May 1978 50p

studio sound

AND BROADCAST ENGINEERING

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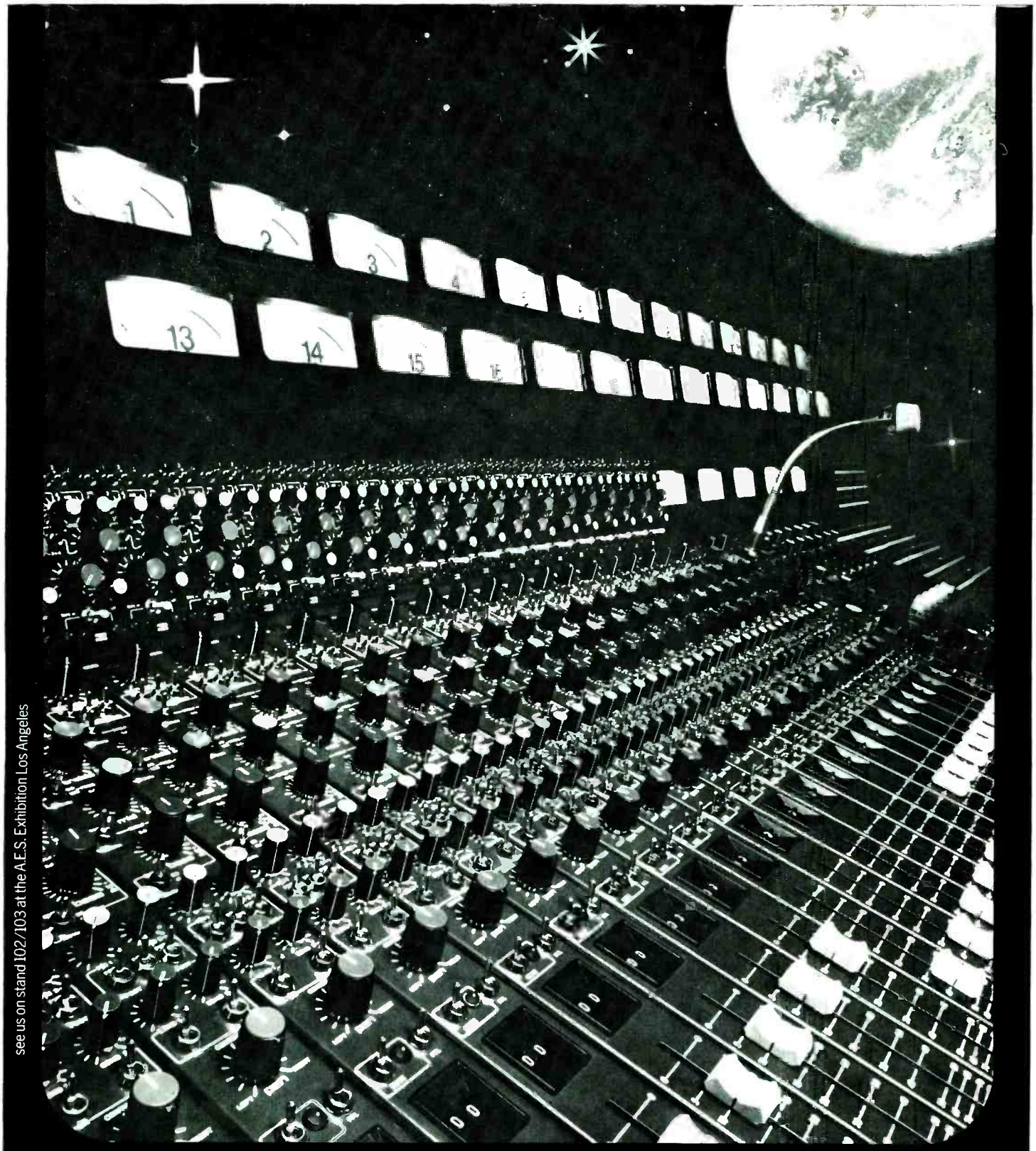

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studio sound

AND BROADCAST ENGINEERING

Get it right

In our report of the last New York AES Convention we stated (hopefully) '. . . it appears that the large desks have reached a stage where manufacturers are taking a timely stock of the situation. Primarily the goal has been automation and this in itself warrants much user and manufacturer analysis'. Information received concerning the LA Convention this month seems to bear this out. But what *is* the situation?

Over the last decade the size of the recording industry has increased to such an extent that manufacturers are relying more and more on mass production techniques (hence the modular concept?) in order to keep prices down. Not all manufacturers, however, are using this philosophy to the same extent, which has led to a situation where the term custom-built has a sliding scale of meaning.

At one end is the manufacturer who will discuss the complete desk design with the studio engineer before building begins, and at the other end is the company who will explain to the engineer how the desk works, more or less after it is installed. But alongside this runs a reasonably parallel scale of decreasing cost; so if you want a truly custom-built desk, it'll cost you. This all seems very reasonable—you pays your money and you takes your choice!

However, because of the relatively high costs involved in the purchase of any large desk, and the pressures on studios to have the most up-to-date and 'impressive' gear as a criterion (so often contrary to the *right* criterion—a good sound) this choice is not always made by the right person.

At present the situation is in no way one of total disregard for the engineer's (the user's) opinions but, as with all expanding industries, the insidious signs are there. So it's up to you, the engineer, not to be steam-rollered into ending up with gear that, even though it looks pretty and wasn't *too* expensive, won't do the job you want it to. In the long run it will probably work out as a bad investment.

It's mutual

For several years now the main point of criticism of STUDIO SOUND has been that we don't cater sufficiently for the 'smaller studio'. This was a deliberate policy decision to ensure that STUDIO SOUND didn't dilute its efforts; but it left a large gap in our coverage of the recording field. We've now filled this space with a new publication—Sound International—which is aimed at 'musicians' on both sides of the glass. Between us our two magazines will cover the entire professional music scene. For more information on Sound International give us a call.

contents

MAY 1978 VOLUME 20 NUMBER 5

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The musical computer.

MXR have been working on a new type of audio delay line. The result is the MXR Digital Delay.

It works on memory banks. Just like an analog computer. The system is called "Digital Random Access Memory". And it's a great improvement on the old type of 'shift register' delay.

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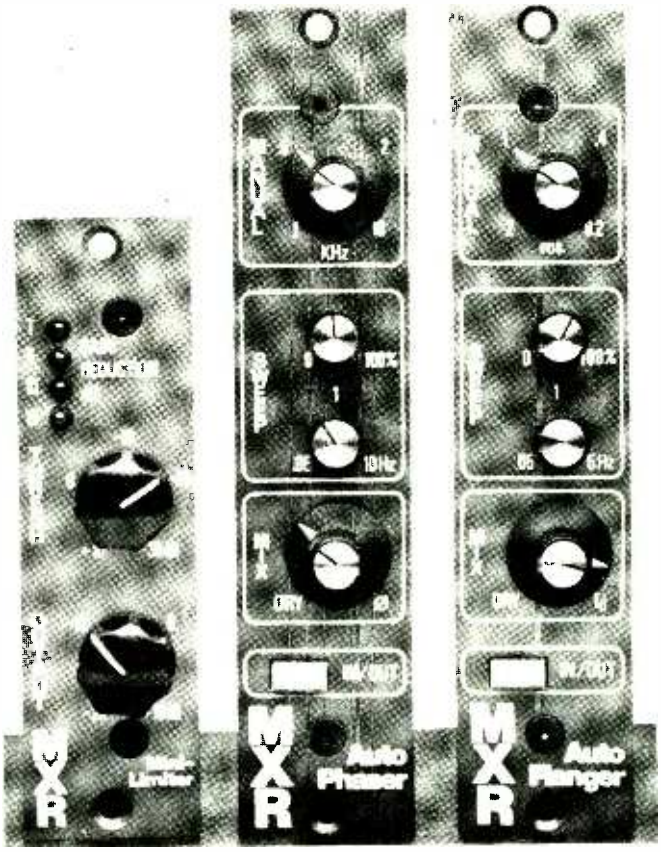

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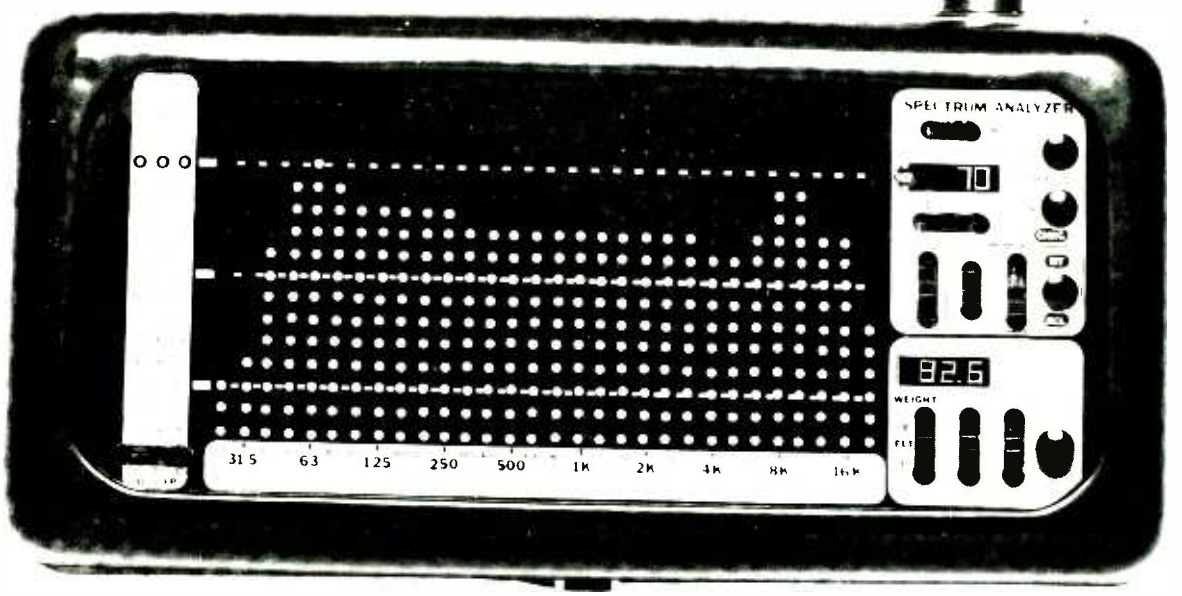

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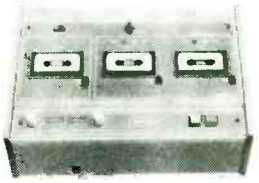

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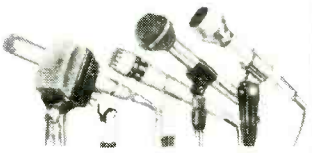

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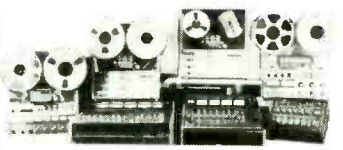

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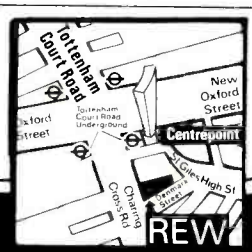

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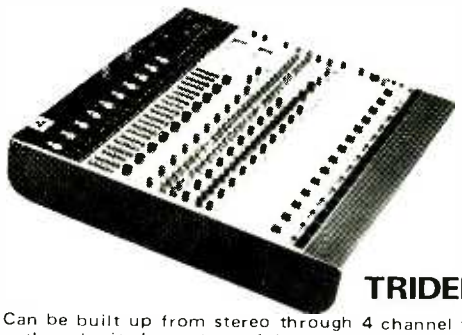

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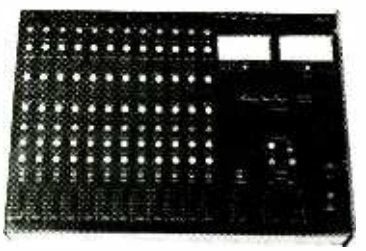

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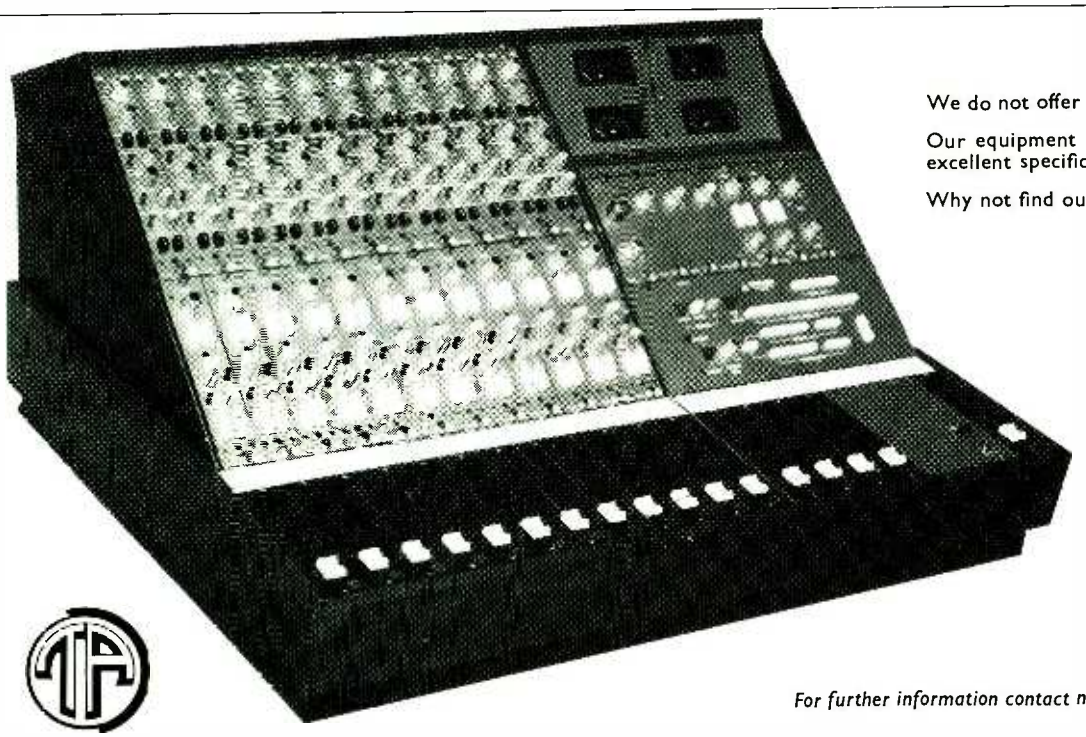

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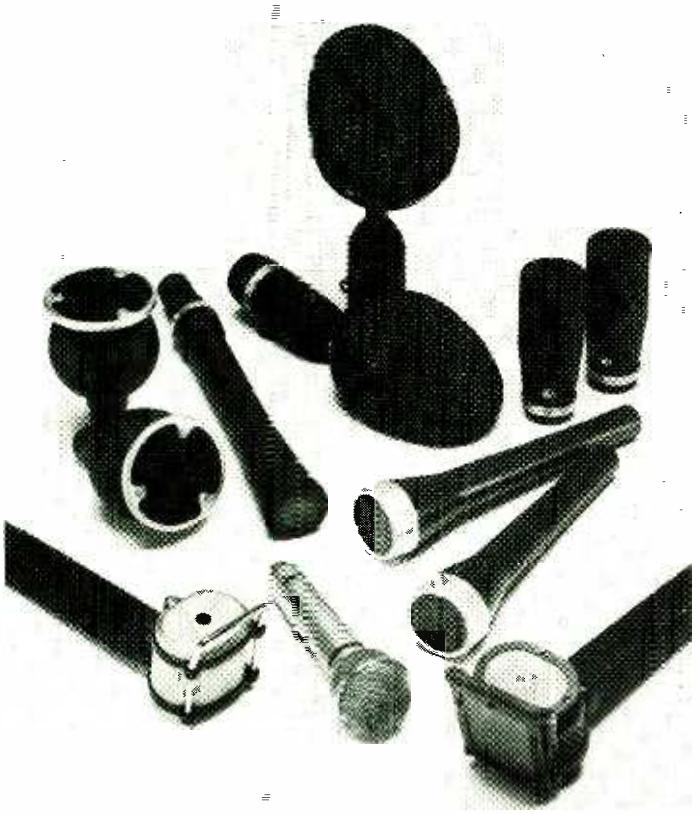

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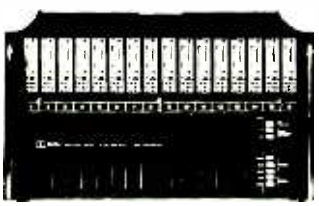
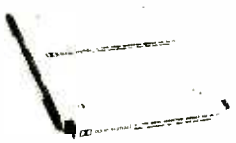
361
The Dolby 361 is similar to the 360, providing a single channel of A-type noise reduction, but with relay switching of operating mode and tape recorder connections The changeover can be controlled automatically by the recorder



M-Series
The Dolby M16H A-type unit is designed specifically for professional multi-track recording, and incorporates 16 channels of noise reduction in a compact chassis only 10 inches high The similar M8H is an 8-track version, and the M8XH allows simple extension of the M16H for 24-track use

Noise reduction module



Cat no. 22
The Dolby noise reduction module, Cat no 22, is the basic functional unit employed in all A-type equipment. The Cat no 22 is available as a spare or in quantity to OEM users for factory installation A half-speed version of the module (Cat no 40) is also available

Dolby

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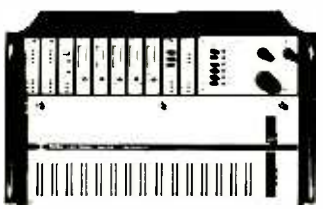
Motion picture industry

364
The Dolby 364 Cinema Noise Reduction Unit is intended primarily for use with Dolby A-type encoded optical sound-tracks. The 364 also includes a standard 'academy' filter for conventional tracks, and provision for playback of magnetic sound tracks with or without Dolby system encoding

E2
The Dolby E2 Cinema Equalizer is a companion unit to the 364, and has been specifically designed to solve the response equalization problems of cinemas Used with the 364 and Dolbyized optical sound-tracks the E2 enables most cinemas to achieve modern sound reproduction standards without replacement of existing equipment



CP100
The Dolby CP100 Cinema Processor is designed for the reproduction of all current and presently foreseeable film sound-track formats including conventional optical and magnetic tracks. Dolby encoded monaural optical tracks. Dolby encoded magnetic sound-tracks and the new stereo optical release prints Up to three noise reduction modules can be incorporated Typically, three channels of theatre equalization, as in the E2, will be incorporated, but facilities exist for five channels of equalization and the connection of an external quadraphonic decoder

Noise weighting filter

Cat. Nr. 98A
Noise weighting filter to CCIR/ARM characteristic (recommended by Dolby Laboratories) Filter is used with average responding meter (ordinary millivoltmeter) allowing noise measurements to be made on tape recorders, tapes, FM tuners, etc, with results which correlate closely with the subjective effect of the noise Filter can be used for the testing of professional and consumer equipment

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330
The Dolby 330 Tape Duplication Unit is a professional quality unit with B-type (consumer) noise reduction characteristics The unit is used for encoding duplicating master tapes in the high-speed duplication of Dolbyized cassettes, cartridges, and open-reel tapes The 330 is a two-channel unit

334
The 334 FM Broadcast Unit allows broadcast stations to encode stereo FM broadcasts with the Dolby B-type characteristic The unit also provides for a reduction of high frequency pre-emphasis to 25 microseconds, this reduces the need for high frequency limiting, thus allowing a significant additional improvement in reception quality

Test set (A-type)

Cat no. 35
The Dolby NRM Test set, Cat no 35, permits rapid verification of performance of Cat no 22 noise reduction modules without their removal or the need for additional test equipment

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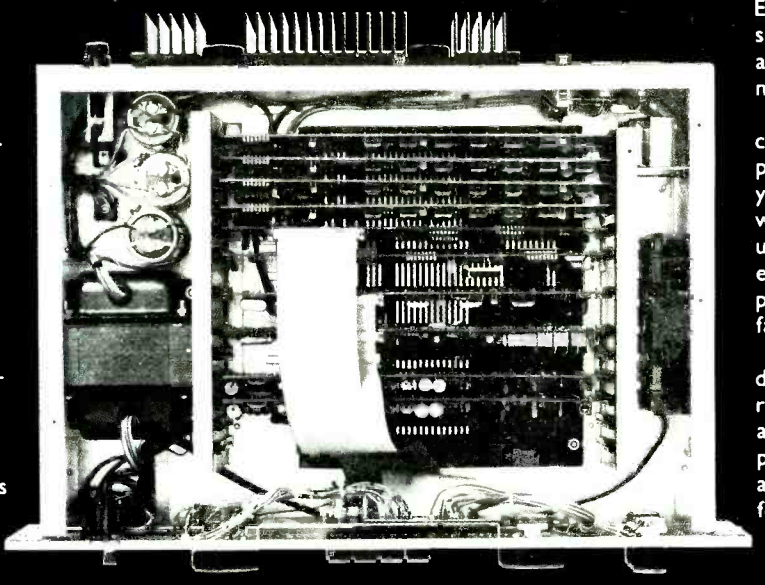

The CPR contains two individual reverb programs and one "open" program provision for future custom sound processing effects. Program 1 is analogous to a live acoustical chamber, and Program 2 creates a simulation of an artificial plate. Program 3 switching facility is pre-wired for a plug-in programming module and Program 4, ECHO allows a "Tape-Echo" simulation that is unobtainable by present mechanical methods.

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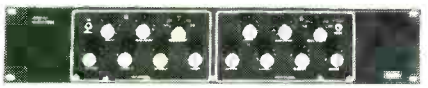

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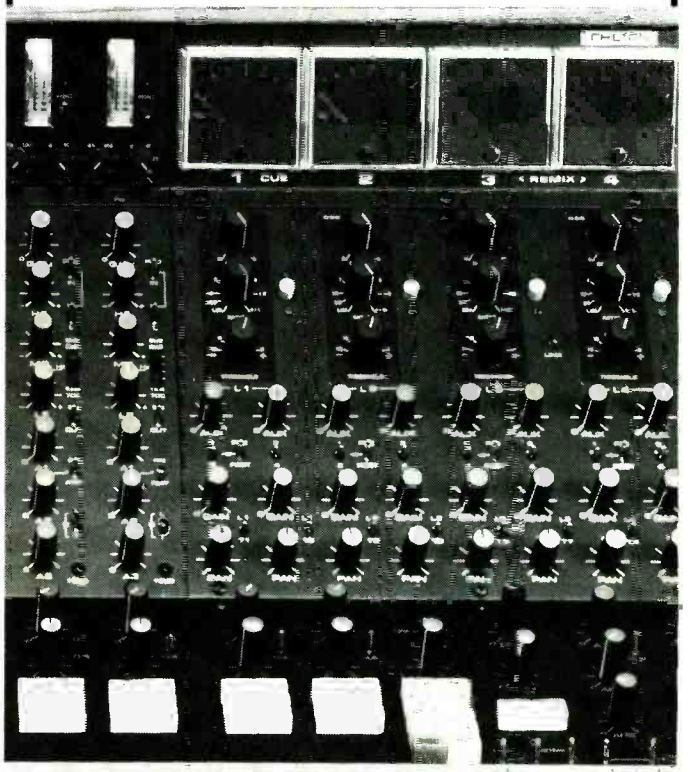

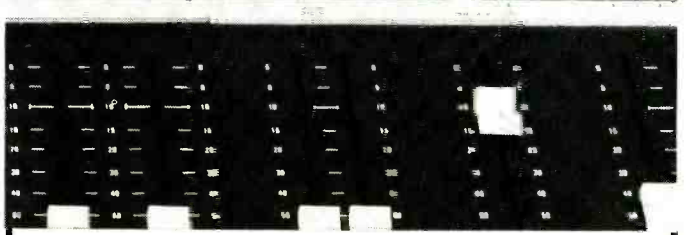

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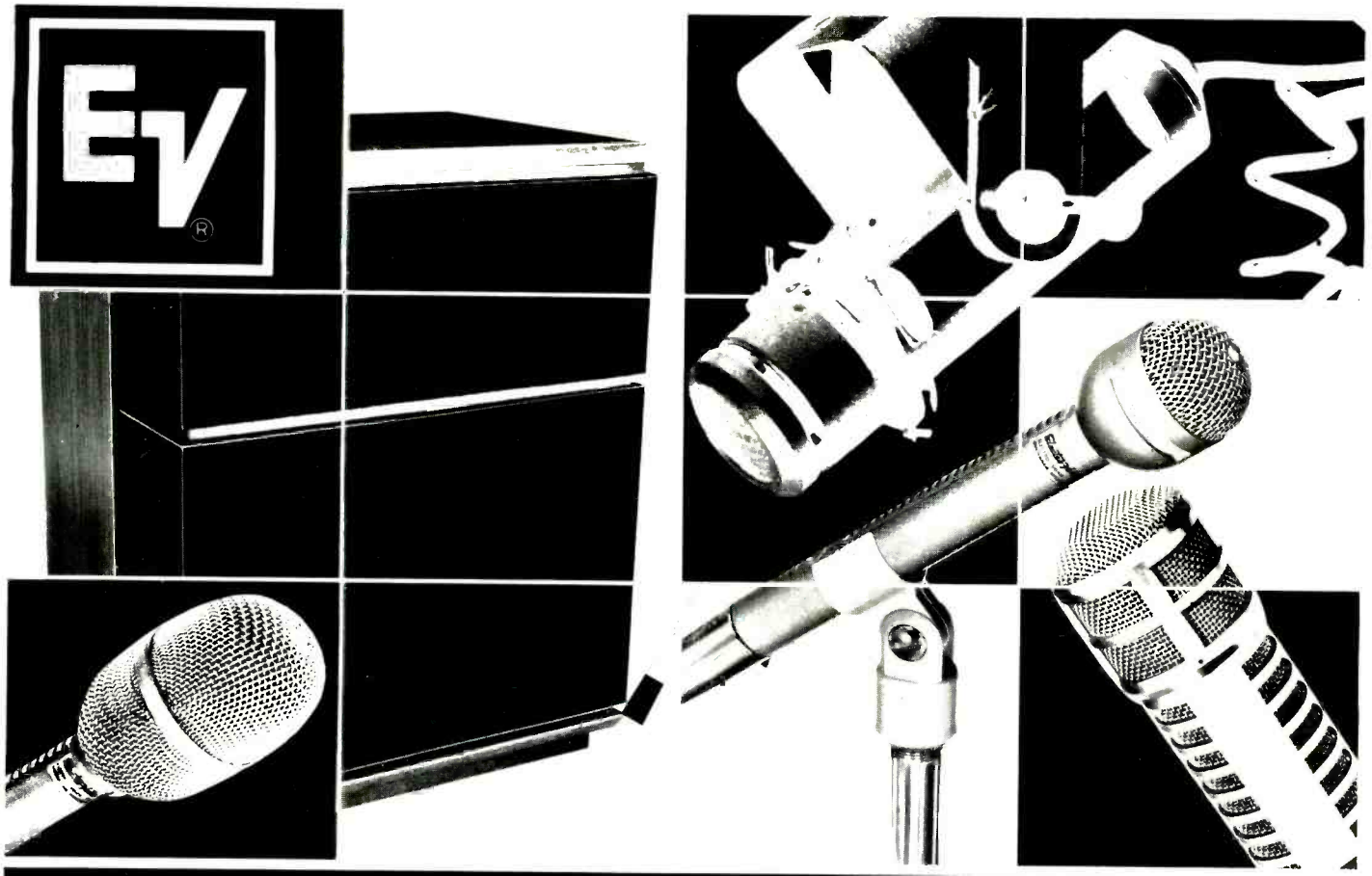

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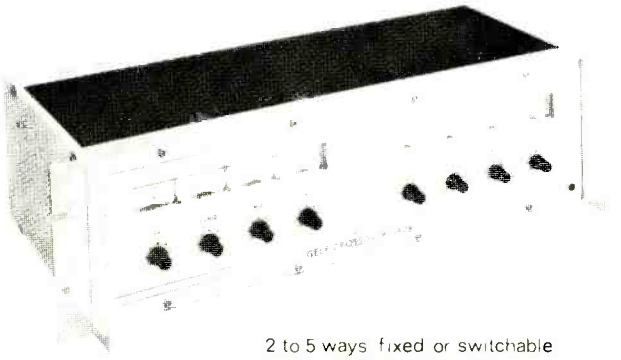

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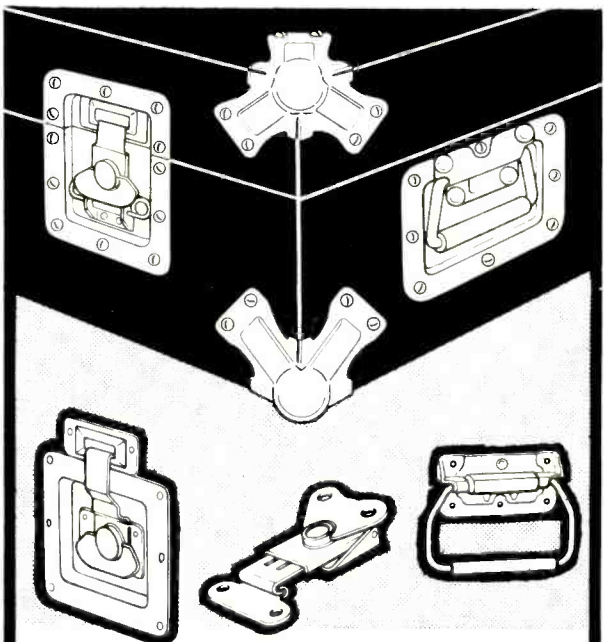

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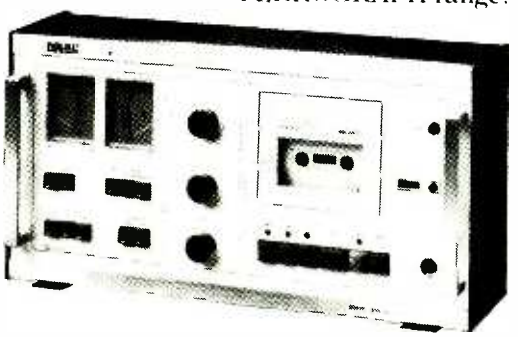

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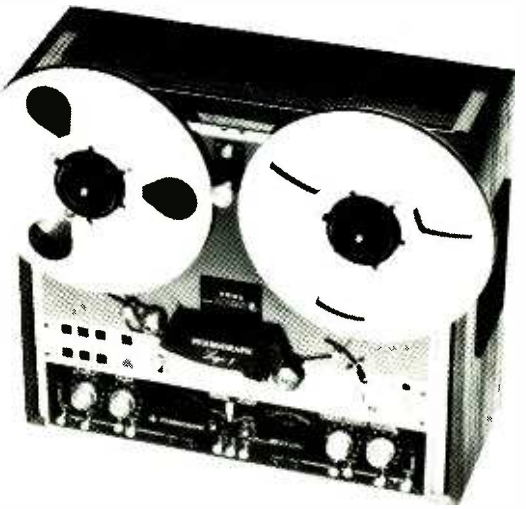

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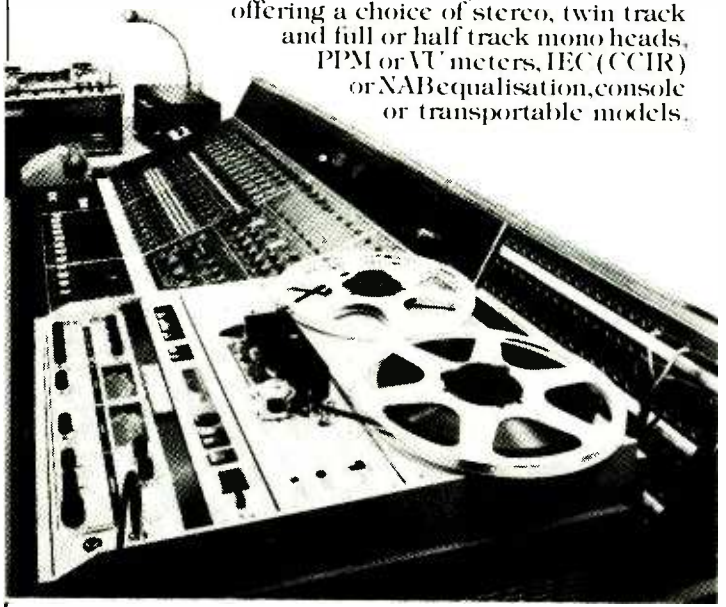

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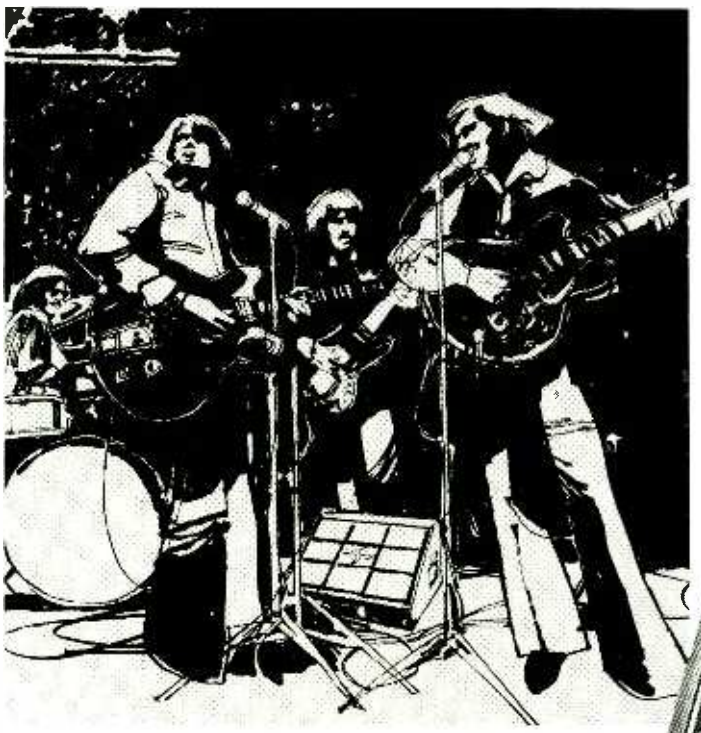

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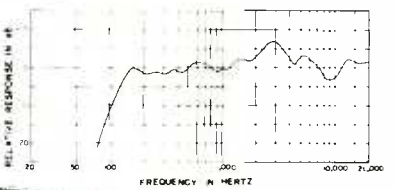

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Tel: 161-657 0812
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Germany:
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Bernstorffstrasse 123,
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Tel: 40-439 7254

USA:
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Since its introduction, the HH S500-D has become established as one of the world's leading power amplifiers. Many prestigious organisations have confirmed the amplifier's unique performance and dependability under tough operating conditions.

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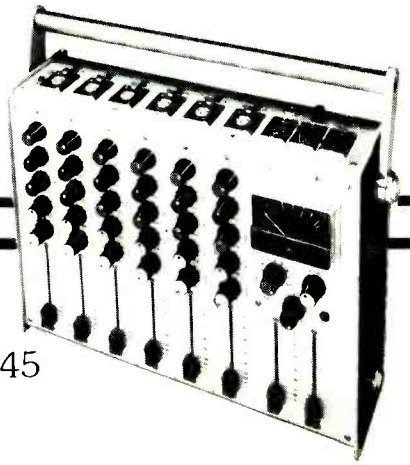

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Specially developed at the request of Thames Television and other T.V. and film production companies with Extra facilities not available on standard model.

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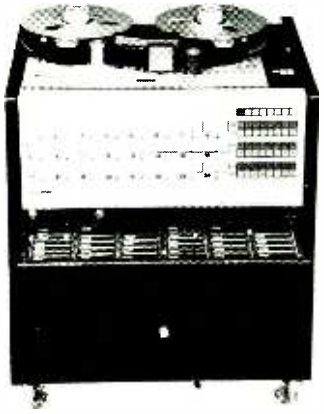

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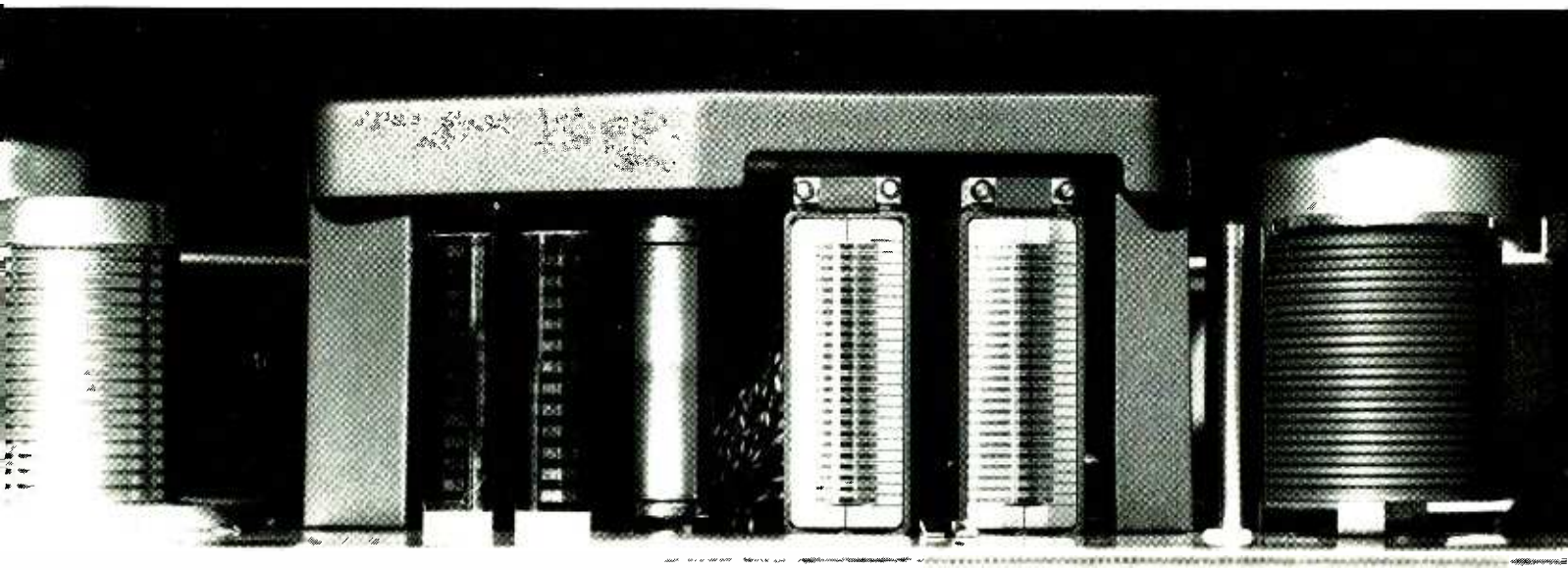

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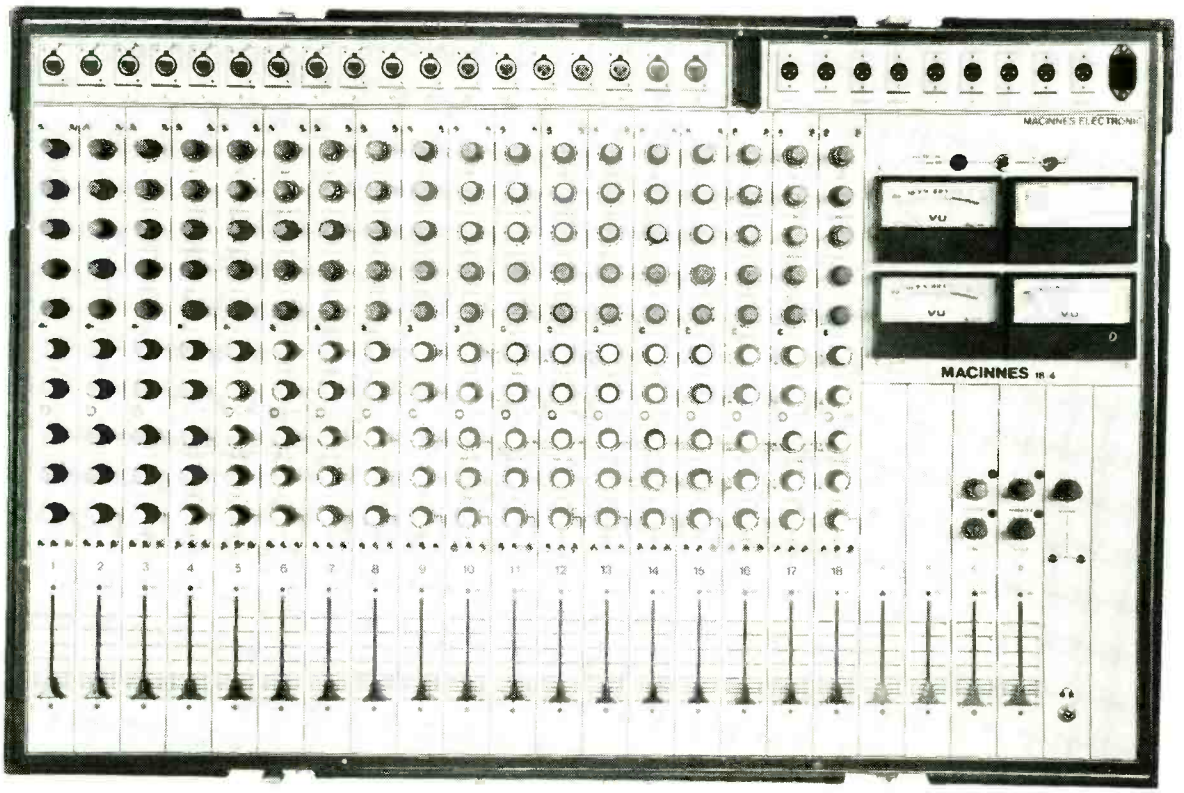

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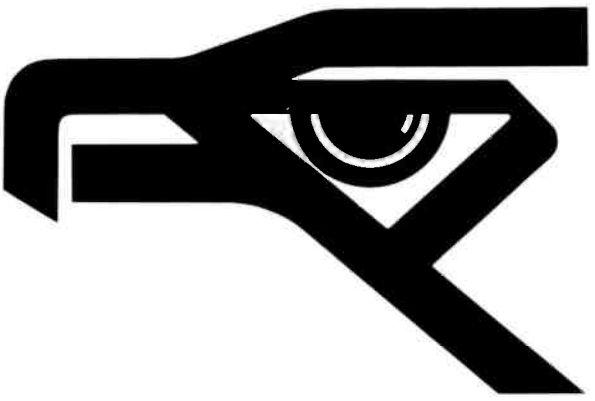

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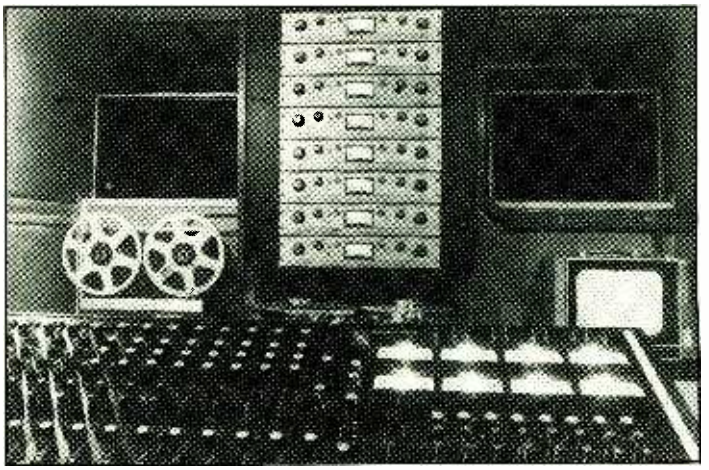
news

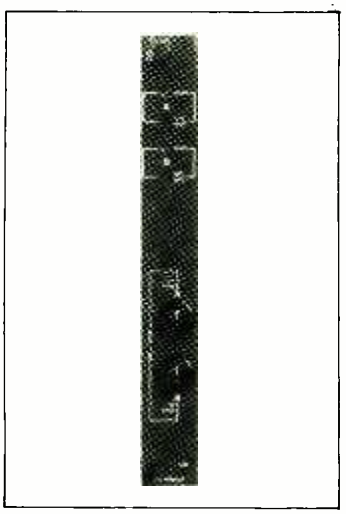


The Mobile Sound Services' 8-track mobile is equipped with a Soundcraft 16/8 Series Two desk, Scully 8-track on 25.4 cm tape machine and Tannoy Devon monitors. The desk has sweep eq, P & G faders, balanced inputs and outputs and ppm metering. Noise reduction is handled by a M8H rack of Dolby A. Outboard equipment includes Pye compressor-limiters, Orban Parasound reverb, Allen & Heath adt and H/H tape echo. The mobile is available for hire at £9/hour or £85/day; rates are cheaper for longer hirings. Full details from MSS Ltd, 33 The Parade, Claygate, Surrey KT10 0PB. Phone: Esher 67087 and (01) 734 3356.

A & D da

The new *SO8* distribution amplifier from the *Scamp* range features two inputs switchable to any or all of eight outputs. Each input is protected against over-voltage, and outputs are individually isolated from each other via line amps and are short-circuit protected. Thus a fault on one of the lines will not bring down the others. Furthermore, each output is switchable between balanced and unbalanced operation, and features ultra-low (<1 ohm) impedance for strapping cans or other monitoring facilities anywhere across the line without unduly affecting the signal.

A fine-adjust preset is provided on each input for adjusting the gain by ±4 dB. Also a led 'optimum modulation indicator' with peak-sensing, slow-decay characteristics operates at +12 dBm to protect outboard equipment. Monitoring of inputs is by means of two jack sockets wired for use with mono or stereo cans.



The *SO8* is just 25 mm wide, allowing up to 17 units to be fitted in a standard 483 mm *Scamp* rack: a total of 34 inputs and 136 outputs.

Extract from manufacturer's specification:

Frequency response: +0, −1 dBm, 20-25k Hz.

Noise: less than −100 dB; ref +8 dBm.

Distortion: <0.008% at 1 kHz and <0.1% at 24 kHz; ref +8 dBm.

Crosstalk: −95 dB at 20 Hz, −88 dB at 1 kHz, −68 dB at 10 kHz and −60 dB at 25 kHz (one input open-circuit, the other driven at +8 dBm).

Clip level: +24 dBm.

Audio & Design Recording Ltd, St Michael's, Shinfield Road, Reading RG2 9BE, UK.
Phone: Reading (0734) 53411.
Telex: 847605.
US: Audio & Design Recording Inc, PO Box 23047, Honolulu, Hawaii 96822.
Phone: (808) 845 7226.

Af test with self-diagnosis

A test set manufactured by Telecommunications Technology Inc for the measurement of level, frequency, noise and weighted noise is now available in the UK from Wandel and Goltermann. The unit is available in two versions: the battery-powered *1120* which weighs only 6.3 kg; and the mains-powered *1122* for rack-mounting.

An outstanding feature of both units is said to be the built-in microprocessor with on-board memory which, in addition to controlling measurement and transit function, also tests automatically all major instrument components. The results of such tests—which take only 12s—appear in word form on the front-panel alphanumeric display.

A low-distortion oscillator acts as the signal source, which may either be tuned in two overlapping frequency bands (50-4k Hz and 1-20 kHz), or at predetermined frequencies by means of push buttons. Level, noise and frequency readings are monitored simultaneously on the dual digital display, all range measurements being fully automatic. Level is autoranging from −50 to +10.5 dBm; noise reading from −90 to +10 dBm; and frequency range 50-20k Hz. Once the impedance has been selected, any one of three weighting switches selects both the noise measurement mode and weighting network.

Wandel and Goltermann (UK) Ltd, 40-48 High Street, Acton, London W3.
Phone: (01) 992 6791.

Lavalier mic

Electro-Voice now offers a lavalier tie-clasp microphone, *CO 90*, to full professional specification. It measures just 9.5 mm in diameter by 22 mm long, and comes complete with necktie mount, windshield, storage pouch and 180 cm of cable connecting to a belt pack of battery and transformer etc. The quoted frequency range is 40-15k Hz with an output level of −57 dB into a low impedance input. The microphone carries a 2-year guarantee.

Electro-Voice Inc, 600 Cecil Street, Buchanan, Mich 49107, USA.
Phone: (616) 695 6831.
Europe: Electro-Voice SA, Romerstrasse 3, 2560 Nidau, Switzerland.
Phone: (032) 516833.
UK: Electro-Voice Division, Gulton Europe Ltd, The Hyde, Brighton BN2 4JU.
Phone: Brighton (0273) 66271.
Telex: 87172.

Room equalisation

The Swedish company AVAB offers a relatively low-cost room analysis kit which operates in conjunction with a domestic television set. The basis is a 10-octave band real time analyser which produces a bargraph when plugged into the set's aerial socket. It eliminates the need for a dedicated led display. Range is 49-130 dB spl in three calibrated steps.

A separate pink noise generator (supplied with the kit) provides the test signal for the speaker/amplifier combination. As per normal room eq, a graphic equaliser is inserted in the signal chain and adjusted for flatest overall response as shown by the tv bar graph.

The *Visu-Lizer*, pink noise source and microphone cost approximately £600, which doesn't include the equaliser. Naturally, AVAB makes an equaliser suitable for use with the room eq kit.

Tommy Jenving AB, Karl Johansg 98, 41451 Goteborg, Sweden.
Phone: 031 124720.

Cadac board

The board of directors now comprise the following: Adrian Kerridge Chairman; Clive Green Managing Director; Robin Bransbury Director of Engineering; Mike Blackburn Sales Director; and Ira D Gale who has joined the company as Finance and Marketing Director.

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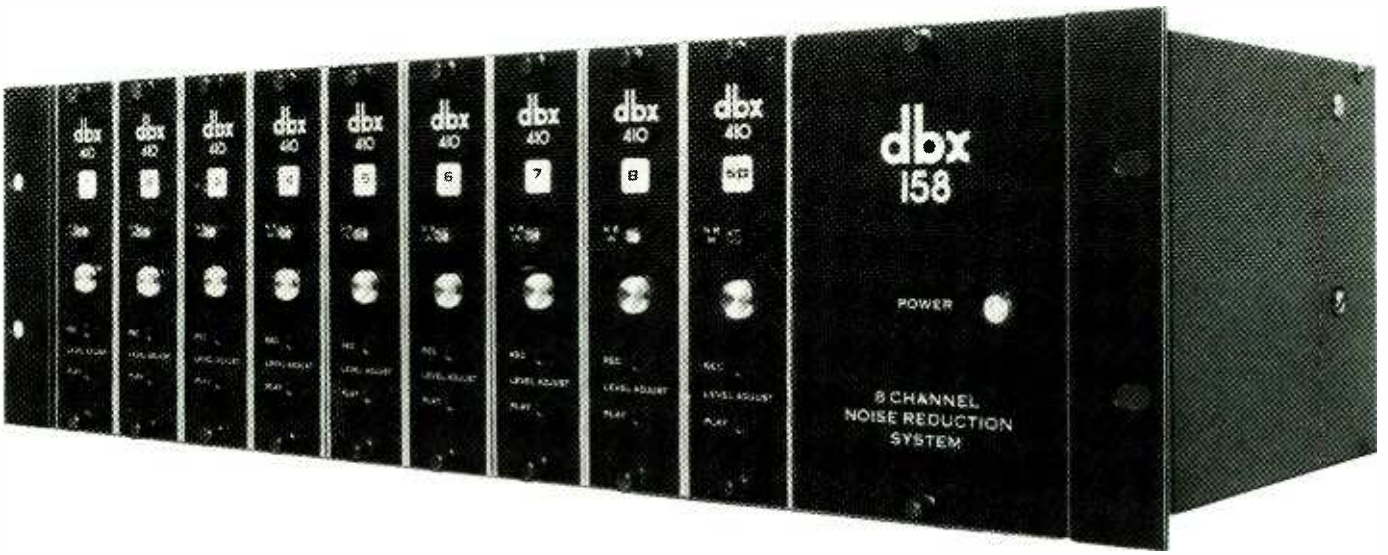
Budget DBX Noise Reduction for the Small Multi-Track Studio



The dbx 158 is a semi-professional version of the well-established dbx professional series of noise reduction units. Recordings made with a dbx 158 may be decoded by any studio using dbx professional equipment.

At a U.K. List Price of **£1485,** the dbx 158 provides 8 tracks of *simultaneous* encode and decode noise reduction, obviating the need for mode switching of noise reduction system by operator or machine.

By reducing tape noise by more than 30db, it significantly increases the multiple overdub capability of any recorder – especially those using $\frac{1}{2}$" 8 track recording formats.

dbx's unique and patented circuitry does not require critical matching of encode (record) and decode (play) levels, therefore no reference tones or metering are necessary.

Phono and Molex multi-pin connections allow rapid interface to the unit and modular construction with inclusive spare module ensures minimum downtime in the event of breakdown.

- ★ **Unbeatable 30db noise reduction**
- ★ **Total compatability with dbx professional studio noise reduction equipment**
- ★ **Modular format**
- ★ **Simplicity of operation**

For full details on the dbx 158 or any dbx professional or semi-professional product, please contact

U.K. Distributors
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Tel: 01-734 2812

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Artillerivej 40,
DK-2300 Copenhagen S
Tel: Copenhagen 570 600

France
3M France SA, Mincom Div.,
Boulevard de l'Oise,
95000 Cergy
Tel: Paris 749 0275

Holland
Pieter Bollen Geluidstechnik,
Hastelweg 6,
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Tal & Ton Musik & Elektronik AB,
Kungsgatan 5,
411–19 Gothenburg
Tel: Gothenburg 130 216

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Didn't they do well

Neve has announced a whole string of orders worth together around £¼ million. The orders comprise mainly broadcast sound desks; £180 000 of equipment is destined for Eastern Europe.

The Rumanian tv organisation in Bucharest has ordered four 20-input channel *5305* sound mixing consoles for use in ob vans. Bulgarian Radio has contracted for three 24/16 *8058* desks as well as a couple of smaller mixers for tv use. A similar *8058* desk is to be installed in a Polish 16-track recording studio.

The company has also sold a few more consoles in the UK. HTV has placed an order for two 30-channel desks for its Bristol studios. One is to be used in a brand new film and dubbing theatre in conjunction with a 16-track machine, while the other goes to Studio 5 as part of a re-equipment programme. General sales manager Les Lewis states that HTV is now exclusively equipped with Neve consoles.

Neve 5305 console

The Raindirk Series III *console recently installed at Olympic is equipped with 28 input channels, eight group outputs, two remix group outputs and 24-track monitoring. Each dual monitor module contains an echo return section that features a comprehensive equaliser and routing to all the group and monitor circuits. The eight group outputs may be submixed via panpots to the two master remix outputs. In addition, routing to these master remix outputs from each input channel is provided via a routing switch and panpots. The console is finished in Indian laurel veneer and sports a real leather padded armrest (for real leather padded arms maybe?). Tape machines include a 24-track 3M M79 and two Studer mastering machines. Dolby 360 modules handle the noise reduction. Up to 30 musicians can be accommodated in the studio, which measures 15 by 6m by 5.5m high. There is also a large isolation booth.*

Institute of Broadcast Sound

The newest Institute in the broadcast sound business is run, in the main, by an enthusiastic gentleman named Ron Ferris from his Surrey home. The declared aims (as it says on the application form) are 'to promote the interchange of ideas and techniques associated with sound in broadcasting. To pursue the improvement of the Art and to encourage the maintenance of the highest professional standards. To liaise with other bodies in pursuit of these aims'.

The membership fees for Mr Ferris's Institute of Broadcast Sound are £10 per annum for a full member (registration fee £3 on top) sliding down to £5 for a student member (registration still £3). While this magazine would hate to put the kaibosh on an organisation for which there might be a need, the writing on the wall—or at least in the rather slim but closely written news letter—bodes ill.

News sheet no 2 reads as follows: 'As promised at the Inaugural General Meeting (sic) this second meeting will take place in our second city, Birmingham.... Our membership now numbers 140 and applications are still trickling in. A standard poster for display notice boards will be shortly available (A4 size) but in the meantime, you could be recruiting members ...' Slightly wistfully, news sheet no 3 reads: 'The Birmingham meeting which took place on December 2 was enjoyed by all those who attended it ... The executive Committee were a little disappointed by the relatively small attendance of members.'

In a more admonishing tone, it continues: 'When the IBS was founded, the Executive Committee made the point to you all that the Institute would only flourish if you, the members, supported it. Based on the Birmingham meeting, this support is not as firm as it should be.'

Without wishing to be unkind, the birth pangs of the IBS seem rather painful. However, they would appear to be exacerbated by trying to cover the regions in one fell swoop. Whatever the actual need for the IBS, it should heed the proverb which decrees that it's a mistake to run before you can walk.

Potential members wanting more information should contact Ron Ferris at 65 Chertsey Road, Windlesham, Surrey GU20 6HE. Phone: 0276 75553.

SARM damaged by fire

Sound and Recording Mobiles of Osborn Street, London, suffered a serious fire on March 5. The studios, better known as SARM, were extensively damaged not by the fire itself, but by the quantities of water flooding the area by the time the fire was extinguished.

Directors John and Jill Sinclair were understandably shocked by the damage to their studio, now closed for the first time since it opened in July 1973 as the first 24-track studio in the UK.

'Luckily, only two master tapes were damaged, and our tape library wasn't affected,' said Jill, 'but it's been a horrifying experience. The fire didn't spread to the studio, but the smoke density was high—the firemen had to use breathing apparatus—so now almost everything smells of smoke. Although we've baled out most of the water, practically everything that was wet is still damp.' According to brother John the area most affected was the floor, ruining electrical and audio cable installations.

The circumstances surrounding the fire are still something of a mystery. Apparently the main door was left open, presumably by one of the tenants with which SARM share the building. Person or persons unknown, possibly children, then somehow started what was to be a very expensive fire. An insurance claim has been filed.

'We had planned to completely update the studio in September,' said John, 'and we now hope to bring that programme forward.' Plans include replacing the Trident *B* desk with a new 40/32 *TSM* console, and installing two 24-track 3M machines, pulsed together for 46-track operation. Almost all the electrical installation will have to be replaced; also the audio routing, according to damage.

Damage to SARM's collection of ancillary and effects units, reputedly among the most comprehensive in the country, is thought to be negligible. However, in common with all equipment retained in the studio, it will be thoroughly tested before re-use. The refit operation is expected to be completed by late May or early June.

'As you can imagine', Jill told me, 'it's all a bit chaotic at the moment. We're currently channelling client's work to other studios, still using our resident engineer Gary Langen, so it's not the end of the world. Looking on the bright side, we'll have the twin advantages, when we reopen, of a top studio with an established clientele, but refitted with the best equipment currently available.'

Richard Dean

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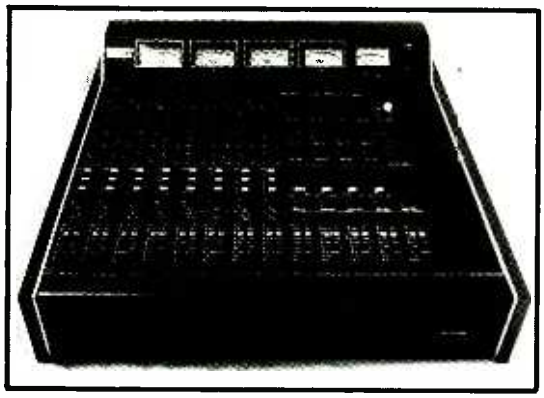
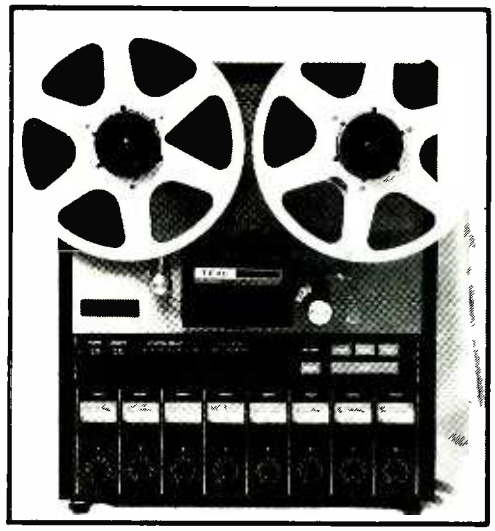


MODEL 5



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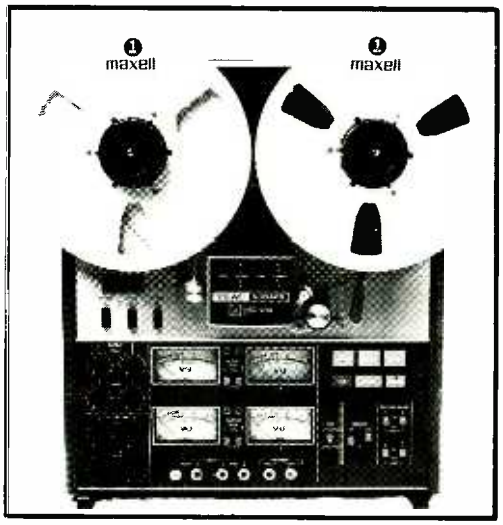
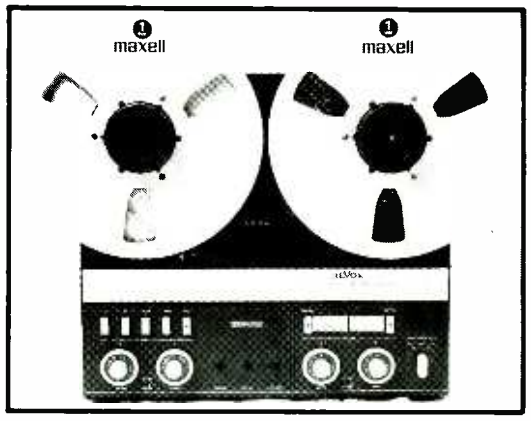


3340 S



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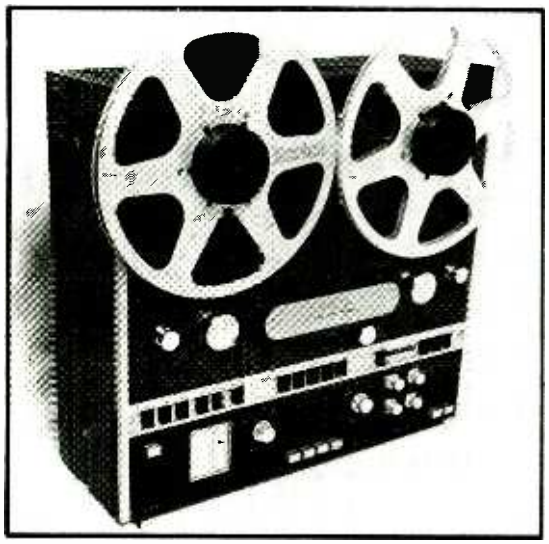

A700

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Sound on stage~engineer's control

Terry Nelson

The second part of this article deals with the engineer's role in achieving a good live sound. And it appears that even the problems and pitfalls are not yet well-defined. So the answers?

CONTINUING our discussion on pa it may be an idea to quickly run through the two principal types of installation: namely, sound reinforcement and the sound system.

Sound reinforcement

As the name implies, this type of setup is used to enhance (or reinforce) existing conditions and may be considered in many cases as a blend between acoustic and electric instruments or sound sources. Obvious applications are theatres and small venues where the main amplification needs are microphones for vocals or speech, playback of prerecorded effects tapes and so on. In the case of a group having amplified instruments, reinforcement can be used to enhance solos or balance out instruments that may be weak in comparison to the others; examples being organ Leslies, percussion and acoustic instruments. Used with discretion, reinforcement is capable of very useful results, often better than those sometimes obtained by 'bunging everything through the pa and hoping for the best!'

Sound system

This is the principal means of amplification of a group, orchestra or whatever. It is aimed at large venues, open-air concerts, stadiums, etc, and often resembles the setups discussed in the first part of this article published in last month's issue.

We may now start discussing the requirements and utilisation of a sound system. Obviously, the first requirement is to amplify the artists for their own benefit and the audience's. And it is here that the decision can be taken as to whether a complete pa is necessary, or if reinforcement would be the better solution. Having taken the decision that a complete sound system is required, we need to accept the fact that from this moment the pa forms the other half of the musical entity—it is as important to the instruments as, say, the soundboard is to a piano, or the bell to a trumpet. 'You don't say!', I can hear. But I wonder how many of us really realise the implications of this most important consideration. Before following the well-trodden and familiar paths to amplification a clear and definite appraisal of the requirements is essential. These can be summarised under four main headings:

1. What are the musical and artistic objectives?
2. What sort of venue is envisaged?
3. What resultant sound is required?
4. How much *control* is desired by the musicians over the resultant sound?

It will be immediately evident that what is right for group A will almost certainly not be what is wanted for group B; whereas for group C it will be an amalgam of the requirements for A and B! From this situation we can extract two main courses of action (which in practice may also be a mixture of the two!):

a) A sound system where the ultimate control is in the hands of the engineer. Here the main mixer will be situated at a good vantage point in the audience area. The engineer will be able to hear what the public wants to hear (in theory, anyway) and can balance and tailor the sound to suit. As for the musicians themselves, they are left with the task of just making music and do not need to bother about technicalities.

However . . . the engineer *must* have a thorough knowledge of the programme material and all special effects required: for example, prerecorded tapes, electronic effects, etc. It is also essential that the engineer has a good experience of concert technique. The stage is not a studio and fast reactions to tricky situations are a must. It is not possible to do another take! Evidently, this is not to imply that studio engineers cannot be pa engineers, but rather to point out that only having studio experience is not enough.

b) A sound system where the main control is in the hands of the musicians. Here the musicians can balance and control the sound according to the 'feel' of the music, and not be at the mercy of an engineer who may be unfamiliar with the music or the musician's ideas and who, when in doubt, turns it all up or down as the case may be. Already hearing the rumbles of critical muttering upon this course of action, I would hasten to point out that the idea is not to do engineers out of a job! Obviously for any system they are indispensable: the setting up and design of a sound system requires

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knowledge and experience, plus a willingness to reconcile artistic aims with what may at first appear technical impossibilities.

Criteria for a system

Starting with the first proposition, namely that of engineer control, speaker towers on either side of the stage will be the most likely situation. Most desks have stereo capability and if the decision is taken to use the pa in stereo, it follows that good separation is a must if we are to have an image that means anything. It is also here that the problems start and standard studio practice falls down—isolation booths are just not practicable!

Take the microphones first. The great majority are floor-mounted with no shock isolation. This means pickup from the vibrations coming up the stand, so an initial remedy is to get those microphones 'off the stand' with good isolation mounts—either the ring or web variety. As the drummer is the man liable to need the most microphones, we can start our tour of the sound stage with him.

Most drummers like to be in the centre of the action with the bass player's equipment in close earshot. Which means really close miking—that overhead pair may be great for the guitar and bass but it doesn't add much for the drums. The microphones themselves will need to handle high spls—up to 130 dB—without folding up, and still sound good during the quiet passages. Plus being unidirectional. Physical robustness is also a must. On-stage mics get dropped, thrown, walked on and all types of abuse, so delicate condensers are definitely out! Good 'workhorse' microphones for stage use are units such as the Electro-Voice *RE20* and *RE15*—the *DO54* omni is also excellent for bass drums if you can place it well inside—or Shure *SM58* and *SM57*. The question of which microphone is an important one, and it is well worth the time and trouble to select and try out various models for the different jobs in hand; you might even try reading the manufacturer's specification to give yourself a start.

Now that we have our drum kit miked up, a phasing check is a good idea. Nothing is worse for drums than sloppy mic techniques giving rise to phase interference and other evils. As with all things, it may take a little longer at first but the payoff in sound will be well worth the investment. With a large kit this will mean a lot of microphones so, if the economics permit, a submixer may be a good idea. It will also mean less 'clutter' on the main desk plus subgroup volume control.

Moving on to the instrument amplifiers we very often arrive at a conflict of interests. A lot of rock musicians like to play loud (*too* loud some will say) and don't feel happy if they haven't got two Marshall stacks behind them. This is where a bit of common sense is needed. Nothing appeared more ridiculous to me than the sight last year of one microphone stuck in front of one speaker of Ted Nugent's multiple amp/speaker array. By way of interest, Ted uses four 'beefed up' Fender *Twin 100*s with EV speakers plus four extension cabinets: two 4 x 12 and two 2 x 15, all EV. That, ladies and gentlemen, is loud! It is also what is known as a big sound and one mic stuck in front of a stack like that will just not convey the same impression. Even at large venues, amplification of this kind will be loud enough on its own. And if not reinforce it when (and *only* when) needed through the pa. This is also a prime case for directs, but with the signal taken from the amp's speaker outputs. This way *all* the characteristics of the amplifier are retained and transmitted to the console—with no separation problems!

Mixing all the instrument amplifiers in this way can make no small contribution towards cleaning up the overall sound through the system, leaving the engineer with a lot less open microphones to worry about during silent passages etc, as well as solving phasing problems. The di boxes themselves are often cheaper than the mics. I have used a Courage box for about four years that only cost $30 and works a treat. It is easily tucked away behind the cabinets (no more stands to knock over!) meaning fewer cables to trail across the stage. However, a musician may want his amp miked up . . . and no discussion. Well, chum, in that case why not think about a smaller amplifier? If your bag is overload characteristics etc, an amp like the Mesa Boogie is the one for you, or any medium amp using master volume controls in the circuitry. All nice and loud where you are, but not enough to worry the other musicians or tickle the fancies too much of all those microphones nearby.

Bass guitar amplification has always been a bit of a problem. Apart from custom-built jobs, it is only recently that there has been

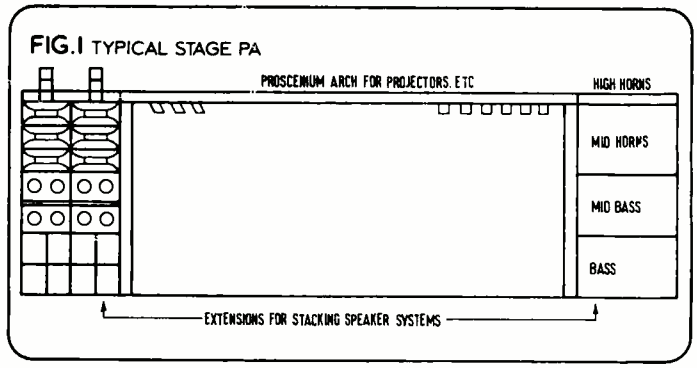

FIG.1 TYPICAL STAGE PA

what I would call serious commercial equipment being built. Acoustic were perhaps one of the first to give the lead. Many bass amps use folded-horn cabinets, though a well designed reflex is still a very good proposition. We have also used a Vitavox *Bitone Major* cabinet as part of a bass system with outstanding results. (The player in question used two Electro-Voice *Eliminator* bins, *Bitone* cabinet with EV *FR150* re-entrant horn crossing over at 1100 Hz. This gave a tight, punchy full-range sound, with lots of 'guts' in the bass end without being soggy.) As with guitar, the use of direct boxes will give a far more positive result as far as mixing is concerned, keeping the sound tight and more pronounced.

The keyboardist has risen from being a pianist trying vainly to make himself heard, to the multikeyboard performer of today. As such he/she needs special attention. I feel the best approach is to feed all of the keyboards into an onstage submixer, enabling the artist to balance his instruments himself as required. For the money-conscious, people such as Acoustic and Peavey have brought out keyboard mixers or control centres designed specially for the job. Synthesists might also want to check out the new Moog *SynAmp* which features a whole host of goodies. It is most important that a keyboard mixer be designed and capable for the job—tarted-up mic mixers are just not on. The mixer should then feed the main consoles and the performer's own monitor system, which should be power amplifiers and speaker system capable of correctly reproducing the instruments. *Minimoogs* through guitar amplifiers can sound rather strange.

Even with modern phasers, flangers, etc, most organists feel that their Hammond without its Leslies is like fish without chips. And accepting this we have a problem on our hands. Miking up a Leslie to make it sound right is no mean feat. One solution is to put the cabinet(s) in at least a fairly soundproof room offstage with a *good* omnidirectional microphone and feed it through the pa and monitor; the sound is much more life-like than with top and bottom mics. The organist, however, says: 'No go. I like to see the rotors turning', or 'I want it onstage'. As with many things in life, this is a case of making a compromise—here we are back to the top and bottom mics again. Still, now armed with shock mounts and cardioid mics, place them at the back of the cabinet (the side facing backstage—he wants to see the horns, remember?) and try angling them so that the sound passes *across* and not into the microphone. (Where there is a high risk of spurious pickup it is probably better to 'stick 'em inside'.) In this way we can often reduce the characteristic swishing of the rotors; a little bit of experimentation can work wonders. This is especially exaggerated at chorale speed into a deep slow tremulant and any attempt to smooth it out is well worth it. Also, *please* take care when balancing the two microphones: it is all too easy for the treble horn to cover the bass, especially when the organ is in ensemble with other instruments. In passing it may be mentioned that, where possible, a mixture of onstage and offstage Leslies can also give pleasing effects. In this way a simulation of several organ chests is possible—try a ddl on the offstage cabinet.

The remaining microphones will be for acoustic instrument and vocal use. Stifling the cries of 'Oh no, not *more* on mic technique!', I will content myself with a few observations. (You ought to know your mics anyway.) As we noted earlier, use the right mics for the job and even take time out to correct bad technique on the part of the musicians. For instance, tell the trumpeter politely but firmly to play a bit off-axis and not ram the mic inside the bell—explaining

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the problems to the musicians will nearly always help things along and make for better sound. A 'them and us' attitude does nobody any good. Where possible, Barcus-Berrys or FRAPs are best for acoustic guitar in order to get a good clean sound at a high level. The same goes for piano, though you could also try the Countryman or Helpinstill pickups. Each one has its merits and vices so once again, try . . . I have already mentioned that the microphone needs to be robust, and for vocal use this really *is* a must. (Ever seen Roger Daltrey?) One of the strongest mics ever made must be the Electro-Voice *RE15*; you could play baseball with it and sing during the runs. Both EV and Shure make units specially designed for stage work, from both the performance and strength angle, and at reasonable prices. The Shure *545* and *SM58* are very popular and for those on a budget, check out the EV *671* model or *DS35*.

Enough has been written on the subject of mixing consoles that it would be superfluous to spend much time on it here. It is worth noting one or two points, however. Make sure the desk will do all you want it to, both now and in the fairly near future—or at least has provision for expansion in accordance with ideas. A concert engineer has enough on his hands without griping about the desk. I like a switchable pfl with meter on all of the inputs and groups. Then if the overload led has collapsed (or there isn't one) you can find out where that distortion is coming from, either when setting up or during performance. This facility obviously has a host of other uses that most engineers will recognise. Rather than make up a specification for a desk we will refer to features as they arise during this article. I could mention, however, that the desk be completely 'roadie proof'—yes, they do get dropped down flights of stairs or off the truck, and when the show is in five hours time you don't want to have to service your console.

Possibly the biggest source of problems of most pa setups is the speaker installation. In spite of all that has been written or said we still see untidy piles of bass and mid bins, radial horns side by side etc, etc (**fig. 4**). The components sit horizontally on top of one another (**fig. 2**) with the sound winging its way straight to the back of the hall. And coming straight back again! We should all know that the best way to arrange our tower is to build up and not out (**fig. 3 and 5**). In this way the bass bins form a nice *solid* airtight wall, effectively extending down the bass response, which is especially useful for outdoor use. (Manufacturers please note: no protruding handles please.) These are followed by the mid bins, if any, then the radial horns and tweeters; all with the drivers nicely in line. Where high stacking is not always possible, one solution is shown in **fig. 5**. Here, for example, 60° radial horns are stacked vertically and side by side but angled so that interference is kept at a minimum. Once again a little thought can save an awful lot of hassle. Manufacturers' specification are there for a purpose so why not read them and work out your system on paper before humping. In **fig. 3a** you may also notice that the horns are angled down to give selective coverage and make use of all that absorbent material present to kill those first reflections—in most cases the audience! **Fig. 3b** shows a variation on **3a** where the stacks are divided in half, one section sat on the stage and the second suspended quite high up. This can be quite effective in arena-shaped halls (Yes used pretty much this setup for the Hallendstadion at Zurich) where the stage equipment effectively covers the central area, while the suspended array caters for the tiered seats. But it's all very well talking about high towers—how do you get it up there? For the T Nelson non-patent-applied-for solution see **fig. 1**. Having noticed a trend for touring groups to carry around their own proscenium arch for lighting and stage props, it seems to me that an extension on either side capable of handling pulleys and hoists should present no real problem. Access ladders can be built into the main vertical pillars.

At this point it may be a good idea to consider the question of stereo or mono. If a stereo effect is required, and we have been able to arrive at a good separation, why not? I have found that in general many sound engineers prefer to work in mono, leaving stereo capability for special effects and drums. Another point to consider is that in large auditoriums, people to the extreme left hear only the left stacks and vice versa. (And they have all paid for their tickets.) Angling and high stacking will compensate to a certain extent, but in the end the decision is best left to the engineer at each venue. **38** ▶

FIG. 2 'SLAPBACK ECHO' FROM LOW SPEAKER STACKING

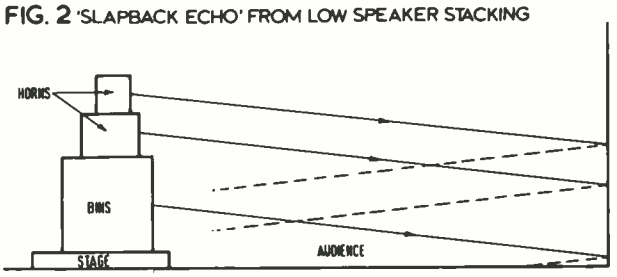


FIG. 3 HIGH STACKING AND ANGLING (AUDIENCE PROVIDES ABSORPTION)

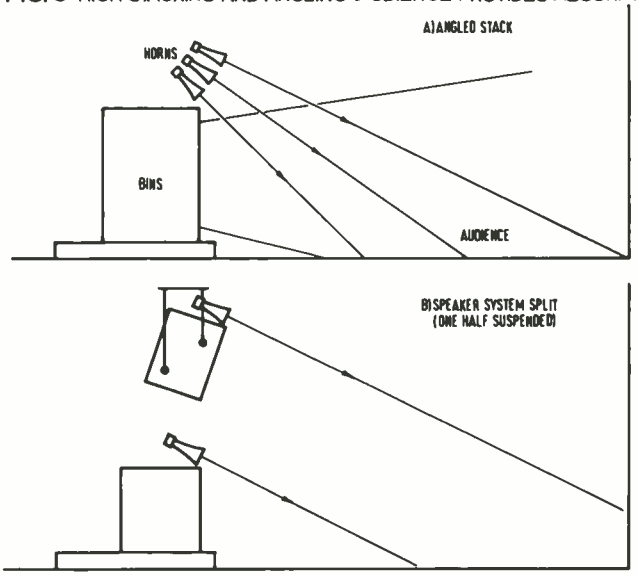


FIG. 4 STACKING SPEAKERS

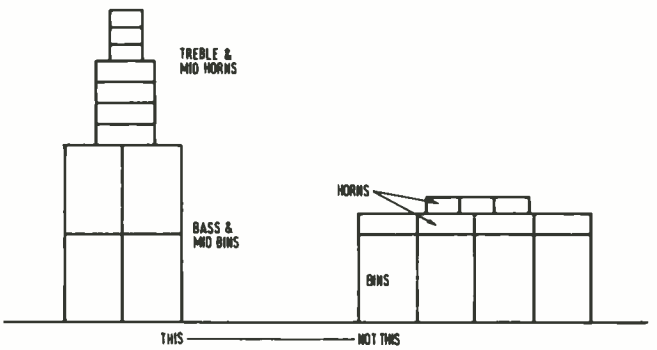
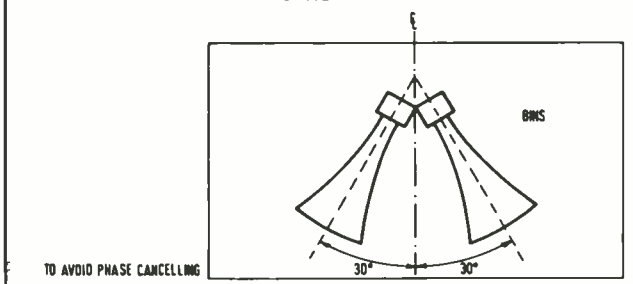


FIG. 5 STACKING RADIAL HORNS



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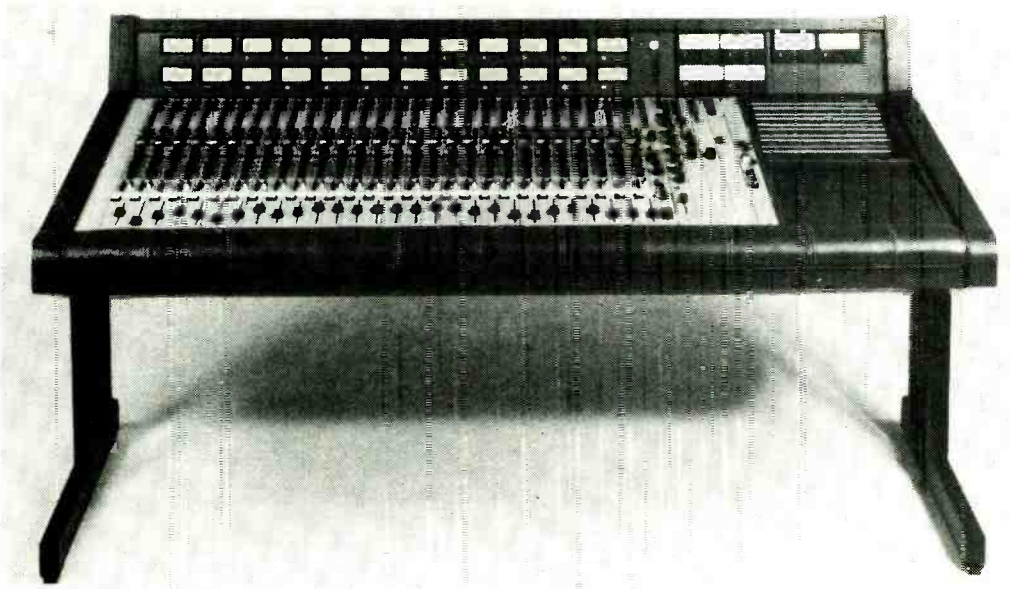

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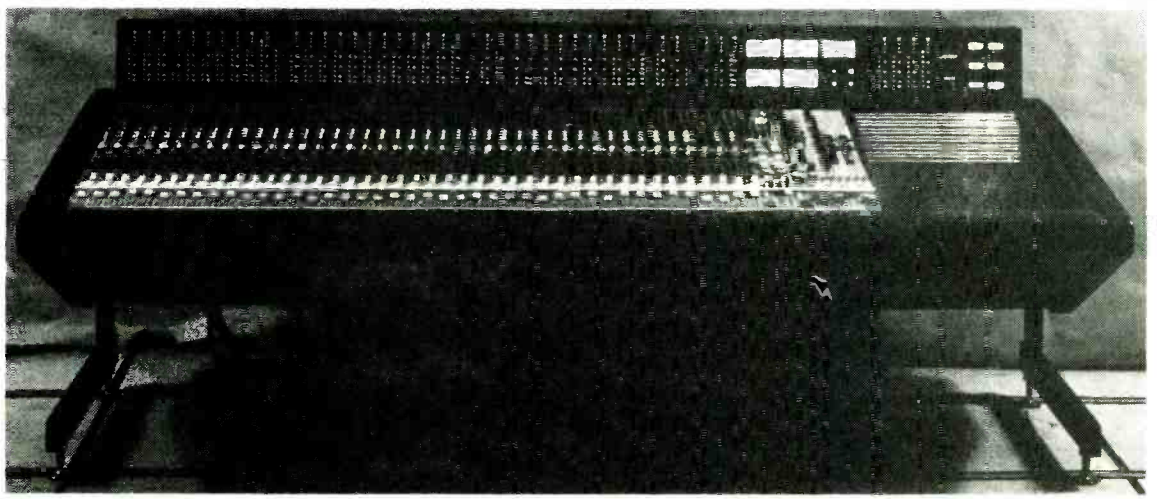

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SOUND ON STAGE—ENGINEER'S CONTROL

(In other words, when doing your sound check, have a toddle around the hall in order to hear what the punters are going to hear.) Before going on, I would just say a word on active crossovers. No one needs to extol the virtues of bi or tri or even quad-amping: we all know the tremendous difference it makes and why. However, make sure the crossover does the job with the *minimum* of phase shift—no point in correctly setting up your speakers if the crossover is going to louse it up!

Another general rule seems to be that, mono or stereo, all the signals go through all of the speaker system together, as if it were some giant hi-fi. This is fine if you are listening to a record, but a concert is a *live* performance. To digress for a moment, when listening to an orchestra or group without a pa you can hear each instrument separately and distinctly plus spatial placement. Buzz it through the pa and what happens? intermodulation distortion, phasing problems; you name it, you got it. Obviously the first thing to do is place your mics properly, check for phasing etc. Fine. Having done all that why not emphasise your good work by splitting the stacks. With at least four output groups on the desk you can route the vocals through 1 and 2 and each half of each stack, and the instruments through 3 and 4 and the remaining stacks. Yes, you've got it—separate amplifier systems for vocals and instruments. And did you notice the improved clarity and depth plus apparent increase in volume? Of course, you could go even further and separate the keyboards from the guitars and so on. Now we're getting towards that 'live' sound that I was hinting at: clean, defined, separated etc. By the way, this is not just daydreaming. I've tried it and does it work! With today's 8 and 16+ output consoles this kind of installation presents no real problem—costs you a bit in active crossovers, perhaps—and the potential is enormous. The moment the main stacks are separated down to sub-systems, each handling an individual instrument(s)—vocals, guitar, keyboards, brass etc—'live' sound really starts becoming a reality. Don't worry about losing power—three instruments each through a good 100W amplifier will sound a lot louder and bigger than all three through one 300W unit. If by now you've got a nagging feeling that somehow all this seems familiar, but you just can't quite put your finger on it, may I suggest the pipe organ? In many ways I feel the analogy between a sound system and pipe organ is quite interesting; we have the manuals (musicians), stops (mixer), and pipe chests (speaker banks for each voice or instrument). And we all know the thrilling sound of a large organ with all the stops out—not forgetting its *dynamic range*. There is also another factor to consider—organs are designed to perform well in large environments, exactly the same criteria for our sound system.

Monitor systems

One of the prerequisite conditions for a good performance is that the musicians must be able to hear exactly what is going on within the group. Most of us will support a fairly poor sound if the band is really cooking, but be let down by a poor performance, even if the sound is excellent. As has been already stated in previous articles in STUDIO SOUND, the idea is to put foldback where and when it is wanted. Where a monitor mixer is available, this means as many outputs as there are musicians. Or groups of musicians such as three brass or vocal groups. Although individual mixes are possible, nearly everyone has different ideas as to what makes a good monitor mix. The stage acoustics should be analysed for feedback-prone peaks and the system equalised—as should, ideally, keyboard monitor systems and even the other instruments. This can be done either by graphics or notch filters, depending upon the economics. The speakers themselves should be designed for the job, being not too large and with a tailored response for the bass and treble end. Too much bass just muddies everything and there's nothing worse than screeching high trebles.

There is a good case here for amp/speaker combination cabinets, complete with tone and volume controls. In the heat of the action it is useful to be able to tweak the volume up or down oneself, rather than have to catch the monitor engineer's attention. (I use a Quad *303J* with an EVM bass unit and *8HD/1829* horn/driver in my own cabinet with very good results. I would suggest, however, that when using mid-range horns for monitor systems to crossover between 1100 and 1500 Hz in order to reduce the 'honk' of being near the horn; an attenuator is also useful.) Where possible the cabinets should be placed in the nulls of the microphones to minimise pickup. One way to 'free up' the monitor signals, and one favoured by musicians, is for the instrument amplifiers to have an extension cabinet on the other side of the stage. The advantage is that it can fit in with the general line of cabinets facing front (and not back as perhaps with a monitor) and contributes to the sound. I have often used my monitor in this way and find it more agreeable to play with the sound coming from behind rather than split front and back.

The monitor system is really one area where everyone should chip in with their ideas and problems. Time should be spent finding the best speaker placement points and balance. Where no monitor mixer is available, the main console should have at least four foldback sends per input; it is gratifying to see that large desks have up to eight auxiliaries. (Perhaps as a result of pa?) I have always thought console manufacturers to have been a bit tardy on this point of multiple foldbacks and am glad to see this being rectified.

The other form of monitoring is foldback for the groups. There are quite a few musicians who like to balance themselves by second nature and who like to hear what is going out from the auditorium speakers. Foldback from groups is the answer, though this does need some care. It is also a good idea to have talkback switchable to either each foldback or all together. This way general instructions can be given or individual 'get your fingers out!' Some new desks, including the Soundcraft *Series 1S*, feature interface with *ClearCom* or compatible intercom systems that are now widely used at concerts. This kind of facility is well worth having. On a final note, using stage backcloths of sound absorbent material (such as blankets) can work wonders for onstage reverberation.

Studio equipment for pa

The increasing use of studio equipment in sound systems means that we are virtually obliged to take a mobile studio around with us; a brief look at what this entails may be useful. Space and portability is an important consideration and equipment of the *Scamp* or Allison variety comes in very handy. A good roadie-proof rack is the order of the day, complete with patchbay. Compressor-limiters are finding an increasing use for vocal work. The problem of noise from open mics or hiss and hum from amplifiers via directs can be attacked with dynamic noise filters; drums, especially, can benefit from this form of treatment. Digital delay is useful, either for studio effects such as flanging or adt, or compensating for time delays where speakers are placed in the hall away from the stage area. Phasers, Flangers and other forms of time delay equipment all have their place for special effects, as do equalisers for signals needing special processing.

Hall equalisation is accomplished by ⅓-octave analysers (real time is best) and graphics. It may also be noted for large halls and venue it is better to give a house curve with a 3 dB per octave rolloff (reverberant field equalisation) above 1 kHz—a flat response will nearly always be far too bright. This done, another pair of test equipment—your ears—can be used for the final adjustments. (Such as, perhaps, a little bit of presence for vocals and a bit of 10 kHz boost for the cymbals). If a lot of power amps are to be slaved together the final link in the chain will be the distribution amplifiers eliminating any loading effects.

It can be seen that the putting together of a sound system requires a lot of planning and hard work—and expense—but the results gained will be well worth it. Established groups promote record sales with good concerts, either to existing fans or to create new ones; new groups can certainly create a demand for records if their concert performances create a stir. Poor concerts do nobody any good, least of all the tour promoters and record companies. What of the future? The next likely step will be automation and for those with plenty of money the new Harrison *Auto-Set* system is worthy of interest. For complicated mix changes—or in a multigroup festival situation—this piece of equipment would be very useful to have.

I hope I have given you some food for thought in the interests of better sound and look forward to hearing the results! The third part of this article will deal with the second proposition for sound systems. It will look at the pa systems of some well-known groups and how they accord with their artistic objectives. ■

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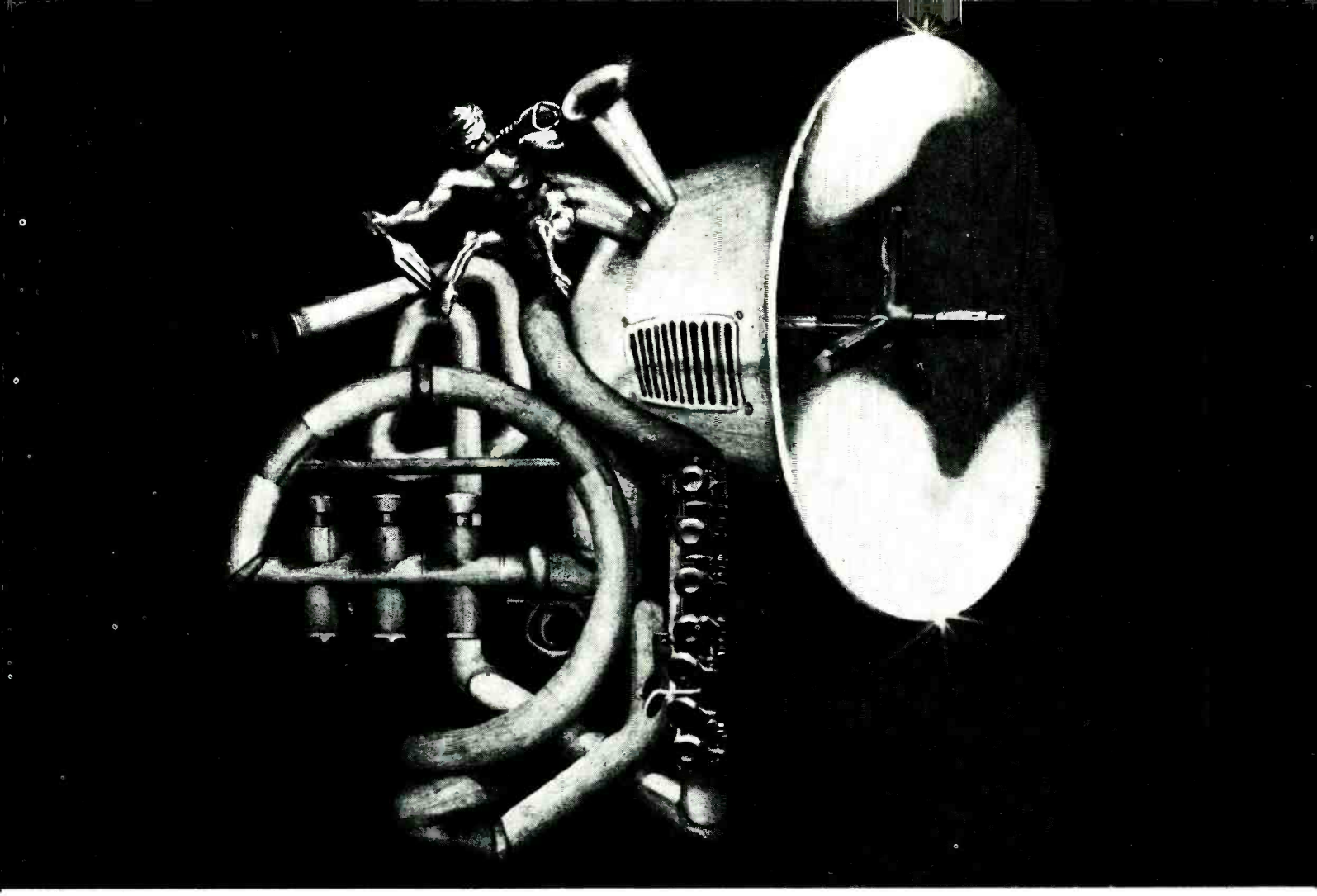

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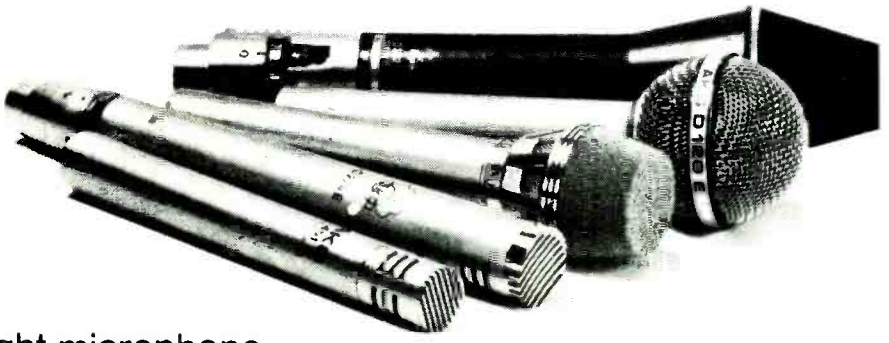

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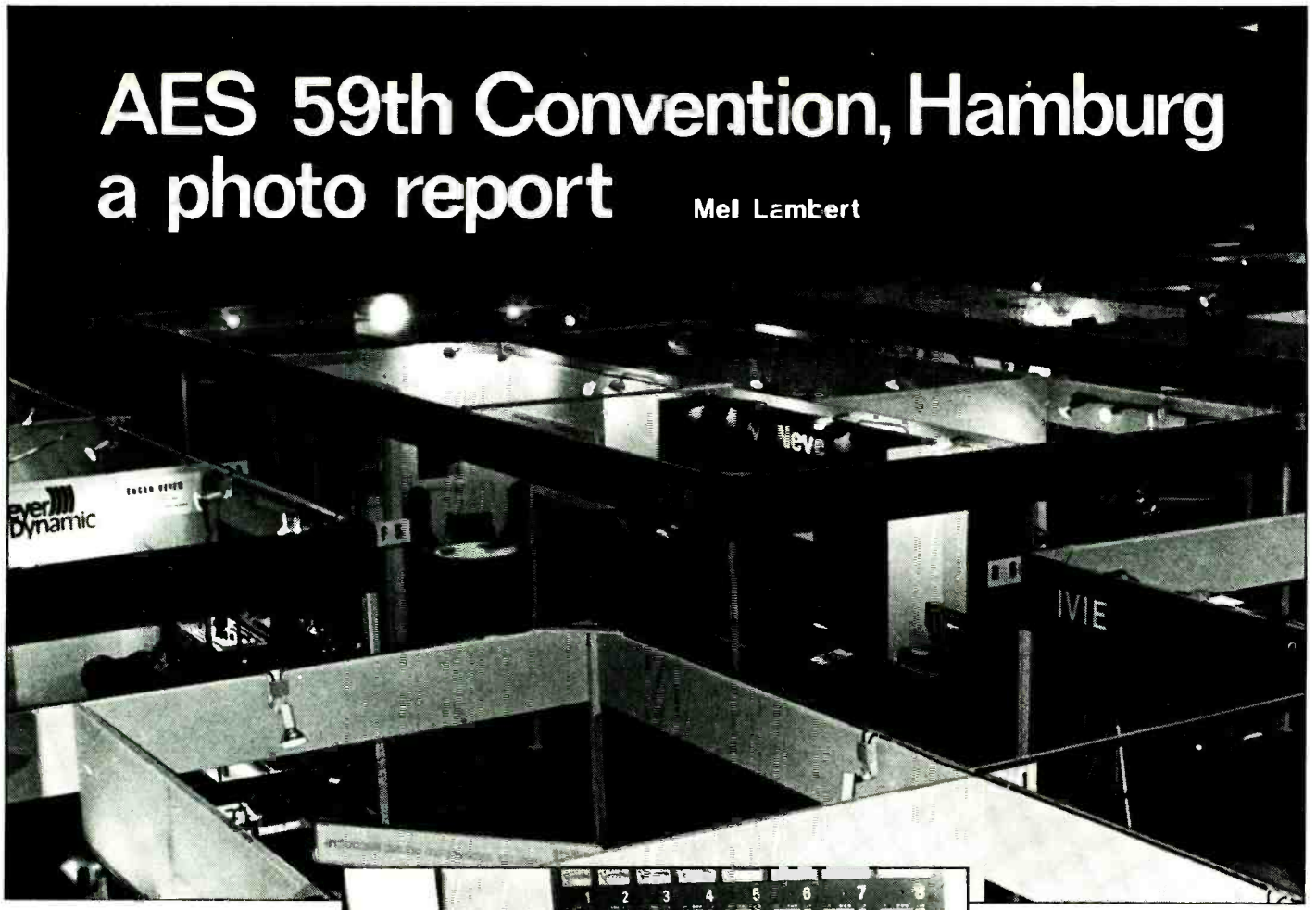
AES 59th Convention, Hamburg a photo report

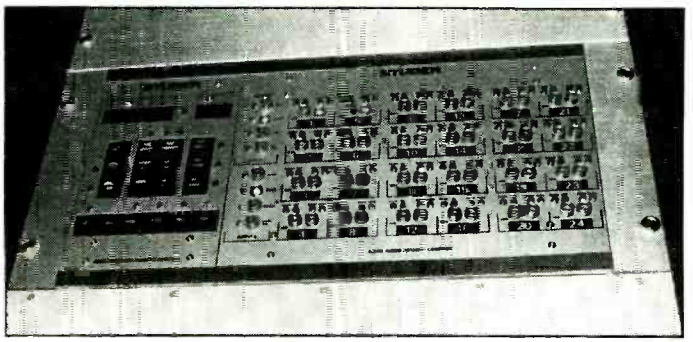
Mel Lambert



A warm round of applause please for the organisers of the 59th AES Convention, which was held from February 28 to March 3 at the Plaza Hotel, Hamburg. Both the exhibition and technical sessions ran as smooth as clockwork, and a liberal supply of a most excellent German beer was on hand at all times. What more could you ask?

Without a doubt the star of the exhibition was the new Studer *A800* multitrack, which features microprocessor control of the transport functions and can handle 360 mm reels. Speed of operation is quite staggering; the machine will cycle from fast wind to play in well under a second, without passing through stop. (The transport monitors the tape's speed as it slows down and selects play at the appropriate point.)

An improved replay signal-to-noise ratio is claimed, mainly because the pre-amplifiers are now located under the headblock. The time needed for routine machine line-up and re-adjustment following a change of tape has been reduced by incorporating a master bias control for each speed, which adjusts all the tracks at the same time.



Individual remote control is provided for the deck and audio electronics. The two outputs per track can be switched for all tracks simultaneously between input/sync/repro /individual control on output 1, and input/repro/sync/line out on output 2. A master safe/ready switch controls all tracks (presently only 16 or 24 on 50.4 mm tape).

The remote control unit (bottom picture) duplicates the master switching between outputs 1 and 2, and controls the mode of individual tracks. Because of the *A800's* microprocessor control, it can be readily interfaced with the *TLS 2000* tape synchronisation system. An autolocator is a standard feature, combined with a 66-150% varispeed.

However, you won't be able to buy one until early next year. Price? Nothing has been finalised yet, but we hear that it should be round about £30k for a 24-track version.

But the Studer *A*800 wasn't the only interesting exhibit to be seen at Hamburg. The next four pages are devoted to a double-page spread of some nice-looking mixers, followed by a two-page 'pot pourri' of odds and ends that attracted our attention.

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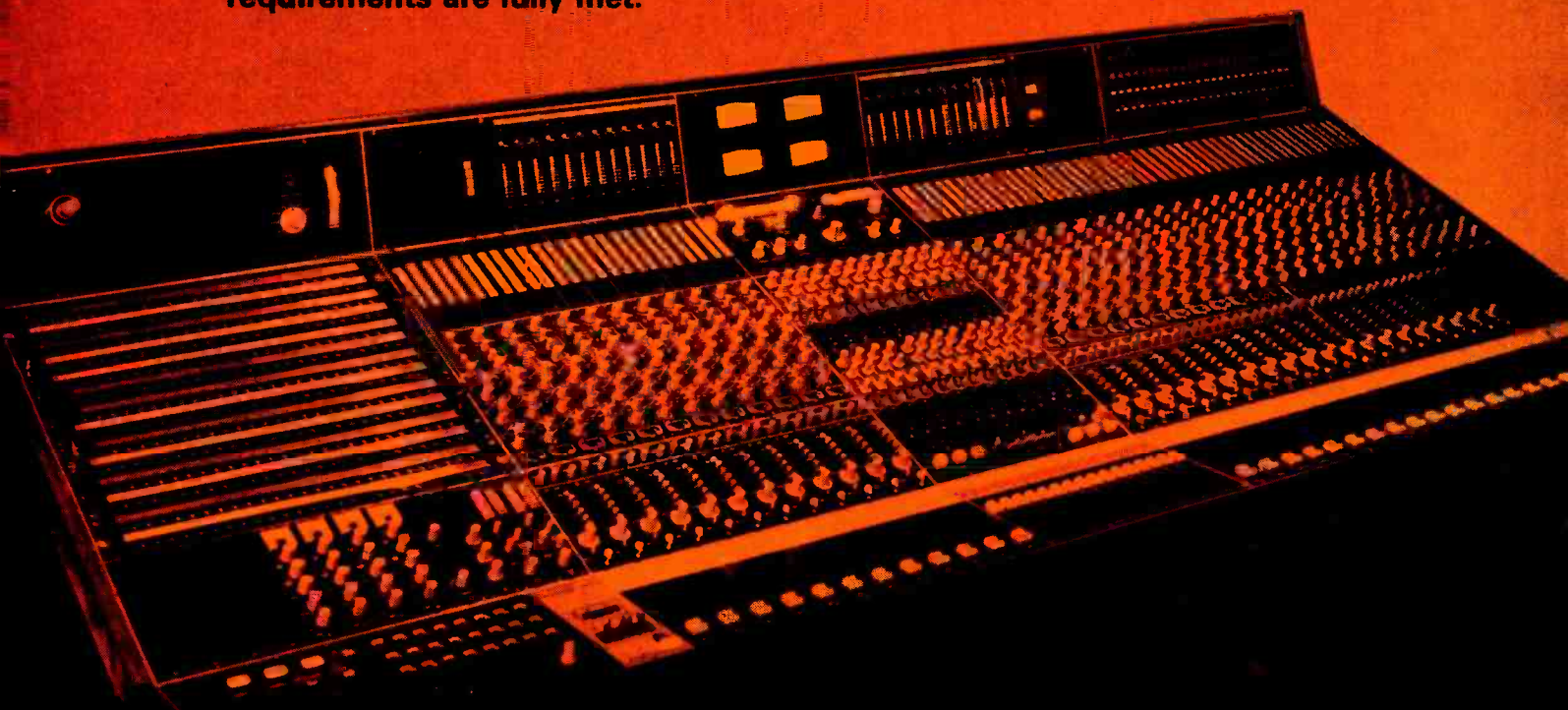
Broadcasting Helios

Télémetropole (known generally as Channel 10) is the largest French-language commercial broadcasting company in Canada. In common with Mainos TV, Finland, and Capital Radio, London, they have recently opened a studio for multitrack music recording and mixing, and for re-mixing of audio tracks for 'sweetening' of video tape sound. Each station operates a Helios console, custom built to it's own technical/ergonomic requirements.

A new Helios console is the outcome of an in-depth study of each client's requirements. The latest and best circuit designs and advanced production engineering methods are employed, to achieve the most cost-effective solution to the operational requirements. Only Helios specialise in custom building - only through the Helios approach can you be sure that all your requirements are fully met.



The Télémetropole console is shown in the background of this advertisment and has 32 input channels each with parametric equalisers, 16 output groups, 24 track monitoring, and many other features including a Helios-built noise reduction interlace. For further details of this desk or any other information, please write or telephone to any of the addresses below detailing your requirements.

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AES Report

1. *A Midas 24-input console with six sub-group outputs and monitor channels. Direct outputs are provided on each channel for multitrack recording. Routing is by means of two thumbwheel switches in conjunction with a pan control. This particular desk is destined for a customer in Spain.*

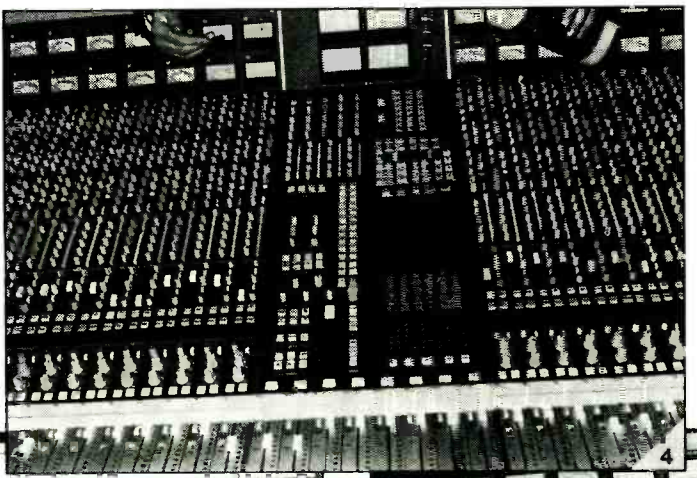
2. *Neve brought along a custom-built 40-input/quad-output disc-cutting console ordered for the new CBS-Sony recording complex in Tokyo. The desk is equipped with* Necam *automated mixdown. Inputs can be switched between mic and line level for direct-to-disc or multitrack-to-disc mixdown. The total value of the CBS-Sony deal, which also includes two consoles without* Necam, *is worth a reported £250k.*

3. *The Schlumberger* PMA124 *microprocessor - based 'premixer' can memorise up to 15 sets of routing and level information for 12 input and four output channels. Discrete changes between one particular mix and another are available at the touch of a key. Sequences can be set up and then recorded on cassettes for use at a later date. The crt facilitates visual checking of the memorised data.*

4. *Surprise of the show, console-wise, was this new computer-assisted desk from Solid State Logic. Two floppy disc stores handle the fader automation. The desk on show, which is destined for Country Lane Studios, Munich, featured 32 'ordinary' vcas, eight subgrouping vcas and a master control. The desk is also equipped with a central crt that displays track details (title, duration etc) as well as labelling take numbers on the multitrack tape.*

5. *Allen and Heath were exhibiting for the first time in Europe the new* Syncon *'synergetic' console. The model on show was of a 24/24/24 configuration with quad mixdown, and is destined for Decibel Studios, London. Free-subgrouping in the record and mixdown modes, without upsetting normal channel operation, is a feature of the* Syncon's *routing system.*

6. *MCI were demonstrating a* JH-400 Series *console fitted with the JH-50 automation package. Mixdown data from the vca channel faders is recorded on two tracks of a multitrack tape (one mix per*



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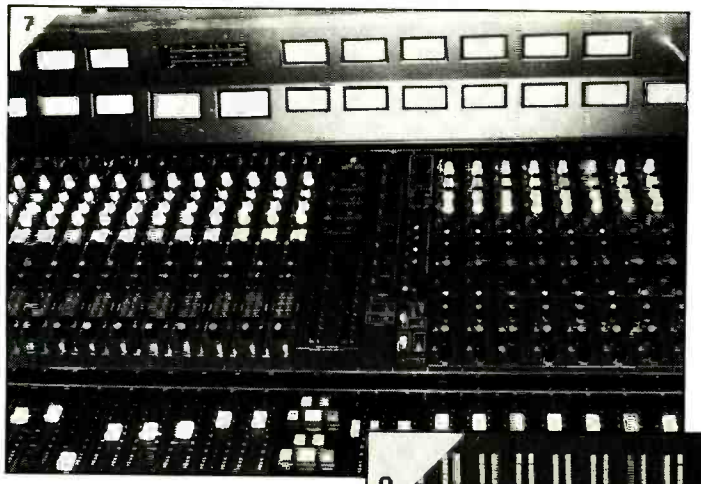
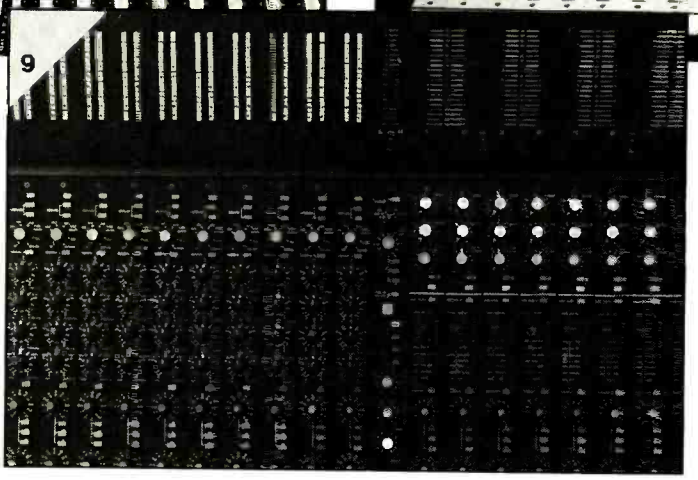


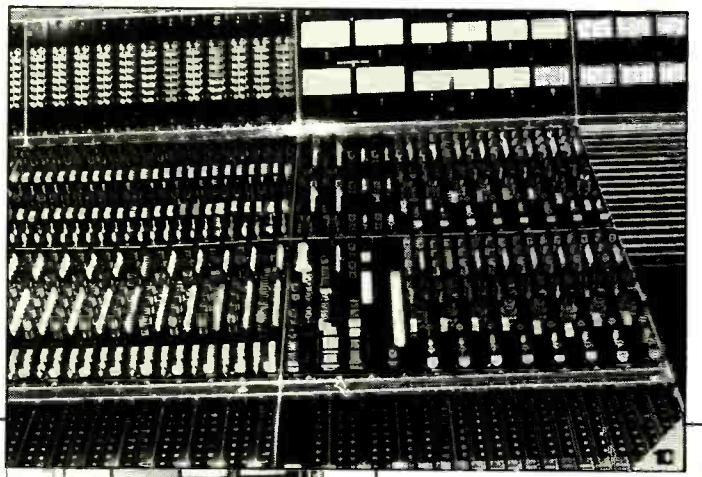


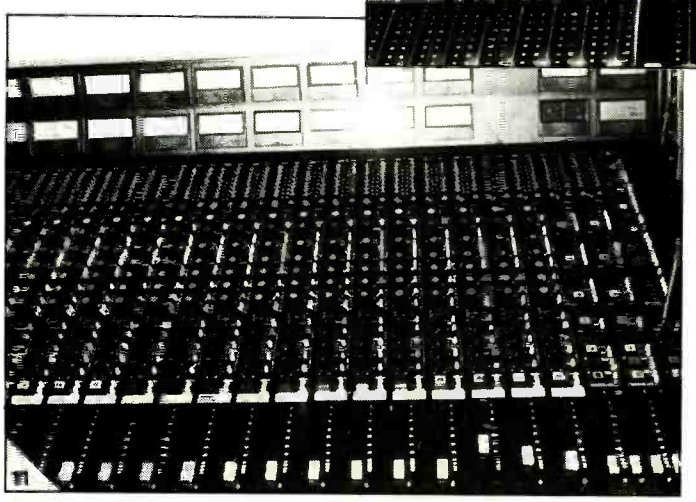
track). If you need to record more mixes, the company suggests that the multitrack be linked via the JH-45 synchroniser to one of the new JH-110A-8 eight-track machines. That way you can record seven more mix attempts (you need one track for the SMPTE code) and also have a spare 8-track on hand for other odd jobs

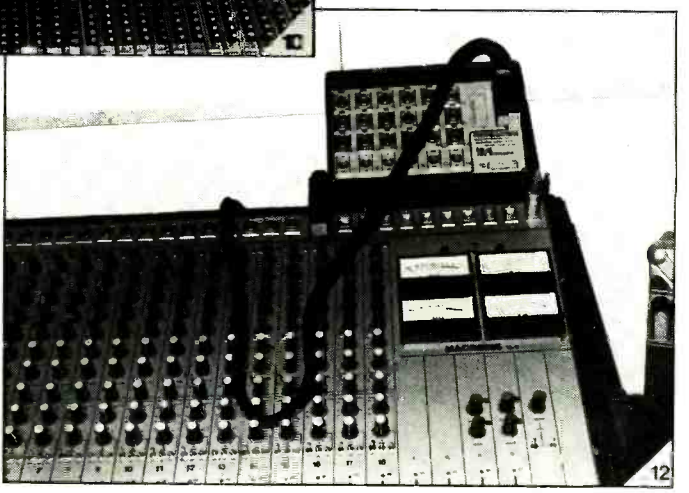
7. The Series III desk on the Raindirk stand featured 26 input channels with direct out on each, eight mix-down outputs and 24-track monitoring. Six auxiliary busses and eight echo returns, each with equalisation, are also provided.

8. Helios were showing a broadcast console destined for Mainos TV in Finland. A free-grouping facility allows any or all of the 30 input channels to be put under the control of another channel designated as submaster. The submasters in turn can be re-grouped onto two main outputs.

9. Soundcraft were showing a 24-input/16-output Series Three modular console, which is available with a maximum configuration of 32/16 with 24-track interface. Special facilities include auto-solo on inputs, groups and auxiliary sends, and optional 20-segment led metering.







The company tells us it is currently selling 80-odd mixers a month, worth a total of about £100k.

10. Trident were showing an odd-sized 24-input / 16-output / 16-monitor version from the very attractive TSM Series. The largest configuration available is 40/24/32. Half-width group output faders and tandem-banked monitor modules keep the overall size to 'reasonable' proportions.

11. Amek brought along a 28-input / 16-output / 28-monitor version of their M2000 Series. Four stereo subgroups are provided for routing during mixdown. We hear that the first of the new M3000 Series consoles has been ordered by Amazon Studios, Liverpool.

12. Macinnes were showing their new 18/4 portable mixer and its associated stage box. The two are linked with a new multiway cable manufactured by Macinnes. Cables with up to 35 individually-screened pairs can be supplied. The glass-fibre case is laminated with balsa wood for added strength without excessive weight, and has reinforced corners. A rubber seal is fitted between the two halves of the case to keep out moisture.

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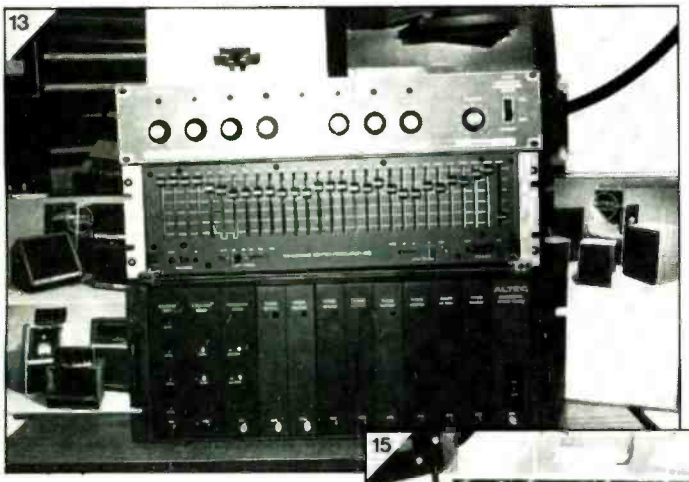


AES Report

13. *Among the products on the Altec stand, we came across the new 1650 ⅓-octave equaliser with variable-frequency high and lowpass filters. Also on show was a new modular 'incremental' power amplifier system. This contains up to eight 75W power amps that can be used independently, in a parallel or bridged mode, or in a combined parallel/bridged configuration.*

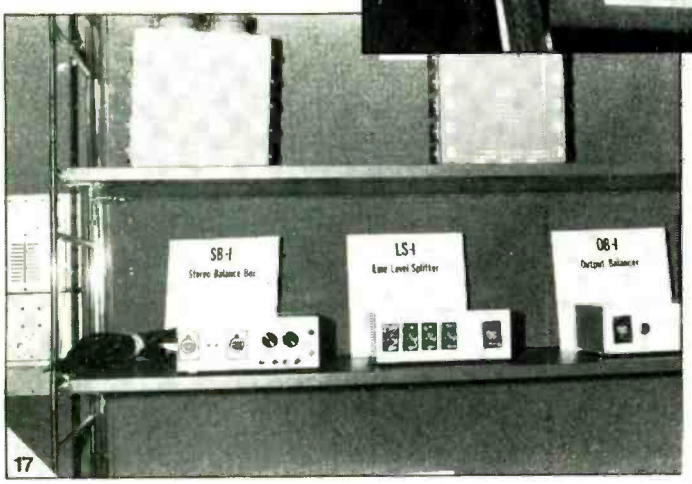
14. *The Teac* Tascam 90-16 *16-track, 25.4 mm tape machine features full logic interlock of transport controls plus motion sensing. The panel housing the output and function select buttons can be removed from the machine and mounted on a console. An optional dbx noise-reduction package within the cabinet automatically selects encode or decode according to track mode.*

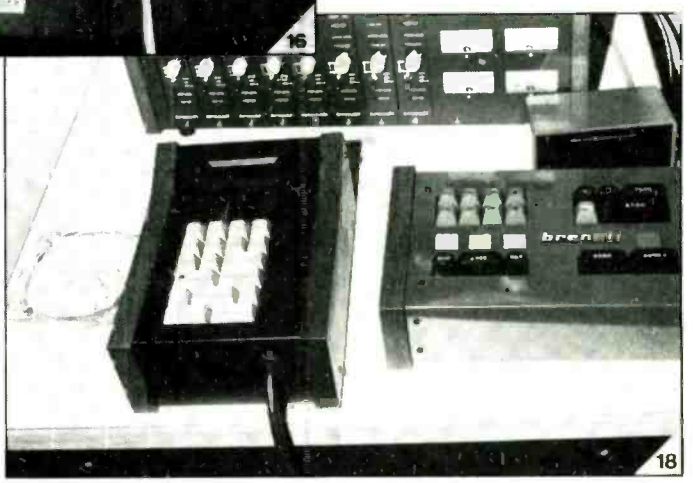
15. *Calrec had laid on a very interesting demonstration of the new* Soundfield *microphone. It consisted of a B-format recording of an acoustic guitar and vocalist. Visitors to the stand could adjust controls on the playback 'decoder' and tilt the angle between the (virtual) 'coincident-pair', change the characteristics of the microphone between omnidirectional, cardioid, hypercardioid and figure-of-eight and alter the stereo 'width' from mono through stereo to 'stereo-plus'. Other modules in the decoder, still under development, will allow the same degree of control on quadraphonic material.*

16. *A 'brace' of new* XT24 Inter-locators *on the Audio Kinetics' stand. The combined autolocator and remote control can be used with a 3M* M79, *Studer* A80 *or Ampex* MM-1200 *and 'learns' the behaviour of the transport over the whole tape—not just between two locations. Four memories are included, and the unit can be set to cycle once or recycle between these positions.*

17. *Sescom had a wide selection of its products on show, including the* SB-1 *stereo balance box, which contains two input transformers for balancing and impedance matching and two adjustable line amps with output transformers; the* LS-1 *line-level splitter box, which provides up to four balanced and isolated outputs from one unbalanced input; and the* OB-1 *stereo output balancer.*

18. *Brenell were showing the* Mini-8 *eight-track, 25.4 mm tape machine complete with the presently-available remote control unit*





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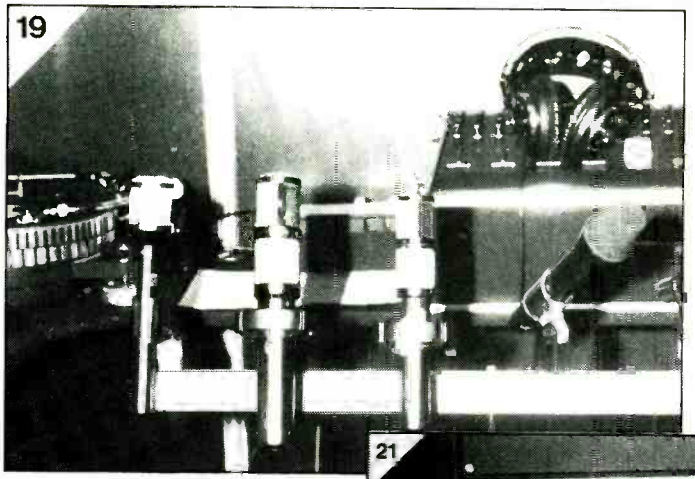
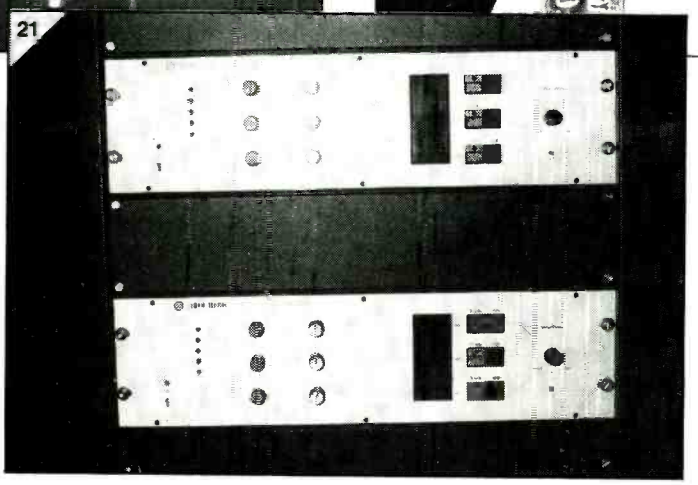




(left) and a prototype of an improved version (right).

19. *AKG were showing four new microphones. From left to right: the* CK4 *capsule from the* CMS *range with fixed figure-of-eight polar response; the coincidence-pair* C422, *a remote-controllable successor to the C24 in solid-state form and with led indication of phase angles; the* C34, *a smaller brother to the* C422 *and based on capsules from the* CMS *range; and the* D222, *a successor to the well-known* D202.

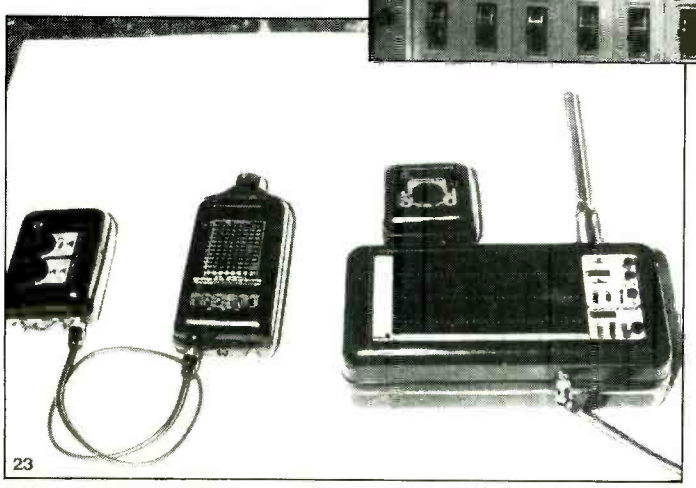
20. *The keyboard and display unit of the new Harrison* 864 Auto-Set, *on show for the first time in Europe. Two distinct modes of operation are featured: fader automation via, for example, an Allison programmer, offering four mixes/track onto the multitrack tape; and the recording onto a data cart of up to 630 preset static mixes. The position of as many as 63 faders can be memorised on each static mix.*

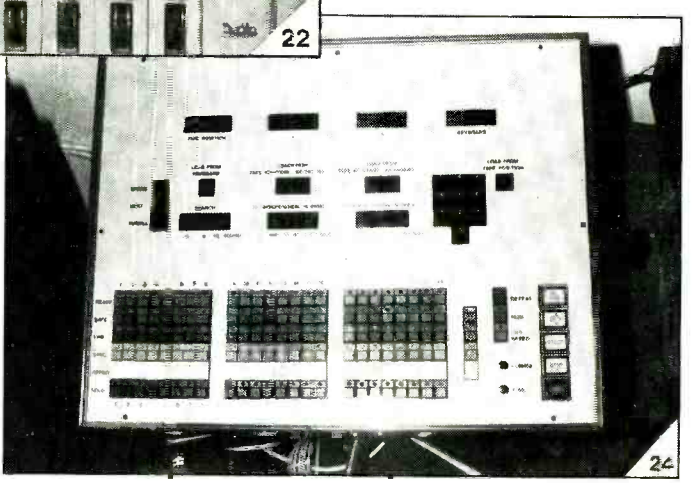
21. *Klark-Teknik were exhibiting not one but two of the new* DN70 *digital time processors. It incorporates three separate delay lines (the range of which can be individually adjusted between 0 and 633 ms) plus a mix and regeneration controls. Individual outputs of the delay lines are provided, plus a mixed output. A 50 kHz clocking speed is said to maintain frequency response up to 15 kHz.*

22. *Pride of place on the Audio Developments' stand was the new* Pro Graphic *programmable graphic equaliser. The unit will memorise 16 sets of equalisation comprising up to 14 dB cut and boost on 16 equally-spaced centres between 20 Hz and 20 kHz.*

23. *Ivie brought along their entire range of sound analysers. From left to right: the* IE-15A *distortion analyser accessory; the* IE-10A *octave band analyser and spl meter; and the* IE-30A ⅓*-octave or octave band analyser and spl meter. Above the* IE-30A *is the new* IE-20B *pink and white noise generator.*

24. *The optional, more comprehensive remote control for the Lyrec* TR532 *24-track tape machine. Each track has individual controls for ready, safe, line, sync, replay and solo. Sixteen memories are included, and the transport can be made to shuttle between combinations of a memory location, the present tape position, or the keyboard setting. Lyrec were also showing a prototype of a new tape synchronisation system for use with SMPTE or* Mag-Link *coding. The system will comprise two independent subsystems for coarse and fine control.* ■





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Dates of Exhibition. Wed. June 21st — 10.00 hours to 18.00 hrs
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1(–)*	LOVE YOU LIVE Rolling Stones – Rolling Stones	17(33)*	EVEN IN THE QUIETEST MOMENTS Supertramp – A & M	35(40)*	DERRINGER LIVE Rick Derringer – Blues[illegible]
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3(3)	LIVE Status Quo – Vertigo	18(37)*	BOSTON Boston – [illegible]		
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Doing it for effect...the noise-gate

Len Lewis

The modern day studio control room is likely to house any number of different pieces of auxiliary processing gear. Yet the noise-gate (or low level noise expander/gate—to give it its full name) is often sadly lacking in this, a field where it pre-dates just about all others. Although its uses are many, varied and quite unique the noise-gate is still frequently cast as poor relation to the latter day noise reduction systems which it fathered.

IN 1926 a Russian born singer Asa Yoelson (Al Jolson) appeared in a short talking picture entitled 'April Showers', followed in 1927 by 'The Jazz Singer', the first feature film with synchronised speech as well as music and sound effects. The picture revolutionised the motion picture industry and, lucky for us, signalled the end of the 'silent' era.

The arrival of optical film track, which made the new development possible, immediately stimulated interest in developing techniques for making the best use of the strictly limited dynamic range available. One of the first such techniques was—the noise-gate! Optical film recording techniques involved the transcription of varying impulses of sound waves into varying impulses of light, photographed on a film strip. After development the film, when passed between a light source and photoelectric cell in the projector, was transformed back into the 'original' sound. The snag in the system was that with no signal present clear film passed over the cell complete with dust, marks, scratches et al and gave rise to crackles and pops in silent passages. To counter this, early Thirties' recording cameras appeared on the scene with noise reducing shutters or 'gates' which mechanically closed over the light source or cell to give 'infinite' attenuation. The Noise-Gate was born and, together with compressors and limiters developed through thermionic valves to our current solid state devices.

Operation

The object of a noise-gate is to discriminate between and further separate wanted signal from noise. As such it belongs to the 'low level' family of processors since it operates *below* a certain threshold. Since gates at rest are in the attenuated position, the open (or attack) time of the gate is defined as the time it takes to allow the signal through at unity gain; the close (or release) time is defined as the time it takes the gate to fully attenuate. The ratio of input to output gain at which this is effected is illustrated in **fig. 1.** The gate (with say, a 1:20 ratio) will attenuate its full range for a very small change in input level at the threshold point, whereas the expander slope

FIG. 1 EXPANDER/GATE SLOPES

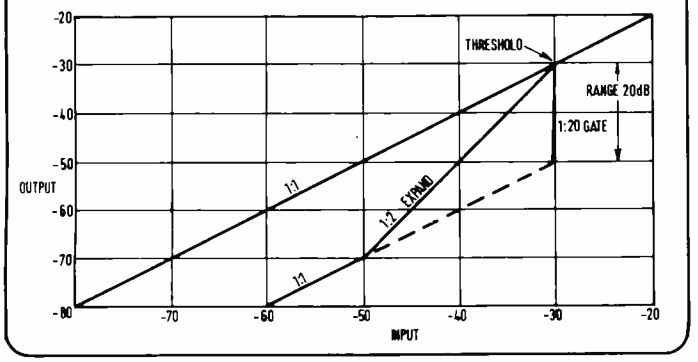
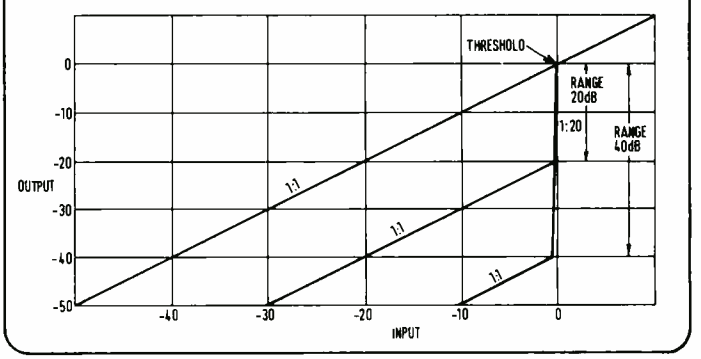


FIG. 2 GATE RANGE ADJUSTMENT



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needs a greater input change to effect a comparable amount of attenuation.

The most common use for both systems is that of eliminating unwanted noise during pauses in programme material and, used in this manner, the threshold will normally be set just under the wanted signal level. The expander's slope, being 'softer', is less critical to set up and easier to use provided the signal-to-noise ratio is reasonable in the first place.

If one is to avoid actually expanding some of the low level signal, the noise must lie well below the wanted signal (eg with a 1:2 slope, 10 dB in order to get greater than 10 dB improvement). If it is only 5 dB below, the expander can only improve it by a further 5 dB whereupon it is held open by the noise itself. In that case the threshold can be lifted so that part of the lower level signal is expanded, but there is the danger of modulation effects and 'hunting' unless slower release times are used. This does, of course, rather defeat the idea of getting rid of the noise fast before the ear can detect it, but has its uses where the noise is so poor that it actually merges with wanted signal. In such cases, as with older recordings, the attenuation range can be reduced to about 8 dB maximum (to avoid great noise contrasts) and with slower attack and release parameters the lower part of the signal can be expanded.

The Gate is effectively an audio switch with an attenuation rate controlled by the release. In poor signal-to-noise circumstances it can be invaluable and more effective than the expander in achieving separation. Gates have, over the years, not achieved a very good reputation either because of slow open characteristics such that initial transients were lost or the fact that they are very prone to hunting characteristics. With modern designs and components, however, there need be little or no apparent transient loss and by arranging the threshold to have a hysteresis effect, such that the 'close' threshold is lower than the 'open' threshold, 'hunting' is largely obviated.

One other factor to emerge more recently, relatively speaking, is the 'keyed' or programmable gate. Here the control volts are applied externally to the signal being processed, *viz* the Allison *Kepex* expander and, more recently, the Audio & Design *F300* expander gate.

Applications

In the studio set-up, probably the most common application of the gate is on drum kit miking. It is quite possible, especially in an isolation booth, to have 12 microphones on a drum set. In order to reduce cross talk and splash from cymbals and hi-hat on snare and bass the threshold is set high at 0 or +10 dBm with slow attack and fast release, adjusting the range of attenuation as desired (**fig. 2**). Faster attack characteristics will tighten-up the initial transients (of the bass drum, for example) to the extent that a sharp cut lowpass filter at 10 kHz would be desirable to filter out the unavoidable

FIG. 3 MODIFYING A BASS DRUM SIGNAL

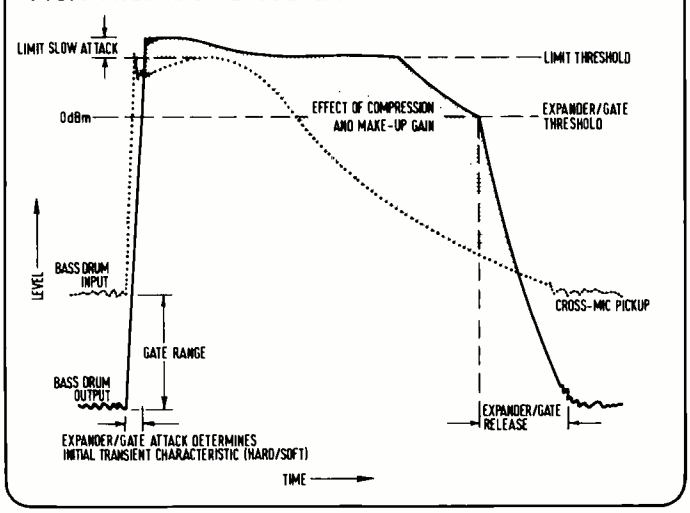
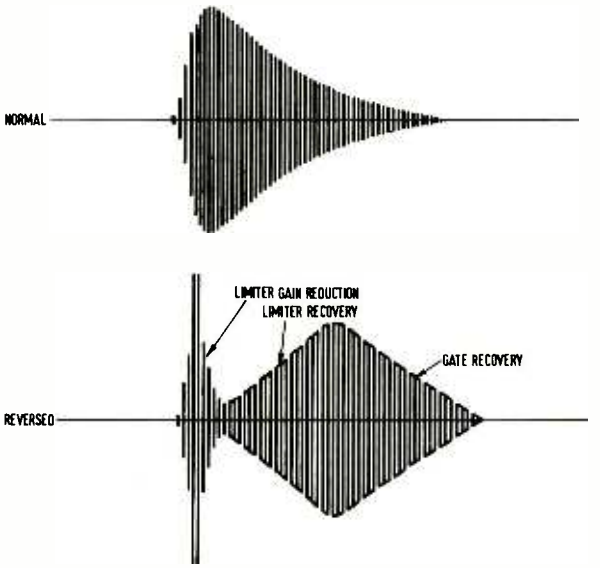


FIG. 4 DYNAMIC REVERSAL



'click' generated by wide range attenuation as the gate opens. Mike Stavro, engineer at Air Studios in London, uses noise gates in this fashion to 'restore' vital initial transient information to a flabby bass drum and, coupled with a slow attacking limiter, recover some of the original 'square-wave like' shape. **Fig. 3** shows how the bass drum wavefront is modified by a very fast attacking gate with the slow attack limiter modifying its decay characteristic. He has also, by application of this technique, produced a very creditable 'synthesised' drum sound using a low frequency signal generator as the input source.

It is also often the case that an equalised version of the gated signal is used to drive the gate via the key or trigger input, thus operating on the essential information (as defined by eq) only.

John Mackswith, Studio Manager of Utopia Studios in London, also uses the gate coupled with a fast attack limiter to create a 'dynamic reversal' effect (see **fig. 4**). Here, in a simulated oscilloscope trace, we can see the initial transient, heavily overlimited by an extremely fast acting limiter with slow recovery, being eventually attenuated by a slow releasing gate. The effect is to give a 'backward' sounding snare or tom-tom. In situations where separation on the track is poor it would be undesirable to limit first because of the gain needed to over-limit. A gate is therefore utilised *before* the limiter to pre-condition the desired separation followed by 'dynamic reverse'. Where two tom-tom mics are in use this means four gates and two limiters on one track.

Modulation of one signal by another and then mixing the two is also an effect worthy of experimentation. On the recent *Consequences* album it was possible to have 'talking wind'. **Fig. 5** shows how a continuous wind noise can be fed to a gate whose control volts are derived from a parallel feed of voice-track. The output of the gate, when mixed with the voice will then be modulated in sympathy. Similarly, another not so common use of the key input is to drive the gate from the sel-sync or advance head of a tape machine, feeding the direct signal through the gate and utilising a slow release time. This ensures that, since there is typically something like 100 ms between the two heads, the gate is opened in advance of the signal thus obviating any possible initial transient modification. Very handy on voice dubbing where signal to noise is poor, time is short and programme content unfamiliar. It is, of course, equally feasible to employ a delay line to delay the direct signal.

The value of the expander has been unexpectedly increased by the introduction of complementary noise reduction techniques since, by removing the masking effects of tape hiss, they increase the listeners awareness of source noise. To combat this, use of an expander on

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DOING IT FOR EFFECT . . . THE NOISE GATE

each track during reduction will ensure that channels are only contributing to the mix in the presence of wanted signal. This can dramatically reduce cross-mic pick-up, additive tape hiss and other objectionable sounds generated by electronic instruments.

This approach is also likely to show benefits in live pa work where many spurious signals are at large, especially where a vocalist with a weak voice may require high gain on his mic, or a keyboards player has anything up to five (or more?) instruments to himself.

Some perhaps less obvious uses of expanders include increasing of the dynamic range of the signal itself, applied either to the high or low end of the signal (**fig. 6**). It will be less noticeable at high signal level relative to low signal since noise cannot then be modulated. Small amounts of attenuation are necessary and the threshold should be set so high that the unit is just coming out of attenuation on peaks. This will be quite subtle and could be used to reprocess older classics or recover some of the dynamics of 'over-compressed' signals. Finally, fixed decay time of some reverberation devices or instruments can be shortened by a little judicious juggling of threshold and release parameters.

It must be stressed that the availability of expander/gates, like all signal processing gear, should not detract from efforts to obtain good mic separation and placement. As always, it is technique that distinguishes good sound engineers—the rest is only aids, and primarily for effect!

This is the first in a series of articles from Len Lewis on studio ancillary equipment. In the near future he will be writing us an article on adt and flangers. ■

FIG. 5 VOICE GATING WIND NOISE

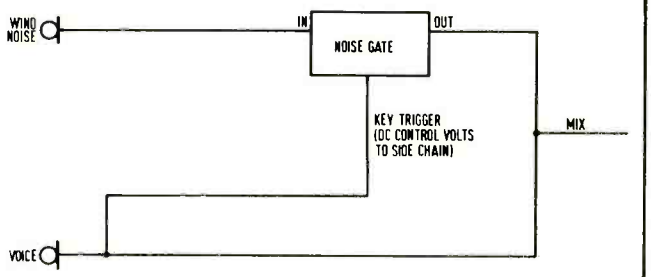
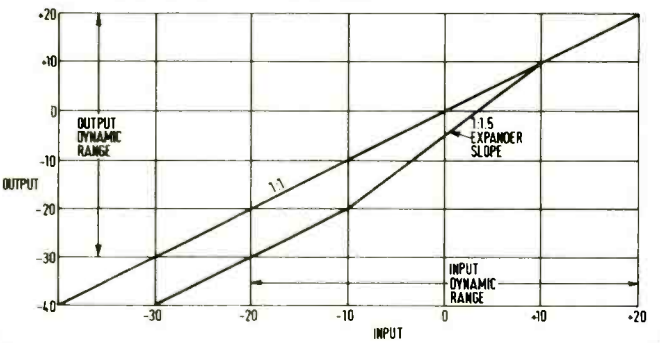


FIG. 6 INCREASING DYNAMIC RANGE



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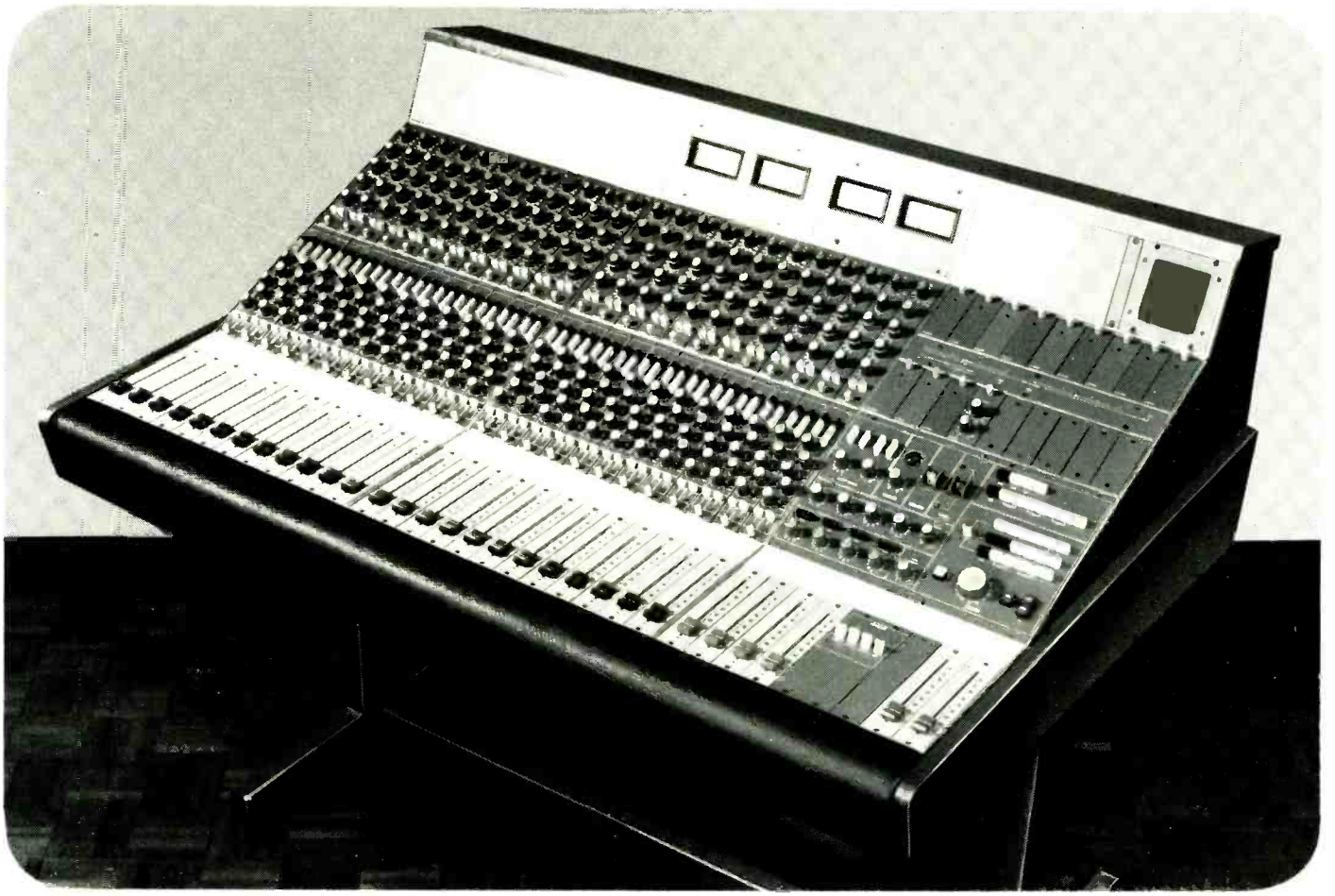
Neve supreme in sound

unsurpassed in broadcast and recording consoles



Neve's superb range of broadcast consoles includes the following standard models:-

The powerful 5315 Recording and Broadcast Console (shown above) featuring 12 or 24 input channels, 4 group outputs and 2 master outputs ideal for 4 group television production, 4 track recording or stereo broadcast production.

The versatile 5312 'Melbourn' All-purpose Console for recording or broadcast where 12 input channels, 2 group outputs and comprehensive monitoring are required.

The comprehensive 5402A Broadcast Console providing highly flexible radio broadcast facilities for disc jockeys or continuity applications.

The compact 8301 'Kelso' Transportable Console featuring 10 inputs, 2 main output groups, cue, speaker monitoring outputs and talkback facilities.

The portable 5422 'Suitcase' Mixing Console suitable for full professional use and powered either by re-chargeable batteries or from an optional mains supply/charger.

Neve

Rupert Neve and Co. Ltd., Cambridge House, Melbourn, Royston, Herts. SG8 6AU. England.
Tel: Royston (0763) 60776. Telex: 81381.
Cables: NEVE Cambridge.

Rupert Neve Inc., Berkshire Industrial Park, Bethel, Ct. 06801 USA. Tel: (203) 744 6230. Telex: 969638.

Rupert Neve of Canada Ltd., 2721 Rena Road, Malton, Ontario. Tel: 416 6776611. Telex: 21 06 983502.

Rupert Neve GmbH, D-6100 Darmstadt, Bismarckstrasse 114. W. Germany. Tel: 6151 87038. Telex: 419581.

DDL 7142

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business

ADRIAN HOPE

Copy-write your broadcast!

RECENTLY a BBC producer inadvertently discovered a loop-hole in British copyright law that could affect all broadcasters. Not only is it a loop-hole in current law, it looks like being a loop-hole in the new copyright laws which are due to be enacted in the UK. Although by publicising the loop-hole we risk encouraging villains to use it, it seems more important in the long run to encourage the government to plug the gap by airing the issue.

The BBC spends a considerable amount of time and money on producing radio programmes based on interviews with famous pop-stars who are often living in the USA. One such programme was broadcast last year and widely acclaimed. And not too long afterwards a book appeared in which streams of the pop-star's words to the BBC appeared verbatim. The BBC approached the publisher who initially apologised, then took legal advice and withdrew the apology. Here's why.

The Copyright Act 1956, which currently governs copyright law in the UK, makes it an offence to record a broadcast without authorisation and then rebroadcast it or issue it as a disc or tape. The Act implicitly allows a radio broadcast to be recorded for private purposes and there is also provision for 'fair dealing' with excerpts, so that magazines and newspapers can safely quote passages of a copyright work in a critical review.

But by default, in other words through not specifically forbidding it, the Act appears to leave a publisher free to record and transcribe a broadcast, and then publish its content. This is what happened in the case of the pop-star's personal tale of his life story. There is room for legal argument on all this, and one hard-to-swallow suggestion is that the pirate is safer if he credits the source of the material, in this case the BBC, because his piracy may then count as 'fair dealing'. A more reasonable suggestion is that, by crediting the BBC, the pirate is putting his head in the common-law noose of 'passing off' his book as something apparently backed or blessed by the BBC. Probably the pirate is safer if he just pirates!

Last year a ten strong committee chaired by Mr Justice Whitford produced a report on British Copyright Law running to nearly 300 pages. Our new laws will be based on this report; but it doesn't appear to acknowledge the loop-hole. Likewise the official Government attitude seems to be that word-for-word reproduction in print of a broadcast interview must be a clear breach of copyright, even if the law doesn't say so. Only an expensive test case in court—or a change in the law—will settle the issue one way or the other. So it would seem to make sense for any new laws on copyright to make quite clear that to lift a hard-produced broadcast interview, word-for-word off the air, and then sell it in print is legally naughty.

In the meantime, and until the law is changed, it seems that there is one way that broadcasters can safeguard themselves against such piracy. If the broadcast interview is transcribed by the station before it is broadcast, so that the station has a written copy of what it subsequently broadcasts, then any unauthorised publication of that interview will be a breach of copyright in the written transcript held by the broadcaster.

Moral. If you have a hot property interview *only* on tape, have it transcribed *before* it goes out over the air, and date and sign the transcription in front of a witness.

Remixed

THE SUNDAY TIMES, recently tracing the history of England's large country houses, inevitably picked on Shipton Manor in Oxfordshire—better known to the recording business as The Manor. It was bought in the early Seventies by Richard Branson of Virgin, reportedly for just £25 000, but has since been converted and renovated to the tune of £½ million—Branson's reward for having had the bright idea in the Sixties of selling rock records at cut price. As 'The Sunday Times' briefly mentioned, in 1956 the then owner had a garish picture painted high in the hall. This showed the local villagers offering up a miniature replica of the Manor to a nude goddess floating above a mountain top. Ten years later the new lady owner of the Manor took exception to such rudity, and obscured the goddess with a cloud over the mountain. So far none of the new residents of the Manor has got round to restoring the masterpiece to its original 'lewd' splendour. But it is already featured on *Tubular Bells*—or rather, it may be or may not be, depending on which version of *Tubular Bells* you play.

Mike Oldfield made *Tubular Bells* between autumn '72 and spring '73, and it was released in May '73. Although essentially an overdub epic featuring Mike Oldfield, MC Vivian Stanshall came in for one track to announce each instrument in turn. After this track had been recorded, there was some pretty heavy drinking by all concerned, and the outcome was some mics strung out of the studio and round the Manor House. As an overdub to *The Sailor's Hornpipe*, Stanshall staggered—both physically and verbally—around the Manor and the mics. En route he chanced the garish painting and described it in such a rambling, drunken fashion that the tapetrack was finally adjudged too much for the masses and left out of the final *Tubular Bells* mix. So the May 1973 issue is devoid of drunken Stanshall.

But last year came *Mike Oldfield Boxed*, a re-issue of all Oldfield's work, including *Tubular Bells*. It was decided that the Great British Public was now ready for Stanshall in all his original glory, so the boxed mix of *Tubular Bells* has a very different *Sailor's Hornpipe* from the original (1973) issue. Comparative listening is rewarding.

So re-mixing a multitrack master for re-release (which in the case of the *Mike Oldfield Boxed* set differs from the original versions in more ways than just the Stanshall Hornpipe section) is a very practical possibility. This prompts an interesting thought: how many issues of a decade ago would benefit from a remix and re-release? Or would it just be a temptation to tamper with perfection?

Broadcast cassettes

NOW THAT a *Unisette* player, from Nordisk in Denmark, is finally available at a halfway-to-reasonable price (around £2000), will the *Unisette* take off—or is it too late?

The *Unisette* idea of a 6.35 mm and much improved version of the Philips 3.8 mm *Compact Cassette* design was unveiled to the NY AES Convention in September 1974. At around that time its mentors, BASF, were obviously well aware of the chicken-and-egg problems inherent in launching a software system without hardware. So BASF offered the *Unisette* to various Japanese hardware manufacturers.

In Europe, EMT and Studer played with *Unisette* machine designs somewhat half-heartedly. Meanwhile, broadcasters moaned about NAB cartridge problems; heads clogged by the lubricated tape and azimuth phase errors are well known. Then, around Easter 1976, a consortium of Japanese companies launched the 6.35 mm *Elcaset* onto the predominantly domestic market—not even a blind man could have failed to notice the similarity to the *Unisette*.

Already several firms are producing *Elcaset* machines for the domestic market, and it can only be a question of time before an enterprising Japanese firm with a foot in both the domestic and professional camps (like Teac or Technics, for instance) has a go at making at *Elcaset* machine with cue and fast wind for broadcasting use. In the meantime, at least two manufacturers are working independently on cue-tone systems for standard 3.8 mm cassettes, and at least one London studio is using a home-grown cue system for triggering the playback of sound effects dubbed onto standard cassettes.

Perhaps the stylish new Danish *Unisette* machine may have arrived just in time to give the system a fair chance in the race. And at least one Japanese company is backing both horses. Aiwa, a Japanese hardware manufacturer which was part of the consortium backing the *Elcaset* system, recently showed a *Unisette* machine at a hi-fi show in Japan. ■

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The Professional's Choice

The Adaptable A77

The industry's workhorse. Over 400 versions ensure that an A77 is suited to your particular application. Make your choice from five tape speeds, three track configurations, Dolby noise reduction, varispeed, three enclosure styles, power amplifiers, remote controls, voice-operated auto-start, balanced input/output, NAB or IEC equalisations, built-in loudspeakers....etc., etc. The standard echo and track-to-track facilities of the A77 are as well known as its proven track record over the past decade. The machine by which all others are judged.

The Versatile A700

The deck that closes the gap between top ranking amateur tape recorders and full grown professional studio machines. Full logic control and motion sensing, 3 tape speeds, real-time counter, open head format, built-in mixer with balanced mic. inputs and RIAA pre-amplifier make the A700 a self-contained and versatile recording system.

The Modular B77

Latest addition to the Revox range, the B77 with its logic control, self-sharpening tape cutter, easy access to heads, remote and varispeed controls and modern styling make it the natural choice of the semi-professional and the true Hi-Fi enthusiast.

Sole U.K. distributors, F.W.O. Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ

STUDER REVOX

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Survey: noise reduction equipment

This survey is divided into two parts. The first part will deal with two-stage compressor/expander (ie compander) systems: specifically the three systems offered by dbx, Dolby and Telefunken (Telcom). The second part will be concerned with single-stage expanders and noise gates.
Readers unfamiliar with the design philosophy of the three compander systems are referred to a comprehensive article by Frank Ogden published in the September 1976 issue.
Forthcoming surveys include test equipment (July), power amplifiers (August) and monitor loudspeakers (September). Manufacturers and agents are invited to submit product details for publication to reach the editorial offices (address page 3) at least two months before the issue publication date (preferably a lot earlier).

COMPANDER SYSTEMS

dbx

dbx Inc, 71 Chapel Street, Newton, Massachusetts 02195, USA.
Phone: (617) 964 3210.
Telex: 922522.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London WIV 5RA.
Phone: (01) 734 2812/3. Telex: 27939.
Agents in most countries.

The by now well-known dbx noise-reduction system is available in a wide range of configurations for simultaneous encode and decode, switched encode or decode, and encode or decode-only.
All units feature the same 2-way compression/expansion system based on a 2:1 linear decibel slope applied to a 100 dB range. Attack and release times are program dependent. It is claimed that the system provides 30 dB of noise-reduction and a simultaneous 10 dB increase in headroom. Frequency response is a quoted ±1 dB 30-20k Hz, total harmonic distortion typically 0.1% and equivalent input noise approximately —90 dBm.

MODEL 142
A 2-channel unit for broadcasters. The processing can be switched between encode or decode for recording or replaying such items as dbx-encoded NAB catridges. The unit can also be used for 'normal' noise reduction on, for example, tape machines, or for improving the signal-to-noise ratio of land lines or microwave links.
Price: £485 ($750) approx.

150 SERIES
Three units for the small recording studio: *Model 152* features two channels of switchable encode or decode; *Model 154* is a 4-channel version of the *Model 152*; and *Model 157* has two channels that provide simultaneous encode and decode facilities. Two *Models 154* or *157* can be rack-mounted with the *RM-150* mounting kit.
Prices: *Model 152* £310 ($475) approx; *Model 154* £485 ($750) approx; *Model 157* £400 ($600) approx.

dbx model 193 for Nagra IV-S

dbx model 158 8-channel unit


dbx K9-22 replacement for Dolby card

MODEL 158
Provides eight channels of simultaneous encode and decode. The system is modular and contains its own power supply module *plus* a spare noise-reduction module for emergencies.
Price: £1495 ($2400) approx.

MODEL 187
A 4-channel system for 'professional' recording studios. The processing is switchable between encode or decode. With an optional plug-in accessory the system can be remote-controlled from a tape machine (to follow the record/replay mode) or from a desk.
Price: £1330 ($2150) approx.

MODEL 216
A modular 16 or 24-channel system providing simultaneous encode or decode facilities. Each module contains the processing circuits for two channels of noise reduction, and can be remote-controlled from a tape machine or desk. A spare module is also provided for emergency backup.
Price: £5250 ($9500) for 16 channels, £7500 ($14k) for 24 channels.

MODEL 193
A 2-channel simultaneous encode and decode unit for the Nagra *IV-S* tape machine. Power is derived from the Nagra's batteries or mains unit. Front-panel

56 ▶

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Presenting plug-in 46 track capability.

Featuring Studer TLS 2000 flexibility.

The difference between a 32 Track Machine and the Studer 46 Track system may only appear to have the obvious advantage of 14 additional tracks and yet it offers unrivalled flexibility.

The principle is simple as is the installation. Merely plug-in two 24 track A80's with the Studer Tape Lock System and 46 Track facility is attained.

And you can go to almost any lengths to install the system, quite literally. Machines can be positioned side by side or on separate floors, interconnection being by means of a standard 3-pole audio line. Updating existing A80 systems is simplicity itself.

As for flexibility you have the advantage of 46 track capability synchronously locked between the two tape transports for recording and mix down, or the independent use of two 24 track machines.

Installed and working at TRIDENT STUDIOS since September 1977.

F.W.O. Bauch Limited

49 Theobald Street, Boreham Wood, Hertfordshire, WD6 4RZ Tel: 01-953 0091

STUDER INTERNATIONAL AG

CH-8105 Regensdorf, Phone (01) 840 29 60, Telex 58489

STUDER REVOX AMERICA INC., Nashville, Phone (615) 329-9576, Telex 55-4453
STUDER REVOX CANADA LTD., Toronto, Phone (416) 423-2831, Telex 06-23310
STUDER FRANCE S.à r.l., Paris, Phone 533 58 58, Telex 24-744

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SURVEY: NOISE REDUCTION

jack sockets provide monitor outputs to drive an external loudspeaker or headphones.
Price: £530 ($850) approx.

K9-22
A plug-in replacement for the Dolby *Cat 22* module. It is compatible in external dimension and interfaces directly with the main frame of Dolby *361*, *M16* and *M24* systems, including power supply and switching functions.
Price: £156 ($250) approx.

DOLBY

Dolby Laboratories Inc, 731 Sansome Street, San Francisco, Ca 94111, USA.
Phone: (415) 392 0300. Telex: 34409.
UK: Dolby Laboratories Inc, 346 Clapham Road, London SW9 9AP.
Phone: (01) 720 1111. Telex: 919109.
Agents in most countries.

There are two standard Dolby noise reduction systems: the 'professional' *A* system and the *B* system for consumer use. Both systems act as a constant gain amplifier over a wide range at low and high levels. Level dependent, variable gain action occurs only over a limited range and only in the side path of the system, while the main path always acts as a constant gain amplifier. In both systems the attack and release times depend on the signal conditions to minimise distortion products and modulation effects. The Dolby *A* system uses four frequency bands in the side chain, which together cover the full audio bandwidth. The Dolby *B* system, however, uses only one band in the side chain, whose cut-off frequency is controlled by the signal. This sliding action is claimed to be specific to Dolby noise reduction, like the dual-path, differential approach.

MODEL 360/361
A rack-mounting, single-channel unit with Dolby *A* characteristics, switchable between encode and decode.
Frequency response: ±1 dB, 30-20k Hz.
Distortion: less than 0.1% at 1 kHz and +8 dBm.
Phase response: less than 5° error, encode/decode.
Noise reduction: 10 dB from 30 to 5k Hz, rising to 15 dB at 15 kHz.
'Subjective noise reduction effect is independent of the signal level and is independent of the noise level over a wide range. Dynamic characteristics are maintained'.
The *Model 361* is identical to *Model 360* except for built-in relay switching of operating mode. The changeover can be controlled automatically to follow the record/replay functions of a tape machine.

MH SERIES
A multichannel rack-mounting unit with built-in encode/decode changeover facilities. It is available in 8, 16, 24 and 32-track formats. Frequency response, distortion, phase response and noise reduction identical to *Model 360*. Crosstalk is 80 dB between any two channels.

MODEL 330
A 2-channel unit incorporating Dolby *B* encoder/decoder for use in tape duplication and quality monitoring. Distortion and phase response are identical to *Model 360*.
Frequency response: ±1 dB, 30-15k Hz.
Noise reduction: 3 dB at 500 Hz, 6 dB at 1 kHz and 10 dB at 4 kHz and upwards.

MODEL 334
A 2-channel unit incorporating Dolby *B* encoder/decoder for use in fm broadcasting. A change of pre-emphasis time constant to 25 µs is achieved when the noise reduction is activated, reducing the need for hf limiting. Specifications virtually identical to *Model 330*.

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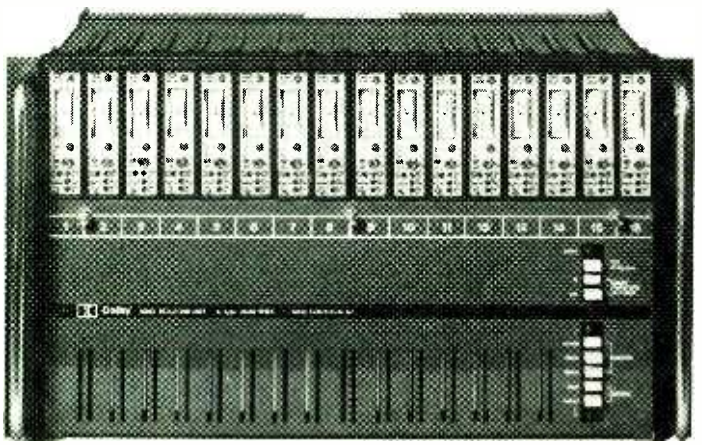
Dolby model M16H, 16-channel unit



Dolby model 334 FM broadcast unit

Dolby model 361 unit

Worldwide agents for audio & design recording.

Australia
Audio & Recording, Holden Hill, S.A.
Tel: 261 1383

Austria
Soundmill Vienna, Peter J.Müller.
Tel: 222 Telex: 75922.

Brazil
Serion Ltd, Sao Paulo. Tel: 34 8725.

Canada
Noresco (Mfg) Co. Ltd., Ontario.
Tel: (416) 661 0541.
Telex: 065-24478, a/b Norescomfg.

Denmark
Ole Christensen, Audiophil,
Copenhagen. Tel: (01) 341 622.

Eastern Europe
Denis Tyler Ltd., West Drayton, UK.
Tel: (089 54) 43681. Tlx 23977.

Finland
Harold Burgen, Helsinki. Tel: 692 5308.

France
3M France, Paris.
Tel: (1) 031 61 61. Telex: 695185

West Germany
Elmus GmbH, Berlin.
Tel: (030) 312 2012.

Greece
Audiolab Hellas, Athens.
Tel: 822 5222. Tlx 5800.

Holland
Pieter Bollen, Eindhoven.
Tel: (040) 512 777 Tlx 59281

Italy
Roje Telcomunicazioni, Milan.
Tel: 415 4141. Tlx 39202.

Japan
Nissho-Iwai Co. Ltd., Tokyo.
Tel: (03) 544 8311.

New Zealand
General Video Co. Ltd., Wellington.
Tel: 872 574. Telex: 31255.

Norway
Siv. Ing. Benum & Co., Oslo, 2.
Tel: (02) 56 57 53.

South Africa
Eltron (Pty) Ltd., Johannesburg.
Tel: 23 0018.

South East Asia
Brunei, Indonesia, East Malaysia, West Malaysia, Singapore — c/o O'Connor's (Pty) Ltd., Singapore 5,
Tel: 637 944. Tlx Oconsin RS 21023

Sweden
KMH ljud Ab, Stockholm.
Tel: (08) 98 07 55. Telex: 13366.

Switzerland
Jim Duncombe, Zurich. Tel: 72 56 877.

United States
Audio & Design Recording Inc.,
Honolulu. Tel: (808) 845 7226.

UK and All Other Territories
Audio & Design Recording Ltd.,
Reading, UK. Tel: (0734) 53411.
Telex: 847605 a/b Tillex G.

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THE 19" PARKING SPACE

S 03 Sweep Equaliser
A 3-band sweep equaliser offering 40dB control range switchable on each section. Input attenuator and optimum modulation indicator.

S 04 Parametric Equaliser
A 3-band fully parametric equaliser with 40dB range; shelf option with variable slope on Hi and Lo sections. Each section switchable with optimum modulation indicators.

S 23 Auto-PAN effects module
offers different *pan* patterns with *trigger. speed* and *envelope* following functions.

S 27 Dual Electronic Crossover
Provides *stereo* dual crossover, or *mono* **triple** crossover networks at 18dB/oct.

S 05 Dynamic Noise Filter
This programme controlled high-pass filter automatically attenuates hum and rumble. It has variable slope (0-18dB/oct) and three t/o frequencies. Can also be used as a 20/40dB noise gate.

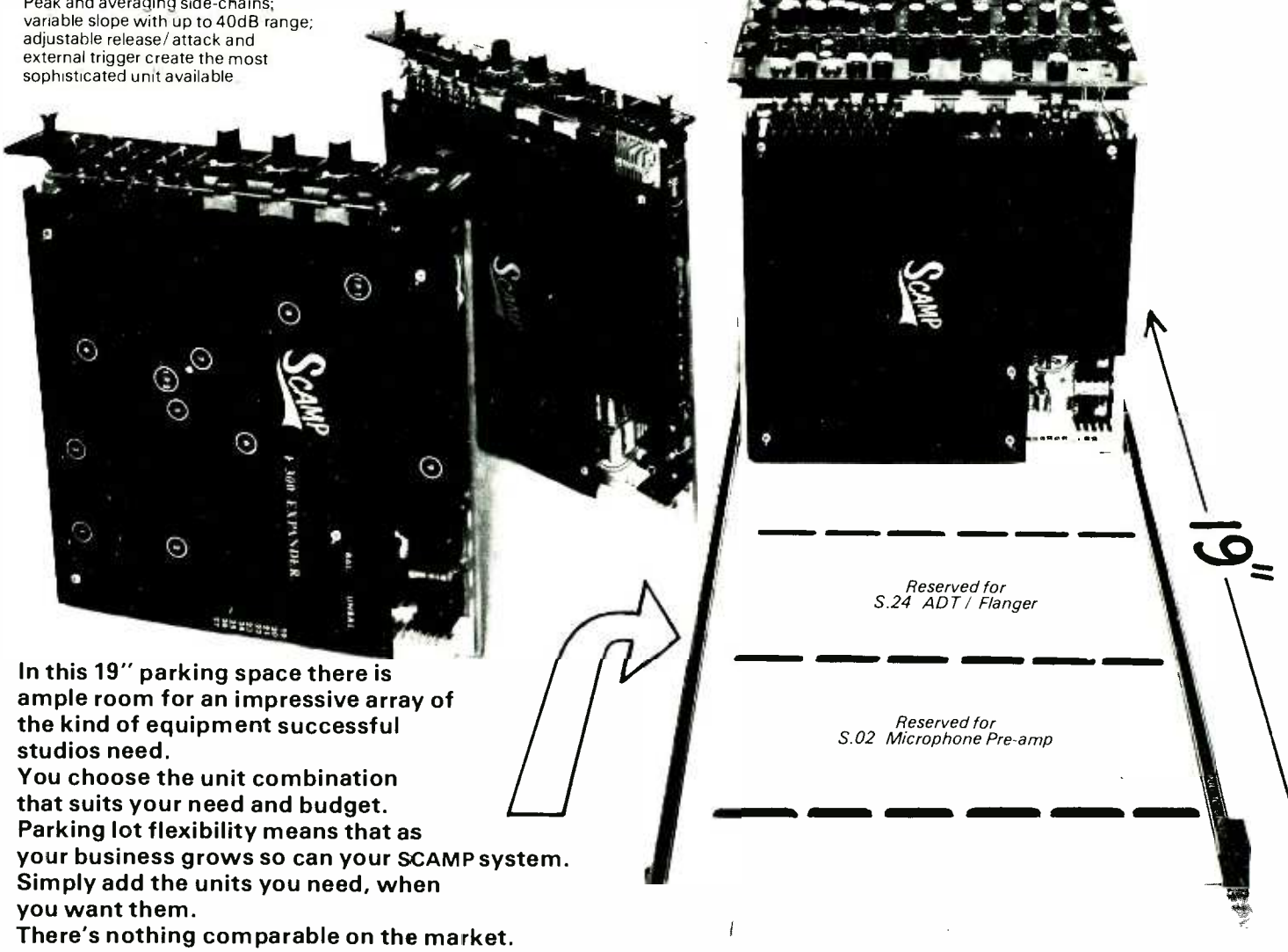
S 06 Dynamic Noise Filter
Similar to S 05 but being the low pass version, cleans up hiss and HF splash without affecting wanted HF transients. Alternatively acts as a wide-band noise gate.

S 07 Octave Equaliser
Ten-band octave equaliser set on standard ISO centre frequecies from 31.25Hz — 16kHz. Optimum modulation indicator.

S 14 Quad PPM l.e.d column
has brightness control and can be ganged with other S 14 modules.

S 01 Compressor-Limiter
A simple-to-operate multi-ratio compressor with overall peak limiter and l.e.d gain reduction meter.

F300 Expander-Gate
Peak and averaging side-chains; variable slope with up to 40dB range; adjustable release/attack and external trigger create the most sophisticated unit available



In this 19" parking space there is ample room for an impressive array of the kind of equipment successful studios need.
You choose the unit combination that suits your need and budget.
Parking lot flexibility means that as your business grows so can your SCAMP system.
Simply add the units you need, when you want them.
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St. Michaels, Shinfield Road, Reading, Berks, U.K. Tel: Reading (0734)-84487. Telex: 847 605.
Manufacturing Members of APRS.

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SURVEY: NOISE REDUCTION

MODEL CP50/100
Rack-mounting cinema processors for the reproduction of Dolby *A*-encoded optical and magnetic sound tracks.

CAT NO 22
The basic noise-reduction module employed in all Dolby *A*-type equipment. A half-speed version—*Cat No 40*—is also available.

FUTURE FILM DEVELOPMENTS

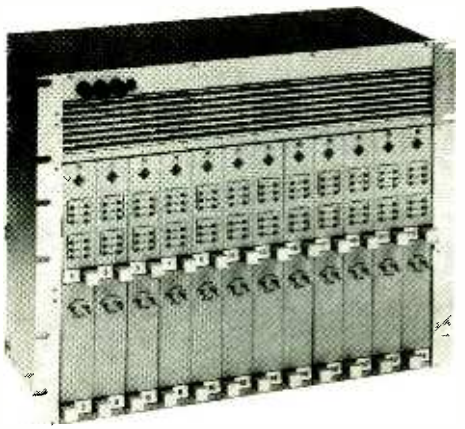
Future Film Developments, 36/38 Lexington Street, London W1R 3HR, UK.
Phone: (01) 437 1892. Telex: 21624.

DNR SERIES
A portable unit containing two Dolby *Cat No 22* modules, plus the necessary buffer amplifiers, automatic record/replay switching etc for interfacing with Nagra *IV* single and two-channel tape machines. Dimensions match that of the Nagra case and weight is under 4.5 kg. Power is derived from internal batteries. Basic price around £1000.

TELEFUNKEN

AEG-Telefunken, Postfach 547, D-3340 Wolfenbuettel, West Germany.
Phone: 05331831. Telex: 95651.
UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.
Phone: Gerrards Cross 88447. Telex: 849469.
US: Gotham Audio Corporation, 741 Washington Street, New York, NY 10014.
Phone: (212) 741 7411. Telex: 236779.
Agents in most countries.

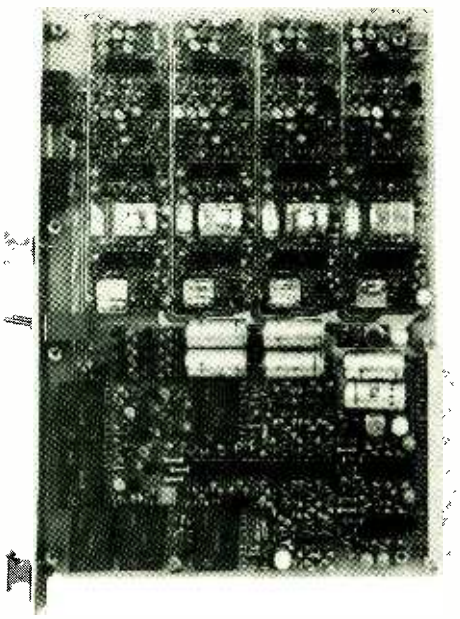
TELCOM C4
See reviews in the March '77 issue, p74, and this issue, p00.
The system is based on a 2-way compression/expansion principle using a 1:1.5 slope. The input is split into four bands—30-215 Hz, 215-1.45k Hz,



24 channels of Telcom c4 noise reduction

1.45-4.8 kHz and 4.8-20 kHz—before compansion. Two modular units are currently available: the *c4* and the *c4D*. The *c4* is a 2-channel switched encode or decode unit for use with the Telefunken *M15A* multitrack, while the *c4D* is a direct replacement for the Dolby *Cat No 22* module.
Frequency range: 30-20k Hz.
Dynamic gain: greater than 30 dB.
Signal-to-noise: greater than 94 dB, weighted and unweighted.
Distortion: less than 0.2% thd.
Price: *c4* £938; *c4D* £367.

Inside a naked Telcom c4 unit



EXPANDERS/NOISE GATES

ALLISON

Allison Research Inc, 2817 Erica Place, Nashville, Tenn 37204, USA.
Phone: (213) 874 6615.
Export: Gotham Audio Corp, 741 Washington Street, New York, NY 10014, USA.
Phone: (212) 741 7411. Telex: 129269.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham-wood, Hertfordshire, WD6 4RZ.
Phone: (01) 953 0091. Telex: 27502.

KEPEX MODEL 500
Type: one-way gain expander.
Process: wide-band gain expander. Input signals greater than the threshold level will raise the gain of the unit to 0 dB; signals below threshold are attenuated by the amount set on the range control (up to 60 dB).
Threshold: —35 to +20 dBm, adjustable.
Ratio: 2:1 from 0 to 15 dB expansion, increasing to 4:1 at 60 dB expansion.
Attack time: less than 20 µs.
Release time: 50 ms to 6s, adjustable.
Frequency response: (system alone) ±1 dB, 20-40k Hz.
Distortion: less than 0.5% thd, under normal operating conditions.
Noise: minimum 85 dB below rated output.
Price: on application.

AUDIO & DESIGN

Audio & Design Recording Ltd, St Michaels, Shinfield Road, Reading RG2 9BE, UK.
Phone: Reading (0734) 53411. Telex: 847605.
US: Audio & Design Recording Inc, PO Box 23047, Honolulu, Hawaii 96822.
Phone: (808) 845 7226.
Agents in most countries.

F300 EXPANDER/GATE
A full frequency, low-level noise expander or gate from the *Scamp* range. The unit uses peak or rms-type sensing characteristics. Threshold is variable between —40 and +10 dBm for source noise reduction or effects use. The unit is said to improve signal-to-noise ratio by up to 40 dB where wanted signal is only 2 dB above noise. Suitable for all types of programme material.
Attack time: 25 µs, 1 ms and 10 ms/40 dB range (max).
Release time: 25 ms to 5s, continuously variable.
Distortion: <0.1% at line level; 0.3% worst case.
Frequency response: ±0.5 dB, 20-20k Hz.
Noise: in effects use less than —86 dB ref +8 dBm

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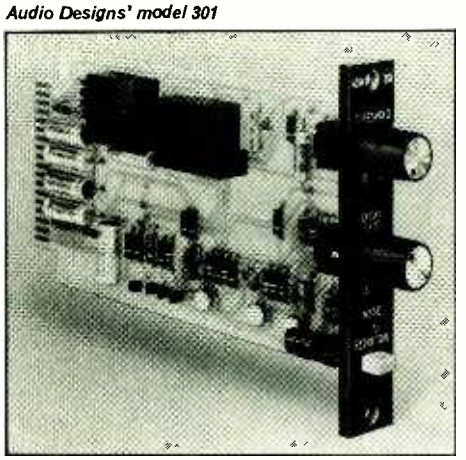
Audio Designs' model 301



PPM2: IEC268-10A; Draft BS5428

The latest refinements of BBC programme monitoring philosophy are now embodied in an International Standard.

The new IEC Standard defines considerably closer tolerances than BS4297 for temperature stability and specifies for the first time the frequency response performance at all signal levels as well as requiring a wider response than previously. Performance to isolated tone bursts is defined in a more stringent way and a new clause specifies the reading to be given when very low levels of signal are applied.

PPM2 is a standard performance drive circuit which can be mounted on the rear of a meter movement or by separate fixing holes. Connections are to a gold plated edge connector, with terminals also provided if direct wiring is preferred. It is manufactured under licence from the BBC and meets the requirements of the BPO, IBA, EBU and broadcasting organisations of other countries. *Ernest Turner* meter movements 642, 643 and TWIN are available from stock, as are flush mounting adaptors and illumination kits.

The coaxial red and green pointers of the TWIN offer an unrivalled method of monitoring stereo. PPM2 drive circuits are aligned for decay tracking such that any two boards will produce pointer overlay on a TWIN during fallback. This allows accurate checking of channel balance during items of programme intended to be centre stage.

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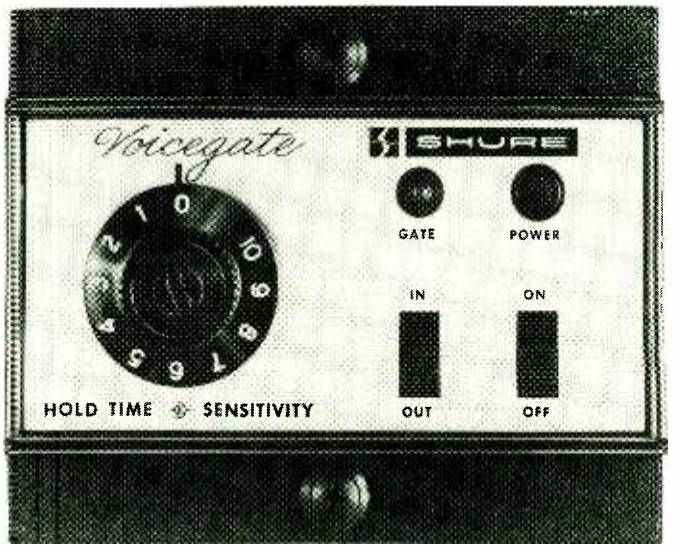
SURVEY: NOISE REDUCTION

(weighted —3 dB at 25 kHz); for noise-reduction use less than —103 dB ref +8 dBm (same weighting).
Price: £195 approx.

SO5 DYNAMIC NOISE FILTER

A low-frequency, single-ended processor from the *Scamp* range using frequency conscious, peak-sensing characteristic that imposes a variable slope roll-off to attenuate low-level lf (rumble etc). Maximum slope is 18 dB/octave; minimum 0 dB/octave (flat) when above threshold. It is claimed that the unit will improve signal-to-noise ratios by up to 18 dB/octave below 100, 200 and 400 Hz turnover frequencies without modulating the high-frequency content. The filter is said to be ideal for reprocessing old masters or attenuating source noise. Optionally, it can be switched to full-frequency 20 or 40 dB range noise gating.
The model *SO6* from the *Scamp* range is identical to the *SO5* except for turnover frequencies of 2, 4 and 6 kHz—making it a high-frequency, single-ended processor.
Price: £195 approx.

Shure model M625 Voice-gate

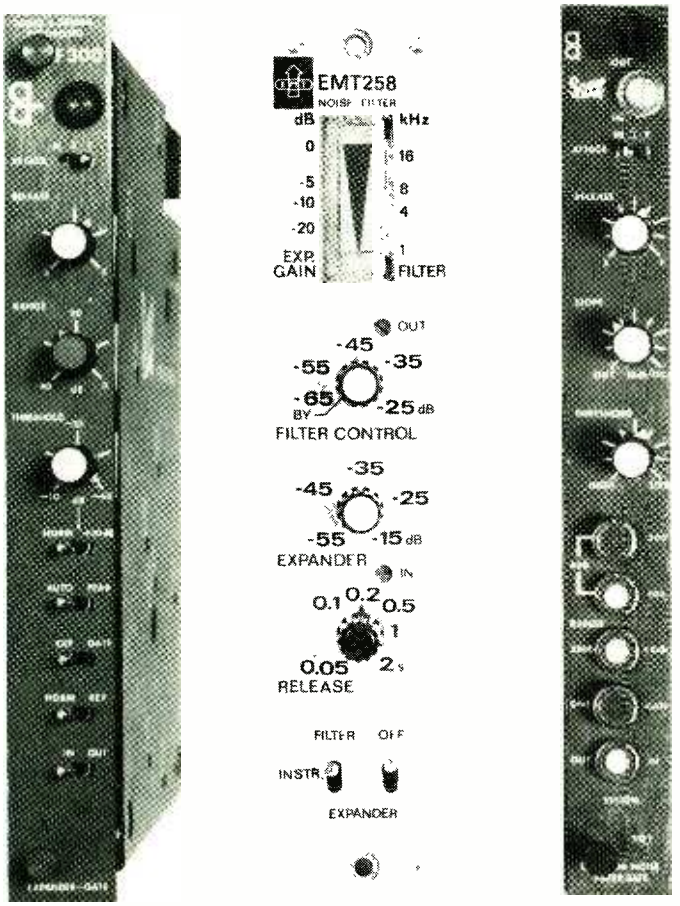


AUDIO DESIGNS

Audio Designs and Manufacturing Inc, 16005 Sturgeon, Roseville, Michigan 48066, USA.
Phone: (313) 778 8400. Telex: 231114.
International: Ampex International, 72 Berkeley Avenue, Reading, Berkshire.
Phone: 0734 55341. Telex: 847611.

MODEL 301
Type: noise suppressor.
Frequency response: ±0.25 dB, 20-20k Hz.
Distortion: 0.15% typical, 0.35% max.
Noise output: —73 dBm above threshold, —90 dBm no input.
Threshold: adjustable from —40 dBm.
Attack time: 5 µs.
Decay time: 10-500 ms/dB.
Available gain reduction: 85 dB.
Power: +20V, 50 mA.
Dimensions (wdh): 2.5 x 13.3 x 19 cm.
Price: $275.

Left: *Audio & Design F300 expander gate.* **Middle:** *EMT 258 noise filter.* **Right:** *Audio & Design SO5 dynamic noise filter gate*



EMT

EMT-Franz VG mbH, D-7630 Lahr, Postfach 1520, West Germany.
Phone: 07825/512. Telex: 754319.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham-wood, Hertfordshire, WD6 4RZ.
Phone: (01) 953 0091. Telex: 27502.
US: Gotham Audio Corporation, 741 Washington Street, New York, NY 10014.
Phone: (212) 741 7411. Telex: 129269.

EMT 258
Type: one-way lowpass filter and expander.
Process: lowpass filter, whose turnover frequency is determined by the programme material being processed.
Filter: turnover frequency 1-20 kHz, programme dependent; release time 0.05-2s, adjustable; threshold (signal) −25 to −65 dB, adjustable.
Expander: total range (at 100 Hz) 20 dB; frequency range below 2 kHz; release time less than 50 ms for 10 dB.
Frequency response: (system alone) ±0.5 dB, 40-15k Hz.
Distortion: less than 0.5% thd at internal zero level.
Noise: greater than 80 dB rms at 0 dB output level.
Price: on application.

ROGER MAYER

Roger Mayer Electronics Inc, 225 East 57th Street, New York, NY 10022, USA.
Phone: (212) 486 1544.
Denmark: Lake Audio APS, Artillerivej 40, DK-2300 Copenhagen S.
Phone: 570 600.
France: 3M France Minicom Division, Boulevard de l'Oise, 95000 Cergy.
Phone: 749 0275.
Holland: Peter Bollen Geluidstechnik, Hastelweg 6, Eindhoven.
Phone: 512 777.
Norway: Audiotron, Tollburgt 7, Oslo 1.
Phone: 417535.
Spain: Mike Llewelyn-Jones, AP Postal 8178, Madrid 8.
Phone: 415 6350.
Sweden: Tal & Ton Musik & Elektronic AB, Kungsgatan 5, S411-19 Gothenberg.
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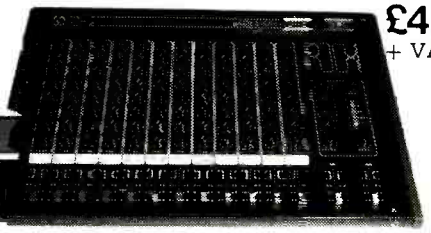

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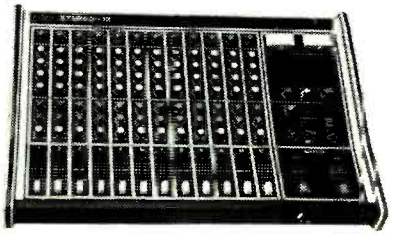

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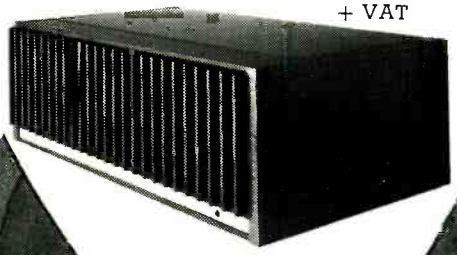

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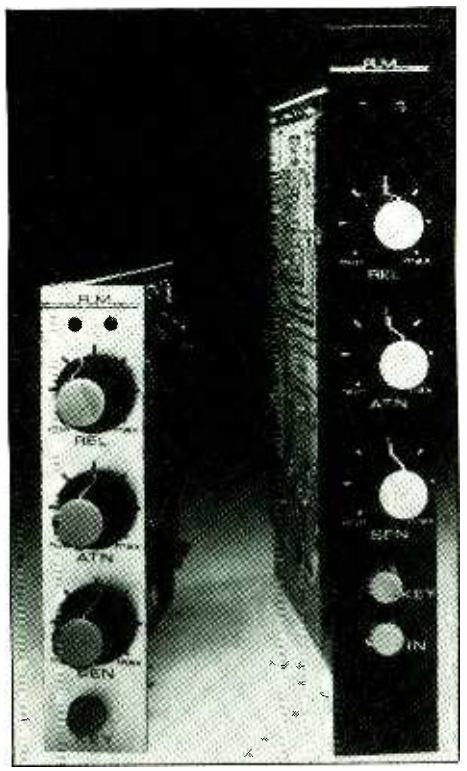
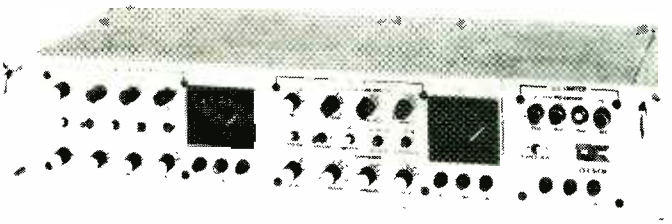


Roger Mayer noise gates



Orange County OCACLX processor including a noise gate/expander

Roger Mayer cont'd

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: (01) 734 2812. Telex: 27939.

MODEL RM68
A single-channel noise gate. Also available as *Model RM68X* which retrofits into *Kepex* rack.
Attack time: 150 ns.
Release time: 30 ms to 5s, continuously adjustable.
Frequency response: ±1 dB, 20-50k Hz.
Output noise: −96 dBm.
Distortion: 0.05% under normal operating conditions.
Features: two leds—red for gating and green for non-gating; keying input; up to 16 units fit optional card rack.
Price: *RM68* £67; *RM68X* £78.

ORANGE COUNTY

Orange County Electronics Corporation Ltd, 1125 Empress Street, Winnipeg, Manitoba R3E 3H1, Canada.
Phone: (204) 775 8151.
PO Box 369, Pembina, North Dakota 58271, USA.
Phone: (204) 775 8151
For agents in Australia, Brazil, South Africa and Sweden see October '77 issue, page 40.

OCACLX MODULE
Type: single or dual-channel unit combining a compressor-limiter, expander and gate, with facility for external key. Expander slope 1:2; gate slope 1:20.
Frequency response: ±0.5 dB, 5-100k Hz.
Distortion: 0.05% thd with no gain reduction; better than 0.1% thd at 15 dB gain reduction.
Noise: 89 dB with expander/gate in; 100 dB out (both at 30 dB gain).

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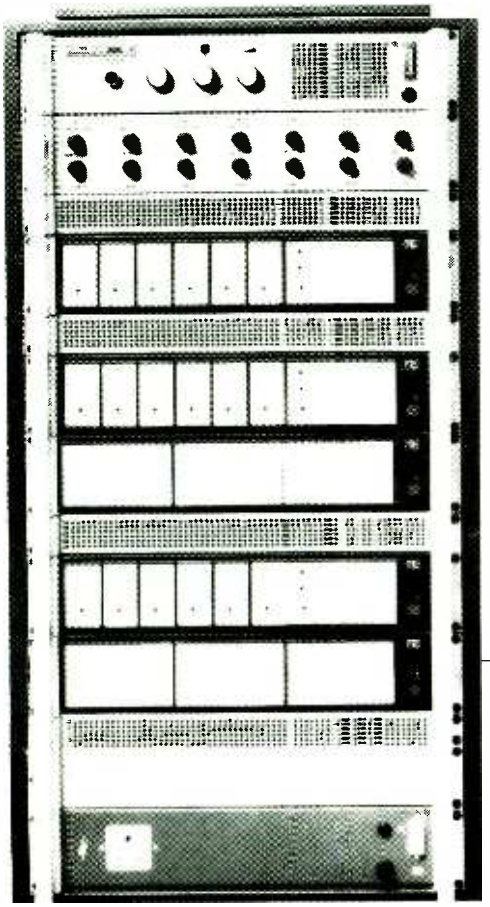
Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Ill 60204, USA.
Phone: (312) 328 9000.
UK: Shure Electronics Ltd Eccleston Road, Maidstone, Kent ME16 6AU.
Phone: 0622 59881. Telex: 96121.
Agents in most countries.

MODEL M625 VOICEGATE
A voice-activated microphone gain controller, typically for pa applications to block out unwanted background noise below a preset level.
Price: £110 approx. ■



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work

Now it can be told

No offence, but Stockport,Cheshire on a wet winter's day isn't too welcoming. But the locals are warm and friendly. Can you tell me the way to Waterloo Road, I asked one old chap. 'Up there past the Hip Tung Chinese Restaurant [yes, really the Hip Tung!] past the lights and over the hill.'

'You'll be wanting Strawberry Studios', he added eyeing my regulation blue denims and scruffy hair. 'Yes, but how did you guess', I played along. 'You look like one of those', he chuckled and disappeared off into the misty gloom.

The Strawberry building in Waterloo Road is equally old and unprepossessing from the outside. But to pass through its doors is to quite literally jump in sci-fi fashion to New York or California. Outside in the street it seems inconceivable that an audio masterpiece like Eric Stewart's *I'm not in love* could have been put together here; once inside it all makes sense.

There has been no shortage of reports in the past on Strawberry and how it began and where it's gone. No need here then to go over old ground. But some interesting things have happened since our last report. For a start the studio proper has been given the Tom Hidley treatment. The control room, of course, was treated years ago, and is one of the few Westlake rooms in Europe. All the rest are Eastlake. What's the difference—other, of course, than the obvious one that Eastlake is Hidley's European operation and Westlake was American. It's hard to pin down the differences in words but the engineers working at Strawberry on the Saturday afternoon that I called last January, Dave Rohl and Martin Lawrence, mention how all the hf dispersal treatment is in front of the engineer, with a very live acoustic in front of the desk and a totally dead acoustic to the rear. Another suggestion is that in a Westlake control room there's rather more of that characteristic stone on the control room walls. But realistically, isn't it just that Tom Hidley has no set pattern for any one studio, just a guiding set of principles that are adapted to each individual location?

On the subject of 'laking', whether West or East, I took the opportunity of raising a point that had previously proved contentious. When I reported a year or so ago on some studios that *hadn't* invested in 'laking' treatment, I quoted the justification offered by those studios —namely that a flat acoustic characteristic isn't necessarily the be all and end all of studio design. To redress balance I asked Dave and Martin for their views on the value of 'laking', It proves to be equally logical and persuasive.

'The point', they say, 'is not necessarily to have the control room acoustically flat, but to have available the reference point of an acoustically flat control room. We bring in spectral analysers every two months and check all the equipment so that we know we have that flat starting point. From there we can deliberately change the sound in any direction—and not in a hit-and-miss manner'.

Like how? Well the monitoring system in the control room at Strawberry is currently deliberately rolled-off by around 3 dB/octave in the region 12-16 kHz. The reason? That way the engineers can mix for the 'right sound' at studio levels (which remember are far higher than domestic listening levels) but end up with a balanced sound on tape that is automatically also right for cutting, pressing and playing on domestic equipment. That slight roll-off at the top end in the studio monitoring chain will encourage the engineers to make the master tape just a little too bright at the top end during mixdowns. Likewise Strawberry has been considering a slight boost in the bass at around 50 Hz. In this way the engineers will tend to put just a little less bass on the tape than would normally be there for a 'right' sound in the control room. This slight cut in deep bass on the master tape—but not in the control room during monitoring—avoids a perennial problem: the producer who wants to hear so much deep bass in the mix that it will inevitably cause problems at the disc-cutting stage.

'The advantage of a standard room', reiterate Dave and Martin, 'is that you can doctor the room acoustics and monitoring sound to taste, and whatever way you wish; but at all times you know exactly what you are doing and you can always go back to the standard situation and start again.'

There's another point on the quality of monitoring. 'It's all too easy to OD on sound,' says Martin Lawrence, 'when you're mixing for hours on end at high level on a good system.' This is one reason why Strawberry have an essentially domestic hi-fi system (Harman Kardon, Fons, Mordaunt-Short) permanently set up in the leisure room downstairs under the studio. This system is virtually permanently hooked up to an output of the desk upstairs. So what is being mixed on the studio monitors can be heard by off-duty musicians and engineers downstairs on the kind of equipment that is likely to be used by the general public for playing the final product.

'Laking' of the studio was only recently completed and it's impressive both in sight and acoustic feel. Dave Rohl explains the way they worked with Tom Hidley: 'Really we more or less told him what kind of thing we wanted and he produced a design that was what we wanted—except for what was impossible.' One whole wall area of the large studio is now faced with mirrors. Another wall is partially mirrored to enable engineers in the control room to see round the corner into the areas that were previously out of sight. This has answered the visibility problem without the need to introduce video monitors, and with them all the associated problems over audible whistles and electrical interference. Apart from looking spectacular—like a penthouse view over a city at night—the mirrors also have an acoustic function. Angled backwards from the vertical they throw all the arriving sound up into characteristic Hidley traps in the ceiling and behind the mirror wall. All the traps are the same; large volumes of space with slats covered in glass-fibre suspended to hang freely. The slats vibrate with whatever sound enters the trap so that it soaks up 'acoustic excess' like sponge. In a

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The control room and studio at Strawberry. The left photograph shows Dave Rohl taking a break at the wrap-round Helios 28/24 console. In the other photograph Ritchie Close is gently caressing the keyboards.

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Frequency response	+4dBu line input to any line output at +4dBu, 25Hz: −3dB, 20kHz: −1dB Signal at mic input with 50dB gain (200Ω at source), 25Hz: −3dB, 20kHz: −1dB
Noise	Relative input noise with 20kHz Bandwidth, < −126dBu Mixing noise, 24 channels routed to mix all at unity gain, < −80dBu (DIN audio weighted)
Input impedance	Mic input, 800Ω (1,5kΩ with pad) Any line input, not less than 5kΩ
Input gain	Maximum mic, 85db Maximum line, 70dB
Output capability	+22dBu into 600Ω

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control room this prevents sound from bouncing round the room to confuse the monitor image or produce standing waves to colour the acoustic at odd frequencies. In a studio it means that the drums can play alongside the bass with only the minimum of screens to separate them, and little risk of audio breakthrough between bass and drum tracks on the tape. The mirror wall of the studio faces a large area of wooden floor; the rest of the studio is carpeted on walls and floor alike. There is thus an acoustic division between both halves of the studio, and it's as precise as the visual division between wood and mirror on one side and carpet on the other. You can stand across that wood-to-carpet dividing line and hear a live sound in one ear and a dead sound in the other. The live sound is rather hard to describe. Although there's a strong first reflection off the wooden floor and glass mirror walls, there is very little else. The sound disappears off into the traps after its first reflection.

When I called at Strawberry the builders who had handled the studio treatment had moved off down to London to start on the Strawberry mastering/cutting room. Things were running somewhat behind schedule for the simple reason that the Stockport studio had soaked up materials, especially wood, faster than supplies could be brought through.

As previously promised we'll report on the London opening as and when it is ready. Meanwhile Strawberry in Stockport remains busy and thus faced with the problem, also previously touched on. How to remain busy as a studio without creating the potentially dangerous impression in the business that you are fully booked up for ever, so there is no point in ever trying to book. It's not just a studio problem. By the time the film *Star Wars* finally opened, the distributors had achieved the ultimate in public relations. So much advance publicity had surrounded the launch of the film that everyone assumed it would inevitably be booked solid for years ahead. So most people never even bothered to try and buy a ticket. As a result, there were seats available at many shows and punters who would have liked to have seen the film stayed home and watched tv. When I visited Strawberry it was booked solid ahead for seven months. So inevitably anyone trying for a booking in that period would be refused.

'We hate refusing work', says Rohl. 'Last year we had to turn down a McCartney album which, of course, we would love to have done. But if we *are* booked solid there is nothing we can do. The studio runs 24 hours a day and the equipment is usually only switched off for a couple of hours at the most so there's no slack to take up.

But we don't want to give the impression that there is no point in even trying to book in here. So what to do? We can hardly put an advert in STUDIO SOUND saying Strawberry now has time available —immediately people would suspect the worst.'

It's a good question to which I have absolutely no good answers.

For the past couple of years Strawberry has been booked intermittently by Chrysalis on what was until recently a secret project. Now all can be revealed. Engineer Dave Rohl is also a musician (keyboards) and a writer. He worked with the band Mandala, which later became Sad Café. The record company Chrysalis asked Dave to reform Mandala and, along with his wife Gilly, he wrote a project album. In fact it is intended as the first of three albums to be released over a 3-year period, with the possibility of an animated film. The trilogy is based on a fantasy world, most conveniently compared to 'Lord of the Rings'. But Rohl is worried about both the 'project' album tag and the 'Lord of the Rings' comparison.

'Reviewers get handed out a project album and wince at the thought', he says. I'll second that; I wince at the thought of project albums. 'Anything relating to a fantasy world gets compared with "Lord of the Rings" ', he goes on. 'Which is ridiculous because Tolkien wasn't even the first in the field.' I'll second that also; it's curious how other works in the genre (like Musrum) have just never clicked in the same way.

The Rohl project—'if he'll pardon the description'—was due for delivery to Chrysalis by February 1 and release on April 1. 'I'm in trouble if we don't make those dates' says Dave, 'because we have got Barclay James Harvest coming into the studio directly after.'

The first album is provisionally titled *Eye of Wendor*. It stands a better than average chance of getting a first listening by reviewers, if only by virtue of its pedigree (Strawberry Studios) and its artistic line-up. The idea was to not only reform the provisional Mandala group, but expand it, as if into a club. There are now around a couple of hundred musicians in that club. All of them have worked on *Wendor*, most of the 'names' being personal friends of Dave Rohl who have worked out of enthusiasm for free.

On the disc there's Justin Hayward, Eric Stewart, Graham Gouldman, Noel Redding (who came over from Ireland specially) and Maddy Prior who was due to call into Strawberry and record on her way down to London from the Lake District the day after I visited. There's also Kevin Godley and Lol Creme, a choir (the Northern Gerald Brown Singers) and a 30-man string section booked out of the Hallé orchestra. Because Strawberry is 24-track ('If you go above that you are inevitably into the area of computer mixing', they say) it has been no mean task to build up an album from an occasional line-up like that.

Unmistakably Tom Hidley acoustic treatment and TM-3 *monitoring.*

The 24 tracks soon disappear. The strings alone were recorded with one mic per stand or pair of musicians; Hayward solos with four of his own harmony tracks; then there is the choir, the backing musicians and so on. It's all added up to an engineer's nightmare with each of the 24 tracks on the *A80* used to what might seem like impossibly full potential. For instance, on some tape tracks there are around nine separate items spaced in time: track one might have a few bars of flute here, a few bars of percussion there, a voice next and so on. To re-equalise and rebalance between items during a mix has meant four hands, those of Martin Lawrence and Dave Rohl, working together in preprogrammed computer fashion.

Although the critics will doubtless give *Wendor* an ear, if only because of its pedigree and participants, this won't help overcome their ever-hardening resistance to self-indulgent project albums. The long list of names on the sleeve could even work against the album. Some of the worst records ever made have come out of impromptu jam sessions by name musicians who felt all they had to do to make a good record was get stoned and play together. But an incongruous musical mix and incompetent performance sounds just that, whatever the names on the label.

I'm happy to report, on the strength of a couple of tracks heard at Strawberry, that *Wendor* seems by no means self-indulgent. What I heard was that dirtiest of all words in some circles: tuneful. It was also beautifully arranged (four separate arrangers have worked on this first album) and some tracks might even make single material. Whether anything will be released as a single, however, is quite a different matter. Although record companies are happy to have their signed stars join in for love and free on an album for a rival label, they aren't so happy to see a track from that album released as a single.

For me there is only one incongruity in the whole project. I still can't reconcile the sunny Californian sound of Strawberry with the sight of Stockport on a wet winter's day.

Adrian Hope

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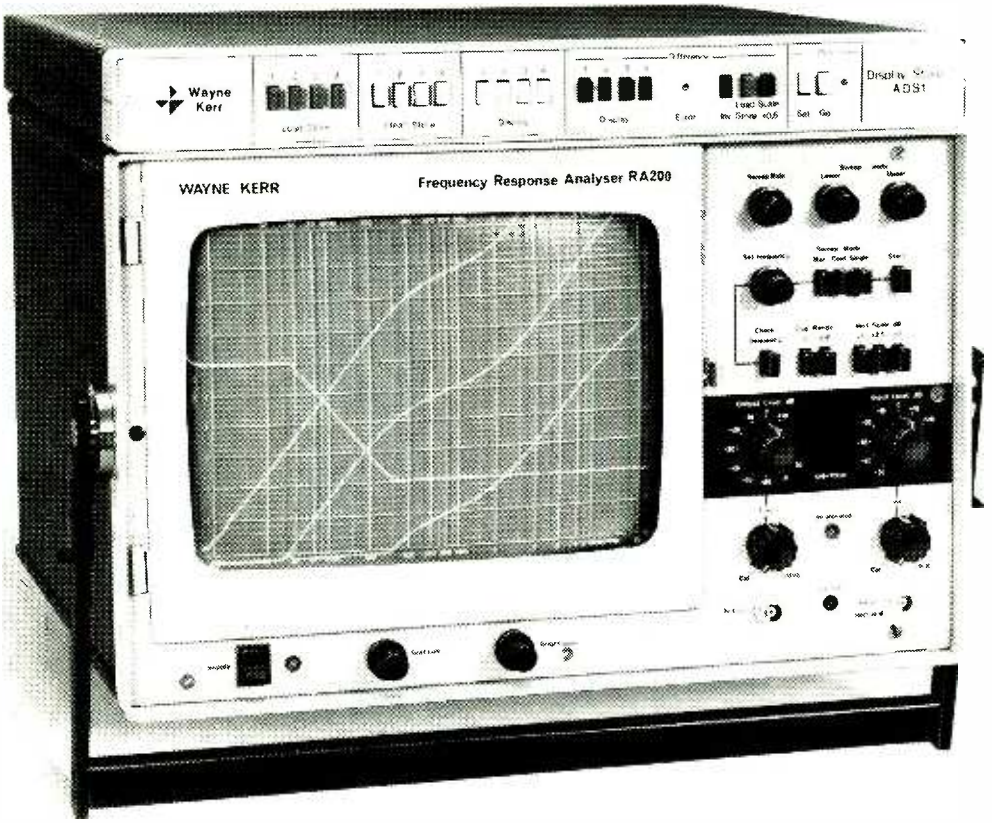
RA200/ADS1

Frequency response analysis with a difference



The Wayne Kerr RA200 / ADS1 is undoubtedly unique. It gives fast, accurate frequency response measurements for any audio system – displaying up to five different curves as gain / frequency plots on a long-persistance CRT. The basic unit, the RA200, performs all the detector and sweep functions, requires no synchronisation, and will adjust automatically to the incoming frequency.

Four Channel Digital Store

The matching display store, the ADS1, is a fully compatible digital storage unit powered by the RA200, and can give continual updating of each curve stored to ensure fast, precise readouts. It incorporates rechargeable batteries to permit stored data to be retained for up to two weeks when the unit is switched off.

The RA200/ADS1

This complete unit provides facilities for displaying the difference between any two stored curves, or comparison of any new input with a stored reference curve. Minor variations from a desired characteristic can be readily amplified, and departures from a linear response clearly shown as deviations from a straight line by use of the store 'invert'. Slow-acting pen recorders can also be driven by the unit.

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G & P Electronics AG, Bernerstrasse-Nord 182, Ch-8064 Zurich, Switzerland, Tel: 794670.

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Unitronics, Torre de Madrid, Princesa 1, Piso 12 Oficina 9, Madrid 8, Spain, Tel: 241 1496.

Scandia Metric AB, Back 171 19, Solna 1, Banvakssvagen 20, Sweden. Tel: 820460.

Please send me further information on the Wayne Kerr RA200 / ADS1.

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Address _____

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Wayne Kerr

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SS5/78

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There's an old mill by the stream

By the time you've finished reading this sentence, the name Cadbury will already have produced an image in your mind of, almost without doubt (you can see I'm giving you plenty of time) . . . chocolate.

Cadbury brothers Richard and George saw the potential of chocolate when they took over their father's failing enterprise in April 1861, and built the business up so successfully that it's no wonder we associate their name with chocolate. Now, Dik Cadbury, great grandson of co-founder Richard, has launched his own enterprise that has nothing whatever to do with chocolate products or the famous company producing them. He's built the 16-track Millstream Recording Studio in Cheltenham, Gloucestershire. But far from conforming to the aloof financier stereotype one may have expected, Dik Cadbury is primarily a rock musician; quiet spoken, rather shy, and totally committed to the studio.

The setup, adjacent to a public park in central one-way Cheltenham, comprises Dik's house originally built as a mill, and opposite the detached studio building which started life as the grain warehouse. The old mill stream runs between the two. Halfway up the narrow access road is a small but adequate car park. The studio idea came about almost by accident. 'I bought the house first,' explained Dik, 'and at that stage the warehouse, which had been used by two potters for some time, was up for sale as a pottery studio. To begin with I was looking for somewhere to rehearse: I didn't have a garage or a garden to build on, so I had a look around the pottery studio. I soon realised that the premises would need a lot of doing up, which would be expensive; so I would have to hire the place out as a rehearsal space, to pay for the renovation. Then it occurred to me that a greater return could be gained by converting the premises to a full studio capability, for a proportionately lower investment, taking into account the extensive sound-proofing necessary when building a rehearsal space. I then started to investigate the viability of the idea, and it all snowballed from there.' An architect was engaged, and work started in December 1976.

The studio building has been largely rebuilt and completely modernised both inside and out. Two independent air conditioning systems were fitted, regulating the studio and control room respectively, and the beige and chocolate (don't be daft—not *real* chocolate) decor is complemented by dimmer-controlled lighting.

The 32m² studio has a length-to-width ratio of around 2:1 with a low ceiling along roughly half the length, above which is the control room. The 20m² control room 'looks' into the studio underneath via a double glass panel and two large mirror panels mounted at an appropriate angle on the facing studio wall. A staircase connects the two levels, at the top of which is a coffee-making area and toilet. A payphone is conveniently situated at the foot of the stairs, alongside the studio entrance which is directly opposite the main building entrance.

Back in the studio, the hessian-faced walls conceal the talkback speaker, and the two reverse talkback mics connected in series situated at either end. The wall is built up on a 10 cm wooden frame supporting a random density *Rockwool* filling of between 5 and 10 cm thickness. This is supplemented by polythene sheet panels positioned at random underneath the hessian facing over 30% of the total wall area. The ceilings are coated with random perforated fibre-board. 'Our studio consultant was Roger Peyton,' said Dik, 'who's a very good bloke—he advised us on acoustical finishes and materials, suggested equipment, wired it in, and modified it where necessary. He's also our flying doctor if we ever experience serious technical problems.

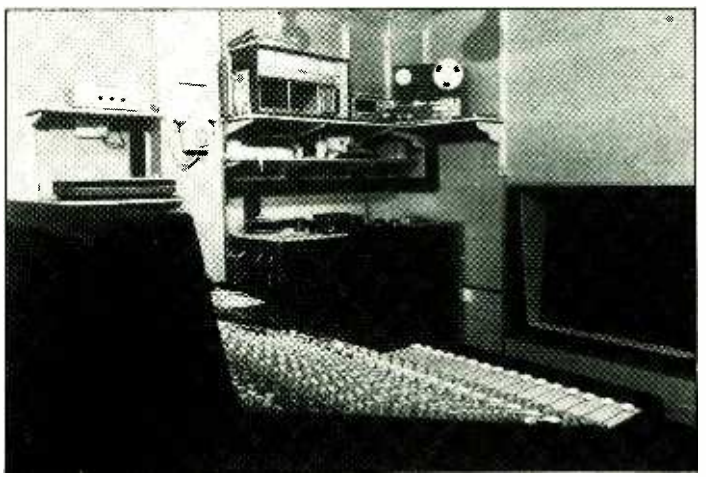
'The resident technician and second engineer is Jonathan March, who was the road engineer when I was with the Decameron band. He installed all the wiring and just about everything else, besides keeping all the equipment in good running order. He's recently made some isolation screens, should we ever need them.' (The four wooden framed screens were of a standard design; *Rockwool* filling with hessian one side and gloss painted chipboard the other.) 'Since we opened in December last year, we've achieved superb separation just by close miking and careful positioning. But I wanted the screens so that we were ready for a wide variety of recording requirements.' By positioning the vertical screens across the room's width the studio can be acoustically cut in half, visibility being maintained by perspex panels in the top sections of the screens. 'Were areas designated for particular instruments?' I asked. 'Not specifically,' returned Dik, 'The low ceiling area is naturally more "dead", and so tends to be used for drums. But we had a punk band in recently and the drums sounded better, in the punk sense, out in the "brighter" high ceiling area.'

In common with the control room hardware and wiring, the studio is plumbed for 24-track capability, between two 12-input mic panels. 'Right from the start we wanted to be sure we could expand easily,' commented Dik. Lavish servings of foldback decorate the walls at regular intervals, the panels housing a level pot and channel selector: 1 + 2 (stereo), 3 and 4. Beyer *DT100* cans hang on adjacent hooks. 'The armoury of mics, ranging from AKG *C414* and *C451* to Beyer *Soundstar* and Shure *SM58* all have their place, says Dik. And when the sun sets slowly in the west, that place is the store cupboard under the stairs which, if need be, could be quickly converted into a booth.

We left for the control room. On my way out, I was surprised to see a clock on the wall, a detail many studios prefer to omit! Both studio and control room doors were packed with Rockwool, and carpet faced on the operating side. Rubber seals on the frame cossetted the door on closure; this is effected by a slot in the frame of a few degrees off vertical and a sprung peg in the door actuated by a conventional lever handle. The combination thus operated on the linear screw principle. My criticism would be that to close you pushed down, and to open you pulled up; very confusing after a lifetime of doing it the other way round!

In the control room, Tannoy *HPD* monitors hang from runners mounted in a slide spanning the width of the room, an X-Y gimbal arrangement permitting omni-directional adjustment of monitor angle. These are powered by Turner *A500* amps installed in a standard rack system, which would otherwise have been empty, in an opposite corner. 'We hope to pack the rack with goodies like a Marshall *Time Modulator* and Rebis stereo compresser once the cash flow improves', said Dik, a man who does not lack foresight. A better example of his philosophy lies in the desk built by Solid State Logic which is kitted out for 16/16 operation. The desk takes the form of two 16-track capability input areas (only the left one being used) and an output, talkback, monitor select and mode-select central area. 'We installed this desk on the advice of Roger Peyton, making sure we could go up to 32/24 without buying a whole new frame, hence the blanked area on the right.' The desk came from Acorn Studios, whose manufacturing division is, in fact, Solid State Logic Ltd. Acorn are at present updating to 24-track with a completely new desk. Millstream's desk is apparently the first of its kind, and its compact appearance can be misleading. Each channel, costing the same as a Neve counterpart, boasts compressor/limiter (four of which are fitted), parametric eq, in-line monitor mix on faders, and solid state 32-channel input/output patching. Dik is keen to install vca fader grouping which can be simply plugged in (once again when funds permit).

The interior of Millstream's control room with the Scully 16-track sulking in the corner.



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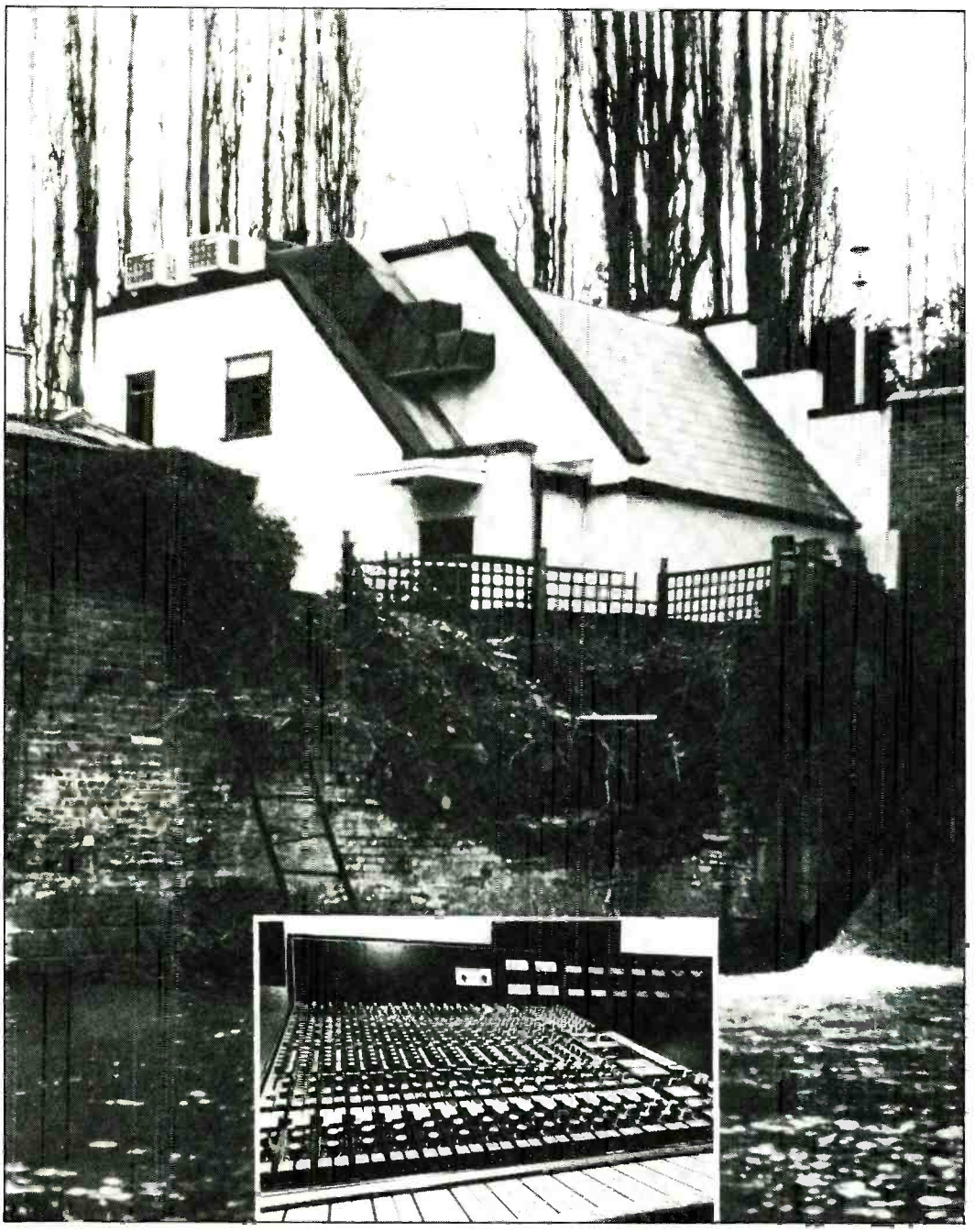
A patch panel fitted in the desk provides breakjack access to all inputs and outputs, and is consequently always in circuit. Studio vision is over the shoulder via the aforementioned double glass and mirror system, while primary tape machines stand to the right. These are the Scully 16-track and Studer *B62*. Above, high speed Revox *A77*, Beogram *1902*, and Pioneer (cassette) *CTF 2121* machines, plus a 24-track Dolby unit are shelved. At present the Dolby operates on the Studer and Revox machines only, but the plan is to Dolby the Scully soon, (the Pioneer cassette deck is fitted with integral Dolby *B*). The high speed Revox has been modified with a 14-turn vernier varispeed pot (!), permitting 100 per cent speed increase. Needless to say, the Revox machine's prime function is to provide time-based effects, but it also doubles for copies. Not all studios provide a transcription deck, and I put this to Dik. 'Our concern is to provide as complete a service as possible to the client. When installing the Beogram *1902*, which we considered was the best of its kind available, we knew that if and when clients brought test pressings in, we could check that stage rather than stopping at the master tape stage. We want people to look at the place and think, they've taken some trouble, they mean business; they haven't bought Otari or Teac, they've gone for the 'big' names with a proven track record, like Scully and Studer, albeit secondhand. And we took pains to achieve a high standard environment. A lot of 16-track studios in London that I've visited are very unpleasant to work in. They've got most of the gubbins, but really they're just holes in the ground when it comes to comfort. We've aimed to provide a pleasant alternative, still offering a high standard of quality.'

A feature of the Solid State Logic 16/16 board is the solid-state patching controlled by the rotary switches at the base of each channel module.



The resident engineer is John Acock, who spent a number of years at De Lane Lea, moving with them to The Music Centre in Wembley. He has an impressive track record, including work with Showaddywaddy and Steve Hackett (ex Genesis), for whom he has just finished engineering and co-producing an album in the States. 'Basically I've followed a policy of choosing experts carefully, and trusting them,' said Dik. 'I've every faith in John's basic ability as an engineer, as have a lot of other people. And Jonathan March, although he hasn't the same experience as John, is a competent second engineer with a natural technical gift. So I think my trust will pay off.' And how does Dik fit into studio operation, apart from holding the vital purse strings? 'I see myself as being more active on the artistic front,' Dik replies, 'moving ultimately into the area of production. I session in the studio on guitars and backing vocals sometimes, and help out on the desk. Other than that, I try to keep the whole thing together and make sure people get what they want.'

What of plans for the future? 'Our first priority is, naturally, to get studio bookings flowing healthily'. (Dik again) 'We've had interest shown by a record company whose acts are locally based, and we've just started contacting musician friends and associates. Once the studio picks up we could look at other ideas like launching our own label. But for the moment, we're aiming at the middle recording market. Studios in the area—names that spring to mind are Rockfield, Chipping Norton and The Manor—are all 24-track and charge much more per hour than we do. I think there must be a lot of musicians working in this area who don't want to spend that sort of money but want a high standard of quality without having to use a middle market studio in London.'

So Cheltenham, famous as the home of National Hunt Racing, Cheltenham Ladies College and (allegedly) gout-ridden ex-colonels, is all set to be put on the more modern maps as the home of a compact, comfortable 16-track recording studio. 'The next six months will tell me whether I'm right or not,' concluded Dik, '. . . but I think I am.'

Richard Dean

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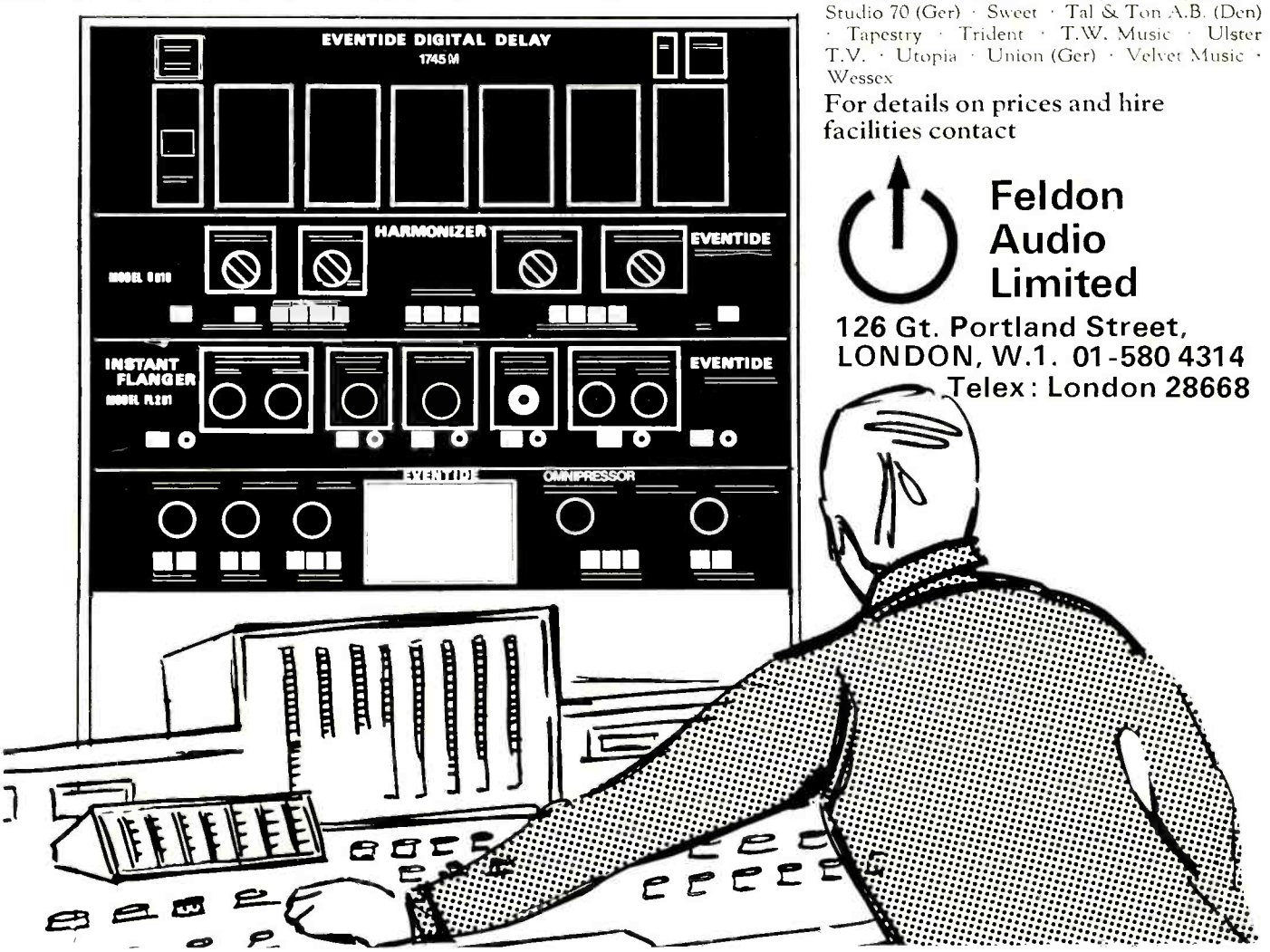

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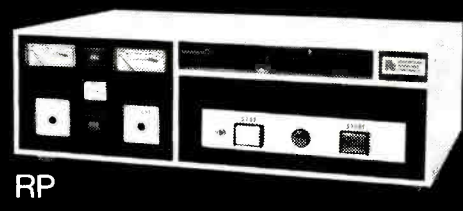

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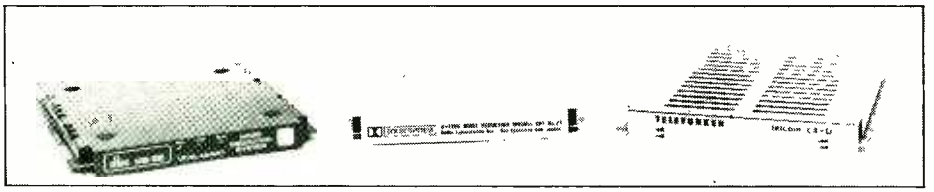
reviews

dbx K9-22, Dolby Cat 22 and Telcom c4D noise reduction systems

Hugh Ford



MANUFACTURER'S SPECIFICATIONS

	dbx	DOLBY	TELCOM
Input	>300k ohm.	10k ohm balanced floating.	—
Input level:	350 mV for 0 dBm.	350 mV min for 185 nWb/m (0 vu).	300 mV.
Output:	less than 1 ohm.	20 ohms for load ≧200 ohm.	—
Output level:	+22 dBm max into ≧200 ohm load.	+22 dBm max bridging +21 dBm into 600 ohm +20 dBm into 200 ohm.	+22 dBm maximum.
Frequency response:	+0, —0.75 dB, 30-15k Hz	±1 dB, 30-20k Hz.	30-20k Hz.
Total harmonic distortion:	0.1%.	At +8 dBm <0·1% @ 1 kHz <0·2% 40-20k Hz.	≦0·2%.
Noise reduction:	>30 dB.	10 dB, 30-5k Hz rising to 15 dB @ 15 kHz.	
Overall noise:	>—80 dBm at input.	record/replay 80 dB, ref 185 nWb/m 20-20k Hz.	≧94 dB signal-to-noise.
Signal delay:	16 μs.	24 μs code or decode.	—
Phase error	<5°, 20-20k Hz.	<5°, 20-20k Hz code or decode.	—
Record/replay accuracy:	±1 dB/20 dB.	±1 dB, 30-20k Hz.	—
Compression ratio:	2 : 1.	2 : 1 maximum.	1.5 : 1.
Number of bands:	1.	4.	4.
Internal oscillator:	none.	Dolby tone.	Telcom tone.
Price:	£155.	£220.	£367 (approx.)

STOP PRESS Since figure 1 (the block diagram of the dbx system) was prepared, we have been told that information in the handbook from which the figure was derived contained several inaccuracies. In particular, the upper bandpass filter (from 'record') in the figure should be labelled as having a range 22-32k Hz, and the range of the lower one 11-22k Hz. Consequently, the range of the bandpass filter in the replay side of the system should read 11-22k Hz.

ALL three of these noise reduction systems consist of plug-in boards which fit into the common Dolby noise-reduction system mainframes, such as the *360*, *361* or *M-Series* units. The intention is that the type of noise reduction system in use can be changed by just fitting alternative boards, which all draw their power from the Dolby mainframe. Similarly, the input and output signals use mainframe components such that it is first necessary to align the mainframe gain controls for use with Dolby. In fact, the Telcom system doesn't have any user controls, while the dbx *K9-22* card has three multiturn gain controls for the record, play and bypass modes.

All three systems use good quality components mounted onto double-sided printed circuit boards, with the Telcom system having far more components than Dolby or dbx. While neither Dolby nor Telcom systems have any preset controls, six factory preset controls are to be found on the dbx board, in addition to the three user controls already mentioned.

As will be seen from the following description of the principle of operation of the three systems, there are substantial differences in the degree of noise reduction and the means by which it is obtained.

dbx K9-22

Fig. 1 is a block diagram of the dbx system in the record and replay modes. Both modes use the same circuitry that is switched in order to achieve the record or the replay sequences shown in the diagram.

In the record mode the input signal is first passed through a bandpass filter, which has −3 dB points at 22 Hz and 32 kHz to eliminate spurious signals outside the audio frequency band affecting the compression of the wanted audio signal. It is then passed through a pre-emphasis stage that boosts high frequency signals by 12 dB. This pre-emphasis, together with a reciprocal de-emphasis in the replay mode, reduces the degree of modulation noise in the higher frequencies. This is based on the principle that modulation noise associated with even low frequency tones is wideband noise. Noise at frequencies near the tone will be masked by the presence of the tone itself but the higher frequency noise will not be masked. Hence the pre-emphasis will reduce the effect of the high-frequency modulation noise associated with lower-frequency tones.

The band-limited and pre-emphasised signal is then passed through a voltage-controlled amplifier to tape, the gain of the amplifier being controlled such that the signal to tape is compressed 2 : 1. The control signal to the voltage-controlled amplifier is derived from the signal-to-tape by first passing this through a 11-22k Hz bandpass filter. This removes unwanted out-of-band frequencies, particularly in the replay mode where excessive high-frequency response of the tape machine could cause mistracking of the decoder.

The 'clean' signal is then subjected to further pre-emphasis to compensate for the earlier signal pre-emphasis, and then fed to a true rms detector from which the control signal for the voltage-controlled amplifier is derived.

With the exception of the input filter, identical components are used in the replay mode. But in this instance the rms detector controls the voltage-controlled amplifier as a 1 : 2 expander,

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DMS5 Distortion Measuring Set. General Purpose

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The DMS5 is itended for general purpose use in the studio, test department, or factory and can measure to 0.001% T.H.D.

Both instruments cover the frequency range 10Hz-100kHz and are semi-automatic nulling. The instruments will operate from any signal source. Nulling to zero is automatic after the DMS has been accurately tuned to the test frequency. The instrument will thus continually read distortion whilst adjustments are made to equipment under test providing the test frequency is not changed.

EXISTING ITEMS

LDO3 Low Distortion Oscillator

A continuously variable frequency laboratory oscillator with a range 10Hz to 100kHz having virtually zero distortion over the audio frequency band with a fast setting time.

Specification:

Frequency range: 10Hz to 100kHz (4 bands)
Output voltage: 10V r.m.s. max.
Output source resistance: 150 ohms or 600 ohms (unbalanced)
Output attenuation: 0-100 dB (eight 10 dB steps plus 0-20 dB variable)
Output attenuation accuracy: 1%
Sine wave distortion: Less than 0.001% 10Hz to 10kHz (typically below noise of measuring instrument)
Square wave rise and fall time: 40/60 n.secs.
Monitor output meter: Scaled 0-3, 0-10 and dBv or dBm
Mains input: 110V/130V, 220V/240V
Size: 17in. (43cm) x 7in. (18cm) high x 8¾in. (22cm) deep

LDO3B Low Distortion Oscillator, balanced output

As LDO3 but additionally fitted with output amplifier and screened transformer providing a 600 ohm floating balanced output and 150 ohms unbalanced Unbalance: —80 dB 1kHz, —60 dB 10kHz.

ANM1 Audio Noisemeter, average sensing

ANM2 Audio Noisemeter, true r.m.s. reading

ANM3 Audio Noisemeter, Quasipeak/true r.m.s. reading

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Brief Specification for all noisemeters:

Frequency response as voltmeter: 4 Hz to 250 kHz, ±0.5dB
Input impedance: 1 M ohm shunted by 30 pF
Attenuator accuracy: 0.25%
Meter scale linearity: 1%. Typically better than 0.5%
Waveform error in true r.m.s. instruments: ±1% for crest factor 10
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CCIR
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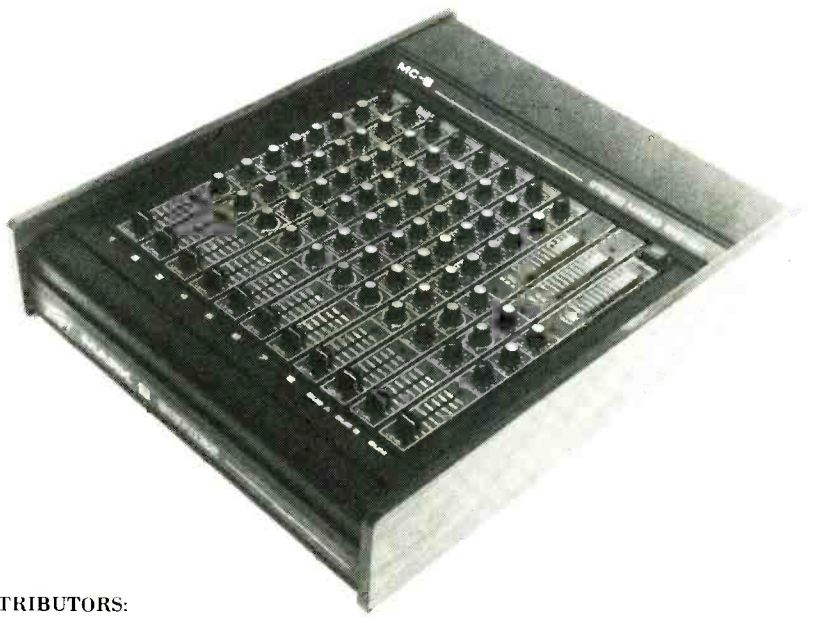

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thus restoring the original signal levels. As a result of phase shifting in the tape machine it is likely that the peak levels of the audio waveform will be distorted. Hence the use of an rms detector (which is not peak sensitive) is a very important feature of the dbx system.

Dolby Cat 22

As can be seen from **fig. 2**, the Dolby system has little similarity with the dbx system. In particular the Dolby system splits the audio frequency spectrum into four frequency bands, each of which has its separate control system. Referring to **fig. 2** it can be seen that the input audio signal is first passed through a 30 kHz lowpass filter to remove unwanted high-frequency signal that could affect the control system. The audio signal is then passed via a subtractor and an adder to the signal output, the noise reduction signal being added to the input signal in the record mode or subtracted from the input signal in the replay mode.

The output signal from the subtractor is passed through four separate chains, each of which produces a noise reduction signal for a particular frequency band and has rectifier time constants to suit. The top chain in **fig. 2** covers frequencies above 9 kHz, the next frequencies above 3 kHz and the bottom chain frequencies below 80 Hz. The fourth chain covers 80 Hz to 3 kHz by adding the below 80 Hz and the above 3 kHz bands, and subtracting this signal from the unfiltered signal.

Each band then has its own voltage-controlled amplifier that is controlled by the output from an 'average' rectifier. This has peak clipping and an optimised attack and decay time appropriate to the particular frequency band.

The four outputs from the voltage-controlled amplifiers are then added to form the noise reduction signal. This signal is not linear with relation to the input level of the four noise reduction chains, such that at both high and low signal levels there is no compression or expansion. At intermediate signal levels, however, the Dolby system acts as a 2 : 1 compressor or expander.

In order to locate this 2 : 1 part of the input/output characteristic at the correct signal level when decoding signals from tape, level standardisation is essential. Thus there is a built-in oscillator for recording the characteristic 'Dolby tone' onto tape, where 'Dolby level' is standardised at 185 nWb/m or Ampex operating level.

One large advantage over dbx system is that the Dolby system uses band splitting, such that the noise variations with signal level are restricted to the frequency band in which the signal exists. Thus noise is masked by the signal itself with the Dolby system, while with the dbx system the noise variations with signal level are wide band and not masked. On the other hand the dbx system offers a much larger noise reduction capability.

Telcom c4D

In some respects the Telcom system is a mixture of the dbx and Dolby systems, in that it is a band-splitting system like Dolby but with a constant compression/expansion curve that eliminates the need for accuracy in level settings.

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FIG.1 DBX BLOCK DIAGRAM

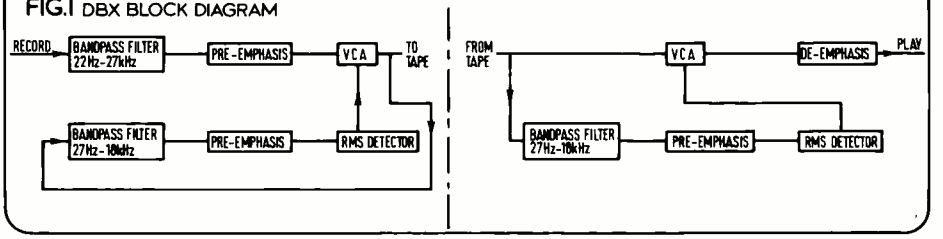


FIG. 2 DOLBY BLOCK DIAGRAM

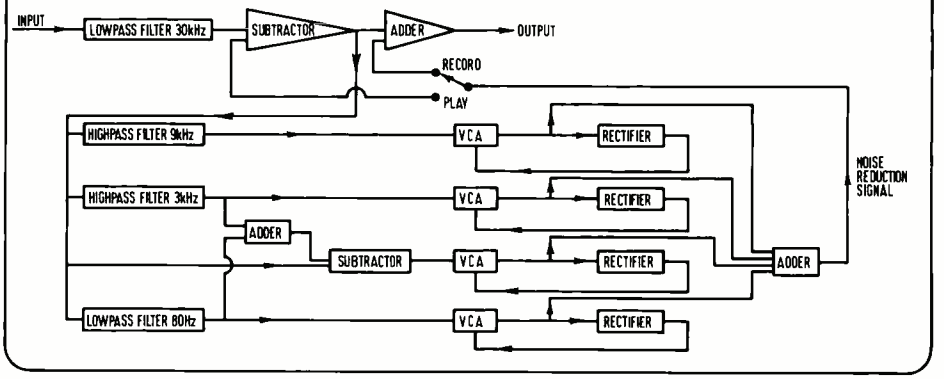


FIG. 3 TELCOM BLOCK DIAGRAM

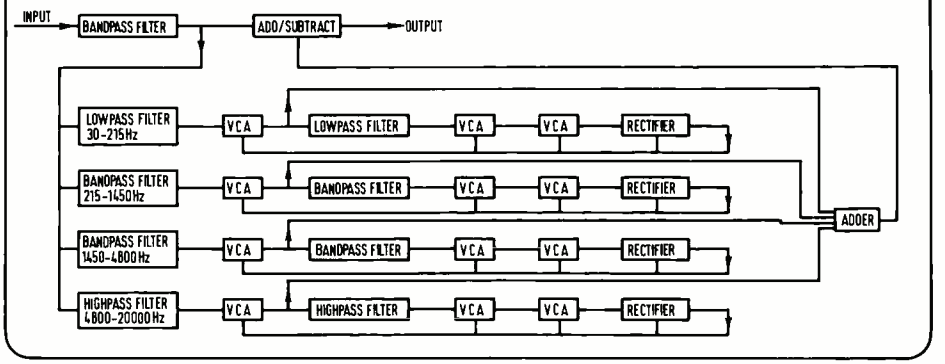
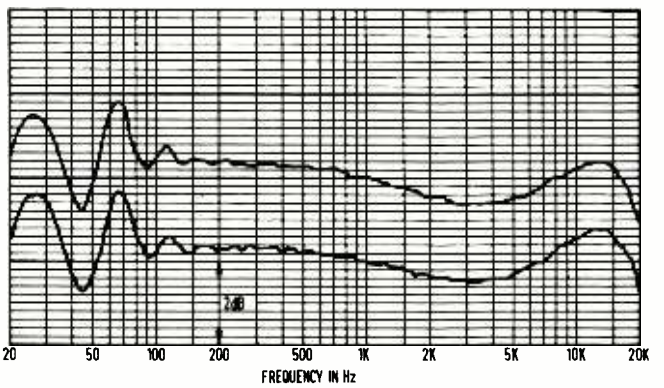


FIG. 4
AMPEX ATR-100 FREQUENCY RESPONSE AT 38cm/s (SEE TEXT)



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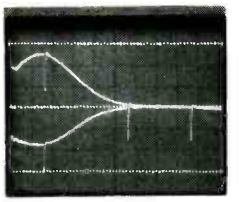
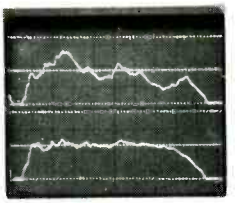
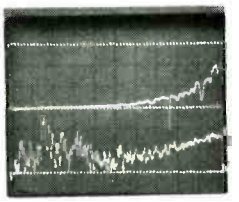
Oscilloscope photographs of some typical examples of plots made using the 4400 and an oscilloscope



Swept sine wave frequency response plot of the reciprical action of a low frequency equalizer. The small negative spikes are markers at 62Hz, 1kHz and 8kHz. The amplitude window between the top and bottom reference lines is 30dB, the horizontal axis is log 20Hz to 20kHz



Frequency response of the speaker and room in a monitor system. The top trace, with 40dB window between reference lines, is before equalization; the bottom trace after equalization. The source was pink noise and the plots were made using the spectrum analysis mode with a ⅓-octave bandwidth



Spectral analysis of the noise floor of a tape recorder playing back erased tape. A 2% filter bandwidth was used. Bottom reference line is -90dBm, top -30dBm. Second trace is phase shift versus frequency between two reproduced tracks. Top reference line is +180°, middle 0° and bottom -180°. The marker is at 4kHz in the 20Hz to 20kHz sweep

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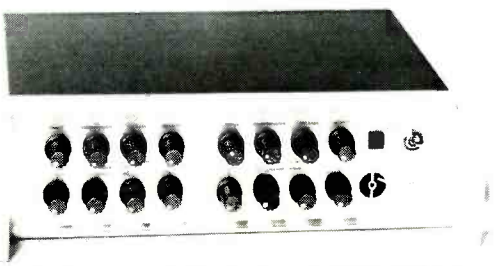

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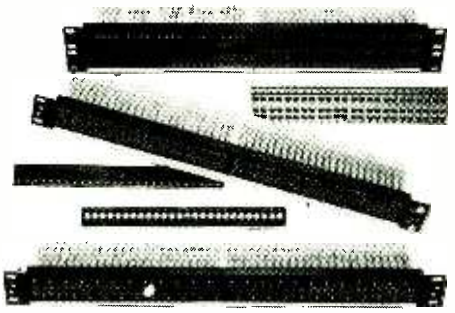

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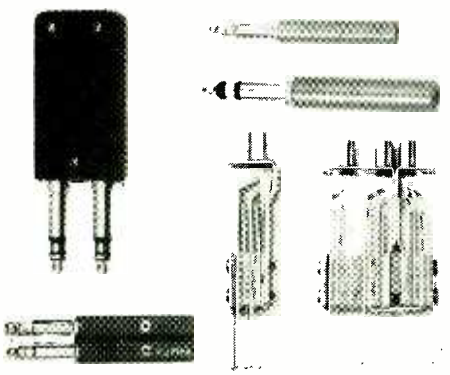

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Purely for the sake of identifying tapes that have been encoded with the Telcom system, the unit includes an oscillator which alternates between 550 and 650 Hz every half-second (unlike the Dolby level tone which is a frequency modulated tone). This oscillator is activated by the Dolby tone pushbutton on the Dolby mainframe.

Fig. 3, a block diagram of the Telcom system, shows that there is a considerable similarity to the Dolby system. The main signal path consists of an input bandpass filter followed by an adder/subtractor, which adds or subtracts the noise reduction signal from the input signal depending upon whether the unit is coding or decoding. Also the noise reduction signal is derived from four chains, each covering a discrete frequency band.

The Telcom frequency bands of 30-215 Hz, 215-1.45k Hz, 1.45-4.8k Hz and 4.8-20k Hz are different from the Dolby system. In addition, each band is filtered separately, as opposed to the adding and subtracting arrangement in Dolby. Each band filter is, in fact, a 6 dB/octave

78 ▶

FREQUENCY RESPONSE (SEE TEXT)

FIG. 5
DBX

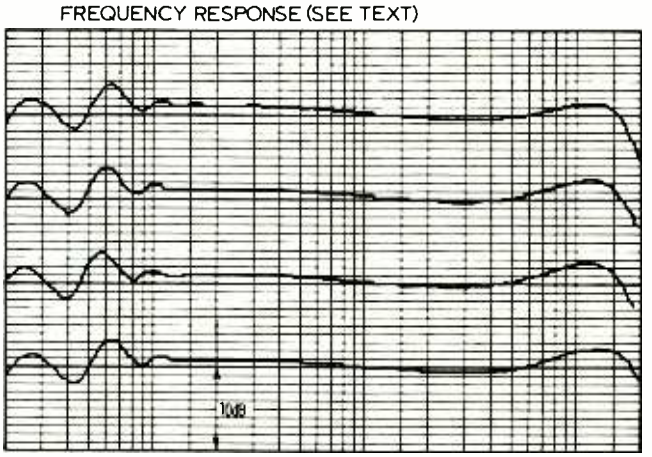


FIG. 6
DOLBY

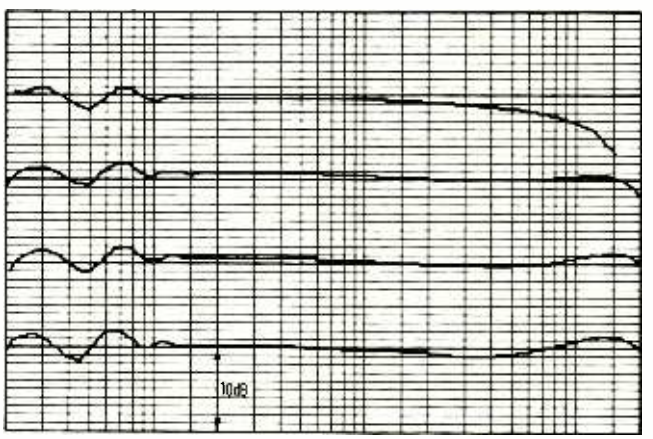
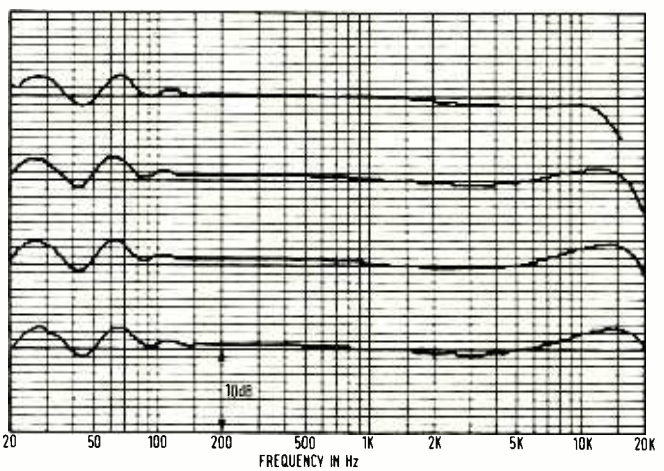


FIG. 7
TELCOM



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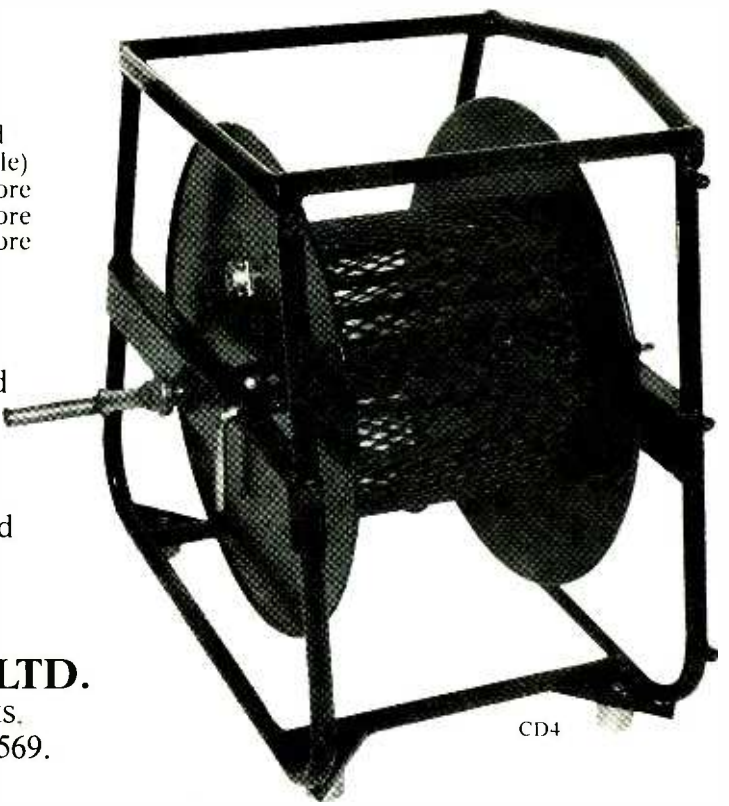

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filter arranged such that there is an overlap between the bands. Each filter output is fed to a voltage-controlled amplifier and thence to an adder that produces the noise reduction signal for the adder/subtractor.

The control signal for the voltage-controlled amplifiers is derived from a rather complex arrangement. The first stage is a 12 dB/octave filter which, in combination with the previous 6 dB/octave filter, defines the control bands precisely, and thus reduces noise breathing that would result from out-of-band signals getting into the control system. The subsequent arrangement of voltage-controlled amplifiers followed by a peak-sensing rectifier effects a control system that gives a 1.5 : 1 compression/expansion ratio. This remains linear over a wide dynamic range, thus eliminating the need for accurate level setting.

General differences

To summarise the above, we have the dbx system that offers up to 30 dB noise reduction in addition to an improvement in headroom using a 2 : 1 constant compression. It is a wideband system—and thus does not take advantage of the masking effect—and is potentially subject to noise-breathing effects.

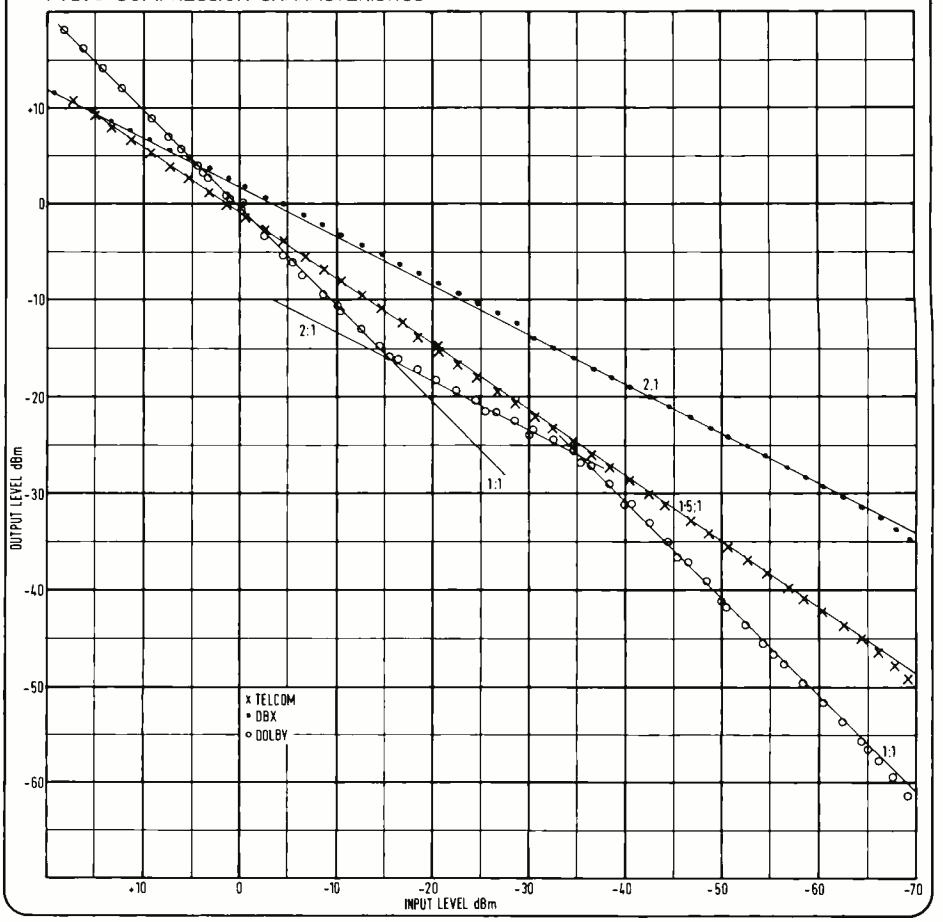
The Dolby system offers about 11 dB noise reduction without any improvement in headroom. However, it is a 4-band system that takes advantage of the masking effect and is less likely to suffer from noise-breathing effects. The compression slope is not constant, being 1 : 1 at high and low signal levels but 2 : 1 at mid levels, making it critical to set the 'Dolby level'.

Thirdly, we have the new Telcom system which, like Dolby, uses the masking effect with its four frequency bands, but has a 1.5 : 1 constant compression. Noise reduction is about 25 dB and there is an improvement in headroom.

From the point of view of print-through, the dbx system offers the best performance, followed by Telcom and Dolby; but considering modulation noise the Dolby and Telcom systems should be advantageous. Of course, frequency response errors in the tape machine will be magnified with all systems in proportion to their compression ratio. It is here that the Telcom system clearly offers an advantage because of its 1.5 : 1 compression ratio and lack of need for an alignment level.

80 ▶

FIG. 8 COMPRESSION CHARACTERISTICS



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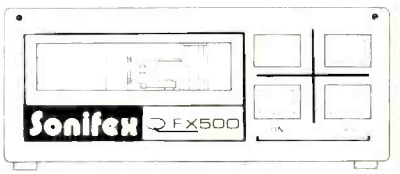

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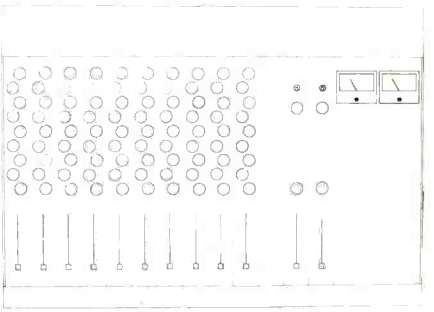

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Performance

The three systems were evaluated using an Ampex *ATR-100* tape machine equipped with a stereo headblock and equalised to the CCIR standard of 35 μs at the tape speed of 38 cm/s. The machine was biased and equalised for 3M *Scotch 206* tape that was used for all tests.

Initially the Dolby *Cat 22* board and mainframe were adjusted for the normal Dolby level of 185 nWb/m. The dbx *K9-22* card was then adjusted in the record, replay and bypass modes for unity gain at −4 dBm (0 vu), which corresponded to 320 nWb/m or approximately 4 dB above Dolby level.

The Ampex *ATR-100* frequency response was practically identical for both channels, as shown in **fig. 4** for a recording level −20 dB with respect to 320 nWb/m. The resulting record/replay frequency response for the three noise reduction systems was then plotted at 10 dB increments from −10 dB above 320 nWb/m to 20 dB below 320 nWb/m, as shown in **figs. 5, 6** and **7** for dbx, Dolby and Telcom respectively. Inspection of these figures shows that the frequency response errors in the *ATR-100* are magnified to the anticipated degree at lower levels, with the dbx system introducing the largest errors and the Dolby system the least. At the −10 dB recording level the dbx system gave distinct advantages at high frequencies, with the Dolby system and its 1 : 1 ratio at this level leading to compression effects from tape.

The compression characteristics of the three systems are shown in **fig. 8,** which depicts the record input and output of the noise reduction systems. It can be seen that all three systems follow their theoretical curves to within a fraction of a dB over the range of inputs from 10 dBm to −65 dBm. Below this instrumentation errors account for the deviation from the theoretical curves.

Measurement of third harmonic distortion at a recording level of 320 nWb/m for the *ATR-100* alone and with each of the three noise reduction systems showed significant differences. (**figs. 9, 10, 11** and **12**). It can be seen that the dbx system achieves a very significant improvement between 80 Hz and 5 kHz, but that below 80 Hz the distortion is substantially worse. Similarly, the Dolby system makes matters slightly worse at low frequencies, but makes little difference at other frequencies. Telcom also makes little difference at higher frequencies but generally improves matters in the bass region.

Measurement of the intermodulation distortion to the CCIF method was carried out using two tones separated in frequency by 70 Hz and examining the third-order difference frequency distortion component. The results reveal that at a recording level of 320 nWb/m the Dolby system made no significant difference but, as is to be seen from **fig. 13,** the dbx system offered a significant improvement at high frequencies. The Telcom system, on the other hand, deteriorated the distortion to a significant extent above 4 kHz, as well as increasing the lower frequency intermodulation distortion.

The effects of applying a sudden burst of

82 ▶

FIG. 9
ATR-100

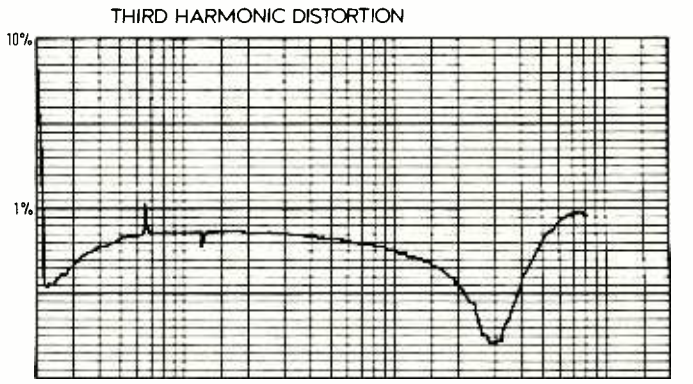


FIG. 10
DBX

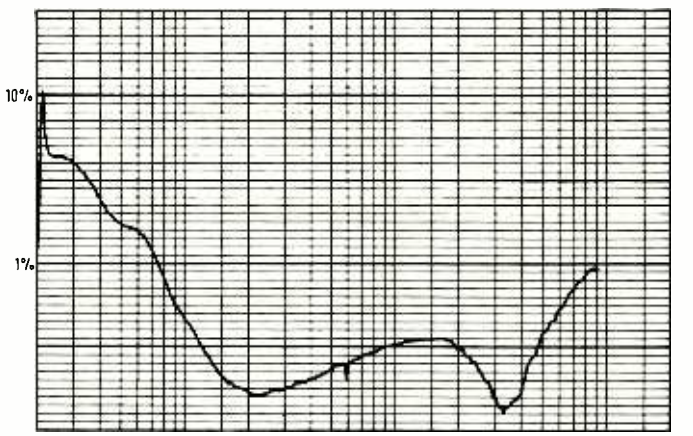


FIG. 11
DOLBY

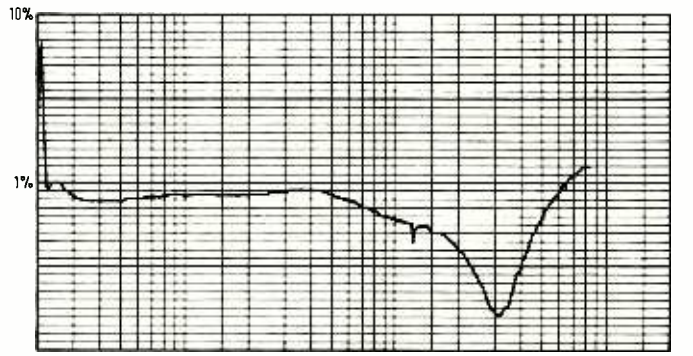
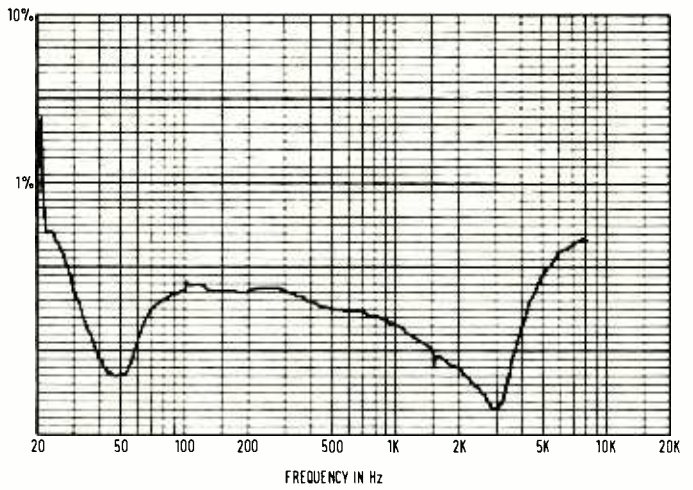


FIG. 12
TELCOM



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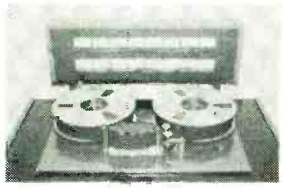

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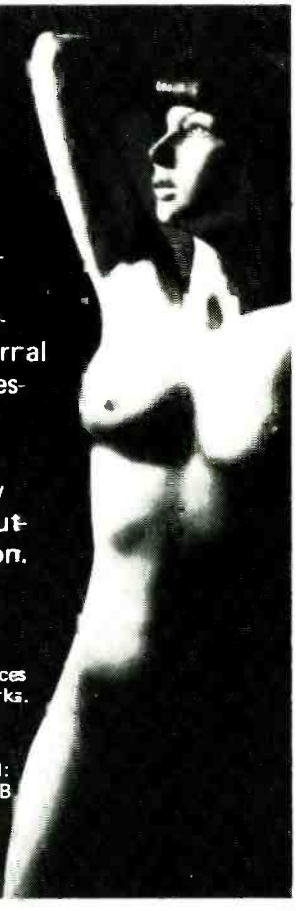

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4 kHz tone at 0 dBm level starting at the zero crossing point of the waveform is shown in **figs. 14, 15** and **16.** It can be seen that the dbx system has a very considerable overshoot, Dolby a small overshoot and a clean attack, and the Telcom system a unidirectional overshoot plus a slight droop at the onset of the burst. It is felt that the dbx overshoot is excessive and that this could be troublesome with the electronics of some tape machines.

A similar exercise, but via tape this time, was to apply a constant-level 1 kHz signal and then to apply a 4 kHz burst 20 dB higher in level for a period of approximately 8 ms. The resulting replayed waveform for the dbx, Dolby and Telcom systems are shown in **figs. 17, 18** and **19** respectively. It can be seen that all systems gave fairly 'clean' results, but that dbx took almost 6 ms to stabilise the burst level and Telcom left a small spike at the end of the burst.

Turning to the noise reduction capability of the systems, tape was recorded via the systems without any input signal and then replayed with and without the noise reduction in circuit

TABLE 1 NOISE REDUCTION

	dbx	Dolby	Telcom
A-weighted rms CCIR-weighted ref	29.5 dB	10.8 dB	24.7 dB
1 kHz quasi-peak CCIR-weighted ref	30.0 dB	11.0 dB	25.7 dB
1 kHz rms	29.7 dB	10.7 dB	24.9 dB

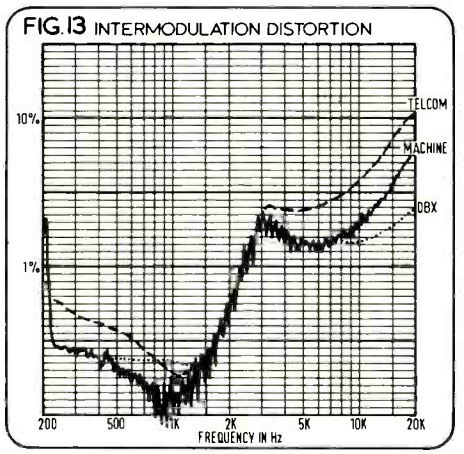


FIG. 14 dbx K9-22,4 kHz tone burst to 0 dBm. Horizontal scale: 20 ms/division.

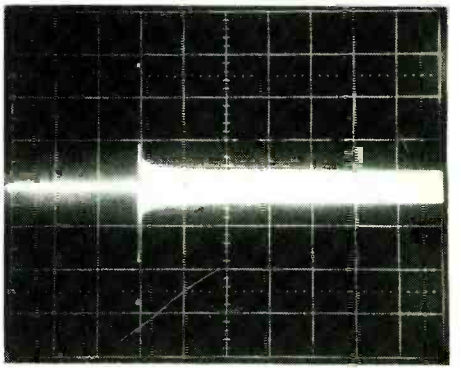


FIG 15 Dolby Cat 22,4 kHz tone burst (as **fig. 14**).

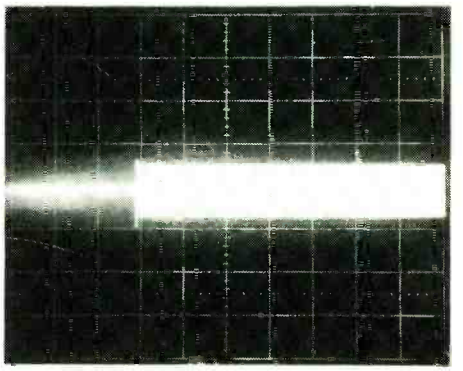
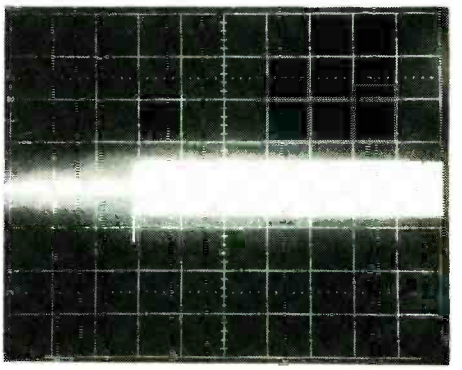


FIG. 16 Telcom c4D,4 kHz tone burst (as **fig. 14**).



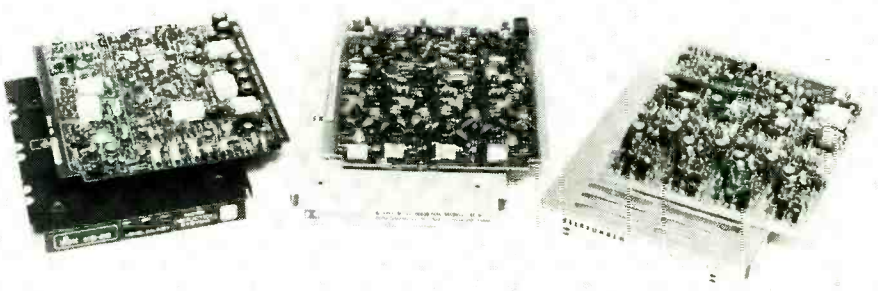


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FIG. 17 dbx K9-22,1 kHz signal with 4 kHz tone burst (see text).

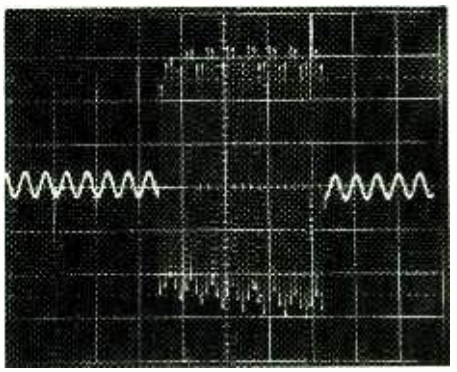


FIG. 18 Dolby Cat 22,1 kHz/4 kHz tone burst (see text).

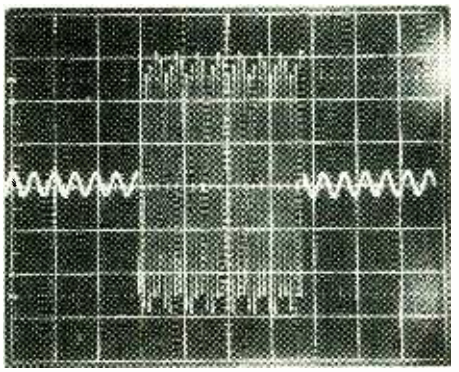
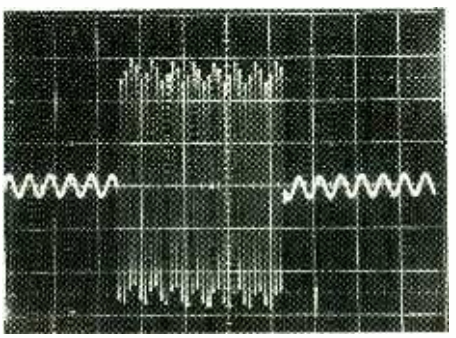
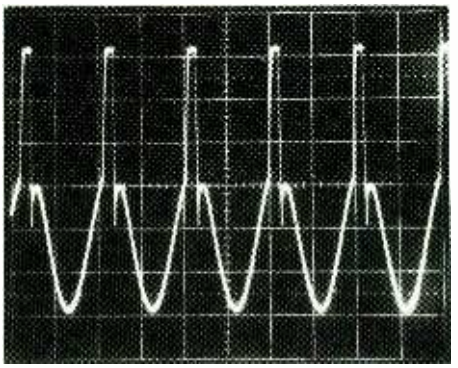


FIG. 19 Telcom c4D,1 kHz/4 kHz (see text).



(**table 1**). At first sight it appears from the figures that the dbx system gives the most noise reduction. However, this depends, in fact, upon the noise performance of the machine with which it is used and upon the adjustment of levels in the Dolby mainframe. With the system gains adjusted as described, the performance of the dbx system was limited by its own noise performance; a comparison on normal bias/erase noise from tape, with and without the noise reduction systems in circuit, resulted in the output

FIG. 20 Telcom c4D, record overload for 1 kHz sinewave (see text).



noise levels given in **table 2.** It can be seen that under the measurement conditions used, the Dolby system gave in round figures 10 dB noise reduction in comparison with machine/tape noise, the dbx system 18 dB and the Telcom system 25 dB.

In practice the dbx system records more noise onto tape in the absence of an input signal (as do the other systems to a limited extent) and this factor reduces the subjective effects of noise breathing.

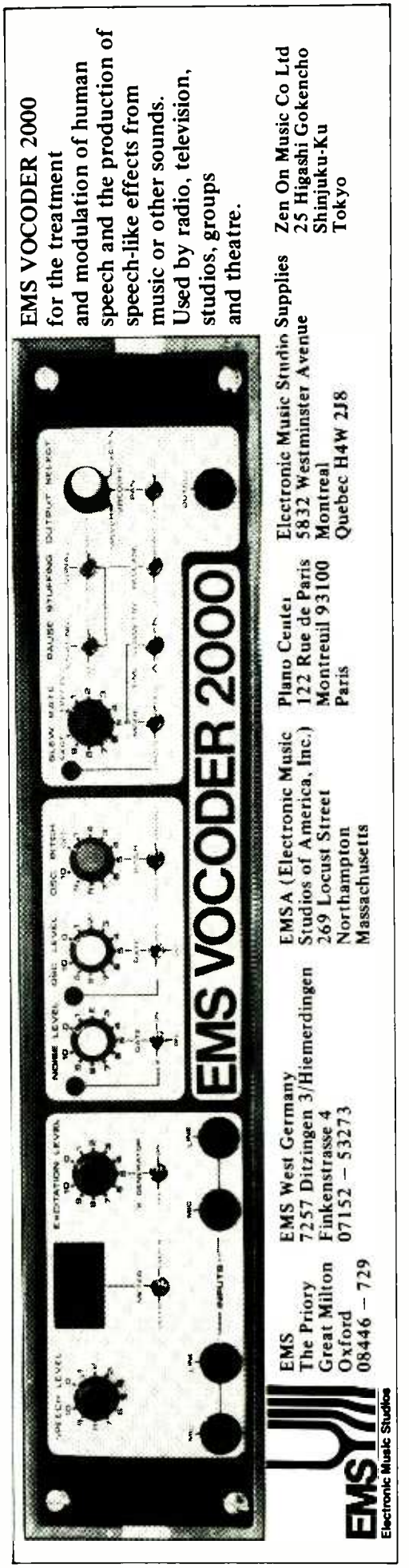
In addition to the noise level, the maximum output level available in the record and replay modes is, of course, important. Here the Dolby system gave +19 dBm output from the mainframe at the onset of clipping into either an open circuit or a 600-ohm load. Dbx gave +18 dBm in the play mode or +12 dBm in the record model—a satisfactory combination in view of the 2 : 1 slope of the system's compressor/expander—while Telcom gave a similarly satisfactory performance with +18 dBm in replay or +11.5 dBm in record. However, overloading the Telcom system in the record mode gave very nasty and severe distortion, as shown in **fig. 20** for a 1 kHz sinewave.

Returning for a moment to the noise reduction performance, the noise spectrum was investigated by feeding each system with white noise at −30 dBm and then examining the noise output spectrum with and without a 1 kHz sinewave signal at 0 dBm. Thus the noise spectrum with and without an input signal was examined, as shown in **figs. 21, 22** and **23** for the dbx, Dolby and Telcom systems. It can be seen from **fig. 21** that the dbx system just shifts the noise spectrum in level over the complete audio band; the noise spectrum having less density at high frequencies due to the inbuilt pre-emphasis and de-emphasis. On the other hand, the Dolby system exhibits little change in the noise spectrum at high and low frequencies due to the band splitting system, but alters the noise level in a band about the signal frequency. Telcom gives a similar effect to that shown by Dolby, but would appear to be slightly more likely to give noise breathing since the level of the complete noise spectrum is shifted slightly upwards in level.

84 ▶

TABLE 2 OUTPUT NOISE OFF TAPE

	no noise reduction	dbx	Dolby	Telcom
A-weighted rms	−63 dBm	−81 dBm	−74 dBm	−88.5 dBm
CCIR-weighted quasi-peak	−49.5 dBm	−66.5 dBm	−60.3 dBm	−75 dBm
CCIR-weighted rms	−54.5 dBm	−72 dBm	−65 dBm	−80 dBm



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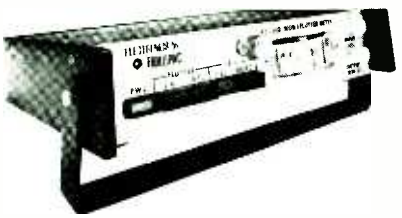

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Listening tests with various types of material confirmed that the Dolby system was the least prone to noise breathing, followed by Telcom and dbx. This order of merit also applied to modulation noise associated with high-frequency recordings, where the Telcom system definitely appeared to be inferior to Dolby. This finding correlates with the different noise spectra exhibited by Dolby and Telcom and although the filter shapes were not investigated, it would appear that the Dolby system has better separation between the found frequency bands.

So far as replay noise is concerned, the Telcom system was by far the quietest using the Ampex *ATR-100* with the levels adjusted as described earlier in this review. As expected the Dolby system gave the least noise reduction.

Unfortunately, listening tests were limited by both lack of time to use the systems and also the inability to make a/b comparisons, so it was not possible to make detailed comparisons. However, none of the three systems were found to have faults such as exhibiting clicks or other similar peculiarities associated with compressors. Undoubtedly 'fine' listening tests will reveal differences between the systems in terms of sound quality, but from the work done it would appear that the most expensive Telcom system offers very good noise reduction which can exceed that of the dbx system. The differences between Dolby and dbx are fairly well known, and I would recommend anyone who has the money available, to give serious consideration to the Telcom system if they want the noise reduction capability of dbx together with the subjective performance of Dolby. ■

NOISE SPECTRUM

FIG. 21
DBX

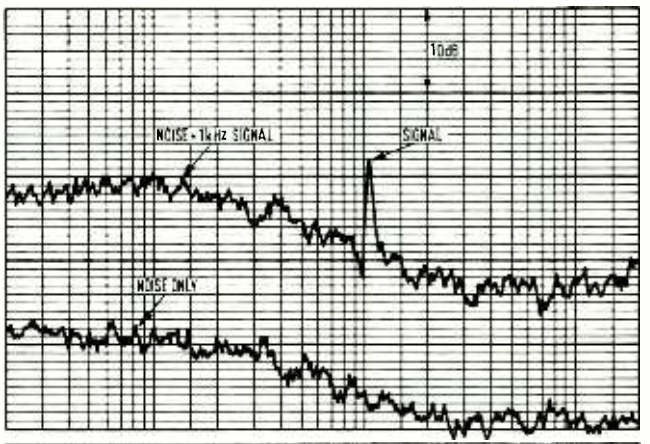


FIG. 22
DOLBY

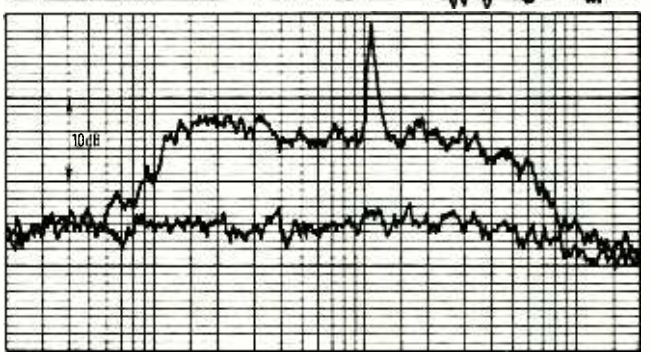
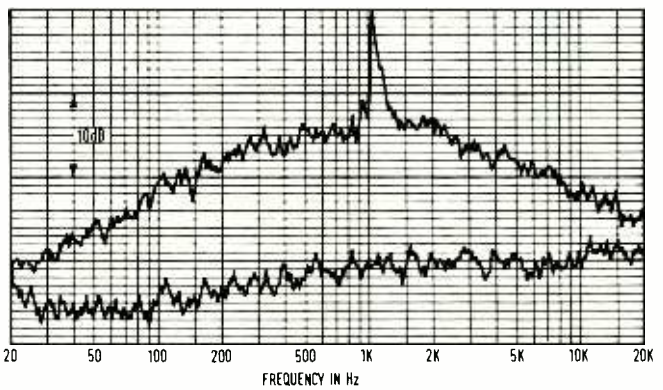


FIG. 23
TELCOM



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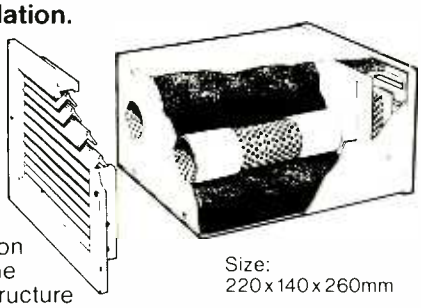

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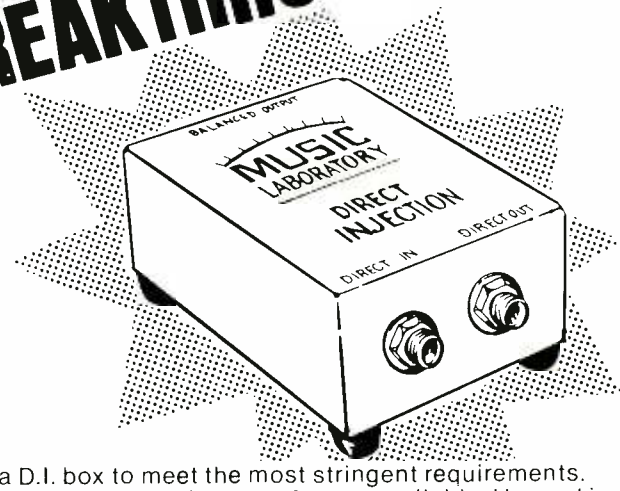

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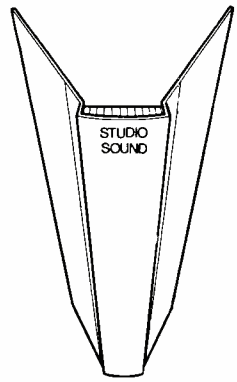

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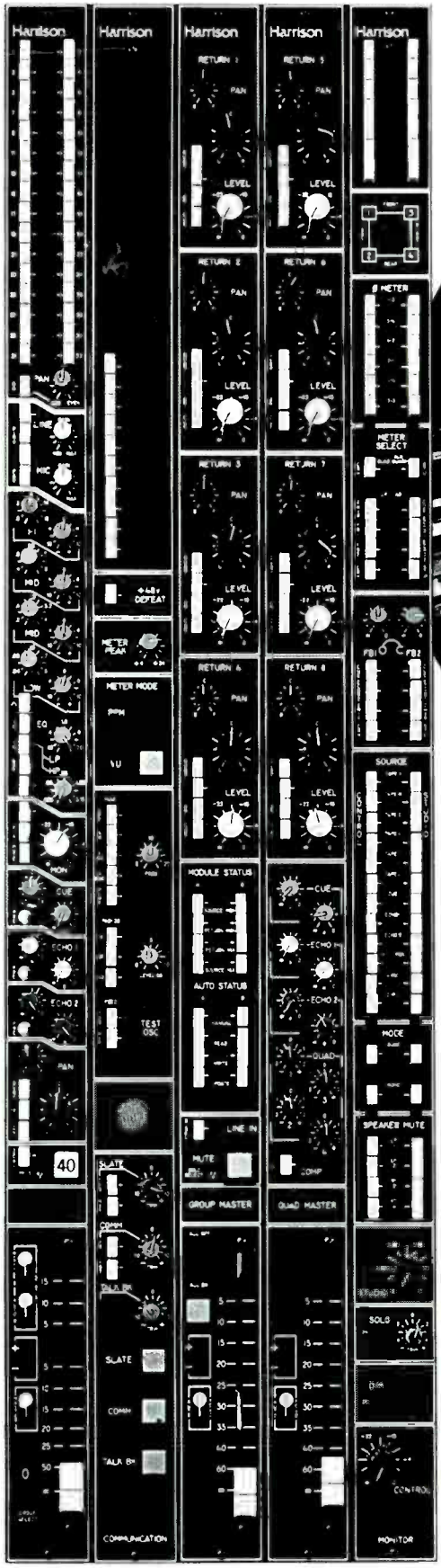

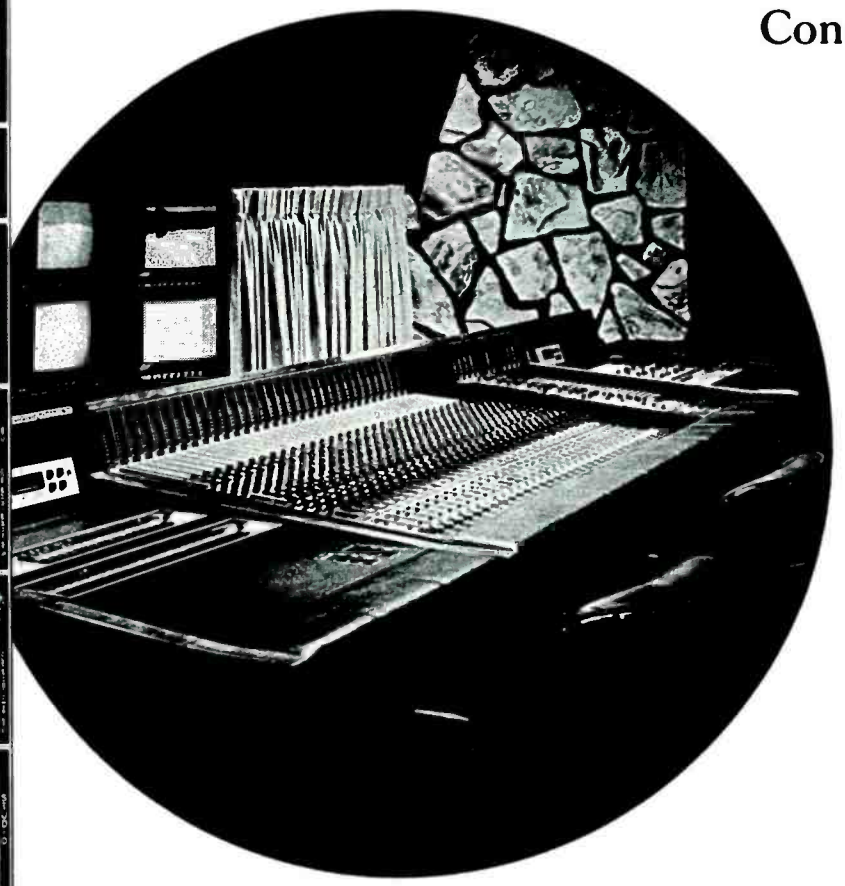

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