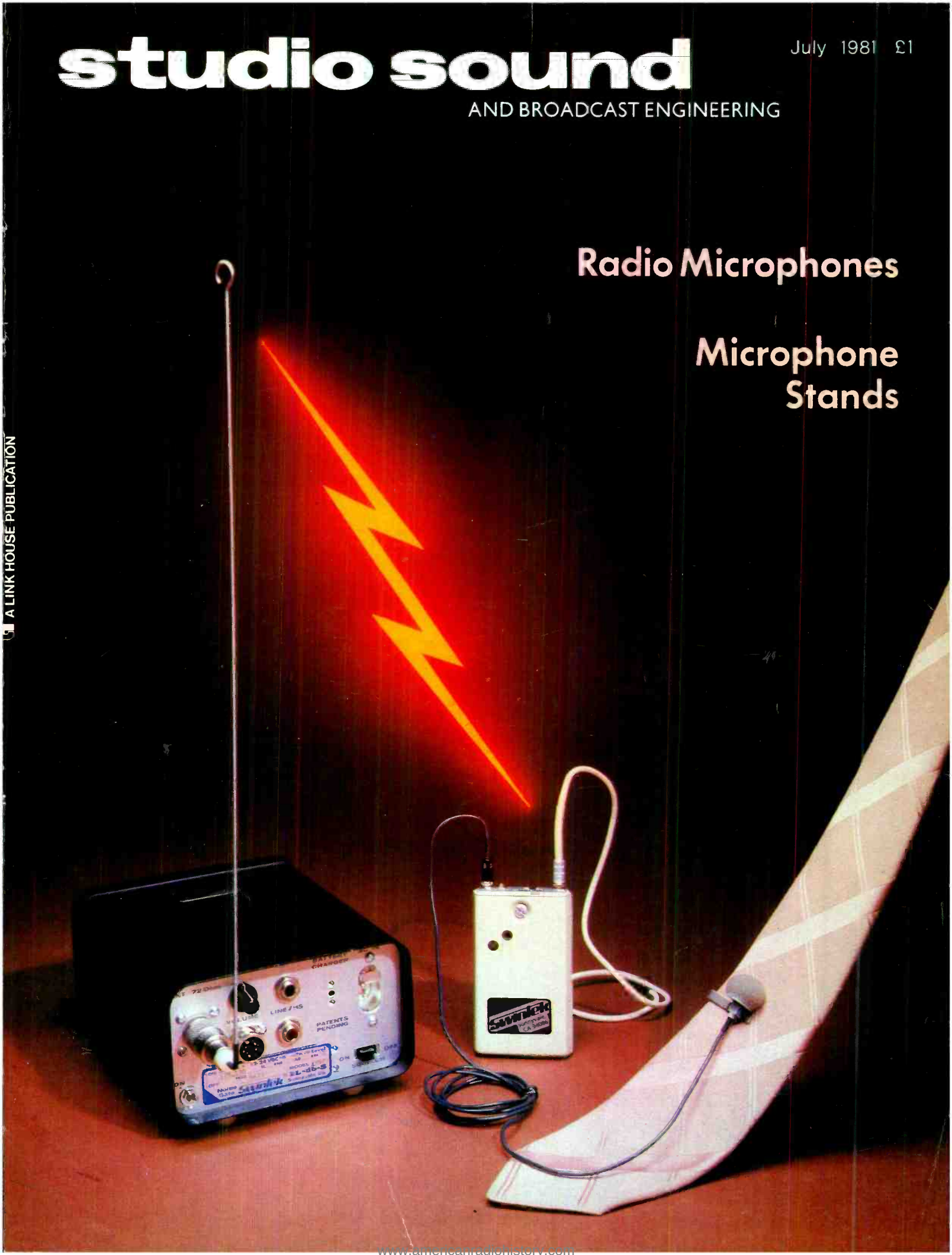
studio sound
AND BROADCAST ENGINEERING
July 1981 £1

Radio Microphones

Microphone Stands



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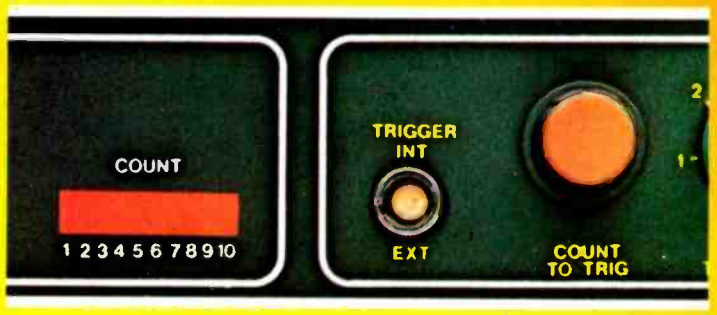

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studio sound

AND BROADCAST ENGINEERING

Surveys in Studio Sound

For the past several years, *Studio Sound* has carried at least one survey of specific items of sound equipment per month, running through a list of subjects which takes two years to complete. Obviously, a lot of information changes in this time, and while we try to keep readers up to date as much as possible in our News pages, we have never had the space to do this as effectively as we might wish. There is also some doubt about exactly how useful our surveys are to readers, as subjects have taken such a long time to 'come round'.

The publication of Studio Sound's *Pro-Audio Yearbook* gives us the chance to change this for the better. The *Yearbook* is compiled annually, by Angus Robertson and his staff, and details of its availability are advertised elsewhere in this magazine. A large proportion of the book's 600-plus pages contains highly detailed and thoroughly-checked information on professional sound products, presented in a way similar to that which we have used in our own surveys. Indeed, over the past few months we have been drawing our survey material directly from the book. In addition, the *Yearbook* also includes details of almost 1,000 dealers, manufacturers and distributors of pro audio equipment all over the world. It would be impossible for us to devote sufficient space to cover this material in as great a detail as the *Yearbook* does, and with the publication of the book, there would be little point in doing so, as it would represent mere duplication of data.

We would therefore welcome your opinions on this proposal: we intend, in the near future, to discontinue our publication of surveys as they have been presented in the past: for those who need such information regularly, there is no better source than the *Yearbook* itself, which will no doubt pay for itself with the first piece of equipment you order. Instead, we intend to publish a monthly New Products section, covering only new equipment which is not included in the current edition of the *Yearbook*, giving priority to subject areas featured on the cover. This will enable us to include new information on products far more rapidly than before, without a 2-year wait for the appropriate month to arrive. These updates, in conjunction with the book, will form a unique reference guide to currently-available gear, unparalleled in the industry. The publication of 'survey updates' will also free valuable editorial space in the magazine for feature articles and other material, enabling us to cover the creative aspects of the industry as fully as we have the technical side. We have already made moves in this direction over the past months, and readers generally appear to have approved.

We are continually working to bring you a magazine which serves your needs best, and any feedback or ideas you can give us which will point our efforts in the right direction will always be welcomed. We feel these proposals will assist these aims: your comments will be most valuable. We also intend to run a readership survey in the near future, which will help us plan even more effectively to meet the needs of our rapidly advancing industry.

Richard Elen

Cover photograph of Swintek 2L-dB-S by Roger Phillips

ISSN 0144-5944
JULY 1981 VOLUME 23 NUMBER 7

APRS 81

UPDATE turnkey

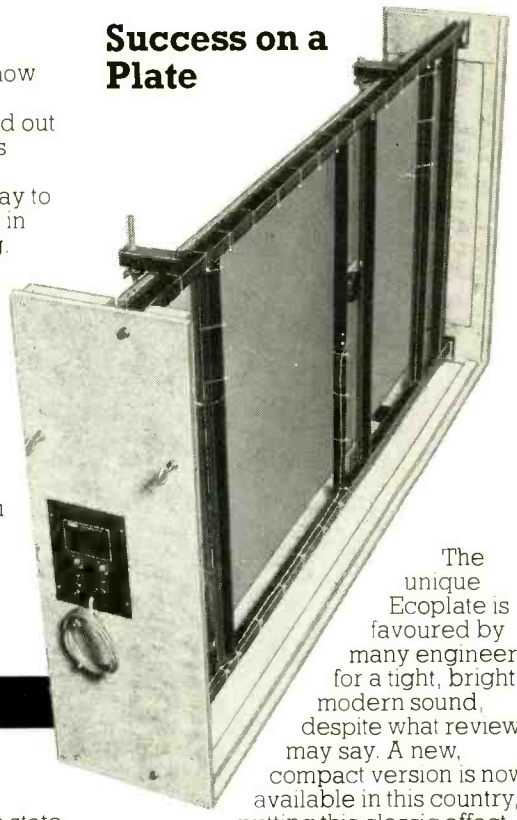
On Stands 41, 42

New Products, exclusive imports and bigger premises are extending our services to the professional audio industry. Whatever your equipment needs, come and talk to Turnkey. Our business is helping you with yours.

SOR

Our new sale or return service now extends to a wider range of signal processors. Find out more about this unique, no commitment way to choose the best in audio processing.

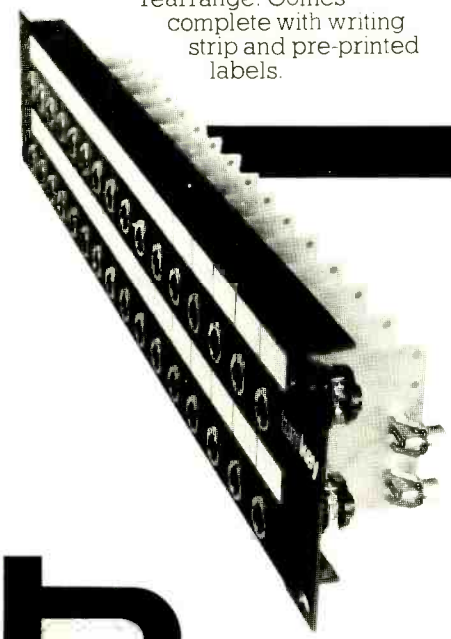
Success on a Plate



The unique Ecoplate is favoured by many engineers for a tight, bright, modern sound, despite what reviewers may say. A new, compact version is now available in this country, putting this classic effect within the reach of cost concious studios. Arrange for a demonstration, and hear what digital devices still have to catch up to.

ModPatch

A solution to burnt fingers and curses. A fully normalised 32 way, rack mounting jackbay with optional phono or jack type connectors on the rear. Simple to install and rearrange. Comes complete with writing strip and pre-printed labels.



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The EXR alternative, an aural exciter that you can buy, is back in stock now.

Our demo tape lets you hear how programme sounds louder with no change in level.

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Latest additions to Accessit . . . a state of the art, discrete, balanced front end dual microphone amplifier . . . a fast silent noise gate with external trip facility . . . a sturdy, six watt, utilitarian amplifier for talkback, cue feeds etc . . .

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Also new . . . the revolutionary Casio VL Tone (see June Studio Sound) . . . quick stripping, fast wiring West Penn wire . . . Sennheiser budget modular electret microphones . . . Comp-Cards, efficient file storage for small servicing components . . . Dr. Rhythm, the programmable percussion composer.

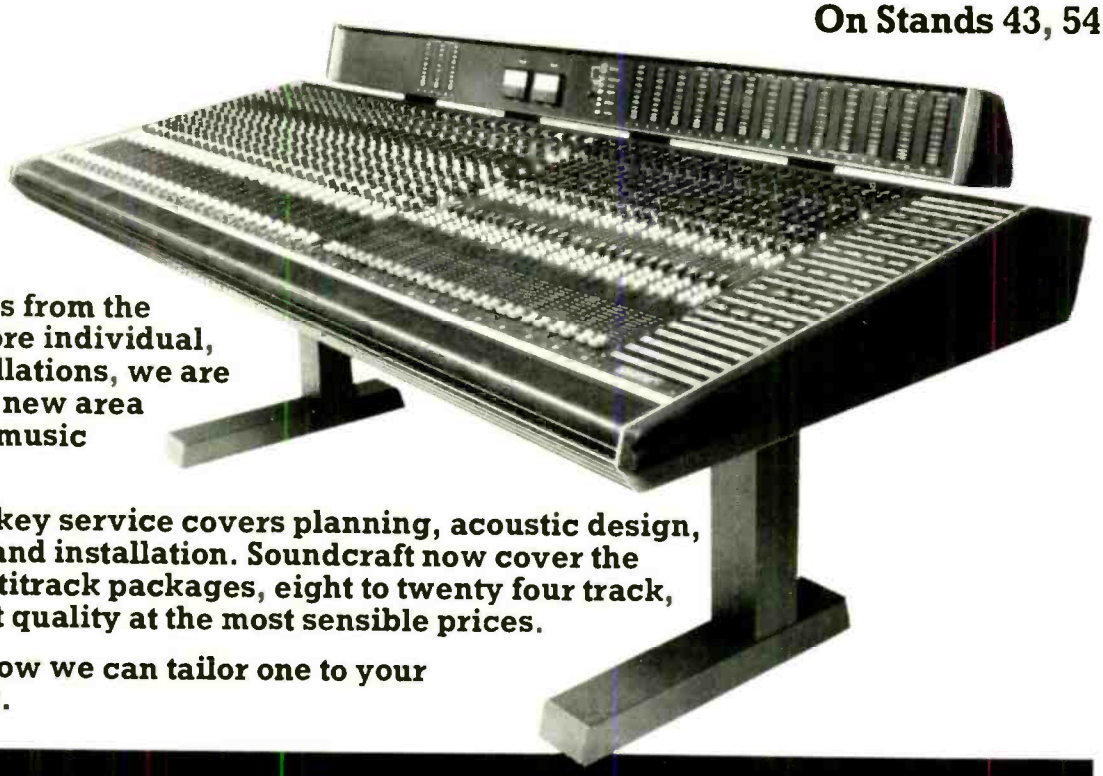
t2

A complete acoustics design or update service is available from Turnkey Two. Recent projects range from complete 24 track studios to quality reinforcement systems. We have access to the latest computer analysis techniques and constructional materials. Contact Andy Munro for full information.

Soundcraft

UPDATE turnkey

On Stands 43, 54



The Package Revolution

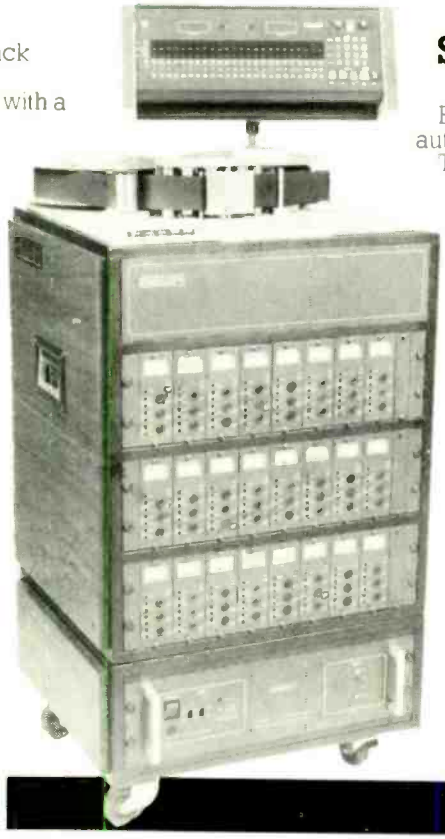
As recording moves from the mega-studios to more individual, cost effective installations, we are specialising in this new area of the professional music industry.

Our complete Turnkey service covers planning, acoustic design, equipment supply and installation. Soundcraft now cover the whole range of multitrack packages, eight to twenty four track, offering the highest quality at the most sensible prices.

Call us to find out how we can tailor one to your exact requirements.

Did you know?

1624 Series is number one 16/24 multitrack console in Europe.... Soundcraft recorders and mixers connect with a single flat multicore.... Krystof, their Swiss brain, is completing the new audiomation system first scheduled for the Series 3B.... the new autolocator prints 'good day' when you switch on.... extraordinary custom export order for one dozen battery powered Series IS mixers with power amps now completed... forty six track recording now possible with new synchroniser system developed jointly with AK.... more Soundcraft on demo in our new showroom.... bigger workshops and more staff means fast turnaround on all Soundcraft service....



SCM382-24

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new SM85 PRO TECH SOUND

brings a new dimension to a hand-held condenser microphone

This new high technology Shure microphone will change the way people think of condenser microphones. The SM85 is designed especially for on-stage, hand-held use. Its sound is unique—far more tailored to the special needs of the vocalist: sizzling highs and a shaped mid-range for superb vocal reproduction, and a gentle bass rolloff that minimizes handling noise and "boominess" associated with close-up use. Ultra-low distortion electronics make the SM85 highly immune to stray hum fields. An integral, dual-density foam windscreen provides built-in pop protection.

What's more, the SM85 Condenser Microphone must pass the same ruggedness and dependability tests required of Shure dynamic microphones. As a result, the SM85 sets a new standard of reliability for hand-held condenser microphones.

The SM85 is *extremely* lightweight, beautifully balanced—it feels good, looks good on-stage, on-camera, on-tour. Ask your dealer for a demonstration of the new SM85 PRO TECH Sound, or write to us (ask for AL664) for full details.

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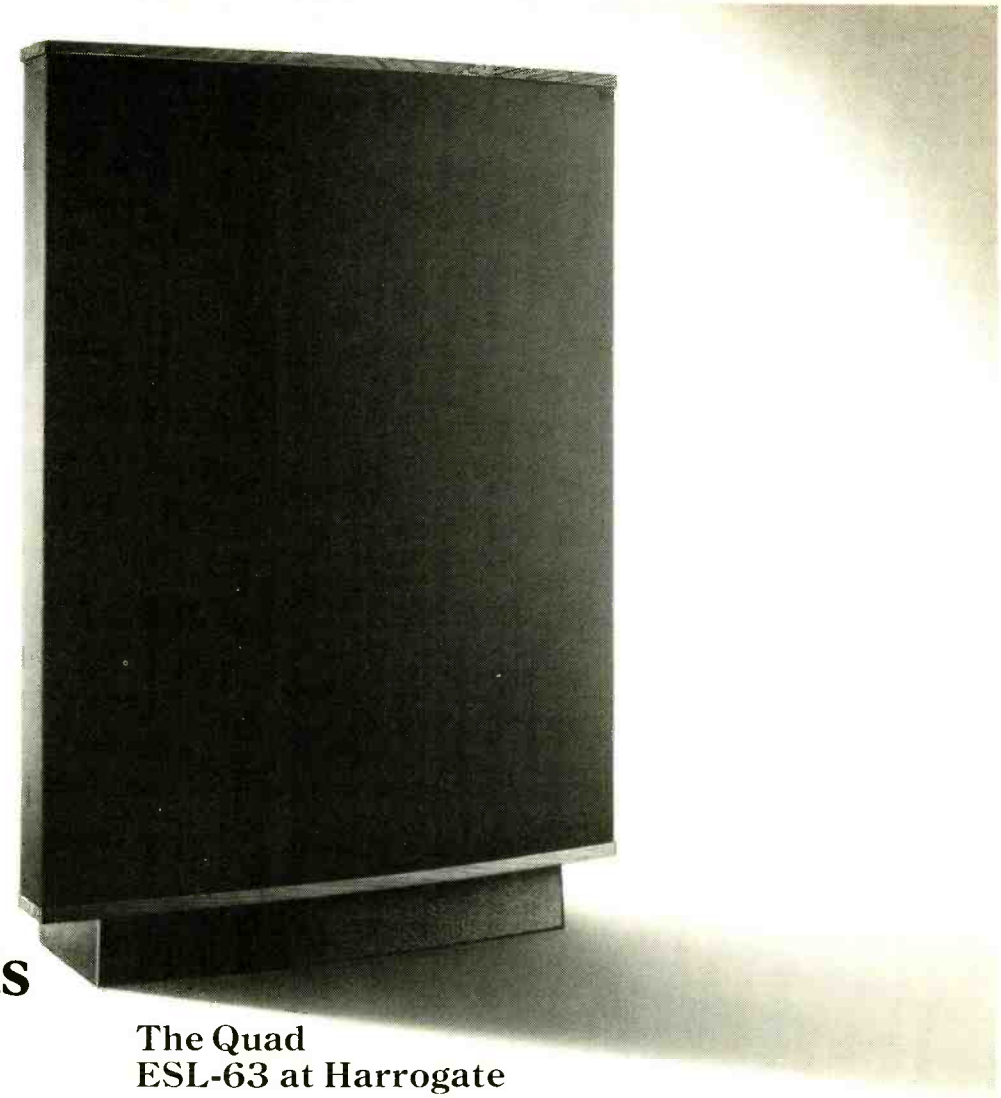


Raising standards

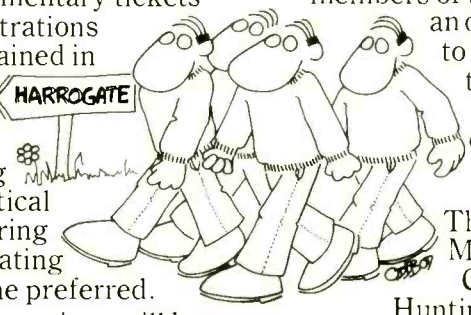
For a quarter of a century leading recording, broadcasting and loudspeaker engineers have used the Quad electrostatic loudspeaker as a standard of reference. Its influence on the quality of reproduction which we have come to expect has been considerable.

The introduction of its successor, the Quad ESL-63 is an event of great significance, destined to set the standards for the future. It is no coincidence that the first customers for the Quad ESL-63 have been recording and broadcasting engineers and loudspeaker manufacturers.

The Quad ESL-63 at Harrogate

The Quad ESL-63 will be on demonstration at the Harrogate International Festival of Sound August 15th-18th in the Duchy Room-Cairn Hotel.

Complimentary tickets for demonstrations may be obtained in advance by writing to or telephoning The Acoustical Manufacturing Co. Ltd., stating day and time preferred.



Demonstrations will be held every twenty minutes from 11.00 a.m. to 7.40 p.m. on Saturday 15th and Sunday 16th August and at the same times on Friday the 14th.

Please note that the exhibition is not open on Friday the 14th, but by kind permission of the organisers we are opening a day early to give members of the public an opportunity to listen to the Quad ESL-63 in comparative tranquility.

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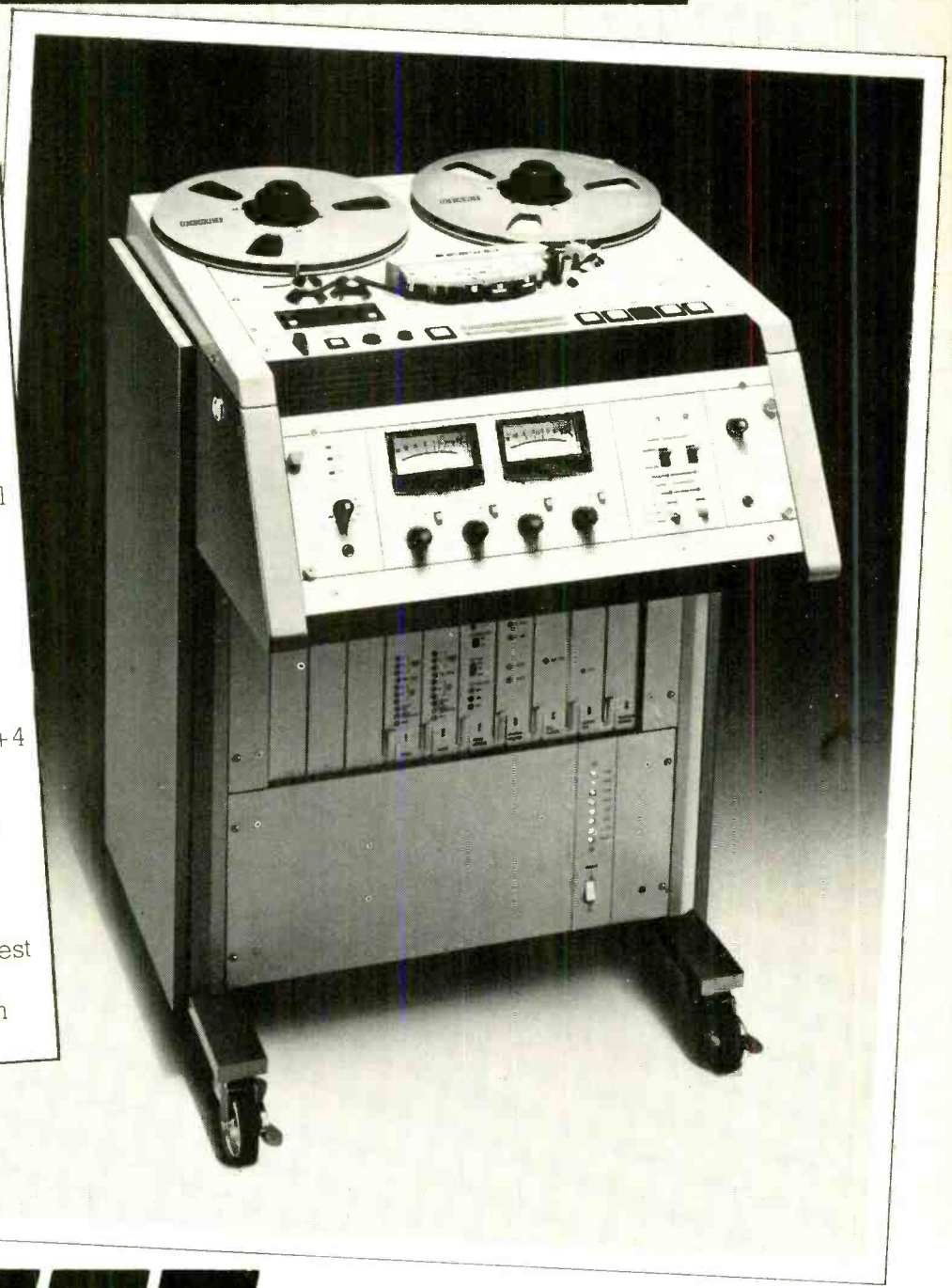

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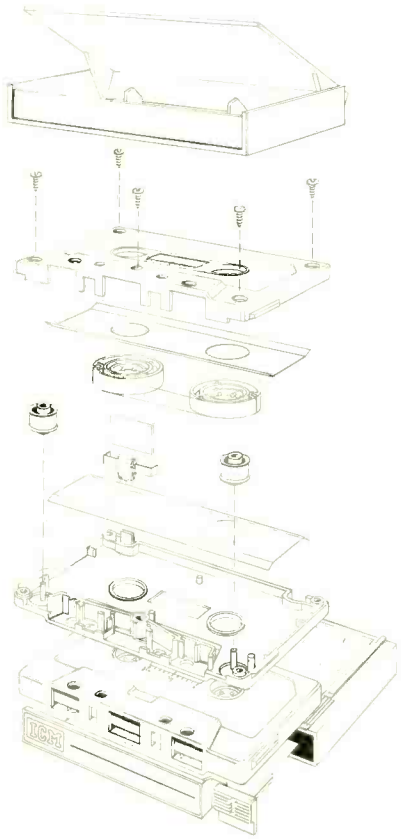

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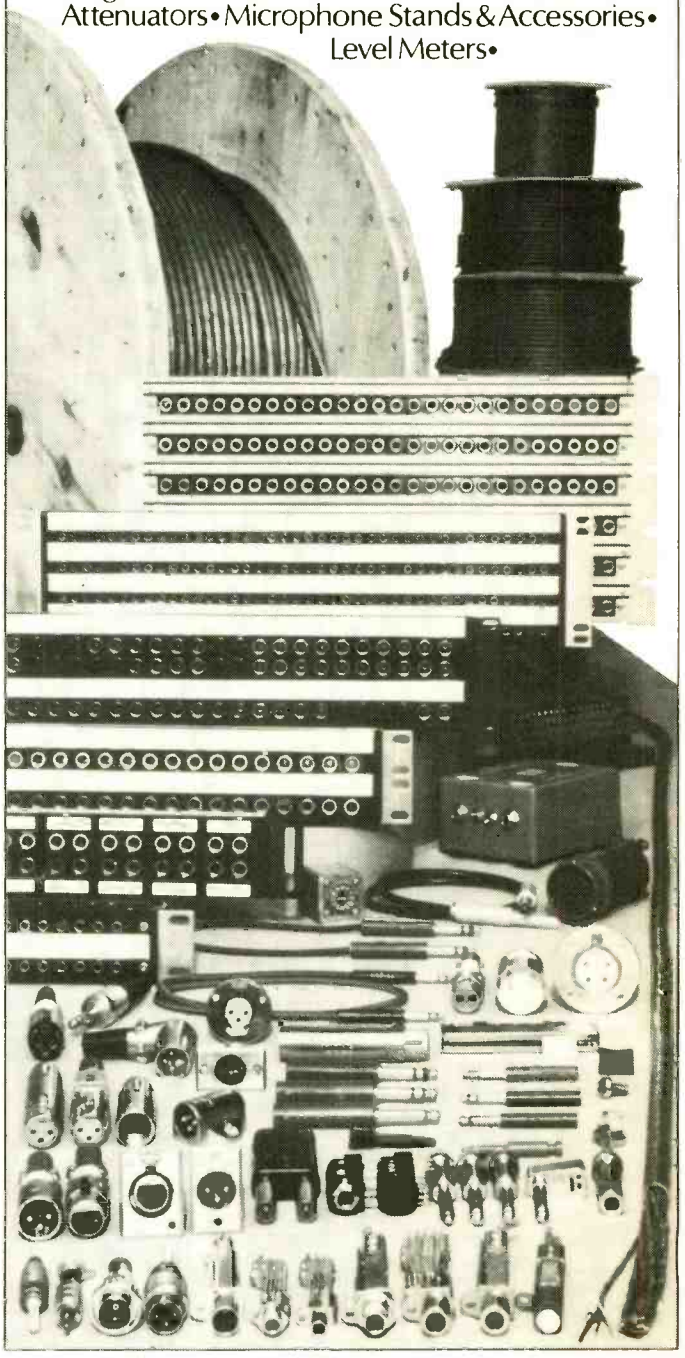

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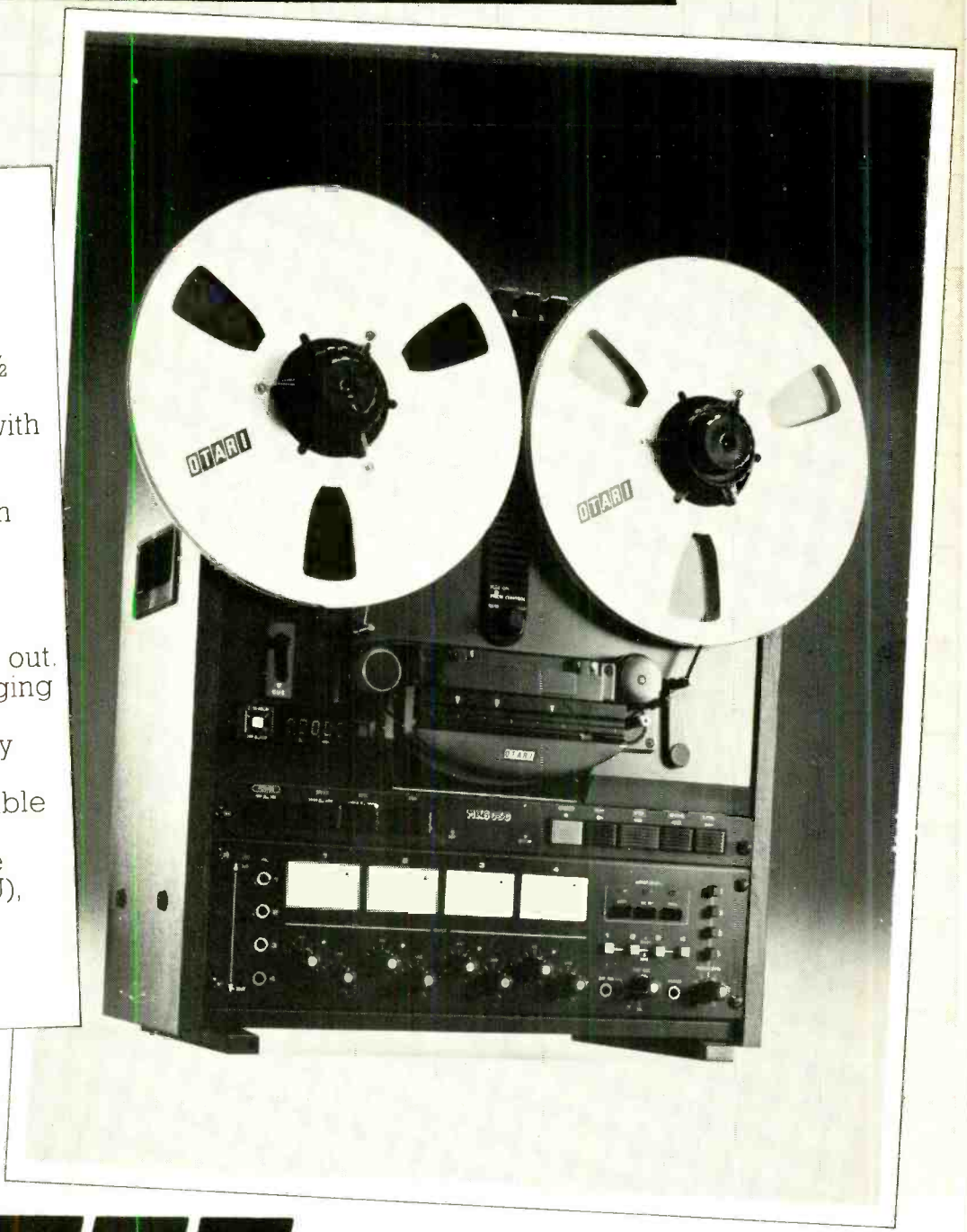

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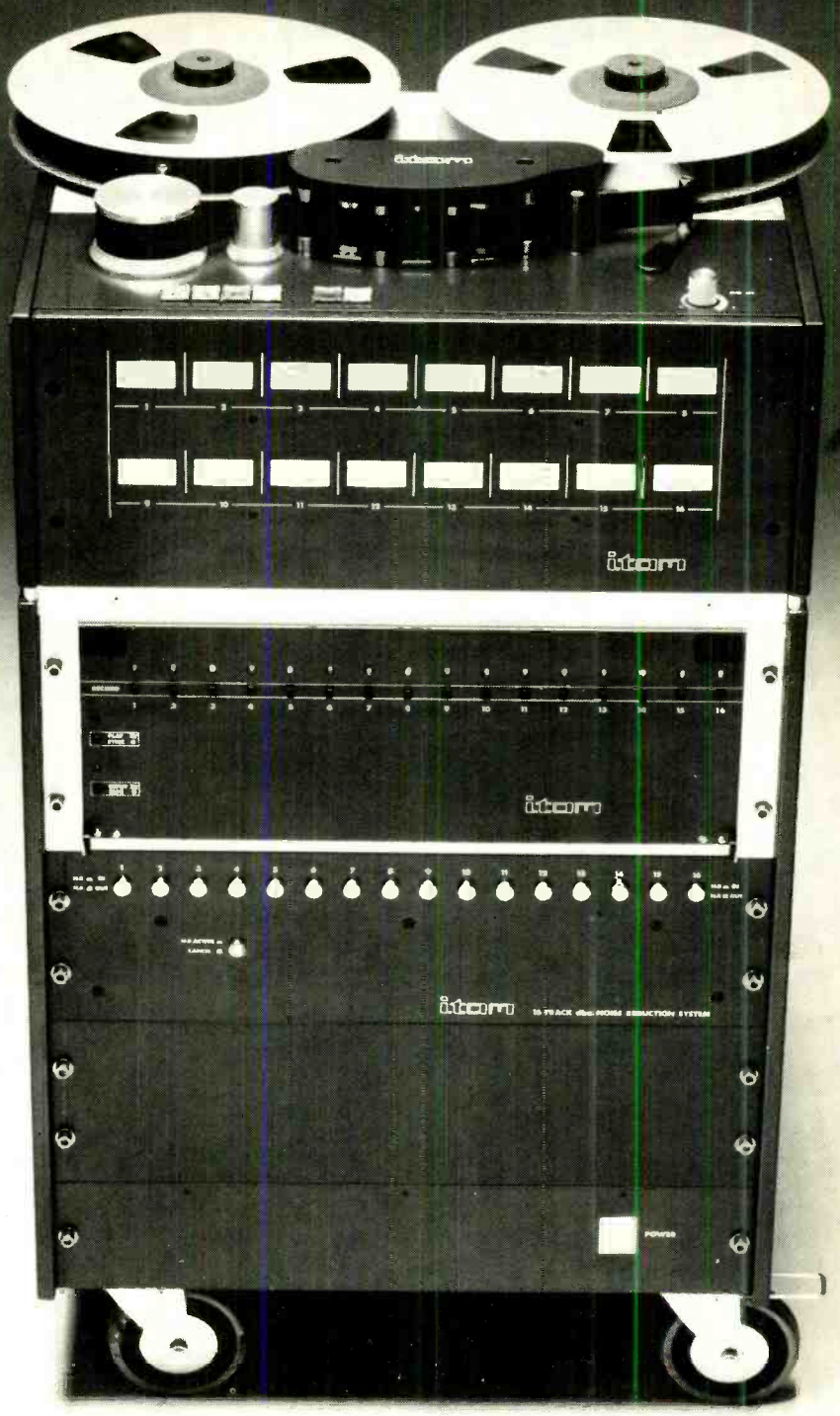

The Itam 1610 is a 1-inch 16-track that is built to meet the performance characteristics of a 2-inch. Add to that the big savings both in purchase and maintenance costs, and it is clear why the 1610 is the biggest selling professional multitrack in Britain today.

* 3 speed 7½/15/30 ips.
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* Ultra compact.
* Optional full function remote.

This machine shown with dbx optional extra.

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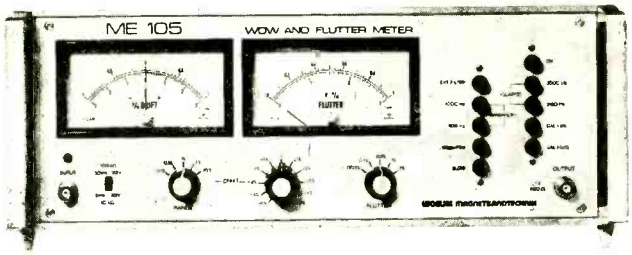

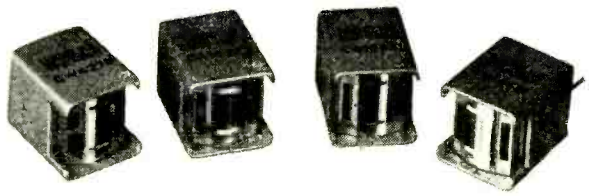

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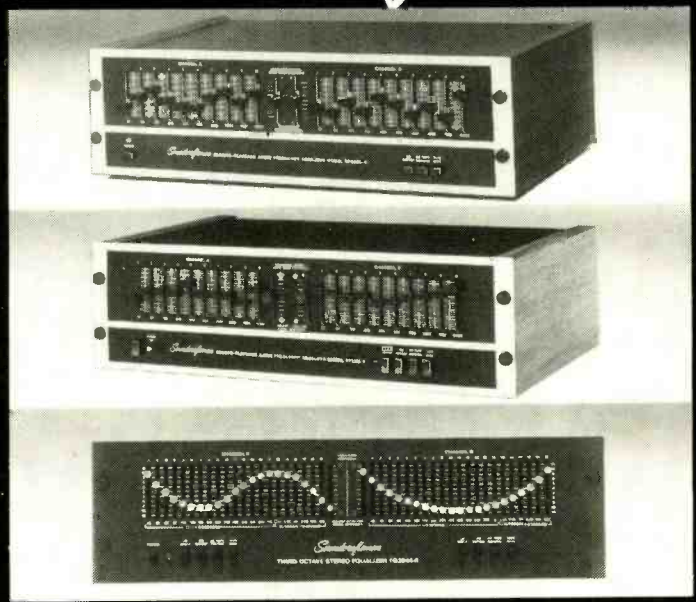

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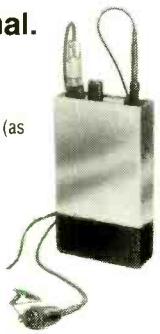

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Available for use with a standard 47k-ohm cartridge, the EMT 948 is an integrated system ready to drop straight into a desk-top. The EMT 948 brings excellence within greater affordability.

For further information contact FWO Bauch.

EMT FRANZ GmbH
Postfach 1520, D-7630 Lahr, Tel. 07825-512, Telex. 754319, Franz D

F.W.O. Bauch Limited
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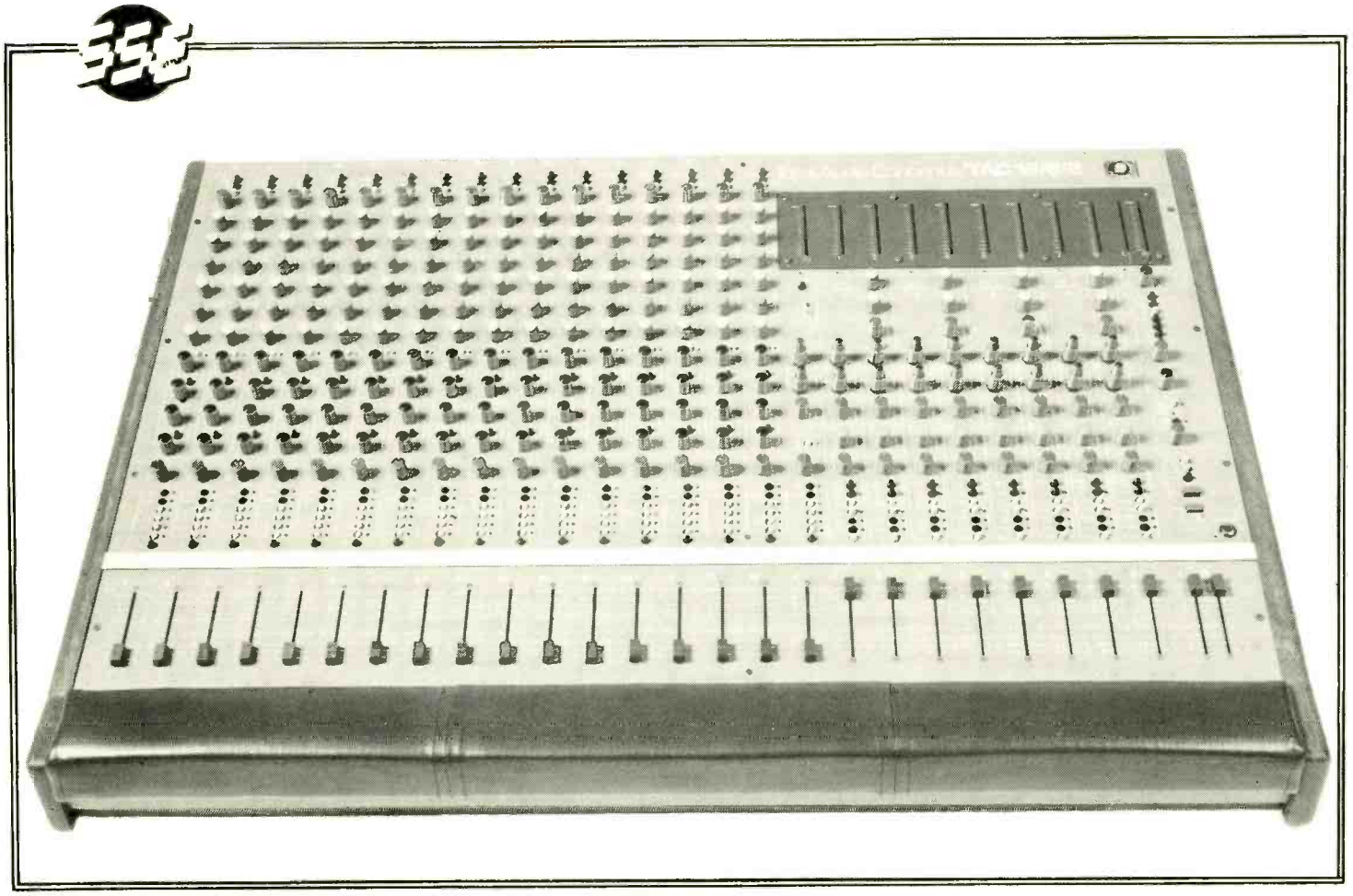
Telephone 01-953 0091. Telex 27502



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- ✳ extendable to 32 channel
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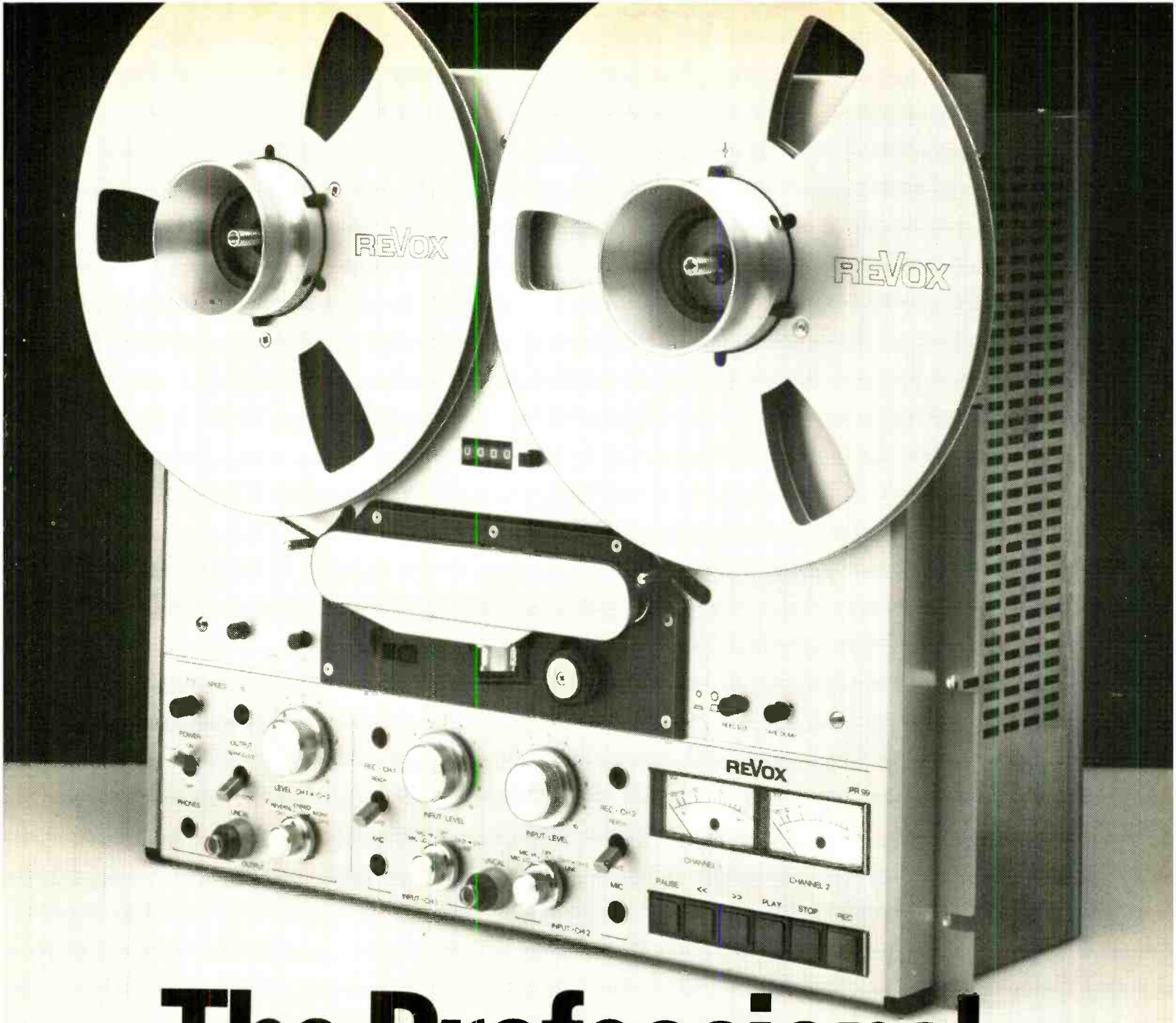

The Professional ReVox.

Introducing the PR99, the Revox design to meet the stringent demands of the recording and broadcasting industries. Developed from the highly successful B77, the Revox PR99 offers the professional the following key features:

1 Raised deck plate for easier editing
2 Improved tape start
3 Tape dump
4 Two way self-sync with automatic sync/input switching
5 Balanced line inputs and outputs
6 Calibrated or uncalibrated level adjustments
7 Manual or remote control operation, with fader start.

The Revox PR99 is available in 3¾/7½ ips NAB or 7½/15 ips NAB and IEC versions. And, being built to Studer precision, the PR99 offers the professional exceptional performance and reliability.

STUDER REVOX

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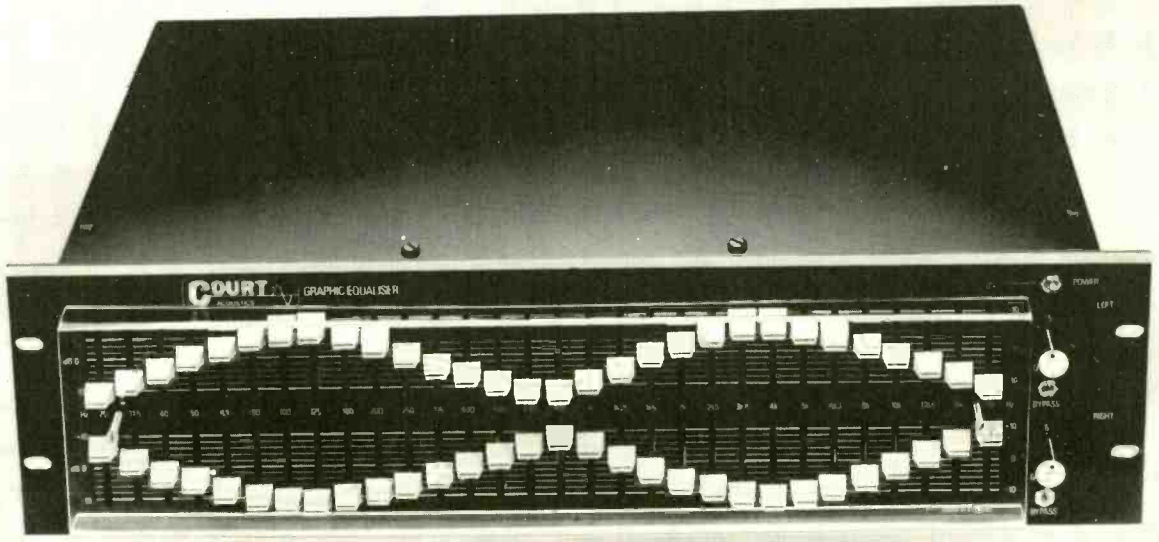
The Ultimate Equaliser



- 2 Stereo bands of 30 faders with centre click stops giving 20db of control
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The studio-microphone RE 20 is a cardioid microphone of the variable-D-series, i. e. incorporating the patented system that avoids proximity effect and reproduces the true sound. It was especially developed for broadcasting, recording studios and sound reinforcement applications and therefore features an essentially flat frequency response, a very wide frequency range, an exellent transient response and numerous further sophisticated qualities appreciated in recording studios.
It is, therefore, not surprising that more and more recording studios so highly praise the various Electro-Voice microphones. Why not ask for further particulars from Gulton Europe Ltd., Electro-Voice Division, Maple Works, Old Shoreham Road, HOVE BN3 7EY.

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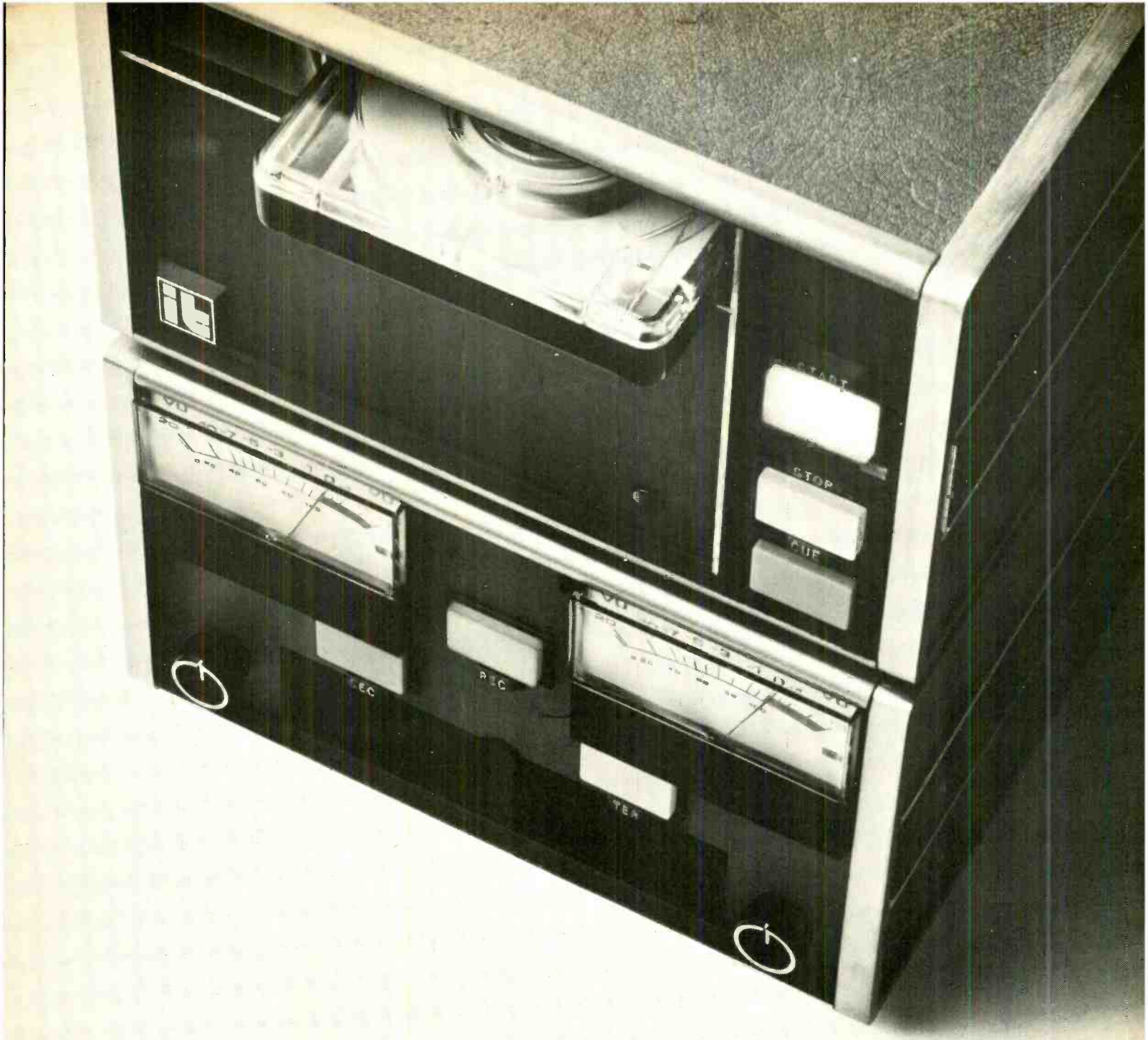

THIS NEW GENERATION CARTRIDGE MACHINE FROM ITC ALMOST SPEAKS FOR ITSELF.

There's been much talk about reel-to-reel quality from cartridge machines. Unfortunately, most of it turned out to be hot air.

But now it's a cold fact with Series 99 from ITC, the world's leader in cartridge machine technology.

With 19 patents pending for both electronic and mechanical innovations, it's no wonder that ITC's Series 99 sets new standards.

For sheer quality of sound. For greater operator convenience. And for simplified maintenance.

If you want to hear the cartridge machine that virtually speaks for itself, write now for a few words on the subject to F.W.O. Bauch Limited.

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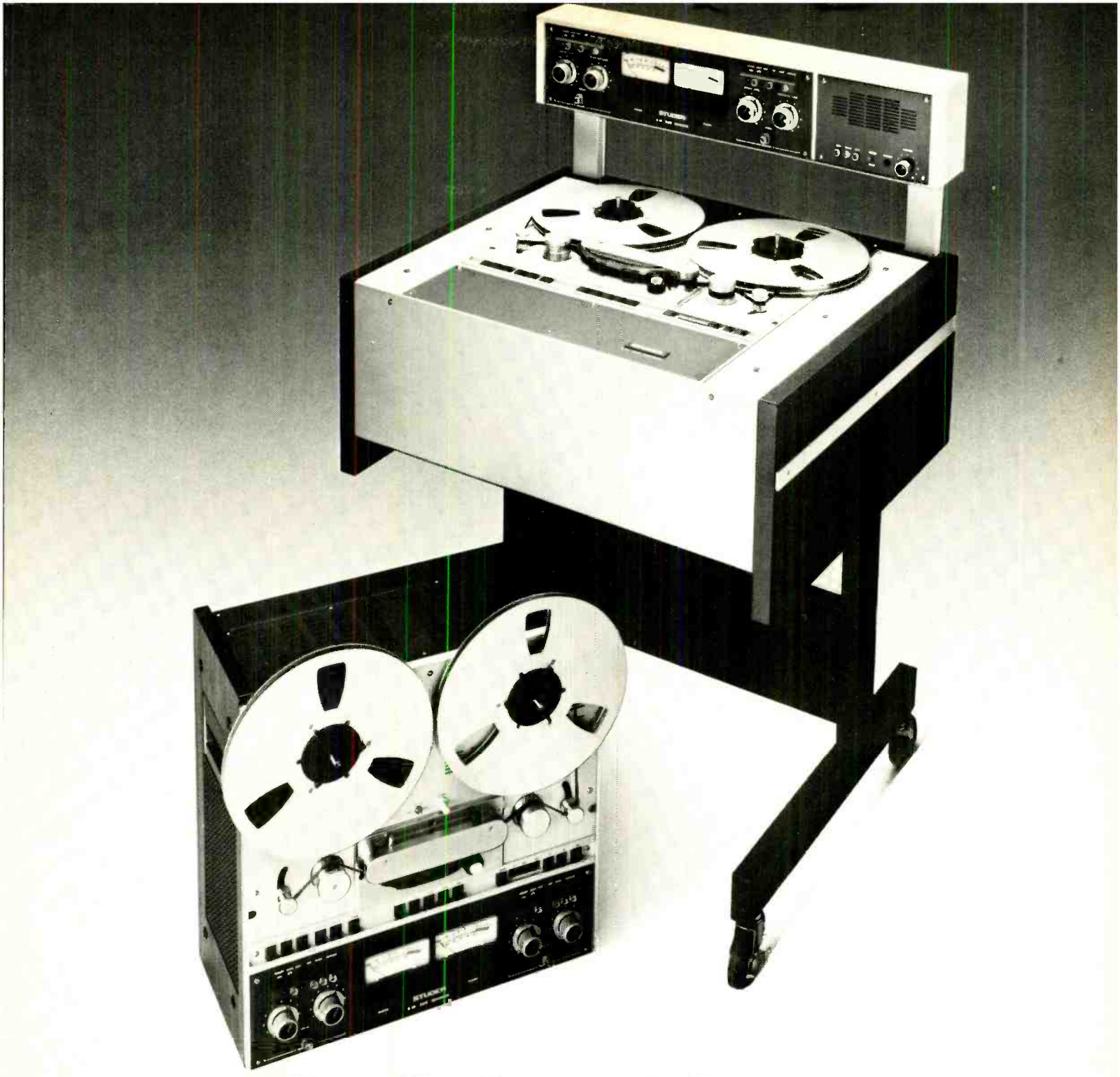

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The value-for-money B67 offers proven reliability and performance to justify its acceptance as the direct replacement to the renowned B62.

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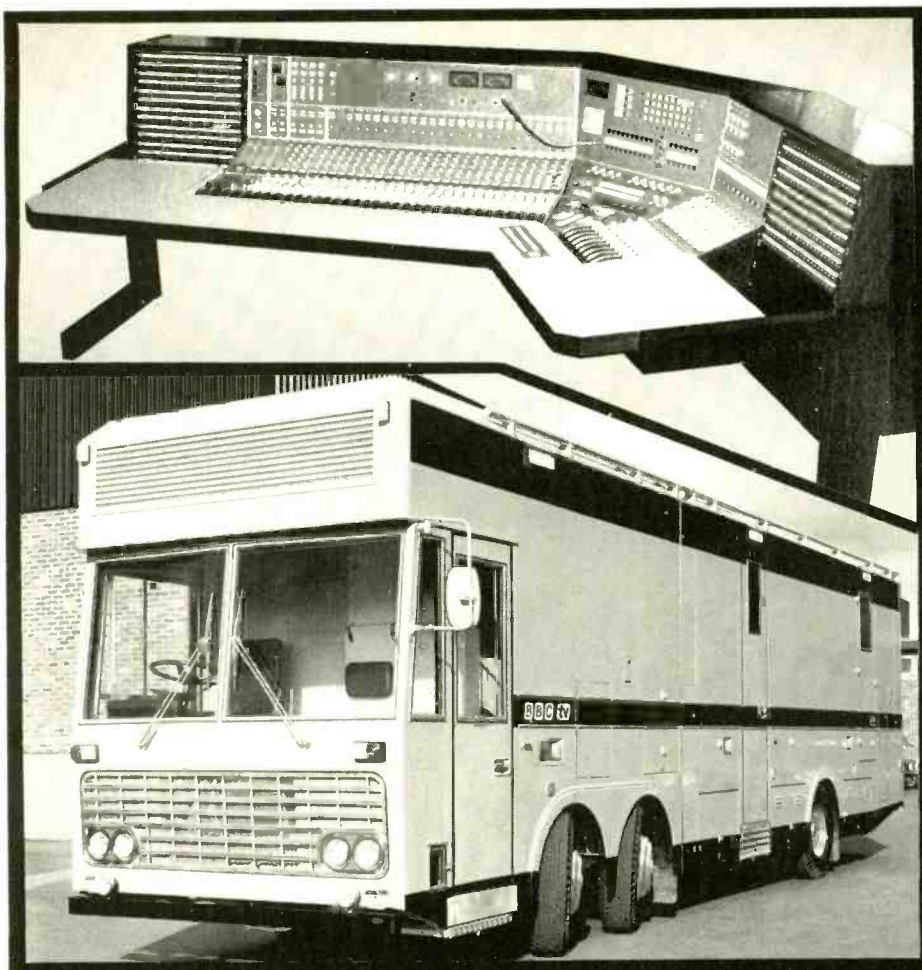
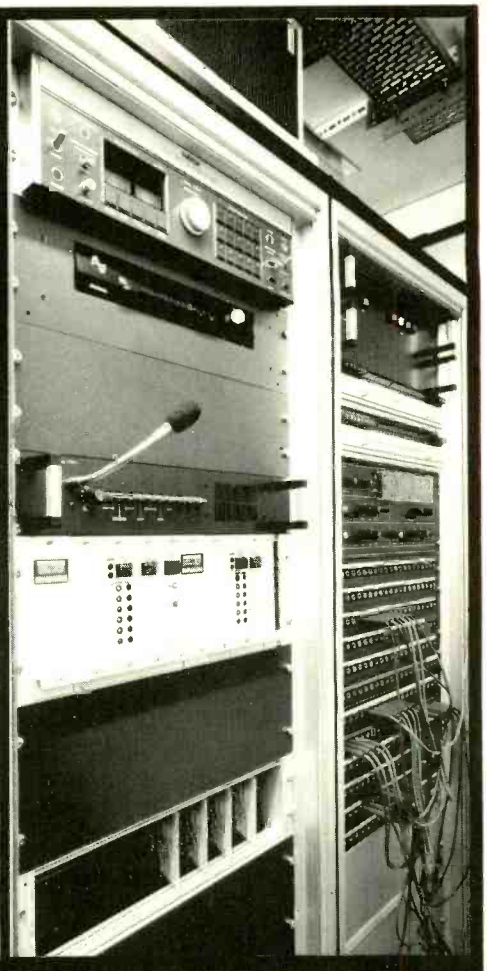
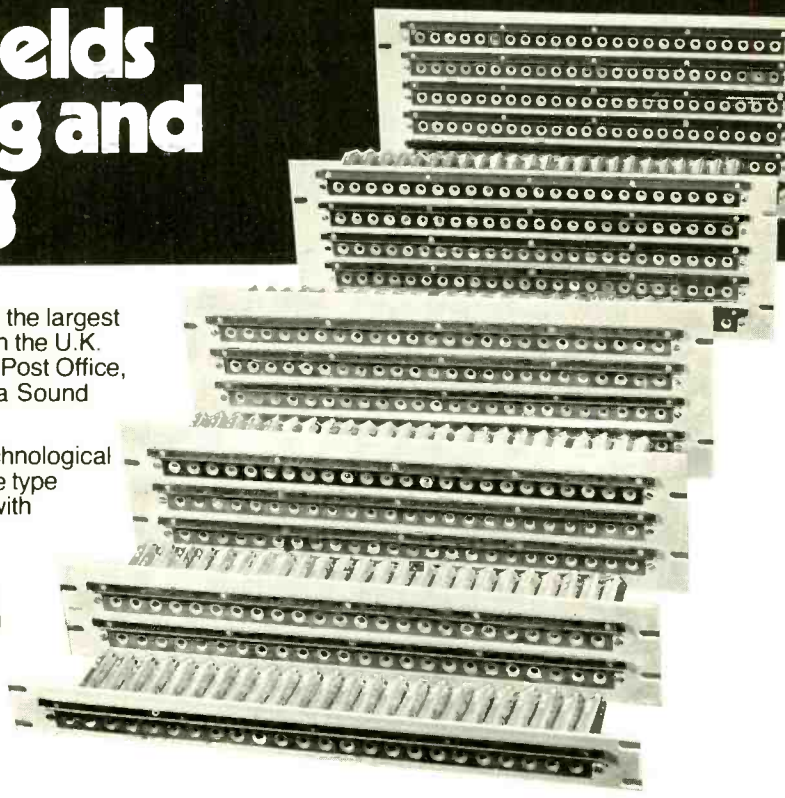




Jacks & Jackfields for Recording and Broadcasting



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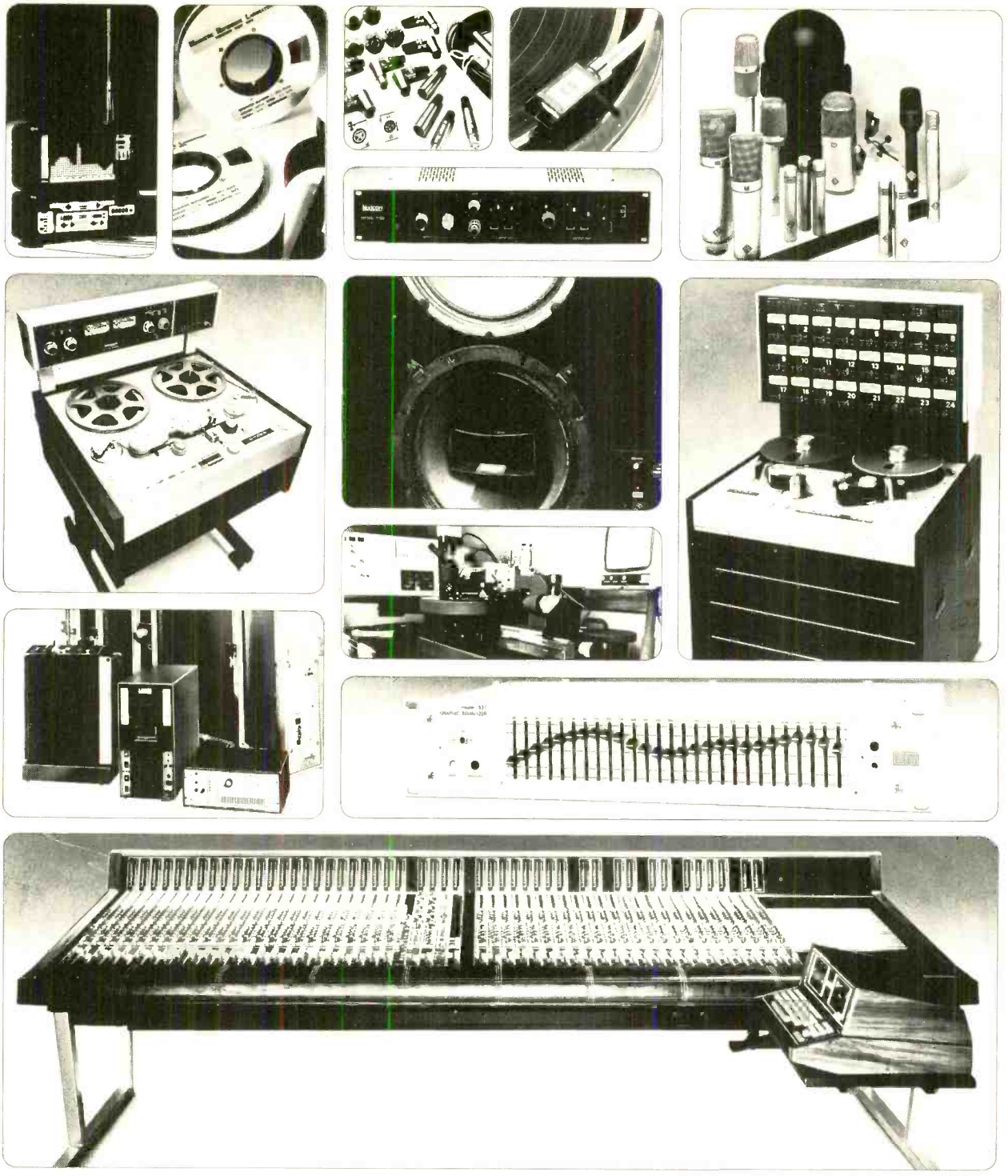

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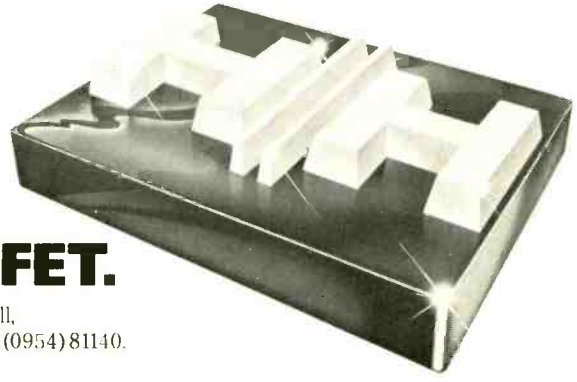
Naturally, we anticipate that most professional sound engineers will be eagerly switching over to MOS-FET at the first opportunity. So to make it easier, there are 4 models (all 19" rack mounting) with outputs from 150 to 800 Watts...and multiples thereof, using the X 300 frequency dividing network.

And once installed, our cool MOS-FET amplifiers will perform with so little distortion, that i.m.d., d.f.d. and t.i.m.d. are almost immeasurable by contemporary standards.

So at last you can boost your input with total honesty – and nothing else.



Graduate to the 80's. MOS-FET.

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Each TRACK TECH channel is a complete input and output channel, with up to 16 track assign matrix capability on the new 24 channel model.

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This is a unique Turnkey service only available to UK residents. Ask for our special 'SOR' price list and application form.

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As well as repitching instruments and turning men into women and vice versa (voices only) . . . retune already recorded tracks . . . and slow down or speed up a recording, transpose up or down, and you can lengthen or shorten jingles etc. . . . new echo effects by processing the send and return signals . . . use multitrack or chorus techniques to create choirs of angels or low down hummers . . . play low and slow then pitch back to normal and perform impossible feats of musical dexterity . . . try it in our new demo area or on SOR.

New DDL – Immediate release

The quietest and the cleanest digital, delay is now even better. As a result of new chip technology you get more milliseconds for your pounds.

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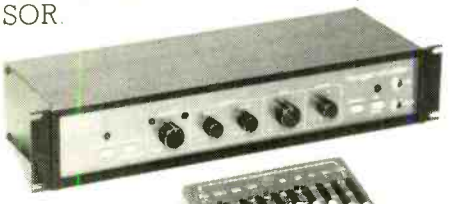
Chopping Limiter

Pulse Width Modulation technique is used to control the gain in this new two channel, rack mount limiter. Distortion, noise and surprisingly, price, are low.

Front panel controls permit stereo ganging and control of ratio, attack, release and levels. LED displays indicate the amount of control. Sidechain patching is also possible. In stock and on dem now.

Here to Stay

Dedicated Time shifters with fancy names go out of date at an alarming rate. Yet modulation, feedback and manipulation of delays in the region of .25-70mS is both creative and useful. The Flanger/Doubler provides this whole range of possibilities, straight delays as well as the swishing of drums to the chorus of voices. Hear it on demo or try it on SOR.



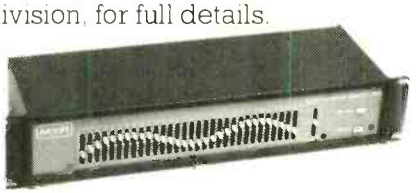
Graphic of All Trades

This studio spec., 10 band MicroGraphic is one of those unique products that are so useful, that they find their way into the most peculiar applications. You'll find them in echo lines, foldback lines and most recently on the road with ENG TV teams.

Tunaroom

Using the latest micro-processor based Ivie analyser, we will equalise your control room free of charge with the purchase of a pair of MXR's precision 31 band graphics. (Travelling expenses charged outside Greater London).

Contact Andy Munro, from Turnkey Two, our acoustics division, for full details.



Specs and Prices

Literature, prices and product are immediately available on the full MXR range.

Write or call for a 'professional price' quotation, or if you live abroad, ask for our 'personal export' price list.

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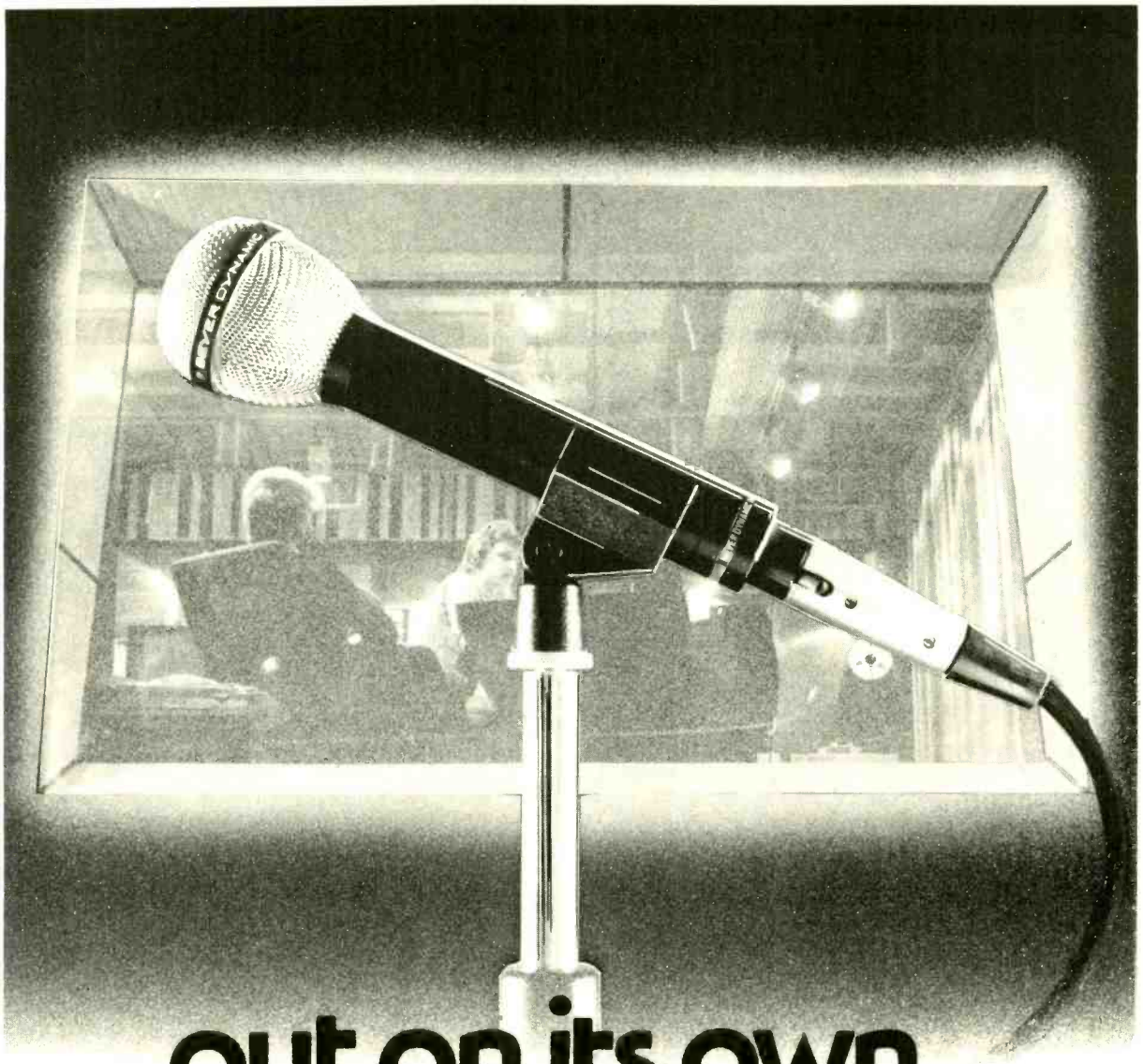

out on its own

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

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

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

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This facility is available as an update to both DMX 15-80 and DMX 15-80S systems.

Keep up with AMS - see us at the AES in Hamburg & Los Angeles and at the NAB in Las Vegas.

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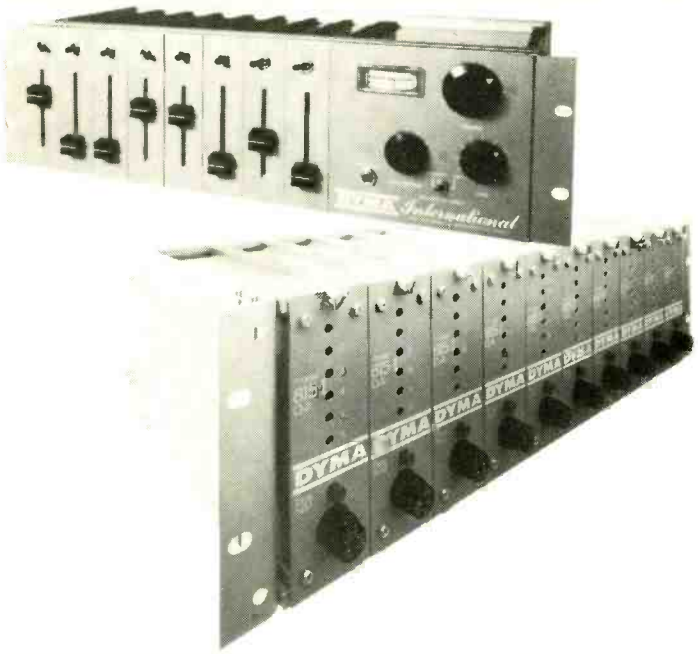

Dyma International

American manufacturer Dyma Engineering has introduced a new small rack mount audio console, the *International,* suitable for use by small production facilities, editing suites, news booths, or remote vans. The console occupies only 5¼in of rack space and features eight input modules, a headphone output, and rotary gain pots for the master output, headphone output and cue. Each channel has two inputs selectable on the front panel and also uses a slide fader with cue. Each preamp is switchable for mic and line level. The unit is available in both mono and stereo configurations.

Dyma also produce the *DA 815* range of audio distribution amps. Two models are available the *815* which has a maximum output of +26dBm, or the *8151* having a max output level of +21dBm. These amps take the form of modules 1.6 × 4.62 × 9.8in (whd) which are designed to interface with the *DAF 815* 19in rack frame. Each module is seperately powered and the modules will drive either 10 electronically balanced 600Ω outputs using the *815* module, or six individually adjustable 600Ω electronically balanced outputs (0 to 30dB gain) on the *8151* module. Inputs are 100kΩ bridging, balanced or unbalanced. Power supply is 120Vac (240Vac optional), 50/60Hz, 15VA max, power supply primary fused. Prices are $289 per module, and $165 for the rack frame.

Dyma Engineering Inc, 213 Pueblo del Sur, PO Box 1697, Taos, New Mexico 87571, USA. Phone: (505) 758-2686/8686.

Wireworks catalogue

Wireworks has produced a fully illustrated and descriptive 12-page price list giving details of the company's wide range of cabling products and accessories including the *Microphone Multicable Components Group,* hardwired microphone multicables, professional microphone cables, and the *TE-2* mic cable tester. Copies of the catalogue are available from Angela DiCicco, Wireworks Corp, 380 Hillside Avenue, Hillside, New Jersey 07205, USA. Phone: (201) 686-7400. Telex: 710-985-4675.

Aphex Automatrix

Aphex Systems has introduced a new computer-based automation system for broadcast use, termed the *Automatrix.* The system which is modular and expandable consists of a VCA matrix, computer, and manual override and readout control. Using the system, radio stations will have the ability to sequence more than 1,000 events, and facilities available include the capability of programming 24 audio channels in mixed stereo and mono configuration, performing this function through standard tones and sensing technology.

Other features include independent stereo programme and Q outputs, software controlled level sensing (ducking, cross-fading), logging and TV monitor (CRT) readouts. Expected price of an operational system including computer, CRT, VCA matrix and interfacing, and manual override and readout control, is in the region of $8,000.

Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046, USA. Phone: (213) 655-1411. Telex: 910-321-5762.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Phone: 01-749 2042. Telex: 28938.

W & G Instruments Ltd

Test and measuring equipment manufacturer Wandel & Goltermann (UK) Ltd has announced a change of name and address. The company is now called W & G Instruments Ltd and has moved to improved premises at Progress House, 142 Greenford Road, Greenford, Middx UB6 9AH, UK. Phone: 01-575 3020. Telex: 934489.

The move has allowed the company to introduce a new showroom and demonstration area, to expand its service and storage facilities, and to add conference and lecture facilities to aid the training of customer personnel.

Neve/Kappa agreement

A formal licence agreement has been signed between Neve and Kappa Systems Inc whereby Kappa have assigned Neve all rights for the manufacture and sale of the Kappa *Communicator* microprocessor based intercom system for use by broadcasting, recording and film studios worldwide. The Kappa system, which was introduced in 1978 and has been developed and refined in several network installations in the New York City and Washington DC areas, is a fully programmable and highly flexible communication system. Both Neve and Kappa are to continue development of the hardware and software of the system, and Neve plans to manufacture the system both in the UK and the USA.

Syn-Aud-Con 1981

Synergetic Audio Concepts has announced its sound engineering seminar schedule for the remainder of 1981. Syn-Aud-Con seminars will be held from June 23-25, July 21-23, August 18-20, September 22-24, October 20-22, and November 17-19. The seminars, which are now in their ninth year with over 4,000 graduates, will be held in the company's recently completed $1 million Seminar Centre located in the heart of the San Mateo Canyon wilderness area in the Cleveland National Forest in the Santa Ana Mountains of Southern California.

Syn-Aud-Con has also announced that it is making its newsletters and 'Tech Topics' news-sheets available to non-Syn-Aud-Con graduates at a cost of $50 for an annual subscription. As an additional facility any non-graduate subscriber may offset this cost should they enrol in a Syn-Aud-Con seminar during the year of subscription.

Further details are available from: Don Davis, Synergetic Audio Concepts, PO Box 1115, San Juan Capistrano, Cal 92693, USA. Phone:(714) 496-9599.

Soundex AMM 200

Soundex has developed a new small economically priced noise meter, the *AMM 200,* which meets the difficult CCIR 468-2 specification for the measurement of audio frequency noise in broadcasting, recording systems and on sound programme circuits. With a measuring range of −100dB to −8dB (−80dB to −10dB selected by pushbuttons in 10dB steps), the noise meter has a 22dB calibrated meter scale and a balanced PO jack input which may be terminated to either 20kΩ or 600Ω by a front panel pushbutton. In addition the meter has a front panel BNC socket allowing a measured signal to be displayed on an oscilloscope, with the facility that the display may have the weighting network filter switched in/out.

A vital feature of the *AMM 200* is an overload warning light which warns of situations where amplifier stages before the weighting network overload at frequencies attenuated by the weighting network. Without this feature such overloads would not be apparent from the meter reading. The noise meter is mains operated on a double insulated power supply and is fitted with a broadcast weighting network as standard. A range of plug-in alternative filters are to be made available in the future. The *AMM 200,* which costs £350, is sized 175 × 113 × 67mm (7 × 4 × 2¾in) and weighs 1.2kg (2¾lb).

Soundex Ltd, Park Lane, Broxbourne, Herts EN10 7NQ, UK. Phone: 09924 64455.

36 ▶

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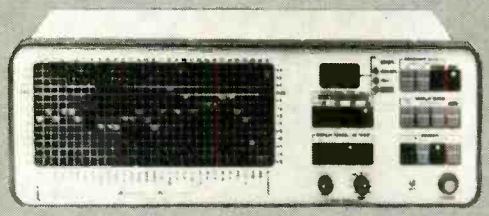
SONY TC-D5 PRO STEREO CASSETTE RECORDER

High performance transport and electronics packed in the smallest possible space. Sony's new cassette tape recorder for professional applications. Shown with Sony MDR3 headphones.



INOVONICS Model 500.

The Inovonics 500 has everything you need for sophisticated real- *and* reverberation-time acoustic analysis in one, easy-to-use package. Also available with plotter interface.

THE SONY PCM-1600
Your key to the world of digital audio.

It's happening now. The most significant technological advance in the 100-year history of sound reproduction.
A profound and dramatic step forward that will affect the entire audio industry.
Don't say a word.
Just listen.

PULSE DESIGN TCS 120
Tempocheck Metronome

The combined digital metronome and chromatic tuner. Dual readout in frames/beats and beats/mins. Measures tempo of music. Programmable beats/bar. Polyrhythmic outputs. Fully chromatic tuning octave. Quartz micro-computer for accuracy. Ideal for click-track, jingles and film scores etc.

SYNTOVOX 221 – The Intelligible Machine

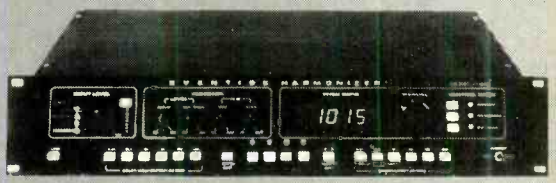
which is a 20-channel vocoder system already in wide use in sound recording studios, radio stations, scientific institutions, and by leading composers, for its outstanding quality and unexcelled intelligibility.

URSA MAJOR SPACE STATION

A complete processing centre providing comprehensive reverberation, multi tap delay, repeat echo plus a multitude of other effects. The most comprehensive digital reverberation and effects unit available at a price you can afford.

EVENTIDE Harmonizer. Model H949

Eventide's Model H949 starts where the H910 left off . . . with outstanding new features like time reversal, randomised delay, flanging and repeat. New digital circuitry and random access memories now actually transpose input signals by one full octave up and no less than two full octaves down.



U.K. Distributors

Feldon Audio Ltd.,

126 Great Portland Street, London W1N 5PH Tel: 01-580 4314. Telex: London 28668.

RTS mic preamp

RTS Systems has introduced the *Model 465* single channel, wideband mic preamp for broadcast and sound reinforcement applications. The preamp features fully floating transformer balanced inputs and outputs; switchable phantom mic powering; an integral power supply; and a switchable limiter facility. The unit is designed to accept dynamic or condenser low impedance (150 to 250Ω) balanced mics having an output level of −60 to −3dBu, and the unit has a gain range of 24dB to 57dB. The unit's output has an effective source impedance of 80Ω permitting it to drive cable lengths up to 1,000ft without excessive hf loss. The limiter facility keeps the output from exceeding a factory set (non-adjustable) level of +5dBu, and has a 5:1 compression ratio with a 1ms attack time and 200 μs release time. Price of the *Model 465* is $392.

RTS Systems Inc, 1100 West Chestnut Street, Burbank, Cal 91506, USA. Phone: (213) 843-7022.

Stolen equipment

Palmer A-V Systems of Wimbledon were relieved of a quantity of recording equipment from the Monster Music No 2 rehearsal room, 134 Wandsworth High Street, London SW18 at approximately 10.30pm on Monday, March 16. Two men aged about 21 (one with a southern European appearance and calling himself Mark Reid) dressed in the usual jeans, etc nondescript style were responsible. The stolen equipment includes: a Teac *Tascam 80-8* 8-track recorder (serial No 8080107); a dbx *DXB* noise reduction unit (serial No 0080312); a Teac *A3350* stereo recorder (serial No 3312); two Calrec *CM1050* mics (serial Nos 1426 and 1412); an AKG *C28* valve condenser mic (serial No 1571); an AKG *D12* mic (serial No 1900); and an AKG *D202E1* mic (serial No 63922).

Anyone with information as to the whereabouts of any of the above equipment is asked to contact either *Studio Sound*, Wandsworth CID (Phone: 01-870 9011), or Palmer A-V Systems, 37 Melbourne Road, London SW19 3BB. Phone: 01-540 2164.

Wrexham & Deeside ILR

The IBA has announced that it intends offering the contract for the Wrexham and Deeside ILR station to Marcher Sound/Sain-Y-Gororau, a group chaired by Lord Evans of Claughton. Broadcasting from the new station is expected to begin in 1982.

Obituary

John Pritchett, president of Quantum Audio Labs in Glendale, California, died at the early age of 41, at the beginning of the year. John who had a controlling interest in the company, which manufactures recording and broadcast consoles, had been with Quantum since 1975. Prior to joining Quantum, John had worked for Fender, Altec Lansing and JBL.

John was an active member of both the IEEE and AES, and his contribution to the professional audio industry will be sadly missed.

PWB active loudspeaker

UK manufacturer PWB Electronics has introduced a new actively driven loudspeaker system. The system comprises a 'tower' unit reproducing frequencies above 200Hz, a bass unit, active drive amplifiers and an electronic crossover. The 'tower' unit houses 105 low mass orthodynamic diaphragm drive units operating as one large diaphragm, while the bass enclosure is a 50 litre reflex loaded cabinet with a 200mm drive unit utilising a twin rear suspension system. The active drive amps (four in total being required) have independent power supplies, parallel connected power MOSFET output transistors, separate sensing circuits to protect the loudspeakers, and dc coupling. No limiting circuits of any kind are incorporated within the amplifier drive circuits.

The electronic crossover frequency is 200Hz with compensation to match the orthodynamic tower response, and attenuation is at 24dB/octave using 4th order filters to ensure correct phase at the crossover point. Amplifiers are available for either 110V ac, 220V ac, or 240V ac and the system is suitable for use with any high quality preamp with a low impedance output. Price per pair for the system is £2,750.

PWB Electronics Ltd, 1 Norfolk Gardens, Leeds LS7 4PP, UK. Phone: 0532 682550.

New England Digital's TSP system allows the Synclavier *to offer many of the features of systems like the Fairlight* CMI *as well as expanding the flexibility of the basic system.*

Synclavier upgrade

New England Digital, the manufacturers of the *Synclavier II* digital synthesiser, have released a software system designed to add further facilities to this already versatile synthesiser. Called the *Terminal Support Package* (TSP), the system offers three new facilities: *Graphics, Script* (a musical language) and *Max,* a music applications development system.

Graphics is a full-scale high-resolution graphics software subsystem, which allows the *Synclavier II* user a readout of numerical data printed on to a VDU screen. This display may be changed into a graphics display (by pressing the 'Return' key) offering a resolution of 480 vertical by 680 horizontal display points. The graphics system may be used to analyse existing sounds and create new ones.

Script is a music composition language written specifically for the *Synclavier*'s 16-bit processor, and offers facilities to write musical performances on the machine without the use of the musical keyboard (if required). Composing with *Script* offers up to 16 'tracks' to record on, and allows the user to create precise polyrhythmic sequences and melodies which would be impossible to play manually. *Script* compositions may be stored on disk, and then subsequently loaded into the *Synclavier*'s digital memory. As *Script* can use SMPTE code, the resulting performance may be played back in perfect sync with a multitrack recording.

Script also offers full editing facilities via the terminal, enabling the user to cut apart, reassemble or tailor in any manner a composition without the loss of any of the original elements.

Max, the third aspect of the TSP system, is a language system which enables the user to access all the NED special-purpose hardware incorporated within the *Synclavier,* including the computer system itself, A/D and D/A converters, and the inbuilt timer which can be programmed to be SMPTE compatible. *Max* is supplied with full documentation incorporating details of the *Synclavier*'s hardware interfaces, allowing a programmer to design his own software. *Max* is a superset of XPL, the language used by NED to program the *Synclavier*'s computer.

Full literature and a demonstration record are available on request from New England Digital, Main Street, Norwich, Vermont 05055, USA. Phone: (802) 649-5183.

Beyer M 600

Beyer has introduced a new dynamic microphone, the *M 600* hypercardioid mic. Features of the new mic include a lockable on/off turn switch; adjustable 3-position bass attenuator (−8dB, −12dB and −16dB at 50Hz); built-in hum bucking coil to cancel electromagnetic hum; and built-in breath and pop filter. Frequency response of the *M 600* is 40Hz to 16kHz with an EIA sensitivity rating of −149dB and an electrical impedance of 250Ω. The mic is finished in a matt black anodised aluminium case with a steel mesh grille, and has a built-in male Cannon *XLR* connector.

Beyer Dynamic, PO Box 1320, D-7100 Heilbronn, West Germany. Phone: 071 31.82.348. Telex: 728771.

UK: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP. Phone: 0444 51003.

USA: Burns Audiotronics Inc, 505 Burns Avenue, Hicksville, NY 11801. Phone: (516) 935-8000.

Forthcoming Exhibitions

June 10 to 12
APRS; London (09237 72907).
June 29 to July 3
Film 81, London (01-242 8400).
September 4 to 13
International Audio and Video Fair, Berlin ((030) 30 38-1).
September 29
Sound Broadcasting Equipment Show, Birmingham (0734 53411).
October 30 to November 2
AES 70th Convention, New York ((212) 661-2355).
November 25 to 27
Prosound '81, London (01-340 3291).
November 25 to 28
Tomeistertagung Convention and Exhibition, Munich (Berlin (030) 308 2234).
March 2 to 5, 1982
AES 71st Convention, Montreaux, Switzerland ((212) 661-2355).
September 18 to 21, 1982
International Broadcasting Convention, Brighton (01-240 1871).

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The Dream Equalizer Goes Stereo

When we introduced our 672A "dream equalizer" in 1979, it became an immediate favorite of recording studios, broadcasters, motion picture production houses, sound reinforcement contractors, and others making their living delivering pro-quality sound. The 672A's eight parametric EQ bands (with reciprocal curves) were combined with wide-range tunable 12dB/octave highpass and lowpass filters to create an amazingly powerful and useful machine. Professionals tuning monitor and reinforcement systems loved the 672A's cost-saving ability to provide a full electronic crossover function from its high and lowpass filters.

The 672A now has a stereo twin—the new 674A. The 674A packs all of the power of two 672A's in the same size 5¼" rack mount package. And controls are configured so that both stereo channels can be effortlessly adjusted together.

Naturally, the 674A is built to full Orban professional standards, with industrial-quality components RFI suppression, a heavy-duty roadworthy chassis, comprehensive back-up support, and a complete and informative manual.

For complete information on the popular mono 672A, or the up-and-coming stereo 674A, contact your nearest Orban dealer.

orban

Orban Associates Inc.
645 Bryant Street
San Francisco, CA 94107
(415) 957-1067

European Master Distributor

Scenic Sounds Equipment Limited
97-99 Dean Street, London W1V 5RA Telephone: 01-734 2812/3/4/5 Telex: Scenic G

England Industrial Tape Applications **Belgium** Sait (Bruxelles) **Finland** MS-Audiotron (Helsinki)
France Schaeffer, Riesser & Cie (Paris) **Germany** Estemac (Hamburg) **Greece** Audiolab Hellas (Athens) **Holland** Cadac Holland (Hilversum)
Italy Audio Products International (Milano) **Spain** M. Llewellyn-Jones (Madrid) **Sweden** Tal & Ton (Gothenburg)

Furman LC-2

Furman Sound has introduced a 19in rack mount limiter/compressor, the *Model LC-2*. This unit features controls for input and output level, attack (400μs to 25ms), release (200ms to 5s), and a compression ratio (2:1 to 50:1). Front panel push-buttons select either normal compression,de-essing or side chain modes with the facility that the gain reduction signal may be processed through either an internal 3-pole highpass filter or external equaliser. Additionally the side chain input may be used alone to allow a completely unrelated signal to control the gain as in voice-over mixing.

Other features of the *LC-2* include programme adjusted release time with transients being released twice as fast as continuous programme material; modular circuit board construction for ease of servicing; and the facility for two units to be easily interconnected for stereo operation. Inputs are 10kΩ unbalanced, optional 20kΩ balanced, while outputs are 270Ω unbalanced, optionally 600Ω balanced. The *LC-2* has an LED meter style display of gain reduction over a 20dB range, also having LED indicators for overload and power.

Furman Sound Inc, 616 Canal Street, San Rafael, Cal 94901, USA. Phone: (415) 456-6766.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Harrison MR-3

FWO Bauch Ltd has announced that the Harrison *MR-3* console introduced at AES Hamburg is now available in the UK from the company. The *MR-3* follows the usual Harrison philosophy of offering flexible configurations and various options are available. The console is available in two frame sizes, allowing a maximum of either 28 or 36 channels. Each console has an integral patchbay, 24 track assign, six aux sends, parametric equaliser with highpass filter on each channel, nine dc sub-groups, and the console is automation ready. Various metering systems are available ranging from standard VU meters through to a CRT display. Automation options include either the Allison *65k* programmer, the Harrison *Autoset* system, or the Melkuist *GT800* dual floppy disk system.

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

New Quad electrostatics

Quad (the Acoustical Manufacturing Co) has released a successor to its reference standard electrostatic loudspeaker, first marketed 25 years ago. The new *ESL-63* embodies a number of ideas presented in Peter Walker's 63rd AES Convention paper, *New Developments in Electrostatic Loudspeakers*, notably the postulate that "if a very light diaphragm is made to reproduce the air particle motion found at an imaginary plane some distance from and normal to the direction of propagation from a theoretical ideal source, the results to the listener would be the same as if he were listening to that ideal source".

The Quad *ESL-63* achieves this lofty goal by means of a very light electrically-polarised diaphragm suspended between two sets of acoustically transparent rigid electrode loops which are fed with a signal derived from a sequential set of delay lines, producing a sound pattern corresponding to an ideal source located 30cm behind the diaphragm. The result is a totally homogenous sound source without the problems of separate drive units, crossovers, cabinet resonances and the like. The sound pressure at any point in space and electrical currents in the electrodes are directly related, giving the designer total control over frequency response and directivity. The result is a claimed greater degree of realism than ever before.

Quad have been researching this area for some time, as the '—63' in the product type number indicates. Their reputation for excellence suggests that the claims for the unit are well-founded. At about £1,000 per pair, however, it's likely to be some time before we can get a pair into the living room!

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

ILR—expansion proposed

The Home Office Local Radio Working Party in its third report which was recently released has supported the proposals of the IBA for the expansion of its ILR services to a further 25 areas. Although these proposals are subject to approval by the Home Secretary after public consultation, if they were to become fact the number of ILR stations would reach a total of 69 (this including the 44 stations already authorised).

The further 25 proposed ILR service areas are in alphabetical order: Aylesbury; Basingstoke and Andover; The Borders including Hawick and Berwick; Brighton; Cambridge and Newmarket; Derby; Dorchester/Weymouth; Eastbourne/Hastings; Great Yarmouth and Norwich; Hertford and Harlow; Huddersfield/Halifax (possibly extending the Bradford ILR service); Humberside; Maidstone and Medway; Milton Keynes; Northampton; North West Wales (Conway Bay); Oxford/Banbury; Redruth/Falmouth/Penzance/Truro; Reigate and Crawley; Shrewsbury and Telford; Southampton; Stoke; Stranraer/Dumfries/Galloway; Yeovil/Taunton; and Whitehaven and Workington/Carlisle.

Errata

There was an unfortunate error in our Audio Tape review published in the April issue. The graphs on page 92 should have been labelled 'Uniformity' and not 'Distortion'. We apologise for any confusion this may have caused.

Financial

● The management team of Wilmot Breeden Electronics Ltd (trading under the name Wayne Kerr and Rendar) has bought control of the company in a deal worth £2 million. The purchase was made via a new company, WKR Ltd, with financial backing from Technical Development Capital, Barclays Development Capital Ltd and Barclays Merchant Bank Ltd. Wilmot Breeden Electronics Ltd was a wholly owned subsidiary of Wilmot Breeden (Holdings) Ltd, which was taken over by Rockwell International in 1979.

People

● Philips Business Systems has appointed John Blackwood as audio sales executive with responsibility for sales of Philips public address and sound reinforcement systems in northern England.

● HM Electronics has appointed Robert Carr, previously with Shure Inc, to the position of marketing manager. In addition John Kenyon has been promoted to assistant sales manager, while Dale Scott continues as national sales manager.

● Richard Goldblatt, studio manager of Marcus Music UK, has resigned and is moving to Los Angeles to open a freelance engineering and production office. His initial contact address is: 1900 Sunset Plaza Drive, Los Angeles, Cal 90069, USA. Phone: (213) 855-0566.

Agencies

● FWO Bauch Ltd have been appointed sole UK and Eire agents for the Melkuist *GT800* console automation system. FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ, UK. Phone: 01-953 0091. Telex: 27502.

● Hayden Laboratories Ltd and Empire Scientific Corp have mutually agreed to terminate Hayden's distribution of Empire cartridges in the UK. All enquiries should now be addressed to: Empire Scientific Corp, 1055 Stewart Avenue, Garden City, NY 11530, USA. Phone: (516) 222-1400. Telex: 125472.

Contracts

● Studio Maintenance Services, Los Angeles is to supply a Melkuist *GT800* automation system for a Trident *TSM* console to A&M Records.

● Chiltern Radio Ltd has appointed Alice (Stancoil) Ltd as the main contractors for the installation of all technical equipment at its twinned studios at Luton/Dunstable and Bedford.

● Audiofad has received an order for 420 *Model 1240P* faders from Swedish Local Radio.

● Marconi is to supply new antenna systems for the broadcast of BBC External Service programmes from two sites—Zygi broadcast relay station Cyprus and the Orfordness station in Suffolk.

● Aphex has supplied studio equipment including *CX-1* compressor/expanders and *EQF-2* equalisers to Pink Floyd, the Doobie Brothers, A&M Records, Record Plant New York, Bijou Studios, Redondo Pacific, Woodland Studios, Bill Schnee, Fidelity Recorders, the Pasha Music House, Rudy Records, Mama Jo's, and Concorde Recorders.

● Audio Developments is to supply ATV with six *ADO31 Micro* mixers for studio and OB use.

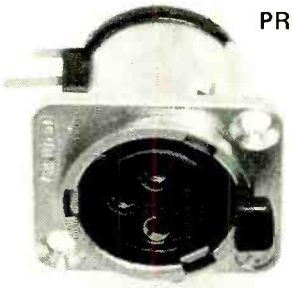
● The CBS Television Network has ordered three Neve *7056* 36/8/16 consoles with an option to purchase a further five consoles. ■

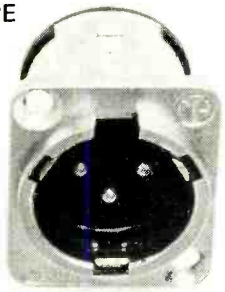
NEUTRIK

WE MIX WITH MANY CONSOLES

PRINTED CIRCUIT TYPE

NC3 FD–H

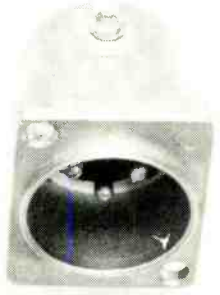




NC3 MD–V

NON-LATCHING TYPE

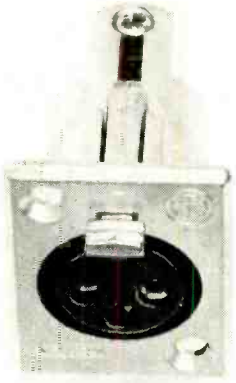
NC3 FZ



NC3 MZ

STANDARD TYPE

NC3 FP



also available in 4 & 5 pin

NC3 MP

Sole Agents U.K.

Eardley Electronics Ltd

Eardley House, 182-184 Campden Hill Road, Kensington, London W8 7AS

Telephone: 01-221 0606 Telex: 299574

studio diary

Record Plant, Los Angeles

"Diversify or die," said Chris Stone, president of the LA-based Record Plant, at *Billboard's* Video Music Convention last November. It's a theme he keeps coming back to, as reportedly at least 30 local studios are up for sale. Consequently, Stone has put his money where his mouth is and converted Record Plant's Studio D into a luxurious, dual-purpose room.

Now equipped as a state-of-the-art film scoring room as well as a recording studio, Studio D opened for business on March 10. That's exactly 13 years since Stone and his late partner Gary Kelgren opened their pioneering service-oriented Record Plant Studio A in New York.

Stone spent $80,000 on Studio A including $35,000 for Scully tape recorders, a 20/12 desk and construction costs of $35 a foot. Studio D will cost about $1.1 million with costs of $135/sq ft.

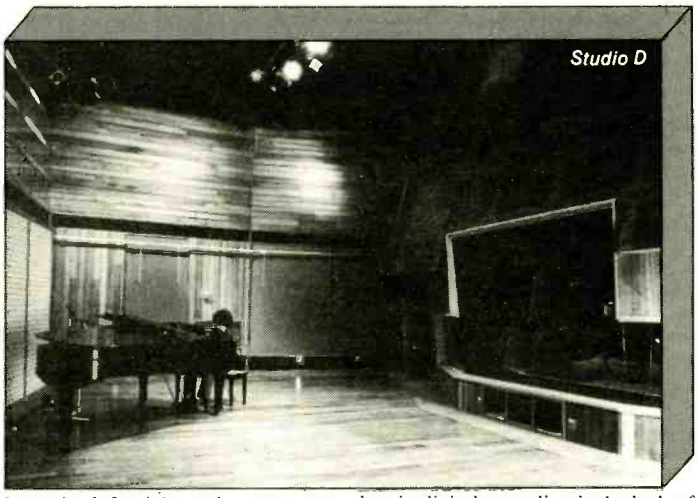
Heart of the system is a built-to-spec 48/30 SSL *Series E* computerised desk—which pulls plaudits for its range, but an engineering raspberry for non-musical equalisation. The logistic advantages appear to outweigh the eq factor. The SSL enables Record Plant to offer an industry 'first'—the facility to interlock digital and analogue directly into the magnetic stock film chain via the SSL computer. Two MTM (MultiTrackMagnetic) recorders and a dubber are interfaced with the computer. Furthermore, the SSL *Total Recall* function eliminates lock-outs, providing for film scoring work during the day and recording work at night.

Plans to complete the film chain—and it is hoped to do digital film scoring—include installation of film dubbing equipment, ADR (Automatic Dialogue Replacement) and sound effects (Foley) gear.

One modification to the SSL creates a solo defeat via a simultaneous solo and cut operation. Thus the solo doesn't mute, and effects can be put in. Another modification is a switching matrix which allows mixing in up to three different amp systems without switching. Three studio monitor speakers are used, because 3-track film scoring requires a hard centre.

Computer automation for the SSL is isolated and cooled outside the control room. Floppy disks are inserted outside the entry to the room and remoted inside. The hard-copy printer which gives a printed readout of all the computer moves is also located here, to alleviate noise.

The control room is roughly 20 × 18ft. Three Hidley monitors are



hung for left, right and centre—two are stereo and one is mono. Studio D uses three Studer *A68* monitor amps. A wall-mounted TV screen gives computer readouts, and Dolby *M24* is standard.

The control room has extra wide cutout windows to accommodate film projection sight-lines and eliminate any 'tunnel effect'. The room will take analogue equipment on one side and digital on the other.

Studio D is equipped with 3M 24-track analogue tape recorders and two sets of 3M *M81* 32-track digital recorders. "We use them," says Stone, "because they're the only digital multitrack recorders on the market that are currently available." The Mitsubishi 32-channel system is planned for delivery in the US market in November 1981 at some $200,000, according to Stone. He's been told the Sony/Studer unit is about two years away, and Ampex is biding its time with its digital plans.

"There just *isn't* another system," he says. "The Soundstream is at best a laboratory system and I think Dr Stockham has been very lucky to last this long. But the digital snowball has started to roll. The biggest problem in digital recording is the lack of standardisation."

The major hold-up in the conversion to digital records is the lack of hardware in the home, and Stone thinks videodisc technology will be a way of getting digital replay equipment in a lot of front rooms. "The transition from analogue to digital has started," he says. "Digital isn't 'if', it's 'when'."

Outboard equipment for the control room includes Eventide DDLs, flangers and *Harmonizers*. There are *1176* and *LA2A* limiters, a Pultec eq and 2-, 4- and 24-track Dolby and dbx limiters. Further gear includes Marshall time modulators, stereo EMT echo chambers and an EMT *250/251* digital echo and digital reverb unit. And, as usual, if anything else is required, they'll get it for you.

The 30-man studio is 24 × 26 × 26ft. It differs from a normal studio room in that it sports a full set of stage lighting designed by Chip Monck. A 40ft video van can pull up, plug in to the 12kA sub-station that Record Plant has installed as an isolated power tie-in and find Studio D converted to a full film and video shooting stage in an hour. A cutout box gives an extra 200A of power. White light can be added quickly.

Tom Hidley designed the room, which has removable panels to modify live and dead areas. The floors are polished oak, and the walls are damped in fetching burgundy and grey carpet. Although it's customary to 'live' in a room to season it, acts like Ron Wood who have already been in say it already has a good sound.

The room has the option of two isolation booths. One can be used for a private office or lounge complete with telephones, couch and a television monitor. It converts to a percussion isolation booth for big scoring sessions.

Chris Stone states that the timing of the Record Plant's entry into film work is not premature. He's been 'staggered' with the bookings they've received, which he credits to his 'marketing plan': "Buying the best production sound man and the best film scoring mixer in the business."

Stone has now formed three independent Record Plant companies. Record Plant Inc handles the studio business. It's handled on a daily basis by chief engineer and independent producer John Stronach.

Union-affiliated Record Plant Scoring Inc handles film scoring and mixing. It is headed by Stone's 'best buy'—music scoring mixer Dan Wallin. Wallin has worked on over 400 films, and is particularly proud of work on *Camelot* and John Cassavetes' *Gloria*. His first project for Record Plant—was Sylvester Stallone's *Escape to Victory* with composer Bill Conte.

Stone's other 'buy'—Tom Overton—handles sales and production via his independent production company Tsunami (Tidal Wave), affiliated to the scoring company. Overton has had over 30 years of pro film sound experience, and he became involved with The Record Plant when using one of the remote trucks for *The Jazz Singer*. "The record industry has created monsters with two ears," he said. "And they all want better sound."

He is enthusiastic about state-of-the-art film sound. The film industry—which can now create 70mm 6-track Dolby releases—is now ready for it. Overton feels the Record Plant film chain multitrack facilities and the ability of digital recording to cut generation loss and distortion will enchant the boom mic-and-Nagra brigade.

Current film work includes Cheech and Chong's *Nice Dreams* with Harry Betts; the horror film

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The Unlimited Limiter.

In keeping with MXR's expanding commitment to the professional recording industry, our engineers have designed and built the Dual Limiter. A world class mono-stereo limiter offering total flexibility and ease of operation, the Dual Limiter produces a musically natural response in any compression-limiting application. All of this versatility is built into a compact, rack-mountable package.

The totally unique VCA's at the heart of the Dual Limiter provide an exceptionally wide dynamic range with low levels of distortion. Continuous bass distortion is much lower in level than typical compressor-limiters, allowing more freedom in setting release characteristics.

The Dual Limiter is also a forgiving limiter. Attack and release characteristics dictated by the front panel controls are modified by program dynamics and compression requirements. The slope increases smoothly past the threshold point, allowing a *gradual* transition into compression. Varying the Dual Limiter's threshold region produces a variety of intermediate slopes with the primary slope being that chosen by the slope switch. These features permit apparent dynamics to be maintained even though the dynamic range is being controllably limited.

The Dual Limiter's remarkable versatility is based on the fact that it can be viewed as two independent mono limiters that can be patched together via front panel switches for stereo limiting applications. Each channel has an In/Out switch, Slope switch, Input, Output, Attack and Release controls and an LED display, showing the amount of gain reduction. On the rear are both XLR and ¼" phone jack (ring-tip-sleeve) input and output connectors. Each channel's detector is accessible via rear panel phone jacks to permit external tailoring of the detectors' frequency response. This feature allows for de-essing (reduction of vocal sibilance) and a wide variety of frequency dependent limiting needs.

Because virtually every form of musical signal was used to evaluate the Dual Limiter's response during the initial stages of development, its sophisticated internal circuitry enables it to sound musically *natural* — even at extreme compression settings.

Balanced inputs, the ability to drive 600 ohm loads, +19 dBm input and output and standard rack dimensions (1¾" high) allow the Dual Limiter to be easily integrated into any professional system. With an extremely rugged case, metal knobs and reliable internal construction, the new MXR Dual Limiter reflects the highest professional standards and has been fully designed and built in the U.S.A.

The Unlimited Limiter — MXR's natural response to the question of performance and versatility in a space-efficient and cost-effective package. See the MXR Dual Limiter at your nearest MXR dealer.

MXR Professional Products Group

MXR Innovations, (Europe)
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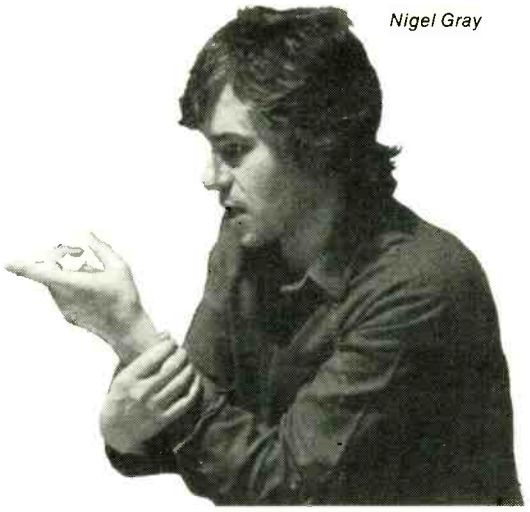
Surrey Sound—an interview with Nigel Gray.

Nigel Gray's enthusiasm, interest and complete involvement and committal to his cause are immediately apparent. The cause is Surrey Sound Studios which have been in operation since 1975, and its offspring Surrey Sound Record Label, which was formed last year as a result of the success of the studios. They can both be found upstairs at 70 Kingston Road, Leatherhead.



Nigel Gray

My interest in the business stems from university days, where I was studying medicine, when I started playing in a band. My recording career began after university, in a back room in a house rented from the hospital where I worked at the time. My equipment consisted of two tape recorders and a few microphones, and there were wires everywhere. I then bought a 4-track Ampex *300* tape recorder, with electronics in a 19in rack. The quality was great, with a good valve sound which I think added warmth and character. I also bought a mixer which originally came from EMI and I suspect was used by the Beatles at some stage. Unfortunately, with all this bulky equipment taking up all the available space, there was no room left for any musicians! I started looking around for premises, and came up with the premises we currently use, which were unused at the time and in a dilapidated condition. However, the rent was cheap and the premises large. With the help of my brother Chris we worked hard together to get things going, bought some more equipment on HP, and rented the studio out at £4 per hour. At this time I was still working as a doctor, and Chris, who was only 16, looked after the studio while I worked.

We advertised in Melody Maker, and found we were quite busy with sessions three or four days a week, mostly doing demos and rehearsal practice. After 18 months we were functioning as an amateur studio and had got into the routine, building partitions, screens etc.

At this stage we decided to go 16-track. We felt that the amount of income generated by 4-track would never pay for more equipment and to attract more customers we had to be bigger. This was in 1976, and this is where Mike joined us (Mike Cobb, general manager). We managed to get a loan of £8,000 and with this, plus the profits of selling the 4-track equipment we bought a 16-track Alice desk, and a 16-track Ampex tape recorder. The effect of changing from 4-track to 16-track was almost magical, the only problem was what to do with all those tracks! The desk was an 8-track modified to 16, and we found on our first session (with a band called String Driven Thing), that we had a few problems. The modification duplicated some of the functions, and the hardest thing was to get the foldback balance right. The band were impatient and kept pressurising us to get it right; this type of customer was a complete change from the 4-track person. However, we persevered and over the next 18 months got more experienced and gradually bought more and more equipment: compressors, limiters, echo plates, phasers, equalisers, and so on. As we got better we moved out of demos and it became possible for people to produce proper records. We were charging about £10 per hour at that time but as we had no reputation and it was cheap, we still only attracted bands who had to pay out of their own pockets.

The first album we ever recorded here which was actually going to be released was the first Police album, *Outlandos d'Amour*. This wasn't successful at first—three singles in a row were released off the album, but they didn't get any airplay. One of these singles, *Roxanne,* had become a hit in certain states of America, and after a year, in which time The Police had become much better known and more popular anyway, it was re-released over here. Radio 1 decided to play it, and it eventually reached no 7 in the charts. Everybody had been involved in the production of this album, all throwing in ideas. On *Roxanne* I laid the backing track first, and then the vocal—but found I had a problem because there are several long 2-bar gaps, and to get everybody to come back in on the beat immediately after the gap was difficult. After numerous unsuccessful attempts I tried it by putting the tape machines into record, running into the studio, standing on the loudspeaker cabinet so they could all see me, and conducting them so that they all came in together on the beat, then running back into the control room to switch tape machines off at the end of the track! The Police and I got on well as a team, and they have been with me as a producer since the first album.

One of the most influential and important productions for me in the early days was an album by Godley & Creme. They came to Surrey Sound because they live nearby. They had just finished doing an 18-month epic *(Consequences)* in an Eastlake studio with every mod con and wanted to do an album going back to a more basic 16-track style, in an atmosphere similar to their Strawberry North studios. They arrived at the studio one day, without any warning, with Phil Manzanera of Roxy Music, to have a look They chose a day when we had shut down to have some building work done and everything was covered with dust sheets and everybody was helping out in some way. Despite the fact that the studio was in a state they really liked the look of it and felt it was the sort of place they were looking for. They booked the studio for four weeks, and arrived on the first day with absolutely nothing prepared—no songs or preconceived ideas. They wanted to do the whole thing in the studio, by creating different permutations of sound using all the available facilities. They tried ideas that you would think are completely crazy, but ended up with a good sound. One of their first sounds was of tom

44 ▶

Record Plant, cont'd

Happy Birthday, and *Zorro* a feature film starring George Hamilton, with composer Ian Fraser.

A round-the-clock system is in operation for Studio D, according to John Strachan. He says that in 13 years he's never seen the Record Plant door locked, and while there are no ego problems, there can be plenty with scheduling.

Film scoring takes place from 9am until 6pm. Record work—which saw Ron Wood in for the debut of D and Rod Stewart working there currently—takes place from 7pm.

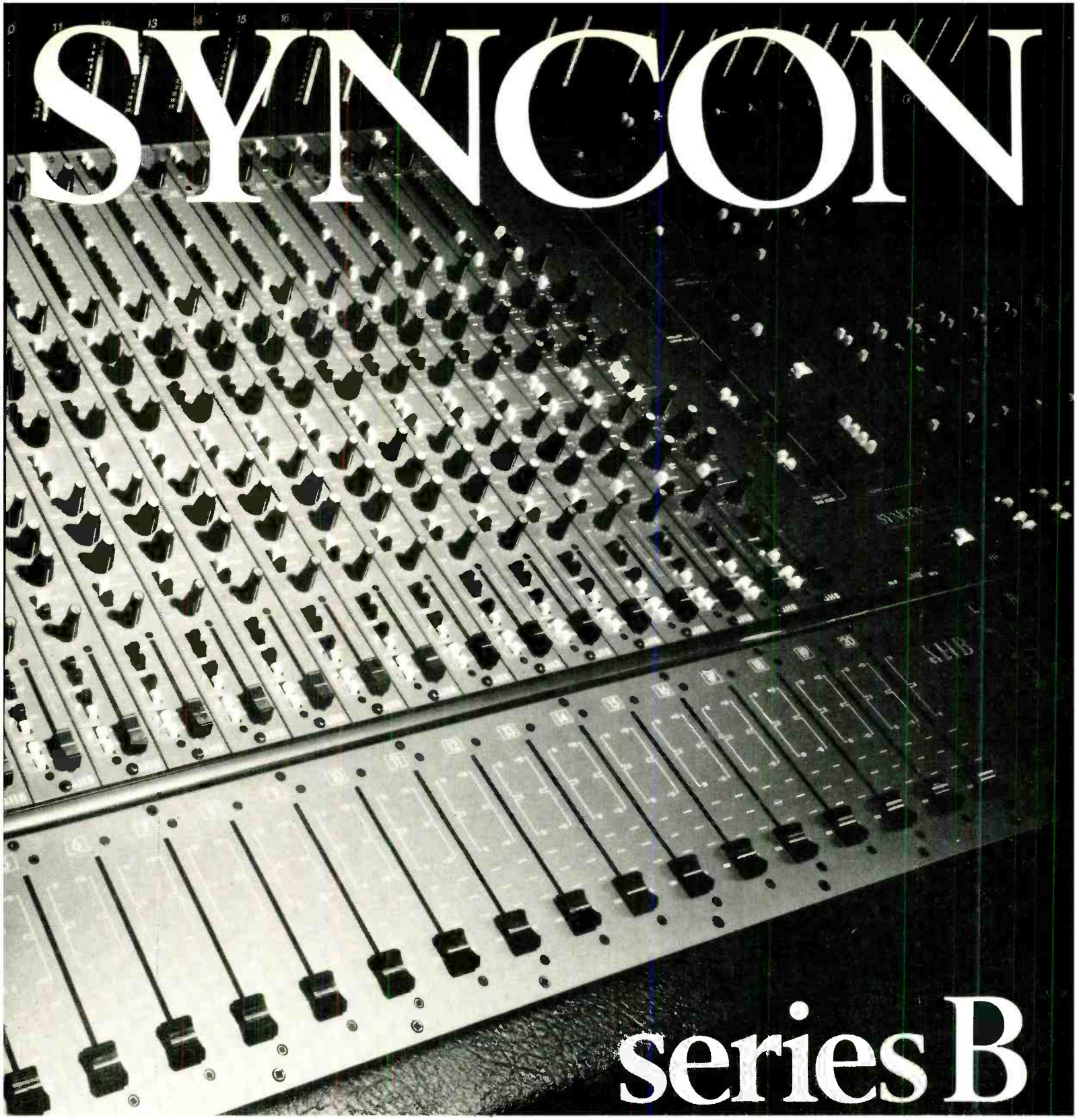
Stone's third company is Record Plant Remote, which operates three location trucks for music and 'visuals'. A fourth truck is being fitted out for 'budget' location work and this will rent for some $1,000 per night, as opposed to $2,500 for the digital-equipped trucks.

Stone, who says that his rates are negotiable since record companies are increasingly unwilling to foot heavy recording bills, also feels that his film and remote work will "definitely" subsidise his record work. "Sad but true—it's cold out there." He further feels that a company which limits itself to one of the three areas he's now involved in will be out of business in two years.

He is quick to stress Record Plant ran at a profit even without Studio D, which was taken down in June 1980. Record Plant's fiscal year runs from August 1 to July 31, and in theory all Studio D's volume will be profit.

Stone states that the film and video industries are "waking up to the necessity of good sound. That awakening will give the studio that knows what it's doing the sales volume for them to remain state-of-the-art. It's the 'world-class' state-of-the-art studios that are feeling the financial pinch," he says. "The middle-of-the-road studios which buy serviceable but no longer advanced equipment and charge $100/hour and the $25/hour demo studios have carved out their niche. But for state-of-the-art studios to stay ahead of the game in equipment and expertise, Stone insists they must spend money. He also insists—despite the impending sale of the very-diversified Wally Heider complex—the way to the money lies in diversification. Or—"do your books, ascertain your capital planning and equipment needs and be a fast talker at your bank. Treat them as your partner." **Beth Jacques**

Record Plant, 8456 West 3rd Street, Los Angeles, Cal 90048. Phone: (213) 653-0240.



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Surrey Sound cont'd

toms being beaten to death, overloading, distorting etc, which created an enormous, almost frightening, sound which in turn would give them an idea for another sound and so on until it fell together and a song would emerge and give them inspiration for the next sounds. It was all experimental: they make all their songs that way. From an engineering point of view everything is recorded separately on different tracks, each with its own sound effect. One example of such an effect is to create an echo with a tape machine that has been tampered with so as to create a wildly excessive flutter and then to flange the resulting warbled echo. This effect worked really well on a piano, for example. Their first album wasn't commercially successful because there is so much to listen for and although it was very well received, it needs a lot of concentration to hear all there is to hear.

I found it very hard working on this album—it finally took three months to produce and I was working on it for 15 hours or so a day. After completion, I couldn't listen to it for six months which is the time it took me to recover from the trauma! Some numbers may have 100 tracks of instruments, all bounced down. I worked on one vocal, a 4-part harmony with eight voices for each part, then mixed down to a stereo pair of tracks with reverse echo. On a 16-track machine it might take all day just to get one backing vocal. I learnt more from them about engineering than at any time in my career, and learnt how to use my imagination in that anything can be done in a studio. 10cc's backings were world famous, but most bands won't persevere long enough to get the effect. They also produced a second album at Surrey Sound, but in the light of my earlier experience, I only worked on half of it. This time it was engineered by three people.

The second Police album, *Regatta de Blanc,* was recorded after we upgraded to 24-track. They had a bit of trouble with their record company when they decided to come back to Surrey Sound to do this album, as the company wanted them to go to a 'proper' studio, and not a bunch of amateurs down in Leatherhead. However, the band were adamant that they wanted to come back to Surrey Sound and work with me because they felt that it was the right formula for their particular sound.

Their third album was done in Holland, as they couldn't work here any more for tax reasons. I found it very different working in another studio, and feel that you have to rely on the sound you are hearing as being accurate. If you record something that sounds great through the studio monitor speakers, the tape will only be great if the speakers are truly representing what's on tape. This studio was very bassy and trebly. The bass drums and bass guitar would resonate, and the cymbals sing. Out of the studio it all sounded woolly and disappointing. I had to go back and remix some of it. The studio was an Eastlake studio, and the equipment was good, but the sound was radically different wherever you were standing in the room. If you were sitting directly between speakers it was great, but if you went offcentre and leaned to left or right to reach either end of the desk, all the bass disappeared. At the back of the room the bass increased about tenfold, and made my shirt flap like in the wind. In the end I got it about right but felt that the character was wrong and it sounded very indistinct. I think the album would have been better had we worked in a studio more familiar to us.

Other productions include Siouxsie & the Banshees, *Kaleidoscope* which got to no 4 in the charts and also had two hit singles. I produced an album with Hazel O'Connor, *Sons & Lovers,* which came out just before Christmas. This record is very exciting—more rock and roll.

The small record companies are at a disadvantage when it comes to promoting records as it is an expensive business, and a small company can't afford to have a team of reps like the big ones. If it is well promoted it will sell well, but advertising has to coincide with having the record in the chart return shops, and if it isn't there then people will buy something else instead. I get very frustrated with my own record label, the Surrey Sound Record Label, which was formed last year, as some songs have never seen the light of day—the better the record the more annoyed I get.

I am very excited about a new single we have released under our own label by a new band, Fay Ray, who come from Wales. Mike (Cobb) went to see the band on stage and liked what he saw, so we decided to produce one of their demo tracks, written by themselves, called *Family Affairs.* Radio 1 and Capital are playing it and *Melody Maker* made it their single of the week—you can't get better promotion than that. It took about three or four days to produce this single, all expenses paid by us.

I decide on the approach: when the backing track is good enough and what to do. They have a sax player in the band and didn't really know what to do with him. I told him to play all over the track any ideas that came into his head. From this I saw what was good in certain parts and arranged it accordingly. I always have the last say as to how the record should sound, but try to make it their record and not change their sound too drastically. Most bands do good demos and to improve in the studio is hard. I can't have mistakes, and if I want something changed they have to relearn it and think about what they're playing, which makes them nervous and then they might lose the original groove and the whole thing may fall to pieces.

I will influence the direction of different parts and instruments and then select what I want, like a process of elimination. I contribute musically but only with on-the-spot ideas. I like to make good use of stereo. Most instruments are recorded in stereo; room mics and close mics panned into different parts of the stereo image to give the effect of an instrument in a large room. When you hear it in the mix you can't tell exactly where the sound is coming from. I run out of tracks very quickly since most instruments take up two tracks. All chorus effects are stereo. I use all the equipment: phasing, flanging, echos etc, but am tending to get further and further away from gadgets and sophisticated equipment. I like things to sound realistic; if a band sounds exciting onstage you should make the album sound like that too.

I can't wait to get a digital tape recorder and think this is the way things will be in the future. I find the loss of quality annoying on conventional tape machines through wearing down of tape. There is no loss of quality in a new backing track played back but a month later at the end of an album when the tape has been run over the heads 200 times it is different.

My MCI desk is automated, and everything is done with the computer. To begin with it took longer to do a computer mix than a conventional mix, and we thought we would never be able to cope with it, but now it's second nature. It speeds up mixing no end and makes for a much more perfect mix. You can be more objective about the music and make changes more easily with the computer. It gives you the equivalent of lots of pairs of hands, and the mixing doesn't have to be done in edits.

I am hoping to expand in the future by buying this whole building, which is at present owned by the Co-op Dairy. I've heard they might be changing their premises soon, and if we could get hold of all the building we would build a second studio downstairs.

Production is very much an art of confidence. You have to be very confident in your end product and approach to it. If you know exactly what you want out of a record and group and you think to yourself 'that sounds good' then that is all you need. You must have something to aim for that you really believe in. It is out of your own imagination—if you try to make a record sound like you think someone else wants it to sound you may get it wrong. As long as it is satisfactory to you that is the only criterion. I often compromise, but it has to be something I like. If I like it that is a yardstick built into me and makes my job easier. Any producer who tries to please someone else has a hard job on his hands. If his tastes were disastrous, uncommercial and awful he would be out of business. It is a matter of the right opportunity, right place at the right time, right talent and being lucky. **PML**

Surrey Sound, 70 Kingston Road, Leatherhead, Surrey. Phone: Leatherhead 79444/6. 46 ▶

Control room at Surrey Sound

In recognition of his talent, *Music Week* made Nigel their Producer of the Year for 1980.

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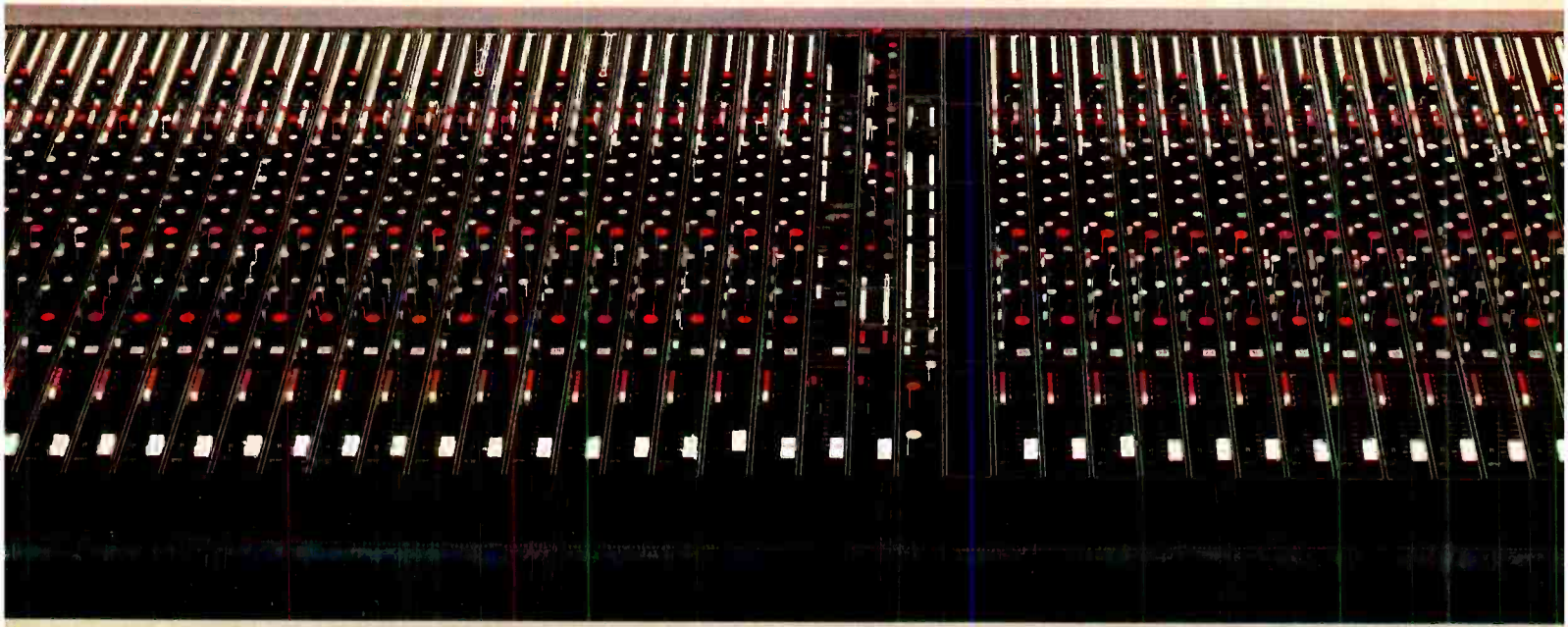

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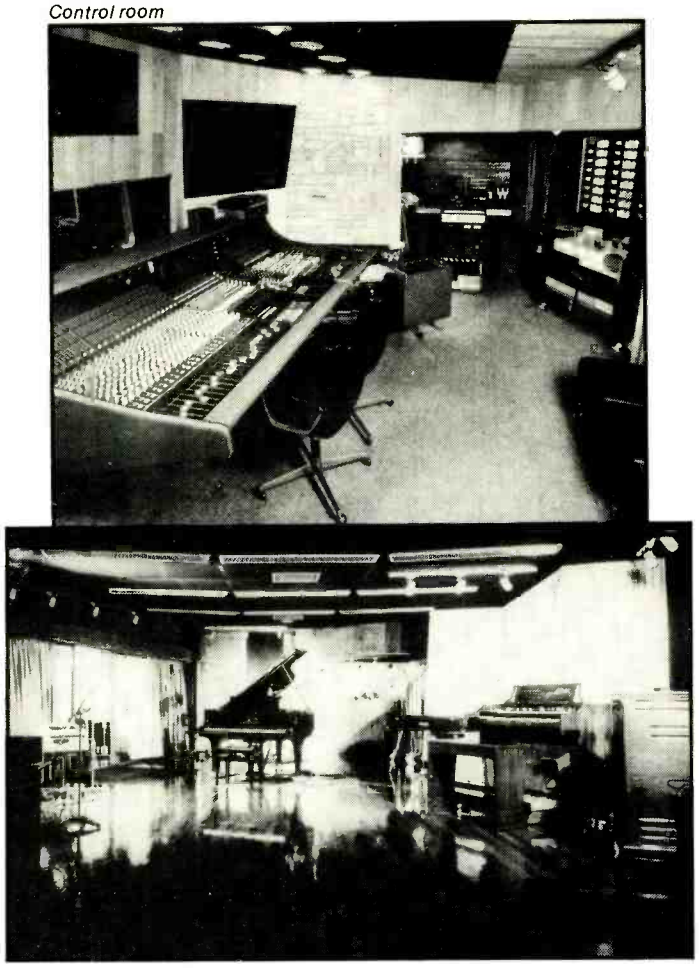
Queen Studio, Milan

Not to be confused with the group of the same name, Queen Studio forms part of the new Polygram building situated near the city centre of Milan. The studio is on the top floor with access for people and equipment provided by a good selection of lifts. Not being a company to do things by halves, Polygram policy for the new studio was to use equipment and studio design services from the front runners in the audio industry in order to provide all the facilities and services expected in today's studios, as well as those of tomorrow. Though the studio is obviously for the benefit of Polygram artists, it is organised as a separate commercial entity—hence the name—that is open to all. At the time of my visit during the summer the finishing touches to the rest-room/bar were being done and in fact the studio has been in operation since February 1980. To date most of the work done has been for the Italian market with artists such as Alberto Fortis, Nada, Laura D'Angelo, Eugenio Finardi with recent visits from Charles Aznavour and Dick Halligan (of original Blood, Sweat and Tears fame) who was involved with producing Italian singer Mia Martini. Supervising the installation programme was Peter Olliff, a well known figure from the British recording scene, who now seems to live between London and Milan. Between two aeroplanes Peter was able to show me around the new complex before rushing off to the airport!

Control room



Studio with isolation room to the left

The studio is the design handiwork of Tom Hidley and has been built by Eastlake Audio. The studio and dubbing room are situated on opposing sides of a central corridor with the rest of the floor taken up by rest area, maintenance and store rooms and the offices for the studio. The studio and control room have separate air conditioning systems for complete flexibility as regards working conditions. The large rest area features daylight, a bar (though no doubt some would put the priority in reverse!), assorted games and TV with lots of comfy chairs and sofas. Snacks are also available.

The visit started with the Studio. Access is from the corridor, eliminating the need for a stream of musicians tramping through the control room. The studio itself has a total floor area of 1,022sq ft, all of which is high gloss parquet, and which includes the main studio floor, drum cage and isolation room. In addition to the standard ceiling trapping there are separate trap areas for guitar, bass and piano, as well as the drum cage. The isolation room features glass walls with access from the studio via sliding glass doors which also ensures that visual contact is not lost. Various pull drapes serve to modify the studio acoustics to suit different situations. Peter told me that they have had very good results with string sections in the isolation room with a near concert hall sound being obtained. The overall decor is suitably low-key with flexible lighting arrangements to create the right working conditions. A large selection of instruments is available including Steinway grand, Hammond *A100* plus Leslie, Rhodes, Minimoog, Celeste, Systro, string bass (?!)—well, I suppose it is a bind to carry that on the metro—tubular bells and Slingerland drum kit, as well as assorted bass and guitar amplifiers.

The control room features the same decor and flexible lighting arrangements as the studio. The room features extra deep soffits meaning that tape machines and other equipment is kept nicely out of the way leaving freedom of movement. Recording centres around a Polygram custom built console with Studer *A80* 24- and 2-track recorders. The desk is basically a 32/24 and has various interesting features. Each channel features parametric mid-frequency eq with sweep bass and treble equalisation, together with high and lowpass filters. There are eight auxiliary sends, four designated echo and four foldback, the main difference between the two being that the foldback sends have eq. There are four echo return channels with full facilities meaning input channels are not lost during mixdown. The separate 24-track monitor section is situated in the middle of the console and has full echo, foldback and panning facilities. As well as the 24-track routing the desk has nine VCA groups plus master stereo fader, this latter also controls the output from the 24-track routing and does away with the 24 separate group faders that one would expect to find on a non in-line console. The monitor section also has its own stereo master fader thus making two different simultaneous mixes possible should it be desired. Another nice touch to the desk is the solo facility on the foldback mix. This enables the mix to be checked over the control room monitors—or the Auratones—without the engineer having to grab a pair of headphones in order to listen to what the bassist is complaining about! A small point perhaps, but the sort of thing that makes for the easy running of sessions. The desk also features bargraph metering with spectral display.

Outboard equipment includes an Eventide *Harmonizer* with keyboard, Lexicon *Prime Time* and *Model 92* DDL, Marshall *Time Modulator*, Dynacord *Tam19* DDL (it is interesting to see how Dynacord, formerly known for their stage gear, are now making inroads into the studio field and are seen in studios among the best of company), with gain reduction being handled by an Audio & Design *Vocal Stresser*, Polygram/comp/limiters and noise gates and UREI peak limiters. A UREI *545* is also in evidence for that bit of extra eq tweaking. Reverberation is from a stereo EMT *140* and AKG *BX20*. An interesting feature of the control room is the use of Tuchel patching instead of the usual PO style jackfield. Though taking up considerably more space, Peter explained that they have never had a Tuchel plug in a patchway give trouble in over fifteen years and that was why Polygram used them! Seems reasonable. All tape machines in the control room have Dolby, the Polygram autolocate is used with the multitrack. This has all the usual functions plus recycle and 12 programmes (using ROMs) with a digital readout that gives the length of the number as well as the timing of the recycle portion. Though an Eastlake room, monitoring has been standardised on JBL *4350* speakers, these being 'the result of experience and preference', with power being provided from Studer amplifiers. Quite a few studios in Italy seem to find the *4350* a good compromise monitor, both in respect of frequency response and power handling.

There is a splendid Polygram disc echo (a sort of ultimate Binson!) which can be patched in as required. Perfect for effects ranging from superb ADT to single and multiple echoes, this unit would cost a fortune to build today and indeed very few of these pieces of equipment were built owing to the high precision and cost involved. The disc alone would probably be the price of a couple of DDLs! The playback heads can be positioned and switched as required around the disc allowing for almost endless permutations of echo effects. Varispeed is also possible.

Suitably low-key in presentation, Queen Studios present an efficient working atmosphere appropriate to 'in town' studios where time is often at a premium—sessions often start at 9am or earlier here! (No wonder they keep a string bass in the studio. Try carrying that during the Milan rush hour!) **Terry Nelson**

Queen Studio, (Polygram), Viale Regina Giovanna 29, I-20129 Milan, Italy. Phone: (2) 20484. ■

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letters

Understanding noise

Dear Sir, First, my compliments on a job well done. As a designer of professional audio products I appreciate your tough but fair reviews and solid technical articles. However I am writing to point out what I feel are deficiencies in an article by Mr Ted Fletcher 'Understanding Noise in Mixers' (February 1981).

His use of the terms 'Johnson Noise' and 'Thermal Noise' without mentioning they are both names for the same thing does little to advance understanding.

Even assuming a perfect transformer (7:1) my calculations don't come close to the 0.9dB NF he states (maybe I need new batteries).

The proper equation for summing noncoherent noise sources is:

$$NV_{TOTAL} = \sqrt{(NV_1)^2 + (NV_2)^2 + \cdots (NV_N)^2}$$

His instructive test of applying a short circuit to the input of a mic preamp completely ignores the contribution of input noise current! A mic amp with high input noise current will show a great difference when you short it out. However it will also be very noisy.

On the other hand I found Mr Dove's treatment of mic amps (December 1980) much sounder. I enthusiastically endorse the instrumentation approach that he considers of questionable parentage. Calling such a mic amp transformerless is like calling a modern console tubeless. Contrary to Mr Dove's statements there are transistors available today that are optimum at mic impedances. (I have included a few samples of a PNP with a 1dB noise figure into 10Ω!)

Yours faithfully, John Roberts, Phoenix Audio Laboratory Inc, 91 Elm Street, Manchester, Connecticut 06040, USA.

Dear Sir, We would like to make a few comments regarding the Ted Fletcher article in the February 1981 issue of Studio Sound, *'Understanding Noise in Mixers'.*

The article itself is interesting and worthwhile, but a few mistakes and lack of clarification exist. The formula given on page 37 has no real bearing on noise calculations. The formula should read:

$$\text{Total rms noise} = \sqrt{[\text{rms } NV_1 (A)]^2 + [\text{rms } NV_2]^2}$$

where rms NV_1 is the noise at the input of an amplifier with a gain of 'A' and where rms NV_2 is the noise of a unity gain mixer. The total rms noise is the noise appearing at the output of the mixer when fed by the amplifier with a gain of 'A'.

For the sake of clarification, we should remember that the program calculates the noise of a resistor under given conditions (user definable) listed in step 270 of the program.

Part of the noise in a resistor is the Johnson-Nyquist noise represented by the formula: $4kTR\Delta f$. k; Boltzmann's constant, T; temperature in Kelvin (therefore step 268: T2 = T + 273, to convert Kelvin to Celsius) and Delta, f; as the defined bandwidth. It should be understood that this program will calculate this set of parameters for resistor noise, but nothing else.

Now for the program:

1. *Step 255: the Rectangular Bandwidth Variable should be replaced with a 'B', rather than the printed 'T'.*
2. *Step 267: the THEN statement should refer to step 550 rather than step 5000.*
3. *Step 340: there is an unnecessary pair of quotation marks between two others, which only confuses matters.* (Should read "Voltage Level"—Ed.)
4. *Step 282: could as easily read VR = 20*Log (RV), rather than having two divide by 1s in it.*

With these changes, the program will now work, but is still somewhat unwieldy for an 'audio, non-computer person', as we found when using it. We added a few steps, which now permit easier use, as well as printout when desired. (We use a PET 32K, *with* CompuThink *drives and* Centronics *printer.) The rewritten program should work, with little if any mods, on most BASIC systems:*

1. *In step 380, Input of Gs is requested. Step 370 prods you with B, T, R, SV, or No. Inputting any other characters will automatically relegate the program to steps 390 and 450; the bandwidth variable. We added step 430, which will only accept the requested input variables. (Sorry, Ted, we also removed the amusing trap, SV.)*
2. *The other major problem with the program is the referals in steps 840 and 1020 to return to step 345. Although this works, the screen display gives the operator no feedback as to the status of his parameters, which are all screen displayed from steps 160 to 340. We prefer to return back to step 150 at these points to give the operator all the information he can get at all times.*
3. *For our own convenience, we added a small routine for printout, which has proved invaluable to us in this and all other programs for our design efforts. Please find enclosed a slightly modified program which we have been very happy with. If you do not require the printout function, wither always enter 'N' at input step 821, or eliminate steps 5, 821-838 and 845. (Be sure your printer has the proper carriage feed code, or you will print out on a single line and get 'mush'.)*

Thank you for a most interesting article and the opportunity to respond to it. We hope in the future we can see more computer programs, which will aid all of us in our design efforts to improve the quality of audio products in general.

Yours faithfully, Winn Schwartau and Ted Hammond, Sleepy Hollow, 141 Croton Avenue, Ossining, NY 10562, USA.

Mic response changes

Dear Sir, Carolyn Davis's response (March 1981, Letters) to Andy Munro's comments regarding the behaviour of small pressure-calibrated microphones mounted flush with rigid boundaries (October 1980) requires a rebuttal.

Mr Munro is perfectly correct when he states that such microphones display a flat frequency response at all angles (ie a hemispherical polar pattern up to the highest frequencies). The statement by Carolyn Davis that such is not the case for all source positions is demonstrably false, and contrary to the laws of physical acoustics. If Richard Heyser's ingenious time delay spectrometry (TDS) measurement technique has produced results showing the contrary, it is being used or interpreted incorrectly.

Our measurements and theoretical analysis will be found in our paper 'The Acoustical Behaviour of Pressure-Responding Microphones Positioned on Rigid Boundaries'—a review and critique presented at the Audio Engineering Society's 69th convention in Los Angeles (preprint no 1796 available from the Society). This paper also discusses the consequences of obscuring the diaphragm of a boundary-mounted pressure mic from receiving any direct sound (as espoused by the pressure zone microphone in the mistaken belief that its frequency and polar responses are not uniform when unobstructed), and shows that such obstruction only leads to a degradation in its superb performance, and not the claimed benefit.

Stereo recording techniques

Hooray for William Feil and Steven Cadenhead's fine article 'Stereo Recording Techniques' (March 1981). Would that we could get more recording engineers this side of the Atlantic to understand the fundamentals of stereo. We are seeing a plethora of technically superb, digitally-mastered records produced in Canada with appalling stereo due to the use of two or three spaced omnis.

Yours faithfully, Stanley Lipshitz and John Vanderkooy, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

■

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Thoughts in

ALL sounds produced by wind, string and percussion instruments, and voices start out as alternating pressure waves in air. In alternating waves, there are positive and negative pressures all moving away from the sound source at a constant average velocity.

A pressure microphone (moving coil or condenser) senses these positive and negative pressures at a fixed point. A velocity microphone (ribbon) senses the minute differences in the velocity of the sound caused by the positive and negative waves.

'Phase' is a convenient word which indicates whether the instantaneous pressure wave is positive or negative at a fixed point, measurements of phase being in degrees. If two identical sounds are 'in phase', the pressure waves occur together and add to one another. If out of phase, a positive wave in one, 'mixes' with a negative wave in the other and cancels—the result being silence. This explanation applies equally well to signals within a mixer.

'Absolute phase' is a shorthand way of saying that a positive wave (or voltage) going into a piece of equipment will cause a positive wave to leave it at its output. This sounds self-evident and unimportant but it must be remembered that a considerable number of electronic amplifier circuits invert phase. Where balanced lines are used to correct equipment it is easy to correct phase errors by inverting the signal leads at one end. In unbalanced systems there is no simple solution apart from the introduction of a transformer in the line. In a music recording studio, absolute phase is of considerable importance in many of the audio signal paths but of little importance in others.

Recording studios

Starting at the microphones, it seems obvious that all should be connected in the same phase—although the physics of the matter indicates otherwise. The speed of sound in air is approx 1,110ft/s therefore at 1kHz a complete wavelength is 1.11ft long. With a little imagination and the diagrams below it can be seen that if two mics are placed in line with a sound source at 1kHz and the mics are about 6in apart, then the signal meeting the two mics will be out of phase at any instant.

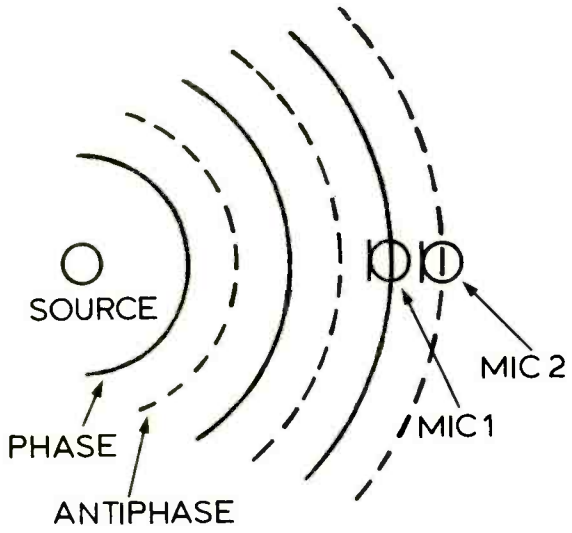
At 40Hz the wavelength is 28ft so our mics at 6in apart would see this as almost exactly in phase. At other frequencies, the mics see various ins and outs of phase with greater variations at extreme high frequencies. This shows that apart from at low frequencies the absolute phasing of the mics is not important. It also shows that mics should not be placed close together in multimic sessions!

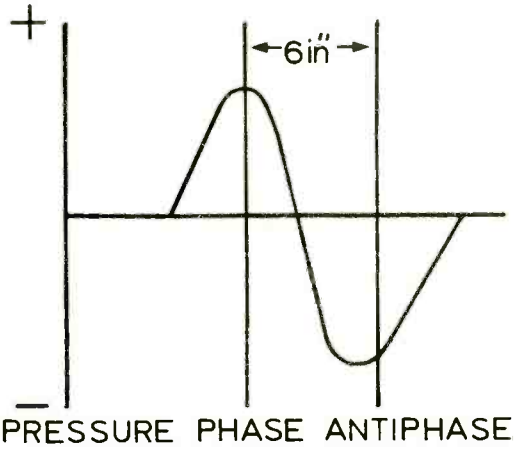
All this appears to prove that multimic techniques will not work (!) but the human ear is an artful device and when coupled with our old friend the inverse square law—where a mic will be extremely selective towards the instruments closest to it, intelligent, close multimic systems work extremely well. Once a musical sound is in electrical form, phase takes on a new perspective. The velocity increases by a factor of 881,052 (my calculator tells me) so unless signal paths are greater than about 5 miles, the phase is constant regardless of distance.

Within the sound mixer no path combination should reverse a phase. If it does, then one day a part of a mix will be routed that way and partial signal cancellation will result. Similarly all tracks on a tape machine must be phased correctly.

Reverberation systems cannot be checked for phase because they operate by delaying sound and interfering with its phase relationships (try sweeping a tone through a plate!)

At risk of causing coronaries in sections of our fraternity, I will insist that absolute loudspeaker phase is also not important with one significant exception. Musical sounds are roughly symmetrical: phase inversion does not alter tonal quality. An exception is the bass drum. This is predominantly unidirectional and is usually recorded with a separate mic. A positive pressure wave from the loudspeaker (the cone kicking towards you) is definitely superior in sound to a negative wave. A simple test through the system will give the answer to loudspeaker absolute phase should you wish to be pedantic.





phase

Ted Fletcher (Alice)

The method is to connect a signal generator to the circuit shown below and adjust its output to produce about +4dBu at the scope test point. Put the scope across the loudspeaker terminals and adjust the mic's gain through the mixer to give a picture which should look the same. If it does you win a prize. If it is inverted you are sentenced to checking through your system until you find the inversion.

All the above presupposes that the bass drum mic used, is made in Europe and connected correctly (and that a positive voltage at the positive loudspeaker terminal makes the cone move outwards!—check this with a 1.5V battery).

Broadcasting

In television studios at the present time, the final sound output is in mono and absolute phase throughout the system, while being desirable, is not essential. Remarks regarding recording studios also apply. In radio stations, phase relationships are of considerable importance. All 'real time' equipment (equipment excluding delay paths or recording) must retain absolute phase in any path or combination.

An example of a reverse phase effect which shows this importance, occurred recently in a new local radio station. During final tests on the main on-air console, the monitoring system was being checked for clicks using the operator's headphone output. Levels were set via a mic and a phase inversion was accidentally introduced into the mono mic input. The effect on the headphones was dramatic—an apparent left-to-right phase error—impossible in this mono/panpot system! Tests using an oscilloscope showed no such problem but a few minutes' thought gave the answer.

It was that a person speaking and listening to himself on headphones has three distinct audio paths to his eardrums; electronic, acoustic via air and acoustic via bone conduction. An inversion of phase in the electronic path causes cancellation of low frequencies at the eardrum, and in practice, this is not symmetrical between the two ears due to inequalities of facial structure and the acoustic seal of the headphones. Hence the dramatic apparent quality difference on phase-inverting the mic or headphones.

So in a recording studio, if a performer complains of a funny sound in his headphones—try reversing the phase of the foldback!

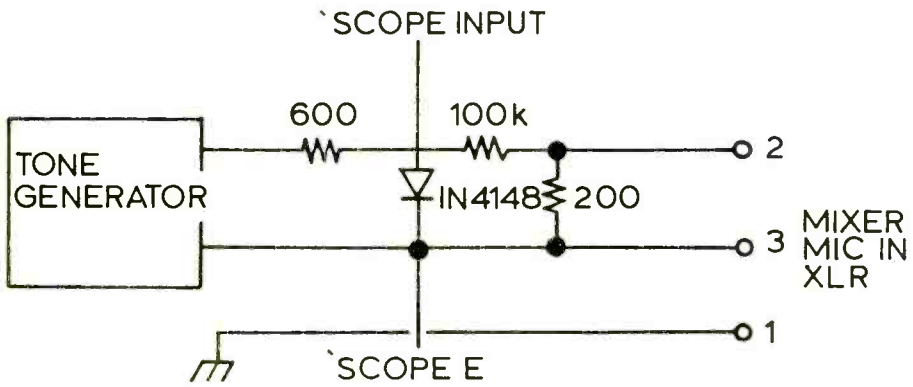
Phase and stereo

An album recorded by a Scottish entertainer whose name is nationally famous was in the shops throughout the British Isles for three weeks before anyone noticed that it had been mastered out of phase. It was noticed by a radio station where an engineer saw the mono $\left(\frac{A+B}{2}\right)$ PPM fall to nothing during a transmission of a track from the album.

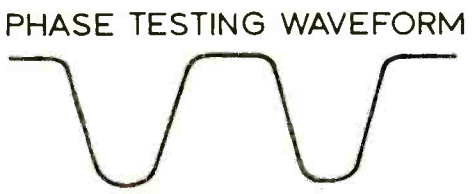
Does this prove that all Scottish engineers have cloth ears? Hardly, it illustrates that with dialogue recording it is not immediately apparent when a problem exists due to the lack of low frequency material in the recording. As pointed out earlier, the wavelength of low frequencies is so long that it is relatively easy to spot cancellation—the ear is not being deceived by reflections and physical distance from the sources. Out of phase stereo speech appears to be clean but not defined with respect to stereo image, the 'picture' being the sensitivity of the human ear to minute phase differences (leads and lags) between the two loudspeakers.

Electronically out of phase signals destroy this delicate mechanism and produce sounds which appear to come from nowhere in particular. This effect becomes important in multimic stereo recording where excessive crosstalk from an instrument on to a mic not intended to pick it up can cause poor imaging due to the phase lags introduced by the physical distance from instrument to offending mic.

A phase correlation meter is a useful tool in stereo master recording. The instrument compares the phase of the left and right signals regardless of level and indicates whether they 'relate', ie are predominantly in or out of phase. Intelligent reading of this meter can show up not only gross phase errors, but also problems in microphones positioning and studio acoustics. ■



The waveform on the scope should be like this:



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INTO THE FUTURE WITH MIDAS

business

BARRY FOX

Digital discs

No one in their right mind thinks that it will be easy to persuade the public to move over from analogue to digital reproduction in the home. Hi-fi buffs will of course buy a digital player as soon as it is offered, but the real challenge will be in persuading Joe Public to do likewise. With the right kind of publicity for the advantages of digital discs, namely far greater audio potential and far denser packing which in turn means a smaller disc and easier storage, the public at large might just be persuaded to follow the Pied Piper. One thing, however, is clear. If the public is confronted with more than one digital disc system, it will simply stick with analogue. Fortunately it does now seem as if the public will be confronted with only one digital disc system even though there was, until quite recently, a real possibility of three or even four systems coming to the market place.

Telefunken of Germany was plugging away at an updated version of the defunct *TeD* videodisc. The Telefunken *Mini Disc* encodes digital sound on a small plastic disc with a hill and dale groove tracked by a piezo pickup. A 13.5cm disc offers one hour's playing time but a 7cm disc was proposed for use where a shorter playing time was acceptable. Telefunken showed *Mini Disc* in Germany, Japan and the USA but never in Britain. Presumably they knew what reaction they'd get. Even in Germany the hi-fi press has been astonished that Telefunken, already in dire financial straits, should waste money on developing such an obvious dead duck. The latest news is that *Mini Disc* is in fact dead. Few tears will be shed.

RCA is mercifully quiet about using its grooved capacitance videodisc system for digital audio, although some Japanese have played around with the idea. In fact many bets will be lost if RCA ever comes to the market in the UK with the videodisc. At a recent London video conference RCA showed only an NTSC player, but claimed to have developed a PAL player and discs. Asked why they were going to the trouble of converting 50Hz mains to 60Hz mains to use an NTSC system, an RCA spokesman replied by publicly inviting me to Zurich to see a PAL player working. Calling RCA's bluff I accepted and have now received a written brush-off.

JVC however has been pushing the digital audio version of its VHD grooveless capacitance videodisc system hard. This is called AHD (Audio High Density) and at the Tokyo Electronics Show last October JVC showed a version of AHD which offered 3 channels of sound and a series of still colour pictures reproduced on a TV screen. Although an exciting piece of technology, and doubtless useful for education, AHD suffers from three inherent problems. Firstly (like Telefunken and RCA discs) the JVC disc must at all times be housed in a caddy to protect the super-sensitive surface from human touch. Secondly the disc is large (26cm) and although the disc can be made smaller for audio it is hard to see how the caddy can be made smaller if it is to be used in the standard videodisc player; and the whole point of the VHD/AHD philosophy is that one player can accept both video and digital audio discs. Thirdly, and perhaps most important, by encoding still TV pictures along with the digital sound, JVC is tieing the audio system to local TV standards (eg NTSC, PAL, SECAM). The one thing we don't want or need is a different digital audio disc format for each different television standard. What we do want and need is a single worldwide standard for digital audio discs.

This is offered by the Philips Compact Disc, now backed by Sony and Matsushita. As Matsushita is the parent company of JVC, this has caused all manner of political problems. In what is clearly a face-saving, stick-together move, Matsushita has talked vaguely about backing both AHD and Compact Disc. But it's plain as a pikestaff that Matsushita's real interest lies with Compact Disc. Even Thorn-EMI, who previously announced backing for AHD, has now climbed down. Although the company haven't yet formally said so, it will be backing Compact Disc, not AHD. Mark my words.

Some of the advantages of Compact Disc are well known, others less so. After Sony joined in, the coding was raised from 14 bits to 16 bits linear and the error correction improved. It's now possible to drill a 2.5mm hole through a Compact Disc without affecting the sound. The digital code also enables the servo system to cope with shocks of up to 5G's, so the system can eventually be used in a car. Although Philips has not been too frank about it, much of the digital improvements in Compact Disc have come from Sony. Also Matsushita has now developed a solid state laser capable of giving 50,000 hours of working life. As so often seems the case with Philips, for instance as with the Compact Audio Cassette, the company comes up with a good idea, then relies on others to perfect it. At the Tokyo Electronics Show Philips was demonstrating Compact Disc with discs mastered from analogue tapes!

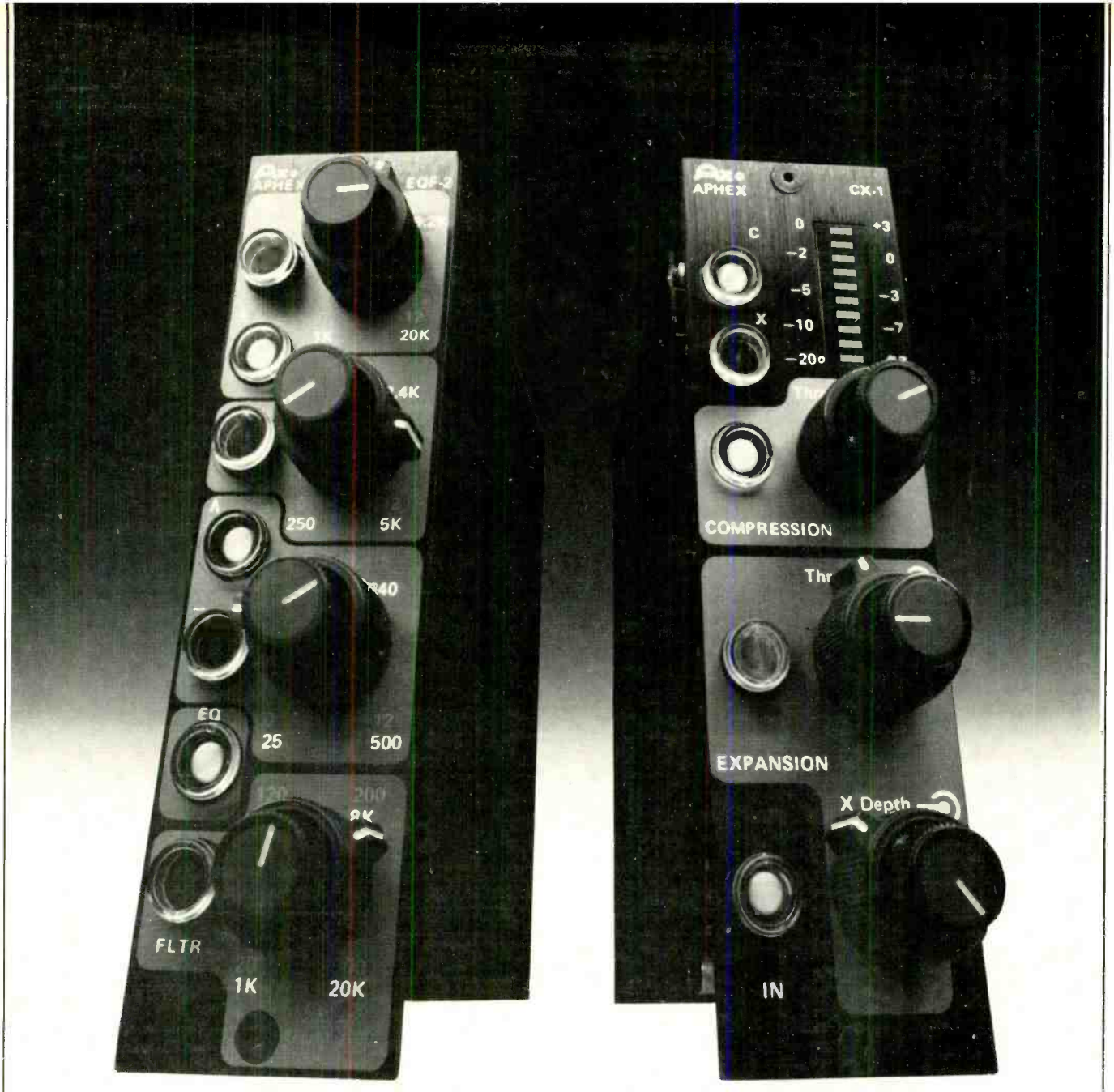
Having been publicly embarrassed twice recently over promising and missing launch dates (first, metal audio tape and then, video disc) Philips is wisely not committing itself to a firm launch date for Compact Disc. The main obstacle is integration of the D/A conversion circuits onto chips small enough to cram into the tiny player. But all the signs are that both Sony and Matsushita will have integrated all their circuits by the end of this year (probably for the Berlin show) and will launch Compact Disc in the autumn of 1982. It also seems likely that a hierarchy of players will be available. Although all the discs will be of 16-bit format, the so-called 'slot' system of encoding will enable them to be played on 16-, 14- or even 12-bit players, with quality traded off for price down the scale. The digital code also includes space for teletext signals, with each disc having the same messages encoded in every one of the world's various teletext standards. This will enable the user to display information on the screen of a TV set, for instance record sleeve data, regardless of local TV standards. More important, there will be a secret coding of copyright registration. Every time a disc is played by a broadcast station its 'needletime' will be automatically notched up by a logging computer.

The risk now is that in an effort to be first on the market, the firms involved in Compact Disc will give insufficient thought to the problems of coding and decoding. If keen-eared listeners find they can hear the ultra-sonic shelf filters working, for instance introducing phase shifts downstairs in the audible range, then it will be no joke for the company which has invested heavily in the large scale integration of the inadequate circuit. Although no formal announcements have been made, it seems that Studer-Revox of Switzerland is one of the few European companies to be looking seriously at this problem. This could put Studer in a strong position when, as sure as night follows day, hi-fi reviewers get over the first thrill and enthusiasm for digital discs, and start really *listening* to digital sound.

In their press literature, Philips, Sony and Polygram say that Compact Disc "... utilises the same 16-bit PCM code now in use for professional digital audio purposes; therefore CD recordings can be made with existing PCM recorders". Unless qualified, this claim can cause confusion. Most professional studio recorders now use 16-bit linear code. Differences between different systems arise when the signals go on tape, with error correction. But these differences are ironed out again when the signals come off tape, with the errors corrected. In other words 16-bit linear code goes into the recorder and 16-bit linear code comes out. Although a different error correction, suitable for discs, is used when the 16-bit linear signal is transferred to Compact Disc it remains generally true to say that Compact Disc is compatible with the digital tapes being stock-piled by studios around the world. So there seems no reason why tapes made on Sony, JVC, 3M and Soundstream systems shouldn't all be transferred to Compact Disc without passing through an analogue stage. An interface may be needed to cope with the different types of serial encoding used for editing or for different sampling rates, but this shouldn't present a practical problem by the time disc mastering gets under way.

Richard Elen comments: *While I am quite sure that the Philips/Sony Compact Disc is the system to go for in consumer digital audio, I wonder about two points. Firstly, what about the Pioneer digital disc? This uses the same basic system as the Compact Disc, but is larger and double-sided (the Philips/Sony disc, I seem to remember, has only one side). In addition, the coding differs somewhat. Built into the Pioneer system is also the capability to take more than two audio channels, and this leads on to a second point: if the Philips/Sony disc is only capable of handling two audio channels whilst offering a reasonable playing time, it may be OK for now, but will not stand the test of time. We may be fine with stereo today, but surround-sound is on the way, despite erroneous comparisons with 'quad'. The Ambisonic UHJ system may be used in an encoded 2-channel form to give horizontal surround-sound, but better results will be obtained with three channels. Four channels of information offer surround-sound with height, and ultimately both the public and the industry will require such facilities. If the Philips/Sony system cannot offer this capability, with a reasonable time between disc changes, it will be outdated within a few years. Let's hope that thought is being given to this question in the appropriate areas.*

56 ▶



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Credit where credit's due

The BPI and British Market Research Bureau (BMRB) recently jumped publicly on WEA after discovering that one of their freelance promotion men had been hyping the charts. He had been making false entries in the sales diaries of shops used by BMRB to compile the charts. Although WEA claimed the offender wasn't acting under company instructions, they had no option but to pay up £10,000 to cover costs of the investigation. All credit to the BPI for making their findings public. Who knows, perhaps all the flak the BPI has been receiving over recent years is finally getting through to them.

But there's one aspect of the affair that hasn't been fully aired in public. *Music and Video Week* is not, how can I put it, normally too bluntly critical of the music trade. But even *MVW* wondered in print why Nesuhi Ertegun, International President of WEA, hadn't spoken on the company's behalf. Instead it was left to Charles Levison, WEA's newly-appointed managing director, to comment. Levison, formerly with Arista, was brought into WEA to fill the gap left when John Fruin resigned as WEA MD and BPI chairman in October 1980. Fruin, who had been with WEA since January 1977, left soon after the *World In Action* TV programme on chart hyping which slammed WEA and finally forced the BPI to acknowledge that hyping happens. For the five months between Fruin's departure and Levison's appointment, Nesuhi Ertegun was in control of the UK company, and according to the BPI the hyping of WEA records took place over a period of 8 weeks between the beginning of January 1981 and mid-March, ie while Nesuhi Ertegun was acting head of the UK company. Hence the obvious question—shouldn't Nesuhi Ertegun comment on the hyping activities that have cost his company £10,000 in hard cash and yet more bad publicity?

The aspect as yet unaired is that Ertegun isn't only president of WEA. He is also president of the IFPI. This is another of those trade bodies which the record industry seems to spawn and its official title is the International Federation of Producers of Phonograms and Videograms (how you get IFPI from IFPPV, is anyone's guess). You have to be very careful what you say about the IFPI. In their words the London secretariat is "composed exclusively of English lawyers" and in my words their Pall Mall office is knee deep in legal eagles with writs at the ready. But I don't think that even the IFPI lawyers can sue if I publish the reminders that their president is Mr Nesuhi Ertegun of WEA and that in the IFPI's annual report they promised that the IFPI would "seek to uphold the status of the industry in the eyes of governments, which were only too inclined to favour other groups, such as consumers, at the industry's expense". The IFPI, like Ertegun, has "no comment" on the recent transgressions of Ertegun's company, WEA. "We have no duties or responsibilities in the area of chart or alleged chart fraud," said David Gibbins, one of the IFPI's lawyers, "therefore it is inappropriate for us to comment on particular cases." Fair enough, but I for one shall await the IFPI's next policy pronouncement with special interest.

A question of depth

Have you ever wondered why some recordings, especially old ones (even mono), seem to create an illusion of depth (as distinct from stereo width)? Dr Peter Craven, of the University of Liverpool, offers what must surely be the answer. It's so simple that you'll kick yourself for never having thought it through. But then, according to those who have worked with Peter Craven, he does have a special talent for coming up with the obvious answers that everyone else has overlooked.

Forget for the moment about stereo width and the question of discerning the angular *direction* of a sound source. This is of course achieved by a clever ear-brain analysis of the difference in amplitude and phase between similar sounds arriving at each ear. Think only about discerning the *distance* of the sound source from your ear, or image *depth*.

Imagine you are listening to the live sound of a musical instrument in a room. Your ear hears sound direct from the instrument and it also hears sound indirectly as a reflection from a wall. (To avoid confusion we are thinking for the time being only about one ear, one wall and one reflection.) Sound reflected from a wall is analogous to light reflected from a mirror. In a mirror you see a phantom image behind the mirror; for sound you hear a phantom image from behind a wall. The indirect sound from the phantom image arrives with a time delay compared to the direct sound because of the extra distance it has travelled compared to the direct sound. For the same reason it also has a loss of amplitude compared to the direct sound. So here immediately are the two all-important clues which the ear and brain can use to pinpoint the precise *distance* of the sound source.

With two ears, several reflecting wall surfaces and a multitude of echoes, the number of clues is greatly increased. This increases the reliability of distance detection. Our ear-brain combination is now able to estimate both the distance of the sound source and its angulat direction. This explains distance perception in live situations. But it raises a question. Why do some recordings offer an illusion of depth whereas others don't? If you follow Peter Craven's arguments all becomes clear.

When a recording is made in a good 'natural' acoustic (as opposed to a dead studio) using a single omnidirectional mono microphone, you have an ideal system for capturing both the clues to distance and depth, namely time delay and amplitude. This is because a single omnidirectional mic occupies a single point in space and so replicates a human ear pickup. Sure enough, old recordings made with a single truly omnidirectional mic do offer an astonishing feeling of depth, even though they are only in mono. A stereo one-point-in-space pickup system also offers an illusion of depth, but only if it involves an essentially omnidirectional stereo pickup. Blumlein's original technique offered omnidirectional pickup (in the horizontal plane only) and the Ambisonic UHJ format in stereo involves a virtually omni pickup in all directions. A spaced pair of omni mics, as favoured by some US engineers, offers two confusing sets of depth clues although these will agree with each other for centre stage images. A badly arranged coincident pair, or a panpotted close-mic multitrack recording drowned in artificial reverbs, is least able to capture meaningful clues to depth.

Try listening to some old mono-omni recordings, and some modern UHJ recordings (eg from Nimbus and Unicorn) in stereo alongside some US-style spaced-omni material and some panpot mixdowns. Forget about width and see if you think the illusion of depth that these various systems give in practice ties in with Peter Craven's theory for what they should give.

But don't jump to conclusions without checking the whole reproduction chain for inherent ability to reproduce depth. Although the hi-fi world has only just started to cotton on to the phenomenon, it does seem that some audio equipment is better suited to create an illusion of depth than others. Almost every link in the hi-fi reproduction chain can degrade depth reproduction and it is only a question of time before depth becomes the new cult selling point for the hi-fi trade. When it does, and people start rediscovering the depth of old mono recordings. Phil Spector will have been proved almost right. He advocated that we should all go "back to mono". What he should really have said is that we should all go 'back to omni-mono', or forward to stereo and surround-sound with omni pickup. ■

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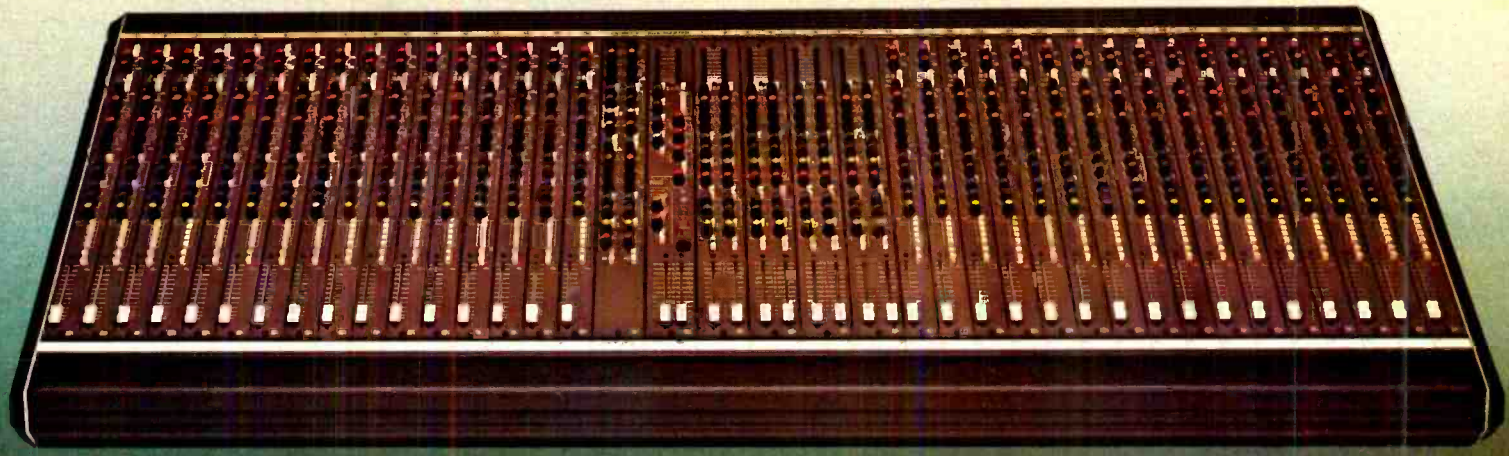

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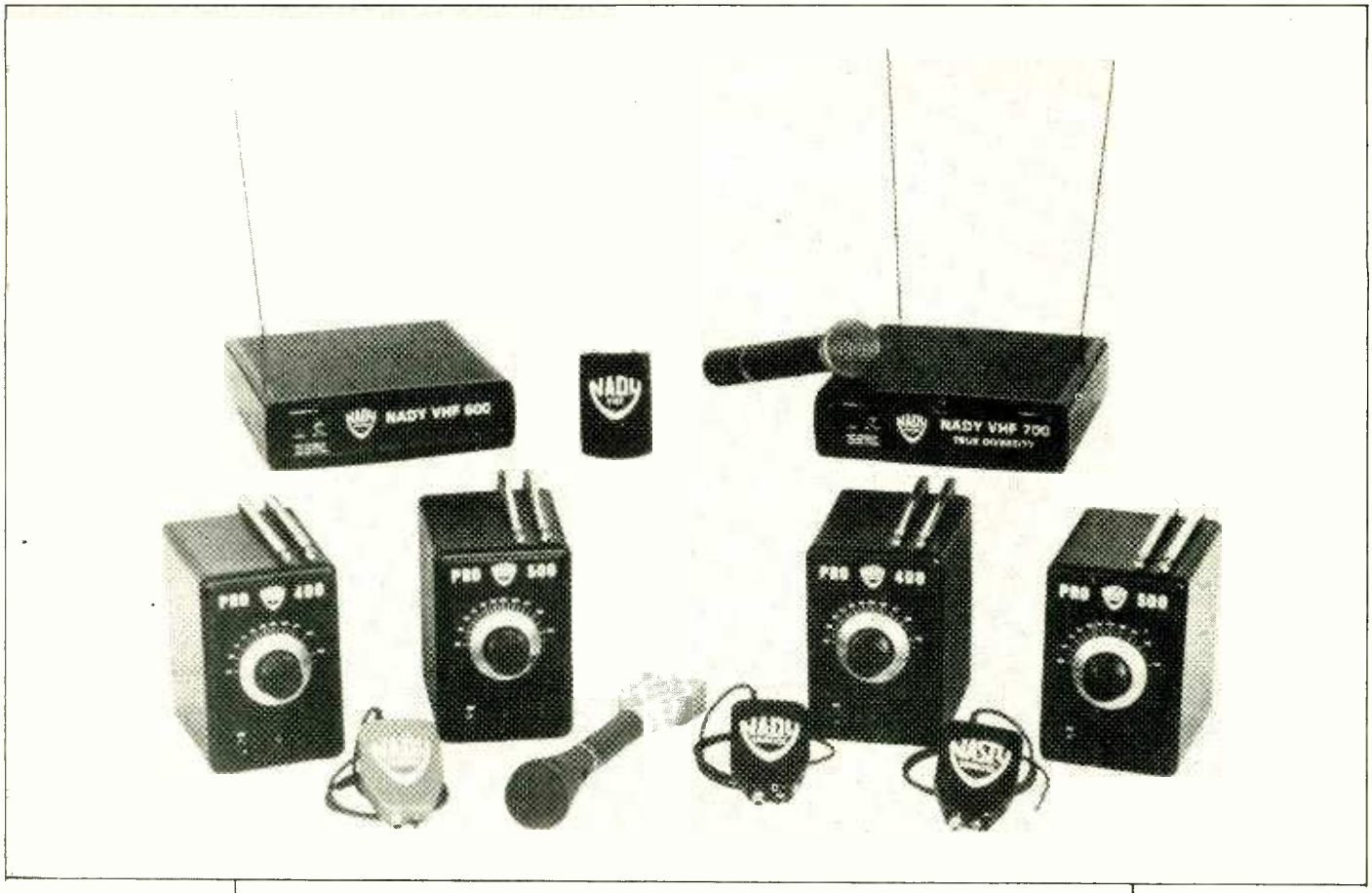


Variety of radio mics including diversity systems from Nady

Radio microphones

Bernard Bush (Optical & Textile)

In this article, Bernard Bush describes the development of radio microphones, including the use of diversity systems and compansion to improve the quality of the signal.

THE NEED for radio microphones started during the 1960s, mainly for stage and cabaret use. Up until this time artistes were content to use a fixed microphone on a stand for their performance but, with the increase in popularity of "pop" singers, a greater freedom of movement for the artist was required, as frequently singers were required to dance (or attempt to do so!) or move among the audience whilst singing. This freedom was given by making the microphone detachable from the stand and providing long lengths of cable, usually with a stage hand feeding the cable out or pulling it back as necessary. This could lead to some embarrassing moments when the performer either became entangled with the cable or the stage hand was not fast enough in feeding the cable out. As you can imagine many performers have fallen flat on their faces during a show because of the mic cable and it was out of this need for greater mobility that the radio microphone was born to give complete freedom to the performer.

From the start, frequency modulation was used for hand-held radio mics and the system used was identical in specification to that used in FM broadcasting, namely a peak frequency deviation of ±75kHz for full modulation. Indeed many early radio mics used the FM band for transmission, namely 88 to 108MHz, and utilised standard domestic receivers for reception, the hand-held transmitter being tuned to a vacant spot in the band. This as you can appreciate is highly illegal and eventually most countries provided a legal band for radio mic use and insisted upon crystal frequency control of the transmitter for licensing. In the United Kingdom this band is from 174.1 to 175.0MHz, a band width of 900kHz.

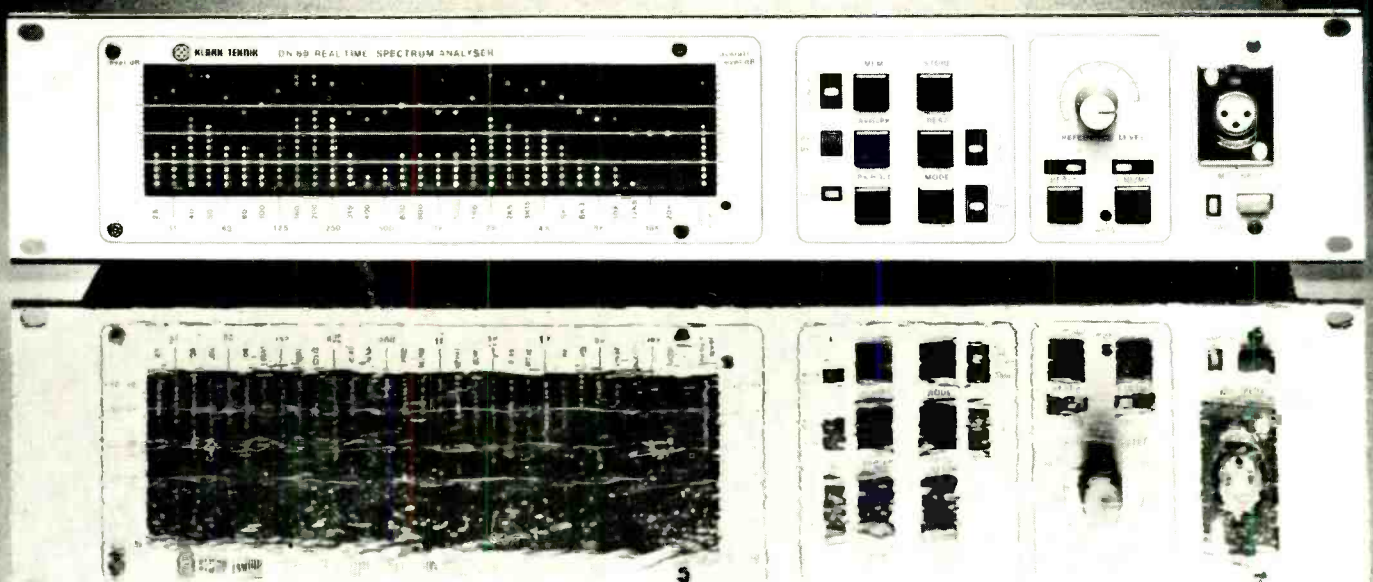
Thus a second generation of radio mics was born, crystal frequency controlled and with a specially designed receiver, also crystal controlled with outputs to match the inputs of the theatre amplification system. Simultaneously a second type of transmitter unit was developed to meet the needs of both the television and film industries. This is the body pack transmitter: a small, flat unit which can be worn concealed upon the performer or interviewer and is used with a small, omnidirectional tie-clip or lapel microphone. This second generation still used a deviation of ±75kHz but fidelity and frequency stability were greatly improved, bringing most reputable units up to professional broadcast quality. Battery operated receivers were also developed giving the film maker independence of mains supplies and an ability to work in the open.

We are now entering the third stage of development where the demands put upon radio mics are even more stringent, greater dynamic range is demanded, greater range is required and, above all, multiple unit operation is required. It is not unusual to require as many as six radio mics to be operated simultaneously with no crosstalk between channels. It may be appreciated, that with a deviation of 75kHz a channel spacing of at least 150kHz must be allowed to ensure no crosstalk between channels. In practice, most receivers are designed to have a total bandwidth of 200 to 250kHz and in order to ensure complete freedom from crosstalk it is usual to operate units at spacings of 400 to 500kHz. Thus it is only possible to use three radio microphone channels within the legal UK band of 900kHz (although it is not unknown for some operators to use more than this number of channels!)

It is perhaps fitting to mention here the other problems associated with the use of radio mics. Dropout is the complete but momentary loss of signal at the receiver. Buzz tones are caused by radio frequency noise emanating from sources such as arc lights, transformers and switching transients. Both these forms of interference manifest themselves in a familiar fashion, namely an annoying click, buzz or plop at the receiver. These problems have plagued the designers of radio mics since the beginning and it is with the advent of the third generation range of radio mics that many of them have been alleviated or cured.

Firstly let us deal with the problem of multichannel operation within a restricted band. The obvious solution is to reduce the transmitter deviation to less than 75kHz. This solution has been used in the Swintek radio mic system but any solution to a problem also brings

60▶



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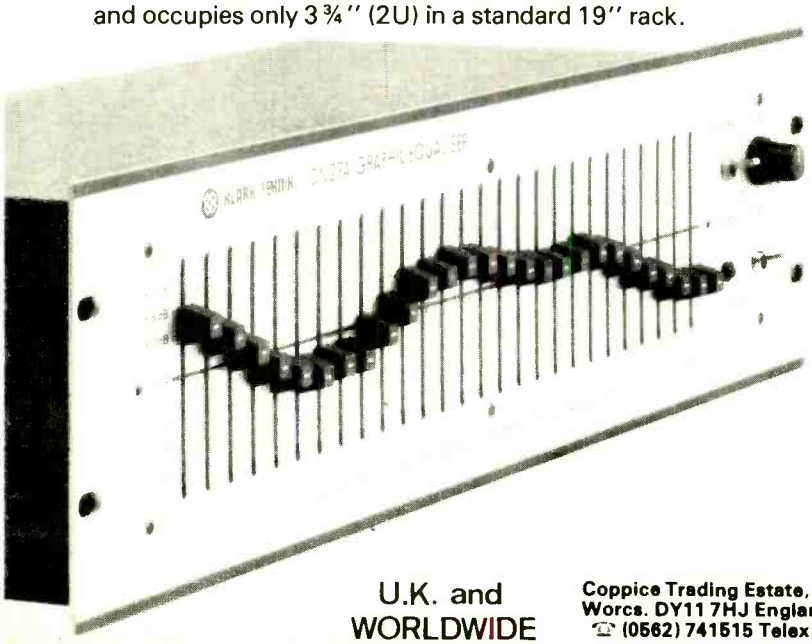

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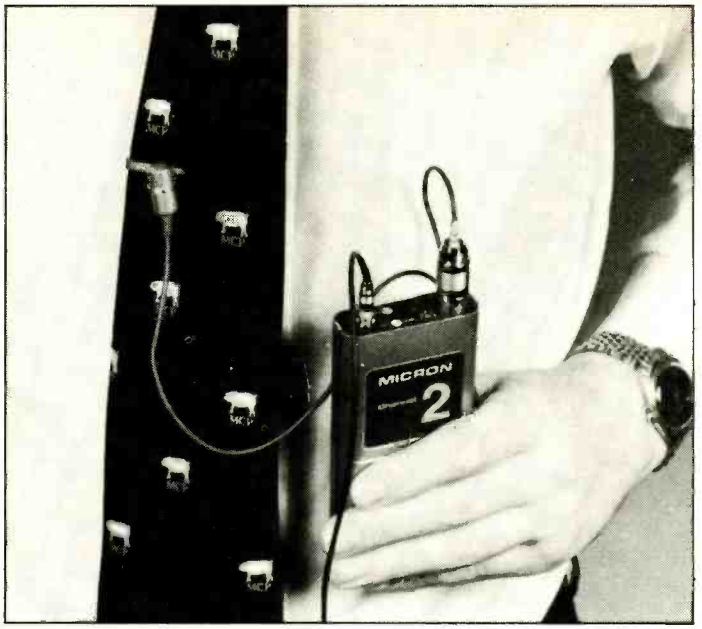
Radio mics

new problems in its train. Swintek use frequency deviation on the transmitter of ±12kHz and coupled to the receiver, a channel spacing of 50kHz is possible. The problems associated with narrow band operation are frequency stability of transmitter and receiver, and audio frequency response. The use of narrow band modulation leaves little leeway for crystal drift due to ageing, or temperature variation. The solution is to use ultra high stability crystals which, whilst costing up to 10 times as much as conventional crystals, give the requisite frequency stability. The narrow receiver bandwidth is obtained by the use of a crystal front end and sharp cutoff crystal filters in the intermediate frequency strip. With regard to frequency response, a certain amount of compromise has had to be made, namely a limitation of the audio bandwidth to 10kHz, with a steep drop off after this point. This, coupled with the careful selection of the time constants of the pre-emphasis and de-emphasis circuitry has achieved the 10kHz bandwidth to within ±3dB. In practice it has been found that the slight reduction in bandwidth is of no serious consequence because the mic is generally used with human speech, which has little or no harmonic content above 10kHz.

Improvement of dynamic range has been achieved by Swintek with the use of the *dB-S* system. Conventional radio mics achieve a maximum dynamic range of 55 to 65dB which in general is adequate for broadcast or recording purposes. In order to achieve this range, however, it is necessary for the sound engineer to set modulation levels accurately at both transmitters and receivers. If these levels are not properly set either poor S/N ratio will occur or the transmitter or receiver will clip the waveform or run into limiting if fitted. In fact it is usual to provide compression on most radio mics. With the advent of digital recording, greater dynamic ranges are demanded and further, the provision of a greater available dynamic range eases the task of the recording engineer. The Swintek *dB-S* system achieves a total range of 100dB by the use of companding techniques and compression. The difference between the two techniques is as follows. Compression means that any change of audio signal level above a given value is compressed to a lower level. Thus a 20dB change could be compressed to 5dB. Companding consists of compressing the audio signal on transmission and expanding to the full range on reception. In the *dB-S* system, 80dB of the audio range is compressed into 40dB, a 2 to 1 ratio, the upper level being fixed and the lower level raised. This is expanded out to the original 80dB at the receiver. The effect at the transmitter and hence at the receiver input is to raise the lowest audio modulating level by some 20dB or so. This confers a second advantage as far as the receiver is concerned in that the audio level is now raised above the buzz-tone level mentioned previously and hence, on expansion, buzz tones are reduced by a factor of 2 to 1. The remaining 20dB of audio range is handled by the compressor which limits it to only 5dB. Thus a useable range of 100dB is achieved.



Micron battery powered transmitter

One criticism of compander systems is that, in some cases, 'breathing' effects are introduced into the recovered signal. These are in fact caused by mismatch of the compressor and expander and can be effectively eliminated by the use of carefully-matched integrated circuits and components in both transmitter and receiver. These are matched, not to each other, but to a given standard so that complete interchangeability of transmitters and receivers is achieved. A further extremely useful feature found on all *dB-S* receivers except the miniature 'Q' receiver is a noise gate which may be switched in at will. This is employed when the transmitter is used in noisy environments and can help to reduce or eliminate the effect of background noises. Noise gates have been used for a number of years now and the usual method of operation is to permit audio signals above a given level to pass through the system but not those below the 'threshold', this level being set above the ambient noise level. The fault with such systems is that since they are an 'all or nothing' system, periods of speech are puncuated by periods of absolute silence and depending upon the attack and decay time of the gate, objectionable 'breathing' effects are apparent. The sound gate in the *dB-S* system introduces a logarithmic characteristic into the system which gives a more gradual transition from open to closed and hence reduces the 'breathing' effect. By judicious use of the sound gate in conjunction with the wide dynamic range to effectively alter its level, many successful recordings have been made in conditions where it would have been necessary to dub the sound in the studio. One major use is in the elimination of noise without the use of heavily 'blimped' cameras where it has proved to be very valuable.

The final problem with radio mics is that of dropout. This, as previously stated, is caused by the loss of signal strength at the receiver. The solution here is a little more difficult because the immediate answer of increasing transmitter power is not practical for a number of reasons, the main one being that most licensing authorities limit the maximum antenna power. In the UK the power is limited to 10mW for broadband systems and 50mW for narrowband units. Dropout is a particularly difficult problem at the frequencies used for radio mics because it is unpredictable. In free-field conditions with transmitter and receiver operating in line of sight it is predictable, but in the confines of a studio with scenery and other obstructions it is possible to get dropout at a range of perhaps 10 yds at a particular location in a studio whereas at another location in the same studio a range of 50 to 100 yds will still give adequate signal strength. A general rule is to locate the reception antenna as high as possible but this becomes difficult when multichannel reception is required as a separate antenna is required for each channel. The Swintek solution to this problem is to provide two types of antenna output boxes allowing a single antenna to be used with either up to four receivers or eight receivers. Furthermore, should a long length of coaxial cable be used between antenna and receiver, then there is available an inline rf amp giving 12dB of gain over the band 10 to 470MHz. Ideally this should be located near to the antenna, but as it requires powering by approximately 12V dc, a power supply coupler can be located at the receiver end which will allow the dc to be taken up the cable to the amp whilst the rf returns along the cable.

In many cases either more range is required or there is a particularly difficult location which is prone to dropouts. The current state of receiver design is such that the theoretical limits of sensitivity have been reached and thus it is not possible to improve upon sensitivity. This is true of the Swintek range of receivers and thus no improvement in dropout performance is achievable by this means. The solution adopted by most manufacturers is the use of a receiver diversity system where two receivers are located in different positions and the audio outputs are switched from one receiver to another by a switching diversity unit which senses the receiver with best S/N ratio and switches the appropriate output to the recorder. This is in many cases satisfactory but suffers from two major defects. Firstly it is practically impossible to make the switching inaudible and thus annoying clicks are received as the unit changes receivers. Secondly, in a multichannel system, for example a 4-channel system, eight antennas, eight receivers and four diversity switching units are required, a truly formidable array of hardware and cables! Swintek have adopted a solution based upon research performed by the BBC where an antenna diversity system is used. This combines the output from two antennas located at a spacing of at least 6m, the outputs being added and phase-corrected so that a single combined rf signal is obtained. As there is no switching there can be no switching transients and the hardware for a 4-channel system is thus reduced to two antennas, one antenna diversity unit, one power up unit which may be dispensed with if it is convenient to power the diversity unit directly, a 4- (or 8-) way splitter box and a single receiver per channel. The hardware is reduced from 20 units in a receiver switching system to eight or nine units and the savings are greater, if more than four channels are used. ■

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New directions in stereo

Denis Vaughan

Ear exercises for experts

FIG 1
MEAN VALUE OF MEASURED TRANSFER FUNCTIONS OF THE EAR CANAL

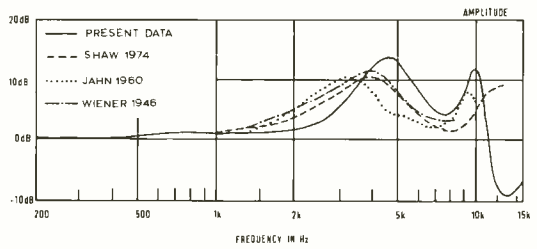
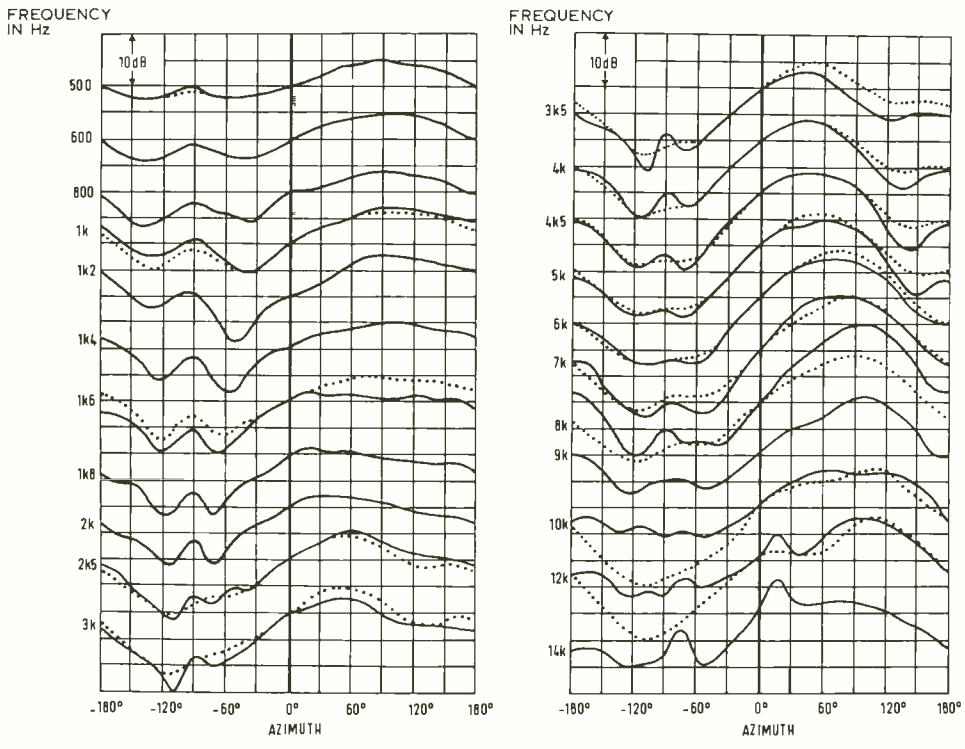


FIG.2
LATERAL DIFFERENCE IN PERCEPTION OF FREQUENCIES



••••••• SHAW'S RESULTS OF 1974 FOR COMPARISON

THE publication in 1977 of the latest measurements of the transformation characteristics of the external ear[1] places a clear challenge to all professional users of their ears to come to terms with the details of our perception of timbre. With these measurements placed side by side with the many aspects of listening described in Blauert's book[2] it is possible to sketch out some of our aural tendencies, and to offer conjectural answers to the questions posed by certain aural experiences. It is also possible to project some future developments in the enrichment of stereophonic recording and reproduction.

Fig 1 shows the filters through which sound must pass on its way to the eardrum. A constant filter between the sound source and our cochlea is the ear canal. This imposes a 13dB peak on the sound between 4 and 5kHz, a sharper 12dB peak at 9.5kHz, and a −9dB trough above 12kHz. This colouring is common to all that we hear, and so we are used to making allowances for it. The graph explains why we are so sensitive to extreme upper frequencies—we receive basically so little of them.

Fig 2 shows the lateral differences in the perception of frequencies in comparison to the frontal spectrum. The outer ear imposes these changes. These represent frequencies as heard by the right ear in the horizontal plane, 0° representing a point in front of our nose. In contrast to the ear canal, the filtering effect of the outer ear is much more varied, changing the spectrum according to the angle of incidence of the sound. Consequently we hear a different timbre in every direction. The frontal spectrum is already very remarkable, as may be seen easily from **Fig 3.**

If we take 400Hz as 0dB in sound reaching us from straight ahead (0°), we hear a peak of + 12dB between 2 and 3kHz and a trough of − 10.5dB at 10kHz. **Tables 1** and **2** list the varying strengths of the frontal spectrum, and

TABLE 1 LATERAL DIFFERENCES

Frontal Spectrum (dB)	Frequency in Hz	0° (dB)	18° (dB)	36° (dB)	54° (dB)	72° (dB)	90° (dB)	108° (dB)	126° (dB)	144° (dB)	162° (dB)	180° (dB)
−0.5	200	0	1.5	2.5	2.0	1.0	2.0	1.0	0.5	0.5	0.5	0
+0.5	500	0	1.0	2.5	4.0	4.0	5.5	4.5	4.0	3.5	2.0	−0.5
+1.0	700	0	1.0	2.5	3.5	4.5	5.0	5.0	4.5	3.5	1.0	−0.5
2.0	1k	0	2.5	4.0	4.5	6.5	7.5	7.0	6.5	5.5	5.0	4.0
+10.0	2k	0	2.0	2.0	1.5	1.5	0	0.0	−1.5	−2.0	−2.0	−3.5
+12.0	3k	0	1.0	2.0	3.0	2.0	−1.0	−2.0	−2.5	−2.5	−3.0	−3.5
+5.0	4k	0	3.0	4.0	3.5	1.5	−2.0	−5.5	−8.5	−8.0	−6.5	−5.5
−1.5	5k	0	3.5	4.0	5.0	4.5	3.5	0.5	−5.5	−9.0	−8.0	−7.0
−0.5	6k	0	4.0	6.5	7.0	7.5	7.0	5.5	2.5	−3.0	−4.5	−5.0
+1.5	7k	0	4.5	6.5	10.0	11.0	10.0	8.5	6.5	2.5	−1.0	−2.5
−2.0	8k	0	4.5	9.0	11.0	14.0	15.0	14.0	12.0	7.5	3.5	2.5
−8.0	9k	0	3.5	5.5	7.0	8.5	11.0	11.0	8.0	4.5	1.0	−0.5
−10.5	10k	0	3.0	3.5	7.0	7.0	8.5	7.0	6.5	4.5	2.5	−2.5
−10.0	11k	0	3.0	3.5	5.0	7.5	7.0	2.5	3.0	6.5	2.0	−2.0
−7.0	12k	0	5.0	1.5	3.5	7.0	8.5	8.0	5.5	3.5	1.5	−2.5
−2.0	13k	0	4.0	0	1.5	5.0	5.5	6.0	5.0	1.0	0	−4.5
+2.0	14k	0	6.5	2.0	2.0	2.5	2.0	1.5	−0.5	−2.5	−4.0	−7.0
+3.5	15k	0	4.5	2.5	3.0	1.5	0.5	−1.0	−2.0	−3.5	−5.0	−7.5

TABLE 2 COMPARATIVE TIMBRE READINGS AT SEVERAL ANGLES IN THE HORIZONTAL PLANE

Ear Canal (dB)	Frontal Spectrum (dB)	Frequency in Hz	18°	36°	54°	72°	90°	108°	126°	144°	162°	180
0	0.5	200	1.0	2.0	1.5	0.5	1.5	0.5	0	0	0	−0.5
0.5	0.5	500	1.5	3.0	4.5	4.5	6.0	5.0	4.5	4.0	2.5	0
1.0	1.0	700	2.0	3.5	4.5	5.5	6.0	6.0	5.5	4.5	2.0	0.5
1.0	−2.0	1k	0.5	2.0	2.5	4.5	5.5	6.0	4.5	3.5	3.0	2.0
2.0	10.0	2k	12.0	12.0	11.5	11.5	10.5	10.0	8.5	8.0	8.0	6.5
5.0	12.0	3k	13.0	14.0	15.0	14.0	11.0	10.0	9.5	9.5	9.0	6.5
12.0	5.0	4k	5.0	9.0	8.0	6.5	3.0	−0.5	−3.5	−3.0	−1.5	−0.5
12.0	−1.5	5k	2.0	2.5	3.5	3.0	2.0	−1.0	−7.0	−10.5	−9.5	−8.5
9.0	−0.5	6k	3.5	6.0	6.5	7.0	6.5	5.0	2.0	−3.5	−5.0	−5.5
5.0	−1.5	7k	4.0	10.0	11.5	12.5	11.5	10.0	8.0	4.0	0.5	−1.0
4.5	−2.0	8k	2.5	6.0	9.0	12.0	13.0	12.5	10.0	5.5	1.5	0.5
8.0	−8.0	9k	−4.5	−2.5	−1.0	0.5	3.5	3.0	0	−3.5	−7.0	−8.5
11.5	−10.5	10k	−7.5	−5.0	−3.5	−3.5	−4.0	−3.5	−4.0	−6.0	−8.0	−13.0
2.5	−10.0	11k	−7.0	−6.5	−4.0	−2.5	−3.0	−2.5	−3.0	−3.5	−8.0	−12.0
−8.0	−7.0	12k	−2.0	−5.5	−3.5	0	1.5	1.0	−0.5	−3.5	−5.5	−9.5
−9.0	−2.0	13k	2.0	−2.0	−0.5	3.0	3.5	4.0	3.0	−1.0	−2.0	−6.5
−8.0	2.0	14k	8.5	4.0	4.0	4.5	4.0	3.5	1.5	−0.5	−2.0	−5.0
−7.0	3.5	15k	9.0	6.0	5.5	5.0	4.0	2.5	1.5	0	−1.5	−4.0

then the comparative variations at several angles to the side in the horizontal plane.

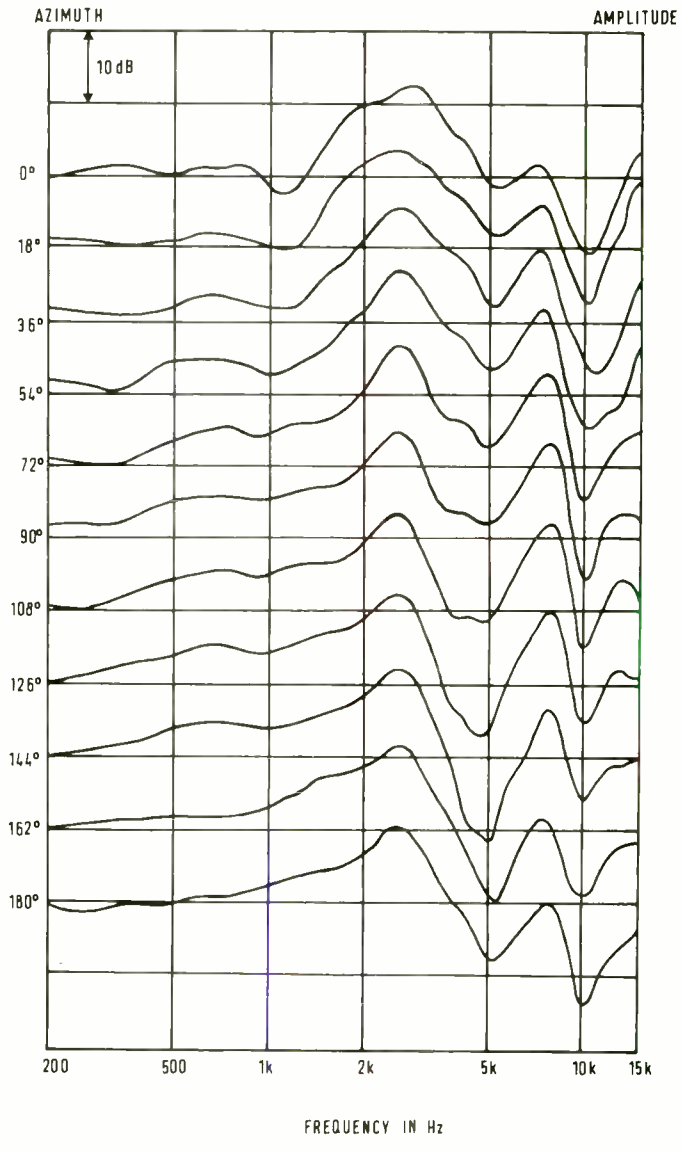
The areas where the differences exceed 5dB are within the dark panel, and the lighter panel shows the negative quantities. Where the 10kHz trough in the frontal sound recovered slightly at 15kHz, it is supported still further at 18° to the side, allowing 14 and 15kHz to compensate at that point for the big drop caused by the ear canal. Between 6 and 13kHz, we have to move further to the right, virtually between 54° and 126°, to have a good reception of these frequencies.

Some of Blauert's experiments proved that we associate certain directions with certain timbres. Consequently it was possible to change the apparent direction of a sound by changing its frequency spectrum. Everyone is used to adding 'presence' to a sound by increasing the strength at or around 2.5kHz. By looking at the frontal spectrum it is obvious that the chief characteristic in that direction is just this peak—ie the strongest frequency in the sound which we can perceive from the front. An increase at that pitch we associate with increasing the feeling that the sound is in front of us—in other words, 'presence'.

In **Table 2** the comparative spectra at each angle is transferred through in the separate columns (measured virtually in a free field horizontally) to help readers to see at what angle the timbre is smoothest, but still discounting the filtering of the ear canal, which is listed in the very first column, for reference purposes. At the normal angle at which stereo speakers are placed—usually not more than 36° to the right and to the left—there is a range of 20.5dB between the strongest pitch (3kHz at +14dB) and weakest pitch (11kHz at −6.5dB). This is a little smoother than the frontal range, which has 22.5dB between its strongest (3kHz) and weakest (10kHz) response. The

64 ▶

FIG. 3
AMPLITUDE OF THE TRANSFER FUNCTION



New directions in stereo

smoothest response curve is that which we can perceive at 72° and 108°, which have only a 16dB range between +12.5 at 7kHz and −3.5 at 10kHz.

Although adjacent curves are often similar, say 72° and 90° horizontally, there is always a strong jump at one or two frequencies, sufficient to help our ear to recognise the different directions easily. In this case 3kHz jumps down −3dB, 4kHz −3.5dB, whereas 9kHz jumps up +3dB and 12kHz +1.5dB. Thus a contrast of 6.5dB is obtained at these pitches.

Fig 4 and **Table 3** give the vertical differences, as heard in the median plane, in front, over our heads and behind us, graphically and in figures, to clarify the timbre in each direction.

Two further diagrams are essential to put readers more in the picture about the extent to which we associate certain directions with certain pitches. For instance 8kHz, no matter where the sound source, we hear as coming from above us. Blauert's experiments give the following general front-back pattern of directions, shown in **Fig 5.** Also interesting are the results of a test which Roffler and Butler made on 50 people who, on being asked to identify from which of four loudspeakers came a number of random sounds between 250Hz and 7kHz, gave almost unanimously the pattern shown in **Fig 6.** No-one pointed to the bottom loudspeaker, even when sound was coming from it. In fact the sounds were emitted by one or other of the four loudspeakers at random, but the answers bore little or no relation to the actual direction of the sound source, and the subjects rarely pointed directly at a loudspeaker. Roffler and Butler report that these angles were not fixed, but varied according to the distance from the sound source, and were influenced by what the subjects saw. However the relationship of high frequencies high and low frequencies low remained under any circumstances.

Before making speculations from these facts it is useful to examine a set of musical qualities in sound put together to represent a rough order of preference. This exercise was the result of an acoustical study[3] which was first to ascertain the physical conditions necessary for warm string tone in acoustics, and as a result of that, to propose a musical series of criteria to be used in building studios and concert halls[4] (*Musical Times*, Jan, Feb, March 1981). Vilhelm Jordan emphasises[5] the need for these criteria, and the list has already met with a certain amount of approval, from conductors, recording engineers and producers.

In condensed form, the qualities are as follows:

Richness—powerful multiple reflections from all angles shortly after the original sound.

Density—a large number of reflections (impulses) in a short interval of time.

66 ▶

TABLE 3 VERTICAL DIFFERENCES

Frontal Spectrum (dB)	Frequency in Hz	0°	9°	27°	45°	63°	85°	99°	117°	135°	153°	171°	180° (hinten)
−0.5	200	0	−0.5	−0.5	1.5	1.5	−1.5	−1.0	0	1.0	−1.0	0	0
+0.5	500	0	0.5	2.0	1.5	−0.5	−1.5	−0.5	0	1.0	1.5	0	−0.5
+1.0	700	0	0	−1.0	−4.0	−4.5	−5.0	−3.0	−2.5	−2.0	1.0	0	−0.5
−2.0	1k	0	0.5	1.0	1.5	2.0	0.5	0	0.5	1.5	3.5	4.0	4.0
+10.0	2k	0	−2.0	−4.0	−5.0	−5.5	−6.5	−7.0	−5.5	−4.5	−4.0	−4.5	−3.5
+12.0	3k	0	−0.5	−2.0	−3.0	−4.0	−4.5	−5.5	−6.0	−5.5	−5.0	−3.5	−3.5
+5.0	4k	0	−0.5	−1.0	−2.0	−2.5	−4.0	−5.5	−6.5	−7.0	−7.0	−6.0	−5.5
−1.5	5k	0	−0.5	−1.0	−0.5	−2.0	−4.5	−5.5	−6.5	−7.0	−7.0	−7.0	−7.0
−0.5	6k	0	1.0	3.0	2.5	2.0	−0.5	−2.0	−2.5	−3.5	−4.0	−4.5	−5.0
+1.5	7k	0	1.5	6.0	7.0	6.5	4.0	2.0	2.5	2.0	0.5	−2.0	−2.5
−2.0	8k	0	2.0	8.0	12.0	12.5	12.0	10.0	9.0	10.0	7.0	4.0	2.5
−8.0	9k	0	1.5	7.0	10.0	12.5	13.5	12.0	11.5	11.0	7.0	1.5	−0.5
−10.5	10k	0	1.0	5.0	5.5	8.0	8.5	7.5	7.0	3.5	0.5	−1.5	−2.5
−10.0	11k	0	0.5	1.0	−1.0	2.0	4.5	0.5	1.5	−4.5	−4.5	−2.0	−2.0
−7.0	12k	0	0.5	2.0	−1.0	−2.5	0	−3.0	−5.5	−2.5	−3.0	−2.5	−2.5
−2.0	13k	0	1.0	2.0	−3.5	−7.5	−4.0	−7.5	−10.0	−6.0	−8.0	−7.0	−4.5
+2.0	14k	0	0.5	1.0	−3.0	−7.0	−2.0	−8.0	−10.0	−8.0	−7.5	−7.0	−7.0
+3.5	15k	0	0	0	−3.5	−8.0	−0.5	−8.5	−11.5	−8.0	−7.0	−7.5	−7.5

FIG. 4
DEPENDENCE OF THE TRANSFER FUNCTIONS

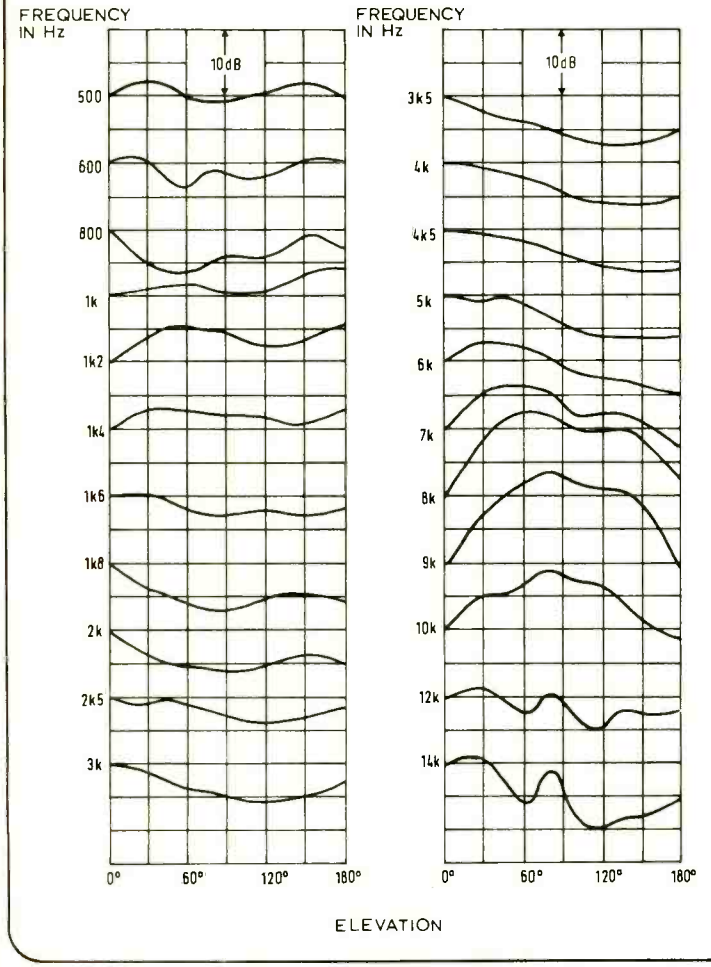


FIG. 5
HUMAN INTERPRETATION OF THE DIRECTION OF SOUND SOURCES

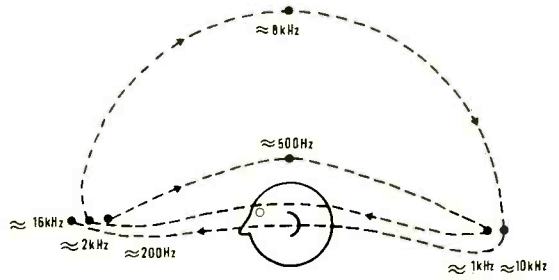
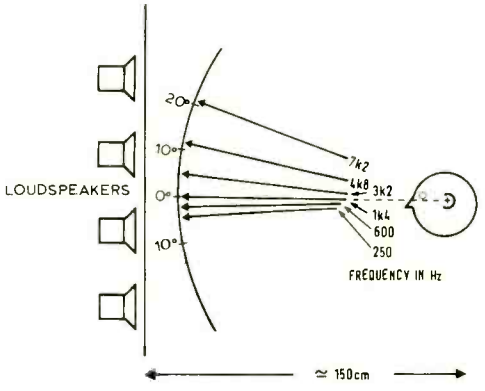


FIG.6
RESULTS OF ROFFLER AND BUTLER TEST



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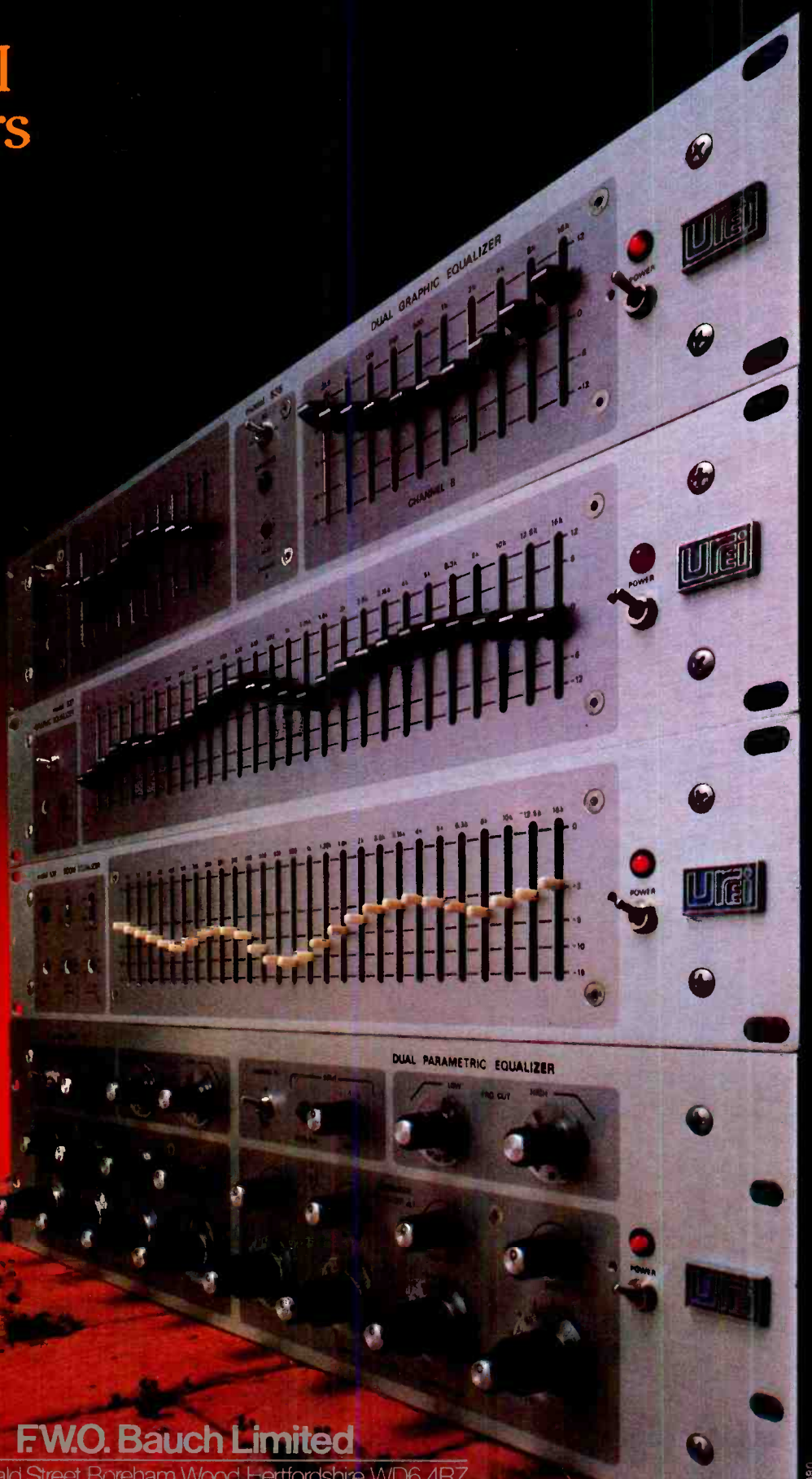

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Warmth—a bass-heavy frequency response curve, with a peak between 125 and 250Hz, and a smooth fall-away above that.

Intimacy—an adequate number of lateral reflections of frequencies above 10kHz (the atmosphere absorbs these frequencies noticeably after 15m travelling time).

Clarity—an adequate number of early lateral reflections (to give the upper frequencies) and an absence of confusion due to the predominance of reverb instead of first reflections.

Singing tone—a peak in the reverb curve (Echogram) usually with a 'rise time' of about 75 to 100ms, a peak of 50ms and then a smooth decay starting 150ms after the original sound.

As Jordan points out, it is becoming increasingly clear that reverb time is not the most important element in summing up an acceptable acoustic, as first-rate acoustics have been approved with reverberation times varying from as much as 1.4 to 2.8s. As a conductor I lodged a protest against the imposition of a 2.1s acoustic minimum reverb, as this undue length prohibited the achievement of many fundamental musical effects which required a sudden silence at the end of the music to make a dramatic point. It also did not allow the musicians to hear what they are doing, when it was associated with an inadequate supply of early reflections. The desire for a minimum reverb time of 2.1s (contrary to the 1.8s[6] requested by Bernstein and the New York Philharmonic Society) can be traced back partly to control-room listening conditions, and the consequent long reverb on most recorded music of all types. The dryness, lack of lateral reflections and restricted number of sound sources cause the producer and engineer to fill in the void, and the simplest way for them to beautify the sound is to prolong the reverb. If richness in sound is put as the primary aim, an analysis of its components prompts a series of innovations, which would allow us not only to enjoy the music much more, but also to hear much more of its frequency range with greater clarity.

When a conductor is surrounded by an orchestra, he can tell the direction of each instrument and can hear, on the whole, simultaneously the harmonic structure of 90 different instruments in as many locations. This miracle happens notwithstanding that the whole message is channelled through only two ear canals. Probably the first factor which helps his mind and ear to sort all these instruments out is the arrival time. We know that the brain can perceive time differences as short as .007ms, which is the equivalent of a perceived 1° movement of a sound source to the right or left. Consequently the placing of the ninety instruments causes the conductor to receive the arrival times in a quick arpeggio of impulses.

It is the timbre filtration which helps him to localise the instruments just as much, particularly in the vertical plane, where the interaural time differences are identical. The more each part of his ear is fed with a different sound, the more his timbre filter system allows him to discriminate between the sound sources and, ultimately, to blend the whole orchestral sound into one euphonious timbre. Incidentally the disadvantage of headphone listening is that it tends to cut out our filter system, and thus foreshortens all the directional information which this faculty would otherwise supply to us.

Because the frequency coverage is far more complete when we receive sound from all directions instead of only two chief directions, the satisfaction which we gain from richness is based on a wider frequency range, a larger number of impulses, and a complete filling out of each aural hemisphere with sound sources. If these three listening conditions are available in the control room, then it is possible to record music in such a way that increased information is put on the tape, at the same time as a reduction of confusion (in the form of unnecessary reverb).

If we can for the moment discount the common listening habits of the last 30 years, it is possible to affirm the following.

(a) A microphone hears sounds which we cannot possibly perceive in the same way in the same direction.

(b) Loudspeakers replaying these unnatural sounds at 30° left and right give us a frequency spectrum which is far from what we can hear in that direction.

(c) Placing the speakers higher or lower will influence the efficiency with which we pick up various frequencies—this efficiency will be greatest when the angles correspond with those of Fig 7. (It would be interesting to see this hypothesis confirmed scientifically).

(d) The size of the control room will influence our perception of the upper frequencies because when certain bass frequencies are fully formed, which can only happen when the room is large enough for the longer waves to form, the centre of gravity of our aural attention changes, and we give less notice to high frequencies of identical strength.

Richer hearing in the control room and consequently in the home could be achieved by bearing the following points in mind:

- Hard surfaces throughout, would assist reception of early reflections from all directions.
- A series of empty shelves around the studio and room at several heights on the walls, would help send down lateral reflections from all angles. We perceive reflections from the ceiling with considerably reduced high frequencies above 10kHz. If we receive the lower lateral reflections earlier, in the directions from which we receive best the upper frequencies, the volume can be reduced, so that confusion is avoided in a satisfying and musical way.
- If we place loudspeakers at various heights (and not in the same plane as in quadrophony) we will cover a wider frequency range, governed by the available timbre in each direction. As the example of the orchestra shows, there is no upper limit to our powers of perception in this field.
- If we filter the sound in a loudspeaker to correspond with the direction in which it is placed, the direction of its sound will be easily recognisable, no matter how we turn or sit in a room. (This is an expansion of the 'presence' principle.)
- By setting up a series of, say, 10 loudspeakers above and below us around the room, filtered in this way, the perceived stereo picture would remain unchanged, just as the actual sound in a concert hall, independently of our position.

Listeners' satisfaction would be increased if these loudspeakers were arranged similar to the position which often gives most satisfaction in a hall—usually the front row of an upper back balcony, with walls fairly close on the sides. In loudspeaker terms that would give:

- One large central loudspeaker, low, to cope with the bass and the frequencies we can hear frontally. One reason for the sound seeming to be better when heard from high up in an auditorium is that we hear bass better when it is below us. High speakers in a control room may cause producers to put more bass on a track than is necessary, thus adding to confusion.
- A pair of speakers, low and high, to the left and a similar pair to the right at about 30°, each filtered with their corresponding timbres in that direction. Some of these spectra have been measured in Germany, and those for the upper right hemisphere are due to be published this year. Millisecond delays on the tracks to each pair, (only one track per pair) give an effect similar to that in a large hall.
- A speaker pair, low and high, left and right about 108°, suitably delayed. A central back speaker above ear level with the longest delay.

The whole would make six tracks, possibly on a six-track cassette, with the delays on the tape, and timbre filters and volume controls in the speakers themselves. Graded volume recommendations would be calibrated on each speaker. The speakers need be neither large nor cumbersome (perhaps BBC *LS3/5A*). This system would allow the recording to be made with no added reverb but would give such richness, that the reverb would seem an unnecessary intrusion. Should reverb seem necessary to help a particularly poor original sound, it should be of the 'singing' type, which rises to an early peak about 100ms after the original sound, but then has no unduly long decay curve, so that it adds to the complexity of the sound without undue confusion.

Prof. Blauert kindly warns me that the above timbre lists are by no means absolute, and that phase cancellations in small rooms can play havoc with some of the values. However the possibility is not to be ruled out that two new acoustical laws may be developed—one that the timbre of a sound is influenced by the angle at which we hear its first reflection and its weaker subsequent reflections; the other that richness in musical sound is the most important quality, overriding even such elementary features as loudness. So far loudness has been placed as the most important quality in an acoustic, according to Cremer.

Prolonged playing of the clavichord, the quietest of all keyboard instruments, to expert listeners has proved to me that in the end they are more satisfied with a quiet sound of great musical intensity, as it obliges them to concentrate more in order to perceive it. This concentration is musically more rewarding. This view has been strongly confirmed in recent reviews in the USA of my recording, and perhaps the time has come to reverse the general process of ear bashing which has already maimed many ears of the younger generation, and even endangers the more precious ears of balancers in control rooms, who work at very high volume levels. I long for the day when I can walk from podium to control room and hear even more aural satisfaction in the latter, in particular with regard to the filling out of the whole of my field of hearing. ■

Denis Vaughan is the musical director of the State Opera of South Australia.

Notes

1 Mehrgardt and Mellert, Journal Acoustical Society of America, June 1977.
2 'Raumliches Hören bei einer Schallquelle', Blauert, S Hirzel Verlag Stuttgart 1974.
3 Denis Vaughan, Journal of Sound and Vibration, March 1980.
4 Musical Times, January to March 1981.
5 'Acoustical Design of Concert Halls and Theatres', Wilhelm Jordan, Applied Science Publishers, London 1980.
6 Recent measurements by T J Shultz of BBN show the reverb time of Boston Symphony Hall occupied (the hall preferred by most conductors and the New York Philharmonic Society) to be only 1.6s and *not* 1.8s as published previously.

Figs 1 to 4 are reproduced from 1 above and Figs 5 and 6 from 2.

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Part Ten~Monitoring

Monitoring—the desk-related function, not the big nasty loud things nailed on the wall—is usually the last sub-system to be considered in console design. After all the programme paths have been established, zipping about everywhere and jumping through hoops, a suspicion dimly glimmers that it might possibly be useful to listen to them occasionally.

IN THE context of recording systems this 'lapse' is definitely more common than broadcast where the monitor selection and routing often exceeds the programme path in complexity and functions. (If you get a chance, check out the monitor section of a BBC radio continuity desk and *think* about what is needed to achieve everything.)

Monitor system design, like much else, falls into two phases; deciding what it needs to do and the implementation.

At its simplest, monitoring consists of a power amp and speakers hung across the mixer's main output(s), auxiliary functions being either unused or preset—in PA work the PA actually *is* the monitoring, the only other function necessary being PFL and then only during 'panic mode'. Alternatively the monitoring demands for multitrack recording extend to effectively an entire secondary submixer replete with panning and pre/post foldback effect feeds, stand-alone soloing together with listen access to all desk send and return ports. The in-line console principle makes efficient use of electronics to combine often coincident signal path and monitoring requirements for the multitrack machinery, to the extent that it is operationally rare to listen to anything other than the stereo buss output. This serves as both the multitrack monitoring buss and the stereo mixdown buss.

Three distinct types of monitoring activity evolve in multitrack work:

(a) Mainline—the stereo buss, which encompasses the multitrack machine sources/returns and stereo mixdown.

(b) Transient—short-term check listening of individual channels for reassurance or adjustment, using prefade listen or solo functions.

(c) Auxiliary—access to the assorted foldback/effect feeds, effect returns, mastering machine and subsidiary 2-track and cassette machine returns.

From an operating point of view, that seems to be the division—from a technical stance it's a different matter entirely. The solo function is very closely related to the stereo buss—in fact using exactly the same single path throughout—and can be seen simply as a modification of it. PFL, though, despite a similar seeming operation (only prefade as opposed to postpan listening) actually requires an entirely separate buss and mixing system, its output switched to override the main path into the monitors. (It may seem a bit strange to go through all this palaver for a spot-check function that tells you less than the stereo in-place solo, until it's remembered that a solo disrupts the mix whilst a PFL is non-destructive.) System complexity disguised under operational transparency. Conversely, an operator usually has a psychological hook about the main stereo buss monitoring being the Great Holy Unblemished Gospel signal path, all the auxiliary functions being somehow tarnished and 'unclean'. Wrong.

In reality, the monitoring chain selects directly between all its sources, merely treating the stereo mix as one of the many.

An assumption is made that the 'solo' function is as outlined in Part One (September 1980) where, simply, if a console channel is 'soloed' all other sources contributing to the main stereo buss are muted, leaving the desired channel in isolation at its set level and panned position. An exception and extension to this is for other channels (principally those returning effects to which our soloed channel may be contributing) to remain unmuted in the stereo 'mix'.

The upshot of this is that 'solo' monitoring is inherent to the stereo mix path—if that path isn't selected to monitoring then neither is the solo. So although a solo overrides the main stereo mix (unless disabled altogether by the 'solo safe') it cannot override anything else, unlike the prefade listen.

PFL, although it could just be brought off as another monitored source, is made to simulate the 'solo' in single button touch operation, with the added advantageous capability of overriding everything.

This then gives us a logical priority

on which to base the monitoring routing system.

Controls

OK. So now we've worked out how to get what signal and at what priority, into the monitoring chain—once it's there, what other torture do we put it through?

- Level control: volume to you, mate.
- Mute: so that you can turn the row off.
- Dim: so you can hear what people say.
- Mono: people still use it, you know.
- Phase Reverse: to make sure you haven't already done it inadvertently. (This function with the Mono makes for one of the quickest ways in history of lining up machine azimuth.)
- Split: (Huh?) a cunning frolic unashamedly pinched from broadcast monitoring technology. This routes a mono sum of the main stereo mix buss continually to the 'left' side of the monitor chain and a mono sum of whatever source is selected (including PFL override) to the 'right' side, providing simultaneous monitoring of two different sources—one of which would almost certainly be desk output anyway. Why?

Well, its origins lie in network radio, where an announcer on air has to talk up to a programme junction and smoothly hand over to another studio/network feed/'Independent Radio News'/whatever, at a cue. In order to do this, he has to be able to hear both himself and the network he is opting into to hear the lead-up and handover cue.

Other than its primary design use, the 'split' function is used considerably under other normal programming, affording random source monitoring without losing track of what the main desk output is doing. It's also used extensively in programme pre-recording and production enabling, with practise, real-time multisource edits without recourse to razor blades and that dreadful tape that curls up and sticks under your fingernails. A technique (who remembers this?) very reminiscent of jump-editing on discs.

This author is convinced that 'split' will find a niche in multitrack recording techniques. If nothing else, it will fulfil the requirement for single speaker mono monitoring, by simply selecting the 'right' side to a dead source.

- Idiot speakers: those nasty things gaffer-taped on the meter penthouse to do Dansette record player and Radio One impersonations, also affording a respite from the deafness-inducing 'normal' monitor speakers.

Crosstalk

In a programme sense, two forms of crosstalk are relevant. The first, *related* crosstalk is a signal bleeding over into another signal path which is carrying a musically and temporally related signal, eg between the left and right of a stereo pair or between adjacent tracks of a multitrack. It happens and is fortunately not often subjectively obvious or embarrassing.

Crosstalk within multitrack recording systems is usually little short of horrifying. As a result of the large physical size of the console, ground paths are unavoidably long and ground currents generate (and cross-inject into other paths) crosstalk voltages across the resultant ground impedances. Capacitance between interconnecting cabling, looms, modules, busses, everything result in a reasonably dreadful overall crosstalk performance.

This is only mitigated by multitrack machine crosstalk between tracks—a safe order of magnitude worse than even a horrid desk ever could be. It is all tolerable and usable simply because all the crosstalk is related and blends in unnoticeably. The only area where this is not necessarily so is in monitoring, where a 'hostile' signal (say a delayed replay 'B' check of a master) can be screaming about in uncomfortable proximity to the main stereo mix paths.

Broadcasters face this problem all the time—all their sources are hostile (!) unless brought up on air.

This is *unrelated* crosstalk where the bleeding signal is totally dissimilar and irrelevant to the interfered signal. Basically, if any unrelated crosstalk is audible above system background noise, it will be noticed.

A fairly recent and insidious sort of unrelated crosstalk comes in the form of assorted chirps, buzzes and sizzles stemming from the relentless march of digits into mixer designs. SMPTE timecode and automation

70▶

FIG. 52 BLOCK DIAGRAM MONITOR SELECT CONTROL LOGIC

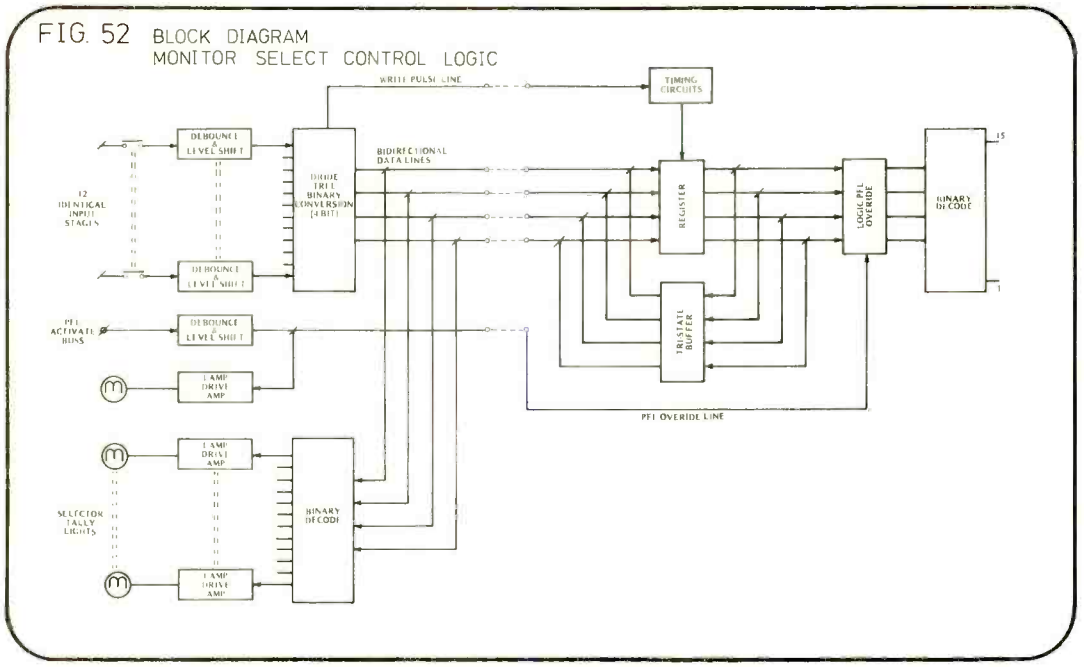
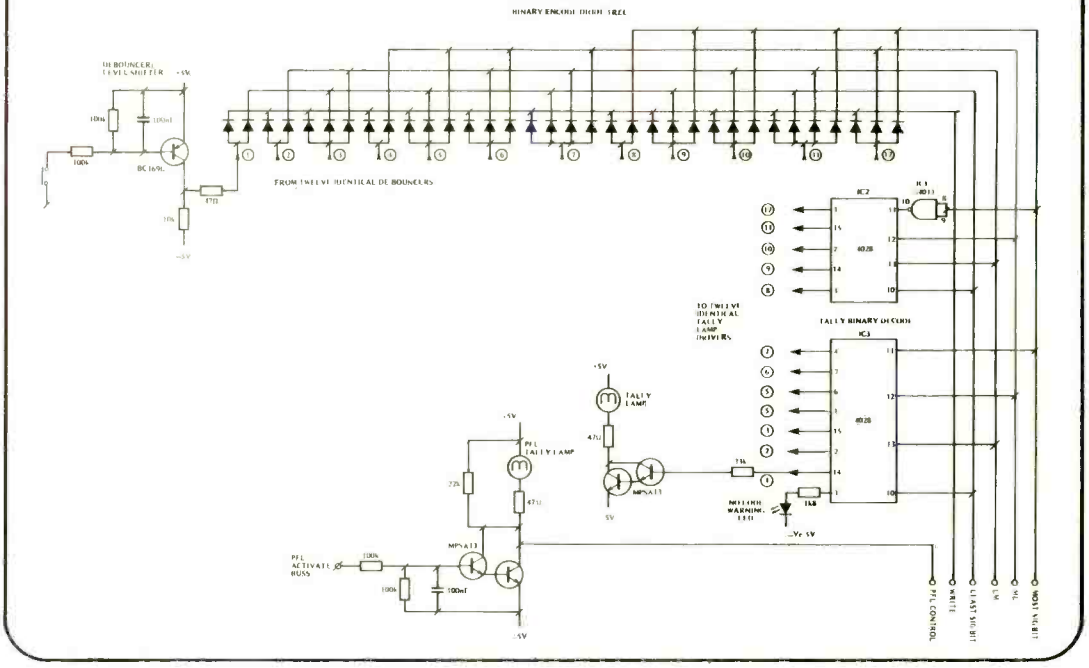


FIG. 53 MONITOR SELECT CONTROL LOGIC – DESK END



codes were bad enough, but trying to get computer clock droning out of mixing busses is not one of life's fun tasks.

A very reasonable quantitative measurement technique of all such effects is specified in the IBA local radio Code of Practice.

Originally the test for interchannel crosstalk (*ie* between any channels in a desk), it's also used for any dissimilar path crosstalk measurements. In short, it asks for better than 60dB of isolation at 6kHz between the paths, measured with a standard PPM with a CCIR 468 weighting filter in line. Since this CCIR curve has 12dB of gain at its crest (at 6kHz, surprise) the specification is actually calling for better than 72dB of isolation at 6kHz—not easy, and very realistic. Such a figure is not far above system noise floors, generally. Remember, it's a peak measurement.

This harping on about crosstalk is not without a point, as it is actually concerned with the physical construction of the monitoring switches.

The switcher

A technique used to minimise crosstalk across broadcast monitoring and particularly outside source selection (whole hordes of hostile sources) is employed here.

The selecting switcher (based on electronics for outside source selection matrices) is contained in a rack mounting box near the jackfield, the routing controlled by digital logic level lines from the desk. In this way only a single pair of hostile signals is returned into the desk—far easier to engineer away from things that may be unduly influenced. All the required sources, including PFL, main stereo output, auxiliaries, 2-track machine returns, etc, are accessible on the field as a matter of course—short jumping links to the terminations on the switcher replace all the messy hassle of getting dozens of bits of signal via motherboard or hard wired connectors into the back of a conventional monitoring module. Ugh!

The monitor control electronics (mono, split, volume, etc) are conventionally located and constructed in the now mercifully un-hectic monitoring module.

The data link

(Figs 52, 53 and 54)

Communication between the console controls and the rack is via a 6-line data buss—four lines of which form a one-in-16 binary code to select the lucky source, the other two being control bits. The write command line goes high immediately a different routing is selected, enabling the

72 ▶

FIG. 54 MONITOR SELECT CONTROL LOGIC – RACK END

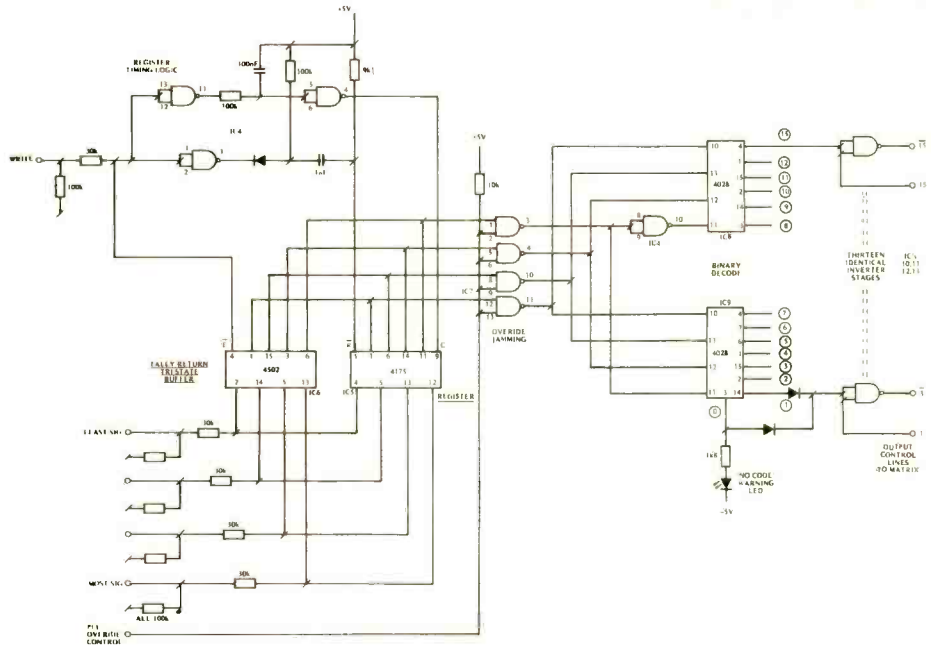
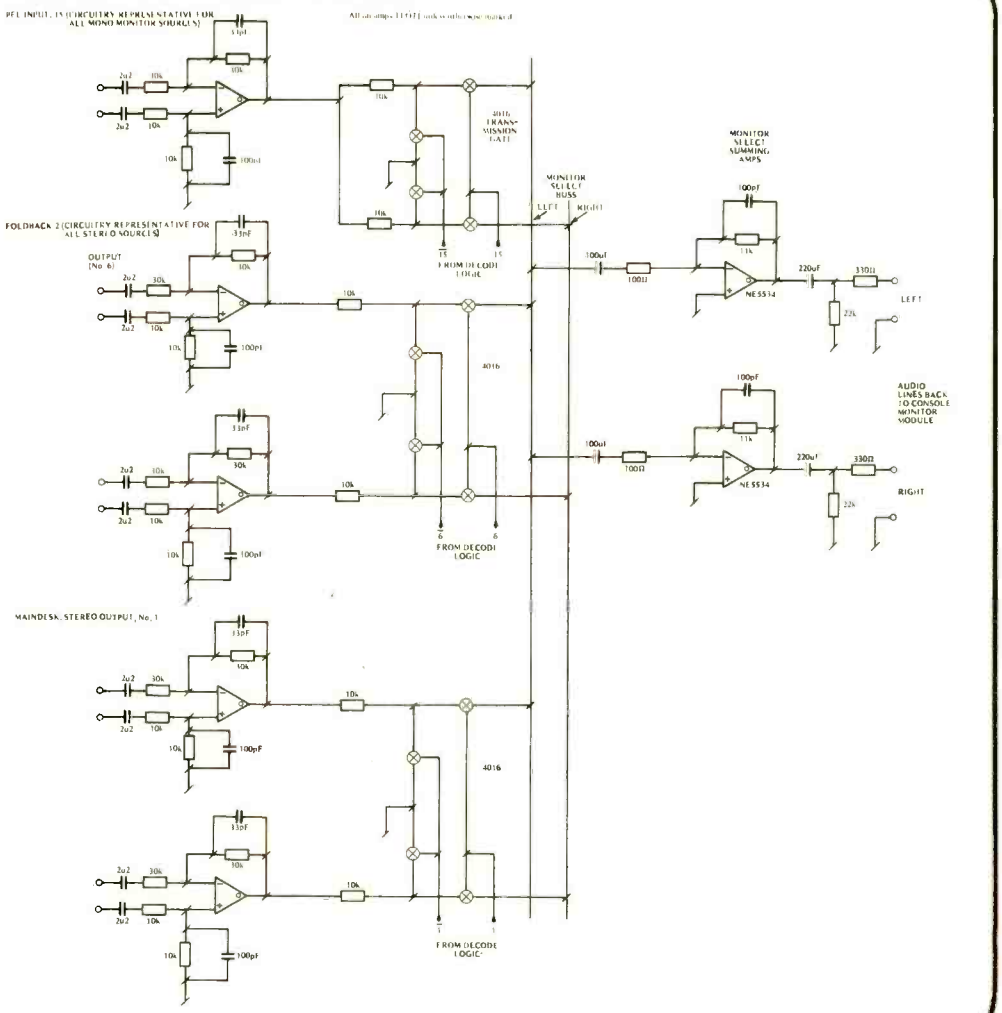
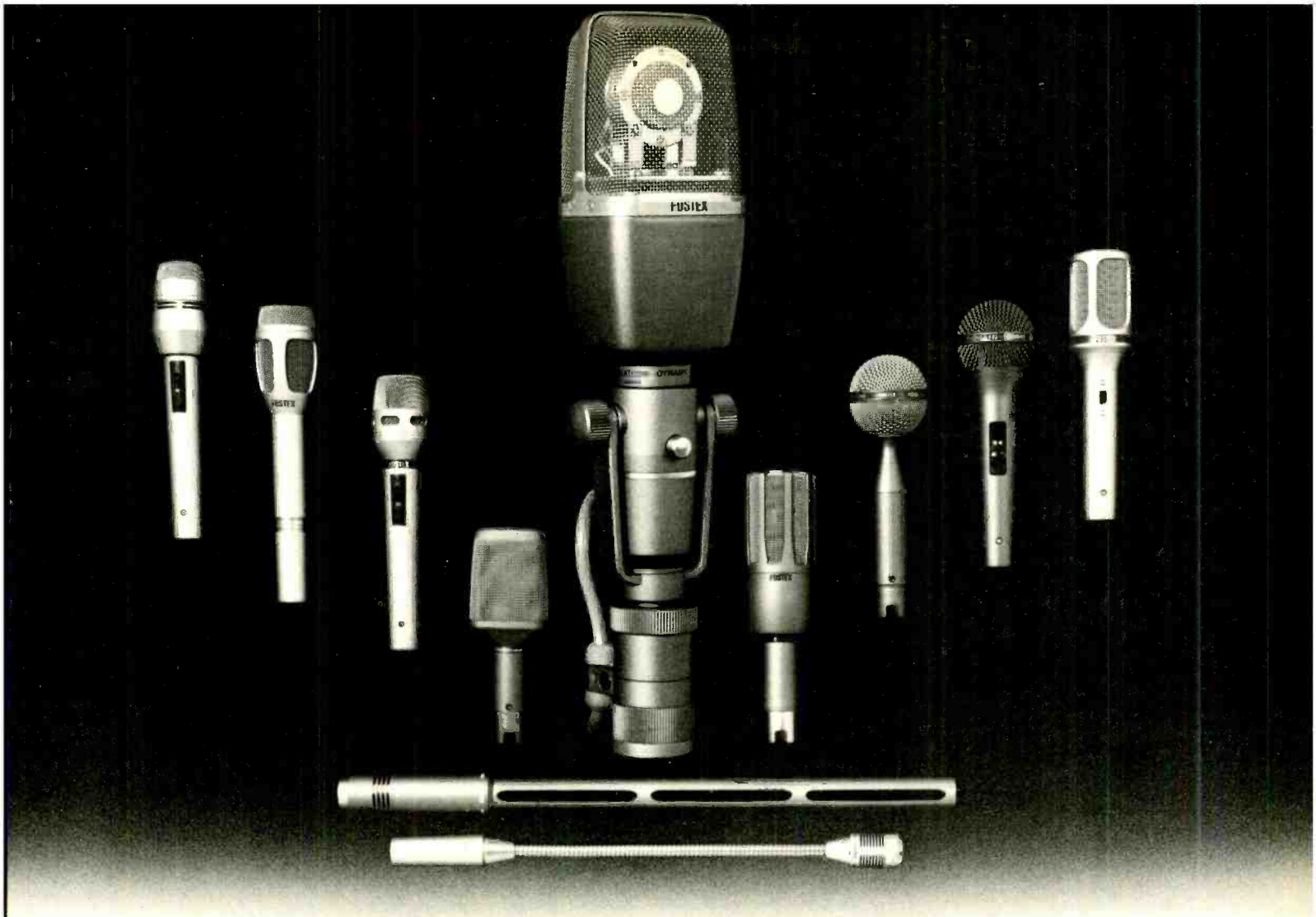


FIG. 55 MONITOR SELECT SWITCHER





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4175 register (IC 5) at the rack end to swallow whatever code is set up on the 4-bit code buss by the diode tree. Regardless of any other monitoring condition, if the PFL activate buss is grounded, the PFL override line drops low (it is ordinarily tied high) preventing the stored code in the register reaching ICs 8 and 9, the 4028 binary decoders. Instead, they see all data lines high and decode that as source 15—where the PFL (audio) is brought up on the matrix. This code 'jamming' is relieved when the PFL activate line is released, so the matrix reroutes back to the code stored in the register.

No apologies are offered for the somewhat 'agricultural' diode tree approach to binary encoding. It's simple, fairly inexpensive and bomb-proof. Similarly, why use a one-shot timing chip for the register timing logic when two resistors and a capacitor will do?

A nicety is that use of the code buss is made to send a tally code back from the rack end to the console end, at all times other than the instants when re-routing is occurring. This is achieved by the 4502 (IC ring. This is achieved by the 4502 (IC 6) tri-state inverter/buffer which stuffs the register output back up the lines to be decoded by a pair of 4028s (ICs 2 and 3) which then, via Darlington transistors, drive the lights. Thus, there is a readout of what the switcher is *actually* doing, not what it *ought* to be doing. The tri-state is disabled whenever the write line goes high, which of course signifies another bunch of digits steaming up the code buss the other way from the diode tree.

Sixteen selections are possible (0 to 15), but as shown below, only 14 are used. Code 15 is dedicated to PFL, Code 1 to main stereo mix. A default mode exists, whereby if the code buss logic takes a walk or becomes disconnected and no codes are being generated, the busses will almost certainly rest all low—code zero. Zero, when decoded by ICs 8 and 9, brings up warning LEDs on the monitor modules and rack front panels, whilst also pulling on source one (main stereo mix) through the switcher. At least it won't all go quiet on you.

Audio path

The 12 normal routing selections are detailed in the following table. Some of these sources are stereo, some mono. **Fig 55** shows the only difference as being a mono source only needing one input amp, the output of which is split through the two analogue transmission gates into the stereo monitor select mix buss. Operation of this type of switching is detailed in Part Five (January 1981 issue).

ROUTING SELECTION CODES	
0	'No Code' warnings, defaults to source 1
1	Main desk stereo monitor/mix
2	Stereo mastering machine return
3	Two-track machine return
4	Stereo cassette machine return
5	Foldback 1 (stereo)
6	Foldback 2 (stereo)
7	Effect send 1
8	Effect send 2
9	Effect send 3
10	Effect send 4
11	Spare, access on field
12	Spare, access on field
15	Pre-fade listen desk output

The monitor summing amp outputs are taken directly back from the rack back into the console monitoring module via a pair of ground-free differential input amplifiers and hence into the monitoring chain.

An interesting paradox—which fortunately is of no real effect in any of the intra-control area routing for which they are utilised in these designs—dealing with the input impedances of differential input amplifiers is worth mentioning here. With the simple one op-amp circuit (as at the front end of the matrix in **Fig 55**) it is possible to arrange the input impedance of the two legs to be equal for a differential (normal) signal *or* equal for common-mode (interfering) signals—but not both simultaneously. In other words, it doesn't work! In the former case, interfering signals are likely to be induced at dissimilar levels into the two legs causing a differential and hence transferred resultant of the common-mode signal. If, though, it's optimised for common-mode input impedance matching, the inescapable differential input impedance unbalance could cause a balanced *source* connected to it to have a worsened common-mode rejection ratio because of that intolerance—boring, eh!

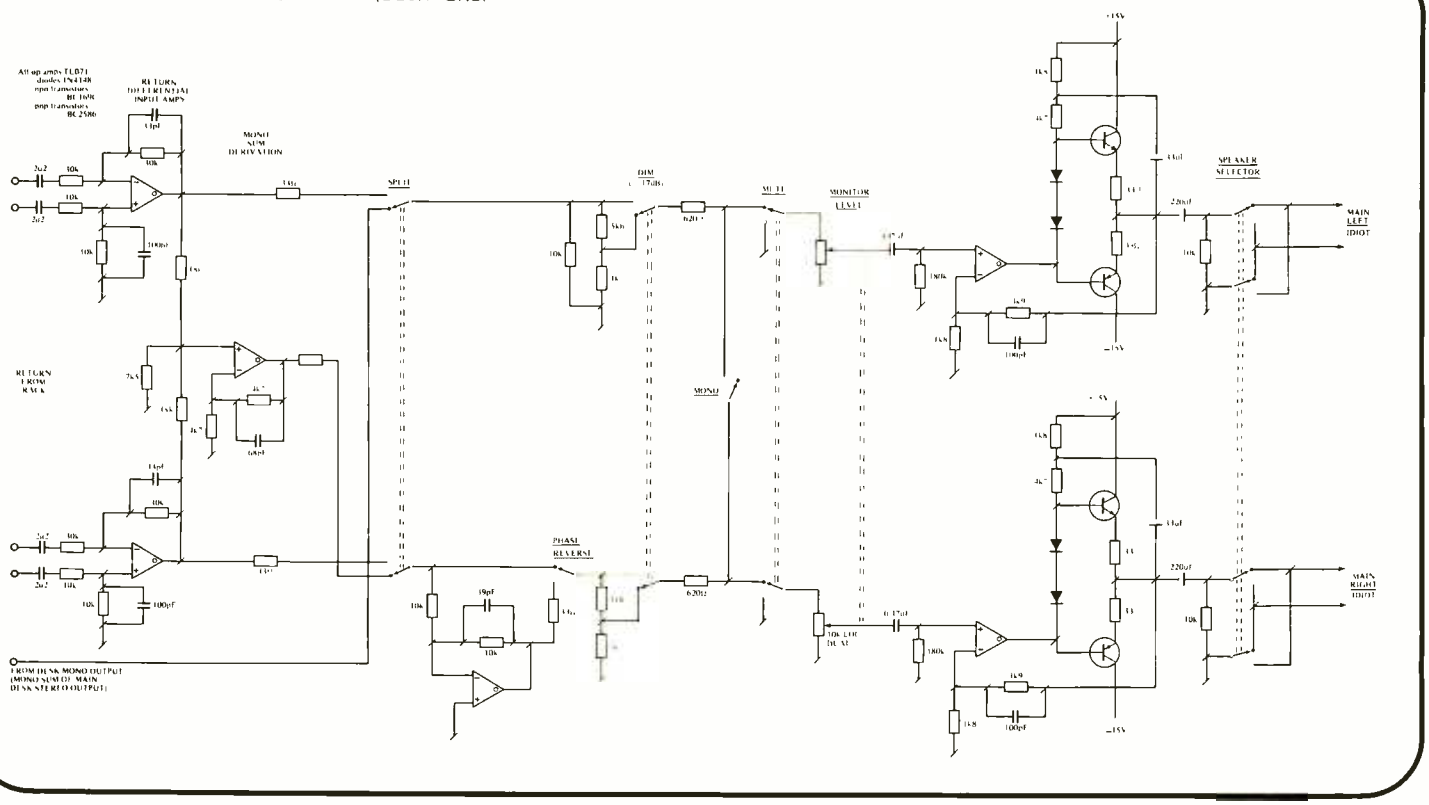
There are means, well documented elsewhere, by the use of active feedback paths or multiple op-amp 'instrumentation amp' type circuits, of avoiding these imbalance effects. Since this simple circuit is used solely to provide a measure of ground isolation from zero or very low impedance sources here, these effects are largely irrelevant to our purposes.

For the 'split' function, a mono sum is brought into the desk monitor chain of the main stereo mix. A mono sum is also derived of the switcher output immediately after the return differential input amps in the desk. Phase reverse is implemented by inserting a unity gain inverter into the 'right' path.

The rest of the monitor chain is self-explanatory (**Fig 56**)—dim attenuation may be varied simply by changing the value of the 1kΩ lower leg resistor.

Almost as a retaliation against the trend elsewhere in these designs to digital control, storage and remote capability, the monitor audio chain is unremarkably straightforward and conventional. Yes, it uses strange things called 'switches' as opposed to analogue transmission gates. This lapse, it is trusted, will be forgiven. ■

FIG. 56 MONITOR AUDIO PATH (DESK END)



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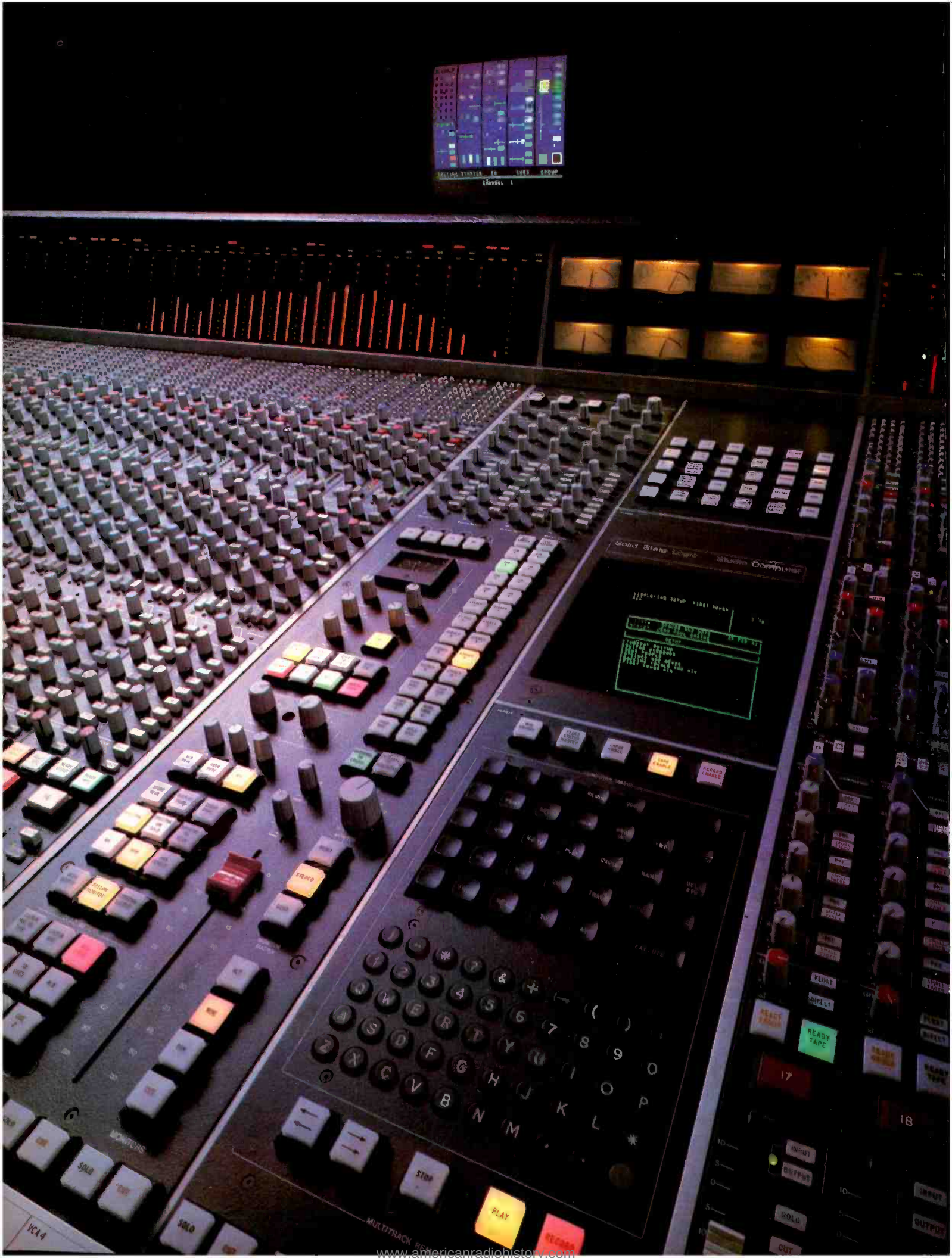

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Master Studio Systems

Using the Harrison 32

When we reviewed the Harrison *32 Series* console in our December 1980 issue, we were well aware of the fact that a technical review of console modules tells only part of the complete picture. If you're thinking of spending large sums of money on a new desk, it's important that you see the other side, too: the operational side. This is perhaps best elucidated by using the desk yourself; however, we hope that this article, describing my own reactions, will be useful.

Richard Elen

IT WOULD be very difficult and expensive to book a full recording session, musicians and all, to examine all aspects of the Harrison *32 Series* desk, so we arranged a mixing session at Marcus Music UK, in London's Kensington Gardens Square, taking along a previously recorded 24-track tape. The tape was recorded for KPM Music Library, and consisted of tracks including a mixture of synthesisers—providing a selection of 'pure' sound sources, useful for test purposes—and more conventional instruments.

The first thing I noticed on bringing up a few faders was the excellent clarity of the sound, due no doubt in part to a good monitoring system, and a good room, but also testifying to the accuracy of the straight-through response of the console. Sounds appeared to be a fraction bass-light, but this was due to the fact that the studio in which the tracks were recorded had a slight lift in the monitor's bass end.

As one would expect from the "channel attenuator, fabricated by Penny and Giles to exacting electrical and mechanical specifications for Harrison consoles", the faders were very smooth in action, giving good control over the signal levels. The channel cut buttons were click-free in operation, but prompted one small negative comment: an LED is associated with the mute button on each channel, this being illuminated when the fader is above the infinity mark and when the channel is 'on'. However, pulling the fader down to the bottom extinguishes the LED whether the channel is muted or not, so it is sometimes difficult (if for example you wish to fade a channel out, mute it, and re-position the fader ready to bring in a later section) to know whether you have in fact muted the channel or not. If the fader is at the bottom of its travel, it is possible to push the mute button twice and not know until you raised the fader again. On the new *MR-2* console, Harrison have rectified this by adding a second LED, but it would be useful if a 'fix' could be arranged on the *32 Series* to avoid engineer's embarrassment. In fact, there's no real need for the LED to show you that the fader's down—you can see that! (In fact this can be modified on the board.)

A line level signal may enter the console from one of two major sources, typically multitrack tape machines, designated 'A' and 'B' and selected via a pushbutton on the input amplifier section of the card, beneath the seemingly vast array of routing buttons. Being a single-strip 'in-line' console, the actual module is quite long, and the routing buttons are a fair distance away. As these only require setting occasionally, there is no serious disadvantage.

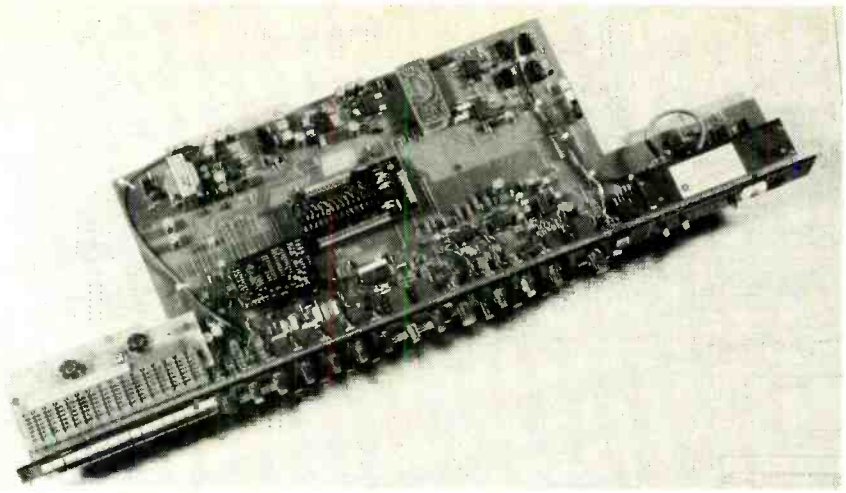
The length of the module, and the resulting distance you have to reach, is undeniably a factor one can hold against the concept of the 'in-line' console (ie one in which input, output and monitoring are all handled primarily from a single channel strip). The Harrison, having a relatively high degree of complexity, and thus a greater number of knobs than average, suffers a little in this respect. One could also, perhaps, argue that the knobs are a little small and too tightly packed: however, I had no problems wrapping my fingers round them. To my mind, the primary problem with in-line desks is that they can be confusing if you're recording in a hurry. I'm afraid I prefer a separate monitor panel more or less every time! I suppose it comes down to the choice between 15ft consoles with separate monitors and groups, or smaller consoles which, at first sight, are more confusing. You pays your money and takes your choice.

Very usefully, the Harrison *32* includes a +6dB level trim pot, in addition to the mic gain control: a useful addition in certain circumstances. The signal, from either line or mic inputs, is routed via a slightly oddly-named button, 'Ping'. In essence, this swaps the mic and line input destinations over. Either 'mic' feeds the monitor chain and 'line' the main channel and eq, or vice versa. This simple little button—difficult to describe, but easy to use—adds tremendous versatility to an already versatile setup. One of its most useful functions is to enable easy track bouncing, overdubbing and signal processing in which part of the signal originates on the multitrack and the final result ends up there also.

A pleasantly comprehensive eq section appears on this console, comprising a 4 band sweep equaliser plus variable-frequency low- and highpass filters. The 'Hi' band covers 800Hz to 16kHz; the two 'Mid' bands overlap, covering 400Hz to 8kHz and 200Hz to 4kHz; and the 'Lo' end handles 40 to 80Hz and peaking/shelving selection. All the bands have simple frequency and boost/cut controls, no independent Q variation being fitted (or required, really). The filters are 12dB/octave designs covering 25Hz to 3.15kHz and 160HZ to 20kHz. Separate pushbuttons bring in the eq and the filters independently, and there are two further buttons: 'Solo' and 'Mon'. The latter button removes the equaliser section from the main channel path and places it in that channel's monitor chain.

I don't often use extremes of equalisation myself, but I was pleasantly surprised by the smoothness of sound produced by the Harrison eq unit, this smoothness being characteristic of the console in general. Indeed, my first thought on playing the mixes back elsewhere was that the sound was unusually clean, smooth and generally very pleasing indeed (make what you like of all this subjectivity: in brief, I liked it!).

The fact that a VCA fader system, whether or not attached to a console automation computer, can still be used for dc grouping, is a very good reason for considering an 'automation-ready' console, even if you have no intention of getting automated in the near future. In the case of the Harrison, this useful feature is implemented in pretty much a standard fashion, with a 'group select' numeric thumbwheel and 'Master' button. Depressing the 'Master' button places all other channels set to the same group on the thumbwheels under control of that fader. The simplicity and versatility



of such a system in operation is often overlooked. It's easy to think: "I don't need automation, so I don't need to spend the extra money on VCA faders". It's not necessarily true, though.

The 'Mute' button already referred to has a second function: solo-in-place. The exact function of this button is controlled by the combination of the channel's 'local' button (which removes the input/output module from the solo-in-place), and the master mute/solo programming switch on the central group master module. I must admit that I found the combination complex at first sight. Without time to acquaint myself with the subtleties of the solo-in-place system, I found it easier to press the master 'Mute' button and 'turn on' the channels I wanted to solo (two buttons and no thinking!).

The Harrison *32* has quad mixdown busses—by this I assume it means that there are four of them, rather than that they're designed to be used for 'quad' mixing . . . Oh, maybe I'm wrong. Just above the 'Mute' button is a pair of panpots, one marked 'L, C and R' (no problem there) and the other, smaller button labelled 'B, F' (oh, dear). The latter pot is brought into action by a 'quad' pushbutton. Well, I thought all that 'quad' nonsense had been forgotten years before this console was designed. For the life of me, I can't imagine what you'd use them for. Give me a button that suddenly provides four Ambisonic groups, W, X, Y, Z . . . and we might be on to something. Never mind, it's sure to come one day. The larger (L, C, R) pot has an associated pushbutton labelled '—6'. Predictably, this button makes a centre-panned signal 6dB down (sine/cosine square characteristic) rather than the normal 3dB (sine/cosine). This is useful for mono compatibility when mixing with less than full separation—indeed, there is a button on the 'Quad' master module labelled 'Comp' which reduces the channel separation for better 'quad/stereo/mono compatibility'. I tried this button once but in my opinion it turns your lovely stereo mix into something approaching mono, and is thus very boring and sounds horrible (in other words, it does what it's supposed to do, and very well).

Each channel has no less than six auxiliary sends: a stereo cue send, featuring level, L/R pan, and pre/post control, and two pairs of echo sends, offering level control on each and a pre/post switch for each pair. There are correspondingly eight echo returns on the group master module. Somewhat surprisingly, while they all allow routing to the mixdown busses and have cue sends (for foldback echo), none of them offer any facility for routing echo to a tape track. OK, you don't do it very often, and when you want to send echo to a track, you can always patch it up another channel, but it's still just a little odd, even though 32-track routing buttons take up a lot of room. Indeed, were the routing buttons replaced by my own personal favourite routing method, two rotary knobs with dual 7-segment LED displays, a fair amount of space would be saved all over (although the economics may be nasty). Of course, an even more effective method might be to use the mighty micro . . . a numeric touchpad and two LED displays and you could simply enter (channel number)/(track number) and there's your routing.

The Harrison has four basic operational modes, or 'Normal Status Programming Modes' I should say, 'Source Monitor' is designed for live recording, and assumes that the majority of signals will be from mics. Here the 'ping' buttons on individual channels may be used to select a line input. In this mode, the 32 multitrack busses are routed to the monitor pots, and all the eq and other facilities on the main channels are available for signal processing—in other words, this is the primary mode for recording basic tracks. 'Return Monitor' is a variant on this mode, in which the monitors pick up the channel line returns, enabling multitrack output monitoring/playback. 'Return Mix' is the normal mixing mode, in which the line returns are routed via the main channel to the 'quad' mixing busses. In the meantime, the mic preamps may still be used, and assigned to the multitrack for overdubbing, or special effects (like playing things out into the studio, miking them up, and using them in the mix?), in which case the monitor pot on each channel metamorphoses into a mic level fader. Here, of course, the dreaded 'Ping' button enables mic preamps to be routed to the mix busses via the main channel. Finally, 'Source Mix' reverses the function of the monitor pot and VCA main fader. It's designed so that a monitor mix may be created on the main faders during recording, and, with automation, an automated mixdown may be started while you're still recording (nothing like asking for trouble now, is there). More importantly, your automated monitor mix on the main faders in this mode will be recreated perfectly by the automation system later on, when you enter the 'Return mix' mode and replay the tape for mixing: in other words, you've already got your monitor mix as a starting point.

There are two metering options on the *32 Series!* 12-segment and 36-segment light-bar meters, the latter being standard. A lower cost option is the 12-segment device, which offers VU characteristics plus a presettable peak detector, which may be set up for all channels simultaneously by means of a control on the main panel. Peak threshold may be set to between +4 and +24dBm. Harrison tell us in their literature that as there is so much headroom in a Harrison console, this feature is of importance primarily as far as tape machines are concerned—and I'm quite prepared to believe it; I didn't attempt to overload a *32 Series* channel, but the Bauch crew kindly brought along an *MR-2* module (very impressive) and the amount of gain you can wind up on it before distortion was simply absurd. Incidentally, if you do deliberately overload an *MR-2* channel, it produces the most amazing controlled fuzz sound I've heard for years. I didn't know that modern desks did that; they usually seem to distort nastily. This one doesn't. But to return to the metering on the *32 Series*. When the peak threshold is exceeded, the whole bar flashes brightly (disturbing!). Of the 12 segments of the display, the bottom eight segments (the lowest coming on at −20VU) are yellow, while the rest are red, with the first red segment beginning, naturally enough, at 0VU (+4dBm). Due to the width of both types of meter, they follow the channel strip, giving an instant indication of what's going to or from every tape channel.

I must admit that I wasn't really enamoured of the 12-segment meters. They are probably OK for reading tape tracks, but if you're ordering a Harrison *32*, may I recommend that you order the standard 36-segment instead, at least for the mixdown meters? They offer switchable PPM and VU characteristics (apart from being a PPM freak, I reckon that a couple of PPMs on mixdown must help the cutting engineer who, after all, is quite concerned about peaks!) and the extra resolution is useful on a mix, at least giving you the feeling that you know exactly what the level is when you happen to glance occasionally at meters like I do! The VU scale runs from −20 to +3VU, and the PPM from −23 to +10. Both types of meter take up the same space. The console at Marcus Music had the high-res meters on the mix busses and the lo-res types everywhere else—a pretty good compromise, I would think.

Summary

The main thing that impressed me about the Harrison *32 Series* was, quite simply, the beautiful smooth sound that it produced. Both the straight-through sound and the feel of the eq is exemplary, and one of the best I've come across recently. The layout is easy to follow, and sensible (in so far as an in-line console can be) and although the modules are very long, good ergonomics has kept long reaches to the minimum. I found the operation of the channel-on LED a little annoying, and I suspect there is a little more inter-channel crosstalk than one might perhaps like (although this isn't serious, and my opinion may well be coloured by the fact that the desk I recorded the tracks on was probably rather worse). All in all, a very pleasant console to work with, and one which I'd recommend to anyone who is in the market for an in-line desk and who can't afford an *MR-2*. Harrison definitely deserve the fine reputation they have gained in the industry. ■

My thanks for assistance in research to Richard Goldblatt and assistant engineer Tim of Marcus and Richard Kelley and Dave Neal of FWO Bauch Ltd.

APRS exhibition preview

The 14th annual exhibition of the Association of Professional Recording Studios will be held from Wednesday June 10 to Friday June 12 at a new venue, the Kensington Exhibition Centre, Derry Street, Kensington, London W8. Some 90 exhibitors will be showing their product lines. Opening hours are 10am to 6pm, closing early at 5pm on Friday. Admission is by trade card.

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B

● **BASF:** range of professional tapes, cassettes

80 ▶

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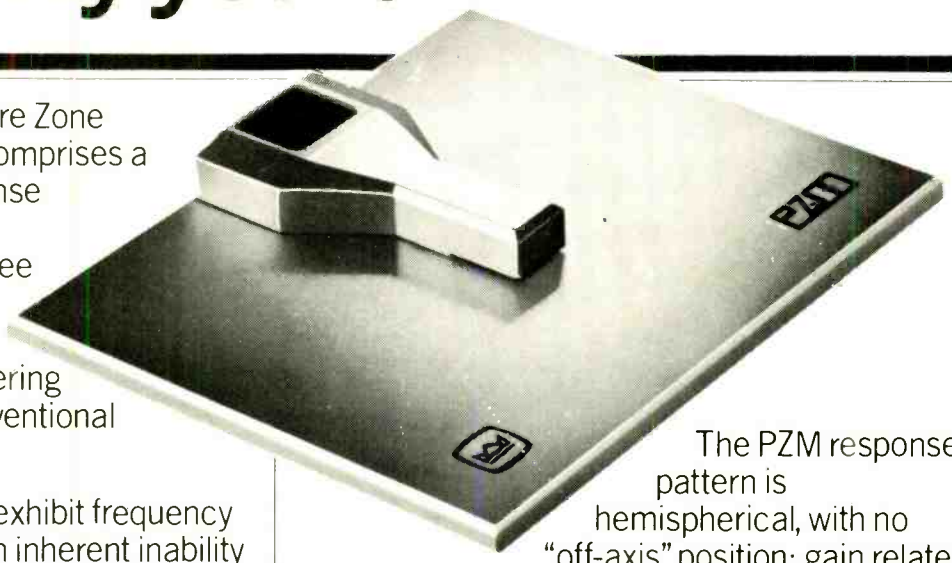


The revolutionary Pressure Zone Microphone (PZM[tm]) family comprises a range of hemispherical response microphones which give a transparently natural sound, free from non-linear characteristics – such as proximity effect and comb filtering – that are exhibited by all conventional microphones.

Traditional microphones exhibit frequency response anomalies, due to an inherent inability to satisfactorily combine direct and reflected signals, thus leading to phase-induced amplitude cancellations and reinforcements, or comb filtering.

Amcron PZMicrophones[tm] eliminate this effect because they detect sound by means of a new process. This takes advantage of the fact that, as a sound wave approaches a boundary (such as a wall, table or floor), there is formed at this boundary a pressure field four or five mm. deep, within which the direct signal and its reflection from the boundary remain in phase and add coherently.

The Amcron PZM places a small pressure transducer inside the primary boundary pressure zone, facing the boundary. This prevents any direct signal reaching the microphone, thus eliminating the possibility of phase-induced interference and providing a significant improvement in signal quality.

The PZM response pattern is hemispherical, with no "off-axis" position: gain related to distance will change, but not tonal quality. The PZM responds accurately to up to 150 db spl, yet hears a whispered conversation in an ordinary room at ten metres.

Engineers are finding that the PZM continually suggests new miking techniques. And that in many applications fewer PZM's are required than traditional microphones. In fact, the PZM is changing ideas about how a microphone should look, sound, and be used. Don't you think that it's time you got in on the act, and gave the PZM a listen?

Details of available models, prices, and suggestions for applications are obtainable from the sole UK importers and distributors.

HHB

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

amcron

PZM and PZMicrophone are registered trade marks of Crown International.

APRS preview

and magnetic film including calibration and test tapes. ● **FWO Bauch:** wide range of products from Albrecht, CMX, Elector, EMT, Europa Film, Gotham, Harrison, Ivie, ITC, Klein & Hummel, Lexicon, Melkuist, MRL, Neumann, Revox, Studer, Switchcraft, Transco, UREI, and Valley People. Products to be highlighted include the EMT *450* digital recording system; EMT *251* and *245* digital reverbs; Ivie *Gold Standard* calibration mic capsules; Harrison *MR2* and *MR3* consoles; Melkuist console automation system; Lexicon *PCM 41* digital processor and *Model 1200* audio time compressor; Revox *PR99* tape recorder; Revox *B710* and *D88* cassette units; Studer *A800 Mk 2, A80/VU Mk 3,* and *B67 Mk 2* tape recorders; and Studer *Series 900* mixing consoles. ● **Beyer:** range of dynamic and condenser mics plus various headphones. ● **Bruel & Kjaer:** comprehensive range of audio measurement instruments. ● **Bulgin Soundex:** range PPMs and associated power supplies, plus the recently introduced *AMM 200* noise meter.

C

● **Calrec:** range of professional condenser mics including the *Soundfield* Ambisonic mic; a microprocessor controlled OB switching unit; and the company's range of sound control consoles. ● **Canford Audio:** wide selection of studio furnishing equipment and ancillary studio equipment. New products include 19in racks; jackfields and patchcords, floor mounting *XLR*-type connectors, and an expanded range of connectors. ● **Capital Components:** range of bargraph displays including VU and switchable VU/PPM styles. ● **CB Electronics:** new 16 or 24-track tape machines utilising a Studer transport. Also plug-in modular electronics for multitrack tape machines. ● **Cetec International:** high speed cassette duplication system, plus Gauss loudspeakers and crossovers. ● **Clive Green & Co:** multitrack in-line console available with modules suitable for broadcast or recording applications. Also a selection of units from Enertec. ● **Clyde Electronics:** first public showing of the company's range of broadcast products. Units on display will include the *Alpha Series* DJ on-air console; the *Delta Series* news mixer; a broadcast turntable unit; and a selection of 19in rack mount broadcast ancillary units. ● **Court Acoustics:** range of studio monitoring systems and associated equipment including the BGW range of power amps. ● **Covemain:** RCF *AFSA1* ⅓-octave realtime spectrum analyser, plus monitor loudspeakers and drive units.

D

● **Dolby Labs:** range of Dolby-A noise reduction units including the new *Cat 225* module for portable applications. Also Dolby-B, Dolby-C, and the *HX* headroom extension system, plus units for cinema applications.

E

● **Eardley Electronics:** comprehensive range of Neutrik products including *XLR*-type connectors, the *K-Check* cable tester; and the company's audio instrumentation range. ● **EMI Tape:** range of professional and duplicating tape, plus cassettes and accessories. ● **Ernest Turner:** comprehensive range of VU and PPM meters including bargraph display units.

F

● **Feldon Audio:** wide range of products from Eventide, Inovonics, Marshall, Ortofon, Pulse Designs, Syntovox, and Ursa Major. Highlighted products will include Sony professional mics, the Marshall *Model 5402* time modulator, Pulse Designs *Tempo-Check* programmable metronome, and the recently introduced Ursa Major *8X32* digital reverb system. ● **Fitch Tape Mechanisms:** range of record and playback cart machines. ● **FM Acoustics:** *FM600A* and *FM 800A Series II* power amps, plus two new units – the *FM 212a* moving coil pre-amp and *FM 240* thermo-quad-A-stage reference preamp. ● **Formula Sound:** S19G 2-channel, ½-octave, 19-band graphic equaliser and *SG19A* equaliser/analyser. Also the *Mini-mix* modular production mixer. ● **Fraser Peacock Associates:** Sony high speed cassettte duplicating system, plus details of the company's cassette duplication service. ● **Future Film Developments:** comprehensive range of cables, cords, connectors, jackfields, wiring aids and associated components, plus a wide range of audio accessories.

G

● **Gulton Europe:** full range of Electro-Voice professional mic and loudspeaker systems, plus mixers and amps from the Tapco range.

H

● **Harman (UK):** JBL range of monitor loudspeakers and *7510* automatic mic mixer, plus the complete range of Teac-Tascam units including mixers, tape recorders and the new *System 20* mixing system. ● **Hayden Labs:** wide range of products from Nagra, Sennheiser, Sondor, and Telefunken. Highlighted products include the new Nagra *TA* tape recorder; new Sennheiser *S40* cardioid condenser mic; Sondor *Libra A80* magnetic film recorder; and the new *PS81* studio turntable unit from Telefunken. ● **HHB Hire & Sales:** Crown/Amcron range of amps plus the Crown *PZM* range of mics. New products will include the *PS200* and *PS400* amps; the *MX4* active crossover; the *SL-2* preamp; the *FM-2* pulse count detection tuner; and a repackaged version of the *Badap* audio micro computer. Also on display the Gauss range of professional loudspeakers including the new 3in voice coil series. ● **HH Electronic:** *TPA Series D* and *S500D* professional power amps and the company's *MOSFET* power amps. Also electronic echo units and portable stereo sound control mixers.

I

● **ICM Cassettes:** no information received. ● **ITA:** equipment from ITAM, Otari and Teac. New products include the *Sigma* 16/8/16 mixer and a range of compact 12/4, 16/4 and 16/8 mixers from ITAM.

J

● **Jackson Recording:** details of the company's used equipment retail operation. ● **James Yorke:** details of the company's cassette recording, production and packaging services.

K

● **Keith Monks:** new producers turntable unit, new colour additions to the company's range of mic stands, new powered loudspeaker, plus a wide range of ancillary studio equipment including EDC radio mics. ● **Klark-Teknik:** new *DN80* 16-bit realtime audio computer; recently introduced *DN30/30* graphic equaliser: *DN27A* graphic equaliser; plus the company's established range of analysers, equalisers, and analogue and digital time processors.

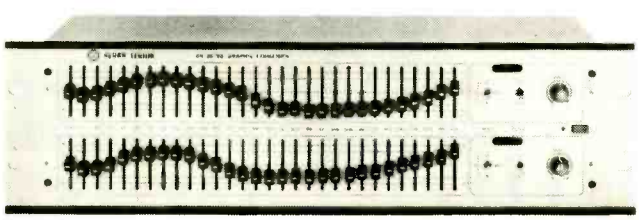
L

● **Lake Audio:** details of the company's design, consultancy, installation, service and retail operations. ● **Lee Engineering:** wide range of products for the broadcast market including Spotmaster cart machines; QRK turntables; Micro Trak turntable arms; Audio Pak cartridges; Nortronics professional head care products; McKay-Dymek Pro-Am hf receivers; and the Orban *Optimod-AM* signal processing system. ● **Leevers Rich:** *Proline 1000* and *2000* tape machines including slow speed logging systems; BMX mixing consoles; Tomcat cart machines; Garner bulk erasers; plus various ancillary items including tape tension gauges. ● **Lennard Developments:** complete range of Woelke professional record, playback and erase heads; plus wow and flutter meters, wave analysers, and bias/distortion meters. ● **Lyrec:** recently introduced *TR55* compact 2-track tape machine, plus the *TR532* 24-track and *ATC* remote controller. Also the company's high speed cassette duplicating system.

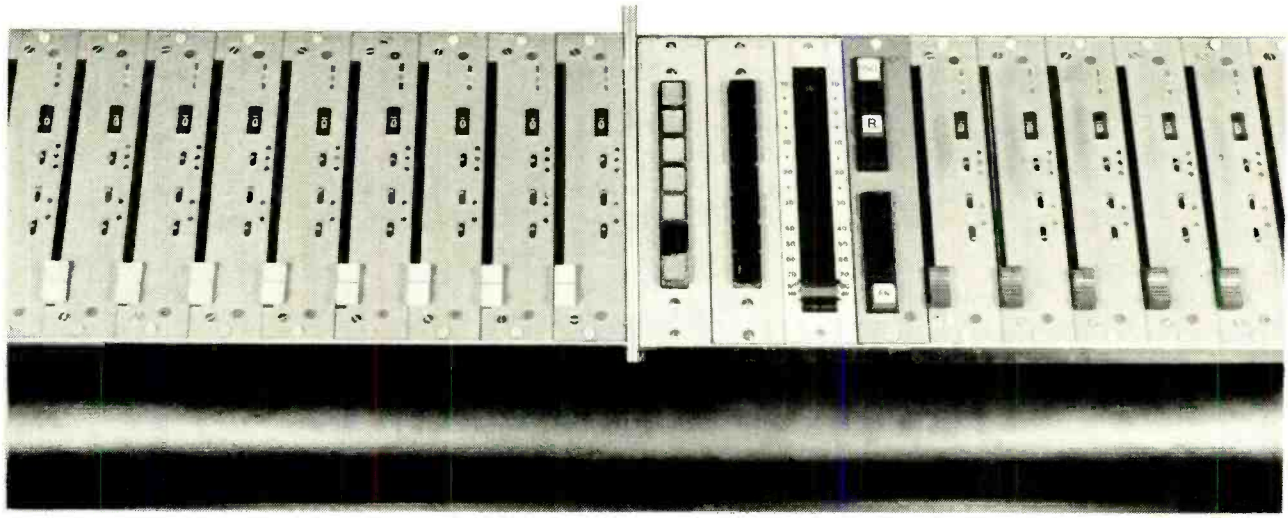
M

● **3M:** 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor including the new crossfade facility. Also the *M79* 24-track recorder; Wollensak cassette duplicators; and *Scotch* audio tapes including *Scotch 265* digital mastering tape. ● **Maglink:** range of synchronising equipment using the Maglink code and including various generators, readers and timecode interface units. ● **Magnetic Tapes:** *Chilton* portable mixing desks and the *QM2* range of consoles. ● **MCI:** complete range of tape machines, consoles and ancillary items. New products include *JH-110BX Series* of mono and stereo recorders; *JH-110C-8* 8-track machine with remote and autolocate; a new audio/video synchronisation package; and a *JH-600* console for mobile usage. ● **Midas:** *PR System* consoles for sound reinforcement, on-stage monitoring, recording and production applications; plus the *TR System* range of modular theatre consoles. ● **Mosses & Mitchell:** range of jacks and jackfields including the *440* range of miniature jack sockets and jackfields. ● **Music Labs:** PSE range including an echo-reverb plate, spring reverb, DI boxes, phantom power supplies, and equipment racks. Also the *Master 8* 8-track 1in conversion of the Teac Tascam *80-8* tape machine. 82 ▶

Klark-Teknik DN 30/30 graphic equaliser



Melkuist
GT800 Automation System



MELKUIST GT800 AUTOMATION SYSTEM

IT IS BY FAR AND AWAY THE EASIEST TO USE AND ECONOMICAL DISK BASED AUTOMATION SYSTEM CURRENTLY AVAILABLE.

UP TO 64 CHANNELS AND 64 SEPARATE CUT FUNCTIONS PER FRONT END MODULE CAN BE AUTOMATED.

IT USES SMPTE/EBU TIMECODE AS ITS TIME SIGNATURE AND ACHIEVES DOUBLE EBU SCAN RATE.

THE VOLTAGE INPUT-OUTPUT SCALE CAN BE ADAPTED FOR ALMOST ANY DC CONTROLLED APPLICATION.

FRONT END ADAPTOR PACKAGES ARE AVAILABLE AS STANDARD FOR HARRISON TRIDENT, AND ALLISON EQUIPPED AUTO-READY CONSOLES.

RETROFIT MELKUIST FADER MODULES ARE ALSO AVAILABLE FOR NEVE 35 MM & 40 MM WIDE CHANNELS, CADAC LONG THROW FADERS AND ALSO AS A STAND ALONE FADER-ONLY CONSOLE FOR INSERTION INTO JACKFIELDS.

ANY CURRENT, AUTO-READY CONSOLE CAN INTERFACE WITH GT800 AND VIRTUALLY ALL SEPARATE FADER CONSOLES CAN BE UPDATED TO USE IT.

AS A THIRD GENERATION SYSTEM, GT800 IS UNIQUE IN THAT THE LEVEL OF AUTOMATION HAS BEEN EXTENDED TO COVER ALL THE FILE HANDLING ETC., THAT PREVIOUSLY HAD TO BE DONE MANUALLY BY THE ENGINEER.

SPECIAL INTERFACE PACKAGES ARE AVAILABLE TO RUN VIDEO- SWEETENING IN A TOTALLY TRANSPARENT MANNER, GT800 FUNCTIONING AS AN EXTRA SLAVE MACHINE.

THE DISK MEMORY IS SPECIALLY SILENCED TO OPERATE IN THE CONTROL ROOM TO AVOID THE NEED FOR SPECIAL COOLING SYSTEMS ETC.

'BUSY' 10 MINUTE TAKES OCCUPY ABOUT 15% OF ONE OF THE EIGHT STORAGE AREAS AND FACILITIES ARE EVEN AVAILABLE TO DOUBLE THE AREA IF REQUIRED.

INSTALLATION DOES NOT REQUIRE SPECIAL TRUNKING SINCE ALL MAJOR DATA HIGHWAYS RUN IN STANDARD SINGLE SCREENED CABLES.

CUSTOMISING OF INSTALLATIONS IS SIMPLE SINCE SPECIAL SOFTWARE PACKAGES CAN BE SUPPLIED AS OPTIONS TO THE STANDARD AUTOMATION OPERATING SYSTEM. THUS IF SYSTEM USE ALLOWS AND TERMINAL / PRINTER OPTIONS ARE INSTALLED, BUSINESS AND WORD PROCESSOR PACKAGES CAN BE RUN.

COMPREHENSIVE SELF TESTING SOFTWARE IS INCLUDED AS STANDARD.

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

APRS preview

N

● **NEAL—Ferrograph:** new *SP7S* servo controlled ¼in tape recorders available in a number of customised versions, plus the company's established range of tape machines, cassette recorders, and audio test equipment. ● **Neve:** *Model 8108* microprocessor controlled multitrack console, plus the *Necam* automation system and *Necam II* system for audio sweetening applications.

O

● **Otari:** *MTR-90* multitrack tape recorder; recently introduced *MTR-10* 2- and 4-channel master recorders; *MX5050-BQII* ¼in 4-channel recorder; *MX7800* 1in 8-channel recorder; and the *DP4050* cassette duplication system.

P

● **Penny & Giles:** comprehensive range of faders including a digital fader and newly introduced *3000* series of 65mm faders. ● **Philip Drake Electronics:** *Commsbox* ring intercom system; *Mini Mobile* talkback system; *7000 Series* broadcast modular amplifying equipment; and modular OB commentator equipment. ● **Progressive Electronic Products:** wide range of mixer modules for DIY mixers, plus details of the company's custom built mixers. ● **Publison:** range of audio processing equipment.

R

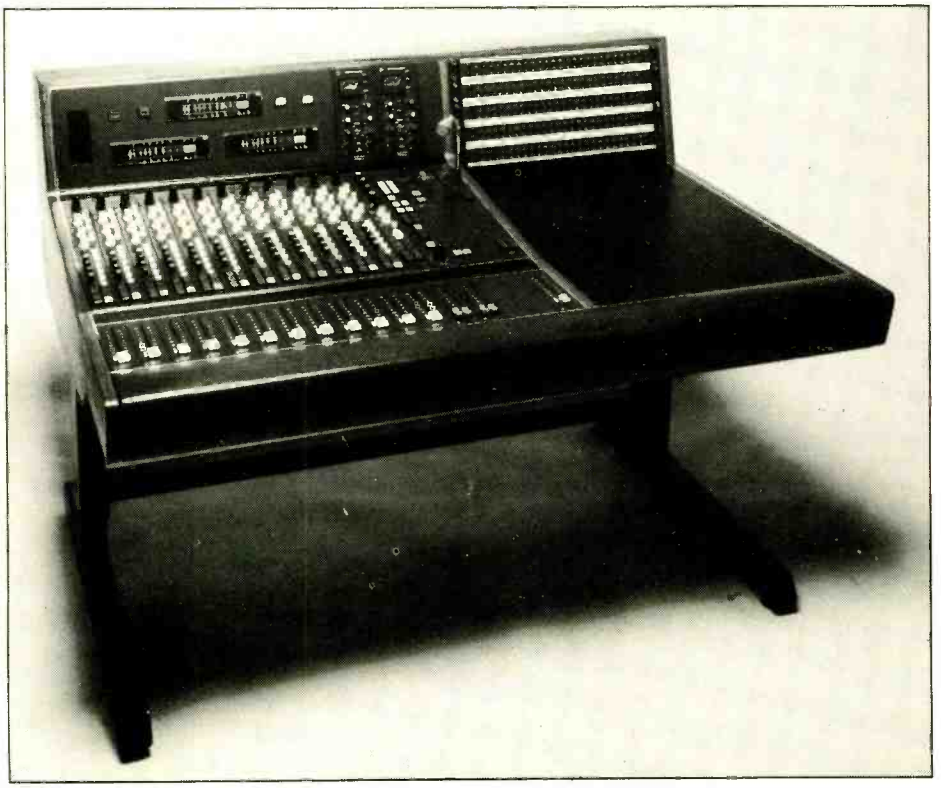
● **Raindirk:** new *400 Series* of broadcast mixers; recently introduced *Britannia* range of in-line consoles; plus the *Status 500* MOSFET power amp and *Status 20* modular stereo control unit. ● **Rebis Audio:** *RA200 Series* compact modular signal processing system; plus the *RA402* parametric equaliser and *RA301* comp/limiter. ● **REW:** new *Portamix* flight-cased 6/2 mixer, plus the Soundcraftsmen range of equalisers including a new dual 10-band equaliser. Also a new range of class H power amps from Soundcraftsmen.

Soundcraftsmen RA7501 Class H power amp

S

● **Scenic Sounds Equipment:** wide range of products from Amber, Amek, APSI, BTX, dbx, Deltalab, Editall, Emilar, Lexicon, Linn, Micmix, Orban, Schoeps, TAC, 360 Systems, and White Instruments. Highlighted new products include the Linn *LM-1* drum computer; dbx *20-20* computerised/automated equaliser and realtime analyser; dbx *900 Series* of modular signal processors; new low cost noise reduction units from dbx; and the Deltalab *DL5 Harmonicomputer*, a pitch transposer using delta modulation techniques. ● **Shure:** *SM81* cardioid condenser mic; *SC39 Series* phono cartridges; and *Pro Master* sound system; plus the company's range of dynamic mics. ● **Sifam:** wide range of VU and PPM meters, control knobs, switches and transformers. ● **Solid State Logic:** *SL-4000E Series* automated console; *SSL* studio computer system; and *Total Recall* studio computer. ● **Sonifex:** range of broadcast cart machines including the *μHS Series*. ● **Sony:** *DAE-1100* digital editor to accompany the *PCM-1600* or *PCM-1610* digital recorders; a digital compact disc system; and a wide range of professional mics and radio mics. ● **Soundcraft:** first British showing of the *Series 800* multitrack console and *SCM 382-24* 24-track recorder. New products include a new automation system and the new *Series 2400* automation-ready console. Also the *Series 1624* console, plus the *SCM 381* range of multitrack recorders. ● **Soundstream:** details of the company's digital recording system and new UK facilities. ● **Statik Acoustic:** range of ancillary equipment comprising the *SA30* electronic crossover; *SA10* octave equaliser; and *SA20* dual reverb system. ● **Studio Equipment Services:** details of the company's design, installation and retail operations: plus a display of AHB and Teac *Tascam* equipment. ● **Surrey Electronics:** stereo rf clipper; broadcast monitor receiver; stereo disc amps; PPMs; plus various ancillary audio units. ● **Swisstone:** Chartwell range of studio monitor loudspeakers including BBC licensed designs. Also Rogers studio monitors.

Raindirk 400 Series broadcast console



T

● **Tannoy:** *Buckingham* 3-way monitor loudspeaker; *Classic Dual Monitor* and *Super Red* monitors; *Little Red* and *SRM Series* monitors; *Dreadnought* monitor; and the company's hybrid passive/active crossover unit. ● **Trad:** details and products from this company which specialises in buying and selling new and second-hand studio equipment. ● **Trident:** *TSR Series* multitrack recorder with autolocate and compact remote control unit; *TSM Series* and *Series 80* multitrack consoles; and dual channel stereo limiter/compressor. New products include a new 8 group *Trimix* console, and a new 2-channel parametric equaliser. ● **Turner:** range of stereo power amplifiers for studio and sound reinforcement use. ● **Turnkey:** *Ecoplate* reverb; *Auratone* loudspeakers; EXR *Exciter*; *Accessit* budget signal processing systems; *Seck* mixers; *The Great British Spring*; and the new digitally controlled *Time Processor*. Also details of the company's retail and turnkey operations, plus a display of 8 to 24-track systems mounted in association with Soundcraft. ● **Turnkey Two:** details of the company's acoustics analysis and studio and sound reinforcement design services. ● **Tweed Audio:** range of mixers suitable for broadcast or recording studio usage, plus details of the company's custom design and manufacture service.

V

● **Vitavox:** range of stage entertainment loudspeakers; range of mixing consoles and ancillary processing units from D & R Electronica; plus *Blue Snake* multicore cables.

W

● **Wayne Kerr Radford:** range of audio test instruments including the *RA200* analyser, *ADS1* digital store unit, and *ALM1* line measurement adaptor.

● **Studio Sound:** editor Richard Elen and assistant editor Noel Bell will be attending the exhibition together with advertisement manager Phil Guy. Copies of *Studio Sound* will be available from our stand number 106. ■

WOW ...it's dyna-mite™

That's what they said last month when we introduced DYNA-MITE at the 69th AES Convention in LA.

Why the surprise?

Dynamic manipulation—i.e., limiting, expansion, noise gating, de-essing, etc.—has been around for some time. It's ironic, in view of today's rapid pace technology, just how unsophisticated a collection of such devices exits in the marketplace. Limited function. . . marginal dynamic integrity. . . higher and higher prices. Rehashed circuits from a decade ago.

Suddenly, DYNA-MITE has struck. . . opening a fresh new page in the journals of audio processing.

Why all the fuss? Just because DYNA-MITE performs *all* the standard dynamics processing functions—including limiting, expansion, de-essing, KEPEXING®, gating/ducking—plus a few new ones (18 functions in all)? Or is it because it offers two independent or stereo channels, self-powered and contained in a briefcase sized, yet rack mountable package? Perhaps because it's downright affordable, even for semi-pros?

No, these are only the icings. DYNA-MITE's real forte lies in its fundamentally superior performance. Listenability which surpasses the very best of the single function devices. . . in any mode.

It must be stressed that DYNA-MITE employs proprietary VALLEY PEOPLE circuit principles not available from other sources; important engineering achievements, not gimmicks. The result is that DYNA-MITE performs sensationally in situations where other devices cannot even be used without severe dynamic distortions. By comparison, there is no comparison.

Only your ears can fully describe the DYNA-MITE experience. We warn you, however, not to listen to a DYNA-MITE unless you're fully prepared to buy it on the spot. It's that good.

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ARTECH (UK)

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Phone: (213) 362-2566.

Transmitter
Type: available as pocket pack or handheld with either Shure *SM58* or electret omni elements.
Audio input: – 33dB to 60dB (45mV to 0.78mV), 150 to 600Ω.
Limiter: variable compression over 35dB range.
Audio connector: 4-pin Fischer *Quick-loc,* for standard dynamic mics, positive ground power for electrets, and power for Neumann *70* series, Sennheiser *– 05, – 15, – 35* and certain Schoeps mics.
FM deviation: normally 25kHz, can be reduced.
Spurious emissions: at least 40dB below carrier, typically 48dB.
Rf power output: 50mW into 50Ω, high power units 500mW.
Antenna: strong highly flexible cable terminated in submin connector.
Battery: single or dual versions, *PP3* type, Mallory *MN1604,* single battery model 12 to 15 hours, dual 30 to 33 hours.
Dimensions: single battery pocket model 102 x 60 x 21mm, 270g; dual battery model 102 x 85 x 21mm, 298g; handheld model 241mm long, 30mm diameter, 440g (only one battery).
Construction: 2-piece brass with integral shield between audio and rf circuitry, battery in separate sealed compartment, case clad in black epoxy finish.
Prices: VHF single $495, dual $520; high power single $575, dual $595: UHF single $575, dual $595; handheld with Shure *SM58* element $635; with omni electret element $575.

Receiver
Type: available as battery operated portable with optional mains power supply, or rack mounting cards for mainframes with built-in mains power supplies.
Audio outputs: mic level 150Ω bal, line unbal 50Ω + 10dB, phones will drive 50Ω.
Connectors: mix *XLR,* line out with dc power input Lemo 4-pin *Quick-Loc.*
Rf sensitivity: 1.5μV for 20dB S/N, 5μV for 40dB.
Adjacent channel rejection: 85dB.
Image and spurious response: 85dB.
Antenna: 50 to 75Ω, F&E (UHF) socket, numerous antennas.
Indicators: signal field strength meter, battery meter.
Power: six internal AA (*MN1500*) giving 40 hours, nicads or external 9V 50mA.
Construction: brass case with black epoxy finish.
Dimensions: portable 125 x 180 x 25mm, 880g, rack 480 x 134mm.
Prices: portable VHF internal batteries $695; UHF $775. VHF rack mount card $695 each, frame for six cards with power supply $300, for eight cards less power suppiy $225. Power supply for portable receivers $25, for large rack $85.

Overall system specification
Frequency response (20dB below limiting): 80Hz to 20kHz ± 2dB, includes 6dB/octave roll-off at 60Hz to remove wind and rumble.
S/N: 64dB unweighted, 66dB A weighted.
Harmonic distortion: 1kHz typically 0.5%, 100Hz to 20kHz 1%.
Pre and de-emphasis: 50μs.
Carrier frequency range: VHF 120MHz to 240MHz, UHF 400MHz to 470MHz.
Frequency stability: 0.005%.

Mini-Mic
This is a professional subminiature electret condenser mic measuring 11.7 x 8.38 x 8.28mm, noise 26dB SPL, output impedance 3kΩ unbal (bal available), audio sensitivity 60dB below 1V rms per μ/bar, battery, 1.1V to 20V dc, available with a multitude of connectors to match Swintek. Vega, Artech and Micron radio mics, and most other standards.
Price: from $128 depending upon connectors.

AUDIO (UK)

Audio Ltd, 26 Wendell Road, London W12 9RT.
Phone: 01-743 1518.
USA: Murray Rosenblum Sound Associates Inc, 21-36 33rd Road, Long Island City, New York 11106. Phone: (212) 728-2654.

RMS5
Frequency response: not specified.
Distortion: 1%.
Pre-and de-emphasis: 50μs.
Carrier frequency: 70MHz to 200MHz.
Stability: ± 10kHz at 175MHz.

AU18/RMS5H transmitters
Type: *AU18* pocket transmitter. *RMS5H* handheld with cardioid or omni electret elements.
Audio input: suitable for moving coil or electret mics, 30 and 600Ω.
Connector: locking Preh.
FM deviation: 35kHz.
Rf power output: from 1mW to 20mW.
Antenna: flexible.
Battery: *PP3.*
Dimensions: pocket 118 x 59 x 22mm, 270g; handheld 260mm length 30mm diameter, 450g.
Prices: *AU18 £120; RMS5H* £295.

RMS5 receiver
Type: battery-operated receiver.
Audio output: mic level 30Ω.
Connector: Preh.
Rf sensitivity: 5μV for 40dB S/N.
Antenna: 75Ω coax.
Power: 9V *PP9.*
Dimensions: 225 x 155 x 64mm, 1.6kg.
Price: £295.

RMS8 Series
Frequency response: 100Hz to 15kHz ± 2dB.
Distortion: 1%.
Pre and de-emphasis: 50μs.
Carrier frequency range: 70 to 200MHz, UHF system available between 400 and 500MHz.
Frequency stability: ± 5kHz.

AU18/RM8H transmitters
Type: *AU18* pocket transmitter, *RMS8H* handheld transmitter with omni or Shure *SM58* cardioid element.
Specification otherwise similar to *AU18/RMS5H.*
Prices: pocket £120; with Lemo socket and on/off £135; handheld cardioid £200.
Optional high power transmitter in 140 x 66 x 22mm case, with two *PP3*s allows up to 100mW. With separate 12V power supply and without space for internal batteries up to 500mW is possible.
Price: £150.

RMS8 receiver Series
Type: battery-powered receiver.
Audio output: mic level 30 to 150Ω, headphone 1mw/600Ω.
Connector: Preh, headphones on jack.
RF sensitivity: 5μV for 40dB S/N.
Antenna: 75Ω, various antenna available.
Indicators: tuning, rf level and battery meters.
Power: six *HP7/Mallory MN1500* batteries.
Dimensions: 180 x 125 x 25mm, 880g.
Price: £280. *RMS8/2* is a 2-channel version of the above.

RMS8A
This is an updated version of the *RMS8* with headphone level control, Lemo socket for external powering and aux out, and *XLR* audio out.
Price: £315.

RMS8M
Mains powered receiver with *XLR* audio, headphone output and rf level meter.
Price: £330.

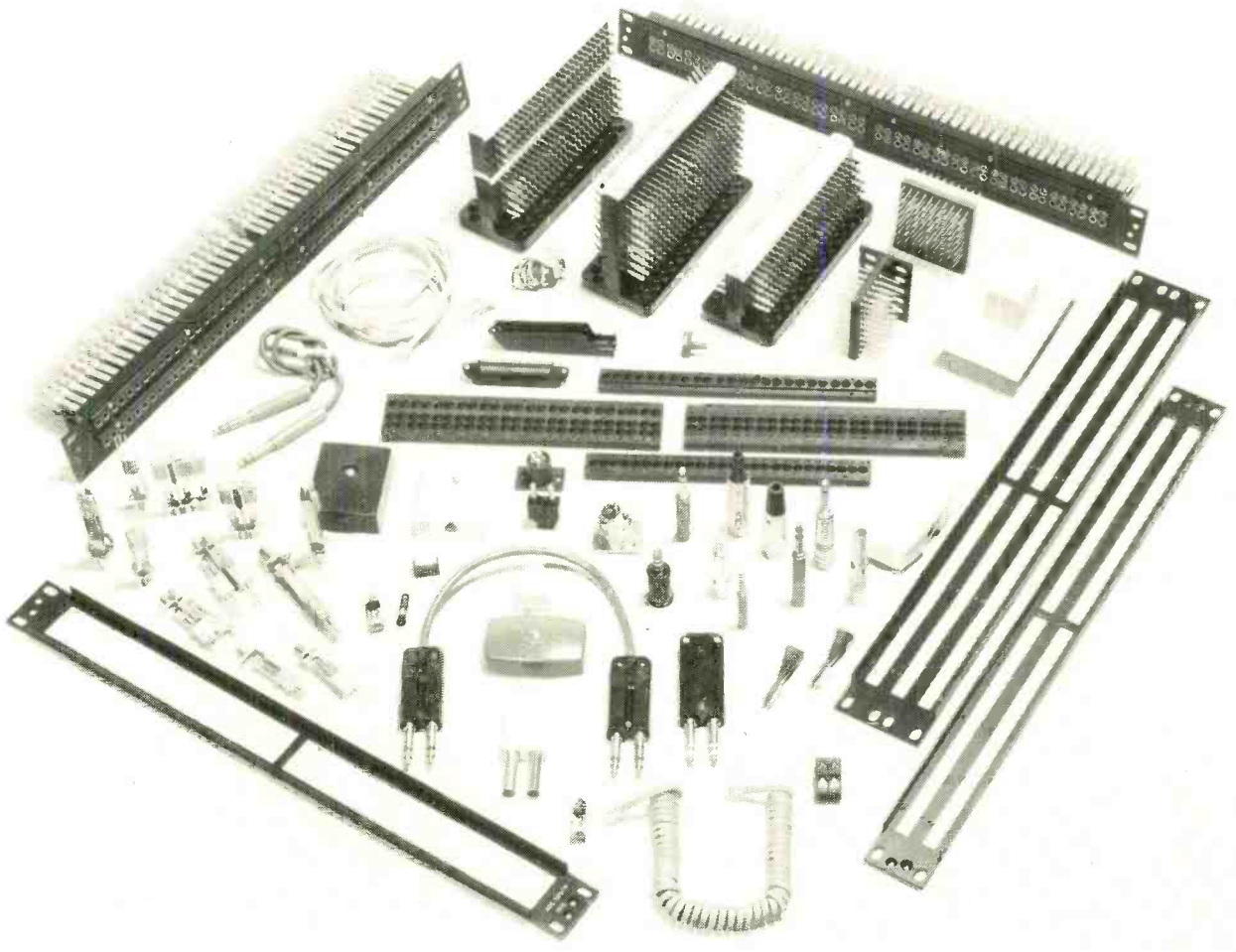
RMS8T
Twin-channel receiver.
Price: £455.

TR58
Subminiature electret microphone 13.3 x 7.6 x 4.5mm operating voltage 1 to 1.5V, available with optional powering adaptor enabling it to be used with ordinary tape recorders.
Price: £55; £95 with adaptor.

86 ▶

If you need Jackfields

Jacks, Plugs, Panels, Patch Cords and Cables



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.....

REF. NO. 0025

C.A.E. LIMITED, 70/82 Akeman Street, Tring, Herts. HP23 6AJ. Telephone: Tring (044 282) 4011 Telex: 825876

Survey

BEYER (West Germany)

Beyer Dynamic, PO Box 1320 D-7100 Heilbronn.
Phone: 071 31.82.348. Telex: 728771.
UK: Beyer Dynamic (GB) Ltd., 1 Clair Road, Haywards Heath, Sussex RH16 3DP
Phone: 0444 51003.
USA: Burns Audiotronics Inc, 505 Burns Avenue, Hicksville, New York 11801.
Phone: (516) 935-8000.

TS73/TS83/SM84
Type: *TS73* pocket transmitters, *TS83* with built-in limiter, *SM84* handheld radio microphone with exchangeable heads.
Operating frequencies: 1 or 2 channels between 26MHz and 46MHz.
Rf output power: available in 1mW or 10mW.
Power: two 9V batteries, 15 hours life, one only in handheld, 7 hours life.
Dimensions: pocket 105 x 67 x 25mm, 200g, handheld 170 x 50 x 41mm, 300g.
Prices: on application.

TE20
Type: portable receiver, battery operated.
Frequencies: up to 3 channels between 26 and 46MHz.
Power: two 9V batteries, 20 hours life.
Dimensions: 140 x 85 x 30mm, 280g.
Price: on application.

NE75/NE84
Type: mains/battery receivers for up to three channels, built-in modulator loudspeaker, 9V battery, diversity connections on *NE84*.
Prices: on application.

CETEC VEGA (USA)

Vega, Division of Cetec Corp, 9900 Baldwin Place, El Monte, Cal 91731.
Phone: (213) 875 1900. Telex: 910-587 9539.
UK: Cetec International Ltd, Unit 15, Northfield Ind Estate, Beresford Avenue, Wembley HA0 1YB.
Phone: 01-900 0355. Telex: 935847.

77B/80/81/88 transmitters
Type: *77B* is pocket transmitter with circuitry sealed in compartment separate from battery, *80/81* is handheld transmitter with built-in mic element. Transmitter power is 50mW, frequency range 150 to 216MHz. *88* is pocket pack with built-in mic.
Prices: *80/81* $900; 77B $669; *88* $387.

58/63 receivers
Type: *58* standard receiver, *63* diversity receiver. Response 40Hz to 15kHz., multi-function metering, mains or 12V power.
Prices: *58* $990; *63* $2,105.

66/990 receivers
Type: similar to *58/63* but portable, battery powered from four 9V batteries.
Price: $856.

89 receiver
Type: mains powered receiver for *88* transmitter, 70Hz to 12kHz.
Price: $445.

Cetec Vega has a wide range of accessories and aerials.

COMREX (USA)

Comrex Corp, PO Box 269, 60 Union Avenue, Sudbury, Mass 01776.
Phone: (617) 443 8811. Telex: 710-347 1049.

450RA/TA system
Type: pocket UHF transmitter with identically sized pocket receiver designed to be mounted on a camera.
Frequency range: 450 to 451MHz, 455 to 456MHz.
Transmitter input: any low imp mic.
Rf output power: 150mW.
Receiver sensitivity: 1μV.
Power: both have nicads, optional extra nicad pack for extended operation and optional mains power supply.
Dimensions: each 76 x 127 x 25mm.
Prices: *450TA* pocket transmitter $900; *450RA* pocket receiver $600.

450DS diversity system
Type: diversity receiver mounted in rugged *Haliburton* luggage type case. Includes two *450RA* receivers, a diversity combiner, a monitor amplifier and speaker, and an internal power supply enabling the system to be operated from ac power or internal nicads. Case also holds *450TA* pocket transmitter and *HHT-1KA* handheld transmitter.
Price: $1,950 receiver and case only.

HHT-1KA transmitter
Type: handheld transmitter with built-in electret mic, with dual automatic modulation control. 1W output.
Dimensions: 220 x 44 x 38mm, 554g.
Price: $950.

CTA/CTB Cue Transmitter
Type: rack mounting 1W transmitter, 26.1 to 26.48MHz *CTA*, and 161.625 to 161.775MHz *CTB*. Includes ducking limiter operating on line level, 6kHz bandwidth.
Price: $750.

CRA Cue Receiver
Type: pocket-sized cue receiver with high level headphone output of 600mW into 8Ω, antenna operates from earphone cable, battery 9V Mallory *MN1604*, size 75 x 125 x 25mm, 50 to 550MHz or 26.1 to 26.48MHz.
Price: with squelch $550; without $395.

EDC Cygnus system with pocket transmitter (top) and receiver

EDCOR (USA)

Edcor, 16782 Hale Avenue, Irvine, Cal 92714.
Phone: (714) 556-2740. Telex: 685557.

PM1/PM5 transmitter
Type: pocket transmitter with belt clip, available as *PM1 Interviewer* with built-in mic or *PM1 Demonstrator* with attached dynamic external mic, *PM5* handheld with dynamic cardioid element.
Operating frequency: 30 to 50MHz.
Frequency response: 50Hz to 14kHz.
Rf output power: 200mW.
FM modulation: 40kHz deviation.
Battery: *PM1* 9V alkaline 4 hours, mercury 18 hours.
Dimensions: *PM1* 31 x 70 x 98mm, 310g.
Price: $198 to $478.

ST-3B/ST-3B2
Type: mains or dc powered receiver in cabinet case, *ST-3M2* has two channels.
Audio output: up to 5V for driving high impedance, 100mV for low impedance.
Connectors: audio *XLR*.
Rf sensitivity: 2μV for 20dB quieting.
S/N: 55dB.
Power: mains or 12V.
Indicators: field strength meter.
Dimensions: 75 x 185 x 254mm, 1.3kg.
Price: $440.

PR1
Type: personal mini pocket receiver with belt clip, basic specification as above, but 500mW into 8Ω output for headphones, battery operation from 9V alkaline, 4 hours life.
Price: $220.

ST-3B diversity Receiving System
Specification similar to *ST-3B* but with two receivers, two antennae and a diversity switch.
Price: $730.

E-COM1 The Elite
Type: pocket transmitter, crystal controlled, with mini jack, optional phantom powering, 40dB compressor, external antennae, 9V alkaline battery.
Operating frequency: 150MHz to 210MHz.
Price: $596.

E-COM3 Receiver
Type: single channel crystal controlled receiver, signal energised electronic switch.
Operating frequency: 150MHz to 210MHz.
Price: $640.

E-COM5 Diversity
Similar to *E-COM3*, but diversity with two receivers and electronic switch.
Price: $930.

E-COM7 Body Receiver
Type: battery powered pocket receiver, headphone output.
Operating frequency: 150MHz to 210MHz.
Price: $396.

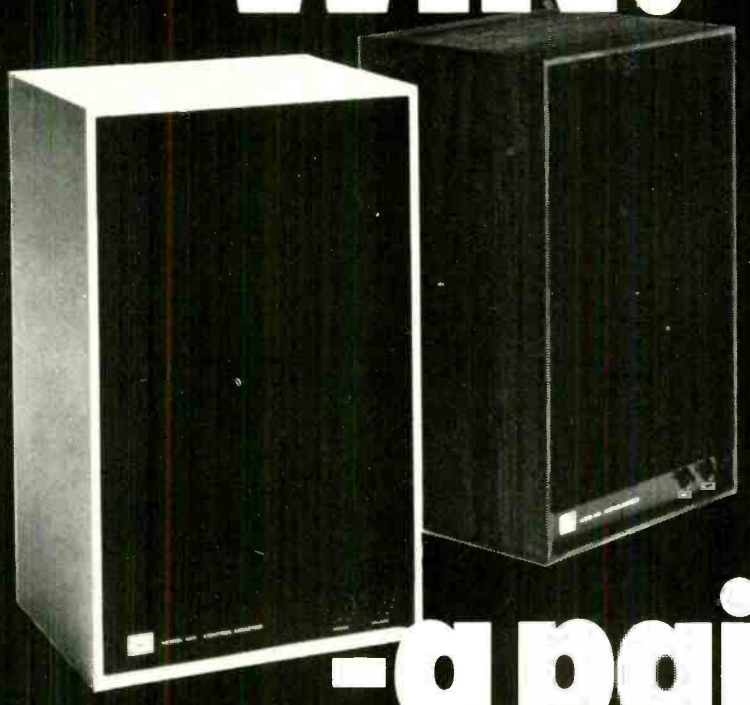
EDC (UK)

Elkom Design Ltd, 29A West Street, Wareham, Dorset BH20 4JS.
Phone: 09295 6050/6061.
USA: Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906.
Phone: (203) 348-4969.

Cygnus transmitters CTXP/CTXH
Type: available as pocket *CTXP* or handheld with cardioid electret (omni to order) *CTXH*.
Audio input: matches any 200Ω, low impedance or 2kΩ electret.
Limiter: 30dB range with typically less than 1% distortion.
Audio connector: 4-pin connector.
FM deviation: ±75kHz.
Rf output power: 10mW, higher output power available for export.
Antenna: 9cm helical or 46cm free hanging.
Battery: 6.5V from nicad (4 hours) or Mercury cell (50 hours).
Indicators: approx 15 mins operating time after LED extinguishes.
Dimensions: pocket transmitter 111 x 45 x 19.5mm, 128g; handheld 215mm x 20mm diameter, 199g.
Construction: pocket moulded plastic, handheld gold plated.
Price: £173.95 with mic, nicad, aerials, pouch and charging lead; handheld £181.63.

88 ▶

WIN!



-a pair of these JBL monitors at APRS

We, at Scenic Sounds Equipment, hope that you buy JBL products from us as a matter of course,–visit our stand at APRS '81 and you may walk away with a pair for nothing!

All you need do to win a pair of JBL 4311 studio monitors is play the Space Invader that you'll find on our stand. If at the end of the exhibition yours is the highest score, the monitors are yours.

Incidentally, all proceeds from the machine go to DEAF.

Even if you're not the lucky one, a visit to our stand won't be wasted because you'll find displayed some of the most advanced quality audio products available to the professional recording studio.

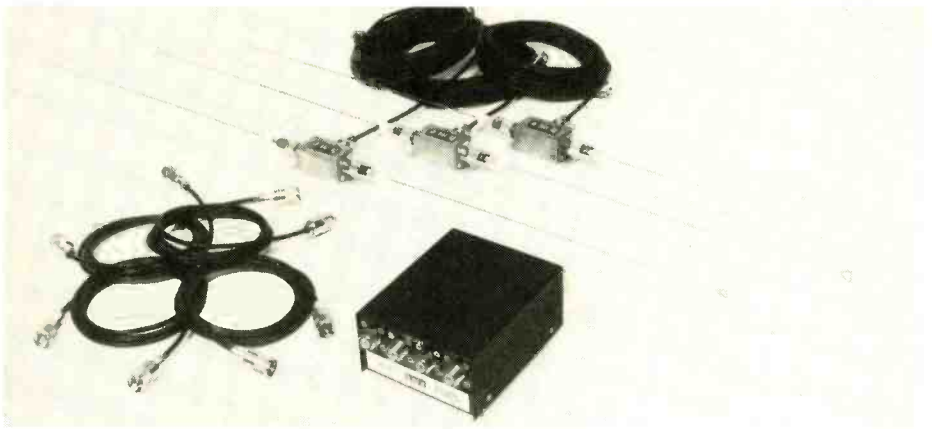
If you fancy your chances come and see us on stands 68/69/70 at APRS.

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

SSE

AMEK dbx DeltaLab JBL MICMIX orban White

HM Electronics AD10 diversity system



Cygnus receivers CRX and CRX/A
Type: mains or external battery operated, numerical channel and status indicator, *CRX/A* simplified panel version with only on/off on front.
Audio outputs: mic level 30 to 300Ω balanced, line bal or unbal.
Connectors: 7-pin DIN.
Rf sensitivity: 5μV gives 50dB S/N.
Adjacent channel rejection: 80dB.
Antenna: 15cm helical, or external dipole.
Indicators: meter reading battery, signal strength or audio output.
Power: mains or external 12 to 24V.
Construction: compact two-tone blue box with front panel.
Dimensions: 209 x 52 x 150mm, 1.25kg.
Price: *CRX* £289.06; *CRX/A* £277.93.

Overall system specification
Frequency response: 35Hz to 15kHz – 3dB points.
S/N: 64dB, typically 68dB.
Harmonic distortion: less than 0.04%.
Pre and de-emphasis: 50μs.
Carrier frequency range: UK: 174MHz to 175MHz band; Europe: 37.1MHz standard, or 27MHz to 60MHz band; to order 150MHz to 200MHz band.
System prices: including carrying cases handheld system with standard receiver £462.28; pocket system with standard receiver £456.14; handheld with */A* receiver £417.28; pocket with */A* receiver £412.02.

Minkom System
Type: transmitter and receiver are each pocket sized in plastic cases. Specification very similar to *Cygnus* but receiver same as transmitter with 0dB into 8Ω output, 6 hours operation from nicad.
Prices: transmitter £204.44: single channel receiver £244.91; dual channel £251.53.

Sirius System
Type: handheld mic/transmitter with integral Shure *R97* dynamic mic capsule. Specification similar to *Cygnus* system, transmitter has silver zinc rechargeable battery for 8 hours continuous use, receiver has optional switched channels (5 crystals), built-in charger.
Price: system £575.60.

Wide range of rechargeable batteries, vertical and right angle helical aerials, dipole aerials, lapel mics, windshields, and coloured slip on sleeves for handheld mics also available.

HME (USA)

HM Electronics Inc, 6151 Fairmount Avenue, San Diego, Cal 92120.
Phone: (714) 280-6050. Telex: 697122.

WM222/WM225A transmitters
Type: Body Pac pocket transmitters, *WM222* has dynamic expansion providing wide dynamic range but requiring expansion receiver; *WM225A* has soft compression plus adjustable non-clipping limiter.
Audio input: low imp dynamic or electret mics, switchable bias, positive ground, *WM222* – 52dBm, *WM225A* – 65dBm.
Connectors: locking *microplugs*.
Rf power output: 50mW nominal, *WM225A* switchable 50/100mW.
Spurious emissions and harmonics: – 40dB.
Battery: 9V alkaline, 8 hours life; 4 hours for 100mW.
Dimensions: 102 x 64 x 20mm, 142g without battery.
Price: *WM222* $860; *WM225A* $755.

WM250/WM252 transmitters
Type: handheld transmitters, WM250 similar to *WM222* specs, *WM252* similar to *WM255A* specs, but both with either Shure *SM57* or *SM58* elements.
Dimensions: 267 x 30mm diameter, 450g.
Prices: *WM250* $890; *WM252* $990 with either element.

WM122/WM125
Type: mains or externally powered receivers, *WM122* with dynamic expansion capability, *WM125* straight.
Audio outputs: line level bal 600Ω (0dBm), mic level bal 200Ω (– 52dBm), monitor 1V into 50Ω.
Connectors: *XLR* audio, jack monitor.
Rf sensitivity: 1μV for 30dB quieting.
Antenna: 50Ω external dipole or whip.
Indicators: meter for VU, rf or battery.
Power: mains, external battery packs giving from 2 to 70 hours, or 10 to 30V.
Dimensions: 146 x 76 x 178mm. 1.13kg.
Prices: *WM122* $1,295; *WM125* $1,145.

WM152/WM155
Specifications basically similar to *WM122/WM125*, but *Flat Pac* receivers with two or four 9V batteries, or external 10 to 30V.
Dimensions: 146 x 39 x 178mm, 900g.
Prices: *WM152* $1,195; *WM155* $1,130.

WM300
Executive receiver, specification similar to *WM125* but simplified controls and outputs, mains only.
Price: $560.

AD5/AD10 Diversity Systems
Passive diversity systems that combine the outputs of three antennae into one receiver, while *AD10* also provides four outputs.
Prices: *AD5* $565; *AD10* $695, both complete with antennae and cables.

Overall system specification
Frequency response: 100Hz to 15kHz ±2dB.
S/N: 60dB on standard system, 95dB on dynamic expansion system.
Distortion: 1%.
Carrier frequency range: 150MHz to 174MHz, or TV versions 174MHz to 216MHz.

HME produces a wide number of systems composed of the above transmitters and receivers, with roadcases and other accessories.

MARTI (USA)

Marti Electronics Inc, PO Box 661, 1501 N Main, Cheburne, Texas 76031.
Phone: (817) 645-9163.

Marti Electronics manufactures a range of rack and freestanding wideband transmitters and receivers providing broadcast quality for links and reverse talkback purposes. Range includes 8W 950MHz model, and 1W and 40W versions in 150MHz to 172MHz band, and 0.7W and 25W versions in 450MHz to 470MHz band.

MICRON (UK)

Audio Engineering Ltd, 33 Endell Street, London WC2A 9BA.
Phone: 01-836 9373.

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The Professional Choice*

Rogers
BRITISH HIGH·FIDELITY

4/14 Barmeston Road, London SE6 3BN.
Tel: 01-697 8511. Telex: 893980 SWISST.

*Designed by the BBC and manufactured under licence by Rogers in the strictest of quality control environments, the LS5/8 loudspeaker is the choice of the real professional. Worldwide experience and the dedication to faithful sound reproduction that designer and maker share are an unwritten guarantee of excellence in a business where to be without excellence is to be just another studio. Full technical details, professional price list and review reprints are available upon request.

LS5/8 BBC-licensed Studio Monitoring Loudspeaker (Active).
PM510 Studio Monitoring Loudspeaker (Passive). Studio 1 Loudspeaker.
LS3/5A BBC-licensed Miniature Monitoring Loudspeaker.

AMPLIFIERS???

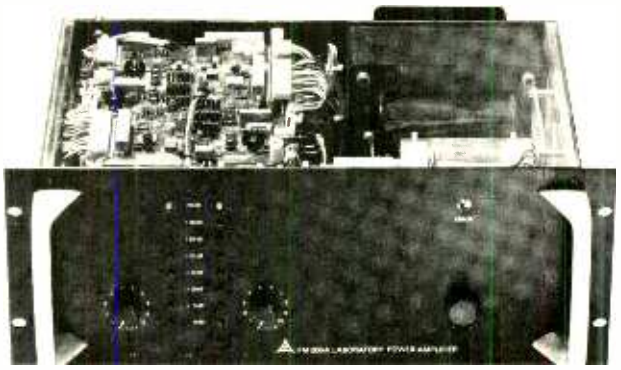
'SEE YOU AT APRS'

There are many so called amplifiers:
- impressive-looking sheet-steel boxes
- distortion generators
- oscillators
- loudspeaker killers
- RF receivers
- DC generators
- low-distortion, but unmusical dummy-load drivers that cannot handle a hefty speaker load

etc., etc.

For a truly stable, superbly engineered, reliable and beautifully natural sounding power amplifier there is only one name to be remembered:

FM ACOUSTICS. There is no alternative.



Distributors:

ASEAN:	LULLA MOTION SINGAPORE, 2528030
BENELUX:	CD TRONICS EDEGEM, 031/402299
CANADA:	PERSPECTIVES AUDIO LORRAINE, 514/6214087
DENMARK:	SC SOUND TAASTRUP, 02/998877
EASTERN EUROPE:	MCI LONDON, 01/3887867
FRANCE:	SINGLETON BARCELONA, 2287602
GERMANY:	HARMAN D HEILBRONN, 0713/4801
GREECE:	LYRIC ATHENS, 01/3606787
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U.K.:	FM ACOUSTICS WEYMOUTH, 0305/784049

All other countries:
FM ACOUSTICS LTD
TIEFENHOFSTRASSE 17
CH-8820 WÄDENSWIL/SWITZERLAND
PHONE: 01/7806444
TELEX: 56058 telag/fma

Survey

Micron 100 series transmitter
Type: available as *101* with one 9V battery, or *102* with larger case and two 9V batteries, pocket packs.
Audio input and connector: uses 8-pin Lemo connector which can directly accept (depending upon links and wiring), 200Ω dynamic (– 74dB), dynamic via 20dB pad 2kΩ (– 54dB), powered for Sennheiser *– 04, – 05, – 15* series mics via pad, powered for Sony *ECM50* 5kΩ unbal, 0dBm line level, AKG *CE10*.
Limiter: 45dB range, 25ms/10dB attack, 10dB/s recovery short term, 10dB/20s long term.
FM deviation: ±75kHz max, normally 22kHz at limiter threshold.
Rf power output: 10mW or 30mW.
Antenna: flexible cable.
Battery: *101* one *PP3* (2 hours), *MN1604* (12 to 15 hours); *102* two *PP3* (6 to 9 hours), *MN1604* (30 hours).
Dimensions: *101* 93 x 62 x 22mm, 235g; *102* 120 x 62 x 22mm, 290g.
Construction: lightweight stainless steel cases.
Prices: *101* £308.40; *102* £313.76.

MR1/MR2 receivers
Type: *MR1* mobile receiver with external power and leather case, and *MR2* mains powered receiver in diecast case with monitor loudspeaker.
Audio output: – 51dB into 50Ω.
Audio connector: *MR1* 3-pin Preh; *MR2 XLR*, jack monitor.
Rf sensitivity: 2μV, 20μV gives 50dB S/N.
Adjacent channel rejection: 80dB.
Image rejection: 60dB.
Antenna: helical or dipole.
Indicators: multi LEDs indicating battery volts, tuning, signal strength and transmitter battery status. A simple table gives quantitative values for various LED combinations.
Dimensions: *MR1* 120 x 95 x 32mm, 445g; *MR2* 185 x 115 x 55mm, 1.22kg.
Power: *MR1* 12V dc from battery pack or recorder *MR2* mains.
Prices: *MR1* £309.75; *MR2* £354.16.

Overall system specification
Frequency response: 50Hz to 16kHz.
S/N: 500μV signal strength 55dB with receiver at max af, 70dB with af gain – 20dB.
Distortion: 0.4%.
Pre and de-emphasis: 50μs.
Carrier frequencies: 30MHz to 50MHz, 100MHz to 200MHz, 400MHz to 500MHz.
Frequency stability: 0.005%.

MDU1 Diversity System
Type: a diversity switch that takes the output of two standard receivers (which already includes signal strength information) and selects the audio output of the highest level receiver. If both are equal, the outputs are summed.
Price: £230.

Audio Engineering intends to introduce a range of rack mounting receivers in the near future which will include dual receiver with diversity types, and an aerial distribution amp allowing a single aerial to feed several receivers.

NADY (USA)
Nady Systems Inc, 1145 65th Street, Oakland, Cal 94608.
Phone: (415) 652-2411.
UK: Hardware House (Sound) Ltd, 34 St Philip's Road, Dalston, London E8.
Phone: 01-249 0916.

Black Systems
Type: pocket transmitter using FM Band II, *Nasty Cordless Black* has high impedance input for musical instruments, *Nady Cordless Black* has low impedance input. Used with good quality FM receiver.
Operating frequency: tunable from 88MHz to 108MHz.
Modulation: wideband FM.
Frequency response: 20Hz to 20kHz ±3dB.
S/N: 65 to 75dB.
Harmonic distortion: less than 1% THD.
Operating range: 250ft.
Features: on/off toggle, vernier action tuning control externally, level adjustment, 30in wire antenna, 9V alkaline battery provides 12 hour operation.
Price: $400 either model.

Blue Systems
Basically similar to the *Black* systems, but use 'lo-noise' circuitry that provides 99dB S/N with less than 1% distortion. Must be used with *Pro 400* or *Pro 500* receivers operating over 88MHz to 108MHz.
Price: *Nady* transmitter $850; *Nasty* transmitter $800; *400* receiver $800; *500* diversity receiver $800.

Nady VHF Systems
Type: pocket or handheld transmitters, fixed frequency with wide dynamic range.
Operating frequency: 150MHz to 216MHz.
Transmitter output: 50mW or 125mW switchable.
Frequency response: 25Hz to 20kHz ±3dB.
S/N: 102dB.
Harmonic distortion: 0.6%.
Modulation: FM, ±15kHz.
Operating range: 1,500ft line of sight, 200ft adverse conditions.
Receivers: basic or diversity available.
Image rejection: 100dB image and spurious rejection.
Prices: VHF high impedance transmitter $900; VHF low impedance transmitter $900; VHF *600* receiver $1,100; VHF *700* true diversity receiver $1,850; VHF handheld mic with Shure *SM58* head $1,000.

RELLO (UK)
Martello Sound Ltd, Eagle Road, Rye, Sussex TN31 7NB.
Phone: 07973 3959. Telex: 95447.

TXR
Type: pocket transmitter.
Audio input: mic level 200Ω on Preh 5-pin socket.
FM deviation: ±75kHz.
Frequency response: 50Hz to 14kHz.
Harmonic distortion: 1%.
Rf output power: 10mW.
Operating frequency: 174.8MHz.
Antenna: free hanging wire.
Batteries: 9V alkaline *MN1604* 2 to 3 hours, silver zinc rechargeable 10 hours.
Dimensions: 57 x 38 x 83mm.
Price: on application.

RXR
Type: mains powered case receiver.
Audio output: mic level 300Ω bal, and 400mV high impedance.
Rf sensitivity: mute at 5μV.

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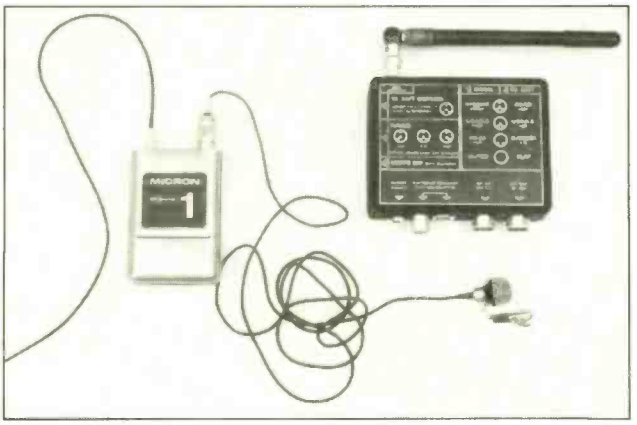
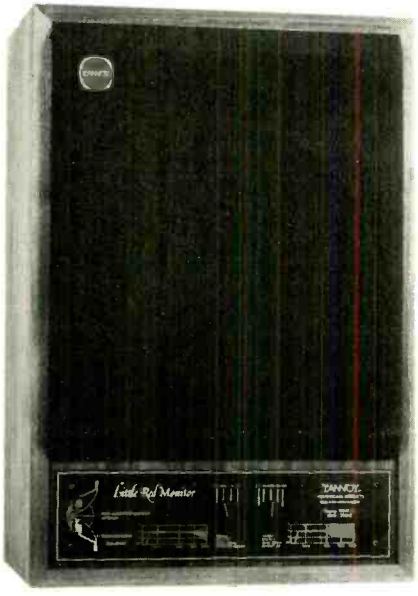
Micron 101 transmitter and MR1 receiver



Like Father...

How many times have you listened to playback in the main control room (or mobile), then moved to a re-mix suite and heard a totally different sound because the monitors in each location possessed totally different sound characteristics?



At Tannoy we set out to solve your problem by creating a Family of Monitors that retained the same sound characteristics, even though their physical size may be different to suit each location and purpose.

You can now be certain that by choosing Tannoy Dual Concentrics for all your monitoring the sound you hear will always be the same—whether you are listening to the Daddy of The Family, the Super Red M1000; or his young son Little Red 12B.

Let The Family make you an offer you just can't refuse.

...like Son

TANNOY®

The Name for Loudspeakers

Tannoy Products Ltd.
77/79 High Street, Watford, Herts WD1 2DT
Telephone: Watford (0923) 48868

Survey

Antenna: telescopic aerial. 75Ω BNC socket.
Power: mains.
Dimensions: 203 × 127 × 51mm.
Price: on application.

Performer
A complete radio microphone system using hand-held transmitter with dynamic ball-top element, and receiver built into custom case, telescopic aerial built into lid, mains powered.
Price: on application.

RF (USA)

RF Technology Inc, 54 Wilton Road, Westport, Connecticut 06880.
Phone: (203) 226 9511.

Transmitter
Type: pocket pack transmitter.
Audio input: – 40dBm to – 60dBm, 3kΩ unbal, will power electrets.
Limiter: 20dB soft.
Frequency response: 50Hz to 10kHz ±1dB, – 3dB at 15kHz.
FM deviation: ±50kHz.
Carrier frequency range: 947MHz to 952MHz, other to order.
Spurious emissions: – 40dB.
Rf power output: 50mW, optional 500mW amp/battery pack.
Antenna: flexible cord.
Battery: 5 hours life.
Dimensions: 76 × 20 × 137mm, 355g.
Price: on application.

RM100 series diversity receivers
Type: *RM100* 5-channel in rack, *RM101* 1-channel pocket pack or strapped to recorder, *RM102* 1-channel in metal case, *RM104* 2-channel in metal case. All with main and diversity receivers.
Audio output: *RM100* line + 8dBm 150Ω bal, – 50dB 150Ω bal, *RM101* – 50dBm 150Ω.
Rf sensitivity: not stated.
Power: *RM100* mains, *RM101* 12V, nicad or AA; *RM102* 12V, mains or nicads; *RM104* 12V or 9 internal D cells.
Dimensions: *RM101* 100 × 33 × 140mm, 650g; *RM102/4* 230 × 310 × 50mm.
Prices: on application.

SCHAFFER (USA)

The Ken Schaffer Group Inc, 10 East 49th Street, New York, NY 10017.
Phone: (212) 371-2335.

B and T
Type: pocket transmitter and battery or mains powered receiver, transmitters available with high or low impedance inputs.
Operating frequency: 50MHz to 216MHz, single channel only.
Frequency response: 50Hz to 15kHz ±2dB.
S/N: 90dB.
Distortion: 1%.
Range: with 'proper antenna placement' 600ft.
Battery: 9V, 6 hours life.
Receiver sensitivity: 1μV for 20dB quieting.
Image rejection: – 70dB.
Price: system $2.150.

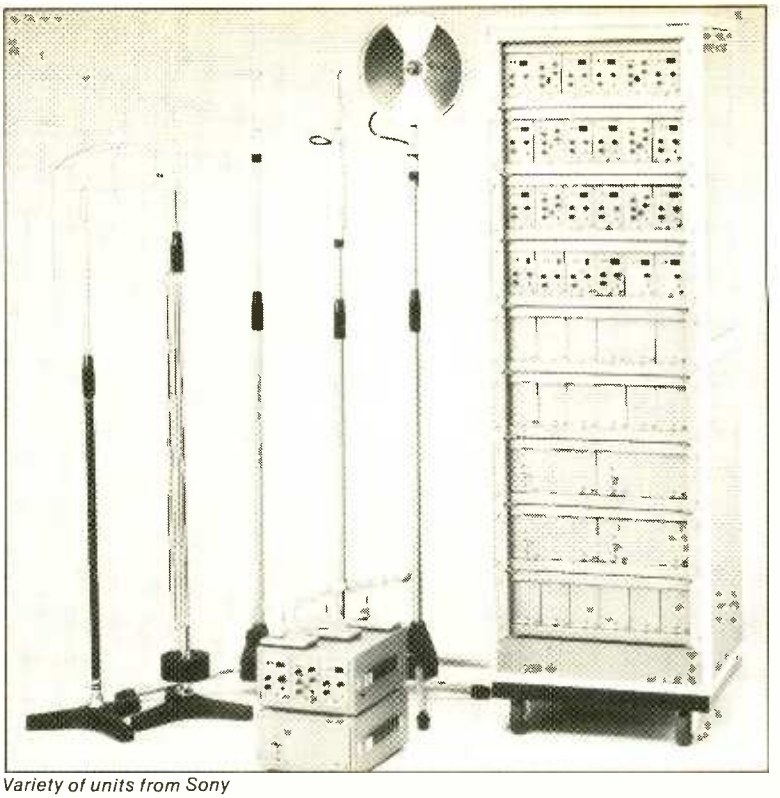
SENNHEISER (West Germany)

Sennheiser Electronic, D-3002 Wedemark 2.
Phone: 05130 8011. Telex: 0924623.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG.
Phone: 02813 88447/89221. Telex: 84969.
USA: Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018.
Phone: (212) 239-0190.

SK1010-9
Type: pocket pack transmitter that also includes removable mic elements and has optional neck noose. Omni or cardioid elements.
Audio input: 8-pin connector with 1mV input for 40kHz swing.
Limiter: 36dB range.
Carrier frequency bands: 30MHz to 45MHz, 140MHz to 174MHz; UK 174MHz.
Rf output power: 50mW.
Antenna: flexible.
Battery: 9V, 8 to 48 hours life depending upon type.
Dimensions: 150 × 46 × 24mm, 226g.
Price: £334, mic element omni £30, cardioid £44.47.

EM1010-4 receiver
Type: cabinet mounted receiver, built-in monitor loudspeaker.
Audio outputs: 1.55V, 200Ω.
Connector: DIN.
Rf sensitivity: 2μV, 10μV gives 50dB S/N, 50μV gives 65dB.
Indicators: meter for field strength, audio and battery.
Power: mains, twin 9V batteries or 12 to 21V.
Dimensions: 294 × 172 × 97mm.
Price: £350.76.

Sennheiser also has systems operating in the 72MHz to 76MHz, 25MHz to 110MHz and 40MHz to 44MHz bands.



Variety of units from Sony

SONY (Japan)

UK: Sony Broadcast, City Wall House, Basing View, Basingstoke, Hants RG21 2LA.
Phone: 0256 55011. Telex: 858424.
USA: Sony Corporation of America, 9 W 57th Street, New York, NY 10019.
Phone: (212) 371-5800. Telex: 424595.

WRT42/WRT57/WRT27 transmitters
Type: *WRT42* VHF handheld, *WRT57* UHF handheld, *WRT27* UHF pocket pack. Handheld have cardioid electret elements.
Audio input: *WRT27* 4kΩ suitable for *ECM50* mic. Also dynamic mics.
Connector: 4-pin.
Frequency bands: VHF 40MHz to 47MHz, UHF 470MHz to 488MHz, 900MHz to 950MHz.
FM deviation: VHF 2kHz, UHF 2.4kHz.
Rf power output: 30mW, available for any national standard.
Antenna: flexible wire.
Battery: 9V mercury cell. VHF model 3 hours. UHF 2 to 5 hours.
Dimensions: handheld 171 long × 20mm diameter, pocket 59 × 20 × 82mm.
Price: *WRT27* £630; *WRT57* £610.

WRR52/WRR57/WRR27
Type: *WRR52* VHF module mount, *WRR57* UHF module mount, *WRR27* portable, shoulder slung.
Rf sensitivity: muting level —30dB. S/N 55dB with 60dB rf input.
Frequency response: 100Hz to 15kHz.
Audio output: – 20dBm 600Ω, portable – 64dBm 600Ω.
Power: dc 24V, portable, 9V battery.
Dimensions: 68 × 89 × 205mm, portable 148 × 35 × 106mm, 800g.
Prices: *WRR27* £1,650; *WRR55* £1,400; *WRR57* £1,600.

Sony also produce diversity units for separate receivers and tuner base and portable base units.

SWINTEK (USA)

Swintek Enterprises Inc, 1180 Aster Avenue, Unit J, Sunnyvale, Cal 94086.
Phone: (408) 249-5594.
UK: Optical and Textile Ltd, Barnet Trading Estate, Park Road, High Barnet, Herts.
Phone: 01-441 2199/0098. Telex: 934756.

SM58/dB-S Transmitter
Lightweight handheld VHF transmitter with *SM58* (*SM57* optional) head. External comp/limiter adjustment. Silver, black or gold. Features *dB-S* companion system and 80dB dynamic range.
Price: £761.

M500/dB-S Handheld VHF transmitter for rock audio levels with Beyer *M500* head.
Price: £289.

1L Receiver
Ac VHF receiver with peak audio, field strength, ac, internal dc, LED indicators. Helical front-end and crystal IF. Aux dc input, ext dc switch, ext squelch switch. Balanced mic level outputs on *XLR*-style connector, high-level and headset outputs. Whip antenna, ac lead, NiCd batteries.
Price: £732 *w/dB-S*.

50A/dBS *Body Pac*
VHF transmitter with step attenuation, input impedance switch, condenser mic bias, LED audio indicator, comp/limiter, music input, optional ENG model with high-gain mode.
Prices: £596; ENG model £633.

50/UHF/dBS
Body Pac UHF transmitter similar to 50A. Complementary UHF receiver available.
Price: £726 transmitter, £899 receiver.

Mark 3
Portable dc VHF receiver, AA battery power or ext 12V dc, LED indicators for field strength, audio, battery on. *XLR* connector, internal high-level switch, LEMO power input plug.
Price: £628.

Mark Q
Dc body VHF receiver, 12dB SINAD at 0.3μV, unbal low-level output at 0.3dBV. Two 9V battery power or ext 12 to 18Vdc, ext LED for battery and audio level. Adjustable line out at 10dBV. Pocket size, weight 9oz. *dB-S* option.
Price: £599 (inc *dB-S*).

A wide range of transmitter, receiver, antenna and complete system options are also available. ■

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SOMERSET. TA6 3LP TEL 0278-424560 (24 HR ANSAPHONE).

Survey: Microphone stands

Keith Monks MSW stand with counterbalanced boom arm

Noise free operation with panning and tilt handle control. Rear boom overhang is short making it useful in confined areas. Boom length from the pivot point is 96 to 202in. Tilt of boom can be adjusted from +25°/—31° to the horizontal position. The boom can be mounted on the *Compact* pram *540-011* enabling the height of the boom pivot to be adjusted between 78¼ to 120in. The boom can be rotated through a full 360° plane with telescopic wheel axles to increase stability and collapsible side flaps increase manoeuvrability.
Price: on application.

ACCURATE SOUND (USA)

Accurate Sound Corp, 114 5th Avenue, Redwood City, Cal 94063.
Phone: (415) 365-2843. Telex: 348327.

Starbird microphone boom
Substantial rubber castor mounted stand with 360° rotation boom arm, counter balance weight, various microphone adaptors.

AEA (USA)

Audio Engineering Associates, 1029 North Allen Avenue, Pasadena, Cal 91104.
Phone: (213) 798-9127.

Mic stands
Range of collapsible mic stands, brushed aluminium finish, three models, *AEA/4707* 18in to 7ft, *AEA/428* 28in to 12ft, *AEA/532* 32in to 15ft.
Price: $40, $60 and $85 respectively.

AKG (Austria)

AKG GmbH, Brunhildengasse 1, A-1150 Wien.
Phone: (0222) 92.16.47. Telex: 11839.
UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.
Phone: 01-749 2042. Telex: 28938.
USA: AKG Acoustics Inc, 77 Selleck Street, Stamford, Connecticut 06902.
Phone: (203) 348-2121.

ST30
Lightweight telescopic boom stand adjustable between 80 and 143cm with collapsible legs (tripod radius approx 49.5cm), and 70cm boom arm with securing lock. Weight 1.36kg.
Price: on application.

ST102A
Studio boom stand, telescopic upright adjustable between 91 and 163cm, with 70cm boom arm and screw mounted legs, tripod radius 37cm. Weight 4.9kg.
Price: £37, fixed boom £16, telescopic £18.

ST200
Telescopic upright stand adjustable between 110 and 180cm with collapsible legs, radius 37cm. Weight 3.55kg.
Price: £40.

ST12
Massive cast iron base with telescopic tube adjustable between 35 and 55cm, circular base 18cm diameter, weight 2.35kg.
Price: £20.

ST4A/41/43
Rectangular solid base with rubber feet for gooseneck mics, stand adaptors and flexible shafts. 150 x 90 x 23mm. Weight 360g.
Price: *ST4A* £11; *ST41* has additional signal lamp and switch £24; *ST43* three switches £36.

AKG also manufactures a range of goosenecks, stand adaptors, numerous mounting facilities, windshields and extensive accessories for the CMS range of capacitor mics.

ALTEC (USA)

Altec Corp, 1515 South Manchester, Anaheim, Cal 92803.
Phone: (714) 774-2900. Telex: 655415.
UK: Theatre Projects Services Ltd, 10 Long Acre, London WC2E 9LN.
Phone: 01-240 5411. Telex: 27522.

UMS100/101/102/103
Mic stands with heavy circular bases and adjustable telescopic upright, 88 to 160cm, base 25cm diameter except *103* which is 30cm, *100/103* both black wrinkle finish, *101/102* bright chrome.

UMS110/111
Mic stand with heavy circular base and adjustable telescopic upright, 87 to 162cm diameter, *110* black wrinkle, *111* bright chrome.

UDS100/101
Desk stands with circular base, *100* 10cm upright, *101* 20 to 33cm adjustable upright, 15cm diameter bright chrome base.

UBB100
Boom attachment with solid machined brass swivel mount.

UBB200
Baby boom attachment with all chrome steel counterweight and ratchet-type lock.

UBS200
Guitar mic holder which holds two mics and is completely adjustable in level, includes 15cm tube.

Altec also manufactures goosenecks, and various adaptors.

ATLAS SOUND (USA)

Atlas Sound, 10 Pomeroy Road, Parsippany, New Jersey 07054.
Phone: (201) 887-7800.

SB-100W
Boom stand with 110in boom, height adjustable 61½ to 91½in. Operator controlled 350° microphone follower. Tapered counterweight, cable guide clips and hanger. Base with three heavy duty lockable wheels.
Price: $513.90.

SB-36/SB-36W
Boom stand with solid tripod-shaped base. Grip action clutch with air suspension system for counter-balance. Boom length 62in and adjustable height 48 to 72in.
Price: *SB-36* $148.60 (general purpose); *SB-36W* $170.85 (stage version).

Atlas also produce a wide selection of general purpose upright, desk and special purpose stands with accessories.

BERKEY (USA)

Berkey Colortran Inc, 1015 Chestnut Street, Burbank, Cal 91502.
Phone: (213) 843-1200. Telex: 677252.
UK: Berkey Colortran UK, PO Box 5, Burrell Way, Thetford, Norfolk IP24 3RB.
Phone: 0842 2484. Telex: 81294.

Compact microphone boom 540-009
Boom uses automatic balancing and stainless steel wire pulley system for extension control.

BEYER (West Germany)

Beyer Dynamic, PO Box 1320, D-7100 Heilbronn.
Phone: 071 31.82.348. Telex 728771
UK: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex RH16 3DP.
Phone: 0444 51003
USA: Burns Audiotronics Inc, 505 Burns Avenue, Hicksville, New York, NY. 11801
Phone: (516) 935-8000.

ST220
Anti-vibration stand, adjustable column 83 to 157cm height range, weight 2.6kg, stove enamelled folding legs.
Price: £30.64

ST199
Lightweight stand, adjustable 30 to 150cm height, weight 1.3kg.
Price: £14.11.

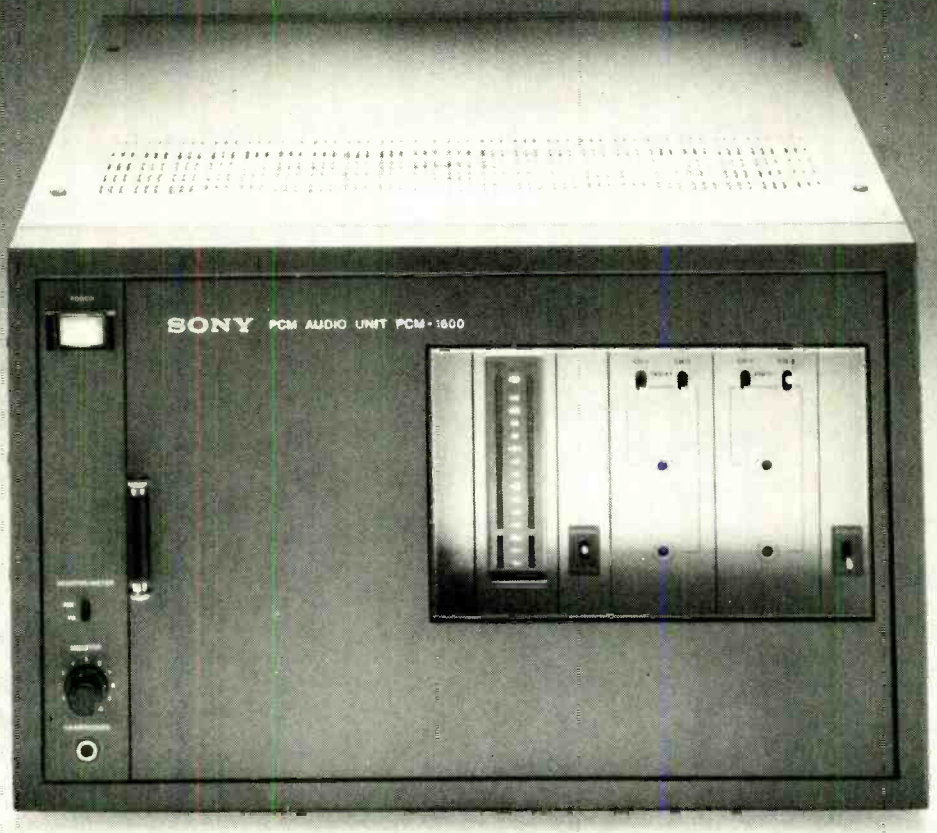
ST201/1
Standard stand, noiselessly adjustable with rubber shock absorbers, screw-in legs, height 83 to 150cm, weight 2.8kg.
Price: basic £16.05; *ST201/A1* with heavier legs £18.18; *ST201/2* with foldaway legs £16.53; *ST201/A2* with heavy duty foldaway legs £19.30; *ST210/1* similar to *ST201/A1* with 71cm boom £27.26; *ST210/2* similar to *ST201/A2* with 71cm boom £28.42.

ST251
3-section adjustable stand with folding legs, height 60 to 152cm, weight 3.2kg.
Price: £19.57; *ST252* similar but with 66cm adjustable boom, £29.54.

96 ▶

THE DIGITAL AUDIO REVOLUTION HAS BEGUN

The Sony PCM 1600



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* Electronic editing capability, using the D.A.E.1100, to an accuracy of 363 microseconds.

The PCM 1600 is available from stock. Contact FELDON AUDIO LIMITED for further details.

U.K. Distributors

Feldon Audio Ltd.,

126 Great Portland Street, London W1N 5PH Tel: 01-580 4314. Telex: London 28668.

Survey

ST205A1
Lightweight stand with flat section folding legs, height 91 to 152cm.
Price: £14.23.

ST212
Heavy duty stand with 2-section column, height 1.5 to 2.25m, boom reach 0.9 to 1.8m, stand weight 5.5kg.
Price: £81.47.

ST195
Heavy duty stand for mounting PA cabinets, removable folding base, stove enamelled base, height 1.1 to 1.7m.
Price: £40.12.

ST208A
Heavy duty stand with 4-section column extending to 4.5m.
Price: £110.12.

ST255
Short column stand with telescopic boom with reach 83 to 152cm.
Price: £26.91.

ST259
Drum stand with boom.
Price: £25.43.

Beyer also manufacture a range of table stands, goosenecks, clamps and accessories.

EAGLE (Japan)

UK: Eagle International, Precision Centre, Heather Park Gate, Wembley HA0 1SU.
Phone: 01-902 8832. Telex: 922131.

FS2/FSB2
Adjustable stands with two section, max height 1.4m, snap fit legs, 32cm each.
Price: £14.50; *FSB2* with boom 84cm £19.75.

FS268/BA132
Adjustable stand with extra long detachable legs and speedlock adjustment.
Price: £24.95; *BA132* is 70cm boom arm £16.70.

Eagle interchangeable PRO range

Keith Monks MS/PA toggle stand

PRO range
Range of interchangeable parts enabling a variety of stands to be constructed. Basic parts as follows: *S1N* 28cm short stem £4.65, *S2N* telescopic stem 80 to 150cm £11.30, *S3N* collapsible tripod base with folding legs. £11.75, *S4N* boom arm with counterweight, length 79cm £10.70, *S5N* similar boom but 102cm long £12.15, *S6N* swanneck extension for stems and booms £6.90.

DS1N
Desk mic stand with a 130mm diameter base and removeable 136mm stem, £2.90.

DS2
Telescopic two section desk mic stand adjustable from 230mm to 390mm, £6.90.

DS3
Desk mic stand with a 76° angle and 'V' shaped base. Removeable 122mm stem, £3.75.

FLEXO (USA)

Harris Corp, PO Box 4290, Quincy, Illinois 62301.
Phone: (217) 222-8200. Telex: 404347.

Mikester arms
Range of mic arms that remain in the position set while holding a mic of up to 4lbs. Consists of two sections with hinged joints and a mounting bracket. Max extension: 36in in any direction. Cable clips and enamel finish. General model clamps or screws to any surface. Bracket version is for wall or vertical mounting. The floor model is the same as the general model but on a 40in floor stand with a heavy 13in diameter base.
Price: General model $34.95; Bracket model $44.95; Floor model $79.95.

KEITH MONKS (UK)

Keith Monks (Audio) Ltd, 26-28 Reading Road South, Fleet, Hants GV13 9QL.
Phone: 02514 20568. Telex: 858606.
USA: Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906.
Phone: (203) 348-4969.

MS/M and BA/M
Heavy duty mic stands of medium weight, height 98 to 180cm, three 35cm long screw legs, 4.3kg weight, available in chrome, or plastic finish in red, black, light blue, white, yellow, metallic grey. *BA/M* boom/arm also in chrome or colour.
Prices: *MS/M* stand £22.40; *BA/M* boom £12.50.

MS/S and BA/S
Lightweight mic stands, height 96 to 117cm, three screw legs, weight 2.72kg. Chrome or black plastic finish. Boom arm *BA/S*.
Prices: *MS/S* £14.30; *BA/S* £9.40.

MS/L and BA/L
Heavy duty floor stand forming the base for the *Studio* series, four screw legs, *MS/L14* 35cm long, *MS/L22* 56cm long, height 114 to 213cm. *BA/L42* boom arm has 0.9kg counterbalance weight, 98 to 121cm reach, *BAL/72* boom arm has 1.8kg weight, reach 170 to 210cm. *EXT/1* allows the *BA/L* booms to be lengthened by 91cm and can be stowed inside boom when not in use.
Prices: *MS/L/14* £29.70; *MS/L/22* £34.40; *BA/L/42* £16.90; *BA/L/72* £25.20; *EXT/1* £7.85.

MS/W
Studio stand with wheels, reinforced base assembly, with a spread of 80cm, includes four chromed screws with rubber suction cups which enable the stand to be locked in position. Takes both *BA/L* booms, Height 118 to 208cm.
Price: £60.90.

MS/CT/2
Chrome floor stand with 5kg cast base, height 96 to 117cm, weight 6.57kg.
Price: £23.20.

MS/LM and MS/LCT/2
Low floor stand, similar to *MS/M* and *MS/LC/2* respectively, but only 50 to 91cm height range.
Price: £20.20 and £20.80.

MS/F/2
Folding floor stand, height 71 to 183cm, three folding legs, weight 3.5kg.
Price: £23.90.

DB/1, DB/2 and CF
Drum boom arms which attach to *MS/CT* or *MS/M* stands giving 360° coverage in a 71cm length from the clamp, *DB/1* 53 to 96cm, *DB/2* 91 to 168cm. *CF* is a 180cm ceiling or wall mounting fitting to which the *DB* clamps may be attached, thus freeing the studio floor of stands and cables.
Prices: *DB/1* £12.50; *DB/2* £15.80; *CF* £33.50.

BS/1/B and BS/2/B
Banqueting stands for table or floor use, with telescopic tube that can be angled or upright; *BS/1/B* height 30 to 53cm, 2.15kg; *BS/2/B* height 48 to 81cm, 3.75kg.
Prices: *BS/1/B* £16; *BS/2/B* £20.60.

MS/PA/C
Toggle stand with telescopic upright that provides 180° vertical coverage, four screw legs, 132 to 215cm, weight 6.12kg.
Price: £29.90.

Keith Monks also manufactures a wide range of clamps, stereo bars, spring grip clamps, table stands, goosenecks, and 18-thread adaptors.

LUXO (USA)

USA: Harris Corp, PO Box 4290, Quincy, Illinois 62301.
Phone: (217) 222-8200. Telex: 404347.

Multipurpose arms
Range of multipurpose arms that can be used for holding mics. All the range are spring balanced and stay where positioned with loads of up to 6lb and reaches of 21 to 56in. The arms can be mounted using a variety of fixing brackets.
Prices: $19.95 to $49.95.

MATTHEWS (USA)

Matthews Studio Equipment Inc, 2405 Empire Avenue, Burbank, Cal 91504.
Phone: (213) 849-6811. Telex: 691599.

Studio stand
Tripod stand, foldable to 41in, and adjustable in two sections from 41 to 112in. Weight 8lb.
Price: $139.

Concert stand
Similar to the *Studio* stand but with articulated leg.
Price: $161.

Location stand
Tripod stand with articulated leg, folded height of 57in, min height of 53in and extendable to 196in in four sections. Weight 131lb.
Price: $355.

Pro Roller
Tripod stand mounted on locking wheels, folded height of 62in, and extendable from 66 to 210in in four sections. Weight 30lb.
Price: $318.

98 ▶

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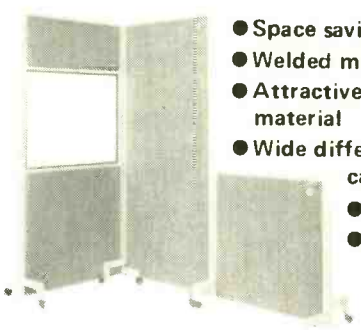

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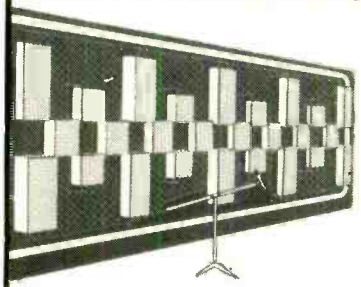

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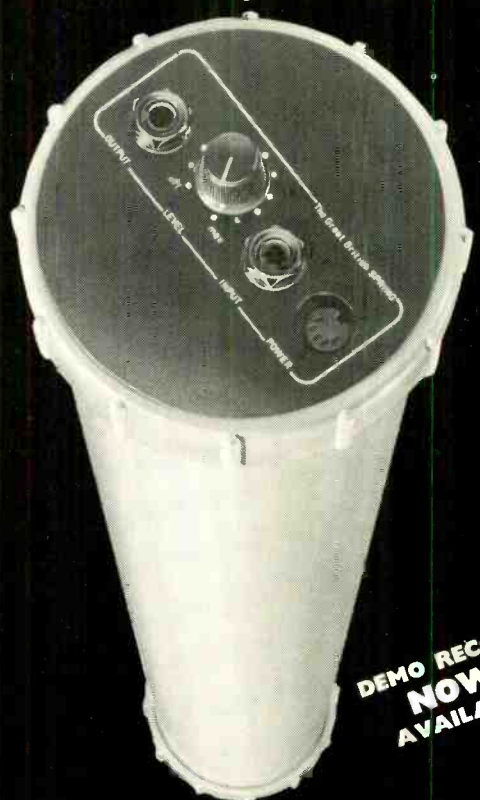
The six spring paths produce a natural sounding reverberation that is full at the low end and sparkling on the highs. But don't take our word for it. Fifty pence brings you our demo cassette, or drop in and hear it live.



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01-458 9133

DON LARKING AUDIO, 50 Cheapside, Luton, Beds
0582 26693

BUZZ MUSIC, 65 Widemarsh Street, Hereford
0432 55961

Survey

High Roller
Larger version of *Pro Roller* with folded height of 8¼in, extendable from 84 to 266 in. Weight 35lbs.
Price: $335.

All the stands can be fitted with a 6ft boom arm if needed. Wheels are also available for the stands not fitted with them as standard.

MOLE-RICHARDSON (USA)

Mole-Richardson Co, 937 North Sycamore Avenue, Hollywood, Cal 90038.
Phone: (213) 851-0111. Telex: 910-321 4615.

Type 103B
Boom with adjustable length of 158¼ to 274¾in in two sections. System of control cords enables adjustment of boom length with one hand and the ability to rotate the mic through 320° with the other hand. Automatic counterbalancing during length adjustment in addition to counterweight box containing nine weights allowing for adjustments for the weight of different mics used with the boom. This boom may be mounted on *Type 500572* folding *Crank-up Litewate* stand with wheeled tripod or the *Type 126B* perambulator with pneumatic tyres and adjustable overall width. There is also a range of mic hangers for different mics.
Price: $3,300.

MUSIC TECHNOLOGY (USA)

Music Technology Inc, 105 Fifth Avenue, Gardena City Park, New York, NY 11040.
Phone: (516) 747-7890.

Microphone stand
Tripod base, boom stand with rubber stoppers to prevent mic from accidentally banging against stand or boom trapping fingers when collapsed. Can be used with second boom or gooseneck fitting.
Price: on application.

NEUMANN/DANNER (West Germany)

Georg Neumann GmbH, Charlottenstrasse 3, D-1000 Berlin 61.
Phone: 030 251-4091. Telex: 184595.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014.
Phone: (212) 741 7411. Telex: 129269.

M31
Basic stand with solid base, height 110 to 180cm.
Price: £47.27.

M32
Collapsible tripod leg stand, height 90 to 180cm.
Price: £76.15.

M35/G35
Substantial stand, 8.5kg, max height 5m, minimum 1.4m, tripod legs.
Price: £239; *G35* boom arm 2.5m long £206.

M184
Substantial stand with solid wheeled base, 4.5m height, 60kg, with boom.
Price: £695.

M272 series
Series of stands with solid circular base, height 1.2 to 2m, and with built-in wired connector for mic, available in five types to fit most Neumann mics.
Prices: £288 to £298.

MFS31 series
Series of mic stands with built-in connector on gooseneck.
Price: about £97.35.

MA
Fishpole with min 1.25m length, max 3.75, weight 0.55kg, swivel mic holder.
Price: £132.68.

Neumann also produces goosenecks, stand adaptors, and elastic suspension units.

P & N (UK)

The Peter & Nicholas Engineering Co Ltd, Treforest Industrial Estate, Treforest, Mid-Glamorgan CF37 5.
Phone: 044385 2453.

167
Economy stand, lightweight, screw height adjustment, push-in legs, height 83.9 to 157.5cm, 1.8kg.
Price: £12.80.

119 series
Low level mic stand with curved boom arm providing 151cm max vertical extension, *S* screw leg base, *F* folding base.
Price: *119S* £30.20; *119F* £31.30.

138PB/139PB
Stand with polypropylene base which receives three push-in tubular legs, and has vertical holes for leg storage, height 81 to 150cm, weight 2.15kg.
Price: £14.75, *139PB* with boom arm £24.60.

102/CT102 series
Heavy duty mic stands with long or short boom, height 87 to 156cm, *S* screw leg base 3.9kg, *F* folding leg base, *R* round solid base 4.1kg. *CT102 series* similar with curved top tube and adjustable adaptor for a second mic.
Prices: *102F* £22.25, *CT102F* £27.20.

162 Series
Boom mic stand adjustable to a vertical stand, height adjustable between 1.75 and 1.01m.
Price: *162F* £32.25.

118R
Low level telescopic boom mic stand, height 55mm, weight 3.1kg. Suitable for piano and drum miking.
Price: £22.00.

P & N also have available a range of table stands, separate stand components, hi-fi speaker and disco stands, music and conductors' stands, and accessories.

SENNHEISER (West Germany)

Sennheiser Electronic, D-3002 Wedemark 2, Hanover.
Phone: 05130 8011. Telex: 0924623.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG.
Phone: 02813 88447/89221. Telex: 84969.
USA: Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018.
Phone: (212) 239-0190.

Wyndcliff Coombi-Major stand and boom

MZS142
Lightweight floor stand, height 41 to 138cm, collapsible.
Price: £11.47.

MZS144
Floor stand with rubber tipped detachable legs, height 84 to 158cm.
Price: £15.44.

MZS210
Deluxe floor stand, heavy duty with antivibration mounts in legs, height 84 to 158cm.
Price: £27.89.

MZS211
Boom arm for mic stand extension 84cm.
Price: £10.09.

SHURE (USA)

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204.
Phone: (312) 866-2200. Telex: 724381.
UK: Shure Electronics Ltd, Eccleston Road, Maidstone, Kent ME15 6AU.
Phone: 0622 59881. Telex: 96121.

MS10C
Regular floor stand, positive ring lock, adjusts 89 to 160cm height, weighted circular 10in diameter base.
Price: £15.60.

BB44
Baby boom 78cm reach.
Price: £10.80.

MS20
Heavy duty floor stand, rubber feet and decoupling, 94 to 168cm range, base 12in diameter.
Price: £21.

S15
Very lightweight tripod stand, fully adjustable between 1.06m and 4.3m. Carrying bag supplied.
Price: £51.

Shure also produce a wide range of mic holders, windshields, table stands and mounts.

SONY (Japan)

UK: Sony (UK) Ltd, Pyrene House, Sunbury-on-Thames, Middlesex.
Phone: 09327 89581/876441. Telex: 266371.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314. Telex: 28668.
USA: Sony Corporation of America, 9 W 57th Street New York, NY 10019.
Phone: (212) 371-5800. Telex: 424595.

B-401N
Boom floor stand, folding legs, two sections 85 to 145cm height range, boom 82cm reach, weight 3.9kg.
Price: on application.

VALAN (UK)

Valan Electrics, 1034 Yardley Wood, Warstock, Birmingham B14 4BW.
Phone: 021-474 2229.

Range of goosenecks and mic mounting bars.

WYNDCLIFF (UK)

Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH.
Phone: 01-668 3448.

HD1
Double extension stand complete with roller castors, heavy duty, height 117 to 260cm, folded length 94cm, weight 4.4kg.
Price: £35.

HD2
Single extension, otherwise similar to *HD1*.
Price: £32.50.

Coombi-Major
Lightweight boom stand, height 147cm, boom arm 40cm, weight 1.59kg.
Price: £25, boom *4/4* £12.80.

FH/84 fishpole
Fishpole with min length of 128cm, max 239cm, weight 0.675kg, variety of mounts.
Price: £20.

Wyndcliff produces a range of head accessories for these stands. ■

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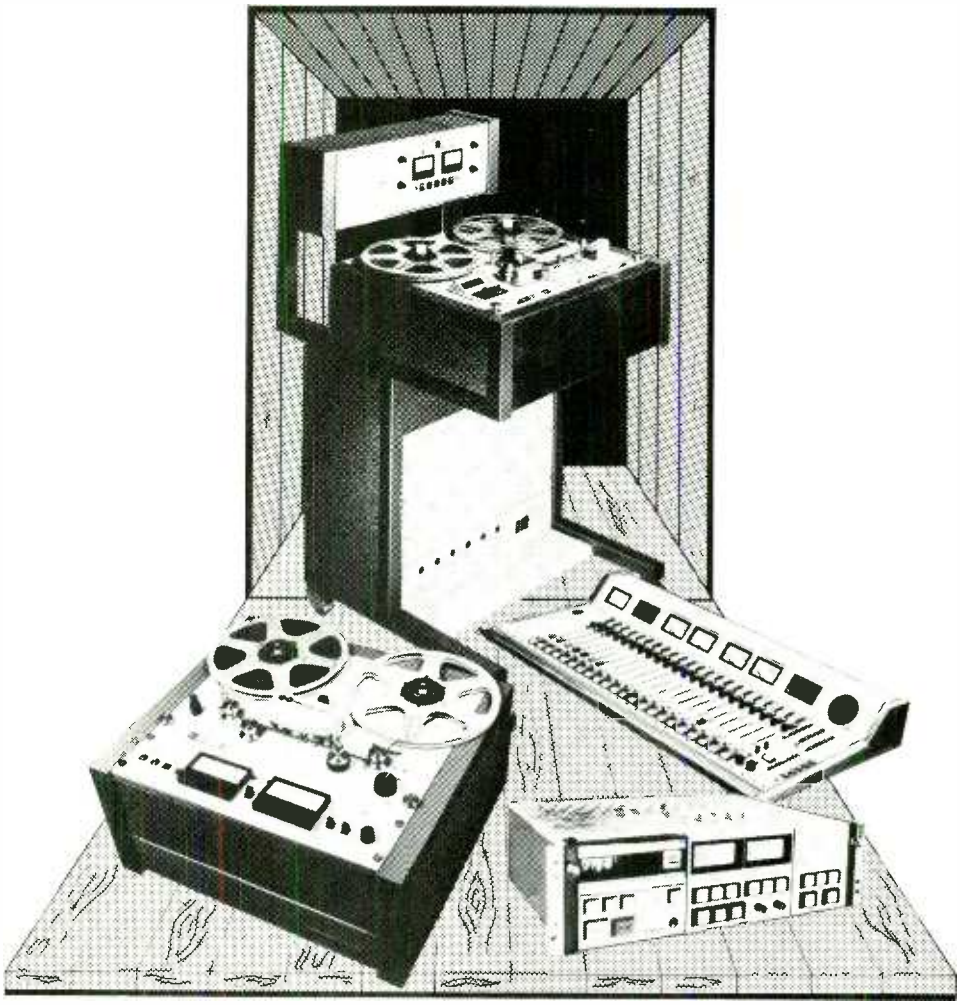
package



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MANUFACTURER'S SPECIFICATION
Overall system *(dB-S 5000 Series)*
Frequency response: ±2dB 30Hz to 12kHz.
S/N ratio: better than 85dB.
Total harmonic distortion: less than 0.7%.
Operating temperature: −20 to +60°C.
Rf carrier frequency: 150MHz to 220MHz standard. Customer to specify.
Frequency stability: 0.0015% (crystal controlled).
Modulation: 10kHz deviation, frequency modulation with transmitter pre-emphasis and matching receiver de-emphasis.
System range: S/N ratio in excess of 70dB at 100 feet typical, ½ mile on clear channel.
Carrying case: one Cycolac case per system.

***Mark 50A dB-S* Lavalier transmitter**
FCC type No: TV and MP: *FCC TX Data WMS-111-50A; TV (161 band): FCC TX Data WMS-111-50B;* Business: *FCC TX Data WMS-111-50.*
Rf output power: 50mW typical.
Rf radiation: 10kμV/m at 50ft typical.
Radiated harmonic and spurious: less than 40dB.
Modulation limiter: Swintek audio scaling expander/compander *dB-S.*
Mic input: positive or negative (switchable) phantom bias for Sony *ECM50,* AKG *C 567, Mini-Mic, EVCO85,* etc. through miniature phone plug with locking collar.
Bias voltage: −2Vdc to 7.2Vdc at 5kΩ source impedance.
Inst input: high impedance 100kΩ input accepts line drive level.
Audio level: internal 5-position step level adjustment with a range of 40dB, externally adjustable.
Battery life: 10 hours typical for standard mercury transistor radio type, *MN 1604.*
Antenna: durable 18in flexible lead.
Weight: 5oz.
Dimensions: (whd) 2.25 × 3.75 × 0.85in.

General receiver
Rf sensitivity: 0.25μV for 12dB SINAD.
Ultimate quieting: 85dB typical.
Audio squelch sensitivity: 0.5μV.
Bandwidth acceptance: 30kHz at 1μV, 36kHz at 100μV.
Adjacent channel rejection: better than 70dB.
Image and spurious response attenuation: better than 70dB.
Hum and noise ratio: 70dB unsquelched or squelched, typical.
Antenna impedance: 50Ω to 75Ω.
If: crystal standard 30dB BW ±35kHz; option *IF69* 60dB BW ±45kHz.
Optional: 5kHz deviation filter package on request.

***Mark 2L* Receiver audio outputs**
Mic level: balanced 50Ω to 250Ω, −36dBV max level, 3-pin *XLR* connector, pin 2 and 3.
High level: unbalanced, 0dBV max, 47kΩ phone jack.
Line level and headset: unbalanced, +10dBV, 100Ω adjustable audio level, phone jack.
Power source: 115Vac 50/60Hz, external 12-24Vdc, optional 230Vac 50/60Hz, and internal *Nicad* battery pack.
Dimensions: (whd) 5.4 × 3.0 × 7.0ins, ¼-wave whip antenna, 18in long.
Weight: 3.5lb.

***Mark 2L dB-S* receiver controls and connectors**
Front panel: on/off ac and battery power switch, *LED* monitor and low impedance *XLR* connector.
Rear of case: ac power connector, line, high level and audio monitor output phone jacks, transmitter battery charger VHF antenna connector, and external dc input.
Internal: fuse, audio master level control.

Manufacturer: Swintek Enterprises Inc, 1180 Aster Avenue, Sunnyvale, California 94086, USA.
UK: Optical and Textile Ltd, Barnet Trading Estate, Park Road, High Barnet, Hertfordshire.

THIS Swintek radio microphone system uses a system coined *dB-S* by Swintek. In effect this is an audio compression system in the transmitter before the modulator with complimentary expansion in the receiver. Not only does this system, in theory at least, increase the available dynamic range but also it leads to a reduction in the interference susceptibility of the receiver.

The complete system including the transmitter, receiver, mic, aerials and connecting leads is supplied in an alloy-framed, moulded plastic carrying case within which a plastic moulding has compartments for the contents with a rubber cushion within the lid. A sensible carrying handle is fitted with locks being provided on the two catches.

Turning first to the transmitter, this is housed in a metal case about the size of a packet of king-size cigarettes with three 2.5mm jack sockets in the top which also has a slide switch to turn the transmitter on and off. One jack socket connects the antenna in the form of a 550mm long and approximately 3.5mm diameter rather stiff wire. The remaining two jack sockets permit the connection of a mic and a high level 'instrument' input.

The choice of 3.5mm jack sockets for connectors is unfortunate as they do not provide any mechanical security for the connection wires which can readily and accidently fall out of the sockets. Locking connectors would be a far better arrangement and I'm not too happy about jack sockets at 174MHz!

One hole in the side of the case allows screwdriver adjustment of the mic input sensitivity over a 40dB range in 10dB steps with a second hole providing sight of a red LED indicator which acts as a power on indicator and also as a modulation indicator.

Undoing a screw in the side of the case allows it

102 ▶

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to be hinged open with a hinge at the base, the securing screw sensibly being captive. Within the case the *PP3* size (eg *MN1604*) battery fits into fixed connectors in the bottom of the case with the electronics being packed onto a pcb occupying the rest of the space. An alloy plate with screen printed identifications is secured over the electronics section by four screws with access holes for the various controls which comprise the mic input sensitivity switch, a high level input sensitivity pot, a mic bias voltage control and a transmitter frequency trimmer.

Overall the mechanical construction of the transmitter is solid and should withstand rough handling.

Turning now to the receiver, this is housed in a tubular metal section which is secured to the receiver chassis by four screws which support the plastic feet. The receiver itself is mounted on to an alloy plate which supports the front and rear panels.

At the front panel there are two slide switches for switching on and off either the ac or an external dc power supply, an LED 'power on' indicator being provided. A balanced output at mic level in the form of an *XLR* plug is fitted to the front panel which also includes a display of five LED indicators. The top two red and green LEDs give an indication of the received carrier level with the red LED being illuminated at 0.5μV, both LEDs at 50μV and only the green LED at 100μV. The remaining three red LEDs give an indication of the peak received audio level with the LEDs corresponding to −4dB, −16dB and −28dB below maximum carrier deviation.

To the rear there is an Amphenol *SO-259* type connector for the aerial, the supplied type being a stiff wire fitted to a *PL-259* plug which screws into the receiver. Power is supplied via an American type 3-pin Belden connector for the ac supply and a five pin Tuchel connector for the alternative dc supply.

Two ¼in jack sockets provide high level unbalanced outputs, one of which has its level controlled by a pot on the rear panel. Finally there is a master on/off toggle switch and a slide switch which actuates the squelch or muting circuits.

Within the unit one pcb is used for the rf front end with a second board containing the if and audio electronics. A further board underneath the chassis is used for the power supply and includes a 115/230V selector switch and a soldered-in fuse with no indication of its value and finally a fourth printed circuit is used behind the front panel for the LED displays. The latter and the if and audio board are plug connected for servicing, however the board layout and wiring are rather untidy and no component identifications are provided on the boards.

The operating and service manual did include circuits and layout diagrams in addition to operating instructions, but the general standard of the manual was not good and no electrical alignment information was included.

Receiver performance

Initial tests on the radio mic receiver were done using a high quality frequency modulated signal generator in conjunction with a Bruel and Kjaer heterodyne voltmeter and a very accurate frequency counter.

The maximum sensitivity of the receiver was found to be at 174.091MHz which coincided with the minimum audio frequency distortion, the nominal operating frequency of the review sample being 174.1MHz.

Harmonic distortion was measured in the audio output at 100Hz, 1kHz and 5kHz using ±5kHz carrier deviation and found to be rather high as shown in **Table 1.**

FIG.1 SWINTEK RADIO MIC RECEIVER FREQUENCY RESPONSE

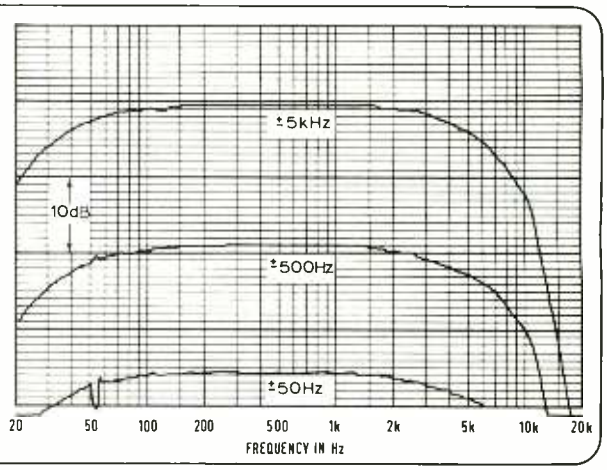

TABLE 1

	Harmonics			
	2nd	3rd	4th	5th
100Hz	> −60dB	−42dB	—	−40dB
1kHz	−52dB	−30dB	−48dB	−42dB
5kHz	−31dB	−35dB	−43dB	−52dB

TABLE 2

Indicated level	Actual input level
100μV	500μV
50μV	250μV
0.5μV	2.5μV

The ultimate S/N ratio of the receiver was found to be 85dB(A) reference ±10kHz FM deviation at an rf input level of 300μV at which level the maximum S/N ratio was achieved with an S/N ratio of 70dB(A) being measured at only 30μV rf input.

Limiting in the receiver was found to occur at 0.5μV input which coincided with a 12dB S/N ratio.

Checking the accuracy of the rf signal level indicators showed them to be rather inaccurate, but in spite of this they performed a useful function with the upper two levels showing that safe operating conditions existed. The input level at which the indicators became just illuminated is given in **Table 2.**

So far as the rf interference performance was concerned this was found to be satisfactory with the image rejection being measured as 76dB, the if rejection 74dB and the adjacent channel rejection as greater than 70dB.

The audio output level of the various outputs for ±5kHz carrier deviation was found to be as follows:—

Fixed level jack (unbal)	+1dB.7	68Ω
Variable level jack (unbal)	−11.6dB.7	37.6kΩ
Mic level (bal)	2x −39dB.7	2x240Ω

The three LED indicators showing the received audio level were found to be adequately accurate and to be fast in action with the audio frequency response of the receiver being shown in **Fig 1.** This plot shows that an approximately 50μs de-emphasis is used with the lf −3dB point being rather high at 50Hz. De-emphasis remained constant with carrier deviation.

Transmitter

The rf power output of the transmitter was found to be 44mW into either 75Ω or 50Ω with the maximum carrier deviation being internally limited to ±10kHz. Whilst the nominal transmitter frequency was below the specified 174.1MHz the frequency stability was satisfactory, this being shown in **Fig 2** for a 10°C temperature change and over a period of 90 minutes.

Touching the transmitter's case or altering the position of the wire aerial made no significant difference to the frequency and the audio limiter was found to be satisfactory in action.

For the onset of limiting, the audio input level at the mic input was found to be variable from +2dBm to −38dBm in 10dB steps with the input impedance being almost constant with gain setting at 2.6kΩ. At the high level input the maximum sensitivity was −6dBm with any level above this

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being acceptable, the input impedance varying with sensitivity setting from 23.4kΩ at maximum gain to 48.9kΩ at minimum gain.

A control within the transmitter provided a variable dc bias at the mic input, ranging from −3.1V to +4.2V for use with Sony *ECM50* and similar mics.

Indication of limiting was by means of the internal red LED indicator which became illuminated at 4dB of limiting and thus provided an indication of adequate modulation.

The dc current consumption was found to average 23mA which should give about 6hrs battery life using normal batteries 2hrs per day.

Checking the overall system frequency response at various input levels produced **Fig 3** for the input being varied in 10dB steps. This shows that the pre-emphasis and de-emphasis of the transmitter and receiver are not very well matched and also that the compression/expansion of the *dB-S* system does not track very well.

This factor may well account for the not very good second and third harmonic distortion performance shown in **Fig 4a** for a level 10dB below limiting and **Fig 4b** for 20dB of limiting.

Summary

I am yet to come across a radio microphone system which offers a good performance: this system is no exception and clearly illustrates why radio mics are avoided where possible.

Hugh Ford

FIG.2 SWINTEK RADIO MIC
TRANSMITTER FREQUENCY STABILITY

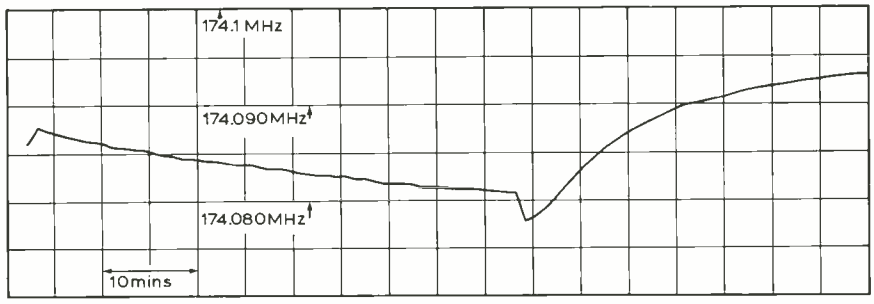


FIG.3 SWINTEK RADIO MIC
SYSTEM FREQUENCY
RESPONSE

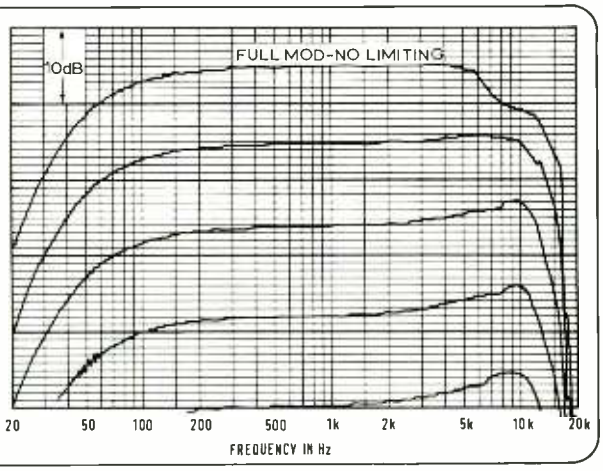
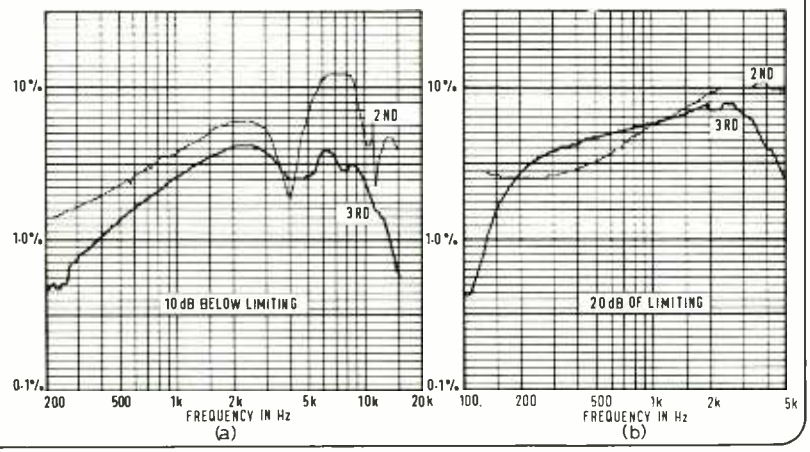


FIG.4 SWINTEK RADIO MIC
HARMONIC DISTORTION



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Holland	**Special Audio Products BV** Scheldeplein 18, Amsterdam Tel: Amsterdam 797055
Sweden	**Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel: Gothenburg 130 216
Spain	**Mike Llewelyn-Jones** Francisco de Rojas 9, 2 DER, 9 Madrid 10 Tel: Madrid 445 1301

MANUFACTURER'S SPECIFICATION
Speeds: 33⅓ and 45rpm, each with a ±10% variation.
Colour: metallic silver with blue felt. Other colours available to special order.
Line voltage: 115V to 220V. 50 or 60Hz.
Start-up time: at 33⅓rpm: $\frac{1}{16}$th revolution.
Rumble (stereo with respect to NAB standard): −55dB.
Wow: 0.06%
Flutter: 0.08%
Drive: outer rim with idler.
Capstan: phenolic, ground on motor shaft.
Platter: 12in diameter ±0.001in concentricity. 5lb aluminium.
Speed control: analogue servo control.
Motor: dc, Hall effect.
Readout: three digit, ½in 7-segment LED.
Dimensions: front to back 17 $\frac{3}{16}$th in, width 16½in, depth below table top 2½in.
Weight: 17.12lb. Domestic pack 23lb.
Price: £440.
Manufacturer: Broadcast Electronics Inc, 4100 North 24th Street, PO Box 3606, Quincy, Illinois 62301, USA.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey.

QRK Galaxy turntable

THE QRK *Galaxy* turntable is basically a 2-speed turntable with the speeds being continuously variable over a very wide range as the unit is driven from a variable speed Hall effect dc motor. A sloping front panel accommodates a 3-digit, 7-segment type display of the current turntable speed in rpm, reading with 0.1rpm resolution. To the left of the panel, two pushbutton switches fitted with LED indicators select the high or low speed and display which is in use with two nearby potentiometers operating as fine speed controls for the fast and slow settings and giving a ±10% range.

Screwdriver-operated controls accessed through holes near these potentiometers provide a coarse speed adjustment for the fast and slow settings with both controls offering a range of practical operational speeds from 30rpm up to 85 rpm, the lower speed being limited by the motor which becomes very coarse in action at lower speeds.

To the right of the front panel there is the self-illuminating type power on/off switch and a momentary pushbutton switch with an integral LED indicator for starting and stopping the turntable motor, no braking system being fitted so that the unit may be back cued.

The basis for this turntable is a $\frac{3}{16}$in (4.8mm) thick alloy plate which supports the main components. The turntable platter itself takes the form of a not very well machined alloy casting which is fixed to a steel spigot for the sleeve bearing which fits into a bearing which passes through the main alloy plate, this bearing having a ball bearing to take the end thrust and being partially filled with oil. The latter lubricates the sleeve bearing by means of a spiral recess in the platter's spigot bearing.

Runout at the spindle and at the periphery of the platter was minimal at 0.001in (25μm) TIR (total indicator reading) with the vertical runout at the periphery of the platter also being satisfactory at 0.005 in (125μm) TIR.

Measurement of the turntable centre pin diameter showed this to be 0.2827in which is very close to the NAB standard of 0.283in.

The drive to the turntable platter is via a rubber idler roller which is inserted onto the inner rim of the platter and the phenolic capstan on the motor by means of a solenoid, the solenoid arm being fitted into a casting which is attached to the main alloy plate giving a positive location to the idler roller.

Three flexible mounts locate the Hall effect motor below the main alloy plate with its shaft passing through the plate to make contact with the idler roller.

In spite of the use of a heavy (5lb or 2.3kg) turntable the start was very fast, occupying about $\frac{1}{16}$ in turn or 200ms to reach 33⅓rpm.

The electronics of the unit consist of three pcb's one behind the sloping front panel and the other two attached to the main plate. Whilst these boards were quite tidy in layout, no component identifications were provided but the instruction book did contain board layouts, circuit diagrams and parts lists. The printed circuit behind the front panel supports the speed indicators and all the front panel controls with the high power motor drive transistors on a second board mounted vertically on the main alloy plate. The third board which is mounted parallel to the main plate contains the power supplies, the motor control and the counter logic with its crystal reference oscillator. With the exception of the front panel board the connections to the boards are soldered.

Mains power is via a barrier strip which was, in the case of the review sample, wired to an American colour coded mains lead, the mains fuse being beneath the turntable platter and not identified in value. The complete unit is covered with a silver metal trim which bolts to the main alloy plate and is used to support a pickup arm, the sides of the unit having a wooden trim.

Measurement of the wow and flutter to the IEC quasi-peak weighted method gave very disappointing results at 0.4% with the source of trouble being traced to the rubber idler roller which ran a long way out of true.

Naturally this fault in the review sample also affected the rumble measurements. It was also noted that fairly severe vibration emanated from the motor and this severely affected rumble unless the complete turntable was securely clamped to a large mass.

Rumble to the A rumble weighting to the DIN 45 539 and similar curves was only 29dB below 10cm/s in mono and the B weighted rumble was also poor at −50dB in mono and −46dB in stereo.

Summary

I find it difficult to be enthusiastic about this QRK *Galaxy* turntable even allowing for the faulty idler. Ignoring the measured results the unit was not to a high standard of finish with the machining of the inner rim of the turntable leaving much to be desired.

From a mechanical point of view I do not like the pickup arm being fixed to the cover trim plate in lieu of the main alloy plate and no attempt had been made to damp the resonance of the trim plate which sounded quite 'live'. **Hugh Ford**

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QRK 12C turntable

MANUFACTURER'S SPECIFICATION
Speeds: 33⅓, 45 and 78rpm.
Standard colour: beige with felt pad for slip cueing. Other colours available.
Line voltage: 115V – 60Hz standard (230V – 50Hz optional).
Start-up time: at 33⅓rpm $\frac{1}{16}$th of revolution for full speed.
Rumble (stereo with respect to NAB standard of – 35dB): – 48dB.
Wow and flutter: less than 0.1%.
Speed regulation: 99.5%.
Drive: outer rim with idler.
Capstan: phenolic, ground on motor shaft.
Platter: ±0.001in concentricity, 5.5lb aluminium.
Dimensions: front to back 15½in, depth 15in, depth below frame 5in.
Weight: 21½lb. 25lb domestic pack.
Price: £280.
Manufacturer: Broadcast Electronics Inc, 4100 North 24th Street, PO Box 3606, Quincy, Illinois 62301, USA.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey.

THE QRK type *12C* turntable is designed for broadcast use but is equally suitable for disco applications where a solidly built turntable is of advantage.

The form of construction is fairly conventional with the basis of the unit being a fairly heavy diecast platform having strengthening ribs on the underside. On the top side the turntable platter is largely recessed within the main casting and well protected against being knocked from the side.

The turntable platter which weighs about 6lb (2.7kg) is supported in a steel bearing which recesses into the main casting the bearing being effectively a sleeve bearing with a ball bearing taking the end thrust and the unit being filled with oil. A spiral slot in the platter's spigot lubricates the sleeve section of the bearing by pumping the oil from the bottom upwards.

Drive to the platter is conventional and consists of a stepped spigot on the motor which drives an idler which in turn drives the inside of the turntable platter's rim.

The three speeds are selected by a lever at the front of the turntable which has three positions where it locates in slots for the three speeds and two resting postitions where the rubber idler roller is out of contact.

Reverting to the platter, the upper surface is covered with a felt mat for slip-cueing with the spindle diameter being measured as 0.283in which is exactly the NAB standard pin diameter. Whilst this close tolerance is good for giving minimum wow and flutter it can be troublesome when quick record changing is required.

In the review sample the turntable platter spigot had an excessive runout at 0.006in (150μm) TIR (total indicator reading) and the vertical runout at the periphery of the platter was grossly excessive at greater than 0.02in (500μm) TIR.

The synchronous drive motor is mounted on a separate casting which is suspended below the main casting on three soft rubber mounts with the motor's phase shift capacitor also being on the sub-assembly. The speed control lever at the front of the turntable is connected to a hinged casting which slides in a vertical direction to move the rubber idler roller up and down the stepped motor spigot to select the desired turntable speed.

Measurement of the three turntable speeds showed that all were too fast by an appreciable amount with the 33⅓rpm being 0.63% fast, 45rpm 0.8% fast and 78.26 rpm 1.3% fast. It was however found that the speed was stable and normal loading had no significant effect.

Whether the turntable was started by engaging the idler roller or by switching the mains power supply made little difference to the start time which was rapid and took about $\frac{1}{16}$th of a turn at 33⅓rpm (about 300ms) or about ⅛ turn (500ms) at 78rpm.

The measurement of wow and flutter to the peak weighted IEC standard did not have any surprises in store having regard to the poor vertical runout of this sample of the turntable, the weighted wow and flutter being in the order of 0.2%. However, the weighted flutter alone was respectable at 0.09%. Certainly I am under the impression that peak weighted wow and flutter should be in the order of 0.1% with a turntable platter which runs true and does not cause cyclic motion of the complete motor platform as in the review sample.

Rumble was measured at 33⅓rpm using an rms meter with the standard A- and B- rumble weightings as specified in DIN 45 539 and elsewhere. Just as a reminder, the A weighting extends from 10Hz to 315Hz with a 12dB/octave roll off and the B weighting peaks at 315Hz rolling off either side at 12dB/octave. With reference to a recorded velocity of 10cm/s lateral at 1kHz the rumble was found to be as shown in **Table 1**.

Table 1

	Left	Right	Mono
A-weighted	– 29dB	– 29dB	– 42dB
B-weighted	– 57dB	– 54dB	– 56dB

In the case of the stereo rumble the quoted measurements were taken at the inner grooves of the disc to reduce the effect of the vertical turntable runout which had very significant effect with the A weighted rumble.

Summary

It was unfortunate that this particular sample of the QRK *12C* turntable had a faulty platter as this obviously interfered with most measurements.

However it is fair to say that this model is of substantial construction and should put up with a lot of hard work. In general the unit was well made with a reasonable finish and there is a fair amount of room for mounting alternative pickup arms.

Hugh Ford

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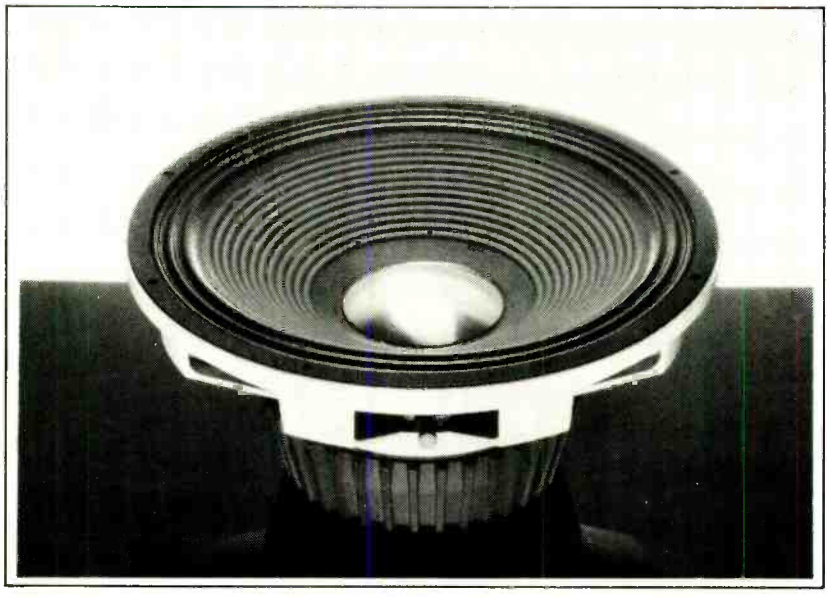

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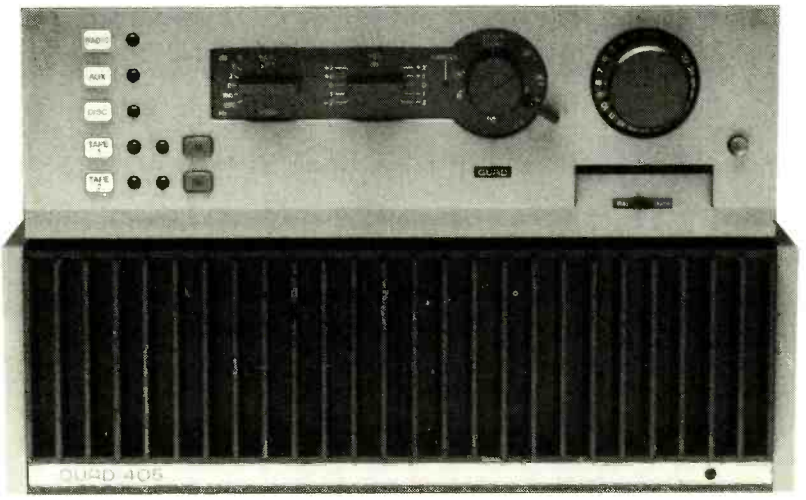
reviews



Quad 44 preamplifier

MANUFACTURER'S SPECIFICATION
Distortion: worst case any input, 0.05%, typically any input 0.02%, both at 30Hz to 10kHz.
Residual noise: A weighting, volume control set to minimum, −104dB.
Frequency response: any input except disc, any output, +0, −1dB from 30Hz to 20kHz. Disc ±0.5dB of IEC 98-4 from 30Hz to 20kHz.
Tilt and bass: curves supplied—see review.
Filters: curves supplied—see review.
Interchannel balance: ±0.5dB with volume control varied from maximum to −60dB.
Crosstalk: replay/record typically better than −70dB, interchannel better than −50dB, both 30Hz to 10kHz.
AC input: 100-130V or 200-250V, 50/60Hz.
Weight: 4kg.
Dimensions: (whd) 321 x 103 x 207mm.
Outputs to tape recorder: 3mV/32Ω, 10mV/100Ω, 24mV/32Ω 100mV/1kΩ, 0dBm (775mV)/1kΩ, or alternatively 33kΩ source impedance.
Outputs to power amplifier: 0.5V/1kΩ, 5V/75Ω.

Inputs

SOURCE	Input sensitivity for full output	Maximum input	Load impedance	Signal to noise A weighted input loaded
DISC	1mV	35mV	47kΩ//47pF	63dB
			or	
	3mV	100mV	47kΩ//227pF	72dB
	10mV	300mV		82dB
RADIO AND AUX	100mV	5V	1MΩ	86dB
TAPE REPLAY	100mV	5V	39kΩ	86dB
	300mV	15V	121kΩ	86dB
	0dBm(.775V)	40V	94kΩ	86dB
	3V	100V	85kΩ	86dB
	10V	100V	82kΩ	86dB

Note: figures refer to 5V output for convenience, all voltages are rms.
Price: £177.
Manufacturers: Quad Electronacoustics Limited, Huntingdon, Cambs PE18 7DB.

WHEN a new product appears under the Quad trademark, it inevitably heralds a new product of significance and not just a gimmick or restyling of an old product. So it is with the new Quad *44* preamplifier reviewed here.

Whilst the Quad *44* retains some of the features of its predecessor, the Quad *33*, its design is a completely new concept and it is a far more versatile amplifier capable of driving up to 5V output to the power amplifier.

Being slightly larger than the Quad *33*, the width of the *44* is just under that of the matching Quad *405* power amplifier (reviewed in March 1976 *Studio Sound*) with the styling retaining the brown colouring with clear white legends. However, the switching between input sources is now by means of light pushbutton switches instead of mechanically interlocked switches with the audio routing now being determined by analogue switches.

The left of the front panel has five input source switches in vertical array with adjacent green LED indicators showing which source is in action. As standard, the input sources are radio, auxiliary, disc, tape 1 and tape 2 but as will be seen, any combination of five inputs may be used by changing modules. To the right of the two tape input sources are two red LEDs and two red pushbuttons which activate the monitor mode for either tape input.

The centre section of the front panel contains the tone controls of which there are four. The bass control is in the form of a four position rotary switch providing three degrees of bass boost and two degrees of bass cut in addition to the 'flat' position. The next control labelled 'tilt' is a new concept in tone controls. It literally tilts the overall frequency response curve introducing two degrees of bass boost with treble cut and two degrees of bass cut with treble boost in addition to the 'flat' position.

The remaining tone control is a variable lowpass filter similar to the excellent filters included in previous Quad preamplifiers. These consist of a potentiometer control concentric with a four position switch including a 'cancel' position when all tone controls are deactivated and a small adjacent red LED indicator illuminates. Also there are 10kHz, 7kHz and 5kHz positions which select the lowpass filter turnover frequency with the concentric potentiometer controlling the slope of the filter.

To the right of the tone controls is the stepped volume control underneath which is the balance control and a 'balance/mono' switch. In the balance position, the balance control functions as a full range balance control which can eliminate the output from either channel; however in the mono position of the switch, the balance control effects the mix of the left and right inputs when a stereo input source is used. Finally there is the power on/off pushbutton operating the main power switch at the rear of the unit.

A small hinged perspex window in the top of the cabinet gives access to a series of DIL slide switches, one affecting the disc input and two each for the tape input/outputs. In the case of the disc input, the switches select the input sensitivity to 10mV, 3mV or 1mV in addition to switching in extra shunt capacity across the inputs. In the case of the tape conections, one switch is associated with the tape replay and the other with record. In the case of tape replay four input sensitivities are available, 10V, 3V, 0dBm or 100mV with the tape outputs being selected from 0dBm, 10mV or 3mV, with the fourth section of the switch selecting either a high or low output impedance.

Turning to the rear of the preamplifier, the left section is concerned with the power supplies and houses the IEC power input plug plus three

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switched IEC mains power output sockets—a most excellent feature for feeding tuners, turntables, etc. In addition there is the properly identified power fuse together with the input voltage selector covering the ranges 200-240V or 100-120V.

The remainder of the rear of the preamplifier is occupied by six modules each of which are secured by two screws. With the exception of the output module, the remaining modules may be interchanged in any combination. The output module provides two pairs of outputs at 'phono' sockets giving nominal output levels of 5V or 1.5V from a low impedance in addition to a further output at a 4-way DIN socket intended for feeding Quad power amplifiers at 500mV.

Turning to the interchangeable modules, the 'Radio' or auxiliary input modules accept a fixed nominal input level of 100mV into 1MΩ at a 5-pin DIN socket. It's a shame that this is the only input connector on these modules and also on the tape modules and I would have thought that at least 'phono' connectors might have been fitted in addition to the DIN connector as there's plenty of room on the modules to fit additional connectors!

As previously described, the tape modules have switched input and output sensitivities but only single DIN connectors which, incidentally, do have their pin connections marked adjacent to the connectors.

Turning now to disc inputs, five different input modules are available at the time of writing. As standard an IEC equalised (RIAA is not yet available) input with switchable sensitivities of 10mV, 3mV or 1mV is fitted with both DIN and 'phono' inputs plus an earth terminal. Alternatively there is a range of four moving coil cartridge input amplifiers of similar construction as shown in **Table 1.**

When the latter modules are supplied, they come with a front panel selector switch cap which may be used to replace one of the existing identifications. Also included is a new identification cover for the DIL switches which just displays the disc input module type instead of the sensitivity switches which appear with the normally fitted disc input module.

TABLE 1

Type	Input sensitivity impedance
A	300μV 470Ω//22nF
B	100μV 100Ω//68nF
C	300μV 100Ω//68nF
D	100μV 470Ω//22nF

Within the preamplifier all the modules plug into a mother board by means of rather fiddly pin connectors, the mother board having relatively few components. Other than the power transformer, all the remaining audio components are supported by a second printed circuit board onto which the front panel tone controls are mounted, a small third printed circuit board being associated with the front panel source selector switches. Any of the boards are readily removed for servicing as they are interconnected by means of plugs and sockets. Whilst the instruction book contains full circuits and parts lists, it does not have board layout diagrams and the components are not identified on the boards to ease servicing—however, it's not difficult to follow the circuits as the layout is clear.

Overall the standard of components and of construction is very good with what wiring that does exist being tidy.

Frequency response and tone controls

The frequency response from the 'Radio' input to the output with the tone controls cancelled is shown in **fig 1** which illustrates a response flat to within 0.5dB from 20Hz to 20kHz. The situation with the tone controls in circuit is shown in **fig 2** which also shows the effect of the four other positions of the 'tilt' control. As can be seen, the effect of this control is to provide a maximum ±2dB boost/cut in the treble and bass. Whilst the

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FIG.1 QUAD 44 FREQUENCY RESPONSE FROM RADIO INPUT TO OUTPUT, TONE CONTROLS CANCELLED

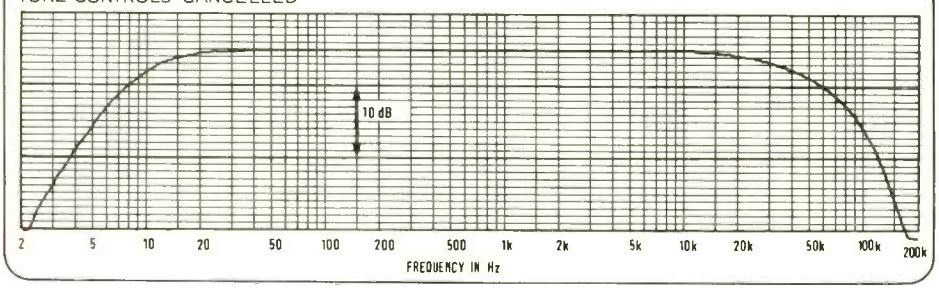
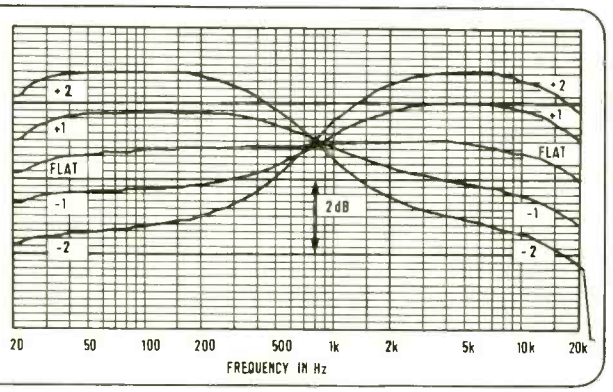


FIG. 2
QUAD 44 FREQUENCY RESPONSE WITH TONE CONTROLS IN CIRCUIT (FLAT) AND WITH OPERATION OF TILT CONTROL



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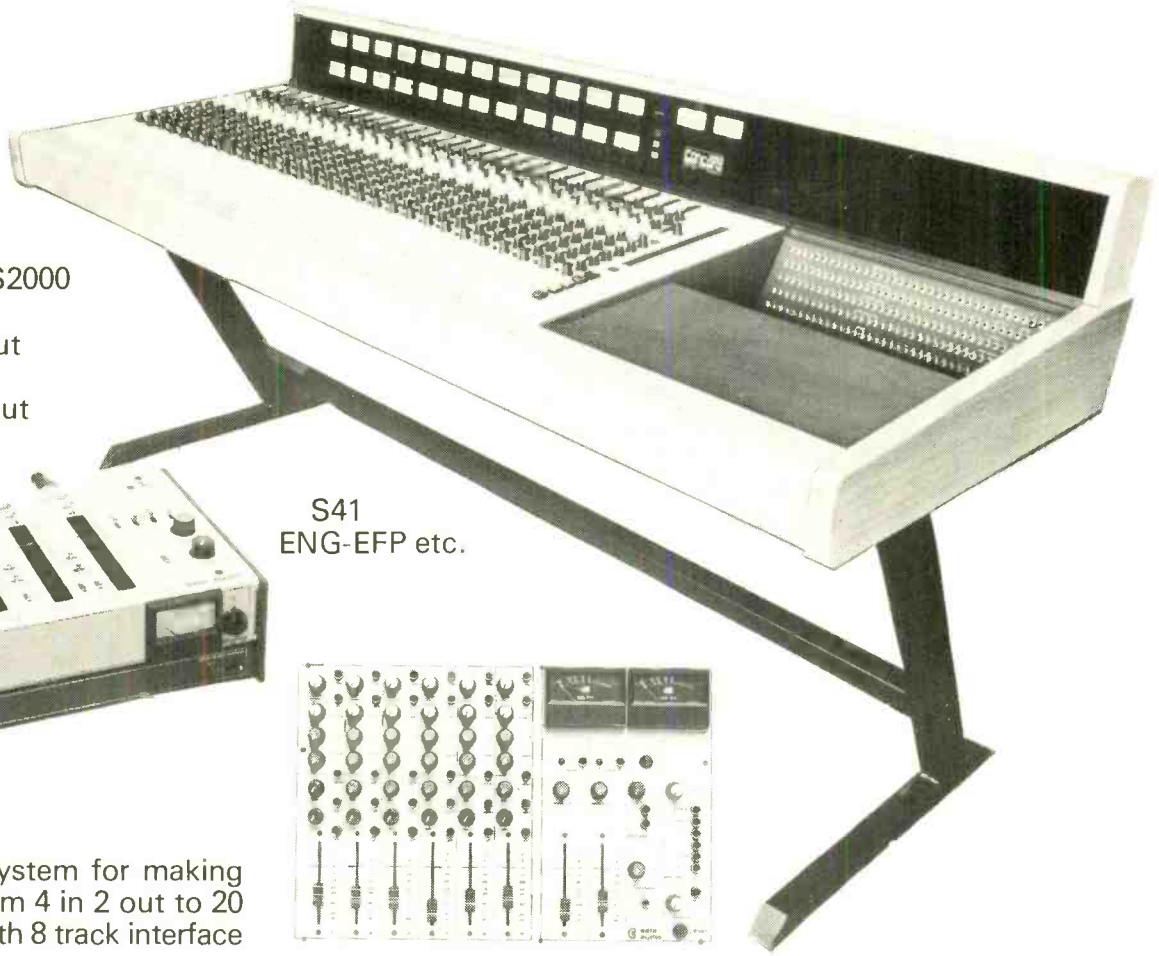

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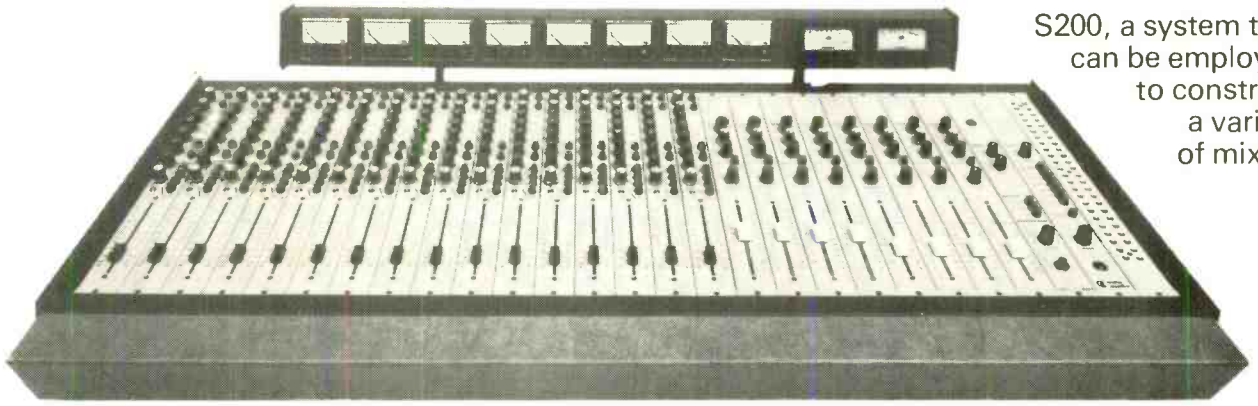

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range of ±2dB may at first sight appear to be too small, it must be remembered that the control simultaneously affects the treble and bass and thus has the same equivalent effects as say a ±4dB treble control. In practical terms this range is quite adequate and I have always regarded the common ±12dB or more range of conventional control quite unnecessary.

Turning to the bass control, its characteristics are shown in **fig 3** with the three boost positions giving approximately +3dB, +6dB and +9dB boost at 100Hz, and the cut positions giving approximately −3dB points at 150Hz or 300Hz—this control did however have a mild effect upon the overall gain at high frequencies.

At the maximum rate of cut, the effects of the three lowpass filter frequencies are shown in **fig 4** with **fig 5** showing the effect of different positions of the slope control upon the 5kHz filter. Clearly this is an effective and versatile filter system ideally suited to taming anything from slightly noisy discs to old 78s or cassette reproduction. Whilst it will be noticed that in some instances the frequency response rises at frequencies above the maximum attenuation, I do not believe this to be a significant characteristic.

So far as the disc input was concerned, the frequency response was virtually flat to the IEC98 amendment 4 characteristic up to 10kHz, falling to the specification limit of −1dB at 20kHz which is not of practical significance.

Noise

Noise in the output was measured under various conditions and found to be equal to within 0.5dB for the two channels. **Table 2** shows the noise in the 5V output related to 5V at maximum gain with the tone controls in the cancelled position.

In the case of the disc input, the noise was proportional to the sensitivity setting, as it should be, and the tone control had the anticipated effect upon output noise. Unlike many amplifiers the worst noise occurred at the maximum setting of the volume control and not at some intermediate setting where the control impedance is high. Under all conditions the power frequency hum and its harmonics in the output were at exceptionally low levels.

Distortion

Both harmonic distortion and intermodulation distortion to the CCIF twin tone method using two tones separated by 70Hz were measured.

The harmonic distortion introduced from the radio or auxiliary inputs to the 5V output at an output level of 5V is shown in **fig 6.** From this it is to be seen that the second and third harmonics remain at a low level over the entire audio frequency range. Similarly referring to **fig 7** shows that under the same conditions the intermodulation distortion also remains at very low levels with the third order intermodulation products being close to the residual distortion of the measurement system.

Feeding the same CCIF intermodulation test signal to the disc input via an inverse IEC network enables the intermodulation distortion of the disc preamplifier to be plotted as shown in **fig 8.**

Inputs and outputs

Dealing first with the inputs, the sensitivity of each input (where appropriate at each sensitivity

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FIG. 3
QUAD 44
CHARACTERISTICS OF
BASS CONTROL

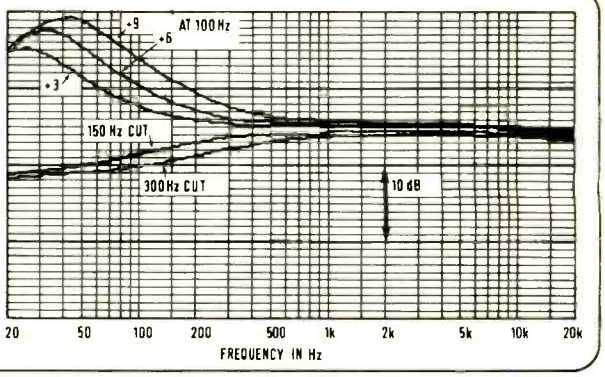


FIG.4
QUAD 44
CHARACTERISTIC OF
LOW PASS FILTERS

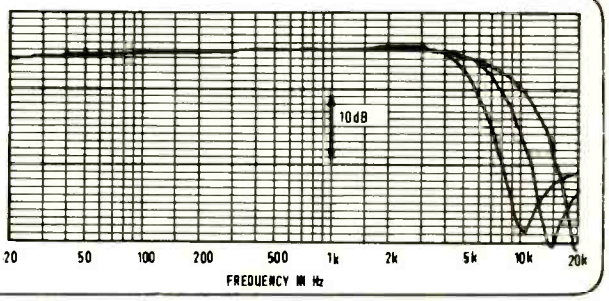


TABLE 2

	Unweighted 22Hz-22kHz	A weighted rms	CCIR weighted rms	CCIR weighted quasi-peak
Minimum volume	103dB	106dBA	97dB	93dB
Radio/tuner	82dB	85dBA	76dB	72dB
Tape monitor (any sensitivity)	81dB	86dBA	77dB	73dB
Disc (1mV shorted)	60dB	69.5dBA	64.5dB	60dB
Disc (1mV with dummy cartridge)	59dB	62.5dBA	53dB	49.5dB
Disc (100μV)	56dB	67dBA	61dB	57dB
Disc (300μV)	67dB	75dBA	68.5dB	64.5dB

FIG. 5
QUAD 44 EFFECT OF
SLOPE CONTROL
ON 5kHz FILTER

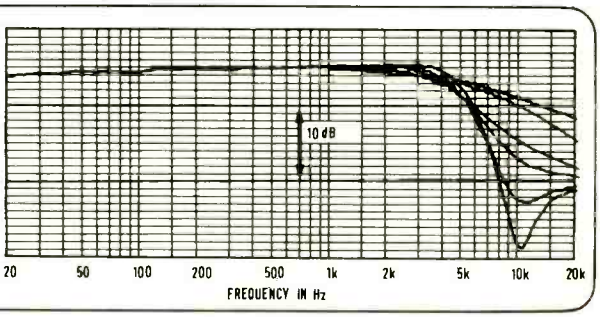


FIG. 6
QUAD 44 HARMONIC
DISTORTION ON RADIO
AND AUX INPUTS TO
5V OUTPUT

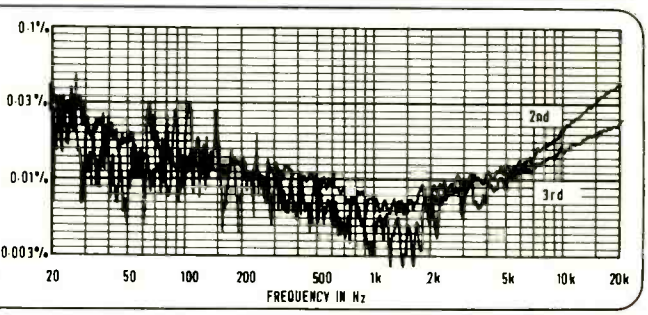
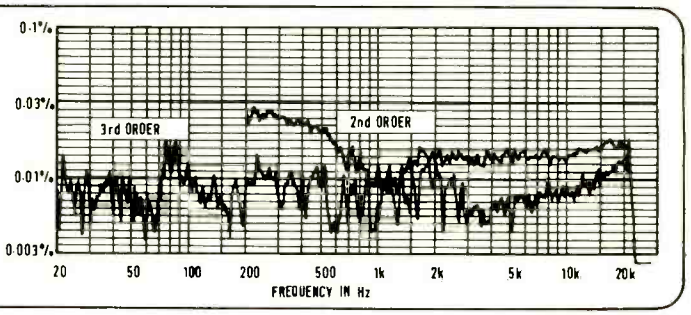


FIG.7
QUAD 44
INTERMODULATION
DISTORTION FROM
RADIO AND AUX INPUT
TO 5V OUTPUT



setting) was measured at maximum gain for 5V out at 1kHz at the nominal 5V output connections. In addition the maximum input level for the onset of significant harmonic distortion and the input impedance were measured.

Under the same conditions the tape outputs and other preamplifier outputs were also measured.

As the differences between the left and right channels never exceeded 0.15dB, the performance of the individual channels is not noted in the results shown in **Table 3.**

Overall the input and output facilities are capable of matching virtually any tape recorders and amplifiers and the availability of the 5V output means that the Quad *44* may be interfaced with professional amplifiers unlike earlier Quad preamplifiers.

Looking at the nominal 5V output, this could in fact drive up to 9V rms before the onset of severe distortion, with the other outputs having an equal margin on the nominal output levels.

Other matters

A particularly irritating feature of some other preamplifiers is crosstalk between wanted inputs and unwanted inputs, such as radio breakthrough into the disc signal. Checking the Quad *44* for this showed that the isolation of the unwanted inputs was excellent with the crosstalk from the unwanted inputs being negligible.

Similarly the crosstalk across the tape monitor feature was very low as shown in **fig 9.** Likewise, using the auxiliary inputs, the interchannel crosstalk was more than adequate as shown in **fig 10.**

The balance between the left and right channels was checked for all control positions and found to be to an exceptionally high standard with a maximum difference between the channels of only 0.5dB worst case for any combination of volume and tone control settings.

Checking the volume control steps showed that they were well chosen with 2dB steps for the initial 28dB of the range, with the steps then increasing as the volume was lowered to minimum.

Listening tests revealed that the operation of the channel selector buttons was completely silent and free from clicks and that the operation of any other controls was noise free, as was switching the preamplifier on or off.

Turning to the subjective effect of the tone controls, the performance of the low pass filter was excellent. The tilt control had adequately fine steps with an overall range adequate for correcting any reasonable programme material.

The steps on the bass control were also found to be satisfactory, but it is felt that the maximum boost position would not normally be required.

Summary

The Quad *44* preamplifier offers excellent performance and is a very versatile amplifier in view of its modular form of construction.

Input and output interfaces were versatile, but the sole use of DIN connectors on most modules leaves something to be desired.

Overall this well built amplifier is a welcome addition to the rather limited range of preamplifiers available in comparison with the variety of available power amplifiers.

Hugh Ford

TABLE 3 INPUTS AND OUTPUTS

Input	Sensitivity Nominal	Sensitivity Actual	Overload Level	Impedance (ohms)
Radio	100mV	88mV	5.4V	977k//24pF
Tape	10V	9.3V	>10V	88k//24pF
	3V	2.7V	>10V	85k//24pF
	0dBm	690mV	>10V	95k//20pF
	100mV	90mV	5.8V	38k//30pF
Disc	10mV	7.6mV	360mV	47k//32pF
	3mV	2.6mV	125mV	47k//32pF
	1mV	0.8mV	43mV	47k//32pF

Output	Sensitivity Nominal	Sensitivity Actual	Impedance (ohms)
5V	5V	5V	75
1.5V	1.5V	1.5V	2k2
500mV	500mV	500mV	1k
Tape	0dBm	998mV	31k8 or 998*
	10mV	10mV	31k8 or 100*
	3mV	3mV	31k8 or 32*

*Depends on the setting of the low impedance switch.

FIG. 8
QUAD 44
INTERMODULATION
DISTORTION OF
DISC PRE-AMP

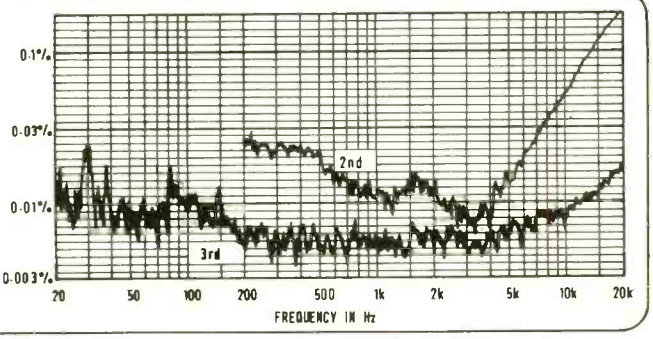


FIG. 9
QUAD 44 CROSSTALK
ACROSS TAPE MONITOR

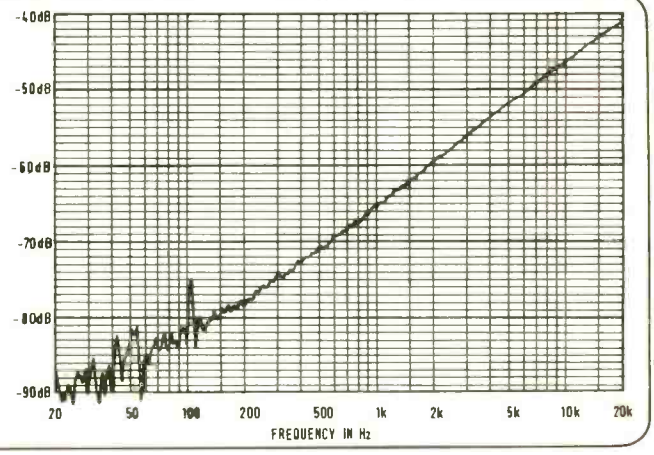
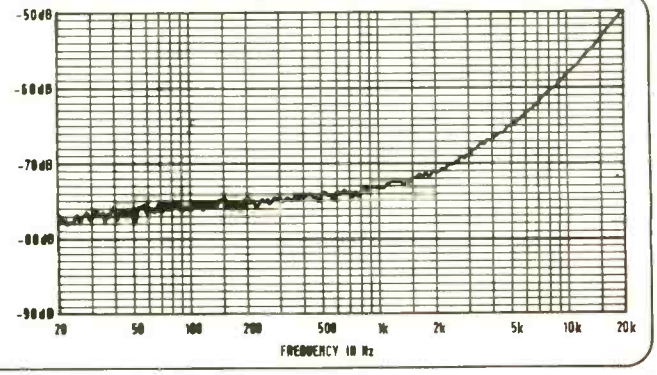
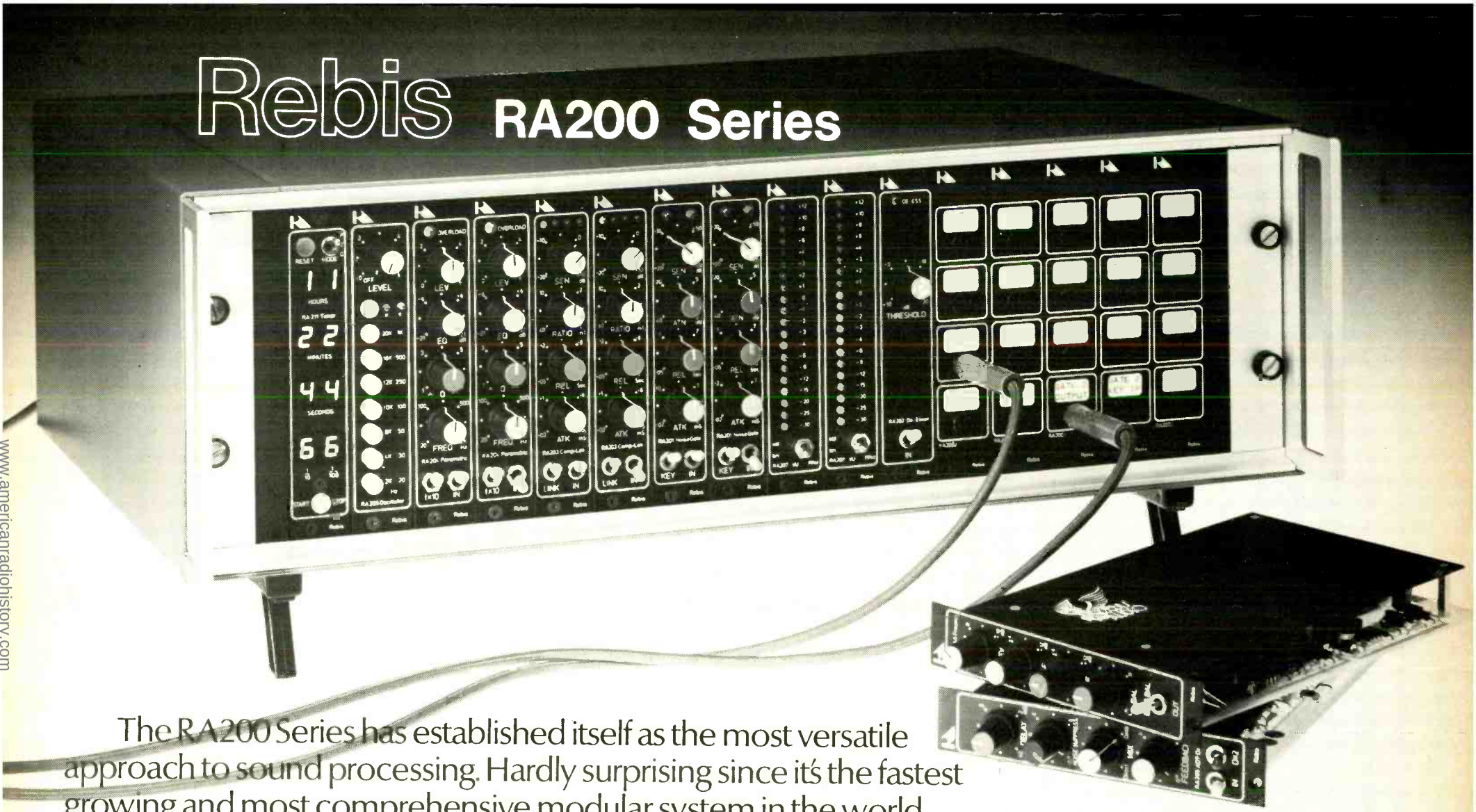


FIG. 10
QUAD 44 INTERCHANNEL
CROSSTALK USING
AUX INPUTS



Rebis RA200 Series



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RA214 Stereo MDA.
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Rebis For further information contact: Rebis Audio Ltd., Kinver Street, Stourbridge, West Midlands DY8 5AB. Tel: 0384 71865. Telex: 335494

Belgium; S.E.D., Brussels 522 7064. **Netherlands;** SAP, Amsterdam 797055. **Japan;** Continental Far East, Tokyo, Tlx. 72 22498. **Spain;** Mike Llewellyn Jones, Madrid 637 0752. **U.S.A.;** Klark-Teknik Electronics Inc., Farmingdale, N.Y. 249 3660. **Sweden;** Tal & Ton, Gothenberg 130216. **France;** Lazare Electronic, Paris 8786210. **Finland;** Studiotec, Espoo 520 604.

Micro-Trak 303 tone arm

THE Micro-Trak arm is supplied as three major assemblies: the tone arm, the arm base and the pivot assembly plus a bag of small parts and a mounting template. The latter not only provides drilling data for the mounting plate, but also defines the arm pivot to turntable spindle distance which is 8 $\frac{5}{16}$ in.

The drilling required for mounting is simple and comprises three small holes for the mounting screws (1 ¼in screws being provided) and a single 1 in diameter hole for the mounting pivot and the connecting leads which take the form of four very flexible wires in a single braid.

At the turntable end, the connecting wires are separated from the screening and have their ends tinned with the four wires having the normal red, green, white and black colours with the screen being isolated from the signal connections.

Turning to the arm itself, the headshell is of a plug-in type using a 5-pin connector with the metal body of the shell being connected to the shield of the connecting cable. Four colour-coded and rather stiff wires with slide-on tags are provided for connecting the chosen cartridge. The headshell is a cast alloy shell complete with finger rest, the outside surfaces of the headshell being machined and the interior a bare casting finish. It was found that with both of the sample arms provided the shell was a very tight fit on the arm.

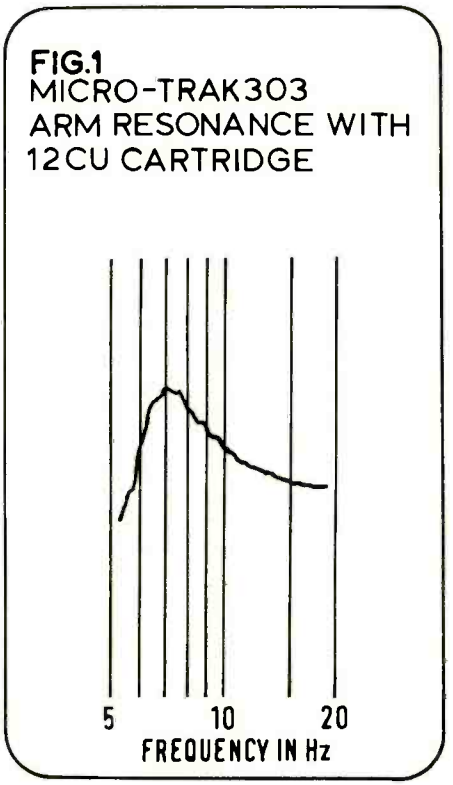
Within the shell, two tapped spigots are located on the standard ½in spacing for mounting the cartridge. However this arrangement was not found to be particularly satisfactory as the thread depth within the blind holes in the spigots meant that only screws closely matching the cartridge thickness could be used.

The arm itself is made of hardwood with a slit under the arm being used for the wiring which is 'potted' in the arm with epoxy compound to emerge near the pivot assembly. At the pivot end of the arm a fixed rectangular section counterweight balances the headshell. Balancing the arm is done by 'memory balancing'. That is, the weight of the combined cartridge and headshell is adjusted for the desired tracking force. It follows that headshells may be interchanged without having to rebalance the arm.

This system is all very well, but it leads to an arm with a high effective mass. In the case of this arm, balance was obtained with 12g added to the headshell weight (leading to a combined headshell and cartridge weight) of 27g for balance, to which must be added the desired tracking force to come to the total headshell weight. Measurement of the effective mass of the arm showed this to be about 43g.

MANUFACTURER'S SPECIFICATION
Tracking error: zero at 3.0in radius. At 3.75in radius, 1°28'. At 4.75in radius, zero. At 5.5in radius, 2°.
Minimum tracking force: 0.1g.
Overhang: 0.682in spindle centre to stylus.
Resonance: less than 10Hz, 0.5g with 30CU cartridge.
Dimensions: 12.5in (317.5mm) overall. 8.3125in (211.1mm) spindle to pivot. 2.875in (73mm) from pivot to back of arm.
Weight: 11lb (0.454kg).
Manufacturer: Micro-Track Corp, 620 Race Street, Holyoke, Mass 01040, USA.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey.

Calculation of the required cartridge compliance for an arm resonance of 10Hz which is generally desirable means the compliance must be very low at 5.9CU (compliance units). The use of high compliance cartridges of say 30CU will drop the resonant frequency below 5Hz which may lead to groove jumping and other undesirable effects.



Balancing the arm is achieved by adding 1g brass shims to the headshell until balance occurs and then adding weights to obtain the desired tracking force. The balance weights are then secured between the cartridge and the headshell. The manufacturer's instructions for this procedure were very poor and unclear. It is however important that the weights are well clamped if they are not to resonate within the headshell.

Turning to the pivoting arrangements the vertical pivoting is derived from a steel pin passed through the wooden arm and pivoted in sapphire bearings within an alloy casting. This system provided a very low friction pivot with the bearing having considerable play. The horizontal pivot fits into a hole in the vertical pivot's yolk and is secured by means of an Allen grubscrew.

The horizontal pivot takes the form of a vertical tube which is secured with a single grub screw into the arm's base to allow height adjustment. The pivot being a sealed unit it was not possible to discover the type of bearing or the method of damping which is connected with the insertion of a damping fluid into the pivot tube. The pivot did however appear to be very free and sensibly damped.

Observation of the output when replaying a slow frequency sweep going down to 20Hz did not reveal any unwanted arm resonances. As shown in **Fig 1** when using a 12CU compliance cartridge the lf resonance peaks at 7Hz with no other significant resonances being observable.

Finally it should be noted that a sensible and variable-height arm rest is provided which, together with the finger rest on the cartridge shell, made cueing very good.

Summary

Overall this is a solid arm which is very practical in disco and other applications where a tough and easy to use arm is required. It is simple in design and does not include such niceties as side thrust compensation. Overall the standard of finish was not impressive and the fixed effective mass irrespective of the cartridge weight may be a limitation.

Hugh Ford

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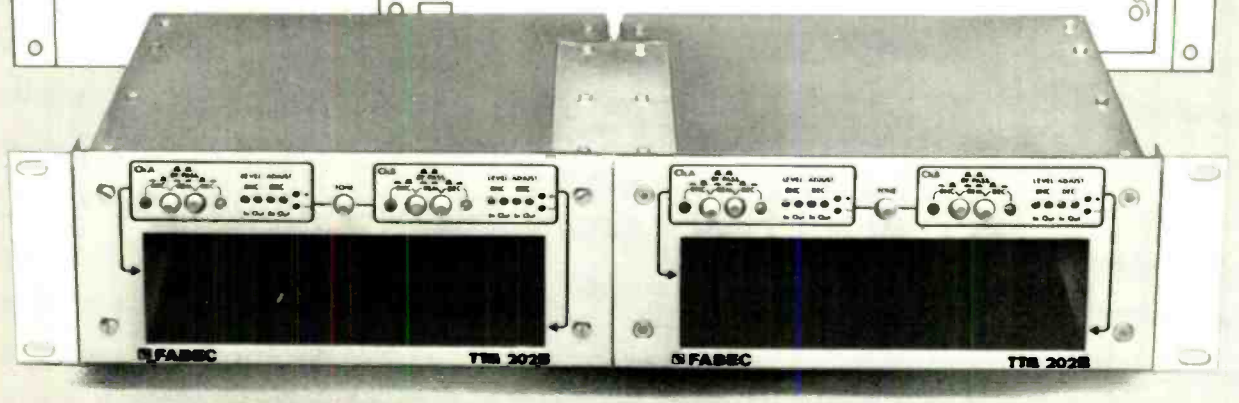

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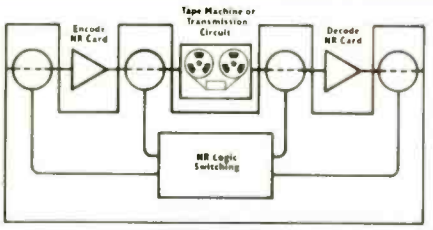

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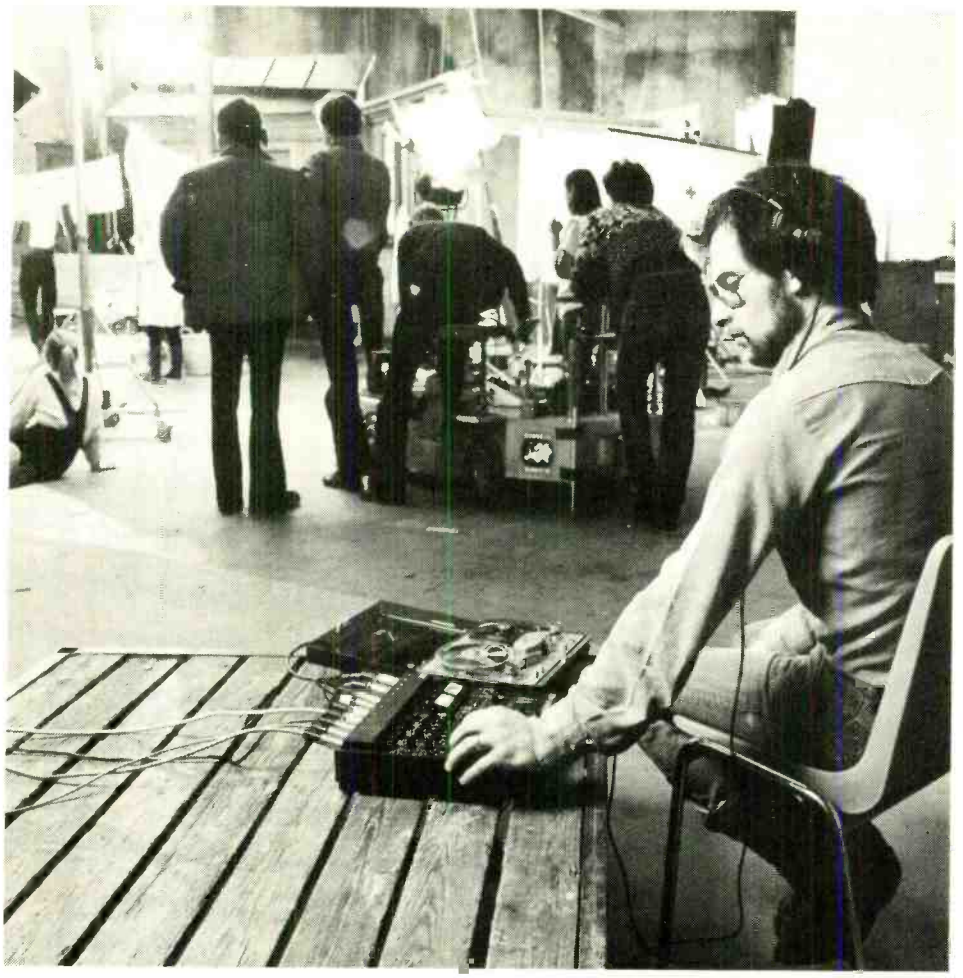

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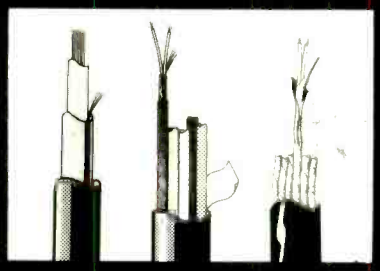

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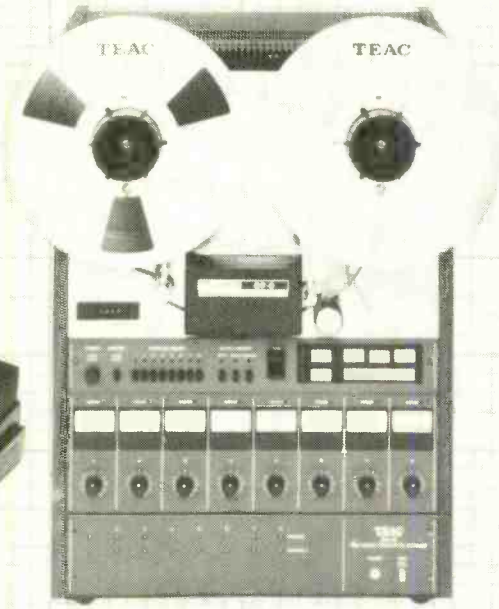

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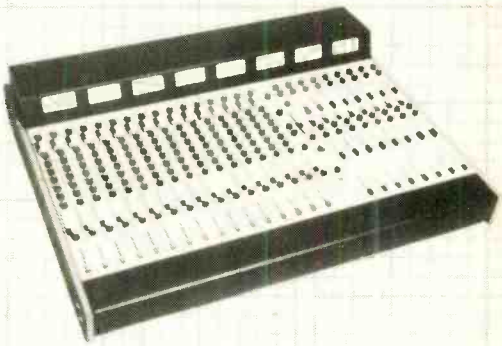

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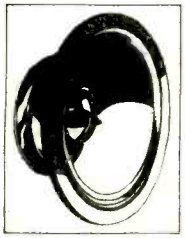

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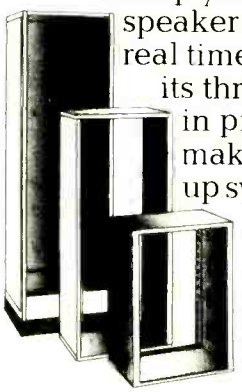

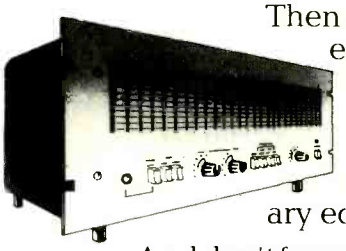

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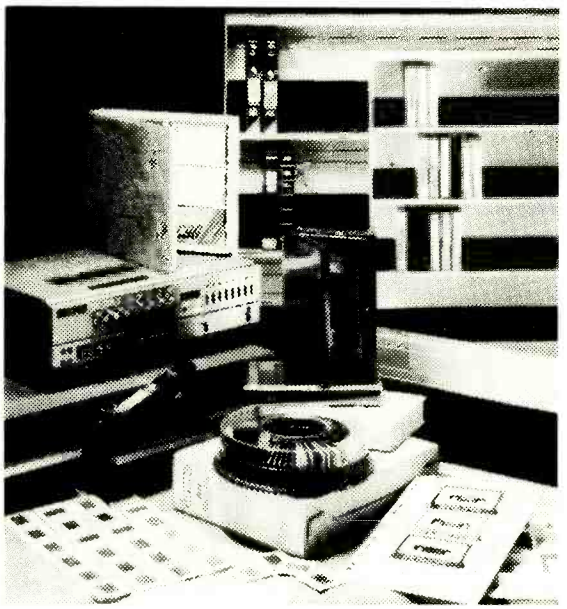

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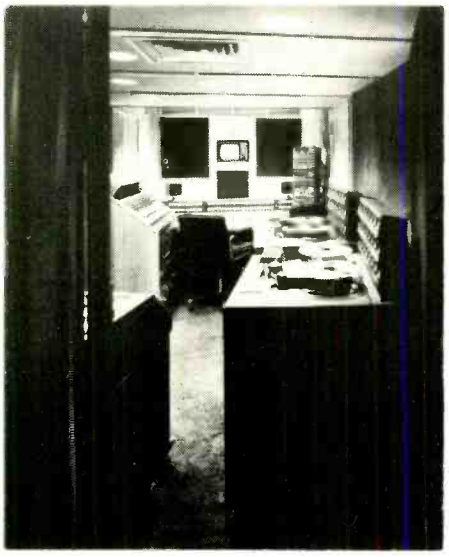

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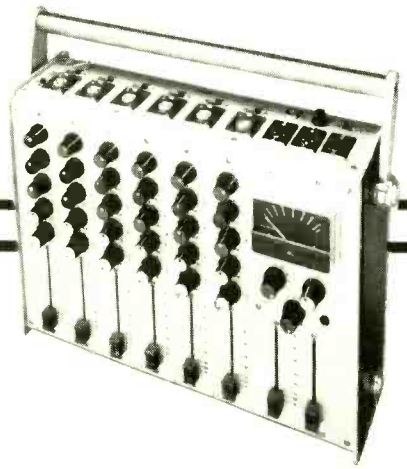

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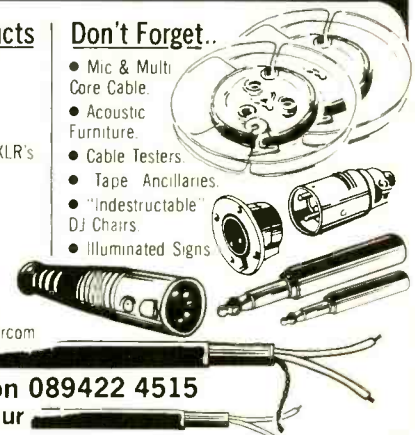

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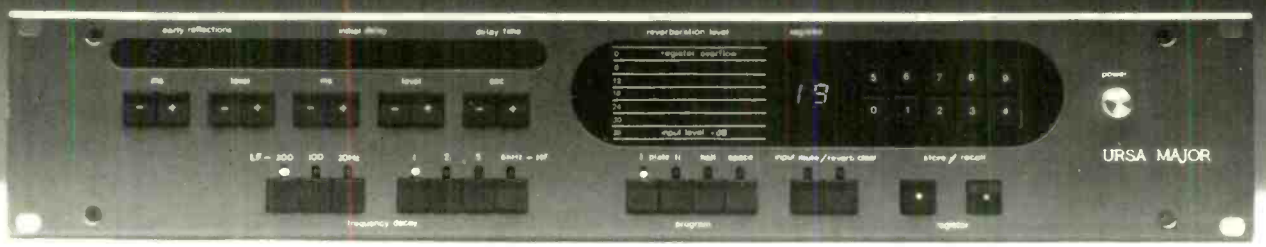

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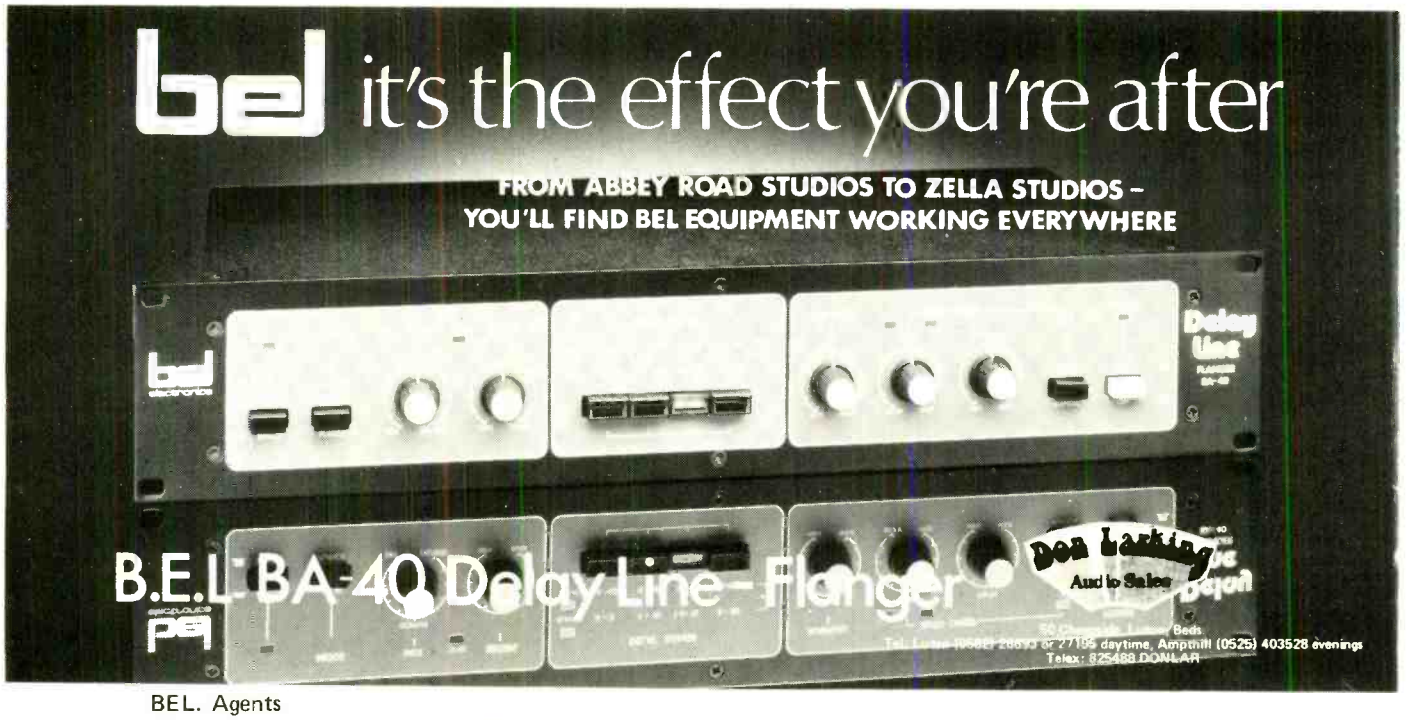

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Note: Advertisement copy must be clearly printed in block capitals or typewritten.

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50-99	58p	60p	62p	65p	68p	71p	78p	86p	94p	104p	114p	124p
100-149	57p	59p	61p	62p	64p	66p	73p	82p	89p	99p	109p	119p
150-249	53p	55p	57p	58p	60p	62p	70p	79p	84p	94p	104p	114p
250-499	51p	53p	55p	56p	57p	58p	66p	74p	80p	90p	100p	110p
500-999	49p	50p	51p	52p	53p	54p	61p	69p	77p	87p	97p	107p
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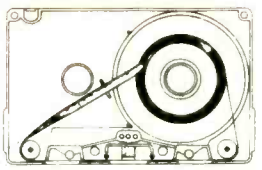

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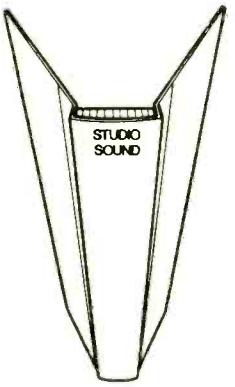

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