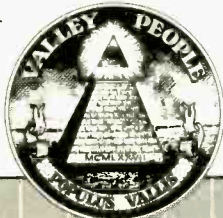
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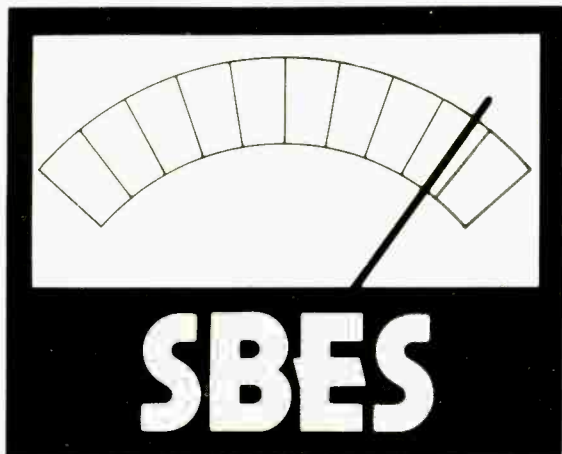
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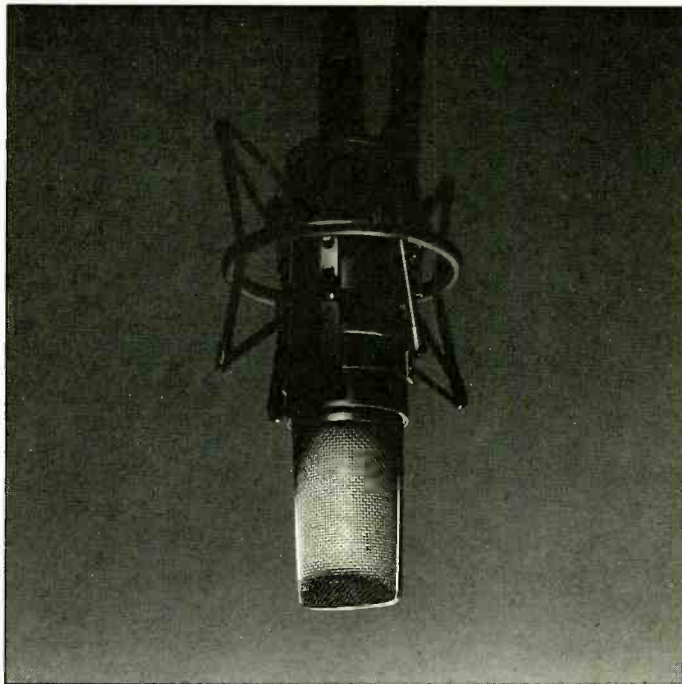
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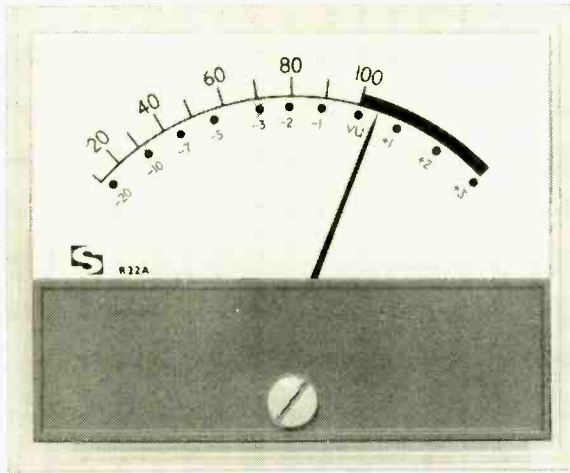
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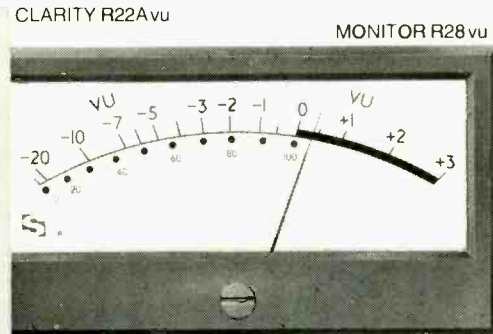
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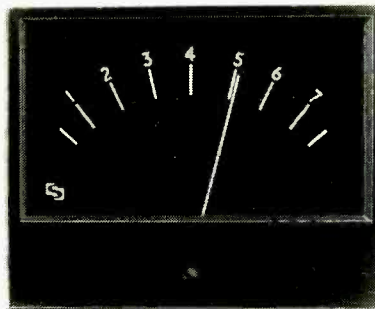
VU METERS

Sifam vu meters are the real thing! They meet in all respects the technical requirements of the American National Standard C16.5-1954 in terms of dynamic characteristics, frequency response, harmonic distortion, impedance, etc. There are three styles to choose from, each in three or four sizes, all with the correct dial colour and alternative scale markings.



CONTROL KNOBS

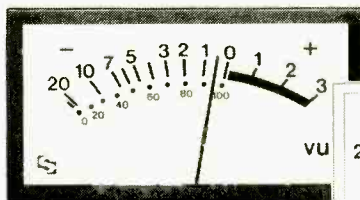
What can be said about knobs – besides the fact that Sifam knobs are the perfect complement to Sifam meters. They combine the best features of styling, function, handling and easy assembly: there are six sizes from 10mm to 38mm in black, red or grey: short knobs, long knobs, wing knobs: all with plug-in figure dials, pointers and caps in a range of colours: collet-fixing and push-on types. Plus slider knobs.



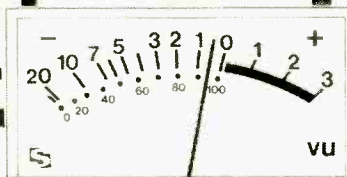
PEAK PROGRAMME INDICATORS

These are available in three styles, again in three or four sizes, fitted with a black dial/white pointer and scaled either to European broadcasting standards or BBC specifications ED1476 and 7. Five of them meet the technical requirements of BS5428:1981 and the others, though they do not conform in every detail, are made available by customer demand.

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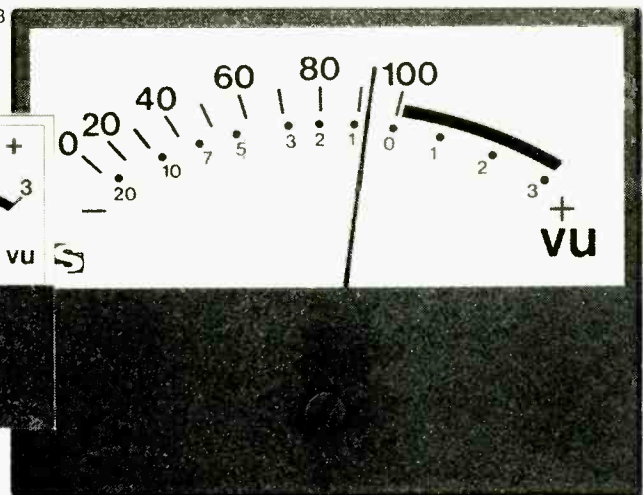


AL19WF



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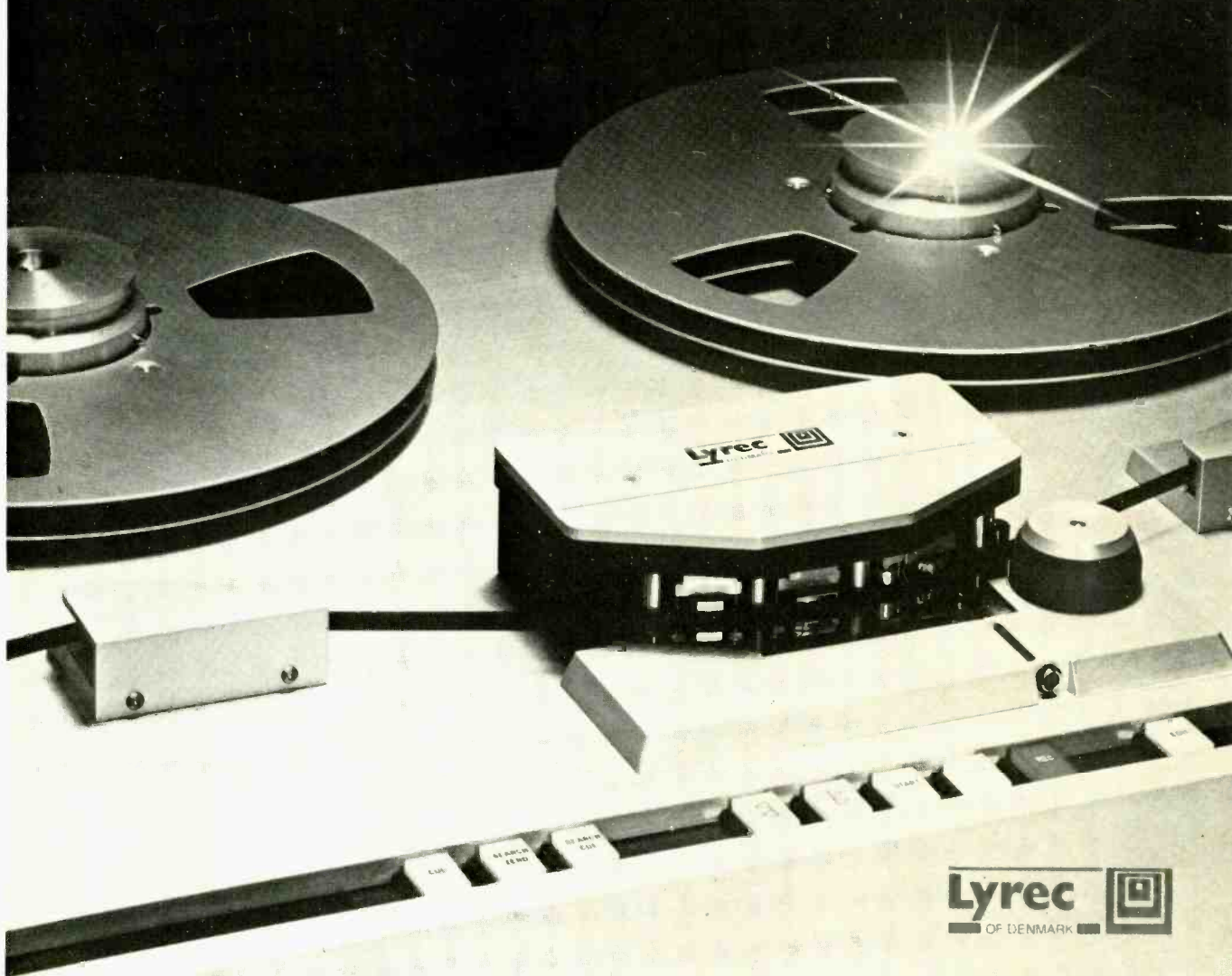
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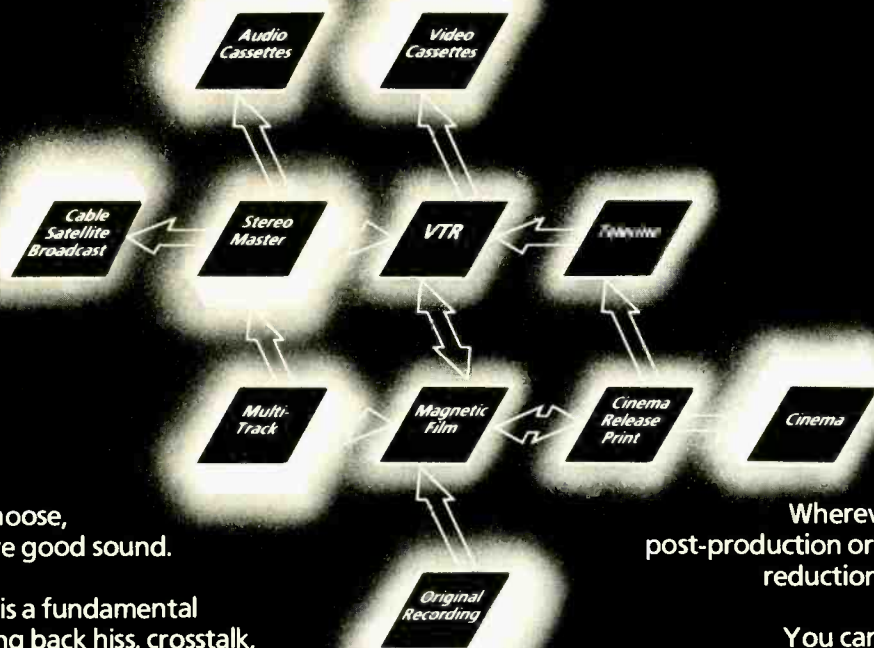
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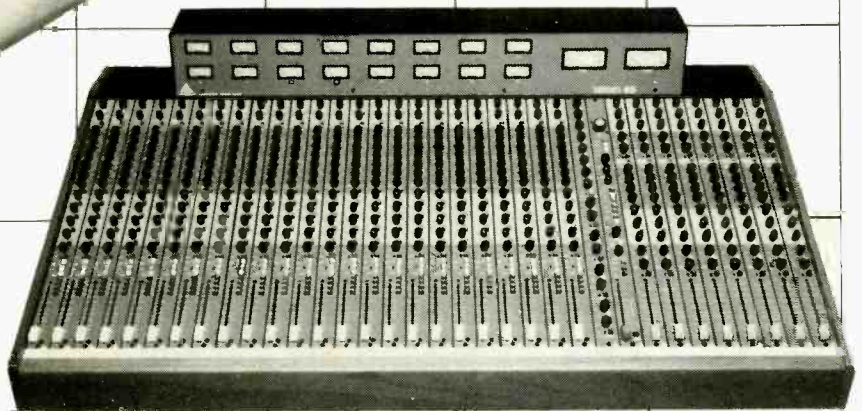
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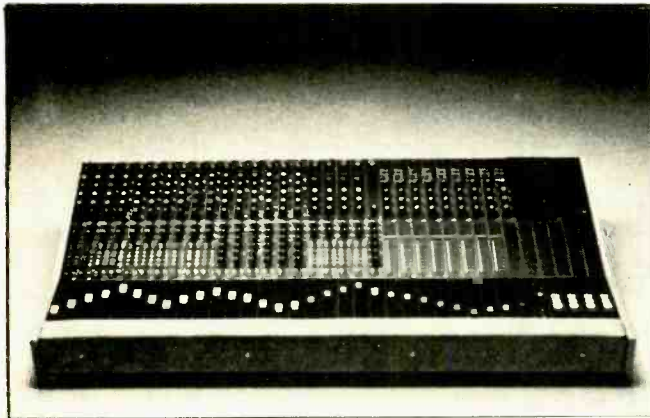
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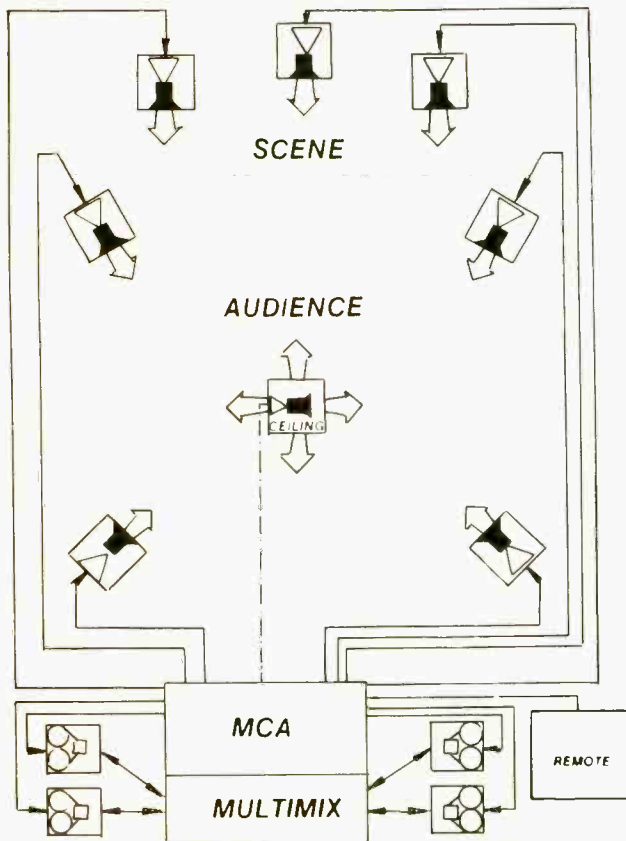
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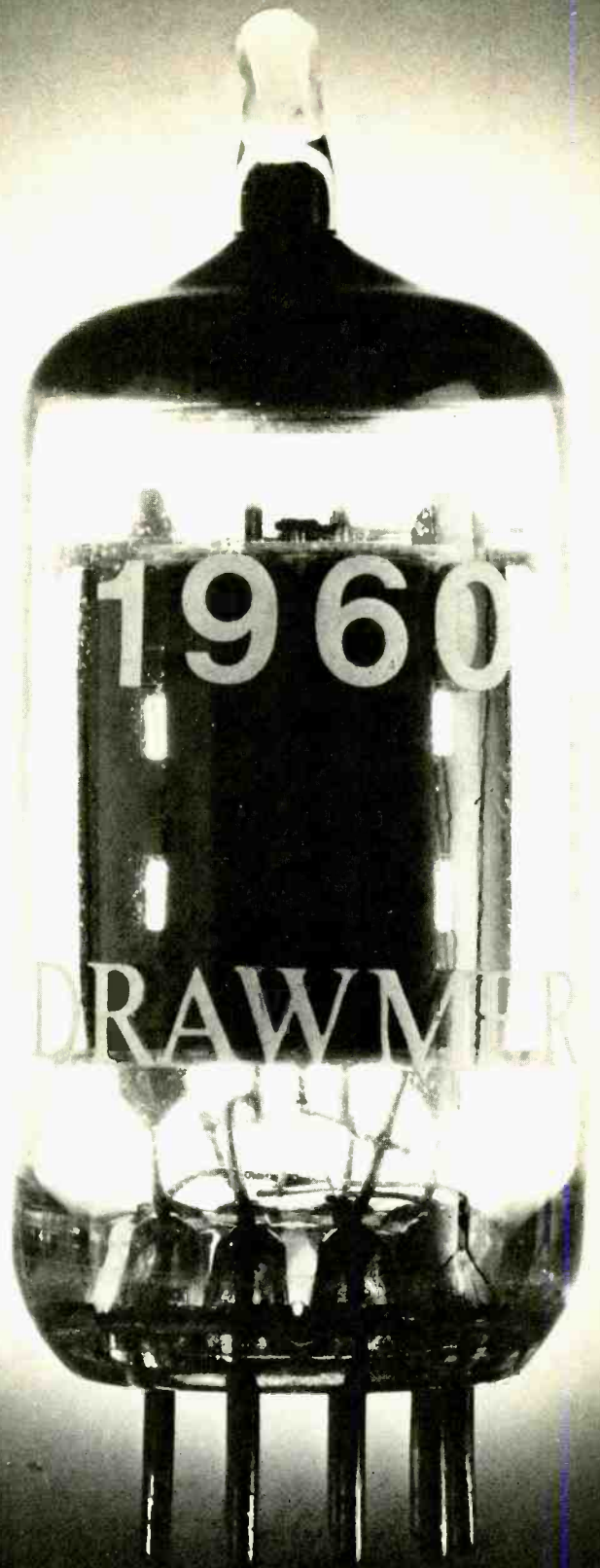
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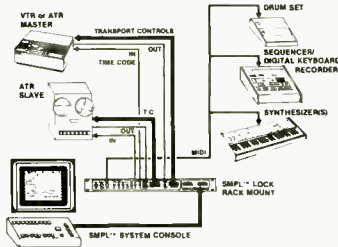
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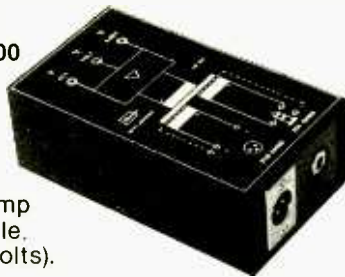
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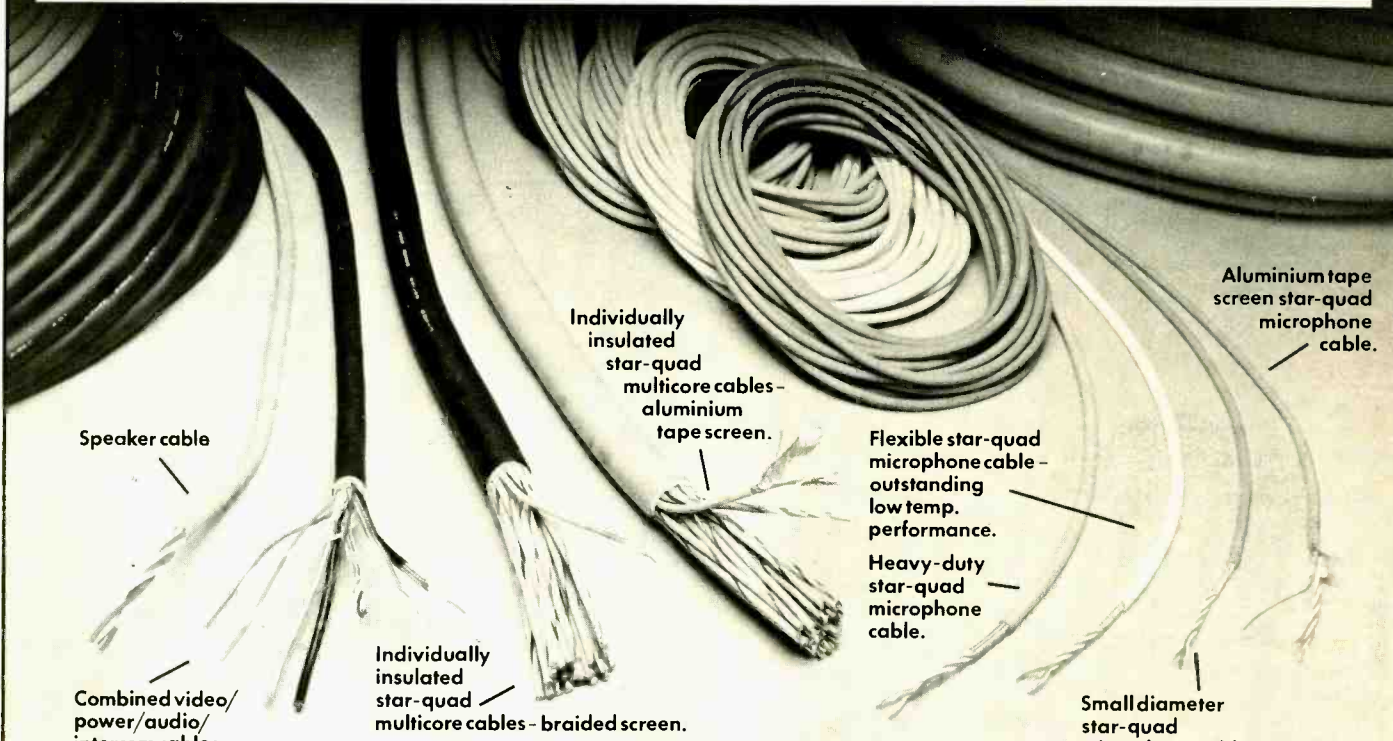
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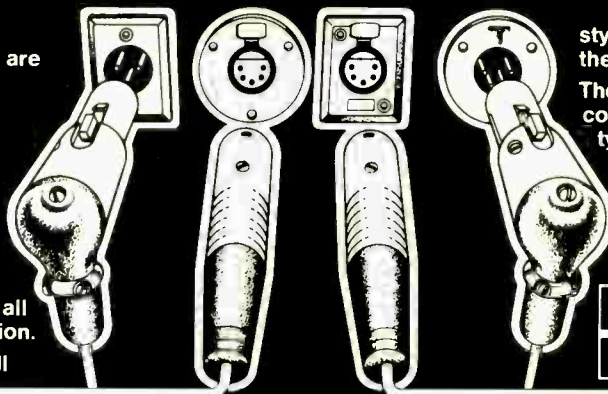
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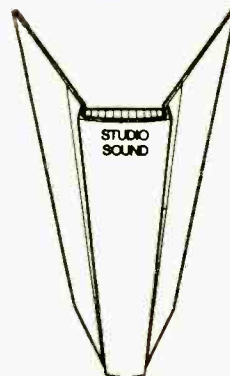
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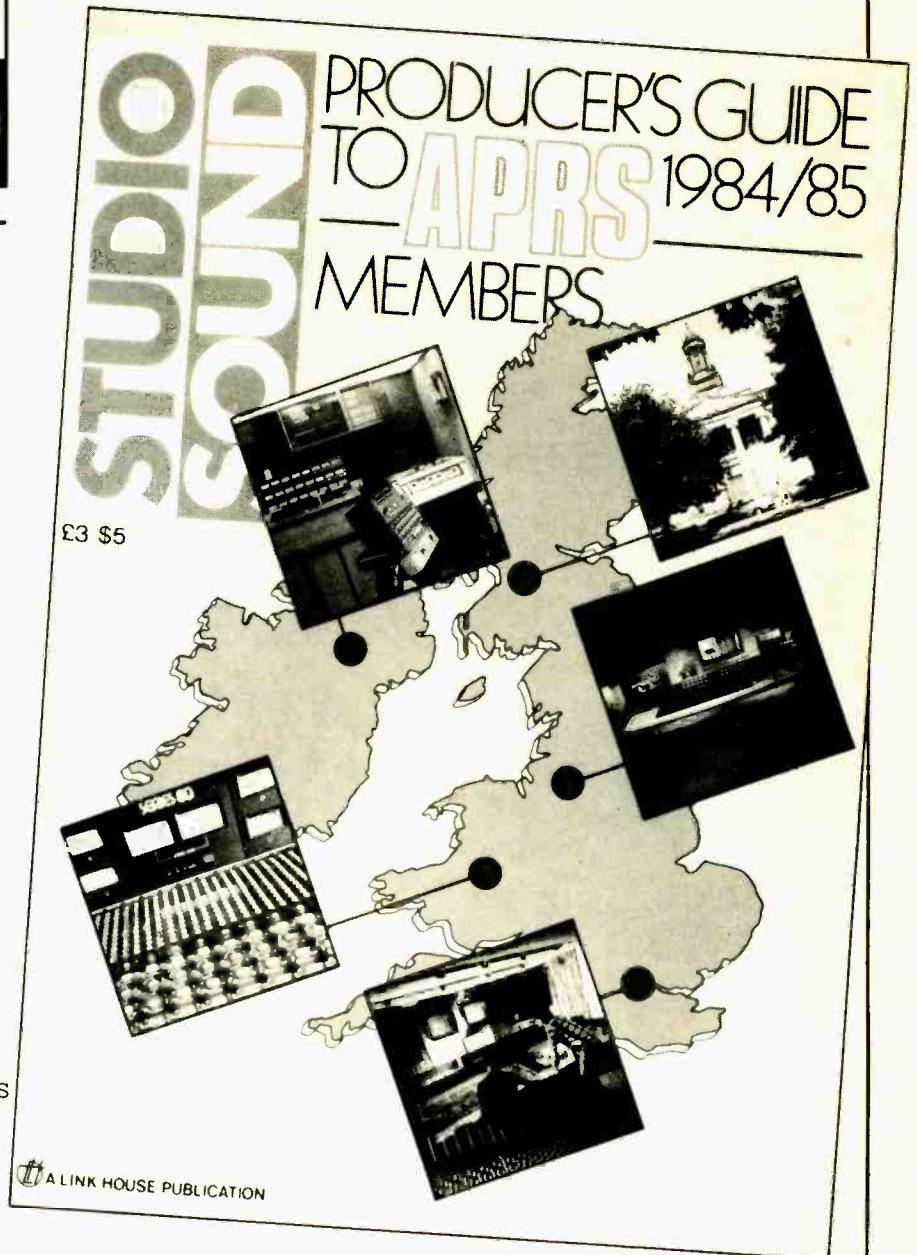
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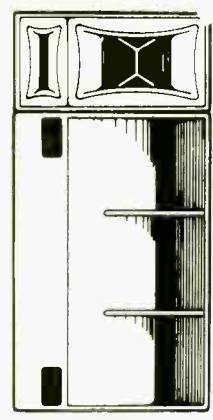
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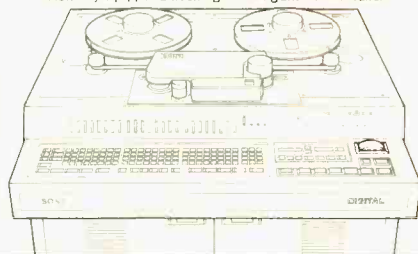
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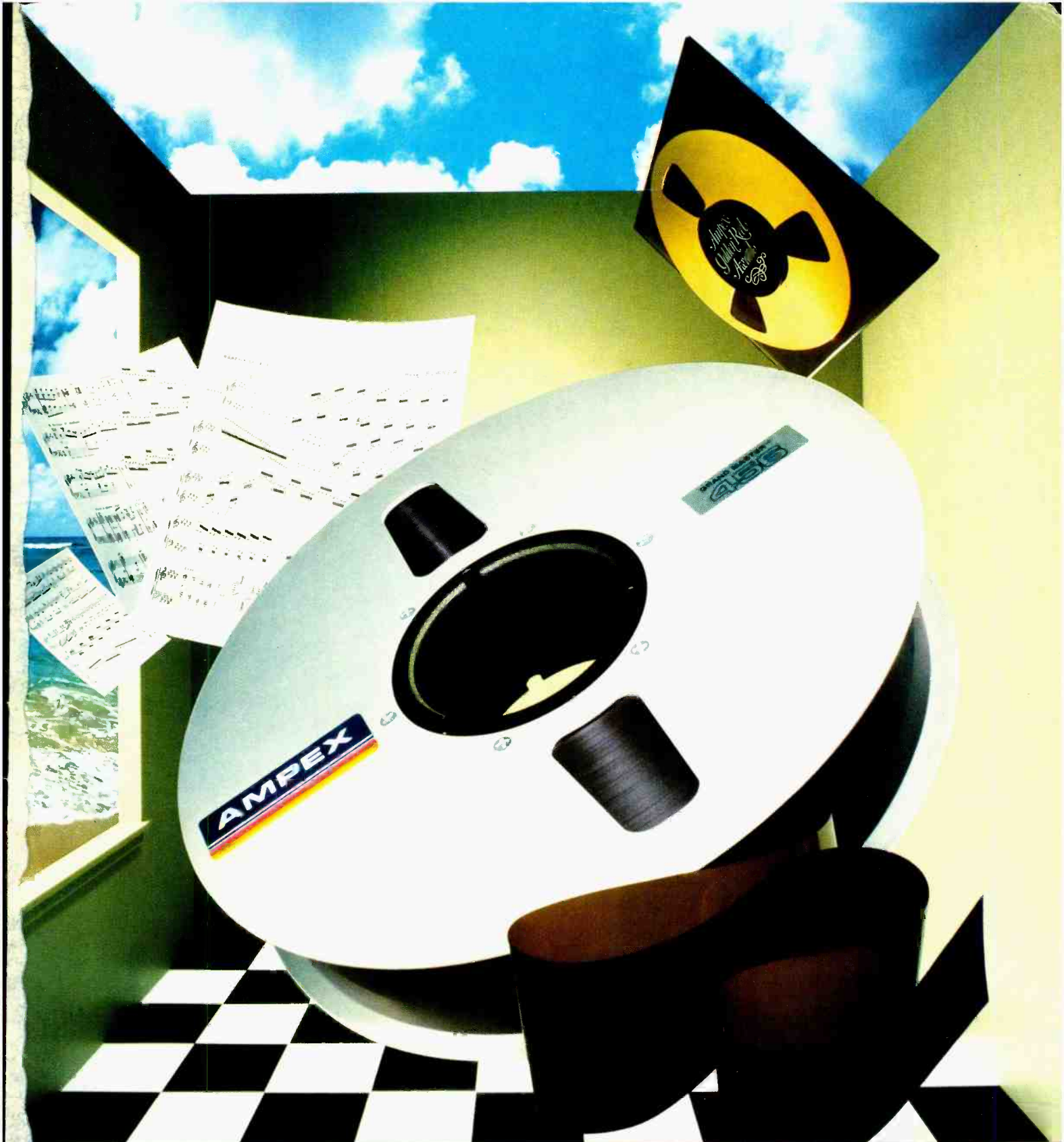
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