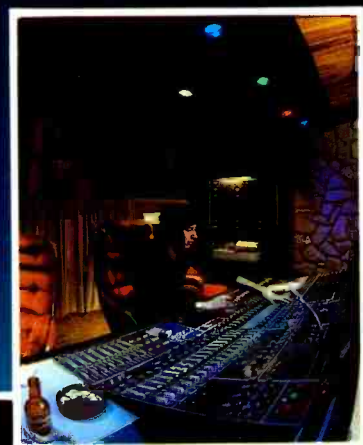


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April 1983 £1

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AES Eindhoven preview**



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EDITORIAL

EDITOR: RICHARD ELEN
DEPUTY EDITOR: KEITH SPENCER-ALLEN
PRODUCTION: ANN HORAN
LINDA FIELDHOUSE
CONSULTANT: HUGH FORD
SECRETARY: CARRIE LOVE

ADVERTISEMENT

GROUP EXEC MANAGER: PHIL GUY
ASSISTANT MANAGER: MARTIN MILES
SECRETARY: AUDREY SLATFORD
PRODUCTION: JACKY THOMPSON

PUBLISHER PAUL MESSENGER

Editorial and Advertising Offices:
LINK HOUSE, DINGWALL AVENUE,
CROYDON CR9 2TA, GREAT BRITAIN

Phone: 01-686 2599

International: + 44 1 866 2599

Telex: 947709

Telegrams: Aviculture Croydon

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A LINK HOUSE
PUBLICATION



MEMBER OF THE AUDIT
BUREAU OF CIRCULATIONS

This month's cover has an international flavour, showing Kritz International, Belgium (top left); Eurosonic, Spain (top and centre right); Metronome, Denmark (centre left); Studios 301, Australia (top and bottom centre); and Unicorn, Nevada (bottom left).

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Showing new wares

Up comes another AES—the European AES show in Eindhoven. I wonder how the new format for AES Conventions is being regarded. I seem to remember that there was a fair spread of opinion as to whether there should be two or one US Conventions per year—those in favour of one have succeeded for the time being. The real question is how good an idea it has turned out to be.

The first thing that I think a fair number of people will have noticed is the increased attendance of *recording* manufacturers at last year's NAB Convention in Dallas. Of course, broadcast audio is an area that is increasing in importance—that is why we've introduced *Broadcast Sound*, after all. Several manufacturers now offer products that are tailored for both markets, or separate versions for the two areas. But how many of those manufacturers were there at NAB because one of the US AES Conventions was missing? A good question. I still feel that the two annual Conventions had quite different characters and functions, but now you only get one or the other. I know that some manufacturers were concerned, in these times of recession, about the amount of expenditure and effort required to gear up for two American shows as well as, in some cases, a European one. These days you have to work much harder to stay where you are. But AES Conventions are prime selling occasions: how many manufacturers badly need that extra opportunity for promotion in these difficult times? The other side of the coin—the Convention attendees—should also be considered. It is seldom these days—again, recession takes its toll—that the average studio can afford to send a representative across the North American continent to see what's new. 'Regional Conventions' are an idea that has been suggested, but it is difficult to imagine that the majority of manufacturers would support anything other than a full-sized Convention. Overall, it's a triangle of forces, in which the major force is that of economics. Manufacturers need to sell, so they need the Conventions. But exhibits are expensive—can they afford them? And these days, can visitors in general afford to attend other than reasonably

local Conventions? It is perhaps time for the AES to consider another poll on the subject of Conventions in general. If this were also tied up with organisations like SPARS and the APRS—representing many visitors who are not AES members—it would provide welcome pointers to how the industry can best communicate among its different parts—sellers, buyers, innovators, artists, engineers and everyone else involved in the audio arts—to mutual advantage. The AES Conventions are a vital part of this communication.

On a slightly different tack, I have wondered from time to time about the European Conventions. The attendance sometimes seems to be a little disappointing on both sides of the exhibition stand, compared with the US events. Europe is an important centre of the industry, and it needs an AES Convention. But often they are quite difficult to get to. Remember Montreux last year? Eindhoven isn't going to be plain sailing either. And I believe it is transport at the heart of this problem. The US Conventions are—in New York and Los Angeles—a direct flight from nearly everywhere: a direct flight and a cab journey. Montreux isn't; Eindhoven isn't; for American visitors, I don't believe Hamburg is, either. There is a lot to be said for holding AES Conventions in locations which are at the end of a *direct flight* from the world's major audio centres. New York and LA are; so are London, Paris, and a rather limited selection of other European cities. Last year, it was more difficult getting from London to Montreux than it was to get from London to either American location. The fact that the European expo moves around doesn't help either. Manufacturers and attendees alike know all the procedures for shipping gear and themselves to LA or New York; for the European Conventions it's a different setup every time. It would be worth considering *fixing* the European location in a major recording centre—London is an excellent idea, and not just because we live here! You can get a direct flight here from absolutely anywhere, and everyone knows where it is. What do you think?

Richard Elen

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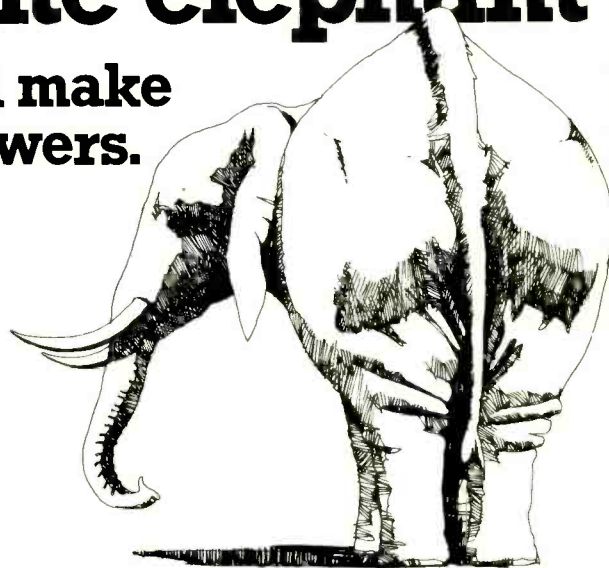
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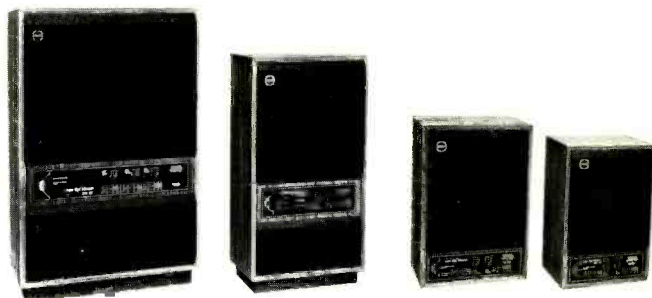


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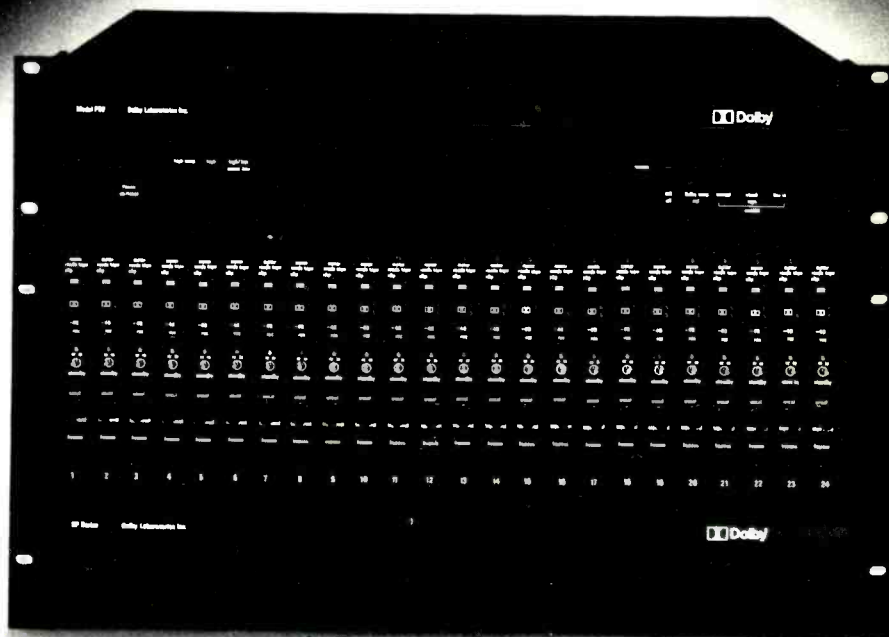


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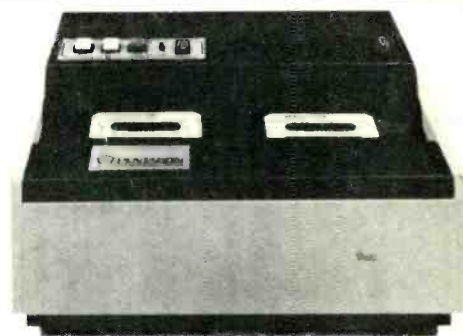


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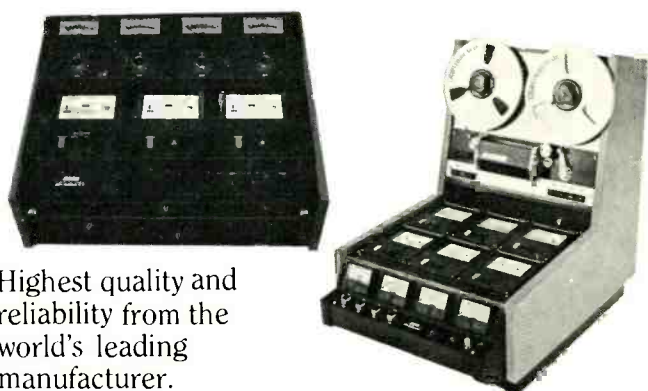
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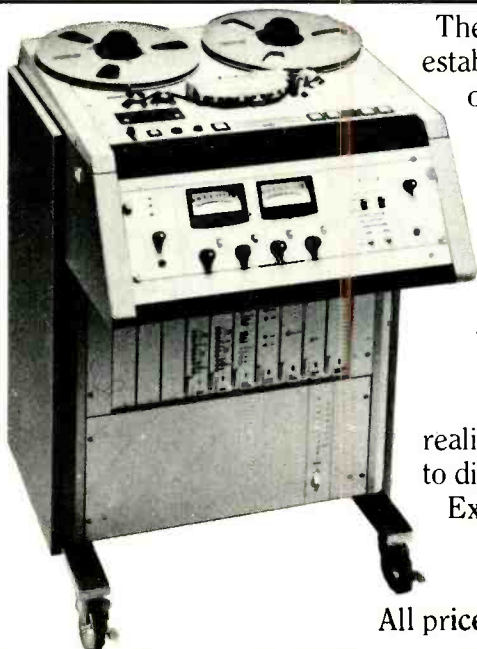
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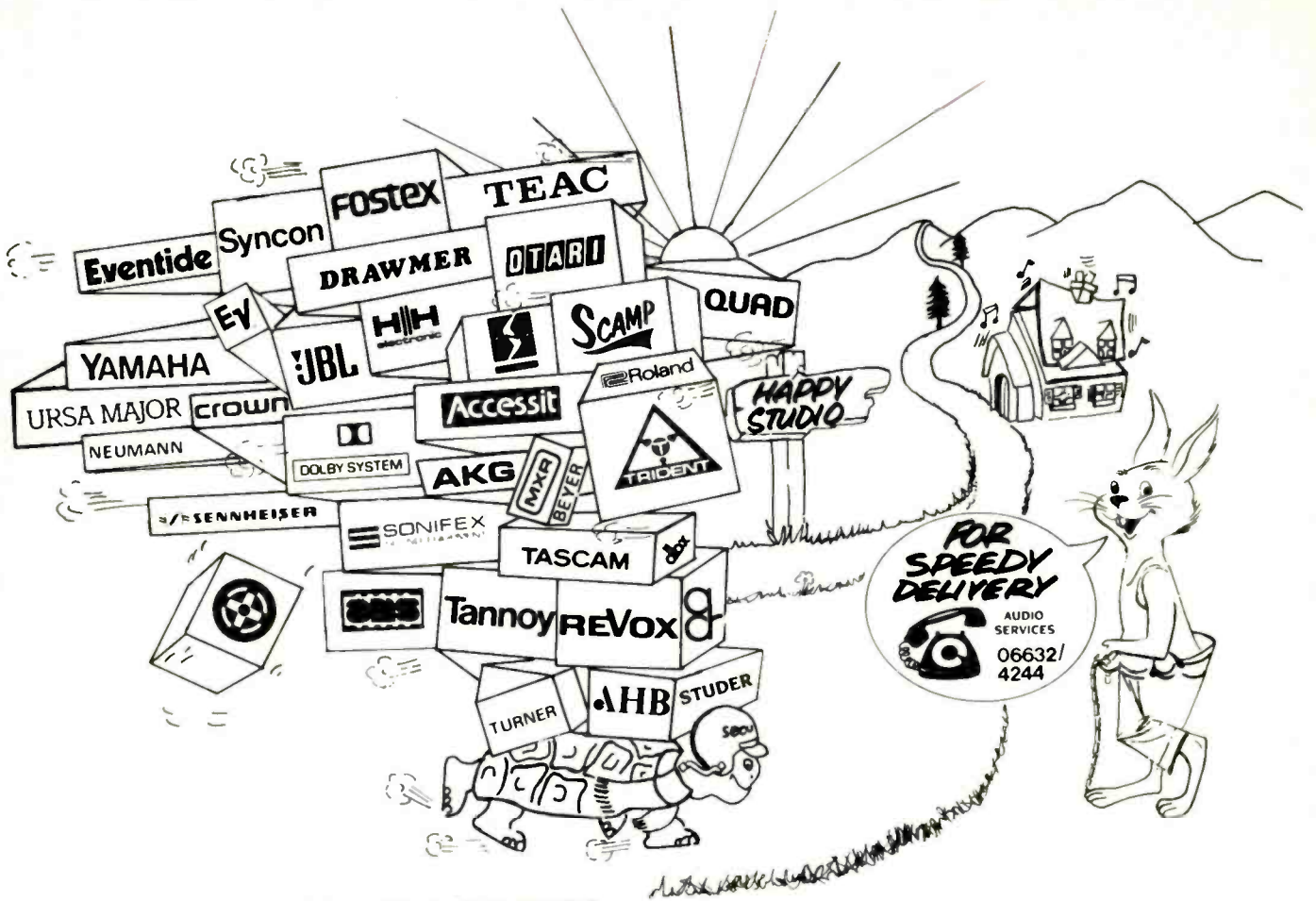


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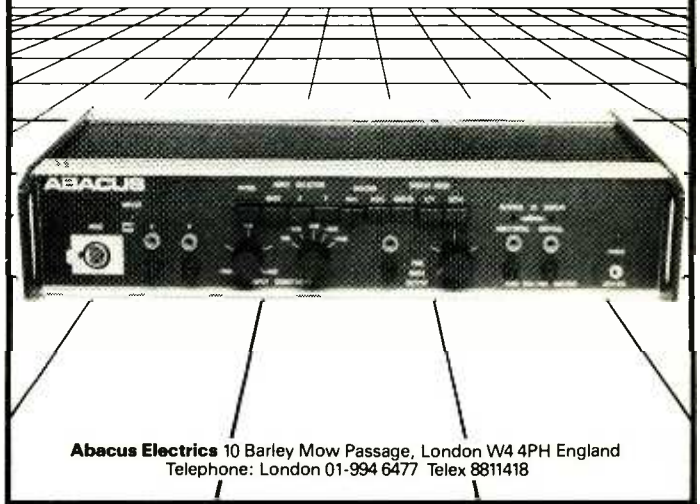
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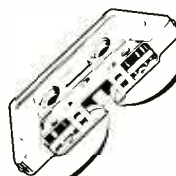
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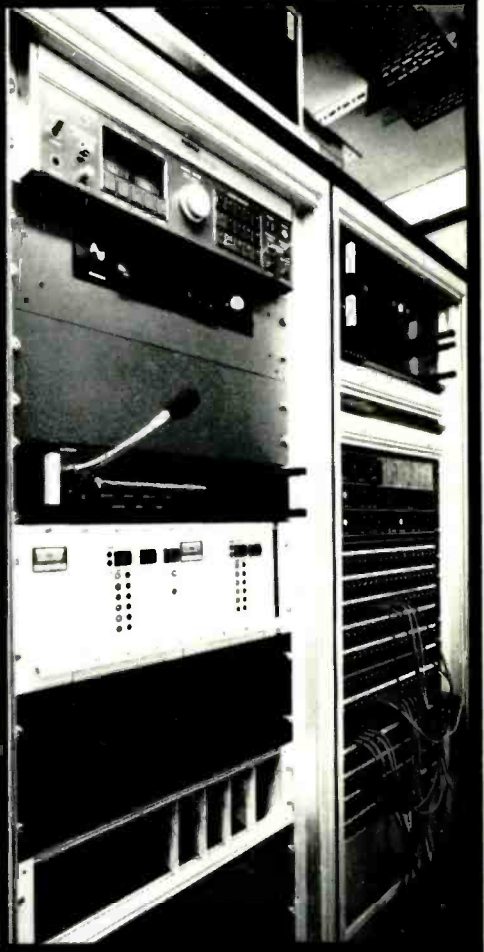
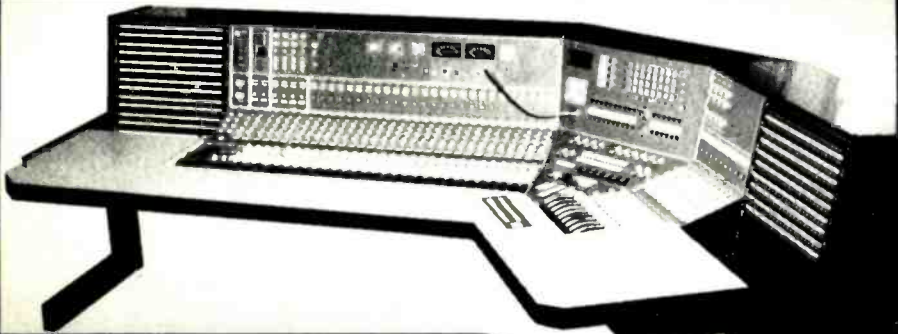


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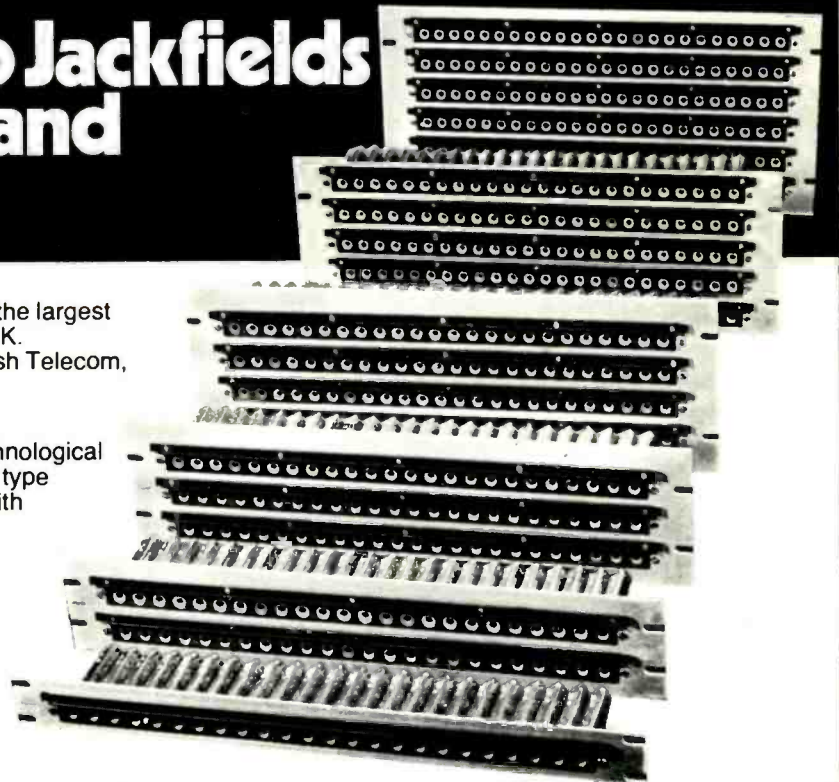
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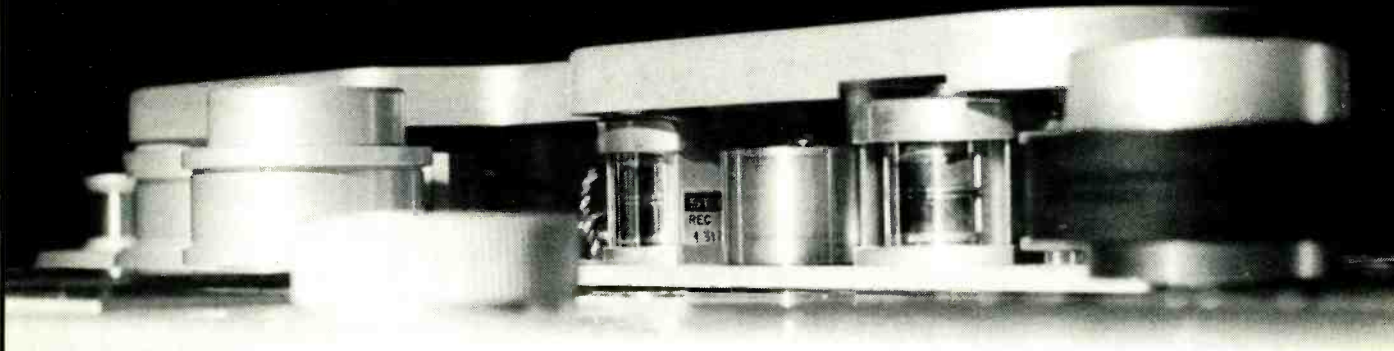
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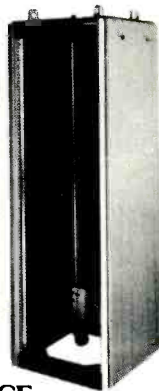
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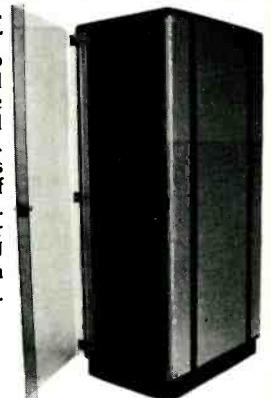
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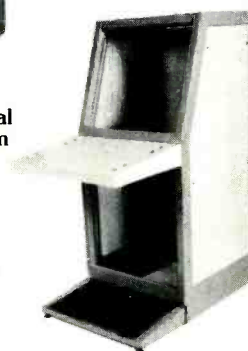


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C55-CONSOLE

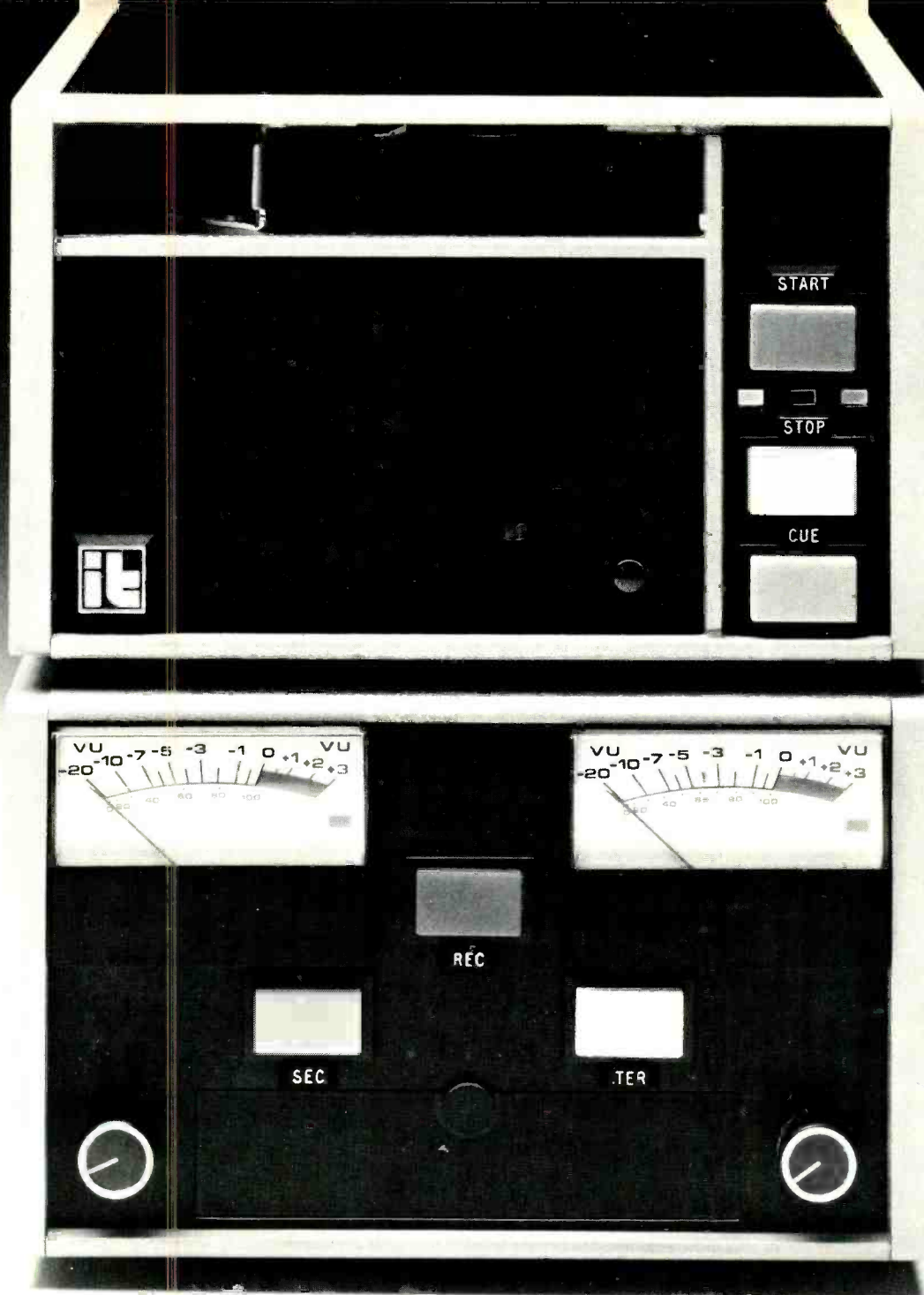
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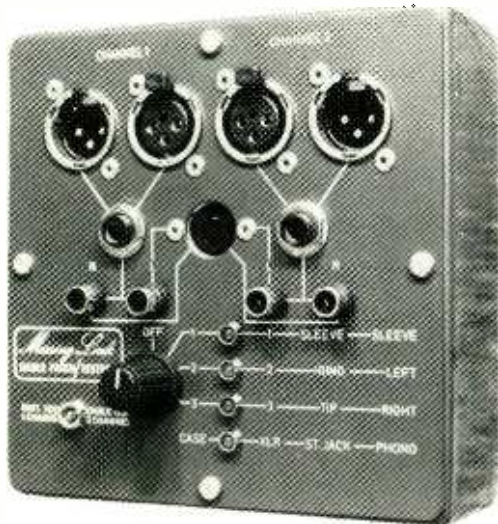
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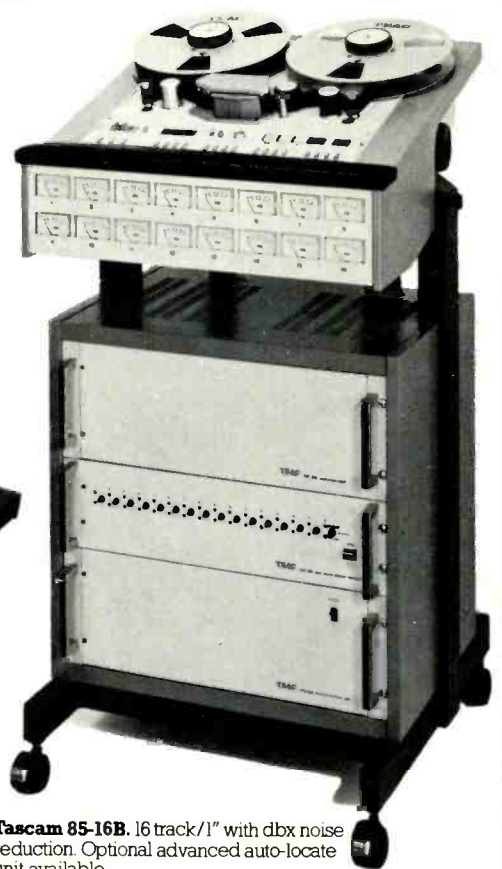
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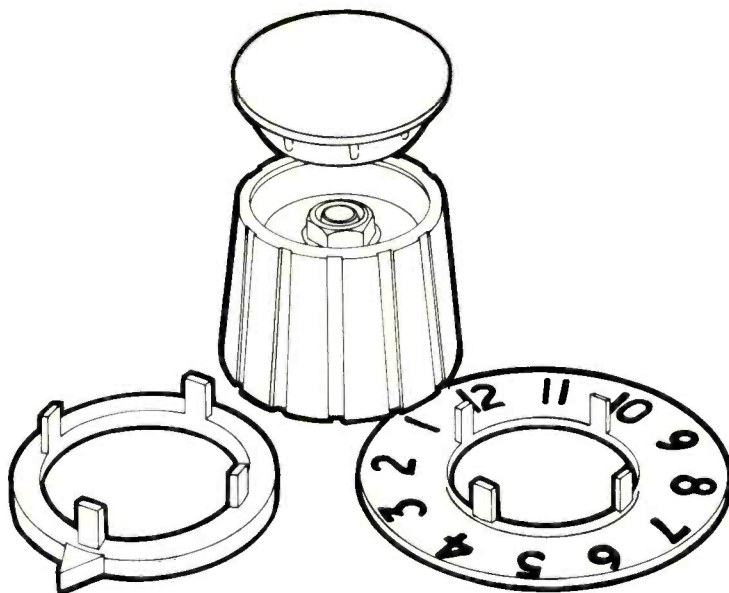
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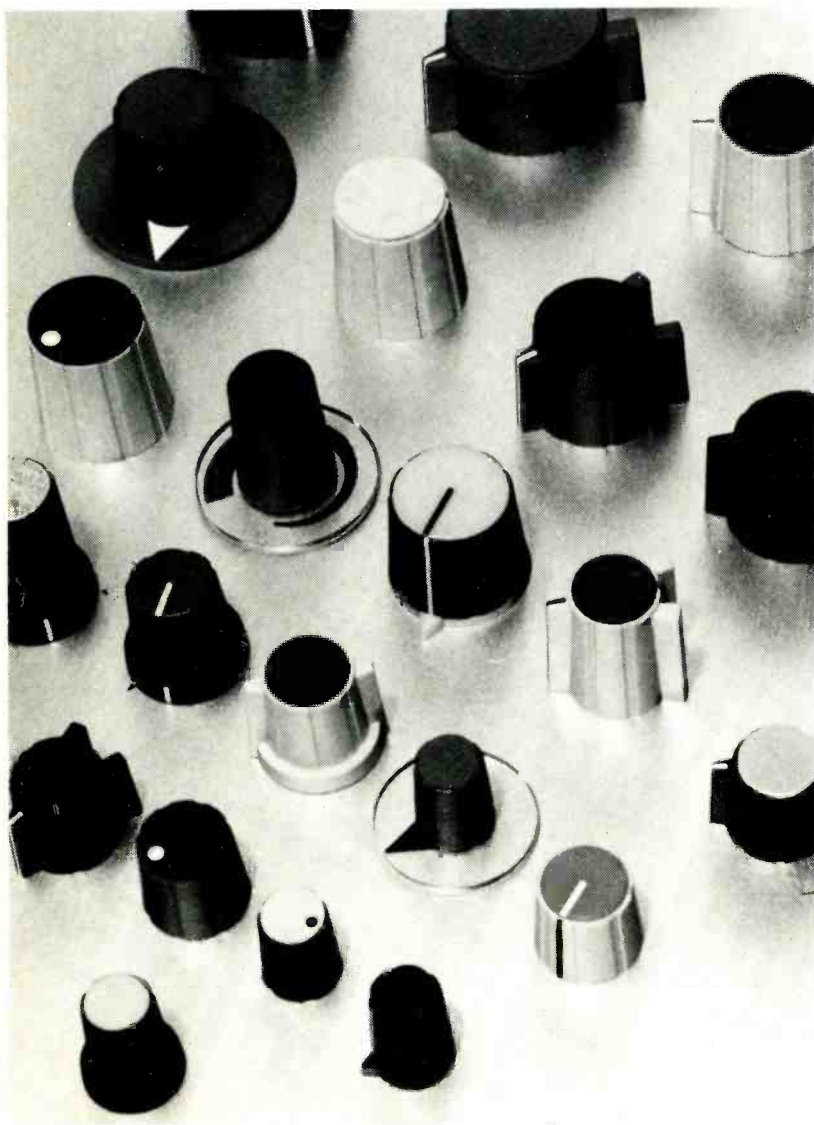
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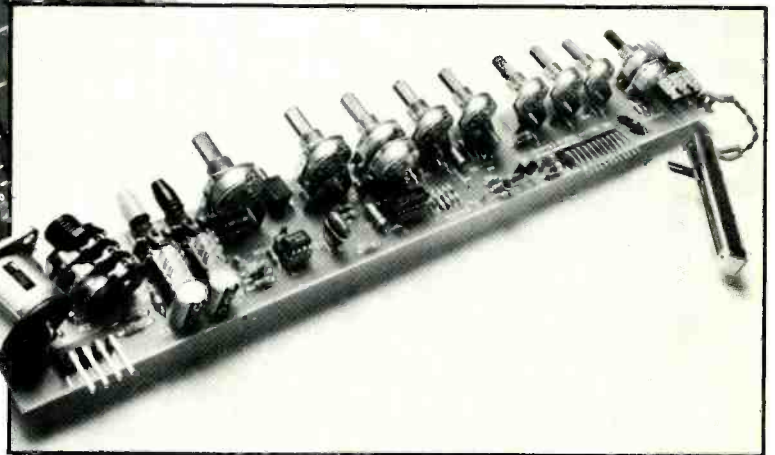
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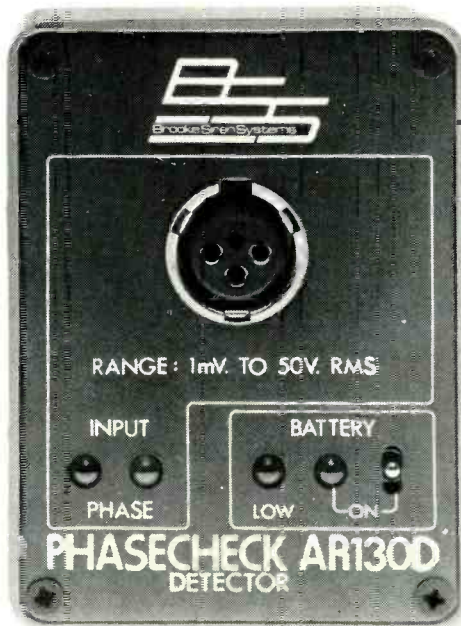
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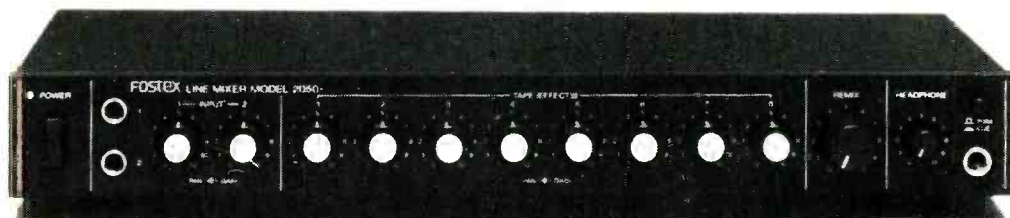
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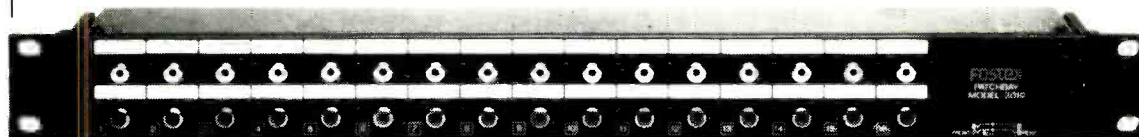
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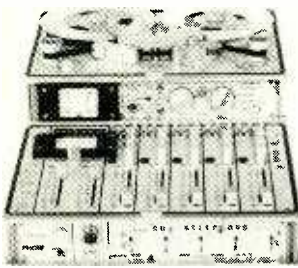
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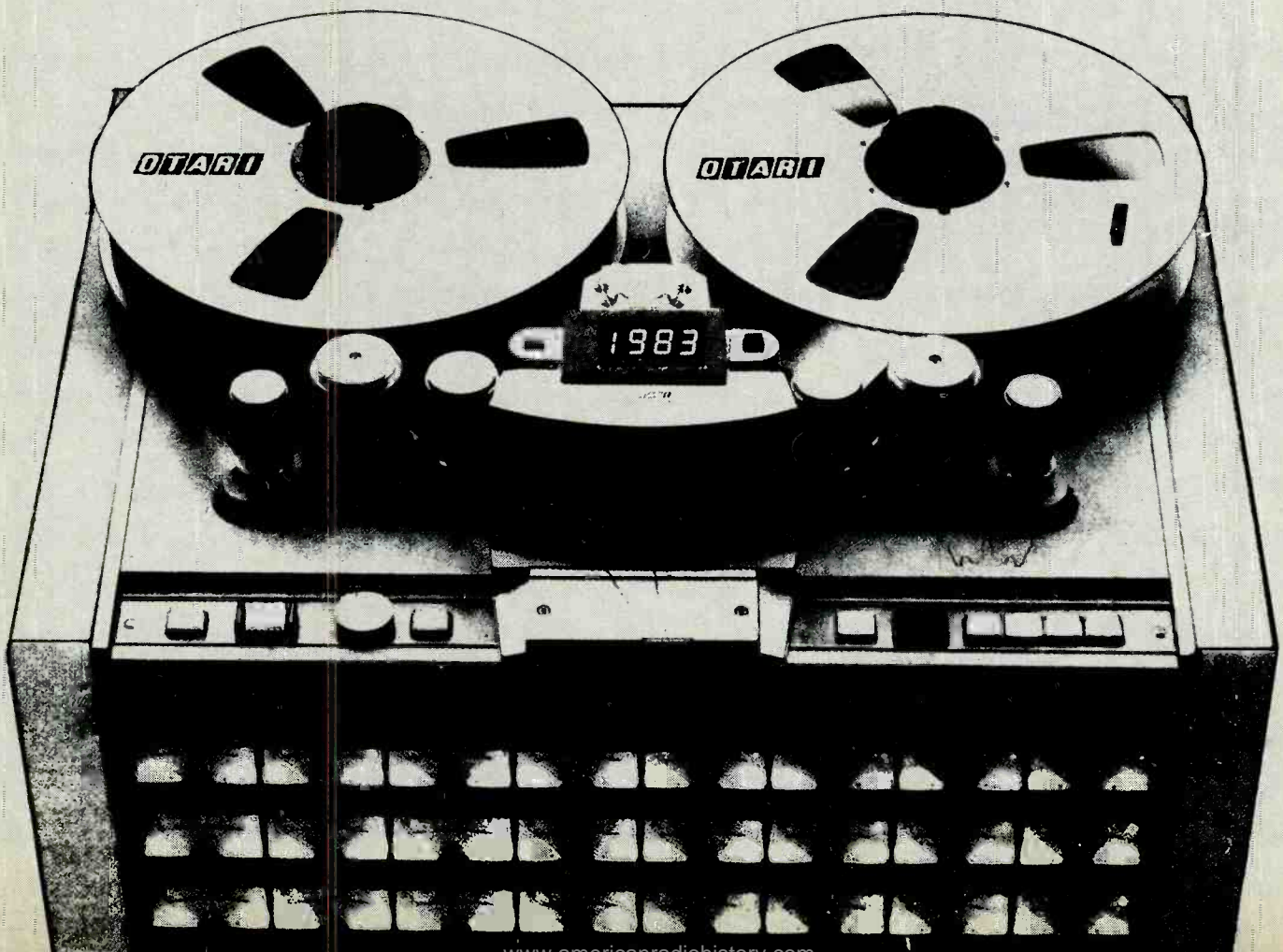
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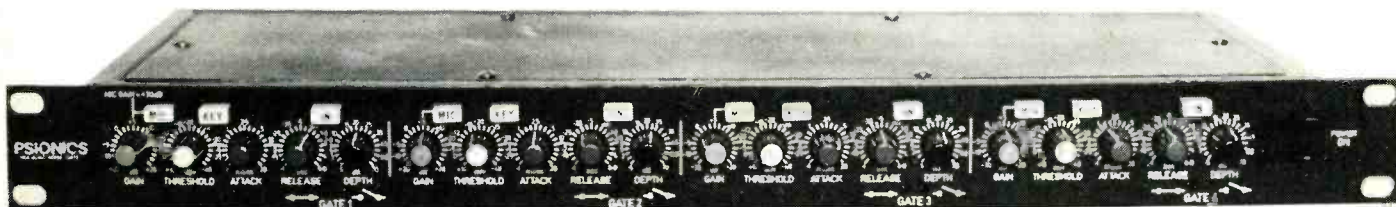


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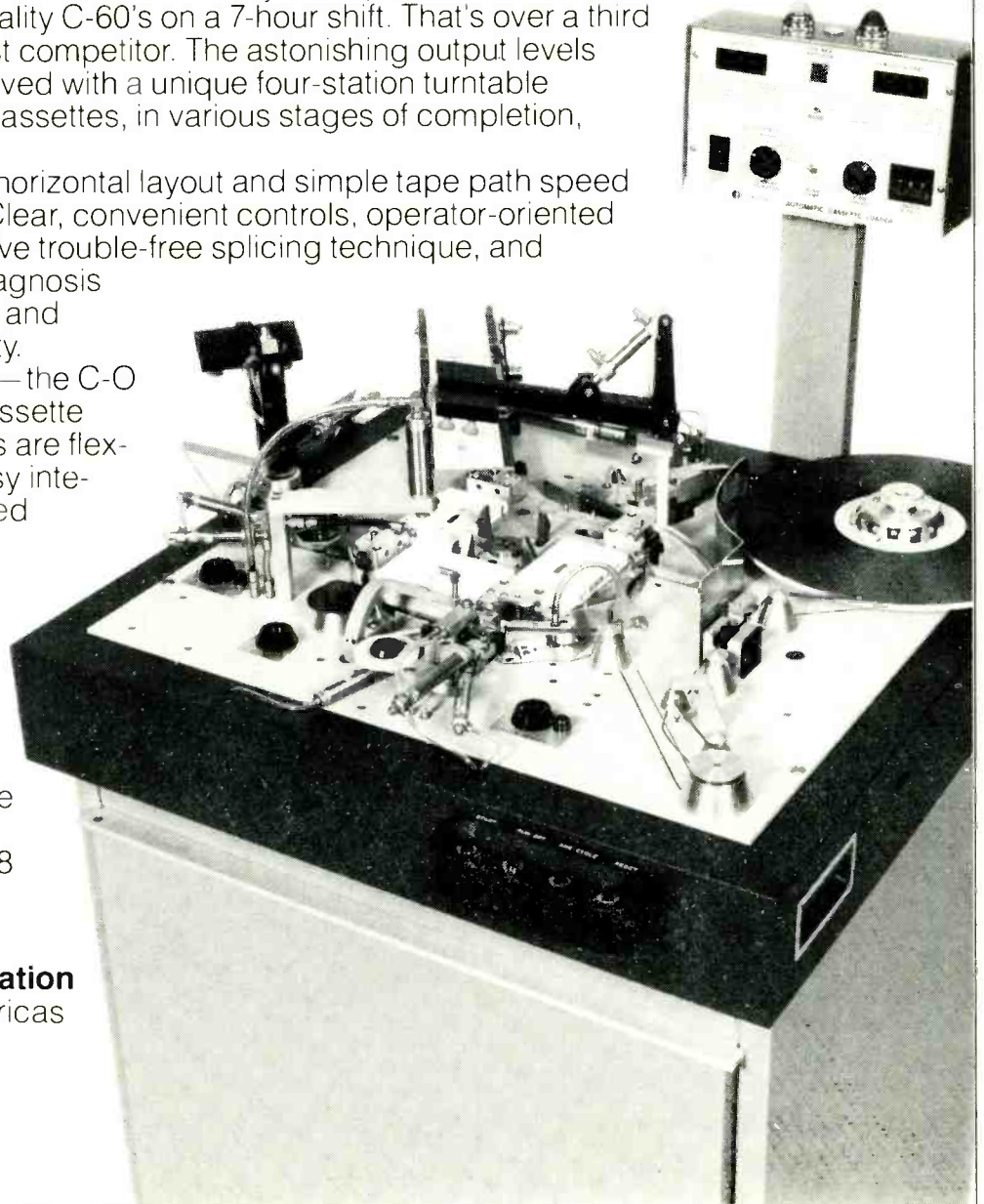
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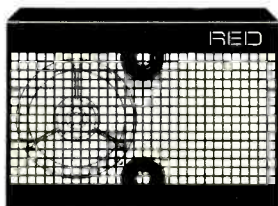
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RED A-2

RED A-2

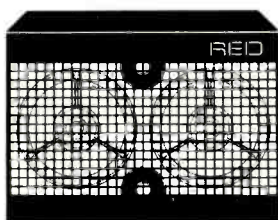
PRO MONITOR
TWO WAY AIR SUSPENSION SYSTEM ONE 8" CO AXIAL DRIVER 150 Watts ELECTRONIC SECTION
45 Hz 20,000 Hz RANGE 112 dB 1m MAX PEAK PROGRAMME SPL Dimensions W 245 x H 345 x D 335mm Weight 17 Kgs



RED A-3

RED A-3

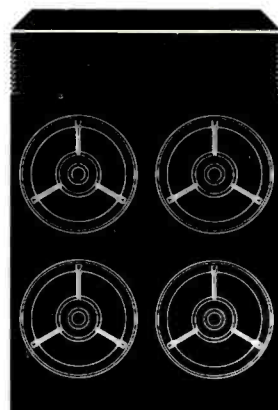
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45 Hz 20,000 Hz RANGE 112 dB 1m MAX PEAK PROGRAMME SPL Dimensions W 480 x H 345 x D 335mm Weight 20 Kgs



RED A-4

RED A-4

PRO MONITOR
TWO WAY AIR SUSPENSION SYSTEM TWO 8" LF DRIVERS TWO HF DRIVERS 250 Watts ELECTRONIC SECTION
45 Hz 20,000 Hz RANGE 118 dB 1m MAX PEAK PROGRAMME SPL Dimensions W 480 x H 345 x D 335mm Weight 22 Kgs



RED A-SB

RED A-SB

PRO MONITOR
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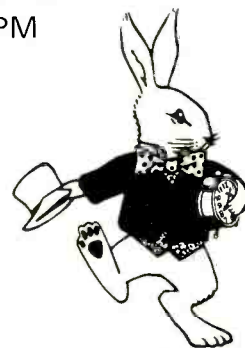
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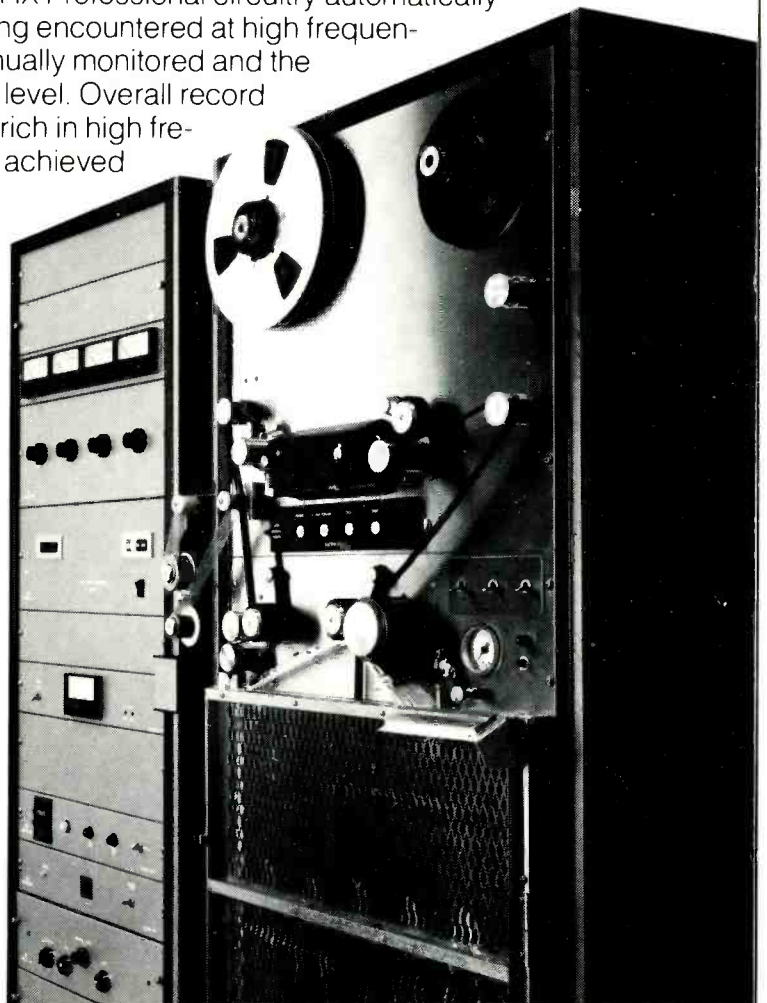
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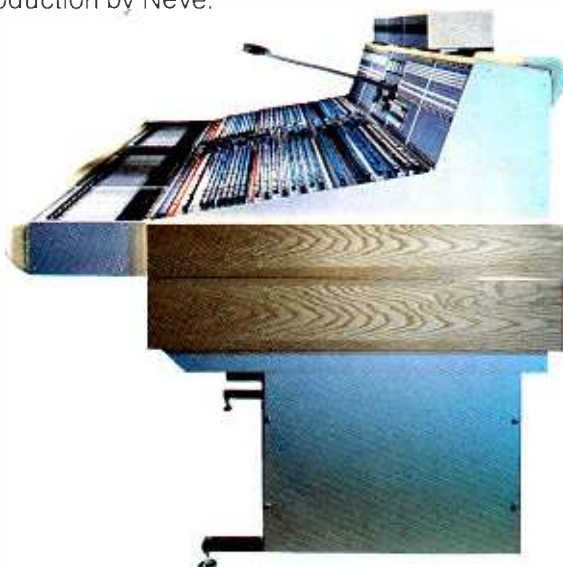
Production Consoles for Radio, Television and Film

The NEVE 51-Series comprises a range of versatile multiple-application audio consoles for Radio, Television and Film programme production including multi-track recording. Excellent performance designed to national and international specifications satisfies worldwide requirements.



All models are suitable for both studio and vehicle installation and have been designed to offer maximum flexibility in application with standardisation in manufacture to give a cost effective product. The range consists of four types of console, each being available in different configurations and numbers of input channels and groups. All consoles are designed for use in either mono or stereo operation and incorporate the much acclaimed Neve Formant Spectrum Equalisation (F.S.E.)

Standard consoles, available on prompt delivery, range from 12 channel/4 group to 48 channel/8 group with 24 track recording facilities. These consoles are of unsurpassed versatility in use. The 51-Series represents the culmination of 20 years of professional audio equipment design and production by Neve.



Neve

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The Neve 542 series is a range of small, compact audio mixing consoles designed for professional recording or broadcast applications. Available in 8, 12 or 16 channel configuration the consoles provide two main and two auxiliary outputs and all inputs have a 3-band equaliser and high-pass filter.



The 8 channel console is also available in a light-weight fully portable suitcase version with integral rechargeable batteries for professional mobile applications.

A 6 channel, 19" rack-mounting unit is also available for O.B. Vehicles.

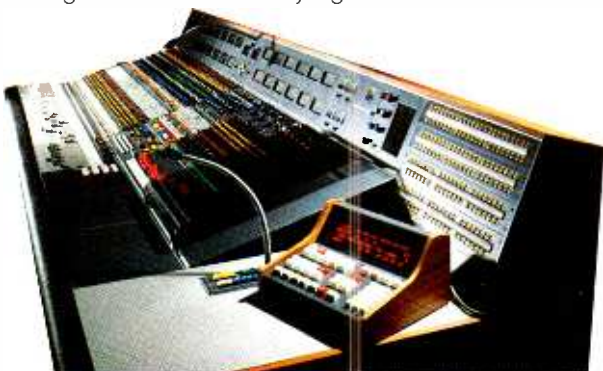
NECAM Automation Systems

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The most sophisticated aid yet devised for the task of music mixdown, NECAM is not simply an automated console, it is an integrated system, responsive to the balance engineer's style and preferences and designed to simplify operations and allow more time for the creative work in mixdown. NECAM is a highly cost effective investment for today's busy studio.

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A compact and efficient Audio Distribution Amplifier system of great flexibility and fully professional quality. Based on a range of 70mm high plug-in cards housed in a standard 3½" sub-rack frame the DA90 Series will provide up to 90 isolated outputs from one self contained unit complete with power supply.

All inputs are balanced and floating, having 10K ohm nominal input impedance. Outputs are balanced but centre grounded and a choice of three output impedances are available. Where fully floating outputs are required, a plug-in transformer card is available.

The system consists of a choice of 4 cards plus a sub-frame which is supplied pre-wired for power, leaving input and output wiring to be completed according to cards fitted and required configuration.

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A wide range of ancillary units are available for the professional audio user, including limiter compressors and distribution amplifiers.

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Neve has been supplying Sound Control Systems to the world's broadcast, music recording and film industries since the early 1960s.

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Employing over 400 personnel in Great Britain with subsidiary operations in the USA and Canada, and with a world-wide network of agents and representatives, Neve is the world's foremost specialist manufacturer of sound mixing consoles and second-to-none when it comes to after-sales service and support.

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C-Tape Developments Ltd, Transducer Laboratories, 73 High Street, Aldershot, Hampshire GU11 1BY. Phone: (0252) 319171.

Superamp from Brain

Brain Electronics Ltd of Quebec have introduced a super-power (3,600 WRMS) amplifier, presumably for PA applications. The unit includes 48 250 W power transistors mounted on a massive heatsink cooled by three powerful fans.

The amplifier has an input sensitivity of +12 dBm at 5 k Ω balanced and the slew rate is given as 5 V/ μ s. It appears to have six distinct 16 Ω outputs and weighs a solid 90 lb. It is rack mounting.

Brain Electronics Ltd, 12605 69 Avenue, Montreal, Quebec H1C 1L5, Canada. Phone: (514) 648-2730.

Roland's new synths

New synthesizers from Roland, exhibited at the Frankfurt music fair, include a low-cost polyphonic preset, a smaller version of the *Jupiter*, and a new *Microcomposer*.

The *JX-3P* is an economical 6-voice polyphonic synth featuring 32 preset sounds, 128-step polyphonic sequencer with external trigger-stepping facility, and programmability via the *PG-200* programmer control panel which interfaces with the machine, allowing the creation of another 32 sounds. The *JX-3P* utilises digitally-controlled oscillators which offer very high stability. Also fitted is the new international standard Musical Instrument Digital Interface (MIDI), developed by a committee representing all the major synthesiser manufacturers, which allows all manner of inter-machine crosspatching. The synth has stereo output capability.

The *Jupiter-6* is a simplified version of the highly successful *Jupiter-8*, offering 61-note keyboard, 48 sound storage memories and 32 'patch preset' memories, the latter allowing the storage of performance control values and settings. The synth is 6-voice polyphonic, and in other respects is very similar to the *Jupiter-8*.

Perhaps the most interesting unit is a budget *Microcomposer*, the *MC-202*. Instead of the *MC-4*'s 4-channel control capability and £1,800 price tag in the UK, the *MC-202* offers two channels, a built-in miniaturised *SH-101*-style synth and a good deal more, in a portable £325 package. Of course, the *MC-202* does not have the sophisticated control

functions of the *MC-4*, but it does offer a synth/sequencer/programming unit with tape sync, data storage on cassette, control signals for *TR-808* and similar drum machines, and a wide range of other functions.

Also released are three new *100M* modules, the *RM 165* portamento controller, *RM 173* signal/gate/multiple jack module, and the *RM 174* 4-band parametric EQ module. An interesting accessory is the *TU12* chromatic tuner from Boss, which automatically senses which note you are trying to tune to, and gives LED and meter indication of accuracy.

Roland Corporation, 7/13 Shinkita-jima, 3-chome, Suminoe-ku, Osaka 559, Japan.

UK: Roland (UK) Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middx TW8 9DN. Phone: 01-568 4578.

USA: Roland Corporation US, 2401 Saybrook Avenue, Los Angeles, CA 90040. Phone: (213) 685-5141.

Drawmer dual gate

The Drawmer *DS 201* is a 1 U rack-mounting device incorporating two independent, but stereo-linkable, noise gates with both gating and 'ducking' capability.

Each channel features frequency-conscious keying: HPF and LPF controls allow the key input (derived from the signal input or externally) to be filtered to avoid erratic gating on signals with wide frequency ranges, for example when it is desired to gate a snare drum and there is a good deal of cymbal leakage on the signal. A threshold control adjusts the gate sensitivity in the normal way, but in addition to the normal attack-time control, the unit features 'hold' and 'decay' controls. The 'hold' time is equivalent to the release time on most gates, while the 'decay' control adjusts the time taken for the gate to close completely—in other words, you can obtain a gradual gate-closing attenuation, so the unit can be employed usefully to control, for example, reverb decay on a noisy reverberation unit. Three LEDs indicate which part of the envelope is in progress. The attenuation range is extensive—down to -80 dB—a useful advantage. In stereo link mode, the Channel 1 key circuitry controls both gates, but the individual gate controls are still operative, so the unit can be used for automatic panning as well as stereo gating. I/O is via ¼ in jacks, but there is an *XLR* option. The unit is very competitively priced.

Also available is a single-channel *DS 100* which is compatible with the ADR *Scamp* module rack system. **Recording Maintenance Services, 6 Manor Road, Teddington, Middlesex TW11 8BG. Phone: 01-943 1368.**

38 ▶



Crown phantom power supply

Crown International has announced the availability of the *PH-4* phantom power supply which is capable of supplying 48 V DC for up to four mics. It also has the ability to power additional slave units (*PH-4S*) each of which will provide power for a further four mics with the slaves daisy-chained with cables from the master. A master *PH-4* will supply up to 100 mA of current and this Crown estimate to be enough to power about

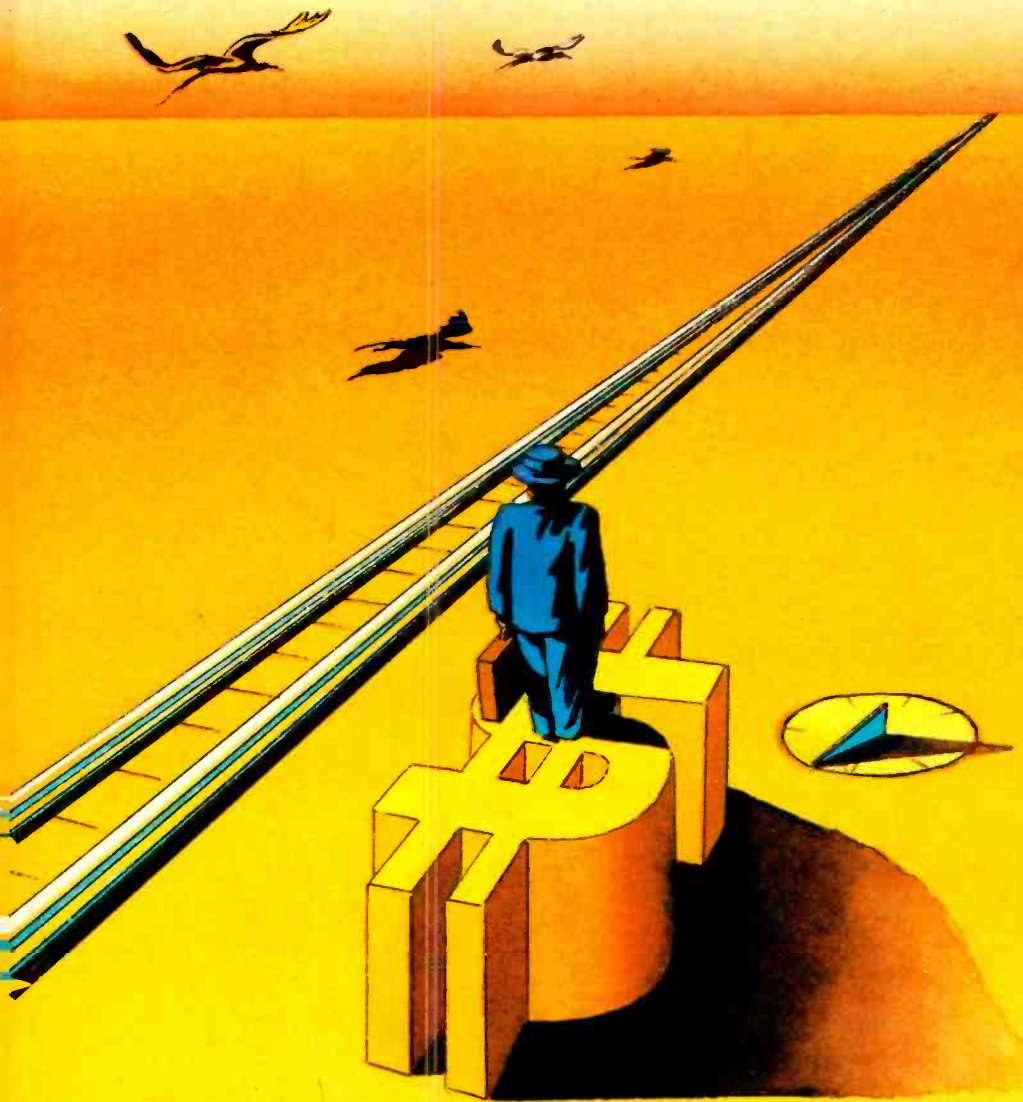
12 mics or about 20 in the case of *PZMs*.

All connections to the unit are by standard 3-pin *XLR*-type connectors which are mounted in a lightweight aluminium case. Dimensions are 12 in wide, 7 1/8 in deep and 1 3/4 in high and if fitted with the optional ears, it will fit into a standard 19 in rack.

Crown describe the *PH-4* as being suitable for all kinds of mics but Crown *PZMs* need the Crown *PXT* impedance matching accessory for proper operation.

Although now fully available in the USA, we have not received any details regarding worldwide distribution as yet but as with all Crown products, it soon should be—of course bearing the Amcron name.

Crown International Inc, 1718 West Mishawaka Road, Elkhart, IN 46517, USA. Phone: (219) 294-5571. UK: HHB, Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Phone: 01-961 3295.



You haven't had this much delay for the money since the 7:43 stopped running.

The new MXR Digital Time Delay leads the way in affordable, professional-quality digital delays. For less than half the price of most digital devices, you get up to 320 ms of clean, quiet delay for studio-quality stereo flanging, stereo doubling, stereo chorus effects, simple reverb, long echo and slap-back effects.

The Digital Time Delay lets you add a deep, resonant flange to the rhythm guitar, double harmony vocals in stereo, fatten up the keyboards with stereo chorus or add long echo to give the overall mix added depth. The Time Delay's dynamic range is greater than 90 dB which makes it ideal for sound reinforcement and broadcast. The amount of delay is push-button selectable and the Time Delay's

sweep Width and Speed controls vary the selected delay times over a 4:1 range for flanging, chorusing and doubling effects. Stereo outputs are provided for multitrack recording and mixdown. This compact (1 3/4" high) and attractive unit also features a green/red LED signal present/overload indicator and a footswitchable bypass function.

The MXR Model 175 Digital Time Delay. The most delay for the money in recent memory.

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

MXR Professional Products Group



new products

Automatic tape splicer

If you work with ¼ in tape and are fed up with trying to find single-edged razor blades (although this is not the problem it was a couple of years ago), you might consider the *Collins Automatic Taper-joiner*, or *CAT* for short. The unit is only available for ¼ in tapes at present, but there are many applications—particularly where speed is important, like broadcasting—where this device could be a real boon.

Consisting of four main parts—two baseplate-cutters, a hinged splicing tape carrier and a splicing tape cassette—the *CAT* makes splicing really straightforward. First you find your edit points in the normal way and mark them by whatever means you like. Then you take the first cutting point and lift one of the guillotines, placing the tape in a groove not unlike those found in conventional blocks. You then bring the other guillotine down and the tape is cut, accurately and cleanly. Then you lift the first guillotine (with the tape still in position) and place the second cutting point on the edge, pressing the tape into the groove on the second guillotine. Bringing the first guillotine down cuts the tape again, leaving you with a perfect angled splice ready for the splicing tape. Then the hinged splicing-tape carrier is brought down over the join-to-be, and the lever is pressed, depositing a pre-cut length of splicing tape onto the join. Lifting the carrier again and pressing the tape down firmly with a finger completes the join, all of which is done in a fraction of the time taken to find a suitable place to keep odd bits of splicing tape in the conventional way (and you don't end up with the front of your recorder covered in bits of unused—and unusable—splicing tape).

The splicing tape is contained in a cassette which is easily fitted into a holder and contains several hundred pre-cut lengths on a backing strip which is used to advance the tape for each splice, and there is absolutely no waste. The whole concept is excellent and the device is very solidly made. A splicing-tape holder of the same type is also available to attach to conventional splicing blocks, converting them to what might be called 'semi-automatic' operation.

I have used this block myself for some time and am very impressed. It is exceptionally fast and accurate, and the only way to get a bad splice is to concentrate too hard on pressing the lever; if you do it without thinking everything is fine, but if you try too hard to align the splicing tape holder as you push it, it usually ends up slightly angled rather than straight. Trust the machine; it knows what it's doing better than you do. The *CAT* is most at home with

standard-play tape, although it is fine on LP tape as well. I would prefer not to try cutting double play as it might be asking too much. Very thin leader tape can occasionally fail to cut properly on the guillotines, but this is not a problem if you do it a bit more slowly than with ordinary tape. I have no hesitation in recommending this block if you need fast, accurate splices. I recently edited and ordered an album in less than half the time I expected, and ne'er a duff join. Engineers should keep one of their own in their survival kits, preferably engraved with their name to avoid losing it!—RE

The *CAT* is available in the UK from **Mike Fraser (Film Services) Ltd, 225 Goldhawk Road, London W12 8ER. Phone: 01-749 6911.** We have no data on overseas availability as yet. [The cutter design has now been modified to handle thin tape and leader completely reliably.—ED.]

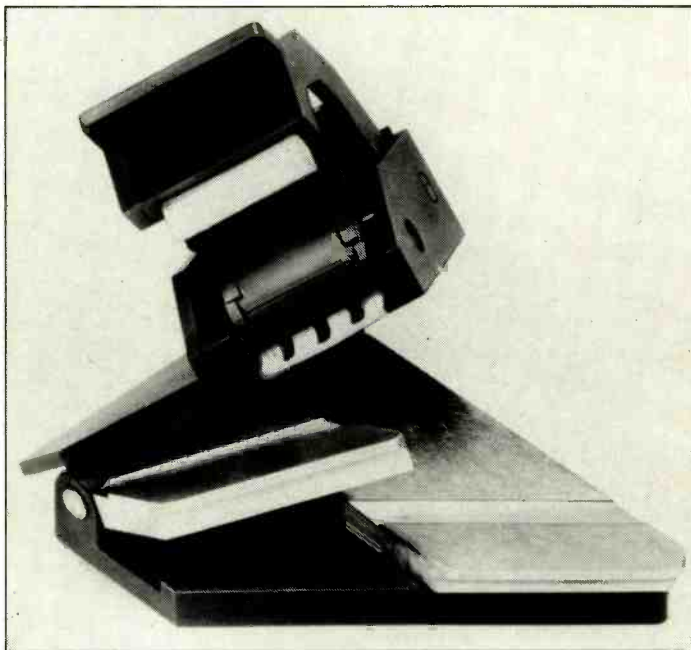
PE by Shure

Shure Brothers have announced a completely new range of mics for live performance use under the title of the Professional Entertainer Series. Of the nine basic models available, five are designated as being instrument mics and the other four intended for vocal applications. All models are low impedance (no actual values stated) with some of the cheaper models also having high impedance versions. Externally all the mics have a similar semi-matt black finish although design differs considerably with many of the models having shapes that follow familiar Shure lines.

Written specifications on the mic are rather brief although Shure have produced a colour brochure detailing specific recommended applications for the individual mics together with frequency response graphs and polar diagrams. To accompany the brochure, Shure have prepared a Graphic Calculator that contains diagrams and other information. You simply move the internal card within the external envelope so that the instrument/application lines up with the window labelled source, and the numbers appear against the mic model numbers indicating the preferred mic for the job in order of preference. This is a useful device when confronted with a complete new range for the first time. Unfortunately there is the odd anomaly when information is presented in this format such as the *PE35* vocal mic only being a third choice for a bright vocal sound with no other mentioned applications at all.

USA: Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204.

UK: HW International, Eccleston Road, Maidstone, Kent ME15 6AU. Phone: 0622 59881. Telex: 96121.



CAT tape splicer

New products from BGW

BGW has announced the availability of an updated and improved amplifier as a replacement for the *Model 7000*, to be known as the *Model 7000B*. The design improvements include alterations in the chassis design giving greater structural strength and a separate power supply compartment. Electronic short circuit protection as used in the *750 series* has been added as has a two-speed fan control circuit. To protect the power supply, the thermostatic switches are wound into the power transformer. Finally, DC speaker protection has been added as standard.

Also newly available is the *Model 5012* 2-channel, 2-way crossover with fixed subsonic filters. The chassis is a compact, one unit high, standard rack mount design and operation may be easily converted to three-way mono. All input and output connections are on ¼ in jacks. Crossover frequencies may be set at 300, 500, 800, 1 k, 1.2 k, 1.4 k, 1.7 k and 1.9 kHz using the *BGW Switchset* system. The filters employed are 18 dB/octave Butterworth for the

high and low pass sections as well as the 20 Hz subsonic filter on each input. The filters are all passive and are fully buffered. The level controls are screwdriver-operated through the front panel.

BGW Systems Inc, 13130 South Yukon Avenue, Hawthorne, CA 90250, USA. Phone: (213) 973-8090.
UK: Theatre Projects, 10 Long Acre, London WC2E 9LN. Phone: 01-240 5411.

SFX Library

The Sound Ideas sound effects library is produced by Sound Ideas recording studio, Toronto, and includes more than 2,000 effects occupying 100 reels of tape available at 15 or 7½ in/s, NAB or IEC EQ. All the effects are alphabetically cross-referenced in a comprehensive catalogue. The complete library is available for a one-off price, and there are no royalty payments. All the sounds were recorded in the studio or on location by Sound Ideas staff.

Sound Ideas, 86 McGill Street, Toronto, Ontario M5B 1H2, Canada. Phone: (416) 977-0512. ■

Shure Mics



Imagine you live in a house where everyone's called Mike...

You'd be well pleased if someone moved in who had a different name.

When it comes to mikes, that different name is Electro-Voice.

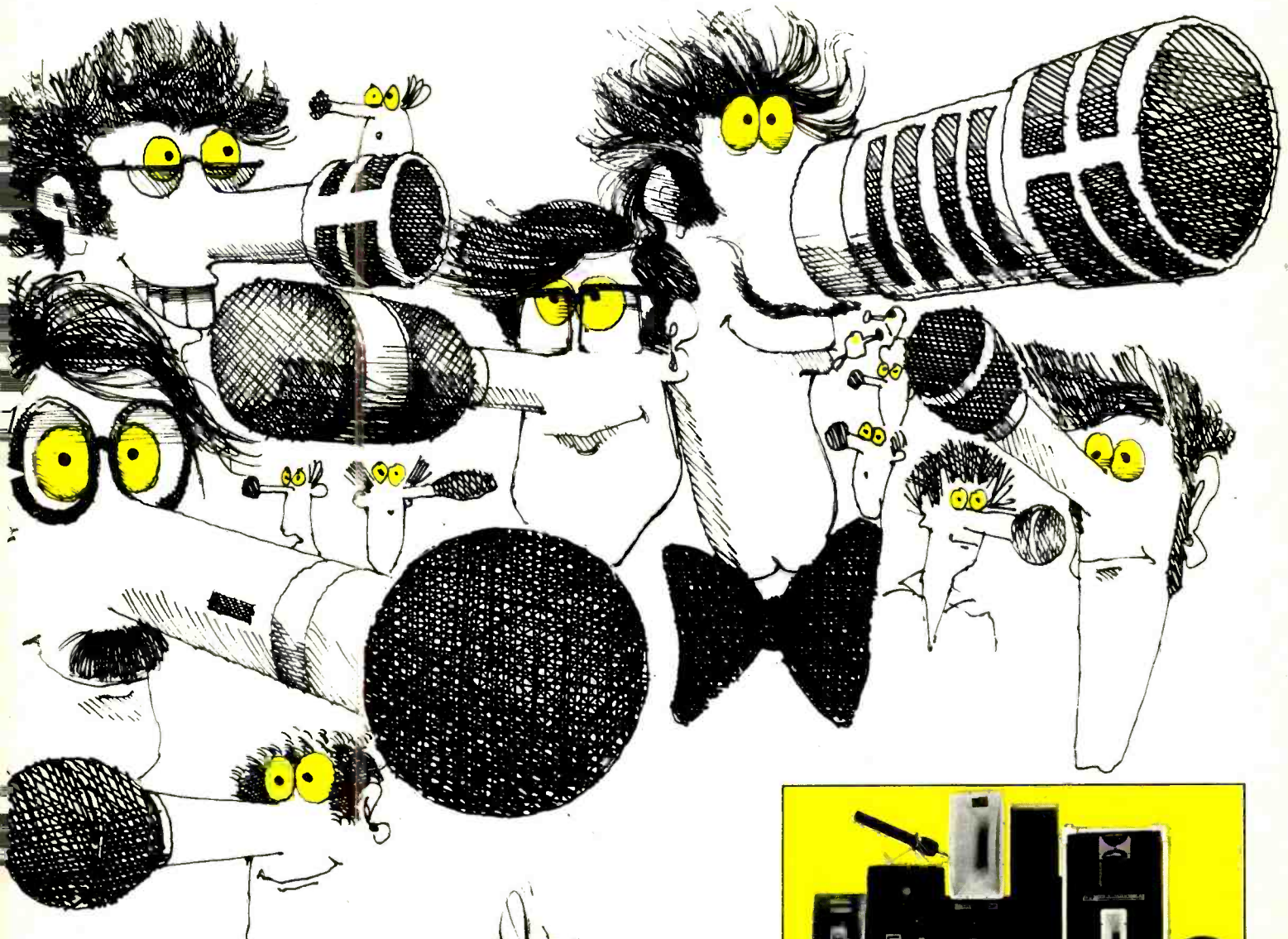
From our range of Microphones, you can choose, or we can help you choose, exactly the right mike to give you exactly the right sound. Every time, any place.

Take the PL80. A crisp high end and crystal-clear bass brings up your vocals without the faintest compromise on quality. Or there's the DS35 vocal concert mike, which has more gain-before-feedback than any other dynamic microphone. That's a claim we invite you to test.

That means no feedback nightmares. No low level signals. No difficult placements. What's more they're extremely robust. And they won't cause horrible echoing noises in your bank account, either.

That's why Electro-Voice mikes are used world-wide by some of the best groups and sound men in the business, both recording and performing.

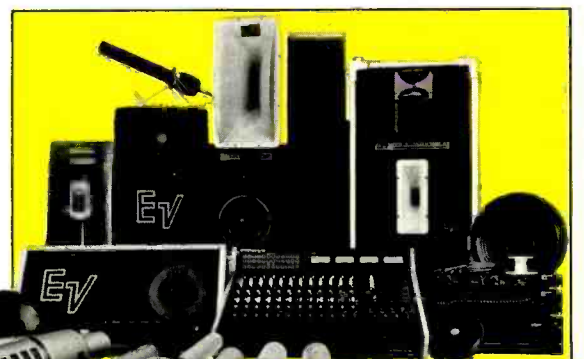
To find out which E-V mike can solve your audio problems, call us on 01-736 0907. We're the sole UK distributors of the entire range of Electro-Voice audio equipment, so we know all about it. And—unlike some others—we don't mind parting with our knowledge.



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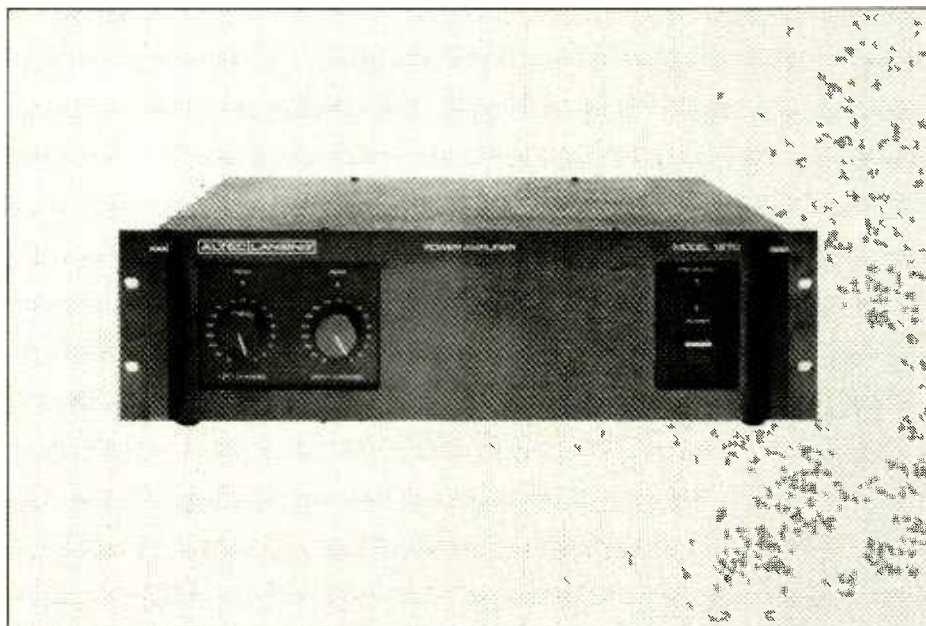
AES Convention Eindhoven

preview

The 73rd AES Convention will be held March 15 to 18 at the POC Congress Centre, Eindhoven, The Netherlands. As usual we present our preview of the exhibition and exhibitors with emphasis on new products to be shown. This preview is based on information received at the time of going to press and so may be subject to change.

A

- **AEG-Telefunken:** will be showing the *M15A* range of tape machines and *Telcom C4* noise reduction system featuring the recent addition of the *C4 DM* compander board to replace the *C4D*. It has a smaller size and reduced power consumption while being in Dolby NR frames designed to take *Cat 22* modules.
- **Agfa-Gevaert:** full range of tapes and cassettes.
- **AKG Acoustics:** full range of AKG products and a 'new' mic—*The Tube*. AKG will also be demonstrating the *Aphex* range of products.
- **Altec Lansing:** wide range of entertainment and studio speaker systems in addition to individual drivers and other components.
- **Alice (Stancoil):** full range of mixing consoles and broadcast ancillaries.
- **Amcron/Crown:** full range of amplifiers, crossovers and audio measurement *Badap* range, recent additions to the range of *PZM* mics such as the *2LV*, *20RMG* and *3LV* tie-clip model.
- **Amek and Total Audio Concepts:** a selection from their wide range of consoles. Featured will be the new *Angela* multitrack recording console available in 28/24 and larger formats, and the *TAC 1042* mixing console. Also expected are items from their forthcoming range of computer-assisted mixdown systems.
- **Ampex:** The full range of Ampex tape machines from the *ATR 124* multitrack to the *ATR800* tape machine, the *ADD-1* disc mastering system, the *EECO MQS 100A* synchroniser and the full range of tapes.
- **AMS (Advanced Music Systems):** the *DMX 16* stand alone digital reverb, the *A/V* sync audio delay compensator, *DMX 15-80SB* stereo broadcast delay, *Digital Loop* editing system for the *DMX 15-80 Series*, *DM-DDS* digital disc mastering delay line and the *DM2-20* phaser/flanger.
- **Audio & Design (Recording):** full range of



Altec Lansing 1270 power amp

- signal processing equipment plus the new ambisonic *Transcoder* for surround sound mixing.
- **Audio Developments:** *AD-062 Minimixer*, *AD145 Picomixer* and *AD160 ENG* mixer.
- **Audio Kinetics:** demonstrations of *Q.LOCK 3.10C* synchronisers in standard *VAPP* use and for film dubbing using the *Unifilm* interface. A software option known as *Q.SOFT SFX* will also be shown; this dedicates secondary functions to the keypad so that single strokes will control operations previously multikeyed, in this case for use in a sound effects assembly application. The actual electronics section of the *3.10C* has been replaced with a more compact design with the addition on a *RS232* interface, an option available for existing units.
- **Audiomatic Corporation:** Electro Sound range with special emphasis on two new models—the *ES 1860* automatic cassette loader has a 4-station turntable that can handle four cassettes at a time in different stages of completion, and the *Series 8000* of high speed tape duplicators which are claimed to be the first to incorporate Dolby *HX*.
- **Audio Technica:** range of professional stage and

- studio mics as well as examples of their other products.
- **Auditronics:** mixing consoles and a newly developed programmable EQ.
- **Auvis-Asona:** no information received.

B

- **R Barth:** *Param* programmable equaliser, *Dynaset U311*, *Audios*, *Musicoder* and *W308* signal processing equipment.
- **BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes.
- **Beyer:** dynamic range of dynamic and condenser mics plus headphones.
- **Bose:** *Model 802* loudspeaker and *802-E* active equaliser.
- **WH Brady:** range of splicing and sensing tapes for audio and video applications.
- **Bruel & Kjaer:** comprehensive range of audio test instruments.

C

- Showing at an AES for the first time will be **C-Tape Developments** who will have their full range of contact transducers on display. The C-

42 ▶

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successor to the much acclaimed LINN LM1

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- ★ Stereo mixer with volume and pan sliders, plus separate outputs.
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- ★ Drums tunable by front panel controls or control voltage inputs.
- ★ Drums may be externally triggered by drum synthesiser pads or any audio source.
Will sync to tape/sequencers/synthesisers.
- ★ Programmed data is retained with power off, or may be off-loaded to cassette.
- ★ Drum sounds are user changeable.
- ★ Designed for non-technical musicians.



Linn Electronics Inc.

Distributed by:



Scenic Sounds Equipment Limited

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

AES preview

ducer is a strip type unit available in 8 or 20 cm lengths, requiring the use of a power supply preamplifier, available in a variety of formats for applications from drums to acoustic guitar. Recordings and instruments fitted with *C-ducers* will be available for headphone listening.

● **Calrec Audio:** another first showing—a working VAPP installation comprising a 16-channel, 16-track *6024M series* console with *Rolling RAM* automation and *ET16+* events timer with all the necessary peripherals. Also on display will be a fully operative assignable mixing system and the debut of the *Soundfield Mark IV* microphone. ● **Cetec-Gauss:** range of studio monitors, loudspeaker drive units and tape duplication systems. ● **Clear-Com:** intercom systems. ● **Court Acoustics:** the *Proflex* range of speakers and amplifiers and graphic equalisers. Also the 1.6kW 'Black Box' constant directivity reinforcement system. ● **Crest:** wide range of power amplifiers.

D

● **Dolby Labs:** A-type noise reduction modules for I, B and C format VTRs, a 2-channel portable *model 372*, and the multitrack *SP series*. ● **Domain Magnetics:** no information received. ● **D & R Electronics:** wide range of mixing consoles from portable units to multitrack including ancillary equipment.

E

● **Eastlake Audio UK:** details of the company's consultancy services and studio monitor loudspeakers. ● **Eela Audio:** *S300* broadcast mixing console which meets international specifications, *S50* portable 4-channel stereo mixer, *S20 Reporthone*—a 2-input mini mixer to be powered from a standard telephone connection. Also to be shown is the *S3000* successor to the *Concord 2000*. ● **Electro-Voice:** wide range of mics, speakers and live sound consoles with ancillary equipment. New items include the *Sentry 500* monitor speaker and the *model 370* barrier plate for use with the miniature *CO94* mic. ● **Electroimpex:** *FIT-IC* modular automation ready console; *STM-610* tape machine, *SL-101* direct drive turntable and *PCP-101* commentator's desk. ● **EMT:** *EMT 450 Digiphon* digital recorder with disc storage; *EMT 245* digital reverb plus the EMT range of test equipment, signal processors and turntables including the new *model 938*. ● **Enertec:** *UPS-4000* automation ready multitrack console; *UPS-5000* and *UPS-510* consoles and the *F500* ranges of tape recorders. ● **Eventide:** wide range of signal processing equipment including the *SP2016* programmable effects processor; *Model H949 Harmonizer* and a range of delay lines including two new broadcast units—the *BD931* mono and *BD932* stereo.

F

● **Ferrotronic:** no information received. ● **Freevox:** no information received. ● **FM Acoustics:** the complete range of power amplifiers which now includes special *LI* versions for driving low impedance loads down to 1 Ω. In addition they will also be showing a new electronic crossover designated *FM 236A*. ● **Future Film Developments:** comprehensive variety of cables, cords, connectors, jackfields, wiring aids and associated components plus a wide range of audio accessories.

G

● **Genelec:** range of powered monitor loudspeakers comprising the *1019A* biamplified mini-

monitor; *S30* and *L024A* triamplified monitors. Also on display will be a portable version of the *1019A*. ● **Gotham Export:** wide range of products from Amber, Fabec, Inovonics; Lexicon; Switchcraft; Valley People and MRL; and Quantum Audio.

H

● **Harrison:** a selection from their range of mixing consoles with the featured item being the *MR-4*. ● **Heino Isemann:** *KZM3* automatic cassette loader and the *ETK-1* and *ETK-1S* cassette labelling machines. ● **Heyna:** no information received. ● **HH Electronics:** the *S500D* professional power amplifiers; the 'V' range of MOSFET amplifiers; the *M-900* new power amp; electronic effects units and portable live sound consoles and ancillary equipment. ● **Holophonics:** no information received.

I

● **ICM:** range of C-0 cassettes; *DO-2000* drop-out checker; *ICM 7804* automatic wind tester; cassette packaging and storage systems. ● **Illbruck:** no information received. ● **ITC:** range of broadcast cartridge machines.

J

● **JBL:** recently introduced drive units for PA and studio monitoring applications; the range of studio monitors; the new compact monitor *4401* and a range of ancillary products. ● **JVC:** the *Series 90* digital mastering system.

K

● **KEF Electronics:** range of monitor loudspeakers. ● **King Instruments:** self-feed cassette loaders and various video tape loaders. ● **Klark-Teknik:** two major new ranges on show: the *Series 300* range of graphic equalisers using proprietary micro-electronic filter designs and thick film technology will be shown together with the *Series 700* digital products.

L

● **Leevers-Rich:** *Proline 2000TC* and *Proline 1000* ¼in tape machines. ● **Lyrec:** *TR55* ¼in tape machine; *TR532* multitrack recorder and ATC remote control; *P-2000* high speed cassette duplicator.

M

● **Mattijssen Audio:** no information received. ● **Melkuist:** will debut the *Supermix* console automation system which will interface with

Harrison and Sound Workshop consoles.

● **Meyer:** full range of sound reinforcement systems. Also *L833* studio monitor and *MS8201* time correction fitter. ● **Midas:** *PR System* consoles for sound reinforcement applications; *TR Systems* modular theatre consoles, and *Auditorium* console system. ● **Milab:** wide range of mics including the recently introduced *LC25* line level mic. ● **Mondial Electronique:** range of broadcasting equipment for local radio applications. ● **Keith Monks:** wide range of microphone stands, booms, record cleaning equipment and accessories. ● **Mosses and Mitchell:** range of jacks and jackfields including the *440* range of miniature jack sockets and jackfields. ● **Musik Productiv:** no information received.

N

● **Nagra:** range of portable tape machines in a variety of configurations including the *T-Audio* twin capstan multi-format recorder. ● **Neumann:** complete range of condenser mics and the *VMS 80* automated disc mastering lathe. ● **Neutrik:** comprehensive range of *XLR*-type and other connectors; the *K-Check* cable tester; and the audio test equipment range. ● **Neve International:** representative models from their many ranges of consoles, including a *Series 51* broadcast model, a *542* portable, the new *8128* multitrack and the latest developments in *NECAM*, will be shown in the demonstration room. The *8128* features digitally controlled routing using touch-sensitive panels and alphanumeric read-outs with an interrogation system that frees the engineer from the restrictions of central control panels. ● **NTP Electronic:** comprehensive range of PPMs, equalisers, phase meters, limiters and a compressor/expander.

O

● **Ortofon:** wide range of ancillary disc cutting units; phono cartridges; the *P400* audio measurement computer with CRT display and integral printer. ● **Otari Electric:** examples from their wide range of tape recorders and duplication equipment including floor standing *MTR10-2* 2-track ¼in as well as two new models on ½in tape format, stereo and 4-track; the latest version of the *MTR90* 24-track; the *MX5050* series with two or four tracks on ¼in and the 8-track on ½in; the *DP4050/OCF* and *DP4050/C2* cassette duplication systems. Also on show will be automatic video tape loaders for the domestic cassette formats.

P

● **Penny & Giles:** wide range of conductive plastic audio control elements including linear faders of various types and potentiometers. ● **Philips:** full range of Compact Disc players, two new loudspeaker systems and *Sound Mix 5* mixer. ● **Publison:** range of audio processing equipment.

Q

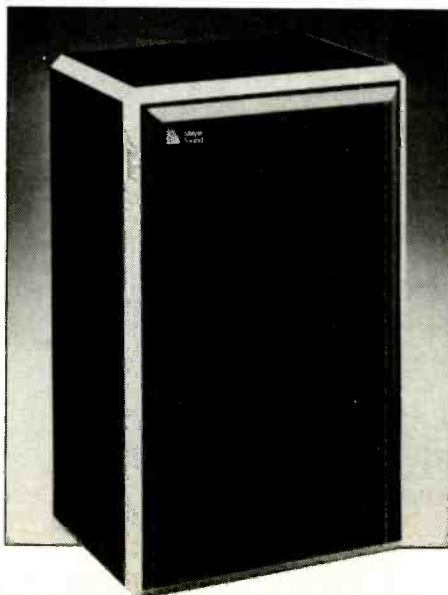
● **Quad Acoustical:** the established range of Quad products with more recent models including the *FM4* tuner, the *ELS* electrostatic speaker system and the *405/2* power amplifier. ● **Quad/Eight:** range of mixing consoles with automation systems such as the recent *Ventura* disk-automated post production console. ● **Quantec:** the Quantec *QRS* digital reverb and processing system.

R

● **Raindirk:** the *400 Series* broadcast console; the *2000 Series* film, TV and general production

44 ►

Meyer 833 monitor



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248

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AES preview

console; the *Status* range of amplification. ● **Red Acoustics:** a range of monitors including *A-4 Red* professional monitor loudspeaker plus the *A-3* with built-in monitor amps and the *Red Studio Monitor* which includes a sub bass system. ● **Rhone-Poulenc:** no information received. ● **RTW:** wide range of bargraph meters and an interface unit to allow the use of the Sony *PCM-F1* digital processor with full standard 16-bit digital equipment. ● **Reditec:** no information received.

S

● **SAJE:** range of recording consoles. ● **Saki Magnetics:** range of hot pressed glass bonded ferrite tape heads. ● **SATT:** *SAM82* 8/2 portable mixer and the *SAM42* 4/2 compact mixer. ● **Schoeps:** comprehensive range of studio condenser mics and accessories. ● **SCV Audio:** wide range of signal processing equipment. ● **Sennheiser:** the complete lines of dynamic and condenser mics, the *MKE 212* boundary mic, the *KAT 15-2* adapter for use with a *Nagra IV* allowing the use of a third mic; new wireless mic systems with the multichannel receivers *EM 1026* and *EM 1036* and the new pocket transmitter *SK 2012*. ● **Selectronic:** no information received. ● **Sescom:** wide range of audio accessories and modules; transformers, splitter boxes; direct boxes, parametric and graphic equalisers; and a range of test equipment. ● **Shure:** the range of dynamic and condenser mics, phono cartridges and sound reinforcement systems. ● **Siemens:** wide range of audio products. ● **Sierra Eastlake:** acoustic consultancy service. ● **Solid**



Two Sennheiser MKE 212 boundary mics

State Logic: examples from the *SL-4000E* and *SL-6000E* ranges with *Total Recall*, *Real Time* and *Events Controller* additions. ● **Sonosax:** ranges of flexible small and medium sized consoles. ● **Sony:** digital equipment with the complete line-up being the *PCM3324* digital multitrack, *PCM1610* and *DAE1100* mastering systems, *CDP5000*, *CDA5000* and professional compact disc player analyser, *DAQ1000* cue editor, *DRE2000* digital reverb and a *CDP101* consumer compact disc player. Sony wireless mic systems will be shown and demonstrated together with an *MX-P42* ENG mixer and the *MX-P21* small console. Sony will also have **MCI** equipment on display including *JH636* and *JH500* consoles with the new *JH800* broadcast console together with a selection of tape machines from the *JH-24* and *JH-110* series. ● **Sound Workshop:** several ranges of mixing consoles and the *Diskmix* automation storage system. ● **Soundcraft:** wide range of live and studio consoles including the *2400* with automation; *800B* and *400*; *Series 1600* and the range of multitrack tape machines. ● **Soundtracs:** full range of live sound and multitrack consoles including *16/4*, *16/4/2*, *24/4/2*, *16/6* monitor and the *Omni* series. ● **Stage**

Accompany: display of their power amplifiers and electronic crossover systems. ● **Stanton:** wide range of phono cartridges for broadcast applications plus a phono amplifier. ● **Stellavox:** range of portable tape machines and the multi-standard studio *TD88* tape machine. ● **Studer:** the full range of tape machines, multitracks and consoles including the new *A810* range of 2-track tape recorders with microprocessor control, the *A800 Mk III* the *A710* professional cassette recorder, different versions of the *PR99*. Also the *TLS 4000* synchroniser, *ECS-600 Event Controller* system, *Model 2706* monitoring speaker system and *A726* VHF-TM tuner. ● **Syn-Aud-Con:** details of the consultancy's professional audio courses, seminars and workshops. ● **Synton:** *Syntovox 222* vocoder; *Syntovox 221* effects vocoder and the *202* vocoder; the *Syntovox 232* 16-channel vocoder with voltage controlled filter bank.

T

● **Tandberg:** full range of tape machines, cassette decks, and ancillary equipment. Featured will be the new *TCD 3014* cassette deck which allows comprehensive control over the cassette parameters. ● **Tannoy:** wide range of professional monitor loudspeakers including the *Dreadnought*; *Super Red*, *Little Red* and the *SRM Series*. There may also be amplifiers from the new Tannoy Tresham division. ● **Tapematic:** *TMD 470/630* automatic cassette winder; *TMD 470* semi automatic winder; *TMD 530* cassette labelling machine; and *TMD 670* cassette boxing machine. ● **Teac:** wide range of tape machines and consoles with emphasis on the new 8-track 1/2in *Model 38*, the more sophisticated 8-track 1/2in *Model 58* and the 4-track 1/4in *Model 34*. ● **Technical Projects:** the redesigned *MJS 401D* test set; *Series 5000* stereo production console; the *Multi-Pan* programmable multichannel memory panner; telephone *FX* generator and a wide range of items. ● **Toa:** wide range of live sound and studio oriented mixing consoles, power amplifiers, speaker systems and ancillary units. ● **Tongraphie App:** no information received. ● **Tore Seem:** range of sound consoles from small portable units to large multitrack systems. ● **Total Audio Concepts:** see Amek. ● **Trident:** consoles from their range including the *Series 80*, *Trimix* and the budget *VFM* consoles. ● **Turnkey Two:** details of the consultancy, design and construction services.

U

● **Ursa Major:** *SST-282 Space Station* and the *8X32* digital reverb.

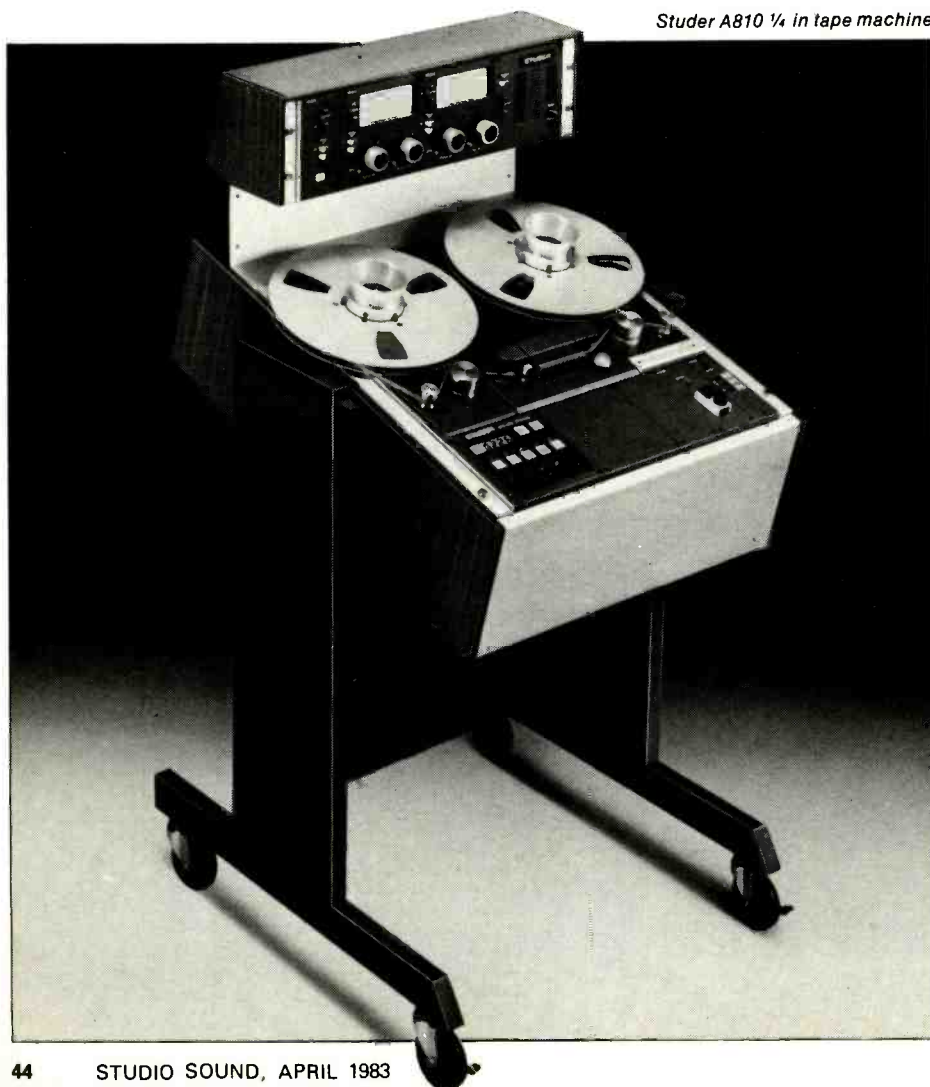
W

● **Woelke:** range of multitrack record, play and erase heads; plus cue track heads for 1/4in use. Also test equipment.

Z

● **Zonal:** range of audio tapes and cassettes and magnetic film stock.

● Editorial and advertising staff from *Studio Sound* and our sister magazine, *Broadcast Sound* will be attending the convention. Copies of the magazines will be available from the stand. ■



Studer A810 1/4 in tape machine

Consistent with Fairlight's policy of always offering the musician a choice, the CMI offers no less than three compositional programs – a real-time multitrack sequencer (Page 9), a non-real time music composition language (MCL) and the revolutionary Rhythm Sequencer. Each specifically designed to suit different styles and methods of composition. Together they are probably the most complete compositional package available today.

The Real Time Multitrack Sequencer records performances from the CMI's six octave dynamic keyboards together with all expressive nuances from either the keys or the six real time controllers. The recorder is organised in such a way that there is no limit to the number of tracks that may be laid down or overdubbed, and total storage capacity is in excess of 50 000 notes. After recording, each track may be easily 'patched' to any of the CMI's voice channels, allowing orchestration and arrangements, even while the music is replaying.

MCL is a non-real time composition language that allows all the parameters of a composition to be specified from the alphanumeric keyboard. Designed primarily to allow non-keyboard players to record music within the CMI, great attention has been paid to the expressive control of each sound. Powerful editing facilities allow any part of the score to be located and changed as necessary. MCL incorporates an error detection program that assists the composer by pinpointing any error he might have made while entering the music.

The Rhythm Sequencer, which has caused more excitement amongst CMI users than any other single development, allows real-time composition of complex rhythmic phrases which may then be combined to form complete songs. After specifying a phrase length eight separate channels of sound may be combined while that phrase is looping. The interactive program displays notes on the screen as they are played. All pitch, timing and dynamic information is recorded and an adjustable time correction facility will correct any playing inaccuracies. The Rhythm Sequencer may also be used in non-real time using a combination of the keyboard and the lightpen.

Each channel in the CMI benefits from a separate audio output allowing it to be independently equalised and echoed: the complete composition may then be recorded onto tape in one take. With the use of the analog interface, a hardware/software peripheral for the CMI, that musical information may be extracted as voltages and used to control up to eight analog synthesisers simultaneously.

If you are a composer you will find the CMI one of the most creative tools you have ever used. If you're not, we have a feeling that very soon you will be.

CMI-Extending your compositional creativity...



For further information on the CMI please contact:
Syco Systems Ltd, 20 Conduit Place,
London W2.
Telephone: 01-724 2451.
Telex: 22278 Syco G.

LEDE*

Jerry Jacob

control room design

*LEDE is a US registered trade mark of Syn-Aud-Con

The Live End Dead End (LEDE) concept is a relatively recent approach to control room design and there are very few fully certified rooms at present in operation. This is the background—both theory and practical experience—of Tres Virgos, one of the first LEDE studios built.

IT WAS a dream, a simple dream at that. A dream conjured out of necessity and fed by hope. It was a dream that probably got a little out of hand. We were going to build a new studio that was simply a nice place to make music.

Our first studio was a 4-track opened in 1975 in a garage in Mill Valley, California, a San Francisco suburb. Each of the partners, Mike Stevens, Robin Yeager, Allen Rice and I had come into the studio business as musicians or from allied music-related fields.

The studio under Robin's management grew rapidly to 16-track. Unfortunately we were getting famous, not just with musicians, but with our neighbours as well who just loved hearing vans load up at 4.30 in the morning. Each session brought new success and a summons from the Law to keep it quiet.

By 1978 we knew our days were numbered. We started to think about the new studio.

Our demands seemed simple. We believed that a place which is to be used to record music should make musicians feel good. Feelings are what music is all about and a studio should take on the characteristics of the players regardless of the form of their creative expression. A studio should be able to handle everything from solo cello to a full rock ensemble.

Studio technology, aside from its cosmetics, should be invisible to both the performer and the producer. The musician, producer, engineer, microphone and loudspeakers, and the listener and record buyer, should be one linked chain responding to the emotion of the music. No portion of the set-up from cue system to master tape can be askew. A control room is a monitoring system in which producers and engineers perform. It is their stage and it should allow them to acoustically view the performance as the microphone hears it and as the tape captures it. A control room should

not impose its will on the performance.

If you do achieve these lofty goals then it stands to reason that any tape recorded there will translate exactly on any playback system.

Off we went in search of the studio design. Allen Rice first learned about a new design theory called LEDE (Live-End, Dead-End) at a seminar held by Synergetic Audio Concepts (Syn-Aud-Con) in Southern California. Syn-Aud-Con holds the trade mark on LEDE and shares development credit on many new technologies.

The new kind of control room design was supposed to be revolutionary. The idea was to put the soft stuff at the front of the room and the hard stuff at the back and nice things would happen to your tapes and your ability to hear. LEDE developed out of a new level of scientific acoustic measurement technology called Time Delay Spectrometry (TDS). This patented measurement system was developed by Richard Heyser, of the Jet Propulsion Laboratory.

A studio owner and designer named Chips Davis had actually translated the theory to reality in his own control room at Las Vegas Recording in Nevada. Chips had received the first certification and authorisation to use the trade mark LEDE from Syn-Aud-Con. His room had been measured and it performed predictably! It did what it was supposed to do. Allen insisted that we consider the LEDE design and proved his point with a couple of hundred dollars worth of building materials, a pair of UREI 813 Time Aligned loudspeakers and a weekend of hard work. On Monday morning we owned what might have been the first LEDE-style garage. The frequency response flattened out to the point where we could toss away our 1/3-octave graphic equalisers, the stereo perspective was like wearing a headset and the imaging was really amazing. More amazing now that we

know how really primitive our early efforts were.

The success was short lived for soon the sheriff and the county encouraged by our outraged and very tired neighbours were at the door with padlocks.

We started searching for a location for our nice little new studio. Due to considerations including our budget, skills, quality and emotion we were going to build the new room ourselves, with our own hands. We talked to designers who we thought might be qualified to provide a real LEDE room for the new Tres Virgos, and although most backed away from the project Chips Davis said yes almost instantly.

Chips had built a couple of rooms since Las Vegas Recording, but he wasn't quite satisfied with any of them. They weren't what Chips knew he could deliver to a committed set of owners building from the ground up. We promised Chips that there would be no compromise. What he designed we would build. What he specified we would do—on the agreement that if it didn't work we would probably do him great bodily injury.

In January of 1980 we signed a very attractive lease on 2,900 sq ft of warehouse space in a most convenient location in San Rafael, California. We planned to add an additional 900 ft by creative lofting over halls and offices. The full 20 ft ceiling height was to be utilised over the studio and control room.

February 1, 1980, saw the beginning of the construction project that was to last 22 months until opening day and probably for ever to complete the off-line facilities and to accommodate future plans.

So that we're all on somewhat common ground perhaps this would be an ideal time to list the seven criteria established by Syn-Aud-Con to qualify for LEDE certification.

- 1 There should be a low-frequency asymmetrical outer shell, free of pronounced resonances at low

frequencies. This shell to be large enough to allow the development of bass frequencies.

- 2 There should be a symmetrical inner shell. The crossover frequency between the outer bass shell and the inner geometric frequency shell should be:

$$f_x = \frac{3 \text{ (velocity of sound)}}{\text{smallest room dimension}}$$

- 3 An effectively anechoic path should exist between the monitor loudspeakers and the mixer's ear which extends for at least 2 to 5 ms beyond the studio's initial time-delay gap.

- 4 A highly diffused (at geometrical frequencies) sound field should be present during the initial onset of the so-called Haas effect.

- 5 The monitor loudspeakers, microphone technique, and mixing console should not 'mask' the desired anechoic path from the monitors to the listener, including the period beyond the monitor to the ear's physical distance (studio ITD + 2 to 5 ms).

- 6 No early early sound (EES) should be present. This is sound that arrives at the mixer's ears ahead of the direct sound travelling through the air. EES occurs when monitor loudspeakers are not shock mounted and therefore radiate through the structure and re-radiate in the air, usually from the ceiling, near the listener.

- 7 The hard-surfaced rear wall, rear side walls, and rear ceiling should be so spaced temporally as to provide interwoven comb filter patterns which become a high-density early sound field without measurable anomalies.

We agreed that if we were to become LEDE certified, we would have to really understand the reasons and the logic behind the system. It all became clear as Chips explained TEF, TDS and the LEDE concept: "TDS is a vast improvement on pulse testing which has been in extensive use for over 40 years.

48 ►

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on audio effects.**



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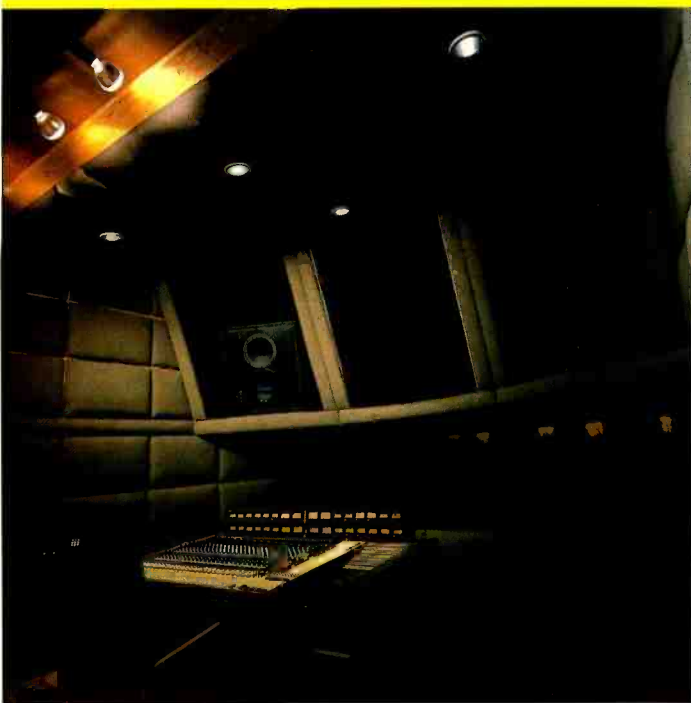
Super Prime Time. The effects are out of this world. For full details, contact F.W.O. Bauch Limited.

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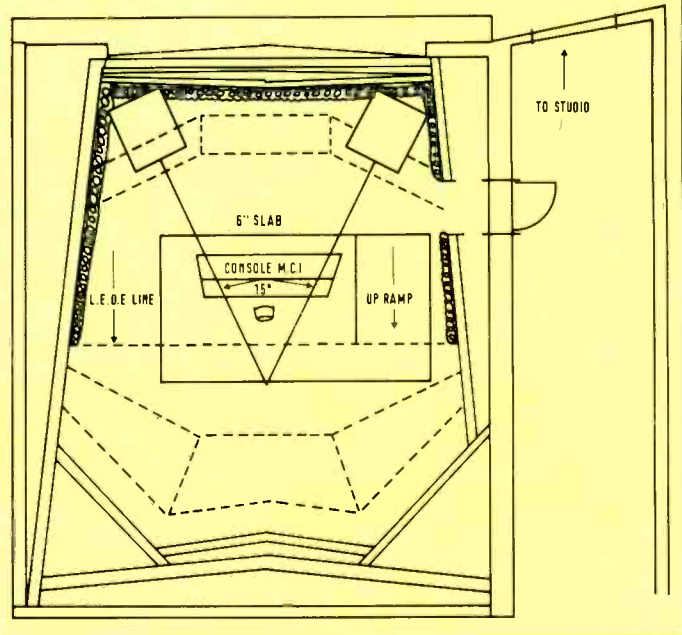
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CONTROL ROOM TOP VIEW



Briefly described, the receiver or tracking filters are delayed in time and do not start the receiver sweep until the signal reaches the microphone. This time delay sweep can then see the direct wave without having any interfering room reflections (60 dB of signal-to-reflection). *TDS* can delay the receiver and open the receiver window for longer periods of time until the first reflection is shown on the screen of the analyser. The frequency, the depth in dB, can be seen and the time delay calculated to determine the surface from which the reflection came. Tuning can continue out in time until there are no other reflections, or the window is so wide that only the total sound of the room can be seen.

"Point-wave duality is an intrinsic property of the Fourier transform map. What appears as a point in one description, will show up as a wave in the alternate description. Therefore, anything that happens in a restricted interval in one description will show up as broad wave-like smears in the other description.

"The signal used in *TDS* has a constant total energy density and a uniquely defined partition into potential and kinetic energy densities. Using the *TDS* wave analyser as the 'front end' of our measurement system and the fast Fourier transform as a predictable 'storage bin' has resulted in measurements that are several orders of magnitude better in resolution than more orthodox fast Fourier transform impulse techniques.

"Use of a *TDS* analyser in conjunction with a fast Fourier transform as a demodulator and 'storage bin' to obtain energy density versus frequency curves (EFC), energy density versus time curves (ETC), and frequency versus time curves (FTC), have been packaged into what is called the Time, Energy, Frequency (*TEF*)

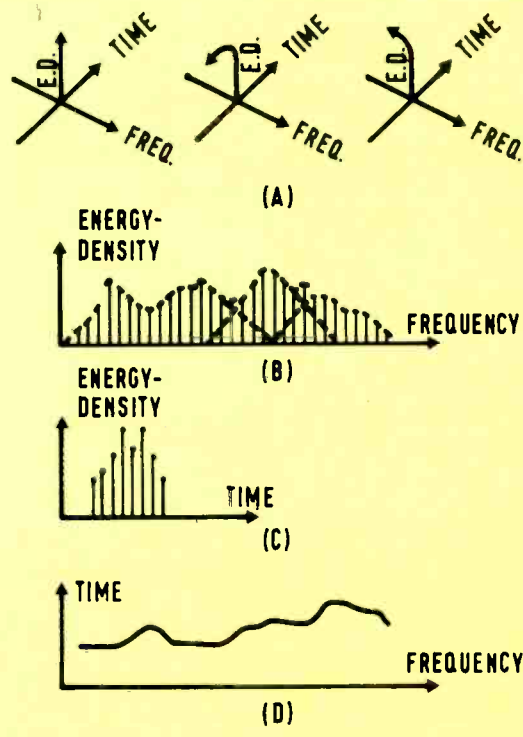


FIG.1

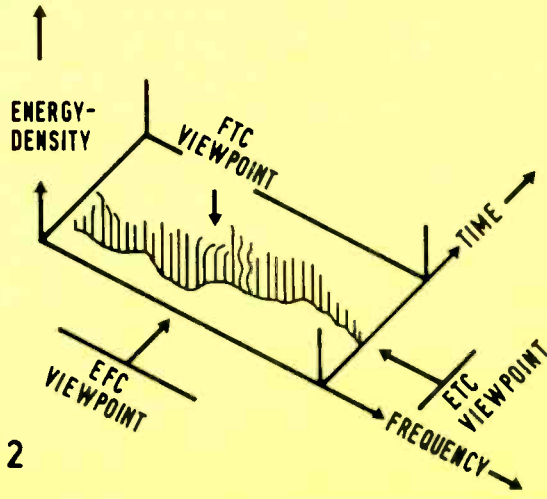


FIG.2

measurement system (Figs 1 and 2).

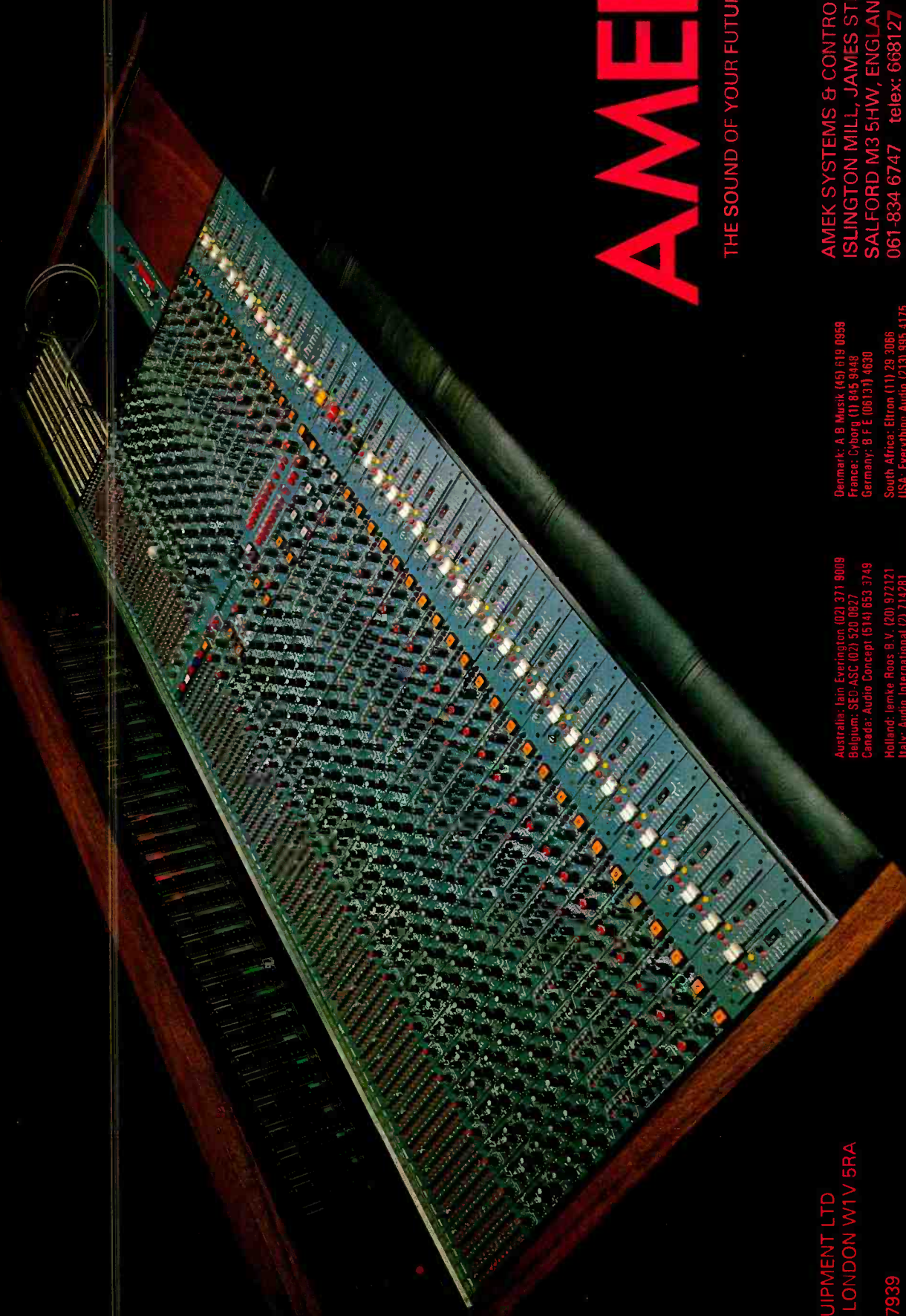
"*LEDE* is basically the complete opposite of all other control rooms. That is, the rear of the room is hard and reflective while the front is as absorptive as possible.

"Let's start with the front of the control room, and explain the reasons behind the absorptive half. Through *TDS*, we've found that mixing of early reflections from the hard ceilings and walls of conventional control rooms with the direct wave causes very deep anomalies in the order of 25 to 30 dB. (Anomalies are any deviation from the original response, therefore, distortion.) These anomalies are broadband and very deep when generated by very early reflections. They occur from the low mid to the uppermost frequencies beyond the audible range. The anomalies, from improper acoustical design, are caused by addition and cancellation of signals arriving at the mixing position out of phase, the phase depending on the time interval or the distance of the early order reflections.

"The acoustical anomalies and anomalies due to improper loudspeaker design cannot be equalised into a smooth, flat reproduction spectrum. To equalise a control room under these conditions with the equalising microphone at one position (in the mixing position), you could obtain a reasonably flat response. Move the microphone 2 in and the curve becomes a gross, maladjusted, unequalised mess. Try this in your control room. Move the microphone in the area of the mixing position and watch the response curve change.

"*LEDE* acoustical design minimises this effect and helps keep a uniform frequency response in the mixing position. The anomalies are real and do exist in hard-front control rooms. We can see these effects and mathematically study

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their cause and effect with the aid of time delay spectrometry.

"The live end of the control room is, I think, the most important part of the room. The Haas effect is a simple, but very important, fact of the *LEDE* control room. The Haas effect is the ability of the brain to discriminate against echoes and delays of sound that arrive approximately 10 to 20 ms after the original waves. The sound is still present but psychoacoustically does not exist so far as the listener is concerned. If the listener is 10 ft or less from a wall, the sound wave travels past him to the hard wall and back—a total of 20 ft—and he will not be aware of its origin. This is called the Haas effect. At greater distances the listener hears echoes or flutter. A hard-backed wall that is 10 ft or less away does not acoustically exist in our brains. The brain doesn't recognise or receive it. Again, this is the Haas effect. Therefore, we have, for the listener, eliminated the back wall, created an infinite distance in space psychoacoustically, and all we can hear are the front loudspeakers.

"We have discovered at Tres Virgos how to extend the apparent Haas effect out to over 40 ms with the Haas effect extenders (Fig 3) and by the tight control of the reflected Energy Density in time.

"Now that we have a disappearing back wall, we have to treat it acoustically, and this is where everything becomes like a game of acoustic pool at 1,130 ft/s. We splay, angle, direct and bounce the sound that strikes the rear wall back to the mixing position. This stacking of an immense number of reflecting paths from the back wall is very precise and is figured extremely closely as to time interval.

"What we are trying to achieve is a very dense and diffuse total sound spectrum by combining the paths of the back wall into a series of controlled narrow band comb filters. Successfully done, the overall result is a very smooth total sound spectrum without any broadband anomalies. This procedure also masks console reflections, tape machines, people, etc, so that what is heard by the mixer is a true and extremely accurate sound.

"If the back wall is designed incorrectly, the possibility of having reflections arriving outside the 20 ms time interval would be disastrous. Inside the 20 ms range, an initial time delay gap of a much larger room is present at the mixer's position. You can turn and face the rear wall, cup your ears, and none of the sound from the monitor loudspeakers ever seems to come from anywhere but the monitors. It is totally undetectable in direction, but audible in level. Careful diffusing of the rear wall and a very soft, nearly anechoic front wall are what makes an *LEDE* design an incredible mixing environment. You have complete control of placement, depth and locality."

We couldn't argue with the

concept and the idea of knowing a control room's performance before the first day of construction, was really attractive.

In order to achieve our goal we adopted the attitude that we were indeed designing a system into which every piece and part would be specified in advance, to the limits of practicality. Obviously, budget limits madness, but creativity and predictability and hard work can overcome budget. We didn't want to have to do this again and, frankly, there was no real budget set because we didn't have any money anyway. What we spent we raised as we went by personal investment and mortgaging every tangible personal asset we could find.

We understood that all of our efforts would be in vain if the construction fell short of excellence.

The outer boundary wall system with its asymmetrical outer shell called for the most creative planning. Local building restrictions prevented us from using filled cinder block with a scratch coat of stucco (an ideal technique). Due to weight restrictions, we had to improvise a broadband, massive, rigid boundary system that weighed less than cinder block while equalling its acoustic properties as a low frequency containment system.

This system was comprised of the following sandwich over Fibreglass-filled 2 x 6 ft panels. One layer of high density industrial grade particle board, one layer of Celotex (sound board) and 1 in of hand laid stucco (concrete), on both sides of the 2 x 6 ft panels.

The entire studio and control room systems were isolated, floated and built like a ship. All construction was to tight tolerances and all construction was screwed and glued except for final finish trim strips which were nailed and glued. No rattles! The air conditioners are

mounted on an adjacent building. The music room, control room and office all carry separate 4-ton capacity units. Quiet, very quiet. All lateral support connections between walls, ceiling and at all intersections were made with a 'Motor Mount' system we devised that allows for both structural integrity and virtual total isolation. Every seam, joint and corner was caulked with a variety of black, white and green gooey stuff specified for the application.

The acoustic absorption panels were of our own design, and *TDS* measurements show them to be at least twice as absorptive as the leading cut foam absorption product. They were also far less expensive too, if you have slave labour!

The inner and outer wall geometry, the control room specific reflection and diffusion geometry and the psychoacoustic parameters were all worked out by Chips and Ed set out to solve some mysteries in the electronics chain. Once you had a control room that was effectively passive to the loudspeakers, the loudspeakers started letting you hear things that had to be in the electronics chain. Phase distortion and shift became painfully apparent. All the other little mismatches, problems and glitches which were hidden by time smear and various anomalies in most control rooms would surface like dragons in our new control room. Ed's understanding of phase coherence and his insistence that a signal stay in electronic phase alignment from the mikes to the loudspeakers, and in acoustic phase

(time) alignment from the loudspeakers to the listener, was invaluable.

Part of the theory of the electronics system Chips and Ed specified for Tres Virgos was the concept that in multitracking situations (the normal in a studio) your ability to capture music is limited by your ability to pass the high level transients of the loudest rock instrument, the kick drum (131 dB). Thus the studio's *MCI 500B Series* console 38 V power supplies allow you to use voltage not current to push your signal around. Push a signal with current and you overdrive the system into changing phase. Massive power on the loudspeakers helps though, in our case using Crown *M-600* power amps. Nearly 1.3 kW per side linked with a special circuit (Delta Omega) that for all purposes 'sees the loudspeaker as a dead short'. We use a lot of *PZM* microphones, too. Because of this we can hear their subtleties in our control room and they are phase coherent.

Headroom means never having to trim your masters in a mix. Headroom means never having to clip. Headroom coupled with coherent phase means monitoring for hours at 120 dB impulse with no pain and no noticeable degradation of hearing integrity. Also, no ear fatigue.

So far, Tres Virgos has been visited by dozens of studio owners, designers and musicians from all over the world. The reaction has been universally enthusiastic. We maintain an open door policy (at the discretion of our clients) and love to show the studio off.

We're proud to have been a part of the birth of this new science and are thrilled with the number of both certified *LEDE* control rooms and non-certified attempts that have given their owners the benefit that even minimal adherence to the principles can provide. ■

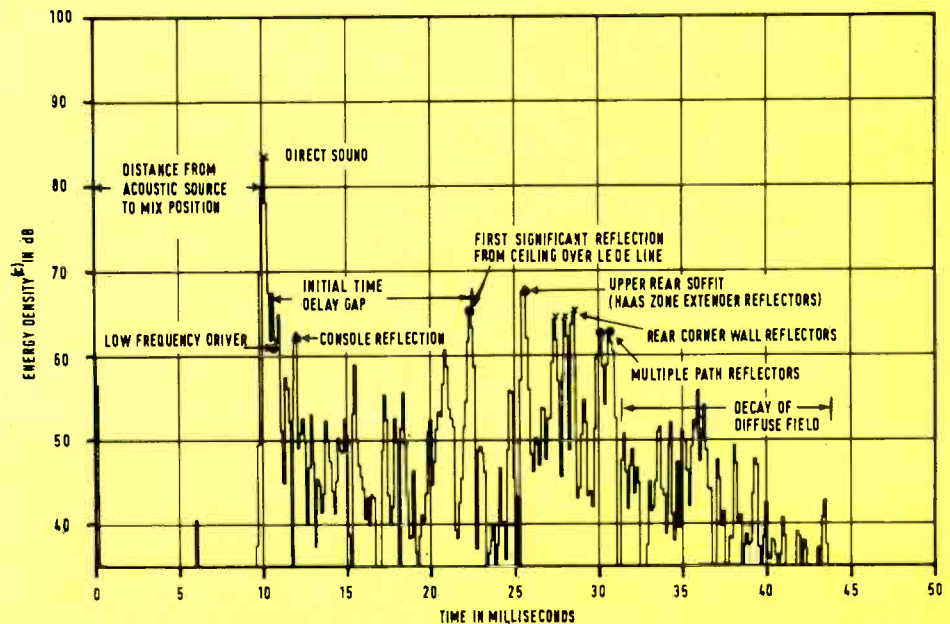


FIG. 3

"No noise, nor silence, but one equal music."

John Donne, 1571-1631.

The new Klark-Teknik high-performance DN30/30 graphic equaliser offers much more than just a quiet ability to balance channels right across the audio spectrum. Thoughtful ergonomics are backed by a new circuit design breakthrough using ultra-stable microelectronic filter networks to set performance standards comparable with Klark-Teknik's 'golden oldie' the DN27A. The DN30/30 is the equaliser to boost a studio's reputation, meet broadcasting specs in less rackspace, cut costs and equipment failures on the road — because ...

It fits two matched high specification graphic channels into a single unit, each providing $\frac{1}{3}$ octave equalisation over a full 30 ISO centre frequencies.

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Its advanced design, tough construction, stringent testing and long burn-in exceed even Klark-Teknik's previously high standards for reliability and consistent performance on the road.

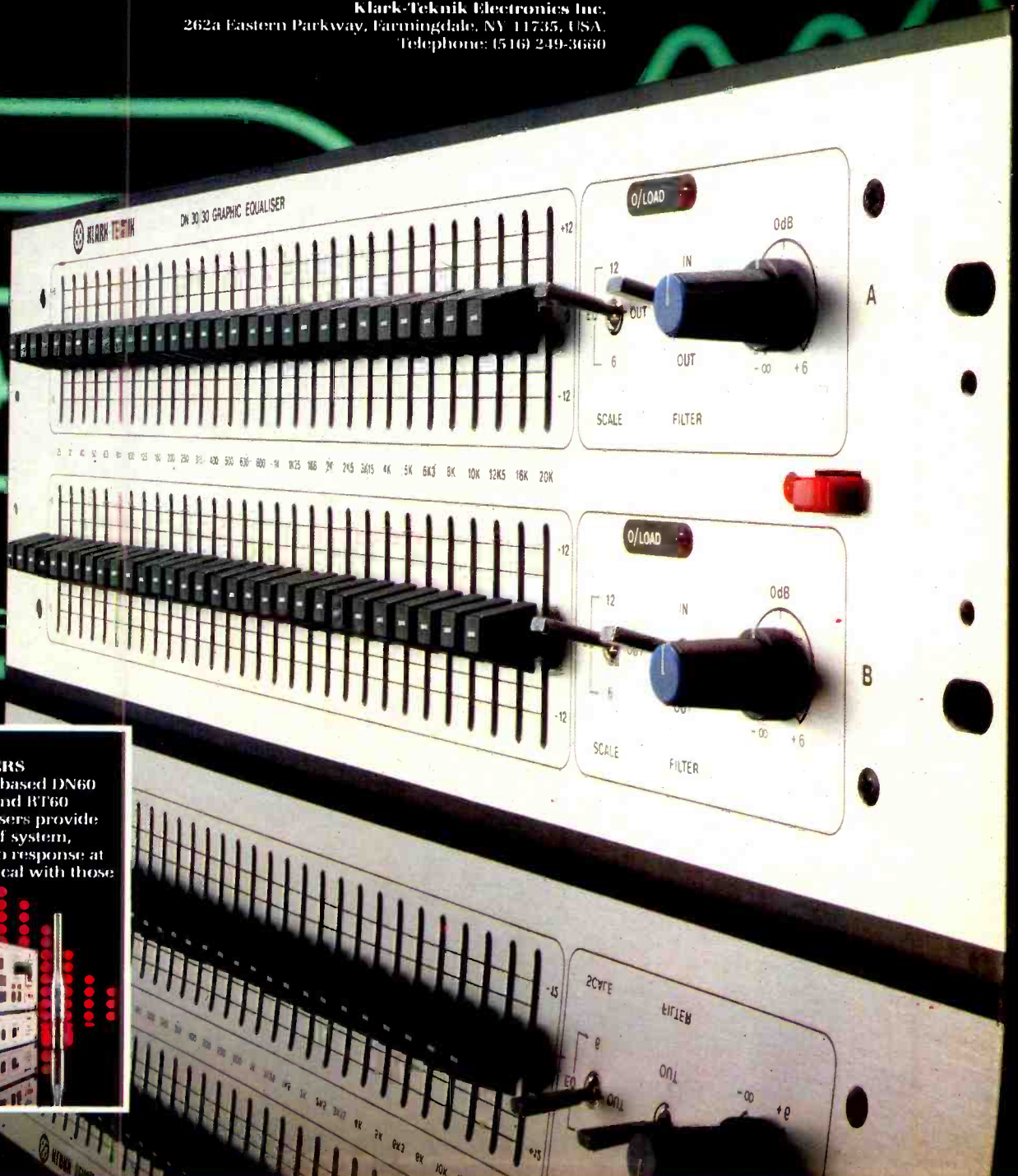
For technical information ask for: Our DN60/RT60 Data Sheet. Our DN30/30 Data Sheet. Our Application Notes on equalisation.



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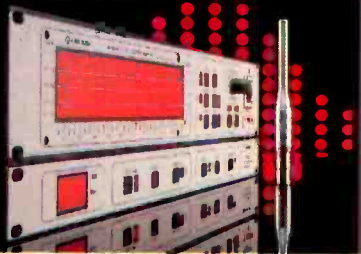
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Richard Elen

Chipping Norton was completed in September 1972 and the first sessions took place the following month. Ever since then, the facility has grown steadily over the years in both technical sophistication and facilities until today it is one of the most highly respected out-of-town studios in the country. But although Chipping Norton was only the third major commercial 'countryside' studio in Britain, after Rockfield and The Manor, it is significantly different from either of the others. For one thing, it was originally intended to be set up in North London.

A studio on the horizon

By the early '70s, Richard and Mike Vernon were well known in the British recording industry. They owned Blue Horizon Records – an important specialist blues label – and Mike was a house producer for Decca. In addition, they set up a record store in Parkway, Camden Town, specialising in blues material. It was virtually inevitable that one day the idea of a studio would come

to mind, and when that day came, plans were drawn up for the backyard studio-to-be. The brothers took the plans along to Dave Grinstead, then a Decca engineer with a strong track record, and asked his opinion. "Great," said Dave, "but there isn't enough room!" The search began for other premises.

The first discovery the Vernons made was how expensive central London overheads were. A continuation of the search out of town was the obvious choice, and sites were examined in ever-widening circles. One day a potential location in Wales was examined – unsuccessfully – and the return journey took the Vernons back through the Oxfordshire market town of Chipping Norton. Rounding a corner they spotted a building for sale. It had originally been the 'British School' and had been built in 1854. A brief examination indicated that the building had great potential, and a visit to the estate agents was made. It turned out that the building was remarkably good value for money, and the Vernons decided that,

finally, a site for the studio had been found. Dave Grinstead was employed as 'general technical person' and design got under way.

The birth of a studio

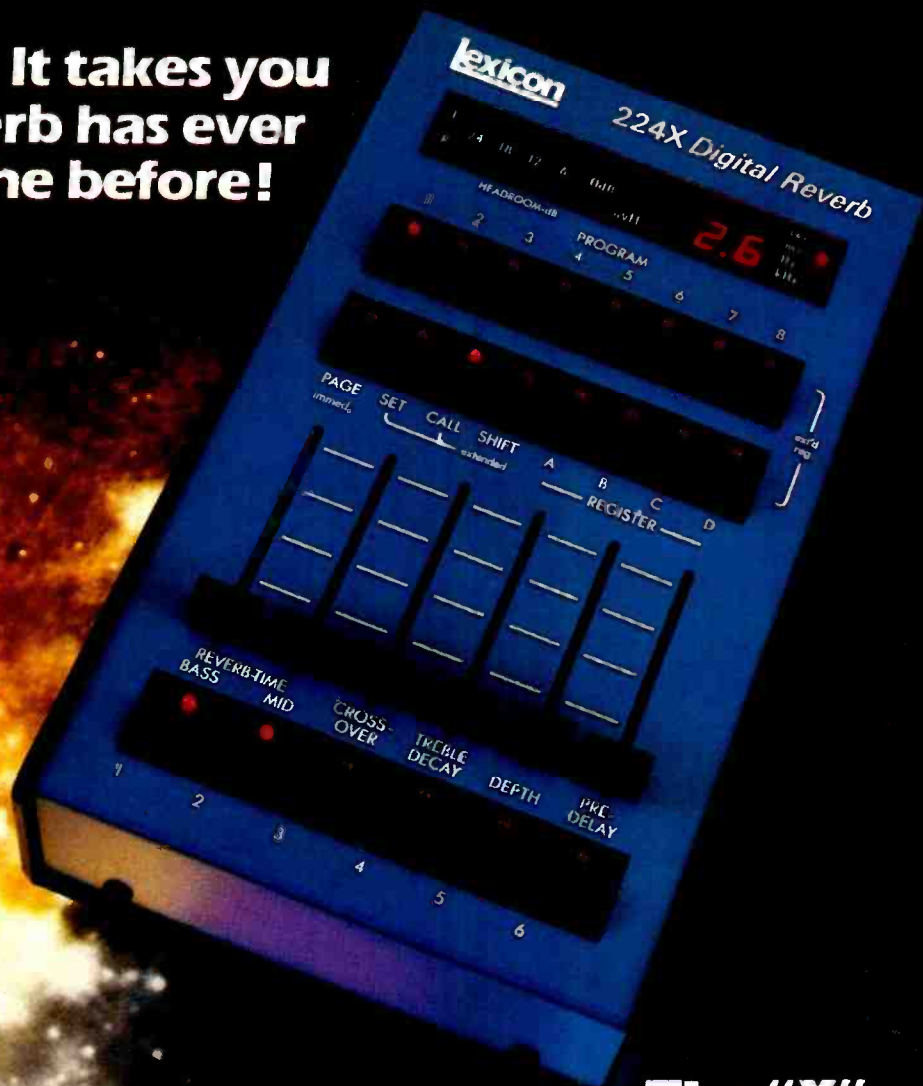
The majority of the design work was performed personally by Dave and the Vernons, including the acoustic treatment, which relied largely on acoustic tiling and included little in the way of traps and the other accoutrements of modern designers. As late as the early '70s, studio acoustics were still generally worked out with a combination of common sense and rule of thumb, and it was very unusual – in Britain at least – to involve anything much more complex. There was also the accommodation to consider: obviously, it was necessary to have a sufficient number of bedrooms for a band to stay. In the early days the studio building incorporated six bedrooms and self-catering facilities. The accommodation side was fairly low-key, and bands had to look after themselves to a fair degree. Luckily, this is not so difficult in a place like

Chipping Norton. It is a busy market town, with a good selection of pubs, very high quality restaurants and other facilities, all within walking distance. You are not forced to use the car for absolutely everything.

On the technical side, the studio was to be 16-track, and the tape machine was to be an MCI – one of the first in the UK. The console was not quite so straightforward. It was discovered that Malcolm Toft, then studio manager of Trident Studios, had built a console which appeared to have all the facilities that the new studio required. Malcolm was in charge of building consoles for Trident's own use – the origin of the 'A' range – and it turned out that John Kongos had also approached them about a console. Malcolm felt that two orders plus in-house consoles were a good reason to start a console manufacturing division of Trident, and approached the Sheffield brothers – the people behind Trident – with the idea. They agreed, and the result was the setting up of a new division of Trident –

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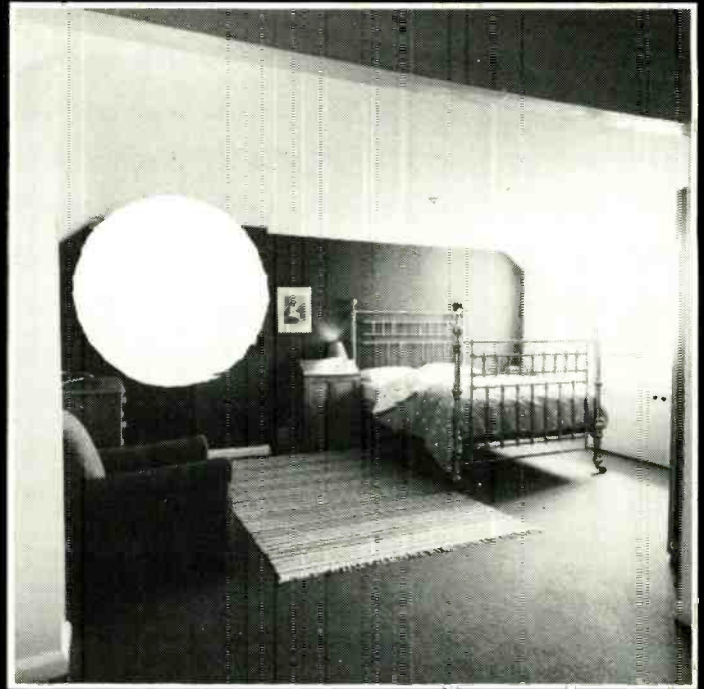
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Trident Audio Developments, or Triad, as it was then known – to make consoles, with Malcolm Toft in charge. Thus the Chipping Norton console became the second 'B' range desk made, and Chipping Norton was at least partially responsible for the setting up of one of Britain's foremost console manufacturers!

The console itself was an 18/8 with 16-track monitoring, and was clad in a green plastic laminate.

The gear was finally installed and wired in – again by Dave Grinstead – and the studio finally opened in October 1972. It was booked solidly from Day One, which gave all three plenty to do. Richard Vernon was responsible for studio management, Mike Vernon spent most of his time producing, and Dave Grinstead did more or less everything else – including engineering and maintenance!

Development

The original intention had been to run the studio specifically for Blue Horizon acts, but by the time the studio opened, the British music scene had changed a good deal, and there was little call for a blues label as such. The label entered retirement and the studio was run as an independent commercial entity, although as it happened, the first session was with a Dutch blues band for EMI Holland.

From the beginning, the studio was busy, and after six months or so Dave brought in Barry Hammond – previously an assistant engineer at Morgan – as a staff engineer.

Technical upgrades were carried out every three or four years, as

necessary, and 1975 saw the upgrade to 24-track with the addition of an MCI JH-100 machine and a Trident 'A' range console. Then in 1979–80 the studio was updated again. A Trident TSM was installed along with another MCI machine – a JH-24. Prior to this it had been decided to change the studio design somewhat, and in 1977 John Storyk of Sugarloaf View had been called in to redesign the acoustics. Storyk's approach to their requirements – for improved separation but without losing the generally 'live' feel of the room – did not rely on large trap areas in the Eastlake style, but on smaller treatment areas which suited this particular environment more closely. In the 16x16ft control room, which has a ceiling height of about 9ft, the monitors were recessed and flush-mounted into panelled walls which were angled appropriately, and in the studio a crum rostrum (now used for piano) was added along with carefully-designed recesses to suit amplifiers and the like under an overhang. A very pleasing – and acoustically appropriate – effect in both rooms is given by the combination of wood panelling and occasional stone facings. The studio includes a good ceiling height of around 12ft, while the roughly rectangular room measures 32ft long by an average of about 16ft wide. Extra recording areas are provided by other rooms in the building which are fitted with ceiling lines, thus giving access to a wide selection of ambient acoustics. The control room is above and alongside the studio itself, and parallel to it, such that the engineer looks right

and down from the console into the studio.

The Best In The Country

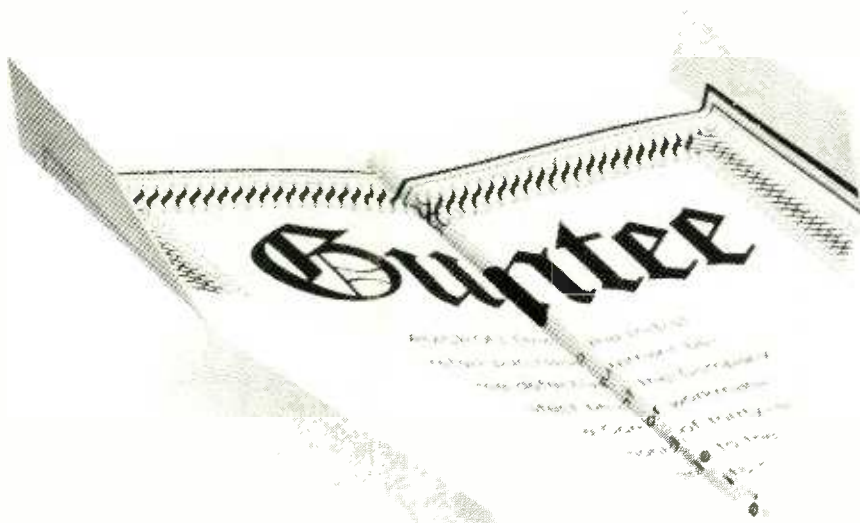
Chipping Norton gained a firm reputation, and attracted a large number of 'name' clients. For some reason, the studio held a particular attraction for singer/songwriters who used the studio a great deal in the mid-70s, including Richard and Linda Thompson, Chris Rea, Richard Digance, Ralph McTell and, possibly the best-known, Gerry Rafferty, who recorded his chart albums and the hit single *Baker Street* at the studio. The facility thrived on the rural image – a painting was produced by a local artist and copies were issued as posters and flyers, depicting the building surrounded by scenes from within the studio and surrounding countryside, presented in the manner of a traditional country brewer's sign, with 'Chipping Norton Recording Studios' displayed above the slogan 'The Best In The Country'. The image suited the studio, the music and the clients of the time.

But once again, musical tastes changed, and the studio changed with them. Chipping Norton has entered what one might call its 'New Romantic' period, and a large number of modern bands have used the facilities in recent years. Solidly booked as ever, the studio is today the recording centre for several top acts, including Duran Duran, Talk Talk, Level 42, and Dexy's Midnight Runners. While I was talking to Dave Grinstead in mid-January, the studio was occupied by one of EMI's

top new acts, KajaGooGoo. Neither have all the clients been UK-based: the studio has played host to acts from all over the world, and the present state of sterling means that more than ever the studio is attractive to North American clients for whom the flight expenses will be completely offset by the value-for-money obtained from a British studio which includes full 5-star accommodation as well as world-class recording facilities.

In fact, the accommodation at Chipping Norton is integral to the studio package. The studio is available on a daily or weekly basis, and each day means the full 24 hrs: hiring the studio also brings the benefits of 12 double bedrooms in five different locations, three of which are self-contained cottages next to the studio with TV, sound system, kitchen and bathroom; a full English breakfast in the panelled dining room; a leisure evening meal with wine or traditional real ale – plus snacks available at all times; and video and pool rooms plus electronic games and an adjacent squash club. But despite the self-contained nature of the studio, and its apparently rural location, Chipping Norton Recording Studio is not in any sense inaccessible. It is little over 90 minutes from central London by car, and it is not in the middle of nowhere – on the contrary, it is near the heart of an English market town. Yet this does allow recording to continue without the untoward interruptions which mar recording in major cities. You can park there; you can get the gear in without getting a ticket; and you will not

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have people turning up all the time during sessions – unless you ask them to. Yet as far as recording facilities are concerned, it's a studio as advanced and sophisticated as any in a major city: the best of both worlds.

Equipment

In the control room, pride of place is obviously given to the Trident *TSM 32/24* console, facing the JBL *4326* wall-mounted monitors, the latter being driven by a Crown *Ameron DC-300* amp. In addition to the main monitors, a pair of *Auratones* rest atop the desk in the usual way in case you want to see how the track would have sounded if there were still *Dansette* record players alive in the world. Here, though, they are dwarfed in performance by a pair of the excellent *Visionik David 6000* speakers which sit beside them for the use of the cognoscenti – a select group to which every self-respecting engineer should belong. Both sets of secondary monitors are driven by *Quad* amplifiers. A nearby video monitor provides the engineer with a CCTV link to the studio which gives a useful addition to straight visual contact. In the ceiling is a large and powerful ioniser which helps to clear the air and brighten the atmosphere in the indisputable way such devices do.

Behind the console is a row of tape machines flanked to left and right by noise reduction and outboard equipment racks respectively. The *MCI JH-24* has 24 channels of Dolby-A associated with it, and next in line are two *Studer A-80 RC* 4 in

recorders, each with Dolby. The standard tape used in the studio is *3M 226*. In the corner sits a ubiquitous *Revox A77*, while above it on the wall is a *Tandberg TCD-330* cassette machine for high quality cassette copies (there is also a *Wollensak* high-speed cassette duplicator). Also available is a *Pioneer* record deck with *Quad* preamp.

Reverberation is handled by a pair of *EMT 140* echo plates, plus a *Master Room MR11* reverb, and the *AMS RMX16* digital reverberation system. Other outboard equipment – some in the rack, while other units are mounted within the console – includes *AMS DMA 15-80S* and *Eventide 1745M* DDIs; *Eventide H910 Harmonizer*; *Bel* stereo flanger; *Survival Projects Auto-panner*; *Orban De-esser* and stereo parametric equaliser; *Marshall Time Modulator*; half a dozen *dbx 160* and *165* compressors plus a pair of *Urei 1176* units; and a selection of noise gates from *Valley People* and *Roger Mayer* alongside the remarkable *Drawmer* dual gates.

In the studio is a comprehensive selection of mics, including all the well-known names: *Neumann*, *Beyer*, *Sennheiser*, *AKG*, *Shure* and *Electro-Voice*, and the studio is presently getting excellent results from some new *PZMs*. The studio foldback is via *Quad* amps driving *Beyer* cans, utilising a custom 4-way system giving each musician an individual volume control. Studio playback is via a pair of *JBL 4311s* driven by a *BGW* amplifier. Instruments include a *Yamaha* grand, *Fender Rhodes*, *Hammond C3*,

Clavinet and *Minimoog*, and there is a wide selection of LA percussion.

People

Just as the studio facilities have improved over the years, and the accommodation has been increased, so more staff have been taken on to see to the day-to-day requirements. *Dave Grinstead* has retired from active engineering to concentrate on studio management, administration and maintenance, while *Barry Hammond* is the resident engineer (although of course, the studio welcomes freelance engineers). *Dorothy* looks after day-to-day administration and there are two cooks: *Jane*, who come in from Tuesday to Friday and *Laurie*, who handles Saturday, Sunday and Monday. In addition, a team of cleaners comes in three times a day to keep the place looking spick and span.

Although both *Richard* and *Mike Vernon* are 50/50 shareholders, *Mike* is involved mainly in his production activities while *Richard* is the MD of the studio and, with *Jane Scobie*, runs a recently-established London office which handles studio bookings in addition to operating an associated management company. Recent signings include *Linda Thompson* and a new Belfast-based band, *Silent Running*. The management company has recently succeeded in securing a record deal for the band with *EMI*, following some very impressive recordings made at the studio. The company also represents producer *Hugh Murphy*, and they expect to branch out into music publishing in the near future.

The future

The studio is certainly capable of adjusting to changing fashions, as its very successful 10-year track record testifies. *Dave Grinstead* recognises that this depends on people and atmosphere just as much as on equipment. But he does have ideas for the studio which will improve its versatility even further. One plan already under consideration is to enlarge the studio, placing a live area at one end. Live studios are becoming fashionable again, and this modification will help the studio to offer 'liver' sounds with greater ease and speed as well as offering more recording area. A longer-term plan, requiring some structural alterations, involves enlarging the control room and turning the console round to face the window. So far the studio has not found it necessary to diversify into video and related fields, since despite the recession the bookings situation has been strong. The studio is however very much aware of the need to keep abreast of new areas of importance to the industry. Overall, the studio admirably succeeds in offering what its clients want most of all: a fully-equipped 24-track recording studio in a peaceful and undisturbed environment which isn't 25 minutes drive from the pub! ■

Chipping Norton Recording Studios, 28/30 New Street, Chipping Norton, Oxfordshire OX7 5LJ. Phone: 0608 3636.

London office: 9 Thorpe Close, Portobello Green, London W10. Phone: 01-960 7192.

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Rules and Regulations for The World Record Distance of Communication by Tin and String

DEFINITIONS

Communication by string and tin shall be deemed to have been established where verbal communication between two consenting adults has been established over a length of flexible material henceforth known as 'string' to which are attached at each end a potentially vibrating transducer henceforth defined as 'a tin'.

Filtering shall be provided between the two communicators such that direct radiation between the communicators is limited to the frequency band 20 Hz to 10 kHz within the bandwidth of the audio, tactile and visual facilities of *homo sapiens*. Furthermore, no frequency transformation apparatus may be employed by either communicator.

'Communication' is defined as the communication of verbal information correctly between the two communicators. Words shall be defined as utterances in the local means of verbal communication which can be translated into graffiti without offence to Ms Whitehouse *et al*.

SPECIFICATIONS

1) String

String shall consist of a flexible material, the electrical properties of which are immaterial but shall in no circumstances directly contribute to the transmission of communications. The transmission of communications by string shall rely upon the mechanical properties of string which shall be within the following strict limits:

Density (gms/ml) within the limits of the density of Charcoal (0.4) and of Constantin (8.9)

Youngs Modulus shall be less than 0.46×10^9 dyn/cm²

Tenacity (dyn/cm²) shall be within the limits 0.6 to 50×10^9

The operational tension of the string shall in no circumstances exceed either 105 kg total tension or the limit of 25 kg per square millimetre of cross sectional area of string as measured by an optical interference method at an ambient temperature of 294°K and a relative humidity not exceeding 100%, the atmospheric pressure being held within the limits 600 millibars to 1105 millibars.

2) Tin

The tin section of the transmission system shall comprise two transducers which are known as the 'transmitter' and the 'receiver', the former being a transducer for the transmission of sound to string waves and the latter being a transducer for the conversion of string waves to sound waves.

The conversion efficiency of the two transducers shall be determined by statistical analysis of the theoretical efficiency of a hypothetical sample of a random number of similar transducers and shall not demonstrate probable errors of efficiency in excess of n^5 dB where (n) is the sample size.

The materials used for the construction of either transducer shall be at the option of the manufacturer provided that the standard of construction shall be to engineering standards that are appropriate to the purposes for which the transducers are intended in use. Notwithstanding



British National Tin and
14 St. Ethelred's Place, London WC3H

the preceding, the use of materials having a flash point below 127°C should be avoided unless it can be shown that the transducers comply with the Factories Act in force at the time of demonstration.

Neither transducer shall have a volume in excess of that occupied by 8×10^{28} atoms of a pure silicon crystal and it is recommended that this dimension be evaluated by ascertaining the volume of pure hydrogen dioxide displaced by sample transducers.

The availability of spare parts for transducers is of paramount importance in order to make available adequate field maintenance services. It is therefore a requirement that transducers shall be constructed from piece parts that are readily available from one or more of the common retail trade outlets which are to be commonly found.

OPERATION AND ADJUDICATION

The evaluation of system performance necessitates the provision of controlled climatic conditions in combination with strict control of pollution. In view of the dimensions of the necessary controlled environment the British National Tin and String Evaluation Centre has been set up to agree suitable sites for the definition of National Tin and String Evaluation Areas. The Committee is expected to report on this matter in the near future.

Notwithstanding the above, the evaluation shall exhibit controlled temperature within the range 280°K to 300°K with a relative humidity below 98% and a maximum precipitation of 0.97 cm/hr. The

wind velocity during the evaluation shall at no time exceed Beaufort force 11 within 5 km of the test site.

The noise pollution at the test site is of paramount importance and shall, if necessary, be maintained by artificial pollution within the limits 35 dB(A) ± 2 dB(A) as determined by means of a precision sound level meter complying with British Standard 4197:1967.

Adjudication of the system performance shall be undertaken by a suitable number of independent adjudicators two of whom shall be stationed at the mid point of the string. Should a transmitted word be correctly heard by either adjudicator this word shall be disqualified. Each pair of system operators shall prepare in advance a list of 15 words for transmission; the centre string adjudicators shall be aware of the words to be transmitted. The transmitter operator shall transmit the words to the receiver operator in random order as determined by an independent adjudicator accompanying the transmitter operator, the order of the transmitted words being recorded by the adjudicator. A further receiver adjudicator shall record the words received by the receiver operator. The correct reception of 80% of the transmitted words shall be deemed to demonstrate satisfactory transmission.

At the termination of each successful transmission sequence the distance between the termination of the string shall be measured and recorded by all adjudicators. The maximum length of string consistent with satisfactory transmission shall be determined for each competitive transmission system.

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product power amps guide

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Dynacord Electronics GmbH, Siemenstrasse 41-43, D-8440 Straubing. Phone: 09421 3101.
USA: Dynacord Electronics Inc, PO Box 26038, Philadelphia, PA 19128. Phone: (215) 482-4882.

A 1001: 2-channel, 80W/channel, bridgable, LED level indication.
A 2002: 2-channel, 170W/channel, bridgable, LED level indication.
A 3003: 3-channel, channel 1 170W, channels 2/3 75W, LED level indication.
AX 303: mono triamp, LF 170W, MF 75W, HF 75W, adjustable electronic crossover frequencies, LED level indication.

EDCOR (USA)

Eddor, 16782 Hale Avenue, Irvine CA 92714. Phone: (714) 556-2740.

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ELECTROCOMPANIET (Norway)

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UK: Gotham Audio Ltd, 12 Glendoline Avenue, London E13 0RF. Phone: 01-471 1512.

Amplifier 1: 2-channel, 200W/channel.
Amplifier 2: 2-channel, 50W/channel.
Amplifier 1: mono, 200W.

EXPOSURE (UK)

Exposure Electronics, Richardson Road, Hove, Sussex. Phone: 0273 777912.

Exposure IV: 2-channel, 75W/channel, available in two versions (either single power supply or separate power supply for each channel).

FM ACOUSTICS (Switzerland)

FM Acoustics Ltd, Tiefenhofstrasse 17, CH-8820 Wädenswil. Phone: 01 780.64.44. Telex: 56058.
UK: FM Acoustics, 2 Kempston Road, Weymouth, Dorset DT4 8XB. Phone: 0305 784049.
USA: Win Laboratories, PO Box 332, Goleta, CA 93017. Phone: (805) 968-8741.

FM 300A: modular 2-channel, 100W/channel, LED level indication.
FM 600A: 2-channel, 200W/channel, bridgable LED level indication.
FM 800A: 2-channel, 400W/channel, bridgable LED level indication.

FOSTEX (Japan)

UK: Bandive Ltd, Brent View Road, London NW9 7EL. Phone: 01-202 4366.
Main distributors: RWO Fostex Division, Interlake Audio Inc, 620 Kind Edward Street, Winnipeg, Manitoba, Canada, R4H 0P2. Phone: (204) 775-8513. Telex: 07-55725.
USA: Interlake Audio Inc, 2432 North Cedarwood Circle, Simi Valley, CA 93063. Phone: (805) 583-0540.

Model 300: 2-channel, 100W/channel with LED indicators.
Model 600: 2-channel, 200W/channel with LED indicators.

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DH-200: 2-channel, 100W/channel.
DH-500: 2-channel, 225W/channel.

HARMAN/KARDON (USA)

Harman/Kardon, 55 Ames Court, Plainview, NY 11803. Phone: (516) 681-4000.
UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berkshire SL2 5DD. Phone: 0753 76911. Telex: 849069.

Citation 16: 2-channel, 150W/channel, bridgable, LED level indication.
Citation 19: 2-channel, 100W/channel, bridgable, LED level indication.
Citation XX: 2-channel, 320W/channel, includes input filters.
HK770: 2-channel, 65W/channel, LED level indication.

HEIL SOUND (USA)

Heil Sound, No 2 Heil Industrial Drive, Marissa, IL 62257. Phone: (618) 295-3000.

Pro-series 200: 2-channel, 150W/channel into 4Ω.
Pro-series 400: 2-channel, 250W/channel into 4Ω.

HH (UK)

HH Electronics, Viking Way, Bar Hill, Cambridge CB3 8EL. Phone: 0954 81140. Telex: 817515.
USA: Audio Techniques inc, 652 Glenbrook Road, Stamford, CT 06906. Phone: (203) 359-2312. Telex: 996519.

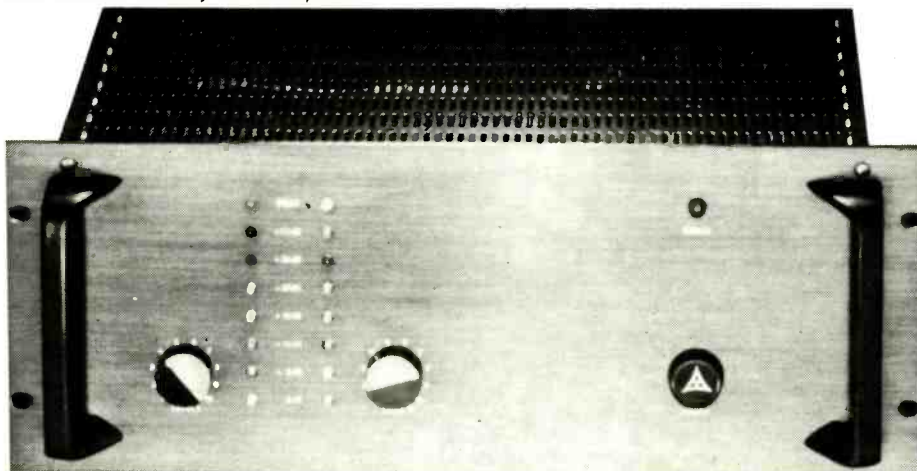
S500-D: 2-channel, 210W/channel, bridgable.
V150L: mono, 105W, MOSFET output.
V200: 2-channel, 65W/channel, MOSFET outputs.
V500: 2-channel, 150W/channel, MOSFET outputs.
V800: 2-channel, 260W/channel, MOSFET outputs, LED level indication.
M-900: 2-channel, 400W/channel, MOSFET outputs.
TPA25D: mono, 45W.
AM8/12: BBC version of the TPA25D.
TPA50D: mono, 75W.
TPA100D: mono, 180W.

HILL (UK)

Malcolm Hill Associates, Hollingbourne House, Hollingbourne, Kent. Phone: 062780 556.

DX 140: 2-channel, 80W/channel, VU meter option.
DX 200: 2-channel, 175W/channel, VU meter option.
DX 350: 2-channel, 115W/channel, VU meter option.
DX 500: 2-channel, 185W/channel, VU meter option.

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DX 700: 2-channel, 260W/channel, VU meter option.
TX 400: mono triamp, LF 200W, MF 100W, HF 100W, electronic crossovers.

ICE (UK)

IC Electronics Ltd, 131/2 Blackdown Rural Industries, Haste Hill, Haslemere, Surrey GU27 3AY. Phone: 0428 2015.

S200: 2-channel, 115W/channel, VU meters.

IVIE (USA)

Ivie Electronics Inc, 500 West 1200 South, Orem, UT 84057. Phone: (801) 224-1800. Telex: 910-971-5884.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

5805/5806: 100W, part of the 5000 Modular System. 5805 master (bridgable), 5806 slave may be paralleled with the master.

JBL (USA)

James B Lansing Sound Inc, 8500 Balboa Boulevard, Northridge, CA 91329. Phone: (213) 893-8411. Telex: 674993.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Phone: 0753 76911. Telex: 849069.

6007: mono, 60W into 4Ω, VU meter, direct and transformer outputs.
6008: mono, 60W into 4Ω, VU meter, direct output.
6011: mono, 100W into 4Ω, VU meter, direct and transformer outputs.
6012: mono, 100W into 4Ω, VU meter, direct output.
6021: mono, 200W into 4Ω, VU meter, direct and

transformer outputs.
6022: mono, 200W into 4Ω, VU meter direct output.
6233: 2-channel, 200W/channel, bridgable, illuminated level indicators.

JVC (Japan)

UK: JVC UK Ltd, Eldonwall Trading Estate, Staples Corner, London NW2. Phone: 01-450 2621. Telex: 923320.
USA: US JVC Corp, 58-75 Queens Midtown Expressway, Maspeth, NY 11378. Phone: (212) 476-8300.

M-3030: 2-channel, 105W/channel.
M-7050: 2-channel, 150W/channel, VU meters.

MCINTOSH (USA)

McIntosh Laboratory Inc, 2 Chambers Street, Binghamton, NY 13903. Phone: (607) 723-3512.
UK: Unileit Products Ltd, 35 High Street, New Maiden Surrey KT3 4BY. Phone: 01-942 9567. Telex: 8814591.

MC 75: mono, 75W, valve (tube).
MC 275: 2-channel, 75W/channel, bridgable valve (tube).
MC 2105: 2-channel, 105W/channel, VU meters.
MC 2125: 2-channel, 120W/channel, bridgable VU meters.
MC 2205: 2-channel, 200W/channel, bridgable, VU meters.
MC 2300: 2-channel, 300W/channel, bridgable, VU meters.
MC 3500: mono, 350W.

McMARTIN (USA)

McMartin Industries Inc, 4500 South 76th Street,

Omaha, Nebraska 68127. Phone: (402) 331-2000. Telex: 484485.

LT-500D: mono, 50W, direct or transformer output.
LT-1000D: mono, 100W, direct or transformer output.
LT-2000D: mono, 200W, direct or transformer output.
LT-3500D: mono, 350W, direct or transformer output.

METEOR (USA)

Hammond Industries Inc, 155 Michael Drive, Syosset, NY 11791. Phone: (516) 364-1900. Telex: 961396.

Powermaster 190: 2-channel, 90W/channel, peak LEDs.

MILLBANK (UK)

Millbank Electronics Ltd, Uckfield, Sussex TN22 1PS. Phone: 0825 4166. Telex: 95505.

PAC System: modular mono amplifiers to suit PAC rack, 40, 60, 120 and 250W amps available.

MUSTANG (UK)

Mustang Communications, Industrial Estate, Cayton Low Road, Scarborough, North Yorks YO11 3UT. Phone: 0723 582555.

SS50: mono, 80W, VU meter.
SS100: mono, 150W, VU meter.

OLSEN (Norway)

Olsen Electroacoustics, Elveveien 26-26, N-1472 Fjellhamar.

O2: 2-channel, 200W/channel, bridgable. 74 ►

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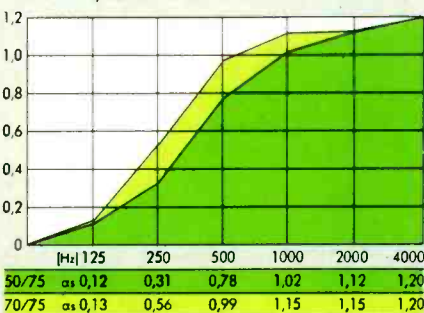


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PEAVY (USA)

Peavey Electronics Corp, 711 A Street, Meridian, MS 39301. Phone: (601) 483-3565.
UK: Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX. Phone: 0825 5566. Telex: 957098.

CS400: 2-channel, 150W/channel, clipping indication.
CS800: 2-channel, 280W/channel, bridgible, clipping indication.
M-2600: 2-channel, 75W/channel.

QMI (USA)

QMI, 21356 Deering Court, Canoga Park, CA 91304. Phone: (213) 340-1313.
UK: Music Laboratory, 72-74 Eversholt Street, London NW1. Phone: 01-388 5392.

GC500: 2-channel, 200W/channel.

QSC (USA)

QSC Audio Products Inc, 1926 Placentia Avenue, Costa Mesa, CA 93703. Phone: (6714) 645-2540.

A3.7: mono, 90W.
A4.2: 2-channel, 40W/channel.
A5.1: 2-channel, 80W/channel.
A21: 2-channel, 80W/channel.
A31: 2-channel, 125W/channel.
A41: 2-channel, 200W/channel.

QUAD (UK)

Quad Electroacoustics Ltd, Huntingdon, Cambs PE18 7DB. Phone: 0480 52561. Telex: 32348.

303: 2-channel, 45W/channel.
405-2: 2-channel, 100W/channel, current dumping output circuit with improved output protection.

RAMSA (Japan)

UK: National Panasonic Ltd, 308-318 Bath Road, Slough SL1 6JB. Phone: 0753 34522. Telex: 847652.
USA: Professional Audio Division, Panasonic Co, 1 Panasonic Way, Secaucus, NJ 07094. Phone: (201) 348-7000. Telex: 710-992 8996.

WP-9210: 2-channel, 200W/channel, peak LEDs.

ROLAND (Japan)

UK: Roland (UK) Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middlesex TW8 9DN. Phone: 01-568 4578. Telex: 934470.
USA: Roland Corp US, 4201 Saybrook Avenue, Los Angeles, CA 90040. Phone: (213) 685-5141.

SPA120: 2-channel, 60W/channel.
SPA240: 2-channel, 120W/channel.

RSD/STUDIOMASTER (UK)

Recording Studio Design Ltd, Home Farm, Northall, Dunstable, Beds. Phone: 0525 221331.
USA: Studiomasster Inc, 1365C Dynamics, Anaheim, CA 92806.

400C: 2-channel, 115W/channel, VU meters.
800B/C: 2-channel, 220W/channel, VU meters.

SAE (USA)

Scientific Audio Electronics Inc, PO Box 60721, Terminal Annex, Los Angeles, CA 90060. Phone: (213) 489-7600. Telex: 674062.

3100: 2-channel, 50W/channel, LED level indication.
2200: 2-channel, 100W/channel, LED level indication.
2300: 2-channel, 150W/channel, LED level indication.
2400L: 2-channel, 200W/channel, LED level indication.
2600: 2-channel, 400W/channel, VU meters.

SERTEC (France)

Sertec SA, 2799 Avenue, John Kennedy, F-83140 Six Fours. Phone: (94) 87.18.50.

SR 1000: 2-channel, 300W/channel, bridgible.

SHURE (USA)

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, IL 60204. Phone: (312) 866-2200. Telex: 724381.
UK: HW International, Eccleston Road, Maidstone, Kent ME15 6AU. Phone: 0622 59881. Telex: 98121.

SR105: mono, meter level indication, optional transformer output, 200W into 4Ω direct, transformer 150W.

SOLIDYNE (Argentina)

Solidyne Srl, Tres de Febrero 3254, 1429 Buenos Aires. Phone: 701-8622.

7000A: 2-channel, 230W/channel, peak LEDs, mono, stereo or biamp with internal electronic crossover. Drives 70 and 100V lines directly.

SOUNDTRACS (UK)

Soundout Laboratories Ltd, 91 Ewell Road, Surbiton, Surrey KT6 6AH. Phone: 01-399 3392. Telex: 8951073.

400S/200S: 2-channel, 130W/channel, 400S identical but separate power supplies for each channel.
420S/260S: 2-channel, 130W/channel, LED peak indicators, 420S identical but separate power supplies for each channel.

SPECTRA SONICS (USA)

Spectra Sonics Inc, 3750 Airport Road, Ogden UT 84403. Phone: (801) 392-7531.

Model 701: modular amp system with eight modules fitting a rack-mount, 80W into 2Ω, bridgible in pairs for 160W into 4Ω.

S & R (UK)

S & R Amplification, 6 Tanners Hill, London SE8. Phone: 01-692 2009.

PA 500 - 1000: 2-channel, 300W/channel, bridgible. Mono and studio versions available; studio version may be configured with VU meters, balanced line, etc.

STAGE ACCOMPANY (The Netherlands)

Stage Accompany BV, Industrieweg 30, 1775 PV Middenmeer. Phone: 02270-2157. Telex: 57680.

SA 500: 2-channel, 135W/channel.
SA 900: 2-channel, 280W/channel.

STATUS (UK)

Raindirk Ltd, 33A Bridge Street, Downham Market, Norfolk PE38 9DW. Phone: 0366 382165. Telex: 817737.

USA: Audicon Inc, 1200 Beechwood Avenue, Nashville, TN 37212. Phone: (617) 256-6900. Telex: 554494.

USA: ACI/Filmways, 7138 Santa Monica Boulevard, Hollywood, CA 90046. Phone: (213) 851-7172.

500: 2-channel, 250W/channel, bridgible, MOSFET output stage, optional LED level indication.

STUDER/REVOX (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf. Phone: 01 840.29.60. Telex: 584889.

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

USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Phone: (615) 254-5651. Telex: 554453.

A68: 2-channel, 100W/channel, bridgible, overload indication.

B740: 2-channel, 100W/channel, VU meters.

SYMETRIX (USA)

Symetrix Inc, 109 Bell Street, Seattle, WA 98121. USA. Phone: (206) 624-5012.

Model A-220: 2-channel, 20W/channel for low power monitors or headphone distribution systems.

TANDBERG (Norway)

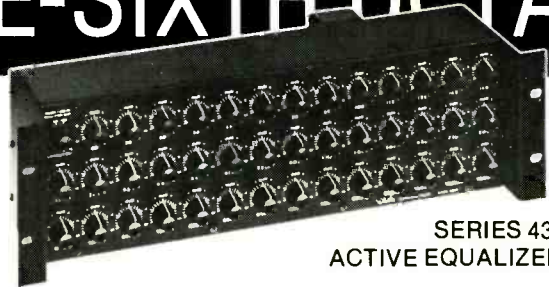
Tandberg A/S, Fetveien 1, N-2007 Kjeller. Phone: 02 71.68.20. Telex: 71886.

UK: Tandberg Ltd, Unit 1, Revie Road Industrial Estate, Ellend Road, Leeds LS11 8JG. Phone: 0532 774844. Telex: 557611.

USA: Tandberg of America Inc, Labriola Court, Armonk, NY 10504. Phone: (914) 273-9150. Telex: 13757.

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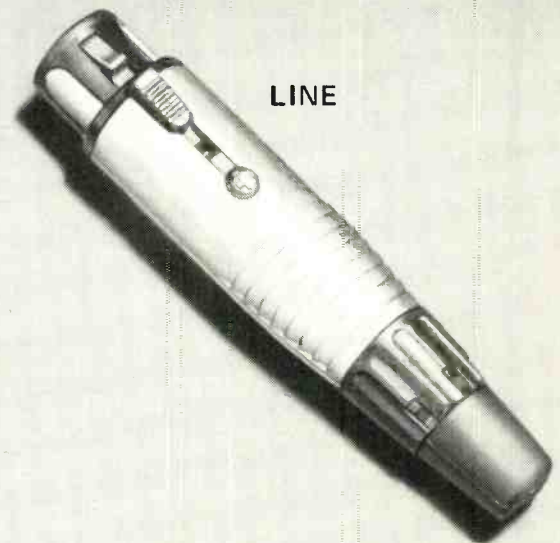
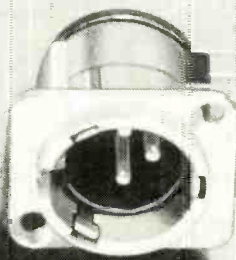
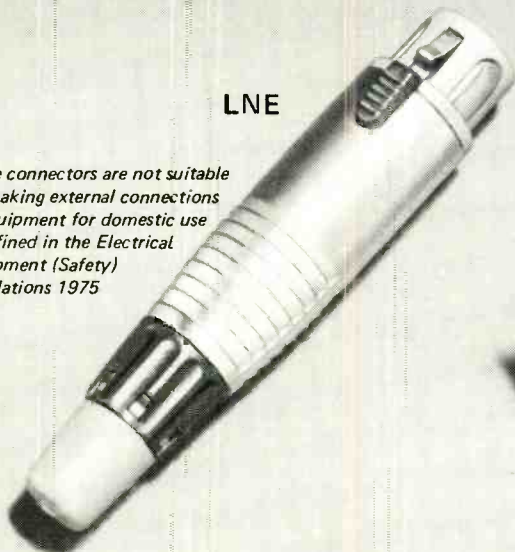
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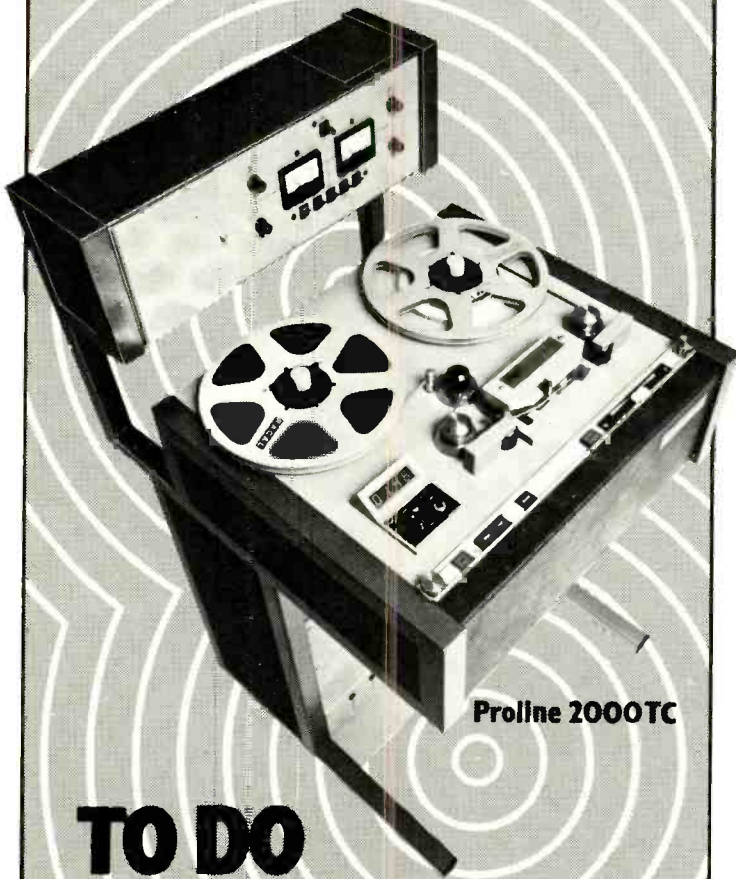
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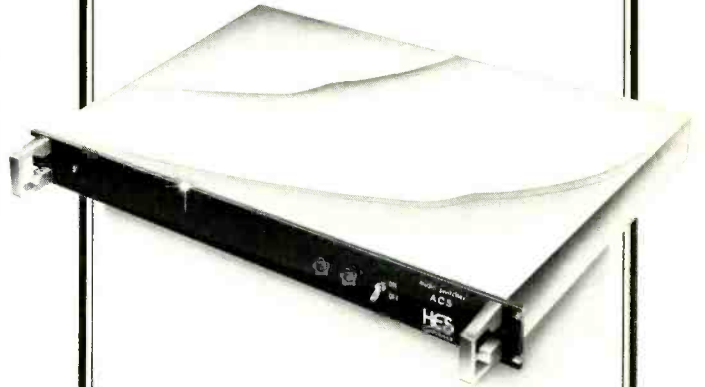
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Monitoring speakers: active or passive?

Ilpo Martikainen (Genelec)

In a recent article on studio monitor design,⁽¹⁾ Neil Grant introduced some important facts concerning the current state of affairs. The main problems touched upon were beaming and poor sonic performance of 380 mm paper-coned drivers in midband; radical changes of directivity around crossover frequency; and high distortion in compression drivers. He clearly indicated the importance of a

separate, good, midrange driver for the speech band. In the same issue, Eddie Veale⁽²⁾ pointed out that good domestic speakers are usually of more advanced design than their professional counterparts. When searching for the best quality system, driving methods become important. This article includes the amplifier under discussion and concentrates on the pros and cons of active and passive speaker systems.

Passive

By far the most common solution to the problem of building a monitoring system is to take an enclosure, including at least two drivers and a passive crossover network, and drive it with a single power amplifier. This kind of system is popular: the user can apply his personal taste to choose between many speaker and amplifier manufacturers. The overall cost is usually reasonable and people are used to considering the prices of speaker, amplifier and equaliser separately. If the requirements change over time, renewing either speaker or amplifier is usually sufficient and the cost remains low. Regardless of these important benefits, this principle also has some technical drawbacks:

- The amplifier loading varies greatly with frequency and power level. The steady-state impedance magnitude vs frequency plot is sometimes the only data presented by even the most advanced manufacturers, but the impedance variation itself is normally of little consequence, as it has no connection with the acoustic response. The nominal impedance value is usually the only data available. However, it was verified recently⁽³⁾ that under dynamic conditions the momentary impedance may be very low, a guide value being only 25% of the nominal. Moreover, it is not stable but may increase or decrease depending on the driving level. The life of a power amplifier becomes complicated when an output stage designed to drive 8Ω resistance is asked to handle 2Ω reactive loads. This may be one of the reasons for different-sounding amplifiers.

- The voice coil temperature varia-

An example of a medium-sized active monitor in a free standing configuration capable of producing 115 dBA in a normally damped 70 m³ control room. The input stage, active filter, response controls and three power amplifiers are integrated into the enclosure.



tions cause well-known power compressions amounting to several dB. A second and less-known consequence is the shift of crossover frequency. A passive crossover filter is designed to be terminated, say, with 8Ω. After a few minutes' loud listening, the voice coil temperature can be 200°C and the resistance has changed to 13Ω (about 0.35%/°C for copper). The shift in crossover frequency depends on the filter design, but half an octave is often found in practice. Even more confusion results because the voice coil time constants are not similar in different drivers, but the frequency shift takes place first where the time constant is shortest.

- The high amplifier power necessary for loud listening can easily burn out the tweeter during accidental fast wind operations. The normally-used protection device is a fuse, but its resistance depends on signal level which causes still more power compression.

The previous facts are typical for all passive speakers, not only for monitoring systems. At domestic listening levels the sound quality of the best passive speakers can be very good. From time to time claims are made that the perceived degradation of loudspeaker performance at high levels is due to our hearing mechanism, but this is not the whole truth; the smearing is also due to technical reasons.

Active

Active speaker, or multi-amplification, is the principle where loudspeaker drivers are connected directly to power amplifiers, one amplifier

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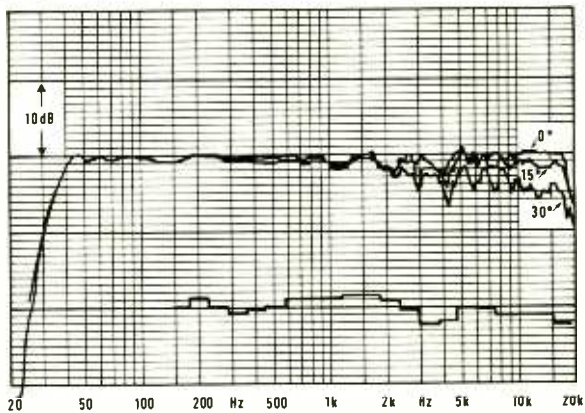


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The upper curves show the free-field performance and also indicate very smooth response off-axis. Ripples below 80 Hz and the steep cutoff below 40 Hz are properties of the anechoic chamber, the actual -3 dB point of the system being 32 Hz. The lower graph is the power response measured in a reverberant chamber and presented in 1/3-octave steps. The smoothness of the power response (tolerances are less than ±2.5 dB) indicate very stable directivity over the whole measured bandwidth and give an indication of what can be expected in a correctly-designed room.

TRIAMP 1024A



for each driver, and the amplifier group is usually driven by an active, low-level crossover filter. Speaker systems intended for bi- or triamplification have been known for years in high-level PA applications, and several manufacturers produce active crossover filters for this purpose. This principle has many inherent technical benefits which all can, if correctly used, contribute to better sound quality in a monitoring system:

- When a driver element is connected directly to a power amplifier without normal reactive circuit elements, its transient response is good due to superior damping. This results in better clarity, especially near crossover frequencies, where the source impedance seen by the driver is otherwise high.

- As stated earlier, driver voice coil temperature and resistance varies with listening level. Because there are no filter components between the amplifier and the driver, the actual load value has no effect on the crossover frequency.

- Power amplifiers can be designed for a limited frequency range which usually results in less distortion.

- Under dynamic conditions, the transient input current to a single driver element is practically one half of the current absorbed by a multi-way passive speaker system.⁽³⁾ This further relaxes the requirements of the power amplifier and can result in better amplifier sound quality.

- The driver elements can be designed for good sound quality only. The differences in sensitivities are easy to compensate with power amplifier gains.

- Individual drivers can easily be protected against overload, and the protection circuits can respond to real voice coil temperature and signal history.

- In relation to the total amplifier power you get higher output. With wideband programme material, the MF and HF components superimposed on an LF signal cause clipping in a single-channel amplifier earlier than in a multi-amped system where they are separated before the

power amplifiers and can pass through undistorted.

- The channel gain controls can be used for balancing the response in the listening room, often making a separate equaliser unnecessary.

- Significant cost savings are available when the amplifier/filter group is integrated with the speaker enclosure.

Thus there are many obvious technical benefits that favour multi-amplification. Because monitoring speakers of this kind are not very common, there must be something basically wrong in the design of the systems which are currently available. You have taken a speaker system A having driver terminals at its back, noting its suitability to multi-amplification, then you buy a filter of brand B with a lot of selectable crossover frequencies and slopes and finally connect power amplifier type C in between. Who guarantees that the driver and filter responses, and amplifier gains, fit together? This is the clue: nobody is really responsible for the total system. To get a good result without comprehensive design effort is really an extremely rare accident.

The correct way to design an active monitoring speaker is like that of any other system—it must be designed as a total concept. (The problems in this area may simply lie in the lack of amplifier and electronics designers in speaker companies and vice versa.) Starting from the basics, the bandwidth and output level must be defined, then the drivers can be designed. It is important to note that the concept allows a lot more freedom to driver design, because the sensitivity no longer plays an important role. To avoid thermal overload it is again quite straightforward to design protection circuits to track the voice coil temperature and limit the output before any damage occurs.

The crossover filter forms the 'brain' of the whole system. Whether the filter design is active or passive depends on convenience and the manufacturing process; the filter type is unimportant of itself.

However, due to price considerations and an apparent irrational fear of inductive components, the realisation is usually active.

The design process itself is a very comprehensive task: copying a standard electric filter is simply not enough and most of the errors found in practice are due to poor filter design. The filter electrical response is not finally what should be of interest, as we listen to the acoustic response of the whole system. So the designer must first consider the inherent acoustic response of the particular driver and the desired total performance in its frequency band. The basic filter response is then actually found as a difference between these two responses. More ingredients to the design process come from the radiation and directivity properties of the enclosure connected to its final acoustical environment (radiation space), time offsets between the acoustic centres of the drivers and from the electric delays of the filters themselves. The common approach to 'time alignment' by placing the voice coils at the same level rarely leads to correct performance simply because the acoustic centres are seldom located at the voice coil level. The radiation origin may also lie in front of the voice coil, and with many drivers it is frequency dependent. A good compromise between all these requirements is not an easy job, but once performed the final results clearly surpass the performance of a conventional passive loudspeaker system.

Our world is not perfect, however, and obviously active speaker systems must also have some drawbacks:

- Price is usually thought to be high. However, we must compare the total cost of comparable passive systems, including amplifier and equaliser. With these borne in mind, the active system may work out to be more economical.

- The whole idea seems to be psychologically unattractive to many people who want to use their own experience to choose the best components for their system. An active

system is too 'ready-made': the manufacturer has already made the choice for you, +6 dBu in, 110 dBA out, and you do not necessarily even know what happens inside.

- Multi-amplification means more components and therefore more to go wrong. To keep reliability high the component and manufacturing quality must be better than in a comparable single-band design.

- If the amplifier is integrated with the speaker, the electronics are subject to vibration. The existence of vibration does not inherently mean poor reliability (compared to aviation and marine electronics, they are reliable) but it is one more requirement to be taken into account in the design. Actually, field proven MTBF figures in excess of 50,000 hours are met with integrated systems. This means one failure in six years, 365 days a year, 24 hours a day—which is better than many normal power amplifiers can do.

- The design process is much more complicated and calls for dedicated people not only in speakers but also in electronics and mechanics. It is not so easy to find a good combination of these skills in one house.

As has been pointed out, from a purely technical point of view an active monitoring system can be better than a passive one. The same is also true from the 'sound' side, if 'neutral' reproduction is required. But here is the big if, because people usually like *some* coloration and the pure sound is often not exciting enough. This is 'wrong'—and we all know it—but usually the choice is more psychological and visual than technical. However, the overall tendency to improve the speakers at home inevitably means that improvements are also necessary in studios. ■

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- (2) Eddie Veale in conversation with Harry Mangle, *Studio Sound*, July 1982, pp 96-100.
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GLOSSARY OF RECORDING TERMINOLOGY

Microphone: An acoustic-to-electrical transducer designed to be placed inside a musical instrument (see also *Vocal Mic*) to examine its distortion characteristics. Originally designed to pick up musical sounds from a safe distance (*arch*).

Vocal Mic: A *Microphone* designed for internal use only, available on prescription.

Master: The second-best performance of a musical or other recording, and the one used for the eventual record or other product, the *best* performance having not been recorded, or having terminal recording faults (eg no signal on track 3, a nasty fizzing noise from channel 10, an edit in the wrong place, etc).

Mono: Single-channel reproduction (monophonic).

2-track Mono: A form of monophonic system in which different elements of the sound are positioned in a line between two speakers by means of panpots, resulting in no apparent 'depth'. Developed to facilitate the use of expensive echo plates, digital reverb units and other *Signal Processors* which would otherwise be unjustifiable capital investments.

Stereo: (1) An archaic method of recording in which two mics were placed a safe distance away from the musicians. (2) *2-track Mono*.

Quad or Quadraphony: (1) *2-track mono*, twice (4-track mono). (2) A now little-used method of reproduction based on three false premises: firstly, that four totally dissimilar signals could be made to sound like a real sound-field; secondly, that these four channels could be mixed into *2-track mono* and then changed back into four dissimilar channels by obscure mathematical means which were both theoretically and practically impossible; and thirdly, that a sensible name for something could be created by mixing Greek and Latin words.

Noise Reduction: A *Signal-Process-*

ing system designed to stop noise and other musical sounds getting on to or off tape without being altered in a random or otherwise difficult-to-predict fashion. See also *Equaliser*, *Limitter*, etc.

Microgroove Record: (1) *A Test Pressing* which causes the replay stylus to jump because it has been cut at -25dB with very narrow groove-spacing to get 62 minutes on one side, but otherwise suffers from virtually no production faults such as warping, eccentricity, surface noise, etc. (2) A production record, as bought by a *Member of the Public* in a *Record Store*, which causes the replay stylus to jump *because* of the above production faults.

Record Store (Record Shop): A retail source of low-quality copies of musical and other recordings, and recording raw materials (eg blank tape), destined for domestic disc-to-tape transfer suites.

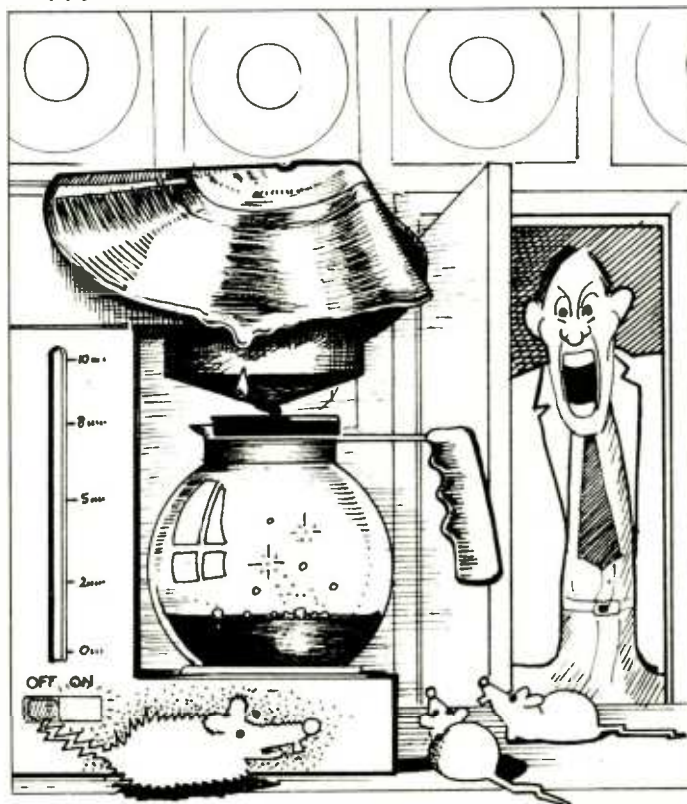
Member of the Public: Owner of a domestic disc-to-tape transfer suite.

Test Pressing: One of a few initial records which are manufactured to assure the record company that the cut is OK. As they have no relation in sound quality to production copies, they are not played to artists, engineers, etc, who might consider criticising them. If artists, etc *do* criticise, the fact that the production copies will be different is pointed out in a manner almost indistinguishable from the opposite of the truth.

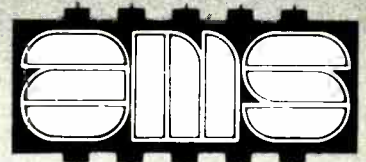
Floppy Disk: An American *Test-Pressing* which has been inadvertently left on the coffee machine overnight.

Muting: (1) A method of switching off a console channel inadvertently at any time, but not allowing it to be switched on again. Primarily used by producers leaning across to talk to the engineer just at the start of the guitar solo. You *could* switch it on again if you knew which one it was. (2) A button which produces a loud bang when pressed.

Floppy disk



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GLOSSARY OF RECORDING TERMINOLOGY

Programmable Muting: A form of *Muting* which may be preset to switch off a vast number of console channels at once, inadvertently.

Top: Frequencies on a recording which cannot be transferred to disc. In *Digital Recording*, frequencies

built into the console channels which enables the recording engineer to create a frequency contour which it is almost impossible for the mix engineer to cancel out.

Parametric EQ: (1) A form of *Equaliser* which it is *totally*

prevents loud noises exceeding a certain level, and amplifies quiet signals to a certain, higher, level. Cutting engineers like them because they can go for a drink during the cut.

Compressor: A *Limitter* which doesn't work. Instead of preventing loud noises exceeding a preset level, it just turns them down a bit, according to the ratio set on the front panel. This is usually calibrated from 1:1 (ie it doesn't work at all) to n:1, where n isn't very much, but less than infinity (ie it doesn't work very well). It also adds a lot of noise, 'breathing' and other things which producers like on their records and enable them to blame engineers when it isn't a hit.

Standards: A set of often sensible suggestions and agreements on a certain subject, argued out over a long period by many manufacturers and experts all over the world so as to form the basis of anti-trust litigation. The theory is that Murphy's Law of Technological Standardisation states that 'Any standard will be superseded technically after a period of time inversely proportional to the time taken to agree on it.' This is usually shortened to 'Standards are international agreements which are already out of date'. (See also *Recording Characteristic*.)

Classical: Music which is beautifully recorded but nobody buys.

Popular: The opposite of *Classical*.

MOR: Music that is neither *Classical* nor *Popular* but combines the negative characteristics of both.

AOR (Album- or Adult-Orientated Rock): *Popular* music of a style that everyone bought ten years ago. (See

Golden Oldies.)

Golden Oldies: Music which would have been called *AOR* ten years ago.

Automated Mixdown: Computer system which enables you to have extended breaks during mixing sessions while Maintenance fix it.

Maintenance Engineer: Someone employed by a studio because of their extensive knowledge of manufacturers' telephone numbers.

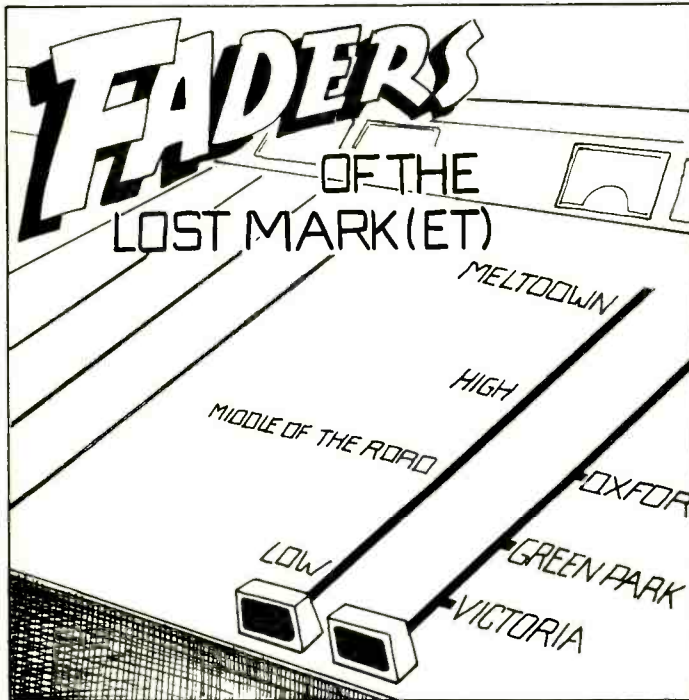
Manufacturers' Maintenance Department: A group of *Maintenance Engineers* employed by a manufacturer. They don't know either, but the only person they can telephone is you.

Workshop: The only place in the studio complex where a) anyone does any work; b) you can get a cup of tea without doing it yourself; c) where you can sit down quietly and see if any of your records are getting any airplay.

Pot: Type of *Fader* used to enhance the awareness of studio staff. Has the advantage of raising the subjective quality of good recordings to infinite levels whilst reducing their negative aspects to zero: in other words, it does what a *Limitter* ought to do if it worked. A mental amplifier.

Coke: Type of mental amplifier introduced by some automobile manufacturers. Operates in the same kind of way as *Pot* on studio personnel, enhancing awareness, but with the reverse results. It is thus known as a type of *Expander*.

LSD: Used to pay engineers for late sessions before the advent of decimal coinage (UK). Now replaced by *Coke*. Rumours of a return to the Mescaline standard might be true if there ever really was any. 88 ▶



which *still* cannot be transferred to disc.

Faders: Linear level-control devices which allow the sound level to be adjusted so that the meters read in red, and permit the addition of pops and crackles to simulate the sound of the final pressing. Some models also provide liquid collection facilities to prevent beverages dripping on to the knees of recording personnel.

Equaliser: A sophisticated tone-control which allows the engineer to correct the problems created by using *Microphones* and other methods of applying audio signals to the console and to alter the sound so that it differs from the sound of the instrument or other source as much as possible. It is usual to equalise one channel first, as an experiment, to ensure that all the other channels will also need modification.

Graphic Equaliser: A special type of *Equaliser* which is too big to go into the console. It has many *Faders* which enable assistant engineers to create picturesque curves (*graphics*) for advertising brochure photo-sessions. It may also be used to 'cancel out', or otherwise enhance, poor acoustic design in the control room by placing several in the monitor chain and adjusting the faders so that they are as far away from zero as possible.

Console EQ: A form of *Equaliser*

impossible for the remix engineer to cancel out. (2) An especially complex form of *Equaliser* which it is impossible to adjust without listening to the signal. If this is done, the knobs will be found to be finally pointing at 'Flat', or in a position indistinguishable from 'Bypass'.

CCIR Characteristic: A *Recording Characteristic* adopted by US and UK recording studios which cannot get their monitoring to sound right, and by European broadcasters who can't be bothered anyway.

NAB Characteristic: A *Recording Characteristic*, a) designed to make American recordings sound better than European ones by enhancing the level at 50Hz line frequency; b) adopted by European studios which cannot get their monitoring right either.

Recording Characteristic: A set of defined parameters laid down by groups or individuals with as little connection with the recording industry as possible, designed to restrict the recording capability of tape machines so as not to threaten live broadcasting. By definition, all recording characteristics are designed to optimise the performance of tape types which were removed from the market 25 years ago. If they were invented recently, and no-one can agree on them, they are termed *Standards*.

Limitter: A *Signal Processor* which



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GLOSSARY OF RECORDING TERMINOLOGY

Tape: Rusty plastic used to store engineers' mistakes.

Master Tape: *Tape* containing one take of each song, which is neither the best performance nor the *Master*. Also known as a *Master Reel*.

Out-Takes: Reel containing the *Masters*, if they haven't been edited out and thrown away, hidden in amongst other versions of the song which also aren't indicated on the box label, which refers to another reel. Murphy's 14th Law of Recording states that 'Masters are always on an out-takes reel unless you look there first.'

Expander: A *Signal Processor* which increases the level of noise and other loud signals to infinity and leaves signals below a certain threshold alone. An Expander is thus a kind of inverse *Limitter* which also doesn't work very well (see *Pot*). Used in compansion-type *Noise Reduction* systems to restore the noise which has been reduced by the encoding process.

Amplifier: A device which takes a signal as its input and delivers distortion and noise as its output, generally associated with other modifications to the signal.

Signal Processor: A type of amplifier in which certain distortion components may be added as desired, or at random, with a corresponding increase in noise.

Monitoring Amplifier: A type of *Amplifier* in which the output is louder than the input, and therefore correspondingly more noisy and distorted.

Monitoring Level: A studio listening volume level sufficient to drive the engineer out of the control room. This is equivalent to the producer's threshold of hearing. After the labelling at the top end of the control room monitor level knob, this level is known as 'zero'.

Direct-Inject (DI) Box: (1) A type of *Fader* used in conjunction with certain types of mental amplifiers (see *Pot*, *Coke* etc); (2) £5-worth of components in a £25 box used instead of a *Microphone*.

Tape Head: (1) The end of the reel with red leader, or no leader at all (*Tail* is thus the other end); (2) Device used in a *Tape Recorder* to impede the passage of signals to and from the *Tape*.

Impedance: The amount of signal lost when passing through any studio equipment.

Erase Head: A *Tape Head* with infinite *Impedance*.

Record Head: A high-impedance *Tape Head* designed to minimise the signal level being recorded.

Sync Head: (1) A *Record Head* connected up backwards by a *Maintenance Engineer*; (2) A *Tape Head* which plays back out of synchronisation with all the other tracks and increases the probability of a re-take

of the guitar solo (see *Master*).

Playback Head: A type of *Sync Head* which produces a greater level of *Hum*.

Hum: A low-frequency signal produced by all studio and musical equipment which will not go away. Hum frequency is automatically optimised to coincide with the LF 'hump' in a *Recording Characteristic*.

Hum Loop: A type of *Hum* which gets worse when you attempt to reduce it.

RFI (Radio-Frequency Interference): The ability of all studio equipment to amplify, without noise or distortion, a signal outside the audio band, whilst simultaneously decoding any modulation on such a signal and raising it to +13dBm. Such modulation generally includes the words 'Breaker, breaker', or 'Romeo One-Seven to Control, P.O.B. at Bloggs Sound Studios' and will be noted just before the fade during the master take.

Tape Recorder: An expensive device used in modern studios to allow, simultaneously: the replacement of good recordings by progressively worse ones (see *Overdubs*); the recording of different signals many times where once would have been better; the addition of noise and distortion to mask record pressing faults and confuse reviewers of allegedly *Digital* recordings; the loss of the best elements of recording sessions (see *Master*); and the production of short, unexpected periods of total silence and following hysteria when the 'record' button is pressed during *Overdubs*.

Overdubbing, Overdubs: The process of replacing an excellent recording with progressively lower-quality attempts.

24-track: A recording process in which progressive *Overdubs* may be stored instead of being erased (except for the best one), so that the worst attempt can be selected on the mix, or constructed out of a minimum of 14 separate and unrelated attempts at a later date, when there are no tracks left.

Echo: (1) A type of *Reverb* produced by a machine; (2) The addition of noise and distortion to justify the selection of a particularly bad *Overdub* when better attempts have been erased; (3) A method of masking problems that would normally be dealt with by *Vibrato*.

Reverb: The intended sound of a room which studio designers and engineers do their best to avoid encroaching on the recording process (if they fail, designers strive to make it as boring or nasty as possible). This enables engineers to add it again with expensive *Sound Processors* (see *2-track Mono*).

Vibrato: Cyclic or otherwise variations in pitch designed to overcome

tuning problems.

Pitch-Shifter: *Signal Processor* designed to produce *Vibrato* to apply to recordings of instruments where it was not provided by the musician. Also used to attempt to correct pitching problems by altering the pitch so that all the notes except one are out of tune, the reverse being previously the case.

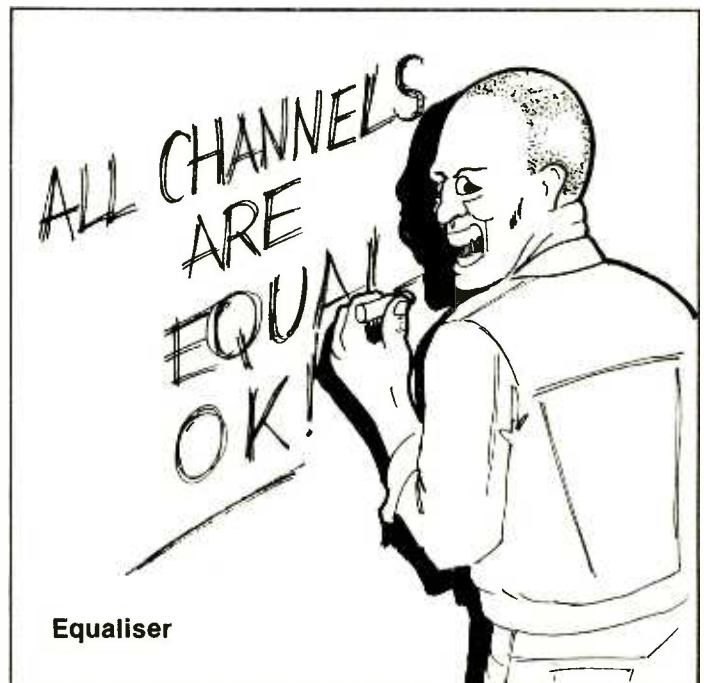
Tremolo: (1) Guitarist's name for *Vibrato*; (2) Amplitude-modulation effect produced by moving a *Fader* up and down very rapidly to attempt to clear the cause of the problem that ruined the previous take (see *Master*).

Digital, Digital Recording: (1) A system designed to enhance almost infinitely the already prodigious ability of consumers to have access to equipment which is capable of far better results than that in a recording studio; (2) A more efficient and expensive recording system (see *Tape Recorder*) which reduces noise and distortion (as they can be added more effectively by *Signal Processors*) and replaces them with more random and unpredictable phenomena such as *glitches* and *quantisation errors*.

Digital recording is a method of cutting ordinary audio signals up into very small pieces (known as *Bits*, after the well-known hit record *Bits And P.C.'s* - see *Golden Oldies* - which was the first record made by this process - *Pardon? - Ed.*). These *Bits* are then scattered on to the tape, about 48,000 times per second (or 44,100, or various other rates) in groups of 16 (or 14, or 1) - see *Standards*. These groups each represent a small *Byte* of the signal, but not very well. Sometimes they are scattered incorrectly, and these

are called *quantisation errors*, as they are due to the quantity of bits being incorrect, this being indicated by a *Checksum Byte* every so often which has no connection whatsoever with the signal. On replay, the bits are collected together in the wrong order, leading to *glitches*, which are the bits between the bytes where they are reassembled incorrectly. The random nature of the system is enhanced by a factor of 10⁶ by the use, in some cases, of video recorders, which are well-known to be far inferior to even the worst analogue *Tape Recorders*, and additionally allow the use of so-called 'error-correction' systems which replace all errors by much larger ones. Some of these are called 'drop-off' errors, due to the bits of signal falling off the tape, or being scraped off by the video recorder heads (also known as 'drop-outs' to be kind to them, and because they do not conform to the behaviour of the majority of other particles). These are 'corrected' by forgetting the data altogether and replacing it by the previous lump which was wrong as well, and is now doubly wrong by being in the wrong place as well as scrambled in other ways. If there are enough errors, the 'correction' system adds a loud sputtering noise or cuts off replay altogether, which is called 'muting' and is very like turning the machine off or going down to the pub for a drink (or to any other place where you can't hear the audio). In addition, these machines often use special tape which nobody manufactures, and if they did, it would be very expensive.

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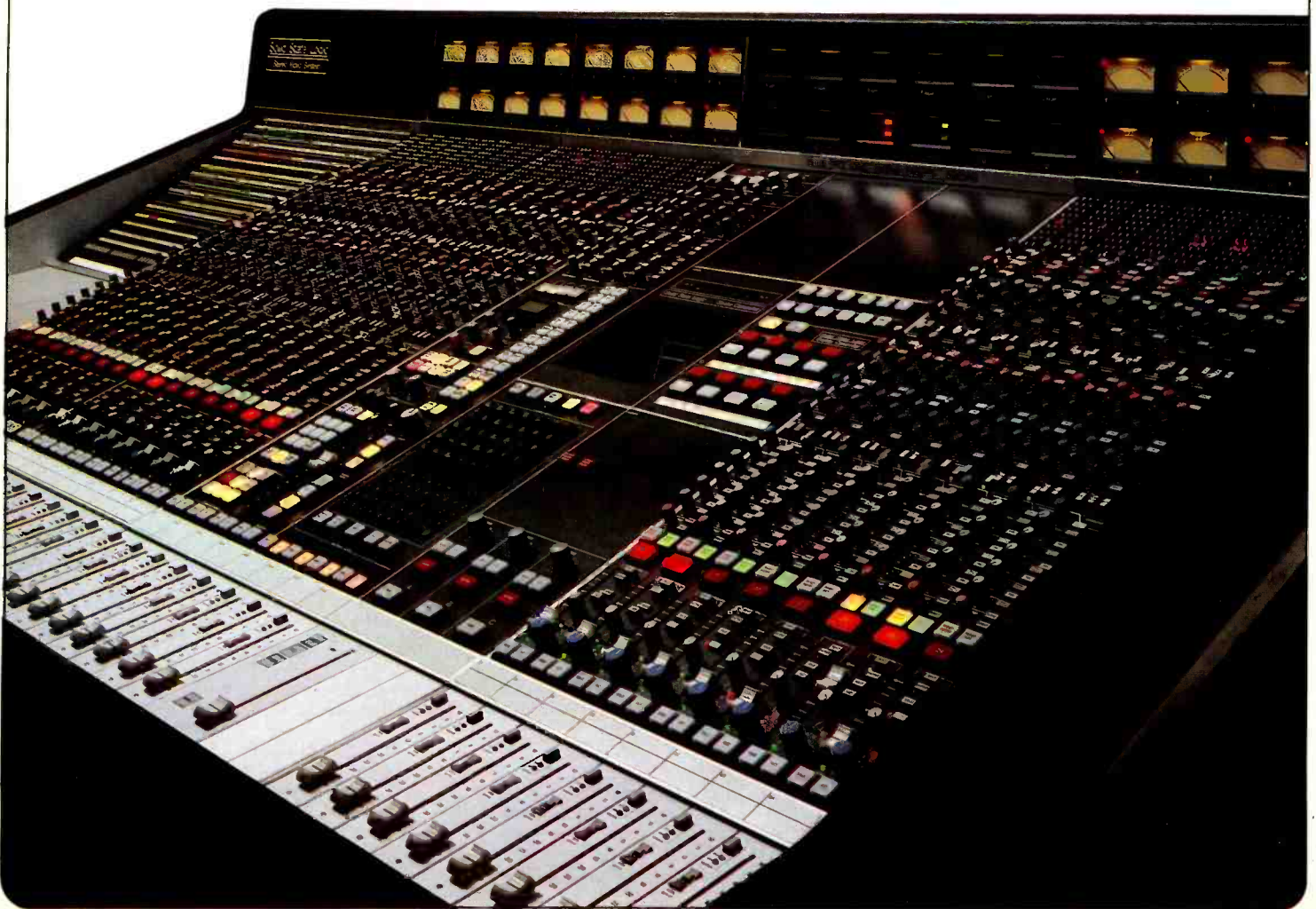
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The SL 6000 E Series places all of the signal processing, switching and machine control required for live and post-production stereo audio under the control of a single engineer. Fully distributed master logic and extensive local switching accommodate the immediacy of broadcast requirements with the versatility of multi-track technology. Exclusive SSL software and a unique mix bus system combine the creative flexibility of film sound technique with the efficiency and economy of electronic production.

The SL 6000 E Series lets you specify a system which will meet your current needs exactly. As those needs grow and change, SSL fills them with additional hardware and software modules which retrofit in the field. The Stereo Video System is designed and built to last. Your investment is further protected by performance specifications which exceed the challenge of the best 16 bit digital recorders.

And of course, the Solid State Logic Stereo Video System provides you with the ergonomic and sonic attributes which have made our companion SL 4000 E Series the leading choice of the world's great music studios.



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The Stereo Video System's six bus mix matrix accommodates all audio-for-video formats. Along with standard mono, stereo and multi-track operations, each input may be panned between one of three stereo mix buses. This allows the engineer to freely divide the console into dialogue, music and effects sections as each project requires.



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The Solid State Logic Stereo Video System is available in studio and Outside Broadcast versions from 16 to 56 I/O modules, with up to 112 line and microphone inputs plus four stereo effects returns. Please call or write on your letterhead for complete details and prices.

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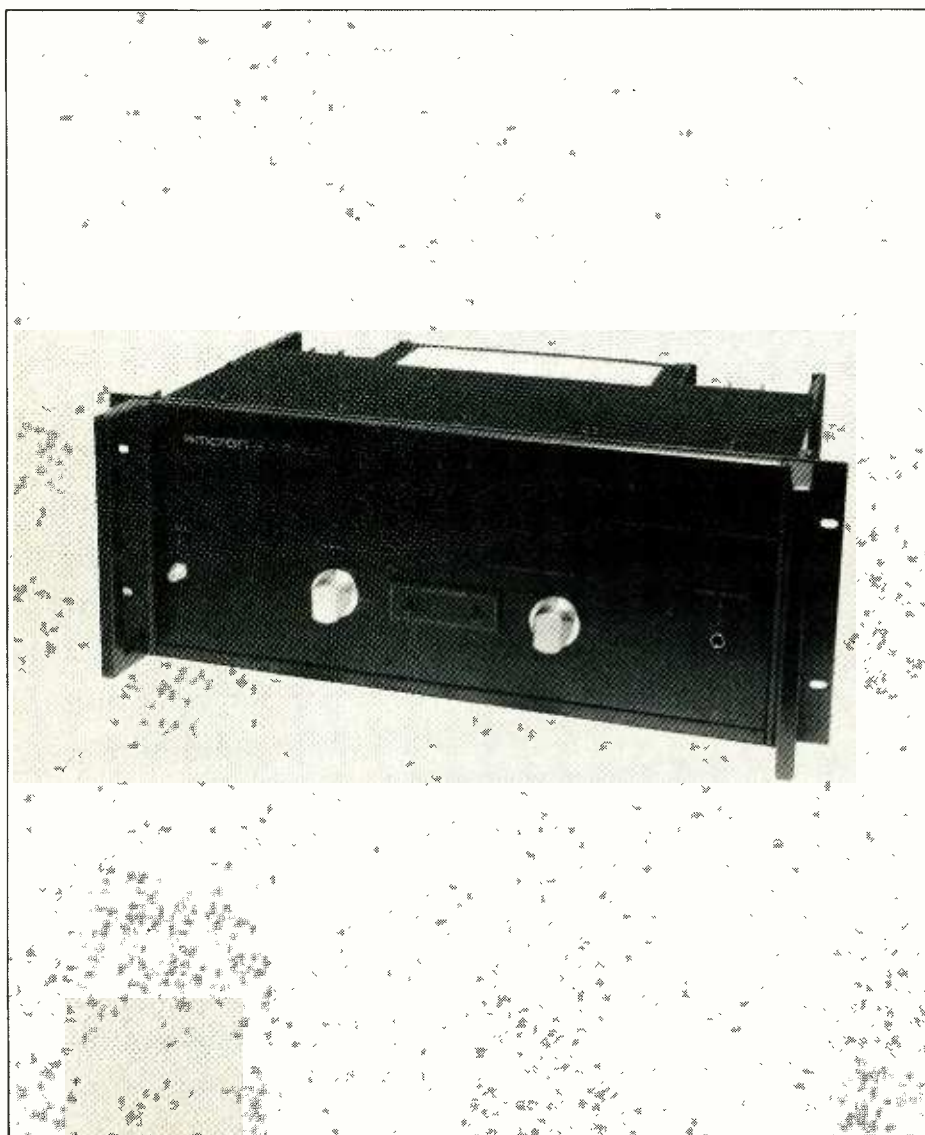
Solid State Logic

Stereo Video Systems

Solid State Logic

2352 Wisconsin Avenue N.W.
Washington, D.C. 20007 USA
Telephone (202) 333-1500
Telex 440519 SSL DC

Crown/Amcron PS-400 power amplifier



THE PS-400 is a dual channel power amplifier intended for professional use in sound reinforcement with a rated output of 165 W into 8Ω or 265 W into 4Ω in the stereo mode. Switching the amplifier to the mono mode provides 330 W into 16Ω or 530 W into 8Ω.

Designed for rack mounting, the amplifier is 4U in height and optional cooling fans are available for use when amplifiers are stacked in racks. Mechanically the basis of the amplifier is two large heatsinks at the rear corners. These are joined together and to the front rack mountings by 2.6mm alloy plate thus forming a fairly substantial case with solid handles at the front which protect the controls.

Behind the front panel a sheet metal channel section is used to support most of the amplifier components including the heavy conventional laminated power transformer. The support for this would be under severe strain if the amplifier were dropped and the strength of the transformer mounting is not satisfactory nor is the mounting for the power supply electrolytics which had already broken free in the review

94 ▶

Manufacturer's specification

Hum and noise (20Hz to 20kHz): 112dB below rated output.

Phase response: +0, -15° DC to 20kHz at 1W.

Input impedance: 30kΩ, ±20%.

Amplifier output protection: short, mismatch, and open circuit proof. Limiting is instantaneous with no flyback pulses, thumps, cutout, etc. No premature limiting transients.

Overall protection: AC line fused. Thermal switch in control logic protects against overheating caused by insufficient ventilation. Controlled slewing rate voltage amplifiers protect overall amplifier against RF burnouts. Input overload protection is furnished by internal resistance at inputs of amp.

Low frequency interrupt: interrupts output drive (standby mode) with automatic sampling every 4s. Activates at DC outputs greater than 10V or low frequency outputs greater than 10V at 2Hz.

Turn-on: 4s delay with minimum thumps and no dangerous transients.

DC output offset (shorted input): 10mV or less, internally adjustable to zero.

Power supply: 1kW transformer with massive

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adequately high for any likely application.

Perhaps the steps of the gain controls were on the large side at 1dB down to -20dB, 1.5dB steps from -20 to -30dB and then three steps of approximately 3dB, 10dB and 15dB.

At the power outputs the impedance was as shown in Fig 1 with the damping factor being about 800 up to 1 kHz related to a 8Ω load in the stereo mode. When operating in mono the two channels are driven in antiphase with the individual channels retaining their overall performance.

At the front panel jack the outputs were wired directly to the main amplifier outputs without any series resistance—an arrangement which could be lethal to headphones.

Frequency response and noise

The overall frequency response of the two channels was identical within the audio frequency band and was very flat as shown in Fig

2 at both 1 W and at the rated 165 W into 8 Ω.

Within the audio band the gain control had no significant effect upon the frequency response but at ultrasonic frequencies the -3dB points were at 103/143kHz at maximum gain falling to 73/92kHz at -20dB gain setting.

Initially some trouble was experienced measuring noise in the outputs due to intermittent mains hum. This was traced to the level control potentiometer shafts which pass through the front panel and through a screen at the rear of the power transformer where they are coupled to the potentiometers—the location of the coupling was such that it shorted on to the screen with a resulting hum loop.

Having solved this problem the noise in the outputs related to 165 W into 8Ω was as shown in Table 1, being similar for the two channels.

Power output and distortion

All high power measurements were done under

carefully controlled conditions using precision digital meters and a 240V ±0.5% stabilised power supply in conjunction with accurate load resistors.

First the onset of waveform clipping was determined at 1kHz when working into 8Ω, 4Ω and 2Ω, the reason for the latter being that nominally 4Ω loudspeaker impedances may fall well below 4Ω.

Table 2 shows a good balance between channels with a satisfactory performance into 2Ω. The peak power handling capability for the onset of clipping of a 10 ms burst of 1 kHz tone every 100ms was also good for both channels being 225 W into 8Ω or 406 W into 4Ω.

The red overload warning (input/output comparator) lights on the front panel were found to operate accurately at the onset of clipping and were fast in action being visible for only 100μs of overload. Similarly the green 'signal presence' LEDs provided a useful function operating at 0.48 V output level.

Harmonic distortion in terms of total harmonic or individual second and third harmonics followed the same pattern with a distortion peak occurring between -20dB and -30dB below the rated output into 4Ω or 8Ω.

Table 3 shows the total harmonic distortion working into 8Ω for the two channels at spot frequencies.

Distortion was predominantly crossover distortion of an asymmetrical nature as shown in Fig 3 for 1 W at 10kHz into 8Ω measuring 0.03% on an average responding meter.

Fig 4 shows that the second and third harmonics at 0.125 W into 8Ω follow the anticipated pattern from the total harmonic measurements.

Intermodulation distortion to the CCIF twin tone method remained below 0.01% up to

99 ▶

FIG 1.
CROWN/AMCRON PS-400
OUTPUT IMPEDANCE AT 10mA

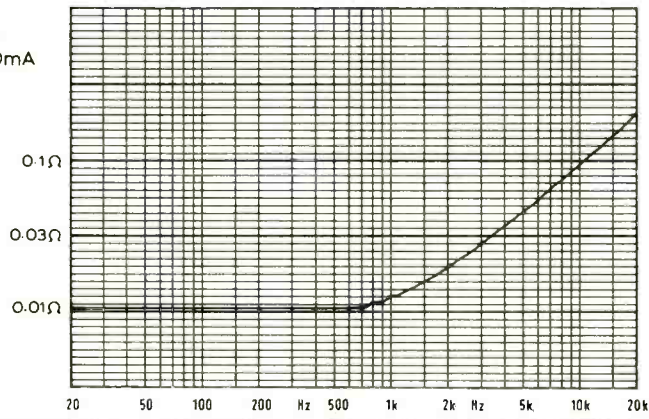


FIG 2.
CROWN/AMCRON PS-400
FREQUENCY RESPONSE

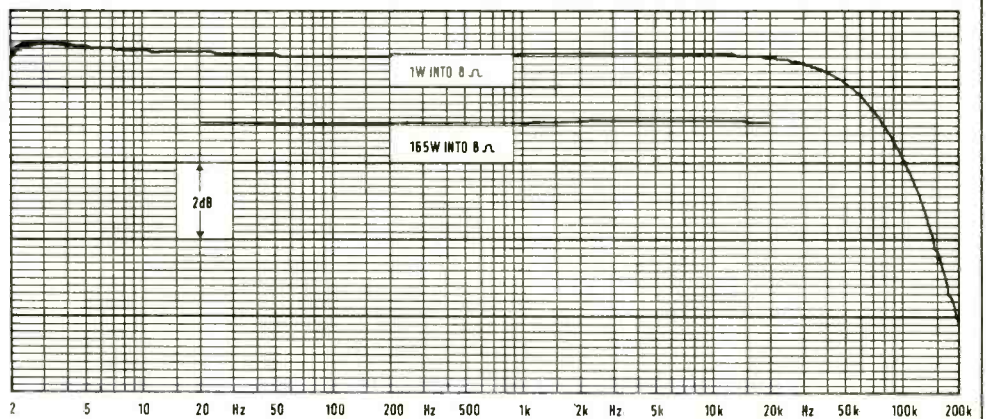


FIG 3

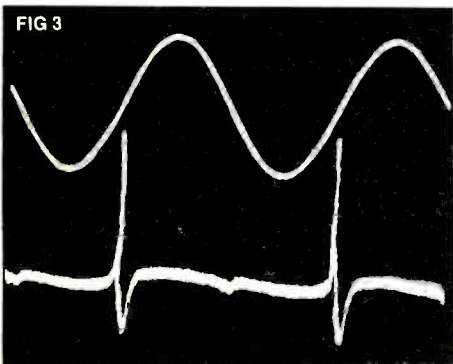
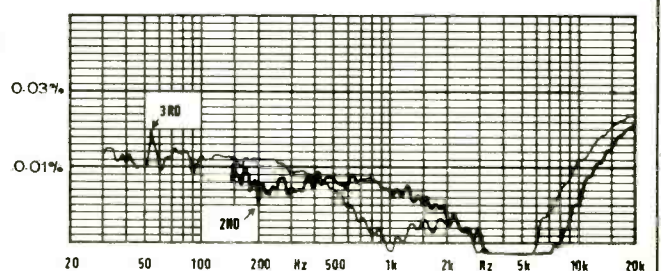


FIG 4.
CROWN/AMCRON PS-400
HARMONIC DISTORTION
0.125 W, 8 Ω



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200kHz at any level below clipping with the SMPTE intermodulation distortion into 4Ω or 8Ω using 50Hz and 7kHz mixed 4:1 being <0.006% from full power to -40dB.

Running a 1kHz squarewave into 8Ω in parallel with 2μF produced Fig 5 with a significant degree of overshoot but little ringing.

The rise and fall times were symmetrical at 3.5μs with a maximum slew rate of 18V/μs.

Other matters

Crosstalk between the two channels was as shown in Fig 6 being at a very low level with interaction between the two channels being minimal except at levels close to waveform clipping.

DC offset was found to be -33/+5mV as received with the output protection disabling the amplifier if the DC output exceeded -15/+13V or the AC output exceeded 12.5V RMS at 2Hz to 25V RMS at 5Hz. This protection was free from nasty spikes or other undesirable effects as was the recovery from overloads. Fig 7 shows complete freedom from DC offsets or other effects when driving the amplifier into heavy asymmetrical overload, the only 'peculiarity' being the introduction of 100Hz mains hum whilst clipping.

Power consumption did not vary with the operating frequency as with some amplifiers which take excessive power at high frequencies. At all times the amplifier ran relatively cool, failing to operate the thermal trip during testing.

Phase shift was negligible at audio frequencies as shown in Fig 8. Finally the instruction manual whilst including circuits does not include board layouts and the components are not identified on the boards. No servicing information or parts lists are included, thus servicing could create unnecessary problems.

Summary

The standard of construction of this amplifier was disappointing and cannot be recommended for mobile use when components or wiring might come adrift.

In terms of performance many aspects are good, particularly the protection mechanisms, but the crossover distortion using the Crown AB+B circuitry is undesirably high particularly at low output levels.

Hugh Ford

Manufacturer's comment

The amplifier supplied for Hugh Ford's review is in fact a pre-production unit and has therefore not been put through the rigorous quality control procedure at the Crown factory.

TABLE 1

Measurement method	Maximum gain	-20dB gain
22Hz to 22kHz RMS	119.7dB	116.0dB
A-weighted RMS	125.4dB	120.4dB
CCIR-weighted RMS ref 1kHz	116.9dB	112.0dB
CCIR-weighted quasi-peak ref 1kHz	112.3dB	107.7dB
CCIR-weighted ARM ref 2 kHz	123.9dB	118.6dB

TABLE 2

Load	Channels	Power output at clipping
8Ω	Single	202W left 201W right
8Ω	Both	184W left 186W right
4Ω	Single	344W left 354W right
4Ω	Both	308W left 318W right
2Ω	Single	256W left 373W right

TABLE 3

Output level	100Hz L/R	1kHz L/R	10kHz L/R
165W	0.0024/0.0024%	0.0022/0.0022%	0.0052/0.0056%
-10dB	0.003/0.003%	0.0045/0.0050%	0.013/0.013%
-20dB	<0.005%	0.0060/0.0055%	0.03/0.022%
-30dB	Below noise	0.009/0.010%	0.043/0.025%

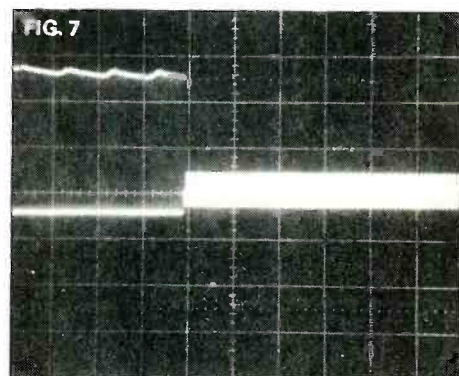
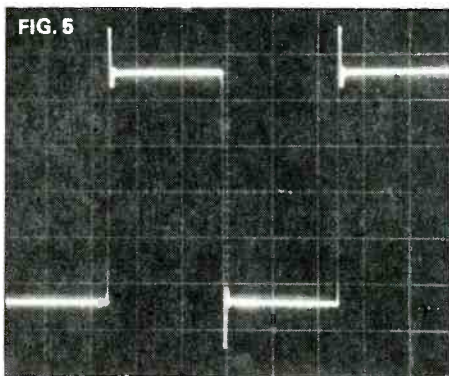


FIG 6.
CROWN/AMCRON PS-400
CROSSTALK

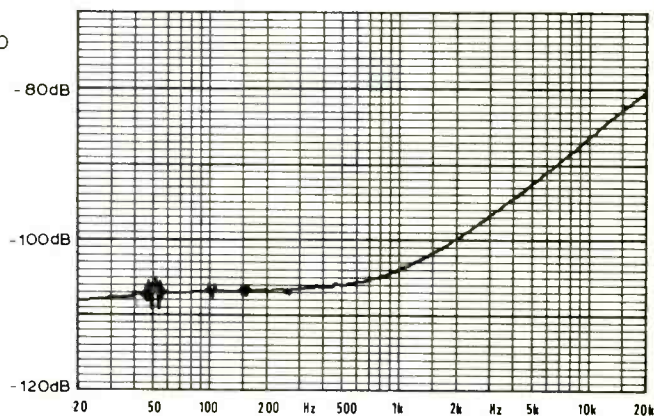
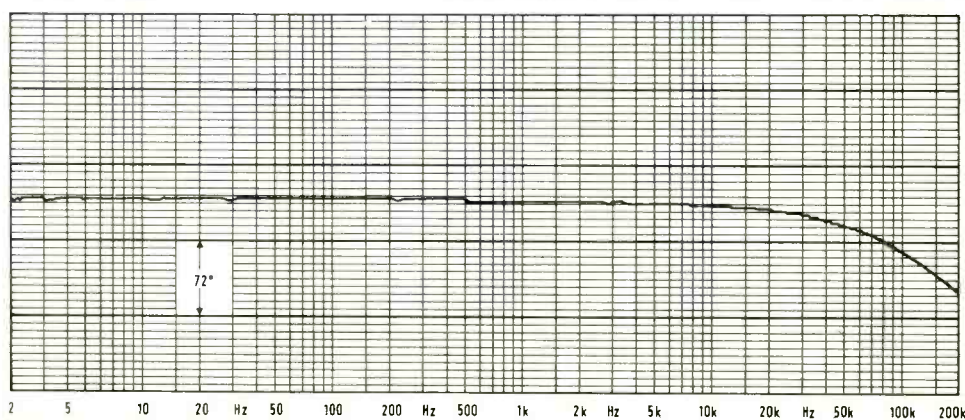


FIG 8.
CROWN/AMCRON PS-400
PHASE SHIFT





BGW 550 power amplifier

MANUFACTURER'S SPECIFICATION

Intermodulation distortion: less than 0.03% from 250mW to rated output (60Hz and 7kHz, 4:1).
Small signal frequency response: +0, -3 dB, 1 Hz to 100 kHz. +0, -0.25 dB, 20 Hz to 20 kHz.
Hum and noise level: better than 102dB below rated output into 8Ω (unweighted, 20 Hz to 20 kHz).
Input sensitivity: 1.23V for maximum output. Voltage gain 30.24dB (32.5 times).
Input impedance: greater than 10kΩ.
Damping factor: greater than 150 to 1 referenced to 8Ω at 1kHz.
Output impedance: designed for any load impedance $\geq 4\Omega$.
Power requirements: internal jumper selects either 100, 120, 200, 220 or 240V, 50/60Hz.
Semiconductor complement: two op amp ICs (equivalent to 44 transistors each), 39 transistors, 8 zener diodes, 25 diodes and three LEDs.
Dimensions: (whd) 19 x 5 1/4 x 11 3/4 in (482.6 x 133.4 x 298.5mm).
Weight: 41lb net, 47lb shipping (118.64kg net, 21.36kg shipping).
Manufacturer: BGW Systems, 13130 South Yukon Avenue, Hawthorne, California 90250, USA.
UK: Theatre Projects, 10 Long Acre, London, WC2E 9LN.

THE BGW 550 is a 2-channel power amplifier rated at a continuous 200W/channel into 8Ω or 325W into 4Ω using the IHF dynamic headroom measurement. Mono bridged mode operation is also provided when the amplifier can deliver a nominal 625W into 8Ω using the IHF dynamic headroom test waveform.

Based on an alloy front panel dimensioned for mounting into a 19in rack 3U high, the front panel has two substantial handles which protect its controls. Attached to the front panel is a steel chassis with a 'U' shaped cover which has perforations at the top of the sides. Inside these perforations, the two amplifier modules are supported at the front and rear of the amplifier, with a noisy cooling fan at the centre of the rear panel passing cold air over the modules.

Each module consists of a finned heatsink which extends the depth of the unit, the base of the heatsinks being covered by a good quality printed circuit board which supports all the

components for one amplifier channel. Removal of a channel for servicing is simply accomplished by removing four Allen screws, unplugging an octal connector and removing two slide connectors from the protective thermostat on the heatsink.

The laminated power transformer is located at the centre of the chassis with the rectifier and the electrolytic capacitors being properly secured to the base. A further small printed circuit board also fixed here contains the protective circuit for the outputs which are relay switched in the event of excessive DC output or short circuits and also at switch on.

To ease servicing almost all interconnections are either pin or slide-on connectors with the overall standard of construction being good and access to components excellent. There is however room for improvement in the tidiness of the wiring layout. No component identifications are provided and at the time of writing no users' manual was available.

Whilst mains tap changing is not a common requirement this could be tiresome as the main transformer taps are interconnected with 'bomb tail' crimp connectors. Furthermore it is necessary to change the magnetic circuit breaker on the front panel for alternative power line voltages. This safety device, which is rocker actuated, forms the power on/off switch on the front panel and has an adjacent LED indicator.

Two other red LEDs next to the detented gain potentiometers act as clipping indicators, the gain controls having clear calibrations from zero to 21 to provide accurate resetability.

To the rear the power input is via a large fixed lead just over 2m long with positive clamping to the chassis and a magnetic circuit breaker replacing mains fuses.

Very sensibly the unbalanced audio inputs are duplicated 1/4in jack sockets for looping amplifiers in parallel, with the power outputs being at terminals/banana sockets on the standard 3/4in spacing.

All rear panel features are clearly identified with a recessed screwdriver-operated slide switch providing mono or twin-channel operation, mono operation being in the bridged mode.

Inputs and outputs

The two inputs were found to have identical sensitivities of 1.240V for the rated output of 200W into 8Ω at maximum gain at 1kHz. At maximum gain the input impedances of the two channels were reasonably similar at 14.1kΩ in parallel with 480pF and 14.5kΩ in parallel with 330pF. At -20dB gain the compactive components reduced considerably with the resistive components being 20.2/20.9kΩ which remained constant at lower gains.

The attenuator steps were perhaps on the coarse side at <1dB down to -7dB gain increasing to <1.5dB down to -28dB and <2dB down to -45dB.

The impedance at the power outputs is shown in Fig 1 in relation to frequency being 0.037Ω at low frequencies providing a damping factor of 216 into 8Ω. DC offset at the outputs remained constant at -5.4/-3.6mV for the two channels.

Frequency response and noise

The frequency response of the two channels was effectively identical within the audio band with one channel driving 1W and the rated 200W into 8Ω being shown in Fig 2.

At low frequencies the -3dB points were at 1.9Hz with the high frequency -3dB points being very similar when working at 1W or 200W into 8Ω at 79kHz and 82kHz for the two channels. The gain control settings had no influence on frequency response below 20kHz but shifting the -3dB points down to 76/70 kHz at 20dB attenuation.

Noise in the outputs was found to vary with gain setting, being worst at around -7dB with the inputs shorted. It was also found that the right channel had far higher power line hum and

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H 110 HARMONIZER

Pitch change: one octave up, one down. Delay: output one, 112.5 ms output two, 82.5 ms. Frequency response 12 kHz. Dynamic range: 90 dB. Feedback control.



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Designed specifically for the broadcast industry and is primarily intended for the policing of live transmissions. There are three maximum delay times available 1.6, 3.2 or 6.4 seconds plus a unique program dump and catch up facility.



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The Omnipressor combines the characteristics of a compressor, expander, noise gate and limiter in one package.



JJ 193 DELAY LINE

Four outputs, each with up to 510 ms of delay, independently switchable in 2 ms steps. Extra delay is optional to a maximum of 1.022 or 2.046 secs. Frequency response: 12 kHz. Dynamic range: 90 dB.



R.D. 770 MONSTERMAT

Mono/Stereo Matrix unit. The Monstermat solves the problem of tape phasing and noise on cartridge machines.



1745M DELAY LINE

Up to five outputs, each with a maximum of 320 ms of delay (640 ms in the double mode) selectable in 20 μ steps. Optional modules available include a pitch changer, and a remote control module which controls the delay line with a micro-computer. Frequency response: 16 kHz (8 kHz in 'double' mode). Dynamic range: 90 dB.



U.K. Distributors

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reviews

TABLE 1

Measurement method	Left		Right	
	Max gain	Worst	Max gain	Worst
22Hz to 22kHz RMS	109.5dB	107.5dB	97.3dB	97.3dB
A-weighted RMS	115.4dB	110.3dB	111.8dB	110.3dB
CCIR-weighted RMS	106.1dB	103.1dB	105.3dB	103.6dB
CCIR-weighted quasi-peak	100.8dB	93.9dB	97.7dB	94.8dB
CCIR-weighted ARM	113.0dB	111.3dB	112.7dB	111.3dB

TABLE 2

Load	Channels	Power output at clipping
8Ω	Single	276W left 276W right
8Ω	Both	239W left 241W right
4Ω	Single	449W left 451W right
4Ω	Both	368W left 366W right
2Ω	Single	227W left 187W right

hum harmonic levels than the left channel. This appeared to result from the location of the right channel gain potentiometer close against the power transformer. Moving this control away from the transformer changed 150Hz output by 14dB!

Table 1 relates noise in the output to the rated output of 200W into 8Ω with the inputs shorted for maximum gain and worst case gain settings.

Other than the hum problem in the right channel no other undesirable components were found in the output noise.

Power output and distortion

The normal precautions were taken when measuring at high powers, the mains supply being stabilised to within $\pm 0.5\%$ and precision digital meters being used for voltage measurements in conjunction with calibrated load resistors.

Initially the power output at the onset of 1kHz waveform clipping with 240V AC input was measured for single and both channels driven into 8Ω, 4Ω and 2Ω. The latter being included because some nominally 4Ω loudspeakers have an impedance which falls well below 4Ω at some frequencies.

The Table 2 illustrates a good balance between

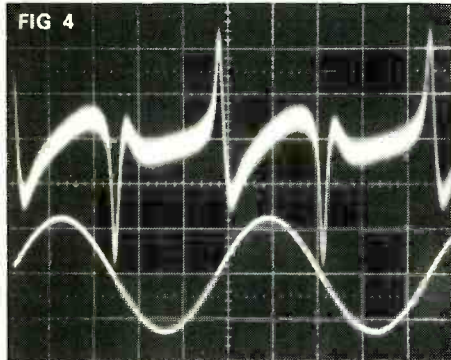


FIG 4
BGW 550
FREQUENCY RESPONSE

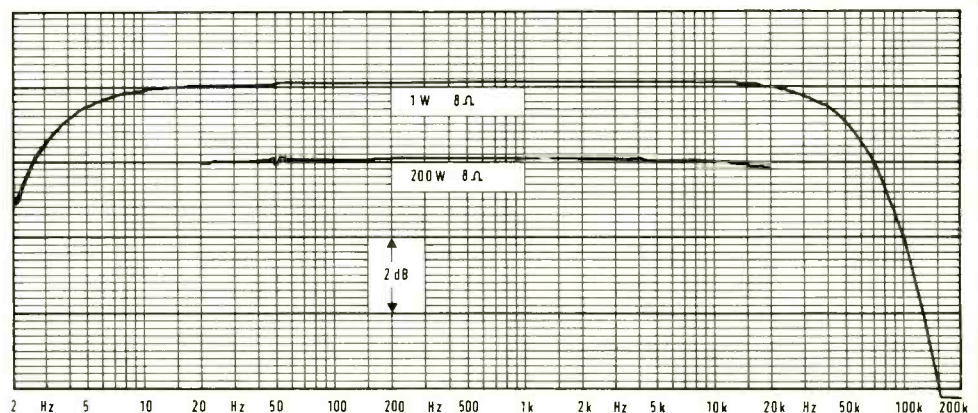


TABLE 3

Output level	100 Hz L/R	1 kHz L/R	10 kHz L/R
200W 8Ω	<0.0022/0.0028%	0.008/0.008%	0.062/0.060%
-10dB	<0.0032/<0.006%	0.0075/0.0092%	0.055/0.055%
-20dB	below hum	0.0080/0.0095%	0.057/0.067%
-30dB	below hum	0.0130/0.0150%	0.056/0.066%

the two channels but suggests that hard driving of 4Ω loudspeakers which have a particularly awkward impedance characteristic might be inadvisable.

The peak power handling capability was measured by finding the onset of clipping of a 10ms burst of 1kHz tone every 100ms. Again the performance of the two channels was similar with the amplifier delivering 306/315W into 8Ω or 540/560W into 4Ω.

The red overload LEDs operated at clipping on continuous tones and required 5ms overload at 10kHz or 12ms overload at 1kHz for a clear

indication of clipping.

The individual second and third harmonic distortion when driving the rated 200W into 8Ω is shown in Fig 3. At lower powers the second harmonic remained constant down to 0.2W and then fell with level whilst the third harmonic fell with level to rise again to the same level at 20mW output. When working into 4Ω the pattern was similar with a slight increase in second harmonic.

As with the individual harmonic components the difference between the total harmonic performance of the channels was small as shown in Table 3.

FIG.1
BGW 550
OUTPUT IMPEDANCE

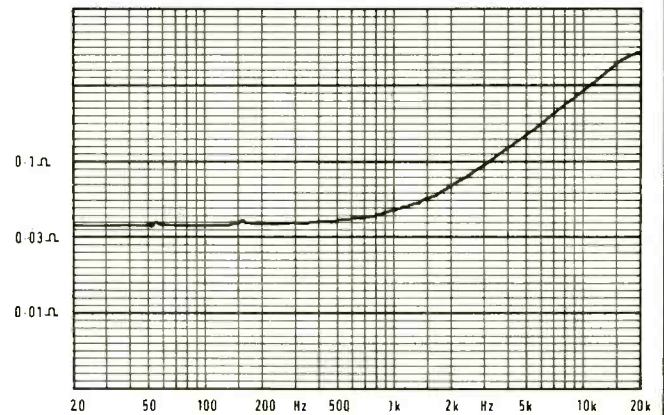
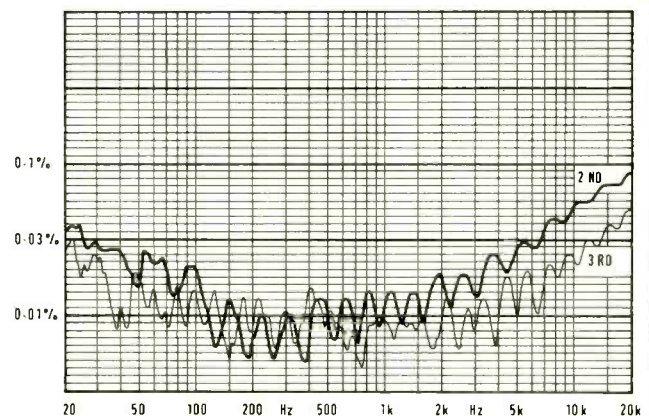


FIG.3
BGW 550
HARMONIC DISTORTION
AT 200W, 8Ω



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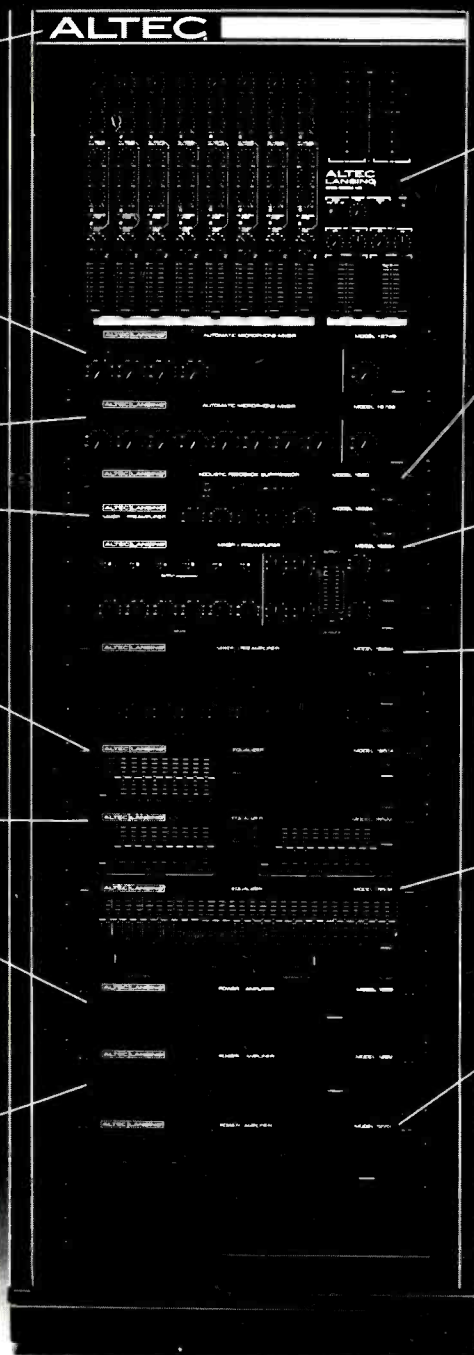
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At 10kHz the distortion was predominantly crossover distortion the nature of which is shown in Fig 4 for 1W at 10kHz into 8Ω reading 0.076% on an average responding meter. When driving 4Ω the 100Hz and 1kHz distortion altered little but the 10kHz performance was degraded by a relatively constant 4dB.

Intermodulation distortion to the CCIF twin tone method at a peak equivalent of 200W into 8Ω is shown in Fig 5. It was found that the second order product remained relatively constant with level but that the third order product improved by 10dB at lower levels.

SMPTE type intermodulation distortion using 50Hz and 7kHz tones mixed 4:1 in amplitude remained constant at 0.005% into 8Ω or 0.012% into 4Ω from full power down to -20dB for the left channel or 0.009% (8Ω) and 0.022% (4Ω) for the right channel.

Driving a 1kHz squarewave into 8Ω in parallel with 2μF produced Fig 6 giving a degree of overshoot with slight ringing.

Rise and fall times were symmetrical at 6μs with the maximum slew rate being 20V/μs into 4 or 8Ω.

Other matters

Crosstalk between the two channels was reasonable as shown in Fig 7 but probably suffered from crosstalk between the input wiring at high frequencies.

The effect of driving the amplifier into heavy asymmetrical overload is shown in Fig 8 for a 10ms burst of 1kHz tone at 10V/division. Whilst the amplifier took about 60ms to recover its DC conditions, there were no nasty effects. Generally the overload protection worked without audible defects and the amplifier could stand a lot of punishment before the thermostats tripped or the overload relay operated. This occurred without dangerous spikes in the output as did restoration of the signal.

The relay operated if DC occurred at the output in excess of ±20V for more than 400ms or if the output at 2Hz exceeded 31V RMS.

Phase shift in the audio band was minimal as shown in Fig 9 with the high frequency roll-off aiding stability.

Summary

The BGW 550 is a well built amplifier suitable for heavy duty use, but it suffers from noisy cooling fans. Ease of servicing is a good point and it is assumed that a suitable servicing manual will become available.

Overall the performance was good but crossover distortion was on the high side as was hum in one channel
Hugh Ford

FIG.5
BGW 550
IM DISTORTION
AT 200W, 8Ω

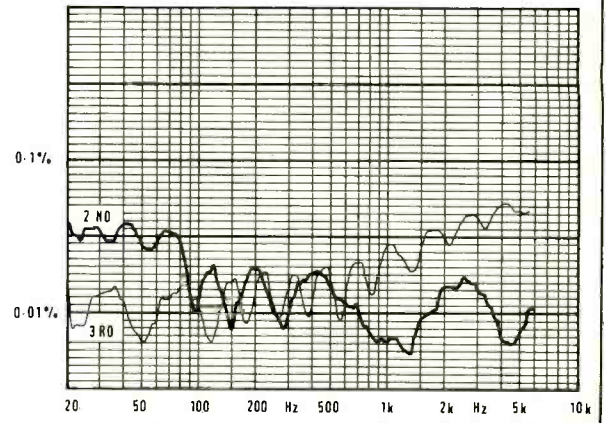


FIG.7
BGW 550
CROSSTALK

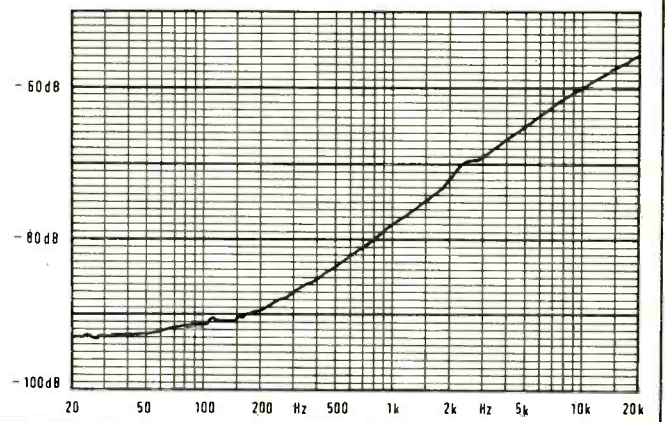


FIG 6

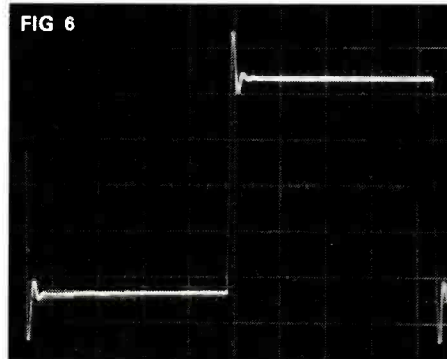


FIG 8

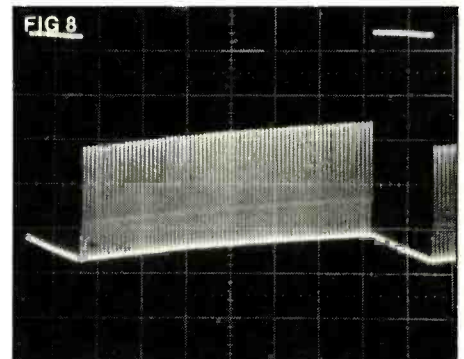
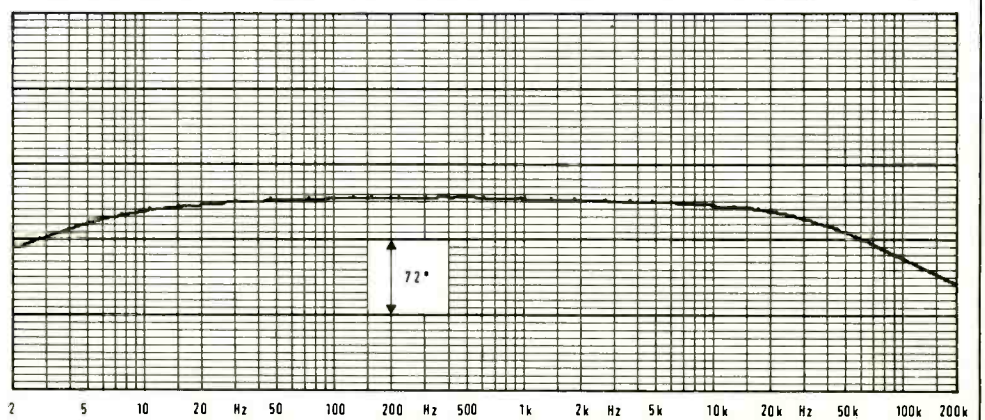
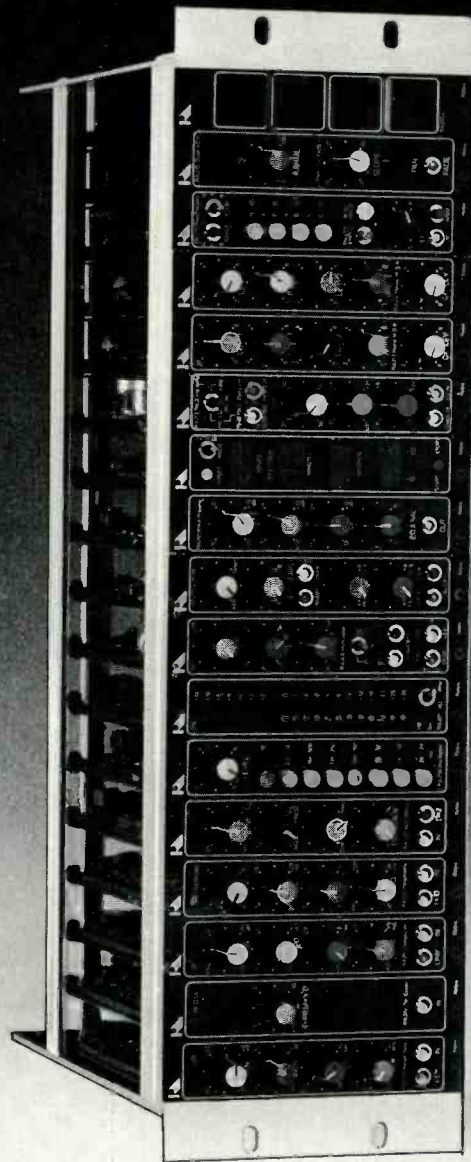


FIG 9
BGW 550
PHASE SHIFT



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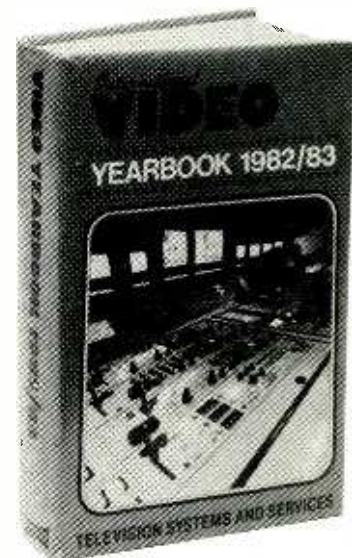
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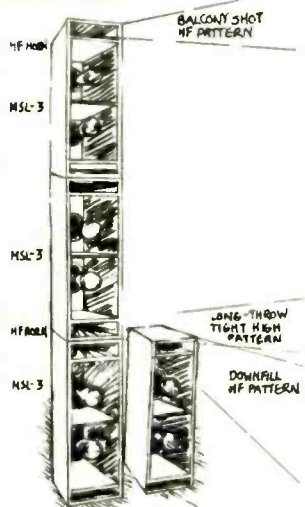
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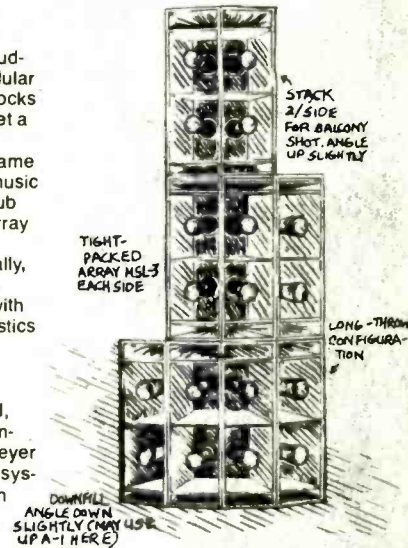
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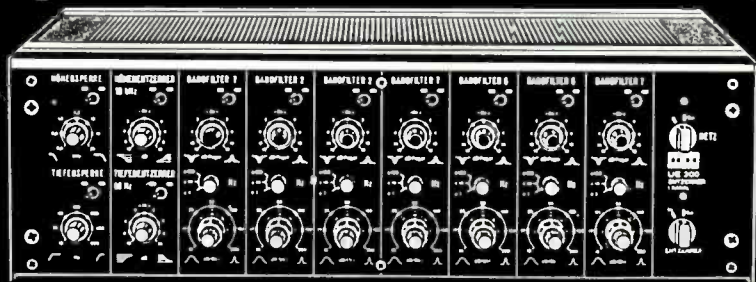
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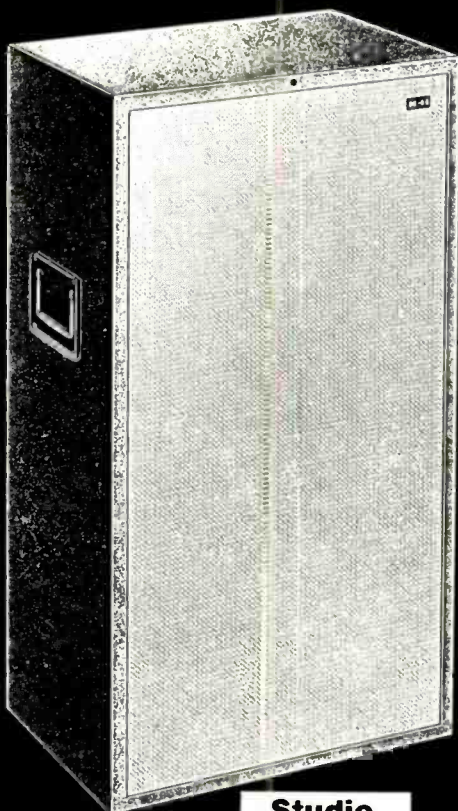
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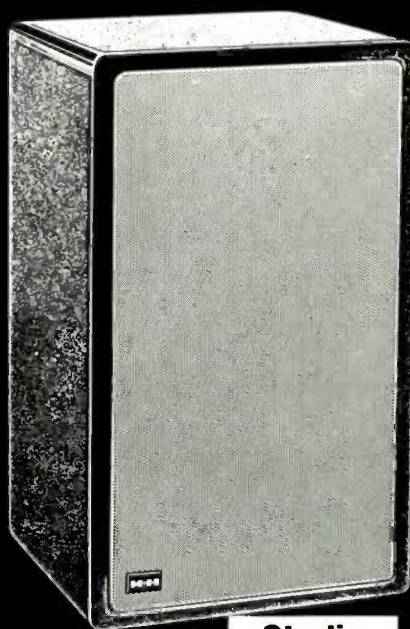


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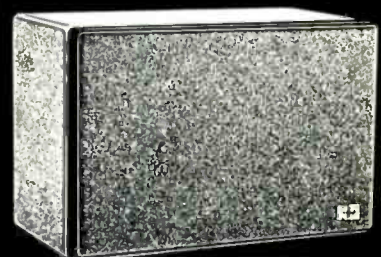
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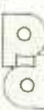
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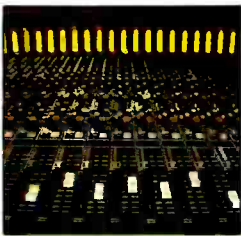
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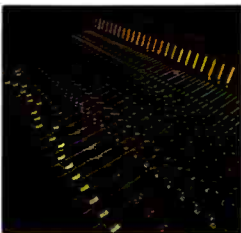
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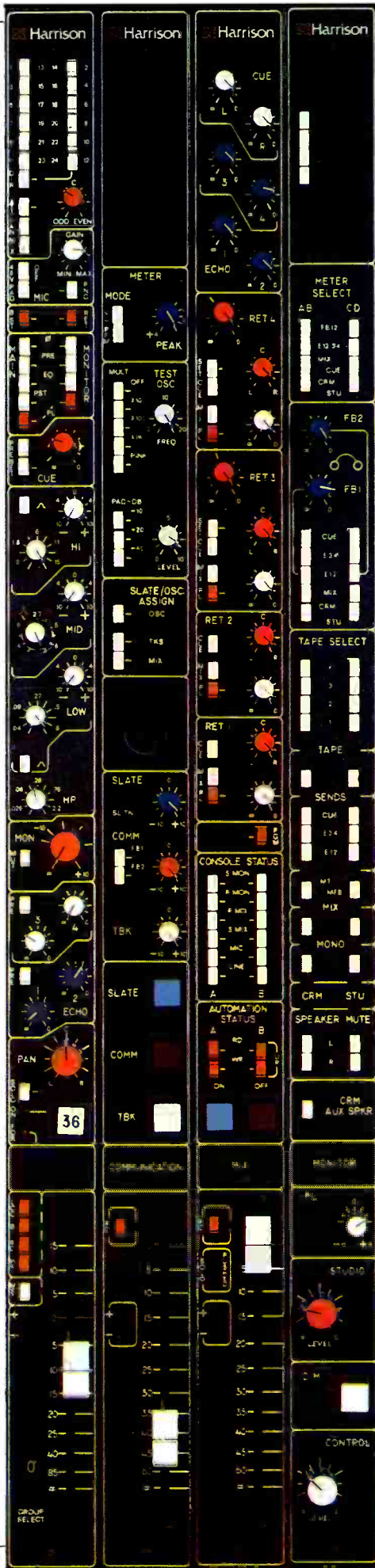


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