

studio sound

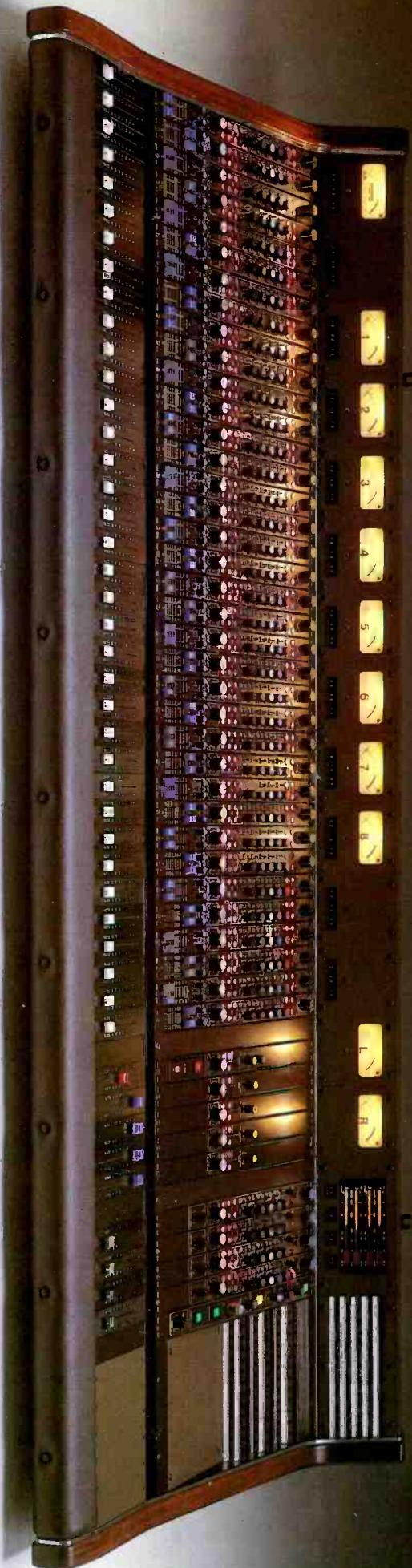
June 1979 60p

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ANGUS ROBERTSON

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PRODUCTION EDITOR

DRUSILLA DALRYMPLE

CONSULTANT

HUGH FORD

**EDITOR'S
PERSONAL ASSISTANT**

WENDY SMEETH

ADVERTISEMENT MANAGER

MIKE STORMER

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PHIL GUY

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MARION MOISER

PUBLISHER

DOUGLAS G. SHUARD

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

Phone: 01-686 2599

International: +44 1 686 2599

Telex: 947709

Telegrams: Aviculture Croydon

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*STUDIO SOUND is published on the second Friday
of the preceding month.***SUBSCRIPTIONS***STUDIO SOUND is available on a rigidly controlled
requested basis only to qualified personnel (see back
page for terms of control), or for an annual cost of
£9.50 to non-qualifying readers or where more than
two copies are required in a studio or small organisation.*

EUROPE Subscription cost £9.50

UNITED STATES Surface mail subscription \$20,
airmail subscription \$40OVERSEAS Surface mail subscription £9.50, airmail
subscription £20.*All subscription and circulation enquiries to:
Subscription Dept, Link House Publications Ltd, Robert
Rogers House, New Orchard, Poole, Dorset BH15 1LL,
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BACK COPIES*A limited number of back copies are available, 60p each***BINDERS***Loose-leaf binders for annual volumes of STUDIO
SOUND are available from Modern Bookbinders,
Chadwick Street, Blackburn, Lancashire. Price is £2
(UK and overseas). Please quote the volume number
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1978. UK: 6,257. Overseas: 7,109.***A LINK HOUSE GROUP
MAGAZINE**

studio sound

AND BROADCAST ENGINEERING

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In my March editorial, I wrote about the coming of digital audio discs and discussed the possibilities of the introduction of a joint audio/video disc format, pointing out that it makes sense to market players capable of replaying both digital audio and video discs. Since publication of these particular comments, Philips has given press demonstrations of its new *Compact* disc, a photograph of which was included on page 24 of the May issue. Various other information has come to light over the past few months, and *Studio Sound* will be publishing a feature next month detailing the technology of the new generation of digital audio discs that will start to make an impact in the early Eighties.

The 78rpm disc had a reign of about 30 years followed by the Long Playing disc which is just coming up for its thirtieth birthday, amidst continual complaints from both public and industry as to quality control and actual disc quality, something that has been mentioned on this page more than once. To be fair, the problem is not so much with the actual pressing plants, but with the quality of replay equipment that is now being used by the vast majority of the LP buying public. In 1950, it was mostly crystal cartridges and such things, and no great concern had to be taken over quality, while today every little imperfection is noticed often resulting in massive returns from record shops, with little prospect of finding higher quality discs even from different batches.

Although digital audio discs will overcome many of these quality control problems, there is currently debate as to how digital audio discs will be realised. The Japanese stand on one side of the ring proposing digital audio discs 12in in diameter which would play for only one hour, but be totally compatible and directly interchangeable with the same company's video discs, while Philips in the opposite corner is suggesting that 12in discs for audio are now not necessary, and offering instead the 4½in diameter *Compact* disc which also plays for one hour. The recording format used on the 4½in *Compact* disc just happens to be identical to that used on the same company's video disc, so that it would be simple to arrange for video disc players to play back the smaller *Compact* disc.

On the other hand while a 12in disc is totally unmanageable in a car, the 4½in disc just fits conveniently into a car radio cutout. *Compact* cassettes currently cost rather more to manufacture than LP records and unless recorded on very expensive raw tape (such as metal), cannot approach the quality. So the possibility of having a consumer disc capable of being used in the car has considerable market potential. While we certainly haven't heard the end of the arguments, I personally feel a compromise will arise with the 4½in disc being the basic market leader, but with say a 7in disc which would provide a considerably improved playing time for classical and operatic music (for instance) that could then be played back on the 12in dual audio/video player. Although Philips denied this as a possibility at the press conference, I am sure that the possibility has not been totally ignored.

JUNE 1979 VOLUME 21 NUMBER 6

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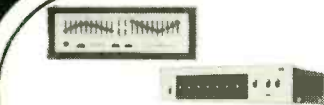
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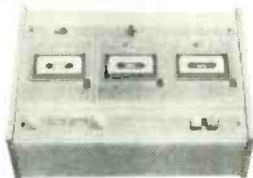


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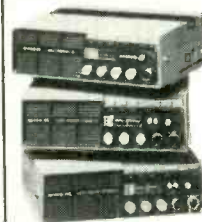
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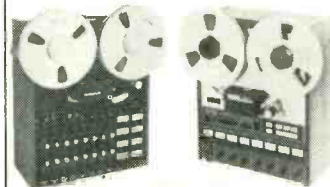
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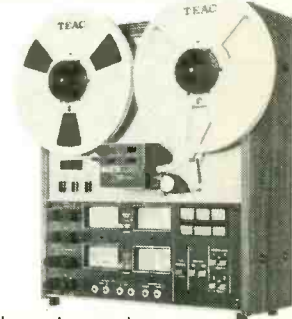
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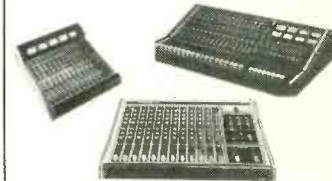
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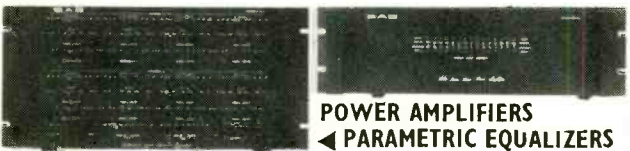
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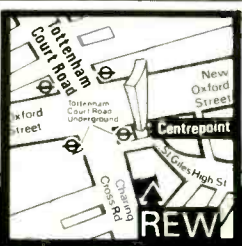
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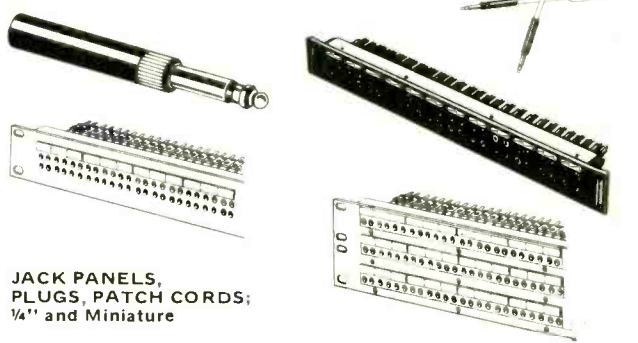
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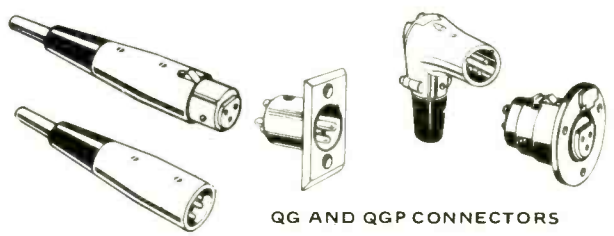
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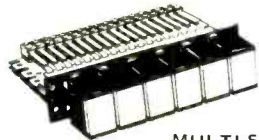


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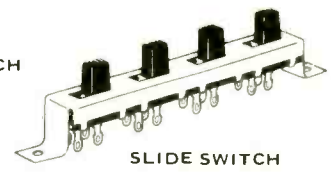
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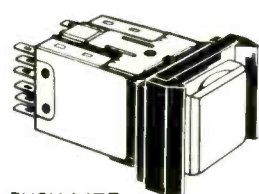
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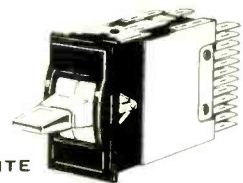
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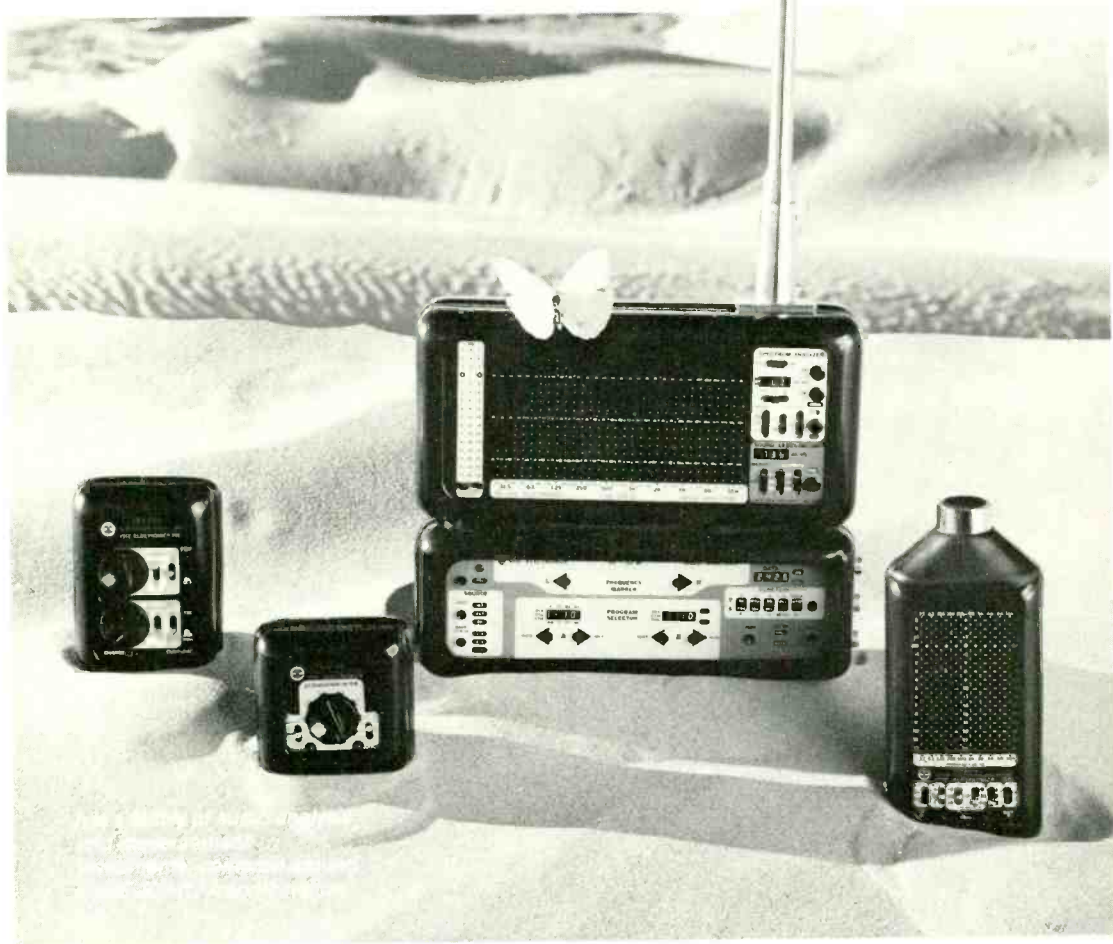


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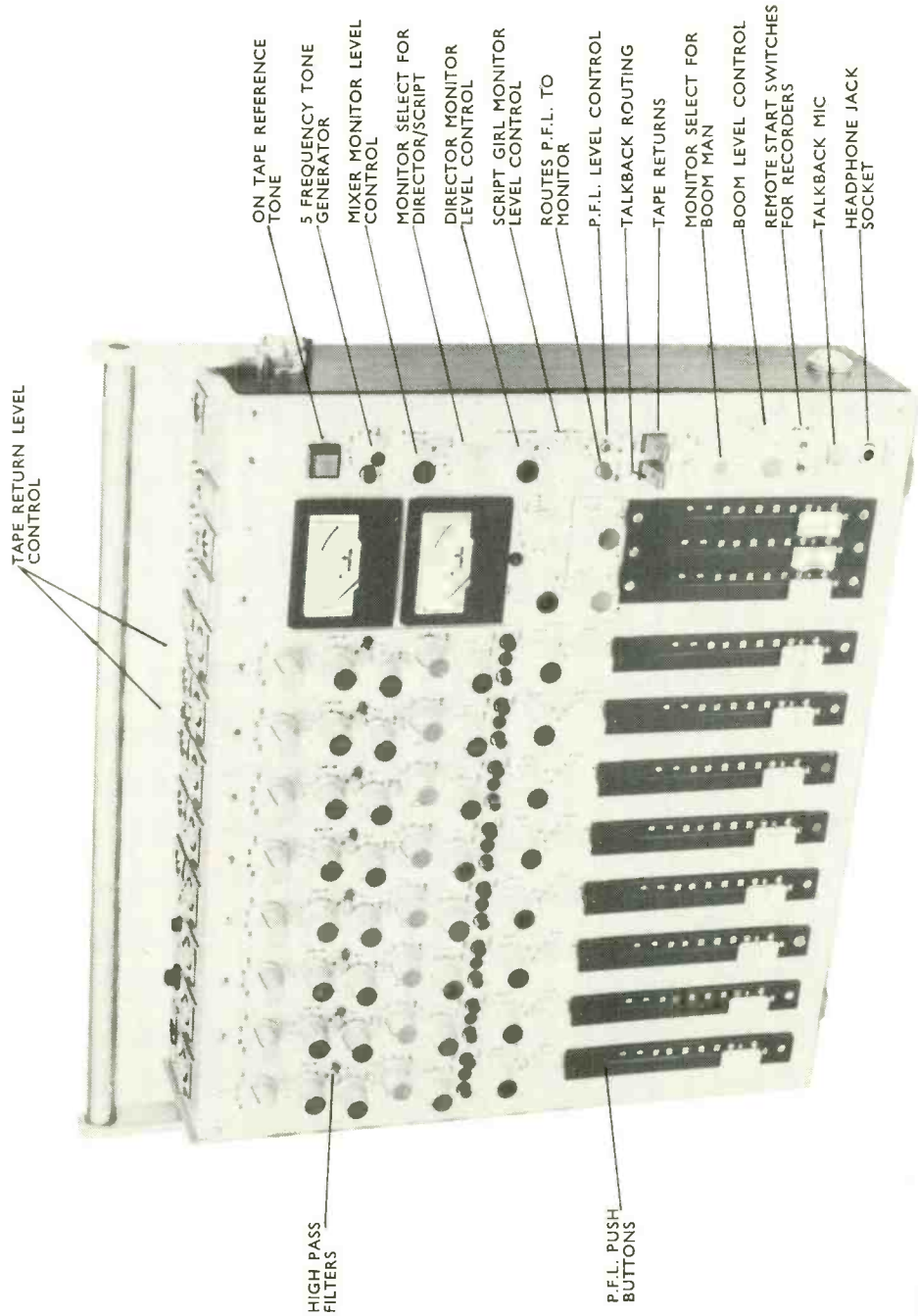


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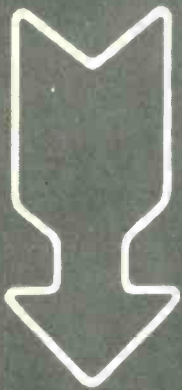
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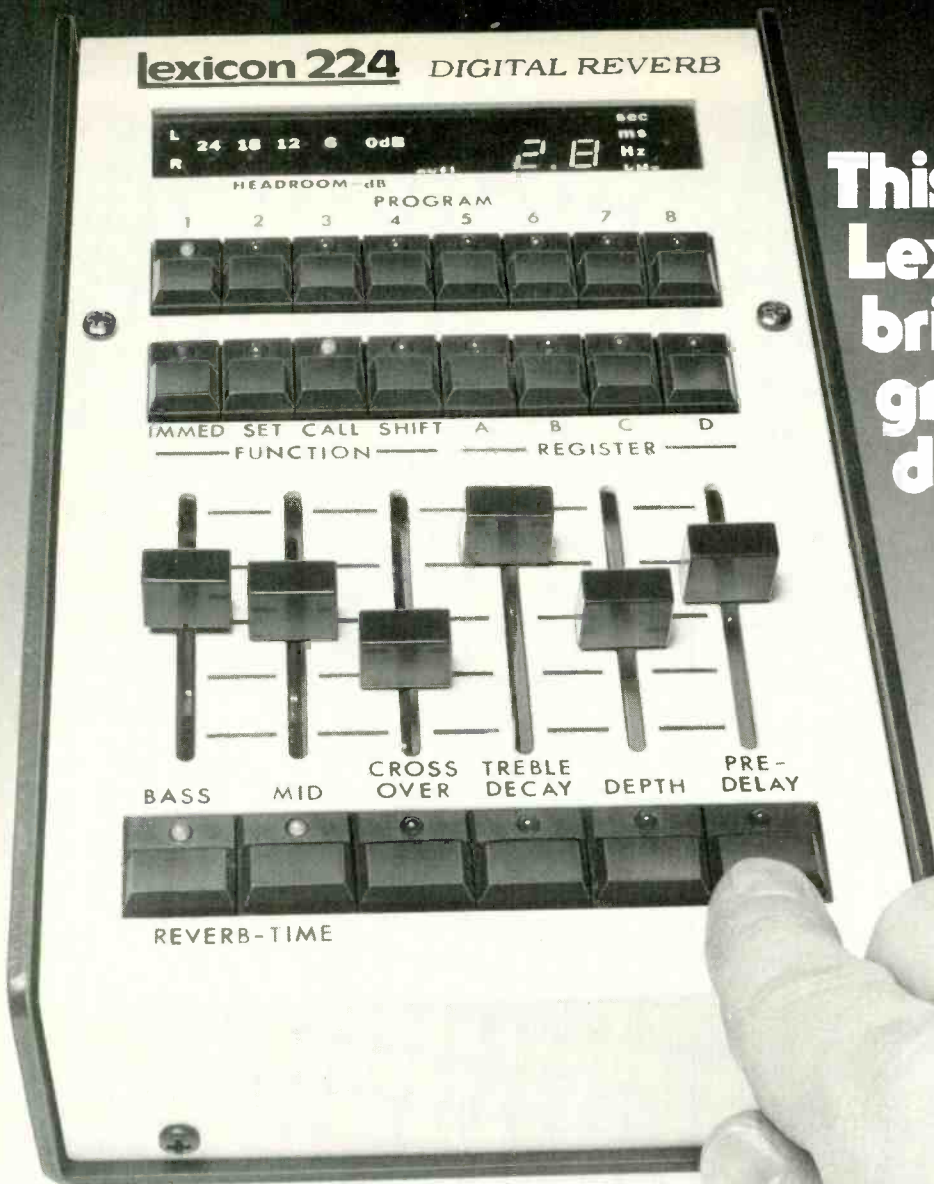
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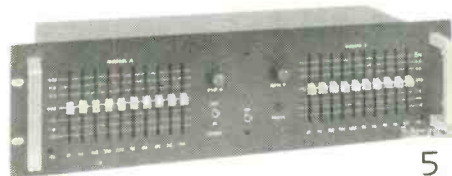
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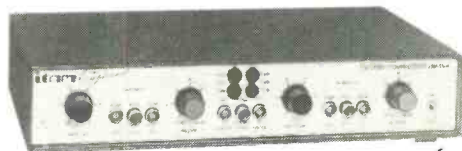
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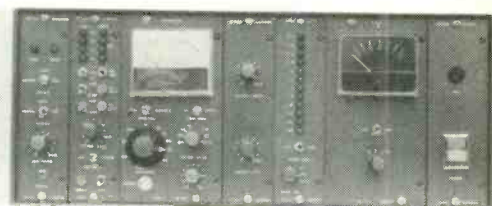
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The HARMONIZER employs digital circuitry and random access memories to actually transpose input signals by up to a full octave up or down. Any musical interval can be achieved by the continuously variable control and the optional monophonic or polyphonic keyboard allows real-time 'playing' of the HARMONIZER so that the musician can harmonize with himself. The HARMONIZER can be used to maintain constant pitch in direct ratio when the speed of pre-recorded tape is varied up or down.

DIGITAL DELAY

In addition the HARMONIZER is a low cost, very versatile delay line. The delay is variable in 7.5 ms steps up to 112.5 ms. A second output is optionally available that varies up to 82.5 ms.

SPECIAL EFFECTS

Simultaneous use of feed back, delay and pitch change can be used to create previously unobtainable effects.

Other devices available in the Eventide range include the
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FLANGER
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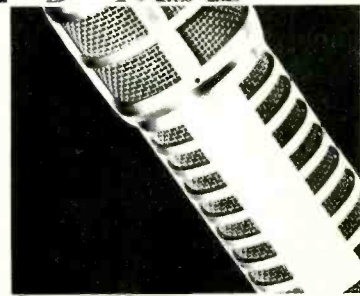
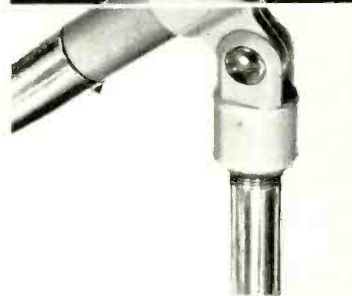
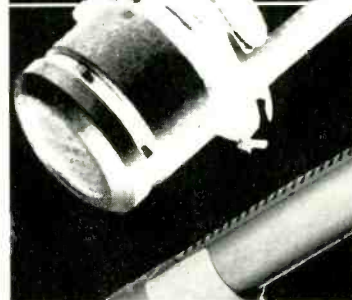
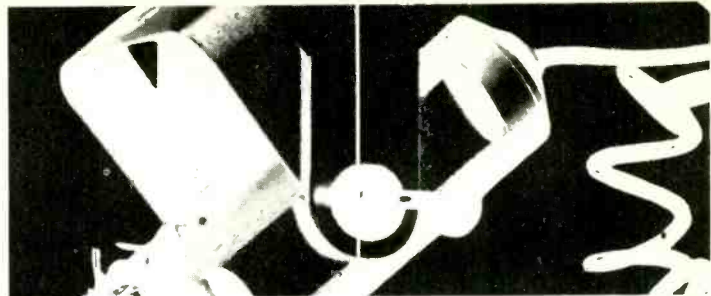
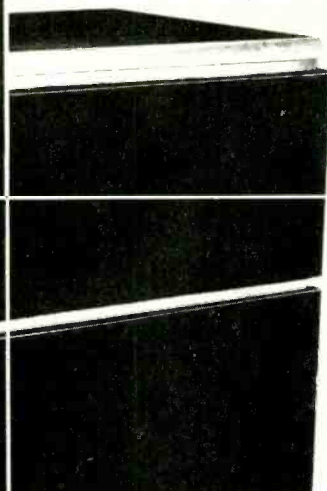
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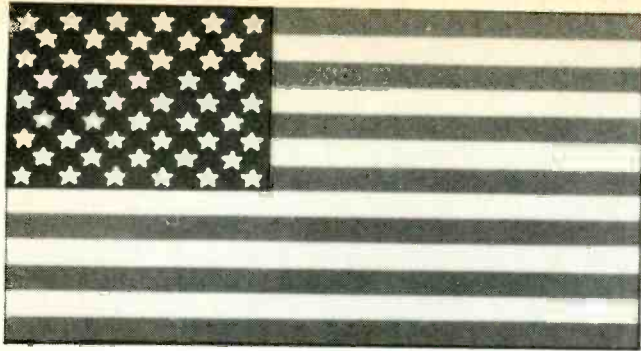
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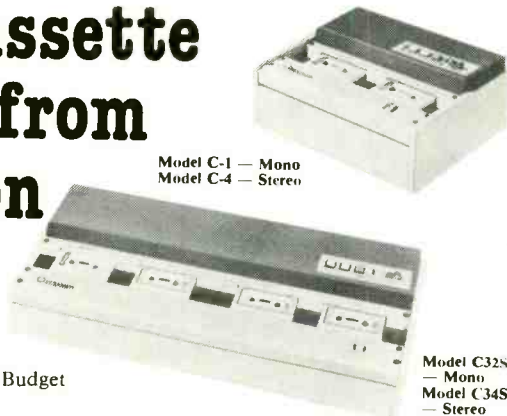
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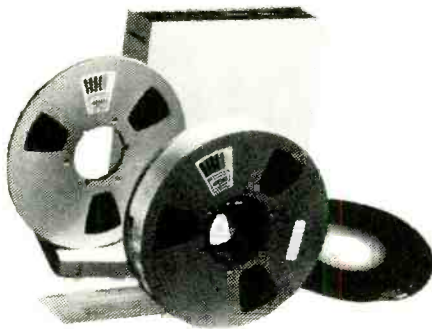
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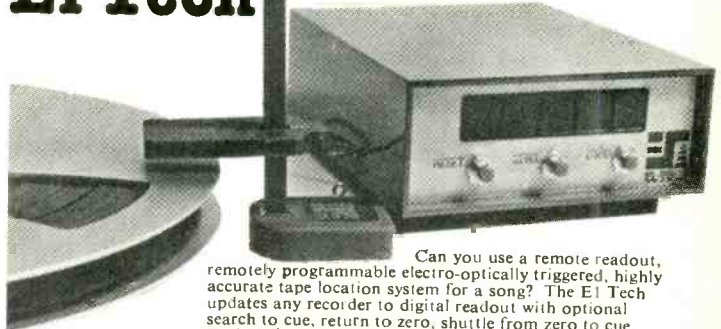


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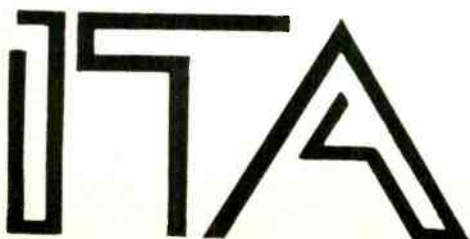
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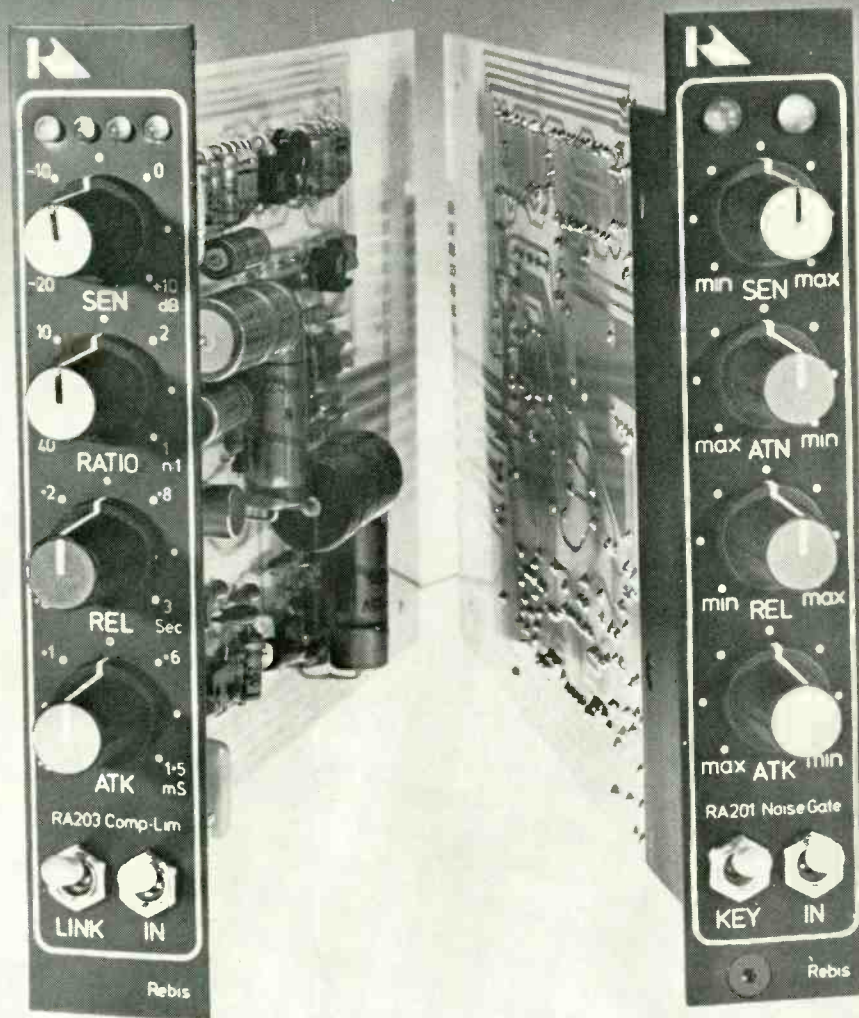
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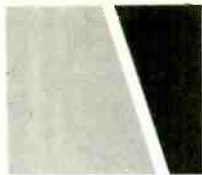
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CS-800 STEREO POWER AMPLIFIER



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fact: you can choose your microphone to enhance your productions.

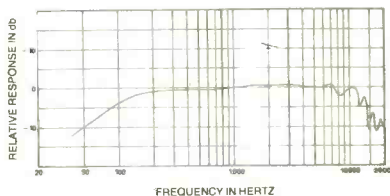
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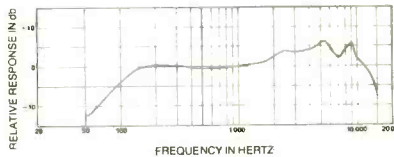


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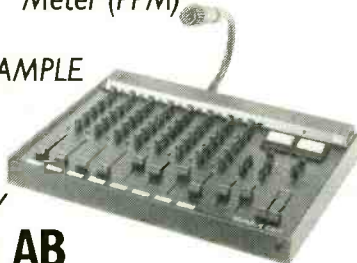
- 2 Master Channels
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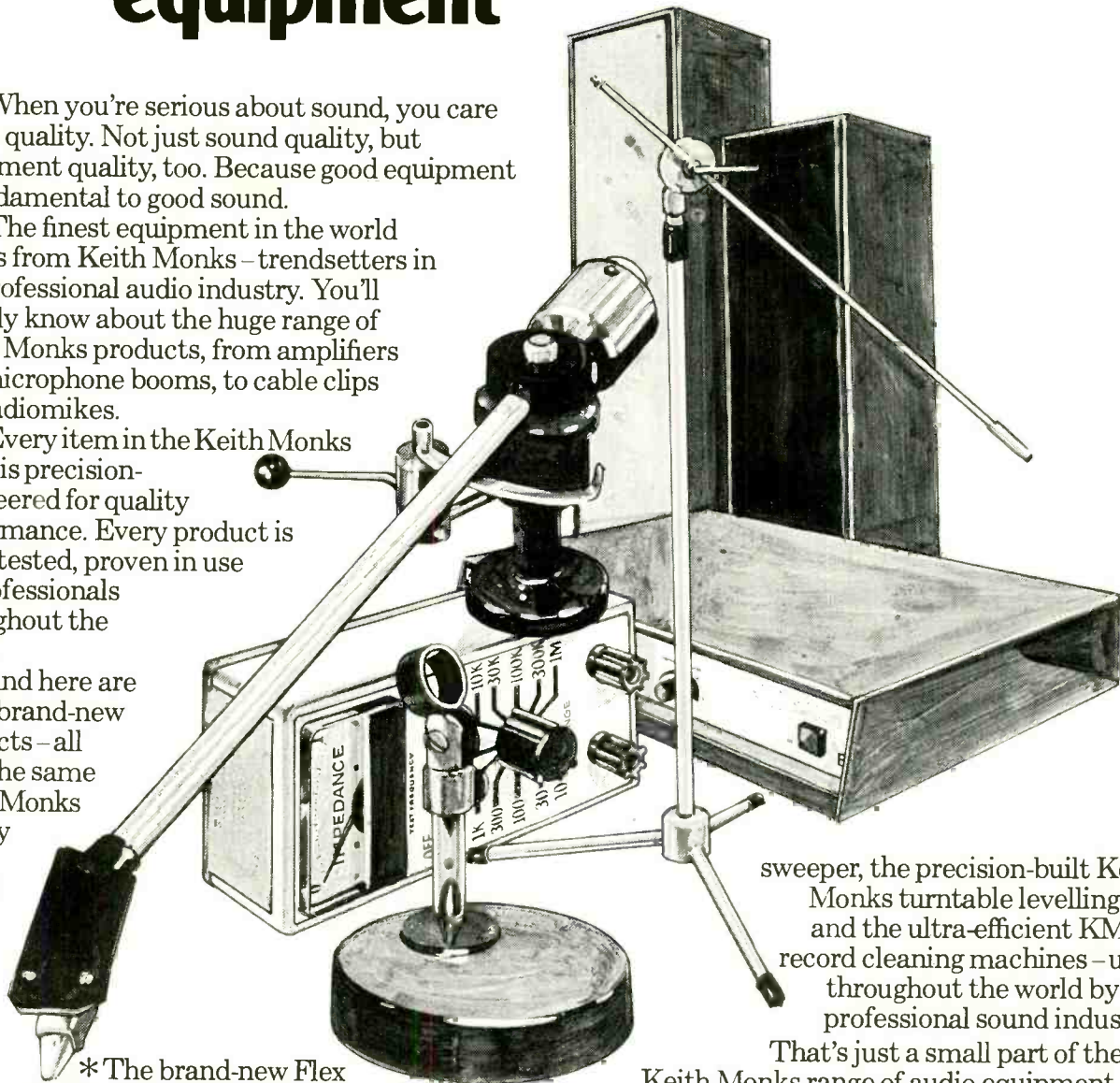
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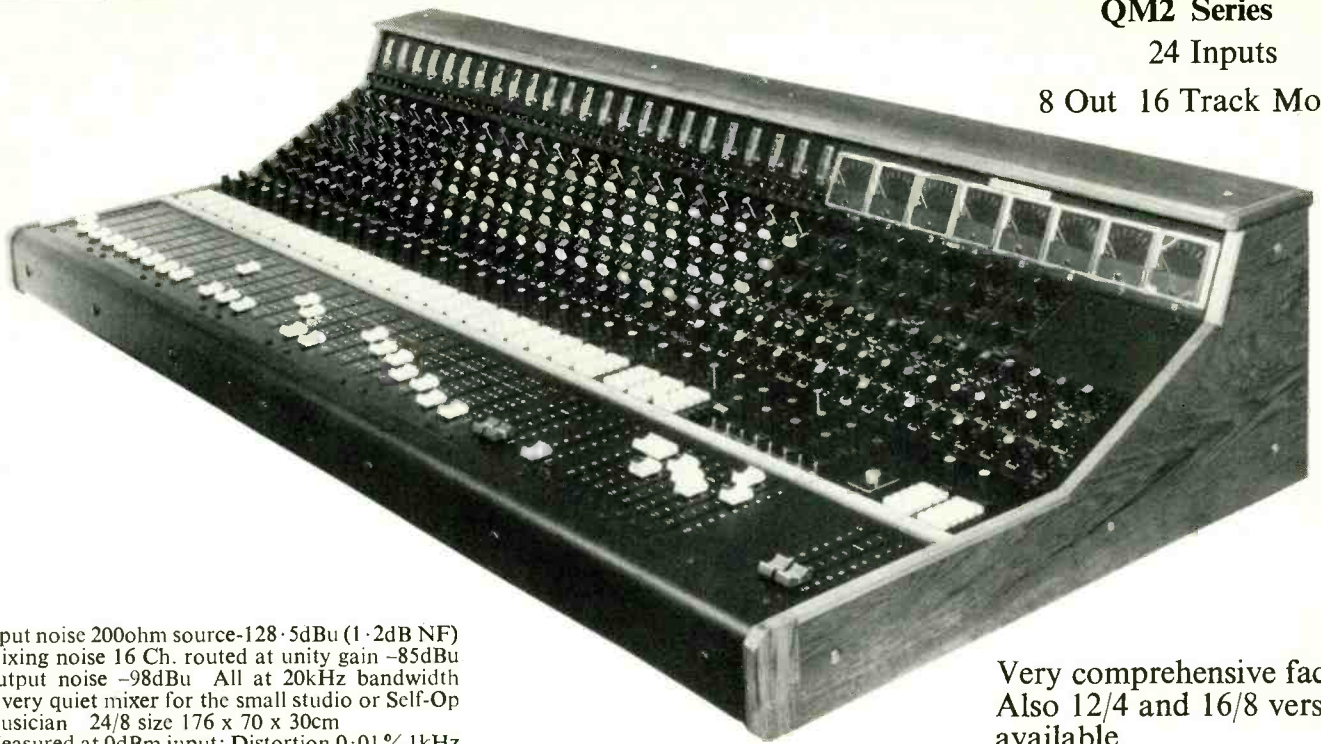
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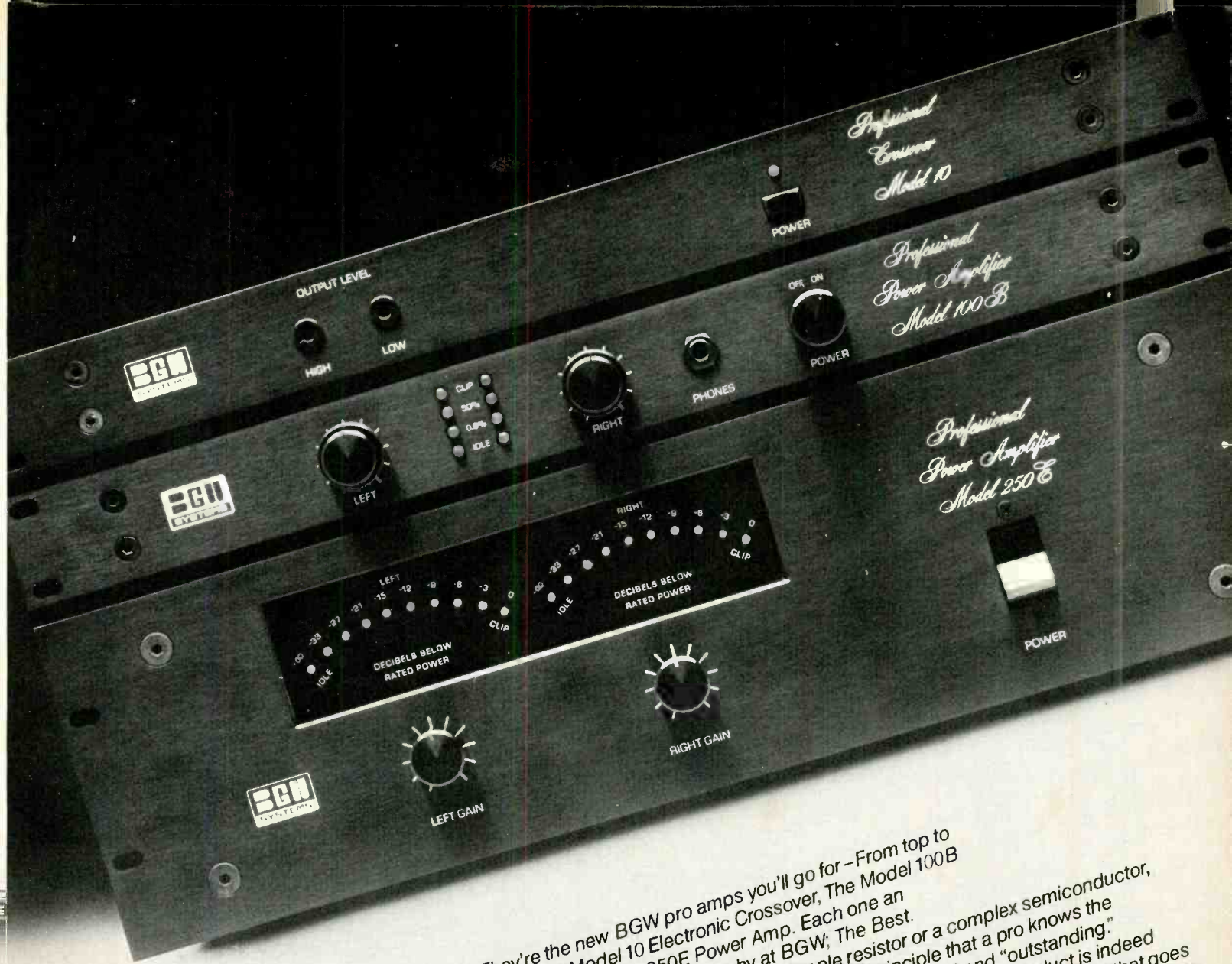
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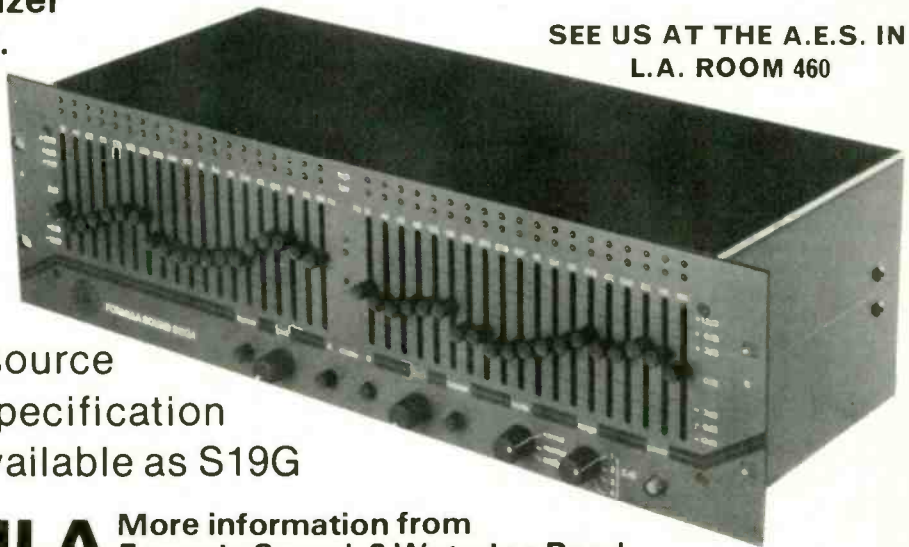
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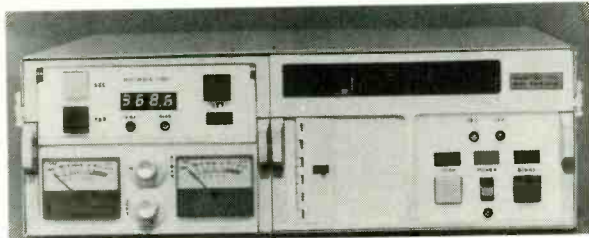
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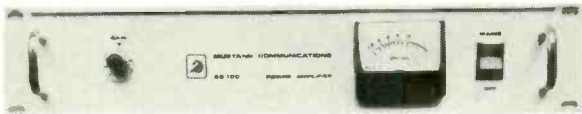
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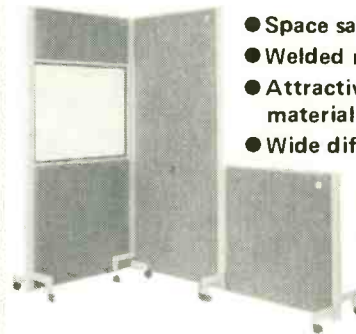


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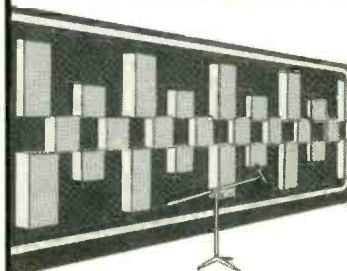
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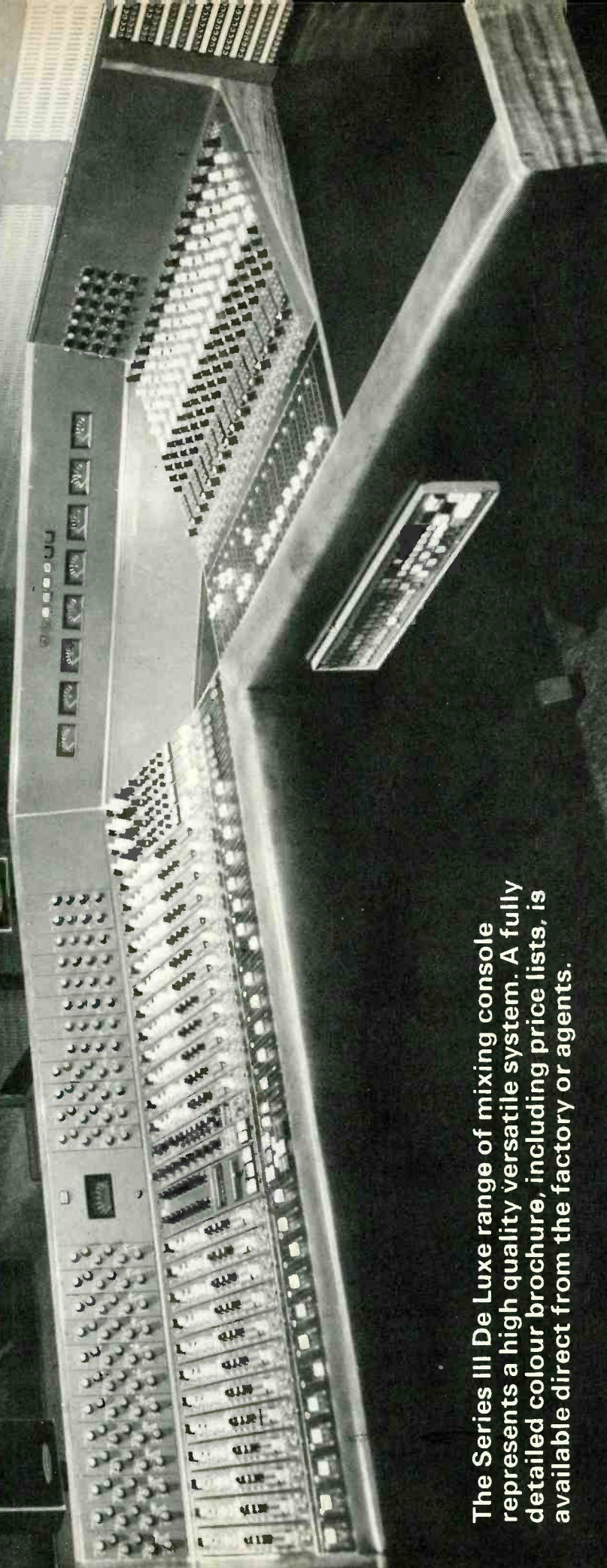
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Telex 262741

replacement record amplifier units for Studer *A80* and Revox *A77* tape recorders. The circuitry, designed by Barry Porter, is arranged such that high frequency equalisation is added with a lagging instead of the usual leading phase shift. This, it is claimed counteracts the phase shift introduced by the replay amplifier, giving an overall linear phase response which subjectively improves bass response and improves transient performance. The new units replace the existing record amplifiers, no modifications to the recorder being necessary, although the Studer *A80 Mk1* requires a link to be inserted in its mother board electronics. It is intended that similar linear phase record amplifiers will be introduced for other tape recorders.

PACE Studio Equipment Limited, 32 Tresham Road, Orton Southgate, Peterborough, Cambs. UK. Phone: 0733 234340.

Swedish real time analyser

A compact, low-cost real time audio analyser has been launched by the Stockholm firm of Consilium Industri AB. The unit designated *RTA 11* is marketed in three formats—one-octave, $\frac{1}{2}$ -octave and $\frac{1}{3}$ -octave—all of which can be supplied in standard or precision versions. All formats are internally convertible for maximum flexibility and the precision versions include filters complying with IEC standard 225.

Consilium Industri AB, Dirter Jarlsg. 15, 10011 45 Stockholm, Sweden. Phone: (08) 22-23-40.

Centre is Oliver Berliner presenting Dr Goldmark's sons with the mic award



Neutrik Audiotracer

Eardley Electronics are importing the Neutrik *3201 Audiotracer* compact automatic level recorder, the first in a range of devices devoted to measuring and producing hard copy graphic recordings of various electrical parameters. The *3201* will make precise measurements of amplitude versus frequency, impedance versus frequency, or amplitude versus time, making the unit ideal for measuring the audio response of electronic or electro-acoustic systems. The unit features a variable two range (20Hz to 20kHz and 200Hz to 200kHz) VCO which can be driven by a 5Hz warble generator; a 1kHz reference oscillator; 3W output amplifier; input amplifier with calibrated attenuation; pen-drive with switchable amplitude and writing speed; adjustable paper speed; and graph print out on smudge-proof thermosensitive paper.

Neutrik AG, FL-9494, Schaan, Liechtenstein.

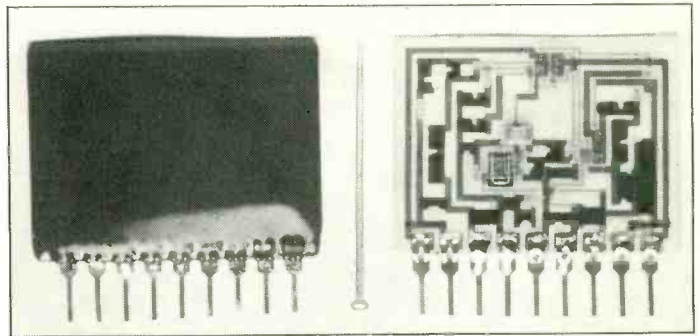
UK: Eardley Electronics Limited, Eardley House, 182/4 Campden Hill Road, Kensington, London W8 7AS. Phone: 01-221 0606.

Award to Dr Goldmark

The late Dr Peter Goldmark has been awarded the Maker of the Microphone Award in recognition of his work on the development of the fine groove LP disc and other audio and video innovations. The award was accepted on behalf of their father by Dr Goldmark's sons from Oliver Berliner, grandson of Emile Berliner, in whose name the award is given annually. Dr Goldmark was the 15th recipient of the award which is to be presented only 25 times in commemoration of the fact that Emile Berliner was aged 25 when he invented the microphone.

Linear phase recording

PACE Studio Equipment has announced the availability of



dbx 202H VCA

A new 9-pin in-line monolithic version of the established dbx *202 VCA*, the *202H* has been introduced by dbx. The new VCA offers a gain control range of +40dB to -90dB at 100Hz; dynamic range typically greater than 110dB; frequency response 20Hz-20kHz, ± 0.1 dB at 0dB gain (± 0.5 dB at +20dB gain); Second harmonic distortion less than 0.01% at 1kHz, 0dB gain, 100mA (less than 0.03%, -20dB gain); and third harmonic distortion less than 0.01% at 1kHz, 0dB

gain, 100mA. The control voltage is 6mV/dB with 0.0V giving unity gain. The power supply is trimmed for ± 12 V (± 0.1 V) 10 to 15MA, with the option of 15V rail use, which may be set by applying bias, symmetry and log slope overrides. Mounting is via one half of an 18-pin DIP lead frame.

dbx Inc, 71 Chapel Street, Newton, Mass 02195, USA. Phone: (617) 964-3210.

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

GLI integrated Sound Systems

A new range of 19in rack mount preamp/mixer, amplifier, and audio processor units has been introduced by GLI Integrated Sound Systems, a subsidiary of the VSC Corporation. Top of the range is the *PMX-9000* professional preamp/mixer/equaliser with two sets of switchable line and phono inputs, plus mic input (all with preset and level controls); 5-band ± 12 dB graphic equaliser; switchable signal processor loop for connection of reverbs, phasers, dynamic range

expanders and tape decks; master level control; a headphone audition system; and illuminated, calibrated VU meters. Next in the range is the *3990* broadcast preamp/mixer with similar mic, line, phono and master features to the *PMX-9000*, but without graphic equaliser, signal processor loop and VU meters; and with rotary rather than slider controls. A companion unit to the *3990* is the *1010* audio processor which features full tape facilities including two sets of tape monitors with dubbing; blend and balance controls; electronic patching; low noise 3-band active equaliser; and VU meters. The final unit is the *SA-2125*, dual channel 250W power amp for professional applications, with clipping indicators, built-in fan, and thermal protection and auto-reset.

GLI Integrated Sound Systems, VSC Corporation, 29-50 Northern Boulevard, Long Island City, New York 11101, USA.

People

- John Delissio has been appointed vice president of international sales for the Broadcast Products Division of the Harris Corp.
- Fred Allen has been appointed the new managing director of Westrex Company Limited.

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For full information or a demonstration of any of the Orban products, contact:

Scenic Sounds Equipment

97-99 Dean Street, London W1V 5RA. Telephone: 01-734 2812/3/4/5

Sweden: Tal & Ton Musik & Elektronik AB,
Kungsgatan 5, 411-19 Gothenburg Tel: 130 216

AKG/Revox

AKG has announced that Revox is now equipping its *B790* tangential tracking turntables with AKG *P8ES* pick-up cartridges rather than Ortofon cartridges.

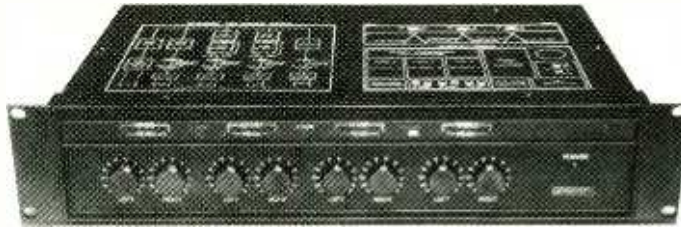
Panasonic

As from March 1, the familiar National Panasonic consumer electronics brand name has been contracted to *Panasonic*. The change which has been made by Panasonic's parent company Matsushita Electric is in order to standardise its main brand name throughout the world. The change will, however, have no effect on the *Technics* brand name.

Decca Digital Recording

New Year's Day 1979 saw the Silver Jubilee of the Vienna Philharmonic's New Year's Day Strauss concert. This occasion was not only notable in itself but also marked the first recording by the Decca team to be undertaken with the new Decca digital master recorder. Two digital recorders were used to make a complete recording of the concert which was held in the Vienna Musikverein, with the VPO being conducted by Willi Boskovsky. The result being the issue in April of Decca's first digitally recorded and edited stereo LP (in actual fact the release is a double album). The recording of the concert was carried out in two takes—one of these being the rehearsal. Decca personnel involved were, James Mallinson and Andrew Cornwall producing, with James Lock, David Frost and Jack Law as recording engineers, and Tony Griffiths and Roy Hankinson as digital recording engineers. Editing of the concert was carried out in early January and the master lacquers were cut on Friday January 11.

Technical details of the Decca digital system are largely being kept very hush-hush at present for patent reasons, but we were able to discover that Decca is using two IVC broadcast videotape machines utilising 1in tape and helical scan recording. Only two tracks are being recorded on the machines for stereo purposes and the digital encoding is 16-bit linear. Decca has developed a very heavily protective error correction system for its machines and chose these particular units because it enables them to carry out TV type electronic editing. Decca has built its own digital processing equipment but is using commercially available



Soundcraft electronic crossover

Soundcraft Electronics has introduced the *EX4S* stereo electronic crossover unit, switchable for 2, 3 or 4-way applications. The unit is the only professional crossover employing fourth order Bessel function filters which make possible 24dB per octave filtering with linear phase response. This results in a cleaner sound permitting higher power levels to be used without damage to compression driver diaphragms. In addition acoustic phase cancellation between LF and HF transducers around the crossover point is greatly reduced. The *EX4S* has balanced line inputs with switchable gain (0dB or +10dB); unbalanced line outputs, optionally plug-in transformer

A/D and D/A converters. Released specifications of the Decca system are, frequency response 20Hz-20kHz ± 0.5 dB; dynamic range 90dB; and tape speed 7in/s approx (actually slightly less than 7in/s).

Information on the editing process is that it uses television editing procedures and allows butt joints and cross fades, including the rate of the cross fade, to be made. Once the digital recorders are locked together edits can be rehearsed. It is possible to change the levels at the edit point and the system also allows digital effects such as equalisation to be inserted.

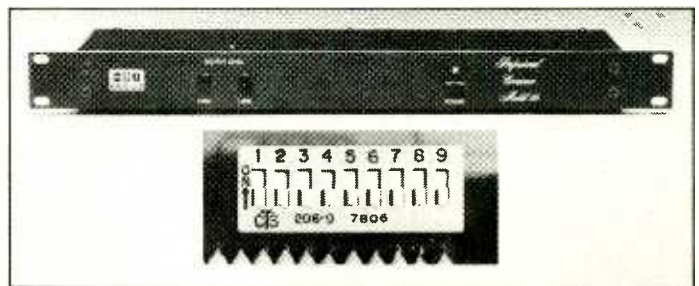
At present Decca has only two recorders available, however we understand that another four recorders are in the pipeline and that Decca intends building up its digital recording capacity particularly with regard to the classical department as soon as possible. News of Decca's current digital plans is that a recording of the Vienna Philharmonic Orchestra in the Sofiensaal, of Mendelssohn overtures and his *Italian* symphony under Christoph Dohnanyi has already taken place with the record due for release in early May. At present Decca is recording the Israel Philharmonic Orchestra under Zubin Mehta and it is intended that its next digital project will be a recording of the Chicago Symphony Orchestra under Georg Solti.

balanced; duplicate XLR and multipin connectors; and two built-in high pass filters of 12dB/octave at 30Hz. The front panel has eight rotary attenuators, power switch, LED overload indicators for each band (presettable from -10dB to +15dB), and LED indication of the operating mode. Specifications are noise on any output, better than -80dB, DIN weighted; distortion, less than 0.03% at +6dB; input impedance, 6.8k Ω ; output capability, +20dB; and output load no less than 600 Ω . Price of the, *EX4S* is £425 or \$995. Soundcraft Electronics Limited, 5 Great Sutton Street, London EC1V 0BX, UK. Phone: 01-251 3631.

New BGW models

BGW has introduced a number of new 19in units including new power amplifiers and an electronic crossover. The *Model 10* electronic crossover is a single channel unit feeding two outputs and utilises a *Switchset* filter system mounted inside the chassis which allows independent adjustment of the high pass, low pass and integral subsonic 18dB/octave passive filters to give up to 120 possible roll-off curves. The *100B* power amp delivers 60W per channel into 8 Ω at 1kHz, with 0.1% THD. The *250D* and *250E* power amps deliver 105W per channel into 8 Ω at 1kHz, with 0.1% THD. The difference between the units is that the *250D* has dual channel clipping indicators, while the *250E* has an LED light-ladder VU meter display. The *750B* and *750C* power amps deliver 360W per channel into 4 Ω , with the *750B* having the LED

BGW Model 10 electronic crossover



meter display and the *750C* having clipping indicators. Prices of the units are *Model 10*: \$199/£112; *Model 100B*: \$399/£210; *Model 250D*: \$599/£320; *Model 250E*: \$699/£373; *Model 750B*: \$1,099/£585; and *Model 750C*: \$999/£530. BGW Systems, PO Box 3742, Beverley Hills, Cal 90212, USA. Phone: (213) 391-0320.

UK: Court Acoustics Limited, 35/39 Britannia Row, London N1 8QH. Phone: 01-359 0956.

Quantum Audio consoles

Quantum Audio has announced the introduction of three new consoles—the *QM-8P* broadcast production console; the *QM-12P* broadcast production console; and the *QM-168B* console. The *QM-8P* is an 8-channel, 4-buss (dual stereo) console featuring 3-way equalisation, headphone send, echo send, and panning circuitry on each channel. The console has balanced inputs and outputs, four monitor and two foldback sections, true VU meters and separate program and audition channels. The *QM-8P* will accept up to 20 inputs and retails at \$3,900.

The *QM-12P* is a 12-channel, 4-buss (dual stereo) console incorporating all the features of the *QM-8P* but with the addition of four more input channels. The basic configuration is six stereo inputs and six mono inputs but the console may be ordered with 2/4/6/8/10 stereo channels. The console may also be expanded to 16, 20 or 24-input channels. Retail price of the basic configuration is \$4,700.

The *QM-168B* is a compact multiple input, 8-buss output console available in a 16-track basic configuration. The console may be expanded up to 32 inputs in groups of four, and features automatic switchable buss or multi-track metering, and subgroup mixing into the stereo mixdown modules. Prices of the *QM-168B* consoles start from \$8,000.

Quantum Audio Labs Inc, 1905 Riverside Drive, Glendale, Ca 91201, USA. Phone: (213)841-0970.



The Soundcraft 1" 8-track.

Produced after two years of development, it's sophisticated, easy to use, reliable, and its specifications are superb. The deck plate is a rigid aluminium casting of extreme dimensional accuracy, ensuring the absolute stability of the tape path.

Tape tension is servo controlled, as is the capstan (which has +15, -50% varispeed control), and wow and flutter is only 0.03%.

Control and monitoring facilities are comprehensive. A simple push-button matrix permits selection of line-in, sync and replay for any of the tracks and led's indicate the selected status.

The tape counter has a plasma display reading in minutes and seconds. There is also a highly accurate search-to-zero facility.

A special feature of the machine is that the whole of this control panel, and the varispeed control, can be used remotely. So once the machine is prepared, a single engineer can work a recording session without leaving the mixing console.

Replay S/N is 76dB (reference 510nWb IEC curve A); erasure is 70dB and record/replay frequency response is +1, -2dB (30Hz to 20kHz).

All signal levels can be adjusted by presets on each channel. The external power supply is fully protected and 19" rack mounting.

The Soundcraft SCM 381-8 is built to the highest professional standards throughout for the production of master quality recordings.

The UK professional price is £5,250 (excluding VAT). It includes all the above features as standard.

Contact Soundcraft for a brochure giving more details and a full technical specification.

Soundcraft Magnetics Ltd, 9-10 Gt Sutton Street, London EC1V 0BX, England. Telephone 01-251 3631 or 01-253 9878. Telex 21198.



SOUNDCRAFT
MAGNETICS LIMITED

studio diary

Digital recording developments

Of late our pages seem to be increasingly turning to all matters digital. Further to our AES, New York report (February 1979), News (February 1979) and the article by Jeffrey Bloom entitled 'Into the Digital Studio Domain' (in the April and May 1979 issues), news reaches us of the first installations of the 3M digital recorders, and of a tie-up between New York-based Tomato Records and Thomas Stockham's Soundstream Inc to complete a number of digital recordings.

February 6, 1979, saw the installation at the Record Plant, Los Angeles and simultaneously at the Los Angeles A&M Studios, of 3M digital audio mastering equipment—a 32-track digital recorder and a 2/4-track mastering recorder. These two studios are the first of four US studios selected to receive the 3M system under lease. In fact as you read this the remaining two studios, Warner Bros Studio, Los Angeles, and Sound 80 in Minneapolis, should be receiving delivery of their 3M digital equipment. Europe, meanwhile, still eagerly awaits 3M's leasing decision as to who will be the recipients of their digital equipment.

Following installation at the Record Plant on February 6, Stephen Stills became the first major artist to record digitally. Stills recorded a digital session on February 7, with members of the California Improved Blues Band, and it is hoped that the result will be the first commercially available digital single on the CBS label. Michael Braunstein of Record Plant engineered the session, with Stills producing, and with Bob Youngquist of 3M in attendance. Several tracks were laid down at the session and a decision on whether to release a digital single, or whether to press an industry demonstration disc, will be made later.

Whilst Record Plant were extremely quick off the mark, A&M weren't far behind. February 8 saw A&M recording a practice session with studio musicians and latest news is that Herb Alpert is considering recording a digital LP which would be released on the A&M label.

Already one or two pointers are coming to light as to the likely cost of hiring 3M equipped digital studios. Under 3M's leasing system there is a \$10,000 reservation/

installation fee, a monthly rental fee of \$4,000, and a usage fee of \$4 an hour. Because of this it is expected that digital studio hire rates will necessarily be higher than the equivalent analogue studio rates. For example, Record Plant owner Chris Stone expects that he will be increasing his hourly rate by about \$25 as a means of passing on the lease price of the system to the client. However, it remains to be seen if this will become the norm.

Although 3M does not as yet have available an operational digital editing system to accompany their multitrack recorders, Thomas Stockham's Soundstream Inc already has a system with digital editing capability. It is therefore interesting to note the signing of an agreement between New York-based Tomato Records and Soundstream to complete a number of digital recordings. According to Tomato A&R director, Heiner Statler, several classical and jazz recordings will be digitally recorded. Present digital recording plans being for a set of percussion pieces by avant gardist John Cage, performed by the Knaack percussion group, and albums from jazz pianist Dave Brubeck and classical pianist Joao Carlos - Martins. Expected price of the recordings will be \$9.98 per disc and it is intended that the digital albums will be pressed at Wakefield, Phoenix. It should be most illuminating to compare these finished discs with Tomato's analogue recorded counterparts.

As we go to press further news of digital recording plans have just reached us. Soundstream has scheduled recordings of repertoire ranging from big band jazz to baroque trumpet concertos and 19th-century Italian opera. Record companies involved being Telarc, Delos and RCA. Telarc had intended making a recording with the Boston Symphony Orchestra; however, the orchestra's tour of China has intervened. Despite this Telarc presently plan recordings of Verdi's *Te Deum* and the Prologue to Boito's opera *Mefistofele* with the Atlanta Symphony Orchestra and Chorus, under Robert Shaw, with vocal soloist Jerome Hines. In addition to these Telarc also plan to record Tchaikovsky's *Fourth Symphony* with the Cleveland Orchestra under Lorin Maazel. Delos are to record baroque trumpet concerti, with Stan Ricker of the JVC Cutting Center, Los Angeles engineering.

The introduction of RCA to the digital recording field together with the news that CBS Masterworks intend recording digitally if they can secure the use of 3M equipment, points to the intense rivalry and interest of record companies on the digital front. In the battle of the giants RCA's current plan is for a Soundstream session with the Philadelphia Orchestra under Eugene Ormandy in April. Further details are presently unavailable although it is likely that a major mid-20th-century orchestral score has been selected. CBS Masterworks, meanwhile, are scheduled to record Mussorgsky's *Pictures at an Exhibition* with the New York Philharmonic Orchestra under Zubin Mehta, again in April.

Sunset Sound, Hollywood

Sunset Sound is on Sunset Boulevard in the very heart of Hollywood—within a few minutes walk, there must be over 100 similarly equipped studios . . . the competition for any one independent studio such as Sunset is a sobering thought.

Sunset Sound is well established and has over the years retained an edge over many of its competitors producing best selling albums of consistently high quality. This is the Studio used by the Doors, the Rolling Stones, Captain Beefheart, Herb Alpert and the TJB, Linda Ronstadt, Little Feat, Elton John, Ringo Starr, Carly Simon, the Doobie Brothers, among others, throughout the sixties and seventies; and is the studio being used by Neil Diamond, Van Halen and Bob Welch at the time of writing.

Of the three present studios at

Sunset, Studio 1 is the original and largest and is considered unique by many. Measuring 45ft by 25ft with a high ceiling it includes two very large isolation rooms—one at the back of the studio and one to the front left. With brick walls and a hard floor and ceiling it is the liveliest of the Sunset studios; and with the carpets up and the baffles out you can really *feel* it—more live than many, and a favourite for many engineers who come in, take everything out and do string overdubs . . . with a big sound. Or using the isolation room at the back to record strings and rock 'n' roll together. In earlier days when Studio 1 was built, it was this sound and the active room that clients wanted and it seems to have come round to this again—many new studios and existing studios building active rooms again. The studio itself has been highly modified over the years; in the beginning it was half its present size. Bill Robinson, general manager; "Following a fire in Studio 1, we tried a compression design in Studio 1 (as opposed to the active design of all the Sunset Studios) when it was popular about three or four years ago. But I never had so much negative reaction to a sound and it all had to be undone very quickly . . . it almost caused a riot and can probably be described as the biggest mistake of my life. So we returned to the active design; our clients wanted a functional design with no tricks where you know that what you hear coming out of a speaker is what you have on tape . . . a compression room gives a false sound. The finished product has got to sound good at home so the recording environment has to be compatible with the end user. Systems

Control room at Sunset Sound



which hype a sound are the worst thing you can do to a customer—you'll find that very little from Sunset needs to be changed when mastering."

A description of Control Room 1 is essentially a description of Control Rooms 2 and 3, these being based on the original design of 1—not only in physical design but also from the equipment stand point. The consoles are all to a basic in-house design which Bill Robinson and three other engineers put together. The original in CR1 was really the up-date from tubes (valves) to solid state and the team at the time set about (successfully in retrospect) out-guessing the industry for five to 10 years and putting everything they could possibly think of in terms of versatility on the console including things that have never been used. From this evolved the design for the two later consoles—where something wasn't used in 1, it wasn't built into 2 and 3; where it wasn't and was needed, it was added. As it stands today, the Sunset Console is a simple console and can be figured out by a newcomer to the studio in about five minutes (and with the standardisation in each studio, a client can move from one to another without having to re-learn the console); it is essentially a 32/24 Console of superb quality with API Components *but* with a very comprehensive patch bay allowing any piece of equipment to be plugged anywhere in the signal path. Bill Robinson—"As studio manager, its my job to run a profitable business and I want to give people who use Sunset the tools to do the job; and its my philosophy to give them the best tools available. We've gone more for quality than gimmicks on the console; and with the patch bay, if something special is needed they can just plug it in rather than having a special item built in and taking up room while only one in 10 may use it. We've always concentrated on achieving the best quality obtainable from electronic equipment—allowing nothing in the console to degrade the signal. A lot of time and trouble has been expended on reducing noise in the system even to the extent of modifying the API amps."

Other standard equipment in each control room includes 24 channels of Dolby noise reduction (dbx is available using the Canine Card) patchable anywhere plus two channels of Dolby built into the Studer A80 2-track. Multitrack recorders are a choice of Ampex

1200 and 1100 and MCI JH100. Monitoring is via a custom system with JBL components employing two Woofers, one midrange and two Tweeters per side. Although all the control rooms appear to be capable of 'Quad', the two rear monitors in every case are dummies, the speakers having been removed from 1 and 2 when Quad died its natural death and have been deliberately included in the new CR3 which has been designed to match CR1 in every way. Being shared between the three studios are five EMT Plates, three AKG BX20 s, and three large acoustical echo chambers built to an in-house design. In each case the control rooms are basically of the same size and layout, allowing freedom from the need to re-orientate between studios.

Studio 2 was added during 1968/69 and is different in that the acoustics of the room can be varied using folding panels set into the wall—one side being soft and absorbent, the other side hard and reflective. Thus, where some isolation is needed on some hard rock, the room can be deadened or livened up for a string date or overdubbing. These folding panels can effect over half a second in the reverberation time of the room. The studio measures 34 by 40ft and with a 19ft ceiling has more volume than many apparently larger studios and is known for its big open sound. To achieve this without too much 'boominess', low frequency absorbers (tuned to about 100Hz) have been mounted over the control room window effectively attenuating low end build up. A good sized vocal booth off to the left compliments the room allowing isolation of almost anything—while remaining very much part of the room with large windows connecting the two.

In Control Room 2 the console is as described—in this case the construction was completed by Sunset having been started by a manufacturer who ran into difficulties and was unable to finish. Studio 3 was only completed recently and designed primarily for over dubbing measuring 16 by 12ft but with the inclusion of 12 mic lines and has already been used to record tracks as well. Unlike the other studios, this has been finished in wood. The carpet is removable with linoleum on concrete for a more live sound. The frequency response of the room is flat, but the room is not completely dead—a bit of reverb being preferred so that a musician

can hear himself without headphones being worn of necessity. And in Control Room 3, the Sunset Console was built by De Madio Engineering—and very fine it is too.

Each Sunset Sound studio is equipped with its own lounge complete with TV and telephone enabling groups/producers the luxury of private discussion as well as all the home away from home comforts when taking a break. The studios are all accessible from a central area which includes offices, the maintenance shop, and out-board equipment store which is very comprehensive including Eventide Digital Delay and *Harmonizers*, phasers, Orban Parametric equalisers and D'essers, Urei Limiters and an Audio and Design *Vocal Stresser*.

Looking to the future of Sunset Sound, Bill Robinson has some very definite ideas about automation, digital recording, and the industry in general. "The question of automation is confusing. If we were to spend another twenty to twenty five thousand dollars on any type of automation, Sunset would have to increase its rates to recover the cost. I've talked to many engineers on the subject and they've nearly all said 'you'd be screwing up my act—it isn't going to help me that much'. I'd say one out of maybe 50 has said 'On a particular job I could have used automation—but for nearly everything they do they'd rather have that feeling of creating the music themselves. Everybody feels they contribute to making a record—they're part of it, their heart and soul is in that record and my feeling is that (even though automation, may make it quicker or easier) engineers don't feel that automation is making any creative contribution to the record at all—they want to control the music and react to and with the music. The machine doesn't react, it just does what its programmed to do. If it were simply a question of business and I wasn't going to get the business because I don't have automation, I'd have automation tomorrow. Furthermore, if I did have automation, I wouldn't want it to degrade the sound, and there really hasn't been a good VCA yet—there's a new one getting close—and if that VCA adds noise or distortion, I'd rather do without it. Give me quality rather than convenience—convenience is a crutch."

Sunset is perhaps unique in another respect in that the owner (S

Camerata) has a different outlook to many. Having been in the music business for 40-odd years and being an accomplished musician at the same time, Camerata sympathises with musicians and at the same time is aware of the costs to the record company (perhaps more aware than the record companies themselves); and is constantly trying to keep recording costs down while other more profit conscious studios are pushing their rates towards the \$200 per hour mark. There is a constant search for ways of making the Sunset operation more efficient and removing the need for increased rates. With album projects often running in excess of \$250,000 in studio time alone, the record companies appreciate this and it seems to have been a very successful policy for Sunset. Jim Robinson, "profitable, yes. But not \$100 per hour profit—we don't look at it that way. We see it as a long term relationship with the customer."

Looking towards digital recording, Sunset Sound has been working closely for the last three years with Dr Stockham of Sound Stream in Salt Lake City (responsible for one of the first working digital recorders). Three main problems remain before Bill Robinson sees Sunset going digital; the availability of the equipment, the high cost, and most important the need for a standard (something 'Quad' could never agree on). "Tracks recorded here may go across the street, or the world, to add strings or mix down or vice versa. There has to be a standard before you can do that". And in general, "I think a tremendous change in the recording industry is on its way in the next two years—not only from the equipment end but also the philosophy. Record companies will begin exercising tighter control over their product—hence artistes and producers—resulting in even better quality product. The fact that money may be getting tighter could have something to do with this."

As for the immediate future at Sunset Sound—with Neil Diamond and Frankie Valli having just completed projects, with Van Halen and Bob Welch in session now, and the studio booked solid four months ahead with the likes of Earth Wind and Fire, the Doobie Brothers, Rita Coolidge and Kris Kristofferson, Little Feat, Valerie Carter, Hall and Oates, and another Bob Welch album—its looking very good indeed.

Enbee

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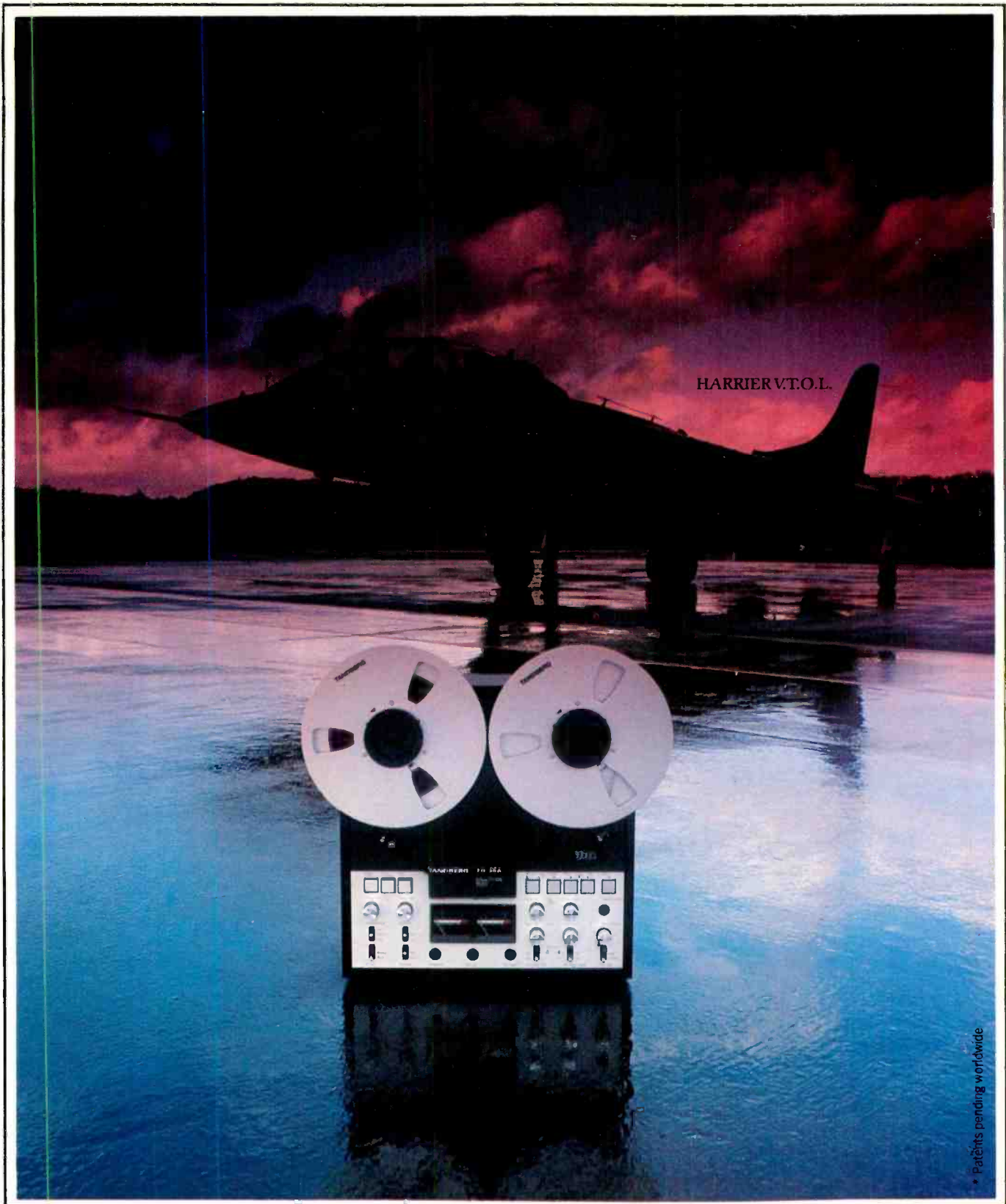
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Digital primer

Hugh Ford

Digital technology is rapidly invading the analog world of the recording studio. Not only is sound itself an analog phenomenon but also our actions are analog; operating faders, editing tapes, and all such actions are essentially analog functions. However digital recording, automated desks, auto-locators, delay units, reverberation units and special effects units are all nowadays rapidly leaving the analog world and being digitised.

I HAVE THE impression that the sound man is rather frightened by this abrupt entrance of digital technology, possibly following the fear that the general public have of computers whose programmers (not the computers) make interminable errors which torment us from day to day.

In this article it is hoped that the fearsome digit will be tamed—there's nothing really complicated about computers or digits, it just happens that we have 10 fingers and thumbs which are useful if we think in decimal—if we were simple and had only one such attachment we might have standardised on digital thinking; or if we had eight, on octal thinking (scale of eight instead of ten).

In the following explanations I will avoid the complicated mathematics which are attached to some of the theory behind digital processes and stay with our feet on the ground dealing with the practical engineering aspects of digital techniques with which the studio engineer may be concerned.

Analog versus digits

The position of a fader, the amplitude of a sound, the distance along a tape are all measurable in basic physical units such as voltage or distance. If we try to make a record of these, there are inevitable errors in the measurements and even worse if we try to transmit this information we will inevitably introduce further errors as a result of not only secondary measurement errors, but also errors in the transmission chain.

Such errors accumulate—we all know that copies of tapes are of worse quality than the masters and that the more remote the copy of the master is, the worse the quality is, as a result of transmission errors. These errors are a direct result of handling analog information—information which is measured in physical quantities rather than in pure numbers.

If we could convert sound into a series of numbers, our fader positions into numbers and tape position into numbers, then these can be recorded for any length of time without introducing any errors. If we could write a particular performance of Beethoven's 5th onto paper as a series of numbers (or for that matter punk rock) and reproduce the original sound from numbers, the quality of the original performance could be recorded for posterity without any degradation—indeed the reproduction might improve in quality, rather than suffer from the analogue diseases of print-through and high frequency losses.

Digital techniques involve the recording, replay, transmission and manipulation of numerical information. Whilst, as will be seen, this is not always without error, such techniques offer a tremendous advantage over analog techniques—but just what are digits and digital techniques?

Digital numbers

Binary was an unknown word to all but recent school leavers who have studied the 'O' Level syllabus and I'm sorry if I will now bore them with the basic understanding of digital or binary numbers, but with any luck you lot will have forgotten your math's classes and need a refresher course!

Most people's understanding of numbers is based on the decimal system where we use the 10 numbers from 0 to 9, and when we require to express a number greater than 9 we start with a 1 again, but displaced one place to the left and followed by a 0, ie 10.

After this we start increasing the right-hand digit from 0 to 9 until we again run out of symbols and change from 19 to 20 and so on. By adding further places for numbers we can carry on this process as long as we like.

Digital numbering is similar (as are numbers to other numeric bases) but in the digital system we use only two symbols, 0 or 1. This is very convenient as many physical phenomenon have two states which can respectively represent the 0 or the 1.

Such conditions are zero volts or voltage present, magnetised north or south, energy or no energy, charged or not charged and so on. It is easy to verify such conditions with a very small chance of error—as opposed to determining a precise voltage or charge etc . . .

Comparing our normally used decimal numbering system with the binary (digital) system will show you just how to represent numbers in binary where the position occupied by our normal 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 can only accommodate the numbers zero or one.

| Position | 6 | 5 | 4 | 3 | 2 | 1 |
|---------------|----------|---------|--------|----------|--------|--------|
| Decimal value | 100000's | 10000's | 1000's | hundreds | tens | units |
| | 10^5 | 10^4 | 10^3 | 10^2 | 10^1 | 10^0 |
| Binary value | 32 | 16 | eight | four | two | one |
| | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |

The decimal number four in binary becomes 100 which is four + zero + zero, or in other words 2^2+0+0 just like the number 35 in decimal is $(3 \times 10^1)+(5 \times 10^0)$.

If we take the binary number 1011 we can convert this to decimal as you can see from the above which comprises $(1 \times 2^3)+(0 \times 2^2)+(1 \times 2^1)+(1 \times 2^0)$ and equals $(1 \times 8)+(0 \times 4)+(1 \times 2)+(1 \times 1)$ which is $8+2+1$ making 11 in decimal or 10^1+1 .

Let's just look at the decimal numbers zero to 15 in their binary form as an example.

| Decimal | Binary | Construction of Binary |
|---------|--------|------------------------|
| 0 | 0000 | 0+0+0+0 |
| 1 | 0001 | 0+0+0+1 |
| 2 | 0010 | 0+0+2+0 |
| 3 | 0011 | 0+0+2+1 |
| 4 | 0100 | 0+4+0+0 |
| 5 | 0101 | 0+4+0+1 |
| 6 | 0110 | 0+4+2+0 |
| 7 | 0111 | 0+4+2+1 |
| 8 | 1000 | 8+0+0+0 |
| 9 | 1001 | 8+0+0+1 |
| 10 | 1010 | 8+0+2+0 |
| 11 | 1011 | 8+0+2+1 |
| 12 | 1100 | 8+4+0+0 |
| 13 | 1101 | 8+4+0+1 |
| 14 | 1110 | 8+4+2+0 |
| 15 | 1111 | 8+4+2+1 |

If we wish to multiply by 10 in the decimal system we just add a zero in the least significant position, ie 4 multiplied by 10 is 40. In the binary system adding a zero multiplies by two, ie 011 (3), 110 (6). Similarly dividing by two is accomplished by shifting to the right just the same as dividing by ten in the decimal system:

$$\begin{array}{l} 340 \div 10 = 34 \quad 1010 \div 10 = 101 \\ (10) \quad (2) \quad (5) \end{array}$$

Addition, subtraction, multiplication and division

Just like decimal numbers it is possible to manipulate binary numbers to perform the normal mathematical operations and basically this is how digital computers function.

Addition is extremely simple as one just carries over to the next column whenever two ones are present in the same way as one carries over a number in the decimal system when nine is exceeded.

$$\begin{array}{r} 47 \quad (7+5=12) \quad (01+01=10) \quad 101111 \quad (47) \\ 35 \quad \text{carry 1} \quad \text{carry 1} \quad 100011 \quad (35) \\ \hline 82 \quad \quad \quad \quad 1010010 \quad (82) \end{array}$$

Subtraction follows the same pattern as the decimal procedure by borrowing from the more significant column whenever it is necessary to subtract a one from a zero.

$$\begin{array}{r} 46 \quad (6-9) \quad (0-1) \quad 101110 \quad (47) \\ 39 \quad \text{borrow 10} \quad \text{borrow 10} \quad 100111 \quad (39) \\ \hline 7 \quad \quad \quad \quad 000111 \quad (7) \end{array}$$

In circumstances where the result of a subtraction is a negative number, some manipulation is necessary, but this is simple when it is realised that $A-B = -C$ is the same as $B-A = +C$. Thus all that is necessary is to subtract the smaller number from the larger number and change the sign of the result.

Multiplication and division can be accomplished in the same way as we have been taught to multiply and divide decimal numbers but the methods used by machines to multiply and divide are rather complicated and will not be explained here. Just as an example, this is how you multiply 18 by 19.

$$\begin{array}{r} 18 \quad \quad \quad 10010 \quad (18) \\ 19 \quad \quad \quad 10011 \quad (19) \\ \hline 162 \quad (9 \times 18) \quad \quad 10010 \quad (10010 \times 1) \\ 180 \quad (10 \times 18) \quad \quad 10010 \quad (10010 \times 10) \\ \hline 342 \quad \quad \quad 00000 \quad (10010 \times 000) \\ \quad \quad \quad 00000 \quad (10010 \times 0000) \\ \quad \quad \quad 10010 \quad (10010 \times 10000) \\ \hline 101010110 \quad (342) = (256 + 64 + 16 + 4 + 2) \end{array}$$

As an example of division, this is how 342 can be divided by 19.

$$\begin{array}{r} 18 \quad \quad \quad 10010 \\ \hline 19 \quad 342 \quad 10011 \quad 101010110 \\ 19 \quad \quad \quad 10011 \\ \hline 152 \quad \quad \quad 10011 \\ \hline 0 \quad \quad \quad 10011 \\ \hline 00 \end{array}$$

In practical machines negative numbers may be represented by the addition of another digit to represent the sign of the number, or more likely the compliment code will be used, simplifying arithmetic. This compliment may commonly take one of two forms, the two's compliment or the one's compliment, the latter being a convenient way of finding the former.

Rather like the addition of another digit to represent the sign of a number (called a sign bit), the compliments also require another bit of information. The two's compliment of a number is found by subtracting the number from this extra bit. Thus the two's compliment of 39 in a code using six bits for the numbers is as follows.

$$\begin{array}{r} 1000000 \\ -100111 \quad (39) \\ \hline 011001 \end{array}$$

An alternative way of finding the two's compliment is to find the one's compliment and then add one. The one's compliment is found by replacing all ones with zeros and replacing zeros with ones, that is inverting each bit.

$$\begin{array}{r} \text{eg } 100111 \quad (39) \\ 011000 \quad \text{One's compliment of (39)} \\ +000001 \\ \hline 011001 \quad \text{Two's compliment of (39)} \end{array}$$

The two's compliment may be conveniently used for subtraction because if we add the two's compliment of a number this is the same as subtracting it from the other number. For example try our earlier sum of subtracting 39 from 46.

$$\begin{array}{r} 101110 \quad (46) \\ 011001 \quad \text{Two's compliment of (39)} \\ \hline 1000111 \quad (7) \end{array}$$

In the above example it can be seen that an extra one has appeared in the seventh bit location, but in a 6-bit code this would be lost so it is not significant. Because division also uses subtraction the two's compliment also very much simplifies division.

When a machine uses the two's compliment to represent negative numbers, this is known as the two's compliment code. An example of this in a 6-bit machine is as follows.

$$\begin{array}{r} +63 \quad 0111111 \\ +62 \quad 0111110 \\ +1 \quad 0000001 \\ 0 \quad 0000000 \\ -1 \quad 1111111 \\ -2 \quad 1111110 \\ -62 \quad 1000010 \\ -63 \quad 1000001 \end{array}$$

Codes for the transfer of data

It is often necessary to feed information for instruments such as digital voltmeters and timer/counters to a computer, or to feed information from a computer to instruments, printers or displays. Doing this is not simple in a straight binary code, for instance we might wish to interface a four decimal display voltmeter with ranges from 9999V to 0.9999 in four ranges. This could be interfaced in binary millivolts from zero to 9999000 but this would require 24 bits and potentially 24 wires to transmit the voltage. This situation can be much simplified by using a code known as 'binary coded decimal' where each decimal digit is converted individually into binary and a further decimal digit used to indicate the voltmeter range as an exponent.

Thus 9999 would be transmitted as 9999×10^3 millivolts, 12V as 12×10^3 millivolts, 40mV as 40×10^0 millivolts etc. This requires the transmission of four decimal characters and each of these may be transmitted on four wires requiring a total of 20 wires and much simpler logic circuits in the instrument.

In binary coded decimal 6931 $\times 10^2$ millivolts would be transmitted as the binary equivalents or 6, 9, 3, 1 and the binary equivalent of the exponent 2, eg 0110 1001 0011 0001 0010
(6) (9) (3) (1) (10²)

| Decimal number | Binary coded decimal |
|----------------|----------------------|
| 0 | 0000 |
| 1 | 0001 |
| 2 | 0010 |
| 3 | 0011 |
| 4 | 0100 |
| 5 | 0101 |
| 6 | 0110 |
| 7 | 0111 |
| 8 | 1000 |
| 9 | 1001 |

From the table it can be readily seen that binary coded decimal, or BCD as it is known, is an inefficient code because it only uses the numbers zero to nine out of the possibility of the numbers zero to 15. Another code known as binary coded hexadecimal is the same as BCD but uses the spare number to represent the letters A to F.

| Letter | Binary coded hexadecimal |
|--------|--------------------------|
| A | 1010 |
| B | 1011 |
| C | 1100 |
| D | 1101 |
| E | 1110 |
| F | 1111 |

Before concluding the section on codes, mention must be made of a very efficient code known as binary coded octal, the octal number

Digital primer

system being a system to the base eight, unlike decimal which is to the base 10 and binary which is to the base two. Octal numbers therefore consist of the eight numbers zero to seven.

| Decimal number | Binary coded octal |
|----------------|--------------------|
| 0 | 000 |
| 1 | 001 |
| 2 | 010 |
| 3 | 011 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |

Clearly this is an efficient code because it uses the three digital bits fully with no spare codes, but just how are decimal numbers expressed in the octal or binary coded octal codes?

Well, it's quite simple to see if we look at binary and decimal numbers and compare the octal numbers. Let us for example take a four character number in each of the codes.

| | | | | | |
|----------------|-----------|----------|--------|-------|----------------------------------|
| Binary | EIGHTS | FOURS | TWOS | UNITS | |
| | 1 | 1 | 1 | 1 | = 15 (8+4+2+1) |
| Decimal | THOUSANDS | HUNDREDS | TENS | UNITS | |
| | 9 | 9 | 9 | 9 | = 9999 |
| | | | | | (9000+900+90+9) |
| Octal | 512's | 64's | EIGHTS | UNITS | |
| | 7 | 7 | 7 | 7 | = 4095 (7x512+7x64+7x8+7x1) etc. |

If we consider the binary coded octal of the above octal number, it takes the form 111 111 111 111 which if considered as a binary number is 111111111111 and when converted into decimal is identical to the original 4096—this is therefore a very convenient code!

Bits, bytes, blocks and bauds

All digital data consists of an arrangement of binary digits which are abbreviated as 'bits'. There are data bits and also some special bits such as the earlier mentioned sign bit, and also extra bits which are added to data for checking its accuracy; these may be check bits or parity bits.

Data is always organised in a particular way such as the four octal characters used in the above example each comprising three bits. This organisation of the four characters or 12 bits may be referred to as a byte as may any other set organisation of bits. When storing data on magnetic tape, discs or other similar means, the storage is organised in blocks of data which may often be of varying length. The reason for this is that it is not economical to store individual characters or bytes as it is necessary to leave a gap between sets of data or blocks to allow the storage device to start and stop etc.

The rate of transfer of data (particularly in telegraph systems) is expressed in Bauds where one Baud is a data transfer rate of one code element per second.

Data storage

The more elementary forms of data storage are mechanical means such as punched holes in computer cards or holes in paper tape—where a hole is present or absent in a known location clearly defines a form of digital storage.

However, the amount of information that can be stored for a given bulk of the medium is limited and also high data transfer rates are mechanically impossible.

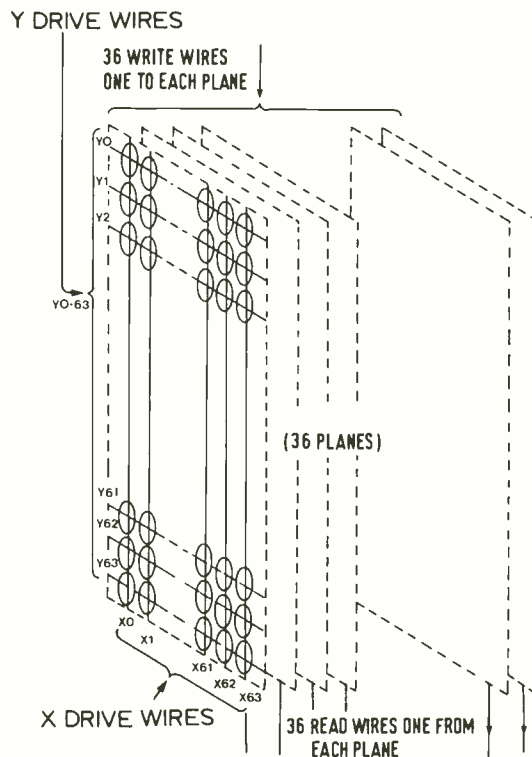
The best form of off-line (external to a computer) storage is magnetic tape or magnetic discs. In the case of magnetic tape it may be necessary to wind through a complete reel to find a particular block of data, but with discs it is possible to locate a particular block immediately, so these are called random access devices.

Both devices are of course subject to dropouts, just like audio dropouts, but in these cases dropouts would cause errors in the data replayed or in computer jargon 'read'. This problem is tackled by recording redundant data so that errors can be detected. The simplest form of redundancy system is the 'parity check' and it is for this purpose that the standard 7-track magnetic recording standard for 1/2 in tape employs seven parallel tracks for recording 6-bit data. The extra seventh track is known as the 'parity track' which is used for recording a parity bit. The parity bit is generated such that each row recorded across the tape contains an even number of ones (known as even parity) or alternatively an odd number of ones (known as odd parity).

| Data Tracks | Parity Track | |
|-------------|--------------|-------------|
| 100110 | 1 | |
| 011011 | 0 | even parity |
| 100110 | 0 | |
| 011011 | 1 | odd parity |

When the data is read, it is simple to check the parity and to attempt to re-read the data if a parity error is located. The generation of a parity bit across the tape only provides a certain amount of protection against errors and further protection can be provided by generating a longitudinal parity check for each track at the end of each data block. With this system it is possible to correct single bit dropout errors, but in some applications even more security is required and more redundant data is recorded using various mathematical techniques to give maximum protection and ability to correct errors.

4096 WORD CORE STORE



Data storage within a computer can take several forms, the least complex of which is probably the 'core store'. This consists of matrices of miniature ferrite toroids with a square hysteresis loop, such that a well defined minimum current passed through a wire threaded through the toroid is required to change the core from one magnetised state to the other. If two wires are threaded, each driven by half the critical current and a third wire threaded and connected to a 'read amplifier', the amplifier will give an output if the magnetic state of the core is changed. This will only happen if the currents in both the drive wires are present and are in such a direction as is required to change the magnetic state of the core. From the diagram of a core store, only one core in each of the 36 planes is selected by any combination of the X and the Y drive wires. With 36 planes and 64X plus 64Y wires this core store can store 4096 (64 x 64) words of data each comprising 36 bits. Similar to the reading process, the writing process is accomplished by a write wire through each plane with the writing being done by applying the X and Y drives in the opposite direction to that used for reading and driving the write wire with half the critical current in opposition to the X and Y drives.

Whilst core stores can hold large amounts of data, they are slow random access stores and modern integrated circuit stores are very much faster and efficient. There are two basic types of semiconductor

The 1980's are brought one step nearer by the introduction of the MTR-90. This new sophisticated design is based on accumulated technology and innovation which have been the hallmark of Otari for over 15 years.

The new-generation tape transport incorporates a pinch-roller-free direct drive capstan with phase-locked-loop dc-servo circuitry. Tape speeds are 15/30 ips with $\pm 20\%$ stepless varispeed and a digital percentage readout. Features include full dc-servo on supply and take-up

motors for constant tape tension, automatic switching between input/sync/reproduce electronics with gapless punch-in/punch-out. And a sliding tape-speed controller, built-in digital timer, auto/manual motor-driven head shields plus 40-ohm balanced output, to name but a few. It comes with the latest electronics featuring a single plug-in card per channel.

The MTR-90 is also available in a 16-track frame, and a 16-track prewired for 24 which can be upgraded to a 24-track machine simply

and economically. For the full story, get in contact with your nearest Otari distributor.

OTARI

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

U.S.A: Otari Corporation,
981 Industrial Road, San Carlos, California 94070,
Phone: (415) 593-1648

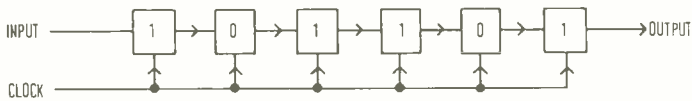
Announcing the new 24-track designed for 1980's. Otari MTR-90.



Digital primer

Whilst core stores can hold large amounts of data, they are slow random access stores and modern integrated circuit stores are very much faster and efficient. There are two basic types of semiconductor integrated circuit stores, the Random Access Memory (abbreviated RAM) and the Read Only Memory (ROM). As its name implies, the RAM is a random access device into which data may be written and read from random locations. On the other hand the ROM, whilst it is also a random access device, has a set of data in permanent storage and cannot have data written into it. A device such as the ROM is very useful for storing data which remains constant and is frequently required, such as the value of π , or information for generating characters on a printer or visual display unit (abbreviated VDU).

SHIFT REGISTER

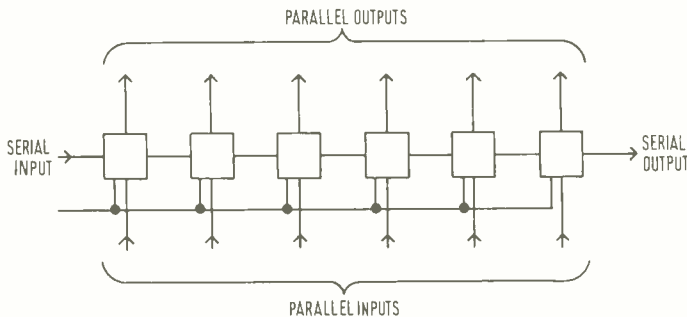


Another useful form of data store is the shift register which consists of a chain of single bit stores connected in series. Each time a pulse is applied to the 'clock' line, the data in the stores is shifted one place to the right such that with no input the data shown 101101 will become 010110 on the first clock and a 1 will be output. On the second clock the data will become 001011 and a 0 output, etc. The first and obvious application of a shift register is a time delay which varies with the frequency of the clock, and indeed some audio delay units use shift registers. However the shift register shown above is very basic and the addition of a few more input and output lines leads to important applications.

Serial/parallel and parallel/serial conversion

If we wish to transmit large numbers in digital form we end up with a great number of wires, one for each bit, such that to transmit numbers up to say 1023, we would need 10 wires. This may well be inconvenient or even impossible if we wish to send digital data by radio or telephone links and the way out of this problem is to convert the parallel digital data into serial form at the transmitting end and at the receiving end to convert the serial digital data back to parallel form.

SERIAL / PARALLEL & PARALLEL / SERIAL CONVERSION



These operations may be conveniently done by using a shift register with additional connections as shown above. For parallel to serial conversion the data is entered into a shift register of suitable length by using the parallel inputs which set each bit in the shift register which is then 'clocked out' by means of the clock input to produce serial data at the serial output. Serial to parallel conversion is done by 'clocking in' the serial data until the shift register is full when the parallel data appears in its correct form at the parallel outputs.

It follows that discrete blocks of data can be easily converted in this way, but the timing of the data is important as we need to know when that data in the shift registers is a complete block ready to read out of the register.

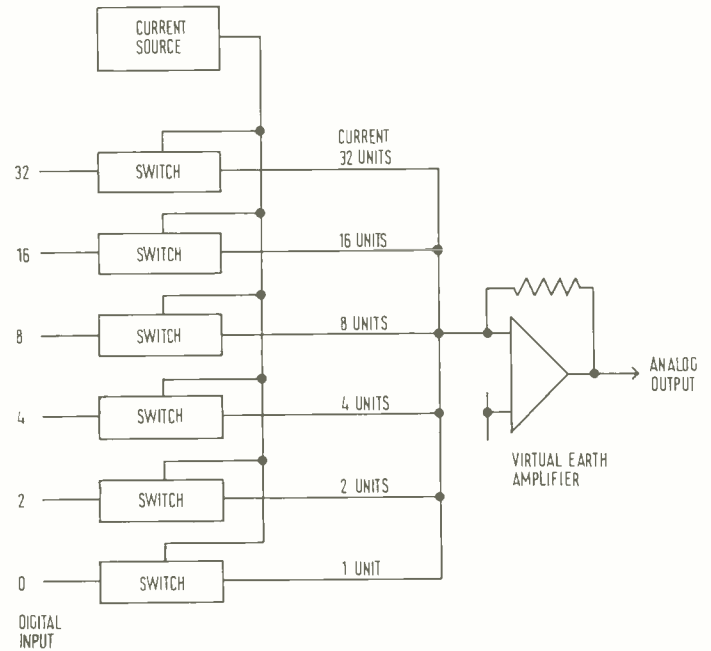
When dealing with data in this way it is a simple matter to understand how we can multiplex data—that is use a single line or set of lines to transmit different sorts of data in a series of blocks. If for instance we arrange three separate shift registers with their outputs commoned we could load data relating to temperature in register one, pressure in register two and fluid level into register three. We can then arrange to

send a character down the line saying 'data ready' followed by the contents of the three registers in series and thus send our three sets of data and repeat the exercise as often as we like. This is how multiplexing works in simple terms and this technique is used in automated consoles to store the positions of the multitude of faders etc.

Analog digital and digital/analog conversion

Whilst there are a number of different ways of making A/D and D/A converters, the methods described here are typical of modern techniques and in order to understand the A/D conversion it is first necessary to understand the D/A converter.

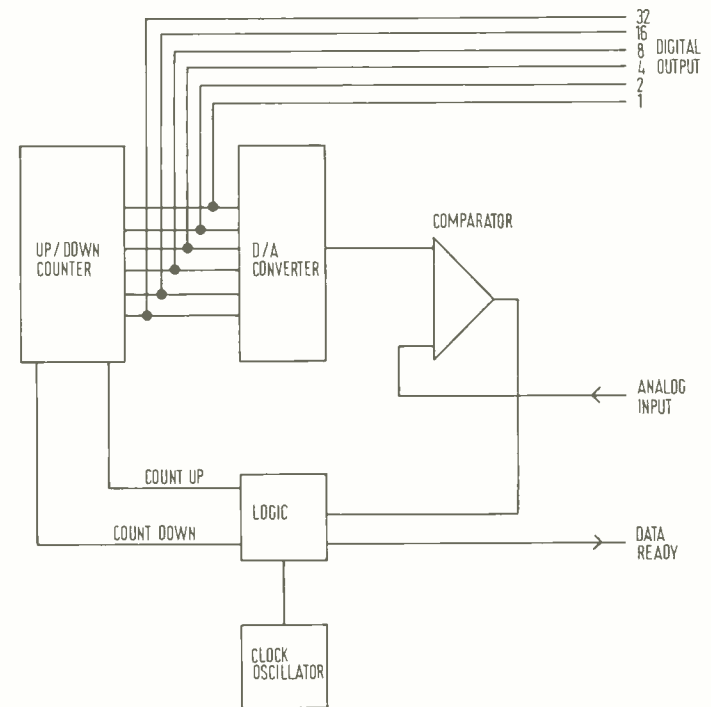
D/A CONVERTER

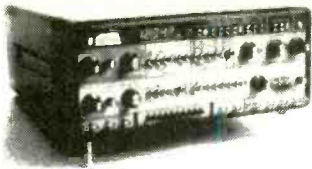


Illustrated is a 6-bit digital to analog converter which may be expanded to cope with more bits by the addition of further switches. Each of the digital input lines operates a switch fed by a precision current

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A/D CONVERTER





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AES 62nd Convention, Brussels—a report

ANGUS ROBERTSON

WASN'T REALLY MY week. Missed my plane on the way out (courtesy of British Rail), missed the ferry on the way back, and my camera didn't manage to produce any usable pictures for the second Convention running. But despite first impressions, the exhibition produced some very interesting new products and of course many products being shown for the first time in Europe. There were no less than 122 exhibitors and 43 papers were presented, preprints only being available for 27 (about the usual 'failure' rate on behalf of authors). Although it had been suggested that digital technology would be the talking point of the show, there was virtually no digital recording equipment on demonstration and four papers (only two of which were preprinted) directly related to digital recording technology.

There was considerable discussion about the future of digital audio discs with JVC presenting a paper on its *AHD* (Audio High Density) disc which was launched to the press last September and uses a grooveless capacitance pick-up system; the Philips *Compact Disc* which was launched last May and uses an optically read track of 'pits'; and the Sony *Long Play Digital Audio Disc System* which is the third development in a series that started in 1976 (with a different system appearing each September). Digital audio discs require a far wider discussion than it is possible to provide in this report, and I shall be covering them fully in a feature article.

In my New York AES Report I discussed digital multitrack recorders from Ampex, 3M and Sony, and the Brussels Convention marked the introduction (on paper at least) of a fourth digital multitrack from Matsushita Electric (otherwise known as National, Panasonic and Technics) which was described by Messrs Matsushita, Kanai, Mura and Kogure. The Matsushita multitrack is different from the others in using no less than four digital tracks on the tape per analogue recorded channel on a tape running at 15in/s. A newly developed thin film magnetic head allows two channels to be recorded on $\frac{1}{4}$ in tape, or 24/32 channels on 1in tape. Recorded format is 16-bit linear quantisation with sampling at 50.4kHz, while the recording frequency with 'modified frequency modulation' is 151.2kHz. Track width is 120-180 microns making high outputs from

The 62nd Convention of the Audio Engineering Society took place at the Sheraton Hotel/Manhattan Centre in Brussels, from March 13 to 16.

the recorded track difficult to achieve, so a magneto resistive element is used with the output voltage being proportional to the current density supplied to the element. But the recording flux required for the recording head is obtained by feeding the recording current of high current density to a head coil of one turn. Advantages claimed for four tracks per channel are elimination of interleave (one track being used for parity), and simplified editing—tape cut editing was suggested in the paper, but no electronic editing is discussed. It is interesting to recall that both Sony and Ampex are proposing 2-track per channel, while 3M is sticking with one.

One other paper that came to notice was from Curt Knoppel of Inter-Technology Exchange in Hollywood, the company that developed the Aphex *Aural Exciter*, called 'Electronic Man-

ipulation of Psychoacoustic Space Perceptions' and which describes the principles behind the Aphex unit (now that the patent has been granted...). As is well known, the Aphex signal comprises a low level subcarrier that is added onto the main signal, the subcarrier containing slightly delayed signal which has passed a frequency dependent phase shift and delay. When this new signal is heard by the ear, the delay/phase combination causes an apparent dislocation of perceived sound orientation providing increased spatiality and presence. At the New York Convention, the *EXR Exciter* was introduced designed to provide a similar psychoacoustic effect, and the Brussels Convention saw the introduction of a similar unit from Publison in France.

While the exhibition saw the introduction of many new lines, possibly the most interesting in the use of old techniques in a new application was the *Cuemix* studio foldback system from **Design Electronics** in London. Designed (no pun intended) to ease cable congestion on the studio floor, the *Cuemix* system comprises a cordless foldback unit that also allows the musicians to control their own foldback mix from five channels which may be assigned to left/centre/right for stereo headphones. Cordless operation is obtained by using an inductive loop system on which multichannel operation and freedom from hum is obtained by the use of single sideband transmission (20kHz to 150kHz bandwidth) upon which the five channels are modulated. The receiver units comprise a heavy base with a lead acid battery, providing two to five days operation, with a flexible stalk upon which is mounted the unit containing the slider level controls and three headphone sockets with 2.5W output. Crosstalk on British systems will be better than 35dB with a considerable improvement possible for overseas markets where rather higher current levels in the loop are permitted. Price of the *Cuemix* transmitter with two receiver units is £1,200 while extra receiver units are £400 each.

Audio Kinetics is a small British company that last year introduced its *Intelocator*, and this year has added the *QLock 210* synchroniser designed to lock two audio-audio or audio-video transports together and contains an integral SMPTE/EBU timecode generator

Design Electronics Cuemix studio foldback system



After spending so much money on a *state of the art* digital delay, why must you still use a tape deck when you need more than 300 milliseconds?

Because even today's *state of the art* digital signal processors are restricted.

Introducing the Shared Access Memory System, by Audio Machinery. The Shared Access Memory System is a modular computer controlled system that takes away the restrictions from digital signal processors.

The Shared Access Memory System consists of a mainframe and up to 8 plug in modules. The mainframe houses the Random Access Memory (RAM) and a computer that allows you to control the distribution of the RAM space to suit any particular

processing requirements. The mainframe comes with 400 milliseconds of RAM, however up to 6,000 milliseconds (6 seconds), may be installed.

The mainframe accepts up to 8 plug in modules. Each module has one or more designated functions including: Delay, Pitch Shift with Delay, Reverberation and Output. The modules determine the in/out configuration. The maximum delay time is only restricted to the amount of

RAM available in the mainframe. And with a possible six seconds available, that's not much of a restriction.

Shared Access Memory achieves 16 bit resolution, which means it is cleaner and quieter than the others. No analog techniques such as companding or pre/de-emphasis are employed, which means that the 16 kiloHertz bandwidth of Shared Access Memory is 16 kiloHertz, even at full

level! Proprietary algorithms are employed which allow the Pitch Shift Module a new level of performance.

The Shared Access Memory System is manufactured by Audio Machinery and is distributed exclusively by Sound Workshop Professional Audio Products, Inc. For more details please see your professional audio dealer or contact us directly.



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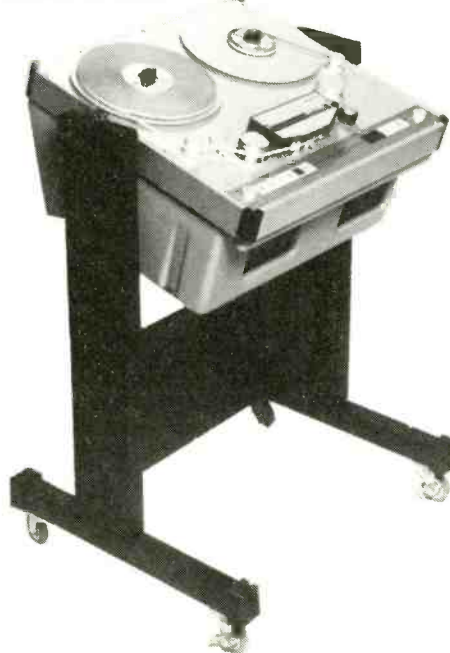
AES REPORT

with readers for each transport (all in software). The *QLock* uses three 6800 microprocessors (one for each transport, one for overall control), and will be available (in June/July) to interface with most common recorders including *A80*, *M79*, *JH-24*, *M1200*, *ATR100* and Sony *U-Matic* editing video cassette recorders. Unlike many other synchronisers using SMPTE/EBU timecode, which require head contact and a special wideband replay amplifier to read timecode in winding modes (often with a special head), the *QLock* uses a tachometer signal during winding (as in the *Intelocator*) only transferring to timecode at twice play speed. Other features include cyclic sequence programming for continuous loop rehearsal/mixing, search programming, auto-record drop-in and out memories, skip/non-skip field for SMPTE with jam-sync, offset memory with calculation facility, 10 memory locations, user definable preroll and instant replay, and cascade enabling units to be linked for multiple transports. The Audio Kinetics *QLock* was designed by Tim Whiffin and is expected to cost less than £6,000.

A rather unusual *Compact* cassette tape position locator was introduced by *Staar SA* of Brussels which is able to determine the time remaining on any unprepared cassette whatever the position when it is inserted after being driven for a couple of seconds. Anybody guess how? It measures the angular velocity of the two tape spools (which are different due to the tape remaining) using optical sensors and is even able to determine that the wrong cassette length selector has been chosen and select the correct one. The *Staar Compucounter* also provides random access on a second basis with an accuracy of five seconds and includes a memory.

Back to the mainstream manufacturers—*AEG-Telefunken* showed the *MTS15A* Magnetophon Timecode System that allows one or more (in the -1 version) *M15A* multitracks

Enertec F462 2-track



CB Electronics modular tape electronics used with Studer deck

(available in eight to 32-track versions) to be locked to a master video tape recorder or another multitrack. It uses EBU (the European 25 frames/s version of SMPTE) timecode and includes off-set, jamsync, and displays for each transport. For more complex requirements, the *MTS15A-2* editing system enables further recorders to be connected and offers timecode related electronic audio editing, loop operation and post-sync.

Lyrec exhibited a prototype 2-track 1/2 in transport that will be introduced later in the year, and also a new controller for the established *TR532* 24-track (that is rather more compact than the present *TPC* (and about double the price). The *ATC* Audio & Tape Controller is just over 2 in deep, is microprocessor controlled and offers ready, safe, line, sync, repro and solo on each channel with master controls, full deck remotes, tape counter reading real time at both speeds, continuously variable speed 7 1/2 to 60 in/s with digital display of actual tape speed, direct tape search to three selected tape positions, memory for 16 tape positions and shuttle mode between two tape positions. Cost of the *ATC* factory fitted as original equipment is 31,950 Danish Kroner, or 48,000 as an update to an existing *TR532*.

CB Electronics Ltd is another small British company run by Colin Broad, that is currently developing a 'cost effective' multitrack tape recorder, but meanwhile has available modular electronics for other transports such as *Studer* or *MCI* which offer three eq settings, phase correction, Dolby/dbx mounting, full monitoring, solo, slate input, noise gate on each channel, fast line-up system, and silent drop-in with no gaps. Using an *MCI* transport, 16-track electronics with one meter only, remotes, noise reduction rack, position indicator and search

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...here is the new dynamic range

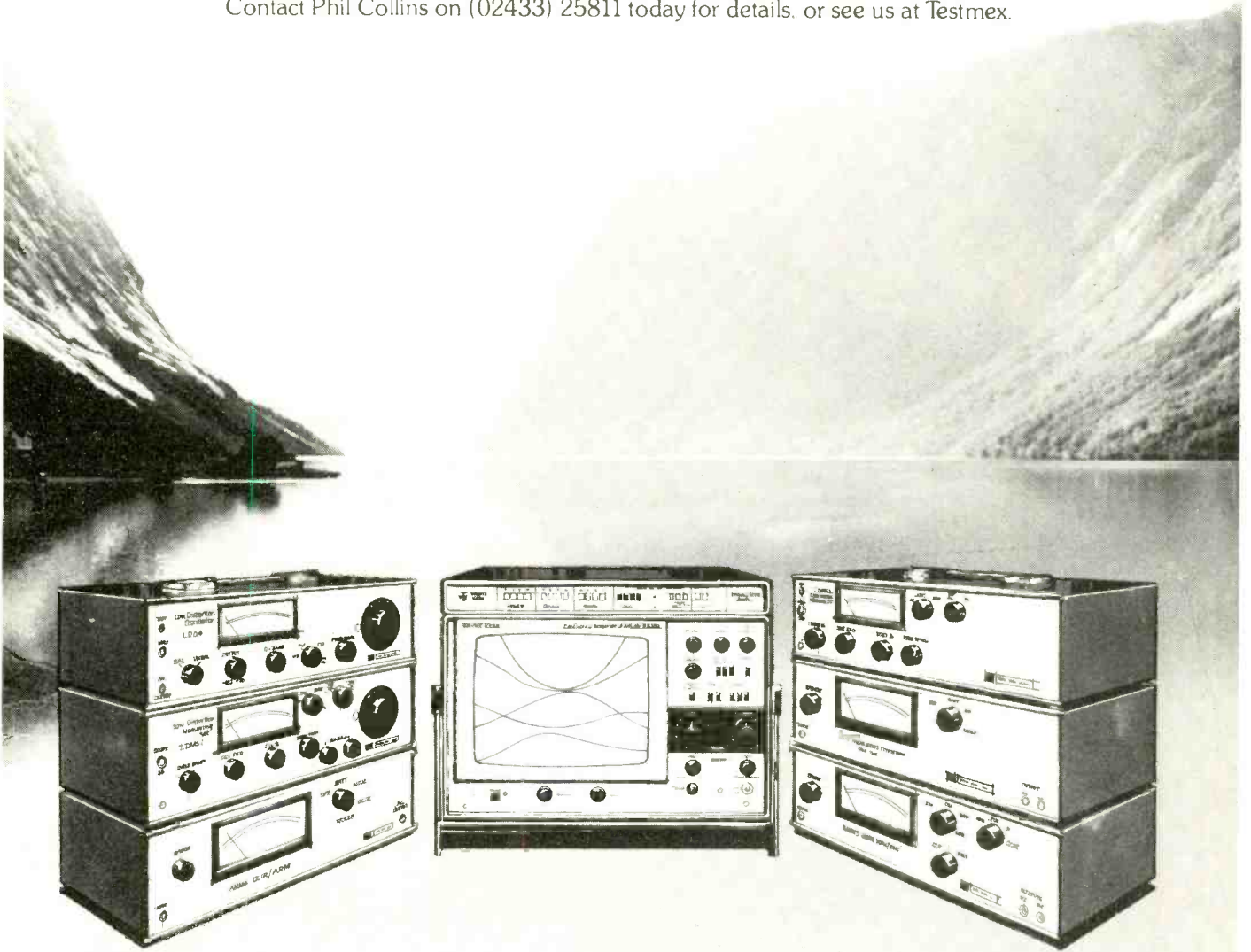
Two leading names in electronics – Wayne Kerr and Radford – have merged their expertise to provide a comprehensive new range of Audio Test Instruments.

The Wayne Kerr Radford range includes distortion measuring sets, frequency response analysers, digital display stores, low distortion oscillators, audio noise meters and high sensitivity voltmeters.

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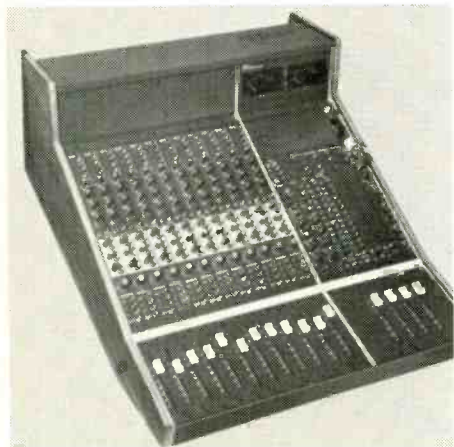


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AES REPORT

to cue (4-position) costs £11,775, while 24-track is £14,400.

Otari demonstrated its first 24-track tape recorder at Brussels, and it incorporates a pinch roller free direct drive capstan with phase locked loop DC capstan servo. Tape speeds are 15 and 30in/s, with wow and flutter at 0.04% and 0.03% respectively while claimed signal-to-noise in 24-track is 62dB.

Compteurs Schlumberger is an established French manufacturer of consoles, tape recorders and magnetic film transports that recently changed its name to **Enertec SA** in Rueil-Malmaison. Among several new products launched was the *F462 Series magnetophone* (tape recorder) which is a 2-track $\frac{1}{4}$ in type and includes DC direct drive, crystal controlled speeds, electronic tape tension control (before and after the capstan in all operating modes) electronic counter, electrical and mechanical braking, auto zero locator, and available in mono, stereo 0.75mm and 2mm, mono neopilot, synchrotrone, and various VU meter versions. Deck mounting is unusual in being swivel mounted for operation either horizontal or slightly tilted, and allowing vertical tilt for easy access to modules. New consoles from Enertec included the *UPS4000* which is typically available with 24/4/4 configuration with two echo and two foldback channels.

A Dutch company, **Pieter Bollen Geluidstechniek BV**, was showing the *Concord S2000* console (manufactured by Raindirk), which is available in three frame sizes for 12, 20 or 28 combined input/output channels. Input/output modules include group assignment (max 16) with pan, mic gain and pad, 4-band eq, two aux sends, stereo cue with pan, stereo monitor (rotary) with pan and slider level control. A master/monitor module is available with oscillator, talkback and master controls with monitoring switching, while a patchbay/status module contains insertion points for all I/O modules, and illuminated master status controls for the console: record, tape and mix, with switching being entirely electronic.

Amek will shortly be introducing a new low cost VCA-fader recording console, the *M2000A* which combines the function of the established *M2000* with the benefits of the automation

ready *M3000* console. Standard format is 28/16 + 24 with additional direct assigns from channels 17 to 24. Full parametric 4-band eq is fitted with four aux busses, and Penny & Giles faders.

Stramp is a German company that manufactures autolocators, synchronisers and a noise limiting system which are distributed by Peter Struven GmbH in Hamburg, US distributor being Charles Lane Studios in New York. The *Autoloc* is available for one or two tape recorders and uses optical sensing units mounted above the tape spools which have marks attached to them, and which allow location of zero or a preset memory. The *Stramp Synchroniser* enables two multitrack tape recorders to be synchronised without loss of tracks on either by adding the high frequency synchronising signal to an audio channel. Finally the *NLS-8* noise limiting system compander unit claims to provide more than 35dB of noise reduction and offers 15dB additional head room with no level matching required—available in 2, 4 and 8-channel units.

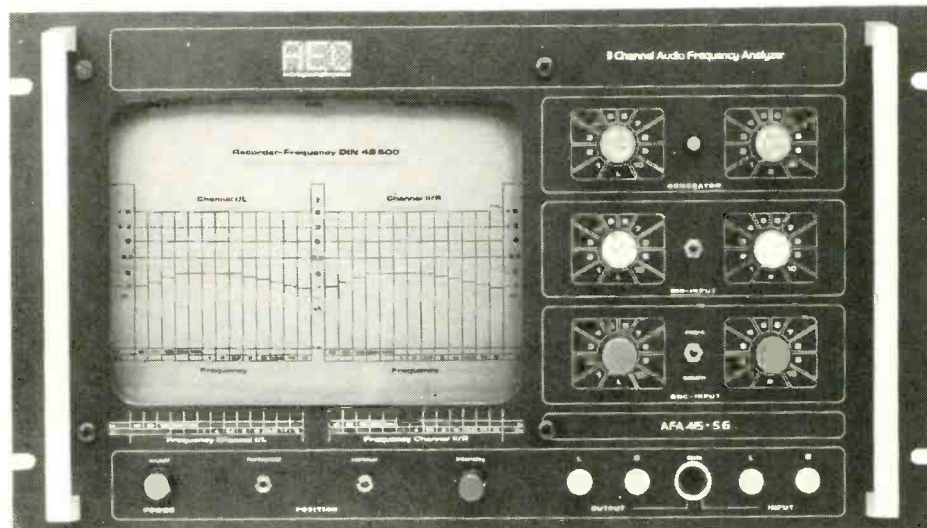
Klark-Teknik was demonstrating its range of graphic equalisers and effects units and showed for the first time the *DN71* which is an accessory for the *DN70* digital time processor (which has three separate digital delays up to max 652ms) offering remote facilities, harmonising, phasing, flanging and such swept digital effects, and also offers a hold and repeat facility allowing the memory content to be continuously repeated.

A Danish company, **Radiometer Electronics A/S**, was showing some new 'slim line' test equipment including the *RE403* wow and flutter analyser that provides a real time frequency analysis using digital filters (equivalent to 30 $\frac{1}{3}$ -octave filters), with a frequency range from 0.2Hz to 200Hz, display being the common LED matrix type. The *RE403* is intended to be used with the *RE402* wow and flutter meter which conforms to DIN, CCIR, IEC, NAB and JIS standards and provides digital display of drift in% (absolute accuracy 0.01%) and contains a crystal controlled oscillator for making master recordings (3kHz and 3.15kHz).

Further test equipment was shown from **Audio Engineering Components GmbH** in Obertshausen, West Germany. The *ARA414* is a $\frac{1}{3}$ -octave real time audio frequency analyser

54 ▶

Audio Engineering Components 11-channel audio frequency analyser



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using a CRT display offering 27 segments with a 27dB vertical range. A built-in noise generator delivers both pink and white noise. Another unit, the *AFA415SG* is a 2-channel unit that allows frequency response performance of a tape deck to be measured in 20s. It displays 14 highly selective frequency bands in roughly $\frac{1}{3}$ -octave segments with a dynamic range of 27dB and a display tolerance of $\pm 0.2\text{dB}$ —it also includes a built-in sinewave oscillator.

Neutrik AG, a Liechtenstein based company, showed a rather interesting *Audio Tracer Model 3210* which weighs only 5 lb but provides a paper frequency response trace. Range is switchable between 25dB and 50dB, paper speed can be varied from 0 to 25mm/s and the oscillator will sweep either 20Hz to 20kHz, or 200Hz to 200kHz. Price is £825 plus £36.80 for a calibrated microphone.

Court Acoustics introduced a new 30-band $\frac{1}{3}$ -band stereo graphic equaliser on standard ISO frequencies from 20Hz to 20kHz. It features XLR balanced inputs (or unbal), a max +30dBm input before overload, and +22dBm output, while individual filters provide $\pm 10\text{dB}$ response with better than 1.5dB interaction.

Skatron A/S, a Norwegian company, showed a range of cable drums taking multi-core cables up to 15mm in diameter. When equipped with a recoil starter, the drums are ideal for stacking sideways, and a brake is included for use when uncoiling the cable.

Malcolm Hill Associates will be introducing a range of consoles for the smaller studio in the near future, the *K series*, and these will be available for up to 32-input channels with routing for up to 24 tracks. Price for a 32/24 would typically be from £4,000 to £8,000. The Hill range of power amplifiers has also been broadened and now comprises the dual channel amps *DX700*, 260W £387, *DX350* 115W £280, *DX200* 175W £248, (no drive into less than 8 Ω), *DX140* 80W £226, *TX400* tri-amp 115W £366, *MX50* mono 60W £135, and *QX50* quad amp 60W £45 for the rack and £115 for each amp. Power figures are into 8 Ω with both channels driven where appropriate. Many options are available.

Hes Electronics, a Belgian company, first produced an automatic telephone line balancing unit about six years ago, and intends to introduce a new model that is totally independent of line impedance later in the year. The company also produces intercom systems which feature a remote switching exchange and includes 30dB compression on each microphone amp. Easily pluggable cords on the electronic exchange enable switch designated destinations to be changed very quickly and simply.

EMT-Franz introduced the *Digiphon 466* 'digital signature tune repetitor' which enables segments of speech or music to be recorded, stored for short cycle times and endlessly repeated. Using a MOS RAM memory with approx 2 million bits, the unit is available in three versions, the *446/5* with 5s storage, 12-bit digital word length and 14.5kHz bandwidth, the *446/6* with 6s storage, 10-bit digital word length and 14.5kHz bandwidth, and finally the *446/12* with a full 12s storage with 10 bits and 7kHz bandwidth. S/N is 66dB with 12 bits, and 54dB with 10 bits.

Stocktronics in Stockholm, distributed by ITA in London, introduced the *RX4000* stereo reverberation unit using mechanical excitement



Neutrik
Audio Tracer

Above: EMT 446 digital signature tuner repeater; Below: Tannoy Buckingham monitor with electronic time compensated dividing network

of a suspended steel plate which provides natural-dimensional reverberation set to approx 3.5s. The *RX4000* is easily transportable and weighs only 66lb—price is about £1,100.

Tannoy demonstrated three units: the *Buckingham*, *Classic Dual Monitor* and the new *Super Red Monitor*. The *Super Red Monitor* has a continuous power rating of 120W below 1kHz and 60W above, with peak handling of 500W and 250W respectively. Sensitivity is 1W providing an average level of 94dB SPL at 1m under anechoic conditions. Tannoy also produces an active crossover and low frequency parametric equaliser operating over the 20Hz

to 200Hz band with variable time delay operational in either the high or low pass channels. Features include switchable 15Hz high pass filter, linear phase Bessel input filter, high pass channel inversion facility, and plug-in card which specifies the crossover characteristics for specific units.

Finally, Kudelski gave the first public demonstration of its long awaited *Nagra T* tape recorder which takes 10 $\frac{1}{2}$ in spools as standard and was initially seen in its instrumentation version offering seven tape speeds and dual capstans. Further details later in the year when the audio version becomes available. ■

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Passive mixing

NORMALLY free gifts are junk, but the freebie offered by Turnkey with every 4-channel sync recorder bought from them really is worth having. It's a four-into-two mixer but with a difference. It's pretty simple, just gain, pan, lf and hf eq on each input. But distortion and noise figures would do credit to a Neve. Overload is rated at around 400V when the components start to smoke. Yes, you've guessed it, it's a passive rather than active board and all the better for it. I've always been astonished at the way semi-pro studios and musicians with home set ups will spend good money on 4 and 2-track machines with good noise, distortion and overload figures and then throw it all away by hooking the machines up through a cheap and cheerful active mixer that adds hiss and hum, distorts like crazy and clips transients. It makes far more sense to use the gain of the two recorders to make up for the loss of a passive mixer, if necessary feeding the 4-track line out via the passive mixer into 2-track mic in. It's a pity you can't buy the Turnkey passive freebie but then I suppose that's the whole point of the exercise—to encourage people to buy their 4-track recorders through Turnkey in the first place. The mixer is part numbered 1478. Get it? The first of the fourth month, April, 1978. Only it isn't an April fools joke, it really exists and it really does do the job.

Compact Disc

THE RECENT Philips announcement of details on the new *Compact* disc system has raised some interesting and contentious issues. Philips first revealed their intentions over digital audio last May, when a brief press release told of plans to offer the world a 4in digital audio version of the 12in video disc. Buried deep in the release, and thus missed by most reports, was reference to laser tracking of the reflective disc at a constant tangential velocity of 1.5m/s. Philips was thus obliquely confirming that the disc would run at a rotational speed which varied as the laser head moved out from the smaller central grooves to the larger peripheral grooves. This incidentally isn't a new idea. Garrard way back in the Twenties introduced the *World Record Contrôller*, a device for virtually doubling the playing time of the 78rpm disc by varying the rotational speed to keep tangential velocity constant. Next, L Boonstra of Philips lectured the AES on the audio disc in New York on the afternoon of November 3, 1978. But Philips did not submit a copy of the text for printing and immediately afterwards clamped a 'confidential' restriction on Boonstra's words. If you'll pardon the pun, this must be a record—the very first time that an open session of the AES has been retro-actively classified as confidential.

The recent Eindhoven launch confirmed

Philips' decision to make their video and audio disc systems totally non-compatible; this puts Philips in direct opposition to the Japanese companies who see the home of the future as equipped with a single player capable of reproducing look-alike video and digital discs. The puzzle here is why Philips won't countenance the idea of a digital audio facility available as an optional extra for their video disc player. In other words why can't the home of the future choose between buying a digital audio disc player *or* a video disc player *or* one of each *or* a pukka player capable of reproducing both audio and video?

But much more important to some sectors of the industry will be the Philips decision to make the audio disc just 4½in or 115mm in diameter. This provides one hour of 2-channel stereo playing time on the single sided disc. Fine. But what happens if you need more than two channels? The system can in theory cope with any number of channels because the encoding is in time multiplex or sequential fashion. In other words in the digital stream a word for channel 'one' is followed by a word for channel 'two' and then a word for channel 'one' and so on. The forfeit for encoding more than two channels into the stream is that the rotational speed must increase to maintain bandwidth and noise figures. Playing time then decreases accordingly, so to record four channels instead of two will axe the playing time to half an hour total. This is plainly inadequate for classical music recording. Philips, while talking on the one hand about the system finally starting to oust the conventional LP in about 15 years time, talks on the other hand about 'having no plans for quadrasonics'. It was this latter statement that frightened some press and broadcasters present at the press conference. Answers given to questions on this issue put at the press conference revealed that the Philips men are totally unfamiliar with the concept of 3-channel encoding for horizontal surround sound (à la Ambisonics-NRDC-IBA-BBC-Nippon-Columbia *et al.*) and 4-channel recording for horizontal plus height encoding. For the men from Philips, four channels still means 'quadrasonics', a wholly out-dated concept.

When pressed, Philips argued that if the need ever arose for more than two channels on the *Compact* disc, space could probably be made by taking advantage of advancing technology, such as shorter wave lasers and finer track pitching. But already the tracks are spaced apart by only 1.66 microns and the six billion digital bits are formed from pits just 0.6 microns wide. This disc will be pressed from vinyl, before coating with a metallic reflective surface. Can you imagine the strain that even this basic format will put on pressing plants? Can we really rely on pressing plants to tackle even tighter tolerances?

There are really two mysteries here. How can the Philips engineers responsible for the

digital discs be so ignorant of modern developments in surround sound technology and why is 4in or 11cms the maximum disc size the company will consider? After all just a few extra centimetres on the diameter of a variable speed disc would readily serve up the extra playing time necessary for an hour of 3 or 4-channel encoding. The second question is easier to answer than the first. It is clear that Philips sees the *Compact* disc as the all-round prerecorded entertainment medium for the future, not just for the home, but for the car as well. The 4½in size of the disc has clearly been tailored to allow the design of an in-car player itself tailored in size to the current DIN standard dashboard mounting for a radio or cassette player!

On the matter of surround sound, there is no doubt that some Philips engineers are exceedingly well versed in modern developments. I know for a fact that when circuit diagrams for the NRDC-Ambisonics decoder were published in *Wireless World* and other technical magazines, it was Philips engineers who pointed to some very minor errors in the circuitry. And they did so within just a few days. I also know for a fact that there has been close liaison between the NRDC and Philips on surround sound, and Netherlands Radio has broadcast more surround sound than the Beeb. Quite simply the failure of the *Compact* disc development team to take serious account of surround sound encoding requirements follows from the lack of inter-departmental communication that has for many years frustrated engineers working inside the Philips organisation. Only occasionally does this lack of communication reveal itself publicly. This is one of those occasions.

A final point. For the past 15 years audio engineers have bewailed 'if only' the *Compact* cassette had been differently designed, to take hifi requirements into consideration. A whole industry has grown out of making the sow's ear cassette into something approaching a silk purse. Pure metal tape is the latest ploy. Now we seem confronted by the threat of a similar situation over the *Compact* disc and surround sound. Philips argues that if the *Compact* cassette had been any larger or more complicated in the first place, the system would never have taken off. But there is one very important difference between the *Compact* cassette concept and the *Compact* disc concept. The disc is aimed initially at the expensive hifi market and will only subsequently move downmarket into cars and portable players. The *Compact* cassette was initially aimed low, and only subsequently moved up market. Perhaps most important of all, in the Sixties when the *Compact* cassette was launched, there was far less competition from Japan than there is now. If the *Compact* disc is to succeed and become what Philips clearly wish, namely a new world disc standard, then it must be as near as damn it right from the word go. If it were just a little larger in diameter, ...

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Room tuning

Pete Smith

Graphic equalisers and spectrum analysers have received much publicity over the past couple of years. But is their application in the studio environment actually beneficial or a hindrance? Pete Smith looks at the basic properties of sound and acoustics in an attempt to answer the question.

GRAPHIC equalisers on monitoring systems have become a standard component on both PA rigs and in recording studios, and very useful they are too! The trouble is, as with all good things, they are easily abused. Although I don't advocate their use at all in the studio environment preferring the alternative of careful design of the room, their use in PA as a modifier to assist in presenting a clear and intelligible performance has improved the sound quality in often appalling conditions. The moment they are used to modify the sound of a control room, real problems can and do occur. The subject of acoustics is now recognised as being suitably important and on a level equal to that of the electronics. It is hoped that this article will enlighten those who think that the silicon chip and its associated components are the answer to the problems of transmitting accurate information through the medium of air.

Those of us who spend more time in a recording studio than at home will appreciate how important it is to feel relaxed in the environment of an elaborate padded cell. It must be admitted that on several occasions the feeling of being trapped has manifested itself in studio people who have nearly toppled from that pinpoint called sanity.

Look around you, and honestly answer these questions:

How aware are you of the recording environment that surrounds you?

Does it affect your performance in creating the sound being

generated in the studio?

How much does it matter to you, if at all?

And finally, how far up your list of priorities does it appear?

With these questions in mind, I would like to take you through some of the pitfalls and conditions that are present in any control room studio situation. For all the advances in acoustics and critical design strategy now present in modern day studios, the ear still manages to criticise, whether rightly or wrongly, any sound field that does not present an accurate result be this in terms of quality, intensity or direction.

Direction, however, is not one of the ear's strong points and relates more to vision. The eye differs from the ear in that, although they both register information about their respective stimuli intensity and quality and the way these change with time, the eye also provides great detail of distribution in space. Unfortunately it does this at the expense of providing far less information about quality. On the other hand the ear has to provide the brain with a harmonic analysis of any sound that stimulates it, so that to comprehend the sensation produced by any complex, or for that matter simple sound, it may be required to determine the values of several thousand independent peaks and troughs per second (harmonic content) and thus for two separate sounds to cause identical acoustic sensations, these sounds must be alike in the values of all their qualities.

The phrase 'all their qualities' is very important as it is the areas

that are not measured which form a large basis of this argument. For example the ear is very adept at determining small variations of pitch (frequency), but room measurements made with much of the available measuring equipment designed to accommodate these functions are such that they tend to skip over many of the very important intermediate stages. In fact a person with perfect pitch has the ability to define any note and any slight variation of it; this shows the great ability of the ear's structure to work as a very accurate measuring instrument in its own right.

What factors do we consider in deciding how monitoring and room systems are to be handled in an attempt to create a pleasing and yet accurate environment in which to work? Frequency bandwidth, dynamic range, levels of each and every frequency involved, the level at which they are presented from the monitoring system, and any distortions that may be present must all be considered. Taking each of these points in turn I will primarily use common sense arguments to achieve what I believe to be some commonsense conclusions. Obviously this must involve some theory and some explanation of the ear's working mechanisms but hopefully the train of thought will be kept as uncluttered as possible.

Frequency bandwidth

All electronic equipment used in a recording studio operates with a single form of energy ie to transfer a signal, within or from one piece of equipment to another, and only requires wire as a transfer medium for the electrical energy. This is not true, however, of both tape recorders and speaker systems. In the case of the tape recorder, electrical pulses have to be converted into magnetic pulses which are then stored on magnetic tape. This

suffers from many natural hazards and so reproduction qualities deteriorate with time and use. The loudspeaker incorporates many more problems in that the energy transfer passes through a further stage of possible degradation. The signal arriving at the speaker coil has once again to influence a magnetic field and requires it to either pull or push a speaker cone, which in turn causes the rarefaction or compression of the air. In modern speakers the energy required to achieve this is colossal in comparison with the returns, but in the fight to reduce distortion sacrifices have to be made!

What has all this to do with frequency response? Well I feel that it serves to illustrate the problems involved in trying to achieve a smooth movement of energy through all these changes of energy state when attempting to derive a result identical to that which was applied. The output of any speaker is reliant on the atmosphere in which it is working and any abuse in any small way can have serious effects which are often not apparent if 'conveniently' masked by the rest of the signal.

Consider the bandwidth over which a loudspeaker must work which ideally should be the same as that of the electronic equipment, ie 20Hz to 20kHz. In the case of speaker units, the upper and lower reaches are all too often not easily attainable, and it is within these areas that a room often has the most disastrous effects caused mainly by standing waves and the absorption characteristics. Whereas a desk may have a flat response throughout this frequency range (and beyond) it is unfortunate that the opposite is often true of speakers. Speakers are normally 'measured' in an anechoic chamber and can often give excellent results in this environment. But repeat the same measurements in its new studio

home, and the final result will inevitably be different.

This is why no two studios sound the same, and correction for any misdemeanours, as already mentioned, is normally performed by a graphic equaliser. As the frequency spacing on the equaliser increases so do the gaps in its effectiveness; thus to control the output of a loudspeaker system efficiently it is necessary to have a large number of centre frequencies although this in itself can create a number of inherent problems.

Dynamic Range

Let us assume that the speaker is asked to deliver 100dB and it requires 100W to accomplish this. If we had a frequency that was only 3dB down on the rest, the speaker, in being asked to correct this anomaly, would be required to accept a level in excess of 200W. This is certainly outside the capability of many speakers and even more so of some amplifiers.

3dB is not a large signal increase for a desk or a piece of ancillary equipment, but for a tiny over-worked tweeter that will have to handle transient peaks well in excess of this, it is often found that the unit's life expectancy is severely reduced. This is often the case in the studio environment due to losses incurred by the room design in an attempt to derive a reference sound that is as accurate as possible whilst affecting it as little as possible. So you can see that the speaker is falling short of its requirements due in part to the drive units themselves and more especially the room.

Levels at each and every frequency involved

If a pure tone reading of the control room is undertaken, then the results obtained are often confusing but more often informative (fig. 1a, 1b). Here we can see the performance of every standing wave present in a typical control room. Whether peak or trough, to

ask a graphic equaliser to broadly handle 30 of these points is a bit much and yet to build a narrow band equaliser to pinpoint every deviation is also totally impractical. Yet with a little careful consideration at least some more points of reference could be incorporated in the parts of the frequency spectrum that are not properly covered by any existing graphic equaliser.

The ear is a very sensitive organ and yet it can create confusions. If we listen to a sound system from new, criticism is easy, but it takes little time for the ear to accommodate the initial criticism. Leave the room and listen to a different system. On returning it is all too easy to label one of the systems as not being so good. This is the problem of the subjective test that all too often ends in an argument as to which is preferred—it is often what you have become used to that prevails.

Here is another problem we have to face when designing a control room. How to build a room that will satisfy the chosen speakers which the client is convinced are the best he has heard—they can easily sound disastrous in a control room that has different reverbera-

tion times and more especially standing wave characteristics that did not exist on his initial appraisal. For me, these little pressure waves are the part of a room's character as well as the speakers. Very little can be done to change this by winding up or down 30 phase shift networks that are probably doing more harm than good. If the frequency is adjusted to compensate for an error at a pre-determined point, the likelihood of exaggerating another fault nearby is a very real possibility. With a chorus from the back row of 'that's better', the only reason they can hear a difference is because the sound character has changed very slightly. The ear being sensitive to changes will only tell you that something has shifted and you can easily fool yourself into believing the sound is better rather than just different. If a recording is made in this 'great' new atmosphere and then taken elsewhere for mixing, it never ceases to amaze me that the sound can change so dramatically. Every one waits for the sound to be the same, but once again it is different in many small details normally covered up by turning the wick up to fever pitch in the hope of deriving the original sound.

Distortion

Let's look at distortion and the problems that dynamic range has now introduced into this field of recording. It's very easy these days to have a control room that is equipped with a monitoring system capable of vast levels often in the region of 1kW and above with sound pressure minimums of 120dB SPL and above. The distortion of the ear is, in all practical terms, likely to occur around 90dB SPL and since it is an organ designed to accommodate low level sounds, such as those experienced in the countryside and not the bustle of modern life, it seems to behave remarkably well under these stress conditions. Fig. 2 shows what happens to the ear drum when sound pressure levels exceed the above level—this is a safety feature of the ear. When the music level increases and with the distortion of the speaker system, distortion created by the standing waves, and that present in the ear, one wonders how the brain is able to comprehend, in this controlled environment, a true analysis of that which it was intended to represent!

Suppose you have inexhaustible funds and an inclination to design and build the finest recording

FIG.1a PURE TONE STANDING WAVE

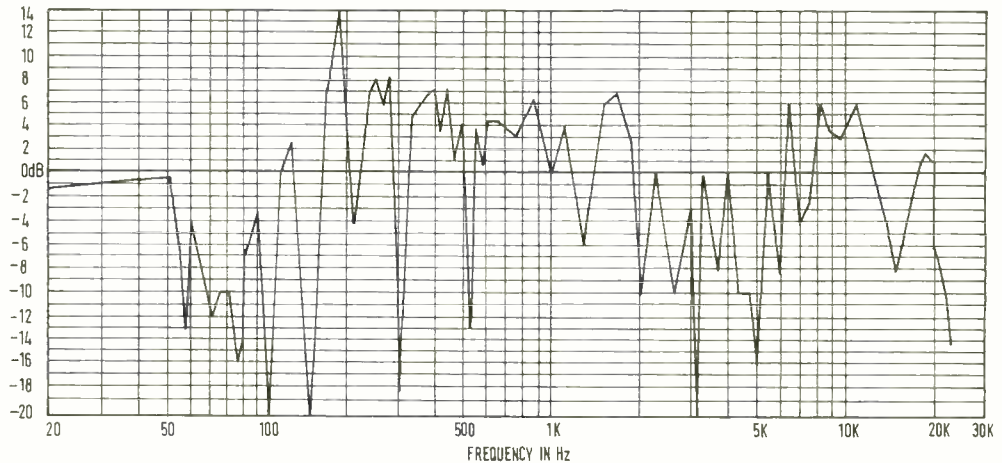
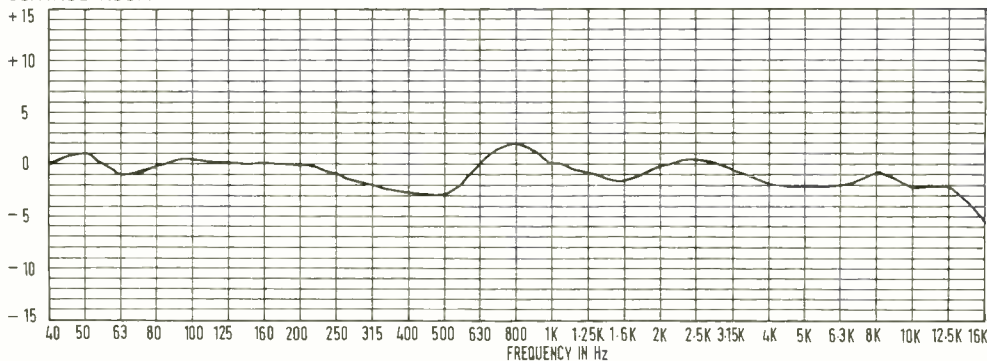


FIG.1b 1/3-OCTAVE ANALYSIS OF SAME RESPONSE AS MEASURED FROM A CENTRE POSITION IN A CONTROL ROOM



studio money can buy. What comes to mind first? The desk, that contains the wonders of modern electronics allowing flexibility far beyond that available a couple of years ago? The tape machine, the effects equipment, the speaker system, or the room itself? After all this is a very important consideration, for if we take the analogy 'which came first the chicken or the egg' we're left with the decision of which is going to control the medium in which we work most effectively.

I find that the recording console seems to sustain the most attention—and why not, after all it is the

Room tuning

centre piece of any control room. You never have a client walk in and say what lovely acoustics as a first comment, rather what a nice desk. Unfortunately in my experience it is not always the most obvious items that effect a working environment, but those insidious properties that contain the power to control results more than may first seem apparent, and acoustics is often a major contributor.

Are there any ways of overcoming these problems?

Do we have to reconsider the measurement techniques utilised?

Or are they just a farce, designed to alleviate fears and nothing else?

On the other hand however, it needs to be considered that many existing control rooms are going to have to cope with the capabilities of digital recorders, including that illusive quality, dynamic range. Is your control room likely to sound better or worse for these improved qualities? Remember that it is the ear that takes the final measurement and analyses it in minute detail. As I said at the beginning *all the qualities* are the key words.

Hearing mechanism

Let's consider how the ear works so that the functions of its direction and sound analysis can be better understood—with the help of fig 3 I will trace the sound path through the brain. The external ear with its trumpet like extension or auricle (this being fixed in man) is designed to increase the efficiency of the S-shaped canal leading down to the ear drum or tympanic membrane. The membrane is about 1cm in diameter and is composed of radial and circular fibres covered with skin that is continuous with the canal wall. Attached to the inner surface of this membrane is the first of three bones called the hammer (malleus) and the tympanic muscle which is attached to the centre of the ear drum and has the effect of pulling in the ear drum causing a concave appearance to the outside world—more about this muscle, and its effects, later. The hammer is attached to a second bone in the inner ear, called the anvil (incus) and this in turn is connected to the third and final bone known as the stirrup (stapes). The foot plate of this bone is attached to the margins, by fibrous tissue, of a small oval window (fenestra Vestibuli) which covers the entrance to the sound sensing unit called the cochlea.

These bones act as a transformer conveying sound pressure waves acting on the ear drum from the

light medium of air, and concentrating this energy to cause oscillation of the fluid filled cavities of the cochlea, it being harder to excite a liquid into movement than air. Reflex causes the tympanic muscle to contract in sympathy with any movement of the ear drum. The eardrum is held under tension by this small muscle and prevents

ear drum, whereas outward movement is relatively simple. Since this causes a reduction of the tension on these fibres, damping of this movement is more reliant on the tympanic muscle, producing distortion effects such as the one shown in fig 2, although this distortion for low level signals is too small to have any real effect. This is not true of those levels at which the ear drum's deformation would be beyond that of its own capability which the tympanic muscle is there to control.

FIG. 2 RELATIONSHIP OF SOUND ENTERING EAR ABOVE 90dB SPL AND DISTORTED EFFECT AS CREATED WITHIN THE INNER EAR

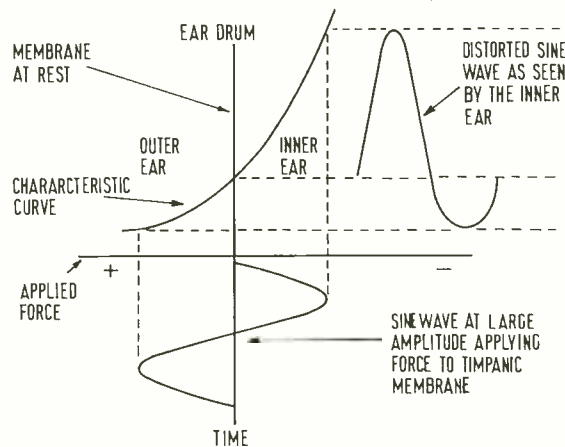
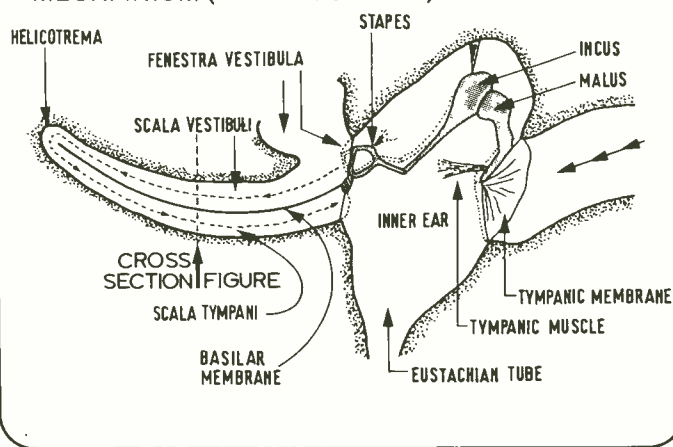


FIG. 3 DETAILS OF THE EAR AND ITS MECHANISM (REFER TO TEXT)



itself from vibrating too violently—because of this, sound transmissions across the middle ear by way of these three tiny bones are impaired for signals of low frequency. At the same time, this muscle acts as a protector against the effects of loud sound pressures that could so easily cause severe damage to the delicate membranes of the inner ear.

Movement in towards the middle ear causes stretching of the radial fibres, which make up part of the

The limiting effect of this muscle, and the eardrum's natural compliance in one direction, generates harmonic distortion which becomes more apparent as the intensity increases. Although this effect has been used to good advantage in the pop music industry for generating excitement and richness of sound, in an area where reference signals are required, the advantages become a great mistake.

Take the example of the modern guitar (electric) which by virtue of

the amplification needed to hear its performance, can generate levels of any intensity that the musician wishes it to—with an amplifier that is working beyond its designed capability, the fuzz effect is created as the speaker presents the multitude of harmonics generated, all too often, at the same intensity as the original note.

Now because of the ear's own harmonic distortion, summation and difference frequencies are created—this effect can be best described by providing the ear with the necessary fundamental note at high volume, then filtering out the fundamental, leaving only the harmonic content but don't be surprised if you can still perceive the fundamental, for the ear is very adept at regenerating this for you.

Insert between the guitar and amplifier a fuzz box of good quality, one that generates plenty of second as well as third harmonic distortion, and reduce the gain on the amplifier. The sound generated, although very pleasant, seems to lack a certain quality which becomes more apparent as the gain is increased. It must be stressed that this quality will only occur as long as the amplifier and speaker do not exceed their own minimum distortion characteristics. This is one reason why studio monitoring and PA systems use such high undistorted outputs—they hope to create the distortion within the ear, where its effects are more pleasing. Although this is a very pleasant experience, it unfortunately has the effect of masking genuine sound errors that may pass unheard.

As you will recall, we left the stirrup attached to its little oval window, this being the access point into the sensing area of the ear or cochlea. Fig 3 shows the path taken, within this organ, by all the transmitted signals applied to this window. The cochlea has been represented here in a stretched out form and would, under normal conditions, be a spiral of some three half turns around a bone structure. The liquid in the cochlea, by its own nature, cannot be compressed. A second window is provided, just below the oval window, known as the round window (fenestra cochlea) and serves the function of allowing fluid movement within the channels of the cochlea.

Fig 4 shows a cross sectional area through the cochlea and provides a more detailed picture of its structure. The voltages indicated in each of the three sections are believed to be the prime motivation in activating the tiny hair cells which lie above the basilar membrane. This membrane runs the full length of the cochlea, supported by the bone structure. It responds to acoustic stimulation and patterns

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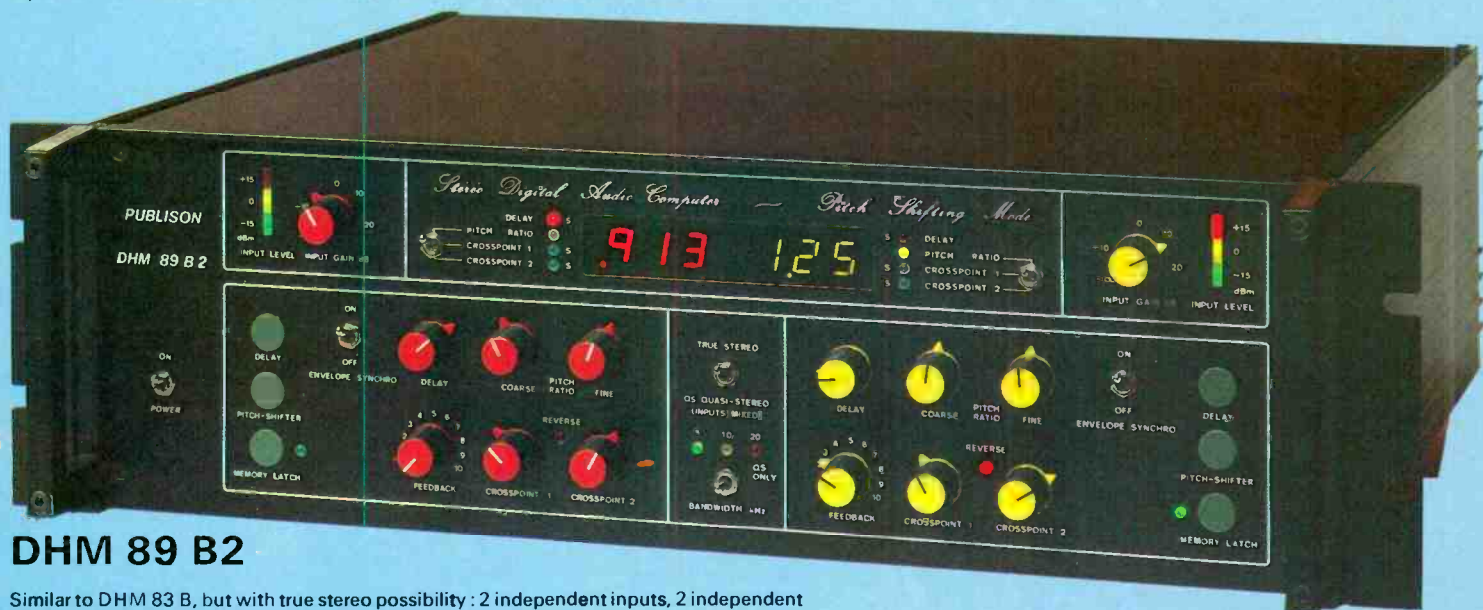
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Room tuning

of vibration set up by the fluid—travelling waves generated by the oval window die out at varying distances from this point of entry, the higher frequencies being eliminated closer to this window, and the low frequencies reaching the apex. This pattern of mechanical excitation, applied to the membrane, produces an effect called cochlea microphonics resulting in the hair cells setting up an electrical representation within the fibres of the auditory nerve. Increases in intensity are proportional to increases in the pulsation rate present in the nerve. It's apparent from research that certain cells show greater selectivity in their response to different frequencies present in the acoustic stimuli. It is probable that at low frequencies, but not at high frequencies, the sense of pitch is conveyed by the rate at which nerve impulses are transmitted to the brain.

Each of the nerve fibres then divide, their information being passed to both left and right hearing centres—this system allows cross reference of information being received by each ear. The brain would then assimilate this information with that received from the other senses and of course the memory areas. This part of the hearing process is still shrouded in a cloud of mystery, and the more we can learn about these areas of the brain, and their associations, the better.

Obviously any anomalies in the transmitted sound, must be minimised, for accuracy to be possible, thus preventing the ear and its associated mechanisms from creating too many deceptions. The brain being the final judge in these matters, relies upon this accuracy to convey a fair interpretation of the signal it is required to analyse.

Room design

If shifts in level within the bandwidth we are dealing with were reduced and contained to within a few decibels, yet still maintaining a suitable reverberation time within the room, we would be heading along the right lines. Further careful consideration must be given to speaker placement taking into account the reflective ability of all the major equipment and of course the resonant frequency or frequencies present in any room under consideration.

Many methods of control of the acoustic environment have been suggested over the years some requiring the construction of units having the ability to resonate around predetermined frequencies. Sound pressure reduction in these

units is achieved by demanding that the air molecules supply some of their kinetic energy, normally removed in the form of heat, by displacing fibrous material with resonances around these points or by causing the whole unit to react to these frequencies having established their resonant point. On occasions, by using both methods and selecting the most appropriate resonance points it is possible to construct a very efficient unit. It does have drawbacks—any miscalculation or variation in the materials used can have the effect of shifting these resonances into parts of the frequency spectrum where they do

of sound modification, the room's response is likely to be smoother with this modification than that of a graphic equaliser. An equaliser has inherent problems which are more unlikely for the acoustic method of correction.

Reflective surfaces in the control room are another hazard facing the designer—large windows have to be provided for visual communication between studio and control room, the large desk with all its glistening metal work and the addition of an array of tape machines and racks of effects devices make the reflection possibilities enormous. They all have to be put somewhere and this normally means close at hand—unfortunately none of this equipment can be conveniently covered in absorbent material and so these

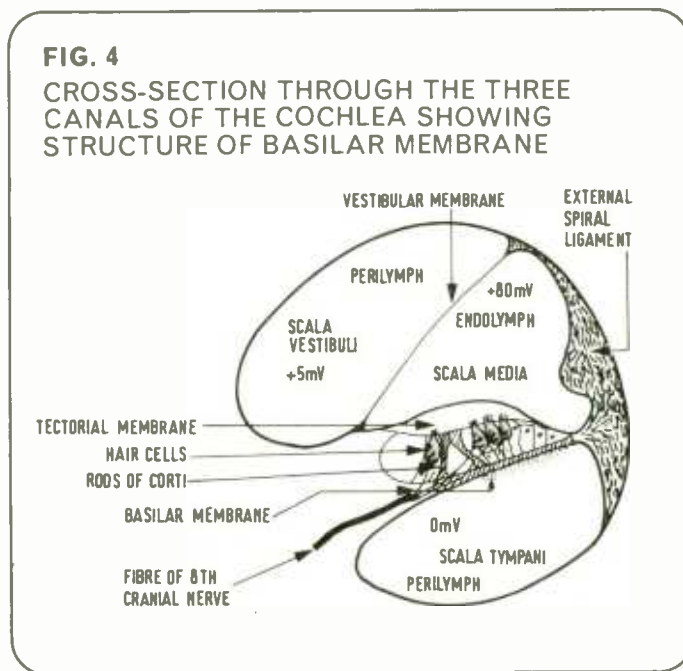
qualities are so numerous—it is little wonder that people get confused. Reliance on electronics is a lot easier for it displays, conveniently for us, its intentions upon a signal. Visual distractions can draw the attention away from sound so easily.

Summary

To summarise, the ear is a delicate instrument that is often misunderstood and even more frequently abused, especially when considering its capabilities, although it does suffer in environments where controllability of a medium is often very unpredictable. In protecting itself the ear generates distortions and when a second hand signal is being listened to, having passed through many processes the ears capability of distinguishing very small amounts of interference is proof of how much harm an instrument intended for broad modification can cause.

Measuring techniques must be improved using dynamic noise but taking into account far more frequencies than at present are considered and the spread of measurements must include the whole listening area not just the centre position of a recording console where an engineer or producer is unlikely to be for 99% of the working time. Visual relaxation is of great value and more time and energy must be placed on the likely strains that can so easily destroy a creative environment.

There are still many questions to be asked, and even more answers to be investigated. In resolving a subject that relies so heavily at present on subjective analysis and personal taste careful design could illuminate, yet not destroy, the individuality of all the sounds that surround us in our working environment. I think in time the mysteries will be solved and the results will provide an accurate and interesting perception of sound, with all its qualities revealed. ■



more harm than good by intensifying the resonances they were intended to remove.

Another important method of sound control is the creation of resonant traps where incoming pressure waves are reduced by phase inversion. This is by far a better system although the amount of space required to house them can be impractical where small rooms are concerned. This is the case concerning low frequencies as their very long wavelength requires traps of similar size. An advantage is that they can be designed for resonance adjustment. Once the studio nears completion, it is possible to correct these units to allow for any inaccuracies in the calculations taken before the equipment and trimmings were finalised. This variability holds great potential as a superior means

units are also likely to add their own character to the perceived sound.

The important part played by the control room ceiling often seems to be neglected for here is an area capable of great potential when designing a pleasing yet practical room. Its use in portraying the illusion of space is very important to those who have to work there for it can generate all too easily the feeling of either space, or confinement, as well as providing a superb area in acoustic directivity and absorption.

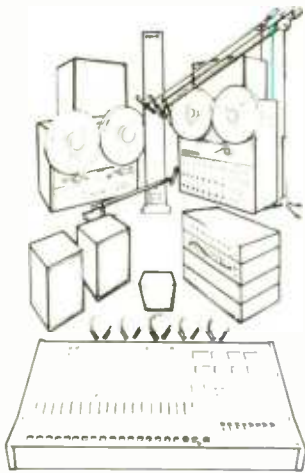
The expression 'what the eye does not see, the heart never grieves over' holds true throughout this discussion on perceived sound. We rely on visual information to tell us what is happening in an acoustic surrounding, for sound is not a tangible item and its

agony

'At a series of location recordings of a musical never to be performed again, the best recording will be of the worst performance, and the best performance will be ruined by direct noise entering the record amplifiers of the tape machine.' Another example of Murphy's Law.

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MICROPHONES

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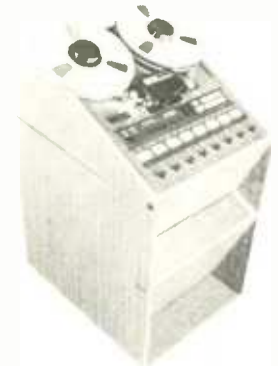
delay and graphics are second to none. **Roland** of synthesiser fame, have introduced their 'Studio Series' of rack-mount units, including a phaser/flanger with extensive control facilities. We also have the budget **ACCESSIT** range.

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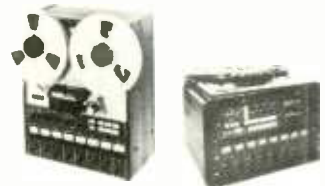
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Survey: microphones

This survey covers microphones used in studios for music PA but does not generally include small mics designed for public address purposes. Where possible, variations on microphones are given, but there are numerous versions with different sockets, clamps, carrying case and so on, so it is not complete. Next month's survey will cover mic stands, booms and radio microphones.

KEY

Transducer type: D—dynamic moving coil; R—ribbon; DR—double ribbon; C—capacitor; E—electret; PG—pressure gradient.

Polar response: O—omnidirectional; C—cardioid; HC—hyper-cardioid; SC—supercardioid; 8—figure-of-eight; V—various; VS—various, switchable; S—special.

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

AKG (Austria)

AKG GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.

Phone: 0222 92 16 47. Telex: 011839.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.

Phone: 01-749 2042. Telex: 28938.

USA: Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, New Jersey 07430.

Phone: (201) 529-5900. Telex: 138022.

| | | | | | | |
|---|----------|-----|-----|-------|--------|--|
| D12 | D | C | 200 | 0.22 | £95 | |
| D58 | D | HC | 200 | 0.072 | £31.50 | Talkback microphone |
| D110 | D | O | 200 | 0.10 | £48.80 | Lavalier microphone |
| D140 | D | C | 200 | 0.23 | £63 | Bass cut switch |
| D160 | D | O | 200 | 0.12 | £63 | |
| D170 | D | C | 200 | 0.19 | £72 | |
| D190 | D | C | 200 | 0.23 | £51.50 | |
| D202E1 | D | C | 200 | 0.16 | £97.70 | 2-way system, bass cut switch |
| D222EB | D | C | 250 | 0.15 | £90 | 2-way system, bass cut switch |
| D900 | D | SC | 200 | 0.30 | £96.60 | Shotgun microphone |
| D1200 | D | C | 200 | 0.23 | £66 | Bass cut switch |
| D2000 | D | C | 200 | 0.23 | £78 | Bass cut switch |
| C501-10 | E | C | 200 | 0.35 | £60.90 | |
| C505-10 | E | C | 200 | 0.35 | £75.60 | |
| C34 comb | C | VS | 200 | 0.45 | £890 | Stereo mic |
| C414EB | C | VS | 150 | 0.6 | £284 | Bass cut switch, 2-position pre-attenuator switch |
| C422 comb | C | VS | 200 | 0.6 | £985 | Stereo mic |
| CMS range of pre-amplifiers, capacitor capsules and accessories | | | | | | |
| C451 | amp only | 200 | — | — | £63.70 | Pre-amp for 9-52V power supply |
| C451EB | amp only | 200 | — | — | £78.30 | Same as C451 but with 2-position bass cut switch |
| C452EB | amp only | 200 | — | — | £78.30 | Pre-amp for 48V power supply with 2-position bass cut switch |
| CK1 | C | C | 200 | 0.95 | £41.40 | |
| CK1S | C | C | 200 | 0.95 | £41.40 | Presence boost |

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

| | | | | | | |
|------|---|----|-----|------|--------|------------------------------|
| CK2 | C | O | 200 | 0.8 | £41.40 | |
| CK5 | C | C | 200 | 0.95 | £78.40 | Built-in windscreen |
| CK8 | C | SC | 200 | 0.5 | £78.40 | Short shotgun |
| CK9 | C | SC | 200 | 1.1 | £95 | Long shotgun |
| CK22 | C | O | 200 | 0.8 | £48 | Built-in wind and pop screen |

All output values are in units of mV/μB at 1,000Hz





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| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|--|-----------------|----------------|-----------|---------------|-------|----------------------|
| ALTEC (USA) | | | | | | |
| Altec Corp, 1515 South Manchester, Anaheim, California 92803, USA. | | | | | | |
| Phone: (714) 774-2900. | | | | | | |
| Europe: Altec Lansing International Ltd, 17 Park Place, Stevenage, Herts SG1 1DU. | | | | | | |
| Phone: 0438 3241. Telex: 825495. | | | | | | |
| UK: Theatre Projects, 10 Long Acre, London WC2E 9LN. | | | | | | |
| Phone: 01-240 5411. | | | | | | |
| D60 | D | O | 200 | -60dBm | | lavalier |
| D80C | D | C | 200 | -59dBm | | grey metallic finish |
| D81 | D | O | 200 | -54dBm | | satin chrome |
| D90P | D | O | 200 | -58dBm | | satin chrome |
| C61L | E | O | 200 | -54dBm | | miniature lavalier |
| C70C | C | C | 200 | -40 to -70dBm | | satin chrome |
| C71 | C | O | 200 | -40 to -70dBm | | satin chrome |

| | | | | | | |
|---|---|---|------------|-------|--------|-------------------|
| ASTATIC (USA) | | | | | | |
| Astatic Corp, Conneaut, Ohio 44030, USA. | | | | | | |
| Phone: (216) 593-1111. Telex: 980712. | | | | | | |
| UK: Stateside Electronics Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX. | | | | | | |
| Phone: 0825 5566. Telex: 957098 | | | | | | |
| 950S | D | C | 150 | -54dB | £58.90 | contoured, switch |
| 952S | D | C | 150 | -54dB | £58.90 | flat, switch |
| 855S | D | C | 150 | -54dB | £61.23 | contoured, switch |
| 852S | D | C | 150 | -54dB | £61.23 | flat, switch |
| 850A | D | C | 150 | -54dB | £58.90 | flat |
| 850SA | D | C | 150/40k | | £65.88 | flat, switch |
| 857H | D | C | 40k | -57dB | £46.50 | peak free |
| 857HS | D | C | 40k | -57dB | £50.38 | peak free, switch |
| 857L | D | C | 150 | -57dB | £46.50 | peak free |
| 857LS | D | C | 150 | -57dB | £50.38 | peak free, switch |
| 815S | D | C | 150 | -54dB | £51.93 | contoured, switch |
| 812S | D | C | 150 | -54dB | £51.93 | flat, switch |
| 810A | D | C | 150 | -54dB | £49.60 | flat |
| 810SA | D | C | 150/40k | | £63.55 | flat, switch |
| 77 | D | C | 38/150/40k | | £58.90 | |
| 820 | D | O | 150/40k | | £44.95 | 'dynamic probe' |
| 860 | D | O | 150/40k | | £56.58 | 'dynamic ball' |

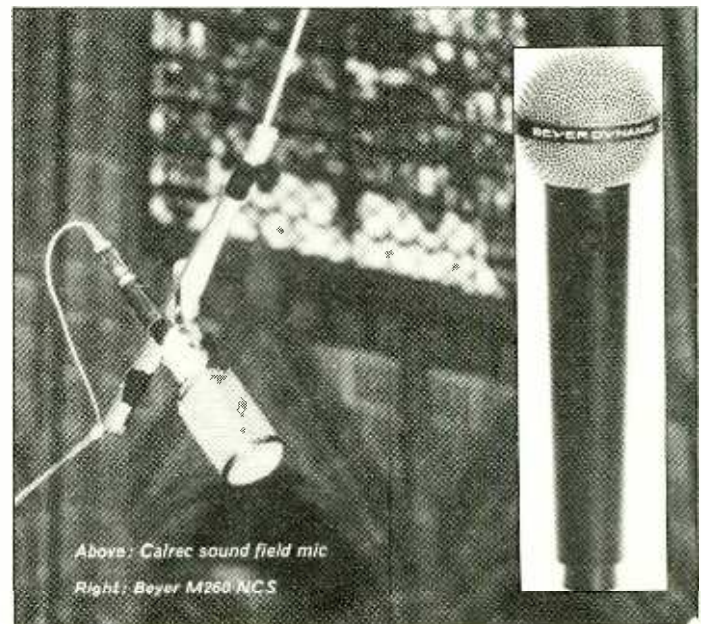
| | | | | | | |
|--|---|---|-----|-------|--------|-----------------|
| AUDIO-TECHNICA | | | | | | |
| Audio-Technica US Inc, 33 Shiwasssee Avenue, Fairlawn, Ohio 44313, USA. | | | | | | |
| Phone: (216) 836-0246. | | | | | | |
| UK: Audio-Technica Ltd, Hunslet Trading Estate, Low Road, Leeds. | | | | | | |
| Phone: 0532 771441. Telex: 557991. | | | | | | |
| AT801 | E | O | 600 | -48dB | £37.56 | XLR |
| AT811 | E | C | 600 | -56dB | £41.61 | XLR |
| AT802 | D | O | 600 | -56dB | £37.56 | XLR |
| AT812 | D | C | 600 | -60dB | £45.47 | XLR |
| AT803S | E | O | 600 | -57dB | £30.08 | Submin lavalier |
| AT813 | E | C | 600 | -55dB | £49.43 | XLR |

| | | | | | | |
|--|----|----|-----|-------|---------|--------------------|
| BEYER (West Germany) | | | | | | |
| Beyer Dynamic, Theresienstrasse 8, D-7100 Heilbronn, West Germany. | | | | | | |
| Phone: 07131 82348. Telex: 0728771. | | | | | | |
| UK: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH163DP. | | | | | | |
| Phone: 0444 51003. | | | | | | |
| USA: Hammond Inc Ltd, 155 Michael Drive, Syosset, NY 11791. | | | | | | |
| Phone: (516) 364-1900. Telex: 961396. | | | | | | |
| M160N | DR | HC | 200 | -60db | £165.99 | DIN |
| M160C | DR | HC | 200 | -60db | £170.48 | XLR |
| M260NS | R | HC | 200 | -61dB | £76.59 | DIN, switch |
| M260NCS | R | HC | 200 | -61dB | £76.59 | XLR, switch, clamp |
| M500N | R | HC | 200 | -61dB | £87.96 | DIN |
| M500C | R | HC | 200 | -61dB | £93.52 | XLR, clamp |

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|---|-----------------|----------------|-----------|--------|---------|-------------------------|
| M69N | D | C | 200 | -52dB | £58.64 | DIN |
| M69C | D | C | 200 | -52dB | £62.65 | XLR, clamp |
| M69SM | D | C | 200 | -52dB | £69.51 | DIN, switch |
| M69N(C)2 | D | C | 200 | -52dB | £74.01 | XLR, switch |
| M88N | D | HC | 200 | -52dB | £125.38 | DIN |
| M88C | D | HC | 200 | -52dB | £129.48 | XLR, clamp |
| M101N | D | O | 200 | -58dB | £78.85 | DIN |
| M101C | D | O | 200 | -58dB | £85.07 | XLR, clamp, windshield |
| M111N | D | O | 200 | -62dB | £93.36 | Lavalier, lead |
| M201N | D | HC | 200 | -59dB | £75.53 | DIN, clamp, windshield |
| M201C | D | HC | 200 | -59dB | £78.01 | XLR, windshield |
| MC series comprise CV710 pre-amp for 48V phantom powering, and the CK701/2/3/4/6/7 range of capsules. With DIN or XLR connectors. | | | | | | |
| MC711/721 | C | O | 200 | -41dB | £165.99 | Modular |
| MC712/722 | C | O | 200 | -41dB | £179.83 | Modular, pop shield |
| MC713/723 | C | C | 200 | -39dB | £183.28 | Modular |
| MC714/724 | C | C | 200 | -39dB | £197.12 | Modular, pop shield |
| MC716/726 | C | SC | 200 | -39dB | £257.95 | Modular, short shot gun |
| MC717/727 | C | HC | 200 | -39dB | £324.95 | Modular, long shot gun |

| | | | | | | |
|--|---|---|----|------|--|-----------|
| B & K (Denmark) | | | | | | |
| Bruel & Kjaer, 23 Linde alle, DK-2850 Naerum, Denmark. | | | | | | |
| Phone: (02) 800500. Telex: 37316. | | | | | | |
| UK: B & K Laboratories Ltd, Cross Lances Road, Hounslow, Middx TW3 2AE. | | | | | | |
| Phone: 01-570 7774. Telex: 934150. | | | | | | |
| USA: B & K Instruments Inc, 5111 West 165th Street, Cleveland, Ohio 44142. | | | | | | |
| Phone: (216) 267-4800. Telex: 810421. | | | | | | |
| The company is better known for its instrumentation microphones, but points out that several are suitable for music recording. | | | | | | |
| 4133 | C | O | 25 | 12.5 | | 3.9-40kHz |
| 4165 | C | O | 25 | 50 | | 3-20kHz |
| A suitable pre-amplifier for these capsules is model 2619. Output figures are in units of mV/Pa. | | | | | | |

| | | | | | | |
|---|--|--|--|--|--|--|
| CALREC | | | | | | |
| Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, West Yorkshire HX7 7DD, UK. | | | | | | |
| Phone: 0422 842159. Telex: 51311. | | | | | | |



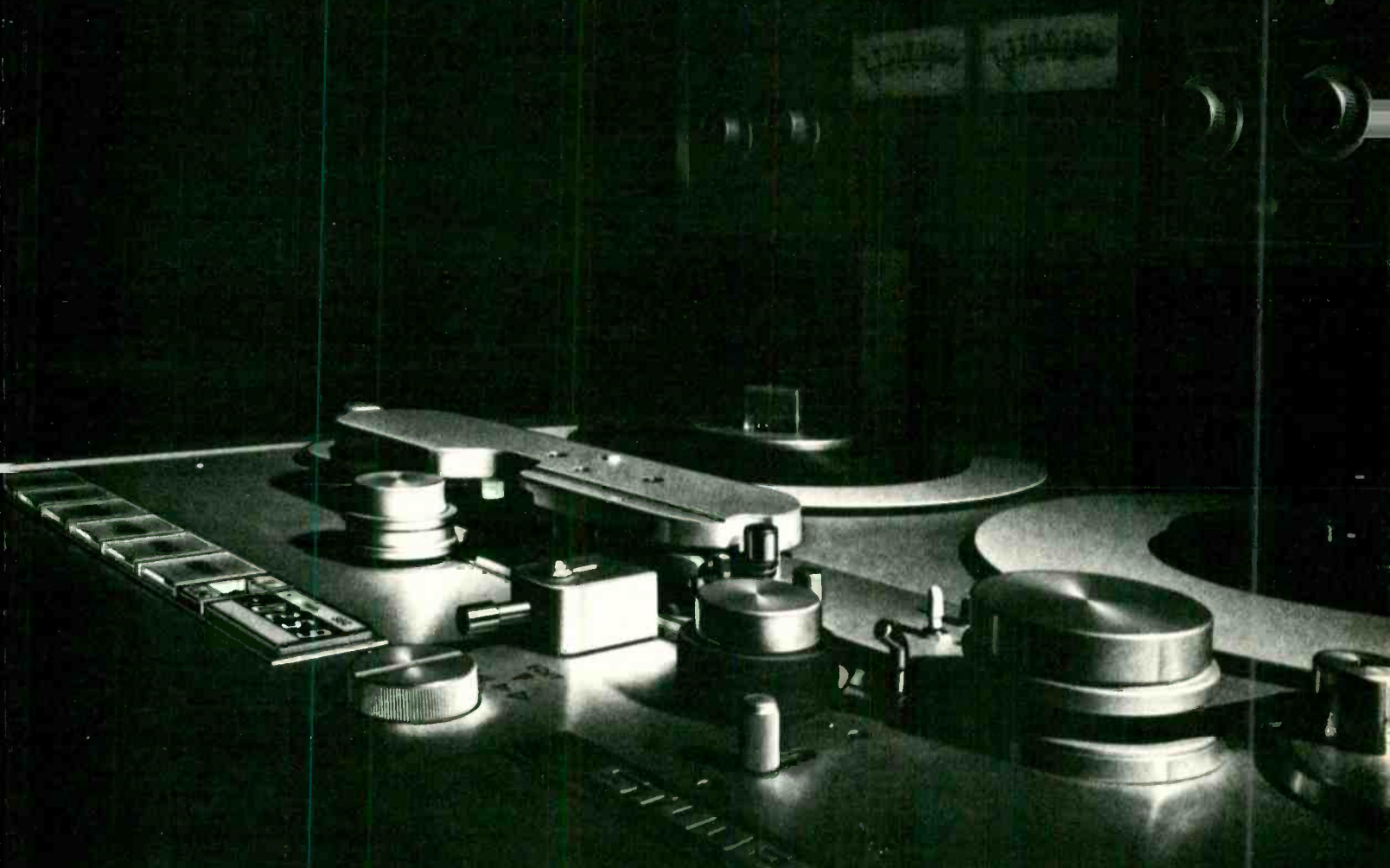
Above: Calrec sound field mic
Right: Beyer M260 NCS



STUDER A80/RC
Professional Tape Recorder
Choice of leading music studios, radio and
TV stations, worldwide.

Performance — we guarantee it...

tomorrow's generation with features you requested,
available today



STUDER INTERNATIONAL AG

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

STUDER REVOX AMERICA INC., Nashville, Phone (615) 329-9576, Telex 55-4453

STUDER REVOX CANADA LTD., Toronto, Phone (416) 423-2831, Telex 06-23310

STUDER FRANCE S. à r.l., Paris, Phone 533 58 58, Telex 24-744

F.W.O. BAUCH LTD., Boreham Wood, U.K., Phone (01) 953-0091, Telex 27502

SURVEY: MICROPHONES

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

Calrec cont'd

USA: Edcor, 16782 Hale Avenue, Irvine, Cal 92714.
Phone: (714) 556-2740.

CM1000 series of 48V phantom-powered mics with non-detachable capsules:

| | | | | | | |
|---------|----|---------|---------------------|-----|-----|-----------|
| CM1001C | C | O | 1k | 0.8 | £80 | Hand-held |
| CM1050C | C | C | 1k | 0.8 | £80 | — |
| CM1051C | As | CM1050C | with bass roll-off. | | £80 | — |

CM2000-series of 48V phantom-powered mics with detachable *CB20C* pre-amplifier and a choice of capsule:

| | | | | | | |
|---------|---|---|----|-----|-----|--------------|
| CM2001C | C | O | 1k | 0.8 | £90 | CC01 capsule |
| CM2003C | C | O | 1k | 0.8 | £90 | CC03 capsule |
| CM2050C | C | C | 1k | 0.8 | £90 | CC50 capsule |
| CM2051C | C | C | 1k | 0.8 | £90 | CC51 capsule |
| CM2056C | C | C | 1k | 0.8 | £90 | CC56 capsule |

CM2100-series of 7.5-50V phantom-powered mics with detachable *CB21C* pre-amplifier and choice of capsule:

| | | | | | | |
|---------|---|---|----|-----|------|--------------|
| CM2101C | C | O | 1k | 0.8 | £106 | CC01 capsule |
| CM2103C | C | O | 1k | 0.8 | £106 | CC03 capsule |
| CM2150C | C | C | 1k | 0.8 | £106 | CC50 capsule |
| CM2151C | C | C | 1k | 0.8 | £106 | CC51 capsule |
| CM2156C | C | C | 1k | 0.8 | £106 | CC56 capsule |

CM10 7.5-50V phantom-powered talkback mic on 320-mm non drop stem. £128.66

Output figures are in units of mV/μB.

CM600 series of professional entertainment microphones, DIN connectors with unbalanced outputs requiring 45 to 50V, *not* phantom.

| | | | | | | |
|--------|---|---|-----|--------|--------|-------------------------|
| CM602D | C | O | 500 | -127dB | £44 | Vocal/instrumental |
| CM652D | C | C | 500 | -127dB | £44 | Instrumental |
| CM654D | C | C | 500 | -127dB | £46.30 | Vocal compensated |
| CM656D | C | C | 500 | -127dB | £54.70 | Vocal comp, wind-shield |

CM4050 *Soundfield* microphone. This comes complete with the *Soundfield* Control Unit *CS501413* and is designed primarily for surround sound and ambisonic recording, and allows post session control of stereo microphone operational mode and position. Greater rigging flexibility reduces setting up time. A feature article about the *Soundfield* microphone is intended for publication in the autumn. £2,600

EAGLE (Japan)

Eagle International, Precision Centre, Heather Park Drive, Wembley HA01SU.

Phone: 01-902 8832. **Telex:** 922131.

Belgium: Eagle International SA, Rue du Midi 147, 1000 Bruxelles.

Phone: 02 513 0477.

Holland: Eagle International Electronics BV, Ridderkerkstratt 15, Rotterdam-Lombardijen.

Phone: 198 661.

Eagle PRO M60



| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|



Electro-Voice DO56 shock mount omnidirectional mic

| | | | | | | |
|---------|---|----|-----|--------|--------|--------------|
| PROM20 | E | C | 600 | -62dBV | £48.35 | — |
| PROM40 | E | HC | 600 | -54dBV | £36.50 | 'Rifle' mic |
| PROM 60 | E | O | 600 | -62dBV | £39.95 | Tie-clip mic |
| PROM70 | E | C | 600 | -62dBV | £39.95 | 10dB f to b |
| PROM80 | D | C | 200 | -64dBV | £42.50 | Body as M70 |
| PROM90 | D | C | 600 | -64dBV | £49.95 | — |
| SME900 | E | O | 600 | -70dBV | £27.50 | Stereo mic |
| CO-96 | E | O | 600 | -62dBV | £27.95 | 'Pencil' mic |

All output values are in units of dBV/Pa (±3dBV).

ELECTRO-VOICE (USA)

Electro-Voice Inc., 600 Cecil Street, Buchanan, Michigan 49107, USA.

Phone: (616) 695-6831.

Canada: Electro-Voice Division of Gulton Industries (Canada) Ltd, 345 Herbert Street, Gananoque, Ontario.

Europe: Electro-Voice SA, Romerstrasse 49, 2560 Nidau, Switzerland.

UK: Electro-Voice Division, Gulton Europe Ltd, Maple Works, Old Shoreham Road, Hove BN3 7EY.

Phone: 0273 778401. **Telex:** 87680.

| | | | | | | |
|-------|---|----|---------|-------|---------|-------------------------------|
| RE10 | D | SC | 150 | -56dB | £90 | Bass tilt switch |
| RE11 | D | SC | 150 | -56dB | £99 | Bass tilt switch |
| RE15 | D | SC | 150 | -56dB | £150 | Bass tilt switch |
| RE16 | D | SC | 150 | -56dB | £156.25 | Bass tilt switch |
| RE18 | D | SC | 150 | -57dB | | Bass tilt switch, shock mount |
| RE20 | D | C | Several | -57dB | £258 | Shock mounting |
| 627C | D | C | Lo/Hi | -58dB | £46 | Bass emphasis |
| 631B | D | O | Lo/Hi | -56dB | £41.88 | — |
| 635A | D | O | 150 | -55dB | £51.56 | Shock proof |
| 660 | D | SC | Lo/Hi | -56dB | £57 | Close use |
| 671A | D | C | Lo/Hi | -57dB | £54 | General purpose |
| DO54 | D | O | 150 | -58dB | £69.69 | Boom or stand |
| DO56 | D | O | 150 | -61dB | | Shock isolated |
| DS35 | D | C | 150 | -60dB | £68 | Blast filter |
| RE50 | D | O | 150 | -55dB | £82.63 | Noise-free |
| RE55 | D | O | 150 | -57dB | £132.81 | 40-20kHz |
| 1724 | E | C | 150 | -68dB | £28 | Lavalier |
| 1776 | E | C | 150 | -50dB | £74 | Blast filter |
| 1777 | E | C | 150 | -54dB | £85 | Close use |
| CS15P | E | C | 150 | -45dB | £172 | 40-18kHz |
| CO90 | E | O | 150 | -57dB | £78 | Lavalier mic |
| CO85 | E | O | 150 | -56dB | £110 | Mini mic |
| RE85 | D | O | 50/250 | -61dB | £81.25 | Lavalier mic |
| RE51 | D | O | 50/250 | -54dB | £98.44 | Headset |
| 644 | D | C | Lo/Hi | -53dB | £105.63 | Gun mic |
| DL42 | D | C | 150 | -50dB | £287.50 | Gun mic |
| CL42S | E | C | 250 | -33dB | £390 | System C |
| CH15S | E | HC | 150 | -40dB | £300 | System C |

More Than Great Specs, Great Ideas.

For the past three years we've been telling you about the benefits of using graphic equalizers; now we've made it even easier to appreciate them. Introducing the MXR Dual Fifteen and Thirty-One Band Equalizers. Two equalizers designed with the imagination and understanding to solve your toughest equalization problems. Designed for use in either studios or sound reinforcement situations, our new eqs offer features not previously available at any price.

The Dual Fifteen Band Eq features two channels of equalization with the bands set two-thirds of an octave apart. By breaking the frequencies down further than conventional octave equalizers, you now have the flexibility to contour your music with much greater selectivity. As most musical information occurs in the midrange, this is where you need even more definition, and the Dual Fifteen Band Eq gives you six bands of contour in this area rather than the usual four. In addition, each channel has its own level control.

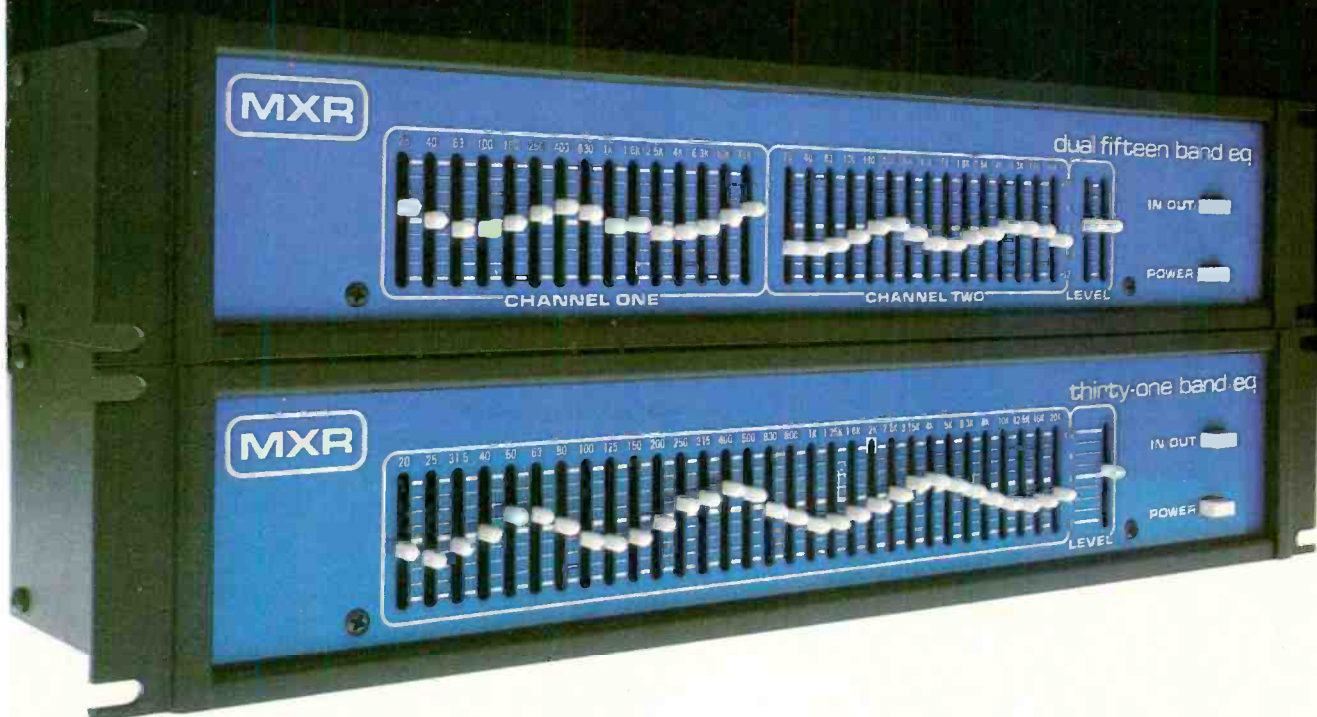
The Thirty-One Band Eq divides the frequency spectrum even further. A single channel unit, the Thirty-One Band features frequency bands set one-third of an octave apart, generally regarded to be the optimum amount of resolution.

When used in conjunction with any PA system, our equalizers can make a bad environment sound good, and a good performance sound great. Unlike parametric equalizers, the frequency response change is immediate and easily visible, so that when you shape a response curve you know what it's going to sound like.

Both units feature a range of -12 to $+12$ decibels on each band, standard 19" rack mount, and the rugged construction you always get with an MXR product. Both units also feature phone plug input/output connections, (the Thirty-One Band also features Cannon type XLRs), high slew rate (7V/microsecond), and incredibly low noise (better than -90 dBM). But not only do we offer great specifications, we produce great ideas... you wouldn't expect any less from us.

Atlantex Music Ltd., 16 High Street,
Graveley, Herts., England, (0438) 50113

MXR Professional
Products Group



SURVEY: MICROPHONES

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

EPM S1000
electronic parabolic mic



EPM (Canada)

RD Systems of Canada Ltd, 1131 Sandhurst Circle, Unit 61, Agincourt, Ontario M1V 1V4, Canada.

Phone: (416) 292-0953.

UK: John Page Ltd, Wesley House, 75 Wesley Avenue, London NW10.

Phone: 01-961 4181. Telex: 24224 ref 568.

P650 A parabolic microphone with a clear plastic reflector, built-in equaliser, pre-amp and speech/music switch. Also provided is a headphone output for onsite monitoring. Power from two 9V batteries. Price \$299.

S1000 Similar to **P650** but with twin microphone capsules side-by-side for stereo pickup. Price \$459.

P200 Non-electronic version of **P650**, \$169.50.

S300 Non-electronic version of **S1000**, \$250.

These EPM parabolic microphones were developed in conjunction with Dan Gibson.

MELODIUM (France)

UK: Amdio Ltd, 26-28 Reading Road South, Fleet, Nr Aldershot, Hants.

Phone: 02514 20567. Telex: 858606.

| | | | | | | |
|-------|---|---|---------|---|--------|--------------------------|
| C133 | D | C | 10/200 | — | £49.84 | General purpose, DIN/XLR |
| M110D | D | C | — | — | £21.86 | PA, on/off switch |
| M121E | E | C | 600 | — | £49.28 | On/off switch |
| MO97D | D | C | 200 | — | £64.30 | On/off switch, DIN/XLR |
| 79A | D | O | 200/50k | — | £35.50 | Lavalier |

NEUMANN (West Germany)

George Neumann GmbH, Berlin 61, Charlottenstrasse 3, West Germany. D-1000.

Phone: 251 4091. Telex: 184595.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts. WD6 4RZ.

Phone: 01-953 0091. Telex: 27502.

USA: Gotham Audio Corp, 741 Washington Street, New York NY10014.

Phone: (212) 741-7411. Telex: 129269.

| | | | | | | |
|----------|---|----|-----|---------|---------|-----------------------------|
| KRM82MT1 | C | HC | 150 | 21mV/Pa | £277 | Shotgun |
| KM83L | C | O | 200 | -131dBm | £152.33 | 10dB cut |
| KM84I | C | C | 200 | -131dBm | £162.52 | 10dB cut |
| KMS84I | C | C | 200 | -131dBm | £294 | Pale finish |
| KMS84IMT | C | C | 200 | -131dBm | £294 | Dark finish |
| SRM84I | C | C | 200 | -131dBm | £413 | |
| KM85I | C | C | 200 | -133dBm | £166.04 | Bass roll-off |
| KM86I | C | VS | 200 | -133dBm | £309 | Switchable responses |
| U87I | C | VS | 200 | -133dBm | £321 | Switchable responses |
| KM88I | C | VS | 200 | -133dBm | £323 | Switchable responses |
| V89 | C | VS | 200 | 8mV/Pa | £380 | Switchable responses |
| U47FET1 | C | C | 150 | -133dBm | £308 | Bass roll-off |
| SM69FET | C | VS | 150 | -125dBm | £710 | Stereo |
| USM69 | C | VS | 150 | 10mV/Pa | £893 | Stereo, local switchability |
| QM69 | C | VS | 150 | -125dBm | £914 | Quad |
| KMA | C | O | 800 | 5mV/Pa | £145.15 | Lavalier |

KU801 Dummy head system comprising two **KM83** mics for binaural recording, complete £1,157.

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

KEITH MONKS (UK)

Keith Monks (Audio) Ltd, 26-28 Reading Road South, Fleet, Hampshire, UK.

Phone: 0251 20568. Telex: 858606.

C133D D O 200 —71dB £49.84 Hand or stand

C133K As C133D with on/off switch. £54.40

C133SU As C133K with XLR connector. £63.65

The **C133SU** is also available in a 30Ω version (—83dB output).

MO97D D O 200 —55dB £64.30 DIN & switch

Output values are referenced to 0dBm = 1mW/10µB.

PASO (Italy)

UK: Amdio Ltd, 26-28 Reading Road South, Fleet, Nr Aldershot, Hants.

Phone: 02514 20567. Telex: 858606.

M8 D C 200 — £37.15 PA, speech/music, lo cut

M103 D C 200 — £21 Elastic suspension

M300 D C 200 — £78.53 Pop shield

PEARL/PML (Sweden)

AB Pearl Mikrofonlaboratorium, Knutsgaten 6, S-265 00 Astorp, Sweden. Phone: 04251520.

UK: Allotrope Ltd, 36/38 Lexington Street, London W1R 3HR.

Phone: 01-437 1892. Telex: 21624.

USA: Cara International Ltd, 4145 Via Marina, 120 Marina del Rey, Cal. 90291.

Phone: (213) 821-7898.

| | | | | | | |
|---------|---------|----|-----------------|---------|---|---------------|
| D44 | D | SC | 200 | 2.8 | — | Hand held |
| LD18 | D | O | 200 | 2.0 | — | Robust |
| HM47 | D | O | 200 | 1.5 | — | Lavalier mic |
| HM49 | D | O | 200 | 2.0 | — | Robust |
| RD16 | D | C | 200 | 2.0 | — | Light-weight |
| RD34 | As RD16 | | | | | — |
| RD36 | As RD34 | | | | | — |
| RD34S | As RD34 | | | | | — |
| F67 | D | C | 200 | 2.0 | — | On/off switch |
| F69 | D | C | 200 | 2.0 | — | Anti-feedback |
| DC20 | C | O | 200 | 5.0 | — | Mini mic |
| DC21 | C | C | 200 | 6.3 | — | As DC20 |
| DC63 | C | VS | 200 | 2.5-4.0 | — | See below* |
| DC73 | C | C | 200 | 5.0 | — | Bass cut |
| DC73/12 | As DC73 | | | | | — |
| DC96 | C | C | 200 | 6.3 | — | 180° capture |
| DC96/12 | As DC96 | | | | | — |
| FP92CO | C | C | Lo/Hi-212.6/126 | — | — | 15V battery |
| FP92KO | C | O | Lo/Hi-28.0/80 | — | — | As FP92CO |
| SP84 | C | O | 200 | 8.0 | — | Variable eq |
| SP85 | As SP84 | | | | | — |
| ST8 | C | VS | 200 | 5.0 | — | Two capsules |
| TC4V | C | V | 200 | 10.0 | — | +120V power |
| VM40 | C | O | 200 | 4.0-8.0 | — | SYMSI 48/12 |

Range of Neumann mics





“The original A77 had set a standard by which I have judged other domestic and semi-professional recorders for many years. It is now clear that the new B77 sets a new standard not easily surpassed at its price”
Angus McKenzie (March 1978)

REVOX

For the full story contact F.W.O. Bauch Ltd, 40 Theobalds Rd, Boreham Wood, Herts, WD6 1PZ

SURVEY: MICROPHONES

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|

Pearl cont'd

| | | | | | | |
|-------|------------------------------|----|-----|-----|--|--------------|
| VM41 | As VM40 with cardioid. | | | | | — |
| 4030 | C | SC | 200 | 4.0 | | Shotgun mic |
| CL4AD | E | O | 200 | 6.3 | | Lavalier mic |
| CL4BD | As CL4AD with self-powering. | | | | | 15V battery |
| PB35 | E | O | 200 | 6.3 | | 15V battery |

Capacitor mics are powered by SYMSI 48: +48V (±6V) unless stated otherwise. (SYMSI 12: +10 to +48V).
 *Model DC63 is fitted with two ring switches and a 5-position attenuator, giving 44 possible combinations of output/polar response.

PEAVEY (USA)

Peavey Electronics Corp, Box 2898, Meridian, Miss 39301, USA.
UK: Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX.
 Phone: 0825 5566. Telex: 957098.

| | | | | | | |
|-----|---|---|-----|-------|--------------|--------|
| PBL | D | O | 250 | -52dB | £62/\$113.50 | PA mic |
| PBH | D | O | 50k | -52dB | £62/\$113.50 | PA mic |

PHILIPS

NV Philips Gloeilampenfabrieken, Electroacoustics Division, Eindhoven, The Netherlands.
Phone: 040 78616.
UK: Pye Business Communications Ltd, Cromwell Road, Cambridge CB1 3HE.
 Phone: 0223 45191. Telex: 81547.
USA: Philips Audio Video Systems Corp, Audio Division, 91 McKee Drive, Mahwah, NJ 07430.
 Phone: (201) 529-3800. Telex: 138022.

| | | | | | | |
|------------|---|----|-----|--|--------|-------------------|
| LBB9003/05 | D | O | 200 | | £39.50 | Lavalier |
| LBB9020/35 | D | C | 200 | | £68 | GP |
| LBB9020/45 | D | C | 200 | | £75 | Switch |
| LBB9031/05 | D | C | 200 | | £47.50 | Gooseneck |
| LBB9100 | D | C | 200 | | £77.50 | Low sensitivity |
| LBB9032/05 | D | C | 200 | | £49.50 | Switch, gooseneck |
| LBB9033/05 | D | C | 200 | | £45 | Gooseneck |
| LBB9018/07 | D | SC | 200 | | £48 | |

RESLO (UK)

Resolound Ltd, Eagle Road, Rye, Sussex TN31 7NB
Phone: 07973 3959. Telex: 95447.

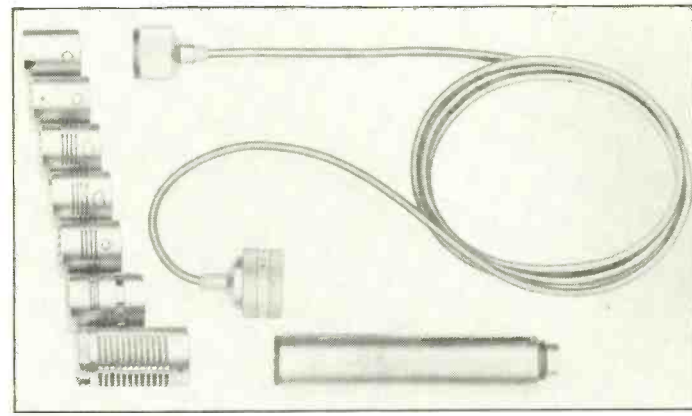
| | | | | | | |
|-------|---|----|-----|-------|--------|--------------|
| MPD | D | O | 30 | -88dB | £21.30 | Pencil-type |
| RGP71 | D | SC | 200 | -82dB | £34.78 | 20dB f-to-b |
| S91M | E | V | V | -52dB | £43.99 | 4.5V battery |
| S80 | D | C | 200 | -58dB | £47.40 | 40-20kHz |
| UD1 | D | SC | V | -58dB | £27.57 | 'Pop' filter |
| UD3 | D | SC | V | -58dB | £32.58 | UD1 capsule |

SCHOEPS (West Germany)

Schalltechnik Dr-Ing Karl Schoeps, 75 Karlsruhe 41, Spitalstrasse 20, Postfach 410970, West Germany.
Phone: 0721 42016/42011.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
 Phone: 01-734 2812. Telex: 27939.
USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tenn 37203.
 The CMC series of complete capacitor mic comprise a pre-amplifier module connected directly, or via an 'active' cable, to an interchangeable capsule. The mics listed below utilise the CMC5 pre-amps (48V phantom powering); the CMC3 operates from 12V phantom and the CMC4 from 12V 'parallel' powering. The type number of the complete mic is composed of the pre-amp model plus capsule (eg CMC56 = CMC5 + MK6 capsule).

| | | | | | | |
|----------|--------|----|-----|---------|------|----------------|
| CMC52U | C | O | 40 | 1.2 | £230 | Flat response |
| CMC53U | C | O | 40 | 1.0 | £230 | Hf boost |
| CMC54U | C | C | 40 | 1.2 | £240 | — |
| CMC540U | C | C | 40 | 1.6 | £245 | Close use |
| CMC541 | C | HC | 40 | 1.3 | £255 | — |
| CMC55U | C | VS | 40 | various | £300 | Two patterns |
| CMC56U | C | VS | 40 | various | £370 | Three patterns |
| CMTS501U | stereo | VS | 200 | various | £695 | — |

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|-----------------|----------------|-----------|--------|-------|---------|
|-------|-----------------|----------------|-----------|--------|-------|---------|



Schoeps CMC series

A stereophonic capacitor mic with cardioid, bi- and omnidirectional patterns on each capsule. The capsules are mounted one above the other, and can be rotated through 360°. 48V centre-point powering. (CMTS301 identical with 12V powering.)

| | | | | | | |
|--------|--------|---|----|-----|------|---|
| MTSC54 | stereo | C | 40 | 1.3 | £500 | — |
|--------|--------|---|----|-----|------|---|

A stereo (110° ORTF-principle) twin-capacitor mic with two MK4 capsules mounted at either end of a T-bar. Axial separation is 170mm. Pre-amplifier module is 48V phantom powered; other modules for 12V powering are also available.

| | | | | | | |
|--------|---|---|----|-----|------|--------------|
| CMH52C | C | O | 40 | 1.0 | £364 | 'Pop' filter |
| CMH54C | C | C | 40 | 1.2 | £364 | 'Pop' filter |

All output figures are in units of mV/μR.

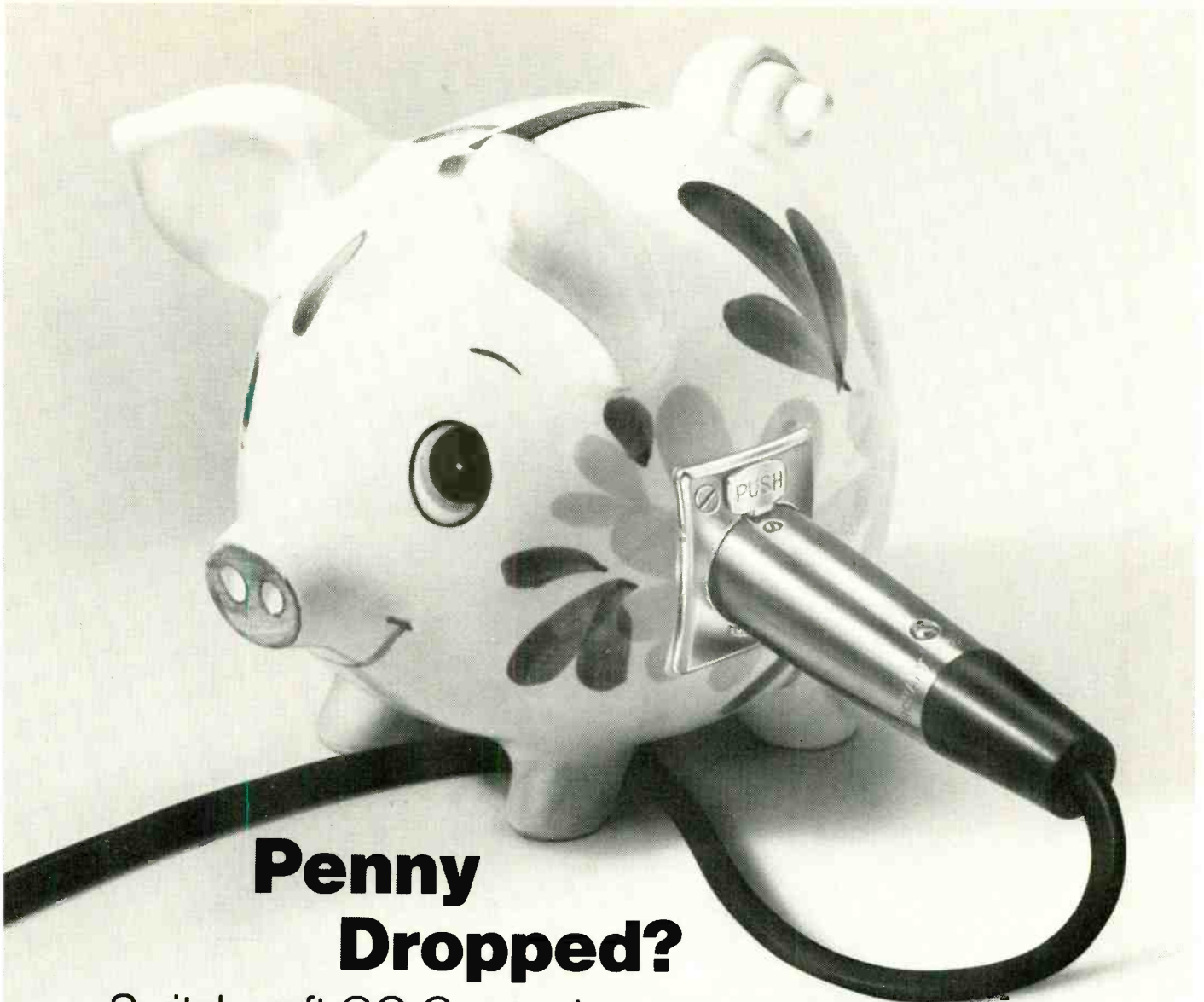
SENNHEISER (West Germany)

Sennheiser Electronic, 3002 Bissendorf, Hannover, West Germany.
Phone: 05130 8011.
UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.
 Phone: 02813 88447. Telex: 849469.
USA: Sennheiser Electronic Corp (NY), 10 West 37th Street, New York, NY 10018.
 Phone: (212) 239-0190. Telex: 421608.

| | | | | | | |
|------------|---|----|-----|-------|--------|--------------------|
| MD211 | D | O | 200 | 0.13 | £68.10 | Flat response |
| MD214 | D | O | 200 | 0.10 | £62.70 | Lavalier mic |
| MD408 | D | SC | 200 | 0.13 | £35 | Integral gooseneck |
| Profipower | D | SC | 200 | -55dB | £73.60 | Musicians mic |
| MD416 | D | C | 200 | 0.13 | £57 | Hand held |
| MD418 | D | SC | 50 | 0.13 | £37.40 | Integral gooseneck |
| MD421 | D | C | 200 | 0.20 | £58.50 | Switched base eq |

Sennheiser MD421





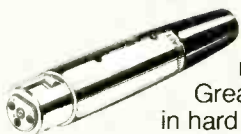
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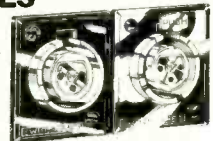


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49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ
Telephone 01-953 0091, Telex 27502

SURVEY: MICROPHONES

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|--------------------------|-----------------|----------------|-----------|--------|--------|--------------|
| Sennheiser cont'd | | | | | | |
| MD430-2 | D | SC | 200 | 0.18 | £35 | Close use |
| MD441 | D | C | 200 | 0.20 | £87 | Shockmount |
| MKE10 | E | O | 4k7 | 1.00 | £31.80 | Minilavalier |
| MKE883 | E | HC | 200 | | £70.60 | |
| MKE803 | E | SC | 200 | 0.50 | £59.60 | |
| MKE403 | E | C | 200 | 0.30 | £50.40 | |
| MKE203 | E | O | 200 | 0.30 | £43.90 | |

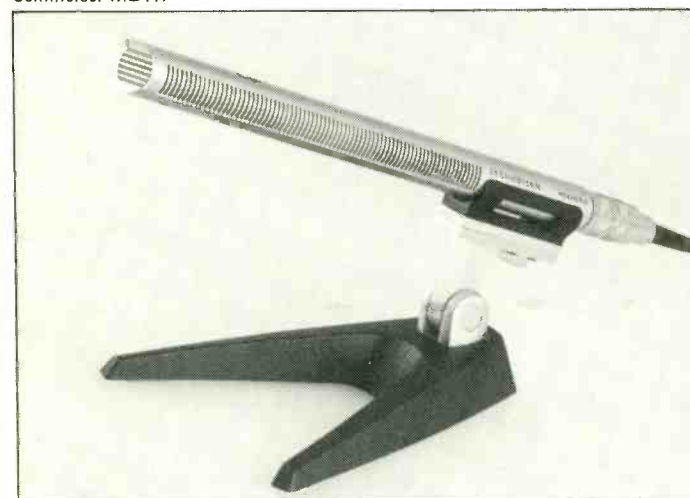
The MKE883/803/403/203 mics use a common powering module with interchangeable capsules which are also available separately at £43.20, £32.20, £23 and £16.50 respectively, powering module £27.40.

| | | | | | | |
|-----------|---|----|-----|------|---------|-----------------|
| MKE2002 | E | O | 1k5 | 1.00 | £92.30 | Dummy head pair |
| MKH105 | C | O | 200 | 2.00 | £138 | 12V a-b |
| MKH125 | C | O | 200 | 0.32 | £193.30 | Lavalier mic* |
| MKH126P48 | C | O | 200 | 2.00 | £193.30 | As MKH125 |
| MKH406P48 | C | C | 200 | 2.00 | £161.80 | 48V phantom |
| MKH406 | C | C | 200 | 2.00 | £161.80 | 12V a-b |
| MKH416P48 | C | SC | 200 | 2.50 | £169.30 | 48V phantom |
| MKH416 | C | SC | 200 | 2.00 | £169.30 | 12V a-b |
| MKH816P48 | C | HC | 200 | 4.00 | £227.80 | 48V phantom |
| MKH816 | C | HC | 200 | 4.00 | £227.80 | 12V a-b |

Output figures are in units of mV/μB.

*MKH125 and MKH126P48 share a common capsule (MK12) with different power unit. The former is 12V a-b powered, while the latter is designed for 48V phantom supplies.

Sennheiser MD441



SESCOM (USA)

Sescom Inc, 1111 Las Vegas Blvd, North Las Vegas, Nevada, 89101, USA.
Phone: (702) 384-0993.

UK: Atlantex Music Ltd, 16 High Street, Graveley, Herts.

Phone: 0438 50113.

| | | | | | | |
|-------|---|---|-----|-------|--|---------------|
| MC325 | E | O | 200 | -55dB | | Tie-clip mic |
| MC326 | A | 4-48V phantom-powered version of MC325. | | | | |
| MC340 | E | O | 200 | -55dB | | Stand or hand |
| MC341 | A | 4-48V phantom-powered version of MC340. | | | | |
| MC350 | E | C | 200 | -55dB | | Stand or hand |
| MC351 | A | 4-48V phantom-powered version of MC350. | | | | |

SHURE (USA)

Shure Brothers Inc, 22 Hartrey Avenue, Evanston, ILL 60204, USA.
Phone: (312) 866-2200.

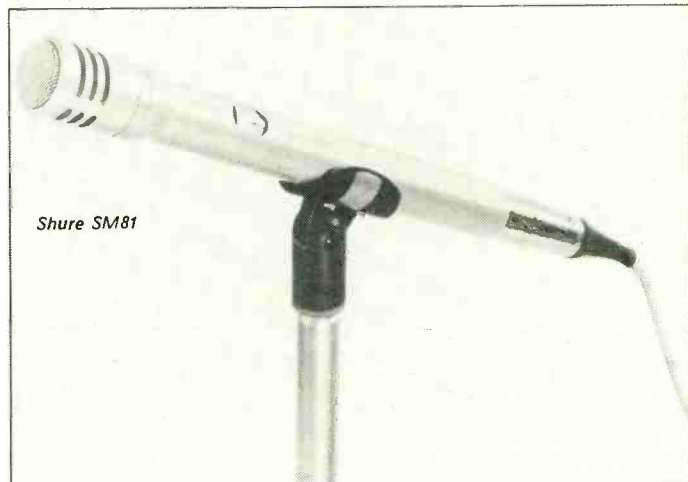
UK: Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU.

Phone: 0622 59881. Telex: 96121.

| | | | | | | |
|------|----------------------------------|----|--------|---------|---------|-------------------------|
| SM7 | D | C | 150 | -79dB | £217.80 | Bass presence |
| SM10 | D | C | 200 | -87dB | £57 | Headset mounted |
| SM12 | As SM10 with built-in ear piece. | | | | £76.20 | — |
| SM11 | D | O | 200 | -85dB | £47.80 | Lavalier mic |
| SM17 | D | O | 200 | -85dB | £45.60 | Mounting for guitar etc |
| SM33 | R | HC | 38/150 | -76.5dB | £142.20 | Bass switch |
| SM53 | D | C | 150 | -81dB | £145.20 | Wide range |

| Model | Transducer type | Polar response | Impedance | Output | Price | Remarks |
|-------|----------------------------|----------------|-----------|--------|---------|---------------------------|
| SM54 | As SM53 with 'pop' filter. | | | | £154.20 | — |
| SM57 | D | SC | 38/150 | -82dB | £70.80 | Presence boost |
| SM58 | As SM57 with 'pop' filter. | | | | £90.60 | — |
| SM59 | D | C | 150 | -83dB | £94.20 | — |
| SM61 | D | O | 150 | -82dB | £63 | 'Pop' filter |
| SM62 | D | C | 150 | -82dB | £72 | 'Pop' filter |
| SM81 | E | C | 150 | -64dB | £146.40 | 10dB atten, switchable LC |
| SM82 | C | C | 260 | -19dB | £139.80 | Line amps & limiter |

All output figures are referenced to 0dB = 1V/μB, open-circuit.



SONY (Japan)

Sony Corporation, PO Box 10, Tokyo Airport, Tokyo, Japan.

Phone: 448 221.

UK: Sony (UK) Ltd, 134 Regent Street, London, W1R 6DJ.

Phone: 01-434 1716. Telex: 264149.

USA: Sony Corporation of America, 9 West 54th Street, New York, NY 10019.

Phone: (212) 371-5800.

| | | | | | | |
|---------|---|----|-----|--------|------|-------------------------|
| C37P | C | VS | 250 | -70dBm | £250 | Broadcast quality |
| C38B | C | VS | 250 | -68dBm | £250 | Instrumental |
| C47B | C | VS | 50 | -70dBm | £560 | Top of range |
| C55P | C | C | 250 | -70dBm | £215 | Ideal vocal |
| ECM50PS | E | O | 250 | -76dBm | £120 | Lavalier |
| ECM30 | E | O | 250 | -70dBm | £59 | Lavalier |
| ECM56F | E | C | 250 | -74dBm | £120 | Back electret condenser |

SUPERSCOPE (USA)

Superscope Inc, 20525 Nordhoff Street, Shatsworth, Ca 91311, USA.

Phone: (213) 998 9333/873 2000.

Europe: Superscope Europe SA, Avenue Loise 430, BP4 Brussels, Belgium.

Phone: 649 9483. Telex: 26602.

| | | | | | | |
|-------|---|---|-------|-------|-----|-------------------|
| EC1 | E | O | 'low' | -52dB | poa | — |
| EC3 | E | C | 'low' | -52dB | poa | — |
| EC5 | E | C | 'low' | -52dB | poa | — |
| EC9P | E | C | 250 | -56dB | poa | Low-cut filter |
| EC12B | E | O | 250 | -52dB | poa | Tie-clasp or boom |
| EC15P | E | O | 250 | -52dB | poa | Mini-tie-clasp |
| EC33S | E | C | 'low' | -46dB | poa | Coincident stereo |

Output figures are referenced to 0dB = 1V/10μB at 1kHz.

TECHNICS (Japan)

Matsushita Electric Trading Co Ltd, PO Box 288, Osaka Central, Japan.

Phone: Osaka 204 5111.

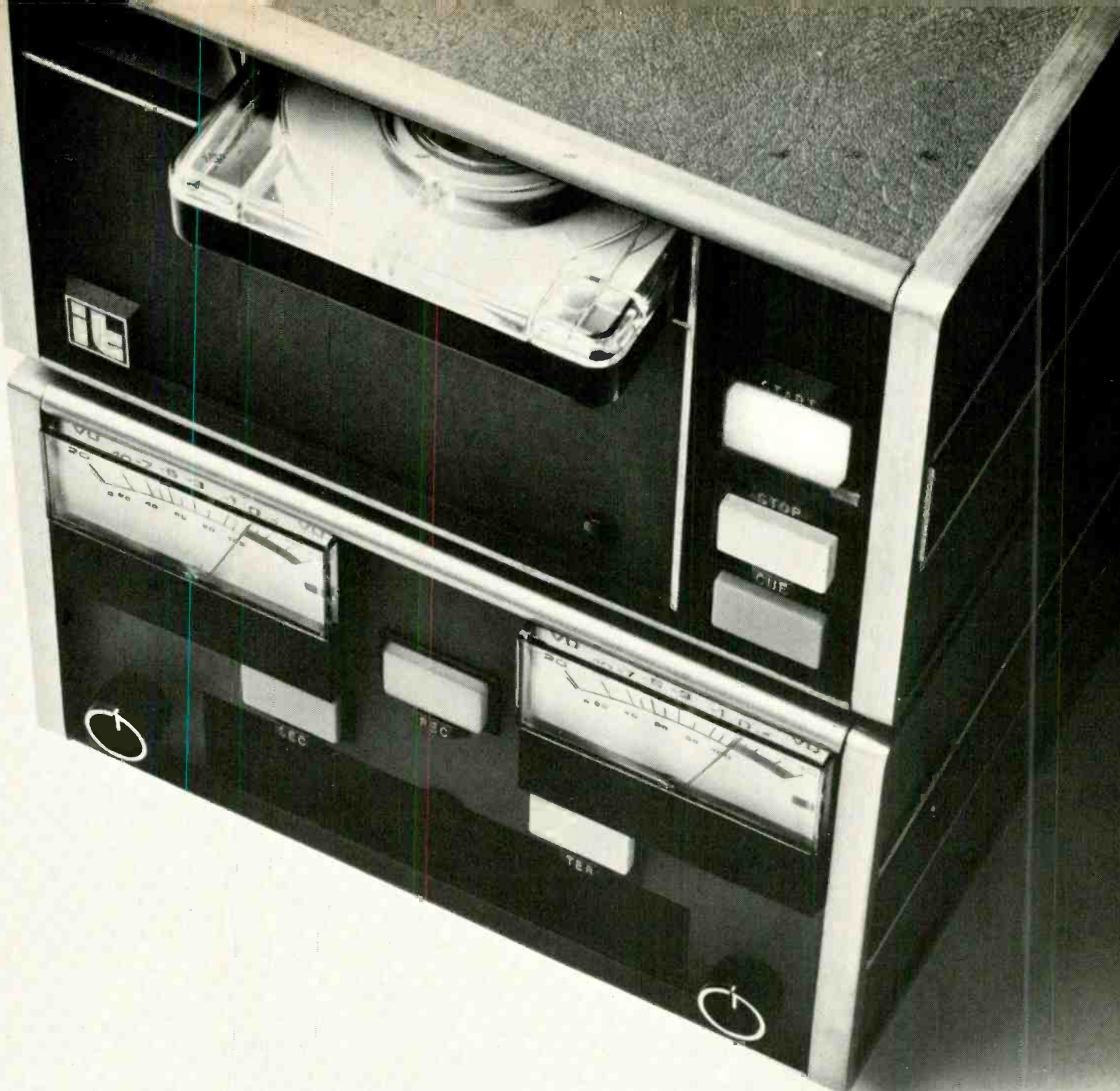
UK: Technics, 107-109 Whitby Road, Slough, Berks SL1 3DR.

Phone: 0753 34522. Telex: 848761.

USA: Panasonic Co. Technics Dept, One Panasonic Way, Secaucus, NJ 07094.

| | | | | | | |
|---|---|----|-----|-------|---|----------------|
| RP3850E | E | SC | 600 | -72dB | — | Low-cut filter |
| Also incorporated is a 10dB pad network enabling use with SPLs up to 128dB. | | | | | | |
| RP3200 | E | C | 600 | -72dB | — | — |

A coincident stereo mic designed primarily for radio reporting.



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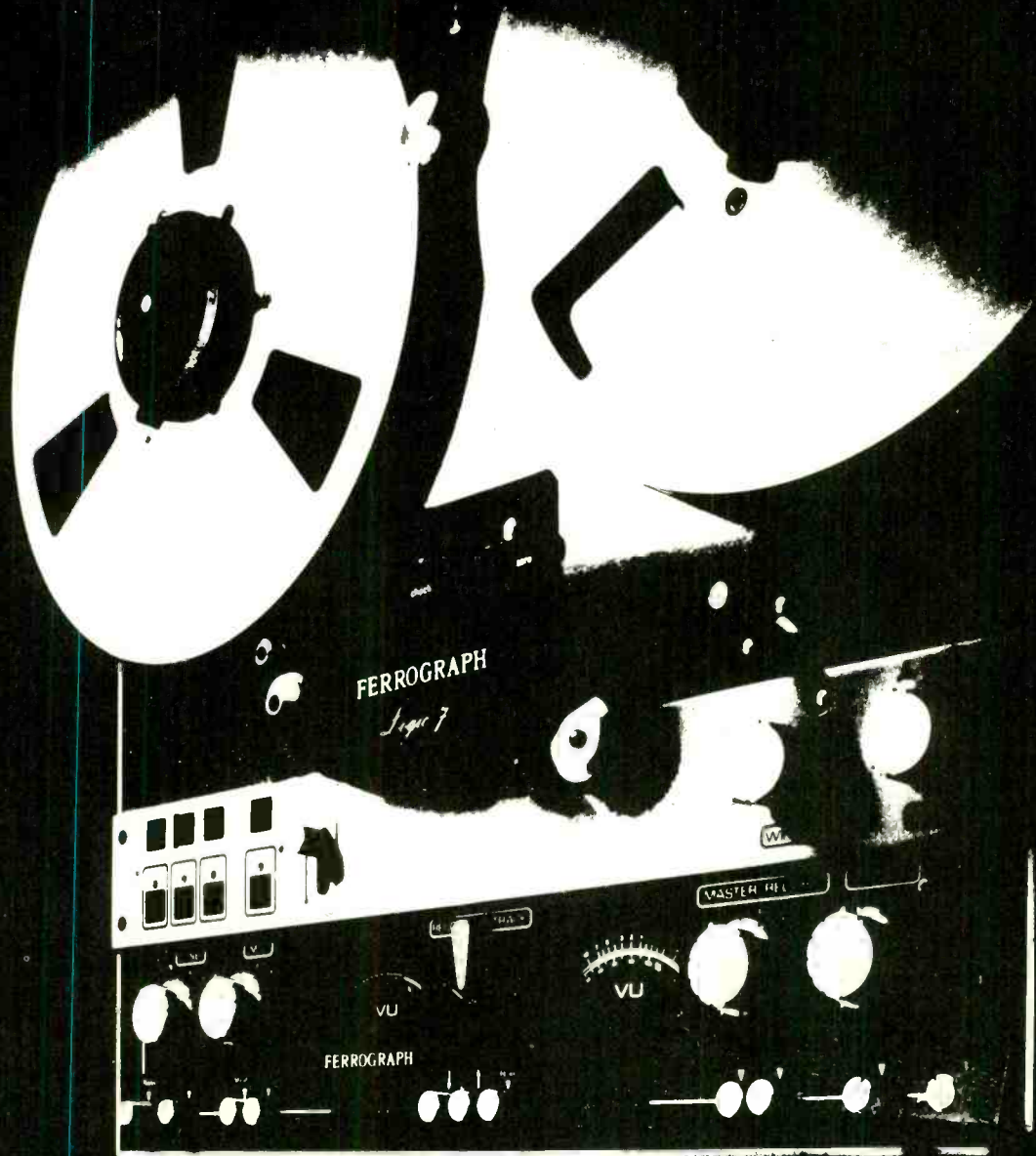
AES 63rd Convention, Los Angeles-a preview

The 63rd Convention of the Audio Engineering Society will be held from May 15 - 18 at the Los Angeles Hilton Hotel. Well over 150 manufacturers will be showing a wide range of products.

LIST OF EXHIBITORS

| | | | | | |
|---|--------------------------|---|--------------------------|---|-----------------|
| AB Systems Design | B18 | Eastern Acoustic Works | R569 | Polydax Speaker | R580 |
| Accurate Sound | B100, 101 | Eddor | R467 | Publison-Audio Professional | BH-6A |
| Acoustic Design | B55B | Electro Sound | Longhorn Suite | Quad/Eight | B27, 28 |
| Acoustilog | B109 | Electro-Voice | New York Room | Quantum Audio Labs | B110, 111 |
| Audio Concepts | B49, 49A | El-Tech | B106 | Raindirk | R662 |
| Audio Development Int | B114 | Emilar | BH-1, Dallas Room | Rauland-Borg | Cleveland Room |
| Agfa-Gevaert | B31 | Eventide Clockworks | B33 | Jonas A Renkus | B49 |
| AKG Acoustics | B81, 81A | Everything Audio | B6, 7 | Roland Corp | R671 |
| Allen & Heath/Brenell | R574 | EXR | R644 | Roundhouse Recording Studios | R481 |
| Allison Research | B56, 57 | Ferrofluidics | R584 | Rupert Neve | Assembly Room |
| Altec Lansing | Mission Room | Formula Sound | R460 | SAE Professional Products Group | East |
| Amber Electro Design | B26 | Furman Sound | B101A | Sagamore Publishing | B66 |
| Ampex Corporation | B14-14D, Madrid Suite | Future Film | R577 | Sansui | R475, 477 |
| Anvil Cases | R584, 582 | GLI Integrated Systems | R605 | Scully Recording Instruments | B2, 3 |
| Aphex Systems | B115, R482, 484 | Genrad | BLA-7 | Selco Products | BLA-5, LA-6 |
| Ashly Audio | BH-3 | Gotham Audio | B20-23 | Sennheiser | R429 |
| Association for Sound & Communication | BH-5 | Gramplan Reproducers | R581 | Sescom | B63, 63A |
| Audico | B119 | Hammond Industries | R573 | Shape Symmetry & Sun | R580 |
| Audio Arts | R575 | Harrison Systems | BH-10 | Shure Brothers | B36, 37 |
| Audio & Design | B123 | Heino Ilsemann | B71 | Sierra Audio | B46 |
| Audio Industries | B86, 87 | HM Electronics | R568 | Solid State Logic | B112, 113 |
| Audio Kinetics | R673 | Infonics | Malaga Suite | Sony | Houston Suite |
| Audio/Tek | R469 | Inovonics | B54 | Sontec Electronics | B19 |
| Auditronics | B38, 39 | Interface Electronics | B95 | Soundcraft Electronics | B69, 70 |
| Automated Processes | B104/105 | International Audio | B64 | Sound Spectrum | BLA-9, LA-10 |
| Bang & Olufsen, USA | BH-2 | ITAM | R669 | Soundstream | R627, 629 |
| Barclay Analytical | B72 | Ivie | B88, 89 | Sound Technology | B53 |
| BASF | R497, 499 | James B. Lansing Sound | St. Louis & Foy Rooms | Sound Workshop | Yosemite Suite |
| BGW Systems | B16, 17 | KEF | R668 | Spectra Sonics | B55, 55A |
| Blamp Systems | R619, 621 | The Kind Horn Co | R675 | Spectra Sound Products | R471 |
| B & K Instruments | B73, 74 | Klark-Teknik | R571 | Stanton Magnetics | B59, 60 |
| Bombadilla Cases | B117, 118 | Klipsch & Associates | Pecos Suite | Stephens Electronics | B79, 80 |
| Bose | R468 | Lexicon | Muir Suite | Straita Head Sound | B4 |
| BTX | B124-126 | David Lint Associates | B65 | Studer Revox America | B77, 78, R562 |
| California Switch & Signal | B96 | Loft Modular Devices | R524 | Swintek Enterprises | B67 |
| Calrec Audio | R465 | Magnifax | B122 | Synergetic Audio Concepts | B58 |
| Capitol Magnetic Products | B93 | Magnetic Tape | B127, 128 | Taber Manufacturing & Engineering | B15 |
| Certron | BLA-4 | Marshall Electronics | B94 | Tangent Systems | B98, 99 |
| Cerwin-Vega | Patio Room | McCauley Sound | R563 | Tannoy-Ortofon | R612, 616 |
| Cetec Audio | B47, 48 and Detroit Room | MCI | B83-85 and Assembly Room | Teac | Boston Room |
| Cetec Vega | BLA-2 | MICMIX | B107 | Technical Audio Devices | Majorca Suite |
| Clear-Com Intercom Systems | B68A | Midas Audio | B102, 103 | Technics | R474 |
| Coastal Speciality Tapes | R674 | Keith Monks Audio | BH-4 | Tentel | B32 |
| Coast Recording Equipment Supply | B90 | Motorola Communications Electronics | B100A | 3M Magnetic A/V | B11, 12 |
| Coherent Communications | R480 | MXR Innovations | B68 | 3M Mincom | B13, R527, 529 |
| Community Light & Sound | Dalhart Suite | Nagra Magnetic Recorders | BLA-11 | TOA Electronics | R597 |
| Crest Audio | R679 | Nasty Cordless | R463 | Trident Audio | B120, 121 |
| Crown International | B75, 76 | National Research Development Council | R663, 665 | Unicord | B108 |
| Cybersonics | B5, R461 | Neotek | B82 | Uni-Sync | R602, 603 |
| dbx | Assembly Room, West | Neutrik Products | R462 | United Recording Electronics | B24, 25 |
| DeltaLab Research | Yuda Suite | Northwest Sound | B97 | Ursa Major | B100B |
| Delta Telecommunications | R579 | Orange County Electronics | B62 | US Pioneer Electronics | Hartford Room |
| Diacoustic Lab | B92 | Orban Associates | B8-10 | Valley People | B61 |
| Diversified Concepts | BLA-12 | Otari | R479 | Victor of Japan (JVC) | Washington Room |
| Dolby Labs | B51, 52 | Peavey Electronics | B29, 30 | Westlake Audio | B34, 35, 40-42 |
| Duncan Electronics | B116 | Pentagon Industries | | White Instruments | B1 |
| | | | | Wireworks | BLA-1 |
| | | | | Yamaha | Buffalo Room |

NEAL FERROGRAPH

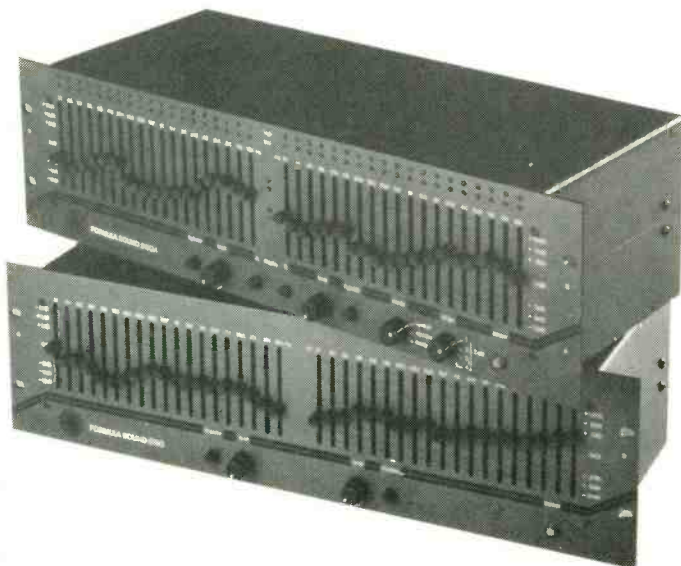


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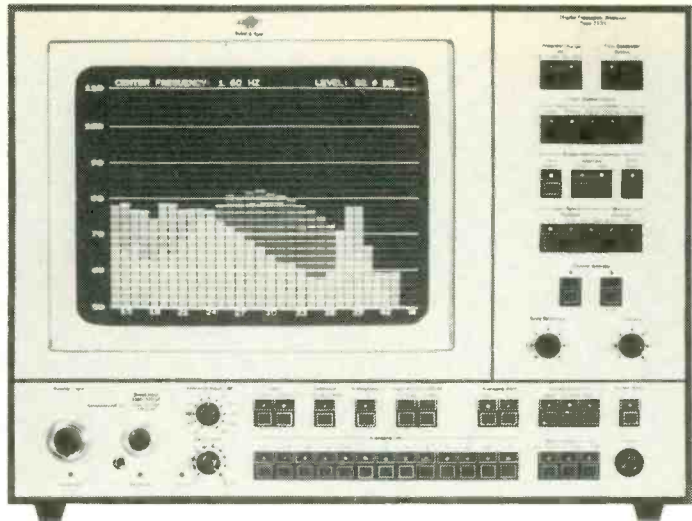
AES PREVIEW

Future Film Developments: portable noise reduction unit for location recording and in-line attenuators for use in mic lines, and mixer and recorder inputs. ●**AKG:** full range of products and introduction of *D-130* mic which features heavy duty shockproof construction and a field replaceable transducer. ●**Neutrik:** versatile *Audiotracer 3201*, *AD-4* analogue audio delay line and range of audio connectors and modular in-line components. ●**Sontec:** *Compudisc* retrofit control package for all Scully and Neumann lathes; *DRC-400* disc mastering limiter/compressor system, *DTC-400* tape-to-disc transfer console; *MES-430B*, *MEP-250A*, and *HF-230* equalisers; and *DRC-202* studio limiter/compressor system. ●**Micmix:** improved model of *Dynaflanger* with greater flanging depth and 'an unusual regenerative feedback mode'. And hopefully a new rack mount stereo reverb unit with 4-band eq. ●**Studer Revox:** *A80VU* 24-track machine with a new 20-address memory autolocating system and new audio channel remote control. Also *TLS 2000-800* sync/edit system using two *A800s*; *A80MR* 8-track master tape production recorder; *A80RC* quality control recorder/reproducer for cassette tape pancakes; *B67* and *Revox* range. ●**Otari:** new *MTR-90* 16/24-track mastering recorder which features a fully symmetrical tape path and pinch-roller-free direct-drive capstan controlled by a phase-locked closed-loop servo system. The recorder can provide full SMPTE sync; is easily convertible between 16 and 24 channels using plug-in pcbs; operates at 30 or 15 in/s; has an optional remote control unit offering selective reproduce on all channels and LED status indicators; and has an optional search-to-cue unit with a 10-memory capacity. ●**Sound Technology:** *Model 1710A*, *Model 1700B*, and *Model 1701A* distortion measurement systems with optional intermodulation distortion measurement and automatic set level capability. ●**Ampex:** *MM-1200* recorder/reproducer available in 8, 16 and 24-track versions; *ATR-100* recorder/reproducer; *ATR-700* recorder; and *AG-440C* series of recorder/reproducers. ●**Electro-Voice:** three new products—*DO56* omnidirectional dynamic mic for broadcast and sound reinforcement applications; *RE18* cardioid dynamic mic; and *313A* shock mount



Formula Sound S19G and S19GA

Briel & Kjaer Digital frequency analyser 2131



clamp. ●**Stephens Electronics:** *821B* range of multitrack recorder/reproducers which are capstanless and without pinchrollers. Also *Q-11* autolocator system. ●**Formula Sound:** *S19G* 2-channel 1/2-octave, 19-band graphic equaliser and *S19GA* equaliser/analyser which is the same as the above unit but with the addition of a 19-band analyser operating at the same band centres as the equaliser. *S19GA* features dual LED display, internal pink noise generator and mic pre-amp. **Formula Sound** staff will also be on hand to discuss its studio equipment custom building capability. ●**Briel & Kjaer:** *Type 6203* wow and flutter meter, which is now available with peak and rms switch selectable calibration; *Type 2031* narrow band spectrum analyser; and *Type 2131* digital frequency analyser. ●**MCI:** complete range of consoles including the *JH-600* series; *JH-32*, *JH-16* and *JH-110* series of tape recorders; *Autolocator III* micro-processor controlled autolocator; and *Autolock* SMPTE/EBU generator/reader/sync unit. ●**Ferrofluidics:** full information on the use of ferrofluids in loudspeaker voice coil gaps and staff on hand for consultation purposes. ●**Synergetic Audio Concepts:** information on SYN-AUD-CON sound engineering seminars. ●**Interface Electronics:** new 1979 line of mixing consoles which claim to have high slew rate,

lower noise levels, LED overload indicators and improved equalisers. Particular emphasis will be put on the latest version of stage monitor mixer and a new *Series 308* eight-submix console. ●**Jonas A Renkus:** range of high frequency exponential horns featuring closely spaced hf lobes, and giving improved horizontal and vertical dispersion characteristics. ●**dbx:** new range of compressor/limiters—*Model 163*; *Model 165*; and *Model 148*, a playback-only system for broadcast use. ●**Keith Monks (Audio):** complete range of mic stands, phase testers, impedance testers, mic splitter boxes, and cable drums. Also on display will be semi-professional record cleaning machine and *LSI-8* small monitor loudspeaker with built-in 10W amplifier. ●**Quantum Audio:** new range

80 ▶

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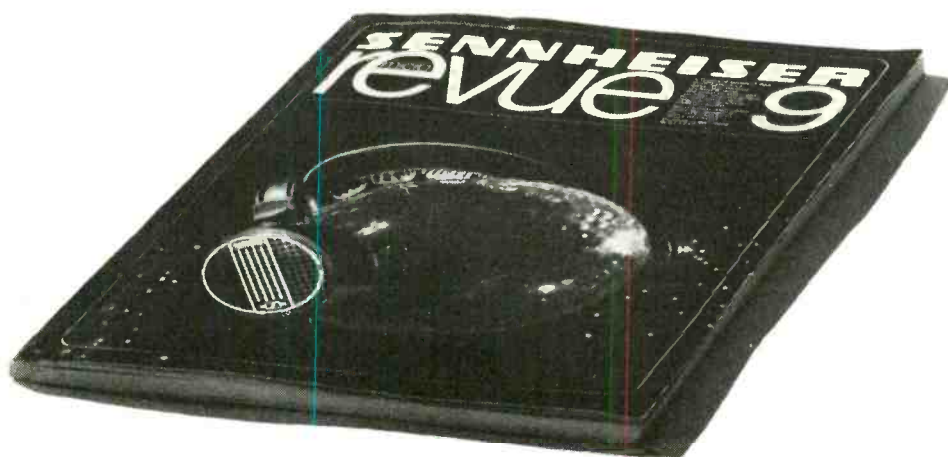
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SENNHEISER

profipower – the

musicians

microphone



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of broadcast production consoles designed for 4-track and stereo production rooms, and for television audio. Also on show, *QA-1010* console and consoles from the *QM* series.

● **Crest Audio:** a series of new high power amplifiers—*P-3500* rated at 250W per channel into 8 Ω , less than 0.05% THD; and *P-2500* rated at 150W per channel into 8 Ω . The units have LED VU meters, dual power supplies, mono bridging switches and thermal protection.

● **Furman Sound;** RV-1 spring reverberation

voice-over limiter; *E900* parametric sweep equaliser; *E500/560* band selectors; and the *F760X-RS* Compex limiter. ● **Allen and Heath:** the production version of *Syncon 28* module, in-line console; *Mod III* 8/16-track console; the new *SR20* series of sound reinforcement consoles; and *Modular 8* package system including the *Brenell Mini 8* 1-inch, 8-track tape recorder. ● **Bose:** new 8-way *Model 802* loudspeaker which is rated at 160W continuous, together with *802-E* active equaliser which is supplied with the loudspeaker for insertion ahead of the power amp. ● **Valley People:** 'Trans-Amp LZ' transformerless mic



system which includes a fast peak limiter, quasi-parametric midrange controls, a shelving control for treble adjustment, and independent wet and dry mix level controls. Also on show *TX-2* tunable crossover/bandpass filter; *PQ-3* parametric equaliser/preamplifier; and *PQ-6* stereo parametric equaliser/preamp. ● **MXR:** a new time-delay switchable flanger/doubler with flanging delay adjustable from 0.25 to 5ms and doubling delay adjustable from 17.5 to 70ms. The unit has manual control of delay time, mix control between dry and undelayed signals, sweep controls of width and speed, regeneration for intensity, and LED sweep indicators.

● **Orange County:** *VS-1* stessor which now includes a full parametric equaliser and stereo processor which includes a peak limiter, compressor, and expander/noise gate. ● **Capitol Magnetic Products:** *Audiopak AA-3* broadcast cartridge designed for good tape stability and low wow and flutter; *Audiopak A-2* continuous loop broadcast cartridge; and *Type Q17* high output, low-noise magnetic tape. ● **Unicord:** *Korg VC-10* vocoder; the *SE-500* state echo; the *MS-20* monophonic synthesiser with external signal processor module; and the new *model 3200* fully polyphonic programmable synthesiser. ● **Heino Ilsemann:** *Type KZM3* automatic cassette loader with a capacity of up to 4800 cassettes per hour; *Type ETK-1* cassette labelling machine with a capacity of 4800 per hour; and *Type ETK-1S* machine with a capacity of up to 7200 cassettes per hour.

● **Amber:** *Model 4405* totally automatic, programmable distortion analysis system and *Model 4400A* multipurpose audio test set.

● **Audio & Design:** range of signal processing equipment including the *F600* limiter for optical film, disc cutting and RF transmitters; *F690*

preamp which is available as a plug-in card, *Model MP-1000*, or as a retrofit kit for the *MCI 400* and *500 Series* consoles. The unit has phantom powering, a mic input phase reversal switch, over-load indicator, and level control.

● **Scully:** *284B* 8-track recorder with varispeed accessory; *280B Series 2* and 4-track recorders; the *250/255 Series* recorders; and the *Dictaphone/Scully 400 Series* voice logger system.

● **Audico:** *Model 751* semi-automatic cassette loader together with cassette loading accessories including a 2-station rewriter/exerciser/timer.

● **Wireworks Corp:** range of microphone cables and multicables together with a number of other cable accessories including cable testers.

● **ITAM:** new 16-channel tape recorder which is also available in an 8-track format, expandable to 16-track. Also on show 2 and 4-output mixers.

● **Accurate Sound:** *Model AS-2400* tape duplicating system which will operate up to 10 slaves per master, at duplication ratios of 4:1, 8:1 and 16:1 with full bandwidth, or 32:1 for educational applications.

Other products on exhibition will be *Starbird* mic boom and *SAK 1* magnetic heads.

● **Toa Electronics:** *VMS-2000 Series* of sound system units, including power amps, $\frac{1}{3}$ -octave graphic equaliser and loudspeakers. Particular emphasis will be put on the preamp/mixer which has modular preamps, line amps and power supply units incorporated into a single frame.

● **Orban:** new *Model 672A* quasi-parametric equaliser which combines features of graphic eq with parametric variables, and new *Model 526A* dynamic sibilance controller, a single channel version of the *Model 516EC*.

Also being shown are *Model 111B* reverbera-

Rauland-Borg 3635 mic mixer



There is a Dolby noise reduction unit for every professional application

Professional recording and transmission applications



360

The Dolby 360 is a basic single-channel A-type noise reduction unit for encoding or decoding. This unit is normally used in a fixed mode such as in disc cutting or landline sending or receiving; the operating mode is manually selected.



361

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

Motion picture industry



364

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



E2

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

Professional encoders for consumer media



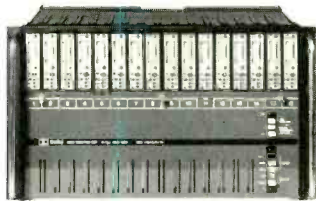
330

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



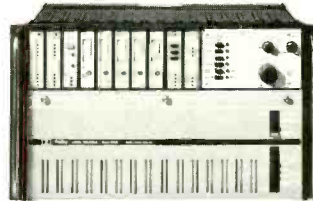
334

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



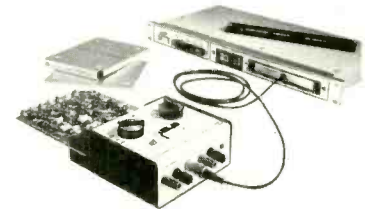
M-Series

The Dolby M16H A-type unit is designed specifically for professional multi-track recording, and incorporates 16 channels of noise reduction in a compact chassis only 10 1/2 inches high. The similar M8H is an 8-track version, and the M8XH allows simple extension of the M16H for 24-track use.



CP100

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



Cat no. 35

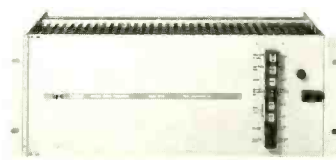
The Dolby NRM Test set, Cat no. 35, permits rapid verification of performance of Cat no. 22 noise reduction modules without their removal or the need for additional test equipment.

Noise reduction module



Cat no. 22

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



CP50

The new Model CP50 is intended for the reproduction of all optical soundtrack formats, Dolby encoded and conventional, mono and stereo. The unit is designed to interface with an existing fader and magnetic stereo installation. A wide range of accessories is available.

Noise weighting filter



Cat. Nr. 98A

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



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tion unit, *Model 245E* stereo synthesiser and *Model 418A* stereo limiter/compressor. ● **Sansui**: new *Model P-1* parametric equaliser which has four tunable bands, switch selectable shelving characteristics, independent variable-tuned notch filter in each channel and selectable high and low cut filters. Other products on show will include *BI* power amp rated at 250W into 8Ω, and *E-1* phono preamp which will accept up to three moving magnet or moving coil pickups, or three line inputs, with adjustable input impedance. ● **Sescom**: new *Model QM-1* 4-channel mic mixer which has balanced low impedance mic inputs, two of which are convertible to balanced line inputs. In addition the company's range of mic-splitters, direct boxes, snake cables, audio modules and audio transformers will be shown. ● **Audio Arts**: mini synthesiser, *Stylophone 350S*, a synthesiser played with a metal-tipped stylus moved over a printed circuit board. The unit has built-in 'wah-wah', fade and vibrato controls as well as a tuning device. ● **Audiotek**: *Model 2000* tape duplicating system which features duplication ratios of up to 64:1, automatic bin loading and unloading, automatic cue tone injection and closed-loop capstan drive. The slave units feature quick change plug-in heads and 2-speed drive. ● **Crown**: *RTA-2*, real time audio analyser for on-site equalisation and analysis of sound reinforcement systems, featuring a 5in oscilloscope and a built-in pink noise generator. Also on display a range of power amplifiers including *PSA-2* power amp rated at 220W per channel into 8Ω. ● **Audio Kinetics**: *XT-24 Intelocator* which may be interfaced with 3M, Ampex, MCI and Studer machines

Solid State Logic SL 4000 Series E



Also on display *Qlock 210* time code synchroniser designed for simple and economic 48-track working and incorporating intelligent search, EBU/SMPTE generator, cyclic programming for mixing, frame accurate auto-record, and instant replay facility. ● **Everything Audio**: details of several studios designed and constructed, and in addition the *Amek M-3000 Series* computerised console, together with advance details of the new *M-1000 Series*.

● **Ashly Audio**: full range of signal processing equipment including *Model SC-63* 3-band parametric equaliser, and peak limiter/compressors, instrument pre-amplifiers, and electronic crossovers. ● **Peavey**: *SP-2* loudspeaker system which utilises a 15in *Black Widow* transducer for low frequencies and a 22A driver with a multiflare horn for high frequencies. ● **Ursa Major**: new digital reverberation system, the *Space Station SST-282*, which comprises a digital delay line and digital reverberation synthesiser with controls for all relevant parameters. The unit may also be used as a straight audio delay unit with built-in mixer. ● **Magnefax**: range of high speed common mandrel ¼ in tape duplicators, and automatic tape degaussers, with particular emphasis being put on a demonstration of their new master tape loop bin/seven slave cassette tape duplicator. ● **Stanton**: new *680SL* pick-up cartridge designed for rugged disco applications and featuring the *Stereohedron* stylus which has a larger bearing radius for increased groove contact. ● **Rauland-Borg**: range of sound reinforcement equipment including several new loudspeaker systems, together with the new *Model 3535* 8-input mic mixer, and range of *Spectrum Master* equalisers. ● **Roland**: *RSS Series* of studio modules for electronic music and recording applications including *RV-800* stereo reverb; *PH-830* 2-channel phase shifter, *GE-820* stereo equaliser; and *GE810* mono equaliser. ● **Gotham Audio**: showing *Telefunken M-15A* 32-track tape recorder; EMT reverb units; and the new *Neumann KMR-82* shotgun mic and *U89* updated version of the *U87*. ● **Solid State Logic**: new *SL4000 Series E* master recording console and studio computer, featuring integrated control of all multitrack functions in tandem with monitor and fold-back switching, allowing one-button drop-ins to be made. Each channel incorporates extensive signal processing facilities and all the computer commands are executed in plain English. ● **Delta IV**: new 2-way 15W loudspeaker featuring a 90mm tweeter

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and 203mm bass driver. ● **Neve:** *Necam* computer-assisted mixing system which has a number of new features, together with several new limiter/compressors. Also demonstrating larger consoles and showing *Lyrec* tape recorders with spot erase, track solo and short head spacing. ● **Lexicon:** new *Model 224* digital reverberation system; new *Model 91* sound reinforcement delay system; and *Prime Time* digital delay processor and other units. ● **Cetec Gauss:** tape duplication system for a master and up to 20 slaves together with the *Gauss* range of loudspeakers. ● **Swintek:** new *MK Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand held lavalier cordless mics with multiple diversity antennas; and *Mk 200* communicator. ● **Sony Model PCM-1600** 2-channel, PCM adaptor for recording digital audio onto *U-Matic* video recorders; plus *PCM-3224* digital multitrack tape recorder and digital, laser based disc system. ● **DeltaLab:** new *Model DL-2 Acousticomputer*, a combined digital delay and special effects processor. Also on display *Model DL-1* digital delay module and it is hoped the new *Model DL-3* digital delay line. ● **Acoustilog:** *Model 232A* low cost reverberation timer; the *Model TR-300* multi-channel meter and spectrum analyser; and *VCO-1* oscillator for time delay spectrometry. ● **JBL:** demonstrating representative units, including *Model 4301* broadcast monitor and *Model 4315* studio monitor, with particular emphasis being placed on the new *Model 4313* 3-way control room monitor and new *Model 2441* compression driver. ● **Aphex Systems:** new *Model 1537A* voltage controlled attenuator; the *Aural Exciter* sound enhancement system; *OAS-24* grouping and automation system and *EQF-2* parametric equaliser. ● **Northwest Sound:** *Anchor* range of compact loudspeakers; the *NWS* range of sound reinforcement enclosures and horns; and the *Boilermaker* range of mic stands and hand held mic booms. ● **Agfa-Gevaert:** range of tapes including *PEM-468* and *PEM-368* mastering tapes; *PEM-526* bin tape; *PE-611*, *PE-811* and *PE-1211* bulk cassette tapes; and *PE-36* duplicating tape. ● **Barclay Analytical:** *Badap 1* digital audio processor which utilises program-

med software to provide audio measurement modes, displayed on a colour CRT. ● **Technics:** new units for PCM recording system together with full range of turntables, several versions of isolated-loop tape recorder; a number of new cassette recorders; new models of linear-phase loudspeakers; and a number of electronic units, including an equaliser, preamplifiers and amplifiers, and a monitor tuner. ● **Sound Workshop:** *Audio Machinery* shared access memory system, *1600 Series* console with *ARMS* automation, and *1280 Series* of consoles. New items will be *Model 262* stereo reverberation unit and a new 16-track console available with optional *ARMS*. ● **David Lint Associates:** new *QC-8/Q* quality control playback unit, together with new laminated sendust recording heads suitable for use with the new metal particle tapes without core-tip magnetisation. ● **AB Systems Design:** new *Model 2400* electronic frequency divider, and *Model 912* preamp/mixer, and *Model 730* tri-amp system. ● **White Instruments:** new *Model 200* audio analysis system, a microprocessor controlled system with software programmed operating modes. In addition the *Model 4301* and *Model 4240* active equalisers and range of real time analysers will be shown. ● **El-Tech:** search-to-cue, autolocator designed to interface with *Take Finder* to supply exact zero and memory point location, autoplay from zero point and auto rewind from memory point. ● **Midas:** new version of *PR* system sound mixing console which is available in a wide variety of formats for sound reinforcement applications. Also on show a *VCA*-controlled system. ● **BGW:** new *Model 10* electronic crossover, together with the new *100B* 60W power amp; the new *750 Series* of power amplifiers; and the *250 Series* of amplifiers. ● **Cetec Vega:** new *Model 63* dual-diversity receiving system for radio mics which has automatic selection of the stronger output from the two receiving sections and switching for diversity or single-channel operation. ● **Soundcraft Electronics:** introducing two new products, *Series 400* range of modular mixers and *SCM-381-8* compact 8-track recorder. Also on display *Series 1S* portable stereo mixers and *Series 3B* multitrack consoles. ● **Emilar:** *EW15* low frequency loudspeaker unit de-

signed for sound reinforcement applications, together with *EA175* high-frequency compression driver, *EH500* and *EH800* exponential horns, and the *EX900* dividing network. ● **Tentel:** range of tape tension gauges including the *T2-H20-ML* Tentelometer for tape transport problem diagnosis. ● **Hammond Industries:** complete range of *Meteor Light and Sound* products, including sound mixers, power amps, and range of sequential light controllers. ● **Klark-Teknik:** *DN70* digital delay line with new *DN71* sound effects generator, which allows the *DN70* to be used as a harmoniser or flanger. Also on show the *DN34* analogue time processor; the *DN36* analogue processor; the *DN22* and *DN27* graphic equalisers; and the *DN15* graphic preamp. ● **Bang & Olufsen:** range of measuring instruments, including wow and flutter meters, wattmeters, volt-meters and power supplies. ● **Calrec:** *Soundfield* mic system together with range of studio condenser mics, and in addition will give the first US demonstration of the *Ambisonic* sound system using *Soundfield* mic. ● **Raindirk:** *Series III 28/24* mixing console together with new *S2000* low cost 16-track console for smaller studio, broadcast and sound reinforcement applications. ● **Uni-Sync** range of power amps including *Models 350, 200, 100* and *Model 50*; plus *PMS-1* metering system; *Trouper* series of professional mixers; *MS-1003* mic splitter; and the *DB-1104* direct box. ● **Selco Products:** range of matt finished nylon collet and push-on style knobs, available in a wide range of sizes and colours, and with numerous accessories. Selco personnel will also be on hand to discuss custom service. ● **JVC:** demonstrating latest digital technology products, together with *Model KD-A8* microprocessor controlled cassette deck; the *M-7050* power amp, and *Type CD-4* demodulator for FM quadraphonic broadcast use. ● **Pentagon:** *Tri-Master Editor Series* copier which will duplicate any combination of reel and cassette copies simultaneously. Also the new *Model C-8* high speed 8-track cartridge copier. ● **Audio Industries:** range of universal mic and tape panels; quick connection studio umbilical cabling systems; and remote 24-position stereo cue mixer; together with items from the *MCI* range. ■

Digital primer

source providing 1, 2, 4, 8, 16 and 32 units of current corresponding to the decimal value of each bit. The output from the switches feed a virtual earth amplifier (an amplifier which has zero input impedance as a result of feedback) the output voltage from which is proportional to the input current. Thus the output voltage of the amplifier corresponds to the combination of the switches which have been operated by the digital input and a digital-to-analog conversion is effected.

Conversion the other way from analog-to-digital form is often accomplished by a technique known as successive approximation. This involves the use of a counter to drive a digital-to-analog converter the analog output of which is compared with the analog input to be converted. When the analog input and the output from the digital to analog converter are equal it follows that the number in the counter is the digital equivalent of the analog input.

Starting at the analog input this is fed to the comparator which gives an output which tells the logic which of the inputs is largest. The logic then applies the clock oscillator to the up/down counter to tell it to count up if the analog input was largest, or down if it were smallest, until the output from the D/A converter is equal to the analog input signal when the counter stops and the logic provides a signal to tell the

outside world that data is ready in the counter and the conversion is complete.

This may appear to be a rather time consuming conversion but conversion rates of only 100ns per bit are common with accuracies of $\pm \frac{1}{2}$ the least significant bit.

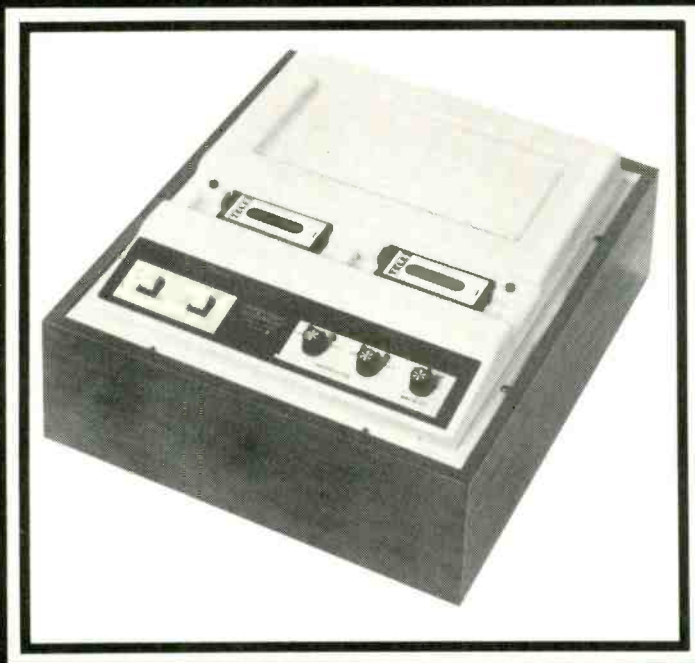
When an analog-to-digital converter is used to convert varying input signals, it is necessary to hold the input steady during the conversion time. This is done by a 'sample and hold' circuit which is arranged to sample the input signal for a very short time and then hold this value until the analog-to-digital conversion is complete when a further sample may be taken.

Conclusion

The principles of digital audio have been covered by Jeffrey Bloom in April & May *Studio Sound* and it is hoped that readers find that the combination of the articles will give them a reasonable understanding of the use of digital techniques.

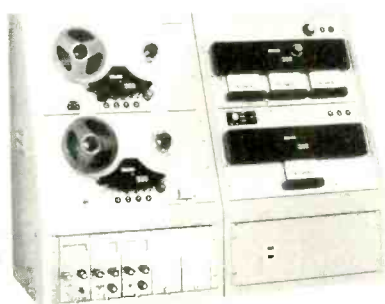
At the time of writing standards exist for connecting digital devices to each other including calculators and computers, but, unfortunately there is no standardisation in the field of digital audio as such. Without doubt the use of digital techniques in the recording studio will increase rapidly over the next few years with the falling cost of digital hardware and increases in speed and computing power. ■

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REVIEWS

Microphones: AKG C34, AKG CK22/C451EB pre-amplifier, Electrovoice 1777, Electrovoice RE20, Schoeps CMTS 501U, Sennheiser MZK 431 'Profipower' and Shure SM81.

General notes on the reviews of seven microphones

Measurements on the seven very different microphones were undertaken under identical conditions with the tabulated results being obtained in the laboratory. Sensitivity was measured using tone bursts in order to avoid the influence of reflections from the walls and floor etc.

Both the polar responses and the frequency response data were plotted under anechoic conditions in the chamber of the Polytechnic of North London through the courtesy of Dr Roger Driscoll.

It will be noted that all frequency response plots exhibit a peaking about 13kHz and it is thought that this is a result of resonances in the microphone stand and not to be attributed necessarily to the particular microphones. Constant sound pressure level was used for polar plots and frequency response plots, the sound pressure level being maintained at 74dB SPL by means of a ½ in Bruel & Kjaer measuring microphone in conjunction with the compressor facility of a Bruel & Kjaer type 2010 heterodyne analyser.

The following table gives a quick comparison of the various microphones:

| TABLE 1 | AKG C34 | AKG C451/CK22 | Electrovoice 1777 | Electrovoice RE20 | Schoeps CMTS501U | Sennheiser Profipower | Shure SM81 |
|---|-------------|------------------|----------------------|----------------------|---------------------|--------------------------|---------------|
| Directional pattern: | Variable | Omnidirectional | Cardioid | Cardioid | Variable | Cardioid | Cardioid |
| Sensitivity for 74dB SPL: | 0.5mV | 0.79mV | 0.17mV | 0.1mV | 1.0mV* | 0.13mV | 0.45mV |
| Equivalent noise 'A' weighted rms: | 22.5dBA | 26.0dBA | 31.5dBA | 31dBA | 26dBA | 22.5dBA | 18dBA |
| CCIR weighted rms: | 28.5dB | 30dB | 29dB | 32dB | 30dB | 33dB | 26dB |
| Impedance at 1592Hz (Ohms): | 130 | 85 | 44 | 170 | 215 | 270 | 95 |
| Transducer type: | Condenser | Condenser | Electret | Dynamic | Condenser | Dynamic | Condenser |
| Power consumption at 48V: | 9.7mA | 10.2mA | 4.5mA | — | 1.34mA | — | 2.4mA |
| at 12V: | 5.3mA | 4.2mA | 2.5mA | — | 0.37mA | — | 1.4mA |
| Equivalent SPL for 100e field: | 70dB | 72dB | 69dB | 94dB | 75dB | 83dB | <55dB |
| Wind noise (equivalent SPL): | 109/94dB** | 85dB | 77dB | 78dB | 104/86dB*** | 82dB | 112dB |
| Pop sensitivity: | Medium/poor | Excellent | Excellent | Excellent | Medium | Excellent | Poor |
| Handling noise: | Good | Very good | Medium | Poor | Poor | Medium | Good |
| Weight: | 250g | 110g | 255g | 600g | 350g | 230g | 190g |

* 0.94mV in omnidirectional pattern. ** 109dB without windshield, 94dB with windshield. *** Varies with directional pattern—omnidirectional best.

Whilst handling noise and pop sensitivity were judged subjectively, the sensitivity to wind noise was measured by placing each microphone in an identical wind velocity and measuring the unweighted output voltage. Similarly the sensitivity to magnetic fields was measured by placing each microphone in a coil carrying a 50Hz alternating current.

MANUFACTURER'S SPECIFICATION

Operating principle: four stable condenser capsules, pressure gradient receivers.

Frequency response: 20Hz to 20kHz.

Sensitivity at 1kHz: 0.45mV/μbar (4.5mV/Pa) (−61.5 dBV on open circuit).

Nominal impedance: 200Ω ±20% (earth-free, symmetrical).

Recommended load impedance: equal to or greater than 500Ω.

Equivalent noise level: equal to or less than 26dB SPL (with filter CCITT-C, DIN 45405).

Weighted noise level: 1.8μV rms (with filter CCITT-C, DIN 45405).

Crosstalk: equal to or greater than 70dB (20Hz to 10kHz); 40dB (20Hz to 15kHz) (measured without condenser transducers).

Supply voltages: via the remote control unit S42E, 9V to 52V according to DIN 45596.

Current consumption: maximum 10mA per channel.

Overall dimensions: 200mm long by 32/25mm diameter.

Weight: 240g net.

Connection: 12-pin DIN connector.

Finish: black chrome all-metal housing.

Included accessories: foam windshield type W34, elastic suspension type H15/6, 20m connection cable type MK42/20, remote control unit type S42E, case and individual frequency response curves.

Optional accessories: stand adaptor type SA30, 2-channel power unit type N46E1 and 6-channel power unit type N66E.

Price: £890.

AKG C34



Manufacturer: AKG Akustische u Kino-Geräte GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.

UK: AKG Acoustics Ltd, 191 The Vale, Acton, London W3.

THE AKG C34 stereo microphone includes four capsules, two of which are in a rotatable head and the other two in the fixed part of the microphone body. The head can be rotated through 180° with the angle in use being shown on a scale in 15° increments. A special 12-way cable connects the microphone to its control box which like the microphone has a DIN locking connector. Audio outputs from the S42 control box are in the form of standard XLR plugs which are wired for 9 to 52V phantom powering.

This control box incorporates an on/off switch, LED indicator and a battery compartment which are not used with the C34 microphone. The functional controls with this mic are two 9-position rotary switches which independently control the directional pattern of the two channels, from omnidirectional through cardioid to figure-of-eight. This silent remote control of directional pattern permits a number of interesting recording techniques.

Changing the directional pattern did not affect the microphone sensitivity and as can be seen from the frequency response plots for the two channels, in three different patterns, the

frequency response on-axis changes little with pattern and both channels are very accurately matched. The rising response above 2kHz is a generally desirable feature, but the large peak around 15kHz while not totally attributable to the mic would appear to be excessive.

Turning to the polar diagrams the omnidirectional patterns are excellent with a good balance between the 1kHz, 10kHz and 15kHz patterns at all angles, however, in the cardioid

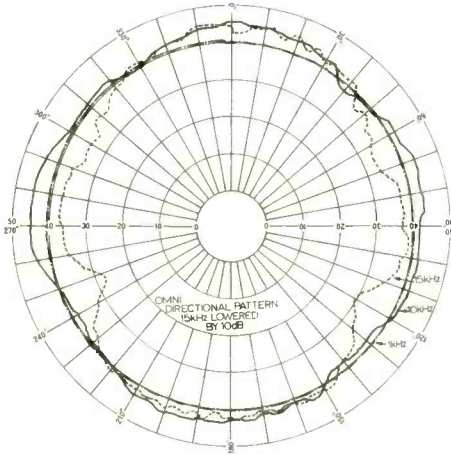
pattern the high frequency response to the rear of the mic is little attenuated giving a rather unbalanced response to the rear. In the figure-of-eight mode the front and rear performance is again good but like the cardioid performance the frequency response at more than $\pm 45^\circ$ off-axis becomes degraded a little.

The microphone is provided with an anti-vibration mount of sensible design and also a windshield which is highly desirable as the

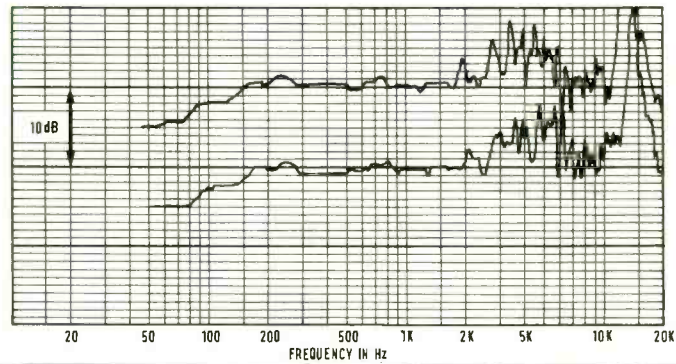
microphone was found to be extremely sensitive to wind without the windshield and not brilliant with the windshield in place.

Microphone noise was to a very high standard and the sensitivity to external magnetic fields is not likely to give problems. As this mic is not likely to be used close to a vocalist the pop sensitivity is of little consequence and the insensitivity to handling noise can only be an advantage. 88 ▶

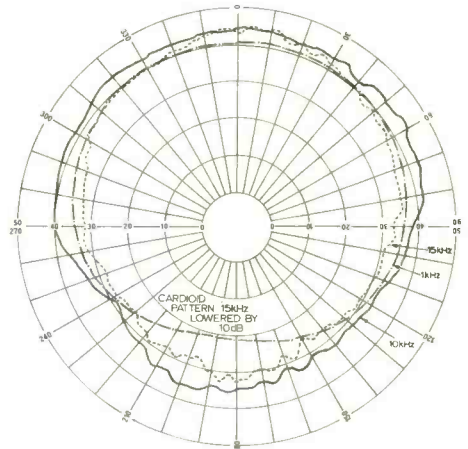
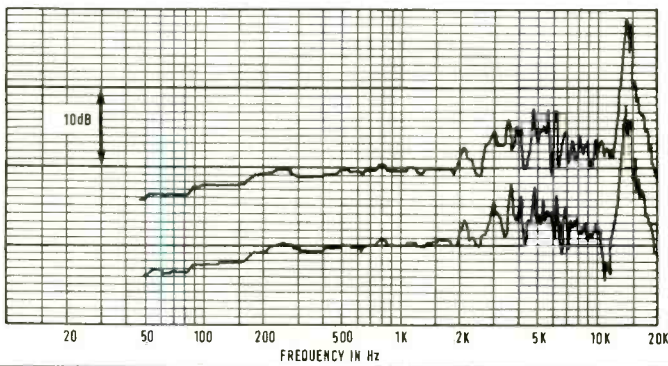
AKG C34 in omni mode



AKG C34 OMNIDIRECTIONAL FREQUENCY RESPONSE

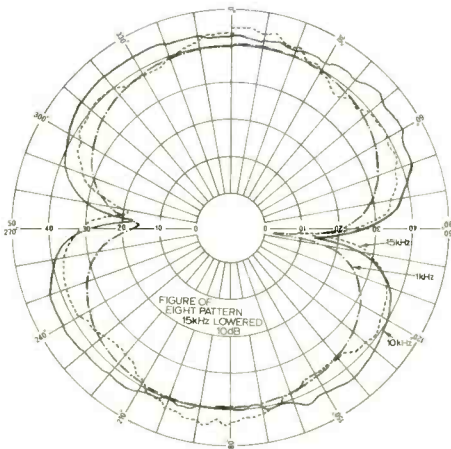


AKG C34 CARDIOID FREQUENCY RESPONSE

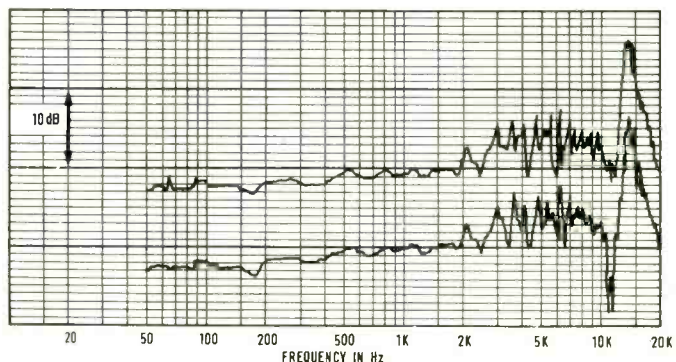


AKG C34 in cardioid mode

AKG C34 in fig of 8 mode



AKG C34 FIGURE OF EIGHT FREQUENCY RESPONSE





AKG CK22

**MANUFACTURER'S SPECIFICATION
CK22 CAPSULE**

Transducer type: pressure receiver.
Frequency range: 20Hz to 20kHz.
Polar response: omnidirectional.
Sensitivity at 1kHz: 0.8mV/ μ bar = 8mV/Pa = -62dBV.

Unweighted noise level: 2.3 μ V rms measured with filter CCITT-C to DIN 45405.
Equivalent noise level: 23dB SPL measured with filter CCITT-C to DIN 45405.

Capacitance of transducer: 27pF.
Weight: 40g net, 80g gross.

Operating temperature range: -20°C to +60°C.
Relative humidity: at 20°C up to 99%; at 60°C up to 95%.

Measuring conditions—The transducer has been measured with an AKG standard pre-amplifier with the following characteristics: No-load amplification 0.47dB. Input capacitance: 12pF. Polarisation voltage: 62V. Output impedance: 120 Ω .

C451EB PRE-AMPLIFIER

FET pre-amplifier in universal phantom circuitry with built-in 3-pin XLR connector.

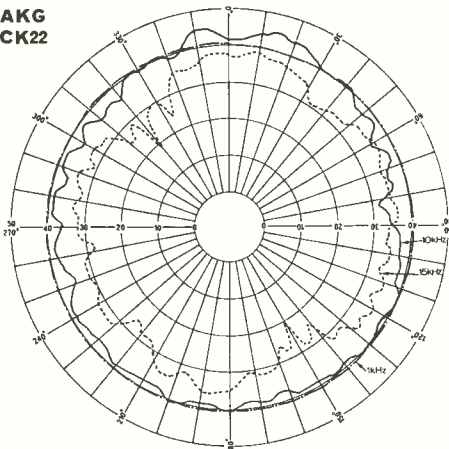
No-load amplification: 0.47dB \pm 0.5dB (feeding via 27pF condenser and load of studio amplifier greater than 3k Ω).

Impedance: less than or equal to 200 Ω from 20Hz to 20kHz.

Operating voltage: 9V DC.

Universal phantom powering: 9-52V DC (within the range of 7.5V to 9V DC with proportionally decreased sensitivity).

**AKG
CK22**



Current consumption: less than or equal to 5.5mA (DIN 45596).

Weight: 85g net, 360g gross.

Dimensions: 140mm long by 18mm diameter.

Price: capsule £48, pre-amplifier £78.30.

Manufacturer: AKG Akustische u Kino-Gerate GmbH, Brunhildengasse 1, A-1150 Vienna, Austria.

UK: AKG Acoustics Ltd, 191 The Vale, Acton, London W3.

THE AKG CK22 capsule is a new addition to the well established AKG 'CMS' microphone system which consists of a range of pre-amplifiers and capsules which range from omnidirectional to gun microphones.

Like the earlier CK2 capsule, which combined with the C451 pre-amplifier has been previously reviewed in *Studio Sound*, the new CK22 capsule is also omnidirectional. However AKG justifiably claims a better polar response together with reduced pop sensitivity and sensitivity to wind noise without the use of a windshield.

Examination of the plot of the polar response demonstrates a most excellent performance at 1kHz and 10kHz and a generally good performance at 15kHz but with two peculiar dips in response at 150° and 320°. The on-axis frequency response was found to be very good up to 18kHz with the bass performance being controlled by a 3-position switch in the pre-amplifier which has a 'flat' position together with 75Hz and 150Hz roll-off positions, the effect of which is shown in the frequency response plot.

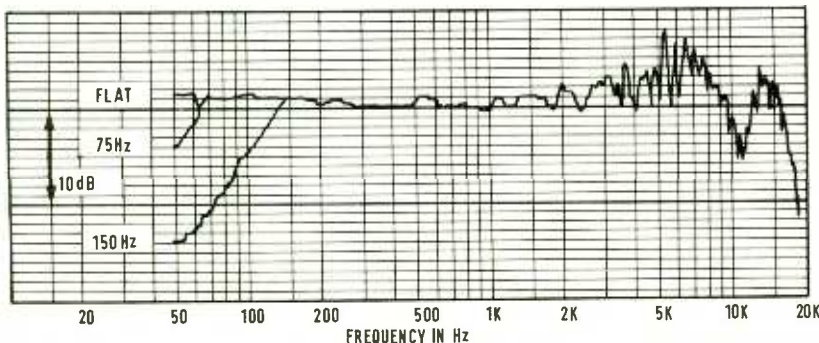
Even in the 'flat' position the handling noise performance was really excellent as was the pop sensitivity. However the sensitivity to wind noise could be bettered and a windshield is certainly desirable for out of doors use and also the microphone's noise level is not to the very highest of standards.

The standard of construction was very good and the mic was clearly built to cater for rough handling in the studio or mobile use. Although the review pre-amplifier was fitted with an XLR plug, alternative versions are available with DIN connectors and also a matt black finish instead of the satin chrome of the review samples.

Powering of the microphone is the normal standard 9 to 52V phantom system but with the current drain being higher than other microphones reviewed here.

90 ►

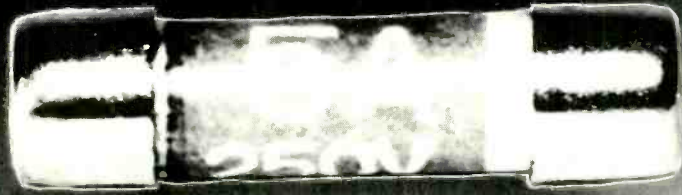
AKG CK22 FREQUENCY RESPONSE



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- Italy**
Roje Telecomunicazioni, Milan. Tel: 415 4141
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Yushin Co. Ltd., Tel: 69 3261
- New Zealand**
General Video Co. Ltd., Tel: 872 574
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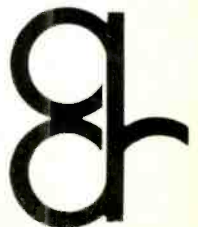
For ADR user list and details of the F 760X-RS Complex Limiter's variety of other uses write, phone or telex.

.....shouldn't you be too!!

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ELECTROVOICE 1777



MANUFACTURER'S SPECIFICATION

Generating element: electret condenser.
Frequency response: 60Hz to 18kHz.
Polar pattern: cardioid.
Impedance: 150Ω balanced.
Output level: -54dB (0dB = 1mW/10 dynes/cm²).
EIA sensitivity: -144dB.
Dynamic range: 100dB.
Equivalent noise level: less than 26dB (0dB = 0.0002 dynes/cm²) A-weighted.
Power supply: 4.5V internal battery (not included) or 24V to 48V phantom supply.
Battery type: Mallory PX-21 or similar size.
Current drain: 3.5mA.
Battery Life: carbon zinc types 150h; alkaline types 175h; mercury types 350h.
Switch: on/off for battery supply only.
Pop filter: built-in 'Acoustifoam' filter.
Cable: 4.6m 2-conductor shielded with Switchcraft A3F XLR connector.
Case material: diecast zinc and aluminium.
Dimensions: 190.5mm long by 50mm maximum diameter.
Weight: 345g.
Finish: non-reflecting grey.
Accessories supplied: 301 stand adaptor.
Optional accessories: carrying case, attenuator and power supply.
Price: £85.
Manufacturer: ElectroVoice Inc, 600 Cecil Street, Buchanan, Mich 49107, USA.
UK: Gulton Europe Ltd, The Hyde, Brighton.

THE ElectroVoice 1777 mic is a cardioid electret condenser which requires either phantom powering or internal battery power to operate the internal pre-amplifier. Unscrewing the handle part gives access to the battery compartment which takes a 4.5V cell with a claimed life of up to 350 hours but phantom powering at 12V only draws 2.5mA.

The complete microphone including its bulbous 'working' end, with an inbuilt windshield, is finished in dull grey with a standard XLR plug at the rear, plus a short lead terminated at the microphone end only.

An on/off switch is fitted for battery operation only, it is recessed to avoid accidental knocking, and thus requires a screwdriver or similar to put into use. As this mic is intended for general use in broadcasting and public address work it is very solidly constructed and would probably bounce off a concrete floor if dropped.

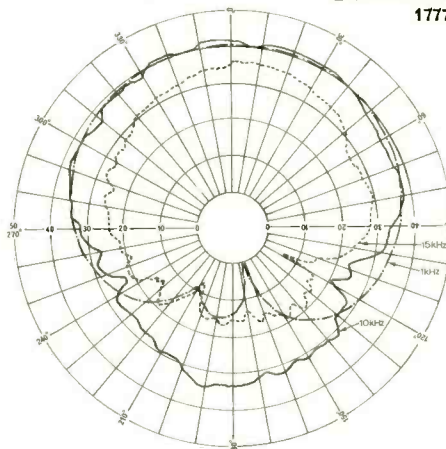
The inbuilt windshield was found to be very effective and while the mic was insensitive to pop noises, it was rather sensitive to low frequency handling noise—in spite of the rapid roll-off in frequency response below 80Hz—this being on the high side for some applications. However the overall frequency response was smooth up to 18kHz on-axis.

Examination of the polar response shows that the response to the front is smooth over almost ±90° but to the rear the performance at 10kHz is disappointing with only 5dB front-to-back ratio compared, with over 20dB at 1kHz and at 15kHz.

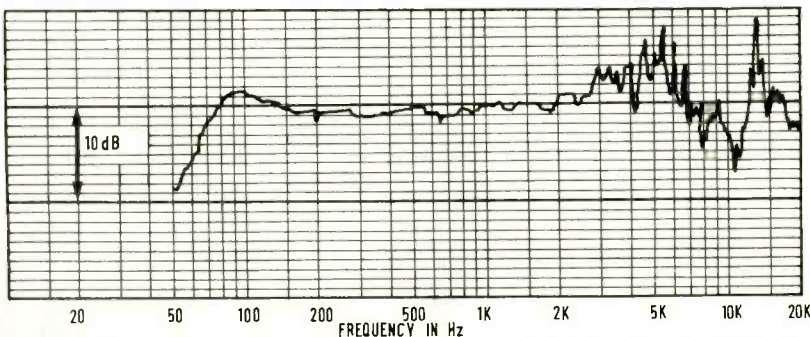
It was also noted that the A-weighted noise performance of this sample was not particularly good but the CCIR weighted noise was relatively much better. For a capacitor mic the output level was unusually low and more compatible with dynamic types, which could cause problems in certain applications.

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Electrovoice 1777



ELECTROVOICE 1777 FREQUENCY RESPONSE



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IN THE U. K.**



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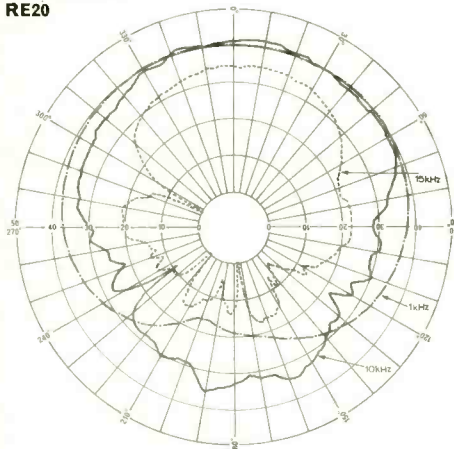
ELECTROVOICE RE20



MANUFACTURER'S SPECIFICATION

Element: dynamic.
Frequency response: 45Hz to 18kHz.
Polar pattern: cardioid.
Impedance: 50, 150 and 250Ω, changed by solder connections.
Output level: -57dB (0dB = 1mW/10 dyne/cm²).
EIA sensitivity rating: 150dB (150Ω output).
Diaphragm: ElectroVoice 'Acoustalloy'.
Case material: steel.
Dimensions: 216.7mm long by 54.4mm largest diameter or 49.2mm body diameter.
Finish: fawn beige micromatte.
Weight: 737g net without cable.

Electrovoice
RE20



Cable: 4.6m 2-conductor, shielded with Switchcraft A3F XLR connector on microphone end.
Accessories furnished: 87213 stand adaptor.
Optional accessories: model 309 shock mounted stand adaptor for use with floor stand or microphone boom.
Price: £258.
Manufacturer: ElectroVoice Inc, 600 Cecil Street, Buchanan, Mich 49107, USA.
UK: Gulton Europe Ltd, The Hyde, Brighton.

THE Electrovoice RE20 is a somewhat bulky dynamic microphone which according to the manufacturer is intended for 'recording, broadcast and sound reinforcement applications'. Clearly its size and ugliness limits its areas of use but it is very solid, does have a substantial front grille and well protected side ports, and an inbuilt XLR plug to the rear. Normally the mic is supplied with nominal 150Ω impedance but, this may be set to alternatives of 50 or 250Ω by means of changing soldered taps on the internal transformer, (the review sample was set to 150Ω and measured close to that impedance).

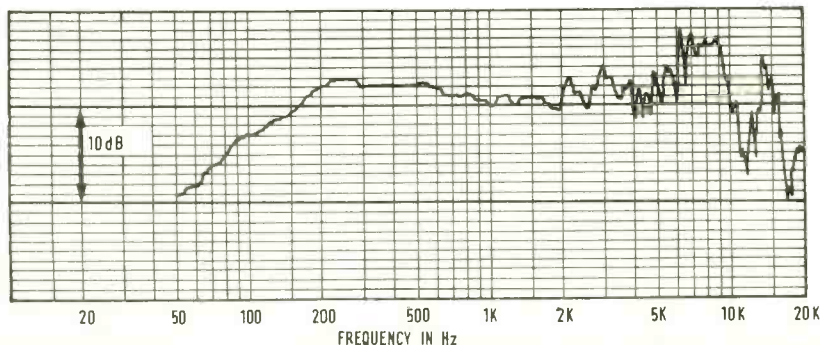
Resistance to pop effects was excellent and was not unduly affected by wind noise but handling noise was poor. However its use in strong magnetic fields would cause trouble as it was far and away the most affected of the mics reviewed here.

The frequency response plot was made with the inbuilt bass cut filter in-circuit, introducing a cut of approximately 5dB at 100Hz such that the unfiltered bass roll-off approximates -5dB at 50Hz. At the upper end the frequency response peaks around 10kHz and other than the peak at 14kHz which I believe to be a resonance in the microphone stand the response fell smoothly.

Turning to the polar response this gives a good balance over ±50° off-axis outside which the 1kHz polar performance is typically cardioid and the 15kHz response shows side lobes more typical of a hypercardioid. At 10kHz there is little attenuation to the rear and a rather uneven polar response.

The low sensitivity of this microphone somewhat taxes the mic-amplifier performance with the result that the measured noise is somewhat above that expected. 94 ▶

ELECTROVOICE RE20 FREQUENCY RESPONSE



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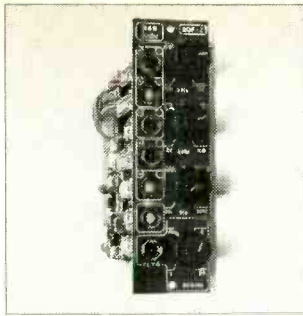
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Parametric Equaliser

A very versatile instrument for getting sounds just right. It's modular and directly retrofits APSI 550.

EQ is peak or shelf. Filter is high or low pass, tunable. Bandwidth is 20Hz to 20kHz. Reciprocal cut or boost on EQ.



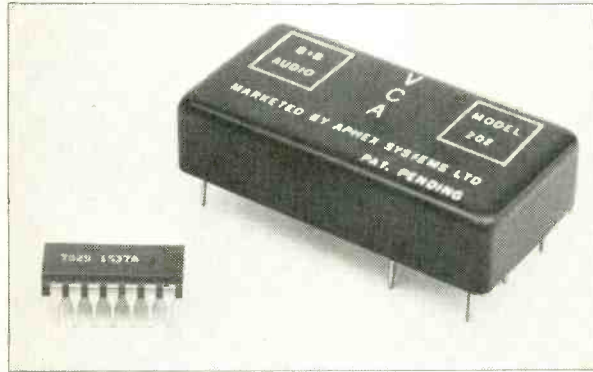
| | | |
|--------------------|------------------|-----------------------------|
| Input | High level | + 30dBm (max) at 34KΩ |
| | Low level | + 20dBm (max) at 11KΩ |
| Output | High level | + 30dBm with - 93dBm noise |
| | Low level | + 20dBm with - 103dBm noise |
| Frequency response | EQ & filters out | 10Hz to 20kHz, ± 0.1dB |
| | EQ & filters in | 20Hz to 20kHz, - 1dB |
| Distortion | Harmonic & IM | < 0.1% |
| Transient response | Slew rate | > 10V/sec. |
| Power | | ± 12V to ± 18V at 75mA |

Voltage Controlled Attenuator

The first high quality VCA in the professional audio market.

It's available in chip form for OEM, or in a complete module, with full input and

output facilities for direct fitting to any automated console with existing VCA's. However, we can design a VCA package to fit any other manufacture.



| | | |
|---------------------|----------------|--|
| Band width | Module | DC to 200kHz; ± 0.1dB |
| | Chip | DC to 50MHz; ± 0.1dB |
| THD | + 10dBm input | 0.004% (20Hz to 20kHz) |
| IMD | - 14dBm input | 0.03% |
| Noise | Unity gain | - 90dBV; ± 1dB |
| Modulation noise | | 6.5dB |
| Overshoot & ringing | | None |
| Slew rate | | > 10V/μ sec. |
| Input impedance | | 20KΩ |
| Input level | | + 20dBV |
| Gain | | 0dB (+ 15dB available on special order in module form) |
| Attenuation | Module | > 94dB; 20Hz to 20kHz |
| | Chip | > 100dB; 20Hz to 20kHz |
| Control voltage | | Can be scaled as needed |
| DC shift | Vs Attenuation | ≤ 5mV |
| Power | | Regulated ± 15V at + 25, -33mA |

Grouping and Automation System

With this system, you can now add semi-automation to your console at a fraction of the cost of a new one. Adaptable logic and extensive matrix grouping make up to ten 24-channel presets available.

And since the unit is portable, it can be moved from one studio to another in minutes, for the most efficient use of studio time.

It's expandable from 8 channels and it's just as useful for PA grouping as studio mixdown.

For MCI equipment, a compatible automation package is available.

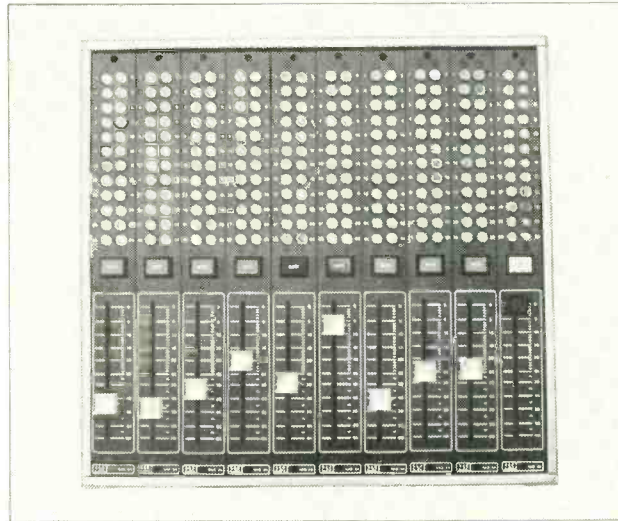
Our own Voltage Controlled Attenuators (VCA) are used throughout, whose high quality assure minimal sound degradation.

Maximum output is + 24dBm.

The system comes in two parts - control console and VCA case.

The control console has group control modules, each containing grouping switches, mute switch and fader, and a master control module with master fader.

The VCA case is self powered and houses the appropriate number of VCA cards and all the input/output XLR connectors.



The Aphex Aural Exciter

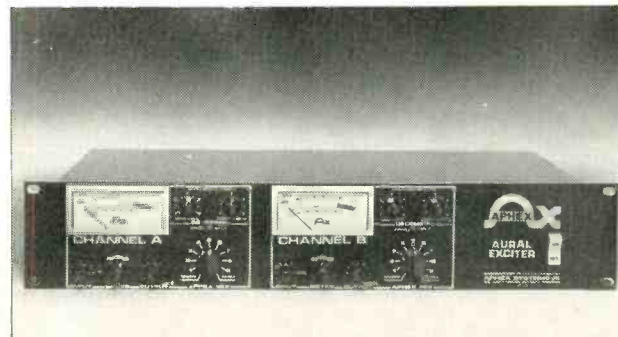
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It brings sound to life and makes it louder, without any actual change in level.

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REVIEWS

SCHOEPS CMTS 501U



MANUFACTURER'S SPECIFICATION

Directional patterns: omnidirectional, cardioid or figure-of-eight-switchable.

Feeding: 48V centre point.

Supply current: approximately 2x0.65mA.

Frequency range: 40Hz to 16kHz.

Sound incidence: radial.

Sensitivity (1kΩ load at 1kHz): approximately 1mV/μbar (omnidirectional), 1.1mV/μbar (other patterns) equivalent to 10 or 11mV/Pa respectively.

Equivalent noise level reference (2x10⁻⁴μbar): approximately 27dB (omnidirectional) or 26dB other patterns to DIN 45405. 20dB (omnidirectional) or 19dB other patterns to IEC 179.

Signal-to-noise ratio: 74dB (omnidirectional) or 75dB other patterns A-weighted reference 1Pa.

Maximum sound pressure level for 0.5% total harmonic distortion: approximately 125dB (omnidirectional) or 124dB other patterns.

Load impedance: 600Ω or more.

Connectors: Tuchel or Cannon.

Dimensions: approximately 30mm diameter by 225mm long.

Weight: approximately 320g net.

Portable AC power supply: Schoeps type NS500.

Price: £695.

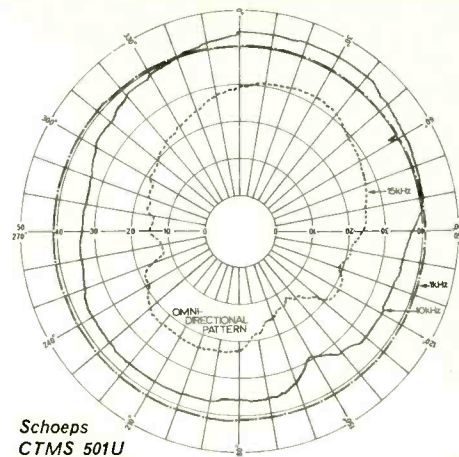
Manufacturer: Schalltechnik Dr-Ing Karl Schoeps, 75 Karlsruhe 41, Spitalstrasse 20, West Germany.

UK: John Page Films Ltd, 167 Oldfield Lane, Greenford, Middlesex.

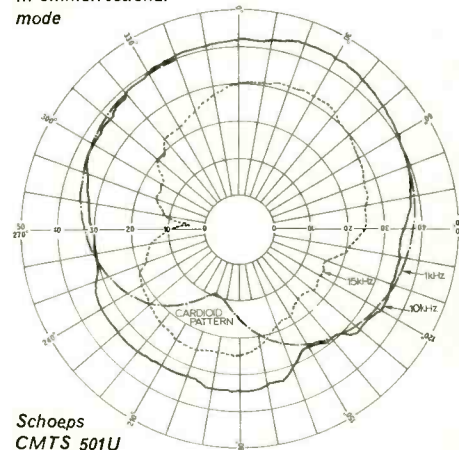
THE Schoeps CMTS 501 is a stereo condenser mic comprising two capsule systems which may be independently adjusted for omnidirectional, cardioid or figure-of-eight polar responses. In addition the upper capsule system may be rotated through 360° with a system of coloured dots giving an indication of each 45° of rotation.

The mic is tubular and finished in satin chrome with a 5-pin signal connector in the base. A short adaptor lead is provided to convert from 5-pin to two standard 3-pin connections. Connectors may be either XLR or DIN with powering options of 48V phantom for this mic and for the CMTS 301 which is similar, 12V phantom or with the positive pole grounded.

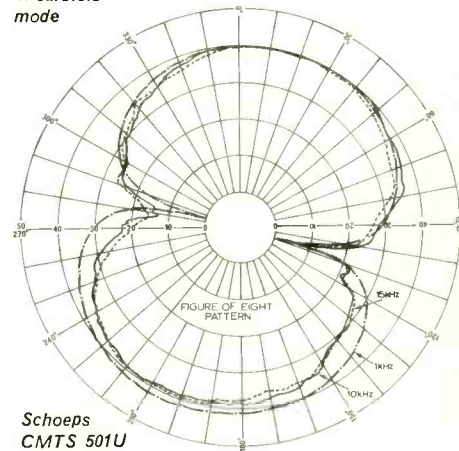
Provided with the review sample, was an



Schoeps
CMTS 501U
in omnidirectional
mode



Schoeps
CMTS 501U
in cardioid
mode

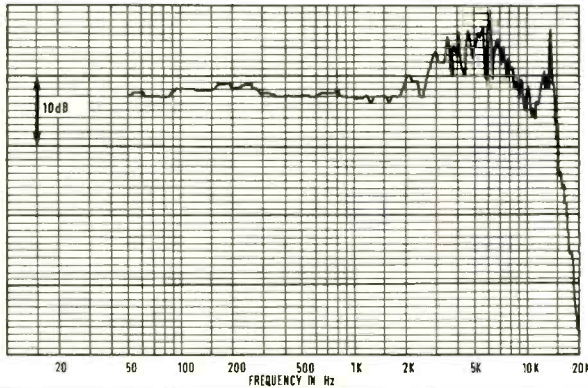


Schoeps
CMTS 501U
in figure of
eight mode

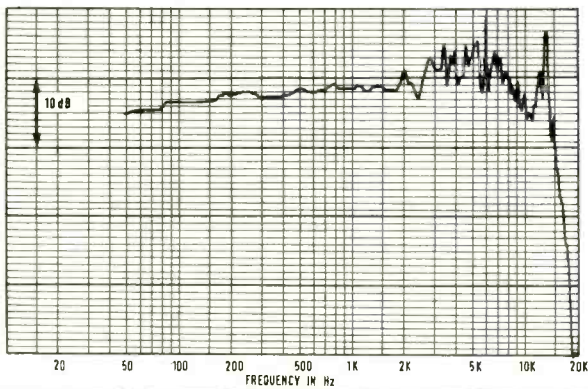
elastic mount consisting of a tubular clamp into which the microphone is securely fixed by means of plastic collets. The fixed part of the mount has a clever cable clamp and a swivel on the stand bush, but this swivel suffered from inadequate frictions such that vibrating the stand readily moved the microphone position however hard one tried to attack the adjusting screw.

As the mic is very sensitive to handling noise it is essential to mount it properly and I noticed that whilst in the omnidirectional pattern it was not particularly sensitive to 'popping', the performance in this respect can be described as medium in the cardioid and figure-of-eight patterns. This was also true of the sensitivity

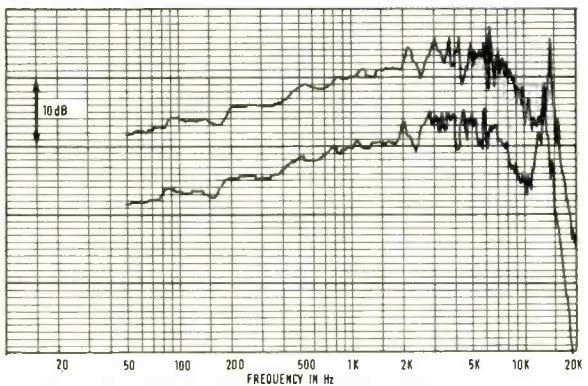
SCHOEPS CMTS 501U OMNIDIRECTIONAL
FREQUENCY RESPONSE



SCHOEPS CMTS 501U CARDIOID FREQUENCY RESPONSE



SCHOEPS CMTS 501U FIGURE OF EIGHT
FREQUENCY RESPONSE



to wind noise.

The noise performance of the two channels was to a high standard irrespective of the directional pattern, with a small variation in sensitivity from 0.94mV for 74dB SPL in the omnidirectional mode, to 1mV for 74dB SPL in the other patterns at 1kHz.

As can be seen from the frequency response plots the on-axis response also varies to an extent with the directional pattern selected, with the figure-of-eight pattern introducing a fairly substantial bass cut and with both channels having a virtually identical performance. In all patterns there is a 'presence' boost at mid frequencies and ignoring the 14kHz peaking

thought to be due to the microphone stand the response falls sharply above 15kHz.

Looking at the polar response it is to be seen that in the omnidirectional mode the 1kHz response is ideal, with the 10kHz performance generally omnidirectional but the 15kHz plot decidedly cardioid. This 15kHz plot is little changed in the cardioid mode where the microphone exhibits a well balanced performance over $\pm 60^\circ$ to the front but a rather excessive lack of high frequency cut to the rear.

However, in the figure-of-eight configuration the polar responses are very close to the ideal with a well balanced frequency response at all angles.

96 ►

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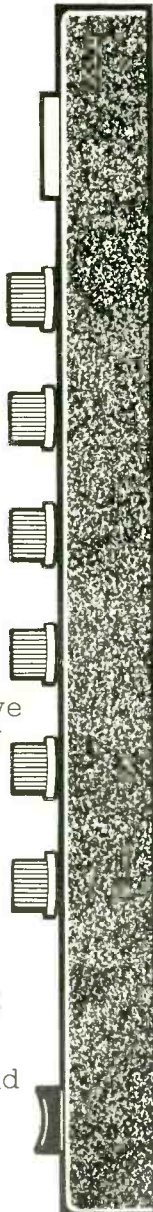
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SENNHEISER MKZ 431 PROFIPOWER



MANUFACTURER'S SPECIFICATION

Frequency response: 40Hz to 16kHz.
Acoustical mode of operation: pressure gradient transducer.
Directional characteristic: super cardioid.
Directivity factor at 1kHz (cancellation): at 120° 24dB-3dB.
Sensitivity at 1kHz: 1.4mV/Pa (0.14mV/μbar) ±3dB.
Open circuit output level at 1kHz ref 1V/10μbar: -57dB.
Electrical impedance at 1kHz: 200Ω.
Minimum load: 1000Ω.
Filter: built-in low cut filter.
Connector: 3-pin Switchcraft (Cannon).
Pin connections: 2 and 3—voice coil; pin 1—housing and ground.
Cable coupling: 3-pin Switchcraft A3F (Cannon XLR-3-11C).
Sensitivity to magnetic fields: less than or equal to 5μV/μTesla.
Dimensions: maximum handle diameter 31mm, head 49mm.
Weight: approximately 250g net.
Price: £73.60.
Manufacturer: Sennheiser Electronic, 3002 Bissendorf, Hannover, West Germany.
UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.

THE Sennheiser MKZ431 is a hypercardioid dynamic microphone intended for general entertainment use. It is supplied with a special stand clamp with this in mind, together with a lead which converts the microphone's XLR connector to a 3-pole ¼in balanced jack connection. The clamp is designed to either rest or

firmly secure the mic.

The main body of the mic is matt black and the front grille is dull chrome fairly heavy gauge metal. Running round the outside of the grille are two bright chrome bands which could prove troublesome in television applications.

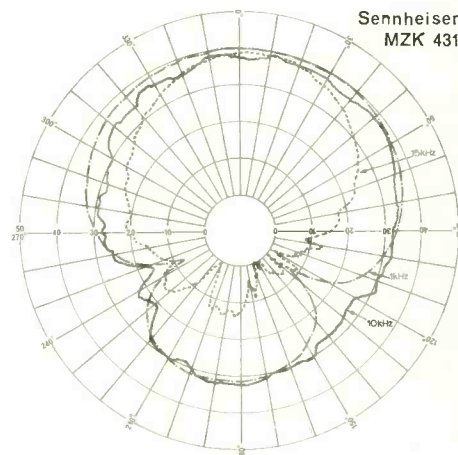
Within the mic body, is a magnetically operated reed relay with a lock to avoid any accidents. However, the mechanical part of the switch may be removed so that the microphone remains switched on.

As the MKZ431 is intended largely for speech use, the bass frequency response rolls off fairly rapidly below 100Hz to allow for the proximity effect and it was also found to be very insensitive to pop effects. However, handling noise performance was not particularly good due to low frequency handling noises. Also the mic was relatively sensitive to external magnetic fields.

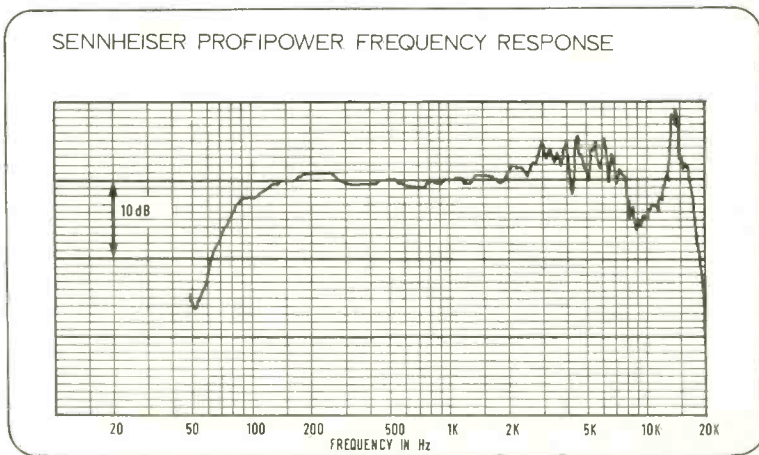
The frequency response plot shows that there is a mild presence boost at mid-frequencies and ignoring the suspected stand resonance at 14kHz the response extends fairly smoothly to 16kHz above which there is a rapid roll-off.

Examination of the polar diagram plot shows a well balanced performance over ±90° to the front with a rear pattern typical of hypercardioid designs.

This is a fairly heavy microphone for hand held use and the on/off switch made it particularly uncomfortable to hold compared with typically tubular microphones. 98 ▶



SENNHEISER PROFIPOWER FREQUENCY RESPONSE



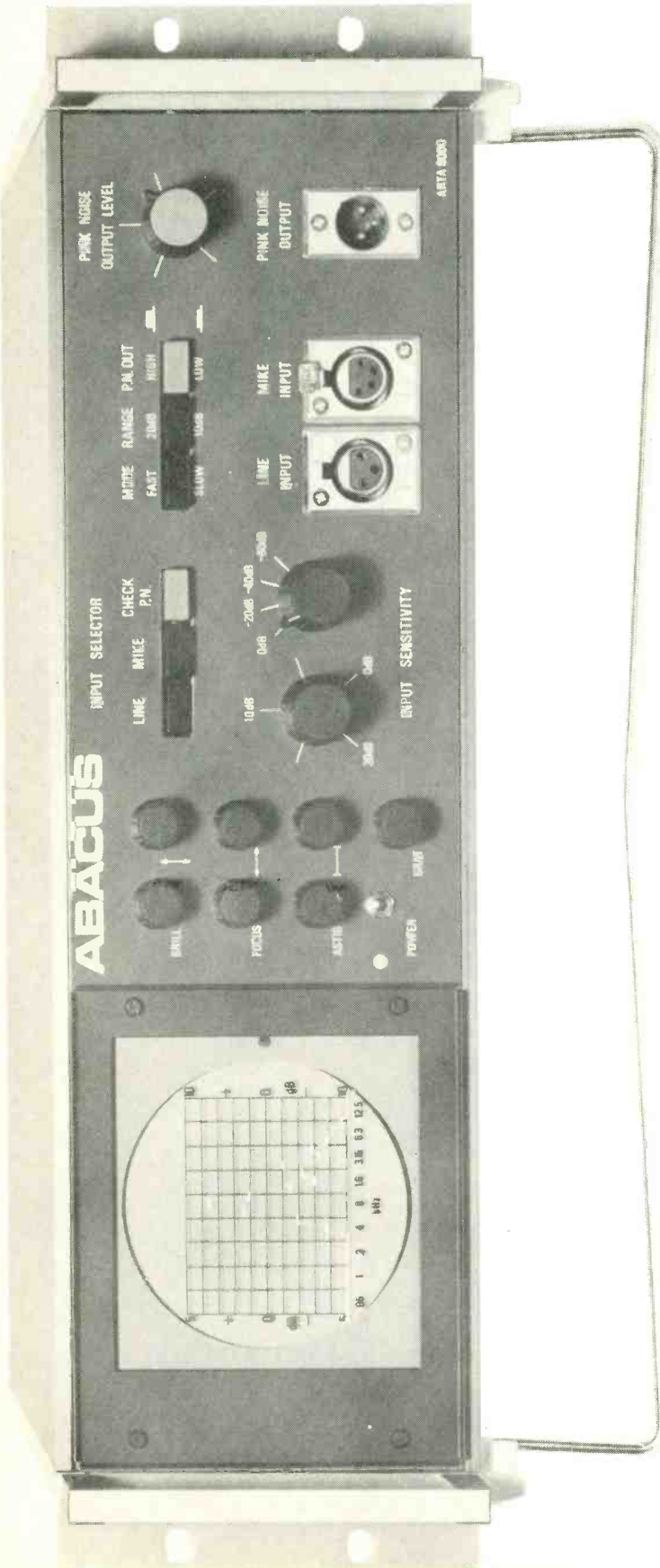
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SHURE SM81



MANUFACTURER'S SPECIFICATION

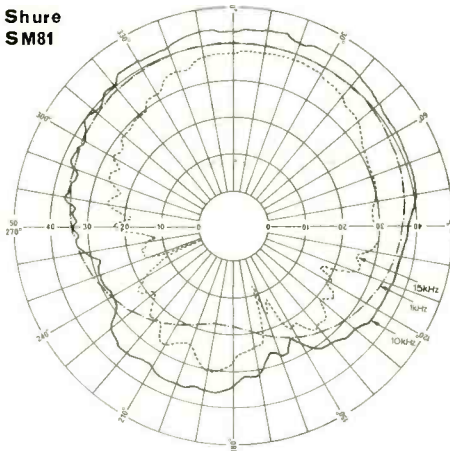
Type: cardioid condenser (electret bias).
Frequency range: 20Hz to 20kHz.
Polar pattern: cardioid (unidirectional) response—uniform with frequency, symmetrical about axis.
Output impedance: rated at 150Ω (85Ω actual). Recommended minimum load impedance 800Ω.
Output level: (at 1kHz) open circuit voltage —64dB (0.63mV) (0dB=1V μbar).
Clipping level at 1kHz: 800Ω load —4dBV, 150Ω load —15dBV.
Total harmonic distortion: less than 0.5% (130dB SPL at 250Hz into 800Ω load).
Maximum SPL at 1kHz: 135dB (attenuator 0); 145dB (attenuator 10) with 800Ω load. 127dB (attenuator 0); 137dB (attenuator 10) with 150Ω load.
Hum pickup: —4dB equivalent SPL in a 1mOe field.
Output noise (equivalent sound pressure levels; measured with a true rms voltmeter): 18dB maximum A-weighted; 21dB maximum weighted per DIN 45405.
Signal-to-noise ratio: 76dB (IEC 179) A-weighted reference 94dB SPL.
Over voltage and reverse polarity protection: maximum external voltage applied to pins 2 and 3 with respect to pin 1 . . . +50V DC. Reverse polarity protection 200mA maximum, diode clamped.
Phasing: positive pressure on the diaphragm produces positive voltage on pin 2 relative to pin 3.
Cartridge capacitance: 54pF.
LF response switch: flat, —6dB/octave below 100 Hz, —18dB/octave below 80Hz.
Attenuator switch: 0 or —10dB.
Power: supply voltage 12 to 48V DC, positive pins 2 and 3; current drain 1.25mA at 12V to 2.25mA at 48V.
Environmental conditions: relative humidity 0-50% . . . —29 to 74°C; relative humidity 0-95% . . . —29 to 57°C.
Connector: XLR type.
Case: steel construction with metallic vinyl paint finish and stainless steel screen.
Dimensions: 212mm long; case diameter 20.1mm; head diameter 23.5mm.
Weight: 230g net; 1.5kg packed.
Cable: 7.6m two conductor shielded, 'TRIPLE-FLEX' with XLR connectors.
Power supplies: four types available; one or two microphones, European or US line.
Price: £146.40.

Manufacturer: Shure Brothers Incorporated, 222 Hartley Avenue, Evanston, IL 60204, USA.
UK: Shure Electronics Ltd, Eccleston Road, Maidstone, Kent.

THIS new addition to the Shure range of microphones is a capacitor mic particularly aimed at vocalist and music recording use and has a smooth frequency response combined with exceptionally low noise.

The microphone body and screw-on capsule

Shure SM81



have been constructed from steel with a low reflective paint finish, the slightly protruding grille is the only part likely to be damaged in rough use. Between the capsule and the main microphone body is a rotatable ring which forms a 10dB capacitive attenuator such that the mic can handle very high sound levels. Further down the main body is a semi-recessed 3-position switch giving either a flat frequency response, —6dB per octave below 100Hz to correct for the proximity effect, or —18dB per octave below 80Hz. This switch whilst it cannot be accidentally operated can be readily operated with the thumb and forefinger.

There is a standard 3-pole XLR plug at the base of the body, providing a balanced output for 12V to 48V phantom powering requiring only 2.4mA at 48V DC.

The handling noise properties of this mic were found to be good, but without the use of the provided windshield the wind noise performance was poor and the pop sensitivity very poor. However the actual microphone noise performance was exceptionally good and the insensitivity to external magnetic fields quite exceptional.

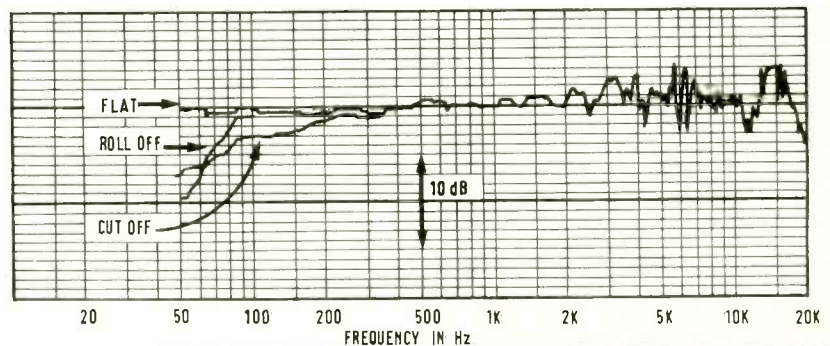
Examination of the frequency response plot shows that the on-axis response is remarkably flat from 50Hz to 20kHz in the 'flat' position of the low frequency filter switch, with the effects of the two filter characteristics being in-line with the manufacturer's specification and being sensibly chosen characteristics.

It is to be seen that the polar response is smooth to the front over say ±40° with the rear response showing lobes typical of hypercardioid microphones with the high frequency sensitivity exceeding that at 1kHz.

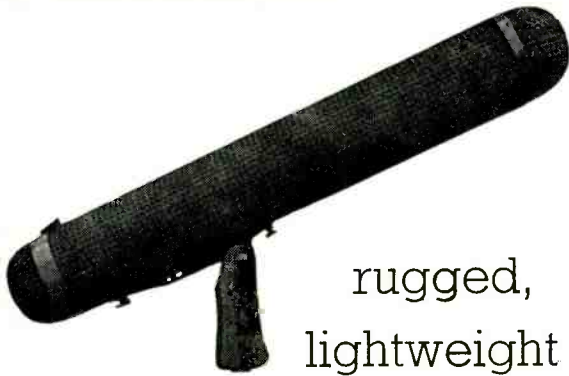
The mic together with a windshield and a stand adaptor is supplied in a good robust metal carrying case fitted with a cut out foam lining to hold the parts securely. A number of optional power supplies are available including the PS1E2 twin-channel supply which was submitted with the microphone. This supply peculiarly provides a +21.5V ±1.5V phantom DC supply from either 115V or 220V AC.

Hugh Ford

SHURE SM81 FREQUENCY RESPONSE



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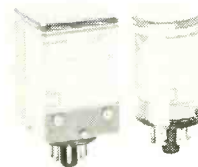
Sescos twin core microphone extension cords, available in 5, 25, 25 (thin), and 100 foot lengths, are made from high quality rubber type cable with XLR 3-pin audio connectors. Shown is the 25T thin belden lead.

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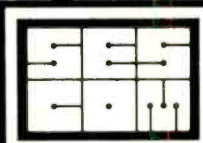


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MM-1200. Lay Down the Ampex Sound

Ampex designed the MM-1200 as a money-making proposition for studio owners. It'll work around the clock as group after group lays down the audio, and then it'll keep right on working as you go back for sweetening, for a vocal, or even for a final mix to a video production (with the addition of a video layback head). Quick-change heads make the MM-1200 even more useful—you can go back and forth between 8, 16 and 24 channels, and switch from one-inch to two-inch tape as easily as a clarinet player changes reeds.

ATR-100. Mix Down the Ampex Sound

This modular one-two-or-four-track machine is the ultimate analog audio tape recorder. In every specification, electrical or mechanical, it is the state of the art. Tape handling superiority comes from a unique closed-loop triple servo system that protects your valuable masters. Convenience features begin with the wide-open



Grand M-

component placement for easy maintenance, and go all the way to a compact lift-out remote control that sets up all functions, channel by channel. And for the last word on reliability, talk to an ATR-100 user.

ATR-700. Carry Around the Ampex Sound

Unsnap the cover of this reel-to-reel portable, plug in the power, and you're ready to work in monaural or stereo. The ATR-700 has a wider dynamic range than you'll find in most other portables, and it has heavy duty switches and connectors to resist the punishment of normal use over many years of constant service.

Switchable equalization makes for fast setup, and full meter monitoring takes the guesswork out of recording and playback. The ATR-700 is a solid money-maker in the studio, too, when you use it for producing and editing commercials.

Grand Master Audio Tape. The Medium for the Ampex Sound

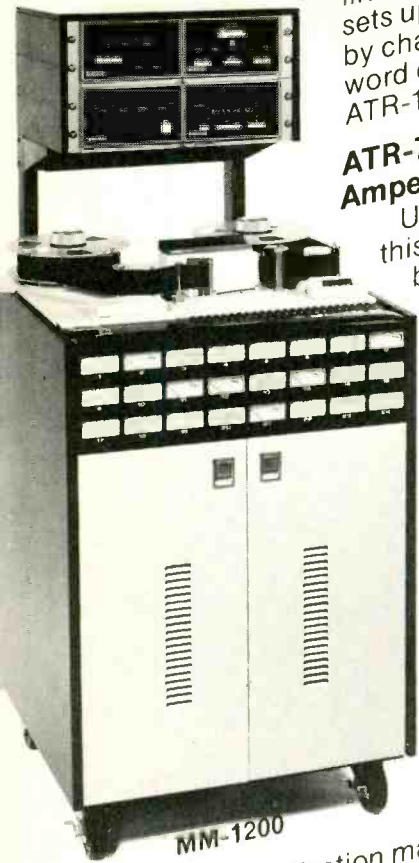
You'll find a reel of Ampex Grand Master audio tape to fit every one of these professional machines. Every width and every length, packed on reels that fit most professional machines in current use. Best of all, you can use both Grand Master or 406/407 without changing the bias setting on your recorders. Use Grand Master or 406/407 tape for state-of-the-art performance by every measure, from dropouts to edge-to-edge consistency. This is the finest mastering tape you can buy.

Golden Reel Awards. The Reward for the Ampex Sound

A Golden Reel is more than just another award. It's a

thousand dollars for the charity of your choice, if you earn it. To qualify for a Golden Reel, you must sell a million singles. Or half a million albums. And you must master your hit on Ampex tape. (Which over 70 top recording artists have done over the past two years.) We're proud of the people who win this Ampex award, and we're even prouder when they give it away to a good cause.

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ATR-700



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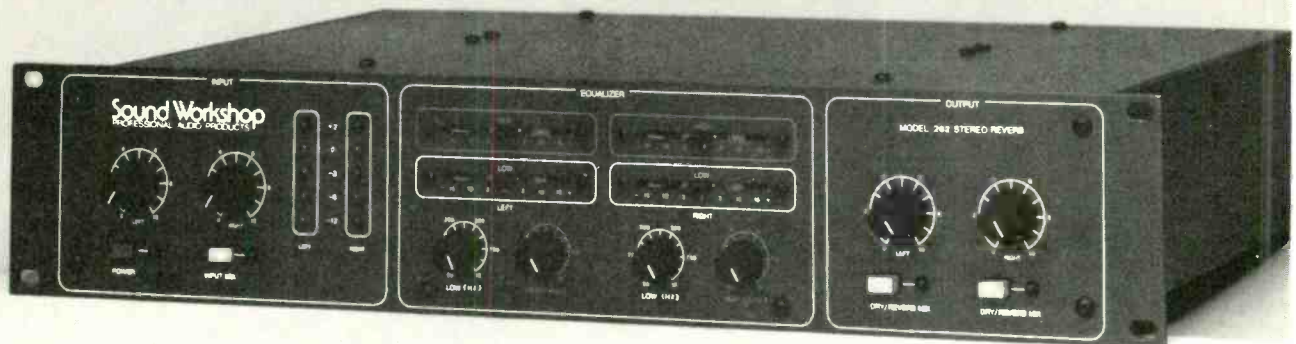
That's a tough decision to make. Perhaps you stay up nights pondering this very question. But please take the time, right now, to consider this important matter.

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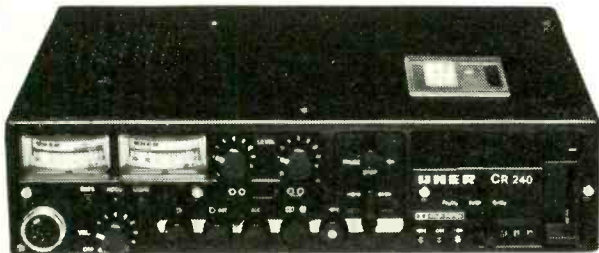
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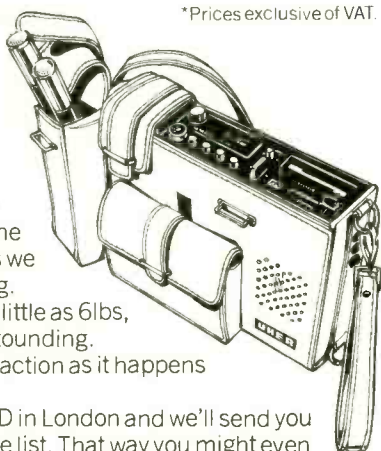


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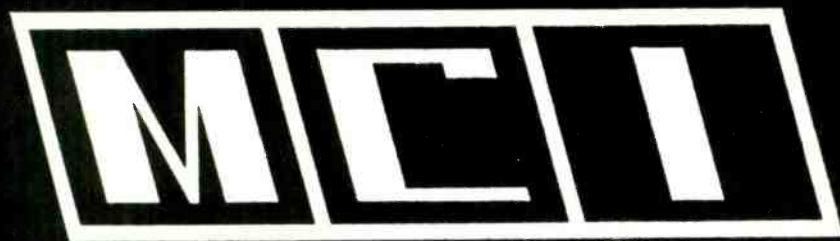
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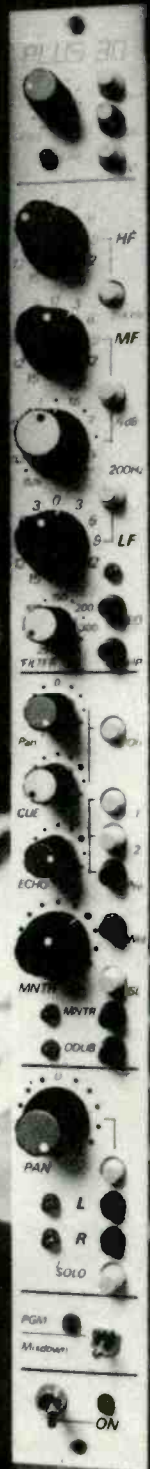
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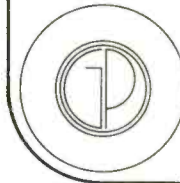
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THIS MONTHS **SCAMP** MEMO DYNAMIC NOISE FILTERS

S05 DYNAMIC NOISE FILTER/GATE - HIGH PASS

- DYNAMIC or STATIC FILTERING
- FREQ. SELECTIVE ATTENUATION
- 0-20dB/OCT VARIABLE SLOPE
- 100, 200 & 400Hz TURNOVER FREQUENCIES
- OPTIONAL FREQ. CONSCIOUS NOISE GATE (As selected by turnover freq. in GATE mode)

The S05 Dynamic Noise Filter/Gate allows treatment of signal without change of level having a programme controlled filter slope with adjustable threshold determining the point at which the slope takes effect, moving from flat to the maximum as pre-set by the 'slope' control. The slope control side-chain is frequency selective so as to respond primarily to signals within the operating band as selected on the front panel. Thus the threshold is adjusted so that the response becomes flat as soon as the signal content masks the noise, the S05 operating imperceptibly with no colouration effects due to slope change. In GATE mode the S05 Dynamic Noise Filter/Gate operates on full programme content with attenuation determined in the range 0-20 or 0-40dB by the 'slope' control. In this mode the threshold of the gate is frequency conscious as selected by the front panel turnover frequencies.

APPLICATION NOTES

1 De-rumble the tom-tom

The close mic. technique employed on a tom-tom gives rise to the problem of a low rumble being picked up as the skin resonates in sympathy with other kit. Static filtering, while removing the rumble, would permanently degrade the tom-tom sound whereas the S05 easily filters the rumble becoming instantly flat in the presence of high level signal when the skin is struck.

2 De-Humming amps and generators

Hum problems on, say, a bass guitar amp can be removed by the S05 without effecting the notes struck by the guitarists. Also, on location, generator noises of predominantly low frequency content can be filtered, as can rumble in 'in-car' recordings without the need for post-production synchronisation.

3 In GATE mode - processing a bass drum

As a frequency conscious gate at 100Hz the S05 would respond less to the snare when separating snare spill from the bass drum, since the side-chain would respond more to the bass.

S06 DYNAMIC NOISE FILTER/GATE - LOW PASS

- DYNAMIC or STATIC FILTERING
- FREQ. SELECTIVE ATTENUATION
- 0-20dB/OCT VARIABLE SLOPE
- 2, 4 and 6k TURNOVER FREQUENCIES
- OPTIONAL FREQ. CONSCIOUS NOISE GATE (As selected by turnover freq. in GATE mode)

The S06 Dynamic Noise Filter/Gate was designed to complement the S05 described opposite and acts, in a complementary fashion, to attenuate tape and general system hiss - particularly electronic instruments when reproducing LF signal.

APPLICATION NOTES

1 Cleaning up old masters

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2 Instrument amp hiss removal

Complementary Noise Reduction Systems (encode/decode) cannot remove hiss from source signal, such as bass amp hiss or electronic key boards/synthesizers (frequently more than one at a session). On a bass guitar amp hiss can be very noticeable because, for example, of its frequency characteristic relative to the predominantly bass notes. The S06, though, will easily attenuate the hiss yet 'get out of the way' should higher frequency notes be struck on the guitar (even high frequency harmonics could be preserved).

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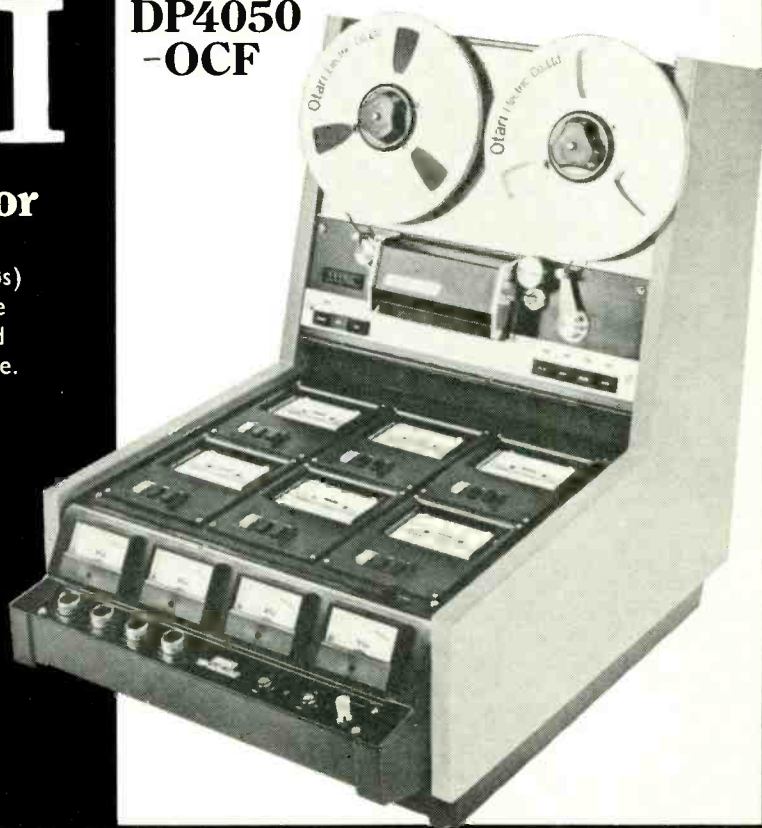
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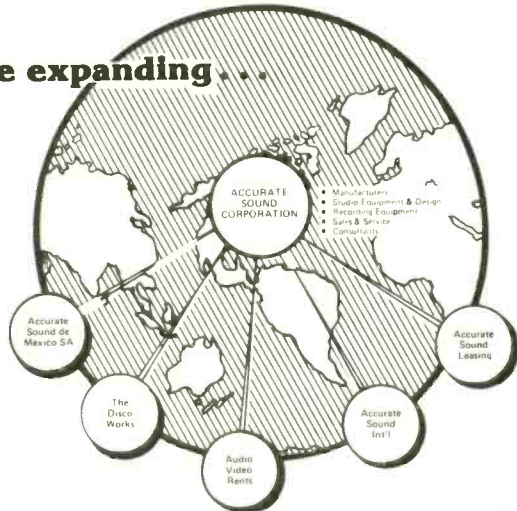
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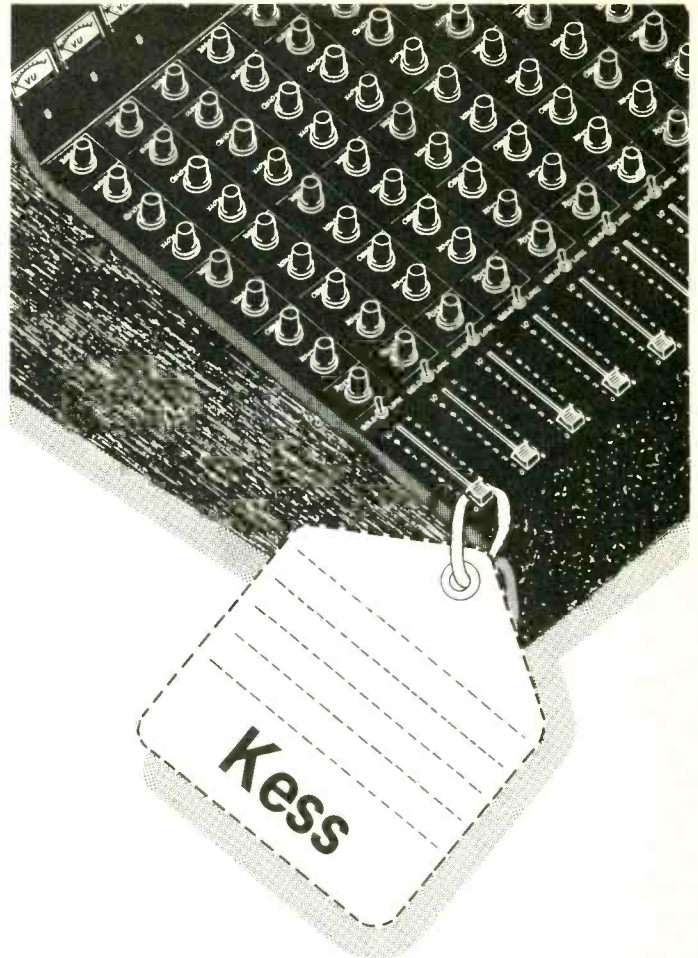
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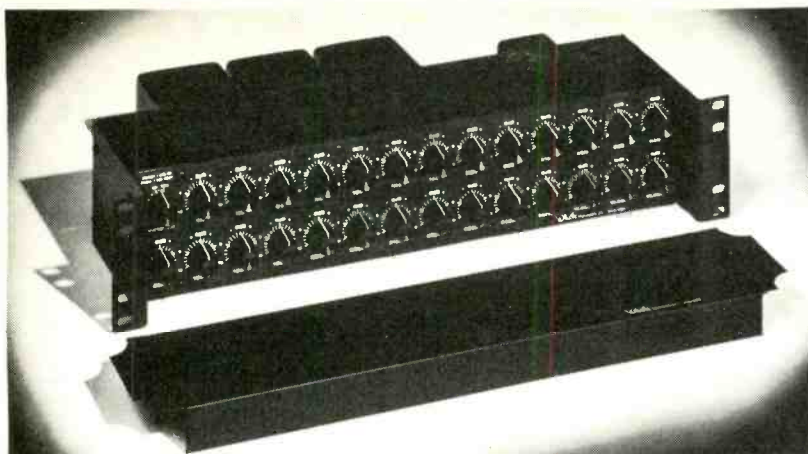
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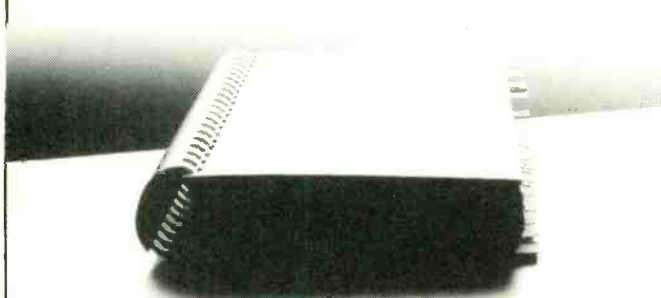
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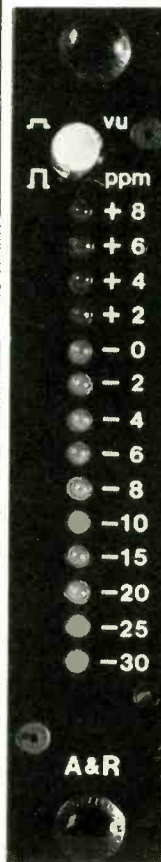
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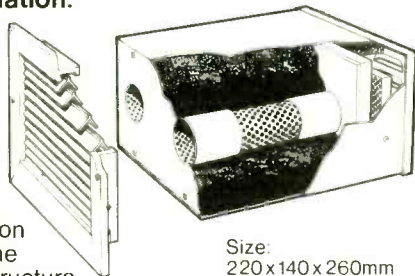
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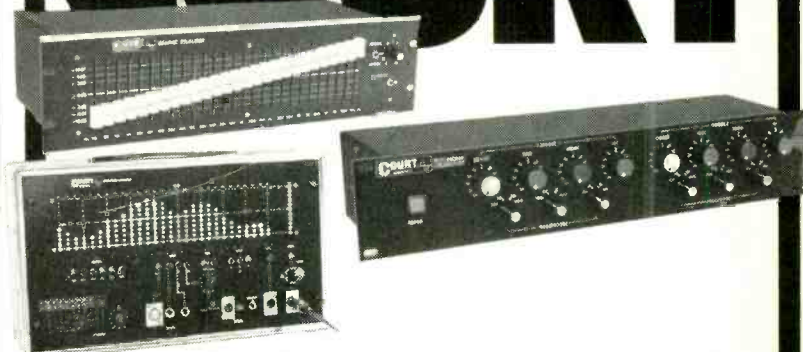
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★Disc Cutting Masters and Demos, Pressings, Cassettes, Mobile Recording Studio. Free brochure. TAM Studio, 13a Hamilton Way, London N.3. Tel. 01-346 0033. K

★Tape/Disc Master, Demos (Neumann lathe), Pressings, Cassettes. Mobile Recording Studio. Free brochure. Tam Studio, 13a Hamilton Way, London, N.3. Tel. 01-346 0033. H

★Sarda Audio and A.V. Speech and Music : Multitrack : Slide/Filmstrip Programmes : Cassette/Open Reel Duplication. A.L. Ltd. (London and New York), Sarda House, Queensway, London, W2. 01-727 2748.

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for

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on 01-686 2599

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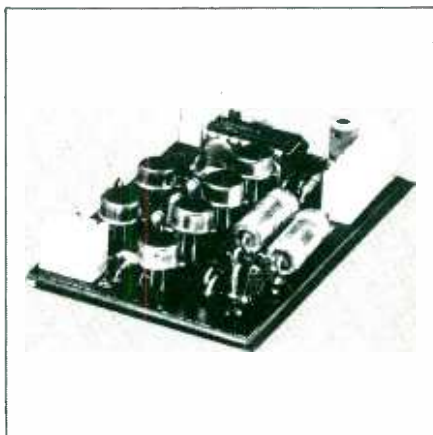
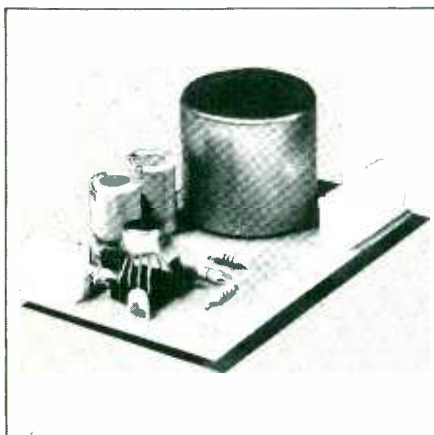
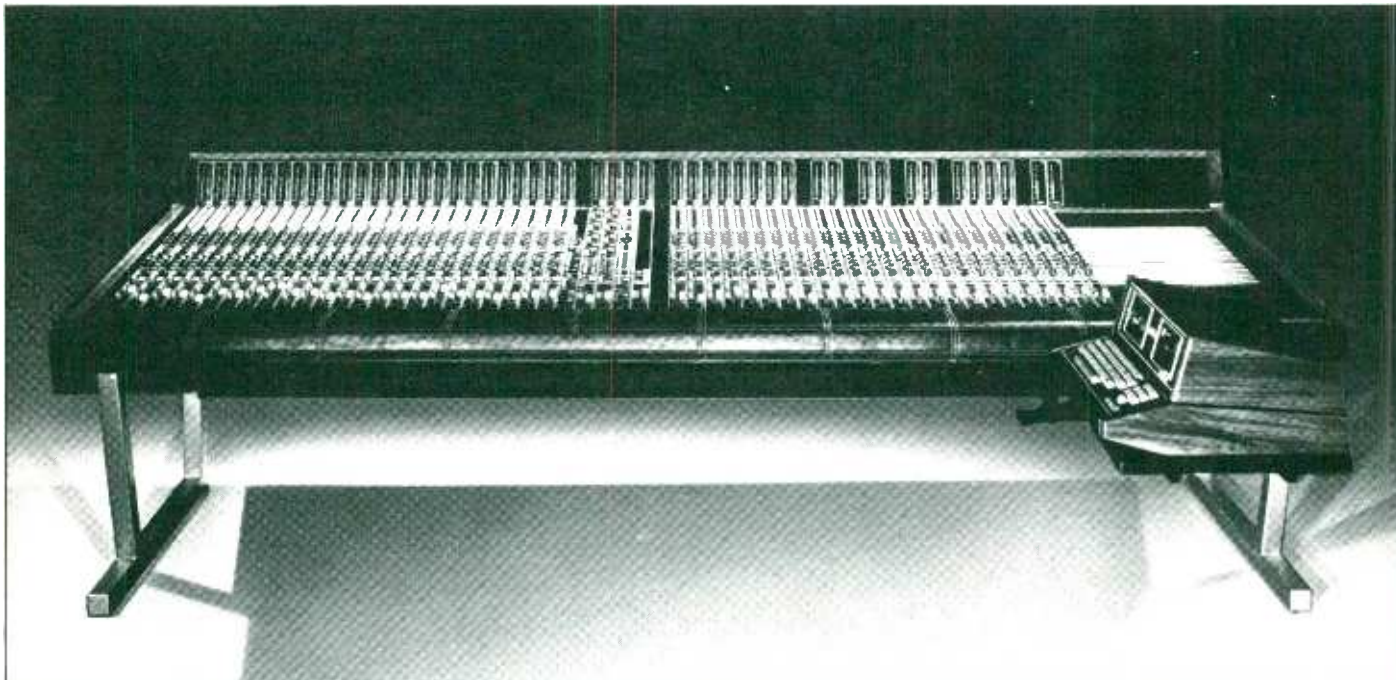
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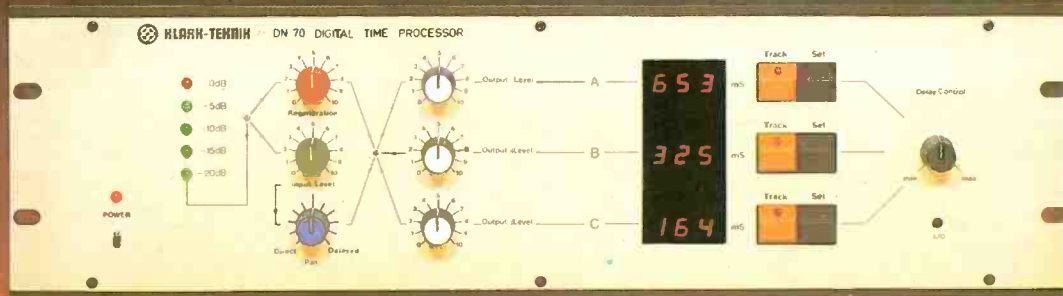
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