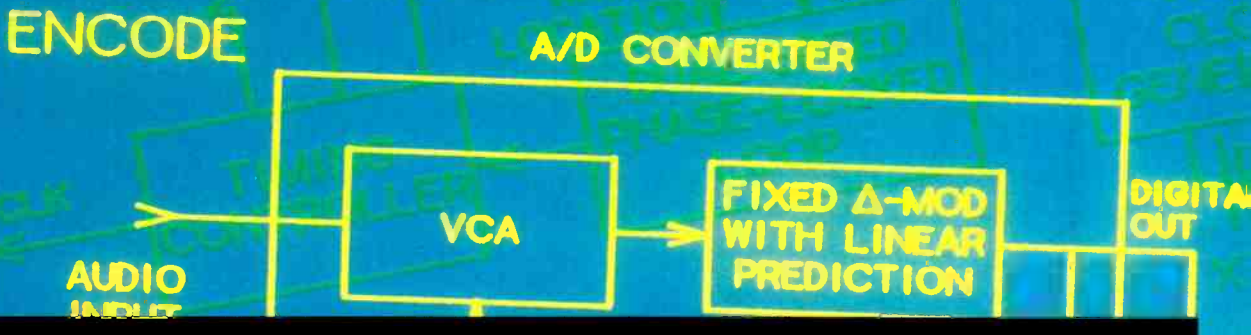
February 1983 £1

studio sound

AND BROADCAST ENGINEERING



dbx digital – the full story

Noise reduction and gating

Studio sound ...on the road

If you're looking at your P.A. system, it could pay to check out the heart of the rig – the mixing console itself. You need a board that will let you be as creative as the music on stage, that'll survive in the back of the truck, and that won't break the bank.

The 400B Live

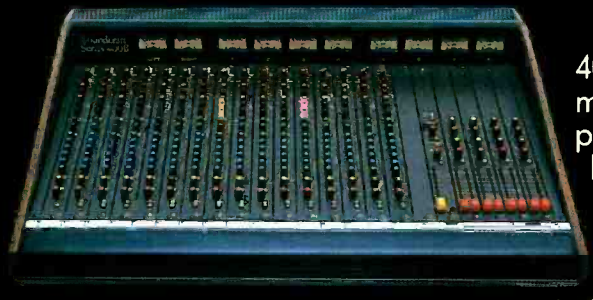
So check out the Soundcraft Series 400B. Designed for the touring band and creative musician, the 400B is compact, transportable, yet still performs like our studio consoles.

That's because its modular construction contains some of the advanced features that have made Soundcraft consoles the first choice for more and more studios and touring sound companies. So you can take absolute control of 16, 24, or 32 inputs, and create the sound your music deserves.

Recording with the 400B

But you get more than an ideal front-of-house mixer with the 400B. With 8 track monitoring and 4 auxiliary buses, you get a desk that will handle your 8 track recording requirements within the same competitive price.

The 400B Monitor



And if that sounds impressive, the 400B also comes configured in a Monitor format for the band which needs independent stage monitor mixing. The 400B Monitor gives you the facilities to create 8 separate mixes plus a stereo mix for side-fills, front-of-house or stereo recording. Available in 16/8+2 and 24/8+2 sizes, all 8 outputs can be mixed into the stereo output via level and pan controls.

The Soundcraft 400B and 400B Monitor. They'll help you make the most of your performance. Just send for our brochure, and we'll show you how to do justice to your music wherever you go.

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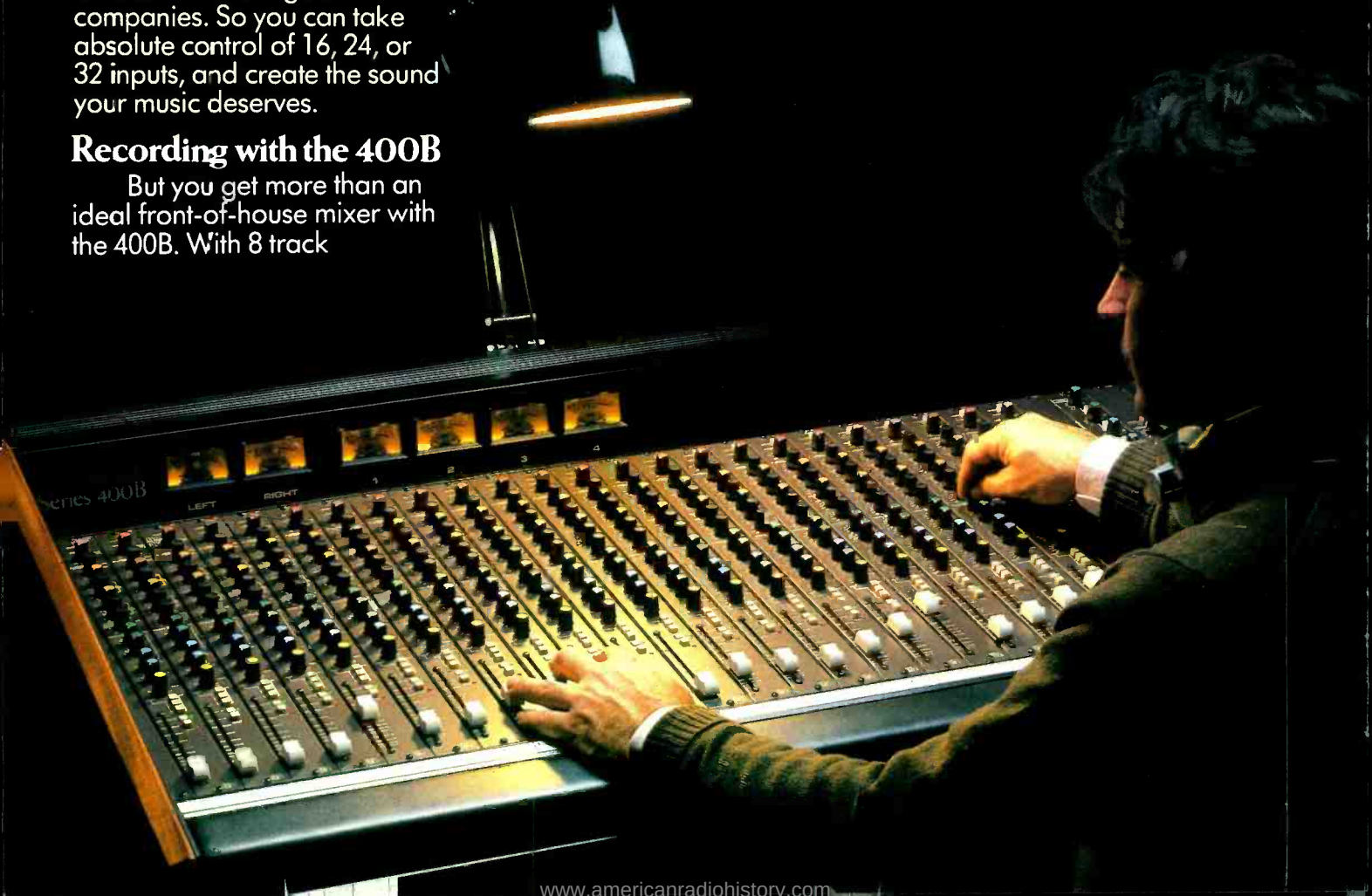

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AND BROADCAST ENGINEERING

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A LINK HOUSE PUBLICATION

ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Cover by Roger Phillips, centre photo by courtesy of dbx Inc

'Silence in the studio!'

Noise reduction is still something to be concerned about, despite the noiselessness of digital (enough of the word 'digital' for this month). In many diverse fields, technological developments seem to be followed by a backlash, and noise reduction in the studios has not been an exception. Many people (including myself) quite often use 30 in/s with no noise reduction on multitrack, and seem to like it (funny things in the bass end apart). I tend to use this approach mainly because I don't have noise reduction available at the moment, due to economic restrictions. But the usual argument against noise reduction systems is that they 'change the sound'. This is probably true, although whether they really do as much damage as the average tape recorder is another matter entirely.

I do not intend to get into the 'dbx versus Dolby' debate at this late stage. Both Dolby and dbx are no doubt capable of altering the sound in a number of ways if you use them badly enough. Dolby levels can be misadjusted (or lineup tones incorrectly related to the *real* Dolby level) on the one hand, while frequency response errors in the record/replay chain can play merry havoc with dbx-encoded material.

There is obviously a 'swings-and-roundabouts' choice here. On the face of it, dbx is more likely to change your sound because it is giving you more noise reduction (30 dB versus Dolby's 10 or so) but I suspect the truth of the matter is that the type of material you are recording has a greater influence. I have used both Dolby and dbx on a large number of occasions and, as luck would have it, I've never had any of the problems that dbx, in particular, is alleged to suffer from. This must have a lot to do with the type of material I record, so if I say that I prefer dbx somewhat, that is the only reason; I would not seek to compare the two major systems in absolute terms (or even objective ones). It's a bit like asking somebody whether they prefer riding a bicycle or the colour blue.

Both of the major systems obviously have a large following, and here I suspect that Dolby wins hands down in terms of the number of channels in service throughout the world. That on its own is evidence of a basically good system, because you won't sell duff gear to professionals for very long, however good your marketing is. Dolby is the system that everybody *has*: dbx is the one they'll *get* for you if you want it (rental companies to the rescue). And these days you only need the appropriate modules to stuff into your rack, as everyone seems to make bits that fit into other people's systems. I reckon the only way of choosing is to use them and work out empirically which system offers you what you need for a given project.

Of course, these days, there are more than two systems. Burwen noise reduction has been a little on the quiet side recently (sorry) and I've never met anyone who has used it. Telcom is a more current approach, and seems to offer the best of both worlds, but for some reason it doesn't seem to have taken off as well as it ought to, despite very impressive Telcom-versus-digital demonstrations (notably the one held during APRS last year). More people should give this one a try, I think. It appears to be a strong contender.

Then there's the other approach. MicMix's *Dynafex* seems to be quite unique as a 'decode-only' noise reduction system, and it does its job very well, as evidenced by our review last year. It's now available in a mini-rack module, which makes multitrack *Dynafex*ing quite attractive.

Analogue recording is by no means dead and will not be for some years. Until it disappears altogether, there will be a need for noise reduction. There are many good approaches to the problem available today (well, at least four) and the rule, as always, is to try them and see which one you prefer.

Richard Elen

A Quiet Boast from Chilton

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ultra low noise mixer ideal for digital recording

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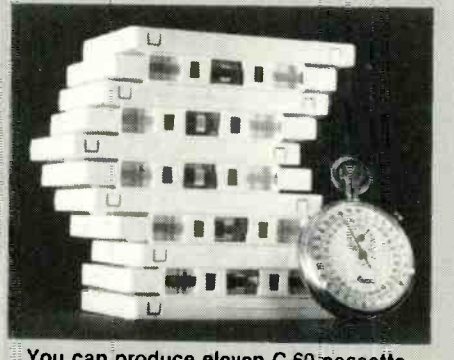

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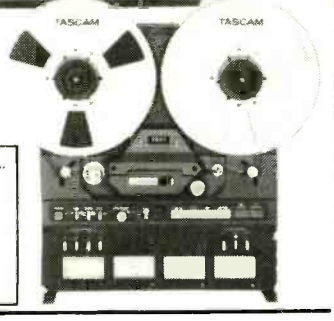
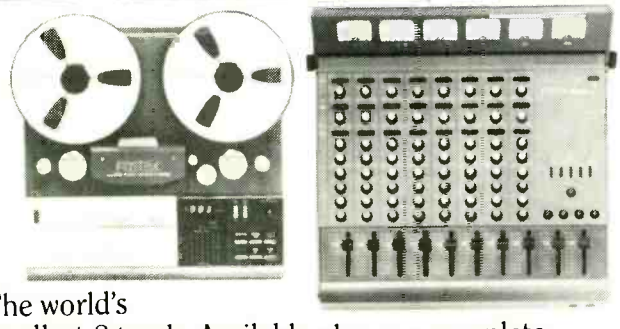


currently on special offer — the 34 recorder with the Seck 10×4 Mixer.

Only £995

Fostex



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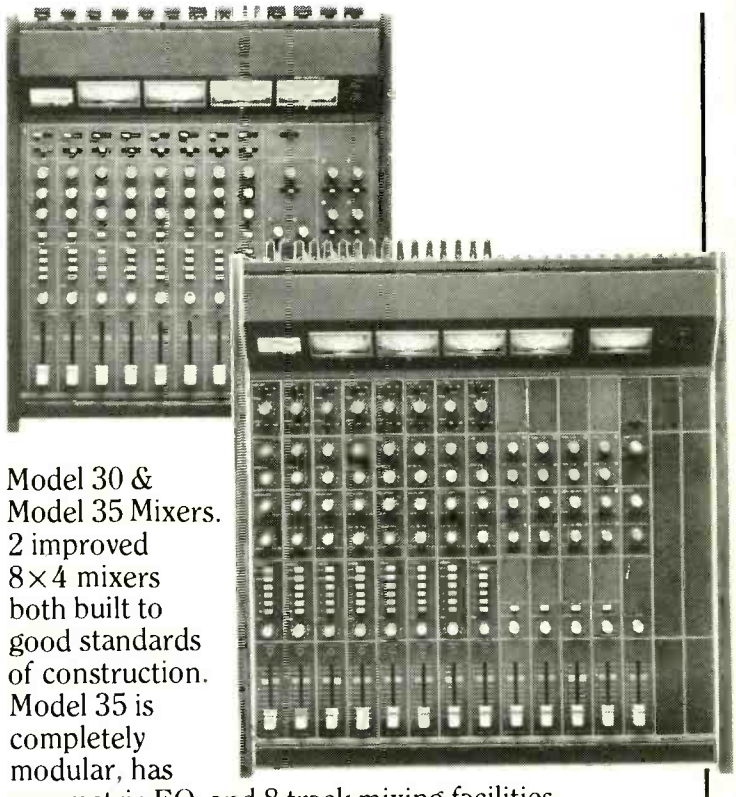
Tascam 8 track systems

38 — the sensational new half inch 8 track has shattered price barriers. Yet performance is better than ever, with digital counter, lower noise electronics, and pitch control.



Model 30 & Model 35 Mixers. 2 improved 8×4 mixers both built to good standards of construction. Model 35 is completely modular, has parametric EQ, and 8 track mixing facilities.

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This brand new package brings 16 track recording to those with an 8 track budget! The Itam 1610 is a one inch 16 track and features 3 speeds (inc. 30 ips) full function remote with varispeed, optional noise reduction. The Trident VFM is a fully modular 20×8×16 console with 20 inputs and full 16 track monitoring.

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STUDIO SYSTEMS

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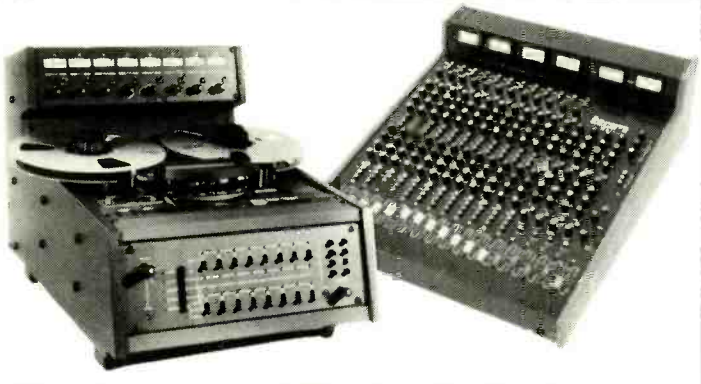

The ultimate compact 8 track studio. Otari's advanced MkIII-8 recorder, with microprocessor controlled transport, built-in oscillator, and full function remote. The MkIII-8 can be interfaced to video synchronizers for "audio sweetening" work.
The entirely new Itam 12-4-8 is a professional multitrack mixer. All 8 tracks can be continuously monitored while recording and the 8 tape returns are additionally normalled to the line inputs on 8 of the 12 input channels.

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TASCAM 38+DB30 Noise Reduction

Only from ITA, — the new Tascam 38, 8 track with Itam dB30 noise reduction. 8 channels of simultaneous NR giving 30dB improvement in sig/noise ratio.

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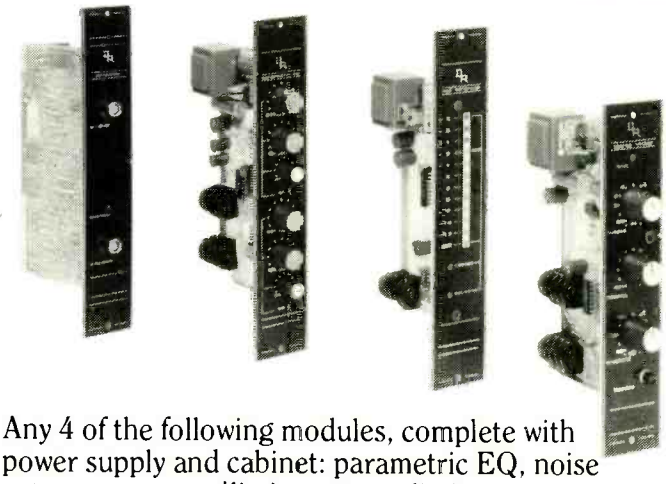

Any 4 of the following modules, complete with power supply and cabinet: parametric EQ, noise gate, compressor/limiter, stereo limiter, compander, stereo disc amp, high-low pass filter.

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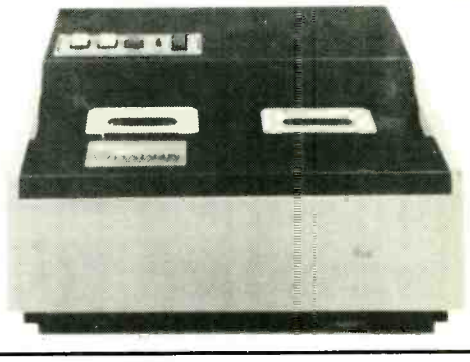

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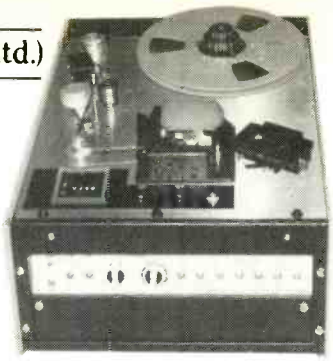

DP2700. An automatic loader for blank or recorded pancakes. Will wind any length precisely. One operator can run up to 3 machines. Reliable and attractively priced.

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NEW MX5050B2II 2 track

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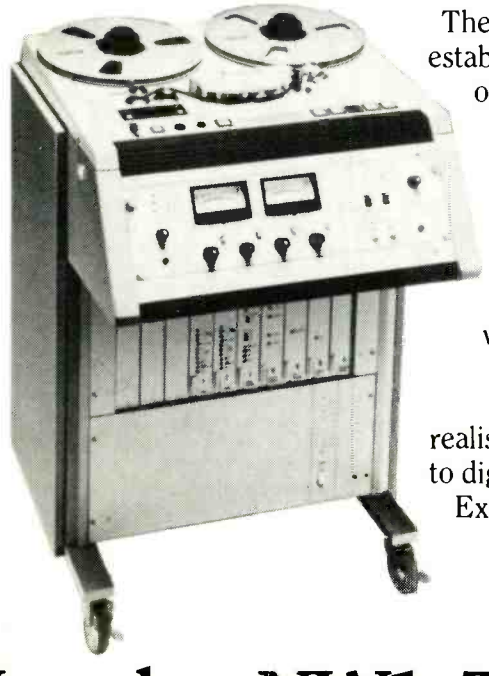
MTR10-2 Half inch 2 track



The MTR10-2 has established itself as one of the most user-friendly mastering machines on the market. The new half inch 2 track version runs at 30/15/7½ ips making it a realistic alternative to digital recorders. Excellent editing facilities.

THE MULTITRACK MASTERPIECE

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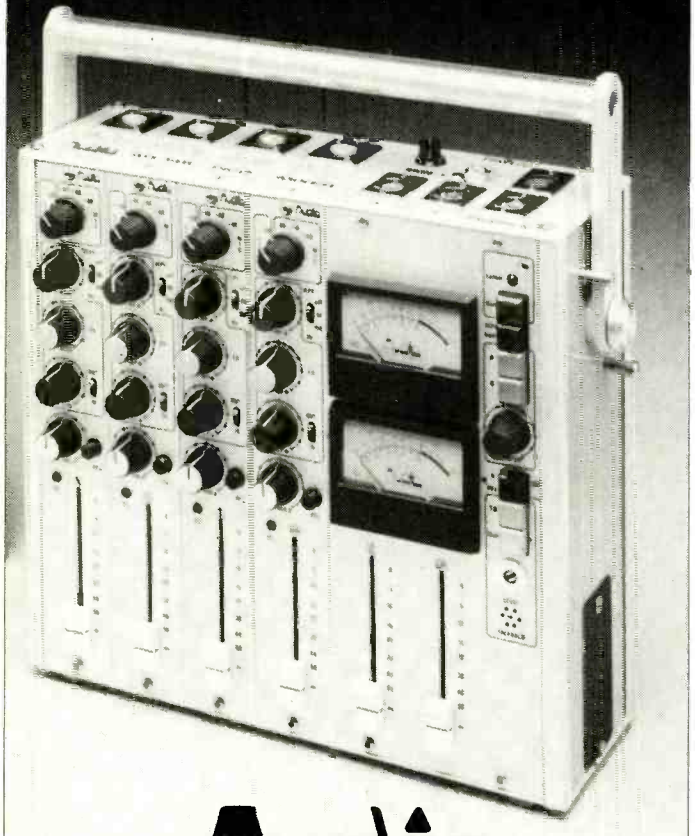

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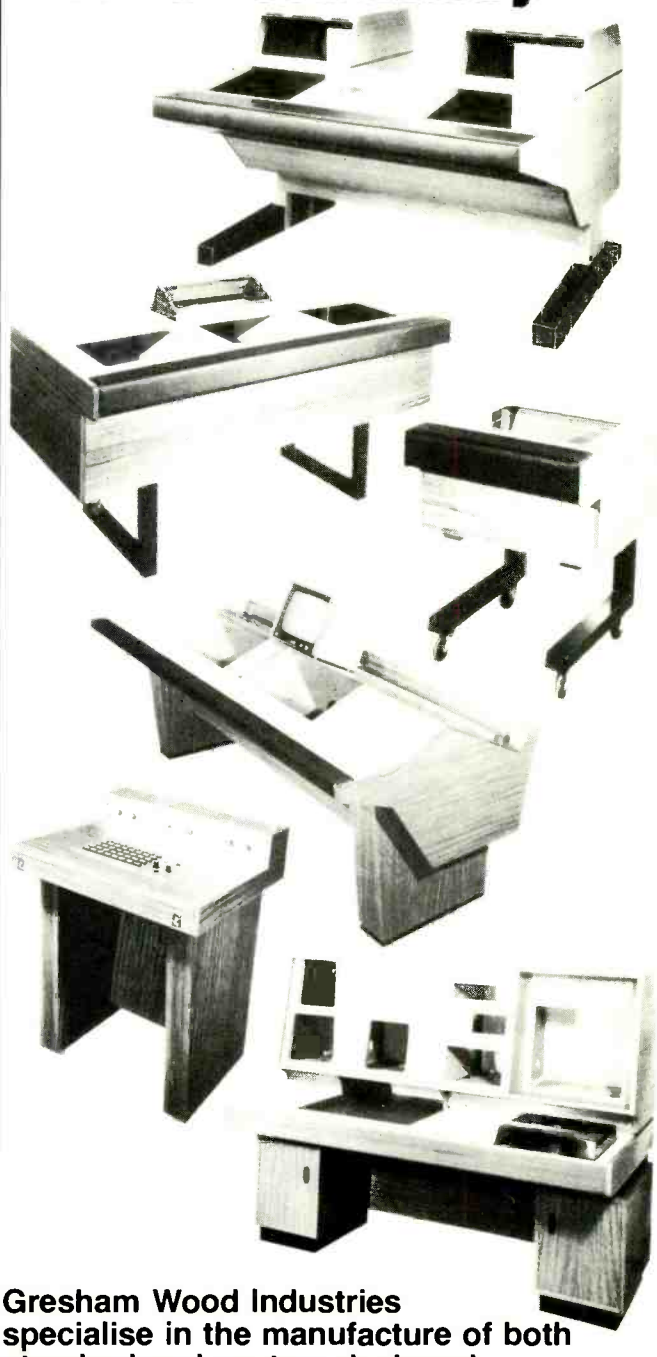

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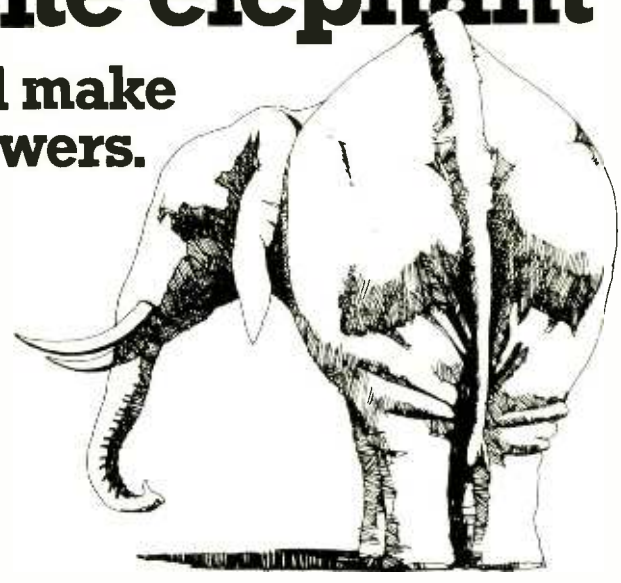
...ask some questions, and make sure you get the right answers.



Do they provide wide dispersion at all frequencies?
The unique construction of the Tannoy Dual Concentric places all of the HF horn behind the LF cone, with the flare of the cone continuing the horn flare. Unlike even other co-axial monitors, therefore, the Tannoy Dual Concentric provides smooth transition at crossover, and extremely wide dispersion at all frequencies, enabling you to monitor an accurate stereo image from any point at the desk.

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The physical relationship of our HF driver to our LF driver remains the same no matter which way the speaker is placed. Unlike more conventional monitors a Tannoy Dual Concentric can be placed upright, laid on its side, even suspended upside down from the ceiling without affecting the superb response and stereo imagery. You therefore have much greater freedom when planning your control room layout.

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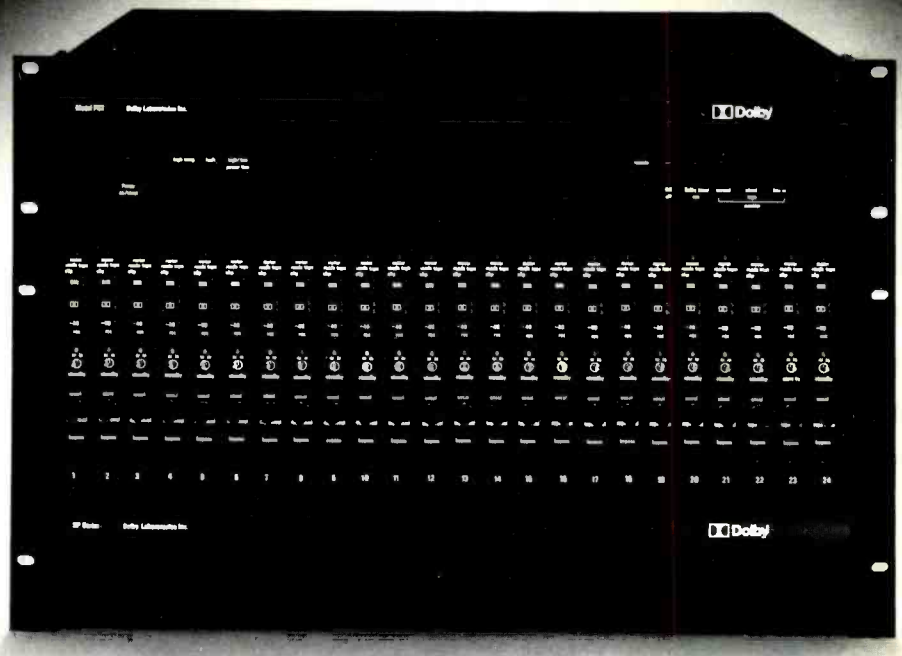

New from Dolby Laboratories:

The Dolby SP Series Multi-track noise reduction unit

Dolby noise reduction is an integral part of professional multi-track recording practice in music, radio and TV broadcasting, and film studios throughout the world. A new noise reduction unit, the Dolby SP Series, has been developed for these and other applications, and provides up to 24 tracks of Dolby A-type noise reduction in only 12¼" of rack space. The SP Series' combination of compact size, ease of operation, and new features makes it ideal for equipping new recording facilities and upgrading existing ones.

For further information on the SP Series and other professional noise reduction equipment, contact Dolby Laboratories.

Highlights of the Dolby SP Series:

- Up to 24 tracks in only 12¼" of rack space, including power supply.
- Dolby A-type noise reduction characteristics utilizing standard Dolby Cat. No. 22 modules.
- Separate regulated power supply unit with electronically-controlled output protection.
- Low-noise fan cooling.
- LED display for each track permits accurate Dolby level calibration (within ±0.1 dB if desired) by matching intensity of LED pairs; further LEDs indicate the presence of signals and clipping, and assist alignment with high-level reference tapes.
- Front-panel "UNCAL" control for each track permits rapid resetting of Dolby level for playback and punch-in on nonstandard-level tapes, then instant restoration of preferred preset studio Dolby level without recalibration.
- User-selectable option of "hard" or electronically-buffered bypass of individual tracks and of all tracks simultaneously.
- Snap-fit connectors on rear panel for rapid disconnection and reconnection.
- Balanced and floating input stages.
- Output stages drive either single-ended or balanced 600-ohm loads at levels up to +28 dB (19.5 V) before clipping.
- Ultra-low-distortion input and output amplifiers.
- Remote ground-sensing output configuration minimizes hum pickup when driving single-ended loads.
- Discrete FET switching for reliable, noise-free routing of audio signals.

Dolby Laboratories, 731 Sansome Street, San Francisco, California 94111, Telephone 415-392-0300, Telex 34409. 346 Clapham Road, London SW9, Telephone 01-720-1111, Telex 919109.

Don Larking
Audio Sales

WE ARE SUPPLIERS OF NEW AND USED PROFESSIONAL RECORDING EQUIPMENT. WE SUPPLY AND INSTALL. IF REQUIRED, COMPLETE PACKAGES AS WELL AS INDIVIDUAL ITEMS. SET OUT BELOW IS PART OF OUR CURRENT STOCK OF USED RECORDING EQUIPMENT. PRICES QUOTED ARE NETT. WE SPECIALISE IN EXPORT PACKAGES.

MULTITRACKS USED

Ampex MM1000 8-track 1in. Well maintained professional machine ref. M1 **£2,500**
Ampex MM1000 16-track 2in professional machine fitted with **Soundcraft** electronics, **B.E.L.** noise reduction and remote ref. M2 **£5,500**
Brenell Mini 8, 3 available all in good order. Price reduced to clear. Sold as seen (each) ref. M3 **£2,000**
Brenell Mini 8 remote **£350**
Brenell Series 19 8-track 1in machine ref. M4 **£1,950**
Cadey 16 track 2in with remote ref. M5 **£2,900**
Itam 8-track ½in recorder, very little used ref. M21 **£1,200**
Lyrec 24-track with ATC. Little used. V.G.C. ref. M6 **P.O.A.**
MCI JH110A 8-track 1in, V.G.C. ref. M7 **£3,500**
Otari 7300 8-track 1in fitted into f/cases ref. M8 **£3,000**
Studer A80 Mk1 16TR, 15/30 ips. 400 hours digital counter with zero locate, updated electronics, excellent condition ref. M9 **£9,000**
Studer A80 Mk1 8-track 1in ref. M20 **£4,500**
Studer A80 Mk1 16-track 15/30 ips ref. M23 **£8,000**
Soundcraft 16-track 1in with remote and auto-locate, very well maintained ref. M10 **£5,000**
Scully 280 8-track 1in ref. M11 **£2,000**
3M M79 24-track with XT24 ref. M22 **£10,500**
Teac 3340 4-track ¼in ref. M12 **£400**
Teac 3340 4-track ¼in ref. M13 **£400**
Teac 3440 4-track ¼in ref. M14 **£500**
Teac 144 Portastudio ref. M15 **£375**
Teac 85-16, privately used ref. M19 **£4,750**
Teac 85-16b, 16-track 1in with **dbx** ex-demo ref. M16 **£6,000**
3M M23 8-track 1in ref. M17 **£1,800**
3M M56 16-track 2in ref. M18 **£6,000**

MIXING CONSOLES USED

Audio Developments 30/8/2 P.A. console in f/case with multicore ref. MC1 **£3,250**
Alletrope Custom Console 24/16 built for John Paul Jones's private use only. Beautiful mixer. Wrap around in very attractive hard wood frame, ideal for a high class home studio situation ref. MC2 **£8,000**
Allen & Heath Mod 3 16/8/16 ref. MC3 **£1,400**
Alice 22/16/16 large floor standing console ref. MC4 **£4,000**
API 16/16/16 ref. MC5 **£6,000**
Allen & Heath 24/8 P.A. mixer. F/case, 8 comp/lims, little used, V.G.C. ref. MC8 **£2,000**
Allen & Heath Special 28/12/4st/2. 16 tape returns, P&G's ref. MC26 **£3,000**
Allen & Heath 16/2 Pop Mixer, modular good condition ref. MC27 **£250**
Chilton 20/8/16. 16 channels para, E.Q., P&G's ref. MC6 **£4,800**
Cadac 24/24/24 Professional floor standing console ref. MC7 **£8,000**
Gelf 12/8/8 ref. MC11 **£750**
Helios 32/16/24 24ppm, 6 A&D comp/lims ref. MC12 **£4,500**
MCI 400 series, 40 way frame, 36 inputs ref. MC33 **£12,000**
Midas SR Series. 28/8/16, 5 years old ref. MC28 **£5,000**
MM 12/4 ref. MC9 **£175**
Neve PCM8 8/2, needs attention ref. MC10 **£2,000**
Raindirk 18/4/8 with full patchbay ref. MC13 **P.O.A.**
Soundcraft 800 Series, 18/8/16, private use, V.G.C. ref. MC14 **£4,000**
Soundcraft 16/24 ref. MC14 **£9,000**
Soundcraft Series 2, 16/8/8, V.G.C. ref. MC15 **£2,000**
Soundcraft Series 2, 24/16/16, sweep E.Q., P&G's, full patchbay ref. MC16 **£4,950**
Soundcraft Series 2, 16/8, with 280-way patchbay and 7 Klark Technic graphic equalisers ref. MC29 **£2,500**
Soundcraft 1S 12/2, P&G's, phantom power, f/case ref. MC30 **£1,600**
Trident Series 80. 32/24/24, 18 months, V.G.C. ref. MC17 **£15,000**
Teac Model 15. 24/8/16. V.G.C., ex demo ref. MC18 **£3,000**
Teac MX8 4/2 rack mounting audio mixer ref. MC31 **£75**
Trident Fleximix 20/4/2 ref. MC19 **P.O.A.**
Trident TSM. 32 frame fitted, 28/24/24 ref. MC20 **£25,000**
Trident Trimix 18/8/8. V.G.C., ex demo ref. MC21 **£4,500**
Trident Trimix 18/8/8, V.G.C., private use, with patchbay ref. MC22 **P.O.A.**
Trident B 24/16/16, excellent condition ref. MC23 **£4,950**
Teac Model 2A, 6/4, with meter bridge ref. MC24 **£175**
Tweed 10/4, fitted ppm's ref. MC25 **£2,750**
Teac Model 3, 8/4/8 ref. MC26 **£400**

PACKAGES USED

Ampex MM1000 16-track 2in with full remote and **Alice** 18/8/16 with full patchbay, both very well looked after ref. P1 **£10,500**
Itam 8-track ½in recorder, **Itam** 10/8 mixer, 1 pr. **JBL** 4310 monitors, **AKG** BX20 and **MXR** DDL2 ref. P3 **£3,500**
MCI 24-track package, 6 years old ref. P4 **P.O.A.**
Otari 7800 8-track 1in with timer, autolocate and remote, plus **Soundworkshop** 12/8/8 with 352-way patchbay, both in V.G.C. ref. P2 **£7,000**
Studer A80 Mk.2 24-track wide version with spare 16-track h/block and **Helios** 28/24/24 and **Dolby** M24 ref. P5 **P.O.A.**
16-track package, 16-track 2in **Cadey** with v/speed and **Chilton** QM1 20/8/16 console with full patchbay **£6,900**

OUTBOARD USED

Delta Lab DL4 Delay Line ref. O1 **£550**
Pro-Audio PA20 2 × 10 band graphic ref. O2 **£150**
Roland Phase Shifter ref. O3 **£199**
Roland Vocoder SVC350 ref. O4 **£335**
Roland SPV355 Guitar Synthesiser ref. O5 **£250**
Ashley SC50 comp/limiter ref. O6 **£175**
Marshall 5002 time modulator ref. O7 **£600**
Audio & Design E900 sweep equaliser ref. O8 **£175**
Audio & Design E560 selective limiter ref. O9 **£600**
Audio & Design F700 mono comp/limiter ref. O10 **£250**
BEL BC3 8TX ref. O11 **£350**
BEL BA40 delay line/flanger ref. O12 **£300**
BEL BF20 stereo flanger ref. O13 **£300**
AKG BX20 stereo reverb ref. O14 **£1,300**
Master Room B reverb ref. O15 **£350**
Teac C2 cassette deck ref. O16 **£250**
Sony U-Matic record/replay ref. O17 **P.O.A.**
PSE spring reverb ref. O18 **£150**
Rebis RA402 parametric equaliser ref. O19 **£300**
Great British Spring ref. O20 **£150**
Teac 19in rack ref. O21 **£55**
Klark Technik DN34 ref. O22 **£600**
DBX 3BX stereo 3-band dynamic range expander ref. O23 **£350**
DBX 2BX stereo 2-band dynamic range expander ref. O24 **£300**
Audio & Design F600 comp/limiters, two linkable units ref. O25 **£150**
Marlux DS200 stereo, **Dolby** B unit ref. O26 **£50**
Dolby B AN80 ref. O27 **£50**
52-way patchbay, 19in rack mounting ref. O28 **£50**
Delta Lab DL1 DDL ref. O29 **£600**
Eventide Instant Flanger ref. O30 **£175**
Fender Tube reverb ref. O31 **£100**
Philips comp/limiters, two units ref. O32 **£375**
Various assorted patchbays (per hole) ref. O33 **£1**
Eventide H910 Harmoniser with extra delay output ref. O34 **£900**
Rebis RA301 stereo comp/limiter ref. O35 **£300**
Eventide H949 Harmoniser ref. O36 **£2,000**
Philips mono reverb ref. O37 **£175**
MXR Stereo compander ref. O38 **£100**
Dolby A M16 ref. O39 **£4,500**
Rebis RA402 St. Para. Eq. ref. O40 **£300**
Orban Parasound dual reverb with E.Q. ref. O41 **£350**
Lexicon PCM41 DDL ref. O42 **£850**
MXR DDL with 2 cards ref. O43 **£500**
Scamp rack and p.s.u., various modules available ref. O44 **P.O.A.**
Ashley SC50 peak comp/limiter ref. O45 **£150**
Audio & Design E900R 4-band sweep E.Q. ref. O46 **P.O.A.**
Turner A500 amp ref. O47 **£350**
Turner A350 amp. 12 available (each) ref. O48 **£300**
Flight-Case containing one set red/green cue lights ref. O49 **£100**
Dolby Flight-Case, will take four Dolby 361 units ref. O50 **£50**
Clark BS10M 5KVA single phase 240 volt generator fitted with Briggs & Stratton engine, very little used ref. O51 **£700**
Master Room XL121 reverb ref. O52 **P.O.A.**
Amity Shroeder stereo record/replay cartridge machine, V.G.C. ref. *53 **£800**
Formula Sound S19GA dual 19-band graphic with built-in analyser, V.G.C. ref. O54 **£700**
BEL BC3 2TJ stereo noise reduction unit, two available (each) ref. O55 **£100**
Crown D60 amp ref. O56 **£150**
Allen & Heath stereo ADT ref. O57 **£99**
Master Room MR3 stereo reverb ref. O58 **£700**
Audio Kinetics XT24 interfaced for M79, two available ref. O59 **£1,200**
Traynor PS600 Power Amp, new ref. O60 **£370**
Roland RE301 ref. O61 **£350**
Pioneer Stereo Tuner SX9000 100 watts per channel ref. O62 **£300**
Pioneer Quad Tuner QX949-A 75 watts per channel ref. O63 **£375**
DBX 155 8-channel Noise Reduction ref. O64 **£470**
Dolby M8XH rack. No cards fitted ref. O65 **£300**
Urie 565 filter set (3 available) (each) ref. O66 **£200**
Allison 65K programmer ref. O67 **£2,200**
Melquist VCA faders (41 available) ref. O68 **£5,500**
Roland GE-810 21-band graphic equalisers (2 available) (each) ref. O69 **£115**
Roland SDD-320. Dimension D ref. O70 **£150**
Roland SIP-301. Bass guitar pre-amp ref. O71 **£105**

USED STEREO MACHINES

Ampex ATR 102, V.G.C. ref. S1 **£3,500**
Ampex AG440C, very good order ref. S13 **£1,200**
Ampex AG440C 4-track, ¼in head block ref. S14 **Offers**
Ferrograph Studio 8 ref. S2 **£800**
Bias 1000 professional mastering machine in console, 2 available, V.G.C. (each) ref. S3 **£600**
Nagra IV D mono, full track ref. S12 **£900 or offers**
Revox A77 3¾/7½ ips, ¼-track ref. S4 **£450**
Revox B77 3¾/7½ ips, ¼-track ref. S5 **£450**
Revox A700 ref. S6 **P.O.A.**
Revox B77 7½/15 i.p.s., ½-track ref. S11 **£450**
Revox A77 7½/15 i.p.s., ½-track ref. S7 **£400**
Studer A62 ref. S8 **£500**
Teac A6100 2-track ref. S9 **£350**
Teac A7300 2-track ref. S10 **£500**

USED SPEAKERS

Cadac Power House monitors ref. SP1 **Offers**
Empty **Lockwood** cabs. To take 10in Tannoy drivers (pair) ref. SP2 **£150**
Electro-Voice EV Century 3,3-way, 150 watts, V.G.C. (pair) ref. SP3 **£1,100**
Griffin Studio Electronic 85 studio monitors with internal 250 watt power amps (pair) ref. SP4 **£500**
Lockwood cabs, each with 2 × Tannoy 15in reds (pair) ref. SP5 **£600**
Lockwood Majors, fitted 15in Tannoy HPD (pair) ref. SP6 **£500**
Lockwood Academies, fitted 15in Tannoy Super Reds (pair) ref. SP7 **£750**
Tannoy Buckinghams (pair) ref. SP8 **£1,000**
Tannoy 15in Golds in Custom Cabs (pair) ref. SP19 **£350**
Tannoy Ardens (pair) ref. SP9 **£425**
Tannoy Lancasters, corner mounting (pair) ref. SP10 **£250**
Tannoy Cheviots (pair) ref. SP11 **£350**
JBL 4313 (pair) ref. SP12 **£400**
JBL 4311, 2 pairs available (pair) ref. SP13 **£450**
JBL E140 (pair) ref. SP20 **£160**
JBL 2482 Compression drivers with JBL horn and crinkle plate ref. SP21 **Offers**
Electro-Voice EV15B (pair) ref. SP22 **£140**
Eastlake Monitors, each fitted 2 × Tad 15in bass drivers, JBL 2440 ref. SP20 **£1,500**
Eastlake monitor system with 1 pair White graphics and 2 Amcron DC300A amps ref. SP14 **£2,500**
JBL 4502 ref. SP15 **P.O.A.**
Tannoy SRM12X ref. SP16 **£450**
Leek 3000 series ref. SP17 **£150**
Lockwood cabinets fitted with Tannoy Super Reds plus Tannoy active x/over and spare driver, very good condition. An ideal monitoring system ref. SP18 **£1,800**

CASSETTE DUPLICATION PLANT USED

2 Asona 1-16 ¾in master machines, one 1979, one 1980. 10 sets of 3 Asona slaves, 30 in total. 12 King cassette winders type 760, purchased 79/80. 12 spare splicers, spare prints and test card **£55,000**

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COMPLETE STUDIO WITH HOUSE IN S. WALES **P.O.A.**
FREEHOLD STUDIO BUILDING IN SOUTH LONDON AREA. A self-contained building in the Croydon area housing a well designed studio and control room. Completely detached **£26,000**
16-TRACK STUDIO IN THE WEST END available end of December. Studio area approx 40' × 15', Control Room 15' x 12'. Further office area over 900 square feet, on two floors. Fully carpeted throughout. Lease expires June '87. Renewal likely. Fully equipped. Would suit small Record Company or Video Production Company requiring offices facilities. ref. ST3 **£35,000**

WE ALSO HAVE A LIMITED RANGE OF USED KEYBOARDS AND OTHER INSTRUMENTS ALONG WITH SOME P.A. EQUIPMENT.

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TAC 10/2 in f/case, unused ref. MC32 **£900**

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The Professional Revox.

The PR99 has been developed from the highly successful B77 in order to meet the stringent demands of the recording and broadcasting industries. The PR99 offers the professional these important features:

1 Raised deck plate for easier editing
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The Revox PR99 is available in several versions: mono or stereo 3¾/7½ ips NAB or 7½/15 ips NAB or IEC. And being built to Studer precision, the PR99 achieves exceptional performance and reliability but now at an easily affordable price.

For more information on the PR99 phone or write for a catalogue.

STUDER REVOX

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A flexible mixing system offering a wide selection of different modules for two or four group operation. The MXT-1000 is designed mainly for broadcasters and is used widely in Radio, and Television studios and outside broadcast vehicles, where full broadcast standards are required.

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INTERNATIONAL AG
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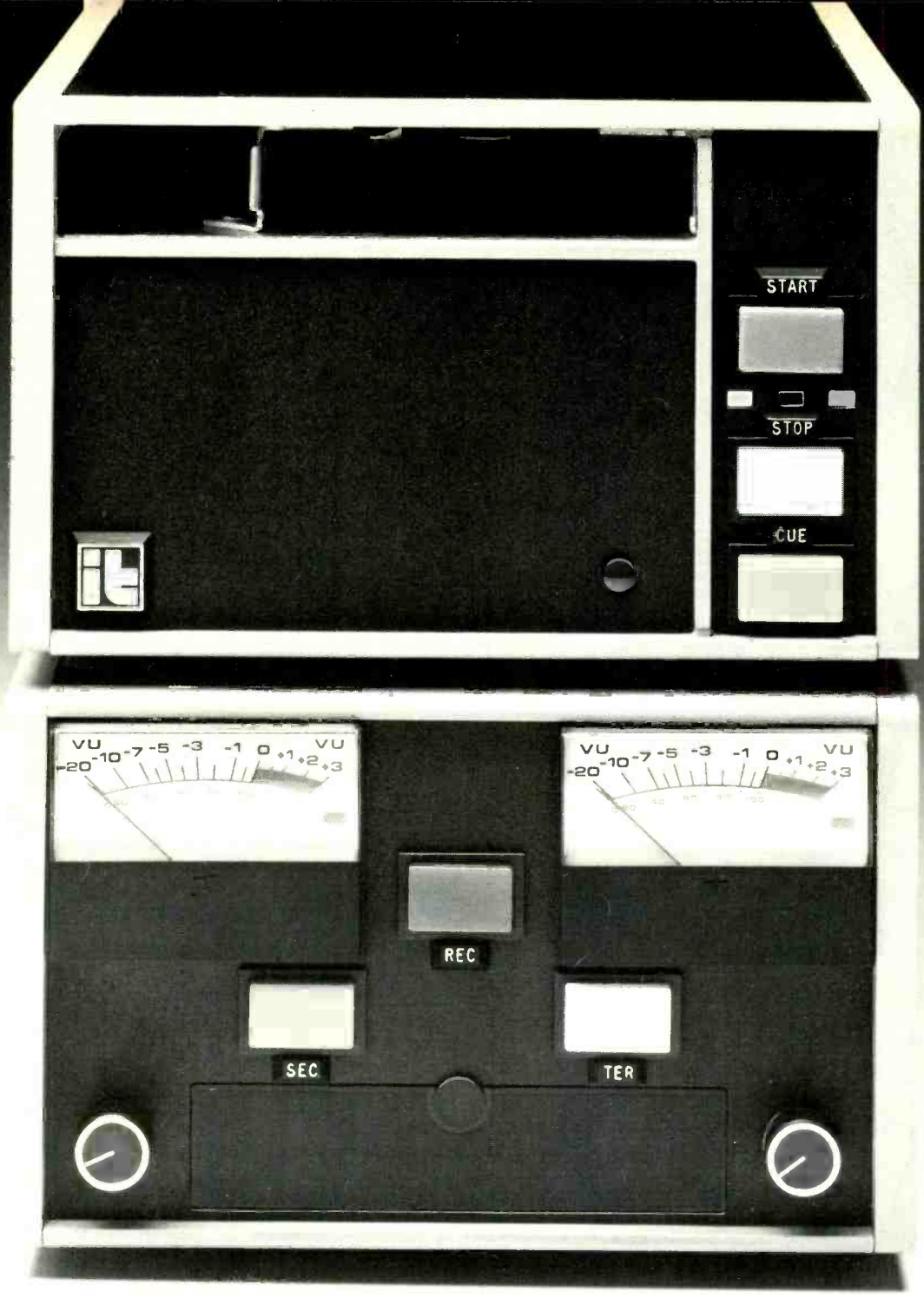

THE NEW ITC 99B IS MORE THAN JUST ONE GREAT IDEA ON TOP OF ANOTHER.

When the microprocessor-controlled ITC 99 was introduced three years ago, it represented a new generation of cartridge machines capable of producing reel-to-reel performance. Numerous mechanical and electronic innovations ensured the highest sound quality, improved operator convenience and much simplified maintenance.

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Ideal where the highest fidelity is essential, Calrec microphones offer the assurance of quality, reliability and economy, and include the famous Soundfield, the latest in microphone development, designed to give the recording engineer and producer unprecedented freedom and flexibility of microphone technique.

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CALREC

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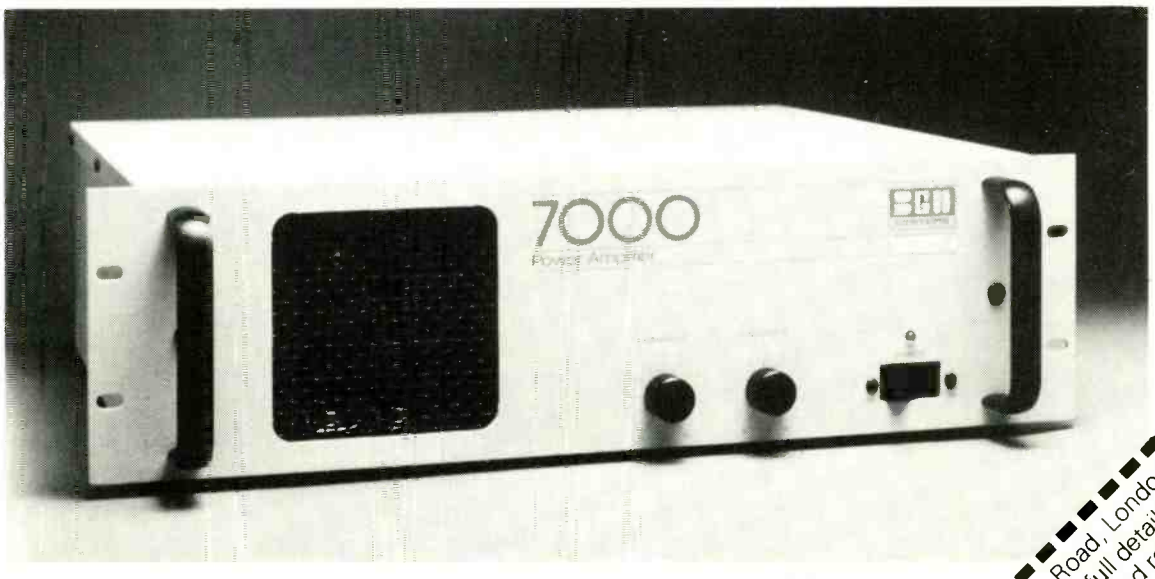

If you demand the kind of performance and reliability essential for live entertainment or recording/broadcast monitoring, yet require a more cost-effective alternative, the Model 7000 is the logical choice.

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The image builders.

PCM41 and Prime Time: Lexicon digital delay systems that enable recording artists and live performers to explore new dimensions in sound.

The Lexicon PCM41, developed from the Prime Time, offers a complete repertoire of effects; such as automatic double tracking, flanging, slap echo, infinite repeat, doppler pitch shift and many others. Its ease of control makes it ideal for on-stage use where dramatic sounds can be created with studio precision.

The Lexicon Prime Time is a real sound builder. It makes studio enhancement 'live' and, offering an integral input and output mixer on two outputs, it is central to the stage performance of many top musicians.

Lexicon digital delay systems are used throughout the world in concert halls, auditoriums and stadiums. Lexicon creates clean musical effects to enhance performance and open up new dimensions in sound.

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One of You Will buy one of These This month

This month, eight new twenty four track recorders will be sold in Britain.

About half will be used for broadcast. A few will update existing studios, and the rest will go into brand new ventures.

Those are the facts which we uncovered for Otari when they invited us to become the alternative source for their remarkable twenty four track machine.

It challenges the most established brand names in the industry, in features, performance and not least price.

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If you're ready for twenty four track, call Garry or Andrew now on 01-440 9221.

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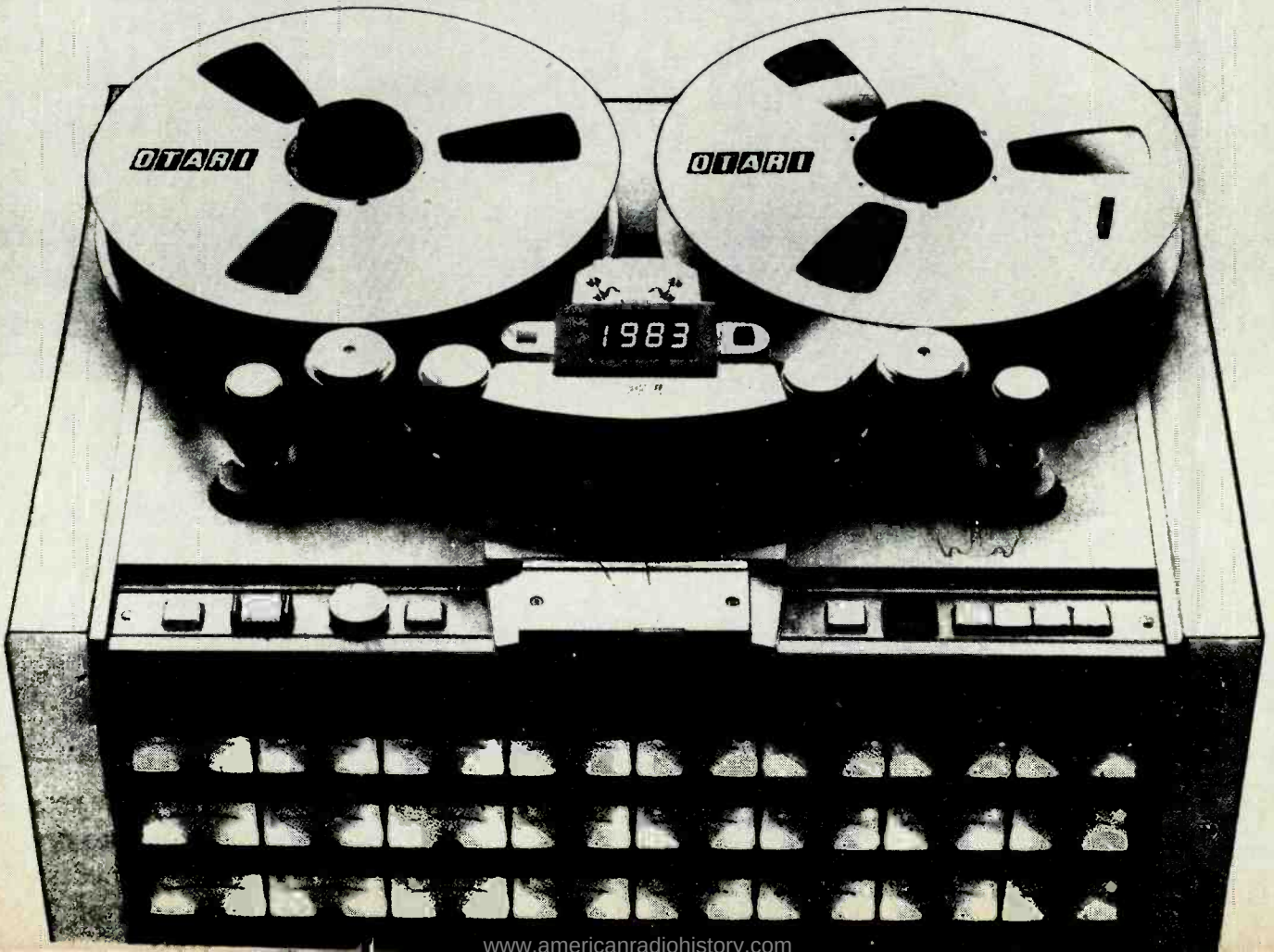

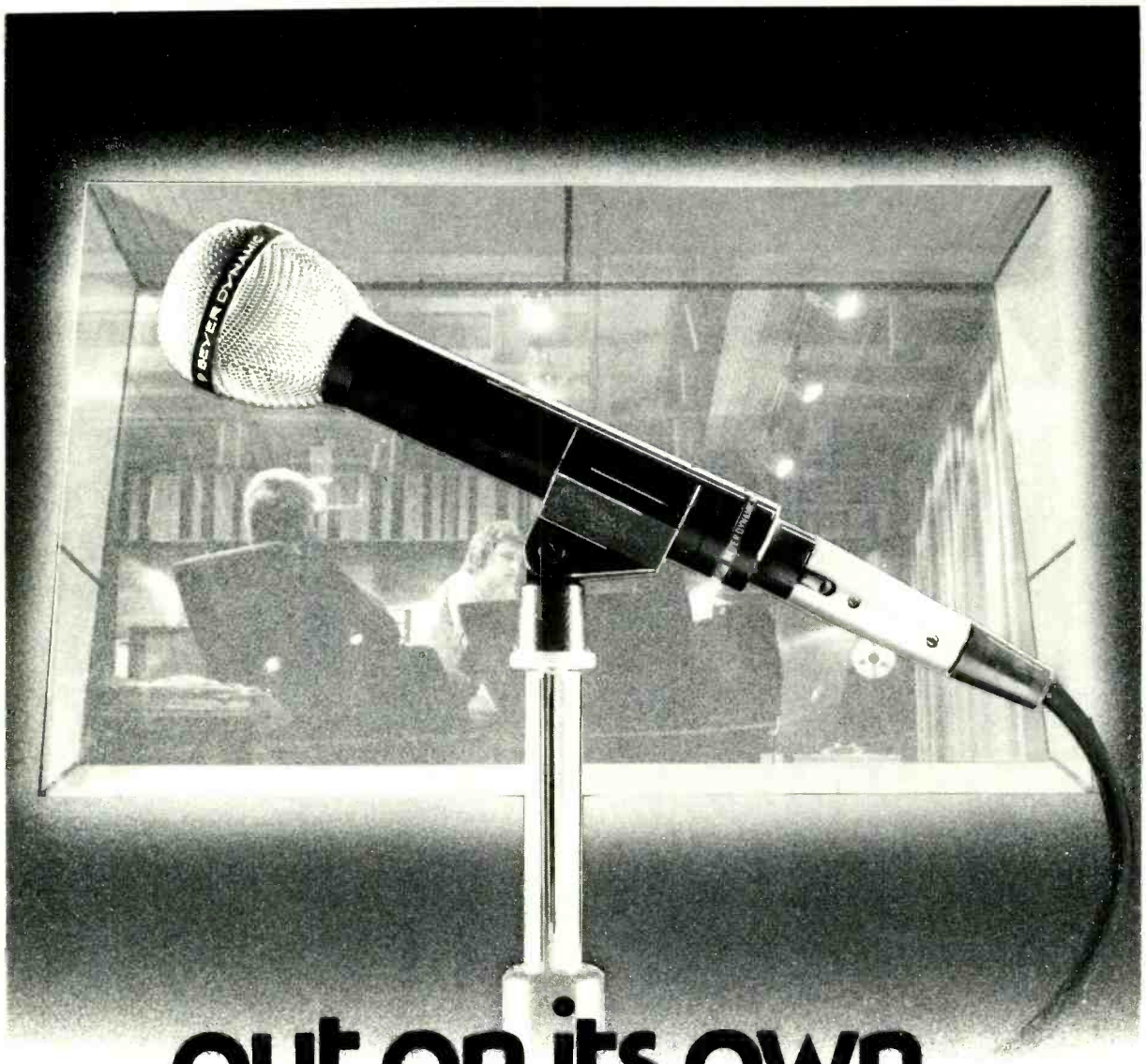

out on its own

The Beyer Dynamic M-88 – one of the world's outstanding microphones. Top of the Beyer Dynamic moving coil line, it combines high quality with toughness reliability, and range.

It has the performance of a highly specialised microphone and the flexibility of a multi-purpose one.

The M-88 enjoys enviable popularity among musicians and studio engineers, but its reputation is well-deserved. The front to back ratio reduces feedback to an absolute minimum. There is an excellent frequency response curve over the range of 30--20,000 Hz, with unusually high sensitivity. The audio characteristics and the robust, heat- and damp-resistant construction make the M-88 ideal for indoor and outdoor recording of vocals and instruments.

Do you prefer to work with professionals? Choose the Beyer Dynamic M-88 and find out why it's the choice of recording studios all over the world.

beyer dynamic

Beyer Dynamic (GB) Ltd, 1 Clair Rd., Haywards Heath, Sussex RH16 3DP. Tel: (04444) 451003

24 Track + Remote + 1600 Series 24 by 8 by 16 = £15,200
As above but 24 by 8 by 24, patchbay, stand = £16,600
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And of course the deal.

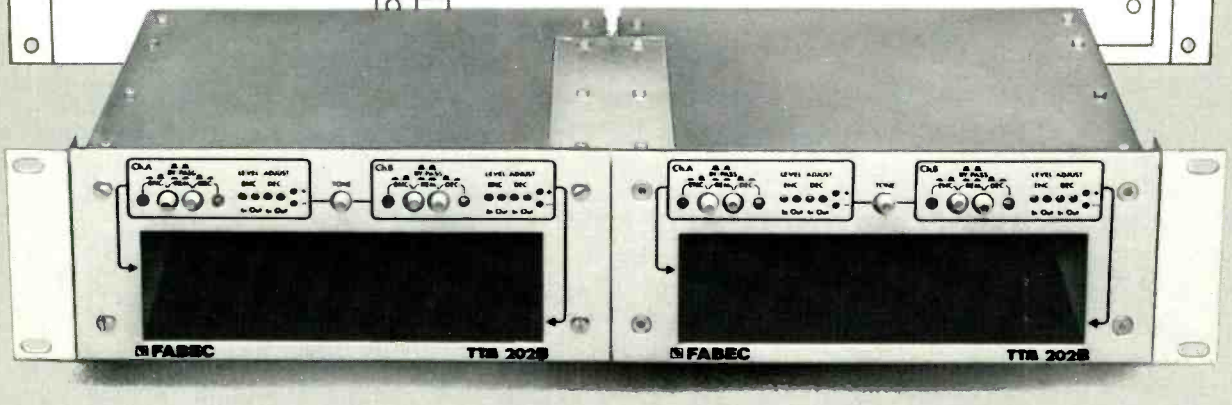
Because as well as the same price as buying the package direct, we'll offer the best deal we can for anything else you need to get your system up and running. Total savings buying this way can be dramatic.

In fact, we're so eager for your business, that if you only want the boxes, with a little arm twisting, we'll throw in the chair.

For more information on the Producer systems, call Andrew or Garry now on 440 9221.

Announcing a size reduction in noise reduction.

TTM 202B.



Your noise reduction frame is doing half the job it should—

In twice the space necessary!

But don't feel bad. Everybody had the same problem—until now.

Until the introduction of the TTM 202B.

For both the recording and broadcasting industries—where rack space is often a problem—this remarkable unit offers a happy solution:

The TTM 202B takes up no more than half the space of the system you're now using. Whichever system it is.

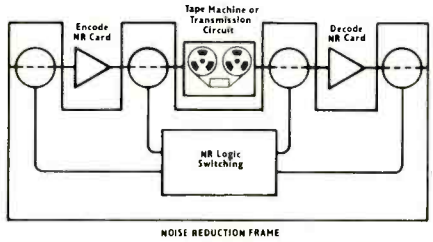
And regardless of your present system, it also lacks our unit's flexibility: TTM 202B—and *only* TTM 202B—takes all types of N.R. cards. Now you can switch or upgrade your noise reduction system anytime you wish—perhaps to Telefunken's fabulous telcom® system.

Other advantages? See the box on this page. And also check the diagram—a good reminder that your signal is actually processed four different times within the frame.

This means you *must* have a frame that performs faultlessly. With any kind of card.* And without using too much space.

Now you can have all this. In the TTM 202B.

Ask for the facts today—and we'll prove it.

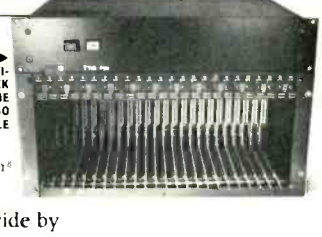


NOISE REDUCTION FRAME

Each signal is processed at four points within your frame—four times when it may be colored and distorted. The same signal passes through the tape only once and the noise reduction card twice—making your frame a crucial factor to your success!

Ours	Theirs
• 4 Channels of noise reduction in 3½ inches of rack space.	• 2 Channels of noise reduction in 3½ inches of rack space.
• Active balanced line inputs and outputs.	• Transformer coupled line inputs and outputs.
• Separate calibration adjustments for input/output levels in both encode and decode modes.	• Common calibration adjustments for encode and decode.
• Led alignment indicators with ±¼ dB accuracy.	• Alignment meter with parallax.
• Timing circuits for thump and click suppression during mode switching.	

*You can, of course, buy Dolby® or telcom® cards, alone, without their frames.



TTM▶ MULTI-TRACK FRAME ALSO AVAILABLE

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MUSIC LAB HIRE RATE CARD

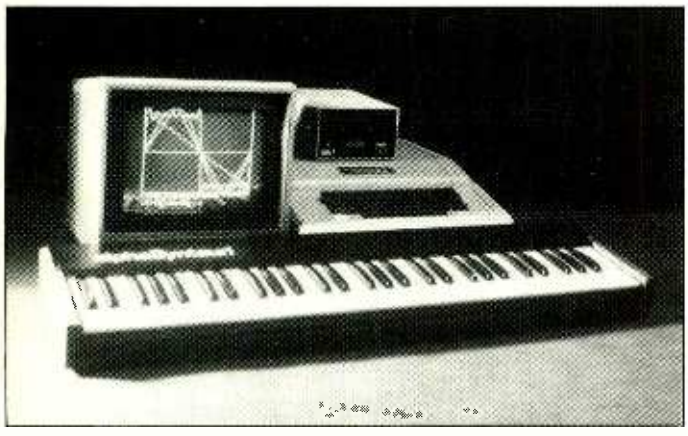
		Day	Week
TAPE RECORDERS			
UHER 4200 REPORT	Portable AC/DC, 4 Speed	8	32
REVOX B77	2 Track, 7½/15ips + Varispeed	10	40
REVOX PR99	2 Track, 7½/15ips, Balanced	15	60
STUDER B67	2 Track, 7½/15/30ips, Balanced	30	120
TEAC 3440	4 Track, 7½/15ips	15	60
TASCAM 80-8	8 Track ½", 15ips + DBX	30	120
SOUNDCRAFT 381-8	8 Track 1", 15ips	50	200
TASCAM 85-16	16 Track 1", 15ips + DBX	100	400
SOUNDCRAFT 762-16	16 Track 2", 15/30ips	125	500
CASSETTE RECORDERS			
SONY TCD 5	Portable AC/DC, Balanced mic inputs	8	32
JVC KD 720	Stereo	4	16
TASCAM 122	Professional stereo, 2 speed	8	32
TASCAM 133AV	Stereo + cue track	8	32
TASCAM 244	4 Channel multi-track	10	40
MIXERS			
ALICE 828	8 into 2	10	40
ALICE 12-28	12 into 2	15	60
SOUNDCRAFT 1S	16 into 2	25	100
TEAC 2A	6 into 4	5	20
TEAC M35	8 into 4	15	60
ALLEN & HEATH 16.4.2.	16 into 4 into 2	15	60
SOUNDCRAFT 800	20 into 8 into 2	50	200
NOISE REDUCTION			
DOLBY 361	Single channel Dolby A	12	48
DBX 150	2 channel simultaneous	6	24
TEAC RX9	4 channel (For TEAC 3440)	8	32
BEL BC3/8T	8 channel simultaneous	15	60
REVERBERATION			
LEXICON 224X	Digital, 13 Program, 15kHz Bandwidth	100	400
LEXICON 224	Digital, 9 Program, 10kHz Bandwidth	75	300
MASTER ROOM XL305T	2 channel Spring	20	80
DIGITAL DELAY			
AMS DMX15/80S	2 channel + pitch change	50	200
LEXICON PCM 41	Effects processor	20	80
DELTA LAB	Effects processor	15	60
SPECIAL EFFECTS			
BEL BF20	Stereo Flanger	10	40
MXR PITCH TRANSPOSER	Harmoniser ± 1 octave	15	60
ROLAND SPACE ECHO	Tape delay/reverb	8	32
COMPRESSOR-LIMITERS/NOISE GATES			
DBX 160X	Single channel	5	20
DBX 165	Single channel "Over Easy"	8	32
KEEPEX NOISE GATE		8	32
AUDIO + DESIGN	Vocal Stresser	20	80
DRUM COMPUTERS			
LINN LM1	Programmable digital drums	45	180
LINN LM2	Programmable digital drums	45	180
ROLAND TR808	Programmable	15	60
EQUALISERS			
KLARK TEKNIK DN 22	2 x 11 Band graphic	10	40
KLARK TEKNIK DN 27	1 x 27 Band graphic	10	40
MXR	1 x 31 Band graphic	8	32
ORBAN 622B	Stereo parametric 4 Band	12	48

		Day	Week
AMPLIFIERS			
AMCRON D75	50w per channel	5	20
AMCRON D150	95w per channel	8	32
AMCRON D300	180w per channel	12	48
BOSE 1800	250w per channel	12	48
QUAD 405	75w per channel	5	20
MIXER AMPLIFIER			
BOSE PM 2	6 channel mic/line, 400w	20	80
LOUDSPEAKERS			
BOSE 402		10	40
BOSE 802		10	40
TANNOY SUPER REDS		12	48
BOSE STANDS		2	8
CONDENSER MICROPHONES			
AKG C451/CK1		3	12
AKG C451/CK8		4	16
AKG C451/CK9		6	24
AKG C414		10	40
NEUMANN KM84		5	20
NEUMANN U47		10	40
NEUMANN U87		10	40
DYNAMIC MICROPHONES			
AKG D12		2.50	10
SHURE SM 57		2.50	10
SHURE SM 58		2.50	10
SENNHEISER 421		2.50	10
SENNHEISER 441		2.50	10
ELECTROVOICE RE 20		6	24
MICROPHONE SUNDRIES			
AKG VR1	18" extension tube (C451)	1	4
AKG VR2	36" extension tube (C451)	3	12
AKG B46	Battery power supply	1	4
AKG 2 Way Phantom Power supply		2	8
AKG 6 Way Phantom Power supply		4	16
BEYER upright/boom stand		1	4
BSS active D.I. Box		1.50	6
PSE passive D.I. Box		1	4
MICROPHONE COMBINER/SPLITTER		1	4
HEADPHONE SPLITTER BOX		1	4
BEYER DT 100 Headphones		1	4
STAGE BOX 12 INPUTS		10	40
STAGE BOX 24 INPUTS		15	60
VIDEO EQUIPMENT			
SONY 2630	U-Matic Record/Playback	25	100
JVC VHS	Triple Standard Record/Playback	25	100
JVC VHS	PAL Record/Playback	15	60
SONY BETAMAX	PAL Record/Playback	15	60
SONY MONITOR	26" Triple Standard	25	100
SONY 7210	72" Projector screen	75	300

Rates are quoted EXCLUSIVE of VAT

Contact MUSIC LAB HIRE LTD, 76 Eversholt Street, London NW1 Tel: 387 9356

diary



alphaSyntauri at Abbey Road

Syntauri Corporation recently held a presentation of their new range of digital synthesiser systems at Abbey Road Studios. The function was not only to show off the latest software and hardware additions to the *alphaSyntauri* synthesiser systems, but also to announce that Personal Computers Ltd no longer held the sole UK franchise for Syntauri products, and this was further emphasised by the fact that Topmark Computers (one of the country's most established small computer companies) were co-sponsoring the event. Topmark are now just one of several importers handling these instruments, however, with experienced salesman Tom Piercey and salesman/musician Geoff Twigg on the case Topmark will probably come out the main Syntauri dealers for the UK.

Syntauri Inc were founded officially in February 1981; however, the first *alphaSyntauri* keyboard synthesiser was shipped in December 1981. All the *alphaSyntauri* instruments utilise the *Apple II* computer and Mountain Computer Inc's *MusicSystem*, and are keyboard (musical) based. Syntauri now offer five basic systems: the Studio *Pro*—with 5-octave velocity sensing keyboard, footpedals and *Metatrak, alphaPlus* and *Sounds Trio* software; *Pro 5*—with 5-octave keyboard (velocity sensing), footpedals, *SuperPlus* and *alphaPlus* software; the *Entertainer*—a 4-octave keyboard, footpedals, *SuperPlus* and *alphaPlus* software; the *Student*—4-octave keyboard, *alphaPlus* and *MusicMaster I* software; and *Music Lab* (available for accredited music schools at a special price)—4-octave keyboard, footpedals, *SuperPlus, alphaPlus* and *MusicMaster I* software. US prices for these systems (excluding the *Apple* computer) range up to $2,000 for the *Studio Pro*.

The abovementioned *Metatrak* is the most recent software update to the range and it offers the musician the equivalent of a 16-track digital tape machine, with all the editing, sequencing and speed variation (1-800%) benefits such a system brings. The nice thing about an *alphaSyntauri* synthesiser is that at present it can keep up with technology. New software disks are continuing to be released by Syntauri providing instrument owners with greater 'musical' power; however, the time will eventually come (some say it has already) when the *Apple II* is no longer *the* computer, and that 16- or 32-bit machines are the order of the day—then the *alphaSyntauri* will require more than just software updates.

Ellen Lapham, the president and founder of the Syntauri Corporation, was in attendance at Abbey Road, and she seemed more than delighted with the attendance and interest shown in her/Syntauri's products. The *alphaSyntauri* isn't up with the Fairlights of this world in terms of performance but, as Ellen pointed out, there is no other system offering anything like the facilities of the *alphaSyntauri* at anywhere near the cost. We look forward to hearing more from Syntauri Inc.

David Crombie

Tannoy buys Tresham

Tannoy have announced that they have acquired the assets—plant and equipment—of Tresham Audio Ltd from the receivers of Tresham. Based in Peterborough, Tresham were manufacturers of a range of power amplifiers as well as a number of other associated items.

Chairman of Tannoy, Mr NJ Crocker, has said that they intend to start production of the amplifiers at the Coatbridge, Strathclyde plant of Tannoy early in 1983 and market them through a new subsidiary company, Tannoy Tresham Ltd. Mark Westley, the former engineering director at Tresham, will be joining the new company.

Tannoy Ltd, Rosehall Industrial Estate, Coatbridge, Strathclyde, Scotland ML5 4TF. Phone: 0236 20199. Telex: 778621.

MCI/Sony for Melodiya

Melodiya, the Soviet state recording company, has recently acquired an MCI-equipped 32 ft remote recording truck. The unit will be used for location recording of popular, classical and ethnic music.

The truck itself was designed and built in the UK by Clyde Electronics, and features full acoustic treatment, static-free carpeting and an overhead ancillary equipment bay. The truck includes a kitchen plus a room for the installation of video recording facilities.

MCI/Sony gear on the truck includes 24-track recorder and console plus two MCI stereo machines.

In fact the truck was not designed specifically for the Soviet record company: it was exhibited and demonstrated there, where it received immediate approval. The Soviet engineers were so impressed that they would not let it go home, and negotiated a sale on the spot.

Swiss Sound from Studer

Swiss Sound is the title of a new publication produced in several languages by the Studer-Revox group in Switzerland. The magazine is intended to 'intensify communication with representatives abroad, with our affiliated companies and with our customers and business friends' and it looks like providing a useful insight into what this important manufacturer is doing on a regular basis. The first issue of this well-produced 8-page magazine includes data on the development of the new *A810*; a report on the Montreux 71st AES Convention and the NAB Convention in Dallas; and a piece by Dr Roger Lagadec on digital recording and the approach towards standards. Further details on receiving the publication may be obtained from *Swiss Sound*, Studer-Revox public relations, Althardstrasse 10, CH-8105 Regensdorf, Switzerland (note the different address) or from your local Studer agent.

Magnetic recording museum

At last, someone is doing something to acquire ancient and modern magnetic recorders in addition to organising a history of magnetic recording. The organisation involved is Ampex (why isn't EMI doing something like this?) and the hope is to research post-war magnetic recording in the USA and Europe before it's too late.

The man behind it all is Peter Hammar, curator of the Museum and Archives of Magnetic Recording, c/o Ampex Corporation, 401 Broadway, Redwood City, California 94063, phone: (415) 367-3127. Peter Hammar is a great enthusiast and welcomes visitors, but you should give him a call first.

While Hammar has assembled machines ranging from Poulsen's *Telegraphone* to the Ampex *ATR-100* and much from American recording history, he is lacking data on UK post-war developments. If you have any useful information on this subject, please drop him a line at the above address. You might also copy *Studio Sound* in on anything you send, incidentally, as it may be useful for our forthcoming series on recording in the UK (see *Diary*, January 1983).

Hugh Ford, whom we thank for passing on this information, points out that many people involved in these developments will not be accessible for ever, and that it will soon be too late to archive this fascinating history.

Product data from Studer

Three Product Information booklets on Studer PCM equipment are now available from Studer distributors. On the cover of each tastefully-bound A4 booklet is a reproduction of the first page of Liebnitz's 1679 treatise on binary, *De Progressione Dyadica* and each book covers one of the three major PCM products from Studer, namely the *A808* PCM recorder, *SFC16* Sampling Frequency Converter and the *DAD16* Digital Preview Unit.

Free Ampex with Fostex

Following the agreement with Studer, Ampex have come to a similar arrangement with the Fostex Corporation on a worldwide basis.

A free reel of Ampex *457 Grand Master*, a tape especially designed to complement the Fostex range of recorders and incorporating green leader and red trailer plus a self-adhesive reel label, will be supplied with each Fostex recorder. Each Fostex recorder will be set up for the new tape. The agreement runs for one year from November 1982.

Address correction

In the Mixing Consoles product guide we inadvertently gave an old address for Enertec.

The correct new address is 1 Rue Nieuport, 78140 Velizy-Villacoublay, France. Phone: 946.96.50. Telex: 697430. Our apologies for any inconvenience this may have caused.

New source for Travis fader

The Travis digital attenuator and automation system, previously handled by Sphere Electronics of Chatsworth, California, is now available from a new source. We have no information as yet, but further details may be obtained from **Orion Recording, 636 Baker Street, Costa Mesa, California 92626. Phone: (714) 546-5718.** ■

dbx

Quietly successful with dbx
(from around £200)

If you're committed to making it in the pro world, give yourself some professional advantages – like dbx noise reduction.

The new dbx 150 gives your tape machine the dynamic range of digital perfect drop-ins and de-coded monitor output without special switching. Rack mounting 1¾ inch slimline package means easy upgrading from 2 to 4 to 16 to 24 tracks.

Also in this format the new dbx 140 provides two channels of type II encoding and decoding, usable separately or simultaneously for use with cart machines and transmission lines to give a full 40 dB increase in dynamic range.

SSE

Scenic Sounds Equipment Ltd
97-99 Dean Street
London W1V 5RA
Telephone: 01-734 2812/3/4/5
Telex: 27 939 SCENIC G

France	**3M France SA, Mincom Div.** Boulevard de l'Oise, 95000 Cergy Tel: Paris 749 0275
Holland	**Special Audio Products BV** Scheldeplein 18, Amsterdam Tel: Amsterdam 797055
Sweden	**Tal & Ton Musik & Electronic AB** Kaempegatan 16, S411-04 Gothenburg Tel: 803 620
Spain	**Mike Llewelyn-Jones** Francisco de Rojas 9, 2 DER, 9 Madrid 10 Tel: Madrid 445 1301
Germany	**Audio Vertrieb Peter Strüven GmbH** Hamburg Tel: Hamburg 5245151
Italy	**Scientel Audio SPRL.** Via Venturi 70, 41100 Moderna. Tel: 059 225608
Norway	**LydRommet** St Olavsgate 27, Oslo 1 Tel: 02 1140 85

new products

Otari expand range

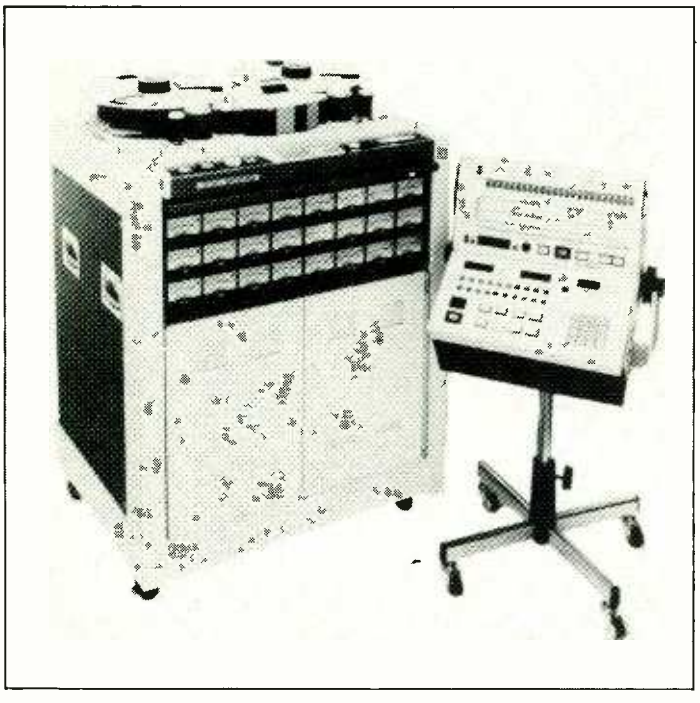
New from Otari are a range of enhancements to their existing line of tape recorders. These include a new ¼ in stereo machine, the *5050B-II*, which replaces the earlier *5050B* at the same price. Also available is a ½ in version of the *MTR-10* 2-track, plus an 8-track version of the *MTR-90 Series II*.

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

UK: Otari Electric (UK) Ltd, Herschel Industrial Centre, Church Street, Slough SL1 1EL, Berkshire. Phone: 0753 38261. Telex: 849453 Otari G.

USA: Otari Corporation, 2 Davis Drive, Belmont, California 94002. Phone: (415) 592 8311. Telex: 910-376-4890.

MTR-90 series II



New EXR Exciter

Unveiled at the Anaheim AES was a new model of the EXR *Exciter* series, the *EX IV*. This unit offers continuously variable notch positioning, to allow the unit to be used anywhere in the audio spectrum. A switch is provided for 0/–20 dB input/output level to improve the S/N at low operating levels, or to allow the unit to be used at both line and mike levels, while adjustable noise gating with threshold and release controls allows processing of noisy signals. An adjustable limiter is also incorporated. The *EX IV* incorporates balanced *XLR*s and new expanded bar-graph metering.

EXR Corporation, 3373 Oak Knoll Drive, Brighton, Michigan 48116. Phone: (313) 227-6122.

UK: Turnkey, 8 East Barnet Road, New Barnet, Hertfordshire EN4 8RW. Phone: 01-440 9221. Telex: 25769.

Fostex ancillaries

New from Fostex is the Model *3010* normalled patchbay, featuring 16 pairs of RCA-style phono sockets enclosed in a steel chassis for RFI protection. The bay will also pass video signals up to 4.5 MHz. Suitable heavy-duty 4-way phono cables are also available.

Also new to the world are the *3070* 2-channel comp/limiter and *3180* stereo reverb unit. The former incorporates a 200 kHz PWM VCA switching system and offers ratios from 1:1 through infinity; 0.2-20 ms attack time; 50 ms-2 s release time; LED gain reduction display; noise gate with independent threshold; and dual mono/linked stereo modes. The *3180* features three springs per channel and has a novel 'first reflection' circuit providing 24 ms minimum delay and increased diffusion.

Fostex Corporation, 512 Miyazawacho, Akishima, Tokyo 196, Japan. Phone: 0425 456111. Telex: 2842203.

UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Hertfordshire EN4 8RW. Phone: 01-440 9221. Telex: 25769.

USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, California 90650.

MXR introduce new effects

Two new units have been added to the MXR Professional Products range: the *Model 174* Pitch-shift Doubler and the *Model 175* Digital Time Delay.

The *Model 174* offers 20 kHz frequency response, with 88 dB of dynamic range. Pitch shift is continuously variable to 3% (¼ step) up or down. A mix control blends dry and processed signals. Signal status is monitored by a dual-colour LED which indicates signal present (green) or overload (red), and stereo outputs are provided. A regeneration control is incorporated.

The *Model 175* is a cost-effective digital delay offering 0.31 to 320 ms delay, selected with pushbuttons. In addition, a knob varies the preset delay between x1 and x0.25. The delay time may also be modified with an internal oscillator whose modulation effect is controllable in speed (0.1 to 10 Hz) and width (4:1 range) and has a sine waveform. Dry/effect mix and regeneration controls are provided and the unit has stereo outputs.

MXR Professional Products Group, MXR Innovations Inc, 740 Driving Park Avenue, Rochester, New York 14613. Phone: (716) 254-2910.

UK: Atlantex Music, 1 Wallace Way, Hitchin, Hertfordshire SG4 0SE. Phone: (0462) 31511.

ICC returns

The International Consoles Corporation, designers of the unique and original *3000* series modular recording console, are back in the field again after working away at a new design for some months.

Having decided that the *3000*, whilst ingenious, was too expensive to compete effectively in a difficult market, the many excellent features of the console have been incorporated in a new design, the *Model 9000*, which, unlike the original design, is based on a single channel strip. The new design gives increased flexibility at about a third of the cost of the earlier model, a cabinet with PSUs being $5,000 and each channel being $1,666, automation-ready. This makes a typical 24-channel console work out at about $45,000. In addition, there is a financing arrangement which covers 50% of the console price. The facilities are similar to the earlier unit (see August 1981 *Studio Sound*) with the addition of a number of functions including a custom-designed VCA system. Full details are available from ICC.

The outfit also has a new address, from which various audio-related activities will be carried on, including pro-audio sales, manufacturing, OEM design and manufacture, audio consultation, studio construction, 24-track recording, production, publishing and record company activities.

Sun Valley Audio/International Consoles Corporation, PO Box 388, Sun Valley, Idaho 83353. The telephone number remains **(801) 377-9044** for the time being.

Loft test set

For a suggested retail price of a mere $299, LofTech will supply a neat little test-set, the *TS-1*. The compact, mains-powered unit incorporates a single range oscillator covering the whole audio band (with very little variation in level over the range) and a handy frequency/level meter, the latter reading down to —40 dB (ref 0.775 V). The LED display is auto-ranging on frequency. With no external connections, the meter reads the oscillator output, which it still does if an output is taken from the oscillator. Only plugging an external source into the meter defeats the normalling, a useful feature.

A comprehensive manual supplied with the unit gives the best introduction to lineup of an audio system, pro or otherwise, that we have seen for some time.

Phoenix Audio Laboratory Inc, 91 Elm Street, Manchester, Connecticut 06040. Phone: (203) 649-1199.

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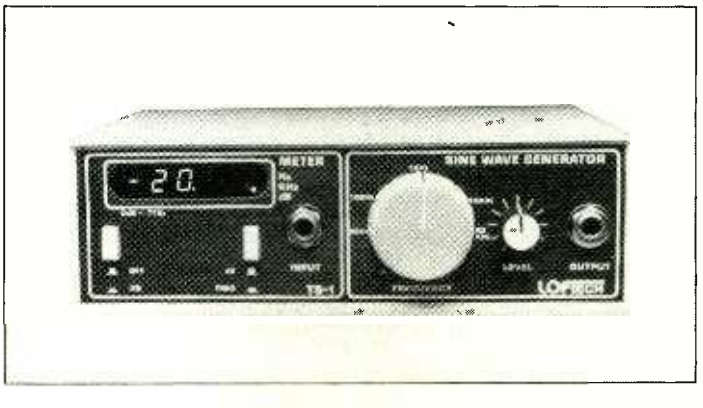
LofTech TS-1



How to get the most mileage out of our three year warranty.

Rest assured. If anything goes wrong with your Amcron power amplifier within three years of purchase, we'll fix it or replace it. But the odds are it'll continue to function sweetly and smoothly into the twenty-first century without so much as a hitch or a hiccup. And our warranty will be ancient history.

For, over the years, Amcron has earned a reputation for peerless engineering. Each of a range of professional power amplifiers represents a near-perfect synthesis of reliability and sonic precision, whether it was conceived for use in sound reinforcement, the studio, the theatre, in broadcast, or any of a host of industrial applications.

The D75, for instance, sets an impeccable standard at the lower output end of the range, with its 50 watts per channel into eight ohms, balanced and unbalanced inputs, front panel controls and patent Amcron IOC indicators.

The high-powered PSA2 is the acknowledged first choice for critical applications in studio monitoring and sound reinforcement, with its high-power output, fast slewing rate and sophisticated design.

Together, the Series II D150A and DC300A represent the standard against which all general-purpose power amplifiers must be measured in terms of sound quality, versatility and sheer cost-effectiveness.

And new developments like the PS200 and PS400 with their Multi-Mode Circuitry™ are dramatic testimony to Amcron's continuing ability to turn radical new technology into rugged and practical hardware.

For further information on the world-renowned range of Amcron power amplifiers, just give Ian Jones a call on 01-961 3295.

Amcron

FROM HHB

HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

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new products

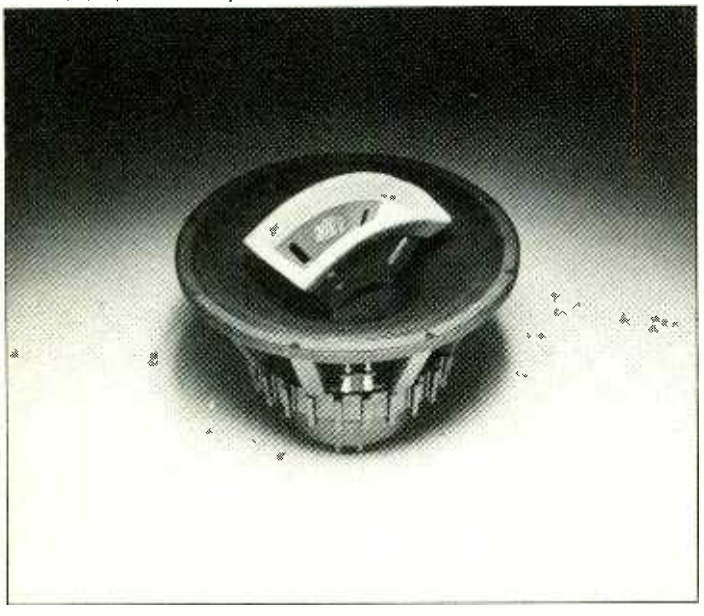
New monitor from UREI

Along with a new club/disco mixer and a pair of broadcast consoles (see our sister magazine *Broadcast Sound* for details), UREI also utilised the Anaheim AES to unveil an updated version of their *813* Time-Aligned monitor system. Dubbed the *813B*, the new system features a new, retrofittable proprietary coaxial driver, the *801B*, developed by UREI engineers. The new transducer uses state-of-the-art materials and manufacturing techniques to double the power handling and sensitivity of the previous *813A* system giving 6 dB greater ear-bending capability and an extra ⅓-octave at the top end. Shadow slots are incorporated in the driver to eliminate midrange shadowing effects common with coaxial drivers, while the unique HF horn and diffraction buffer—in distinctive blue—are retained. In addition, the *813B* includes a BNC connector for interfacing with UREI's power-amp *Conductor Compensator* system which extends a feedback loop to the speaker, to eliminate transient overshoot and other cable-related problems.

UREI, 8460 San Fernando Road, Sun Valley, California 91352. Phone: (213) 767-1000.

UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Model 813B coaxial loudspeaker



New DDL and EQ from Klark Teknik

New products from Klark Teknik, unveiled at the Anaheim AES, include the *DN301* attenuating equaliser and the *DN700* DDL. The equaliser features a full 15 dB of cut at 30 ⅓-octave ISO frequencies between 25 Hz and 20 kHz. The EQ filters are designed around custom thick-film microcircuits developed specifically for the purpose, to replace conventional inductors and offer improved performance. Sweepable HPF and LPF circuits offer switchable slope characteristics, while an output amp offers up to 20 dB make-up gain.

The unit features a silent bypass switch which also restores unity gain. Other features include power-off bypass and a ground-lift switch on the rear panel. A security cover is available.

The *DN700* is a delay unit featuring one in, three out operation and is particularly suitable for PA speaker delay functions, having continuous memory of delay settings and a control lockout system.

All operations are microprocessor controlled, and the unit offers a digital readout in ms. The amount of delay for each output can be set with 'nudge' controls in the range 0-435 ms in 26.5 µs increments. Also featured in the unit are auto diagnostic routines; 1 U rack-mounting format; front-panel adjustment of all delays; in-house custom-designed A/D and D/A converters; and input level indication. The bandwidth is given as 15 kHz at full level, with >86 dB dynamic range at full bandwidth. Electronically-balanced inputs are provided along with optional transformer balanced ins and outs if required, the latter being retrofittable.

Klark Teknik Research Ltd, Walter Nash Road West, Kidderminster, Hereford and Worcester DY11 7HS. Phone: (0562) 741515. Telex: 339821.

UK: Autograph Sales Ltd, Stable 11, BR Camden Depot, Chalk Farm Road, London NW1 8AH. Phone: 01-267 6677.

USA: Klark Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, New York 11735. Phone: (516) 249-3600.

Portable Dolby

Shown by Dolby at the International Broadcasting Convention 82 in Brighton, in pre-production form, was the *Model 372*. This is a new portable unit containing two channels of A-type noise reduction in a very compact battery-powered design. Its intended field of application includes use with video recorders without provision for direct installation into the machine, mobile recording and outside broadcasts.

Features include variable or preset input levels which can also be used to set playback Dolby level calibration, 8-LED display for each channel, permitting Dolby calibration levels to be set within ± 0.1 dB, Dolby tone, mode switching, NR on/off switching, monitor select for normal line in or encoded off-tape output, and a stereo jack for headphone monitoring, with level control.

Lines in and out are via *XLR*-type sockets with electronically balanced inputs and single ended outputs. Connections to tape machines are 7-pin Tuchel sockets. There is provision for remote control of mode, NR and monitor functions via a 12-pin Hirose socket.

The *372* can either be powered by internal batteries (4 × 'C' size cells or equivalent Ni-Cads) with rear panel charging facilities, or by a remote DC input of 5 to 25 V on the recorder connections or remote socket. Dimensions are (whd) 7¼ × 1¾ × 8½ in and the unit weighs 3 lb.

USA: Dolby Laboratories Inc, 731 Sansome Street, San Francisco, California 94111. Phone: (415) 392-0300. Telex: 34409.

UK: Dolby Laboratories Inc, 346 Clapham Road, London SW9. Phone: 01-720 1111. Telex: 919109.

110 V power points

Although not designed for studio applications specifically, this is the kind of unit that many studios may have an application for. Hintcade Ltd have supplied details of a solid-state 240/110 V converter. This eliminates the need for transformers and is a compact and inexpensive unit. The standard model is rated at 100 to 1000 W and is designed to fit into standard 240 V socket boxes or to be flush mounted into panelling or walls. It operates directly from the 240 V mains and requires no powering in addition.

The converter complies with IEE safety regulations and is available in different designs to meet individual requirements.

Hintcade Ltd, 22 St Giles Close, Dagenham, Essex RM10 9TD. Phone: 01-593 0181.

34▶

The funny-looking mike that's taken very seriously.

The PZM with its flat back plate, is as unconventional as it looks. Its revolutionary design eliminates phase-induced interference and provides a significant improvement in signal quality.

Indeed the PZM represents the most important advance in microphone technology of the last fifty years.

But why take our word for it? The PZM has won the utmost respect from sound engineers all over the world.

In a recent issue, Studio Sound examined the applications of the PZM in contemporary recording, and its conclusions are a glowing endorsement of all we've claimed for this remarkable microphone.

Top engineers were interviewed and confirmed that the PZM provided an undistorted output, free from comb-filtering.

They found that it gave a 180° pick-up with no off-axis problems and that it was ideal for reproducing anything from ambience to a grand piano.

They spoke of its extraordinary reach and clarity, of the way in which it simplified the business of miking-up and how its low profile made it ideal in hidden applications such as theatre and television.

All in all, the experts are deeply impressed by the PZM and already regard it as an indispensable tool in the creation of a transparently natural sound, free from non-linear characteristics, both on stage and in the studio.

For details of available models, including the new 3LV tie clip microphone, prices and suggestions for further applications of the PZM microphone, just telephone Mike Silverston on 01-961 3295.

PZM FROM HHB

HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Rd, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

AUSTRIA: HI-FI STEREO CENTER KAIN SALZBURG 37701.
BELGIUM/FRANCE: GENERAL TRADING LUXEMBOURG 471548.
DENMARK: TEAM SOUND APS GRAESTED 02-292522.
GERMANY: AUDIO VERTRIEB PETER STRÜVEN GmbH HAMBURG 5245151.
FINLAND: STUDIOTEC KY HELSINKI 80-556252.
HOLLAND: IEMKE ROOS IMPORT BV AMSTERDAM 972121.
ITALY: AUDIST SRL MILANO 8394728.
SPAIN: MABEL SDAD. ANMA. BARCELONA 3517011.
SWEDEN: ELA-LJUD AB SUNDBYBERG 08-984422.
SWITZERLAND: MUSICA AG ZURICH 2524952.

new products

Q-Lock enhancements

The software-based custom-interfacing techniques utilised in Audio Kinetics' *Q-Lock* series of tape transport control systems enable a wide range of extra facilities to be added, as time, customer requirements and technology allow, with low overheads in equipment terms, thus reducing the price. For the price of software development time plus comparatively small hardware modifications, the system can be expanded almost indefinitely.

Two such enhancements have recently been introduced, one the result of development work by AK's Engineering Director, Tim Whiffin, and the other being the brainchild of Steve Waldman, President of AK's US operation in North Hollywood.

The first of these new items is *Q-Link*, a system which allows the interlock and control capability of the *Q-Lock 3.10* to be increased from 3-machine to 5-machine control. This is not a simple 'chase synchroniser' add-on but an enhancement which adds all of the individualised operation and control functions of the system to two extra transports, including the ability to enter and set machine parameters individually (offsets, record enable/disable, remote transport control) and to alter the machine hierarchy. All this is made possible by custom software design and the addition of a single communications interfacing board in each system. An RS-232/422 serial link carries data, and another line carries timecode, between the master system and the second *Q-Lock*. The communications interface also provides facilities for interfacing a computer system to control the machines (eg an automation computer) via RS232 (2400-9600 baud) or RS422 (38.4 Kbits/s) serial interface. An 8-bit bi-directional parallel port with handshaking is also provided, and this port is capable of 'talking' to HPIL via an *82165A* converter.

Coupled with this latter development is the *Q-Scan* sound cue spotting and list management system. Utilising an included Hewlett-Packard *HP-41C* programmable hand-held calculator, bar-code reader, microcassette storage unit, video interface and portable printer, the system may be used on-line with *Q-Lock* or off-line on its own.

In its off-line mode, the keyboard controller (*HP-41C*) may be used to enter timecode cue points manually, along with a description of the effect required from a printed catalogue in bar-code form (the system may also be used to generate the bar-code descriptions) including reel number, track number, description (24 characters), videodisc chapter/frame etc. A complete list of cues can thus be 'spotted' without tying up the main system. The edit decisions are stored on microcassette, and a print-out—including all edit data plus production title and editor's name—is made. The list can be modified at any time. On-line, the editor has the option of complete auto-assembly from the stored list, or operator-interactive assembly with the capability to manipulate the edits. After editing, a complete decision list is output with address entries reading timecode or film footage.

Audio Kinetics Ltd, Kinetic Centre, Theobald Street, Boreham Wood, Hertfordshire WD6 4PJ. Phone: 01-953 8118.

USA: Audio Kinetics Inc, 4721 Laurel Canyon Boulevard, Suite 209, North Hollywood, California 91607. Phone: (213) 980-5717. (Toll free outside California: 1-800 423-3666.) Telex: 194781.

DeltaLab expands *Effectron* range

New from DeltaLab in its budget-priced *Effectron* range is the *ADM-64* flanger/doubler. The new unit features digital delay circuitry offering a full three octaves of flanging capability (8:1 flange ratio) and an internal envelope follower control voltage. The unit also has a 16-64 ms delay range selected by front-panel pushbutton. The unit maintains full 16 kHz bandwidth and 90 dB dynamic range at all delay settings.

DeltaLab Research Inc, 27 Industrial Avenue, Chelmsford, Massachusetts 01824. Phone: (617) 256-9034.

UK: Scenic Sounds Equipment Marketing Ltd, 97-99 Dean Street, London W1. Phone: 01-734 2812-5.

ADM-64 flanger/doubler

Sansui aims at Sony PCM

No doubt attempting to attract some of the theoretical domestic PCM recording market (although the Sony *PCM-F1* seems to be selling more to professionals), Sansui have released their new *PC-X1 Tricode* PCM adaptor. The *Tricode* is alleged to operate with any VCR, although the spec sheets differ between quoting one TV standard and all three (NTSC/PAL/SECAM). The 'Tricode' aspect is apparently to indicate that it works with all types of VCR, so doesn't help us determine whether or not the unit will cope with differing TV *standards* (although the Sony *PCM-F1* will do this if you fiddle with its innards, unless you have an NTSC version), but later data sheets *do* say 'compatible with any TV format'. The unit utilises EIAJ *STC-007* standard 14-bit PCM encode/decode and offers a frequency response flat from 5 Hz to 20 kHz. Signal/noise, dynamic range and channel separation are better than 85 dB and the THD is below 0.01%, while the wow and flutter is 'unmeasurable', as usual for this type of machine. The sampling frequency is given as 44.056 kHz.

So far, all is pretty normal for this kind of unit. The cleverness is in a special correlation circuit which can tell data from noise coming from the video recorder. The signal coming in off tape in video format is often noisy, especially when low speed recorders are used (eg US VHS recorders with a slow speed capability), and this can often scramble the audio coming out of previous PCM adaptors. The *Tricode*, however, is capable of reconstituting the nastiest VCR signal and playing it back perfectly, unlike a *PCM-F1* playing simultaneously for A/B comparisons at Anaheim. This may not matter much to the professional user, who won't be so silly as to use slow VHS recorders, but the domestic user may like the idea, coupled with a price below that of the *PCM-F1*. You *don't* get the 16-bit capability, though, so the Sony unit looks like remaining the favourite for professional use.

Sansui Electric Co Ltd, 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168, Japan.

US: Sansui Electronics Corp, 1250 Valley Brook Avenue, Lyndhurst, New Jersey 07071. Phone: (201) 460-9710.

PC-X1 Tricode PCM adapter

New Electro-Voice monitor

Electro-Voice have introduced the *Sentry 500*, which is a 2-way monitor for broadcasting and studio applications. It employs a 'Super-Dome' tweeter with a power handling capability of 25 W and a range of up to 18 kHz. This unit is coupled to a high frequency dispersion-controller which channels the acoustic output into a defined area. The LF unit is a 30 cm direct radiator woofer installed in a vented enclosure with fourth-order Butterworth tuning.

One of the principal design points of the *Sentry 500* has been to produce a constant directivity system that provides uniform and dependable coverage without hot spots or dead zones at certain frequencies. To achieve this care was taken over the coverage angle (110° ± 30° horizontal and vertical from 25 Hz to 10 kHz, and 60° ± 15° horizontal and vertical from 10 kHz to 20 kHz) woofer size and crossover frequency (1.5 kHz). Electro-Voice claim that by combining constant directivity and a flat frequency response, they have achieved their aim throughout the critical four octaves of mid-range frequencies.

Other specifications for the *500* include frequency response of 40 Hz to 18kHz ±3 dB, 100 W continuous handling capacity with a max of 400 W for periods up to 10 ms. It is capable of delivering an SPL of 96 dB at 1 m with a 1 W signal.

The monitor is housed in a cabinet finished in a scratch-resistant matt black vinyl with dimensions of 68.6 × 60.3 × 33 cm (whd) and a weight of 31.7 kg. There is also a *WB500* wall-mount kit.

Electro-Voice Inc, 600 Cecil Street, Buchanan, Michigan 49107, USA. Phone: (616) 695-6831.

UK: Shuttlesound Ltd, 200 New Kings Road, Fulham, London SW6. Phone: 01-736 0907/8/9. ■

They've doubled the cost of haircuts, but we've cut the cost of doubling.

The new MXR Pitch-Shift Doubler is more than just a doubler. It uses *true* pitch-shift to transform a string part into a string section, a six string guitar into a twelve string or a vocal duet into a quartet—all in stereo.

The most needed effects in Pitch-Transposer technology are now available in a compact, studio-quality unit at an affordable price. With a frequency response to 20 kHz and a dynamic range of 88 dB, the Pitch-Shift Doubler distinguishes itself in the most critical studio and live performance situations.

The pitch-shift is continuously variable to 3% (¼ step) up or down, allowing the user to contour the de-tuning effect from subtle to thick. Exactly what you need for the commonly used 1.01—.99 harmonizing effect. And besides offering ultra-fat chorusing and doubling effects, the Pitch-Shift Doubler can be used to create helical or "Barber Pole" flanging—the spatial illusion of infinite spirals of sound. In sound reinforcement applications, the Pitch-Shift Doubler can be used for feedback suppression or, when recording, for pitch correction. With a Mix control and stereo outs, the Pitch-Shift Doubler is a cut above for vocals, musical instruments, multitrack recording and mixdown.

The MXR Model 174 Pitch-Shift Doubler. Get the most needed pitch-shift effects without getting scalped.

MXR Innovations, (Europe) 1 Wallace Way, Hitchin, Herts. SG4 0SE England phone 0462 31513, Tlx 826967

MXR Professional Products Group

studio sound's Recording

Almanacs, of course, are supposed to go in one's January issue, but we thought we'd be different and put one in the issue that *comes out* in January. Our highly-trained team of technical soothsayers was put to work late last year making predictions about what might happen in the months to come, and these are their results. Photocopy them and use them in the year ahead for Greater Profitability. Amaze your friends. Break the ice at parties, etc. *Studio Sound* takes no responsibility for inaccuracy, which may well be due to turbulence in the inter-dimensional space-time continuum. Now read on . . .

January

Major developments in digital recording: CBS develop a version of the *CX* system for digital applications. The unit (a custom IC which will be installed in all digital record players as a legal requirement) takes the bitstream and puts it into a Write-Only Memory (WOM), thus reducing all possibility of noise . . . or signal. CBS marketing claim it to be 'totally compatible with silence'.

Rumours of a tape levy in the UK.

Ian Sowerby

Console runs by thought control

February

Rumours of the development of a totally-automated console. The prototype has no faders or other controls, instead using thought control for all functions, thus achieving the so-called 'total ergonomic design' claimed by the manufacturers. There is apparently only one major problem with the system: you have to think in Japanese.

Further rumours of a tape levy.

March

Fostex announce the release of a new low-cost 24-track-on-½ in recorder, incorporating Dolby-D (for digital) noise reduction. Previewed at AES Eindhoven, the recorder utilises ½ in cassette-style tape packs. The system includes a complete 24-track minimixer with full routing and weighs 9 lb. It will cost a little more than the average home video recorder. Also at AES, Philips announce the development of new D/A converters for CD players. Using hyperspatial oversampling, in which the first eight bits are sampled in real time while the second eight are shunted into hyperspace for conversion at the 'same time' by the same chip, the system enables inexpensive 8-bit D/A converters to be used. The release of the *Compact Disc* is delayed 'for a few weeks'.

Murmurs about a tape levy in *The Times*.

April

Alfred Crimble arrives, penniless, at Dover with a new audio system in his suitcase, which is impounded by Customs. Crimble has been working for the past 17 years in a shed in the North African desert, and has come to England to make his fortune. His system is a simple plug-in device which couples a *Walkman* to a set of electrodes offering full surround sound to the listener when the electrodes are attached to the head. In a few weeks he has interested several top bands and one of them, the Screaming Blasters, are to use it on their next album, *Music for Supermarkets*. Then the National Research Development Corporation buys the rights to the patents and offers to finance the project. Crimble's system is never heard of again.

The *Daily Mail* publishes a feature by Arthur Fishwick (no relation) on the imminence of a Tape Levy.

May

Continuing its efforts to uphold quality in Britain's recording studios, the APRS request Unreasonable Recorders of Lower Wapping to leave the organisation. The studio is alleged to be attempting to cut costs by mastering on a Blattner steel tape recorder modified for 8-track operation via the addition of a set of 'whizzer' heads stolen from the German *Magnetophon* in the Science Museum. The studio counters this allegation of poor quality with the comment that 'by the time it's in the shops, no one will notice because of the nastiness of modern pressings'. This is conceded by APRS, but they then discover that Unreasonable Recorders have been taping concerts at the Albert Hall on a 24-track *Telegraphone*

Almanac for 1983

Prognostications edited by Elric H Rande

steel wire recorder and selling them to Arabs as original pre-war recordings. Unreasonable Recorders call in the receiver and the whole outfit is disassembled and shipped to the Museum of Magnetic Recording in California component by component. The ex-directors use the profits to buy six of London's best-known recording studios and convert them to video operation, recording videodiscs on a modified Baird mechanical scanner.

New Left Review carries a 40-page socio-political discussion on home taping and rumours of a tape levy.

June

Two days before the APRS exhibition, contractors acting on behalf of the local council knock down the Kensington Exhibition Centre 'by accident'. At the last moment, the exhibition is rescheduled and takes place in the upstairs room over the Engineer's Arms pub in Maidenhead, Berkshire. A competing exhibition is organised across the street in the Maidenhead Conference Centre, with two floors of exhibition and three floors of demo rooms. However, nobody knows about it and it is a complete disaster. The APRS show, on the other hand, is a model of good organisation and has the benefit of a bar with reasonable prices—a notable first for a UK exhibition of any sort. Penny and Giles launch a new sealed fader at APRS, which is totally impervious to dirt and liquid penetration. It is demonstrated by the MD of a competing manufacturer who spills a pint of Wadworth's 6X over the demonstration console. Although he is electrocuted by some unfortunate last-minute wiring, the faders continue to work perfectly.

The BPI's representative at APRS is quoted by *Studio Sound* as intimating that a tape levy will be introduced 'in the next few months'.

July

The Musicians' Union come up with a solution to the synthesiser dilemma. They hire Watford Town Hall for one day every month and provide a 102-piece orchestra. Any composer wishing to use a synthesiser must submit 102 copies of the required line and bring the desired synth to the hall on the appointed day. The line is played on the synth and recorded in one take. Then the orchestra is allowed three hours rehearsal time and a three-hour recording session (no overdubs) to duplicate the sound, the fees for which are payable by the composer. The tapes are then played to a blindfolded panel of top musicians who must guess which is which. If the panel are right, then the composer is allowed to use the synth, and the Union supplies a team of 'synthesiser operators' at normal rates (one programmer, one 'performance control operative', one tuning adviser with tuning fork, and one player—except in the case of polyphonic instruments, where one player is provided for each hand). If the panel cannot agree, then the composer is obliged to use the orchestra, as it is obviously an imitative application.

A Home Office spokesman 'categorically denies' that a tape levy will be introduced 'in the foreseeable future'. Most observers regard this statement with suspicion.

August

Cerebral Audio Systems Inc announce the release of a new 25 kW audio amplifier for PA and studio monitoring applications. The 10U, 19 in rack-mounting unit contains a massive power supply and no fewer than

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APRS changes venue

Recording Almanac for 1983

300 power transistors mounted on a liquid-helium-cooled heatsink with 5 hp blower and heat-pipe backup cooling systems. The unit is claimed to be able to provide all the audio and heating required by a large auditorium, and there is an add-on central heating system for studio applications, allowing the amplifier to heat the studio and control room plus nearby offices, tape-stores, etc. The only disadvantages are that the unit has an output impedance of 0.1×10^{-6} Ω, and thus requires special loudspeakers; and the amp requires +83.3 dBm drive levels. This latter requirement may be satisfied by a chain of amplifiers designed to interface between the console and the input of the *CA-25K*. Also available, and recommended by the manufacturers, is a small power station, capable of construction in no more than two years. It will power six *CA-25K* units and has optional nuclear capability.

No further rumours about a tape levy this month.

September

Following their success recording their latest album with solar power, US supergroup Solaris arrange a series of solar-powered concerts at the Hollywood Bowl. The parking lot is converted into a field full of mirrors which reflect the sun's rays onto a series of photocells. Unfortunately, the first show is cancelled because of an uncharted total eclipse which lasts until sunset, while the rest of the series is cancelled as a result of an injunction obtained by a US Congressman who claims that Solaris' latest album contains subliminal Sun-worshippers' invocations encoded digitally on the record, which may be decoded with CBS' anti-taping spoiler chip.

Still no word on a tape levy, but there are murmurs about a possible rumour being leaked from GCHQ, Cheltenham, to the Russians.

October

More live-sound news: the sell-out Wembley concert by top UK band, UghNastyVomit and Eric, is tragically terminated by meltdown in the power unit driving the four Cerebral Audio Systems *CA-25K* amps providing the PA amplification. A failure in the emergency core-cooling system is blamed by CEGB engineers for the 'incident', which released a cloud of highly radioactive vapour over London. Estimates indicate that over 63,000 people are killed more or less instantly, while several million are suffering from radiation sickness. All-out nuclear war is averted by a technical failure after the event is mistaken for a missile attack.

Our Glasgow parliamentary correspondent says that the Prime Minister declined to comment when asked about the possibility of a tape levy.

November

This year's smash Christmas hit looks set to be a duet between the great Enrico Caruso and the lead singer of ex-top UK band, UghNastyVomit and Eric, the late Eric Vilemucus. The single is a rendering of *Rudolf the Red-Nosed Reindeer*, and Caruso's part was originally recorded on phonograph cylinder in 1902, during an early visit to London. The cylinder was then lost, only being discovered fortuitously by contractors building a fallout shelter in EMI Records' Manchester Square basement (to avoid any possible fallout from concerts at the nearby Dominion Theatre) a couple of months ago. State-of-the-art technology is installed at EMI's Abbey Road studios to transcribe and 'clean up' the cylinder, including a phonograph borrowed from DJ Tony Blackburn, who previously used it to play back old jokes. EMI digital signal processing equipment is then used to 'enhance' the audio quality, allowing it to be transferred to 24-track digital. Eric Vilemucus was brought in to attempt to sing a duet. EMI Records deny that the attempt was a failure and that Eric's voice was in fact produced by a Fairlight *CMI* recording and playing back 250 members of the Musicians' Union over six octaves after lunch at the local Burger Palace. Following Eric's later demise, the single is expected to reach Number One in the first few days of release, and total UK sales are hoped to exceed the magic 35 copies which ensure a Gold *Compact Disc*.

Rumours of a tape levy are confirmed to be rumours.

Government bows to business pressure

December

The British Government finally bows to continued pressure from the record companies, including terrorist attacks on hi-fi stores and MPs by the so-called Artist's Liberation Army (whose activities have been denounced by the BPI's Central Committee) and imposes a levy on blank audio and video tapes. Tapes may only be sold in the UK if they carry the Levy stamp, which is applied at a special office in Lochboisdale, in the Outer Hebrides. All tapes must therefore be transferred to that office before sale. Unfortunately, tight Government budgets have resulted in only one member of the Tape Levy Board staff of 2,000 Civil Servants being sent to South Uist to operate the office. The rate of stamping is expected to be in the order of 30 tapes per day, as each stamp must be accounted for on 27 triplicate forms. The Levy, including VAT, comes to £250 for a C60, £375 for C90, and videotapes are taxed (sorry, Levied) at the rate of £4,972.04 per tape of any length. There are no exceptions. The British Recording Industry leaves *en masse* for California, where taxation has been abolished following the destruction of all tax records after a nuclear explosion at a rock concert in Sacramento wiped out the offices.

Rumours of a National Government. ■

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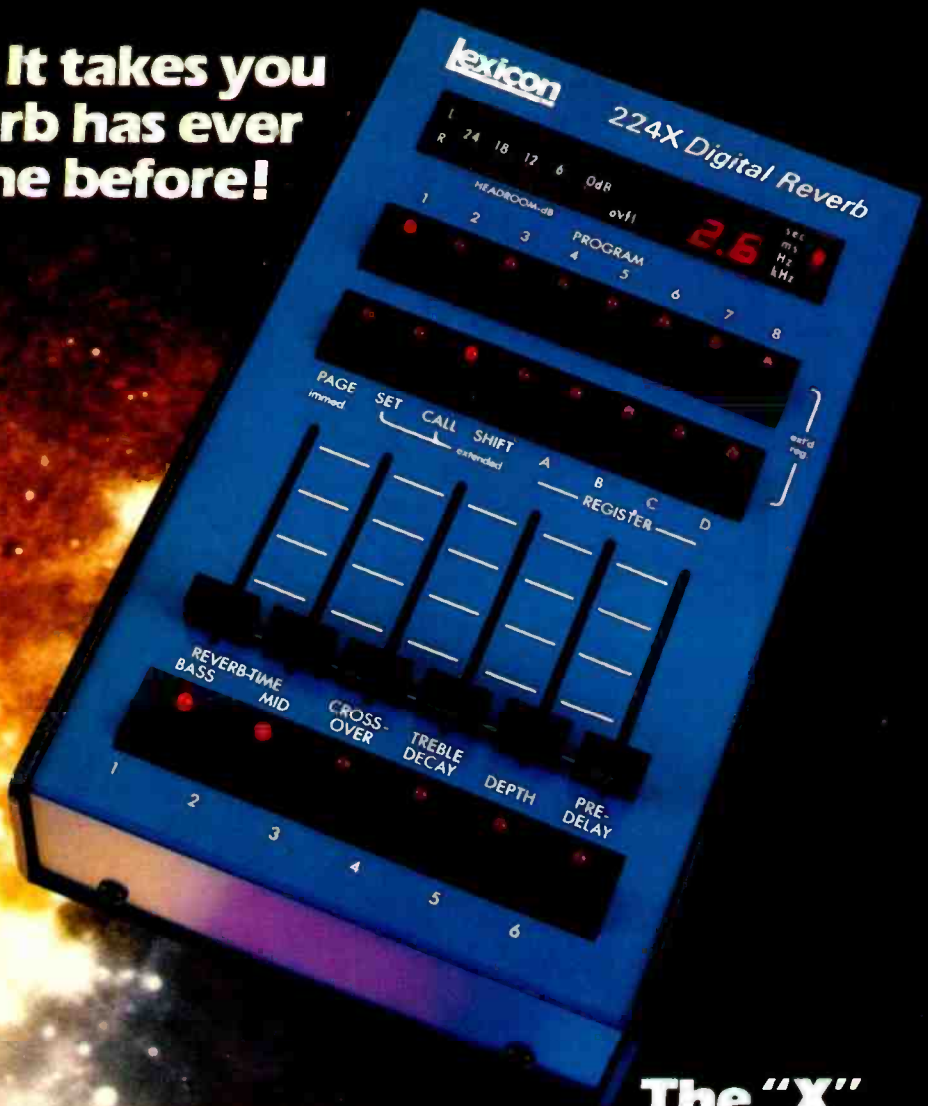

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SSE

AKG Vienna

Ken Dibble

UNDERNEATH the glitter of AKG's glossy brochures and hiding behind a smoke screen of intensive product publicity, is a young and dedicated team of engineers, sales people and managers, all devoted to their company and its products and intensely proud as Austrians, that their Austrian company has achieved the worldwide recognition for quality and technology that it has. Yet despite this, they are a quiet, unassuming team who go about their business and organise their affairs with no fuss and no apparent hurry. They are not trying to impress anyone. There are no carpets on the stairs or in the corridors, no plush executive suite, yet where it counts – on the factory floor and in the laboratories and workshops – is to be found a massive investment in modern machinery, tools and computerised production aids. There are no production lines as such; instead, almost every stage in the production process is a highly automated, carefully controlled, hand operation with a quality control check at almost every stage.

Some history

The company was founded immediately after World War II by Dr Rudolf Görike and Ing Ernst Pless, Dr Görike having served in wartime acoustics research for the German army. Through this connection, he had contact with Neumann and Dr Sennheiser in Germany. One of the earliest problems tackled by the new company was the difficulty in adding commentary to cine film due to the unwanted pick-up of projector noise and this led to the development of the first single-element cardioid microphone and the granting of the first of AKG's numerous patents. In 1950 the famous *D12* was introduced and found instant favour among the leading dance bands and radio stations of the day – and of course, some 30-odd years later, an updated version of this same microphone is still a favourite with musicians and engineers as a bass drum and bass instrument mike. At about the same time the first lightweight headphones were introduced, accompanied by more patents. During this period, with the company about five years old, there was a total staff of 30: the company possessed one coil winding machine and one gluing machine only and was exporting mainly to Eastern Bloc countries with Grundig as one of its main Western customers buying microphones for their domestic tape recorder business.

As early as 1952 the first capacitor microphone, the *C2*, was introduced and this was to be the forerunner of the world-renowned *C12* and *C24* models, while at the same time, the company diversified slightly into the field of flash lighting for cine photography and optical soundtrack pick-ups for cine projectors. In 1954 an underwater loudspeaker system was developed in association with experiments of Dr Hass in the use of audio signals to drive away sharks to facilitate underwater filming in hostile waters. So it would seem that up until this time, the cine film industry had a considerable influence on the direction the company was taking.

Another interesting milestone came when the first live broadcast of the Saltzburg Festival was planned in 1955 when Herbert von Karajan – who is today probably the most technically orientated and most widely recorded classical music conductor in the world – refused to allow any microphones to be visible on the orchestra platform. So AKG developed the 'Karajan microphone': a small capacitor microphone working on the interference principle to provide a narrow forward sensitivity lobe and hence greater working distance – a forerunner of present shotgun microphones. Also at about this time, AKG commenced what was to prove a long and fruitful association with the BBC and other European broadcasting organisations and several very rewarding manufacturer/user relationships were established, the feedback from which has had a considerable influence on the development of subsequent studio microphones and other products.

1955 also saw the establishment of AKG's first subsidiary company in Germany, and by 1957, business had expanded to the extent that larger premises because essential. So retaining their original site in Nobilegasse, Vienna, as a research and development facility, the main factory was moved to a new site in Schanz Strasse a few blocks away. Further expansion came in 1959 with the establishment of representatives in most European countries, in the USA and Africa.

From 1960 onwards the company experienced a meteoric rise to world prominence with the introduction of the legendary *C24* valve stereo capacitor microphone and the development of the first small diameter capacitor microphone system using Nuvistors instead of ordinary tubes and featuring interchangeable capsules in the shape of the *C60* – a model that was used widely in BBC studios and which set the pattern for the development of the *CMS* system a decade later.

The introduction in 1963 of the *DXII* reverb microphone was – by the company's own admission – a major flop. It would seem that they just could not get a spring-line reverb unit to function properly inside the body of a handheld performer's microphone (surprise, surprise!), but are not too ashamed over the incident as it lead to a full investigation into the technology of spring line reverberation which

culminated in the introduction of the highly acclaimed *BX* series of studio reverb systems in 1971.

The company finally ceased its involvement in the film industry in 1965 when it discontinued the manufacture of projectors and related products to concentrate on microphones and studio products and in 1968, AKG introduced its first microphone aimed specifically at the musician, the *D1000*. Further expansion also came in 1968 with the establishment of a daughter company in Zurich, Switzerland, and in the following year, AKG London came into being under the direction of the indefatigable Peter Eardley. At about the same time the first 2-way dynamic microphones, the *D202* and *D224* were introduced with the *D202* in particular finding instant acceptance in broadcasting and field recording.

With the advent of the '70s came the introduction of what must be the company's best success story to date, the *CMS* modular FET capacitor microphone system which is today to be seen in almost every studio in the world. Almost every time a television set is switched on, there is a *C451* in one form or another, be it in front of a newsreader, in a chat show, over a symphony orchestra or a rock band, and every now and again, when a boom accidentally drops into shot, there is usually a *C451* hanging off the end. It must surely be the most widely used microphone of all time.

Further expansion came in 1972 with another move to yet larger premises when the company moved to its present address in Brunhildengasse, Vienna, and at about the same time went into mass production of ultrasonic transducers for remote-controlled domestic TV receivers – a line that held up very well until infra-red ousted ultrasonics for this application, at which time, AKG moved over to the manufacture of telephone handset transducers as its main bulk production line activity.

Milestones of the last decade include the introduction of the electret capacitor microphone and the *CMSE* system, the diversification into hi-fi pick-up cartridges with the development of the *TS* range, the granting of AKG's 1000th patent in 1974, the establishment of a fourth subsidiary company in Japan and the gradual introduction of computerisation from as early as 1973 – not only for R & D purposes but also for production-line process control and quality monitoring.

The point at which the company seem to consider they had 'arrived' came in 1972, when, with the *CMS* system already widely accepted and the order book full, the British Post Office issued a commemorative stamp to celebrate the BBC's 50th anniversary. The 3p issue depicted six microphones spanning the 50-year period and of these, three were current AKG products – the *D160, D202* and *C451* with a *CK1* capsule. A framed mint block of these stamps adorns the sales office walls in both Vienna and London!

Manufacture

The policy is to produce as many components and parts in-house as space and facilities will permit and from what I saw, this objective would appear to have been largely achieved by means of a massive capital investment in modern plant and machinery. All the metal parts – microphone body sections and grilles, capsule magnet assemblies, special pressings and housings and many, many more – are produced in a relatively small machine shop equipped with sophisticated numerically-controlled bar-fed automatic lathes, strip-fed stampers, presses and milling machines. In addition to being programmed to produce the required component, each machine is also its own quality control monitor and will automatically stop in the event of the component not conforming to dimensional tolerance data also included in the programming. Plastic injection-moulded parts – used extensively by AKG – are also produced in-house with a similar committment to quality control and dimensional accuracy, to the extent of making their own dies. By means of a computer-controlled RF wire erosion cutter and an RF erosion stamper, AKG are able to produce practically any die requirement within the physical size limitations of the machine capability no matter how intricate the design might be, to an accuracy of 1 micron. Once the dies have been produced these are installed in the injection moulding machines – again fully computer or numerically controlled and the parts are turned out in their thousands.

Other more specialised components such as microphone diaphragms and voice coils are produced elsewhere in the factory in clean areas, again using automatic, pre-programmed machinery working under the watchful eye of a trained operator. **Fig 1** shows one such installation where dynamic microphone diaphragms are first moulded to the required contour from a flat strip of macrofoil by means of an RF heated die and then fed to a small stamper to cut the diaphragm out of the strip: a very simple, yet effective, process for which most of the tooling is designed and produced in-house. **Fig 2** demonstrates the coil winding process. Again, both machines are computer-controlled and programmed for exactly the required number of turns, coil length and winding tension. The larger machine winds microphone voice coils and the very small high precision machine fitted with binocular viewing facilities winds coils for the *TS* pickup cartridges.

The microphone assembly areas are large, clean and airy, well laid out and planned with good access for component stillages. The assembly process is through a series of separate workstations rather than an actual production line, with a carefully thought out, semi-automated hand operation at each stage. **Fig 3** is a sequence of photographs depicting the assembly of a dynamic microphone capsule. **Fig 3(a)** shows stage one where the preformed diaphragm is cemented to the voice coil, a fine ring of cement being applied to the underside of the diaphragm by the nozzle and rotating anvil seen at the centre of the picture. This is then assembled on to the voice coil in one of the 'egg-cup' alignment jigs on the perimeter of a step-rotating turntable at the base of the machine. Each jig is RF heated and when the turntable has made one revolution, the cemented joint has been fully cured and the diaphragm assembly is ready for the next stage. Meanwhile, the machined parts for the magnet assembly are inserted into the injection-moulded plastic outer housing by a further process of gluing and RF heating (not shown) and then the complete assembly is magnetised on the equipment **Fig 3(b)**. The ring of housings around the centre of the turntable is for measuring the flux

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Fig 1

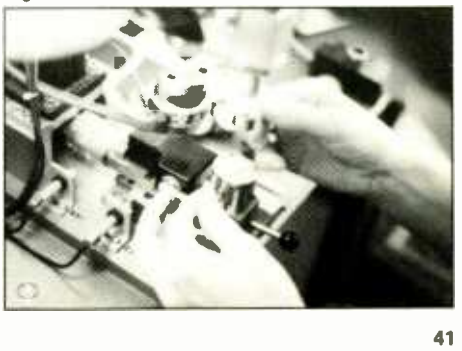
Fig 2a

Fig 2b

Fig 3a

Fig 3b

Fig 3c



density of the magnetised assemblies and gives the operator a green (go) or a red (no-go) indication. **Fig 3(c)** indicates the next stage where the diaphragm assembly is put into the magnet/ housing assembly to form the complete capsule except for the final stage of fitting the perforated top cover.

In another department at the old Schanz Strasse factory, complete microphones are built up from component sub-assemblies. At the time of visiting the *D330BT* was going through the plant. The *D330BT* is a musician's vocal microphone which features LF and HF response adjustment and a 'hum bucking' coil, all of which is incorporated into a cylindrical capsule moulding and the entire capsule plugs into a miniature edge-connector arrangement located at the base of the microphone body just behind the *XLR/3* type connector. Every microphone is individually checked; first comes a detailed visual inspection which is followed by an anechoic chamber frequency response measurement. Finally, each microphone is subjected to a vibration test on a B&K accelerometer setup to monitor its insulation against mechanical vibration and shock.

Capacitor microphones are assembled in much the same way and with the same accent on quality control. All pre-amplifier circuit boards are individually tested for frequency response, gain and noise performance prior to insertion into the microphone body shell and every single capacitor element is individually checked for capacitance and dielectric strength before it is assembled into its capsule housing. And like their dynamic counterparts, each complete microphone is also subjected to a rigorous testing schedule before being moved off the production line for packing. Every professional microphone leaves the factory complete with its own individual frequency response curve.

Another interesting production process is the manufacture of springs for the various spring-line reverb units produced by AKG. Here, considerable accent is put on ensuring that any tendency towards regular wave motion of the spring is broken down by a combination of etching the wire at random intervals along its length to produce random variations in wire thickness; winding some sections of the coil of uniform diameter and some conical; indenting the coil at irregular intervals along its length and to varying degree and extent; and by the introduction of mechanical damping at random points. The springs for the *BX20* are 1.2m in length and those for the *BX25* are 2m, and each is made up from a variety of different sections. In the final product, still further randomisation of the reverberation characteristic is obtained by driving the spring and receiving the reflections from both ends of the spring simultaneously and by the application of variable electrical damping by effectively short-circuiting the spring.

Other production related facilities include a prototype and development section where machining operations for new mechanical components are tried out and the factory process that will be applied to their manufacture is established; a training section for crafts people and machinists; and a section where the special tools and fixtures used at the various production work stations are developed and produced. At the time of my visit, this latter section was engaged in the development of a fully-automated dynamic microphone diaphragm moulding/stamping machine with full logic control including automatic monitoring of the thickness of the macrofoil strip – variations in which are currently a production hiccup in the dynamic microphone capsule assembly shop.

Research and development

This facility is split into two separate areas, that of R & D proper, where research of a purely academic nature is carried out into the scientific aspects of audio and its applications, and that of the development of new products in a tangible form that may eventually end up on the production line.

The scientific department is under the supervision of Dr Poldy – a graduate of Durham University and it seems the only Englishman there. Current work being undertaken includes an investigation into the causes and effects of 'popping' or 'blasting' particularly in respect of vocal microphones, a study of methods for the measurement of the acoustic impedance of membranes (microphone diaphragms etc) and a considerable research programme into the effects of human head interference in the sound field coupled with frontal image location for stereo headphone listening.

The other section is concerned with the development of the finished product under the supervision of Mr Wolf and at the time of visit, the hot news from this section was the imminent production of the brand new *C460* capacitor microphone pre-amplifier and the introduction of the latest version of the *C414* series, the *C414-P48*. The *C460* is a slightly larger version of the *C451* and features inherently stable, quieter

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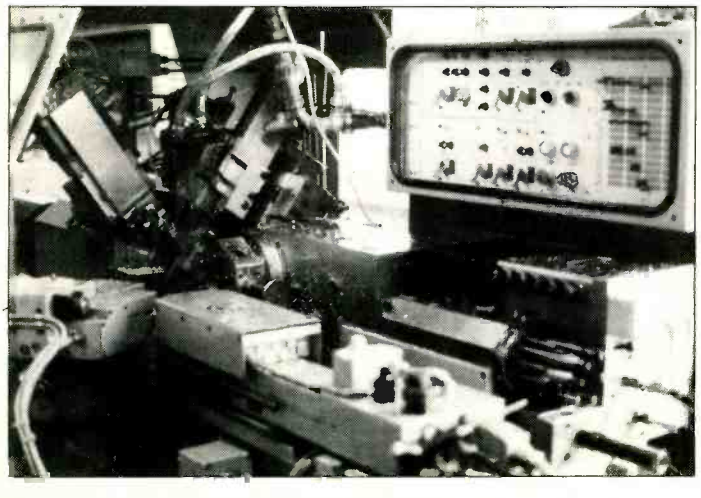
Accelerometer test (above), automatic high speed lathe (below) and (right) RF erosion wire cutter



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Milton, 1608-1674.

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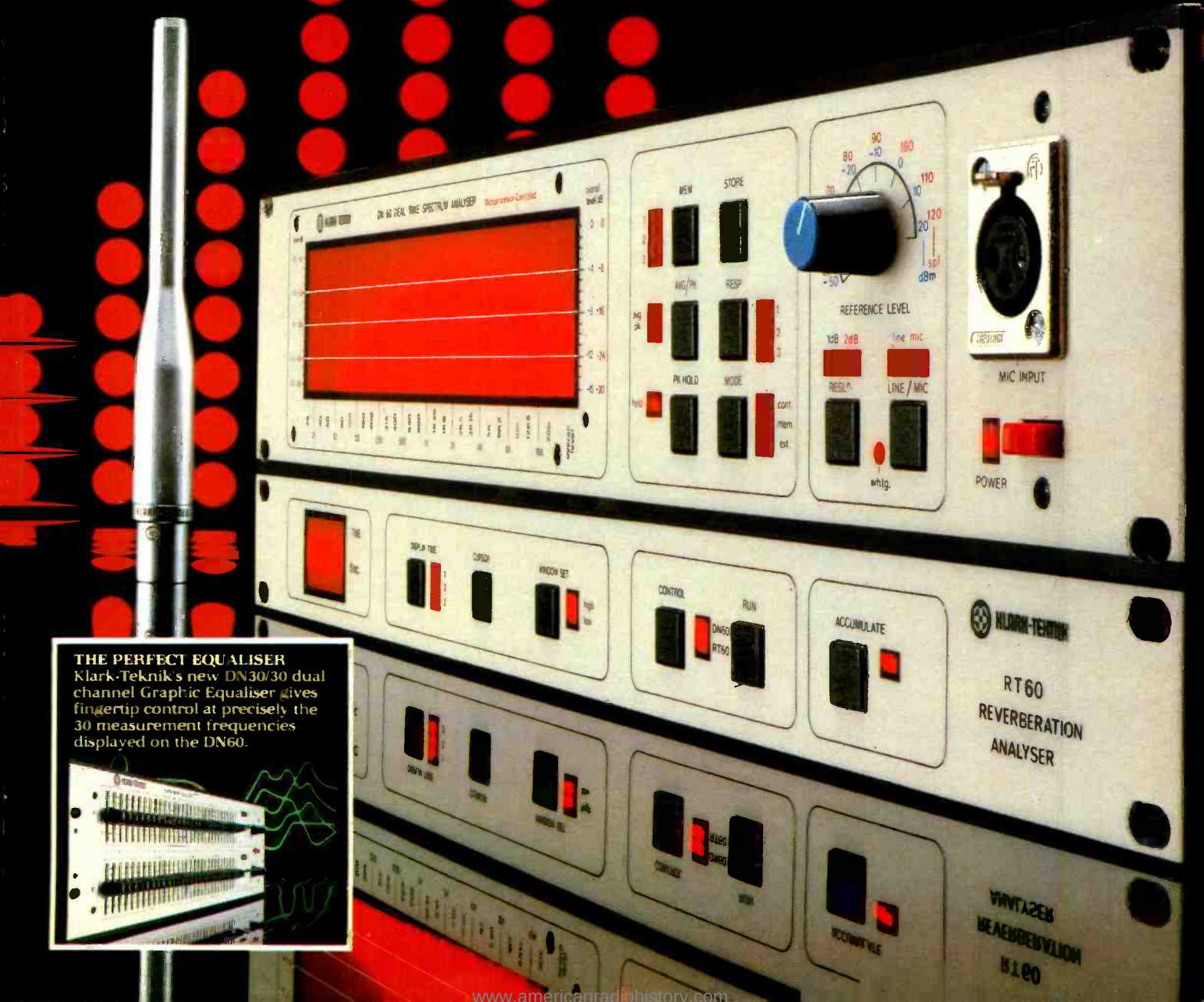

THE PERFECT EQUALISER
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Inserting the capsule assembly

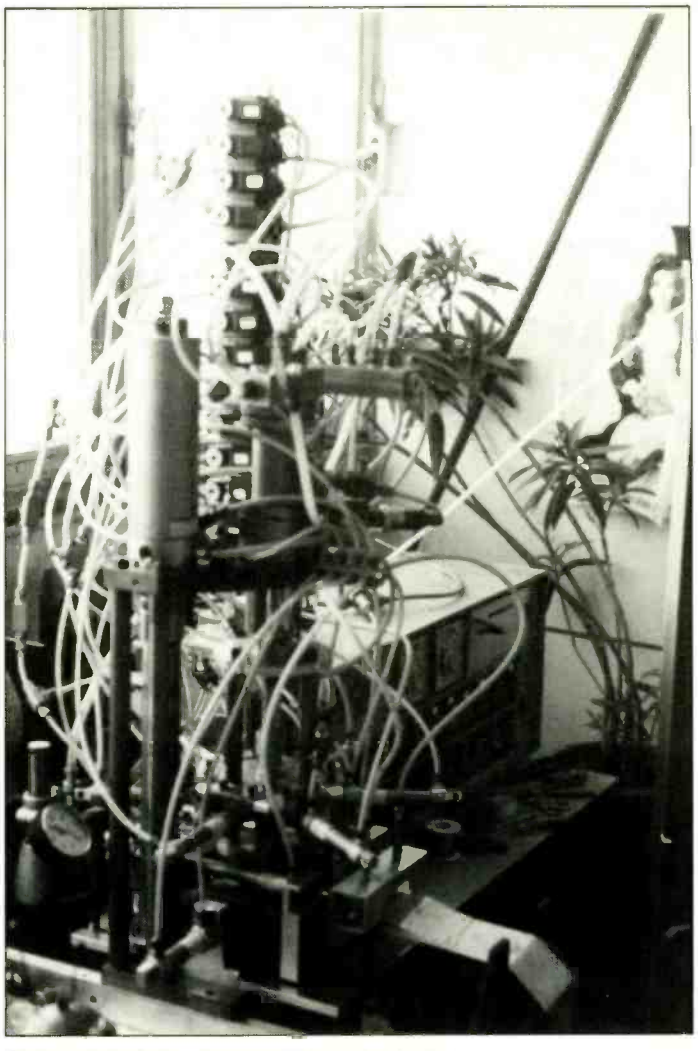
and wider-bandwidth electronics with maximum dynamic range and minimum distortion, along with a much more serviceable capsule mounting thread. For the time being, the new preamplifier is intended to be used with the current range of *CMS* capsules and accessories and a mechanically decoupled adaptor bush is available to enable *CMS* components to be mounted onto the larger diameter body of the *C460*. Eventually, there will be a completely new range of capsules and accessories in the *C460* series and it is envisaged that this will gradually supercede the present *C451* system over a period of years. The new version of the *C414* is AKG's new top model intended to spearhead the company's commitment to cater for the exacting requirements of digital recording and the top end of the analogue market. AKG is convinced that digital processing will soon oust traditional methods and that while all the ills of analogue signal processing will be ironed out, the microphone will remain as the only analogue component in the chain, and will therefore develop to meet the demands likely to be made of it as digitisation takes over. The *C414-P48* remains, in principle, a large diaphragm twin-capsule device with selectable polar response patterns but features greatly improved electronics and a new capsule which combine to provide a greatly improved dynamic range, the lowest possible self-noise and very high SPL capability with minimal distortion. The *P48* suffix is to indicate that it works off 48V phantom only and is not universal (as defined by IEC) as its predecessors have been. Other new products to have recently emerged from this department are a hypercardioid capsule for the *CMS* system, the *CK3*; and the *C535EB*, a universal phantom-powered electret type pre-polarised capacitor microphone which currently seems to be making inroads into that hitherto impregnable domain of the dynamic microphone, the pop vocalist and music amplification market.

Future direction is seen by Norbert Sobol, the studio products manager, as a general reduction of microphone size to something about the size of a pen for certain applications, an expansion in the application of remote capsule capacitor microphones and a move towards line-level-output microphones. Already, the AKG product development section is working on very small, high performance, capacitor capsules and a remote option for the new *C460* is in existence in final pre-production prototype form. Are we then moving towards a situation whereby all that will be out in the studio is the microphone capsules, with all the preamplifiers in a 19in plug-in rack in the control room driving the desk inputs at 0dBm line level?

Some facts

Dr Görike is still a major shareholder in the company, while Ernst Pless' shareholding has been bought from the Pless family jointly by the Austrian bankers Osterr Landerbank and the giant Philips organisation – although it is stressed in Vienna that Philips' interests are purely financial and that they are not involved in any way in the day-to-day running of the company. The board of directors are nominated by Osterr Landerbank, not by Philips, although the managing director is an ex-Philips executive, Mr Steinkellner. Certainly, the only evidence of Philips' presence was a production line in the factory making a stereo dynamic microphones for Philips domestic tape recorders.

AKG have a current workforce of around 700 producing 20,000 complete microphones per week and between 50,000 and 60,000 dynamic capsules per week in addition to headphones, pickup cartridges and studio reverb units etc. Over the last 10 years a staggering 16.5 million microphone capsules have been produced and since the foundation of the company, the figure is over 30 million! In the process of producing these goods some 2.5 million injection – moulded parts are produced each month in-house. Exports take up 94% of output and the company has representation in over 100 countries around the world. Approximately 30% of the output goes to the professional studio and broadcasting industry, 30% to the public address and music industry, 30% domestic hi-fi and 10% OEM – these latter figures being by cash turnover, not by product quantities. To date, AKG hold an amazing 1,300 national and international patents.



Prototype diaphragm moulding/stamping machine

After a period of rationalisation, the present product range is made up of complete capacitor and dynamic microphones, transducer elements for industrial and telecommunication applications, stereo headphones, hi-fi pickup cartridges, sping-line reverberation systems and the *TDU-7000* modular digital delay system, with the users' list reading like a recording and music industry *Who's Who*. Apart from having microphones in almost every recording and broadcasting studio around the world, top entertainers including Abba, John Heisman, Manhattan Transfer, the James Last Orchestra, 10cc, Frank Zappa and the Doobie Brothers are a few of the many users of AKG microphones on stage, with the annual Rockpalast festival in Germany using almost entirely AKG microphones and the international PA company, Tasco, using AKG as the mainstay of the microphone facilities available AKG reverberation units are to be found in every Austrian opera house as well as at the Royal Opera, London, the Philharmonic Hall, New York, the Hamburg State Opera, the Bolshoi Theatre, Moscow and the Kremlin Congessional Palace, Moscow. They are also used in every leading national broadcasting organisation including the BBC in the UK, ORTF in France, NBC in the USA as well as in over 600 commercial recording studios including EMI, RCA, Decca, and so on. To date, the newer *TDU* DDL system is in service in about 20 broadcasting studios, mainly in Germany and Austria, and they were used extensively at the Moscow Olympics in 1980. ■

Author's acknowledgements: Hosts during my stay were Reinhard Brummer, product manager for dynamic microphones, who seemed to be the expert on the local restaurants and bars, Norbert Sobol, product manager for all studio products who took me to the concert and coffee houses, and Alexander Fritz, innovations manager, who took me on a guided tour of the machine shops, production and assembly areas and R & D departments, and who seemed to have a remarkable knowledge of almost every aspect of the manufacturing process in all departments. Erich Hofbauer, the studio products sales manager provided some very useful background information on the products themselves.

Every facility was placed at my disposal, every question or point raised was answered fully, I was shown every aspect of the company's activity and, apart from the camera restriction in the R & D laboratories, I was free to take whatever photographs I wanted – even if this meant stopping the production line and some re-arrangement. So I would like to convey my thanks to the company, and to those people in particular, for their excellent hospitality and co-operation.

To me then, there is little surprise in the fact that AKG enjoy the international reputation they do. They have obviously earned it.

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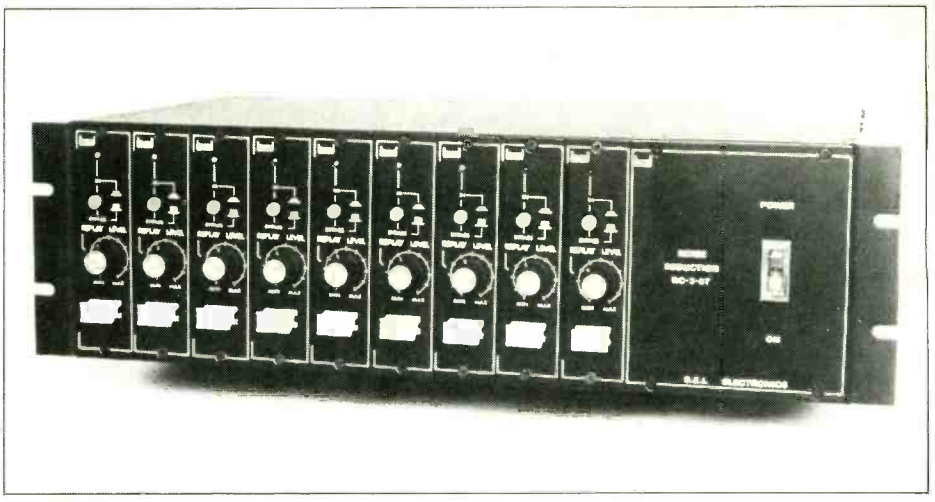
product Noise reduction guide



BEL BC-3-8T

AUDIO & DESIGN (UK)
Audio & Design (Recording) Ltd, North Street, Reading, Berks RG1 4DA. Phone: 0734 53411. Telex: 848722.

S37: crossover module which may be used in conjunction with four *F300* to form a single ended noise reduction system.

BEL (UK)
UK: Don Larking Audio Sales, 29 Guildford Street, Luton, Bedfordshire. Phone: 0582 450066. Telex: 825488.

BC3 noise reduction: available in 2-, 8- and 16-channel formats, all standard rack mounting and simultaneous encode/decode.

DB (UK)
DB Electronics, 2 Ash Street, Buxton, Derbyshire SK17 6LL. Phone: 0298 3756.

Codec: 2-, 4- and 8-channel noise reduction with the 2-channel unit being simultaneous encode/decode.

dbx (USA)
dbx Inc, 71 Chapel Street, Newton, Massachusetts 02195. Phone: (617) 964-3210. Telex: 922522.
UK: Scenic Sounds Equipment Ltd, 97 – 99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

dbx noise reduction: available in 2- and 8-channel rack mount formats simultaneous encode/decode *Type I* (for tape use); 2-channel simultaneous encode/decode *Type II* (broadcast use); also variety of module formats including *Dolby* mainframe compatable *K9-22* module.

DOLBY (UK/USA)
Dolby Laboratories, 346 Clapham Road, London SW9. Phone: 01-720 1111. Telex: 919109.
Dolby Laboratories, 731 Sansome Street, San Fransisco, California 94111. Phone: (415) 392-0300. Telex: 34409.

Wide range of noise reduction systems. Models for the *A-System* include 2-channel manual and auto switching and 24-channel auto switching capacity mainframes. Other models are available for *B-System* use, portable use and for optical and video recorder use.

D&R (Netherlands)
D&R Electronica BV, Chassestraat 26, 1057 JE Amsterdam. Phone: (020) 18 35 56.
UK: DSN Marketing Ltd, Westmorland Road, London NW9 9RJ. Phone: 01-204 7246. Telex: 895 4243.

Two units – a compander unit with simultaneous encode/decode functions and a modular *High-Com* type noise reduction unit with simultaneous encode/decode.

FABEC (Sweden)
Fant & Beckman, Eketragatan 22, S-41712 Goteborg. Phone: 031 22.82.10. Telex: 27305.
UK: Scenic Sounds Equipment, 97 – 99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

Mainframes for standard 19in rack mounting that will accept 24 or two channels of *Dolby*, *dbx* or *Telcom* noise reduction in card form.

FOSTEX (Japan)
Fostex Corp, 512 Miyazawacho, Akishima, Tokyo. Phone: 0425-45-6111. Telex: 2842 203.
USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, California 90650. Phone: (213) 921-1112.
UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Hertfordshire EN4 8RW. Phone: 01-440 9304. Telex: 25769.

Model 3040: freestanding 4-channel *Dolby-C* largely designed for use with the Fostex *A-4*.

FUTURE FILM (UK)
Future Film Developments, 36 – 38 Lexington Street, London W1R 3HR. Phone: 01-437 1892. Telex: 21624.

DNR Series: portable unit containing two Dolby *Cat 22* modules and all necessary switching and interface circuitry with internal batteries.

MICMIX (USA)
MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220. Phone: (214) 352-3811.
UK: Scenic Sounds Equipment Ltd, 97 – 99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Dynafex: single-ended noise reduction system (play only) with two channels in a standard 19in rack mount or in a single channel module format.

MXR (USA)
MXR Innovations Inc, 740 Driving Park Avenue, Rochester, New York 14613. Phone: (716) 254-2910. Telex: 978451.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Hertfordshire SG4 0SE. Phone: 0462 31511. Telex: 826967.

Compander: stereo noise reduction system with simultaneous encode/decode.

RUBY (UK)
Database, 1 Vale View Place, Claremont Road, Bath BA1 6GW. Phone: 0225 316102.

Noise reduction unit designed to reduce the noise of stage effects boxes but includes line level output capability.

STRAMP (West Germany)
Peter Struven GmbH, Bornheide 19, D-2000 Hamburg 53. Phone: 040 801028.

NLS: 2- 4- or 8-channel noise reduction system with simultaneous encode/decode.

TELEFUNKEN (West Germany)
AEG-Telefunken, Postfach 2154, D-7750 Konstanz. Phone: 07531 862460. Telex: 733233.
UK: Audio & Design Marketing, 16 North Street, Reading RG1 7DA. Phone: 0734 53411. Telex: 848722.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

Telcom: available as four and 24 channels of switchable encode/decode noise reduction in standard rack mount units (*c4*) and as direct replacement for the Dolby *Cat 22* (*c4D*).

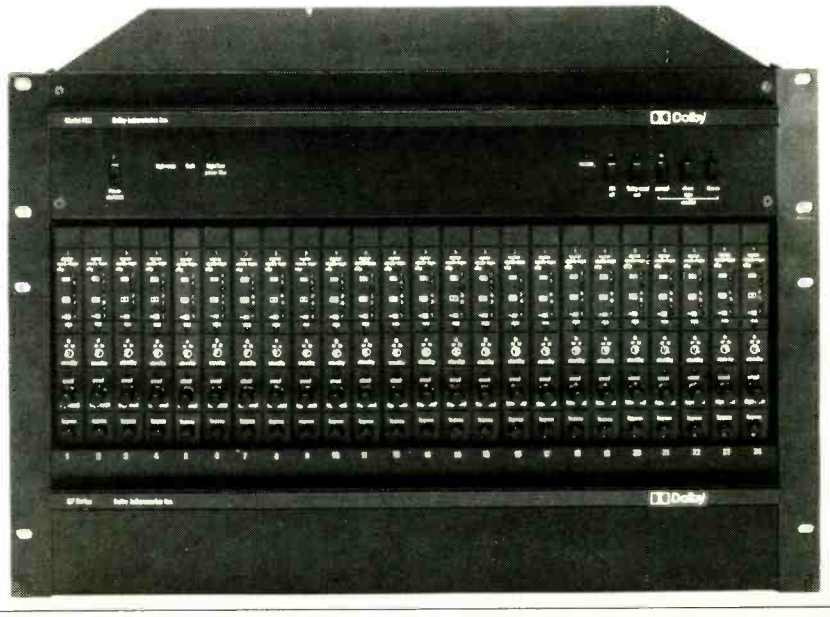
TTS (West Germany)
TTS-Electronic GmbH, Dammuhlenweg 4, D-6270 Idstein. Phone: (006126) 2014. Telex: 4182297.

2- or 8-channel noise reduction systems using *High-Com II* with simultaneous encode/decode facilities.

UREI (USA)
United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, California 91352. Phone: (213) 767-1000. Telex: 65139.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire, WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Model 1181: professional *CX* noise reduction encoder/decoder for the CBS disc noise reduction system. ■

Dolby model SP24



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product Noisegates guide

ADM (USA)
ADM Technology Inc, 16005 Sturgion, Roseville, Michigan 48066. Phone: (313) 778-8400. Telex: 231114.

Model 310: modular noise gate with up to 85dB attenuation.

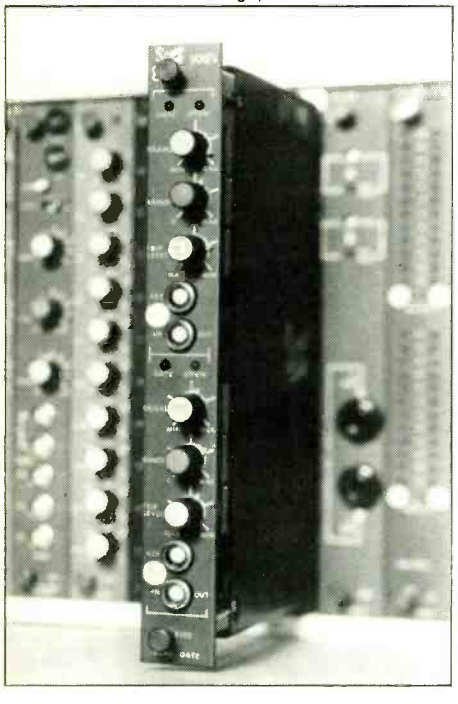
AEC (West Germany)
Audio International Vertriebs GmbH, Gonzenenheimestrasse 2B, Box 560229, D-6000 Frankfurt 56. Phone: 0611 504733. Telex: 413039.

AEC C-39 Dynamic Processor: rack mount stereo expander.

AUDIO & DESIGN (UK)
Audio & Design (Recording) Ltd, North Street, Reading, Berks RG1 4DA. Phone: 0734 53411. Telex: 848722.
USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310. Phone: (206) 275-5009. Telex: 152426.

F300: modular expander/gate for the *Scamp* system.
S100: modular 2-channel gate for the *Scamp* system.
S05: modular dynamic LF noise filter/gate for the *Scamp* system.
S06: modular dynamic HF noise filter/gate for the *Scamp* system.
S37: crossover module which may be used in conjunction with four *F300* to form a single ended noise reduction system.

Scamp S100 (Audio & Design)



dbx (USA)
dbx Inc, 71 Chapel Street, Newton, Massachusetts 02195. Phone: (617) 964-3210. Telex: 922522.
UK: Scenic Sounds Equipment, 97–99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Model 904: noise gate forming part of the *900* rack system.

D&R (Netherlands)
D&R Electronica BV, Chassestraat 26, 1057 JE Amsterdam. Phone: (020) 18 35 56.
UK: DSN Marketing Ltd, Westmorland Road, London NW9 9RJ. Phone: 01-204 7246. Telex: 895 4243.

Noise Gate series II: single channel noise gate module.

DRAWMER (UK)
UK: Recording Maintenance Services, 6 Manor Road, Teddington, Middlesex TW11 8BG. Phone: 01-943 1368.

DS 201: 2-channel rack mount noise gate with frequency conscious keying capability.
DS 100: single channel version for *Scamp* rack compatability.

EMT (West Germany)
EMT-Franz GmbH, Postfach 1520, D-7630 Lahr. Phone: 07825 1011. Telex: 754319.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

EMT 258: low pass filter and expander in modular form.

KELSEY ACOUSTICS (UK)
Kelsey Acoustics Ltd, 28 Powis Terrace, London, W11 1JA. Phone: 01-727 1046/0780.
Psionics *NG-4* quade noise gate 19in 1U rack mount.

MMT (West Germany)
Medical Measuring Technics GmbH, Im hohen Rain 25, D-7050 Wairlingen. Phone: 071 51.55.240.

mmt 2011: modular noise gate with separate front panel, main panel and control module allowing remote operation.

ORANGE COUNTY (Canada)
Orange County Electronics Corp, 534 Berry Street, Winnipeg, Manitoba RH3 045. Phone: (204) 774-3413.
USA: Parasound Inc, 680 Beach Street, San Fransisco, California 94109. Phone: (415) 673-4544.

CLX Module: single or dual channel unit combining a compressor/limiter, expander and gate.

QUAD/EIGHT (USA)
Quad/Eight Electronics, 11929 Vose Street, North Hollywood, California 91605. Phone: (213) 764-1516. Telex: 662446.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

NS-120: modular noise gate.

REBIS (UK)
Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 6A. Phone: 0384 71865.

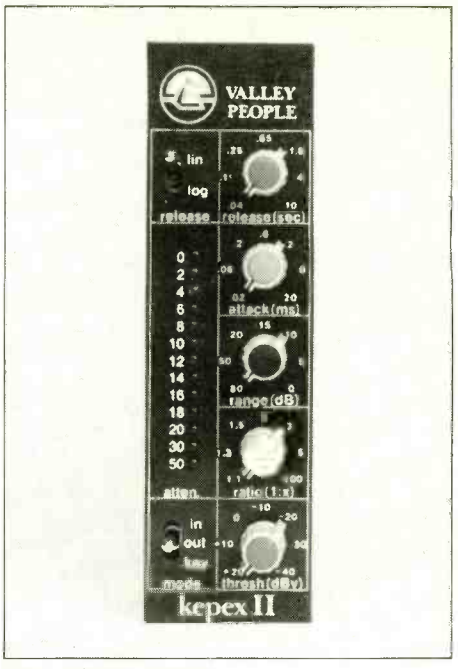
RA201: modular noise gate to fit the *RA200 series* rack or optional version to fit *Kepex* rack.

SCV (France)
SCV Audio, Batiment 3418C Rue de la Jeune Fil, Zone De Fret Sud, F-10314 Roissy. Phone: (1) 862.43.04. Telex: 212802.

Stereo noise gate: 2-channel noise gate in standard 19in rack mount format.

SYMETRIX (USA)
Symetrix, 109 Bell Street, Seattle, Washington 98121. Phone: (206) 682-3076.

Signal gate: 19in rack mount signal/noise gate.



Kepex II (Valley People)

TECNICOBEL (France)
Tecnicobel, 8 rue de la Croix-Matre, BP26, F-91122 Palaiseau Cedex. Phone: (1) 920.80.39. Telex: 692543.

NG50 Dynamic Noise Gate: modular noise gate with coupling for stereo.

tts (West Germany)
tts-Electronic GmbH, Dammuhlenweg 4, 6270 Idstein. Phone: 06126 2014. Telex: 4182297.

NG-2: modular noise gate.
EG-2: modular noise gate with metering and key functions.

TWEED (UK)
Tweed Audio Electronics, Pinnaclehill Industrial Estate, Kelso, Roxburghshire TD5 8DW. Phone: 0573 2377. Telex: 727633.
USA: Tweed Audio (USA) Inc, 12 Ilex Drive, Newbury Park, California 91320. Phone: (805) 499-4764. Telex: 652337.

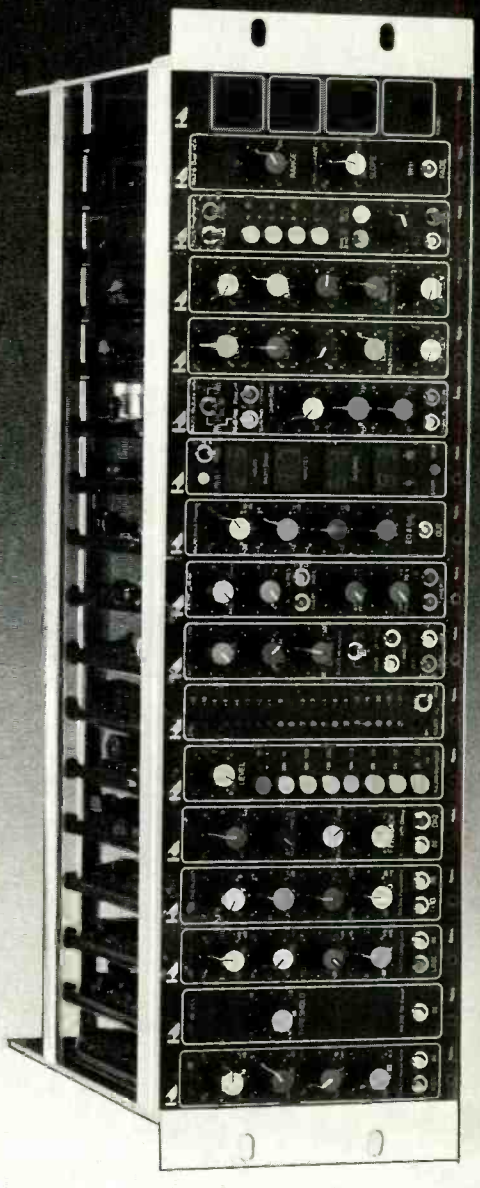
CL606: noise gate intended for console mounting.

VALLEY PEOPLE (USA)
Valley People Inc, PO Box 40306, 2821 Erica Place, Nashville, Tennessee 37204. Phone: (615) 383-4737.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Kepex II: keyable expander module.
dyna-mite: multi-function unit with gating and expansion capabilities including frequency selective modes. ■

Rebis RA200 Series

The Nº1 Gate



The Nº1 System

Get the full facts on the most creative modular system in the world.

Rebis Audio Ltd., Kinver Street, Stourbridge, West Midlands, DY8 5AB, England.
Tel: 0384 71865. Telex: 335494.

Australia; Audio Mix Systems, Sydney 371-9009. **Belgium;** S.E.D., Bruxelles 522-7064. **Canada;** Heinl Electronics Inc., Ontario 495-0688. **Denmark;** Kinovox APS, Lynge 18 76 17. **Finland;** Studiotec, Helsinki 90 556 252. **France;** Lazare Electronics, Paris 8786210. **Germany;** Thum & Mahr Audio, Leverkusen 2173-41003. Hausmann Concert Electronic, Berlin 4336097. Studiotechnik Jurgen Klever, Hamburg 6901044. **Greece;** P.D.R. (Recording Services) O.E., Athens 6820689. **Hong Kong & China;** Audio Consultants Co. Ltd., Kowloon 3-7125251. **India;** Kapco Sound, New Delhi 43718. **Israel;** More Productions B.P. Ltd., Tel-Aviv 62909. **Italy;** Startek, Bologna 23 30 34. **Jamaica;** Audiofon Systems Ltd., Kingston 926-2569. **Japan;** Hibino Electro Sound Inc., Tokyo 864-4961. **Netherlands;** Special Audio Products B.V., Amsterdam 797055. **South Africa;** Tru-Fi Electronics, Johannesburg 838 4938. **Spain;** Mike Llewellyn Jones, Madrid 445-1301. **Sweden;** Tal & Ton, Gothenberg 803620. **U.S.A.;** Klark-Teknik Electronics Inc., Farmingdale, N.Y. 249-3660.

dbx Model 700 Digital Audio Processor

One of the most talked-about items of new hardware at the recent Anaheim AES Convention was dbx Inc's first foray into the world of digital recording. Their aim was to produce a professional 2-channel processor which would at least equal the quality of conventional linear 16-bit PCM systems, but at a fraction of the cost. The dbx *700* is the outcome of their research, and the low price—around $5,000—is achieved by means of a novel approach to digital recording, known as CPDM: Companded Predictive Delta Modulation. In this interview, Robert W Adams, senior project engineer at dbx, discusses the development of the system and its future, including the projected development of a multitrack recorder with the same kind of price-tag per channel as an analogue machine.

dbx digital—an overview

Richard Elen

"I started working on the project about two years or so ago," says Adams, "after I had completed work on the *20/20* automatic equaliser. I was looking for a project which would top that! Basically, I came up with the method of conversion first; I had this idea of doing delta modulation—in which the numbers generated in the A/D represent *differences* between sampled voltages rather than voltages themselves—in a slightly different way, using linear prediction and so on, and I worked on that for a while, and got it to sound pretty good. Then I thought about what kind of products this would enable dbx to do, which we hadn't been able to do in the past.

"My view of PCM was that it made a lot of sense from a theoretical point of view. The math was easy, and it was all worked out. But it's a 'brute force' way to go analogue-to-digital, especially when you get into 16 bits, because of the accuracy required in the D/A converter, and the anti-aliasing filter requirement. I just had the suspicion that there was a 'sneaky way' around it, a better way that, psychoacoustically, would sound as good or better than what they're doing." Adams's view was that some of the novel approaches to linear PCM—like the oversampling technique used by Philips, in which 14-bit D/A converters with 16-bit accuracy are used—was not a solution to the anti-aliasing filter problem and was only really applicable to decoding because of the speed restrictions.

"So I thought, let's go for broke, and work on a digital audio recorder. There were a bunch of prototypes that worked to varying degrees. One of the things I thought about delta modulation was that it was very insensitive to bit errors. There is no such thing as a 'most-significant bit' anymore—it's a bit-stream, and all the bits have a value just large enough to handle the sample differences. Because of the video requirements we have a block format, but even that isn't theoretically necessary. Initially I thought we could get away without error-correction, because we had built dropout simulators and discovered that we could lose 50 or 100 bits and hardly notice the difference. The first prototype we carried around had no error correction, and that's the one we brought to the Boston Symphony Orchestra sessions in March 1982. It took over a year of work before we could build that prototype.

"We got back from the BSO sessions and the tapes sounded pretty good, but over time the tapes started degenerating, and you could hear the errors, so we knew that we needed error correction. We designed an error correction system and, once again, it isn't the standard Japanese system: we use a 'convolutional' method which is somewhat different." Conventional PCM has a defined word-length, and various mathematical operations can be performed on the data to obtain parity words which can be used to reconstruct the data to a certain extent, to re-create a missing data word, for example. For larger errors, a system of averaging between known samples is used. "But," says Adams, "there is some doubt as to how audible that interpolation is.

"We found that there are two types of error: tape dropout errors and tracking errors, where the VCR will just lose sync with the scanning. Even in consumer format, tape dropout errors are generally less than five TV lines. Tracking errors can be quite long, and exceed anyone's error-correcting capability, and the only way to tackle those is to dig into the VCR, use good tapes and use the right VCR. That's when the Sony system will go into its 'mute' mode. Incidentally, we

recently tried our system on a new Sony *U-Matic* front-loader which incorporates 'video correlation' error correction, finding video noise by comparing between frames. This is a disaster for digital recording! Both the Sony system and our system would require that on that particular deck you take the side cover off and turn down the video correlation pot."

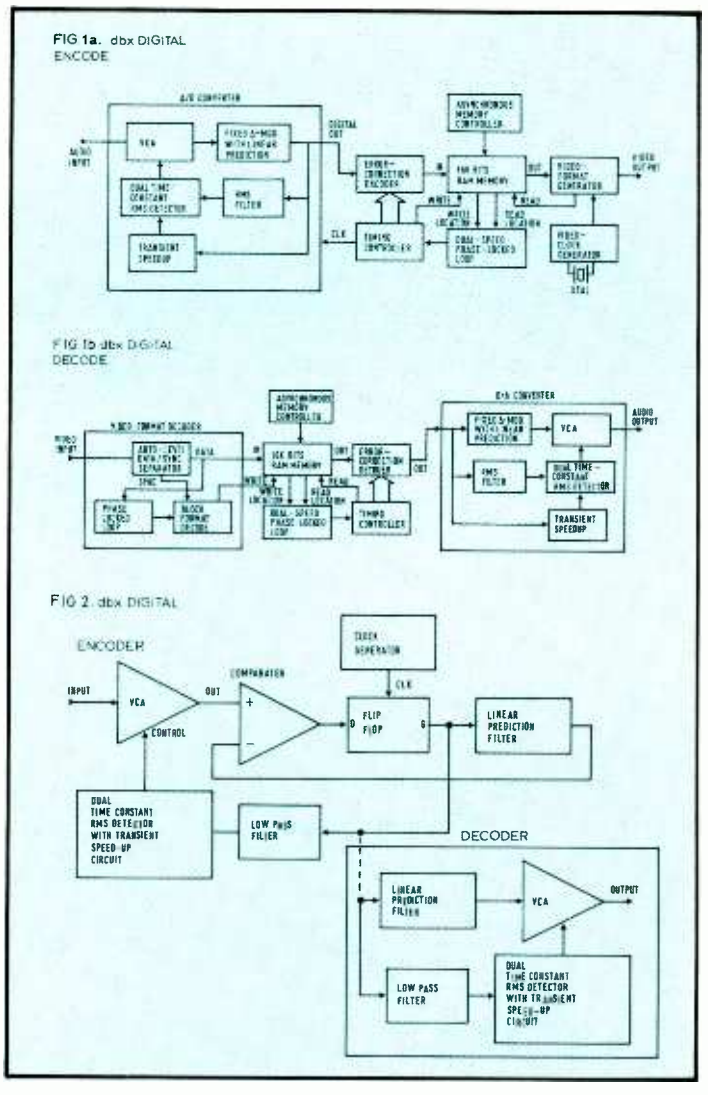
Delta modulation

One approach is to use 'adaptive delta modulation', in which the step size—which determines how the system 'hunts', how large it can go from one sample to the next to follow the signal—is changed according to the signal. The larger the signal, the larger the step size is made to follow the signal. But when the step size is increased, the quantisation noise is increased too, so you end up with a form of noise modulation of the signal. This could be a problem. "One of the problems we found with ADM," says Adams, "is that the noise floor is not always 'white': in fact you can get little 'birdies' and 'tweety' noises which result from not using dither noise. The reason that dither noise is not used with ADM is that the step size, the quantisation level, is changing over a 1000:1 range. There is no single level of dither noise that will cover a couple of quantisation levels. What we used was a *fixed* delta modulator, and instead of adjusting the step size to suit the signal, we adjust the signal with a VCA (which allows an adjustment range of 1,000,000:1) to suit a fixed step size. That allows us to add a fixed, right amount of dither noise. Another difference that we have come up with is that our fixed delta modulator is not the simple integration type: it has a more complex filter than an integrator, and it accomplishes what is called 'linear prediction'. It looks over the past 20 or 30 samples of the signal. Let's say that of those samples, seven were too high, and three were too low, you would be able to tell that the signal was decreasing. So you would be able to predict, since music doesn't normally have large changes from one sample to the next (especially if you're sampling as we are at 700 kHz), what the next step size really ought to be."

A bit rate of 700 kHz sounds very high, and it is tempting to compare that with linear PCM. At 48 kHz sampling rate, you could say that the bit rate is 48 × 16 = 768 kbits/s, but of course, the PCM system needs 16-bit absolute samples: the sampling rate (48 kHz) and the bit rate (768 kbits/s) are not the same. The dbx system does not use 'words': it is a bit-stream in which the sample and bit rates are the same. Such comparisons are thus rather misleading. The *sample* rate is the only real comparison that can be made. "There is no way to come up with a 'word' format to describe the dbx system," says Adams.

In the dbx *700*, an analogue signal is applied to the input of an A/D (see **Fig 1a**). What happens after that? What comes out? "It's a serial bit-stream. A regular delta modulator is a feedback system. The signal goes into one side of a comparator (**Fig 2**) and the estimated signal goes in the other side. Every sample period you compare the estimated signal to the real signal, and if it's too high, for example, you send a low signal out to an integrator, which simply ramps down. We have increased the degrees of freedom. Instead of just ramping down or up, say by ±10 mV as in a normal delta modulator, our system can shift the centre about which it can go down or up. It's not just zero: you can go +15 mV and —5; or +30 and +10 or whatever. The quantisation—which is the difference between those two steps, the maximum error that you can have—stays the same. But the maximum *slope* that you can track goes up. This is all by looking at the past history of the signal—the 'predictive' part of CPDM." But surely this will create ringing with a square wave, where the system is estimating a rising signal, and then suddenly it stops rising? "It will overshoot a little," says Adams, "but that will give you ringing at an ultrasonic frequency, well above 20 kHz. And it doesn't ring very much. We're not looking at the past history in terms of milliseconds: it's a matter of microseconds."

Presumably, this means that there is no real necessity to place a solid limit on frequency response, unlike PCM systems. Says Adams: "There's no brick wall. It's more 'rubbery'!" There is, of course, a theoretical limit at 350 kHz, half the sampling rate, but there isn't much headroom up there! "My own feeling on frequency response," says Adams, "is that a response beyond 20 kHz is not necessary or audible. On the other hand, the problem with the anti-aliasing filters that we're seeing is that in order to get the high rate of rolloff, the phase shift *in* the band is extremely high. There is a lot of controversy about whether that's audible or not. With 10- or 12-pole filters, you're talking about errors of thousands of degrees at 20 kHz. And that extends all the way down. The area where there's likely to be trouble is in the mid-band region, where phase distortion is more audible. Because our sampling rate is so high, our anti-aliasing filter can be very gradual, reaching —60 dB at 200 kHz. This results in a phase shift of less than 100 degrees at 20 kHz."



Companion and prediction

On the dynamic range front, this linear prediction gives distinct advantages. Without linear prediction, you would be looking at about 55 dB signal/noise. "With linear prediction," says Adams, "we get that up to about 70 dB. The system is rather better at making that 'next guess' than a fixed delta modulator would be. Then we have a compander, which is quite different from those used on our analogue tape systems. The RMS detector, and everything that controls the gain of the VCA, comes from the digital output (see **Fig 1a**). One interesting thing about the output from a delta modulator is that the signal itself—in terms of frequency-domain analysis—is present in the bit-stream. If you put the bit-stream into a Fourier analysis machine, you will see the analogue signal right on it. So right from this bit-stream, we can look at how hard the delta modulator is being pressed, and adjust the VCA gain accordingly. The whole key is to make the speed of the gain-change similar to the speed of the music. For slow, non-dynamic music you want a nice, heavily-filtered control voltage. For fast stuff, you may want to make it go as fast as possible. So we have an RMS detector which has basically two speeds, slow and fast. On top of that we have the transient speedup circuit which senses a signal overload lasting more than about 20 μs, at which point it will make the RMS detector go really quickly. This, of course, would not be possible around an analogue tape recorder, because you just couldn't decode it at the other end." Of course, as the dbx system gets its control voltage from the bit-stream, which is the same at 'both ends' of the system, there is absolutely no possibility of the compander mistracking.

The compansion system works more or less linearly up to a certain point, above which it turns into an infinite ratio when the transient speedup circuit comes in. This means that you can overload the system and still recover it at the other end. Although the expander at the other end goes into an 'infinite' mode for a brief period at such times (not a situation to happen for long),

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it does mean that the system can cope with, say, a hot snare drum beat without shutting down or clipping, as would a PCM system. This makes the system more tolerant of operator error. The actual compansion curve has no one ratio: it has a number of carefully-designed 'knees' in the curve, tailored for best results. Dither noise is intentionally built into the compander circuitry, just as PCM systems often have noise designed into the filters for the same purpose.

The bit-stream next passes to a set of circuitry which clocks the bits into and out of 16K of 70 ns, H-MOS static memory, to even out wow and flutter, etc and is then coded into video format for recording on a VCR. "There's a dual-speed phase-locked loop there. The whole point about getting rid of wow and flutter is that you have a memory that is large enough to absorb the variations. You feed the bits in one side and feed them out at a constant rate the other side. But you need some kind of timebase corrector, a phase-locked loop, to ensure that the average 'in' rate is the same as the average 'out' rate, so that you neither overflow nor run out of data. It has to be a very slow PLL so that the wow and flutter spectrum is heavily filtered, so there could be difficulties getting into lock when you first start up. This was one of our early problems. So we went to a dual-speed PLL, which senses when the input and output rates don't match, and switches into its faster rate, settling in about a second or so. After about five seconds it switches into the slower mode, where it filters wow and flutter. For the first two seconds after turn-on, you might have the wow and flutter of the VCR in the output." There is only about a 1.2 μs delay between the two channels, which are alternately sampled, unlike PCM in which there might be as much as 20 μs delay between channels, and that appears to be at the threshold of the ear's ability to detect phase differences.

Video formatting

"The video clock-generator is crystal-controlled. The system uses standard NTSC video format, recording 128 bits/line, on 224 lines out of the possible 262.5. So you leave a bunch of lines in the middle blank for putting in vertical-interval time codes and so on. Using VCRs there's always a point where the head switches, and this is designed always to be in the vertical interval—you can't ever record over that!" There will be a PAL version very shortly. "Another part of the video format is that we have a 'white reference pulse' stuck at the beginning of the line," Adams continues. "This is higher in level than the data pulses, and this gets round the problem with VCR AGC circuits, which often have differential nonlinearities, and a

frequency response which worsens near the white end of the scale. As you need as much bandwidth as possible, you need to avoid recording in the 'whitest' end of the video scale. The white reference pulse stops the AGC from recording the data at the highest possible level." The reference is stated at the beginning of each line, and must be wide enough to 'set up' the AGC correctly. It is in fact three data pulses wide. "We also use the reference pulse to identify which lines have data on them. They don't appear during the vertical interval. One main problem we had in this area was that while the system could allow for a missing reference pulse after it was running, what would happen if it missed the first reference pulse after a vertical blanking interval? This takes a good deal of fancy decoding in the block decoder. We look at pulses during the vertical interval and if a reference pulse isn't recognised after a certain time period, we give up on that line—the error correction will deal with it anyway—and we send a signal to the memory telling it not to shift the next set of data into memory starting from 00; go to position 128 and start from there. As long as you don't lose sync, you're all right. Before the data comes along, there are two horizontal lines' worth of sync information for the PLL to lock up."

The signal comes off the tape and through an automatic level-sensing data separator. The self-same circuits are used for encode and decode, the unit not being a simultaneous encoder/decoder. The clock is regenerated via a PLL, the video block format is decoded, and the reconstituted bit-stream is written to memory. "What's necessary," says Adams, "is that every bit that came from a certain place in memory and on to the video tape, has to come back and get to the *same* place in memory. That's what is necessary for de-interleaving. The beginning of every frame starts at a particular place in memory, let's say 00, and ends up at a certain place, and it is synchronised to the frames. There are 128 bits/line, and 224 lines: that gives you 28.7 kbits per half-frame (per field). It is synchronised so that you can separate left, right and parity. Then the block format decoder makes sure that you don't lose sync between the memory and what comes in from the video. Also you have to be very careful with video: dropouts can fool some of this circuitry, by looking just like a sync pulse. You have to have plenty of checking. Error corrections will not work if you lose sync between what's on the tape in a particular video location, and what goes into a particular RAM location. About 8K of the memory is used for data interleaving, while a further 4K is used for storing data during the vertical interval. The remaining 4K deals with wow and flutter."

The error-correction circuitry consists basically of a shift register with a number of taps, going into a parity generator. When you decode this, you compare the parity that went in with a recomputed parity, computed from the data that came in. If they don't agree, then something went wrong. "The trick is," says Adams, "to make every possible condition of bits being in error produce a unique pattern of parity errors. What we have done to simplify the circuitry is to take advantage of the fact that, on a VCR, you never really get random errors, you get bursts of errors. Using that information, you can design an error-correction system which is simpler, yet can cope with long dropout errors. We use 33% overhead: that means one parity bit for every three data bits. The parity is interleaved with the bit-stream: a bit of left, a bit of right, a bit of left, and a parity; then a bit of right, a bit of left, a bit of right, and a parity; and so on."

There is obviously going to be a variation of headroom with frequency. "It's pretty much a straight line," says Adams. "The system has over 110 dB dynamic range up to about 1 kHz. By the time you get to 10 kHz, you're down to a little over 90 dB; at 15 kHz it's about 86 dB. But fortunately it seems to follow the average peak spectrum of music pretty closely. If you have material with extreme amounts of HF you may not be able to use the full 110 dB dynamic range."

The dbx 700

The machine itself is a rack-mounting unit, 3U high, with a power supply module on the right, with switch, and input and output modules on the left, next to a pair of LED bar meters. "The whole system is modular. The unit will be available with combinations of modules, mike input, record, and playback. There will be a replay-only model, a line-level record/play model, and one with the additional mike preamps.

"The optional mike preamp has stepped gain control for each channel, from 20 to 60 dB, line/mike source select, and switchable 48 V phantom power per channel. The line input is referenced to +4 dBm. The mike circuitry offers a less than 1 dB noise figure for any impedance from 100 Ω to 1 k Ω. There is only one coupling capacitor in the whole preamp, which uses discrete transistors and is a fully-differential push-pull 'instrumentation amp' style circuit."

The input module incorporates pre and post clip lights which allow for accurate gain setting. There are three input/setting possibilities: a pot, a screwdriver preset, and an internally-set 'ref', selected by a three-position toggle switch. "With

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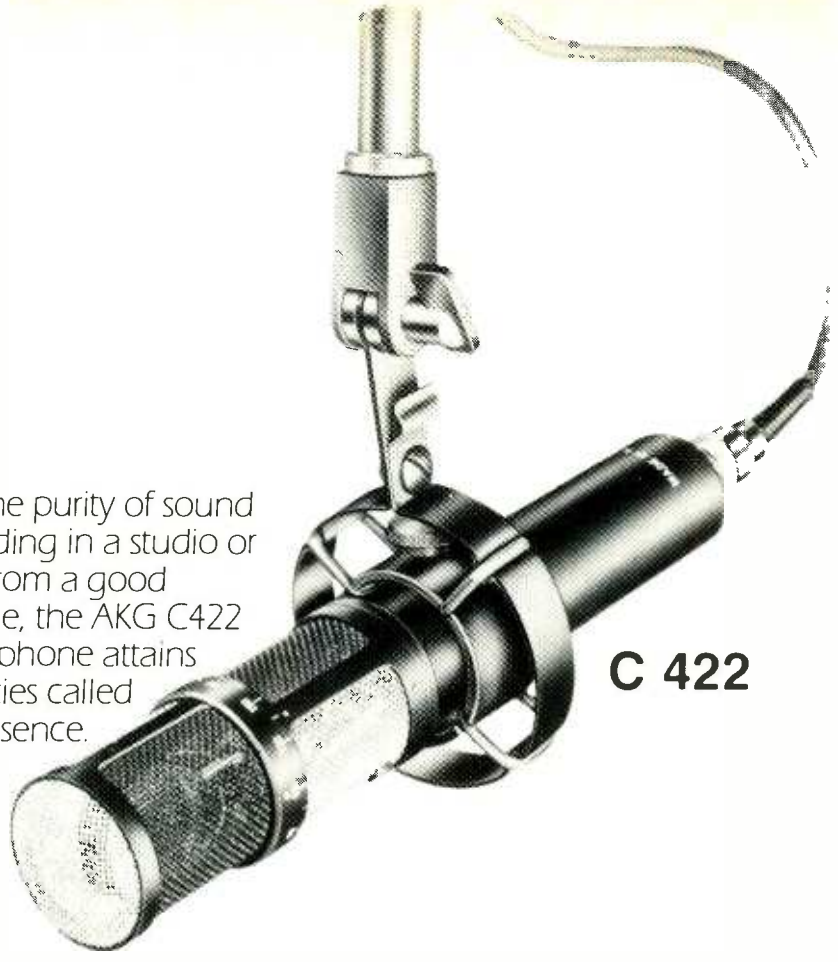
acoustics



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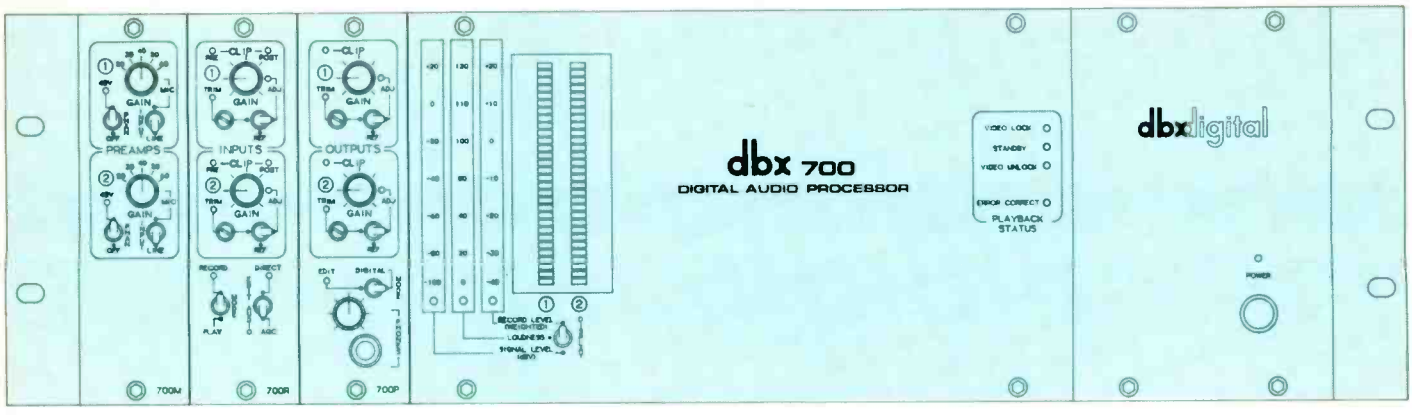
AKG



both the inputs and outputs set to 'ref', there is unity gain through the system. We at dbx feel that people should begin thinking about playing back instruments at real levels instead of the way that some studio people seem to do." The clip lights are either side of the gain control, the preset offering up to 20 dB attenuation, while the rotary pot goes down to infinity for fades, with 10 dB of gain available on the rotary controls. There is also a record/play switch plus switching between direct and AGC-controlled analogue 'edit' mode audio recording. "While you are recording, there are outputs available which are designed to go to the analogue audio tracks of the VCR. These can be used for editing, where the digital audio would not be recovered in slow-motion modes. On the playback module there is a switch to select between analogue and digital, so while you are editing, you can flip into the analogue edit mode, perform the edit, then listen back digitally." Editing can be performed with ± 1 frame accuracy with a standard video editing system. The switch selectable AGC-controlled analogue recording system utilises a 2:1 compression ratio to enable ordinary analogue VCR tracks to cope with what would otherwise be far too much dynamic range.

The output module has similar gain-control options to the input module, with a knob, preset and 'ref' position. There is also the switch for selecting digital replay or analogue 'edit' audio. The analogue ins and outs send and return to and from the VCR audio tracks, the switch selecting whether analogue or digital audio is relayed to the unit's main outputs. The module is completed by a headphone socket and level control.

The metering system has three modes. "In the record mode, you have 2 dB per LED; 60 dB dynamic range. It is pre-emphasised to follow the decreasing headroom at high frequencies. It is very fast: 2 ms attack time. The meter is reading right off the RMS detector, where there is pre-emphasis so that for high frequencies it commands lower VCA gains. The meter's pre-emphasis is therefore exactly the inverse of the headroom, so at every frequency it will tell you the exact point at which overload will occur.

"The 'signal level' mode offers 4 dB per LED and reads in dBV, with 120 dB range (+20 to —100). It reads RMS level from either the record or replay amps. Then there's the loudness meter, which is something else. One of the things that always bothers us is the way that S/N measurements are made. A-weighting is only right for one loudness level, and is wrong for every other level. So we have made a dynamically-varying filter which will follow the Stevens curves (which are the latest version of the Fletcher-Munson curves) within 2 dB over the whole 120 dB range of the meter. That has a fixed section which accounts for the parallel nature of the curves in the 2 kHz and 5 kHz region, and a varying section which changes the low frequency response according to what level you put in. It gives you an idea of what you are really hearing, rather than 'what the machine says'. We expect most people will use the record setting during recording, and the loudness setting on replay. It's very useful to have that meter to find ground loops in the studio, for example, and things which you might not hear in analogue recording.

"On the right of the unit are a set of playback status lights. There's an error-correct light which, believe it or not, indicates that an error is being corrected! Then the other three I call the 'ready, set, go' lights," says Adams. "In playback, when you have no video coming in, the bottom light is on, telling you that the video is not locked. When video comes in, and the PLL is still locking, it's in the 'standby' condition, for maybe one second, then it goes into the green, indicating that everything is go: video lock.

"Most of the components are off-the-shelf, with the exception of the VCA, which is a computer-selected 'best' version of the dbx *2151* 8-pin SIP VCA. There's a bin, containing chips that nobody will ever be able to buy from us, which go into this."

The future

The NTSC version of the dbx *700* Digital Audio Processor will be available in the late spring, in both the US and Europe. The US price will be under $5,000: in England it is hoped to supply the unit for around £3,500 to £4,000, but this price is subject to revision, and should not be taken too literally. Shortly after the release of the *700*, a delay unit will be introduced, which will take the bit-stream and decode it after a delay, for cutting applications. There is a socket on the rear of the *700* which will supply the bit-stream to the delay unit.

One question that many will ask, no doubt, is 'what about editing?'. It is obviously possible to edit with frame accuracy on a video editor. But it is not intended to release an editing unit for the system at present. "With the price of this product being what it is, the cost of providing an editor to do that really tightly would throw out the entire concept of what we're trying to do. Razor-blade and tight editing will be left to the next product in the *700* series, that being some form of a fixed-head, reel-to-reel multitrack machine. You don't even need to run crossfading algorithms to handle razor-blade editing, so it will be easier to implement than on PCM. Our goal is to produce a price for a machine that is very close to an analogue machine of similar track format." The machine should be a great success when it ultimately arrives.

It is worth noting that although the dbx system will be ideal for modern methods of conventional disc-cutting, metal mastering and so on, it cannot be used *directly* for the production of *Compact Discs*. Says Adams: "There is no way, digitally, to convert from CPDM directly to 16-bit format. You have to go back to analogue. I don't feel that is any major drawback because I think our system sounds better than 16-bit. I don't think you'll hear any degradation going through analogue.

"There's one point that has come out of the show, which we raised at the launch of the *700*: and that's the comment that 'finally there's a digital system which *sounds* good'. We at dbx feel that 'musicality' is important. We feel that we're doing 'music' and not 'data'. We had a prototype a year before the show, and we were continually going round the loop of recording something, *listening* to it, and recording again. Because of the way this thing works, with such a high sampling and reconstruction rate, there is a feeling that because there are smaller gaps between the samples, it's probably better. People are saying that it '*sounds* good', and doesn't 'sound digital'." Comments like that obviously bode well for the system, and a philosophy based on 'musicality' can't be a bad thing. ■

MANUFACTURER'S SPECIFICATIONS
Channels: two.
Storage medium: video tape.
Frequency response: 10 Hz to 20 kHz ±½ dB.
Dynamic range (unweighted, maximum RMS signal to noise floor, input shorted, noise bandwidth 20 kHz): > 110 dB.
Wow/flutter: less than 0.01% unweighted; less than 0.006% W RMS.
THD: less than 0.03% total harmonic distortion, 1 kHz, 1 V RMS input.
Sampling rate: 700 k bit/s.
Error correction: will completely correct 1024-bit burst error up to eight times per video frame (1/30 s).
A/D conversion: precision-companded, linear-predictive delta modulation.
Metering: two columns of 30 LEDs, switchable amongst: record level, pre-emphasized, 60 dB range; wide-range signal-level meter, unweighted RMS, dBV-reading, 120 dB range; loudness meter, 120 dB range, matches Stevens curves to within 2 dB.
Mike preamp: adds less than 1 dB to mike noise for all microphone impedances between 100 Ω and 1 k Ω; balanced in *XLR*.
Headphone jack: yes.
Console connections: line in, balanced, 10 k Ω; line out, electronically balanced; will drive 600 Ω to + 24 dBm.
VCR connections: video in and out, NTSC, 75 Ω, 1 V peak-to-peak, BNC connectors; audio in (for editing), balanced, 10 k Ω input impedance; audio out (also for editing), unbalanced, drives 2 k Ω or greater.
Dimensions: (whd) 19 × 5¼ × 11½ in.
Weight: approx 20 lb.

AES 72nd Convention report

Keith Spencer-Allen

The second AES Convention of 1982, the 72nd, was held at the Disneyland Hotel in Anaheim, California. As well as being the first time at this venue, the technical sessions were much expanded with 78 papers presented in nine subject-divided sessions together with eight workshops. As usual we will cover the highlights of the sessions rather than covering all the papers.

THE first session of the convention covered acoustic and reinforcement techniques with one of the first papers presented coming from Arthur K Yeap of Brüel & Kjaer who detailed various applications of microphone technique to sound reinforcement (AES preprint not available). Recent trends have concentrated on improving the electronic aspects of sound systems while neglecting the electro-acoustic interface and pointed out that there are now new aspects of microphone technology that will permit a fresh look at the creative use of mikes in sound reinforcement.

Don Davis of Synergetic Audio Concepts gave a paper on modifications to the Hopkins-Stryker equation. Since its development in 1948 and subsequent frequent use, its initial applications have been expanded from being separate terms for the direct sound field and the reverberant sound field to account for multiple sources, semi-reverberant spaces, modifiers of the critical distance and various electro-acoustic modifiers of the ratio of direct-to-reverberant sound. This paper covered the present state of these modifications and their applications in acoustic calculations (AES preprint 1888).

A practical comparison between Real-Time Analysis and Time-Delay Spectrometry was the subject of a paper by David Moore of Electrocom, Herbert T Chaudiere of Towne, Richards and Chaudiere, and Bernard S Cahill from the Rauland-Borg Corp. They covered the comparison of RTA and TDS curves at several near- and far-field locations, verification of horn coverage area, interference zones between horns and the frequency response of the loudspeaker cluster at various sound system mike locations. These findings were derived from two separate projects and the results obtained were compared together with general observations and comments (AES preprint 1919).

There then followed two papers covering techniques for improving and predicting the performance of sound systems within rooms as well as defining the array location and configuration. Intelligibility Mapping through Array Perspective Analysis by Thomas G Bouliane of Audio Contractors (AES preprint 1927) covered equations which locate a regular matrix of points throughout the seating area that are referenced to actual room dimensions and also locate the intersection of loudspeaker 'aiming axes' with the seating plane and can solve for articulation loss at these points based upon direct-to-reverberant sound for these points. The second paper (AES preprint 1941) covered a procedure for modelling a loudspeaker array for any configuration allowing the sound system designer to observe the interaction of individual components as well as making the sound and rotational requirements apparent. This paper was presented by John R Prohs and David E Harris of Ambassador College and includes documentation techniques, formulae and projection techniques for scale models.

The last two papers in this session continued the theme of computer assisted calculations of room performance. Ralph H Gibson of Gibson Associations covered computer assisted prediction of sound coverage, phase and levels in rooms inlcuding reflection effects (AES preprint not available). John P Wâlsh and Marcel T Rivard of Barron Associates presented a paper on the Godot system, a computer aided room acoustics modelling and simulation system that provides an audible simulation of room acoustics. The paper covers methods by which the program electronically processes source material to generate the sound that would be heard in the room under design prior to construction. It also covers the use of the system on a minicomputer and the hardware and software needed (AES preprint 1910).

The second session covered studio design and technology and one of the most interesting papers presented was on the history and development of the LEDE control room concept. Chips Davis of LEDE Designs and Glenn Meeks of EA Designs outlined the original test data obtained using Time Delay Sectrometry which gave the impetus to the idea of LEDE, and further development of the concept using time-energy-frequency test systems. In an effort to dispell some of the controversy and misconception, the authors, describing themselves only as two designers working with LEDE, gave practical examples of what may be achieved with full and only partial LEDE treatment (AES preprint 1954).

The complexities of choosing monitor loudspeakers for a large organisation—in this case, a National Broadcasting network that generates a great deal of its own music and drama—are many. David A Bennett of the Canadian Broadcasting Corp and Floyd E Toole of the National Research Council described the selection process that used technical measurements and extensive listening tests with 28 people over 122 hours. The techniques used were reliable enough to give consistent results as to the recommended speakers in three power band categories and their experiences may well prove of interest to other users in a similar position (AES preprint 1906).

Dan Dugan of Dan Dugan Sound Design described an equaliser system for flattening head bumps – those irregularities in the replay response of a tape recorder which can be particularly troublesome with companding noise reduction systems. Using the equaliser between the tape deck and the noise reduction will give improved tracking accuracy from the noise reduction as well as improving other parameters even when not using noise reduction. Several actual examples were given (AES preprint 1901).

A particularly interesting paper came from Frank Opolko and Wieslaw R Woszczyk of McGill University on the use of combinative mike techniques using contact mikes and standard mikes on single instruments. The authors covered a range of acoustic instruments with fully documented test results including drawings indicating the results of pickup location as well as the resulting combinative qualities of timbral definition and increased transient quality (AES preprint 1948).

Sound reinforcement

There were two papers in the loudspeakers session that merit special mention. David G Meyer of Purdue University described the development of a model for loudspeaker dispersion simulation particularly in connection with arrays of drivers suitable for sound reinforcement applications. The technique uses a mathematical 3-dimensional model that allows the dispersion characteristics of any configuration of drivers (which have defined amplitude, phase delay and horizontal/vertical polar dispersion characteristics as a function of frequency) to be simulated using an interactive computer program (AES preprint 1912).

Mark E Engebretson of AB Systems described a practical engineering guide to the design of low frequency sound reinforcement systems taking into account architectural acoustic considerations, loudspeaker mechanical displacement limits, thermal power limits, driver types and quantity and electrical power, etc (AES preprint 1937).

The following session, signal processing and amplification, had the first references to digital techniques. Shuichi Obata, Toshikazu Yosumi, Kanja Odaki, Kazuhiko Yamashita and Yoshiharu Nakamura from Matsushita Electrical described the development of the *SV-100* portable digital PCM processor for operation with a consumer VCR. Obviously a competitor for the Sony *PCM F1*, it uses newly developed A/D and D/A converters and large scale integrated circuits for the converter interface (AES preprint 1899).

The subject of small signals and dither with relation to A/D conversion was the topic of a paper from John Vaderkooy and Stanley P Lipshitz of the University of Waterloo. Common belief is that small signals and details are lost when they are smaller than the smallest significant quantising step. The paper proceeds to enlarge on previous arguments that this is actually not the case when the signal to be quantised contains wide band noise dither that is approximately equal in amplitude to the quantisation step size. The conclusions reached are that the addition of dither effectively turns signal distortion into low level wideband noise as it makes the quantisation staircase a more linear function (AES preprint 1930).

Back on the subject of sound reinforcement, J Rodney Cox of the University of Louisville described a acoustic feedback elimination device—a 'Squealer-Killer' with full real time equalisation and phase-locked loop detection circuitry to locate feedback before it is audible and introduce a notch filter at that frequency to remove it. This is achieved by placing the unit under low cost 8-bit microcomputer control and leaving the signal analogue rather than coverting to digital with the attendent quality loss and the need for a larger computer to manipulate the signal. (AES preprint 1904).

New directions

Under the heading of new directions in audio, the fifth session contained a wide variety of papers. One of the more unusual papers was presented by F Alton Everest and titled Instruction in Critical Listening. It described an audio course of study for the novice which attempts to break down the listening skills learnt by the experienced sound mixer, to detect audio problems and deviations from the norm, into teachable units. This then includes instruction and exercises in the estimation of frequency, sound level changes, band limitations, frequency response deviations, distortion, reverb, noise effects and colourations (AES preprint 1890).

Messrs Tabuchi and Kawamura of the Fostex Corporation detailed development of a flat diaphragm, printed ribbon microphone capsule, a completely new design that was developed to have similar characteristics to the traditional ribbon mike without the operational and constructional difficulties that ribbons presented. The paper also gives performance characteristics, manufacturing methods and the application of the capsule to various microphone types (AES preprint 1934).

The problems of high frequency delay in anti-aliasing filters used in digital applications was covered in a paper from John Meyer of Meyer Sound Laboratories. The steep roll-off required results in this HF delay but the paper describes a possible solution in the form of a tunable analogue phase shift filter which corrects for this distortion. The correction may be done before or after digital processing and the paper continues to discuss the audibility of the effect and a description of a phase-corrected 16-bit digital audio recorder (AES preprint 1911).

Continuing digital themes was Dave Rossum from E-mu Systems with a paper discussing the pros and cons of the use of 8-bit companding D/A converters in electronic music. Economics dictate that 8-bit is used: however this does create some problems and the paper gives some practical solutions with particular emphasis on the interface between 8-bit DAC's and 8-bit microprocessors (AES preprint 1922).

Music scoring direct from keyboard playing was covered by Kentyn Reynolds of the American Center for Electronic Music. This is a software program known as the *Composer's Assistant* for use with a polyphonic keyboard, an *Apple II* microcomputer and an output for video display or a dot matrix printer (no preprint available).

Media

The next session was on magnetic and disk media and contained a very wide range of papers. The first paper was from Peter Hammar of the Ampex Museum of Magnetic Recording was entitled 'The Birth of Tape Recording in the US' and detailed the situation from 1945 when Major Jack Mullin of the USA Signal Corps returned home with two German *Magnetophon* audio tape recorders and the first successful US version of the tape recorder from Ampex in 1947. It also details the initial scepticism that tape was a viable medium and the reluctance to abandon disc as a standard medium. It is fascinating to compare the attitudes prevalent at a time of major technological change and the present scene is fairly comparable with the situation in the late '40s (AES preprint 1928).

Digital audio is the topic in a paper from Robert B Ingebretsen and Thomas G Stockham Jr of Soundstream Inc. Although the sound quality of digital audio is the major talking point at present, it may not be this fact that is the most important factor in commercial terms. As well as many other advantages this paper covers one possible technique—random-access editing. The described system uses a large capacity rotating magnetic disk and a smoothing buffer. This enables the rapid creation and modification of splices, to audition them and then play the cuts in a continuous stream. In addition the system will allow various forms of processing to be applied to the signal as well as different forms of interaction such as display of the waveform.

Continuing a similar theme was James Moorer from Lucasfilm. His paper described an audio signal processing station of which a prototype has been built. The station is capable of performing all mixing, editing, processing and synthesis tasks required for film sound production. The prototype is an 8-channel unit with a sampling rate of 48kHz and the ability to be expanded in units of eight channels to much larger systems. Data is stored on 300 Mbyte disks of which each can hold up to 40min of random access sound and up to four disks may be attached to eight 8-channel unit (AES preprint not available).

Messrs Otsuki, Doi, Yamauchi, Mitani and Yamaguchi of the Sony Corporation described the requirements of a master tape for *Compact Disc* production which must contain the digital audio signal as well as subcode information such as numbers of the tracks, index, time data, etc. A full specification of the audio and subcode formats is contained in the paper (AES preprint 1917).

Under the theme of Audio Tests and Measurements, the 7th session commenced with a paper entitled 'Vertical Modulation Angle of Commercial Stereo Phonograph Records'. In playing back a record, one of the objectives is to match the vertical tracking angle of the cartridge to the recorded vertical modulation angle of the recording being played. An analysis of the results obtained from a survey of commercially mastered pressings was reported and covered in relation to existing standards, commercially available cartridges and the playback distortion implications. Proposals for a new standard were made based on this work (AES preprint 1940).

Philip White of Brüel & Kjaer described an application of Time Delay Spectrometry with relation to the design and evaluation of studio mikes. This technique will give performance data such as free-field amplitude, phase response, energy-time curves and directional capabilities (no AES preprint available).

In a paper called 'Rethinking Frequency Response', Bill Allen of dbx Inc covered traditional techniques of measuring the frequency response of audio systems and why there are discrepancies between measurements and perceived frequency response. He places special emphasis on signal dependent systems and noise reduction systems. He then details methods for improving the correlation between subjective and objective measurements (AES preprint 1916).

One of the later sessions was entitled 'Psychoacoustical Illusions', but unfortunately the papers themselves are somewhat illusory as none of them are available as preprints. The first paper was presented by Diana Deutsch of the University of California who demonstrated a number of psychoacoustic illusions which vary in effect with the left- or right- handedness of the listener. These illusions occur predominately in headphone listening although are also found in free field listening. In a paper entitled 'Some Auditory Illusions and their Bases', Richard Warren of the University of Wisconsin demonstrated a number of illusions such as perceptual changes in a repeated unchanging word, confusions in identifying the order of clearly heard sounds and perceptual restoration of sounds masked by noise.

In a paper on the 'Influence of Posture on the Spatial Localisation of Sound', James Lackner, of Brandeis University presented evidence to question the belief that perceptual localisation of sound depends solely on the pattern of auditory clues heard at the ears. He provided information that leads to the conclusion that computation of the auditory direction also involves "...non-auditory information from visual, vestibular, tactile and proprioceptive sources concerning the spatial configuration of the entire body". ■

business

BARRY FOX

CBS Spoiler

You will doubtless have seen some interesting quotes in the press recently. BPI Technical Committee Co-Chairman Gerry Bron said: "It is definitely *the* solution to home taping. It works and I hope it is adopted. I can't fault it." Co-Chairman of the BPI Technical Committee Monty Presky agreed with Bron: "It is technically brilliant. It works and it is a very clever idea."

What were they talking about? The new spoiler system developed by CBS. But this time it's a spoiler with a difference. As Presky went on to say: "It raises a number of practical and political problems." CBS doesn't even want to call it a spoiler. The company prefers a name like 'anti-taping device'. Full marks to CBS for talking frankly about what initially looked like the latest record industry folly but which, when put into perspective, isn't as daft as you'd first expect. The only pity is that CBS and the BPI talked first of all to the music press alone, who as usual garbled the story and thereby generated unnecessary bad publicity.

To begin at the beginning, it's been plain to anyone with any technical knowledge of audio, that it's not practical to put an inaudibly high or low frequency signal on a legitimate recording, which will 'spoil' an unauthorised copy. In the laboratory it's easy to get a high frequency signal to beat with the bias of a tape recorder. Or you can upset the recorder's AGC with a low frequency thump. But in the real world you either don't recover the spoiling signals, or you can easily filter them off if you want to make a copy. In the jargon, they are not robust. Apple, the Beatles' electronics company, were the first people to find this out the hard way. In 1967 and 1968, they tried to develop and patent a high frequency spoiler. It failed, of course, but others tried. The BPI still refuses to release the £10,000 report on spoilers commissioned from the Wolfson Unit at Southampton University in 1978, so unfortunate inventors have gone on retracing the same dead ends, over and over again.

I've never put it in print before, but in 1976 (two years before Wolfson) I did some research on alternative solutions. It seemed to me that as it was clearly impractical to add a robust spoiler to a music signal without degrading it, the answer might be to take something away. I borrowed some very steep filters and tried taking notches out of a music recording. As I suspected, if the notch was steep enough you couldn't hear it. Then with the help of Dolby Labs, I checked that you could recognise the existence of the notch by spectral analysis—you can. By notching at a mid frequency (I went for around 3 kHz) you prevent anyone from tampering with the notch, either by filling it in or filtering off the entire signal.

Within a few days of my visit to Dolby Labs I received a phone call from Geoffrey Bridge, then director general of the BPI. He had heard through the grapevine about what I was doing. When I tried to explain it over the telephone he clearly didn't understand a word I was talking about and that conversation was the beginning of my ever-increasing disillusionment with the BPI, representing as it does the interests of the supposedly technology-based record industry. I offered to draft a description of what I was doing and, following standard legal practice, filed a copy of what I had written at the British Patent Office. For anyone interested, the filing number was 35639 and the date was August 26, 1976. I sent a copy of the document to Geoffrey Bridge and over the next six months became increasingly annoyed that no one came back to me. Presumably no one at the BPI understood what I had written.

Finally, in February 1977, Geoffrey Bridge wrote to me saying that EMI had told him that the notch idea was very similar to something proposed by Crosby a few years earlier. I presumed they meant Murray Crosby, not Bing, and did some digging. Sure enough Murray Crosby had done similar work in the late '60s. Because I thought the work might be interesting to others in the field, and save them duplicated research, I published details of my research, and Murray Crosby's findings, in the July 1977 issue of *HiFi News and Record Review.* After the BPI brush-off I lost interest in the idea, and settled back to several years of frustration watching the record industry (including Gerry Bron of the BPI Technical Committee in 1980) talk about robust spoilers as if they were a practical proposition.

By now you will have guessed how the CBS anti-taping device works. Instead of putting an inaudible signal into the music, it takes a notch *out*. Although specifics are flexible, CBS propose a notch 200 Hz wide, centred on 3.7 kHz. Predictably, such a notch is almost always inaudible. Murray Crosby (and I) were suggesting that the notch should be used to identify material. Crosby also said it could be used to switch a recorder. EMI told the BPI it was unlikely to work but neither EMI nor the BPI bothered to do any experiments. Now CBS has proved that it does work!

The suggestion is that, in future, laws will be passed to make it illegal to sell a tape recorder which doesn't have a notch-sensor integrated in the same chip as a vital circuit, like the bias control. Every new recording, or broadcast of copyright material, will be notched at a matching frequency. When any attempt is made to record a copyright programme, the sensor circuit will hunt around the centre frequency looking for a notch. It will need to hunt for a minute or so to cope with pitch differences caused by replay speed errors, either deliberate or accidental. It will also need to be slugged so that it doesn't respond to silent passages in the music, where there is little or no signal at all. When finally satisfied that the telltale notch is present, the sensor circuit switches off the bias so that the recorder can't record.

Technically, it's an elegant solution, especially when put across by CBS engineers with both enthusiasm for the idea and understanding of the technology. There is no reason, says CBS, why record companies shouldn't start issuing notched discs now, in readiness for legislation if it ever comes. The notch is inaudible, say CBS, because it is only acting like the crack between notes on a piano keyboard. The system can work on any carrier, whether it's tape, vinyl disc, digital disc or broadcast radio. It's also applicable to video. If a record factory, broadcast station or duplication plant installs a notch encoder, costing around £1,000, any programme being handled can be doctored. By putting the sensor circuit in the same chip as some vital part of the recorder, it will be more difficult for users to disable their own machines. Those are the arguments in favour.

All this makes a fair deal of sense, but already there are 20 million tape recorders on the British market (the BPI's own figure) and none of these can be retro-fitted. Also, the logistics of getting every tape recorder manufacturer in the world to fit a disabling circuit in future are daunting. How can Customs possibly distinguish between machines at the docks which do and don't have a sensor integrated in the bias chip? How can the police possibly stop shops from selling tape recorders that don't have modified chips? And once killer chips are fitted to some machines, how can the industry still ask for a tax on blank tape?

The real irony of this is that the CBS idea could have worked, if it had been put forward in the '70s, before the hi-fi boom put 20 million recorders into British homes, and before anyone had even dreamed of today's video boom, which has already put three million video recorders into British homes. I can't help wondering whether matters for the record industry might have been just a little different if, in the autumn of 1976, when I tried to talk to the BPI about the possibility of notching copyright material, I'd been dealing with people who understood what I was trying to talk to them about.

Compact Disc alarm

In November, Polygram UK finally put on a press conference to discuss its plans for marketing *Compact Disc* in Britain this spring. They got some heavy flak from hi-fi journalists for demonstrating *CD* with a pretty nasty sound, but you've got to remember that PolyGram UK is a record company and record companies just don't know about hi-fi. I've been going to hi-fi exhibitions in Britain for at least 10 years and there's never an official presence by any of the major record companies. Hi-fi reproduction and record production should be closely tied, but the sad truth is that they are not. It's one reason why the record industry has got itself into such a mess. But at least PolyGram *tried* and that's worth quite a few points on anyone's scale. They also talked more frankly than most record companies about projected sales of *Compact Disc*, dealer networks and costing. It's a big step in the right direction. Next time will be better.

By the way, if you hear talk of a curious HF whistle that plagued the PolyGram dem, don't blame PolyGram. It seemed worst of all where I was sitting so afterwards I joined the PolyGram engineers hunting for the source. We checked lights, amps and power supplies. The odd thing was that the whistle seemed to move as we moved. So we reckoned it must be coming from the ceiling and reflecting off the walls. But it even moved with us out of the room as we gave up looking for it. Suddenly all was revealed.

I'd travelled to the press conference on the central line tube, soon after a train crash at Marble Arch had closed the line. We'd been trapped for over an hour crushed together like sardines. The crush had cracked my pocket calculator alarm which had developed a short and gone into oscillation. The phantom high pitch whistle had been coming from my pocket all the time. Oops. Sorry.

■

Studiofile:1

Prism Recording Studios, Lausanne

Behind the present Prism Studio in Lausanne lies a story that is probably familiar to all those studio owners who were never able to 'open with a bang' and who had to tread the uphill cli...b from modest beginnings to commercial success. Starting from 2-track and graduating to eight in various basements in the Lausanne area, the present Prism Recording Studios is now a fully fledged 24-track commercial studio situated on the third floor of a large building in the city centre. There are various car parks within easy distance and unloading does not present too much of a problem. For those who are civic minded and prefer public transport, the rail and bus stations are two minutes away! The situation also offers immediate access to a multitude of restaurants, snackbars (even a McDonald's) and bistros so catering for the hungry and thirsty is no problem.

The studio is reached by lift and upon entering a large corridor one finds plenty of room for cases that will not be needed in the studio for the session. This opens into a rest/relaxation area with drinks machines, chairs and hi-fi system, the latter also being connected into the control room monitoring system for 'domestic' listening—or for when the control room is too crowded!

Next stop after the lobby is the control room. This is about 35 metres square and as such quite roomy. There is plenty of space for the engineers to move about without falling over producers, musicians and other odd bods who may be present and adequate seating is provided towards the rear of the room. The acoustics are home-grown and are a mixture of trapping underneath the monitors and window, wood reflective surfaces, hessian covered Fibreglass and rear drapes. This makes for a bright, punchy sound which is one of the Prism trade marks. Monitors are flush-mounted Tannoy *Buckinghams* with suspended Keesonic and desk mounted *Auratones* providing alternative listening. Amplification is by a Quad *405* though various amplifiers providing more beef for the Tannoys are often in use.

Recording centres around an Otari *MTR-90* 24-track recorder and a Harrison *Alive* 32-channel desk. Though designed as an ultimate PA console, the *Alive* can be used for multitrack recording providing a little forethought is used. Sending to the tape machine is either by the channel direct outs or from the four stereo subgroups. Further flexibility is achieved by the use of the 8 VCA subgroups. A little bit of patching never hurts anybody and the results obtained with the console are the same as those with the Harrison studio desks. What about foldback and monitoring? I hear you say. Though this is easily solved by using two of the eight auxiliaries as stereo tape returns, Prism have opted for a rather novel solution that is borrowed from the PA field, that of having a separate monitor desk. This has been built in collaboration with Sonosax and provides monitoring from all tape sources, 2-track as well as 24. Apart from the 2-track sources, the desk is basically a 24/6 configuration with two stereo cues for the studio and stereo mix for the control room, each stereo send having pan and echo send. This arrangement offers a lot of flexibility and allows the engineer to concentrate on the recording while the assistant engineer and/or producer occupies himself with the monitor mix and foldback. Though not everybody's idea of working, it does suit Prism, which, as far as they are concerned, is the main thing! To further facilitate multitrack working a custom-built 24-channel LED column meter has been installed on the main console. As the Harrison is designed to be placed on a table the console at Prism has been built into an attractive wooden console that wraps round in an 'L' to include the monitor desk and patchbay, not forgetting the producer's desk.

As keyboard overdubs are often done in the control room, a wide shelf has been left in front of the control room window to accommodate most of today's electronic instruments—at the time of my last visit a Prophet *10* was sitting there quite comfortably—and allow the musician to have good visual contact with his colleagues the other side of the glass. It also keeps him out of the engineer's way!

Signal processing is confined to two racks to the rear of the room. These contain a *Scamp* rack with compressor, expander/gate, dynamic noise filter, sweep EQ and ADT modules, White ⅓-octave equaliser, Eventide *Instant Phaser*, Technics 'paragraphic' equaliser (though primarily a hi-fi component, this works well in the studio), Publison pitch shifter with keyboard, and hidden among the power supplies for the electrostatic headphones, some MXR *Auto flangers* and *Mini-limiters*. A recent addition to the special effects department has been a dbx module rack which so far has comp/limiter, gate and de-esser modules. Reverberation is provided by an AKG *BX 20* and at the time of my visit the Lexicon *224* was under consideration. An as yet unused room at the far end of the studio can also be used as a natural echo chamber during mixdowns.

Stereo mastering with Dolby is provided by a Studer *A80* RC/VU recorder with a Revox *A700* (not a 77!) on hand for copies and echo effects. Cassettes are taken care of by a large Technics machine.

Coming out of the control room and back into the corridor, the studio itself is just a few steps away. About 80 m^2, the studio is basically rectangular in shape with certain wall surfaces having been offset to reduce standing wave conditions. The acoustic treatments vary from trapping and reflective/absorbent surfaces to large, painted cardboard tubes that act as tuned resonators and at low frequencies rather like slat absorbers, the area behind the tubes being lined with Fibreglass. The floor is treated with fairly thick carpet. One good idea has been the construction of little rostrums for guitar amplifiers which keep them out of the way of clumsy feet while providing a hard surface in front of the speakers. A reflective drum rostrum has also been built, though this can be covered with carpet if needs dictate. Large acoustic screens are also in evidence so that the studio can be used open plan or with the various sections closed off when greater separation is needed. In keeping with the Prism sound, the ambience of the studio tends to be quite bright with no muddiness.

In terms of instruments, Prism is quite well equipped, starting with their pride and joy, a Bosendorfer Grand Imperial piano. Though not many pianists actually get around to using those lower strings, Prism find that they add an extra richness to the piano sound with their resonance. Other instruments include a *Minimoog*, a Rhodes, Slingerland drums and an assortment of amps from Musicman, Ampeg and Marshall. When foldback through monitors is required there is a pair of Cabasse speakers on hand to do the job. Microphones are mainly from Neumann, AKG and Electro-Voice. Like most studios, Prism have their little rarity and this is in the form of two Neumann *MB49* valve microphones. Featuring remote switchable polar patterns, these microphones have a very 'present' sound and are often used as vocal mikes. (Prism do tend to go for a vocal sound with a lot of presence—which their customers like.)

The far end of the studio leads on to another room about 35 m^2 which is under preparation to be used as an isolation room for drums, vocal groups, or whatever.

At present, Prism deals mainly with local groups and artistes but thanks to a faithful clientèle and reasonable prices the studio is always pretty well booked up and studio owner/engineer Philippe Mercier feels that the investment in upgrading the studio has been justified. Like other Swiss studios, they would like to see more growth in international business and there has already been interest from France which bodes well for the future.

Prism Recording Studios, Avenue Ruchonnet 2, 1003 Lausanne, Switzerland. Phone: (21) 23 76 77.

Terry Nelson

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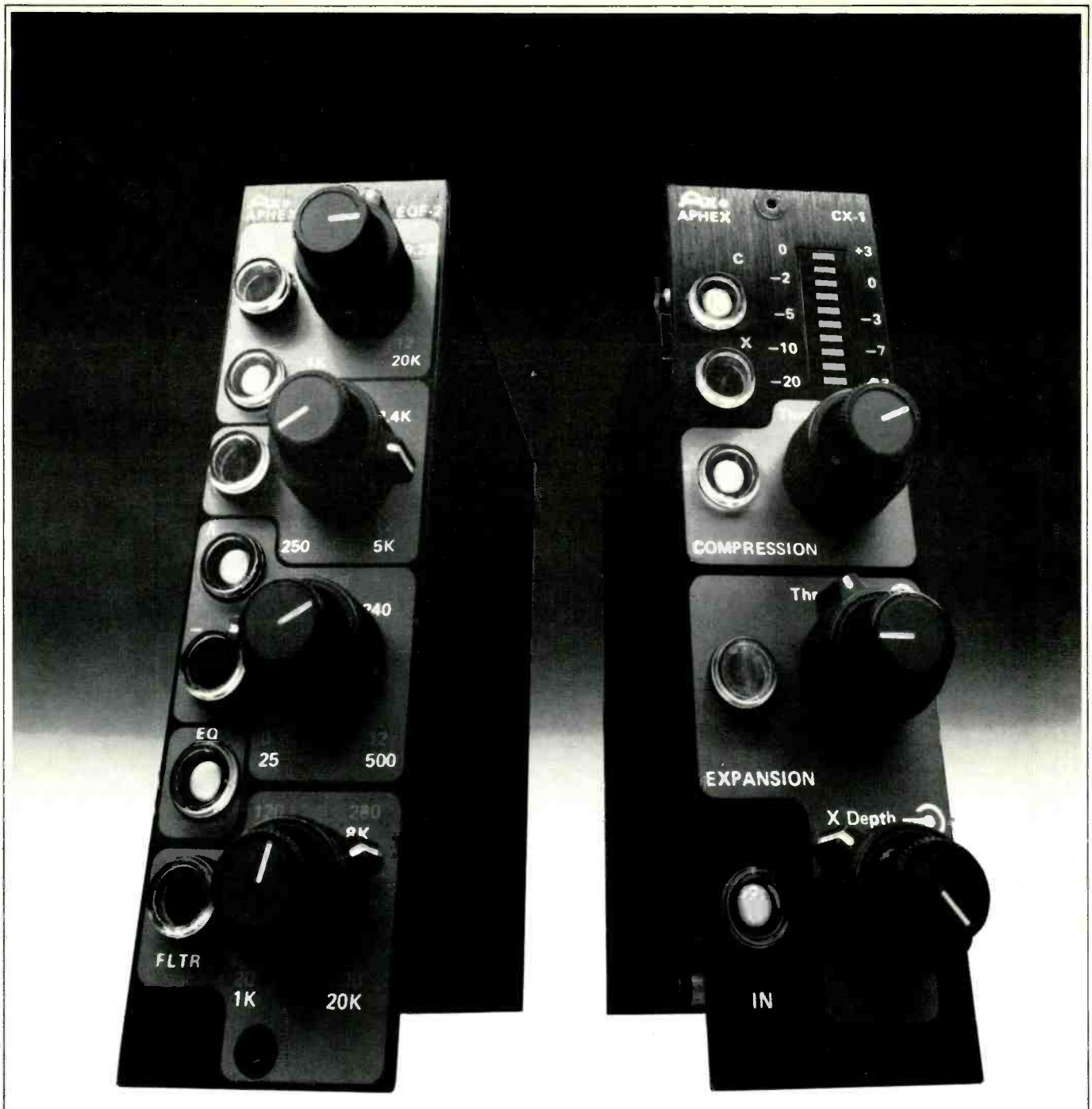
Prism's custom Sonosax monitor mixer



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Studiofile:2

October Sound

The partially restored Christ Church, Spitalfields in the Whitechapel area of London, saw its sixth Summer Festival of Music in June 1982. Directed by Richard Hickox, the festival covered a wide range of music from four performances of Gluck's opera *Armide*, to a piano recital. Contemporary music was represented by a performance by the New London Chamber Choir of James Wood's *Ode to St Michael*, for soloists, chorus and tape. I write, 'performance by the choir', but in the event they appeared *with* themselves a number of times on tape which also provided an organ, some three times, together with a complete Javanese Gamelan orchestra, tuned gongs, electric piano, ocarina and a delightfully named Mark Tree!

Getting joint billing with composer/conductor James Wood was American John Whiting, now domiciled in the UK and operating October Sound in London. He is the 'Mr Electronics' of the contemporary music movement in and around London. At this performance, he was responsible for the multitracking and mixdown of the tape and integrating the live performers with it by amplification at the concert.

Electronic involvement with contemporary music often provides surround sound projection, so on this occasion, what better way of capturing the result for analysis and possible commercial use than making a B-format recording from a Calrec *Soundfield* microphone.

Concert layout

The diagram shows the scene at Spitalfields with four double-stacked Bose *802* speakers either side of the two 16-singer choruses. Each chorus was covered with three AKG *C451*s with *CK22* omni capsules. In front were six female soloists, each miked very closely with her own AKG *C451/CK22*/20 dB pad. Note the use of omnis—no close up bass response anomalies. PA sound levels in classical music do not need to be high, so there are no howlround problems. At the rear, high on a balcony and well away from the back rows of the tiered audience, were another two double-stacked sets of Bose *802*s. These and the front set were driven by HH MOSFET *500* amps. In the centre of the audience area a platform was provided for the amplification mix and tape playback. It makes sense as the performance are as much the contribution of the tape and the amplification as anything else. Mixing was via a Soundcraft *400*, its assignment arrangements easily coping with the need to feed the grouped stage mikes to the front Bose stacks and the 4-channel tape playback to all four sets. John is very impressed with the overall quietness of the system, confessing the need to play a tape, rather than just listening for hiss at the speakers even with the 12 mic channels full up.

Tape compilation

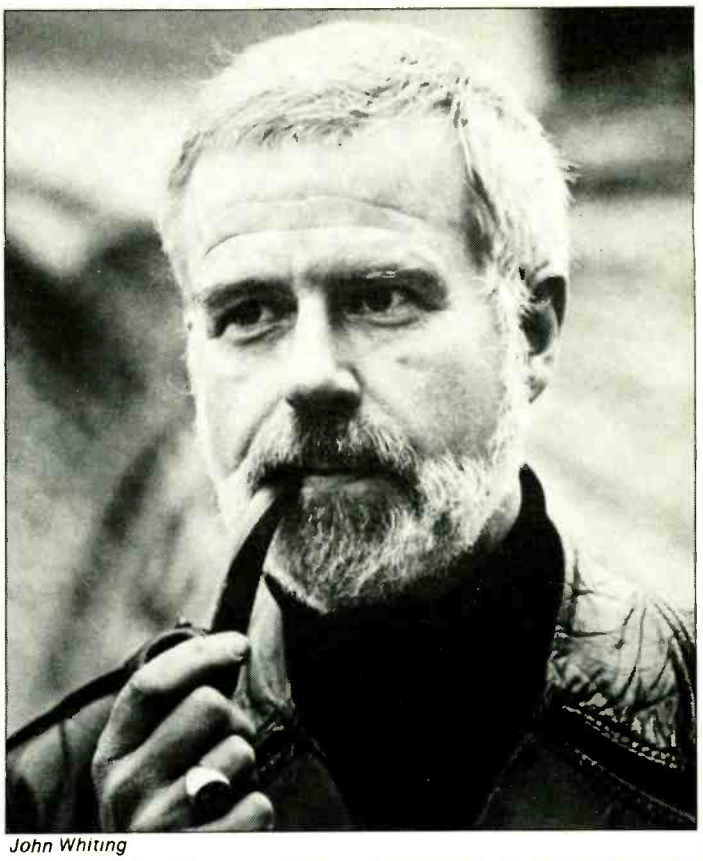
In the light of previous work with John Whiting, James Wood learnt the capabilities and limitations of multitracking and mixdown technology: 'He does my planning job for me,' says John, 'the track assignments come decided with the score!' This, as John discussed with me, is merely an extension of what composers have always done—worked within the capabilities and limitations of the musical tools to hand.

Teac *Tascam* 8-track plus dbx was at the centre of the multitracking on this occasion. It's easily transported and being properly aligned and maintained, it has never made him wish for something more prestigious. Close-miked mono-track recordings were used as on playback the sounds take on the character of the venue and having a stereo playback implies bringing with it the alien acoustic of the recording.

With six AKG *C451/CK22* omnidirectional mics used close on 20 singers, a track was produced which on the final 4-track performance tape appeared as three additional choirs—sometimes augmenting the live choruses, sometimes distant offstage (reduced level and heavy top cut) and sometimes as a full rear chorus from the balcony.

Another three tracks, also laid down at New College Oxford, were of Paul Webster playing the organ. Two close cardioids were mixed into mono. Like the recorded choruses, the result ended up in several different areas of the Spitalfields church.

A further prepared track was complicated by a pitch problem: a complete Javanese Gamelan Orchestra consisting of percussion instruments played with hammers—gongs or bars of bronze or wood. These particular instruments were pitched



John Whiting

¼-tone away from European concert pitch. A pitch correction was made by taping an *A440* tuning fork and a DI'd metronome click track on a Revox with varispeed.

A three-day session of multitracking followed at Claydon House, Bucks. First of all the recording of the *A440* was slowed down to match the Gamelan instrumental pitch, and copied on to one track of an 8-track tape—the click track also going over at its revised rate. James Wood then multitracked his one-man orchestra. Next came mixing down to mono on one track of a Stellavox with the click track on the other. Pitch correction was then applied during further copying on to another 8-track tape. John used dbx throughout all this, leaving the signal encoded during the transfers, except when mixing. With immaculately flat recorders around him he has no response errors for the compansion to exaggerate!

Other tracks were synchronously utilised for additional instruments—12 tuned gongs, Fender Rhodes electric piano, bird calls on ocarina and the Mark Tree, suspended graduated-pitch metal rods. The wiping of these from the low end produces, in John's own articulate description, 'an ascending angelic metallic jangle'. A Roland tape loop *Space Echo* was used during the laying down of this track to enhance the effect. Initially at its lowest speed, it was speeded up so that the upward sweep continued after the Mark Tree had made its contribution.

The final 4-track tape was then made by mixdown of the 8-track, with the appropriate surround sound assignment. During performance it is simply a matter of stopping and starting where necessary and controlling the levels.

B-format recording

Studio Sound August 1982 issue covered the attributes of B-format storage of the soundfield at a particular point. The Calrec *Soundfield* microphone system was hired from Whitetower Records and stood at the centre of the concert's sound stage, just in front of the mixing set-

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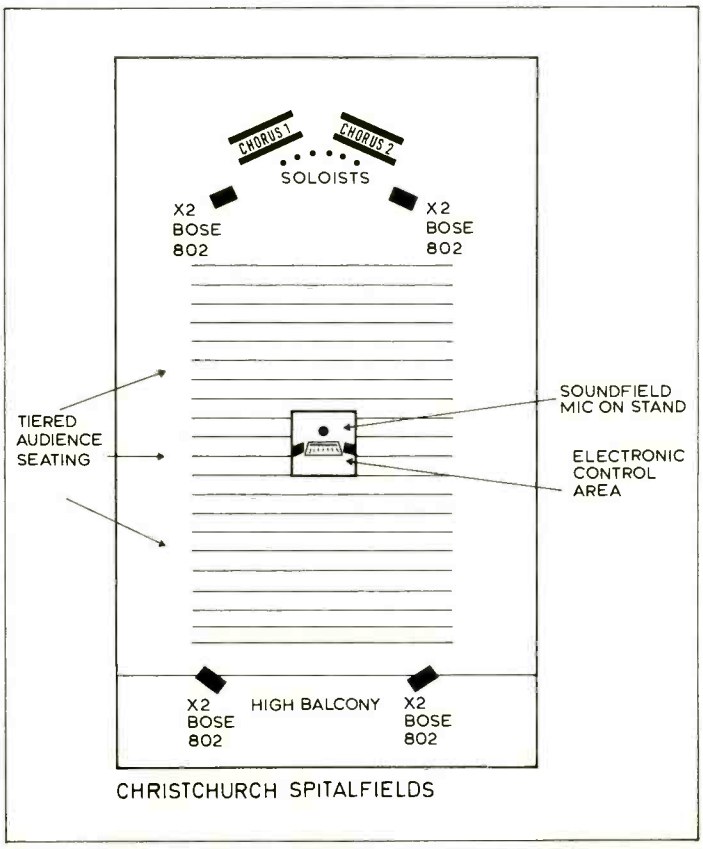

October Sound cont'd

up. John's intention was to set conservative levels at rehearsal on dbx and Teac *A3340* and let the recording look after itself, as the job on site was to mix the sound for the concert. As the mike was receiving a balanced sound at its physical position there was no need to use spot mikes or tape DI.

The B-format storage, X = front to back, W = omni, Y = side to side and Z = up and down, allows many options on playback and dubbing later. It was John's first use of the *Soundfield* mike and he waxes lyrical about it. He has made various different dubs from the B-format signals for assessment and use at his Morley College course on recording techniques.

First a straight stereo version was produced, crossed figure of eight with 8.6° forward dominance—effectively a nearer microphone position than was actually used. John was impressed by the possibility of trying all aspects of capsule angle and polar diagram back in his studio, rather than having to make a decision on site with conventional mikes.

The concert obviously cries out for surround sound recording. From the mike control unit one can derive surround sound in two forms; four mikes simulated from the B-format signals (quadruple) or via Ambisonic decode circuitry which much enhances the surround sound realism. John has often produced his own 'quad' using conventional miking. He is thus in a position to judge the surround sound available from B-format signals.

The 'quadruple' straight simulation of four 'quadrant' mikes is, in his opinion, noticeably inferior to the Ambisonic decode mode. With the latter he discovered the remarkable attribute of surround sound via Ambisonics—very much less dependence on listening position. Also the speakers become more acoustically invisible.

Not having at the moment the permanent use of a *Soundfield* mike control unit (but intending to purchase a complete system) he dubbed the final 'speaker' signals so he would in future be able to listen without subsequent decoding. Ordinarily one would play the B-format tape and make the choice on a *Soundfield* mic control unit. For horizontal surround sound one could also play the X, W and Y through the B-format input of a UHJ 2-channel Ambisonic Decoder.

Finally with a Calrec UHJ 2-channel encoder he dubbed a 2-channel UHJ encoded copy for further assessment of Ambisonic surround sound via a decoder like the above, and of the stereo compatibility of ambisonics. Overall, John reports that his first use of the *Soundfield* mic has given him a great deal to think about.

October Sound, 24 Old Gloucester Street, London, WC1. Phone: 01-405 1581. **Mike Skeet**

Wickham Recording Studio, Surrey

If this period of time is to be remembered for anything within the professional and semi-professional recording industry, apart from the growth of digital products, it will probably be down at the other end of the scale, in the expansion and new accessibility of low budget, 'professional' recording equipment. A quick glance through the popular music press will show an extraordinary number of multitrack facilities offering a 'fully professional' service, most of which have come into being over the last few years, and there are various examples of backroom 16-track set-ups producing material which has charted. This new availability does of course open the field up to 'cowboys', of which there's no shortage. On the other hand, it also allows competent individuals or groups of individuals, without huge financial backing, to set up a recording studio which, as far as the bulk of straightforward rock/pop productions are concerned, is quite capable of producing a professional standard (whatever that is).

An example of this is the newly formed Wickham Studio in Croydon, owned by Barry Godwin and Paul Dunne in partnership. Paul has worked on the copyright side of video and film and was also studio manager at TPA Studios in Denmark Street, whereas Barry has worked mainly as a guitarist in various bands around Europe, ending up last year working for a Dutch company called Disque Electron, soliciting work in England for their pressing plant. After the company's recent demise, Paul and Barry took the name to set up their own production company in England, the operational centre of which is, at the moment, Wickham Studio. That's why an English company, set up by a couple of Englishmen, is called 'Disque Electron Ltd'. They also figure that a name that is already well known in Europe will help them crack that market when the production side of the business gets going. At the moment they are concentrating on keeping the studio full, although they have two or three acts which they are working on for future release.

The studio and offices are housed in what used to be a public wash house so the basic construction of the place is very high mass, with most of the walls being double thickness. This, together with the extra cost involved and the relatively quiet location, was the deciding factor against a mechanically isolated 'room within a room' construction, preferring to rely on the weight of the place for acoustic isolation. Karl Brown of Cindy Electronics was responsible for the acoustic design and construction, which has turned out to be an approximate adaption of various Eastlake techniques, making good use of the original high ceiling, but without taking up too much floor space. The studio floor area measures approximately 23 ft × 24 ft, although the impression is one of a larger room. The false ceiling is raked along its length to a point about 5 ft down and 16 ft from the control room end, where it slopes steeply back up to the original height within the remaining 8 ft, effectively splitting the room into two areas with a ratio of 2:1. The treatment behind the ceiling consists of a system of Rockwool slabs, variously spaced, suspended vertically on a wooden framework of 2 in^2, thus giving low frequency absorption across a broad band of frequencies, dependent upon the rake of the structure and the spacing of its elements. The smaller section of the ceiling is covered with close boarding, the walls and floor being left untreated to produce a generally live acoustic with a controlled bottom end. The remaining two-thirds of the floor area is covered with carpet. The walls are covered to a height of about 4 ft with a treatment consisting of 2 in of Rockwool, ½ in of blockboard, ½ in plasterboard and a finish of nylon carpet tiles. The rest of the wall area is covered with 2 in Rockwool slabs, mounted directly on the wall with a framework of 2 × 2 in, except for the area around the control room communications window, on which acoustic tiles are used, once again applied directly to the wall. A double wall has been built between the control room and the studio floor area of 4 in thermolite blocks, with a 6 in gap between the two skins filled with sandbags, old clothes and pretty well anything else that came to hand at the time. Included in this wall is a two-pane communications window.

The control room measures about 15 ft × 15 ft, and has an acoustic treatment almost identical to the studio floor area, with a live front end and dead rear end. The main monitors, Tannoy *Super Reds*, are mounted directly on to the front half of the raked, close-boarded false ceiling so that the focus point is a few feet beyond the front of the desk, and the monitors throw down on to the listener. Secondary monitoring is via a pair of *Auratone* cubes powered by a Quad *303* with the Tannoys being driven by a Quad *405*. The RT60 of the control room is apparently about 0.2 sec.

The desk is a Raindirk *Concord 2000*, 28-input, in line with 16-output groups. It looks very much like a simplified MCI console, and considering the price (around £8,000) it offers very comprehensive facilities. The 24-track is a Soundcraft *SCM*, and mastering is done on a Revox *B77*, with a Teac *A3300* being used for echo and copies. The use of a *B77* for mastering in a professional studio is usually met with frowns of disapproval; however comparisons between it and, for example, a Studer *A80* will show that on the performance side, assuming it's working properly, there's little to fear, although it's not likely to continue operating at peak performance for as long as the Studer.

The auxiliary equipment included an MXR dual 15-band graphic, an MXR *DDL Mk.2*, a Rebis rack containing a number of compressors and gates, a Bel flanger, an Eventide *Harmonizer H910*, a Klark Teknik *DN34* ADT, and an EMT *140* plate. No noise reduction is available, and the multitrack is always run at 30 in/s. The microphone collection included various AKG dynamics, six Sony *ECM* electrets, an *RE20* and a Neumann *U87*. The piano was a Yamaha acoustic grand.

A small relaxation room is available with 'Hal' the talking pinball machine, a tacit pool table, and facilities for the creation of basic eats and drinks. Price by negotiation, starting at about £28.00 per hour.

James Francis

Wickham Recording Studio, 121 Canterbury Road, Croydon, Surrey. Phone: (01) 683 1470. ■

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Ampex ATR-100 ½ in 2-track headblock

Summary

The ½ in 2-track headblock offers that extra amount of dynamic range with or without the use of noise reduction without interfering with the already good properties of the Ampex *ATR-100*.

The change of headblock, whilst being very simple mechanically, requires re-equalisation of the machine. However this can be avoided if the optional 4-speed/dual EQ 'padnet' is used, the machine then being restricted to a combination of four speed/equalisation standards.

Hugh Ford

CHANGING the standard ¼ in *ATR-100* recorder to a ½ in machine is, mechanically, an incredibly quick and simple operation. The tape guides on the tension sensing arms are simply replaced by unscrewing their knurled retaining screws by hand. The head cover is then taken off and the headblock removed with a half turn of a $\frac{1}{32}$ in Allen key and replaced with the ½ in 2-track headblock.

The new headblock has exactly the same head configuration as the original 2-track (not CCIR stereo) headblock with a bottom edge tape guide at the entry followed by a metal dummy head, a 2-track ferrite erase head followed by the top tape guide which is increased in height by a spacer. There follows the ferrite record head, the original flutter roller, the ferrite 2-track replay head and the exit tape guide at the bottom of the tape.

The record head consisted of two 0.20 in tracks with a 0.06 in guard band between the tracks, the replay head being similar. Theoretically this should give an improvement in signal-to-noise of 2.6 dB over the CCIR stereo configuration or 4.3 dB over the NAB 2-track format.

Measurement of the reference fluxivity (320 nWb/m) to noise performance of my CCIR stereo headblock in comparison with the ½ in, 2-track block gave the results shown in **Table 1**.

The above figures were obtained using BASF *SPR50LH* tape with a maximum output level of +10 dB, thus giving a dynamic range of 79.5 dB A-weighted at 30 in/s—close enough to Ampex's claim of 80 dB.

Using the ½ in head requires substantial changes in record and replay level settings, but minor changes in record and replay equalisation, the tape tension automatically changing to 200 g at the entry to the headblock.

Wow and flutter were the same with either headblock and the tape handling remained very good with possibly a slight improvement of the phase jitter between tracks shown in **Fig 1** for a 10 kHz tone at 30 in/s.

At 30 in/s, the frequency response could be trimmed to be extremely flat as shown in **Fig 2**, where the —3 dB points are at 30 Hz and 31 kHz. However at 15 in/s the best that could be done is shown in **Fig 3**: ± 1 dB from 55 Hz to 20 kHz isn't so bad!

The crosstalk between the two channels at 30 in/s was good as shown in **Fig 4**, permitting the machine to be used as a 2-channel machine for many applications.

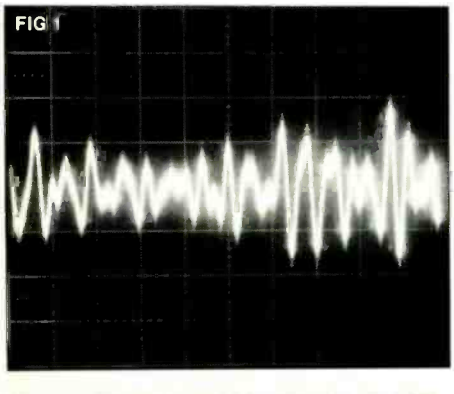


TABLE 1
Measurement method

	30 in/s AES EQ		15 in/s CCIR EQ	
	¼ in	½ in	¼ in	½ in
A-weighted RMS	—67.5 dB	—69.5 dB	—65.0 dB	—67.5 dB
CCIR-weighted RMS	—59.5 dB	—62.5 dB	—57.5 dB	—60.0 dB
CCIR-weighted quasi-peak ref 1 kHz	—55.5 dB	—58.5 dB	—53.0 dB	—56.0 dB
CCIR-weighted ARM	—67.5 dB	—69.5 dB	—64.0 dB	—66.5 dB

FIG. 2
AMPEX HEADBLOCK
30in/s FREQUENCY
RESPONSE

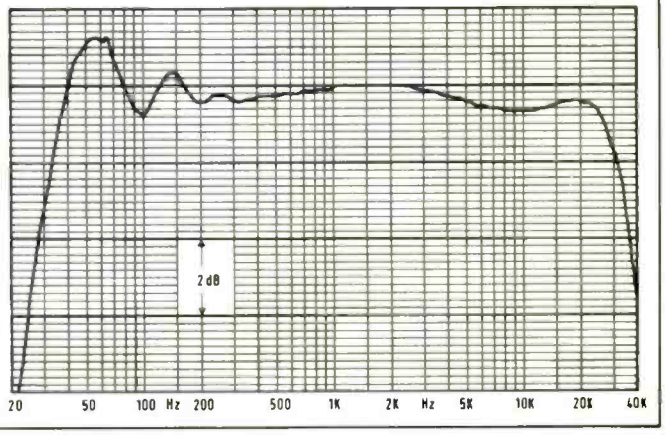


FIG. 3
AMPEX HEADBLOCK
15in/s FREQUENCY
RESPONSE

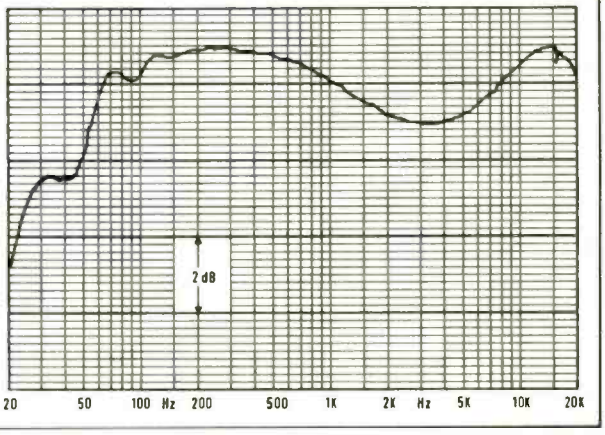
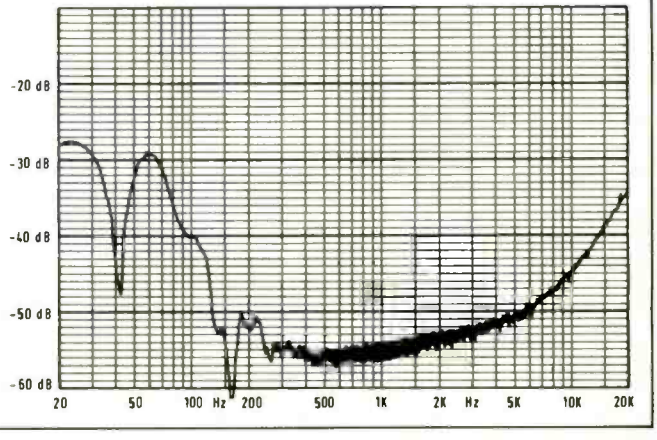
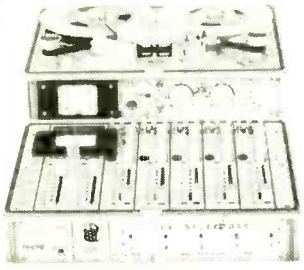
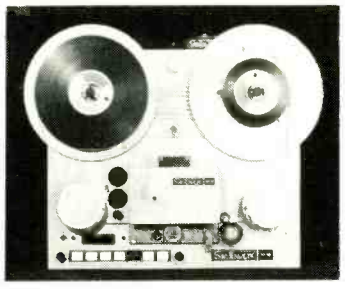


FIG. 4
AMPEX HEADBLOCK
30 in/s CROSSTALK







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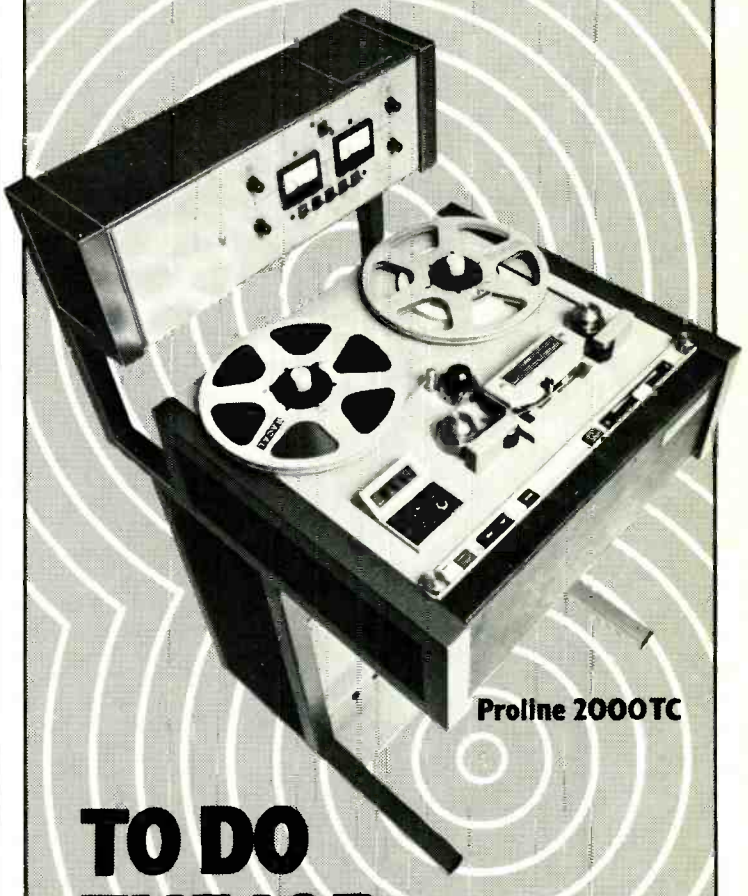

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Ampex ATR-100 4-speed padnet

THE original *ATR-100* model was restricted to a choice of two speeds out of four in the range 3¾ in/s to 30 in/s unless spare pairs of plug-in equalisation 'padnets' were purchased. The accessory 4-speed/dual equalisation 'padnet' allows two configurations which either convert it to a true 4-speed machine with separate record, replay and bias settings, or a 2-speed machine (any two speeds) each with two separate record, replay and bias settings.

The only modification the machine may require is reversal of the front panel overlay on the audio control board. This identifies the four master bias controls which in the new configuration will either have become separate bias controls for the four speeds, or two each for the two selected speeds.

Similarly the overlay on the 4-speed/dual equalisation 'padnet' is changeable. The controls involved are slightly different to the original ones and more versatile. With the exception of the single 'synch bal' control which balances the synch and normal outputs instead of acting as a synch gain control and the bias normalise control as the original, all controls are in sets of four for the 4-speed/EQ combinations.

With the new 'padnet' it is possible to set different record and replay gains for the four combinations instead of the same gain for the two available equalisations. Replay HF and LF controls are in sets of four with an improvement in the record equalisation area. The single HF record equaliser and shelving switch is replaced by an HF control and a variable shelving control.

All the above controls take the form of multiturn potentiometers, screwdriver-operated through holes in the front panel.

The new 'padnet', which consists of two crowded printed circuit boards mounted in parallel, has a bias-ramping 'purc' toggle switch on one board and a DIL switch plus two 4-way slide switches on the other. The four DIL switches select the 3180 μs record equaliser for the four speed/EQ combinations whilst the slide switches select the desired combination of tape speeds.

FIG.1
AMPEX PADNET
30in/s REPLAY LF AND HF EQUALISERS

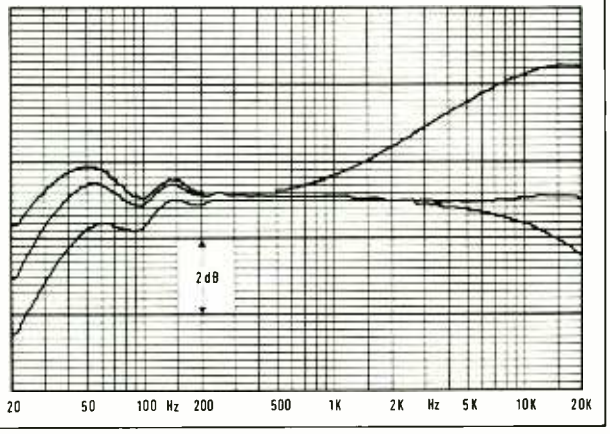


FIG.2
AMPEX PADNET
RECORD HF EQUALISATION AND LF TIME CONSTANT SWITCH.

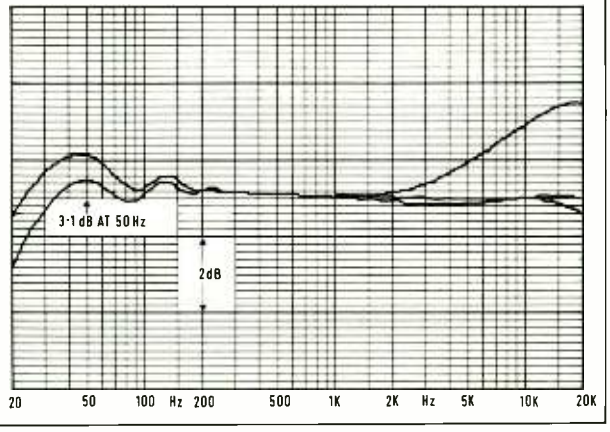
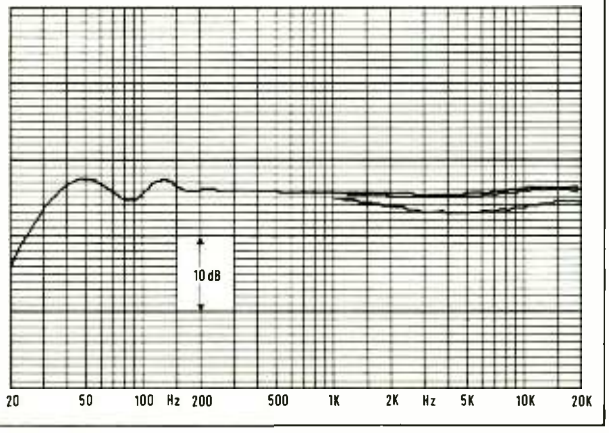


FIG.3
AMPEX PADNET
RECORD SHELF.



Replay equalisation

Relative to a flat response at 30 in/s using the AES 17.5 μs equalisation, the performance of the replay equalisers is shown in **Fig 1,** where the HF equaliser has a range of +16 dB, −4 dB at 10 kHz giving an effective range from zero to 160 μs time constant. This is more than adequate for any current replay standards and the adjustment was fine enough for precise setting.

At the low frequency end, the range of +3 dB, −6 dB at 50 Hz covers the infinity and 3180 μs standards but not the 1590 μs time constant which does not apply at the tape speeds available.

Record equalisation

Using Ampex *456* tape overbiased 3.5 dB at 20 kHz at 30 in/s, the range of the HF record equaliser and the LF time constant switch is shown in **Fig 2.**

The range of +10 dB, −0 dB at 10 kHz gave just enough leeway at 3¾ in/s with Ampex *456* tape overbiased by 3.5 dB at 2.5 kHz. The HF record equaliser range is therefore marginal if the 3¾ in/s speed is to be used.

The switched LF 3180 μs time constant was found to provide a boost of 3.1 dB at 50 Hz which is quite close enough to the theoretical 3.01 dB.

Shelving and bias

The effect of the shelving control at 30 in/s is shown in **Fig 3;** however, it reacts with the HF equaliser in the 4 kHz to 8 kHz region and this provides a fine tuning in this area. This allows a very flat response to be obtained at any common bias setting.

Bias ranges are effectively the same as those of the standard *ATR-100* with the same procedure being used to set bias.

Summary

The 4-speed/dual equalisation 'padnet' is a very useful accessory for the *ATR-100* where multiple equalisations are used. Alternatively it can be used to change record equalisation and bias to match different tape types by the flick of a switch.

Whilst the controls are crowded, they were very easy to set accurately being all multiturn potentiometers. There could, however, be some improvement in their alignment with the holes in the front panel.

With the exception of the record equaliser at 3¾ in/s the range of all controls was quite adequate.

Hugh Ford

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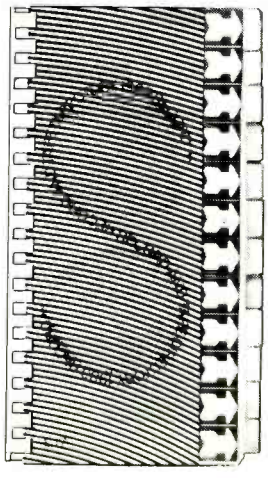

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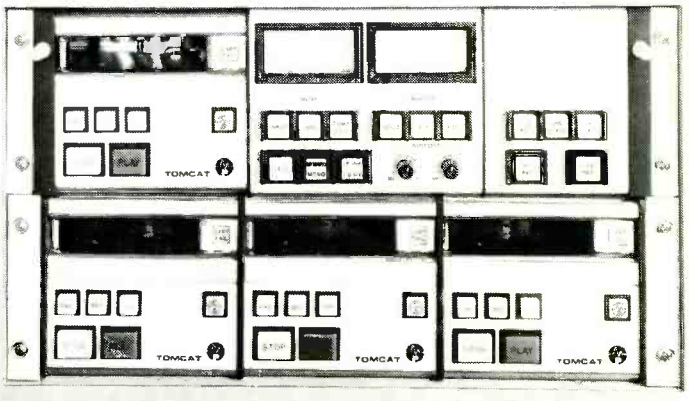
TOMCATS PUT THE ART IN CART



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Lindos LA1 audio analyser

MANUFACTURER'S SPECIFICATION
Signal generator
Frequency coverage: 15Hz to 100kHz in four ranges.
Output voltage: 100μV to 1V RMS in nine ranges giving 10dB steps with fine control reducing to zero.
Accuracy: ±2% on 1V settng at 1kHz (calibration).
Attenuator errors: ±2% max into open circuit (±5% on 100μV range).
Flatness: ±0.2dB maximum 15Hz to 20kHz. ±0.5dB max to 100kHz output settles quickly without overshoot.
Output impedance: 0 to 600Ω depending on output setting.
Distortion: 0.008% typical at 1kHz, 0.015% max; 0.03% typical at 45Hz and 10kHz, 0.05% maximum.
Squarewaves: max output is 600mV PK ±10% on 1V range. Rise/fall time 200ns typical (10% to 90%) mark-space error 1% typical.
RIAA output: equalised for checking cartridge inputs. Nominal level 15mV max at 1kHz.
Frequency meter
Frequency range: 10Hz to 200kHz min.
Display: 6-digit LED; 0.15in high brightness; can be switched off separately.
Counting period: 1s or 100ms selectable.
Input (ext mode): triggers above 25% FSD on any range.
Wow and flutter meter
Carrier frequency: 3.15kHz or 3kHz, changeover is automatic.
Ranges: 0.01% to 10% FSD.
Frequency response: unweighted 1Hz to 300Hz ▶

THE Lindos type *LA1* audio analyser is a multi-purpose test set available in a number of versions with various options to meet individual user's requirements. The basic unit includes a sinewave oscillator covering the frequency range 15Hz to 150kHz with a maximum output of 1V RMS with a switchable squarewave output of ±300mV.

Either the oscillator frequency or the frequency of the input signal can be measured by an inbuilt frequency counter with an analogue meter displaying the input or the output level.

On the measurement side the unit has capabilities for noise to IEC A-weighting, CCIR Recommendation 468 weighting, and 22Hz to 22kHz unweighted. Metering can be average, CCIR quasi-peak or true RMS with the option of a standard PPM characteristic.

Further functions include the measurement of total harmonic distortion at 100Hz, 1kHz and 10kHz with alternative frequencies available to order. Finally the basic instrument can measure drift, wow and flutter or rumble with the standard weightings using any of the available metering characteristics including IEC quasi-peak-weighted wow and flutter.

All these features are contained in a remarkably small battery operated unit complete with carrying handle which doubles as a tilting foot. The important options include a mains adaptor and a mains/rechargeable adaptor with a small monitor loudspeaker. However, important for the professional equipment user/manufacturer is the type *ST1* Studio Interface. The *ST1* option, which bolts on to the rear of the basic unit, includes mains/battery operation with a rechargeable NiCd *PP9* battery, a small monitoring loudspeaker plus balanced inputs and outputs (left and right) with +26dBm output drive capability.

Reverting to the front panel of the basic unit the oscillator controls are to the left with a rotary attenuator providing 10dB steps from 1V down to 100μV ranges with a full-range fine output level control with rough calibrations. In addition the step attenuator has an inverse RIAA equalisation output with a maximum level of 15mV. Oscillator frequency is selected in four decades plus an off position with a 5-position rotary switch with the fine frequency control having rough calibrations from 1.5 to 15 covering the total range from 15Hz to 150kHz.

Above these controls is a 6-digit frequency display with three adjacent toggle switches. One switches the frequency display to measure either the input frequency or the oscillator frequency, the second switch controls the frequency display's counting time to be 1s or 100ms with the intermediate position selecting 10s, and the third switch selects the sinewave or squarewave output.

To the centre of the front panel is the analogue meter with five scales, the upper one being calibrated in dBm from +2dBm to −20dBm with very useful 0.1dB increments in the ±2dBm section. There follows voltage scales from 0 to 10 and 0 to 3 and a PPM scale with the standard 1 to 7 indications. Finally there is a drift scale over the range ±2% plus a battery check marking. In spite of the number of scales on the meter the calibrations were very easy to read, as were most of the front

(– 3dB); weighted to DIN 45507/IEC/NAB.
Indication: mean or quasi-peak to DIN 45507.
Input voltage range: 30mV to 10V (optimum 1V).
Accuracy: ±3% FSD meets DIN 45507.
Residual reading: unweighted 0.006% weighted 0.002%.
Wow meter: this range provides a centre-zero indication with slow speed changes of up to ±2% directly indicated. Use of the digital frequency readout is recommended for accurate speed measurement.

Millivoltmeter
Voltage range: 100μV to 100V FSD in 13 ranges (– 80dBm to + 40dBm); a fine input control giving up to 12dB gain reduction permits reference levels to be set.
Accuracy: ±1% of FSD on 1V range (calibration).
Attenuator errors: 0.5% max below 20kHz; ±1% max when x10 switch is used.
Frequency response: ±0.1dB max 20Hz to 20kHz (mean response) – 3dB points at 1Hz and 200kHz typical.
Meter response: mean — calibrated in RMS sinewave equivalent; quasi peak — complies with DIN 45507 for flutter measurement but may be used on all ranges.
Intrinsic noise: 4μV typical wideband; 3μV typical 22Hz to 22kHz.
Input impedance: 100kΩ ±0.25% AC coupled overload protected.
Overload margin: 23dB of headroom is available when using weighting filters.
Weighting filters: CCIR/ARM2K, DIN Audio Band, DIN-A Rumble and DIN-B Rumble are all provided; a plug-in filter for IEC Curves A and C is available.

Distortion meter
Spot frequencies: 45Hz approx, 1kHz, 10kHz approx; other frequencies can be supplied to order.
Distortion ranges: 0.1% to 100% FSD.
Minimum resolvable reading: 0.005% typical on distortionless signal; 0.01% with 100mV input.
Input voltage range: 100mV to 100V RMS.
Input impedance: 50kΩ approx; 10kΩ for inputs above 3V.
Second harmonic rejection: 0.5dB max.
Accuracy: ±8% of reading ±1% of FSD.
Measurement bandwidth: 22Hz to 22kHz (DIN audio band) on 45Hz and 1kHz settings; 1Hz to 150kHz on 10kHz setting.

Additional facilities
Oscilloscope output: 100mV at rear socket (all modes).
DC output: 1.0V FSD at rear socket.
External weighting: can be added at rear socket.
Battery check: shows battery state on meter.
Power outputs: battery power at ±4.5V is available at both input and rear sockets to permit the addition of preamps and active filters.
Highpass filter: 400Hz 12dB/octave, usable in any mode.
Battery: one PP9; consumption 15mA without display, 60mA with display.
Dimensions: (whd) 12¼ × 4½ × 6½ in/318 × 114 × 165mm.
Weight: 6lb/2.7kg including battery.

Optional accessories
***TL1* test leads:** with micro-hook probes; supplied as standard with DIN version only.
***MA1* mains adaptor:** fits into battery compartment.
***WN1* weighting network:** incorporates IEC Curves A and C.

Optional Studio Interface Model ST1
Output gain: 0dB or + 20dB selected by pushbutton; + 6dB switch corrects level in single-ended use and enables + 26dBm to be set.
Output impedance: 30Ω (0dB gain), 10Ω (+ 20dB gain).
Minimum load impedance: 600Ω at + 26dBm, 300Ω at + 20dBu, 50Ω below 0dBu.
Output noise: – 86dBm (+ 20dB gain), – 106dBm (0dB gain), audio band RMS.
Output frequency response: ±0.1dB 20Hz to 100kHz.
Output distortion: below 0.01% THD up to 10kHz all levels.
Input impedance: 20kΩ balanced with respect to ground; 600Ω selectable.
Maximum input: + 20dBm.
Input noise level: – 100dBm audio band RMS.
Input frequency response: ±0.1dB DC to 100kHz.
Input distortion: below 0.01% THD up to 10kHz.
Connectors: four PO type jack sockets, *XLR*s optional.
Price: basic model *LA1 Professional* £540; *ST1 Studio Interface £150.*
Manufacturer: Lindos Electronics, Sandy Lane, Bromeswell, Woodbridge, Suffolk.

panel legends in black on a silver back-ground. Just a slight niggle — strictly 'KHz' should read 'kHz' and on the output attenuator '100μ' should read '100μV'!

Beneath the meter are two multiturn distortion nulling controls and the BNC input and output sockets, underneath which toggle switches select either the BNC sockets or the optional *ST1* Studio Interface input/output connections.

To the right of the unit a 12-position rotary switch selects the function of the unit with positions for battery check, weighted rumble, IEC A-weighted noise, CCIR Recommendation 468 weighted noise, 22Hz to 22kHz unweighted noise, flat, 100Hz to 1kHz or 10kHz total harmonic distortion, unweighted or weighted wow and flutter and finally, drift.

The function selected works in conjunction with three (optionally four when the PPM option is included) toggle switches which select the metering characteristic to measure average, true RMS, CCIR quasi-peak noise or IEC quasi-peak wow and flutter. When measuring noise to the CCIR weighting the unity gain point automatically switches from 1kHz to 2kHz when the average metering characteristic is selected, thus measuring CCIR/ARM noise.

A coarse input level control allows voltage measurements from 40V to 100μV full scale with an extra 20dB of gain being insertable by means of a toggle switch with a fine input level pot being provided. The level switch also provides ranges from 100% to 0.1% for the measurement of wow and flutter and distortion. The latter function has a distortion input level range switch covering nominal 1V, 3V, 10V, 30V or 100V inputs and also allows the oscillator output to be read.

Other than separate on/off switches for the instrument's power and the digital display — to save battery power — the final front panel feature is a switchable highpass filter, particularly useful for reducing the effects of power-line hum on noise and distortion measurement.

To the rear of the basic instrument and also the *ST1* Studio Interface there is a 7-pin DIN socket for the connection of external filters which may be powered from the DIN socket. The connection can also be used as an oscilloscope output.

Within the instrument the components are mounted on five PCBs, all of good quality with good quality components. Most of the front panel controls are mounted on the printed circuits and interconnections are by 'harmonica' connectors to ease servicing, there being a minimum of preset controls.

Overall the standard of construction was good with tidy component layouts and fairly substantial mechanical construction. Whilst the user's manual was excellent, servicing information is not normally supplied as the manufacturer expects to do any servicing.

Turning now to the optional *ST1* Studio Interface, this bolts onto the back of the instrument connecting into the rear DIN socket and a flying lead with a 'harmonica' connector. A single PCB houses the high level output amps and the balanced input amp plus the mains powering/battery charger. The latter automatically trickle-charges the battery once the full charge has been made, allowing the instrument to safely remain switched on without damaging the battery.

Mains powering is via a standard IEC connector with an illuminated on/off rocker switch, no defects being found in the electrical safety of the unit.

A slide potentiometer in the top of the interface controls the level at the small monitoring loudspeaker at the rear of the interface unit. To the right of the interface four ¼in jack sockets provide the electronically balanced (not floating) inputs and outputs with *XLR*-type connectors being available as an option.

At the top of the interface, pushbutton switches select various functions with one switch selecting the left or right inputs, another the input impedance which may be 600Ω or 20kΩ and a third switch allowing the input or the oscillator level to be read.

Two switches select the output gain of + 6dB or + 20dB or with both switches depressed + 26dB. In the review sample an option allowed the output impedance to be switched to 600Ω, 75Ω, or 10Ω, the two outputs being wired in parallel.

When the switched output impedance option is not chosen, these switches allow selection of the left and right outputs.

Oscillator performance
The maximum sinewave output was found to be 0.998V at 1kHz with the source impedance varying up to about 600Ω according to the attenuator settings. In the RIAA inverse output setting the maximum output level at 1kHz was 14.5mV with the output impedance depending upon the fine attenuator setting and reaching a maximum of almost 1kΩ.

Accuracy of the output step attenuator was excellent, being within 0.05dB at 1kHz and 0.1dB at 100kHz.

Flatness of the output depended to a small extent upon the output level, being at 10mV output within ±0.05dB from 15Hz to 120kHz and rising to + 0.2dB at 150kHz reference 1kHz. **Table 1** shows the flatness recorded at 1V output.

Total harmonic distortion was measured at 100Hz, 1kHz and 10kHz and found to be constant with output level, showing an excellent performance of 0.013% at 100Hz, 0.006% at 1kHz and 0.01% at 10kHz. Measurement of the second and third harmonics which predominated at three points on each frequency range, showed these to be less than 0.01% up to 1.5kHz rising as shown in **Table 2** at higher frequencies.

Examination of the squarewave output showed this to have a maximum amplitude of ±300mV with rise and fall times of 180ns with slight overshoot and droop.

Whilst the accuracy of the front panel frequency calibrations was adequate for many purposes the stability and accuracy of the internal frequency counter was good with – 0.014% maximum error being recorded.

Checking the frequency response of the inverse RIAA output showed it to be within 0.2dB of the 75μs + 318μs + 3180μs characteristic from 20Hz to 20kHz corresponding to IEC Publication 98 without the current 20Hz roll off.

Overall the oscillator performance was found to be very good without any defects such as drift or output level bounce when altering frequency.

Input level measurement
Measurement of the input impedance when measuring voltage showed it to remain constant at 100kΩ in parallel with 40pF irrespective of the fine or coarse input attenuator settings.

In the 'flat' mode the frequency response with reference to 1kHz remained constant with all input attenuator settings to within ±0.1dB from 5Hz to 100kHz then falling to – 0.3dB at 150kHz.

Absolute calibration of the 0dBm point at 1kHz was measured as 0.777V RMS sinewave which is almost within the readability of the meter with the input step attenuator being within 0.1dB over its range from + 40dB to – 60dBm. 72 ▶

Examination of the toggle-switched extra 20dB gain showed this to be not as accurate as I would like, at an actual 19.6dB at 100kHz but within 0.1dB below 40kHz.

Noise measurement

Fig 1 shows the frequency response for the 'flat' position and for the 'unweighted' 22Hz to 22kHz, A-weighted and CCIR weighted conditions.

Examination of the 22Hz to 22kHz characteristic shows this to comply with the requirements of CCIR Recommendation 468 with the roll-offs being 18dB/octave.

Using the CCIR weighting the unity gain point shifted automatically according to the meter characteristic, being 2kHz when using the average meter, the gain being correct to within 0.1dB. Checking the actual CCIR weighting curve showed it to be close to the centre line of the CCIR recommendation.

Similarly, checking the A-weighting curve to the tolerances specified in IEC Publication 179 showed the A-weighting to be satisfactory.

Turning to the metering characteristics, the average reading calibrated RMS was found to be correct with the true RMS setting being within acceptable limits up to crest factors of 20.

Checking the CCIR quasi-peak metering with 5kHz tonebursts showed the characteristics to be close to the accepted limits as shown in **Table 3.**

Further testing using 5ms bursts of 5kHz tone repeated at 10Hz gave an indication of 77% steady state indication with the CCIR requirement being 70% to 90% — all well here as was the requirement for a 20dB overload margin.

Examination of the PPM performance in terms of British Standard *4297-1968* showed the scaling to be very well within the standard requirements as was the frequency response from 40Hz to 15kHz,

74 ▶

FIG.1
LINDOS LA1
FREQUENCY RESPONSE

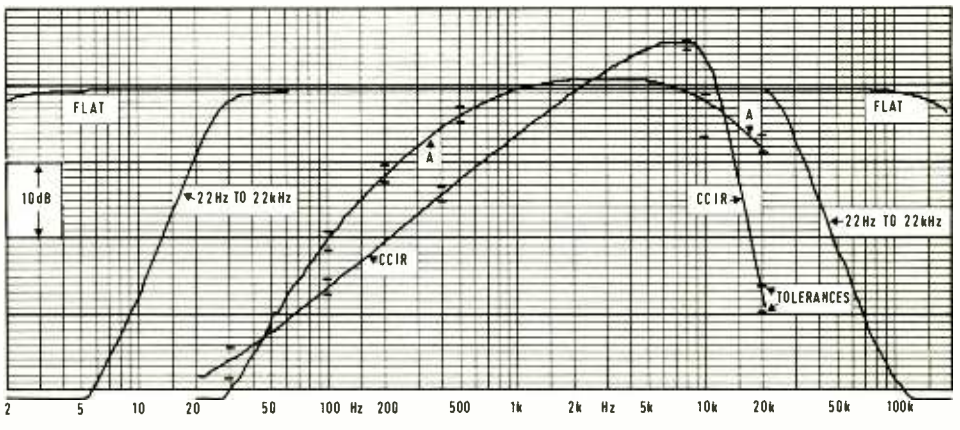


TABLE 1

Reference			
15Hz	0dB	1kHz	0dB
2.8kHz	+0.1dB	8.6kHz	+0.2dB
70kHz	+0.2dB	120kHz	+0.8dB
150kHz	+0.8dB		

TABLE 2

Frequency (kHz)	2nd Harmonic	3rd Harmonic
4	0.01%	0.013%
15	0.053%	0.02%
15	0.04%	0.025%
40	0.13%	0.53%
150	0.56%	—

TABLE 3

Burst duration	Percentage indication	Requirement
200ms	90%	80±12%
100ms	77%	68±10%
50ms	68%	59±9%
20ms	60%	52±8%
10ms	54%	48±7%

TABLE 4

	100Hz	1kHz	10kHz
Using internal oscillator	0.008%	0.009%	0.024%
Using external source	0.005%	0.005%	0.01%

TABLE 5

Indication	Average meter 3150Hz	Quasi-peak meter 3150Hz	Average meter 3000Hz
+2%	+1.95%	+1.89%	−1.71%
+1%	+0.98%	+0.96%	−0.74%
−1%	−1.00%	−1.03%	+1.27%
−1.8%	−1.96%	−1.81%	+2.05%

TABLE 6

Burst length	100ms	60ms	30ms	10ms
Standard indication	100±4%	90±6%	62±6%	21±3%
Measured performance	103%	92%	65%	23%

FIG.2
LINDOS LA1
TOTAL HARMONIC DISTORTION
AT 1kHz

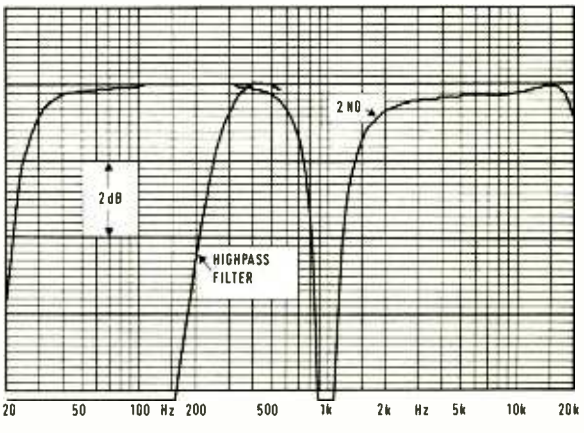
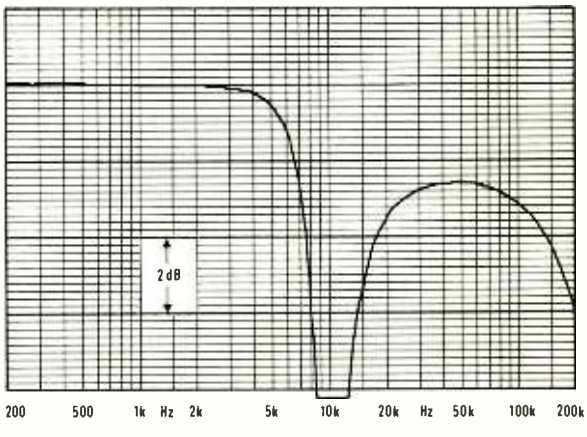


FIG.3
LINDOS LA1
TOTAL HARMONIC DISTORTION
AT 10kHz



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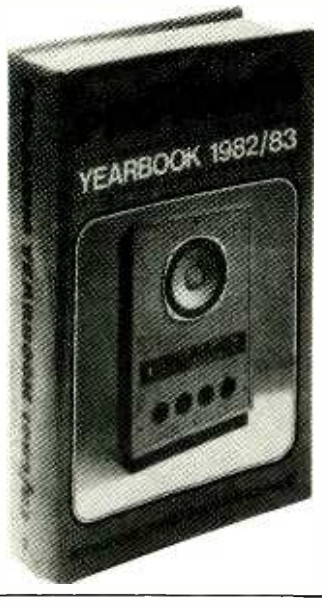

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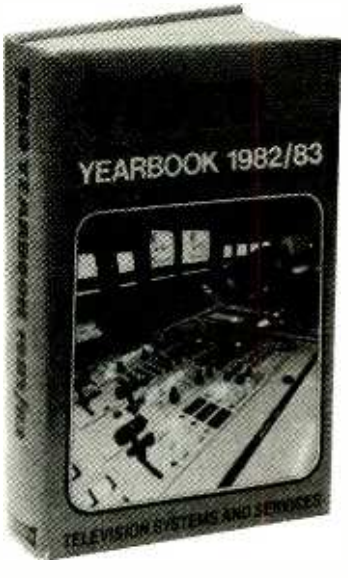

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with the high frequency response remaining flat up to 40kHz and falling to −0.5dB at 100kHz. The low frequency attenuation was marginal on the standard requirements.

The rise and fall times were well within tolerances as was the response to 5kHz tone bursts of 100ms, 10ms, 5ms and 1.5ms durations. Similarly the instrument met the requirements for its response to unidirectional short pulses and the overload requirements.

Subject to the oscillator being switched off (which might be normal) the residual noise in all weighted modes was below −100dBm with the input terminated in 50Ω. It was, however, noted that when the frequency counter was switched on there was some audible breakthrough of tone in the monitor loudspeaker at maximum input gain.

Distortion measurement

Measurement of the residual total harmonic distortion using the internal oscillator and a very low-distortion external source produced the residual readings given in **Table 4**, the two multiturn nulling controls being easy to use and fine in operation.

These residuals could be attained over input frequency ranges from 96.6Hz to 101.8Hz for 100Hz measurement, 970Hz to 1.016kHz for 1kHz measurement or 9.375 kHz to 9.803 kHz for 10kHz measurement, that latter showing a centre frequency error in the 10kHz setting.

The shape of the switchable highpass filter is shown in **Fig 2**, which also shows the accuracy of the harmonic measurement at 1kHz, the filter rolling off at −12dB/octave with the −3dB point at 215Hz which conflicts with the specified frequency of 315Hz. It transpired that in fact the instrument is correct, but that the specification was in error.

Again referring to **Fig 2**, it is to be seen that the second harmonic attenuation is 0.6dB and the third harmonic 0.4dB which is an acceptable margin. At 100Hz these errors were halved, but at 10kHz the second harmonic attenuation was excessive at 3.4dB, the overall response being shown in **Fig 3**. The manufacturer is aware of this situation and is looking into modifications to correct the instrument.

Rumble measurement

Fortunately the manufacturer has realised the very poor situation concerning the standardisation of rumble measurement and in addition to providing the accepted weighting curves as shown is **Fig 4**, enables the use of average, RMS or PPM metering.

The instrument applies the 'unweighted' rumble filter comprising a 6dB/octave highpass filter and 12dB/octave lowpass filter when selecting rumble measurement, the weighted rumble being obtained by inserting the highpass filter of 12dB/octave as shown if **Fig 4**, which shows compliance with British Standard *4852* and other standards.

Drift, wow and flutter

Accurate drift measurement is possible by using the frequency counter but the drift meter provides a useful function and, like the wow and flutter section, operates at input levels above 25mV.

When using the standard 3.15kHz frequency the drift meter was quite accurate providing that average metering was selected, the use of other meter settings introducing errors using either 3.15kHz or 3kHz when the meter was less accurate and operates in reverse. **Table 5** shows the measured performance.

The above figures are relative to the meter zero indication which corresponded within 0.1% to 3.15kHz but was 0.89% too high at 3kHz. However, as previously stated, the frequency counter was within 0.014% and can thus be used for accurate measurements.

Residual wow and flutter was found to be 0.002% weighted or 0.006% unweighted provided that the frequency display was switched off — the display increasing the unweighted residual to 0.016% quasi-peak. For some reason the maximum negative indication of the meter was limited to −1.8%.

The wow and flutter weighting curve used by IEC Publication 386, NAB, DIN, etc, is the same with the measured curve been shown in **Fig 5**, together with the standardised tolerances which were easily met. Also shown is the unweighted response.

Measurement to the NAB and other standards requiring an RMS meter is simply accomplished by switching the meter to RMS measurement with a separate switch selecting the IEC quasi-peak measurement.

The accuracy of measurement was found to be within the readability of the meter which in the IEC measurement mode satisfactorily followed the standard ballistics for bursts of frequency variation (see **Table 6**).

Similarly, the meter met the requirements for unidirectional bursts of frequency variation.

FIG.4
LINDOS LA1
RUMBLE FILTER

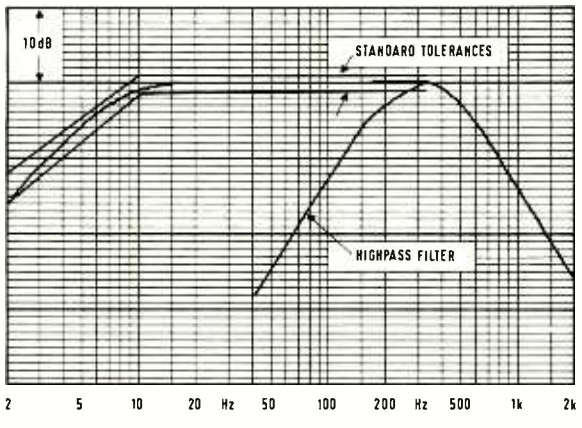
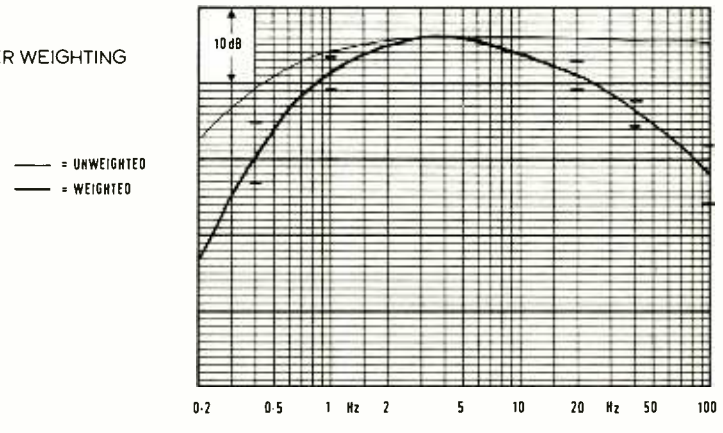


FIG.5
LINDOS LA1
WOW AND FLUTTER WEIGHTING



ST1 professional interface

On the input side, the interface simply contains a unity gain balanced input buffer with the input impedance switchable between 600Ω and 20kΩ (actual 601Ω and 19.95kΩ). Distortion introduced at input levels up to +22dBm was insignificant with the frequency response overall being within ±0.1dB up to 40kHz falling to −1dB at 105kHz and −2dB at 136kHz. Noise in the band 22Hz to 22kHz was less than −100dBm.

On the output end, the balanced output could deliver +26.9dB ref 0.7V at the onset of clipping with the gain into 600Ω remaining within 0.1dB with variation of the output impedance setting such that the output into 600Ω remains constant for testing long lines.

The measured output impedances were 583Ω, 75.7Ω and 29.6Ω, the latter being substantially more than that specified.

Flatness of the output was within ±0.1dB from 15Hz to 55kHz rising to +0.2dB at 150kHz with the noise at maximum gain being −86dBm across the balanced output.

Harmonic distortion remained virtually constant with the variation of the output level, and below 15kHz made no significant contribution to the oscillator's distortion.

Summary

Whilst the Lindos *LA1* alone is an ambitious instrument which may be battery operated, in conjunction with the *ST1* mains-powered studio interface it is a powerful test set for all the common measurements required for professional maintenance at a very reasonable price.

Generally the performance of all measurements was to a very high standard with few shortcomings, some of which are clearly stated by the manufacturer in the instruction manual.

Overall, this is an instrument well worth considering for production or maintenance work on any audio equipment. **Hugh Ford**

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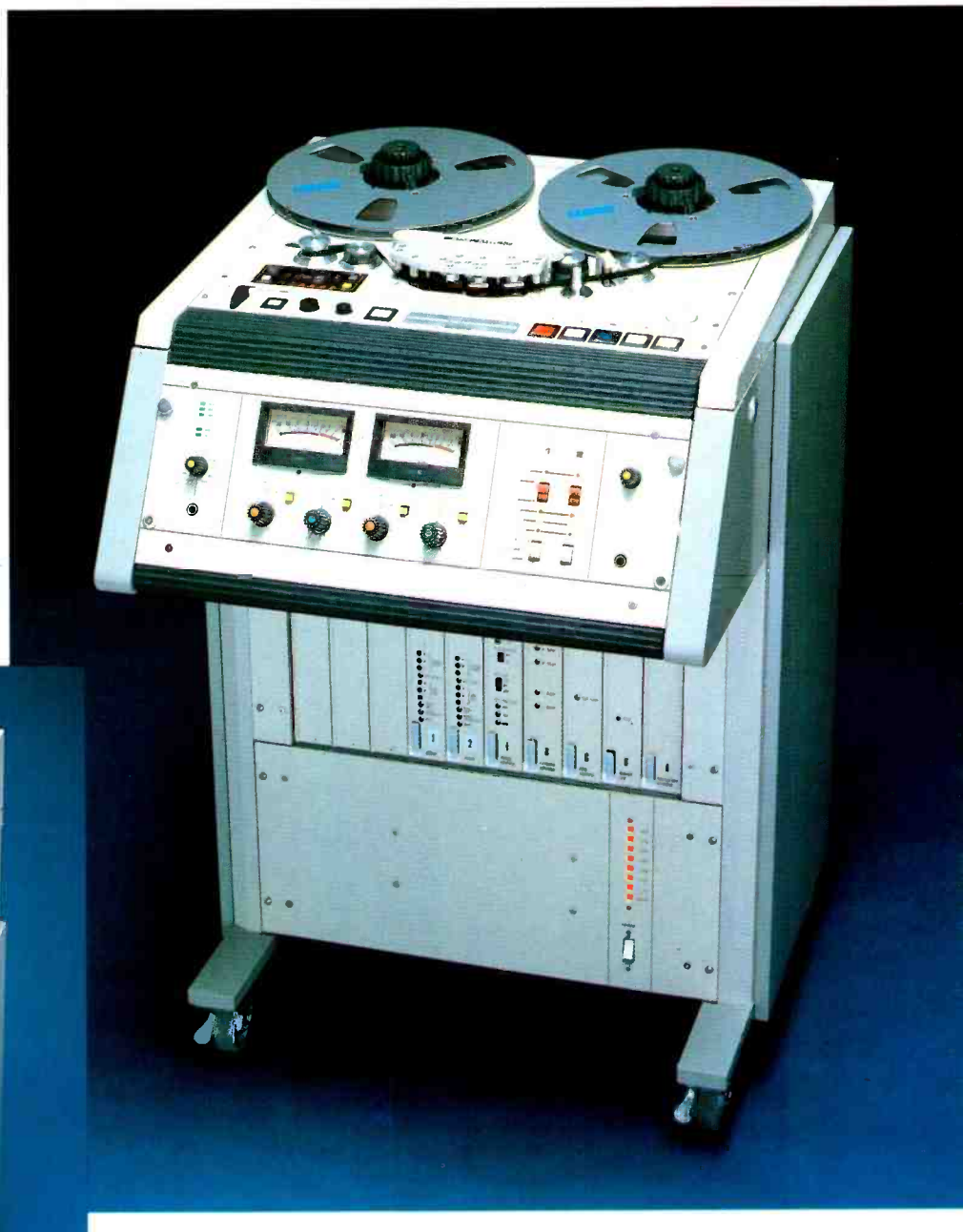

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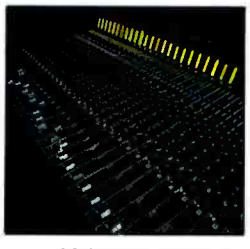
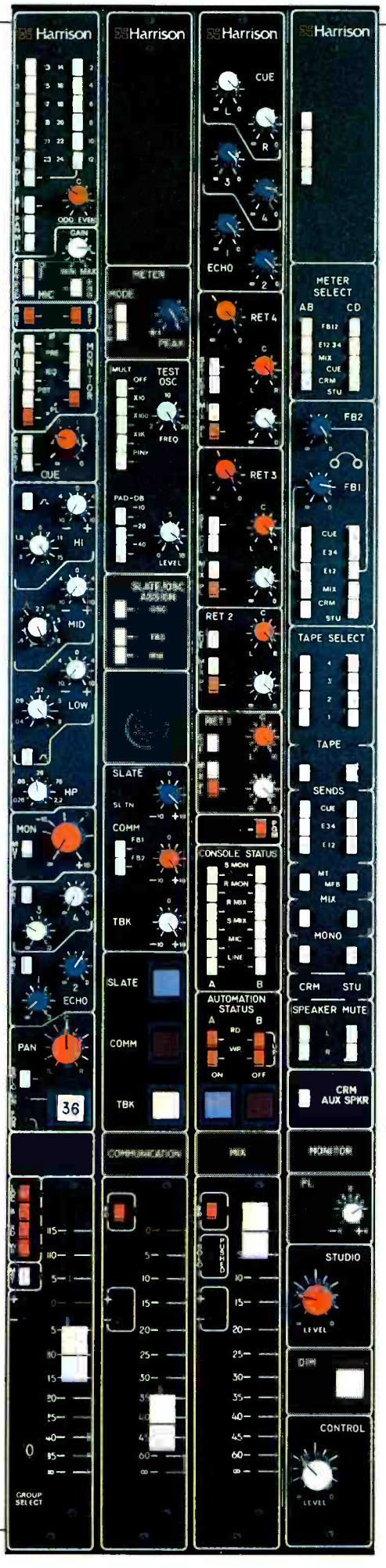


Major console status changes are effected with one-button ease. Six modes of operation are available including two new statuses for broadcast and video post production.

The standard VCA faders enable the operator to establish VCA groups when recording and mixing. The console is prepared for rapid installation of three proven automation systems: Melkuist, Allison and Harrison's own Auto-set.



The Harrison MR-3. High on Features, Low on Price.

You can never afford to buy cheaply. What you must do these days is buy economically.

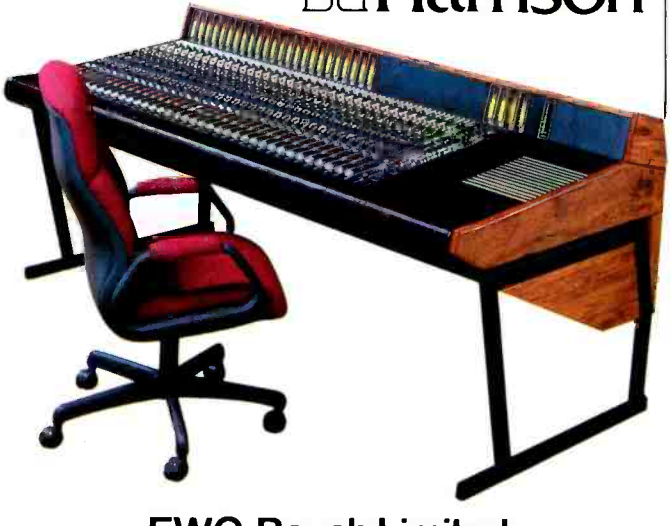
Recognising this, Harrison has developed the MR-3 music desk. High on impressive features, but not on cost, the MR-3 represents excellent value and a unique opportunity to invest in Harrison performance.

In other words the MR-3 guarantees maximum efficiency in 24-track recording.

The Harrison MR-3. Underpriced it may be, undermade it's not.

To find out more about the Harrison MR-3 contact F.W.O. BAUCH at the address below.

Harrison



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