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STUDIO SOUND is published on the second Friday of the preceding month.

SUBSCRIPTIONS
STUDIO SOUND is available on a rigidly controlled requested basis only to qualified personnel (see back page for terms of control), or for an annual cost of £16.50 to non-qualifying readers or where more than two copies are required in a studio or small organisation.

UK Subscription cost £16.50.
UNITED STATES Surface mail subscription $40, airmail subscription $75.
OVERSEAS Surface mail subscription £17.50, airmail subscription £32.50.

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All subscription and circulation enquiries to: Subscription Dept, Link House Publications Ltd, Robert Rogers House, New Orchard, Poole, Dorset BH15 1LL, Great Britain.
Phone: 02013 71171.
Telex: 417109.

US mailing agents:
Expediters of the Printed Word Ltd, 527 Madison Avenue, Suite 1217, New York, NY 10022.

CONTROLLED CIRCULATION POSTAGE PAID AT NEW YORK, NY

BACK COPIES
A limited number of back copies are available, at cover prices.

Total average net circulation of 13,412 per issue during 1979. UK: 6,056. Overseas: 7,356.

Printed in England

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studio sound
AND BROADCAST ENGINEERING

Opening new doors

Although the recording industry is still in a somewhat depressed state, other areas of the professional audio field are expanding and progressing by leaps and bounds. Not only is television moving forward at a great rate, with the introduction of many innovations which make the TV medium more versatile, but sound broadcasting is also making great strides.

This is particularly obvious in the UK, with the rapid expansion of local radio. No doubt spurred on by the off-shore 'pirate' stations of the Sixties, radio has really opened out, and not only in the commercial field. The BBC, although heavily—and regrettably—restricted by lack of funds (and, some would say, over-administration), has also made great strides: the recent conversion of the several BBC local radio stations to stereo FM broadcasting is bound to make a great difference to programming flexibility—if the money is made available to exploit and publicise the possibilities.

The BBC and IBA have made notable technical advances: the BBC have demonstrated the viability of surround-sound Ambisonic broadcasting via *Matrix HJ*, while the IBA have developed the first Ambisonic multitrack mixing console (although it doesn't seem to get much use at the moment!). And although the IBA have departed from the accepted *UHJ* hierarchical Ambisonic system with their MSC ('Mono-Stereo Compatible') developments, it is a fact that both organisations are looking firmly to the future in this area. Hopefully the major record companies will follow suit—Ambisonics could give the record industry a welcome shot in the arm.

AM stereo in the United States will give MF broadcasters a welcome opportunity to compete on more-or-less equal terms with the FM stations. AM stereo is not as pointless as it might seem: the results I have heard are most impressive. The overall quality is quite acceptable, and even average-quality stereo is an improvement on monaural techniques. Japanese studies seem to indicate that stereo TV sound, too, is on the way.

Obviously, there is still some way to go towards obtaining the full benefit from sound broadcasting. I would like to see—particularly in Britain—more experimentation with non-commercial and community broadcasting. Such organisations as Pacifica in the US have shown that subscription radio can operate most effectively, particularly on the community level. Yet there are no plans to allow experiments in the UK (although the recent legalisation of CB may point towards a relaxation of the crippling hold which Government has on communication in the UK).

It is only right that *Studio Sound* should reflect these developments; we will therefore be increasing our coverage of sound in broadcasting over the coming months. To this end, we will be exhibiting at the April National Association of Broadcasters convention in Las Vegas for the first time. Although we have covered the exhibition for some years, this is the first time we will be occupying a stand. Editorial and advertisement staff will be on hand throughout the exhibition period and visitors will be welcome at stand 1959. We will also be present in force once again at the AES Convention in Los Angeles this month. Here, we will be occupying Room 677 at the LA Hilton, and we'll be pleased to see you there, or around the exhibition. **Richard Elen**

Errata

Regrettably, two errors occurred in our published version of Professor Fellgett's Reading University lecture, printed in our March issue (Accuracy in Sound Reproduction).

Page 36, column 3, lines 9 to 12 should read: "This is expressed mathematically by saying that the ear can supplement ordinary spectral information by bispectral information".

Page 37, column 1, line 34: for "of course gave no perceptible sense of direction", read "of course gave no *direct* sense of direction"—one can indeed perceive direction in mono, but the clues are indirect ones.

We apologise to Professor Fellgett and to readers for the inaccuracies.

Cover photograph of EMT 948 by Roger Phillips

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MAY 1981 VOLUME 23 NUMBER 5

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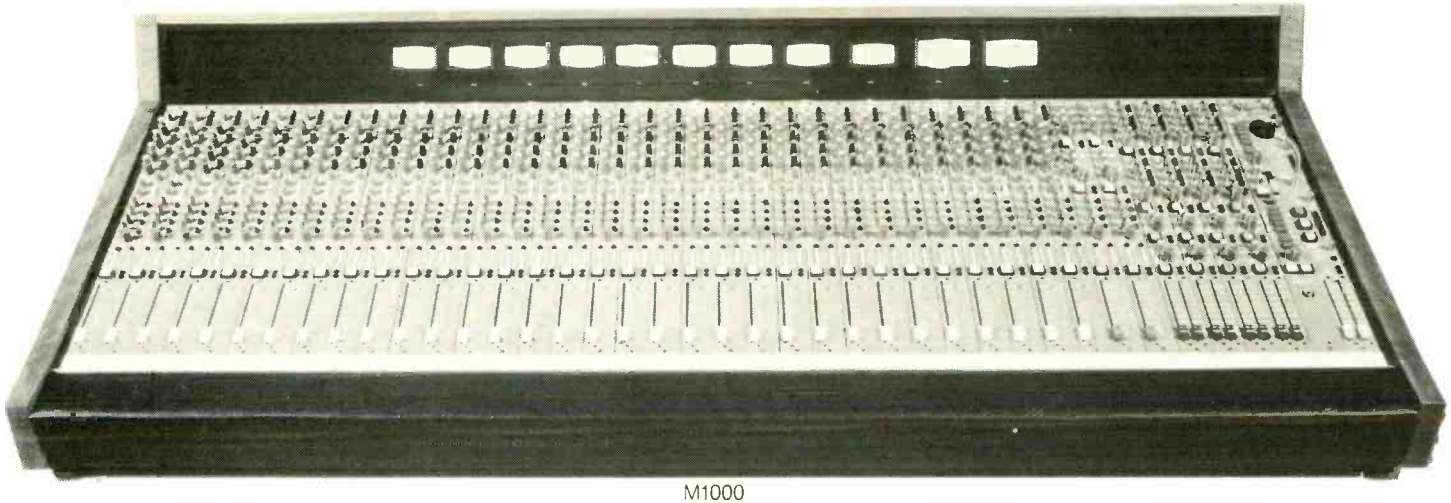

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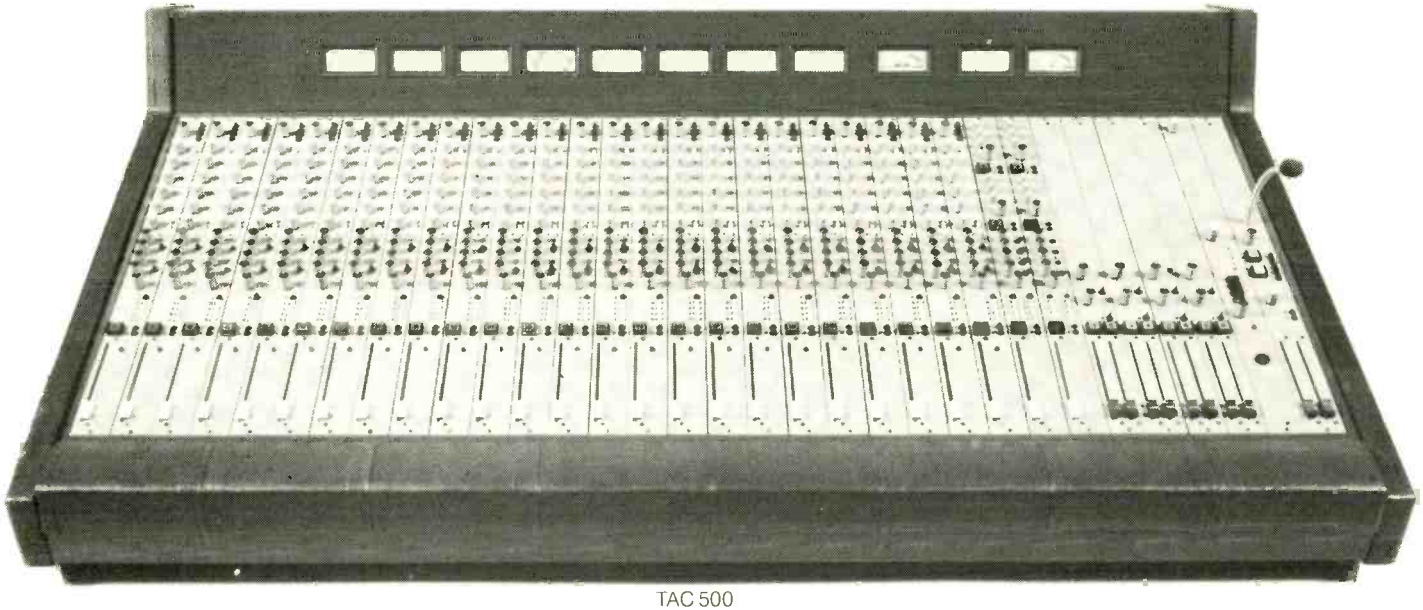

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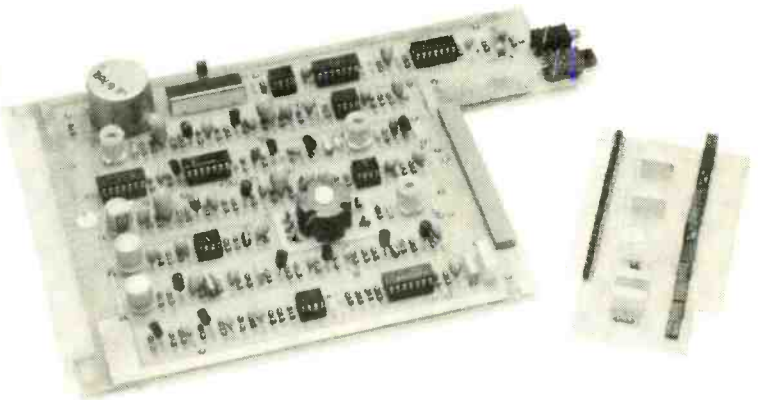

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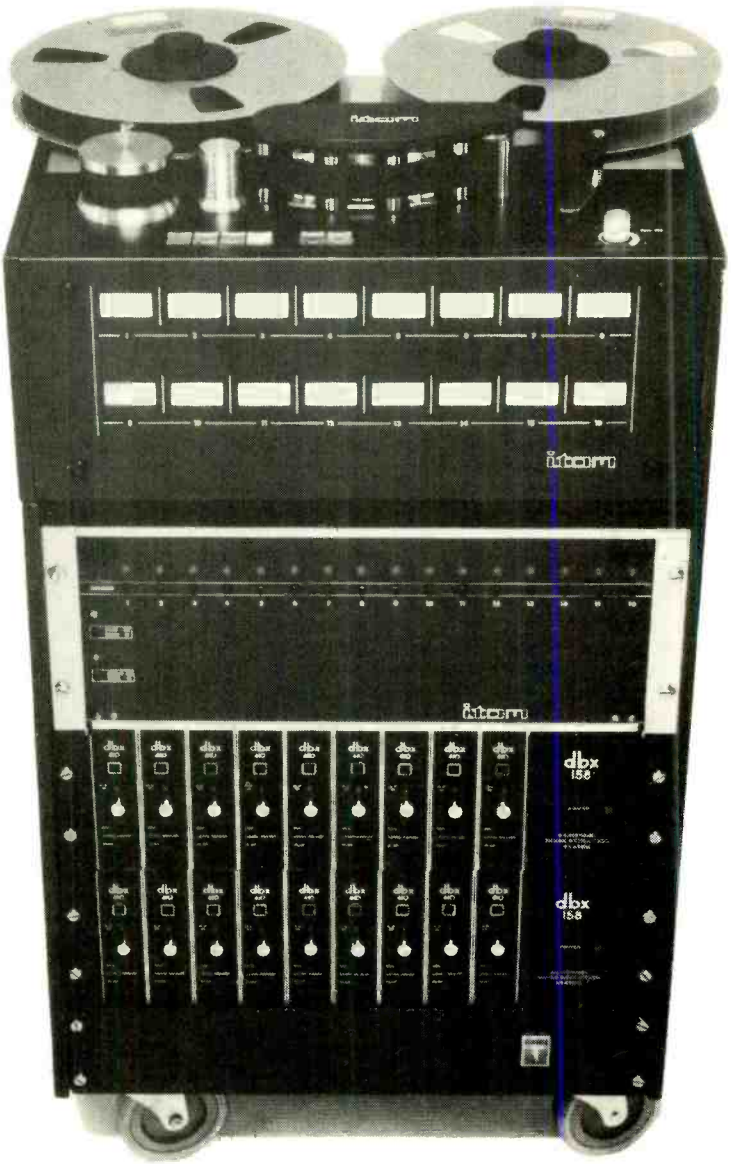

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Model 1610 1 inch 16 track. UK £5750 excl VAT. Model 810 1 inch 8 track (export only).
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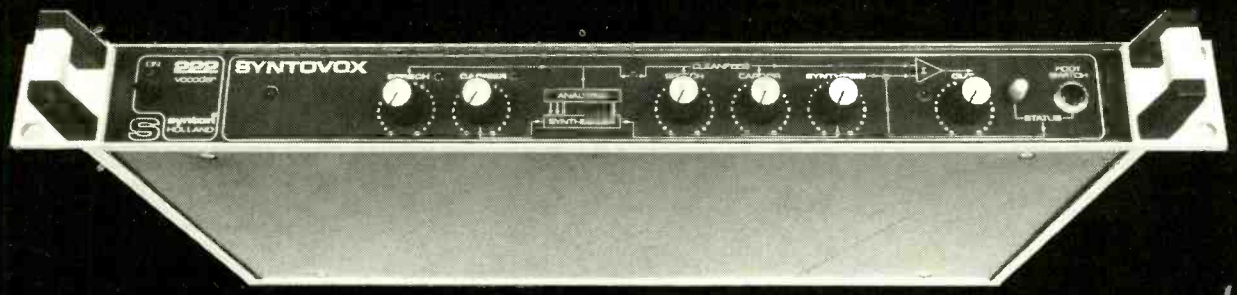

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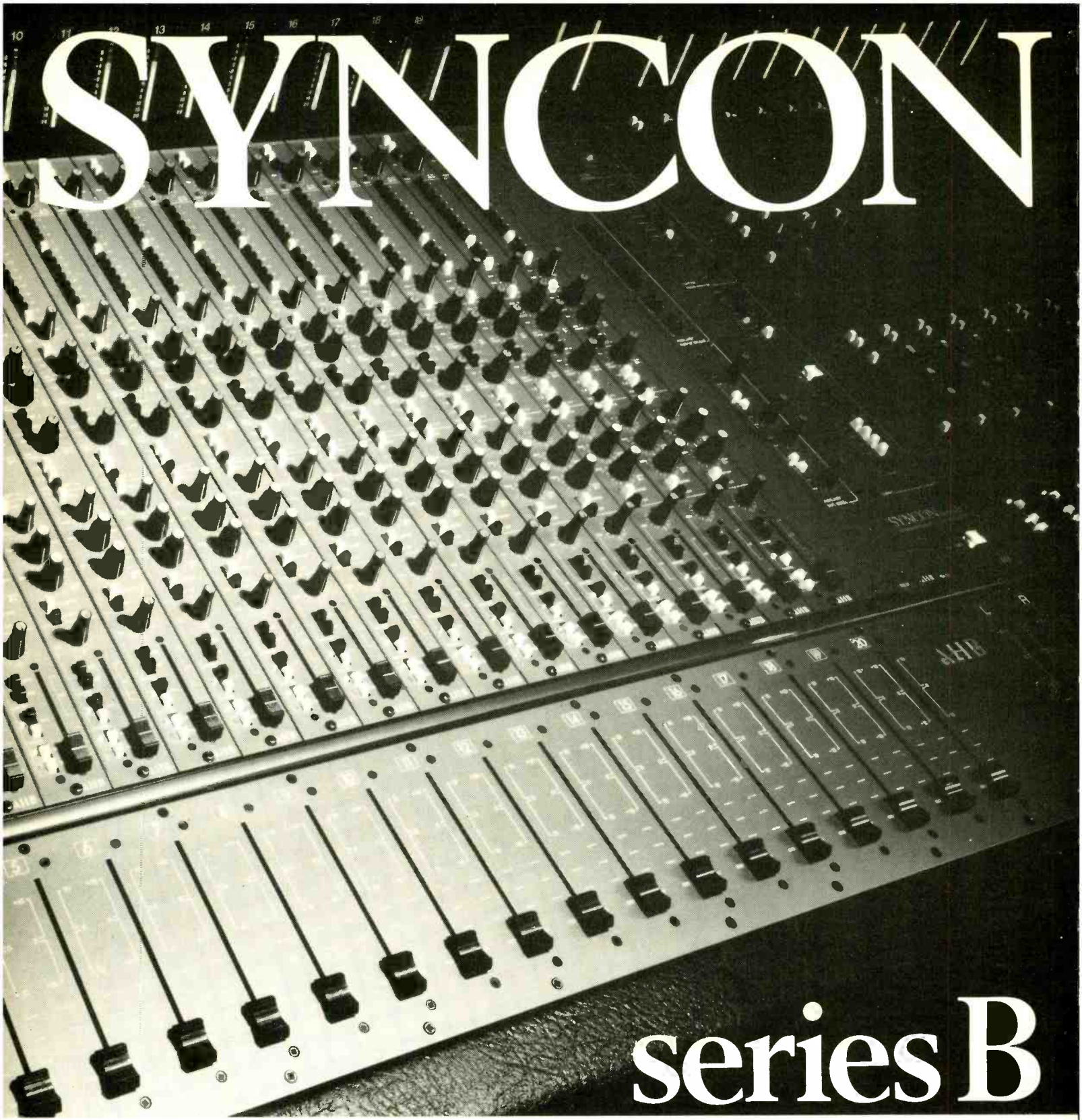

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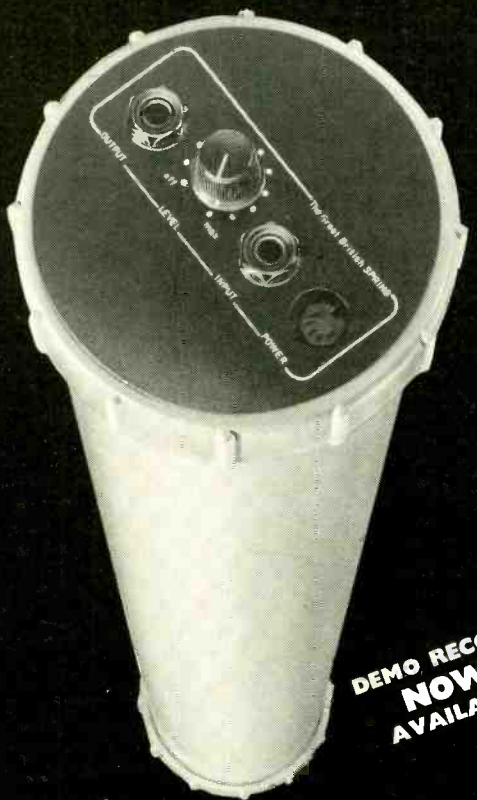

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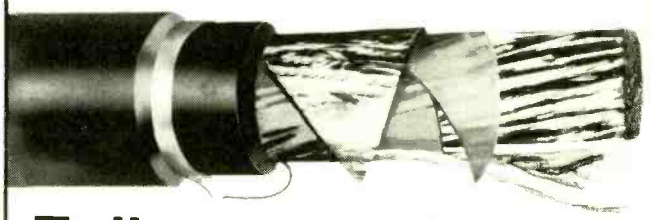

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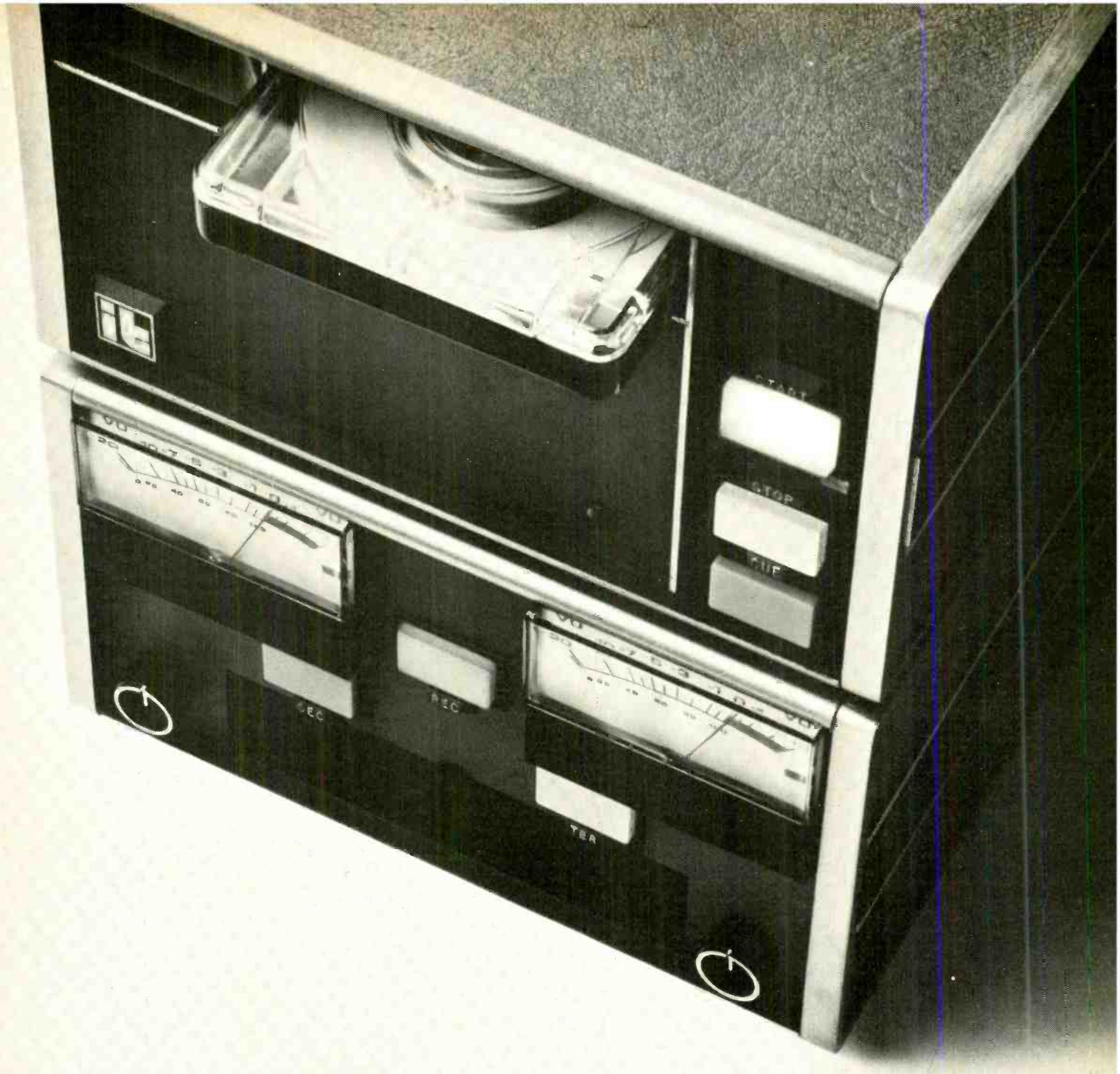

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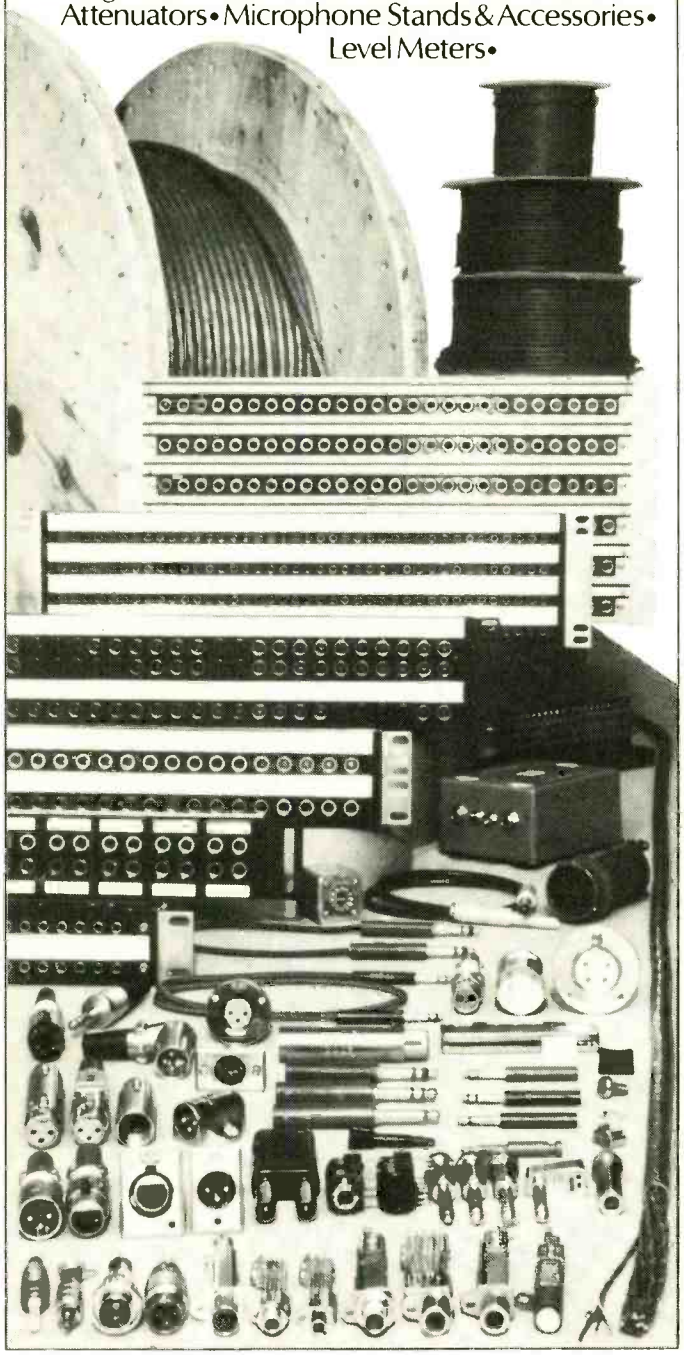

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		15	380		200		200 or 320
1	25	7½	190		200		200 or 320
		15	380		200		200 or 320
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Angus McKenzie (March 1978)

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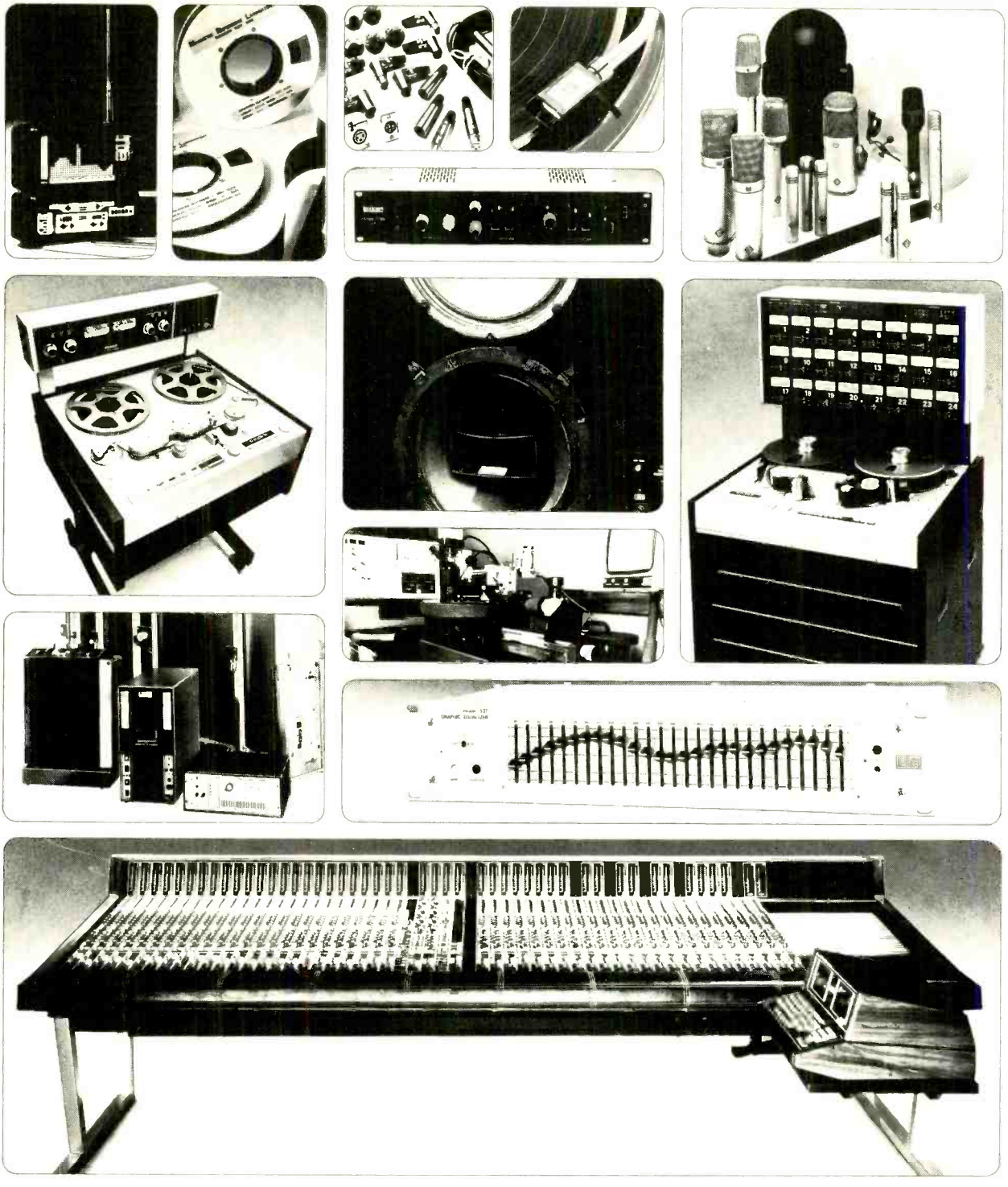

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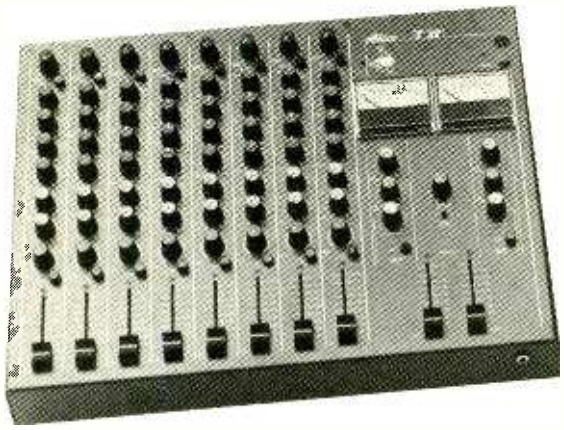

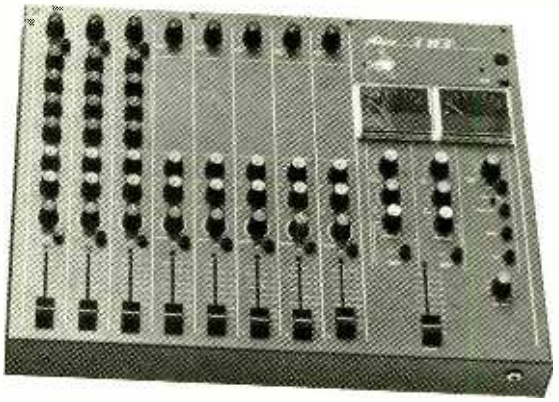

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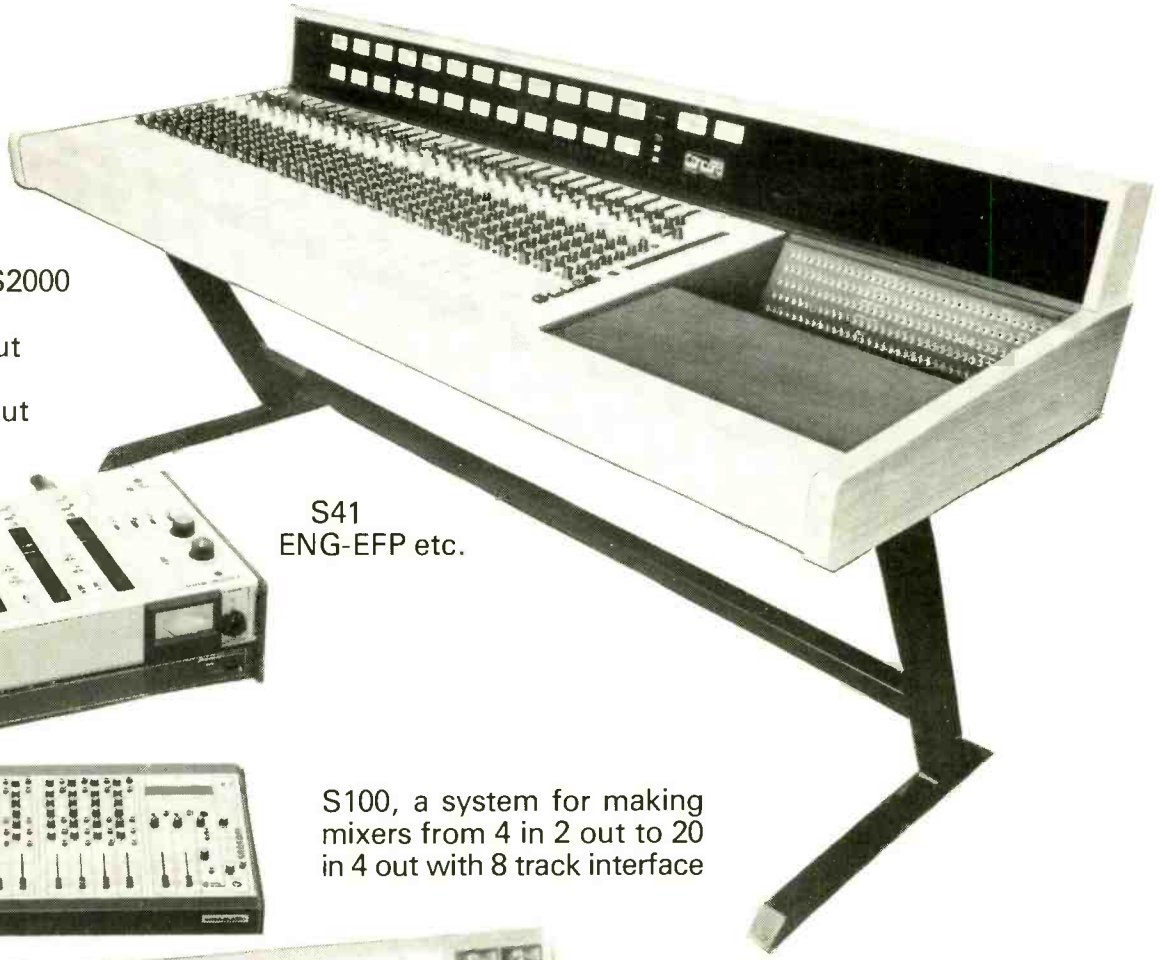

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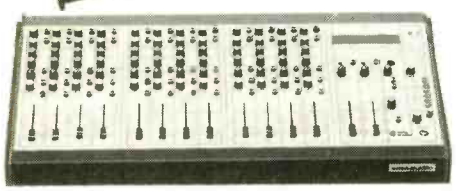

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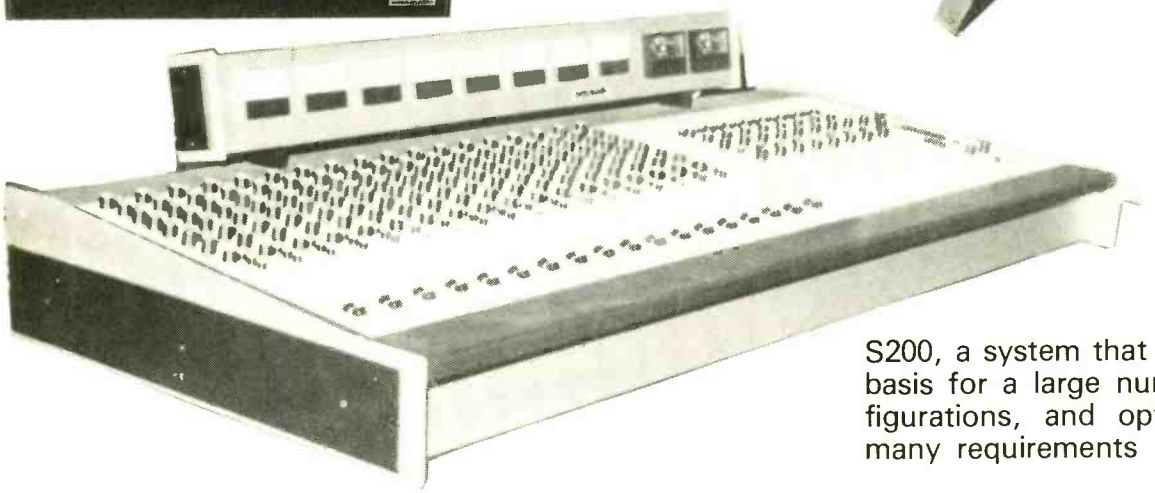

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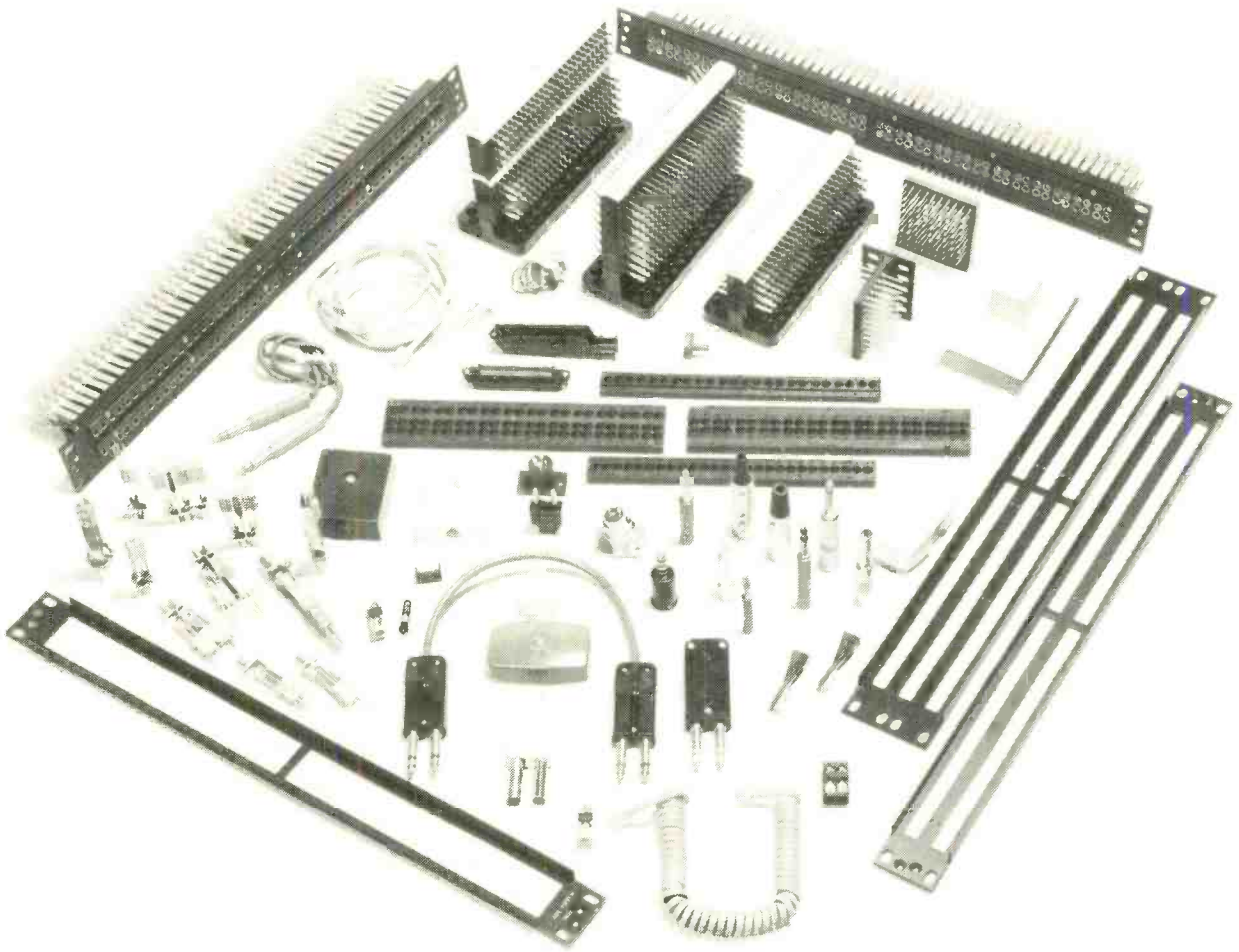

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85-16

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One for the road

Custom Portastudio systems, road-cased or racked, with speakers, amps and effects, can be tailored to your requirements. Call for details, and remember that the 144 is available now at lower prices.

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The other half of TEAC's 16-track package is the massive Model 15 mixer. Specs and facilities outshine anything they have made before. Our mini performance comparator is available on free loan to anyone seriously interested.

Better service

Bigger workshops and more staff enable us to offer fast turnaround on all pro-audio service.

Free with four

We have helped many multitrackers on their way with our offer of the 1478 mixer with every 3440 that we sell. It features treble, bass pan and fader on each of four channels, ideal for bouncing or mixdown.

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The 80-8 is the world's best selling 8-track machine, producing hits in thousands of studios.

Working systems available at package prices.

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All the TASCAM range is covered in the new, 30 page, full colour booklet, available on request. As this ad is written two months before you read it, please call or write for the latest prices and offers.

If you would like to learn more about multitrack, we can supply copies of TEAC's "Are you ready for Multitrack ?" and "Multitrack Primer" at 60p and £3.30 respectively, incl.

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The latest version of TEAC's remarkable, low priced, 2-track mastering machine now features separate left and right record switches extending its already versatile performance. In stock now.

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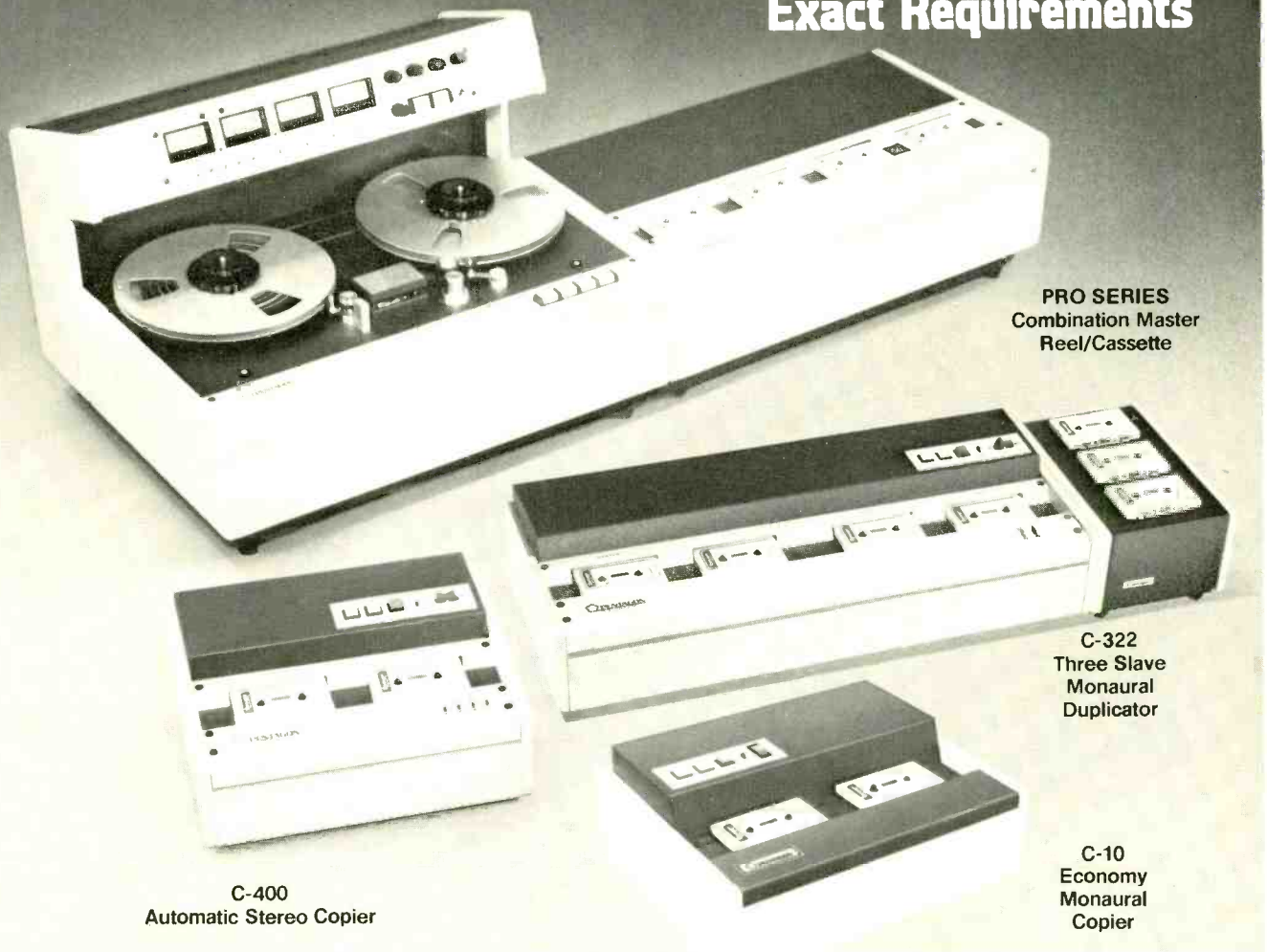

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The quality, of course, is up to Trident's usual high standard, with fully modular patchbay (512 patchpoints), +24dBm output capability and solid state switching, all based on designs proven reliable with the superb TSM range.

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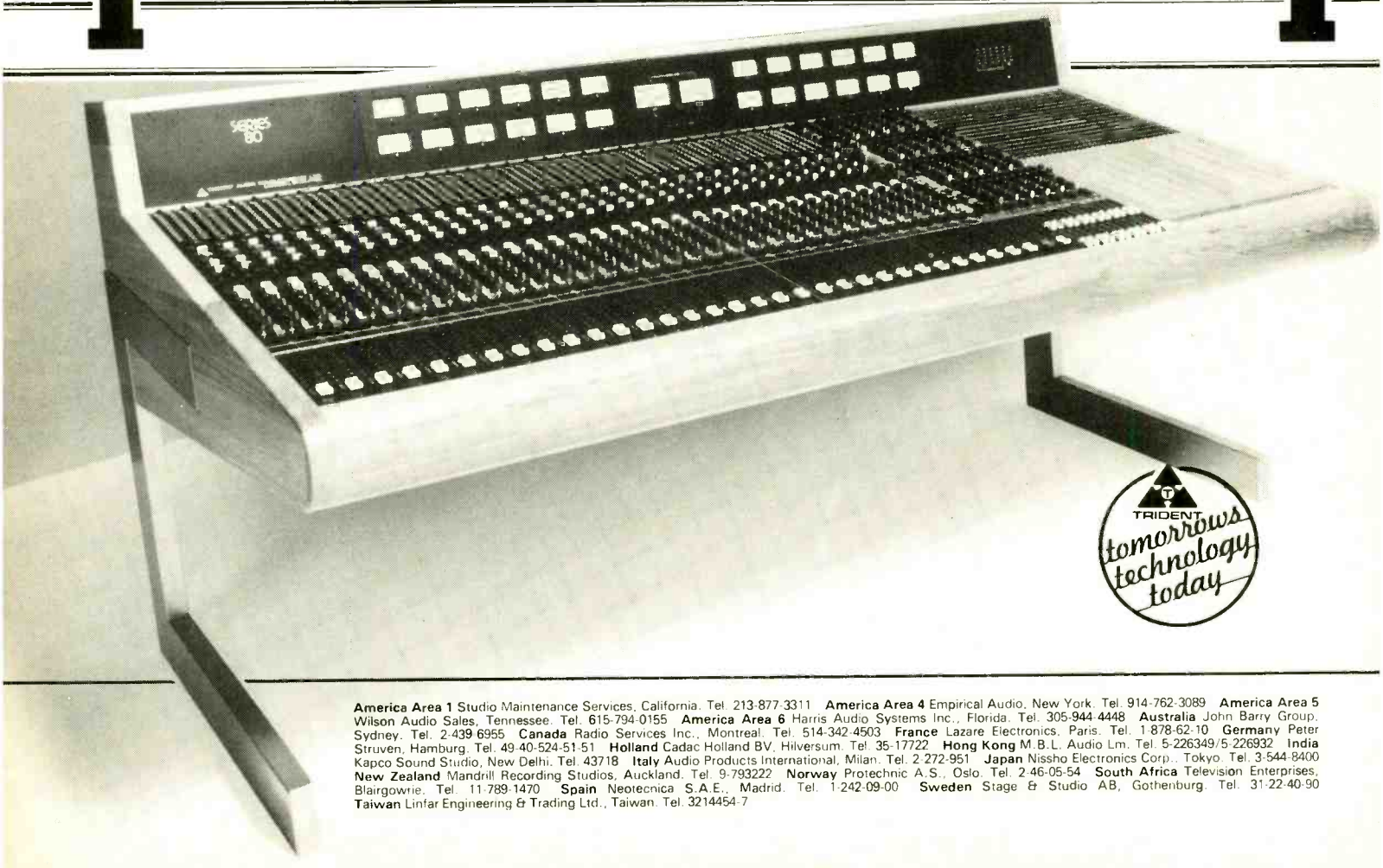

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news

Lyrec TR55

Lyrec has announced the introduction of its new professional stereo tape machine, the *TR55*. Of extremely compact design, the slimline *TR55* incorporates a number of new approaches to the problem of designing a professional mastering, editing and mobile applicable stereo machine. Most noticeable is its ergonomic design which makes it appear almost flimsy in comparison to its closest competitors. However, appearance belies the sophistication of the *TR55*. The new recorder will accept any reel size from 3in to 14in in any combination; incorporates logic control with facilities for full remote control or for interfacing with an external computer and/or synchroniser; incorporates full search logic; and uses servo-controlled solenoids for all mechanical movements. Tape transport is via servo-controlled dc motors with a tape winding speed of 500 in/s, the motors being controlled by a double push-pull system such that tape tension is individually controlled by servo arms for constant take-up and back tension.

Editing facilities are somewhat unusual in that there are no edit or dump mode facilities, edit points being located via a cue or zero search system with a continuously variable tape winding speed. Once an edit point is located, the actual cutting is done by a tape cutter mounted in the headblock which actually cuts right in front of the playback head. To aid servicing the *TR55* is of modular design with the tape deck logic mounted on a sliding sub-chassis, hinged audio amplifiers which swing down for access, and free access to all mechanical parts. The *TR55* is available in 2-speed 15in/s and 7½in/s versions (any two speeds to order) with a varispeed facility of −50 to +100%. Signal inputs and outputs are balanced and fully floating, and NAB or CCIR equalisation is available.

TR55

Specifications (15in/s) include wow and flutter 0.04% maximum; S/N ratio 68dB rms A-weighted (510nWb/m); frequency response 60Hz to 18kHz ±1dB; erase efficiency >75dB at 1kHz; and crosstalk >40dB at 1kHz.

Lyrec Manufacturing A/S, Hollandsvej 12, DK-2800 Lyngby, Denmark. Phone: 02 87.63.22. Telex: 37568.

UK: Lyrec (UK) Ltd, 19 Erncroft Way, Twickenham TW1 1DA. Phone: 01-891 2022.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, Connecticut 06801. Phone: (203) 744-6230. Telex: 969638.

Switchcraft audio adaptors

Switchcraft has introduced a new range of audio adaptors which are likely to prove a 'Godsend' to engineers. The adaptors enable the popular Switchcraft *QG* range of connectors to be patched directly to phono connectors, thus removing the need for the usual myriad of adaptors previously necessary. The range incorporates four adaptors to accomplish *QG* to phono patching.

Switchcraft Inc, 5555 North Elston Avenue, Chicago, Illinois 60630, USA. Phone: (312) 792-2700. Telex: 910-221 5199.

UK: Canadian Instruments & Electronics Ltd, Harris-Bass House, Station Road, Ilkeston, Derbyshire. Phone: 0602 302331. Telex: 377755.

Dynacord vocoder

Dynacord has added the *SRV66* vocoder to its range of PA and sound reinforcement equipment. This unit which is essentially the same as the *Syntovox 222* vocoder from Synton Electronics is to be distributed under licence by Dynacord in West Germany, Eastern Europe and Italy. Dynacord Electronik GmbH, PO Box 68, D-8440 Straubing, West Germany. Phone: 09 421 3541.

FWO Bauch price reductions

FWO Bauch has announced that due to the continuing strength of Sterling against other European currencies, the company has been able to reduce its prices on a number of products. Examples of the price reductions include: Studer *A80 MkIII* 24-track recorder with close proximity heads, £15,801; Studer *A800 MkII* 24-track, £24,993; Studer *B67 MkII* stereo portable tape machine, £1,841; EMT *948/47K* turntable, £1,222; EMT *245* digital reverb, £3,593; Neumann *U87* condenser mic, £305; and Neumann *KM84* condenser mic, £123. Full details of the price reductions are available from FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ, UK. Phone: 01-953 0091. Telex: 27502.

Protech new products

Protech Audio has introduced two new products. First is the *725BA4M*, a new multipurpose 4-channel booster/summing amplifier, comprising four independent amps each with a continuously variable gain of unity to 20dB and output capability of +20dBm per channel, all on a single plug-in card. Featuring direct access to the inverting and non-inverting inputs, the design allows the user to select the desired mode of operation by making appropriate external connections. Typical uses include: post-fader/pre-summing buss booster amps; distribution and/or isolation amps; and summing/combining networks in consoles. The input impedance is 100kΩ in the booster amp mode and essentially virtual ground in the current summing mode. Frequency response is flat, ±0.25dB, from 20Hz to 20kHz, and THD is 0.25%. Each amp is separately decoupled from the common supply buss (±15 to 18V dc). Up to 16 cards may be housed in a *725CFR* 19in rack card file, whilst a single card holder (*725SCH*) and a 1¾in high by 19in 4-card rack mount (*725RMP*) are also available, plus a selection of card and modular system power supplies.

The second new product from Protech is the *PL-AMP* headset intercom system, designated the *684 Series*. This system includes single and dual channel intercom stations for portable use or fixed installations. The system features a 600Ω balanced, transformer isolated PL buss and is compatible with standard telephone type circuits and equipment. High gain amp circuitry with adjustable volume and side tone cancellation are incorporated, while the system may be flexibly powered from any readily available single-ended 9 to 24V dc power source, either individually or from a common supply. *Telex* headsets or telephone headsets may be supplied as standard accessories.

Protech Audio Corp, Flowerfield Building, Suite 1, St James, NY 11780, USA. Phone: (516) 584-5855.

Call for papers

Authors and researchers are invited to submit papers for inclusion at the Fourth International Conference on Video and Data Recording to be held from April 5 to 7, 1982 at the Kensington Conference and Exhibition Centre, London. Deadline for submission of the synopsis of papers is April 30, 1981 and all interested parties are asked to contact the IERE, 99 Gower Street, London WC1 (Phone: 01-388 3071) by this date for details.

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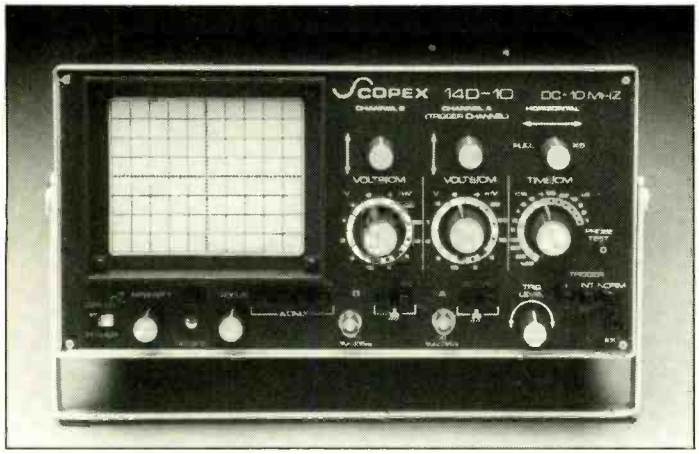


Scopex 14D-10

Scopex Instruments has announced a replacement for its *4D-10B* oscilloscope. Designated the *14D-10*, it is a 10MHz dual trace, high sensitivity oscilloscope retaining much of the standard Scopex format although the display and associated controls have been moved to the left of the instrument and the two input channels to the centre. There are pushbutton function switches and the trigger control has been replaced by a pot and ± pushbutton to enable triggering of positive and negative edges of digital pulse trains without re-adjustment.

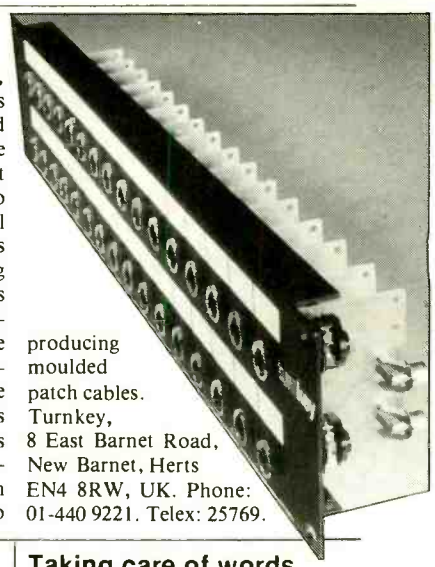
A 5½in rectangular tube can achieve 10MHz (−3dB) over the 3⅞ x 3⅛in display. Both channels have a sensitivity of 2mV/cm to 10V/cm over the full bandwidth and the timebase ranges from 100ms/cm to 1µs/cm with optional x5 expansion.

With a switched mode power supply reducing the weight to 5kg the *14D-10* is portable and retains features of the *4D-10* such as 3% accuracy and trace locate. The price of the *14D-10* is £230.

Scopex Instruments Ltd, Pixmore Industrial Estate, Pixmore Avenue, Letchworth, Herts, UK. Phone: 04626 72771.

Turnkey Modpatch

Turnkey has introduced *Modpatch*, a modular system of prewired pcbs arranged as a studio jackbay and requiring no soldering to install. The system comprises a 19in rack mount chassis with two rows of 16 mono jacks in a 3¾in height. Each vertical pair of jacks are mounted on a glass fibre pcb with pairs of sockets being normalised, the tip connections being shorted via the switching contacts and printed circuit wiring. The rear of each board offering a corresponding pair of jack or phono type sockets. The advantage of this system is that normal connections stay made until a jack plug is inserted into the front socket. In addition to the system Turnkey are also producing moulded patch cables.



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

Editall taken over

As from January 1981, Editall, the company founded by Joel Tall in 1952 to produce magnetic tape editing equipment, has been acquired by the Xedit Corp. Xedit, with its own extensive experience in the design and manufacture of precision splicing blocks and electronic products, will base the combined operation from its plant at: Xedit Corp, 133 South Terrace Avenue, Mount Vernon, NY10550, USA. Phone: (914) 668-0388.

Taking care of words

If you're selling a technical product—like a new studio device—or a technical facility—like a studio—you'll probably know how difficult it is to find someone who can produce brochures and ads for you. Either they are great creative artists and designers who don't have a clue about whether it's an *A-80* or an *A-800*, or they are brilliant technical people who can't write or design a brochure very well. Often you end up doing it yourself, and the results can be disastrous, for both company image and sales.

One company which aims to remedy this problem is Wordsmith Graphics. Based in Street, Somerset, in England's West Country, they offer a complete service for people marketing technical products and services. Wordsmiths have assembled a team of writers, designers, artists and typesetters who can take a basic idea and work with you on a brochure, advert, catalogue, handbook or manual, turning out the final printed material or artwork and presenting your efforts in the clearest, most interesting and most accurate way. As they point out, such a service costs money, but getting it right first time is far cheaper than losing sales and image with a bad piece of artwork.

Wordsmith's major speciality is digital hardware and software—their setting equipment includes an expanding range of special graphic and technical symbols, and in addition are able to 'download' program software for direct setting without re-keying errors. The team also 'speak' the technical 'languages' required, and know, for example, that it's 'ASCII', not 'ASC 11', 'baud' and not 'band', and 'dBV', not 'Dbv'. If you're about to produce a new ad, brochure or manual, Wordsmiths are worth checking out. Wordsmiths Graphics Text Services, 19a West End, Street, Somerset BA16 0LQ, UK. Phone: 0458 45359.

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Clyde Electronics products

Further to our news item announcing the formation of Clyde Electronics Ltd (*Studio Sound*, March 1981, Page 20), we have now received preliminary details of the company's broadcast product range. Top of the range is the *Alpha Series* modular mixing console. This console is available in several formats to suit a wide range of applications and features several different input, output and monitor modules. Modules available include the *MLII* mic/line module (available with several options); *SLII* stereo line module; *DR1* dual return module; *MO2* master output module; *MM1* monitor and meter module; and *CO1* communications and oscillator module. Features of the modules include input modules assignable to either or both of two main stereo busses, functional as either programme and audition busses or as four separate groups; two separate aux busses selectable pre/post fader; optional transformer balanced signal outputs; two clean feed buss outputs on each input module; optional penthouse meter placement; and forward and reverse talkback facility on the communications module which also contains a multi-frequency line-up oscillator. Other features of the console include the availability of several mixer mainframe sizes; the removal of all dedicated hard wiring from the mainframe; complete module interchangeability to facilitate module configuration changes; and steel construction of the modules with interchannel screening.

In addition to this console, Clyde are also to produce the *Delta Series* news mixer. This mixer is basically a sophisticated audio switching system with a certain amount of in-built intelligence, and is designed to interface with cart machines and other high level external sources. The *Delta* has two mic inputs and is intended for use in any situation where ease of operation is of paramount importance. Physically the mixer is in two parts with the bulk of the electronics housed in a 3U 19in rack which contains all the switching and signal routing, while operator commands emanate from a small desk top control unit. This control unit being divided into two main groups with switches with red LEDs selecting the signal source fed to the transmitter, while switches with green LEDs select the monitor source. Monitor selection is in two sections: a loudspeaker feed with automatic muting when a mic is 'live', plus a reverse talkback feed. A feature of the mixer is that there are no faders in the signal path and hence no possibility of inadvertently setting incorrect levels. Both mic inputs have automatic gain controls and the final desk output stage contains a soft compressor and a fast acting peak limiter to ensure preset levels are maintained.

Clyde are also producing the *BTU1* broadcast turntable unit which is a complete turntable system with equalising amps and optional monitoring facilities. The unit comprises a Technics *SP10* turntable with a choice of arm, and the turntable may be started locally, remotely by a fader, or via local fader start. (Fuller details appear in our Turntable survey.)

Other products from Clyde comprise a number of 19in rack mount units. These are the *TB1* communications talkback unit, a self contained talkback station providing bi-directional communication with 10 other stations; the *DA1* modular distribution amp system; the *M1* station monitor unit; the *S1* supervisory system providing visual and audible indication of fault conditions; the *L1* studio/PO line/transmitter interface unit with plug-in peak limiter cards and side chain compressor card; *HP4* headphone amp unit, also suitable for driving *Auratone* or similar small loudspeakers; and the *OM2* general purpose diagnostic unit with an audio oscillator and audio monitor facility.

Clyde Electronics Ltd, Ranken House, Blythswood Court, Anderston Cross Centre, Glasgow G2 7LB, UK. Phone: 041-221 5906.

EXPRESSION

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

Trio FL-180

A new wow and flutter meter from Trio is its model *FL-180*. The meter has a measurement range of 0.003% to 10% at the DIN and CCIR standard centre frequencies of 3kHz and 3.15kHz and has a minimum input sensitivity of 0.5mV. Three types of indication are provided by the instrument's analogue meter: effective rms (JIS); average (NAB); and peak (CCIR/DIN). Features of the unit include a crystal controlled oscillator and a 4-digit frequency counter to monitor tape speed. The frequency counter's timebase being determined either by the crystal oscillator or the ac mains frequency. The frequency counter can also be operated independently over the range 10Hz to 9,999kHz. Price of the *FL-180* is £499.

Trio-Kenwood Corp, 21-24, 3-chome, Ike Jiri, Setagaya-ku, Tokyo 154, Japan.

UK: House of Instruments, 34/36 High Street, Saffron Walden, Essex CB10 1EP. Phone: 0799 22612. Telex: 81653.

Obituary

Douglas Joyce, chief executive and secretary of the Association of Sound & Communications Engineers died after a prolonged illness at the end of January. Douglas took over the duties of the Association's secretariat in April 1974 and carried out an extensive re-organisation and development programme, also undertaking the organisation of the Association's exhibitions and the editorship of its publication *Public Address*. Under Douglas's leadership the Association went from strength to strength to become an established industry force. Amongst his most notable achievements were the formation of the Institute of Sound and Communications Engineers in November 1979, and his efforts through the Association to act as a sponsor (on behalf of the BOTB) of joint ventures overseas. This latter activity reaching a pinnacle with the first ever British professional sound equipment exhibition to be held in Japan (in Tokyo) in October last year. Douglas's flair for organisation and his untiring efforts on behalf of the British professional sound equipment industry will be sorely missed.

Pulse

3M has introduced a new series of technical information bulletins entitled 'Pulse' covering various aspects of the company's *Scotch* magnetic recording tapes. The first two issues cover 'Magnetic tape erasure — how serious is the threat?' and 'The handling and storage of magnetic recording tape', with other issues to follow.

Anyone wishing to receive copies of these and future issues should write to: M Luddington, Recording Materials Division, 3M UK Ltd, 3M House, PO Box 1, Bracknell, Berks RG12 1JU, UK.

Protect your interests!

Following the comments in our February editorial on the rights of studios to withhold tapes from clients who have not paid, we have received a note from the UK Association of Professional Recording Studios which clarifies the position somewhat in this particular case.

"From time to time we have urged studios to protect themselves by using a booking form which embodies the APRS recommended terms; the form to be signed by every customer before the commencement of work on any booking.

"This need is underlined by an unfortunate event that has overtaken one of our members, a major London studio, which did not get a signed booking form. Although the booking took place before the new APRS terms were published, the moral is still there.

"The studio, after receiving its customer's order, undertook recording work to the value of over £12,000 believing itself to be protected by a personal guarantee which it had requested and which had been arranged by the customer. When the customer could not pay his bill the studio withheld the master tapes and requested payment from the guarantor, who was also unable to pay: the guarantee proved worthless.

"Subsequently the customer sued the studio in the County Court and won an action to have the tapes handed over by the studio. The decision is being taken to appeal but (at the time of going to press) the situation is this.

"The studio has not been paid, has lost its hold on the tapes and has suffered considerable inconvenience — and expense to boot. Had the studio, on accepting the customer's order, been able to obtain a signed booking form embodying the recommended APRS terms the customer would not have had any right to the tapes until he (the customer) had paid his bill, in full.

"You have been warned!" ■

Contracts

● Elliott Bros has been awarded the installation contract for Angel Recording Studios by De Wolfe Ltd. The company has also supplied Tannoy monitor loudspeakers to Thames Television, Capital Radio, and Plymouth Sound.

● Rupert Neve Inc has installed its first North American *Necam II* mixdown system at Motown Recording Studios in Hollywood. The company has also received an order for a *5315/24* console for the Los Angeles facilities of KTTV/Metromedia.

● Clyde Electronics Ltd has been awarded the supply, installation and commissioning contract for the new Aberdeen ILR station, North of Scotland Radio.

● MBI Broadcast Systems Ltd has received a contract to supply, install and commission all equipment for Centre Radio, the new ILR station covering the Leicester area.

● The Broadcast Products Division of the Harris Corp has delivered 21 *FM-300KD*, 300W dual FM transmitters to the IBA. Harris has also supplied WHJE (FM), the student-operated FM station at Carmel High School, Indiana with a *9002* automation system for use with its mainly Harris equipped radio studios.

● Rupert Neve Inc has supplied CBS Records, New York with an *8108* 32-channel console with *Necam*. Other recent contracts include an *8078* 44-channel console with *Necam* for Groundstar Laboratories, Nashville; and an *8108* 32-channel console again with *Necam* mixdown for United Sound, Detroit.

People

● Arthur Hausman, a director, president and chief executive officer of Ampex has recently also been elected to the position of chairman of the board. This move follows the merger of Ampex with Signal Companies Inc. In line with the merger the Ampex board has also been increased in number to 14 members, the new members being Forrest Shumway, Daniel Derbes, Charles Arledge, John Teske, and Charles Steinberg.

● Mr K P Robinson has been appointed managing director of Marconi Communication Systems Ltd.

● Timothy Hulick has joined the broadcast product division of the Harris Corp as FM section manager.

● The newly formed Singer Broadcast Products Inc has appointed Donald Richardson as executive vice president and general manager. Joseph Consalvi has been appointed vice president, sales and marketing.

● Wayne Kerr/Rendar has appointed Dr Jack Izatt as its new technical director. Other WKR appointments include Simon Atkinson to ATE product manager and Brian de Laine as manager, customer services department.

● Canford Audio has appointed Jane Walden as its sales manager.

● Thornton Bradshaw, formerly president of Atlantic Richfield, is to become chairman of RCA following the retirement of present chairman Edgar Griffiths.

Financial

● The Broadcast Products Division of the Harris Corp has increased its range of automation systems for radio stations with the acquisition of Automation Electronics Inc of Lafayette, Indiana for an undisclosed amount. The acquisition integrates Automation Electronics computer based systems software for the business side of radio stations (sales, accounts, etc) with Harris's own automation programming equipment for radio stations (commercials, news breaks, etc). The entire Automation Electronics operation is to be relocated to Quincy, Illinois where it will operate as part of the Harris Broadcast Products Division.

Address change

● Syco Systems have moved to 20-21 Conduit Place, London W2. Phone: 01-723 3844.

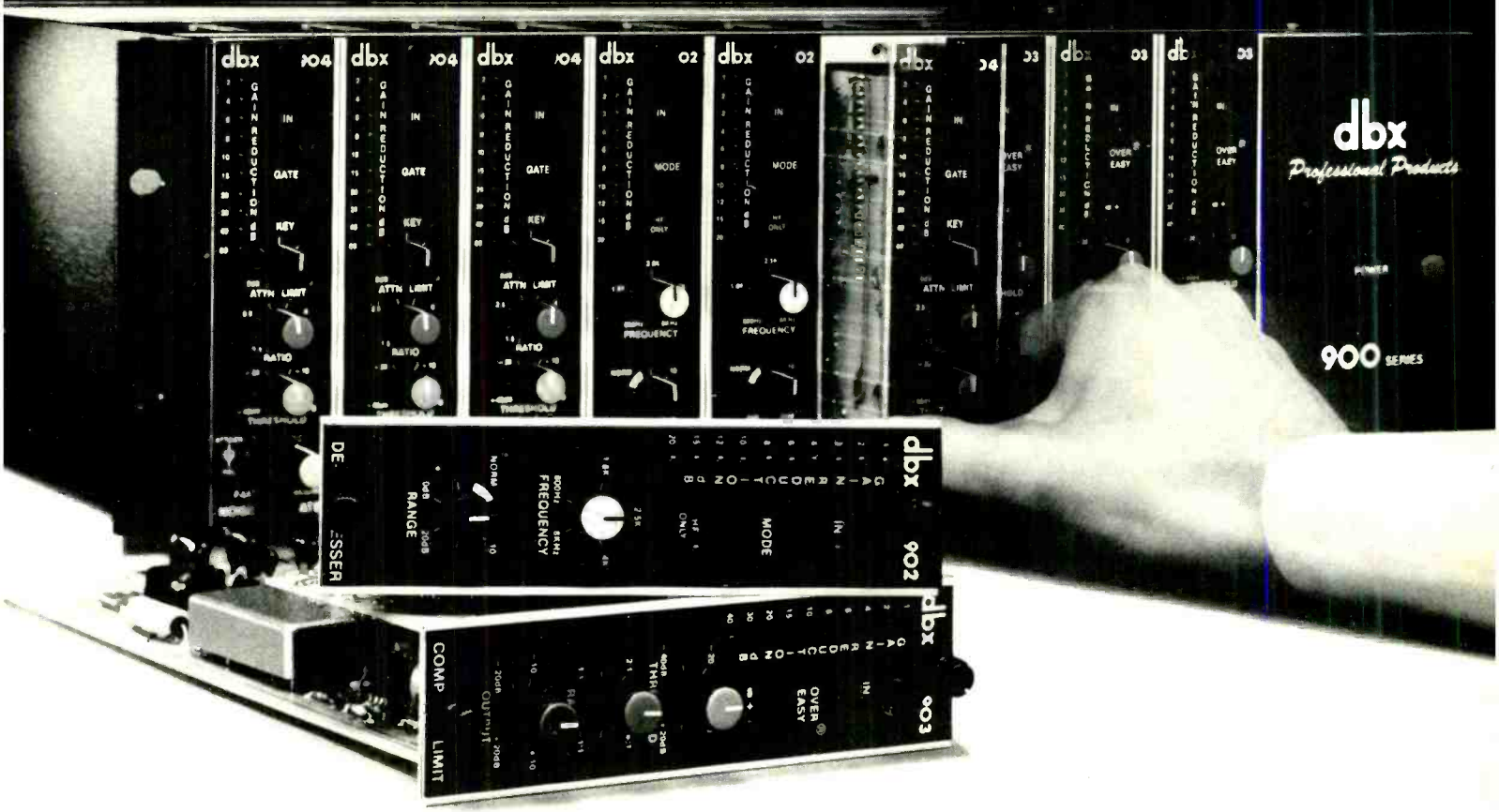
dbx

THE DBX 900 SERIES MODULAR SIGNAL PROCESSING SYSTEM

Today signal processing plays a greater role in sound production than ever before, both in the studio and on the road. As a result, rack space is at a premium. Innovative packaging eliminates redundant power supplies, simplifies interconnects, and saves space. With this in mind, dbx has created the 900 Series Modular Signal Processing System.

The dbx 900 Series features convenience with flexibility. You can fit up to 8 sophisticated signal processing modules into a rackmount unit measuring just 5¼" high. Each 900 Series module represents a step forward in state-of-the-art technology. Installation is quick and easy to accomplish. Standard connectors enable you to wire the rack into your system like any other component. The interchangeable signal processing modules slip in and out in seconds.

The dbx 900 Series is the ultimate in flexibility. These modules place at fingertip control creative tools to express your unique sense of artistry in sound production.



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

France	**3M France SA, Mincom Div.** Boulevard de l'Oise, 95000 Cergy Tel : Paris 749 0275
Holland	**Special Audio Products BV** Scheldeplein 18 Amsterdam Tel: Amsterdam 797055
Sweden	**Tal & Ton Musik & Electronic AB** 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

studio diary

Sea-West Studios, Hawaii

Avid followers of the American recording scene will know that in 1979 Rick and Donna Keefer, owners of Sea-West, transplanted their studio operation from Seattle in the Pacific Northwest to the more pleasant climes of Hawaii. The reason for the change of location being a general disenchantment with Seattle and the fulfilment of a long-held desire to live in Hawaii. A year on from the move and with the studio operation back in full swing, now seems to be a suitable time to take a closer look at the transplant and its history.

Sea-West was formed in Seattle back in 1970. It rapidly gained a name for itself and in the 10 years between its foundation and the move to Hawaii, many top-line artists made use of the facility. Artists which Rick recorded in his mainland days include Johnny Mathis, Bachman-Turner Overdrive, Wendy Waldman, Foghat, the Bob Seger Band, Heart, Bell & James, Al Stewart, and the Little River Band. An additional facility which Rick opened in Seattle and took with him to Hawaii was the Sea-West remote 16-track truck which was used on a multitude of jobs including recording April Wine and Graham Parker and the Rumour. Upon deciding to change location, Rick transferred not only the mobile but also the majority of his present equipment to Hawaii.

The transplanted Sea-West is located on a 2-acre beachside site outside Honolulu (approx 45 minutes from Honolulu airport) on the beautiful North Shore Coast of the island of Oahu, and boasts admirable surroundings. For example the plate glass windows of the studio look over palm trees to the surf breaking on an offshore reef, while the control room looks out to a bamboo grove and a waterfall. It is, therefore, an ideal 'vacation' recording environment which is well suited to relieving the pressures of recording while providing sun and surf for those in need of relaxation/inspiration.

What of the construction and equipment, though. The studio has been designed with variable acoustics and hidden 'active' traps using the latest European style construction techniques. The style of finish being a variegated decorative style using motifs reflecting the studio's Hawaiian location. Both the studio and control room are asymmetrical with access between the two rooms being via a set of double sliding acoustic doors sited in front of the console—the doors also acting as the control room window. Although both rooms are fairly compact there is no feeling of being closed in and both have a conducive working atmosphere which match the exterior surroundings.

The Sea-West control room is equipped with a wide range of goodies, but pride of place must go to the console. This is a 32-channel custom Deane Jensen console which utilises Jensen input transformers, Jensen *918* preamps, Neumann faders, and features full mixdown logic. Rick Keefer describes the console as being "super quiet with very good headroom". The console operates in conjunction with an MCI *JH-24* tape machine with 16 and 24-track headblocks, and the MCI *Autolocator*. In addition Rick has an Ampex *MM-1200* 16-track and btx SMPTE time code generator/synchroniser, hence the studio can be operated as either a straight 24-track facility or as a dual machine 32-track. Mixdown is to an Ampex *ATR-102* machine and all mastering is done at 30in/s, non-Dolby. Other tape machines include Revox copy recorders and JVC cassette recorders.

Control room

Studio

Monitoring in the control room is primarily provided by Altec/Mastering Lab *604-Es* driven by Crown amps, but additionally JBL *4325*s, *4310*s and *Auratones* are available. Outboard equipment comprises the usual wide selection mainly situated in wall mounted 19in racks and includes the following units: Lexicon *Prime Time;* DeltaLab DDLs; MXR DDLs and flangers; EMT plate; Micmix *Master Room* echo; an acoustic echo chamber; UREI *1176LN* limiters, *Little Dipper* filter, and parametric eq; dbx *162* comp/limiter; *Gain Brains;* SAE graphic equalisers; and Roger Mayer noise gates. Also as usual a wide selection of mic types are available including models from AKG, Beyer, Neumann, Sennheiser and Shure.

In the limited time period since the transplant to Hawaii, Sea-West has continued to build upon its already notable track record. Although opening his doors to local acts, Rick Keefer has retained and expanded his international clientele. In fact Rick is at great pains to stress that the studio is internationally orientated and that his market is "the mainland, Australian and Japanese markets". An indication of this attitude can be gathered from the fact that since the move to Hawaii Sea-West has been the venue for album projects by Marvin Gaye, Carlsen-Macek, Kidd Afrika, Mariah (a Japanese group from Tokyo) and Jim Nabours. To facilitate this international image, Rick in addition to providing the normal studio services will rent beach villas for visiting artists during their recording stints at Sea-West, and can also provide session musicians including string and brass ensembles should they be required. A further useful service provided is the provision of a wide selection of musical instruments including a full studio drum kit, Yamaha grand piano, and numerous other keyboards, guitars, amps, etc.

As previously stated the Sea-West mobile was also transported to Hawaii in 1979. This mobile is a 16-track facility and the studio is built into a Dodge Explorer 25ft mobile home complete with bed and bathroom. Equipment in use in the mobile includes an Antares 20-channel console; Ampex *MM-1100* 16-track tape machine; Ampex 2-track; and Studer and Revox 2-tracks. Monitoring in the mobile is via JBL *4310*s driven by Crown power amps, and a full complement of outboard units are carried. The mobile has a 200ft snake plus sub-snakes and transformer isolated splitters, and additionally features a CCTV monitoring facility.

After a year's operation at its new location Sea-West appears to be catering well for a mixture of international and Hawaiian artists. International artists, and Japanese artists in particular, seem to be taking a great deal of interest in the facility. Undoubtedly the transplant has been successful, but then with the string of successes Rick already had behind him on the mainland, the transfer to a Polynesian paradise was perhaps only gilding the lily! **Steve McGarrett**

Sea-West Recording Studios, PO Box 30186, Honolulu, Hawaii 96820, USA. Phone: (808) 293-1800.

40 ▶

MR-2

MR-2 delivers more usable console for the money. Efficient design has reduced the labor and material content, while improving features, signal handling, and reliability.

MR-2 offers a full range of options and features, allowing you to specialize your console to your functional and budgeting needs.

MR-2 expansion frames and module update kits continue to keep your console matched to your future needs.

Resale prices of Harrison-designed-and-built consoles demonstrate that MR-2 will continue to protect you even at trade-in.

More Usable Console for the Money?

Somehow that sounds like cheating—as though you could get something for nothing. NOT SO!!

The secret is to eliminate things that cost money but do not add any function or "quality" to the console.

The console designers at Harrison Systems have identified many traditional inefficiencies and have eliminated these in the design of MR-2.

Printed-circuit boards have been made smaller (thus, less expensive) through the use of double-sided artwork and a more meticulous, time-consuming design process.

Almost all hand-wiring in the frame has been eliminated. Mother-board-mounted multi-pin connectors are used for inputs and outputs.

Seldom-used features (like Quad) have been eliminated and replaced with more desirable and useful features.

Module width has been reduced to 40.6 mm (1.6"), thus reducing metal-work cost for a given console size.

In other words, every small detail of the MR-2 design has been critically optimized for efficiency. This efficiency does not mean, however, a reduction in signal-handling quality or reliability. In fact, just the opposite is true.

A radical new multiple-ground system is at work to even further reduce induced noise.

Modern "dielectrically isolated" switches are used for all logically controlled switch functions.

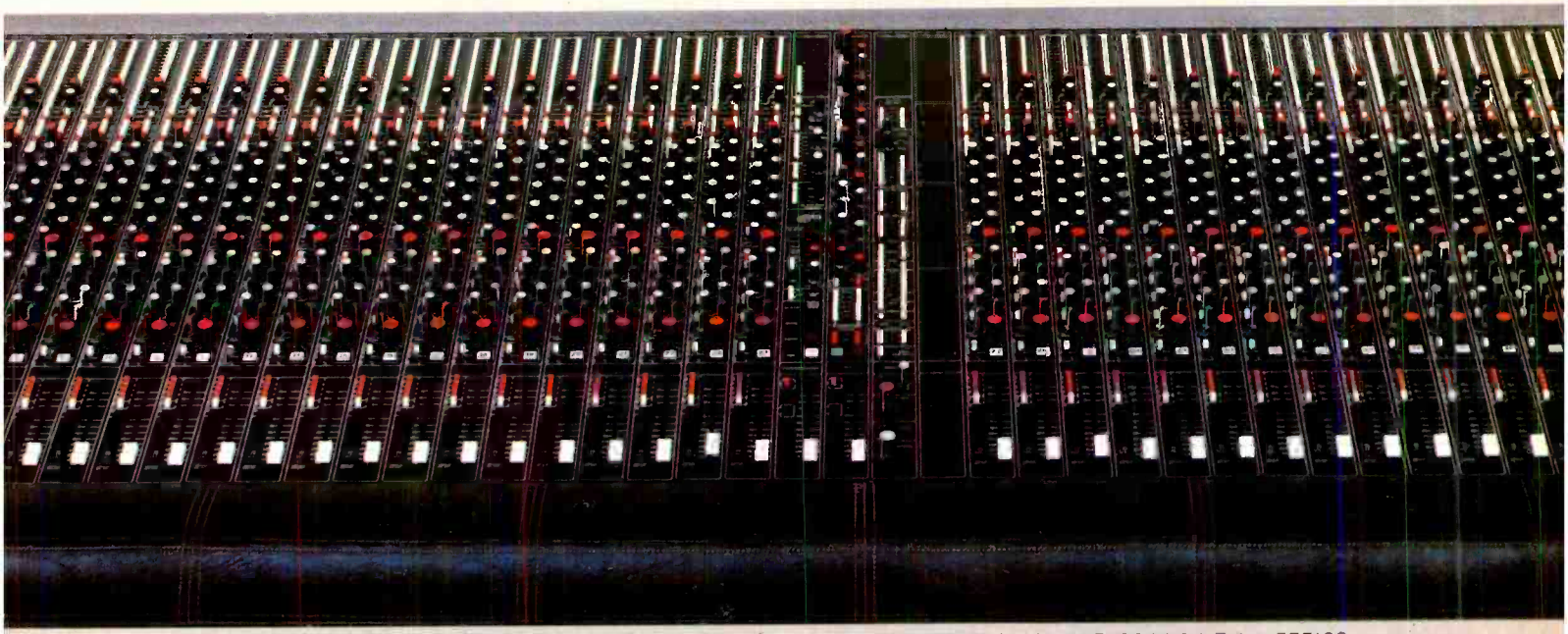
Patch points now operate full line level (+4 dBu or +6 dBu) and are isolated and balanced.

These are only a few of the reasons that allow us to confidently say that MR-2 is the most efficient, cost-effective console ever offered by anyone to the industry.

We think you will agree and make it your choice as well.

Harrison

NOW MORE THAN EVER



HARRISON SYSTEMS, INCORPORATED P.O. Box 22964, Nashville, Tennessee 37202/(615) 834-1184, Telex 555133

Blue Jay, Massachusetts

The fact that Blue Jay Recording Studio is about as close as one can get to a state-of-the-art facility in the New England area is not what makes it unique. Family-owned studios are likewise not unheard of in the area. But take into account that its building is not a converted anything but was purpose-built from the ground up (actually, *down*), that 75% of it is buried underneath the surrounding countryside, that most of its heat is taken care of by a smallish wood-burning stove, that it is in a decidedly rural setting a scant half-hour from downtown Boston, and that it has managed to pay its way in a highly competitive market without either cutting its rates or depending on major-label contracts, and you begin to get the idea that Blue Jay has something unusual to offer.

Bob and Janet Lawson are two-thirds of the ownership of Blue Jay. They initially decided to invest in a small recording studio a few years back when Janet, one of whose great-grandparents invented evaporated milk, sold off her large inherited interests in the Pet Foods Corporation when that company was absorbed by an industrial conglomerate. Bob, meanwhile, had been working in the Boston area as a musician and was studying recording engineering at Steve Langstaff's Audio Workshop School of Sound in Cambridge, Massachusetts. He asked his teacher if he would be interested in working as a consultant on the new project.

Langstaff had worked as an engineer and consultant at many of the area's top studios through the '70s, and was happy to get the chance to put his ideas into a brand-new facility. The project soon mushroomed, and Langstaff was devoting so much time to designing and specifying equipment for the studio, that the Lawsons asked him to become a partner.

Although the town of Carlisle is quite rural, the ¾-acre sloping terrain belonging to the Lawsons has some close neighbours, and isolation of the sound emanating from the building was essential. It was decided to build the studio and the control room underground. A structural engineer was hired to design the shell, which is made out of reinforced concrete, and covered with 16in or more of topsoil.

"Waterproofing the thing was the hardest part," recalls Bob Lawson. "Tarpapering alone would have cracked in the winter, and we couldn't afford that, or any other mistakes, because digging out the roof and fixing anything after it was all done would have been impossible. We ended up using tarpaper and tar, and covering the entire building with a single sheet of ⅛in vulcanised rubber. Even that had its problems, and we spent five days tracking down pinhole leaks, while the crane and dump truck we had hired to replace the soil just sat there and waited."

The building is so well insulated, that, according to Bob Lawson, "It just doesn't understand what winter is." Heat is provided by a heat-pump system and a wood stove in the lobby, which is vented overhead so that warm air can circulate through the complex. Humidification is supported by an open tea kettle on the stove. The control room is not connected to the system—it is sealed so well that the excess heat of the equipment provides enough warmth to keep the place cosy on even the coldest days. There is a fresh-air exchanger and a small air-conditioning system for summer, but the constant 57°F temperature of the surrounding soil provides the bulk of the environmental control year-round.

The sound isolation is likewise extraordinary. When the studio first opened its doors in April 1980, 15 months after construction had begun, Aerosmith came in to do an album for CBS, and conveniently provided the acid test. Recalls Bob Lawson, "At 5am, while they were blasting away, I took a little walk. Ten feet from the building, all I could hear was birds."

The sound isolation works both ways. Inside the studio, even with the ventilators going full blast, the ambient noise level is a remarkable 14dBA, a figure that is low enough, according to Langstaff, to take full advantage of digital recording, when that medium becomes the norm.

The control room is completely floating, and it is separated from the studio by three windows, each consisting of a layer of plate glass and a removable layer of safety glass. It is actively trapped in front, and the rear part of the floor is raised 10in to provide better visual access to the studio and also some extra bass trapping. Barrel halves and sections are set into the walls to help diffuse the sound.

"The traps at the front of the room minimise early reflections," says Langstaff, "while the rear provides a little natural reverb, so that the room sound doesn't get too dry and the engineer doesn't end up putting too much reverb into the mix."

The back of the room looks out through a curtained window to the lobby area, which can also be used as an isolation booth. The lobby has a complete kitchen and well-stocked refrigerator and coffee pot, and it boasts a lovely northern view of trees and birdhouses.

The equipment complement is about the finest to be found in the region. The centrepiece is a fully automated MCI *JH-636* console, and the tape recorders are a *JH-114* 24-track with Dolby, and a *JH-110B* 2-track. Monitoring is provided by time-aligned UREI *813*s, mounted at ear level, and *Auratones,* powered by a Crown *PSA-2*. Outboard gear includes a Lexicon *Prime Time* and *Model 224* digital reverb, UREI *LA-4* and *1176* comp/limiters, a couple of vintage Teletronix *LA-2A* limiters, an orban *De-esser,* a Delta-Lab *DL-2 Acousticomputer, Gain Brains, Kepexes,* and a White spectrum analyser. Lots of other toys are available on fairly short notice.

"Our strong suit is our studio room," says Janet Lawson. "Outboard equipment we can add any time, but the room can't be altered without lots of down time. We did a lot of planning with regard to the ventilation and the electrical wiring, so we should be ready for any situation that may come up." The studio area, which covers about 1,000sq ft, is asymmetrical, and the two areas that wrap around the control room are of different sizes and different characteristics. "The room offers a variety of acoustic environments," says Langstaff, "with movable louvres and baffles providing further variability. We tightened up the low end with up to 4ft of trapping in the ceiling and in some of the walls, giving us terrific separation, or a controlled blend, where needed." House instruments include a 1927 Steinway *B* grand piano, a Rhodes *88* electric piano, and a Hammond *M3* organ. A house drum set and *Leslie* cabinet are on the way. The microphone collection includes a respectable number of Neumanns and Telefunkens, including *U47* tubes and *251*s.

Blue Jay's mastering rate is fairly expensive by local standards, but it is far less than those equivalent facilities in the major urban recording centres charge. Since food and lodging are readily available nearby, the overhead of maintaining a vacation studio is not a problem, although that feeling of splendid isolation is there.

Most of Blue Jay's clientele is local talent, and the major labels have not started to beat the doors down quite yet. The studio's short track record is admirable, however. George Thorogood, whose first album for Rounder Records recently went gold, finished his latest album here, and Pat Metheny and Andy Pratt have been in. Very recently, Jerry Moseley, a synthesist from California, spent a week at Blue Jay working on demo tapes for films using the new Fairlight *CMI* digital

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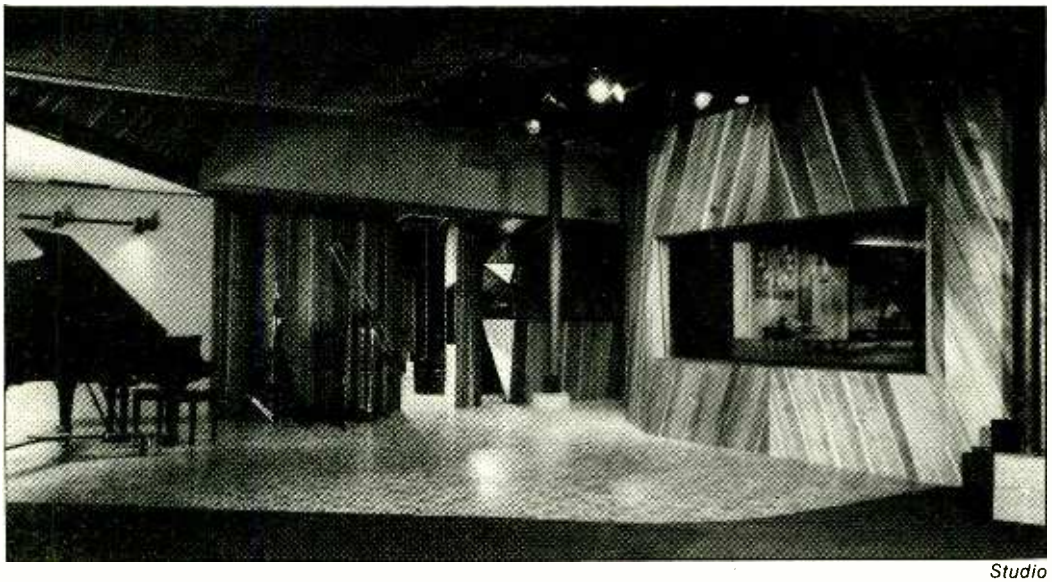

Studio

TOOLS...NOT TOYS

Already well known for its musicality and ultra low noise, the EQF-2 Equalizer/Filter packs 3 bands of sweep EQ with peak/shelf and 12 dB of reciprocal boost or cut as well as an independent sweep hi and lo pass filter section in an A.P.I. sized module. With +30dBm output capability, the EQF-2 can fix that impossible part without adding any coloration of its own.

The CX-1 Compressor/Expander offers performance beyond any similar device previously available. Total transparency, headroom to spare, up to 100 dB of expansion/gating without clicks, smooth acting "soft knee" compression and unique multi-function LED metering. It is simple to use, compact, powerful and effective.

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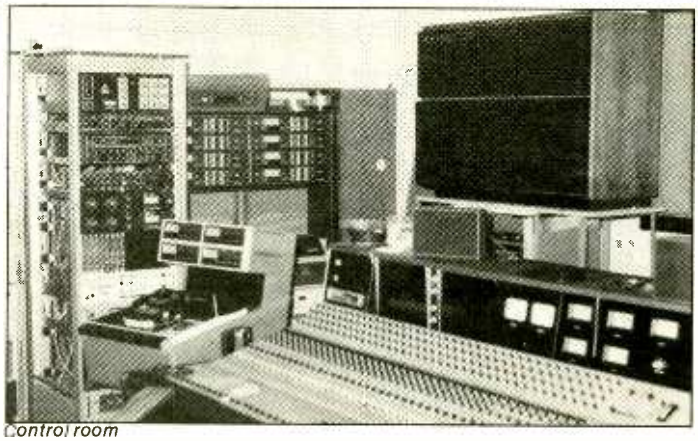
Also available through: AKG Acoustics (U.K., Germany, Austria) Sound Genesis (San Francisco) Cramer Video/Audio (Boston) International Equipment Reps (La Jolla)

Regson recording studios, Milan

Among the earlier studios to be established in Milan is Regson di Carlo Zanibelli. Regson has the reputation among the Milan studios of being the place where 'as soon as a new effects unit comes out, they buy it!'—all in good fun, of course and at the time of my visit, Signor Zanibelli the owner and chief engineer was in London checking out the latest developments for a proposed update which may include going digital. However, this is all reasonably long term and the studio as it presently exists has enough work to keep busy. To show me around the place, cutting engineer Rolando Merlo was on hand, as was Sr Zanibelli's brother who looks after the business side of things.

The studio is situated in a quiet area fairly well out of the city centre and by one of the canals that serve Milan, so, depending upon your means of transport, you could either tie up your rowing boat outside, easily park your car or step off the tram which stops just in front of the door. The complex forms the ground floor of a large apartment block so load-in of equipment is straight in with no stairs or lifts to contend with. Regson consists of four studios, B, C, D and E, Studio A never having quite got off the ground somehow!



Control room

Studio B is the large studio where the floor space is sufficient for a full orchestra and often this means the orchestra of La Scala opera house. The studio was designed in the days before multitrack and has acoustics on a par with those of a good medium-sized concert hall where everything can be recorded with just a pair of microphones. This studio is also used for film and TV scores and has a large screen with full projection facilities. In the interests of isolation a movable drum booth has been built as well as several other dismountable booths that can be set up when the need arises. A full selection of instruments is available from keyboards to percussion as well as the proprietary makes of microphones. The studio also has a good collection of risers permitting different configurations for large formations.

Reflecting the same functional appearance of the studio, control room B features a good collection of equipment in a fairly austere room. Acoustic treatment is mainly tiles, panel absorbers in the ceiling and carpet. Various rails with different coloured spotlights permit the lighting conditions to be adjusted to suit. Recording centres round an Italian-made Argentini custom built desk which is capable of very good results. The console is in a 32/24/32 configuration and is fully quad capable. Features include four band eq, six auxiliary sends and a mixture of standard and LED column VU meters. The LED columns also form the readout for the built-in spectrum analyser. Multitracks and master recorder are all Ampex, being *MM1200* 24-track, *MM1000* 16-track that is still giving sterling service and an *ATR-100* 4-track with interchangeable 4- and 2-track heads. All channels have Dolby. Monitoring is a choice between JBL *4350*s or *6233*s powered by HH *500D* amplifiers with UREI ⅓-octave graphics. Reverberation effects are available with a choice between EMT *140*, AKG *BX20* and *Master Room* devices. That Studio B is not short on toys is witnessed by the several racks full of goodies with time domain processing from a Lexicon *Delta T*, Publison harmoniser and Eventide *Harmonizer* (complete with keyboard), equalisation from Orban graphic parametrics, gain reduction from UREI, EMT, *Kepexes* and *Gain Brains* and an ADR *Vocal Stresser*, with phasing from Eventide. Aphex is also available. The room is large enough to move about in and provides seating space for people not directly involved with the console without them breathing down the engineer's neck.

Across the corridor is Studio C which is more oriented towards group work. The studio has room for about 10 to 15 musicians and includes a fixed drum booth. Acoustics here are much more absorbent with a resulting low reverb time. The control room features a 24/24 Argentini desk with *MM1200* 24-track and ATR *100* stereo machines. All tape channels have Dolby. Monitoring is again JBL with *4333A* speakers and McIntosh amplifiers plus UREI graphics. Outboard equipment includes UREI compressors and parametric eqs, *Gain Brains* and *Kepexes*, a pair of MXR ddls and a *Prime Time*, Astronics graphics and Klein & Hummel filters together with Audio & Design *Vocal Stresser*. An ADR *Autophase* was also found gracing the racks and is not a piece of equipment one often comes across. However, Regson are very pleased with it. As can be imagined, effects units can easily be transferred between studios and what one sees in the racks are not necessarily permanent fixtures, or all that is available.

Regson also have a copy room as well as a mastering suite. The former uses Telefunken recorders with tweaking available on UREI parametrics and monitor/copy equalisation with MXR ⅓-octave graphics. Next to the copy room—or Studio D—is Studio E or the mastering room. This features a Neumann lathe with recently installed 600W amplifiers in order to provide more headroom and 'beef'. Recorder is a Studer *A80* preview machine with monitoring by JBL *4343* speakers with Amcron *DC300A* amplifiers and UREI graphics. A good selection of processing equipment is available should the master tapes need some touching up and this includes an IT parametric disc mastering equaliser, Audio & Design *E560-RS*, UREI *530* graphics and an EMT *156* stereo compressor/limiter. An AEC analyser is also on hand to keep an eye on things.

Regson have enough facilities to cover most contingencies and certainly cannot be said to be short of work. When I asked who some typical clients were the reply was "Everyone comes to Regson!" Whether this is an enthusiastic overstatement or not, past visitors have included international stars as well as the more home grown ones, and today most of the well known names have been through at some time or other. With the advent of the 'recording environment' studios, Regson have realised the need for a major, if not complete, rebuild and update, which is why they are taking their time and weighing up all the possible turns that the industry may take in the foreseeable future. Whatever the developments are, however, Regson will be there! **Terry Nelson**

Regson di Carlo Zanibelli, Via Lodovico il Moro 57, Milan, Italy. Phone: (2) 422.4620, 470.264, 426.991. ■

Lobby

Blue Jay, cont'd

synthesiser. "He came here from Village Recorders in Los Angeles," says Bob Lawson, "and he liked the relaxed atmosphere here a lot better." Steve Klein, from Criteria Studios in Miami, has also been in and has good things to say, and former Phil Ramone associate Glenn Berger is a regular.

Langstaff and Bob Lawson serve as Blue Jay's engineering staff, but on a given day, it's likely that someone else will be behind the board. "We like to attract freelancers," says Janet, "we want the studio to be open to the music community, and it also helps us to hear what other people have to say about the place. We work with and screen the engineers who are coming in very carefully, teaching them the system and giving them time to practise, but we are available to any qualified person."

If taking an easy drive out of Boston to spend a few hours in a fine studio while gazing at trees and the 'critters' that gave Blue Jay Recording Studio its name is your idea of a productive day, then you probably qualify, too.

Blue Jay Recording Studio, 699 Bedford Road, Carlisle, Massachusetts 01741, USA. Phone: (617) 369-2200. **Paul D Lehrman**

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1979

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letters

Tape levy

Dear Sir, The article in your March 1981 issue by Barry Fox covered the problems of home taping and the possibility of a blank cassette levy; however, I believe that the BPI with all its loud noises complaining about the loss of revenue has deliberately tried to ignore, and focus the public's attention away from, the fact that there is a large area of use of cassettes other than for taping of records.

If we looked seriously at other uses I am certain that they would be greater than we suspect. A few that spring to mind are the "Radio Hams" who record their conversations for logging purposes and radio interviewers who use cassettes for recording speech interviews. Are the BPI seriously thinking of trying to force them to pay a levy on items that the BPI can have no claim upon?

A more popular and rapidly growing use is the storage of computer programs by enthusiasts; both programs and data are stored. Probably 70% of home computer users will store data and programs in this manner. While there are also copyright problems for computer programs, the BPI cannot seriously expect to collect royalties from the tens of thousands of computer users since, for example, when I write programs for storage on cassettes there can be no doubt that the copyright is mine. I have not entered into a contract for the BPI to collect my royalties so I would not be willing to contribute to a tape levy for this purpose (unless I can have 50% of Elton John's royalties on a reciprocal arrangement).

While I have concentrated on one aspect of cassette use I would suspect that if the BPI seriously tries to impose a cassette levy it will have opposition from many unexpected users of cassettes; indeed a large head of steam and indignation is already building up in computer magazines.

I would suggest that the BPI would do better in income terms by encouraging more sales. Perhaps the best way would be to market albums at a more reasonable price; otherwise, perhaps, the BPI might not stop at cassettes but want to expand the levy to batteries, integrated circuits, microphones, speakers, etc.

Yours faithfully, Derek Connolly, Radio Hallam Ltd, PO Box 194, Hartshead, Sheffield S1 1GP, UK.

Gemini Easyrider

Dear Sir, Further to the review of the Gemini Easyrider *in the March issue of* Studio Sound, *some confusion seems to have arisen in Figs 5 and 6 which refer to a 1:1 ratio, whereas this should be marked 1.5:1. In the 1:1 switched mode no gain reduction takes place with the idea that the system may be used to provide an occasional source of gain around the studio. In the normal context of operation there is no fear of clipping since all slopes turn into a limit mode after 10dB compression so the system cannot slip. It is emphasised that any comparison with the direct signal would be made using the system (IN/OUT) switches and not the 1:1 ratio mode. Should the 1:1 mode be used to provide a source of gain, then the normal constraints applicable to any amplifier will apply and care should be taken regarding clipping.*

In connection with differences measured on attack time this could be down to one of measurement technique since the Easyrider *is somewhat unconventional having a programme-related response. This is proportional to the potential overshoot and will get shorter for a greater input signal.*

Readers may be interested to note what we believe to be a novel feature on this unit: for gain reduction of 10dB or greater, output level and compression will remain constant (+1dB) throughout the range of slopes (1.5:1 to LIMIT). Once set up, three functional adjustments are effectively combined in the one RATIO control, thereby simplifying operation and speed of adjustment.

Yours faithfully, Mike Beville, Audio & Design Recording, North Street, Reading RG1 4DA, UK.

Noise measurement

Dear Sir, I am afraid I do not understand Ted Fletcher's amazement as a manufacturer with a 2kHz reference level for CCIR/ARM; you can argue about the technical or practical aspects of the matter, but a manufacturer is best suited to build equipment for the market demand. Incidentally, MJS Electronics tell us they also make a CCIR/ARM instrument in addition to the CCIR/PPM meter Mr Fletcher extols.

However, the nub of the argument is admirably expressed in John Woodgate's letter (February issue). No one is trying to change established broadcast practices, where there are very good reasons to retain peak metering systems. It is outside this small specialised market where change is occurring by demand—in the areas of mass production assembly lines, large and small repair organisations, and even hobbyists. Let us not get carried away by any devotion to a 1kHz mystical significance—we already use 3.125kHz, 700Hz and 400Hz for reference frequencies. In the end it is the users who will determine what is best for their requirements; as Mr Woodgate says, a standard "only has value when it is accepted and used".

Yours faithfully, David Robinson, Dolby Laboratories Inc, 731 Sansome Street, San Francisco, California 94111, USA. ■

agony

The opening of an ILR station recently provided some unforeseen hilarity when the chairman's (7½in/s) inaugural speech was short, succinct and incomprehensible at 15in/s.

An audio company, desperate to exhibit its latest product, decided to rewire and reconfigure a board awaiting delivery to disguise its identity at the exhibition. Upon subsequent installation (rewired in its original form) the client expressed his approval of the exhibition console and said, "I want you to wire *mine* like that."

With heavy hearts and worn out soldering irons they started . . . ■

Peter Gabriel on . . .

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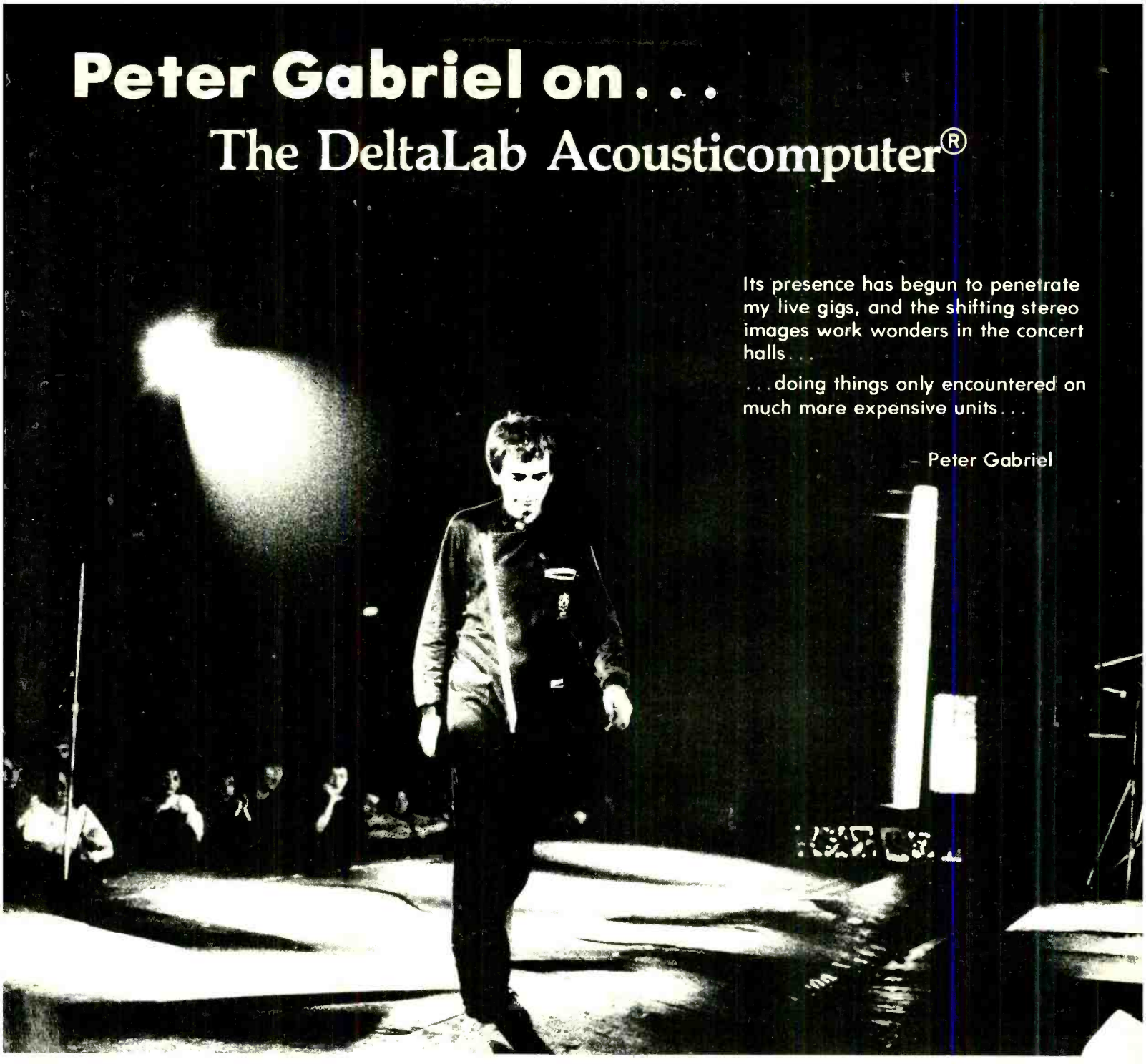

Its presence has begun to penetrate my live gigs, and the shifting stereo images work wonders in the concert halls . . .

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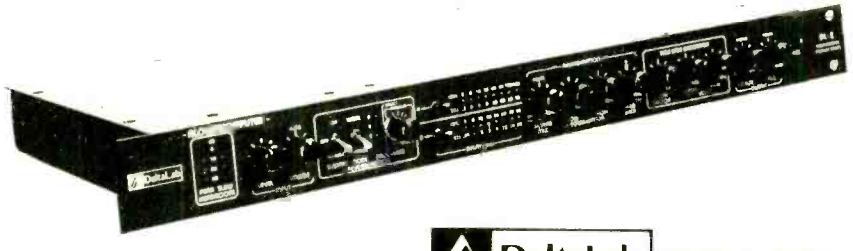
– Peter Gabriel



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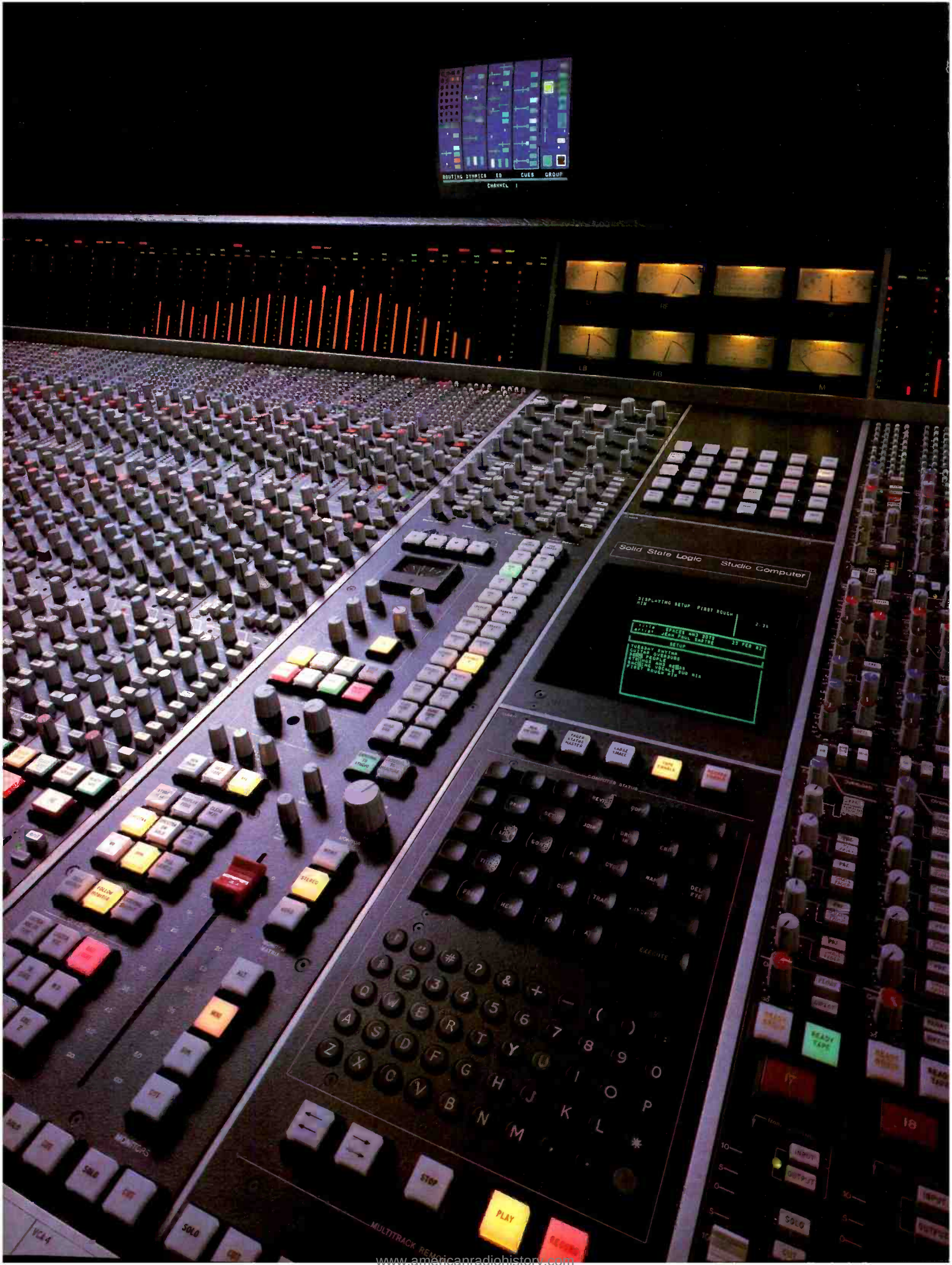
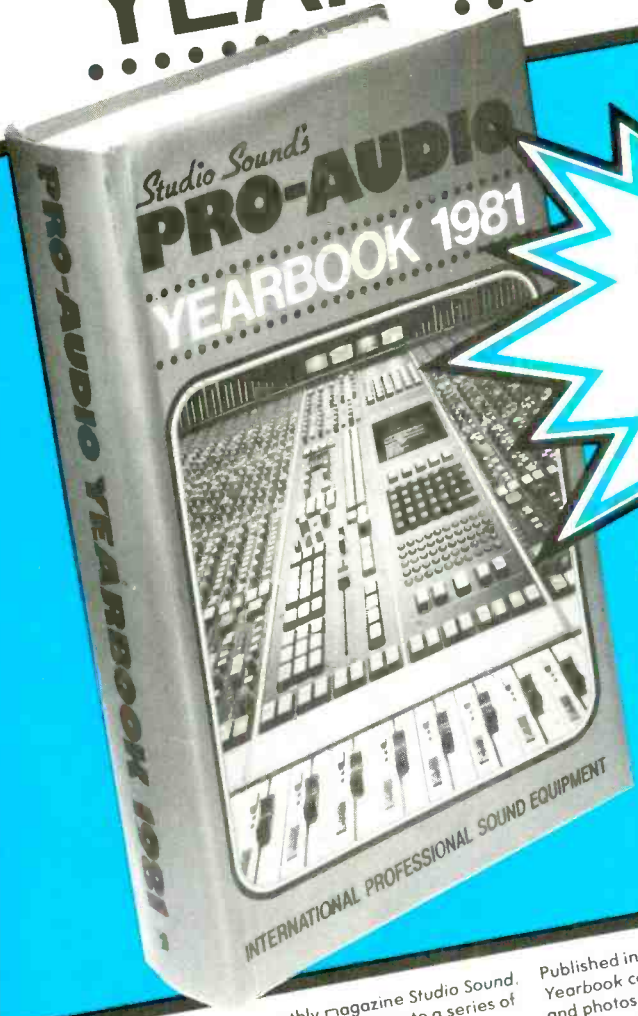


Studio Sound's PRO-AUDIO YEARBOOK 1981



Essential Reading

for every recording studio

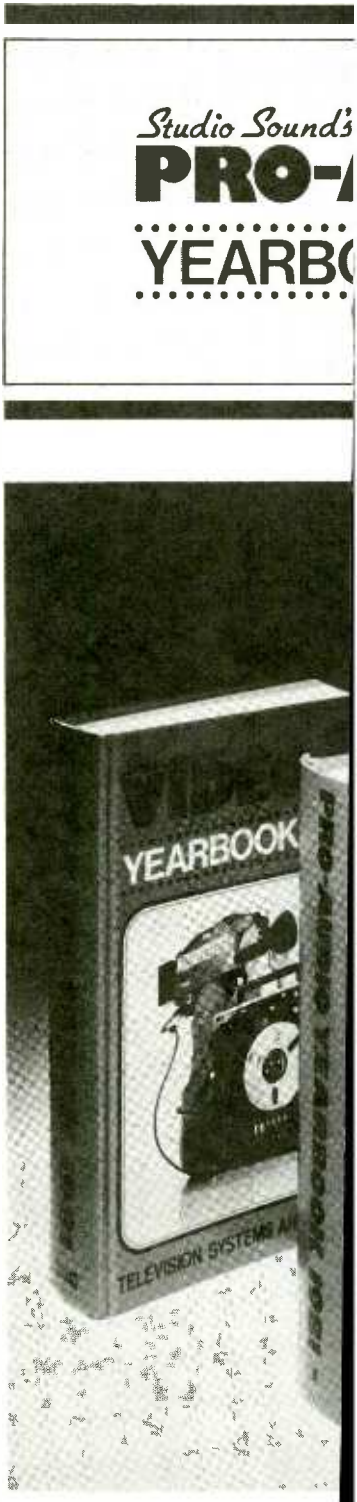
From the publishers of the monthly magazine Studio Sound, the Pro-Audio Yearbook is the latest addition to a series of comprehensive annual publications providing extensive coverage of the ever expanding audio and video markets.

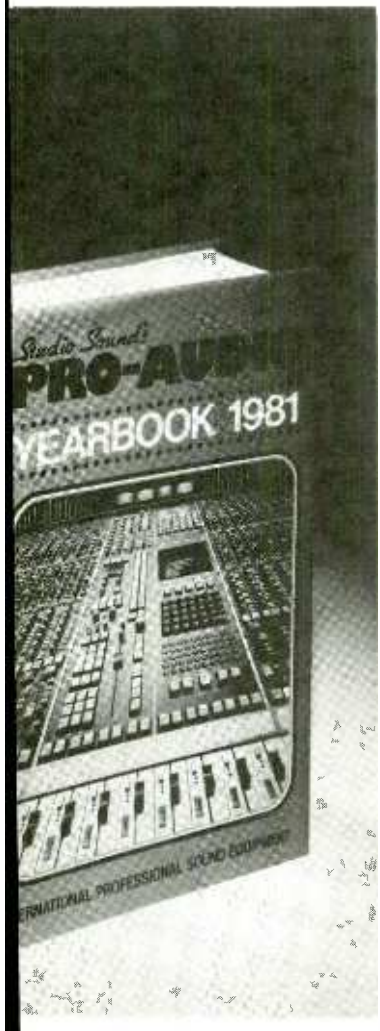
Published in hardback, the first edition of the Pro-Audio Yearbook contains over 600 pages packed with information and photos dedicated to every aspect of professional recording and sound broadcasting, with comprehensive indexing allowing direct access to every specific piece of information in the Yearbook, backed up by details of almost 1,000 pro-audio dealers and distributors in 70 countries worldwide.

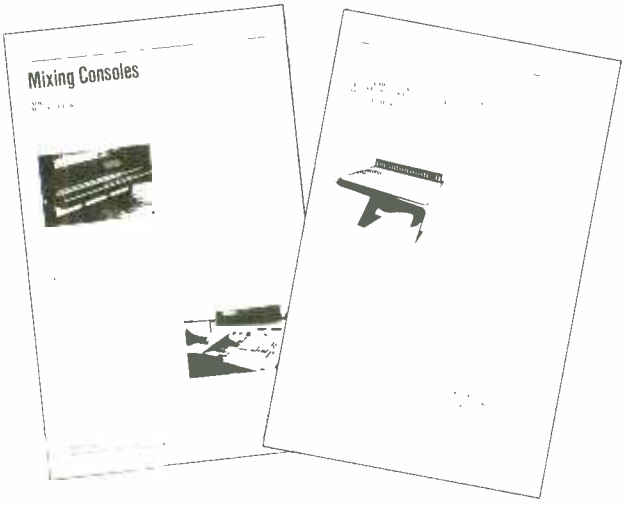
The *Pro-Audio Yearbook* is divided into two parts, the first contains 71 sections covering Pro-Audio Equipment and Services, and the second various indexes. Different sections cover every conceivable aspect of the pro-audio business, ranging from amplifiers through mixing consoles to tape recorders, with most sections being profusely illustrated and containing up to date prices of the majority of the products featured. There are over 7,000 separate entries in the Pro-Audio Yearbook 1981 with over 600 photographs. In addition to the many product sections, there are sections covering engineering and consultancy services, jargon and journals, computer services and training, and an important section providing full details of mains power supplies in almost 200 countries. For each product, the manufacturer, UK and USA distributors are shown, while indexes in the back of the book indicate distributors in other principal countries around the world, with the Dealer sections providing listings of distributors for specific countries. The bulk of the book does not include addresses, these being contained alphabetically in the Address Index which also includes the phone and telex numbers, and principal contact for over 2,500 companies in the pro-audio and related industries, in over 70 countries around the world.

Pro-Audio Yearbook 1981 Contents

Acoustic Materials, Amplifiers, Power, Antenna and Masts, Audio Equipment, Miscellaneous, Automation Systems, Broadcast, Automation Systems, Console, Books, Broadcast Ancillaries, Cables, Audio, Cases, Transit, Cleaners, Clocks and Timers, Compressors and Limiters, Connectors, Audio, Computer Systems, Consoles and Racks, Dealers, Pro-Audio: UK, Dealers, Pro-Audio: USA, Dealers, Pro-Audio: Worldwide, Disc Cleaning, Disc Cutting Systems, Editing, Splicing and Demagnetisers, Effects, Engineers, Freelance and Consultant, Equalisers, Expanders and Noise Gates, Erasers, Bulk, Faders, VCAs and Panpots, Film: Projectors, Film: Sepmag Transports, Headphones and Headsets, Heads, Tape, Intercoms, International Power Supplies, Jargon, Journals, Links, Radio, Loudspeakers, Monitor, Metering, Microphone Stands and Booms, Microphones, Mixing Consoles, Mobiles, Contractors, Noise Reduction, PA Processing Equipment, Radio Microphones, Receivers, Radio, Reference Section, Remote Controllers and Locators, Snakes and Leads, Sound Level Meters, Storage Racks, Studio Designers and Consultants, Studio Furnishings, Synthesisers and Vocoders, Tape, Magnetic, Tape Recorders: Cassette, Tape Recorders: Cartridge, Tape Recorders: Digital, Tape Recorders: Duplicators, Tape Recorders: Reel-to-Reel, Telephone Balancing and Matching, Test Equipment, Test Tapes and Discs, Timecode: Generators and Readers, Timecode: Synchronisers, Training, Sound, Transformers, Splitters and DI boxes, Transmitters: Broadcasting, Transmitters: Communications, Turntables, Pick-up Arms and Cartridges, Address Index, Company Index, Distributors Index, Worldwide, Subject Index.







Other Publications

VIDEO YEARBOOK 1981 Published in January 1981, the fifth edition of the *Video Yearbook* contains 633 pages covering every aspect of the video industry, with listings of all types of television equipment, video production facilities and services, worldwide dealers in video and much more. Format is very similar to the *Pro-Audio Yearbook*.

RECORDING YEARBOOK 1982 Due for publication November 1981, the first edition of the *Recording Yearbook* is designed to be complimentary to the *Pro-Audio Yearbook*, providing comprehensive listings of recording studios around the world, and other related services such as disc cutting and pressing, design and distribution.

Other books planned for the series include one covering the live aspects of entertainment such as touring, theatres, discos, clubs and a book designed for audio visual users such as trainers, college and industry.

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Tape levy

The long awaited Green Paper, or discussion document, on copyright law reform promised by the British Government for the winter of 1980/81 is now expected in the early spring. If this Green Paper does recommend the imposition of a levy on every blank tape sold in the UK, and if the already pretty unpopular British Government is prepared to risk political suicide by making such an obviously unpopular proposal law, then the tape manufacturers will have no-one to blame but themselves.

For well over a year now the record companies have been running a well-oiled publicity campaign to soften up the British press, public and trade to the idea of a levy as the only solution to industry ills. Some quite astonishing statements have been allowed to pass unchallenged, even though anyone with an enquiring mind the size of a pea should have immediately challenged them. For instance early in 1981 the BPI stated that "losses to the industry were measured at £228 million in 1979 by the BPI". *Measured?* How can anyone possibly measure a loss of something that never existed in the first place, ie record sales that weren't. Measured is not a reasonable way to describe estimates based on market research samples. But the tape manufacturers let it pass without a murmur.

Then there was a classic example of how market research samples can be interpreted, like statistics, any way you want them. A survey by the UK market research company NOP was press released by NOP with the headline "Is unlicensed cassette recording overstated?" NOP continued: "Fears that there are vast libraries of unlawful cassette recordings housed in people's homes throughout the UK appear to have been overstated." Meanwhile the BPI issued a press release which interpreted the same NOP findings as supporting their case. "Their figures indicate a substantial increase in the £228 million of lost sales measured in 1971." (Note incidentally the subtle use of "measured" again.)

Subsequently, after 'discussions' between the NOP and BPI, NOP publicly changed its tune and acknowledged that those same original figures now suggested ". . . a significant increase in the purchasing of blank cassettes, particularly among young people". When you cut through the semantics it all adds up to some quite different interpretations of exactly the same figures. But not a word from the tape companies was heard.

The record industry has recently been getting very excited about the levy on blank tape now imposed in Austria. But how many people have bothered to find out the full facts? The Austrian plan puts a levy of just one Austrian schilling (or 3p) on every one-hour tape up to a maximum of just 10 million schillings (or just under £0.3 million) collected per year! I suspect those in the industry who know these facts would prefer to forget them.

I also suspect that 24 record companies led by A & M would prefer to forget their attempt to sue Audio Magnetics, the tape manufacturer, a couple of years ago. But how astonishing that the tape companies have never used the transcript of this case (Fleet Street Law Reports 1971, pages 1 to 10) as a counter to some of the flak they are continually taking from the record industry.

In a series of press adverts Audio Magnetics had used phrases like 'Has your cassette ever twisted to The Beatles?' 'Do The Carpenters sound wooden on your cassettes?' and 'In the middle of a Dizzy jam session you don't want your tape to'. Four record companies with rights to Beatles, Carpenters and Dizzy Gillespie recordings reckoned that these adverts not only incited the public to infringe copyright but also suggested that their own pre-recorded cassettes were defective. Presumably believing that there is safety in numbers, 20 more BPI members joined in the court action against Audio Magnetics. But the judge was not amused. He variously described the claim as muddled, unreasonable and embarrassing, threw the case out of court and ordered the record companies to pay the bulk of the legal costs incurred. Not a word was heard from the tape companies.

So what *are* the tape companies doing? Well, they have been complaining bitterly amongst themselves about what they see as a threat to future sales and the likelihood of serving as unpaid tax collectors for the record industry. Apart from that they've done sweet nothing, and probably forfeited their case by default. In fact it was only by a stroke of undeserved sheer good fortune, that they recently found themselves a powerful ally.

Towards the end of 1980 the MCPS finally got round to sending out letters telling those who held voluntary home taping licences that the scheme had been suspended. Home tapers who had previously held an honest licence were asked by the MCPS to write to their MP or the Department of Trade in support of the levy. Not surprisingly this proved an hilariously counter-productive request. Audio magazines received a deluge of letters from infuriated ex-licence holders. By a stroke of awful misfortune for the MCPS and BPI, Bernard Levin, columnist for *The Times,* was on their mailing list and received a routine letter. He immediately devoted an entire column in *The Times* to castigating the MCPS for its 'weasel-word style' and promised publicly to write both to his MP and the Department of Trade in protest against the levy proposed. This prompted a whining letter to *The Times* jointly signed by top brass of the BPI, British Videogram Association, and Musicians' Union 'beseeching' others not to follow Levin's advice.

Now that I've grown accustomed to the tape companies' silence, only one thing surprises me. No-one yet seems to have considered the obvious. If any government puts a heavy levy on blank tape because it is suitable for copying copyright recordings, this will immediately create a legal precedent in favour of a similar heavy levy on any blank paper suitable for use in a photocopying machine to replicate copyright text. Everyone in the record industry should now ask themselves two simple questions. How often have you copied an author's copyright words on a photocopying machine? Isn't he or she just as entitled to compensation from a levy, as a musician or singer?

For a reasoned, accurate and balanced summing up of the whole business of taping, losses and levies, see the January 1981 issue of *Which?,* published by the British Consumers' Association but you must read the original, *not* the press reports. Although the original full page article puts every side of the case very fairly, the press release which CA issued didn't quote the tape manufacturers' comments. So, predictably, the national and music press didn't quote them either. As a result the report was widely, and incorrectly, publicised as lending unqualified support for the BPI's levy lobby. It didn't. In fact it's not so much the idea of a levy *per se* that gives cause for concern, but the idea of the BPI and their members calling the shots.

Humorous advice

Here's a cautionary tale for anyone addressing a conference through an interpreter. There's always a temptation to try and kick off with a joke. *Don't do it*—especially if the audience is Japanese.

An American recently had surprising success with a joke at a Japanese conference. Although the joke was fairly lengthy the interpreter spoke quite briefly. The audience roared with laughter and rolled in the aisles. After his speech the American congratulated the interpreter on his choice of Japanese words. With disarming honesty the interpreter admitted that he had not in fact translated the joke. "The American gentleman has told a joke in his native tongue," the interpreter had said in Japanese. "He obviously thinks it is funny, so will you all please now laugh heartily."

Get the right man for the job

How *do* people get these jobs? The marketing manager of a tape company with a household name phoned me recently to ask if I would help judge a competition. It turned out not to be a *real* competition, like making creative recordings, but a rather silly quiz with an "I use Blogg's tape because . . ." at the end as tie-breaker. "Sorry," I said, "I can't do it, even if I wanted to. I've written far too many rude things about the BPI and their war on tape to get involved with any kind of publicity stunt for an individual manufacturer of the stuff."

"What's the BPI?" replied the marketing manager of the tape company with the household name.

Even better was the British PR man representing a major Japanese electronics company demonstrating a Beta format digital cassette recorder and PCM adaptor in London last year. Over lunch the subject of digital discs came up. "I'm sorry, you've got me there," admitted the PR man. *"What's digital?"* ■

The first name in sound equipment,

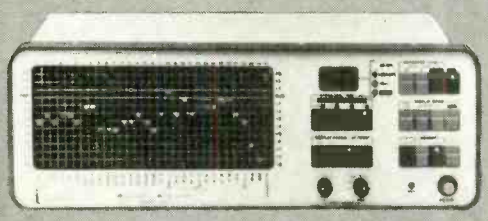
for the professional studio

SONY F.560 DYNAMIC CARDIOID MICROPHONE:

Feldon Audio carry the complete range of SONY professional microphones. Illustrated with the F.560 is the new low cost Tensimount universal microphone isolator.

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.

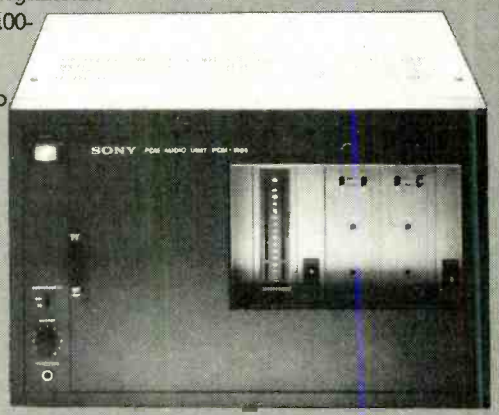


INOVONICS Model 500.

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

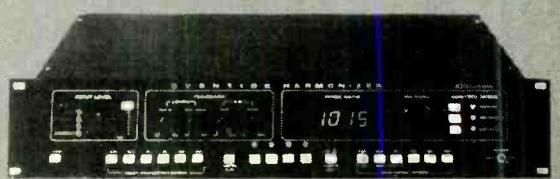
which is a 20-channel vocoder system already in wide use in sound recording studios, radio stations, scientific institutions, and by leading composers, for its outstanding quality and unexcelled intelligibility.

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.

World's most acclaimed reverb is now more versatile than ever

The best gets better

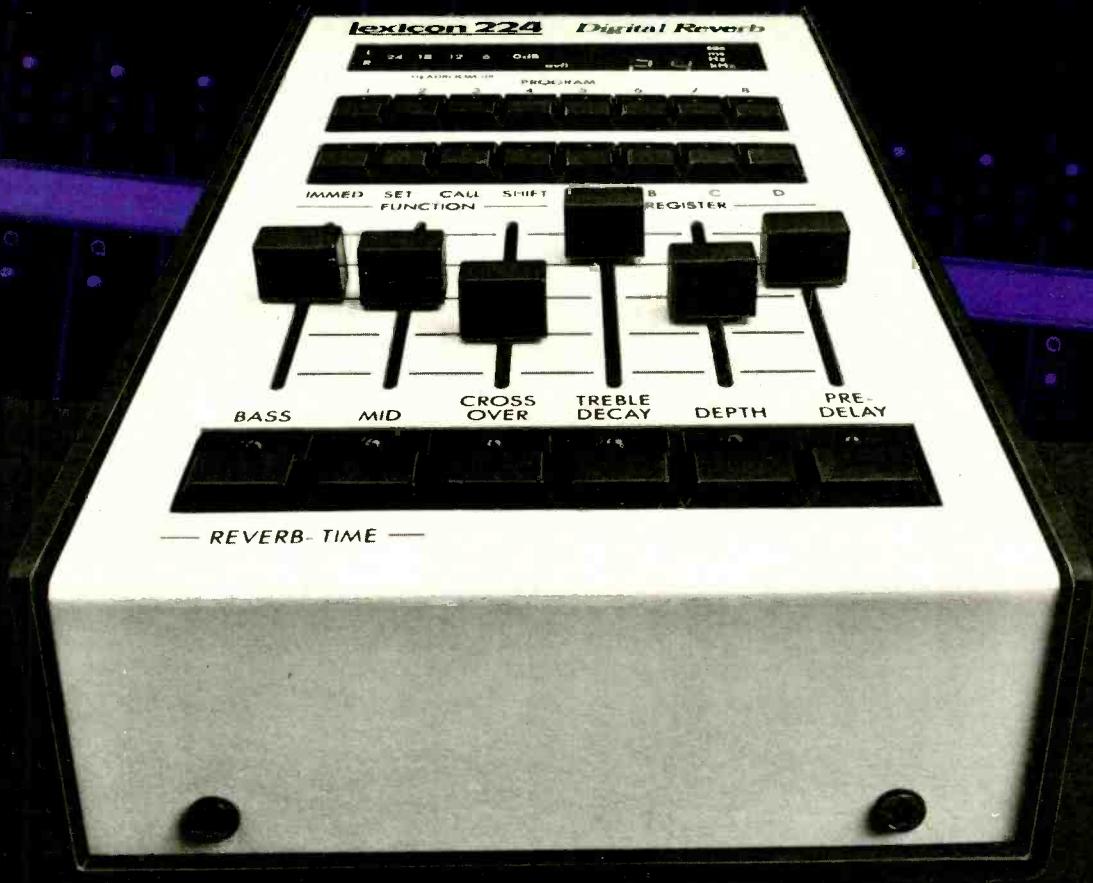
If you already own a Lexicon 224, congratulations! 3rd generation reverb and operating programs have recently been introduced that even further enhance its audio performance. And, you can update your system for pocket money by simply plugging in these new Version-3 programs.

If you haven't yet discovered this superb audio-processing instrument —the most successful ever introduced into pro audio—now's the time. The Model 224 is the number One choice of the world's leading studios, broadcasters and musical artists. Reason: audio performance unmatched by anything else around ... true stereo processing ... completely natural sound ... multiple reverb programs ... full fingertip control of all reverberation parameters ... and retrofit design that accepts new capabilities as they become available. Like Version-3 software.

With the new Version-3 you get even smoother decay ..., enhanced ease of operation ..., plus provision for up to 36 user pre-sets you can store and recall at will ... plus a new non-volatile memory option that permanently saves your reverb program set-ups even though power is removed.

Put the Lexicon Model 224 to work for you. Nothing can touch it for versatility or quality of sound. And field-updateability makes it the most cost-effective choice of them all.

Write for literature on why "the best is better" ... for *you*.



Lexicon

Lexicon, Incorporated Waltham, MA USA TELEX 923468
In U.K.: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA ● tel 01-734-2812

SSE

Survey: turntables, arms and cartridges

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.

P8ES
Type: cartridge for use with arm featuring less than 15mg friction in any direction.
Stylus: elliptical, 5 x 17.8 micron, 0.42mg mass.
Tracking force: 0.75 to 1.25g, optimum 1g.
Response: 10Hz to 28kHz.
Output voltage: 3.75mV.
Channel separation: 30dB.
Optimum load: 47kΩ/470pF.
Weight: 5.86g.
Price: £68.50, stylus £41.20.

PE8
Type: cartridge for manual or semiautomatic turntables.
Stylus: elliptical, 5 x 17.8 microns, 0.45mg mass.
Tracking force: 0.75 to 1.25g, optimum 1g.
Response: 10Hz to 23kHz.
Output voltage: 4mV.
Channel separation: 35dB.
Optimum load: 47kΩ/470pF.
Weight: 5.86g.
Price: £60, stylus £36.

P6R
Type: robust cartridge designed to withstand back-cueing.
Stylus: spherical, 17.8 micron, 0.9mg mass.
Tracking force: 1.75 to 4g, optimum 3g.
Response: 20Hz to 20kHz.
Output voltage: 6.25mV.
Channel separation: 25dB.
Optimum load: 47kΩ/470pF.
Weight: 5.86g.
Price: £16.50, stylus £8.50.

P10ED
Type: robust cartridge designed to withstand back-cueing.
Stylus: elliptical, 8 x 18 microns, 0.9mg mass.
Tracking force: 1.25 to 2g, optimum 1.5g.
Response: 20Hz to 20kHz.
Output voltage: 1.65mV.
Channel separation: 25dB.
Optimum load: 47kΩ/470pF.
Weight: 3.5g.
Price: £24, stylus £14.

P15MD
Type: cartridge for manual or semiautomatic turntables.
Stylus: elliptical, 8 x 18 micron, 0.5mg mass.
Tracking force: 1.0 to 1.5g, optimum 1.25g.
Response: 10Hz to 23kHz.
Output voltage: 0.95mV.
Channel separation: 30dB.
Optimum load: 47kΩ/470pF.
Weight: 3.5g.
Price: £40, stylus £24.
This cartridge is also available mounted in an aluminium – magnesium alloy headshell, price £46.

P25MD
Type: cartridge for use with high quality arms.
Stylus: special *Analog 6* configuration, 5 x 18 micron, 0.4mg mass.
Tracking force: 0.75 to 1.25g, optimum 1.0g.
Response: 10Hz to 28kHz.
Output voltage: 0.75mV.
Channel separation: 30dB.
Optimum load: 47kΩ/470pF.
Weight: 3.5g.
Price: £80, stylus £48.
A special broadcast version to allow use of the cartridge in heavier duty arms is to be produced by AKG.

ALICE (UK)

Alice (Stancoil Ltd), 38 Alexandra Road, Windsor, Berks.
Phone: 07535 51056. Telex: 849323.

Alice GU 200
Self-contained gram unit for broadcast use. Based on the Technics *SP10 MkII* turntable with a choice of tone arms and cartridges depending on the customer's requirements. Wooden cabinet on steel frame with all electronics on chassis which may be removed for adjustments etc. RIAA pre-amplifier, cue speaker and headphone output socket. Remote function.
Price: £1,450.

AUDIO-TECHNICA (Japan)

Audio Technica Corp, 2206 Naruse, Machida, Tokyo 194.
Phone: 0427-22-7641. Telex: 2872-357.
UK: Sondice Ltd, Northwood House, 195 North Street, Leeds LS7 2AA.
Phone: 0532 30562.
USA: Audio Technica US Inc, 33 Shiawassee Avenue, Fairlawn, Ohio 44313.
Phone: (216) 836-0246. Telex: 986411.

APT-12T
Type: tone arm for 12in turntables adjustable for a range of heights and base thickness, equilateral levelling base, removable head shell.
Tracking error: 1° 55'.
Vertical tracking force: 0 to 5g.
Cartridge weight: 3 to 23g.
Price: £113.51, spare headshell £6.83.

APT-16T
Similar to *APT-12T*, but for 16in turntables, tracking error 1° 30'.
Price: £95.68, spare headshell £6.83.

APT-1
Type: robust cartridge for back-cueing with rugged hum resistant construction.
Stylus: spherical, 15 micron.
Tracking force: 3 to 5g.
Response: 20Hz to 20kHz.
Output voltage: 5.3mV.
Channel separation: 21dB.
Optimum load: 47kΩ.
Weight: 7.2g.
Price: £14.82, stylus £9.22.

APT-2
Type: robust cartridge for fixed installations, back-cueing.
Stylus: elliptical, 10 x 17.8 micron.
Tracking force: 3 to 5g.
Response: 15 to 22kHz.
Output voltage: 5.3mV.
Channel separation: 23dB.
Optimum load: 47kΩ.
Weight: 7.2g.
Price: £16.32, stylus £10.83.

APT-3
Type: robust cartridge for fixed installations, back-cueing.
Stylus: elliptical, 7.6 x 17.8 micron.
Tracking force: 2 to 3g.
Response: 15Hz to 25kHz.
Output voltage: 5.3mV.
Channel separation: 23dB.
Optimum load: 47kΩ.
Weight: 7.7g.
Price: £20.65, stylus £12.92.

CETEC (USA)

Cetec Broadcast Group, 110 Mark Avenue, Carpinteria, Cal 93013.
Phone: (805) 684-7686. Telex: 658461.
UK: Acoustics International Ltd, 42-50 Steele Road, Park Royal, London NW10 7BP.
Phone: 01-961 4397.

Model GT12
Type: broadcast turntable designed for one hand cueing and start. One piece cast aluminium alloy frame. Available with Cetec or other manufacturers' tone arms.
Speeds: 33⅓ and 45rpm.
Platter: 12in diameter.
Start time: less than 1/16th turn at 33⅓rpm or 1/10th turn at 45rpm.
Rumble: – 45dB at 33⅓rpm.
Drive: synchronous or 4-pole motor.
Power: 117/230V ac 50Hz.

Model AT1005
Type: tone arm with pivot bearings behind smoked plastic cover for inspection ease, anti-skating device, and precision adjustment of tracking force.
Vertical tracking force: 0-3g calibrated in 0.5g.
Arm length: 12½in total.
Height: 1¾-2¾in.

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Survey

Model ST220
Type: less complex version of *AT1005*, rotation on small precision ball bearing with adjustment for arm height, lateral balance and tracking force.
Vertical tracking force: 1-6g.
Arm length: 12½in total.
Height: 1⅛ to 2⅜in.

CLYDE ELECTRONICS (UK)

Clyde Electronics Ltd, Ranken House, Blythswood Court, Anderston Cross Centre, Glasgow G2 7LB.
Phone: 041-221 5906.

BTU1
Type: broadcast turntable unit. Self-contained unit supplied with Technics *SP10* turntable and choice of tone arm, complete with equalising amplifiers and optional monitoring facilities. The RIAA amp has 20-turn pre-set gain, hf and lf eq pots, to provide accurate adjustment for specific cartridges, and also a fixed 12dB/octave highpass filter with an 8Hz breakpoint. This filter, together with acoustic decoupling of the arm and turntable, are necessary to fully realise the excellent rumble performance of the *SP10*. The turntable may be started locally via the start button, remotely by a fader switch, or via local fader start. Monitoring option is stereo cue program, pre or post fade, with headphone output and optional monitor amp and speaker.
Price: on application.

DOMINUS (UK)

Dominus, PO Box 1, Cranleigh, Surrey GU6 7JF.
Phone: 04866 6477.

Stereo disc amplifier 3
Stereo phono preamp producing line level RIAA equalised outputs from moving magnet cartridge inputs. Features adjustable input loading 22/33/47/68/100kΩ and 50/100/150/270/380pF.
Price: £180.

Moving coil preamplifier
Stereo preamp suitable for use with all low impedance moving coil cartridges. Input loading adjustable from 20/40/100/180/470Ω and 2/15/100/500/1500nF.
Price: £190.

DSD (USA)

Dynamic Sound Devices, PO Box 369, Commack, NY11725.
UK: Wilmex Ltd, Compton House, 35 High Street, New Malden, Surrey KT3 4DE.
Phone: 01-949 2545. Telex: 8814591.

DSD Optimizer
Type: phono pick-up cartridge load optimiser which allows the addition of extra capacitance to meet the correct loading required by many preamps, and also resistive loading. Unit comprises switches to select correct loading as determined by optional *CCM-1* battery operated capacitance meter.
Capacitance range: 0 to 350pF in 50pF steps.
Resistance: infinity to 40kΩ.
Filter: passive lowpass 2.5MHz cut-off.
Price: pair *Optimizers* £24.95, with *CCM-1* meter £69.95.

EMT (West Germany)

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

EMT 928 series
Type: turntable system with built-in preamplifiers with aux platter for fast start under electromagnetic control.
Speeds: 33⅓, 45 and 78rpm.
Platter: 12in diameter.
Drive system: belt drive from 3-phase induction motor driven from internal oscillator.
Start time: quick start 1s, turntable start 6s.
Wow and flutter: 0.1% DIN.
Rumble: – 50dB DIN.
Tone arm: EMT *929*.
Equalisation: DIN 45536, DIN 45537, NAB, RIAA and flat.

Dominus stereo disc amp 3 and moving coil preamp

Preamp: output 1.55V into 200Ω, 44dB gain, max 55dB.
Power: 110/117/220/240V, 50/60Hz.
Price: mono version *928M* £830, stereo *928STM* £887.

EMT 930
Type: turntable system with choice of separate preamps, quick start.
Speeds: 33⅓, 45 and 78rpm.
Platter: 13in diameter.
Drive system: friction drive from mains powered hysteresis motor.
Start time: quick 500ms, turntable start 1s.
Wow and flutter: 0.075% DIN.
Rumble: 26dB stereo DIN.
Tone arm: EMT *929*.
Preamp: EMT *155(st)* output + 4 to + 8dB, equalisation DIN 45536/37, NAB, RIAA/IEC, DIN 45533, BBC, flat, (£370 mono, £510 stereo). EMT *153st* output max + 21dBm, equalisation only IEC/DIN/NAB/RIAA, (£298 stereo for moving coil, £259 stereo for magnetic).
Power: 117/200/220/240V 50Hz, 60Hz to order.
Price: £1,456 to £1,664.

EMT 948
Type: turntable system with direct drive and fast start, stop, back-cue and remote control. Motor driven tone-arm lift. Built in amps with line outputs and cue monitor.
Speeds: 33⅓, 45, 78rpm. Variable speed facility.
Platter: 13in diameter.
Drive system: direct drive from dc servo motor.
Start time: 0.5s max.
Wow and flutter: ±0.075% DIN.
Rumble: – 70dB DIN weighted.
Preamp: plug-in cards, output adjustable between 700mV to 10V (0 to 22dB).
Equalisation: DIN, NAB, IEC or flat.
Power: 100 to 120V, 200 to 240V, 50 or 60Hz.
Price: £1,496 with *TSD15*, £1,174 without.

EMT 950
Type: turntable system with direct drive, console or chassis mounting, preamps, monitor loudspeaker and fast start.
Speeds: 33⅓, 45 and 78rpm.
Platter: 13in diameter.
Drive system: direct drive from dc servo motor.
Start time: 200ms.
Wow and flutter: 0.05% DIN.
Rumble: S/N ratio weighted 70dB.
Tone arm: EMT *929*.
Preamp: plug-in cards, output + 6dB, max + 22dB.
Equalisation: DIN/NAB/IEC/RIAA or flat.
Power: 100 to 130V. 220 to 240V, 50 or 60Hz.
Price: £2,618.

EMT 929
Type: statically and dynamically balanced tone arm with extremely low frictional losses, typically 0.5Nm or 50mg at stylus tip, stylus force adjustable from 0 to 5g.
Price: £143.

OFS15/OFD15/OFS25/OFD25/OFS65/OFD65
Type: mono cartridge for use with EMT *155* preamp.
Stylus: conical 15 micron stereo, mono standard grooves 25 micron or 65 micron (as in type number), *S* version sapphire, *D* version diamond.
Tracking force: *25* 5g, *65* 9g (head is 4g heavier than *25*).
Response: 30Hz to 15Hz.
Crosstalk: mono.
Output voltage: 4mV *25*, 3mV *65*.
Prices: *OFS* sapphire £35.81, *OFD* diamond £56.

TSD15/TMD25/TMD65
Type: stereo *T series* cartridge with magnifying lens for use with EMT *155* or *153* amps.
Stylus: diamond 15 micron stereo, 25 micron mono, 65 micron standard grooves.
Tracking force: 2 to 3g.
Response: 20Hz to 20kHz.
Crosstalk: 25dB, *TMD* mono.
Output voltage: 0.75mV.
Prices: *TSD15* £127, *TMD* £120.

ENERTEC (France)

Enertec, 296 Avenue Napoleon Bonaparte, F-92505 Rueil-Malmaison.
Phone: (1) 977.92.23. Telex: 203404.
UK: Clive Green & Co Ltd, Britannia House, Leagrave Road, Luton LU3 1RJ.
Phone: 0582 411513. Telex: 826138.

TD212/2, TD222/2
Type: turntable system with built-in preamplifiers and monitoring system, fast start with turntable/counter plate under electromagnetic control, logic control, spot lamp, multiple eq settings, available freestanding, or chassis console.
Speeds: 33⅓, 45 and 78rpm.
Platter: 5.5lb, 12in diameter, accepts discs up to 16in.
Drive system: not specified.
Start time: 500ms.
Wow and flutter: ±0.2% DIN.
Rumble: – 50dB.
Tone arm length: 9¾in.
Tracking force: 0 to 6g.
Cartridge: accepts all standard cartridges.
Preamp: + 12dB output, gain 40dB to 48dB.
Equalisation: RIAA, and 25μs, 50μs, 100μs.
Monitoring: built-in loudspeaker.
Power: 127/220V 50Hz, others to order.
Price: *212/2* £1,690, *222/2* £1,867 complete with Stanton or Shure cartridge.

FM ACOUSTICS (Switzerland)

FM Acoustics Ltd, Tiefenhofstrasse 17, CH-8820 Wädenswil.
Phone: (01) 780.64.44. Telex: 56058.
UK: FM Acoustics (UK) Ltd, 2 Kempston Road, Weymouth, Dorset DT4 8XT.
Phone: 0305 784049.

FM 212
Stereo moving coil cartridge preamp with two sets

54 ▶

At last you can put sounds on tape exactly as they happen. Because 3M's sensational new Multi-Track Digital Mastering System has arrived in Europe.

The 3M Digital System isn't just better than any form of analogue recording. It's an entirely new concept.

And what a concept!

Tape-generated noise disappears. Wow and flutter drop to zero. Signal-to-noise goes up beyond 90 Db (without additional noise-reduction equipment). Print-through becomes impossible. Copy degeneration is nil.

Uriah Heep (above) and The Beat. Just two of the top groups attracted to 3M's New 32-Track Digital Recorder at The Roundhouse

No wonder top recording studios like The Roundhouse and The Town House are already turning to the 3M Digital System. No wonder top groups are insisting on recording the digital way.

You've got to hear it to believe it. Phone Derek Stoddart at 3M (0344-58398) to arrange a demonstration, and give your ears the surprise of their life.

Mincom Products
3M United Kingdom Limited
P.O. Box 1
Bracknell, Berkshire, RG12 1JU

IT'S HERE!

THE FIRST AND ONLY 32-TRACK DIGITAL MASTERING SYSTEM

3M and Mincom are Trade Marks

3M

of inputs. Front panel switchable input impedance trimming over the range 12 to 100Ω. Gain is 26dB. A separate power supply is available for either 100-120V or 200-240V.

HARRIS (USA)

Harris Corp, Broadcast Products Division, PO Box 4290, Quincy, Illinois 62301.
Phone: (217) 222-8200.
UK: Dynamic Technology Ltd, Zonal House, Alliance Road, London W3 0BA.
Phone: 01-993 2401. Telex: 935650.

CB1201
Speeds: 33⅓, 45 and 78rpm.
Start times: less than 1/16 turn (22.5°) at 33⅓ rpm, 1/10 turn at 45rpm and ½ turn at 78rpm.
Wow and flutter: 0.1%, NAB-weighted at 33⅓ rpm.
Speed accuracy: ±0.3% at 33⅓ rpm.
Rumble: 45dB (stereo) below NAB reference level recorded at 3.54cm/s rms velocity at 33⅓ rpm.
Features: synchronous motor and idler-wheel drive.
Price: approx. £475.

KEITH MONKS (UK)

Keith Monks (Audio) Ltd, 26-28 Reading Road South, Fleet, Hants GU13 9QL.
Phone: 02514 20568. Telex: 858606.
USA: Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906.
Phone: (203) 348-4969.

M9BA Mk3 Improved
Type: laboratory tone arm, low mass, damped, unipivot, with contact system using mercury wells, magnetic bias (skating) compensation, accurate balance.
Tracking error: zero at 2.375in arranged for minimum distortion.
Vertical tracking force: standard version L up to 1.5g with cartridges weighing 5 to 7g, H version for cartridges weighing 7 to 8g, S version for cartridges with high tracking weights such as the Decca *London.*
Pivot friction: less than 4mg lateral and vertical.
Turntable height: 1.25 to 2.5in.
Arm length: 9in.
Features: additional top arms available enabling spare cartridges to be correctly mounted and set-up for rapid change.
Price: £62.50.

MCI (USA)

MCI Inc, 1400W Commercial Blvd, Fort Lauderdale, Florida 33309.
Phone: (305) 491-0825. Telex: 514362.
UK: MCI (Professional Studio Equipment) Ltd, 54-56 Stanhope Street, London NW1 3EX.
Phone: 01-388 7867. Telex: 261116.

The company is to introduce a broadcast turntable system comprising the following units: a Technics *SP10 MkII* turntable platter, Ortofon arm and an RIAA preamplifier built specially by Audio & Design. The unit will be available in either a standard horizontal 19in rack-mounting format, or built into a standard MCI console. Price of the latter configuration is expected to be about £1,000.

McCURDY (Canada)

McCurdy Radio Industries Ltd, 108 Carnforth Road, Toronto, Ontario M4A 2L4.
Phone: (416) 751-6262. Telex: 963533.
UK: Seltech Equipment Ltd, Rose Ind Estate, Cores End Road, Bourne End, Bucks SL8 5AT.
Phone: 06285 29131.
USA: McCurdy Radio Industries Inc, 1051 Clinton Street, Buffalo, NY 14206.
Phone: (716) 854-6700. Telex: 4923219.

SS3159
This unit comprises a Technics *SP10D* direct-drive turntable platter with speeds of 33⅓ and 45rpm and a Micro-Trak *303* tone arm complete with Stanton *500L* or Shure *M44C* cartridge, mounted in a console. Local or remote operation is provided, and an optional cue amplifier is available.
Frequency response: within 0.5dB of RIAA curve, 30Hz to 10kHz; ±1dB of RIAA curve, 10Hz to 20kHz; 0 to 10dB roll-off below RIAA response also available.
Speed regulation: 0.15% with varying load.
Wow and flutter: 0.03% rms.
Rumble: better than −50dB to DIN A-weighting, or −55dB to IEC B-weighting, or −70dB to DIN B-weighting.
Distortion: 0.5% at +8dBm output, 30Hz to 20kHz, using reverse RIAA input network.
Price: $3,500.

AT235 & SA236 Phono Preamplifiers
The *AT235* is a magnetic cartridge preamplifier intended for broadcast applications. The preamp requires mounting in a frame which is available for single units or various other sizes up to ten. The input connection to the preamp is in the front panel. It is matched to all popular magnetic cartridges with the gain of the unit adjustable by varying the feedback resistor on the edge connector. Roll-off frequencies are available at 5, 7, 10, 12kHz. Six balanced outputs — two 600Ω, two 150Ω, one direct and one summing output for mono output from a pair of *AT235.*
Equalisation: ±0.5dB RIAA curve.
Gain: 24 to 52dB at 1kHz.
Output: −20dBm to +8dBm into 600Ω for 5mV input.
Output noise: −82dBm for 30dB gain at 1kHz, 10Hz to 100kHz
Distortion: 0.25% max from 30Hz to 15kHz.
The *SA236* is a phono preamp package available in mono or stereo versions both using the *AT235* and containing fully regulated power supply.
Price: mono *AT235* $220, stereo *SA236* $655.

MECHANIKAI LABORATORIUM (Hungary)

Export: Elektroimpex, 1392 Budapest, PO Box 296.

SL-101
Type: turntable system with preamps, direct drive, monitoring, console or chassis mounting.
Speeds: 33⅓, 45 and 78rpm.
Platter: 12in.
Drive system: direct drive dc servo motor.
Start time: 1s (¼ rev).
Wow and flutter: 0.07% DIN.
Rumble: 70dB weighted DIN.
Cartridge: supplied with either EMT *TSD15* or Shure *M75EJ.*
Preamp: output +6dBm, max +12dBm.
Equalisation: RIAA or flat.
Power: 220V to 60Hz.

MICRO ACOUSTICS (USA)

Micro Acoustics Corp, 8 Westchester Plaza, Elmsford, NY 10523, USA.
Phone: (914) 592-7627.
UK: Webland International Ltd, 129 Walham Green Court, Moore Park Road, London SW6 2DG.
Phone: 01-385 9478. Telex: 25570.

2002e
Type: professional cartridge.
Stylus: elliptical 5×17.8 micron, beryllium cantilever.
Tracking force: 0.7 to 1.4g.
Response: 5Hz to 20kHz.
Output voltage: 3.5mV.
Channel separation: 30dB.
Optimum load: 10kΩ to 100kΩ.
Weight: 4g.
Price: £65.78, stylus £27.87.

530MP
Type: professional cartridge.
Stylus: micropoint.
Tracking force: 1 to 1½g.
Response: 5Hz to 20kHz.
Output voltage: 3.5mV.
Channel separation: 35dB.
Weight: 4g.
Price: £121.78, stylus £60.89.

MICRO-TRAK (USA)

Micro-Trak Corporation, 620 Race Street, Holyoke, Massachusetts 01040.
Phone: (413) 536-3551. Telex: 955497.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

MODEL 720
Speeds: 33⅓, 45 and 78rpm.
Weight of platter: 5.5lb.
Drive system: synchronous motor driving platter through idler.
Start time: 1/16 revolution at 33⅓ rpm.
Tone arm: deck drilled for Micro-Trak *303* arm.
Wow and flutter: 0.3%.
Rumble: 36dB below NAB standard level.
Price: $328.50.

MODEL 740
Similar to the above model, but with only two speeds 33⅓ and 45rpm. This unit carries a slighlty heavier platter.
Price: $328.00.

Gray Micro-Trak 303/306
Type: professional tone arms which feature horizontal viscous damping providing a retardant force to fast motion whilst allowing slow motion such as tracking without any hindrance.
Size: *303* 12in, *306* 16in.
Price: *303* $106.50, *306* $119.50.

Model 206
Type: Viscous damped transcription arm similar to the *303* but with greater mass.

Model 6405 preamplifier
Stereo preamplifier, small size and can be mounted inside turntable cabinet or on front panel.
Input impedance: 47kΩ.
Gain: 5mV input for 0dBm output at 1kHz.
THD: less than 0.05% at 1kHz.
Frequency response: RIAA equalisation +0.5%.
Signal to noise: 73dB relative to 5mV at 1kHz.
Power: 110V ac 60Hz.
Price: $229.50.

6400 series preamplifiers
Self powered, RIAA/NAB equalised disc preamplifiers.
Gain: 44dB at 1kHz.
THD: 0.5% at 0dBm.
Signal to noise: 60dB.
Input impedance: 47kΩ.
Output impedance: 600Ω balanced or unbalanced or 150Ω internally selectable.
Price: *6400* mono $134.50, *6401* stereo $179.50.

ORTOFON (Denmark)

Ortofon Manufacturing A/S, 11B Mosedalvej, DK-2500 Copenhagen-Valby.
Phone: 01-46.24.22. Telex: 27587.
UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD.
Phone: 0753 76911.

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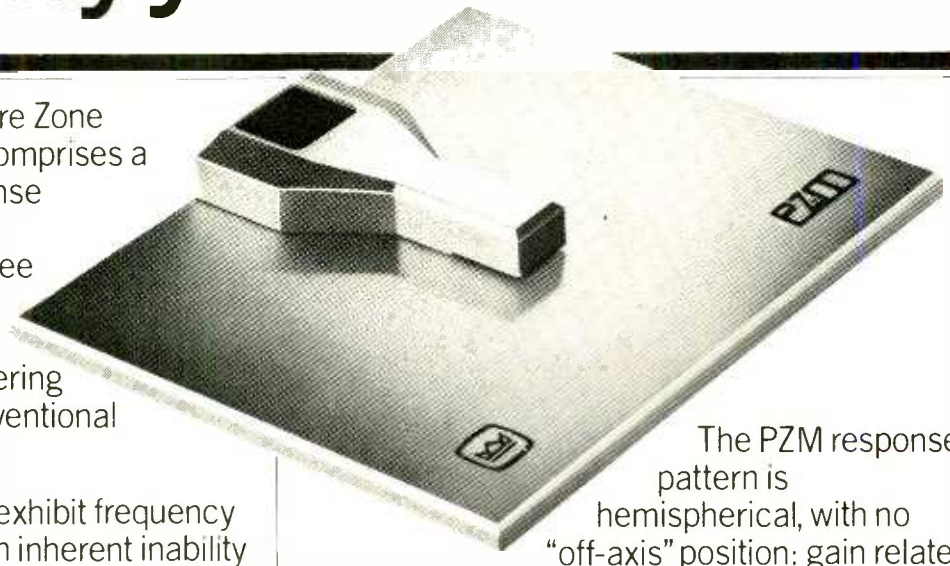
Can you afford to ignore the most significant development in microphone technology of the last fifty years?



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

HHB

Amcron

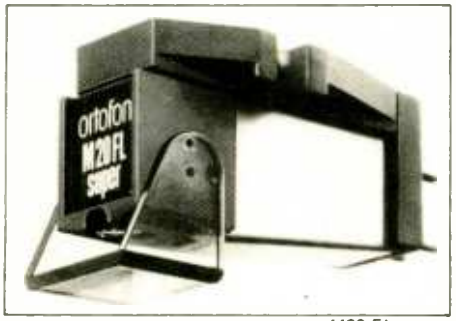
PZM and PZMicrophone are registered trade marks of Crown International.

Survey

QRK Galaxy

M20FL Super/M20E Super
Type: cartridges using variable magnetic shunt principle.
Stylus: *M20FL* fine line 8 micron, tracking 1.25 to 1.75g; *M20E* elliptical 8 x 18 micron 0.75 to 1.25g.
Response: 10Hz to 25kHz.
Output voltage: 4mV.
Channel separation: *M20FL* 27dB, *M20E* 25dB.
Optimum load: 47kΩ/ 400pF.
Weight: 5g.
Price: total/stylus *M20FL Super* £61.78/£37.78. *M20E Super* £52.82/£30.67.

F15E MkII/FF15E MkII/VMS20E MkII
Type: cartridges using variable magnetic shunt principle.
Stylus: elliptical/spherical 18/8 x 15 micron *F/FF*, tracking 1 to 2g; 8 x 18 micron *VMS* tracking 0.75 to 1.5g.
Response: 20Hz to 20kHz.
Output voltage: 5mV.
Channel separation: 25dB, *FF* 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5g.
Price: total/stylus *F15E MkII* £24.40/£13.33, *FF15E MkII* £17.33/£10.22, *VMS20E MkII* £35.11/£23.56.



M20 FL super

MC20/MC30
Type: moving coil cartridge, stylus is not user changeable, but must be returned to factory for exchange.
Stylus: fine line 8 micron.
Tracking weight: 1.5g.
Response: 5Hz to 60kHz, 20Hz to 20kHz ±1dB.
Output voltage: MC20 0.07mV, MC30 0.08mV, pre-preamp required (or transformer).
Channel separation: 25dB.
Optimum load: 47kΩ.
Weight: 7g.
Price: *MC20* £68, exchange £39.36. *MC30* £221.33.

CAP 210
Type: cartridge capacitor designed to fit over the terminal pins of the cartridge and adds 210pF to the load capacity to enable the response to be closer to the specification even when not operating into the desired loading of 400pF.

FF15X MkII/FF15XE MkII
Type: cartridges using variable magnetic shunt principle.
Stylus: spherical X, elliptical XE. Stylus tip radius 15μm and 18/8μm respectively.
Response: 20Hz to 20kHz.
Output voltage: 1.3mV and 1.2mV respectively at 1kHz, 1cm/s.
Channel separation: 20dB.
Optimum load: 400pF.
Weight: 5g.

Ortofon/SME 30H
Integrated arm and cartridge (see SME for arm details).
Stylus: fine-line, nude. 0.35mg tip mass.
Tracking force: 1.0g.
Response: 20Hz to 20kHz.
Output voltage: 3mV at 1kHz.
Channel separation: greater than 25dB.
Optimum load: 47kΩ/400pF.
Weight: 4.5g.

PICKERING (USA)

Pickering & Co Inc, Sunnyside Blvd, Plainview, NY 11803.
Phone: (516) 681-0200.
UK: Sound Source, Station Approach, Rickmansworth, Herts.
Phone: 09237 75242.

XSV/3000
Type: high quality cartridge with stereohedron stylus, and cleaning brush attached.
Stylus: stereohedron.
Tracking force: 0.75 to 1.5g.
Response: 10Hz to 30kHz.
Output voltage: 5mV.
Channel separation: 35dB.
Optimum load: 47Ω/275pF.
Weight: 5.5g.
Price: £64, stylus £31.50.

XV-15 series
Type: range of cartridges with cleaning brush attached.
Stylus: *1200E* elliptical 5 x 17.8 microns, *750E* and *625E* 7.6 x 17.8 microns.
Tracking force: *1200E* 0.5 to 1.25g, *750E* 0.5 to 1.5g, and *625E* 0.75 to 1.5g.
Response: 10Hz to 30kHz (*1200E*), to 25kHz *750E* and *625E*.
Output voltage: 4.4mV.
Channel separation: 35dB.
Optimum load: 47kΩ/27pF.
Weight: 6.3g.
Prices: total/stylus *XV-15/1200E* £50.50/£25, *XV-15/750E* £42/£23, *XV-15/625E* £27.50/£20; *XV-15/625DJ* ruggedised version for disco cueing, white body, no brush, £29.50.

XUV/4500-Q
Type: wide bandwidth cartridge for stereo and discrete quad discs such as *CD4*, with brush.
Stylus: quadrahedral with quadrahedron tip.
Tracking force: 0.5 to 1.5g.
Response: 10Hz to 50kHz.
Output voltage: 4.4mV.
Channel separation: 35dB.
Optimum load: 100kΩ/100pF, low capacitance cables required.
Weight: 5.5g.
Price: £76, stylus £39.50.

QRK (USA)

QRK Electronic Products Inc, 1568 North Vista, Fresno, Cal 93703.
Phone: (209) 251-4213.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

Galaxy
Type: professional turntable with dc servo controlled motor, ±10% speed control, instant start, provision for cue slipping without loss of speed, plus back-cueing with no motor drag. Speed readout on LEDs, remote switching.
Speeds: 33⅓ and 45rpm.
Price: approx. £350.

12C
Type: rugged turntable with tone arm.
Platter: 12in diameter, 5.5lbs.
Drive system: synchronous motor, outer rim drive with idler.
Start time: ¼ revolution for full speed.
Wow and flutter: 0.1%.
Rumble: – 48dB.
Pre-amp: available as accessory.
Power: 115V 60Hz, option 230V 50Hz.
Price: £190.

Custom 2
Similar to *12C* but only 33⅓/45rpm, rumble – 52dB.
Price: £240.

S-260/S-320 Tone Arm
Type: professional tone arm, gimbal assembly incorporating individual double sets of 5 ball, 1mm bearings, silicon damped, spring tension dialable balance control.
Vertical tracking force: 1.0g or less.
Arm length: 9in *S-260*, 12½in *S-320*.
Features: Removable headshell, separate balance and stylus pressure adjustment.

REVOX (Switzerland)
Willi Studer GmbH, CH-8105 Regensdorf, Althardstrasse 150.
Phone: (01) 840 2960. Telex: 58489.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.
USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, Tennessee 37210.
Phone: (615) 254-5651. Telex: 065230.

B790
Type: direct drive electronic turntable with ultra short tangential tone arm with servo electronic tone arm follow-up.
Speeds: 33⅓ and 45rpm.
Platter: 12½in. diameter, 2.42lb.
Drive system: direct drive with electronic control and digital readout, ±7% speed variation.
Start time: 2s at 45rpm.
Wow and flutter: 0.05% DIN.
Rumble: – 68dB DIN.
Tone arm: electronically controlled lowering, linear tracking, less than 0.5° tracking error, tracking force 5 to 20mN.
Cartridges: supplied with either Ortofon *VMS20E MkII* or *M20E* Super.
Power: 100/110/120/200/220/240V, 50 to 60Hz.
Price: £385 with *VMS20E*, £395 *M20E*.

B795
Type: direct drive electronic turntable with ultra short tangential tone arm with servo electronic tone arm follow-up.
Speeds: 33⅓ and 45rpm.
Platter: 12½in diameter, 4.62lb.
Drive system: direct drive with electronic control.
Start time: 2s at 45rpm.
Wow and flutter: 0.05% DIN.
Rumble: – 70dB DIN.
Tone arm: electronically controlled lowering, linear tracking, less than 0.5° tracking error, tracking force 8 to 20mN.
Cartridge: supplied with a Revox *P20MDR* cartridge designed for the company by AKG. Cartridge has a 5 x 18 micron elliptical stylus, 0.46mg tip mass.
Power: 100/110/120/220/240V, 50 to 60Hz.
Price: £295.

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.

M232/236
Type: professional tone arm, simple and rugged with full range of adjustments. Mounting through single hole. *M232* is for 12in turntables, *M236* for 16in.
Price: £31.50.

SC35C
Type: rugged cartridge for broadcast and disco, withstands repeated back-cueing, bright orange spot on stylus tip for increased visibility.

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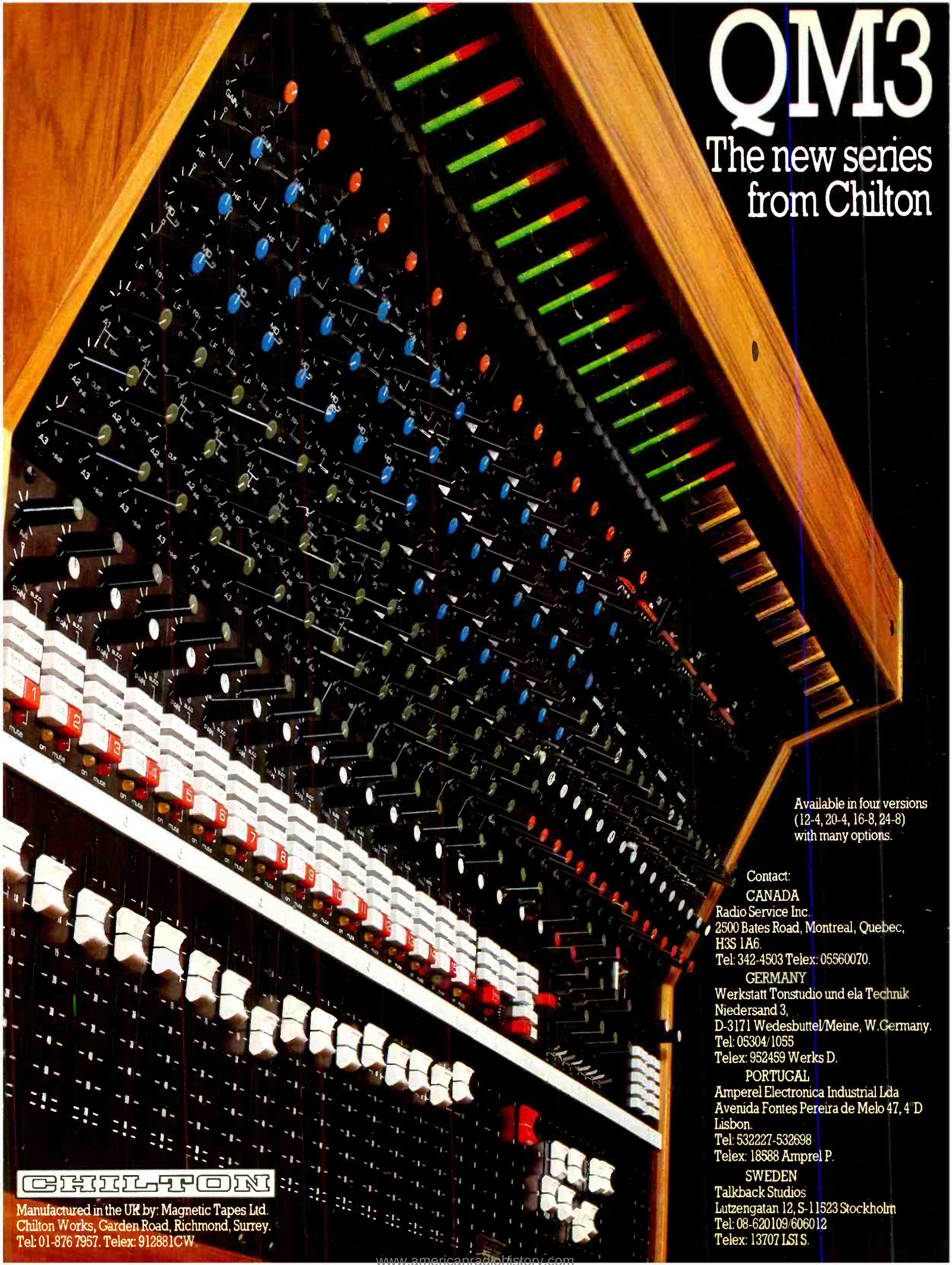


QM3

The new series from Chilton

Available in four versions (12-4, 20-4, 16-8, 24-8) with many options.

Contact:

CANADA
Radio Service Inc.
2500 Bates Road, Montreal, Quebec,
H3S 1A6.
Tel: 342-4503 Telex: 05560070.

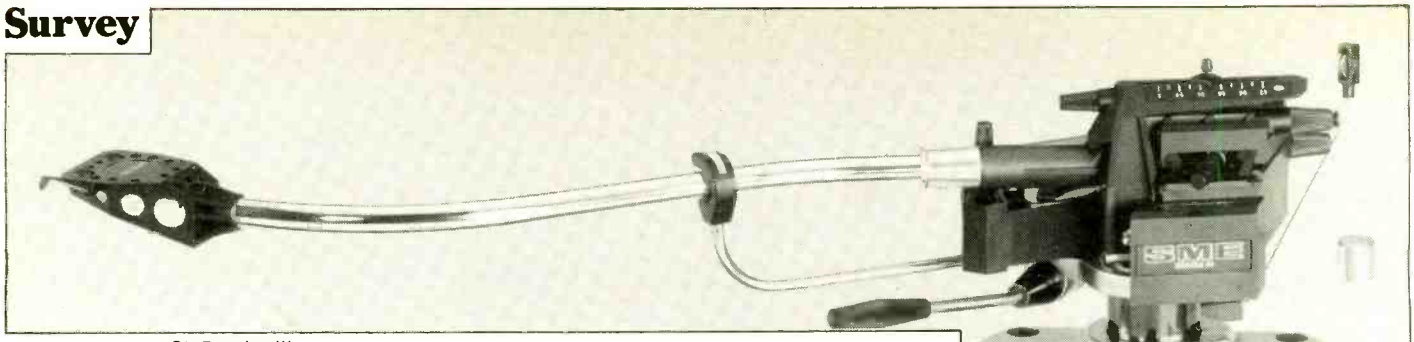
GERMANY
Werkstatt Tonstudio und ela Technik
Niedersand 3,
D-3171 Wedesbuttel/Meine, W.Germany.
Tel: 05304/1055
Telex: 952459 Werks D.

PORTUGAL
Amperel Electronica Industrial Lda
Avenida Fontes Pereira de Melo 47, 4°D
Lisbon.
Tel: 532227-532698
Telex: 18588 Amprel P.

SWEDEN
Talkback Studios
Lutzengatan 12, S-11523 Stockholm
Tel: 08-620109/606012
Telex: 13707 LSI S.

CHILTON

Manufactured in the UK by: Magnetic Tapes Ltd.
Chilton Works, Garden Road, Richmond, Surrey.
Tel: 01-876 7957. Telex: 912881CW.

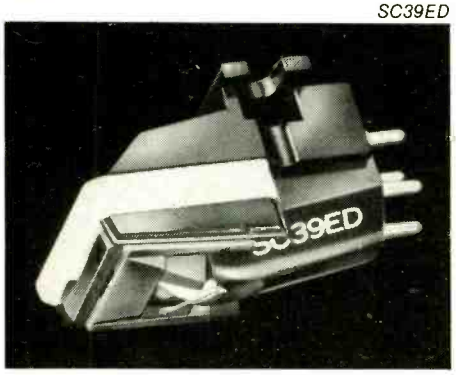


SME series III

Stylus: spherical.
Tracking force: 4 to 5g.
Response: 20Hz to 20kHz.
Output voltage: 5mV.
Channel separation: 20dB.
Price: £17.40.

SC39 Series
Stylus: *SC39ED* 5 × 18 micron elliptical, 0.75g to 1.5g tracking, *SC39EJ* 10 × 18 micron elliptical, 1.5g to 3g tracking, *SC39B* 18 micron spherical, 1.5g to 3g tracking.
Response: 20Hz to 20kHz.
Output voltage: 4.0mV.
Channel separation: *SC39ED* 25dB; *SC39EJ* and *SC39B* 20dB.
Price: *SC39ED* £48.00; *SC39EJ* £33.30; *SC39B* £28.80.

SC39ED



V15 Type IV
Type: high performance cartridge with damper with carbon fibre brush.
Stylus: hyperelliptical biradial, optional spherical.
Tracking force: 0.75g to 1.5g.
Response: 10Hz to 25kHz.
Channel separation: 25dB.
Output voltage: 2.5mV.
Price: £79.20; stylus £27.60.

M64 series stereo preamps
Self powered, RIAA/NAB equalised disc preamplifiers.
Gain: 37dB at 1kHz.
THD: less than 1% for an output of 2V at 1kHz.
Signal to noise: 71dB.
Input impedance: 50kΩ/ 350pF.
Output impedance: high level 22kΩ, low level 600Ω unbalanced.
Price: £54.

SME (UK)

SME Ltd, Steyning, Sussex BN4 3GY.
Phone: 0903 814321.
USA: Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204.
Phone: (312) 866-2200. Telex: 724381.

SME Series II Improved
Type: precision tone arm with low friction pivots, low inertia, lever operated hydraulically, damped lifting control.
Vertical tracking force: 0 to 1.5g.
Horizontal force: 20mg will deflect the arm.
Bias: adjustable to correspond with tracking force.
Arm length: 9in.
Height: 1 1/16 to 1⅝in.
Price: £71.75, with detachable shell £78.65.
Optional fluid damper which renders arm less lively applied at a radius of 1.45in. making it more effective than damping applied at the bearings.
Price: 21.75.

SME Series III
Type: precision tone arm, uses high precision moulded components with added metal inserts where weight is required, nitrogen hardened titanium tube, carrying arm removable for multi-cartridge use.
Vertical tracking force: 0 to 2.5g.
Horizontal force: 20mg will deflect the arm.
Cartridge weight: 0 to 12g.
Arm length: 9in.
Height: 2⅜ to 3¼in.
Price: £130.95.

SME Series IIIS
Simplified version of the *Series III*. Adjustments are made directly instead of through lead screws or rack and pinion. Performance of the arms is the same.
Price: £93.63.

ORTOFON/SME 30H
Low mass integrated cartridge and carrying arm. The cartridge is manufactured by Ortofon and the arm is designed to operate with *Series III* and *IIIS* units. Cartridge details — see Ortofon.

SME also manufacturers a range of accessories for its arms including glass reinforced nylon screws for cartridge mounting.

SONETEC (France)

Sonetec, 21 Avenue du Fort, F-92120 Moutrouge.
Phone: 654.07.07. Telex: 203347.

DR1000
Type: Turntable system using Technics *SP10 MkII* turntable with EPA-100 tone arm, Shure *M75* cartridge and RIAA preamplifier with +12dB output, internal monitor loudspeaker.

SONUS (USA)

Sonic Research Inc, 27 Sugar Hollow Road, Danbury, Connecticut 06810.
Phone: (203) 792-8822.
UK: Mossrail Ltd, 27 Fleet Street, Holbeach, Lincs PE12 7AD.

Dimension 5
Type: cartridge for use with high precision tone arms.
Stylus: Lambda configuration which mimics that of cutting styli.
Tracking force: 1.0 to 1.5g.
Response: 10Hz to 20kHz ± 1dB.
Output voltage: 0.8mV.
Channel separation: 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5.5g.

Gold series II
Type: cartridge for use with high precision tone arms.
Stylus: line contact ellipsoid standard. Also bi-radial elliptical and spherical styli available.
Tracking force: 1.0 to 1.5g.
Response: 10Hz to 20kHz.
Output voltage: 0.8mV.
Channel separation: 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5.5g.

Silver series II
Type: cartridge for use with medium or low mass tone arms.
Stylus: modified line contact ellipsoid, a bi-radial elliptical stylus is also available.
Tracking force: 1.0 to 1.5g.
Response: 15Hz to 20kHz.
Output voltage: 1.0mV.
Channel separation: 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5.5g.

Bronze series II
Type: cartridge for use with medium or low mass tone arms.
Stylus: line contact ellipsoid.
Tracking force: 1.0 to 1.5g.
Response: 10Hz to 20kHz.
Output voltage: 0.8mV.
Channel separation: 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5.5g.

Black series II
Type: cartridge for manual or semiautomatic turntables.
Stylus: bi-radial elliptical, spherical also available.
Tracking force: 1.5 to 2.0g.

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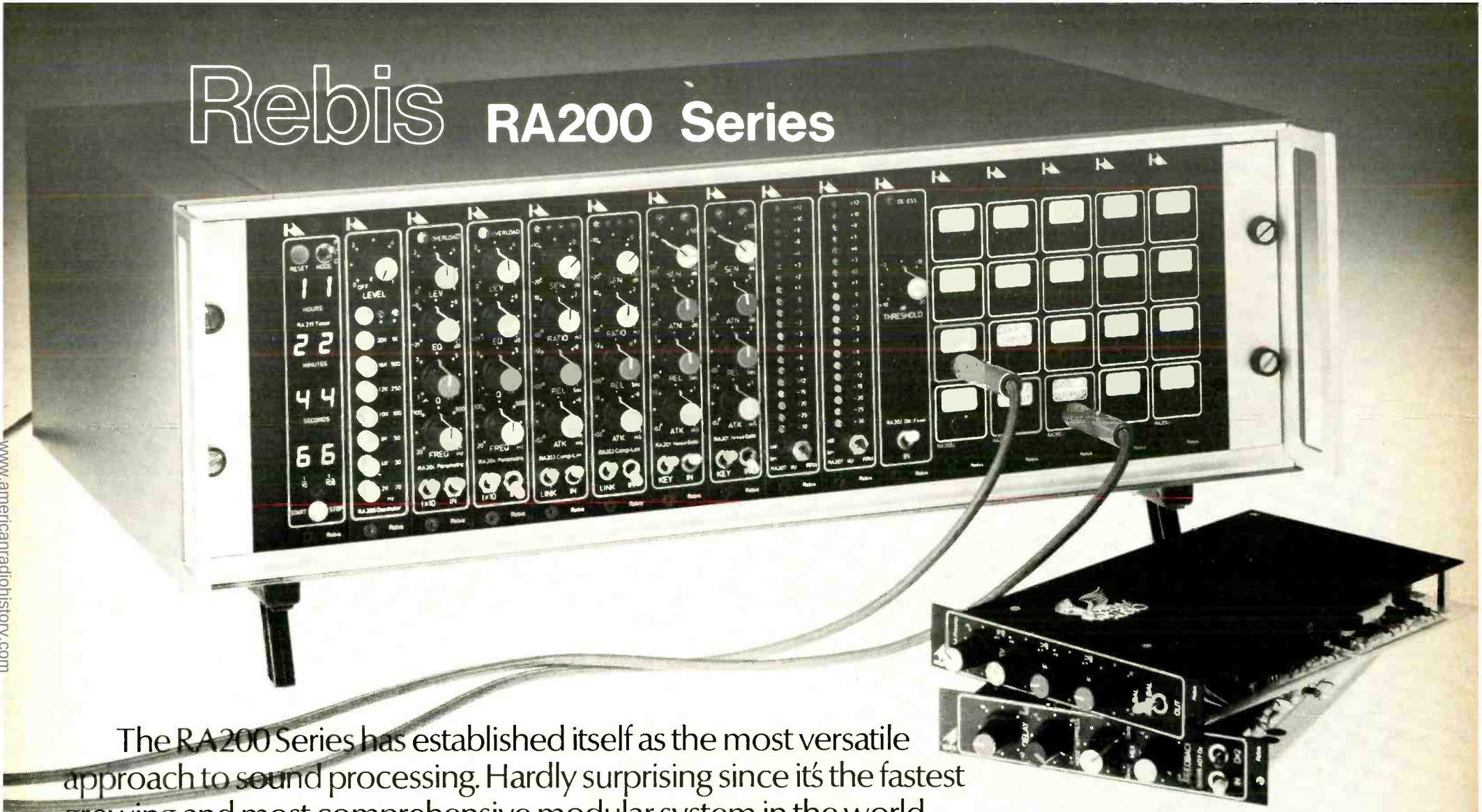
Rebis RA200 Series



The RA200 Series has established itself as the most versatile approach to sound processing. Hardly surprising since it's the fastest growing and most comprehensive modular system in the world.

Modules to date include:

RA201 Noise Gate	RA204 Parametric Equaliser	RA207 LED Meter	RA210 RIAA Preamp.	RA213 Mono MDA.
RA202 De-esser	RA205 ADT/Delay	RA208 Modulator	RA211 Timer	RA214 Stereo MDA.
RA203 Compressor-Limiter	RA206 Oscillator	RA209 Mixer	RA212 Mic/Line Amp.	RA200J Connector

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.

Survey

Response: 10Hz to 20Hz.
Output voltage: 1.0mV.
Channel separation: 20dB.
Optimum load: 47kΩ/400pF.
Weight: 5.5g.

SPOTMASTER (USA)

Broadcast Electronics Inc, 4100 North 24th Street, Quincy, Illinois 62301.
Phone: (217) 224-9600. Telex: 250142.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP.
Phone: 09322 43124. Telex: 928475.

CUE-MASTER

Speeds: 33⅓, 45 and 78rpm.
Start time: about $^{1}/_{10}$th of a revolution at 45rpm.
Wow and flutter: 0.3%.
Rumble: 36dB below standard NAB level.
Platter weight: 4.4lb.
Features: accepts 10in tone arms.

STUDIO PRO

Speeds: 33⅓ and 45rpm.
Start time: $^{1}/_{10}$th of a revolution at 45rpm.
Wow and flutter: 0.2%.
Rumble: 38dB below standard NAB level.
Platter weight: 5½lb.
Features: accepts 10in tone arm.

STANTON (USA)

Stanton Magnetics Inc, Terminal Drive, Plainview, NY 11803.
Phone: (516) 681-0415. Telex: 510-221 1845.
UK: Wilmex Ltd, Compton House, 35 High Street, New Malden, Surrey KT3 4DE.
Phone: 01-949 2545. Telex: 8814591.

500 Broadcast Series

Type: series of cartridges aimed at broadcast use.
Stylus: *500A* 17.8 micron spherical, *500AL* 17.8 micron heavy duty for disco, *500EE* 7.6 x 17.8 micron elliptical, *500E* 10 x 17.8 micron elliptical.
Tracking force: *A* and *E* 2 to 5g, *EE* 1 to 2g, *AL* 3 to 7g.
Response: 20Hz to 20kHz.
Channel separation: 35dB.
Output voltage: 5mV.
Optimum load: 47kΩ/275pF.
Weight: 5g.
Prices: total/stylus *500A* and *AL* £14.75/£8.25, *500E* £15.50/£10.50, *500EE* £17.75/£12.95.

680 series

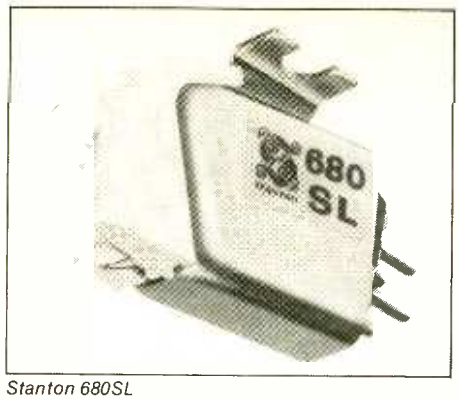
Type: reference series cartridges claimed to offer an 'optimum performance to price ratio' — an unusual technical term.
Stylus: elliptical *680EE* 7.6 x 17.8 micron elliptical, *680EL* robust disco cueing type, elliptical 10 x 17.8 microns, *680AL* disco spherical 17.8 micron stylus, *680SL* stereohedron stylus suitable for broadcast usage.
Tracking force: *680EE* 0.75 to 1.5g, *680EL* 2 to 5g.
Response: 20Hz to 20kHz.
Output voltage: 4.1mV.
Channel separation: 35dB.
Optimum load: 47kΩ/275pF.
Weight: 5.5g.
Price: total/stylus *680EE* £28.50/£17.50, *680EL* £28.50/£17.75, *680AL* £16.60/£9.75, *680SL* £45.00/£24.00.

681 series

Type: calibration cartridge series.
Stylus: *681A* 17.8 micron spherical, tracking 1.5 to 3g; *681SE* 10 x 17.8 micron elliptical, tracking 2 to 4g; *681EEE* 5 x 17.8 micron elliptical tracking 0.75 to 1.5g; *681EEES* stereohedron, tracking 0.75 to 1.5g, *681BPS* 20 micron for playing metal stampers and matrices, tracking 3 to 7g for stampers, 1 to 1.5g for matrix.
Response: 10Hz to 20kHz, to 22kHz *EEE* and *EEES*.
Output voltage: 5.5mV *A and SE, EEE* and *EEES* 3.5mV.
Channel separation: 35dB.
Optimum load: 47kΩ/275pF.
Weight: 5.5g.
Prices: total/stylus *681A*, *£37.25/£19.50*, *681EEE* £46.25/£23.50, *681EEES* £64.25/£32.50, *681BPS* £115.00.

881S

Type: professional calibration series, 'the highest quality (and priced) cartridge Stanton can make



Stanton 680SL

Stylus: stereohedron.
Tracking force: 0.75 to 1.25g.
Response: 10Hz to 20kHz.
Output voltage: 4.5mV.
Channel separation: 35dB.
Optimum load: 47kΩ/275pF.
Weight: 5.7g.
Price: £83.25, stylus £41.09.

Model 310 phono preamp/equaliser

Self powered stereo preamp with selectable flat or NAB postemphasis curves, switchable rumble filter, individual adjustment of gain, and cartridge capacitance loading trimming.
Gain: adjustable 30 to 60dB.
THD: less than 0.05% at 20dBm.
Signal to noise: – 70dB below 10mV at 1kHz, NAB mode.
Input impedance: 47kΩ, 15pF capacitance switchable in 50pF steps to 350pF max.
Output impedance: 150Ω or higher.
Price: £166.

SURREY (UK)

Surrey Electronics Ltd, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG.
Phone: 04866 5997.

Stereo disc amplifier 2

Stereo disc amp suitable for broadcast and disc monitoring and transfer usage. Features include a switchable 18dB/octave scratch filter.
Frequency response: inverse of IEC98-4, RIAA recording characteristic, 30Hz to 20kHz ±0.5dB.
THD: – 82dB, 0.008%, 30Hz to 20kHz at + 20dBV.7 output.
Input impedance: 47kΩ.
Output impedance: 600Ω balanced.
Price: £255.

TECHNICS (Japan)

Matsushista Electric Trading Co Ltd, PO Box 51, Osaka Central 530-91, 1006 Oaza Kadoma, Osaka 571.
Phone: 06 908-1121. Telex: 63426.
UK: Technics, National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks SL1 6JB.
Phone: 0753 34522. Telex: 847652.
USA: Technics by Panasonic, One Panasonic Way, Secaucus, New Jersey 07094.
Phone: (201) 348-7000.

SP-10 MkII

Type: direct drive turntable.
Speeds: 33⅓, 45 and 78rpm.
Platter: 12in diameter, 6.5lb.
Drive System: direct drive, phase locked to quartz reference, dc brushless motor.
Start time: 250ms 33⅓rpm (25° rotation).
Wow and flutter: 0.035% DIN.
Rumble: – 50dB DIN 45539A, – 73dB DIN 45539B.
Price: £604.40.

EPA-100

Type: variable dynamic damping universal tone arm, titanium nitride arm pipe on gimbal suspension.
Vertical tracking force: 0 to 3g.
Friction: 5mg lateral and vertical.
Arm length: 9.75in.
Tracking error: 1.1° inner, 2.1° outer grooves.
Height: 1⅝ to 3½in.
Price: £275.51.

SL-1000 MkIII

Comprises *SP-10 MkII*, and *EPA-100* arm mounted in *SH-10B3* obsidian turntable base weighing 26.4lb to prevent acoustic feedback.
Price: £1,155.42

SP-15

Type: direct drive turntable.
Speeds: 33⅓, 45, 78rpm with variable pitch ±9.9% in 0.1% digitally displayed.
Platter: 13½in diameter.
Drive system: direct drive quartz locked heteropole dc motor.
Start time: 0.4s.
Wow and flutter: 0.025% Wrms.
Rumble: – 56dB DIN A, – 78dB DIN B.
Price: on application.

EPA-500

Tone arm system with interchangeable arms for perfect matching with different cartridges. Three arm models available. Complete system consists of *EPA-B500* base, *EPA-A501H* arm unit and *SH-50P1* stylus pressure gauge.

THORENS (Switzerland)

Thorens Franz AG, Hardstrasse 41, CH-5430 Wettingen.
Phone: 056 262861. Telex: 53681.
UK: Cambrasound Ltd, Freedex House, 4-10 North Road, Islington, London N7 9HN.
Phone: 01-607 8141.

TD126 MkIII

Type: semi-professional transcription turntable.
Speeds: 33⅓, 45 and 78rpm.
Platter: 12in, diameter, 4.73lb.
Drive system: one step belt drive with servo controlled dc motor.
Arm: *TP16 MkIII*.
Wow and flutter: 0.04%.
Rumble: 51dB unweighted, 72dB DIN weighted.
Power: 117/220V 50/60Hz.
Price: £280 including arm, base and cover.

TD 160

Type: belt driven turntable driven by a 16 pole two phase synchronous motor with slip clutch for rapid start.
Speeds: 33⅓ and 45rpm.
Platter: 12in diameter, 7lb.
Drive system: single step belt drive.
Wow and flutter: 0.04% DIN 45507.
Rumble: – 70dB DIN 45539 weighted.
Power: 110-125V, 210-240V ac 50/60Hz.
Price: from £135, *TD 160 Super* with additional resonance absorption features £190.

TP16 MkIII

Type: Isotrack tone arm.
Lateral tracking error: 0.18°/cm radius.
Arm length: 9.2in.
Friction: 0.15mN in both planes.
Bias (skating) compensation: magnetic force without friction.
Price: £35.

TMC63

Type: moving coil cartridge.
Tracking force: 20N.
Stylus: 8 micron diamond fine line.
Response: 20Hz to 20kHz.
Output voltage: 0.75mV.
Channel separation: 25dB.
Compliance: 12 x 10^{-6} cm/dyne.
Price: £175. *PPA990* preamplifier £100.

TRIO/KENWOOD (Japan)

Trio Electronics Inc, 6-5, 1-Chome, Shibuya, Shibuya-Ku, Tokyo.
UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD.
Phone: 0753 76911.
USA: Kenwood Electronics Inc, 11315 E Watsoncenter Road, Carson, Cal 90745.
Phone: (213) 518-1700.

L-07D

Type: direct drive turntable with integral tone arm. Electronic and mechanically controlled brake. Anti-skating device, oil-damped cueing control, LED speed indication, stylus pressure direct readout counter.
Speeds: 33⅓ and 45rpm.
Platter: 13in 12.1lb aluminium alloy die-cast laminated with duralumin.
Drive system: Quartz PLL direct drive. Coreless and slotless dc servo motor.
Wow and flutter: 0.020% Wrms.
Rumble: – 94dB DIN weighted.
Tone arm: Static balanced J-shaped.
Vertical tracking force: 0-2g in 50mg steps.
Arm length: 9⅝in effective length.
Height: adjustable range of ¼in.
Price: on application.

■

FRONTRUNNERS

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Starting at min, any control knob will run through an operational scale simply by turning it to max. But we are not talking about *any* knobs. Sifam collet knobs (and push-ons) do what you would expect a knob to do but more positively, more securely, more aesthetically. They're nicer to look at, nicer to the touch. They're available in a variety of colour combinations, from 10 mm to 38 mm in size, easily assembled, easily installed. In fact they're very pleasing knobs indeed.

If you think all this is a touch lyrical for mere knobs, perhaps you're not a potential Sifam customer after all. On the other hand, you may be stirred enough to ask for a comprehensive catalogue from the UK leaders in knobs and their accessories. The name is Sifam.

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Interior design

Part two

The second part of Norman Bone's insight into interior design continues his coverage of structural items and takes up the story with observation windows.

It is standard practice, where possible, to install observation windows between adjacent working areas, such as studio, control room and recording room, particularly where recording is carried out as a separate function. Sometimes the use of a second or slave studio is required, and vision between all these working areas can only enhance the smooth running of the production.

It has already been mentioned that these windows are the second weakest point in sound isolation, and every effort must be made to reduce any sound leakage that might occur.

Almost certainly the architect will have provided at least two, if not three, separate walls between the areas concerned, and it is vitally necessary to install a separate window unit in each wall, with as large an air-gap between the units as the structure permits. Two 4½in walls with a 2in air gap between will enable a distance of 11in to be achieved and this is excellent. Where there is a third and additional wall in the centre, a third window unit will, naturally, reduce the air gap, but the third window will more than compensate for the reduced air gap and greatly increase the sound isolation. **Fig 6** shows a typical example of a triple window.

The thickness of the glass is most important. Normal domestic glass of about 4mm is useless, 6mm only slightly better, and in most modern studios it is now normal to use glass of not less than 10 or 12mm thickness.

To avoid sympathetic resonance between the two panes, one is usually of 10mm and the other of 12mm thickness. With an air gap of 11in two panes should provide a sound isolation of up to 40dB if fitted as described later, and the use of a 10mm third pane between two 12mm outer panes will increase this isolation up to about 55dB which is near the maximum obtainable.

The construction of the window frames is very important. Preferably they should be of hardwood and should fit the aperture as closely as possible. The glass should also fit into the rebates without undue gaps and it is an advantage to cover the edges with wash-leather, with a cover fillet nailed into position. Any remaining gaps between frame and structure should be filled with mastic and covered with an architrave.

In most cases the builder will have fitted a 4 x 2in (100 x 50mm) wooden subframe to the structure, and again all gaps must be mastic filled as this is where any sound leakage will normally occur.

The disadvantage of wooden frames is that, under the prolonged influence of studio air-conditioning, even hardwood frames tend to shrink and gaps appear at the joints, eventually lowering the isolation value.

In the last two or three years factory-glazed commercial units have become available, constructed of heavy duty satin-anodised aluminium alloy extrusions into which is incorporated a complete U-shaped or double vinyl seal into which the glass is factory-fitted. No shrinkage can occur in these units and the glass is completely isolated from the frame and therefore also from the structure. A self-adhesive rubber or plastic strip is usually fixed to the back of these frames as an additional seal between frame and structure.

With regard to window area, this naturally depends on the size of the studio. The minimum size should be 3ft square, and in an average studio 6ft wide by 3ft high would be considered normal. In large orchestral or similar studios, with control rooms incorporating 24, 36 or even 48-channel desks, 8 x 4ft or even 10 x 4ft are not abnormal. In all cases the bottom glazing line should be about 3ft above floor level.

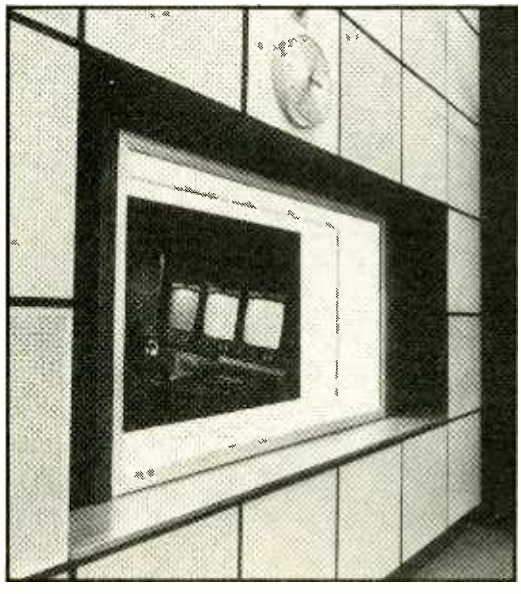
It is necessary to consider the weight of these windows. The weight of 12mm glass is about 10lb/sq ft therefore a 10 x 4ft single unit will be some 400lb (3½cwt). Multiply this by three units and the total weight becomes about half-a-ton. This necessitates very secure fixing of the units, though admittedly, the bottoms of the frames will rest on the supporting walls and take most of the weight. This mass and weight may sound a little extreme but with studio noise levels that can be up to 120dB the 55dB isolation of the window becomes very necessary.

The sound isolation of the windows is considerably increased if the internal wall surfaces between the separate units, technically known as the reveals are lined with a soft and sound absorbent material. Suitable materials are *soft* building board such as *Celotex,* absorbent acoustic tiles (not the plaster type), or ½in thick felt on simple wooden frames. Some lining is necessary to cover the gaps between the cavity walls.

In some cases silica-gel crystals are placed in the areas between the units to prevent condensation, or at least absorb it, but the writer has never yet found this necessary, as there is almost always a slight air movement between the cavity walls and sufficient normally percolates through the absorbent reveal linings to prevent any moisture forming.

Finally, it is sometimes an advantage to slope or slightly incline one of the glass panes. This is not primarily, as is commonly thought, to reduce resonance between the panes by breaking up any standing waves, but more particularly to divert any unwanted reflections from the control room or studio lights away from the eyes of the panel operator, and thus maintain clear and unobstructed vision.

FIG. 6



Structural fittings

The building shell being complete with doors, windows, external wiring and ventilation ducting, we can now discuss the various fittings and terminations to be applied to all internal surfaces as permanent fixtures.

These comprise: acoustic treatment; lighting and power terminations and fittings; technical ducting; technical wiring terminations; ventilation terminations; technical lighting units, ie signal lights, etc; cyclorama fittings; storage units; floor surfaces; and decoration.

Many of these require only brief description but all are important as they affect the final appearance and efficient working of the studio.

Acoustic treatment

This is obviously the most technically important item whose nature is still very much misunderstood, despite the fact that enough has been written on this subject to fill 50 issues of *Studio Sound.* Modern research has resulted in certain indisputable and basic facts briefly covered in this article with details of modern forms of modular acoustic treatment.

It is hoped to shed a little practical light on this very complex subject, and perhaps get rid of a few old-fashioned myths and misunderstandings. This is not really a 'do-it-yourself' subject and the employment of a competent acoustic consultant is a necessity if the result is to be successful.

So why is correct acoustic treatment so important? The quality and reproduction of speech or music is critically dependent on the shape of the reverberation time/frequency characteristic. Reverberation time is normally depicted by the symbol RT_{60}, or simply RT, and is the time taken for an initial sound to decrease by 60dB (or to one-millionth of its original intensity) when suddenly interrupted.

The frequency band to be covered is normally from 60Hz to 8kHz and the results are usually depicted graphically as the RT_{60} 'curve'.

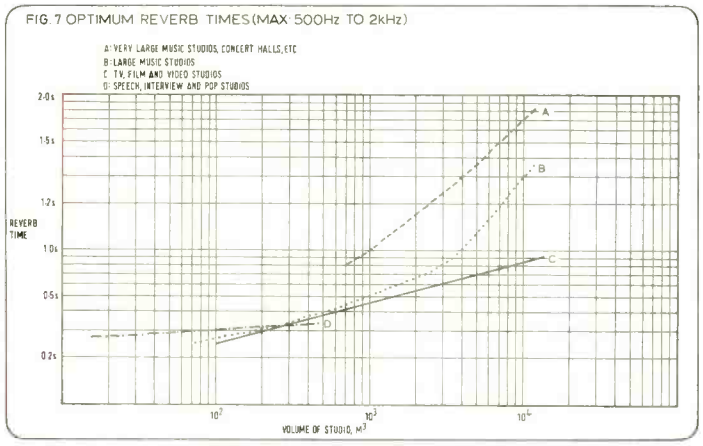
Ideally, the final RT_{60} curve should be flat, with measurements over the whole frequency band being as identical as possible, but in small studios this is rarely achieved and there is inevitably some rise in the low frequency band below 125Hz. Within limits this is permissible, but at 63Hz should not exceed 50% increase over the 250Hz figure, otherwise there will be severe colouration of speech and music clarity which will mask the reproduction of the middle frequency band, and result in the unwanted phenomenon known as bass boom. In studios of more than 300cu m (around 30ft square x 10ft high) there should be no bass rise at all from 250Hz downwards.

Deviations in the reverberation time of more than 10% are noticeable to the trained ear, and current IBA standards state that from 250Hz to 4kHz any deviation should not exceed that figure. Excess in this area can only result in sibilance on speech and a shrill quality to music.

In the case of small studios, because the wavelengths of sounds at the low frequency end of the spectrum will be equal to, or greater than, the dimensions of the studio, strong standing waves and colourations will inevitably occur which, if not dealt with, will severely distort speech quality. This problem is dealt with by reducing the reverb time and introducing selective acoustic absorbers as necessary. The optimum RT_{60} of studios up to 100cu m (18ft square x 9ft high) should not exceed 0.3s, particularly over the frequency band up to 2kHz, but this is quite difficult to achieve and usually results in all available ceiling and wall surfaces being covered by the appropriate absorbers.

Incidentally, it is interesting to note here that the now almost universally agreed RT_{60} figure for control rooms and listening rooms is about 0.4s, and that most well furnished domestic living rooms are normally about 0.5 down to 0.3s, so that there exists an extremely good chain of events right from studio to living room, provided always, of course, that the listener is not using a portable transistor set for listening!

Conversely, large studios have dimensions greater than most of the relevant sound wavelengths and exhibit longer reverb times. Since the users of large studios are normally orchestras and the like, which require a longer RT_{60} for natural reproduction, the correct figure is much easier to obtain. Typical reverb times



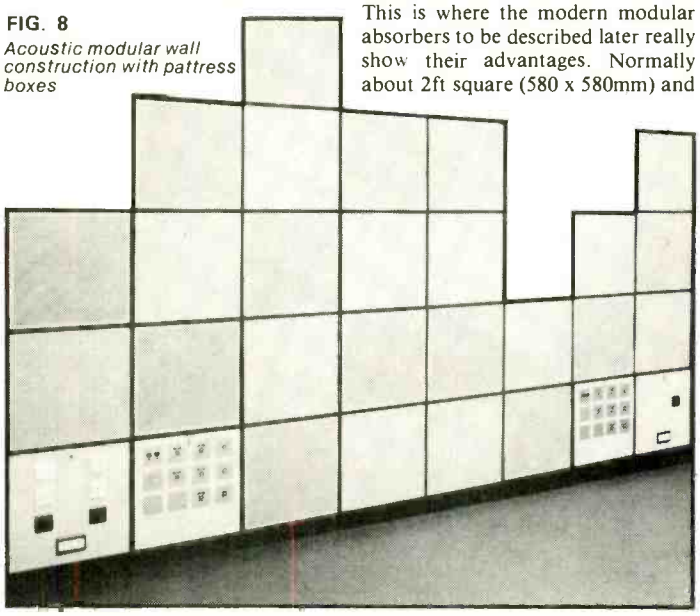
for large studios would be between 0.6 and 0.8s for studios up to 1,000cu m and up to 1.2 to 1.5s for 10,000cu m. Times over 2.0s are likely to exhibit unwanted echoes. **Fig 7** is a graph indicating optimum reverb times for studios of different sizes and uses.

Having said all that, there are, of course, exceptions to every rule, and these occur in the case of pop studios and drama studios. Studios for pop use, require lower than normal reverberation times, certainly not more than 0.3s, and drama studios are usually divided into roughly two halves—the dead end, reproducing open-air scenes, being in the region of 0.15 to 0.2s, and the live end 1.2 to 1.5s, preferably with intermediate sections between.

It is of little use installing the correct types of absorber if they are not accurately dispersed over the wall and ceiling surfaces. This is termed Diffusion, and is just as important as using the correct types of absorber. Perfect diffusion is almost impossible to achieve but every effort should be made towards the best possible distribution. Perfect diffusion only exists when the intensity of the sound is uniform over the whole of the studio area and no microphone position is distinguishable from another. Standing-waves, colourations and, those two bugbears of all acousticians, flutter echo and ringing, will be minimised, or hopefully eliminated, by correct acoustic dispersal.

Optimum diffusion is obtained and unwanted effects reduced to a minimum when the mean coefficient of absorption of any pair of the three parallel surfaces in a studio does not exceed the ratio of 1:1.4, and the nearer to unity this ratio can be made, the better the results will be. This is where the modern modular absorbers to be described later really show their advantages. Normally about 2ft square (580 x 580mm) and basically of four types, each with its own particular absorptive characteristics, not only can the quantities of the various types be pre-determined, but the exact placing of each module can be arranged to provide a high degree of distribution on each wall, and the ceiling, and therefore on adjacent and parallel walls. If sufficient thought is given to the layout of these absorbers quite an attractive pattern can result. **Fig 8** shows a typical example. Most large broadcasting concerns now adopt this method.

FIG. 8
Acoustic modular wall construction with pattress boxes



It used to be thought that differences of wall angles, ie non-parallel walls, and/or deliberately designed wall projections, assisted in the elimination of colouration, flutter echo etc. In small studios, however, experiments carried out have failed to prove that these provide any significant improvement. Indeed, they sometimes cause new and unwanted resonances, and the idea has been largely abandoned. In large studios, however, wall and ceiling projections and coffering have proved effective, and almost necessary.

If any areas of wall surfaces remain untreated, and therefore exhibit reflective tendencies, ensure that there are no corresponding reflective areas on the opposite parallel wall as flutter echoes are bound to result.

Finally, do not be too disappointed if a perfect or even required result is not achieved at the first test. It must be realised that there are many factors involved, some probably unknown at the design stage, all of which tend to interact with each other, sometimes to the detriment of the final result, and, in small studios particularly, final adjustments may have to be carried out. This is where a competent acoustic consultant will really prove his worth.

We are now ready to consider acoustic materials and methods and their application.

All materials have some absorptive element, even brick walls and concrete, but the coefficient is usually so small that in most cases it can be ignored for all practical purposes, when compared with the high absorptive levels required.

Other examples in the chart in **Table 1** show that ⅛in hardboard or ½in wood panelling over 1in thick battens have a coefficient of 0.3 from 63Hz to 250Hz falling to 0.11 at 4kHz. Others rise to 0.7 and 0.8 at the

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higher frequencies but fail miserably at the lower frequencies. No material has an equally high absorptive level over the whole of the frequency band, so it is necessary to select different materials for different frequency bands and apply methods so they exhibit maximum efficiency.

It has long been known that two particular phenomena absorb energy to the highest degree—these are resonance and friction.

Research into acoustics since about 1950 has proved that a suitable vibrating (resonating) membrane over an enclosed air space is most effective for low frequency absorption and further, that the mass of the membrane vibrating with the compliance of the air in the enclosed space will determine the resonant point and also the amount of absorption. Alteration of the amount of air in the enclosed space has a similar effect.

Originally linoleum was used as the membrane, then later roofing felt, and currently a 2mm thick plastic sheet is used. It is also customary to place a porous pad behind, but not touching, the membrane and this has the effect of widening the bandwidth of the resonance. Since roofing felt or even plastic sheet does not present a very suitable appearance either perforated hardboard or a fine wire mesh is usually placed in front of the membrane.

For middle and high frequency absorption the friction method is employed. Very basically what happens is that the soundwave hits a porous pad, loses energy by traversing the thickness of the pad, is reflected back from the hard surface behind the pad, and again loses energy by traversing the porous pad in the reverse direction. The frequency band covered by this method depends on (a) the thickness and density of the porous pad; (b) the depth of the enclosed air-space behind the pad and (c) since, once again, a perforated cover is placed in front of the pad, the degree of perforation of the cover.

In both cases it has been found that absorption is most efficient when constructed in the form of modules. These modules usually take the form of airtight wooden boxes, about 2ft square and from 7 to 10in in depth containing all the materials mentioned. Such modules normally have the air space behind the membrane or porous pad divided into about 25 separate compartments as this greatly increases the efficiency of the modules by preventing transverse air flow in the enclosed air space.

TABLE 1 A SELECTION OF VARIOUS ABSORPTION COEFFICIENTS

	FREQUENCY IN Hz								
MATERIAL OR PRODUCT	62	88	125	250	500	1k	2k	4k	8k
Brick wall	.02	—	.02	.02	.03	.04	.05	.07	.10
Celotex building board (½in unpainted)	.04	—	.06	.10	.15	.21	.26	.26	.29
⅛in hardboard on 1in battens	.30	—	.32	.43	.12	.07	.07	.11	.18
½in wood panelling on 1in battens	.33	—	.31	.33	.14	.10	.10	.12	.15
Average woolcord carpet with underfelt	.02	—	.04	.13	.36	.60	.69	.62	.52
Average haircord carpet with underfelt	.05	—	.13	.17	.24	.29	.30	.30	.37
Wilton carpet with underfelt	.04	—	.08	.22	.51	.64	.69	.71	.70
Curtains: Velour draped	.05	—	.06	.31	.44	.80	.75	.65	.60
Lightweight over 2in air space	.00	—	.04	.10	.20	.50	.60	.50	.40
Heavyweight over 2in air space	.00	—	.06	.16	.30	.55	.65	.65	.65
Full Concert Hall audience with Orchestra	.39	—	.54	.66	.78	.85	.83	.75	.71
Membrane Absorbers: (typical figures) High-density mineral wool backing 12in air space	.81	1.15	.87	.47	.30	.15	.15	.15	.15
Porous Absorbers: 0.5% perforated front 6in air space	.60	.95	.77	.52	.38	.22	.18	.17	.15
25.0% perforated front 6in air space	.40	.80	1.10	1.05	1.00	.98	.95	.80	.60
Wire-mesh front 6in air space	.40	.80	1.10	1.05	1.00	.98	.98	.97	.95
Typical "Acoustic" Tile on 1in air space	.10	—	.14	.52	.52	.61	.61	.65	.65

NOTE The above results are from single samples of materials and absorbers, and on occasion are higher than unity due to diffraction at edges of samples. Where quantities of materials or absorbers are used in large unbroken areas lower absorption values will result.

These modules are commercially produced in large quantities. The cost is about £3 to £4/sq ft and while, admittedly, a few could probably be made in a small workshop, the cost and availability of the materials, plus the time and labour involved and the space required for the manufacture of several hundred modules, does not warrant the effort involved against the precision jig-built commercial products.

It is, of course, possible to build-in these types of treatment, but this is more costly, usually two to three times the cost of *separate* modular treatment. Also if the studio ever decided to move, individual modules could be transferred since they do not normally deteriorate in use.

Any colourations or resonances remaining after full acoustic treatment has been carried out are usually nullified by the use of special Helmholtz absorbers specifically tuned to deal with particular frequencies and bandwidths.

Brief mention should be made of certain other materials used in acoustic treatment. As an instance, the use of excessive amounts of perforated hardboard over porous mats may result in an unwanted rise of reverb time at the top of the hf band, and in this case the use of stretched or pleated fabric in front of the absorbers is employed to counteract this effect. Reference to **Table 1** will show that such fabrics are effective from about 2kHz upwards.

Most small studios, particularly speech and interview studies, usually have carpet-covered floors with an underfelt. The chart again shows that this provides a degree of mid and high frequency absorption and this must be taken into account when estimating the total amount of absorption in these bandwidths.

Finally, in the case of some of the membrane and porous absorbers, the absorption coefficient is shown rising to more than unity. This is theoretically impossible since the maximum coefficient—that of open air—*is* unity. This is not a mistake, but is due to the fact that the figures quoted are those measured for small samples of materials or a few modules, in which case the radiation resistance is less than a wavelength and diffraction effects round the edges of the samples tested give rise to this effect. In practice, larger areas of acoustic materials, or quantities of modules, exhibit lower absorption coefficients and should be taken into account.

Lighting and power

The description of the lighting system required for a TV, film or video studio of anything more than about 1,500sq ft floor area is outside the scope of this article and the services of a competent firm of film or television contractors should be employed. Such a system is highly complex and is likely to cost anything from £15,000 upwards, requiring as it does the inclusion of motorised tracking, winches, dimmers and racks, and a comprehensive lighting console.

For the smaller studio however, much can be achieved by a simpler system utilising a fixed grid of single or double construction composed of tubing akin to scaffold-pole dimensions.

A basic or primary grid would comprise a line of tubes around the perimeter of the studio about 1ft away from each wall, with intermediate tubes at about 4ft intervals

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Your monitoring system is what speaks for you and your entire studio. That's why you should consider Fostex monitor components.

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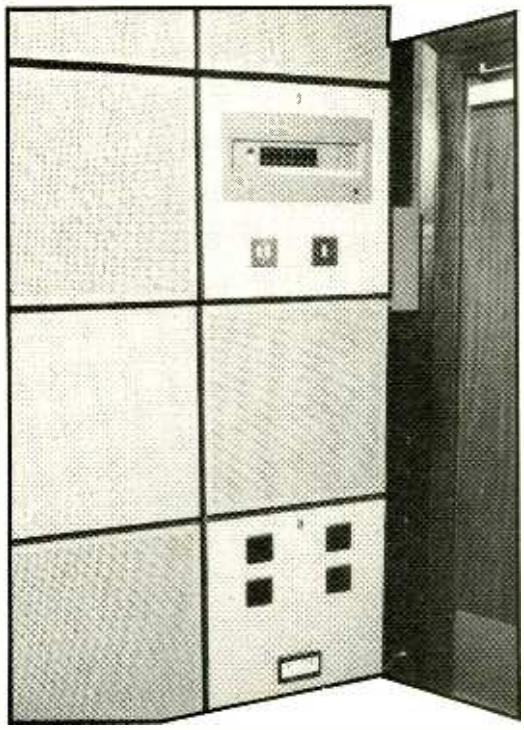
FIG. 9



crossing the studio in both directions thus forming a complete cross grid suspended about 2ft down from the ceiling over the whole area. The lighting units would be suspended from this grid by means of simple metal hangers hooked over the tubing in the positions required. This makes for a simple but flexible arrangement and, of course, the lights would have to be manually adjusted for each set, but this form of grid is relatively cheap to install.

An improvement on this basic system would be a secondary grid suspended about 1ft down from the primary, with the tubing in the primary running in, say, the east/west direction and the secondary north/south.

This has the advantage that the lighting hangers can be slid along the tubes of the lower grid over the whole width or length of the studio, according to the direction of the lower tubes, to provide more precise location of the lighting fittings.

Single or double grids require very secure fixing to the studio ceiling as the combined weight of grid and lighting fittings can be considerable—easily up to one ton in an average studio. Sometimes H-section girders are built into the studio walls crossing the width of the studio, and suspending the grid from these girders avoids weight on the ceiling.

The height of the lighting units above the floor level can be adjusted by the use of hangers of different lengths or by the use of commercially available pantographs.

A variety of lighting units will be required, ie spots, floods and soft lights, and the numbers required will obviously depend on the type and complexity of the productions envisaged, but sufficient should be available to produce a lighting intensity of not less than 1,000Lux at a colour temperature of 2,550°Kelvin.

In the section headed Structural Items it was suggested that the mains supply for this lighting should enter the studio at high level just below the ceiling. This is because the last thing we want in a studio is masses of lighting cable draping over the working area and this can be completely avoided by the installation of a standard 4in square metal trunking installed on the studio walls about 3ft below the ceiling, preferably on all four walls. This would contain all the lighting wiring and the circuits should be terminated on single or double standard 13 amp switched outlet sockets inset into the front cover of the trunking at roughly 2ft intervals, particularly over the production area.

Between 20 and 30 outlets will probably be required, each one controlling one lighting unit, and the whole can be controlled either on an all-on/all-off basis by one or more mains isolators situated in the control room, or individually by a simple switching console also situated in the control room. Lighting switching is very rarely carried out in the actual studio as the programme producer will wish to have the variation or alteration of the lighting under his immediate control.

General lighting for sound studios presents no problem and is catered for by a standard electrical installation with ceiling fittings and wall switching. Once again, the wall switching is usually installed in the control room, often by the use of miniature circuit breakers (MCBs) contained in a special unit. **Fig 9** shows an example of this type of unit contained in a special pattress box.

Lighting can be of the normal tungsten type, with fittings suspended from the ceiling, or recessed into boxes to match the ceiling acoustic modules, or by the use of standard fluorescent fittings with diffusers.

There is, however, one proviso to be observed if fluorescent fittings are used. The majority hum or buzz albeit to a small degree, accentuated by the metal body of the fitting acting as a resonator. In a studio with a noise rating of NR20 and a number of such fittings, the resultant noise is unacceptable. It is standard practice, therefore, to mount all chokes, ballasts and starters outside the studio, leaving only the actual tube in its fitting in the studio.

A third successful lighting system is by the use of tungsten/halogen units, and the availability and use of them could well be investigated.

Whichever system is used, a fairly high and even intensity, without glare, will be required. In orchestral studios where music scores have to be read, a good standard of intensity has been stated as "15ft/lamberts on a script or score when inclined at an angle of 60° from the horizontal". Pedantic maybe, but very precise.

Drama studios follow normal procedure as above, but "pop" studios usually require a special treatment of their own. Good general lighting will be required for other uses, but for reasons unknown to the writer, most pop groups seem to prefer to work in a cave-like atmosphere, with only coloured spotlights for illumination. Most groups work without a music score so the intensity does not have to be particularly high, and is usually achieved by the installation of a number of spotlight tracks suitably positioned, with adjustable spotlight units and coloured lamps, some of which will often be angled to reflect off the studio wall surfaces.

Domestic lighting only requires a very simple standard installation, consisting very probably of two or three standard tungsten fittings with 100W lamps, sufficient only for general cleaning and tidying of the studio or certain maintenance work, thus saving the cost of the main lighting and the generation of unwanted heat.

There will be a necessity in any studio for mains power supplies for loudspeakers, television monitors, electrical musical instruments, mic power units, etc. and quite often the outlet sockets for these are installed around the studio in a rather haphazard manner. When these are added to the domestic outlets and technical outlets a most untidy appearance results.

The use of pattress boxes provides a very neat and efficient method of tidying up the whole system and is strongly recommended. The term pattress box is really only a technical term for a stout wooden box with a door. If modular absorbers are employed, the box should be of identical external dimensions, and examples are illustrated in **Figs 8** and **9**. They could also form part of built-in acoustic treatment where this is employed. Basically they are of very simple construction and comprise a strong wooden box with back and sides of at least ¾in timber with a door of similar thickness hinged with a piano-hinge for reliability and fitted with a lock or carriage bolt for security. They should be very securely fixed to the wall.

The power wiring is brought down the wall, usually in conduits, from the ceiling level, taken into the pattress box and terminated on the back of the box by suitable terminal blocks with covers. Flexible connections are then taken from the terminal blocks to the mains outlet sockets which are inset into the door. Sufficient lengths of flexible cable should be allowed so that the door can be opened for maintenance.

Three or four such boxes, each accommodating up to six individual 13 amp mains outlet sockets, sited around the studio, should satisfy most requirements. The same boxes will also accommodate the separate domestic power outlet sockets, which should be of a different type or colour to distinguish domestic from technical. The mains isolator controlling all these outlets will normally be situated in the control room.

Camera power sockets are usually of a special and heavier type than the standard 13 amp socket, and it is doubtful whether the wooden pattress box would be strong enough to withstand the constant plugging and unplugging of the camera cables. In this case the pattress box is constructed of 16 gauge steel with a cover which screws on instead of a door. The camera power sockets are inset into the cover as before.

To be continued

The cold, hard facts.

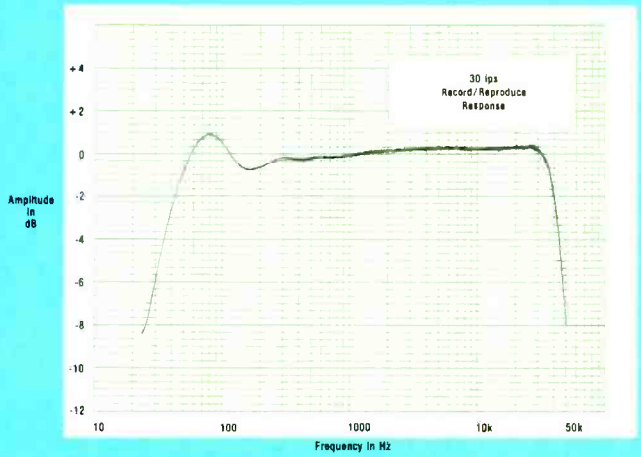
Specifications speak for themselves

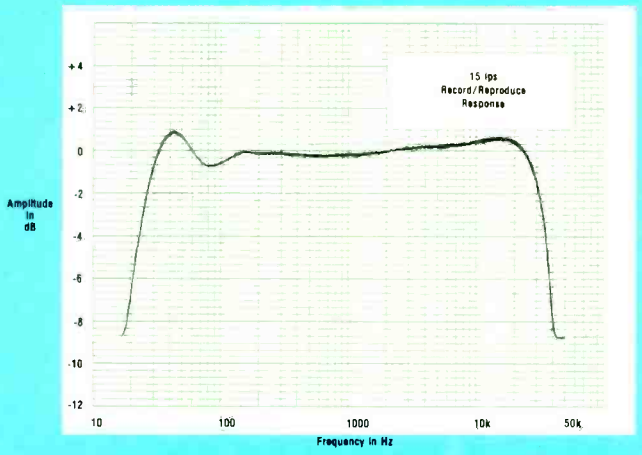
MCI invites you to compare specifications for the JH-110B against those of any other tape recorder on the market today. No pretty pictures, no bright copy, just facts. The JH 110B...unsurpassed in a field of professionals. And that is a cold, hard fact.

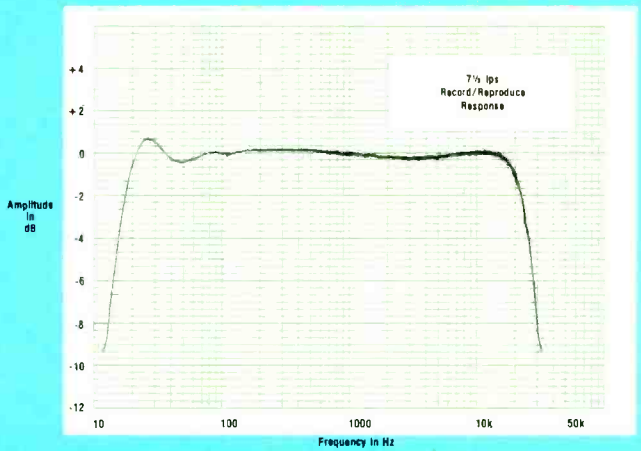
Unless otherwise specified, the following conditions apply to all graphs:

Speed: 30 Ips
Overbias: 1.0dB @ 10kHz
Fluxivity: 0dBm = 250nWb/m
Speed: 15 ips
Overbias: 3.0dB @ 10kHz
Fluxivity: 0dBm = 250nWb/m
Speed: 7½ ips
Overbias: 3.0dB @ 10kHz
Fluxivity: -10dBm = 80nWb/m

All tests were performed utilizing Scotch Type 226 Tape.

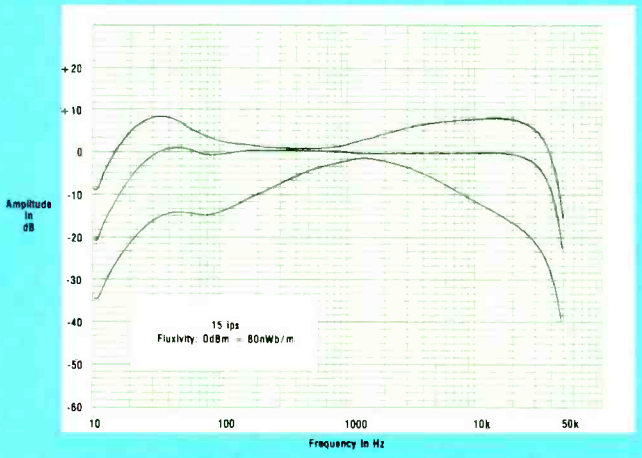






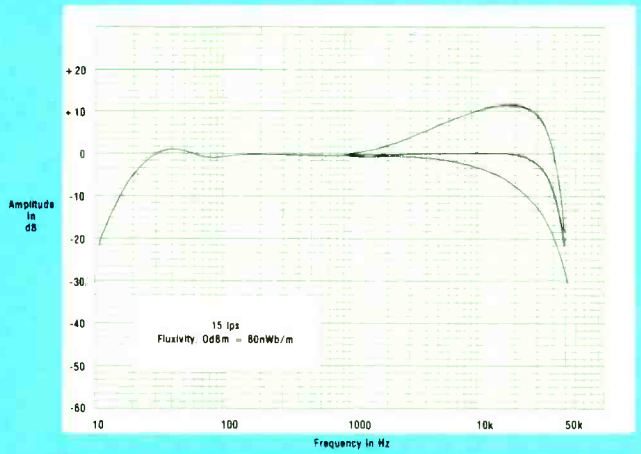
RECORD/REPRODUCE RESPONSE

These graphs represent the frequency response of the recorder on and off tape, assuming a constant input level. They demonstrate the flat and extended response of the JH-110B Recorder.



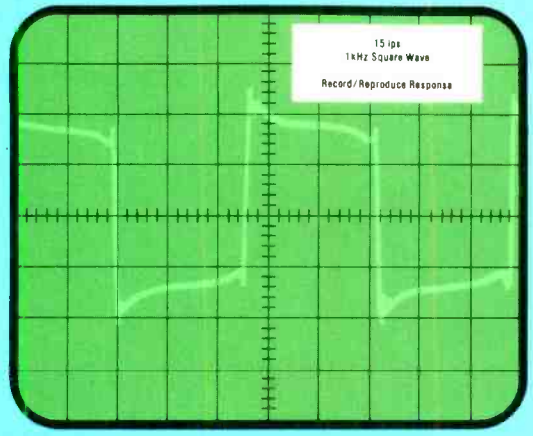
REPRODUCE EQ RANGE

A wide range of reproduce equalization adjustment ensures that the JH-110B will conform to NAB, IEC and AES standard response curves. There is sufficient range to compensate for head wear and to align to reference tones on aged or degraded tape copies.



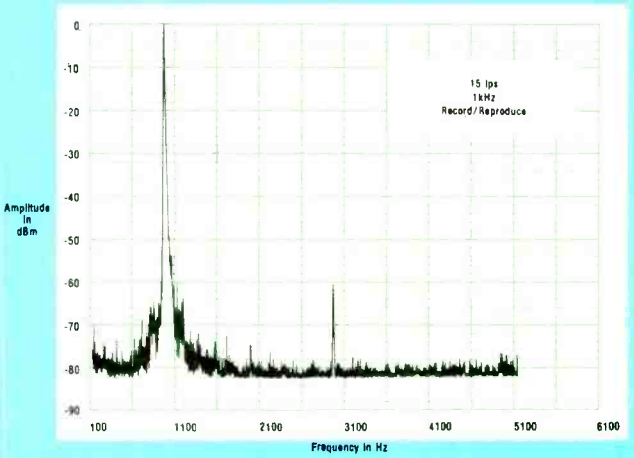
RECORD EQUALIZER RANGE

The record circuitry of a recorder is aligned to complement the reproduce response previously aligned to match standard curves. The JH-110B features a wide range of adjustment to allow alignment using any of the range of tapes available today.



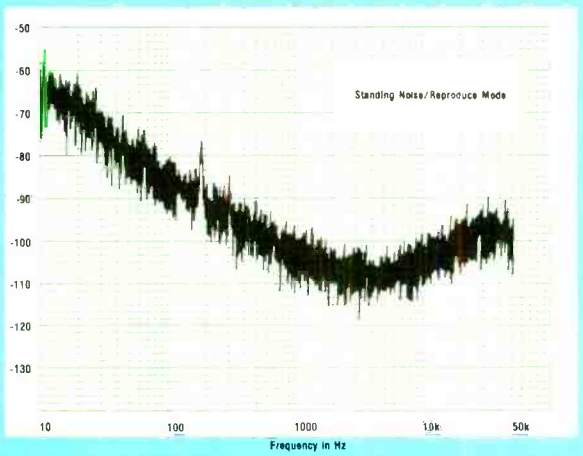
SQUARE WAVE RESPONSE

Square Wave Response demonstrates both transient response and phase linearity throughout the recording process. Response such as with the JH-110B produces excellent reproduction of live, dynamic material and reduces copy to copy degradation.



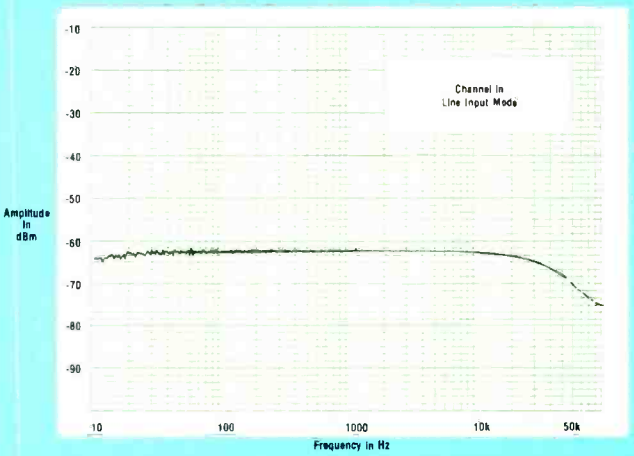
DISTORTION/PURITY OF SIGNAL

Both flutter, or variations in tape speed caused by transport eccentricities, and distortion degrade the purity of recorded signals. Using latest technology op amp design, the JH-110B minimizes second order distortion, while maintaining a wide dynamic range and very low noise floor. This, in combination with the closed loop servo capstan drive system and standard scrape flutter filter provides purity of signal unsurpassed by any other professional recorder. Odd order harmonic distortion and modulation noise are functions of the tape used.



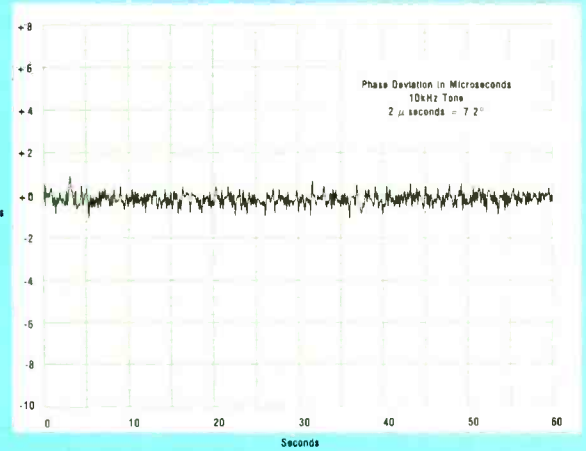
STANDING NOISE/REPRO MODE

This is an amplitude versus frequency plot of the various noise components generated internally by the electronic circuitry. Use of latest technology and high specification components ensures low noise figures on the JH-110B.



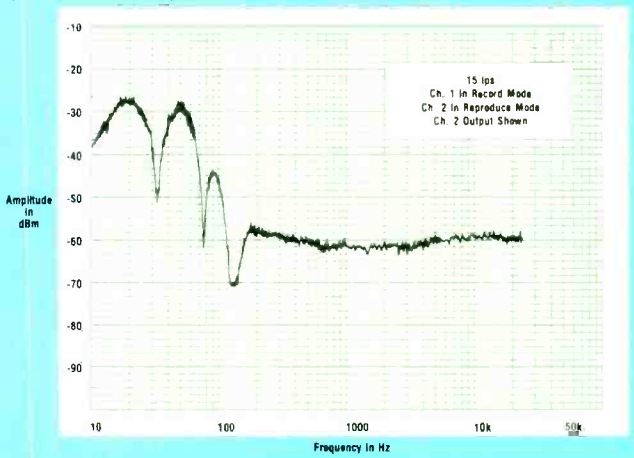
COMMON MODE REJECTION RATIO

Common Mode Rejection is the ability of the electronics circuitry to reject any signal applied equally to both sides of its balanced input, signals such as RF, hum, etc. The JH-110B design ensures a high Common Mode Rejection Ratio, making it ideal for use in any operational atmosphere.



TAPE WALK

Phasing between tracks is very important and is a function of the machine's tape path stability. The JH-110B transport and head assembly design yield a most stable tape path for maximum phase integrity.



REPRODUCE CROSSTALK

Crosstalk is the leakage from one track or channel to another, and is primarily a function of the heads. The JH-110B exhibits excellent crosstalk figures across the frequency spectrum, including minimizing of the low frequency nodes encountered in typical head design.

JH-110B Specifications

Frequency Response

	Record/Reproduce	
30 ips, AES	40 Hz - 28 kHz	+.75/ - 2 dB
15 ips, NAB	30 Hz - 24 kHz	+.75/ - 2 dB
7.5 ips, NAB	30 Hz - 20 kHz	+.75/ -1.5 dB

	Record/Sync	
30 ips, AES	50 Hz - 16 kHz	+.75/ - 2 dB
15 ips, NAB	30 Hz - 10 kHz	+.75/ - 2 dB
7.5 ips, NAB	30 Hz - 4 kHz	+.75/ - 2 dB

Signal-to-Noise

Record/Reproduce, reference to 510 nWb/m

	Unweighted, 20 Hz - 20 kHz		
	mono	2TK	4TK
30 ips, AES	70	66	66
15 ips, NAB	68	64	64
7.5 ips, NAB	67	63	63

	Weighted, dB(A)		
30 ips, AES	74	71	70
15 ips, NAB	70	68	68
7.5 ips, NAB	70	67	67

Distortion

Harmonic distortion,
510 nWb/m, 1 kHz fundamental

3rd harmonic:	30 ips, AES	<.35%
	15 ips, NAB	<.52%
	7.5 ips, NAB	<1.6%
2nd harmonic:	30 ips, AES	<.10%
	15 ips, NAB	<.10%
	7.5 ips, NAB	<.10%
3% 3rd harmonic: fluxivity level	30 ips, AES	1040 nWb/m
	15 ips, NAB	1020 nWb/m
	7.5 ips, NAB	1000 nWb/m

Distortion is primarily a function of tape formulation and bias setting used. All specifications are typical and may vary.

Bias and Erase Frequency

120 kHz

Depth of Erasure

(Ref. 250 nWb/m)
At 1 kHz better than 80 dB

Amplifier Electronics

Input impedance	10k ohms balanced
Output impedance	120 ohms balanced
Output clipping	+24 dBm

Transport

Speeds

Fixed	7.5, 15 and 30 ips
Variable	±20% around fixed speeds

Configurations

¼ inch	Full track
¼ inch	2 track
½ inch	2 track
½ inch	4 track

Reel sizes

Available with NAB A (3,5 or 7 inch), NAB B (10½ or 14 inch), DIN 1000m (11½ inch)

Tension

5½ oz. ± ¼ at all play speeds, beginning to end of reel

Long term speed stability

Better than .02%

Wow Flutter

30 ips	<.022%	DIN 45507 weighted
15 ips	<.035%	DIN 45507 weighted
7.5 ips	<.055%	DIN 45507 weighted

Rewind time

2400 ft.	110 seconds
4800 ft.	170 seconds

Start time

to o.1% DIN 45507 flutter, 10½" reels

30 ips	900 msec
15 ips	500 msec
7.5 ips	500 msec

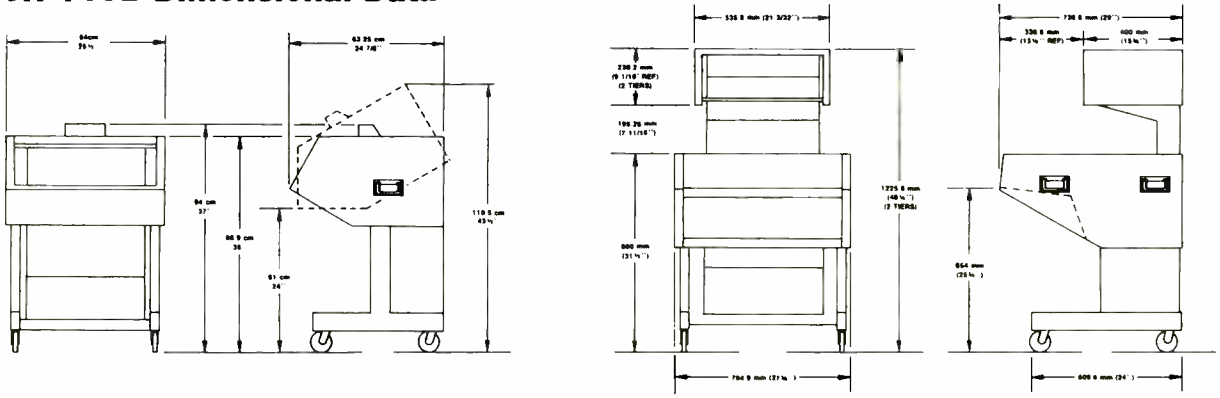
System Weight

Transport unmounted	34 lbs.
Electronic drawer, dual channel	19 lbs.
Variable profile cabinet (VP)	73 lbs.
High profile cabinet (HP)	115 lbs.
Power supply	23 lbs.

FLEXIBILITY TO MEET YOUR NEEDS.

The JH-110B is available stock in mono, stereo, 4-track and 8-track formats for use with ¼", ½" and 1" tape on reels from 5" up to 10½" in diameter (14" diameter optional). Ready for mounting in the MCI variable profile (VP) cabinet with electronics under the transport or in the MCI high profile (HP) cabinet with electronics over the transport, it can also be mounted in your 19" rack or custom console.

JH-110B Dimensional Data



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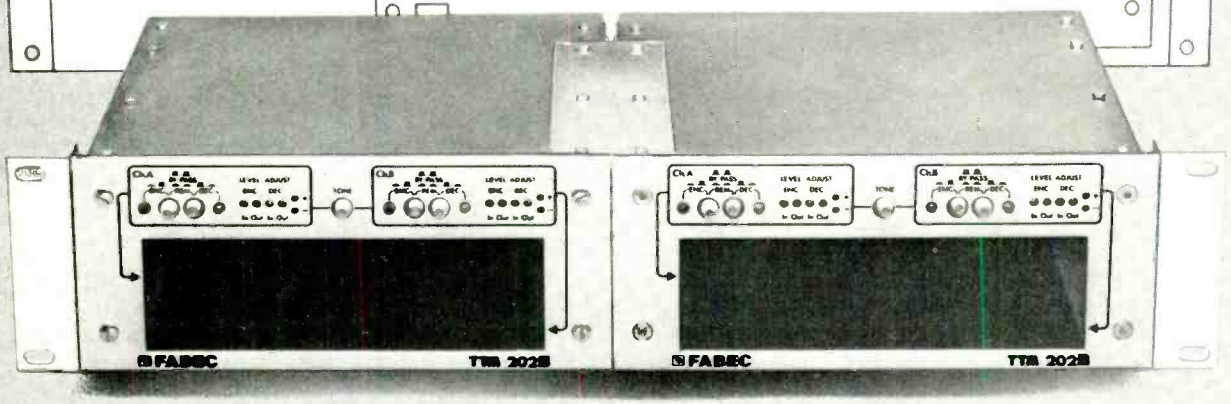
Announcing a size reduction in noise reduction.

TTM 202B.



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

In twice the space necessary!

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

Until the introduction of the TTM 202B.

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

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

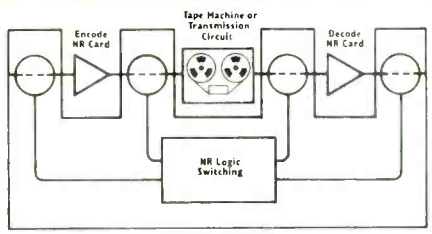
And regardless of your present system, it also lacks our unit's flexibility: TTM 202B—and *only* TTM 202B—takes all types of N.R. cards. Now you can switch or upgrade your noise reduction system anytime you wish—perhaps to Telefunken's fabulous telcom® system.

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

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

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

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

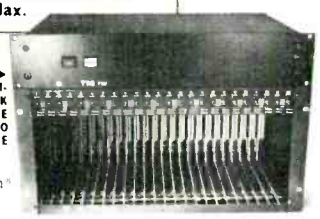


NOISE REDUCTION FRAME

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

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

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



TTM▶ MULTI-TRACK FRAME ALSO AVAILABLE

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AES 69th Convention, Los Angeles- a preview

The 69th Convention of the Audio Engineering Society is to be held from Tuesday, May 12 to Friday, May 15 at the Los Angeles Hilton. Over 170 exhibitors will be displaying their product ranges and a full convention programme of technical papers will be presented.

A

● **AB Systems Design:** *Model 1200A* power amplifier, *Model 2400* electronic frequency divider, *Model 912* preamp/mixer, and *Model 730* tri-amp system. ● **Accurate Sound:** *AS-2400* master/slave tape duplicating system, plus *Starbird* mic boom and *SAK 1* magnetic heads. ● **Acoustic Design by Jeff Cooper:** display of professional recording studio, control room, and film studio designs including details of recent design projects. ● **Acoustilog:** *Model 232A* reverberation timer and the new *Impulser* impulse excitation option which allows checking of loudspeaker polarity, phase and alignment in multi-speaker systems. Also the company's time delay spectrometry equipment used in conjunction with its acoustic consultation service. ● **Advanced Technology Design:** no information received. ● **Agfa-Gevaert:** range of tapes including *PEM-568, PEM-468* and *PEM-368* mastering tapes; *PEM526* bin tape; *PE-611, PE-811* and *PE-1211* bulk cassette tapes; and *PE-36* duplicating tape. ● **AKG:** wide range of mics and reverb units including the recently introduced *D-300* series of vocalists mics, the *BX22* reverb unit; and the *TDU 7000* modular time delay unit. ● **Allen and Heath Brenell:** *Syncon Series B* modular in-line console expandable up to 44/24; *16:4:2* console, first in a new range of budget mixers. ● **Alpha Audio:** *Sonex* acoustical foam ● **Altec:** wide range of loudspeaker drive units, PA equipment, and the *1612A* limiter amplifier. ● **Amber:** *Model 3500* miniature distortion analyser with built-in oscillator, automatic operation, battery powering, and performance to 0.002% residual. Also the *Model 4400A* multipurpose audio test set. ● **Amek:** range of consoles from Amek and TAC including an Amek *M2000A/2500* multitrack console, and the expandable *TAC 1682* console. ● **Ampex:** *ATR-116* and *ATR-124* 16-track and 24-track recorders. Also *ATR-100* and *ATR-700* tape recorders; the ECCO *MQS-100* synchroniser; and the *ADD-1* disc mastering system. Additionally, Ampex tapes and cassettes. ● **AMS:** new *DMX15R* digital reverb system for use with the *DMX15-80* programmable DDL. Also *DM-DDS* digital disc mastering delay line and the *DM2-20* phaser/flanger. ● **Anvil Cases:** range of equipment cases including the *Amp Rack* series. ● **Aphex Systems:** *Model 712 Aural Exciter* designed to replace the *Model 602; Model 602B* broadcast version; *Model 1537A* VCA; *OAS-24* grouping and automation system; *CX-1* compressor/expander; and *EQF-2* parametric equaliser. ● **Ashly:** *SC-44* keyboard input processor; 2-, 3- and 4-way electronic crossovers; *SC-66A* 4-band parametric equaliser and the *SC-63* (mono) 3-band parametric; plus updated versions of the *SC-50* (mono) and *SC-55* (stereo) peak limiter/compressors. ● **Association of Sound & Communications Engineers:** details of the Associations activities plus those of its members and exhibition attendees. ● **Audico:** Electro Sound *ES-8000* high speed tape duplication system and *ES-5000* system. New products include the *QCV* quality control reproducer; *Model 4300* quality control and assurance system; and *ES-1848* automatic cassette loader. ● **Audicon:** *The Plate* reverb systems; *Alpha One* and *Alpha Two* monitors; multipair audio cable; and studio accessory items. Additionally, Barth signal processing equipment; EELA Audio mixers; Raindirk mixing consoles; Woelke test equipment and tape heads; and the Court Acoustics *GE60* 30-band graphic equaliser. ● **Audio Concepts:** no information received. ● **Audio & Design (Recording):** new *Panscan* pan effects unit, and new *Trans-dynamic* tri-band processor primarily for broadcast use. Also comprehensive range of signal processing equipment including *Scamp* units; the *Ex-press* limiter; and the *Gemini Easyrider* rack-mount comp/limiter. ● **Audio Developments:** *AD055* compressor/limiter; *AD070* prographic equaliser; *AD007* portable mixer; *AD045 Pico, AD049 Mixette,* and *AD031 Micro* mixer; plus a small mixer for ENG use and a new PPM. ● **Audio Engineering Associates:** the company's active matrix box; *Ecoplate* reverb units; and the Schoeps range of mics and accessories. ● **Audio Kinetics:** *QLOCK 310* and *QLOCK 210* synchronisers, plus the *XT-24 Intelocator,* and details of the company's acoustic absorption panels and screens. ● **Audiotek:** *Model 2000* tape duplicating system which features duplicating ratios of up to 64:1, automatic bin loading and unloading, automatic cue tone injection and closed-loop capstan drive. ● **Audiotronics:** *Model 532* automated modular console with up to 32 input channels and eight master effects modules. Also the *Model 110A.* expandable, modular recording/remixing/on-air console designed to accommodate up to 16-track mixing.

B

● **BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes. ● **Beyer:** range of dynamic and condenser mics plus headphones. ● **BGW:** range of amplifiers including the recently introduced *320, 620,* and *1250* power amps. ● **B & K Instruments:** comprehensive range of audio measurement instruments. ● **Bose:** *Model 802* loudspeaker plus the *802-E* active equaliser and other units. ● **btx:** *Model 4600* SMPTE tape controller—an audio controller and editing system for two, three or four audio or video recorders—plus the *5000 Series* of SMPTE time code generator/display units. Introduction of the btx *Shadow System,* a computer interfacable audio/video synchronising system.

C

● **California Switch & Signal:** wide range of switches, wire, cable, connectors, etc. ● **Canford Audio:** wide selection of studio furnishing equipment and ancillary equipment. Also Soundex PPMs and the NEAL Ferrograph range of cassette and open reel tape machines, including the new *SP7S* and *SP744* tape machines. ● **Cara International:** no information received. ● **Cerwin-Vega:** range of monitor loudspeakers and amplifiers. ● **Cetec Gauss:** tape duplication system for a master and up to 20 slaves, plus Gauss loudspeaker drive units. ● **Cetec-Vega:** *Model 80* and *81* hand-held radio mics, plus the company's established range of communication equipment. ● **Clear-Com:** intercom systems including the new *System II* remote stations and

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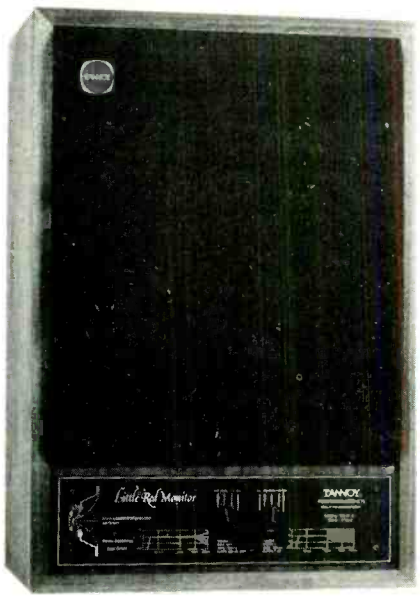
Like Father...

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.

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the *KB-124* duplex remote station. ● **Coherent Communications:** range of mini-production mixers, plus Artech radio mics and Jensen transformers. ● **Community Light & Sound:** range of high-level sound reinforcement equipment including the *PBL-90* cabinet. Also the *Z10D* range of radial horns. ● **Con Brio:** *ADS 200* digital music synthesiser. ● **Cross:** *CT-1800* automatic cassette labelling machine. ● **Crown International:** range of amplifiers including the *PSA-2* and the *SA-2* self-analysing power amplifier. Also *PZM* range of pressure zone mics, plus the *Badap 1* programmable audio measurement system.

D

● **David Lint Associates:** ITI *P*-12-colour label printer and *L-1* cassette labeller; *QC-8/Q* quality control playback unit, and laminated sendust recording heads suitable for use with metal tapes. ● **Dallas Music Industries:** no information received. ● **Datatronics:** no information received. ● **dbx:** expanded range of *900 Series* modular signal processing units, plus variety of noise reduction units and comp/limiters including the *Model 164,* a stereo version of the *Model 163.* ● **DeltaLab:** *Memory Module* delay extender; *DL-1* digital delay module; *DL-2 Acousticomputer; DL-3* digital delay line; and *DL-4 Time Line,* a multi-function special effects delay line. ● **Diacoustic Laboratory:** *Disc Decor* record storage unit. ● **Dolby Laboratories:** range of professional Dolby-A noise reduction units, including new modules for videotape recorders, and the *CP-200* for the reproduction of encoded stereo films. Also details of the Dolby FM system, the Dolby-C system and the *HX* cassette headroom extension system.

E

● **Eastern Acoustic Works:** *MS-50, MS-200,* and *MS-300* monitor loudspeakers. ● **Electro Sound:** tape and cassette duplicating equipment. ● **Electro-Voice:** *Sentry 100* studio monitor loudspeaker, and new *Panjo* mini-mixers from sister company Tapco. Also full range of professional mics and loudspeakers, plus mixers and amplifiers from Tapco. ● **Emilar:** range of loudspeaker drive units and dividing networks. ● **E-Mu Systems:** no information received. ● **Eumig:** no information received. ● **Eventide:** *Model H949 Harmonizer;* range of plug-in realtime spectrum analysers for use with home computers; the *BD955* broadcast delay line; and the *RD770 Montsermat* mono/stereo broadcast matrix unit. Additionally, the *Instant Flanger* and *Omnipressor*; the *BPC-101* plug-in card which converts the *Instant Flanger* to an *Instant Phaser*; and the *JJ193* and *CD254* DDLs. ● **Everything Audio:** details of studios the consultancy has designed and constructed.

F

● **Fairlight:** *CMI* computer controlled synthesiser. ● **Furman Sound:** *RV-1* spring reverb system, plus the *TX-2* tunable crossover/bandpass filter; *PQ-3* parametric equaliser/preamplifier; and *PQ-6* stereo parametric eq/preamp.

G

● **Gotham Audio:** Telefunken *M15A* 32-track recorder; TTM 24-channel noise reduction frame and power supply unit; EMT reverb units, console components and test equipment; Neumann condenser mics; and other units from these manufacturers. ● **Gollehon Industries:** no information received. ● **Grandy:** *Promix 1* adjustable multitrack head assembly with independent control of azimuth, zenith, tape height and wrap. Also replacement tape heads and a range of single crystal ferrite record heads for high speed duplicating.

H

● **Harrison:** recently introduced *MR-2* automated console, plus bargraph VDU monitor and the *Autoset* automation system. ● **Heino Ilsemann:** *Type KZM3* automatic cassette loader and the *Type ETK-1* and *ETK-1S* cassette labelling machines. ● **Hewlett-Packard:** range of audio test instruments. ● **HM Electronics:** wide range of radio mics and receivers including roadcases and accessories.

I

● **Infonics:** *200 Series* of tape duplicators including a high speed metal tape cassette duplicator. ● **Inovonics:** range of audio processing, recording and instrumentation equipment including the *Model 500* audio analyser; *Model 201* average/peak limiter; *Model 231* octave-band compressor; and the *Map-II* broadcast audio processor. Also the 'Gordon Headroom Meter' a UK/EBU-responding level meter. ● **Institute of Audio Research:** president Al Grundy and executive director Phil Stein will be available to give details of the Institute's training programmes. ● **Interface Electronics:** range of mixers designed for recording, sound systems, theatres, stage monitoring and other applications. Available configurations range from 8/2 to 48/16 and features include wide range parametric equalisers. ● **International Audio:** Alpha high speed in-cassette copiers. ● **International Consoles:** new audio control console system. ● **Ivie Electronics:** new *Gold Standard* range of calibration mic capsules, preamps and power supplies. Also the *IE-17A* microprocessor controlled acoustics analyser and *IE-30A* spectrum analyser.

J

● **JBL:** new loudspeaker drive units for PA and studio monitoring applications. Also the company's complete range of monitor loudspeakers and the *7510* automatic mic mixer. ● **Jordan Watts:** range of loudspeaker drive units and monitors. ● **JVC:** PCM recording system and electronic editor.

K

● **K-Disc:** no information received. ● **Keith Marks:** new studio turntable unit, additional mic stands, plus a wide range of ancillary studio equipment. Also EDC radio mics. ● **The Kind Horn:** range of PA loudspeaker horns. ● **King Instruments:** self-feed cassette loaders and various video tape loaders. ● **Klark-Teknik:** new *DN72* memory bank to accompany the *DN70* digital time processor and new dual 30-band graphic equaliser. Also the company's established range of graphic equalisers and effects units, plus the *DN80* 16-bit realtime audio computer. ● **Klipsch:** range of monitor loudspeakers.

L

● **Lexicon:** *Model 1200* audio time compressor; *PCM41* DDL; and *122 series* of stereo delays. Also the *Model 224* digital reverb system; *Model 92* and *Model 91* digital delay units; and the *Model 93 Prime Time* digital delay/processor/mixer.

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. ● **Magnefax:** range of high speed common mandrel ¼in tape duplicators, automatic tape degaussers, and master tape loop bin/seven slave cassette tape duplicator. ● **Magnetic Tapes:** *Chilton* portable mixing desks and the *QM2* range of consoles. ● **Marshall:** *Model 5402* time modulator; *Mini-Modulator* digitally programmed analogue delay unit; *5002A* time modulator; *5050* stereo effects expander; *HP400* expander; *P250* pre-reverb delay unit; and *P500* half-time variable delay unit. ● **Matsushista:** *Technics* range including *SP-02* direct drive motor and drive electronics for a disc cutting turntable, plug-in compatible with Neumann lathes. Also turntable console for recording and broadcast use; professional PCM recording system; digital audio disc system; and *SP-15* and *SP-25* studio turntables. ● **Matthews Studio Equipment:** range of mic stands, booms and accessories. ● **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. ● **Meyer Sound Lab:** range of studio monitor loudspeakers including the Swiss-produced *ACD/Meyer* reference monitor system. Also the new *UM-1 UltraMonitor.* ● **MicMix:** *XL-305* reverb unit and the *265 Dynaflanger.* Also the *XL-500* and *XL-210* reverb units. ● **Mitsubishi:** *X-80* and *X80A* 2-channel PCM recorders; *XE-1* electronic editor; and *X-800* 32-channel PCM recorder. ● **MWM:** *Track Tech* range of mixing consoles including a new 24 input channel in-line console. ● **The Mike Shop:** range of ancillary equipment including items from Accessit and the Great British Spring. ● **MXR:** wide range of ancillary equipment including the recently introduced dual limiter. Units include 31-band and dual 15-band graphic equalisers; flanger/doubler; digital delay; pitch transposer; and linear preamp.

N

● **Nady Systems:** range of 'Nady Cordless' and 'Nasty Cordless' radio transmission systems. Also the recently introduced Nady *VHF600* and *VHF700* transmitter/receiver systems. ● **Nagra:** range of portable tape recorders in a number of configurations. ● **Neotek:** *Series I, II, III, IV* and *Theatre System* range of consoles. ● **Neutrik:** comprehensive range of *XLR*-type connectors including rear-mounting direct to pcb types; *K-Check* cable tester; and new additions to the company's audio instrumentation range comprising the *3204* constant sound pressure source with integrated compressor amplifier and the *3282* artificial ear. ● **Neve:** *Model 8108* microprocessor controlled multitrack console, plus the *Necam* automation system and *Necam II* system for audio sweetening applications. ● **New England Digital:** no information received.

O

● **Orange County:** *VS-1 Stressor* and the *PEQ* parametric equaliser. Also the *Stereo Processor,* a self-contained signal processing system

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including peak limiter/compressor/expander/noise gate. ● **Orban:** *Model 672A* quasi-parametric equaliser; *526A* single-channel de-esser; and an improved version of the *111B* dual spring reverb unit. Also the *245E* stereo synthesiser; *418A* stereo comp/limiter; and *622B* parametric equaliser. ● **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

● **Panasonic:** no information received. ● **Peavey:** new PA consoles; *EQ-27* graphic equaliser; *SP-2* loudspeaker system; *CS-800* power amplifier; and full range of loudspeakers, amplifiers and ancillary equipment. ● **Penny & Giles:** comprehensive range of faders including a digital fader and newly introduced *3000* series of 65mm faders. ● **Pentagon:** range of cassette copiers including the *Pro-Series* and *1100 Series*. Also cassette-to-cassette copiers including the new *C-10*. ● **Phase Linear:** range of power amplifiers. ● **Pioneer:** 16-bit audio laser disc system, compact PCM disc system, and ribbon sendust tape heads. ● **Professional Audio Systems:** details of the company's monitor loudspeakers. ● **Publison:** range of audio processing equipment.

Q

● **QSC Audio Products:** no information received. ● **Quad-Eight:** *MS-4024CX Coronado* 40/40 console which includes the *Compumix III* automation system. Also the *CL-22* comp/limiter and the *EQ333* equaliser. ● **Quantum Audio:** mid priced *Gamma A* modular 8-buss automated console, with separate stereo mixdown busses and 4-buss special effects. Also the *QM-128* console.

R

● **Raindirk:** recently introduced *Britannia* range of in-line consoles, plus the *Status 500* MOSFET power amp and *Status 20* modular stereo control unit. ● **Rauland-Borg:** range of sound reinforcement equipment including several loudspeaker systems, together with the *Model 3535* 8-input mic mixer, and range of *Spectrum Master* equalisers. ● **Renkus-Heinz:** range of loudspeaker drivers, horns and passive crossover networks. ● **Roland:** *RSS Series* of signal processing units; *RE Series* of units, and the *TR808* drum machine. ● **RTS Systems:** range of intercom systems; a small battery-operated mixer; a phono preamplifier; audio distribution amplifiers; and dual-buffered interface equipment. ● **RWO/Fostex:** wide range of studio monitor loudspeakers and drive units.

S

● **Saki Magnetics:** range of hot pressed glass bonded ferrite heads including new heads for in-cassette duplicators and high speed metal tape duplicators. ● **Sansui:** wide range of audio units including power amplifiers. ● **Selco Products:** range of nylon collet and push-on style knobs and accessories in a wide variety of shapes and sizes. Also VU and PPM meters. ● **Sennheiser:** radio mic transmitter/receiver equipment plus the company's range of mics and headphones. ● **Sescom:** wide range of audio modules and transformers; plus splitter boxes, direct boxes, 3-band parametric equaliser, 10-band graphic equaliser, and 4-channel mic-mixer. ● **Shure:** *SM81* cardioid condenser mic; *SC39 Series* phono cartridges; and *Pro Master* sound system; plus the company's range of dynamic mics. ● **Sierra Audio:** details of the Sierra/Hidley facilities which have been designed and constructed over the past year and information on the company's consultation services and monitor systems. ● **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. ● **Sontec:** *Compudisc* digital control system for Neumann and Scully lathes; plus the *DTC-400* disc transfer console; *DRC-400* dynamic range controllers; and a range of equalisers. ● **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 North American showing of the *Series 800* multitrack console and *SCM 382-24* 24-track recorder. New products include a new automation system for the *Series 3B* console and the new *Series 2400* automation-ready console. Also the *Series 1624* console, plus the *SCM 381* range of multitrack recorders. ● **Soundstream:** digital audio recording system. ● **Sound Technology:** *Model 1500A* microprocessor based automatic tape recorder test instrument. Also *Model 1710A, Model 1700B* and *Model 1701A* distortion measurement systems. ● **Sound Workshop:** *Series 20, Series 30* and *Series 40* modular consoles, plus *242* and *262* stereo reverb systems, *Super-Group* grouping system, and *ARMS* automatic system. ● **Spectra Sonics:** *Model 1024-24B* console; *3000B* and *3085B* loudspeakers; and an assisted resonance system for sound reinforcement. Also Spectra Sound *1000B* 10-band graphic equaliser, 4000 flanger, *4010* phase shifter, and *4020* delay line. ● **Sphere Electronics:** no information received. ● **Stanton:** *980LZS* low impedance phono cartridge series based on the *881S Series;* and the *Model 310* phono preamp/equaliser. ● **Statik Acoustic:** range of ancillary equipment comprising the *SA30* electronic crossover; *SA10* octave equaliser; *SA100* dynamic delay/flanger; and *SA20* dual reverb system. ● **Stephens Electronics:** *821B* range of tape recorders featuring capstan-less and pinch roller-free drive. Models on show will include a 40-track, 2in machine, and a 24-track portable machine. Also The *Q-II* autolocator and other accessories. ● **Studer:** new *900 Series* mixing consoles; new version of the *A80/VU Mk3* with narrow headblock; new *Mk2* version of the *B67;* the Revox *PR99* recorders; and a 32-input version of the *369* console. Also the established range of Studer and Revox products. ● **Swintek:** *Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand-held lavalier cordless mics with multiple diversity antennas; and *MK200* communicator. ● **Swisstone:** Chartwell range of studio monitor loudspeakers including BBC licensed designs. ● **Synergetic Audio Concepts:** pressure zone microphones and details of time-energy-frequency measurement systems. ● **Synton:** *Syntovox 222* vocoder; *Syntovox 221* effects vocoder; *Syntovox 202* vocoder for guitar players; and *Syntovox 232* 16-channel vocoder with voltage-controlled filter bank.

T

● **TAD (Technical Audio Devices):** recently introduced mid-bass loudspeaker drive unit capable of handling 300W. Also the company's beryllium diaphragm compression drivers. ● **Taber:** *Taberaser* bulk tape erasing unit and a range of reconditioned and replacement tape heads. ● **Tangent:** *Model 3216* console available in 16/24/32-channel formats, plus the new *Series 4* sound reinforcement consoles, and *Series 16* consoles. ● **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. ● **Teac:** *Model 85-16* 1in, 16-track tape recorder; plus a comprehensive range of units from the *Tascam Series* including consoles, tape machines and accessories. ● **Tektronix:** *TM500* range of audio test equipment. ● **Telex Communications:** range of headsets, intercoms, and cassette duplicators. ● **Tentel:** range of *Tentelometer* tape tension gauges for professional tape recorders. ● **Toa:** modular preamplifier/mixer system from the *VMS-2000 Series* designed for commercial and professional applications. Also the company's range of amplifiers, signal generators, power supply units, equalisers, monitors, meter units, filters, loudspeakers and accessories. ● **Trident:** *TSR Series* multitrack recorder with autolocate and compact remote control unit; *TSM Series* multitrack console; and dual channel stereo limiter/compressor. New products include a new 8 group *Trimix* console, and a new 2-channel parametric equaliser. ● **Tweed Audio:** range of mixers suitable for broadcast or recording studio usage, plus details of the company's custom design and manufacture service.

U

● **UREI:** *Model 6500* power amp and *325/315* DI boxes, plus a wide range of signal processing units including the *Model 562* feedback suppressor; *Model 533* (single) and *Model 535* (dual) 10-band octave graphic equalisers; and the *Model 811* single duplex and *Model 815* super woofer time aligned loudspeaker systems. ● **Ursa major:** *8X32* digital reverb system and the *SST-282 Space Station* digital delay line and digital reverberation system synthesiser.

V

● **Valley People:** Allison *Kepex II* keyable program expander; *Fadex* programmable fader system; the *65K* automation system; *Gain Brain II*; plus the various Allison VCA modules. Also the *Trans Amp LZ* transformerless mic preamp.

W

● **Westlake Audio:** new *HR-1* phase coherent studio monitors; *TM-1* monitor system, plus DI boxes and a headphone multibox. ● **White Instruments:** *System 200* microprocessor controlled realtime analyser; plus numerous active and passive equalisers. ● **Wireworks:** range of hard-wired mic cables and multicables together with a number of audio accessories.

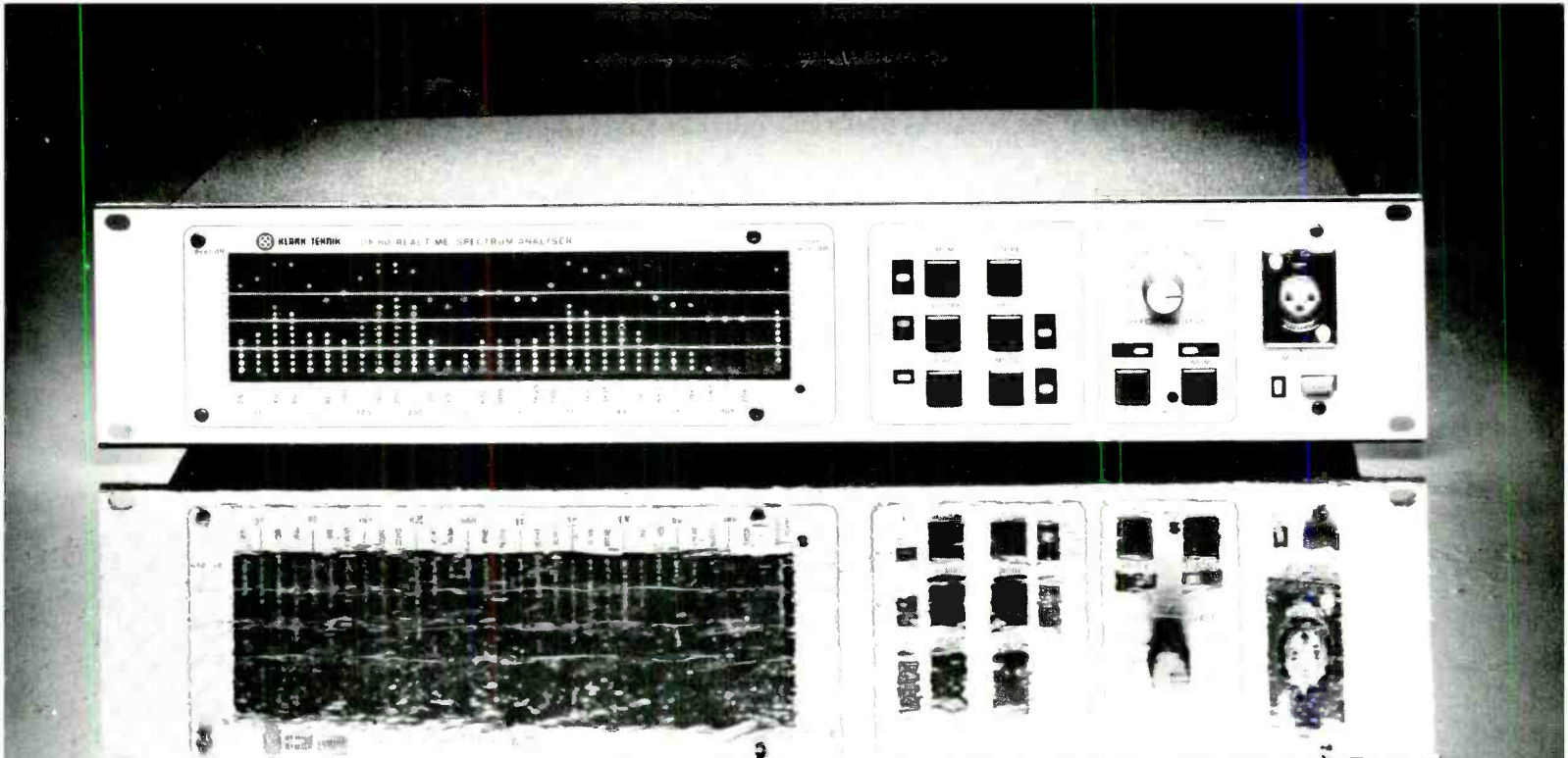
Y

● **Yahama:** wide range of audio products including the *PM-2000* console available in 24 or 32-input channel configurations.

Z

● **Zumaudio:** Zuma disc mastering computer system designed to accompany Neumann *VMS-66* and *VMS-70* lathes.

● **Studio Sound:** editor Richard Elen and assistant editor Noel Bell will be attending the Convention together with advertisement manager Phil Guy. Copies of Studio Sound will be available from our stand number R677. ■



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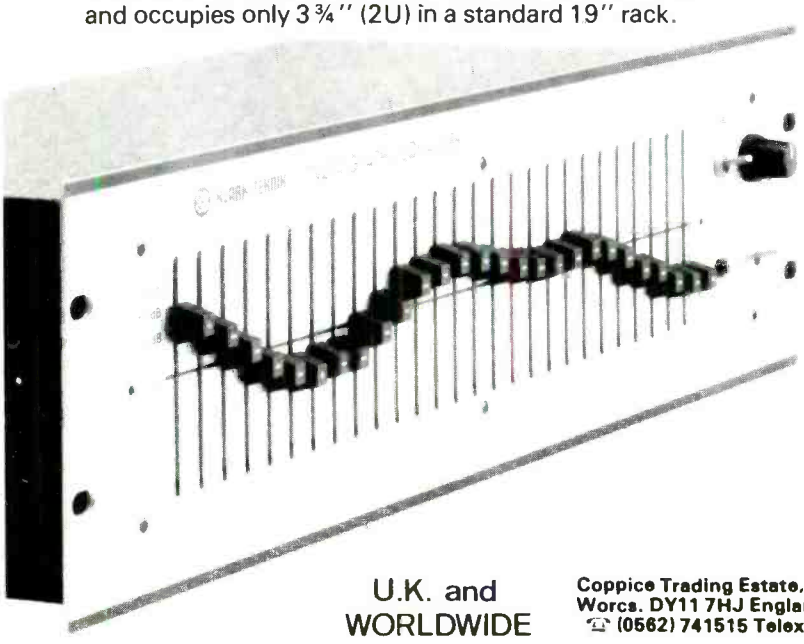

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Steve Dove

Part Eight - Equalisers 2

We hope you enjoyed our April bonus at the end of Equalisers Part One "Mechanical Filters". Although plausible, as you will appreciate this system is an expensive and elaborate means of achieving a high-pass filter effect. Avid constructors should note that construction should have been completed by 12pm, April 1, and that the accompanying Fig 42 is erroneous. We promise to return to the straight and narrow henceforward, accordingly Fig 42 below and its accompanying text replaces the previous entry.

METHODS of filtering come thick and fast once the basics are established. The development of a perfectly popular bandpass filter arrangement is shown in **Fig 42.** It starts out in life as two variable passive single-order filters of a common 'crossover' frequency point, ganged so that they track. Reconfigured slightly **(Fig 42b)** to minimise interaction, they are shown with their drive and sense amps. Wrapping the two networks around an inverting amp isolates them completely from each other, improving the filter shape. The bandpass Q is really rather low, well under one in fact, leaving it rather limited in scope for practical applications. A discretionary degree of positive feedback from the amp output back to the non-inverting input smartens up the Q, if a little unpredictably and more than critical of component tolerances.

Yes, viewers, it does look rather like a Wien Bridge oscillator, doesn't it? Attempting to get the Q too high proves the point unquestionably!

Listening to Q

This raises the problems of excessive Qs. Fortunately, extremely high Qs (rather, any greater than 10), are unnecessary or unusable for eq purposes. The higher the Q becomes, the less actual spectral content of the signal it modifies so despite the fact that its peak gain or attenuation is the same as a lower Q filter, it seems to do subjectively *less.* Judicious care is required in setting up the filter to enhance or trim exactly what is required—accidental overkill is easy.

There comes a break-point with increasing Q where you are not so much listening to the filter's effect as to the filter itself. Resonant tuned circuits are to a degree electrical storage media, where energy inside the circuit shuffles backwards and forwards between the two reactive elements until the circuit losses waste it away. The greater the Q (and by definition the lower the included losses) the more pronounced the signal storage.

Whilst recently playing with silly-Q filters using synthesised L and C elements of virtually eliminated intrinsic losses, an 80Hz bandpass filter of some 0.3Hz bandwidth (Q about 250) continued to 'ring' for quite a few *seconds* after the input signal was removed—a beautiful sinewave slowly decaying away. Despite being good for a laugh, it's of no value at all in a practical eq. A transient hitting such a filter triggers a virtually identical series of decaying sinewaves at the frequency of the filter—who needs that?

Squarewaves sent through audio paths are good for kicking resonant ringing off at almost any frequency—it's a convenient means of unearthing inadvertent response bumps and lurking instabilities. The breakpoint—where you are starting to hear ringing as much as signal—is quite low, a Q of between 5 and 10.

Squegg or slug?

It is not too difficult now to appreciate that resonant circuits and oscillators are very close cousins —often indistinguishable, except for maybe an off component value here and there. There are two fundamental approaches to achieving a resonant bandpass characteristic using active-filter techniques.

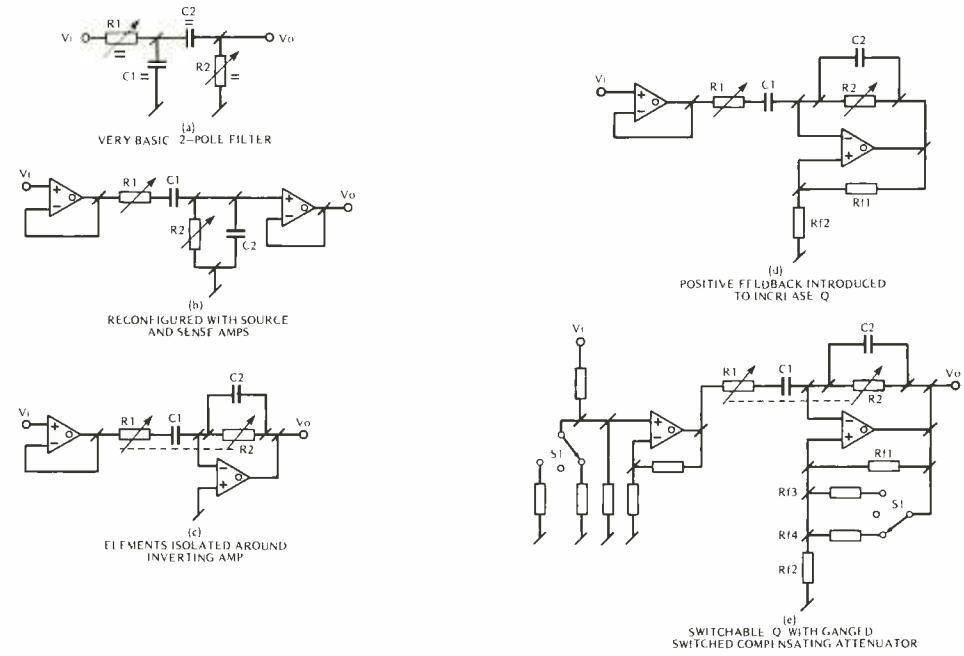
The first is to start off with a tame, poorly-performing passive network and then introduce positive feedback to make it predictably (you hope) unstable—the feedback exaggerating the filter character, increasing Q to the desired extent. A perfect example of this is the 'Wein Bridge' development of **Fig 42.** The major disadvantage of such methods is that the Q is disproportionately critical with respect to the feedback adjustments.

The second approach is to start off with an oscillator, then slug it until it's tame enough. This is the basis of the state-variable, the bi-quad and similar related loop-type active filters.

The 2-integrator loop

Three inverting amps connected together in a loop, as in **Fig 43,** seems

FIG. 42 A BANDPASS FILTER DEVELOPMENT



a perfectly worthless circuit, as such it is. It's there to show (assuming perfect op-amps) that it is a perfectly stable arrangement—each stage inverts (180°), so the first amp section receives a perfectly out-of-phase (invert, revert, invert) feedback so cancelling any tendency within the loop to drift or wobble. Removing 180° of phase shift would result in perfect in-phase *positive* feedback; the result would require scraping off the ceiling.

Arranging for the 180° to be lost only at one specific frequency results in the circuit being totally unstable at just that one frequency—in other words it oscillates controllably. Creating the 180° phase loss is left to two of the inverting amps being made into integrators **(Fig 43b)**, so called because they are an electrical analogue of the mathematical function integration.

The integrator you may recognise from a single-order filter variation in **Fig 37.** It's not so much the amplitude response that's useful here as the phase response, which at a given frequency (dictated by the R and C values) reaches −90° with respect to the input. Two successive ganged-value integrators—presto, −180° shift.

Slugging the loop to stop it oscillating can be achieved in a variety of ways:

(a) Trimming the gain of the remaining inverter—this is unduly critical like the 'Wein Bridge' for Q determination.

(b) Doping one of the integrator capacitors with a resistor **(Fig 43c).** This in essence is the 'bi-quad'. The Q is largely dependent on the ratio of the capacitative reactance to the parallel resistance, which consequentially varies proportionally with frequency. For fixed frequency applications the bi-quad is easy, docile and predictable.

(c) Phased 'negative' feedback. Not true negative feedback but taken from the output of the first integrator (90° shift). This provides an easily managed Q variation, constant and independent of filter frequency **(Fig 43c).** Forming the basis of the state-variable filter, this has turned out to be 'The Active Filter Most Likely To Succeed', if the majority of current commercial console designs are to be believed.

Panaceas, once you've kicked the stone over and grubbed around underneath it for a bit, are never quite as tasty afterwards.

Loop filters, such as described in **Fig 43c**, have a number of inherent bothers that are usually glossed over for the sake of the design's operational simplicity and elegance.

Each amp within the loop has a finite time delay, which together add up to significant phase shifts within the open-loop bandwidths of the amps—some get simply added to the delay imparted by the integrators but the total time discontinuity around the summing amp can promote instability in the multi-MHz region. Compensation for this around the summing amp can introduce further phase shifts upsetting the filter performance at high frequencies. Take your pick.

Two major problems are due to the nature of the integrator arrangement itself. They come to light at the extremes of the feedback capacitance's reactance, ie at very low and very high frequencies where respectively the reactances are virtually open-circuit and short-circuit.

Open-circuit at lf means the op-amp is 'infinitely' amplifying external resistor noise and internally generated thermal and (mostly) lf noise, plus any lf noise presented to the input along with the signal. In fact, and as far as the outside world is concerned, the entire loop feeds round and defines the 'gain', but each individual amp generates and amplifies *a lot* of lf noise.

At high frequencies, the reactance approaches short-circuit connecting the output back around to the inverting input. This arrangement, zero closed-loop gain, is about as critical in terms of device instability as you can get (see Part Three, Op-Amps—Friend or Foe? November 1980) since there is no possible way of further externally defining the closed loop characteristics beyond that of the integrating capacitor itself, which may or may not be adequate.

For audio frequencies, the integration capacitor value can be quite sizable—up to 1μF, say. If there isn't an immediate problem of the op-amp's current output capacity being incapable of charging such a capacitor instantaneously, there will almost certainly be a problem related to the device's open loop output impedance; this corresponds to a resistor in series with the device output, which obviously enough forms a time constant and a filter within the integrator capacitor. Time constant means *more* time delay in the loop, whilst the implicit lowpass filter around the immediate op-amp means a reciprocal rise in hf response, stealing from the op-amp's stability phase margin.

As tame as it may superficially seem, the state-variable is not an unconditionally or reliably stable arrangement, with out-of-band dynamic state nasties potentially degrading its sonic performance.

Improving the loop

With the exception of inevitable loop effects, most of the undesirable things about the state-variable can be eliminated or mitigated by replacing the integrators by constant amplitude phase shift elements, **(Fig 43e)**, resulting in what could best be known as a CAPS-variable filter.

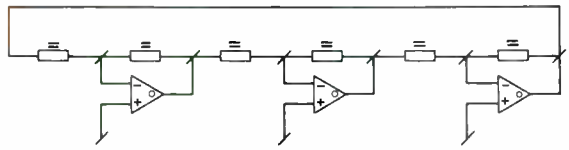
All the constituent elements being basically stable with provision for independent compensation—with no undefined gain for any of the spectrum—seems like a healthier format to start making filters around. Stabilisation is as for the state-variable.

There is another way of looking at the state-variable/CAPS-variable filter that will suddenly resolve the previous discussions on gyrators, L and C filters, series tuned circuits, etc, with the seemingly-at-odds approach of active filters.

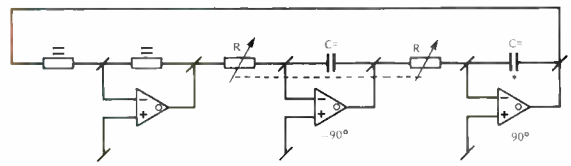
Resonance depends upon the reaction of two reactances of opposite sense—180° apart in phase effect. Rather than achieve this in a differential manner, one element +90° with the other −90° at a given frequency, active filters achieve the total difference by summing same-sense phase differences, (−90°) + (−90°) ie, still 180°. Two reactive networks are still involved, hence it is still a second order effect. At the end of the day the principal difference is that such loop type active filters have their median 'resonance' phase displaced by 90° from their input as a result of both reactances 'going the same way', as opposed to the nil

80 ▶

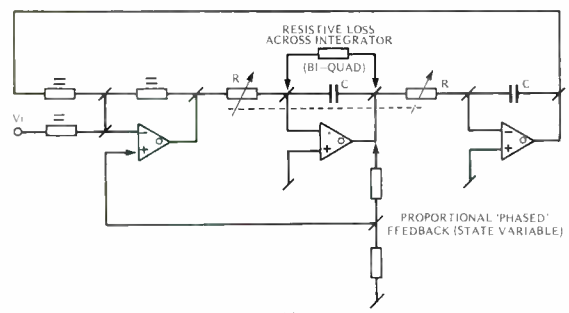
FIG. 43 2-INTEGRATOR LOOP FILTER



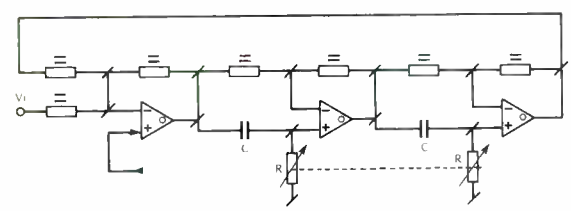
(a)
A THREE INVERTER LOOP-STABLE



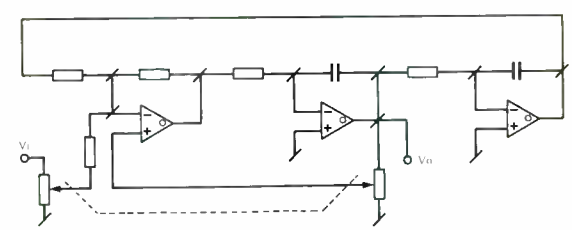
(b)
INTRODUCING 180° PHASE SHIFT VIA TWO INTEGRATORS



(c)
INTRODUCING LOSS TO TEMPER THE Q TO USABILITY



(d)
C.A.P.S. VARIABLE FILTER
(Q DETERMINED AS FOR STATE VARIABLE)



(e)
GANGED POTENTIOMETER SIMULTANEOUSLY ALTERING
Q AND INPUT ATTENUATION

phase shift at resonance of a 'real' L/C network.

Q and filter gain

Pretty much every resonant type active filter has the unfortunate characteristic of its gain at resonance being at least related and often directly proportional numerically to the Q of the filter. This means a filter with a Q of 10 usually has a voltage gain of 10 (or 20dB gain) at resonance.

Naturally, this is 'not on'. Even specifying a maximum Q of five only helps by 6dB of lift.

That represents a very sizable chunk of system headroom stolen at the filter frequency, also making the 'sum and difference' matrixing necessary to provide the usual 'lift and cut' facilities difficult to configure.

The obvious solution is to attenuate the signal going into the filter by the same amount as the gain (hence Q) expected of the filter. Arranging a continuously variable Q control that also attenuates the source appropriately is not a conspicuously simple task, at least with most filters. Perhaps the most straightforward example is shown in **Fig 43e,** a state-variable type filter with an attenuator in the 'slug-back' network altering the Q ganged with an attenuator ahead of the input/summing amp.

Within a couple of dB, this holds the resonant peak output constant over a considerable useful Q range.

Most other filters are not so obliging in terms of continuously variable-Q. Switching between a few values of Q whilst substituting appropriate input attenuation is quite often a practical and operationally acceptable solution, applicable to nearly any filtering approach. **Fig 42e** illustrates a further development of the Wein Bridge arrangement using this method to provide alternative Qs. The attenuator values are necessarily high in impedance to prevent excessive loading of the source, a factor which in some practical eq circumstances is important.

Highpass filters

Two stone-age single order highpass filters are shown in **Fig 37** (Part Seven, Equalisers 1), the keys being the reducing inductive reactance to ground with reducing frequency in **Fig 37c** and the rising capacitative reactance against reducing frequency in **Fig 37b.**

How about combining the two, omitting the resistors as in **Fig 44a**? As expected, the two opposing reactances combining result in an ultimate roll-off twice as fast as one of the single orders but they have also resulted in a resonance peak at the point of equal reactance. Well, resonance Q is the ratio of elemental reactance to resistance, so deliberately introducing loss in the circuit in the form of a termination resistor tames the resonance to leave a nice, flat, in-band response **(Fig 44b).**

Substituting a basic 'gyrator' or simulated inductance for the 'real' one **(Fig 44c)** naturally works just as well, and even better than expected. The filter output can be taken straight from the 'gyrator' amp output to start off with, saving having to use another one as an output buffer.

Secondly, we can automatically introduce the required amount of loss into the inductor by increasing the value of the bootstrap resistor and get the resonance damping right. (Refer to discussion of 'gyrators', in Part Seven).

Thirdly, we can easily change the turnover frequency of the filter by varying what was the 'tuning' resistor. In doing this, of course, the elemental reactance to loss ratio will change causing the Q (hence damping factor) to change with it. No tears. The frequency change and required damping change are directly related and may be simultaneously altered with a ganged control—even if we do our sums right, with the two ganged tracks having the same value!

A slight redraw of **Fig 44c** gives **Fig 44d**—a more conventional portrayal of the classic Sallen and Key highpass filter arrangement. Well I never . . .!

As the Sallen and Key filter evolves, it is seen that an 'equal value' filter (where the two capacitors are equal, the two resistors are equal) results in a less than adequate response shape, with a fairly pronounced resonant peak of one or two dB—demanding further damping. An expedient method, working on the assumption that a few more resistors are cheaper than a special two-value ganged potentiometer, is to increase the damping by introducing gain into the 'gyrator' buffer amplifier (also providing a means of stability compensating it correctly)—see **Fig 44e.** A side effect of this technique of damping adjustment (which incidentally is independent of filter frequency) is that an input/output in-band gain is introduced. This may or may not be problematic. The 4dB-ish gain introduced necessary to render the filter frequency response maximally flat could be included in overall system gain, or alternatively a compensating attenuator could be instituted ahead of it. This could also be arranged to be a fixed frequency band-end single order highpass filter to accelerate the slope out-of-band.

Second or third or more, order?

Because of their simplicity, it is tempting to go overboard on band-end filtering and it is mostly designers' faults because they rarely get a chance to listen to their results.

Without delving too deeply into psychoacoustics, the ear notices easily a third or more order filter being introduced for much the same reasons as a high-Q bandpass filter is obvious—severe modifications to the signal path's transient response and the introduction of 'ringing' type time-related components into the signal's spectrum.

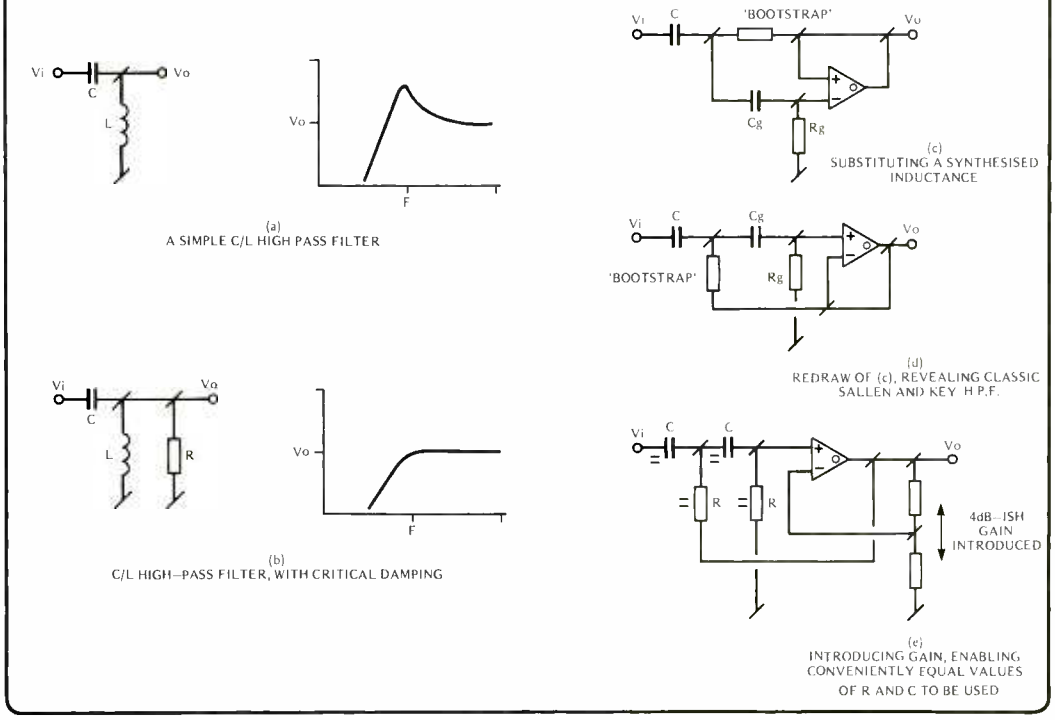
An application where this effect is not overly objectionable is where the filters are defining bandwidth at audible limits (such as in the line amp/filter described in Part Two—Broadcast Consoles, October 1980). Within the audible band, though, the ear is quite merciless toward such noises.

The transient response modification is not the end of the story, it being that the drastic modification of the relationships between the fundamental frequency and the harmonics of instruments in the operating turnover area of the filter is likely to be interpreted as 'unnatural'.

Second order filters score in both respects—there is less transient response disturbance and less tonal characteristic modification—there are few who would dispute that they sound more natural and (ducking to avoid flying objects) 'musical'. A personal wrinkle, for which provision is made in the design, is to leave a small controlled amount of under-damped 'bump' in the filter frequency response. This has two consequences, one being slightly more rapid out-of-band roll-off but the other—a subjective effect—is that the extra programme energy introduced by the 'hump' serves to help offset the loss of energy in programme below the turnover frequency. The perceived effect upon introducing the filter is more of a 'change in sound' rather than a direct drop in lf response.

This raises an interesting possible line of debate: Should equipment in the recording chain (not just consoles) be designed and set up to be perfect according to conventional techniques and wisdom, or to sound 'right'? ■

FIG. 44 HIGHPASS FILTER DEVELOPMENT



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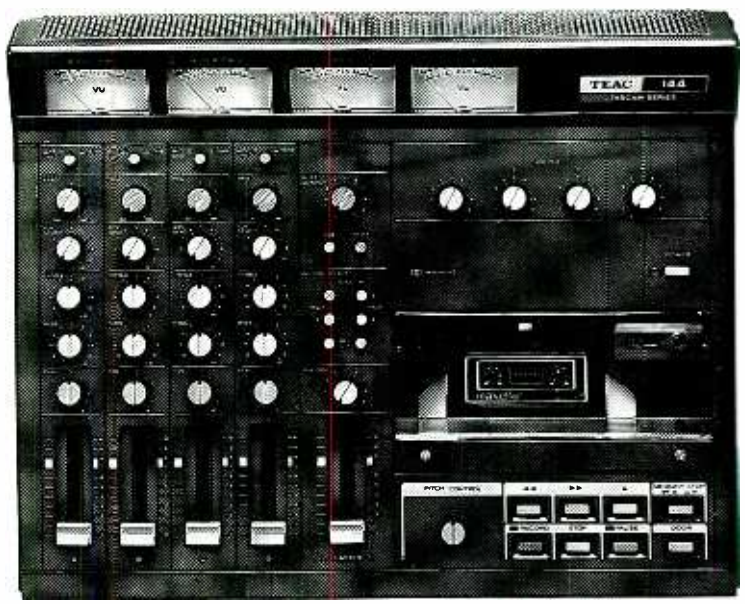

(Incidently, for those who don't know what a Portastudio is, it's a four track, cassette based, tape recorder with built in mixer and equalisation facilities. You can overdub, bounce, and in general produce good quality master demos. It costs around six hundred quid. And if you send off this coupon we'll send you a brochure containing a complete spec.)

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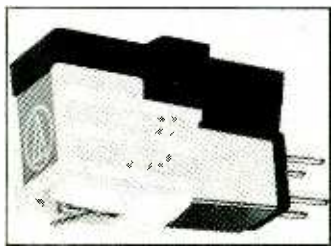
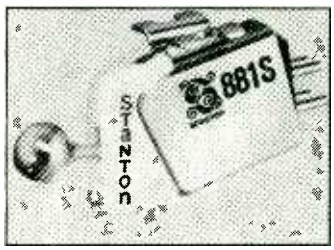




Pickup cartridges types P10ED, P15MD, P25MD by AKG, ATP series by Audio Technica, SC39ED, SC39EJ by Shure and 680SL, 881S by STANTON

MANUFACTURERS' SPECIFICATIONS

	AKG			AUDIO TECHNICA			SHURE		STANTON	
	P10ED	**P15MD**	**P25MD**	**ATP1**	**ATP2**	**ATP3**	**SC39ED**	**SC39EJ**	**680SL**	**881S**
Frequency response	20Hz to 20kHz	10Hz to 23kHz	10Hz to 28kHz	20Hz to 20kHz	15Hz to 22kHz	15Hz to 25kHz	20Hz to 20kHz	20Hz to 20kHz	20Hz to 20kHz	10Hz to 25kHz
Sensitivity (1cm/s)	1.65mV	0.95mV	0.75mV	1.06mV	1.06mV	1.06mV	0.8mV	0.8mV	1.1mV	0.87mV
Balance at 1kHz	2dB	2dB	1dB	1.5dB	1.5dB	1.5dB	2dB	2dB	2dB	1dB
Crosstalk at 1kHz	25dB	30dB	30dB	21dB	23dB	23dB	25dB	20dB	30dB	35dB
Crosstalk at 10kHz	15dB	20dB	25dB	16dB	17dB	17dB	—	—	—	—
Impedance	1,000Ω 200mH	1,000Ω 200mH	900Ω 170mH	500Ω 600mH	500Ω 600mH	500Ω 600mH	1,550Ω 700mH	1,550Ω 700mH	1,300Ω 930mH	900Ω 510mH
Recommended load	47kΩ 470pF	47kΩ 470pF	47kΩ 470pF	47kΩ —	47kΩ —	47kΩ —	47kΩ 200 to 300pF	47kΩ 200 to 300pF	47kΩ 275pF	47kΩ 275pF
Tracking force range	1.25 to 2g	1.0 to 1.5g	0.75 to 1.25g	3 to 5g	3 to 5g	2 to 3g	0.75 to 1.5g	1.5 to 3g	2 to 5g	0.75 to 1.25g
Recommended force	1.5g	1.25g	1.0g	—	—	—	1g	2g	—	—
Weight	3.5g	3.5g	3.5g	7.2g	7.2g	7.2g	6.3g	6.3g	5.5g	5.7g
Tip radii	8×18μm	8×18μm	5×18μm	15.2μm	2.4× 18μm	7.6× 18μm	5×18μm	10×18μm	— stereohedron —	
Alternative styli	—	—	—	—	—	—	—	—	YES	YES
Cartridge Price	£24.00	£40.00	£80.00	£14.82	£16.32	£20.65	£48.00	£33.30	£45.00	£81.08
Stylus price	£14.00	£24.00	£48.00	£9.22	£10.83	£12.92	—	—	£24.00	£41.09

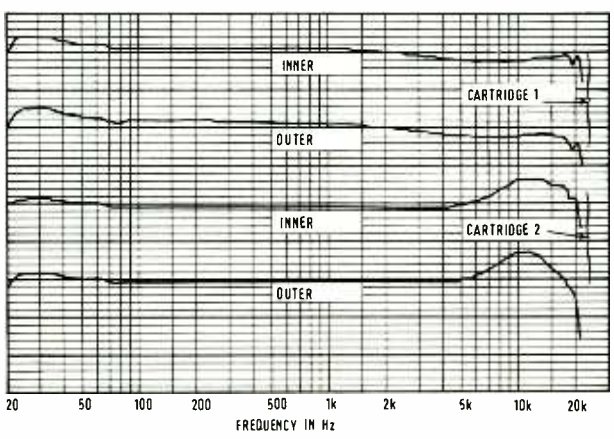
MANUFACTURERS:
AKG GmbH, Brunhildengasse 1, A-1150, Vienna, Austria.
UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS.
USA: AKG Acoustics Inc, 77 Selleck Street, Stamford, Connecticut 06902.

Audio Technica Corp, 2206 Naruse, Machida, Tokyo 194, Japan.
UK: Sondice Ltd, Northwood House, 195 North Street, Leeds LS7 2AA.
USA: Audio Technica US Inc, 33 Shinwassee Avenue, Fairlawn, Ohio 44313.

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204, USA.
UK: Shure Electronics Ltd, Eccleston Road, Maidstone, Kent ME15 6AU.

Stanton Magnetics Inc, Terminal Drive, Plainview, NY11803, USA.
UK: Wilmex Ltd, Compton House, 35 High Street, New Malden, Surrey KT3 4DE.

FIG.1
PICKUP CARTRIDGES
FREQUENCY RESPONSES



DIFFERENT types of phono cartridge find different applications and in this review we have a good cross section of cartridges ranging from the AKG with an elliptical stylus capable of tracking at 1g to the Audio Technica range tracking at 3 to 5g with a variety of styli.

Whilst all manufacturers specify an untoleranced frequency response and do not quote the calibration disc used or the radius being reproduced, in this review I have used the outer tracks of the Bruel and Kjaer *QR2009* disc for the measurement of frequency response, crosstalk and distortion.

When referring to the review figures it must be remembered that the frequency response tolerance of the test disc is ±0.75dB from 100Hz to 10kHz, above which it increases to + 1dB up to 15kHz and ±2dB above. Similarly the crosstalk specification is −30dB between 200Hz and 10kHz falling to −20dB at 50Hz and below and also at 15kHz. All these parameters will vary with the radius being reproduced and as shown in **Fig 1** the changes vary from one cartridge to another.

The upper curves show the frequency response for one cartridge for the inner and outer frequency response bands, both being very close. In the lower curves it can be seen that significant hf differences occur with the second cartridge. For all cartridges the output voltage is quoted at 1kHz with the tolerance of the test disc being

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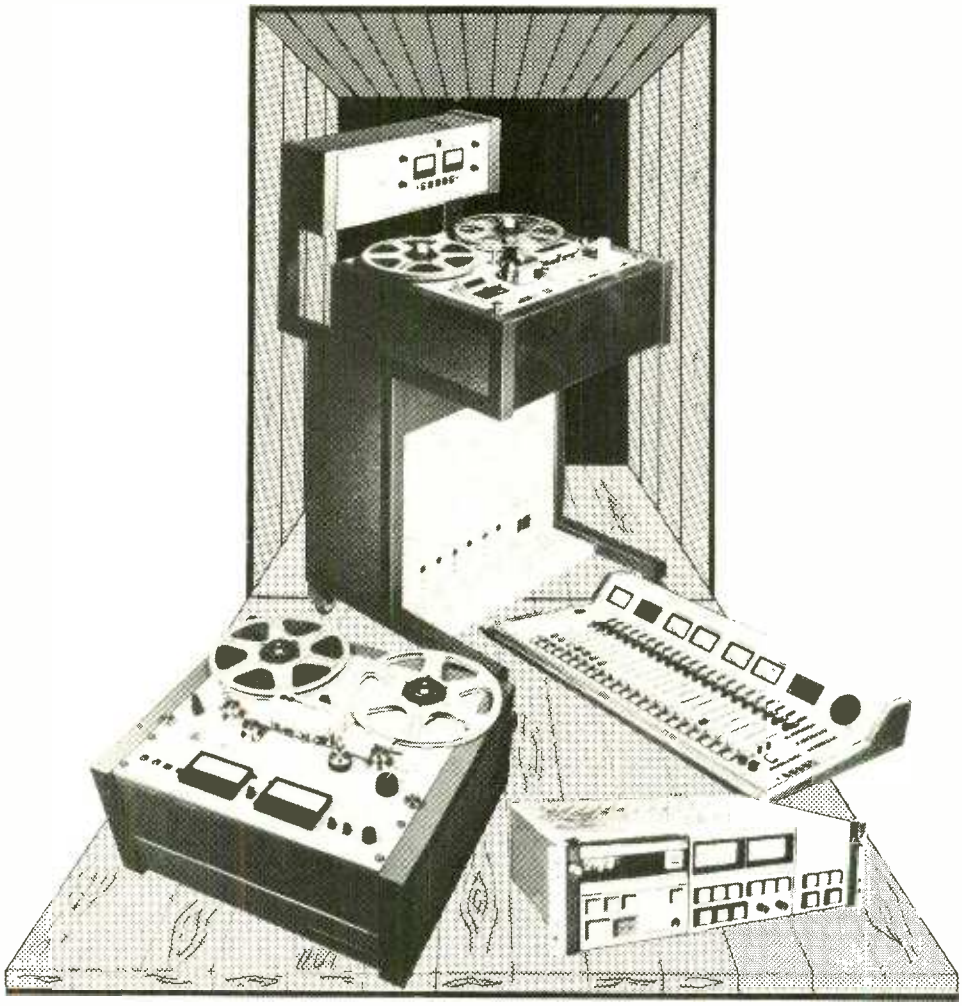

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Something that I find very surprising is that only one manufacturer (AKG) specified the cartridge's compliance, the knowledge of which is vital if a cartridge is to be properly matched to any particular pickup arm. For any arm/cartridge combination the resonant frequency of the combination may be derived from the formula:

$$f = \frac{1}{2\pi\sqrt{C(M+m)}}$$

where f is the resonant frequency, C the compliance, M the mass of the cartridge and m the effective mass of the arm. Preferably the resonant frequency should be at about 10Hz and well damped. Getting the sums wrong leads to the situation shown in **Fig 2** which shows the 'frequency responses' of the same cartridge under different arm conditions. So bad was the resonance in the upper curve that the cartridge jumped out of the groove! The measurement of the system's resonant frequency was done with the aid of the Bruel and Kjaer type *QR2010* calibration disc.

Proceeding to the tracking tests these were done with the CBS type *STR111* disc which refers its levels to 11.2µm peak amplitude which is equivalent to 10cm/s lateral at 1kHz. The 300Hz lateral tracking test has levels of +6, +9, +12, +15 and +18dB with the vertical tests having levels of +6, +9 and +12dB. All tracking tests were done at the cartridge manufacturer's recommended force, or where there is no recommendation half way between the specified maximum and minimum force.

Tracking intermodulation bands at the same levels at both 200Hz and 400Hz was also investigated and the level at which severe mistracking occurred is reported in **Table 1.** Additionally oscillograms of a reproduction of a 1kHz square wave recorded laterally at 5cm/s are included, large differences between cartridges being noted.

Measurement of the vertical tracking angle which should be 20° was done with the CBS *STR160* calibration disc which includes bands for angles from −6° to +43° it being found that most cartridges are acceptably accurate.

With the exception of the AKG cartridges the recommended load was about 47kΩ in parallel with 300pF and all measurements were made into such a load. The AKG samples were also checked loaded with 470pF but this did not show any significant difference.

In addition to the transducer checks the sensitivity of cartridges to external magnetic fields, such as those from turntable motors, can be troublesome. All cartridges were therefore placed in a coil carrying 50Hz to generate 1Oe peak and their outputs measured. In some samples there were wide variations from one channel to the other and the worst case is shown in **Table 1.**

From a mechanical point of view all samples were in broad terms compatible, all mounting on ½in centres and having connecting pins of 1.27mm diameter except for the Shure samples which had slightly larger pins of 1.32mm diameter.

The overhang was similar for all, but the Audio Technica cartridges required more room at the pin end. However a wide variation in weight, not always in agreement with the manufacturer's specified weight, could prove troublesome with some pickup arms. The review weights do not include fixing screws or brushes and just refer to the basic cartridge with the stylus fitted.

AKG

Initial examination of the cartridges under a microscope before use showed that the stylus of the *P10ED* was dirty and the stylus mounting not to the highest standards with the *P15MD* and the *P25MD* both having clean well mounted styli.

The three types have identical bodies made from conductive plastic with colour coded connections. At the front of each cartridge is a small pointer which was found to be very good for accurate cueing. All types have an unusually low inductance which alleviates accurate electrical matching.

Of the three types the *P10ED* is most suitable for heavier arms commonly found in professional use and its lower compliance makes back-tracking a safer occupation.

The AKG samples were considerably more sensitive to external magnetic fields than the others, possibly as a result of the use of a plastic housing which provides electrical screening but not magnetic screening.

In all cases the tracking ability was beyond reproach at the very low recommended stylus

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FIG. 2 PICKUP CARTRIDGES FREQUENCY RESPONSES UNDER DIFFERENT ARM CONDITIONS

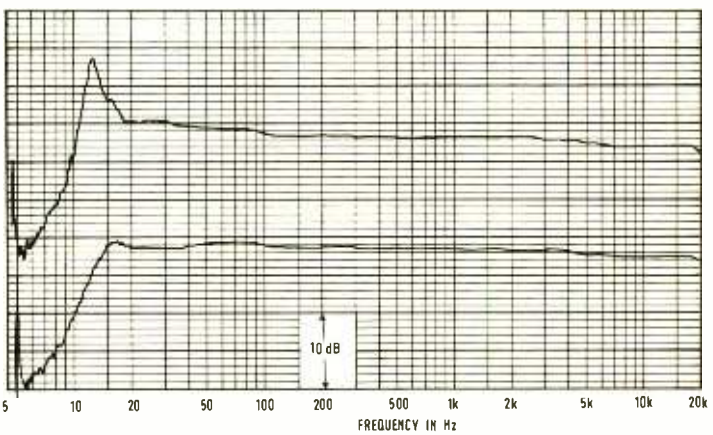

TABLE 1 MEASURED PERFORMANCE

	AKG			AUDIO TECHNICA			SHURE		STANTON	
	P10ED	P15MD	P25MD	ATP1	ATP2	ATP3	SC39ED	SC39EJ	680SL	881S
Weight (g)	4.7	4.7	4.7	7.0	7.0	7.0	6.2	6.3	6.0	6.0
Mounting screws (mm)	8	8+5	8+5	8+5	8+5	8+5	8+4	13+8+5	6+5	6+5
Inductance (mH average)	212	208	206	529	515	527	679	664	878	480
Resistance (Ω average)	1,022	990	1,025	516	525	518	1,537	1,511	1,229	888
Output voltage (1cm/s)	1.4mV	0.68mV	0.55mV	1.07mV	0.97mV	1.22mV	0.8mV	0.78mV	1.02mV	0.92mV
Compliance (CU) #1	19	22	28	11	8	11	28	23	12	17
Vertical tracking angle	19	18	19	19	20	18	22	25	18	22
Sensitivity to magnetic fields (mV/Oe)	0.1	0.15	0.14	0.02	0.03	0.03	0.005	0.005	0.005	0.034
Trackability # 2										
300Hz lateral (dB)	+15	+18	+18	+18	+18	+15	+15	+18	+18	+12
300Hz vertical (dB)	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12
Trackability of IM bands										
400Hz lateral (dB)	+18	+18	+18	+15	+15	+15	+15	+18	+18	+12
400Hz vertical (dB)	+12	+12	+12	+12	+12	+12	+12	+12	+12	+9
200Hz lateral (dB)	+18	+18	+18	+18	+18	+18	+18	+18	+18	+15
200Hz vertical (dB)	+12	+12	+12	+12	+12	+12	+12	+12	+12	+12
Frequency response										
20Hz to 20kHz ref 1kHz (dB)	+2.5 −0	+3 −0	+2 −0	+1 −1.5	±1.5	+2 −1	+0 −2	+0 −1	+0 −2	+0 −1
Crosstalk left/right										
at 1kHz	24/28	26/25	24/21	25/28	23/20	24/18	23/26	20/29	29/36	28/25
at 10kHz	18/18	20/20	16/18	14/14	17/14	15/14	21/25	24/30	39/25	30/27
Second harmonic distortion										
average at 100Hz	1.8%	1.6%	1.6%	1.6%	1.4%	1.8%	1.8%	1.6%	1.8%	1.6%
at 1kHz	1.8%	1.4%	1.3%	1.4%	1.1%	1.4%	1.8%	1.8%	1.1%	1.8%
at 10kHz	14%	10%	10%	9%	8%	11%	8%	8%	5%	9%
Balance left/right										
20Hz to 20kHz vertical (dB)	1	1	1	0.5	0.5	0.5	>0.5	>0.5	2.5	>0.5
horizontal (dB)	1	0.5	1.5	0.5	0.5	0.5	>0.5	1	2	>0.5

#1 CU is a compliance unit being one millionth of a dyne/cm.
#2 The trackability results relate in decibels to a peak amplitude of 11.2µm.

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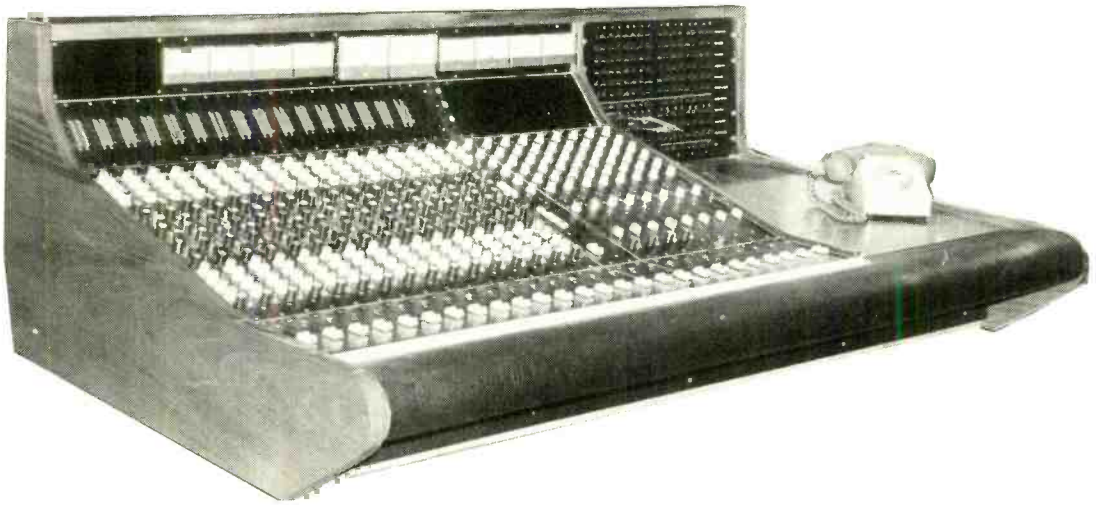

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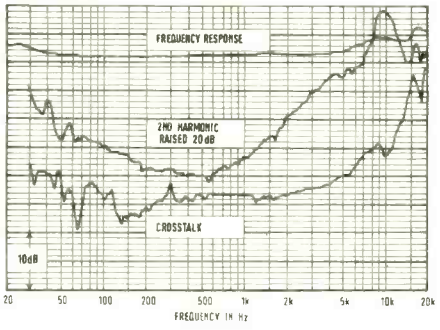
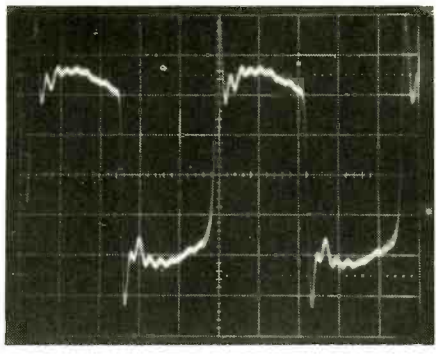
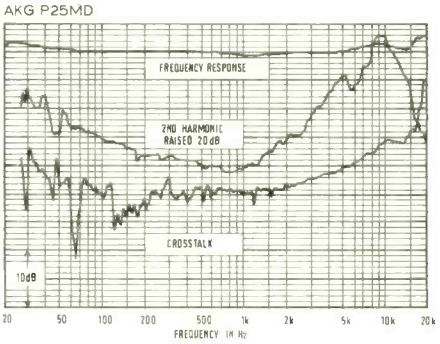
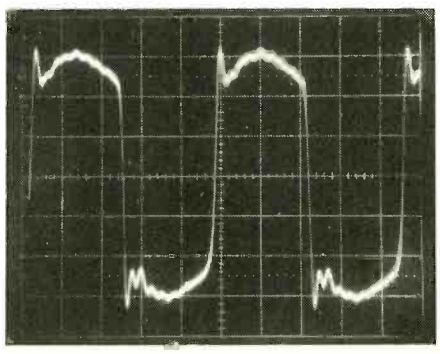
AKG P10ED



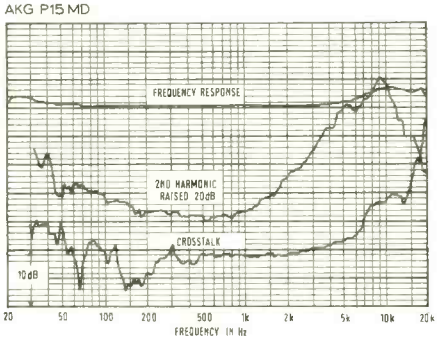


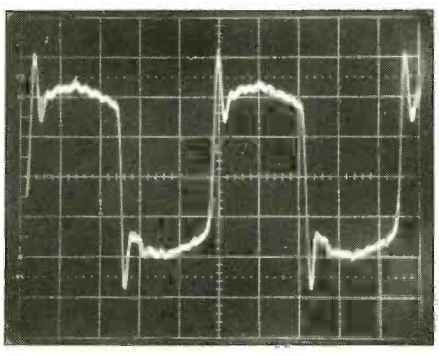
AKG P25MD





AKG P15MD





force. However the measured frequency response of the three samples exhibited a distinct rise above 5kHz. This contradicts the graphical test data provided with the *P15MD* and *P25MD*. It is not however known what calibration disc was used for the AKG test data, however, the differences were not found to be explained by the radius of the calibration track.

This hf boost is also reflected in the squarewave performance which demonstrates some overshoot (particularly with the *P10ED*) together with associated ringing.

The AKG cartridges are supplied in vinyl padded cases (similar to AKG microphone cases) complete with fixing screws, a 2g weight which can be mounted in a recess above the cartridge, a screwdriver, a cleaning brush and a small pack of anti-resonance bedding compound.

Stylus replacement was particularly easy with the stylus assembly plugging into the cartridge body with a positive mechanical snap action.

In the case of the *P15MD* cartridge this is also available ready mounted in a lightweight (8g) headshell with the standard 4-pole connector and a finger rest.

Manufacturer's comment:
AKG is aware of the hf boost noted by Hugh Ford and states that it has modified its cartridges by inserting a magnetic shunt in front of the pole pieces to cure the problem.

Audio Technica

The three Audio Technica cartridges reviewed here have been specifically designed for professional use in broadcast and discotheque applications, this being reflected in the low compliance and the relatively high recommended tracking force in the range 3 to 5g.

All types had identical cartridge bodies formed from plastic with a metallic screen which made them fairly insensitive to external magnetic fields. Normal mounting holes are provided on ½in

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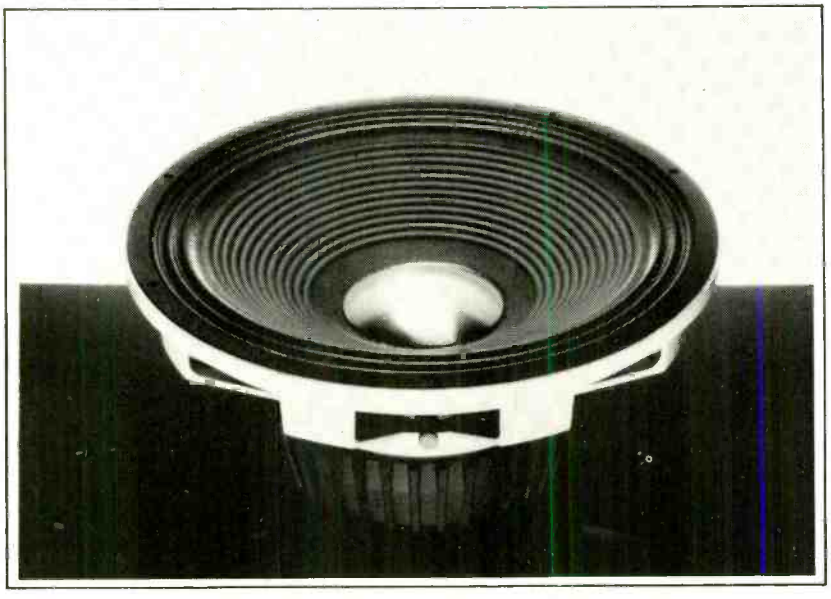

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Details of available models, prices, and suggestions for applications are obtainable from the sole UK importers and distributors.
HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

centres with the stylus assembly snapping into a slot in the cartridge body.

Initial inspection showed the cartridges to be clean with the styli well mounted with the cartridges being supplied in a strong box complete with mounting hardware, a cleaning brush and a small chubby screwdriver.

In each case the tip of the stylus was coloured red to ease cueing, but I didn't find this a particularly easy cartridge to cue as the stylus tip could not be seen from above the cartridge.

When tracking at 4g (mid way between the recommended force of 3 to 5g) all three cartridges failed to track the toughest lateral 400Hz IM test which suggests that the cartridges should be used at their maximum recommended tracking force of 5g.

The three types demonstrated a well controlled frequency response with slight peaking around 15kHz with the squarewave peformance showing slight ringing but no overshoot.

Overall these cartridges offer a sensible performance having regard to their modest cost.

Shure

Initial inspection of the two Shure samples showed that both had dirty styli with the dirt on the *SC39ED* stylus being very difficult to remove.

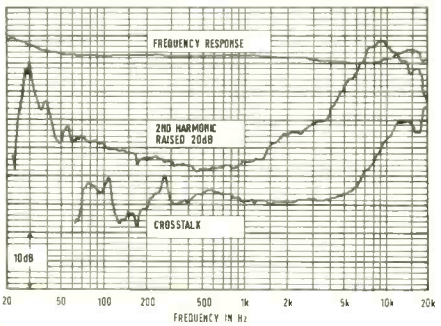
Both types are of similar construction and specifically designed for professional use with the styli being protected for back-tracking and against general commercial abuse in discotheques and the like.

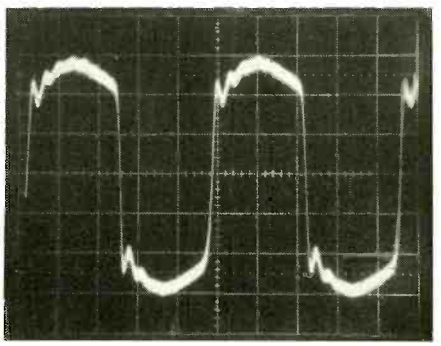
The cartridge bodies are of plastic with an overall metal screen connected to the right channel ground but isolated from the pickup mounting plate which has standard ½in centres. As can be seen from the tabulated data the Shure screening against external magnetic fields was really excellent.

To the rear of the cartridges the connecting pins are colour coded to simplify connections, with rather difficult to read legends. To the front the stylus, assembly of the usual Shure design pushes into a hole in the cartridge body. I must admit that pushing the flimsy stylus assembly into the

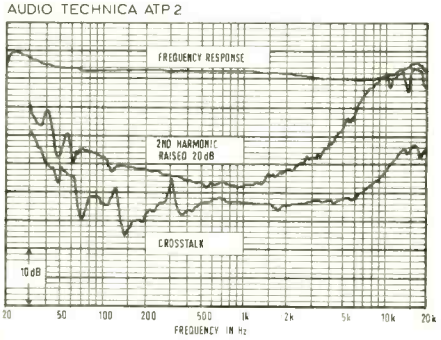
90 ▶

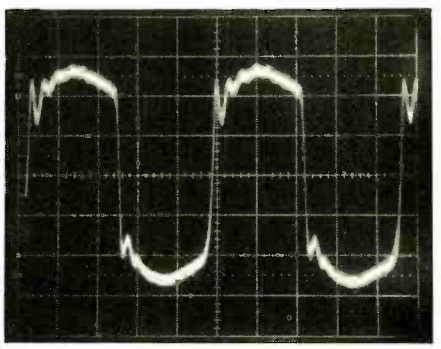
AUDIO TECHNICA ATP1



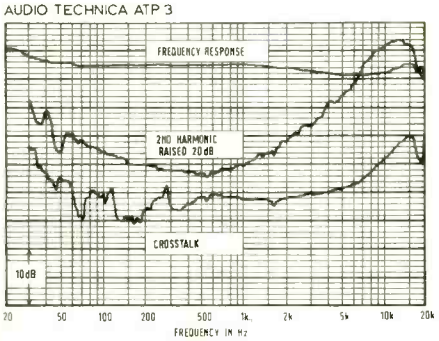


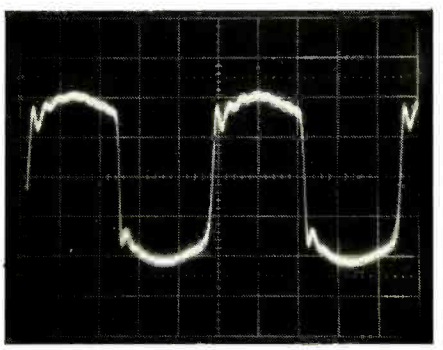
AUDIO TECHNICA ATP2





AUDIO TECHNICA ATP3





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cartridge body terrifies me as it is all too easy to bend the stylus assembly unless care is taken.

A rather novel feature is the in-built stylus guard which is operated by a sliding lever at the front of the assembly, this lever also acting as a cueing guide when the guard is withdrawn. This guide is easily seen from above the cartridge, but, being rather a long way above the record surface some care is required for accurate cueing.

Both cartridges having a fairly high compliance and weighing over 6g dictate the use of a pickup arm of fairly low effective mass for optimum operation and this together with the low recommended tracking force (particularly with the *SC39ED* at 1g) restricts their area of use to high quality pickup arms.

The cartridges showed a well controlled frequency response and a remarkably flat crosstalk performance with a particularly good hf crosstalk performance. It was however noted that the frequency response in the vertical mode fell off to −3dB at 15kHz. Also as can be seen from the oscillograms the squarewave reproduction is well controlled with a small overshoot and no evidence of ringing.

Whilst the *SC39EJ* tracked all the tracking tests at its recommended tracking force of 2g the model *SC39ED* failed the lateral tests at its recommended force of only 1g.

Both Shure cartridges were provided with a variety of mounting hardware including stand-offs and a mounting plate, plus the ubiquitous screwdriver and a cleaning brush.

Stanton

Initial inspection of the two Stanton cartridges showed that they were clean with well mounted diamond styli. Both cartridges can be equipped with a record cleaning brush which is inserted into the front of the cartridge where it hinges on the stylus carrier assembly. The brush adds 1g to the weight of the cartridges and also reduces the tracking force by 1g hence it is necessary to increase the arm setting by 1g.

Both cartridges were supplied with mounting hardware and a rather neat little screwdriver. The cartridge assemblies were enclosed in a metal casing which was grounded to the low side of the left output. It is felt that this can introduce hum loops if the arm has a separate ground and that there should be easy means of removing the grounding to the signal connections. Whilst both cartridges looked similar there was a large difference in their ability to reject external magnetic fields, the *680SL* being excellent in this respect.

The stylus assembly, like the Shure types, pushes into the cartridge. However the Stanton stylus is considerably more substantial than the Shure types and there is little danger of damaging the styli during insertion.

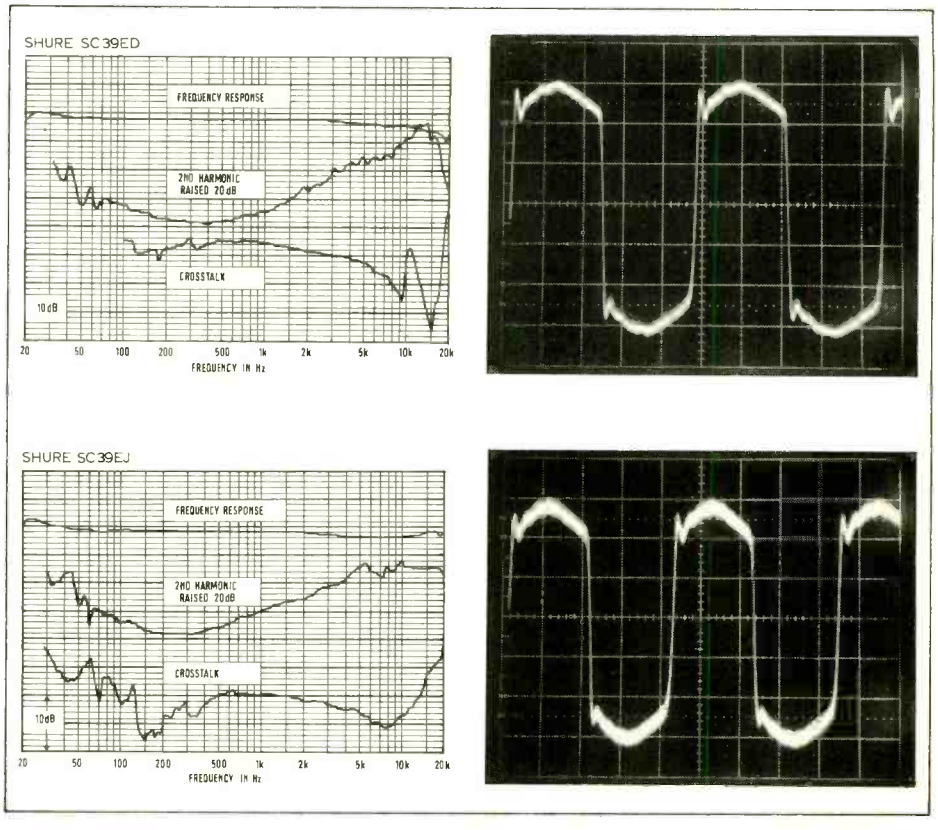
Both types have coloured stylus tips, but as the styli are well underneath the cartridge bodies and there is not any other means of cueing this task is rather difficult.

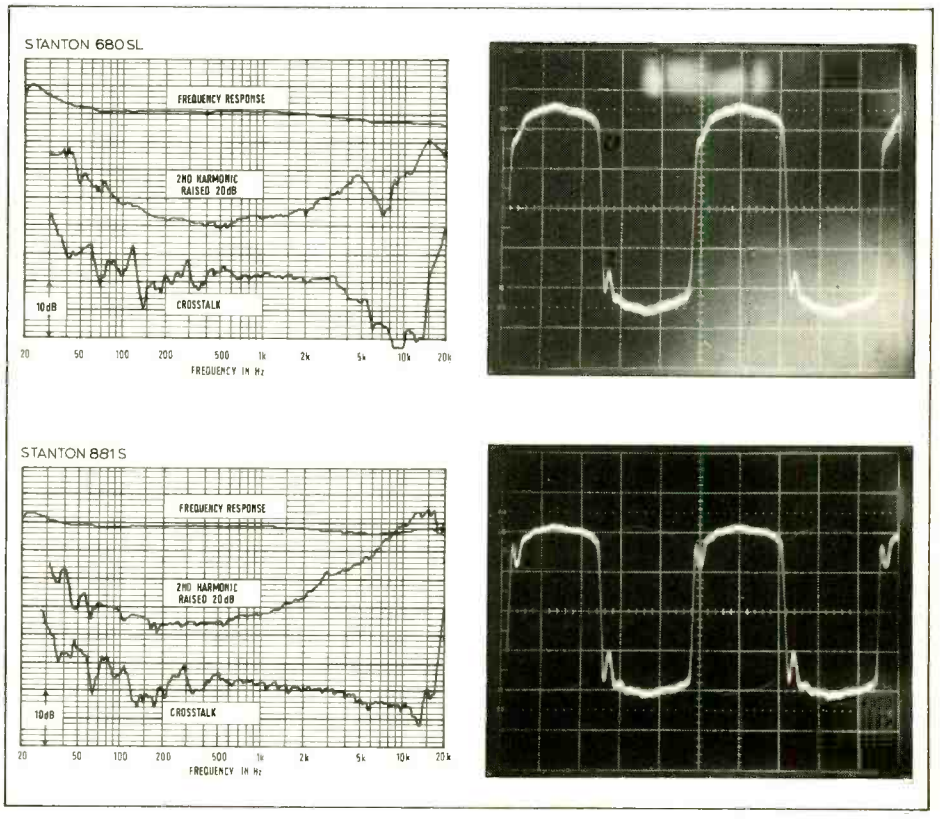
The low compliance of the type *680SL* makes it suitable for heavier pickup arms as does its maximum tracking force ability of 5g with the type *881S* with its higher compliance and tracking force range of 0.75 to 1.25g being suited to lighter pickup arms.

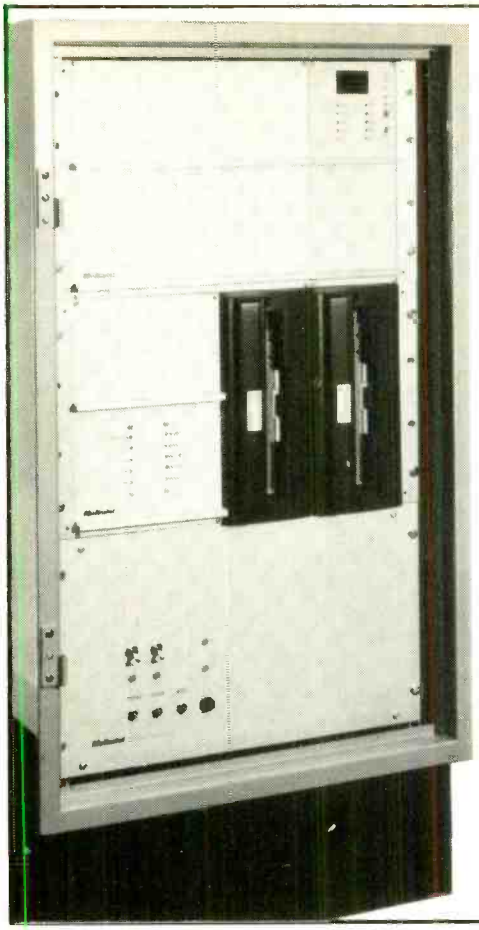
The type *680SL* gave a good tracking performance when set to 3.5g but had a rather poor balance between channels with up to 3dB difference at mid-frequencies. Also the hf response dropped seriously being −3dB at 15kHz in the horizontal mode and even worse to the extent of −5dB at 10kHz in the vertical mode.

Squarewave testing showed that the cartridge had an asymmetrical performance as shown in the oscillogram. However the crosstalk performance was excellent.

The type *881S* offered a good frequency response in all modes with a satisfactory squarewave response and also excellent crosstalk and a very good balance between the two channels in all modes. However when tracking at 1g the trackability was not up to standard and it is felt that this cartridge should be used at a minimum 1.25g tracking force. **Hugh Ford**







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Dominus stereo moving coil preamp

MANUFACTURER'S SPECIFICATION
Input impedance: resistance and capacitance may be switched separately. Resistance is 470Ω, 180Ω, 100Ω, 40Ω, 20Ω (±5%) Capacitance is 2nF, 15nF, 100nF, 500nF, 1500nF.
Input stage clipping level: −25dBV.7 (45mV rms) 20Hz to 20kHz.

Phono outputs
Connectors: colour coded phono sockets.
Signal polarity: non-inverting.
Source impedance: less than 250Ω, 20Hz to 20kHz. Minimum load 4.7kΩ in parallel with 20nF.
Clipping point: +8dBV.7 (2V rms) 20Hz to 20kHz.
Gain: 32.5dB ±0.4dB at 1kHz.
Frequency response: 20Hz to 20kHz ±0.4dB relative to 1kHz. −2dB at 100kHz allows recovery of ultrasonic information.
Linear crosstalk: loading switches set 100Ω, 100nF, outputs loaded with 47kΩ. 20Hz to 1kHz −60dB. 20kHz −50dB.
Non linear crosstalk: below noise, all conditions below clipping.
Switch-on muting: delay 13 to 16s. Will not trigger for gradual or sudden supply variations within the range 200 to 250V (90 to 120V).
Noise: with loading switches set to 100Ω, 100nF. All figures referred to input in dBV.7 (for output noise add 32.5dB).

	20Hz to 20kHz Average	CCIR 468 CCIR/ Quasi-pk	ARM 2k
Short circuit input	−137	−132	−143
3Ω source	−136	−130	−141
10Ω source	−134	−127	−138
Cartridge source 10Ω + 100Ω H	−124	−125	−136
Through IEC98-4 microgroove de-emphasis curve, unity gain at 1kHz			
Short circuit input		−139	−150
3Ω source		−137	−148
10Ω source		−134	−145
Cartridge source 10Ω + 100Ω H		−132	−143

Distortion: distortion figures apply only for source impedances which, in parallel with the selection of the input loading switches, do not exceed 80Ω at 20kHz. Output loaded with 47kΩ in parallel with 20nF.
Total harmonic distortion: at +8dBV.7 output, 20Hz to 20kHz −82dB, 0.008%. At 1kHz −86dB, 0.005%. At 0dBV.7 output, 20Hz to 20kHz −86dB, 0.005%.
Static IM distortion (50Hz + 7kHz, 4:1. With or without pre-emphasis): at +8dBV.7 output −82dB, 0.008%. At 0dBV.7 output −86dB, 0.005%.
Dynamic IM distortion (3.18kHz squarewave [single-pole −3dB at 100kHz] + 15kHz sinewave, 4:1 relative to 15kHz component): with or without pre-emphasis, 100mV peak to peak input −70dB, 0.03% measurement limit.
Radio frequency breakthrough: output level with the unit in a carrier field strength of +100dBμV/m, 84MHz, 100% amplitude modulated with 1kHz sinewave −40dBV.7.
Safety: complies with IEC 65 and BS 415.
Rating: 200 to 250Vac 50 to 60Hz, 5VA, or 90 to 110 Vac 50 to 60Hz. 5VA versions not switchable.
Dimensions: (whd) 4¾x 2½ x 8¼in (120 x 65 x 210mm).
Weight: 3.3lb (1.5kg).
Price: £190.
Manufacturer: Dominus, PO Box 1, Cranleigh, Surrey GU6 7BG, UK.

TABLE 1 Nominal load	Actual load (left/right)
20Ω	19.6/19.6Ω
40Ω	40.1/39.9Ω
100Ω	103/103Ω
180Ω	184/185Ω
470Ω	476/483Ω
2nF	1.24/1.14nF
15nF	12.8/12.2nF
100nF	100/103nF
500nF	476/482nF
1500nF	1470/1475nF

THE Dominus moving coil preamplifier is intended for interfacing low output moving coil stereo pickup cartridges with the normal IEC (RIAA) equalised input of conventional pickup preamps. The nominal fixed gain of 32.5dB (x42) raises the typical 100 to 200μV output from moving coil cartridges at 5cm/s up to 4.2 to 8.4mV which is a sensible input level for normal IEC (RIAA) magnetic cartridge inputs.

Mains powered and available in 240V or 110V versions, the amp is contained in a diecast alloy box with a smart green epoxy resin finish. At one end is the fixed power input lead of adequate length together with the power fuse which is clearly identified in value. Four good quality phono sockets provide the audio inputs and outputs, the ground side of these sensibly being isolated from the mains power earth, there being a ground terminal provided for earthing the turntable or pickup arm.

At the other end of the box there is a red power indicator light and two five position rotary switches for selecting the input loading and providing nominal shunt resistances of 20, 40, 100, 180 and 470Ω and shunt capacitances of 2, 15, 100, 500 or 1500nF. All these features are very clearly identified in white characters and beneath the box there are various operating instructions and the basic specification, four soft feet being provided.

Internally the amp is constructed from three glass fibre pcbs, one being secured to the loading switches and carrying their associated components, the second board supporting the audio amps within a screened box and the third board consisting of the stabilised power supplies and the turn-on delay relay system.

The incoming power cable was properly secured and all mains power connections insulated with sleeves or boots, the power transformer being contained in a shield. The little wiring that existed was tidy as was the overall layout. Component identifications are not included on the pcb but full layout diagrams and circuits were supplied with the amp.

Inputs and outputs
Checking the input loading showed that with the exception of the lowest capacitive values the actual input loading was close to the nominal values as shown in **Table 1**.

The output impedance of both channels was found to be adequately low at 47Ω with the intention that the amp should drive into the normal 47kΩ input of magnetic cartridge amps.

Measuring the overall gain of the two channels showed that they matched within 0.1dB with the gain being 32.4dB at 1kHz. As the amp has a fixed gain there is only a single input/output clipping point which occurred at −23.5dBm input corresponding to 2.2V output—a tremendous margin of safety.

Frequency response and noise
Measurement of the frequency response of the two channels showed them to be identical with the results being shown in **Fig 1** which demonstrates the amp to be within 0.1dB from 20kHz falling to −2.4dB at 100kHz allowing it to be used with ultrasonic systems.

Noise was measured with the inputs shorted and also with the inputs loaded with a moving coil cartridge with an internal resistance of 30Ω. As the two channels were within 0.5dB of each other only single figures are shown in **Table 2.**

No significant hum was observed and at all times the amp remained stable

Distortion
Attempts to measure the second and third harmonic distortion at any levels up to the rated output level of +8dBV.7 over the frequency range 20Hz to 20kHz showed that the distortion components remained below −85dB (0.0056%) with the distortion at 1kHz at the rated output being below −90dB (0.003%)—a creditable

94 ▶

performance.

The measurement of IM distortion to the CCIF method using two tones separated by 70Hz produced **Fig 2** when driving at the peak equivalent of the rated output, the IM Products (f2-f1) remaining below 0.01% up to 150kHz and (f2 ± (f2 – f1) remaining below 0.01% up to 70kHz.

Other matters

Crosstalk between the two channels was measured with the unwanted channel's input shorted and also with it loaded by 100Ω, the results being shown in **Fig 3**. The amp had a more than adequate performance in this respect.

The inbuilt turn-on delay of 14s allowed the amp to stabilise after switch on and operated with a minimal click in the output.

Summary

The performance of this moving coil preamplifier made under licence from Surrey Electronics was excellent with the only deviation from the specified performance being the capacitive load of the input at low capacitance values.

The unit was well made and proper servicing information was provided. **Hugh Ford**

TABLE 2

Input load	Noise at output		Noise referred to input	
Measurement method	**Shorted**	**Cartridge**	**Shorted**	**Cartridge**
22Hz to 22kHz rms	– 110dBm	– 99dBm	– 142dBm	– 132dBm
A-weighted rms	– 112dBm	– 107dBm	– 144dBm	– 139dBm
CCIR-weighted rms	– 115dBm	– 97dBm	– 147dBm	– 129dBm
CCIR-weighted peak	– 101dBm	– 92dBm	– 133dBm	– 124dBm

FIG.1
DOMINUS PREAMP FREQUENCY RESPONSE

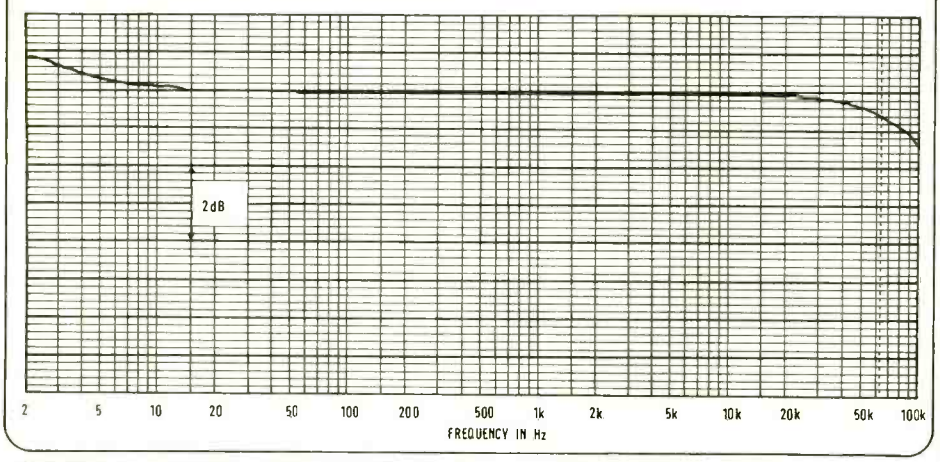


FIG.2
DOMINUS PREAMP
IM DISTORTION

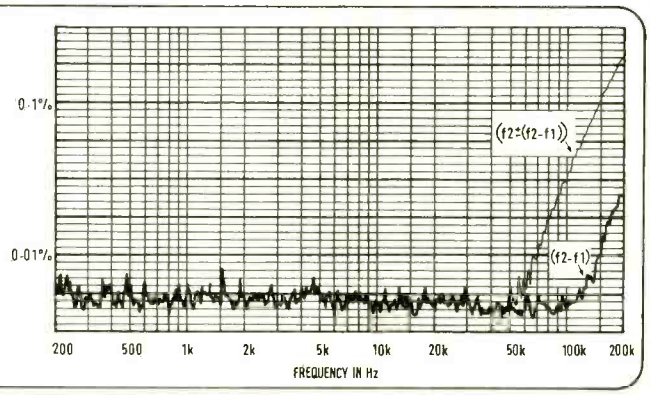
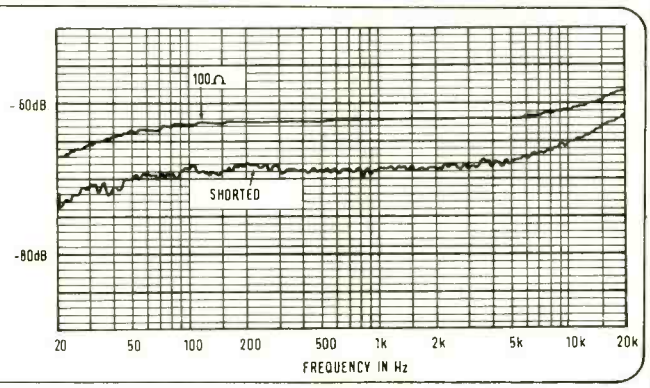


FIG. 3
DOMINUS PREAMP
CROSSTALK



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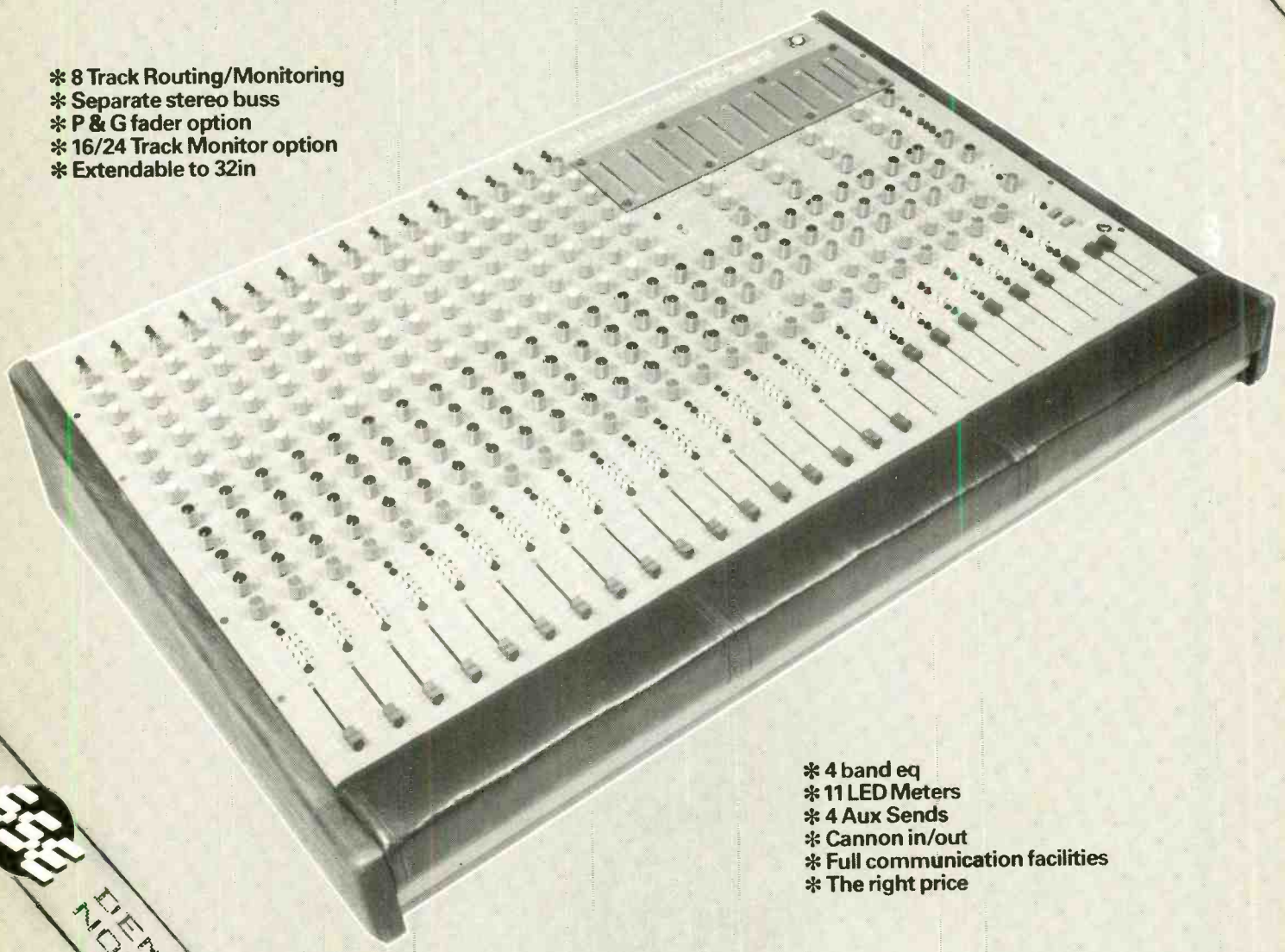

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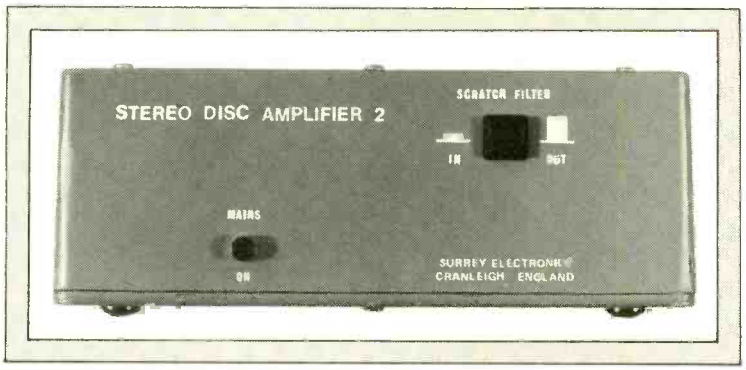
reviews

Surrey Electronics stereo disc amp



MANUFACTURER'S SPECIFICATION

Inputs: colour coded insulated phono sockets. Supply earth ground post.
Input impedance: 47kΩ ±3%, 80pF.
Outputs: electronically balanced *XLR* 3-pole male, signal polarity non-inverting.
Source impedance: 50Ω. Withstands mains or static voltages on lines either individually or common mode.
Total harmonic distortion (1kHz at −44dBV.7 [5mV] set for 0dBV.7 output loaded with 600Ω): at +10dBV.7 output below noise 30Hz to 20kHz. At +20dBV.7 output at 1kHz −88dB (0.004%), 30Hz to 20kHz −82dB (0.008%).
Static IM distortion: (50Hz + 7kHz, 4:1) at +10dBV.7 −90dB, 0.003%, measurement limit. At +20dBV.7 output −82dB, 0.008%.
Dynamic IM distortion: 3.18kHz squarewave (single-pole −3dB at 100kHz) + 15kHz sinewave, 4:1. Relative to 15kHz component. Pre-emphasised input 500mV pk-pk −70dB, 0.03% measurement limit.
Noise: 20Hz—20kHz mean reading meter −71dBV.7 short circuit input, −68dBV.7 cartridge source, (1H + 1kΩ). CCIR468-2 weighting and peak meter −64dBV.7 short circuit input, −56dBV.7 cartridge source, (1H + 1kΩ). CCIR/ARM reference 2kHz −75dBV.7 short circuit input, −67dBV.7 cartridge source, (1H + 1kΩ).
Radio frequency breakthrough: output level in a carrier field strength of +100dBμV/m, 84MHz, 100% amplitude modulated with 1kHz sinewave. 1m input lead with source 1H + 1kΩ less than −70dBV.7.
Crosstalk: linear 1kHz −76dB, 30Hz to 20kHz −60dB. Non linear below noise, all conditions below clipping.
Frequency response accuracy: to inverse of IEC98-4, RIAA recording characteristic 30Hz to 20kHz within 0.5dB.
Low frequency response: 18dB/octave −3dB at 24Hz, 20Hz and below exceeds IEC98-4 replay requirements.
Cartridge impedance interaction on frequency response: high inductance cartridge, (1H + 1kΩ) less than 0.2dB.
High frequency filter: front panel switch 10kHz, 18dB/octave. Change in response at 8kHz or below within 0.5dB.
Differential phase shift between left and right channels: 50Hz to 20kHz within 0.5°. Worst error at lf and hf filter turnover within 5°.
Clipping at 1kHz: +24dBV.7.
Clipping point complementary to IEC98-4 recording characteristic: 30Hz to 20kHz within 1dB. Clipping determined by onset of peaky distortion products or total harmonic distortion exceeding −80dB.
Sensitivity at 1kHz: 2.8 – 13mV (−49 to −36dBV.7) for 0dBV.7 output, adjustable.
Supply input: IEC connector 90 to 120V or 200 to 250V, 50 to 60Hz 10VA.
Safety: complies with IEC65-2, BS415.
Dimensions: (whd) 7½ x 2¾ x 7½in (190 x 70 x 190mm).
Weight: 3.5lb (1.6kg).
Price: £255.
Manufacturer: Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey, UK.

THE Surrey Disc Amplifier *2* is a stereo amp intended for use with magnetic cartridges requiring standard equalisation inverse to the IEC98-4 (or RIAA) standards which define the recording characteristic.

Intended for professional use, the amp has good quality phono socket inputs with isolated earths and a separate grounding terminal connected to the chassis which is earthed through the mains power lead. Both outputs are electronically balanced connections fed via *XLR* plugs and capable of driving well in excess of +20dBm loaded into 600Ω. The remaining features to the rear of the unit are the IEC standard power connector with a nearby power fuseholder.

All these features are very clearly identified as is the scratch filter switch to the front of the unit which also includes a red power indicator lamp.

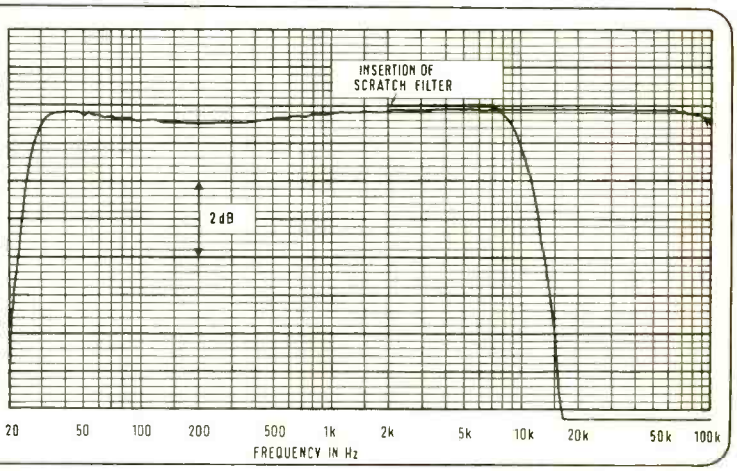
The form of construction is an alloy diecast square box finished in light blue with clear white legends with four soft feet provided in the base of the box.

Internally the complete electronics for both channels and the stabilised power supplies are mounted on a single glass fibre pcb which is secured to the top of the unit with chromium plated screws.

All ICs are socketed for easy replacement. Whilst there are no component identifications on the pcb the instruction sheets provide a clear component layout together with circuits and alignment instructions. Each channel has two preset pots for setting dc conditions in the output stages plus a multiturn pot which may be accessed through the side of the unit for setting overall gain.

Each of the output stages is protected against shorting either leg of the outputs by internal 125mA fuses on the pcb, the value of these fuses being indicated on the outside of the amp. In addition to full screening of the amp by the diecast box the power transformer has electrostatic screening and is in addition being enclosed in a mumetal screen.

FIG.1
STEREO DISC AMP TYPE 2B FREQUENCY RESPONSE



Inputs and outputs

Checking the impedance of the two inputs showed that the resistive components were very close to the nominal 47kΩ being 47,170Ω and 47,303Ω with the shunt capacitances being 77.5pF and 91.0pF. These are adequately low for the input leads and padding if desired to make up the optimum for the type of cartridge in use which will probably be around 300pF.

The maximum input level was found to be controlled by the saturation of the output stages, giving an input clipping point of 280mV at 1kHz with the minimum gain setting. When used in the balanced output mode the overall gain at 1kHz could be adjusted from 50.5dB down to 34dB giving a useful gain trim range for any normal magnetic cartridges and studio operating levels.

As the amp output is electronically balanced, when used unbalanced only, a single output terminal is used with reference to ground. Thus, the overall gain is reduced by 6dB as is the maximum output level which was found to be 25.4dBV.7 in the balanced mode with the output impedance being 23Ω in each leg of the output.

As received the unit had 44.3dB gain in both channels and for the purpose of most measurements this was reset to 40dB which would be a useful gain setting for many purposes.

Frequency response and noise

Fig 1 shows the overall frequency response with and without the scratch filter in circuit as plotted

98 ▶

using an inverse RIAA network with 0.2dB accuracy. Spot checks showed that the precise frequency response was in fact even better than the excellent results shown in the plot which was made at maximum gain. Lowering the gain extended the hf response flat up to 200kHz and had little other effect.

Checking the −3dB points showed that the lf roll-off was almost identical for both channels with the −3dB points being at 21.7Hz and 21.6Hz with a satisfactory rate of attenuation of 18dB/octave.

Inserting the scratch filter provided a similar high frequency roll-off at 18dB/octave with both channels having identical −3dB points at 12.5kHz.

Noise in the output was measured with the inputs shorted and also with the inputs loaded with a screened cartridge with a resistance of 625Ω and an inductance of 700mH. Both channels were found to be identical with the results being shown in **Table 1**.

Distortion

Attempts to measure the second and third harmonic distortion showed that the amp had extremely low distortion at any level up to output clipping at any frequency within the audio band with the distortion in all cases being below −90dB (0.003%).

Measuring IM distortion to the CCIF method using two tones separated by 70Hz at +10dBm output produced **Fig 2** which shows that again the distortion levels are very low, being less than −80dB (0.01%) in most cases in the audio band with the second order difference frequency (f1−f2) rising above 20kHz and the third order difference frequency (f2±(f2−f1) appearing at even higher frequencies.

Other matters

Crosstalk between the two channels was measured with the input to the undriven channel loaded with the cartridge used for noise measurement. The excellent results are shown in **Fig 3.**

Summary

The performance of this disc amp was to the highest standards and the overall conception makes it compatible with professional use in broadcast and similar applications.

The standard of construction was good and it was nice to find that full servicing information was provided together with sensible instructions and a full specification.

Hugh Ford

TABLE 1

Measurement method	Noise at output		Noise referred to input	
	Shorted	Cartridge	Shorted	Cartridge
22Hz to 22kHz rms	−74.0dBm	—	−114.0dBm	—
A-weighted rms	−79.5dBm	−75.0dBm	−119.5dBm	−115.0dBm
CCIR-weighted rms	−72.5dBm	−66.0dBm	−112.5dBm	−106.0dBm
CCIR-weighted quasi peak ref 1kHz	−68.5dBm	−62.0dBm	−108.5dBm	−102.0dBm

FIG. 2
STEREO DISC AMP
TYPE 2B IM DISTORTION

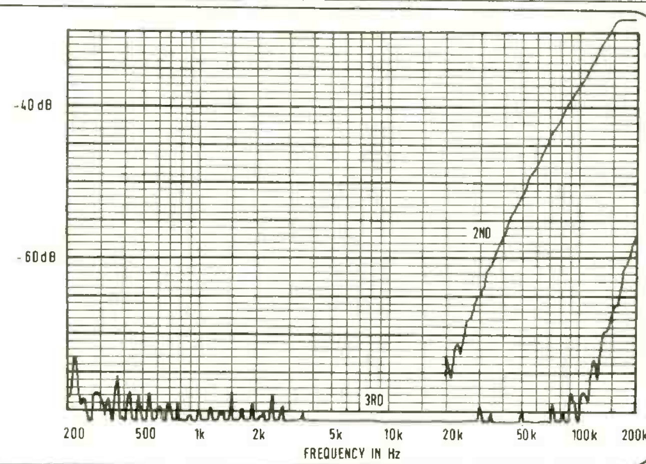
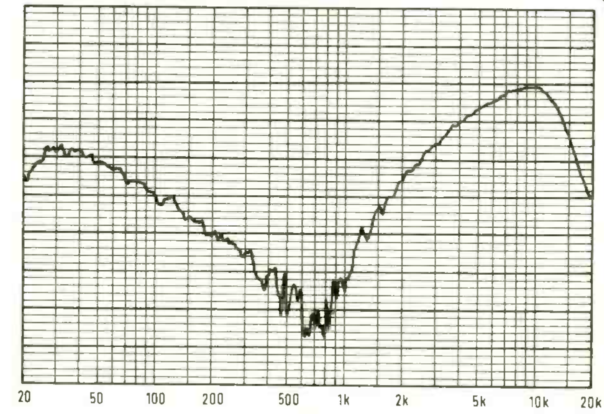


FIG. 3
STEREO DISC AMP
TYPE 2B CROSSTALK



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LHD	— 1	Line Headphone Driver	£6.30
GPA	— 1	General Purpose Amplifier	£5.48
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SUB	— 1	Subsonic Filter	£6.20
MAG	— 1	Disc Pre-Amplifier (Moving Magnet)	£8.70
CM	— 1	Complete Channel Module	££75.26*
CM	— 2	Complete Channel Module (with EQ defeat switch and additional features)	£85.24*
CM	— 4b	Complete Channel Module. Parametric Mid Range 300 Hz to 6.5 KHz Q switchable	£98.50*
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MT	— 1	Microphone Transformer	£14.50 net
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Stanton 310

stereo phono preamp

MANUFACTURER'S SPECIFICATION
Output: + 20dBm maximum.
Frequency response: ± 0.5dB from 20Hz to 20kHz in flat or NAB positions of mode selector.
Distortion: total harmonic distortion 0.05% at + 20dBm.
Output source impedance: 5Ω, designed for loads 150Ω or higher.
Gain: adjustable 30dB to 60dB.
Rumble filter: 3dB knee at 28Hz, – 35dB at 5Hz.
Maximum input level: at 1kHz 120mV.
Noise (input terminated by cartridge): – 70dB or better (ref 10mV input at 1kHz NAB curve, 44dB voltage gain). – 74dB or better with rumble filter in.
Input resistance: 47kΩ.
Input capacitance: 15pF, switchable in 50pF steps to 350pF maximum.
Channel separation: 60dB minimum (20Hz to 15kHz).
Input connectors: RCA phono jacks.
Output connector: 5-terminal barrier strip.
Power requirements: can be switched or strapped for 100 to 125Vac, or 200 to 240Vac, 50 to 60Hz, 5W max.
Indicators: LED pilot light.
Dimensions: (whd) 7 x 2¼ x 5in (184 x 57 x 127mm).
Price: £166.
Manufacturer: Stanton Magnetics Inc, Terminal Drive, Plainview, New York 11803, USA.
UK: Wilmex Ltd, Compton House, New Malden, Surrey.

THE Stanton model *310* stereo phono preamplifier is intended to raise the level from magnetic pickups to line level whilst optionally providing the IEC (RIAA) equalisation, the hf section of which is adjustable.

To the rear of the unit are the signal inputs in the form of rather 'run-of-the-mill' quality phono sockets and the signal outputs available at a barrier strip, the output connections being unbalanced single ended outputs. The barrier strip also includes an earth terminal and it was considered unfortunate that the signal and safety earths are commoned and connected to the power line earth—good luck with hum loops! It was also found that the mounting brackets appeared to have an anodised finish which is usually insulating until it is scratched—a good source for an intermittent ground loop.

Also at the rear is the fixed (US colour coded) power cord with an adjacent slide switch power line voltage selector covering 230V and 115V. Because this switch was intended for operation by hand without the need for tools this was thought to be a potentially disastrous arrangement and the manufacturer should replace this switch with a type which cannot be operated without the use of tools.

The final rear panel facility is a 6-way DIL switch, access to which is through a hole in the panel, the switch providing capacitive loading of the two inputs by shunting them with any combination of 50pF, 100pF and 200pF.

At the front to the left there is a power on/off locking pushbutton switch with an adjacent LED power indicator, this switch and the other two on the front panel being of the 'self illuminating' type. Recessed behind the panel to the right are two multiturn pots for adjusting the gain of the two channels.

Proceeding further to the right a locking pushbutton switch allows the insertion of a highpass rumble filter, two holes in the panel give access to two screwdriver operated trimmer capacitors which adjust the hf equalisation and a third pushbutton switch switches the complete equalisation curve in or out of circuit.

All features of the black and satin finish front and rear panels were clearly identified with a blue coloured 'U-shaped' case providing the top cover and sides, the case being provided with two mounting brackets and the bottom of the unit having soft feet.

Internally the complete electronics were mounted on to a single glass fibre pcb with clear component identifications for servicing. A full circuit diagram was provided in the instruction manual which also had a parts list and quite good operating and alignment instructions. (I found the combinations of Khz, Hz, dB, DB, etc. rather careless!)

Generally the layout of the pcb was tidy, but inspection of the mains power distribution revealed that tracks directly connected to the mains were far too close to parts connected to the chassis to meet the safety requirements of BS415.

Inputs and outputs

Measurement of the resistive component of the input impedance showed that this remained very close to the nominal 47kΩ irrespective of gain with the capacitive component being as follows for the various settings of the loading switches as shown in **Table 1.**

TABLE 1

Switch setting	Left	Right
All out	19.0pF	19.0pF
50pF	68.0pF	66.5pF
100pF	127.0pF	120.0pF
200pF	237.0pF	225.0pF

The available range of capacitive loading is more than adequate for various cartridge types as is the gain range which was from 31.4dB to 61.6dB at 1kHz with the equalisation in, increasing 0.2dB when the equalisation was switched out.

Input clipping was at a very high level, being – 11dBm without the rumble filter in circuit or – 15dBm with the filter in circuit—more than adequate.

Output overload occurred at + 20.5dBm loaded into 600Ω with the output impedance being extremely low.

Frequency response and noise

The overall frequency response of both channels

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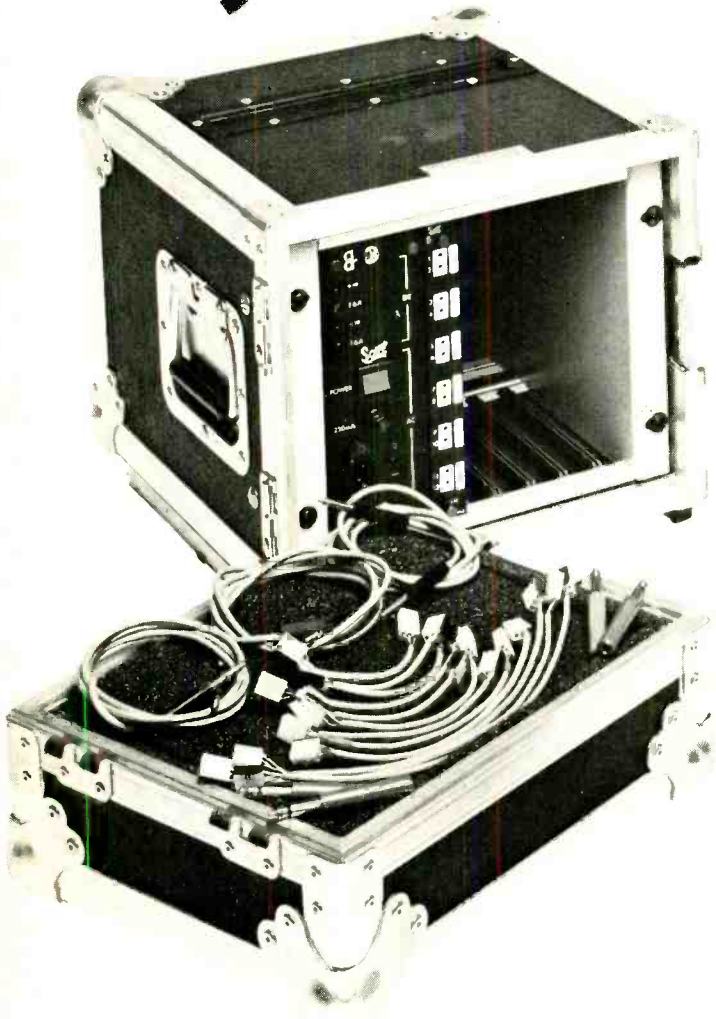
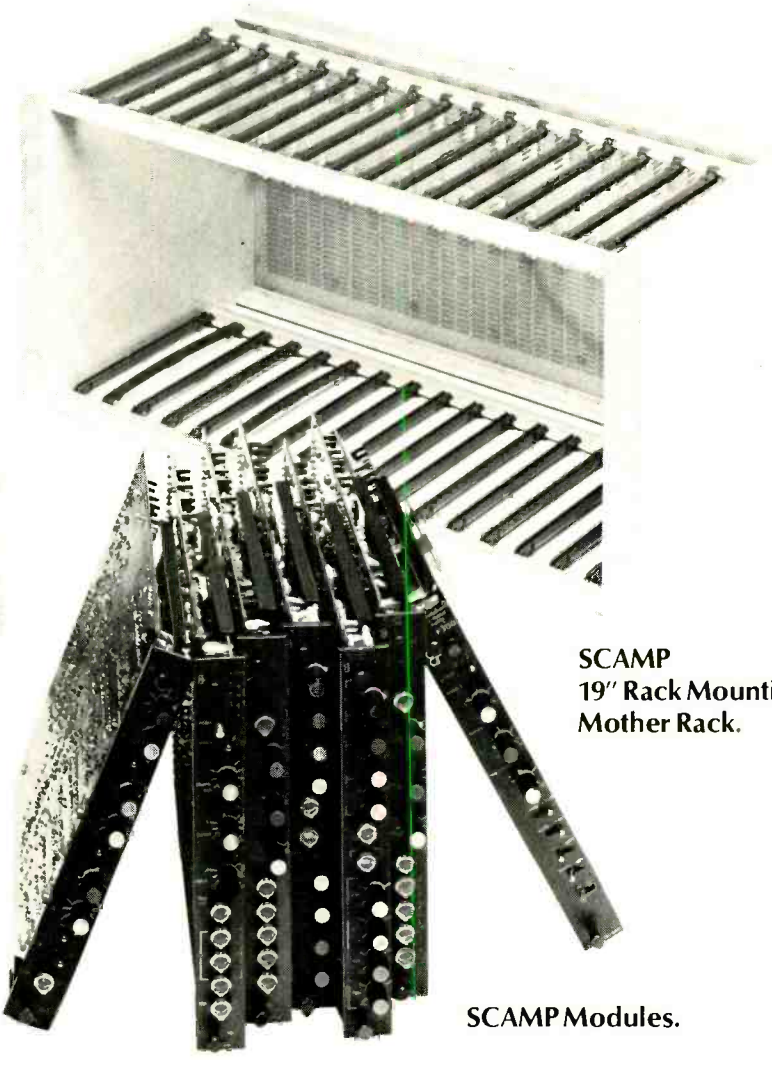
Now there's a Scamp System for everybody.



SCAMP Mini-Rack, comprising robust flight case, S26 Power Supply, S12 Jack Module, Mini-Rack and complete connector kit.



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was found to be identical in the 'flat' mode, this condition being shown in **Fig 1** with and without the rumble filter which is a 12dB/octave filter with its −3dB point sensibly placed at 28Hz. It was however noted that the insertion of the filter gave a slight booost in the 50Hz region as shown in **Fig 1**. Otherwise the frequency response was very flat in the unequalised 'flat' mode.

Investigating the performance in the equalised mode using an inverse IEC (RIAA) network accurate to 0.2dB produced **Fig 2**. In the upper curves the extreme settings of the hf equaliser are shown, it being seen that at 10kHz a +3dB, −1dB range is available. Tuning the equalisers for the closest match to the IEC (RIAA) characteristic for the two channels produced the lower curves in **Fig 2** with the best frequency response being +0.1dB, −0.3dB with respect to 1kHz.

Noise was measured with the equalisation set for the best fit to the IEC (RIAA) curve with the inputs shorted and also with the inputs loaded with a cartridge having a resistance of 625Ω and an inductance of 700mH.

Referring the output noise to the input showed that the effective input noise was very good and constant with the gain setting. Adding the gain (31.4dB to 61.7dB) to the figures in **Table 2** provided the noise at the outputs. So good was the performance that it was double checked, both channels being found to be identical except for the unweighted measurement where slight mains hum was found in the left channel.

TABLE 2

Measurement Method	Noise referred to input	
	Shorted	Cartridge
22Hz to 22kHz rms	−118dBm	−116dBm
A weighted rms	−125dBm	−122dBm
CCIR-weighted rms ref 1kHz	−119dBm	−112dBm
CCIR-weighted quasi-peak	−115dBm	−108dBm

Distortion

Measuring the second and third harmonic distortion at output levels up to the rated +20dBm showed that the third harmonic was consistently less than −80dB (0.01%) with the second harmonic following suit when working into a high impedance, but when working into 600Ω rising to around −70dB (0.03%) over most of the audio frequency band at +20dBm output, but falling at lower output levels.

Plotting the twin tone CCIF intermodulation distortion at the peak equivalent of +20dBm sinewave output produced **Fig 3** showing that the second order (f2-f1) and third order (f2 ± (f2 − f1) were very low up to 40kHz.

Other matters

The crosstalk between the channels with the unwanted input loaded with the cartridge used for noise measurement produced **Fig 4** showing that crosstalk was below −60dB up to 6kHz rising to −50dB at 15kHz.

Summary

Whilst the electrical performance of the Stanton preamplifier was very good I feel that the grounding arrangement could cause problems, particularly as the output is unbalanced.

The manufacturer should modify the voltage selector switch so that it cannot be accidentally operated and should also attend to the track layout of the pcb to improve the electrical safety.

Hugh Ford

FIG. 1 STANTON 310 FREQUENCY RESPONSE IN 'FLAT' MODE

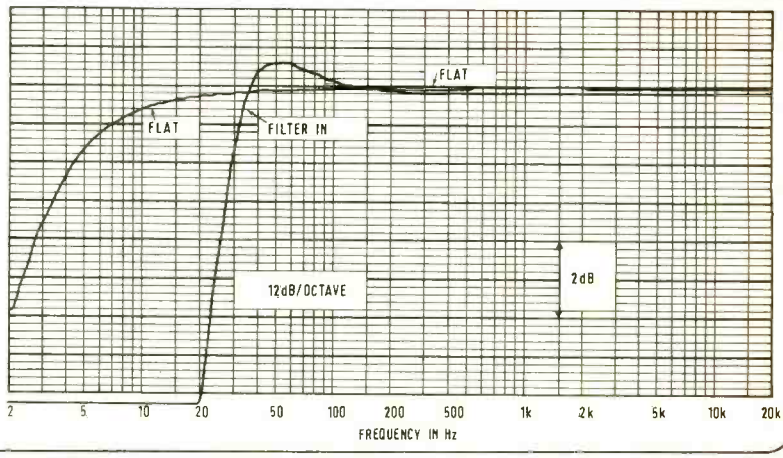


FIG. 2 STANTON 310 EQUALISED FREQUENCY RESPONSE

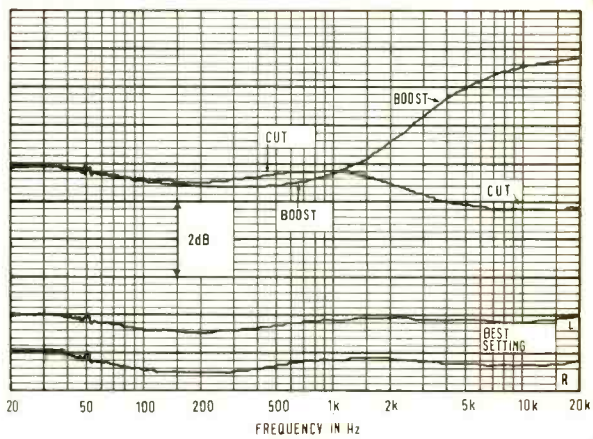


FIG. 3 STANTON 310 IM DISTORTION

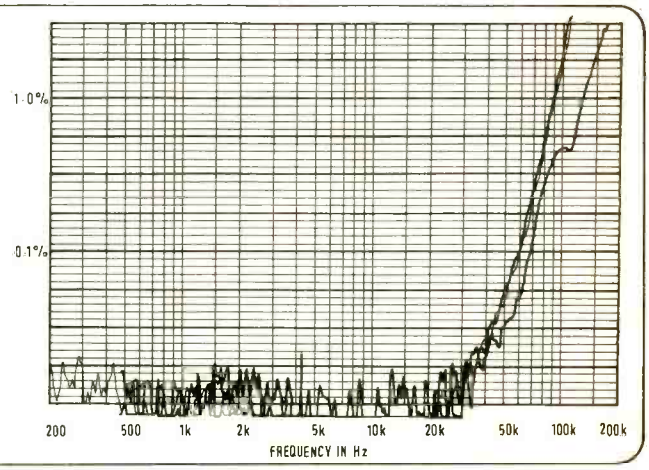
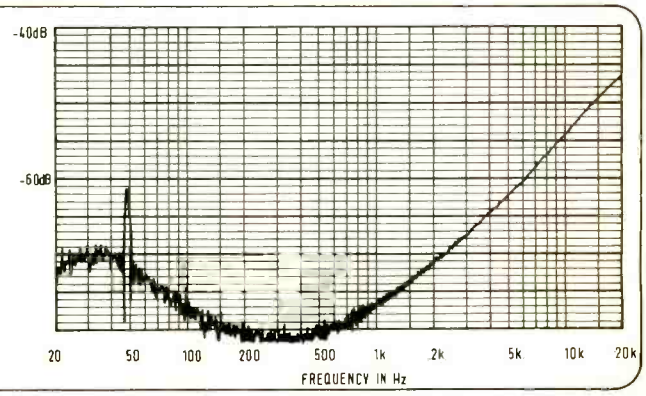


FIG. 4 STANTON 310 CROSSTALK



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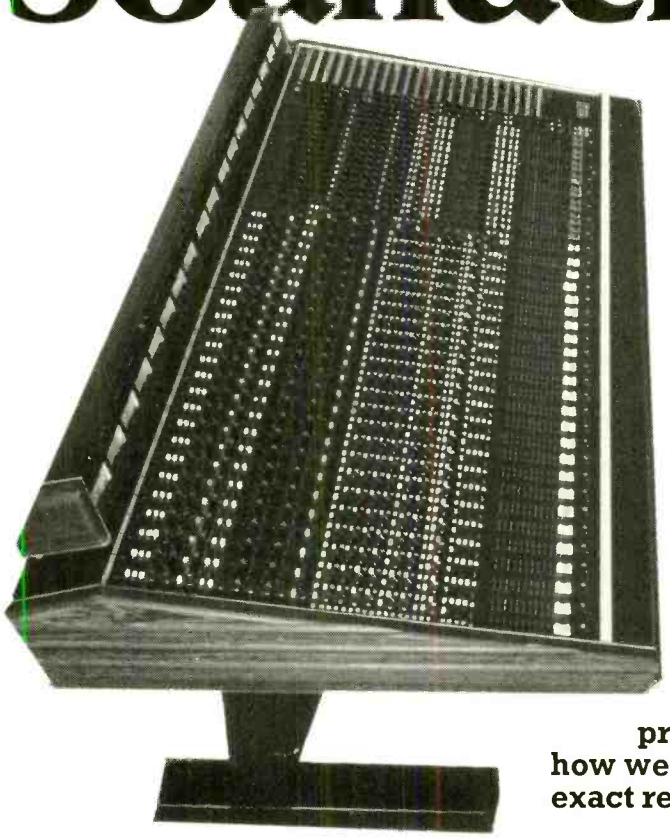

The Package Revolution

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

The long awaited 24 track alternative. Excellent specs, inclusive remote autolocator and a highly competitive price. The full range, including the 8 track workhorse and the 16 on one and two inch are in stock.

Specs & Prices

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As appointed UK main dealer, we offer full before and after sales service on all Soundcraft products.

Series 800 – Immediate release

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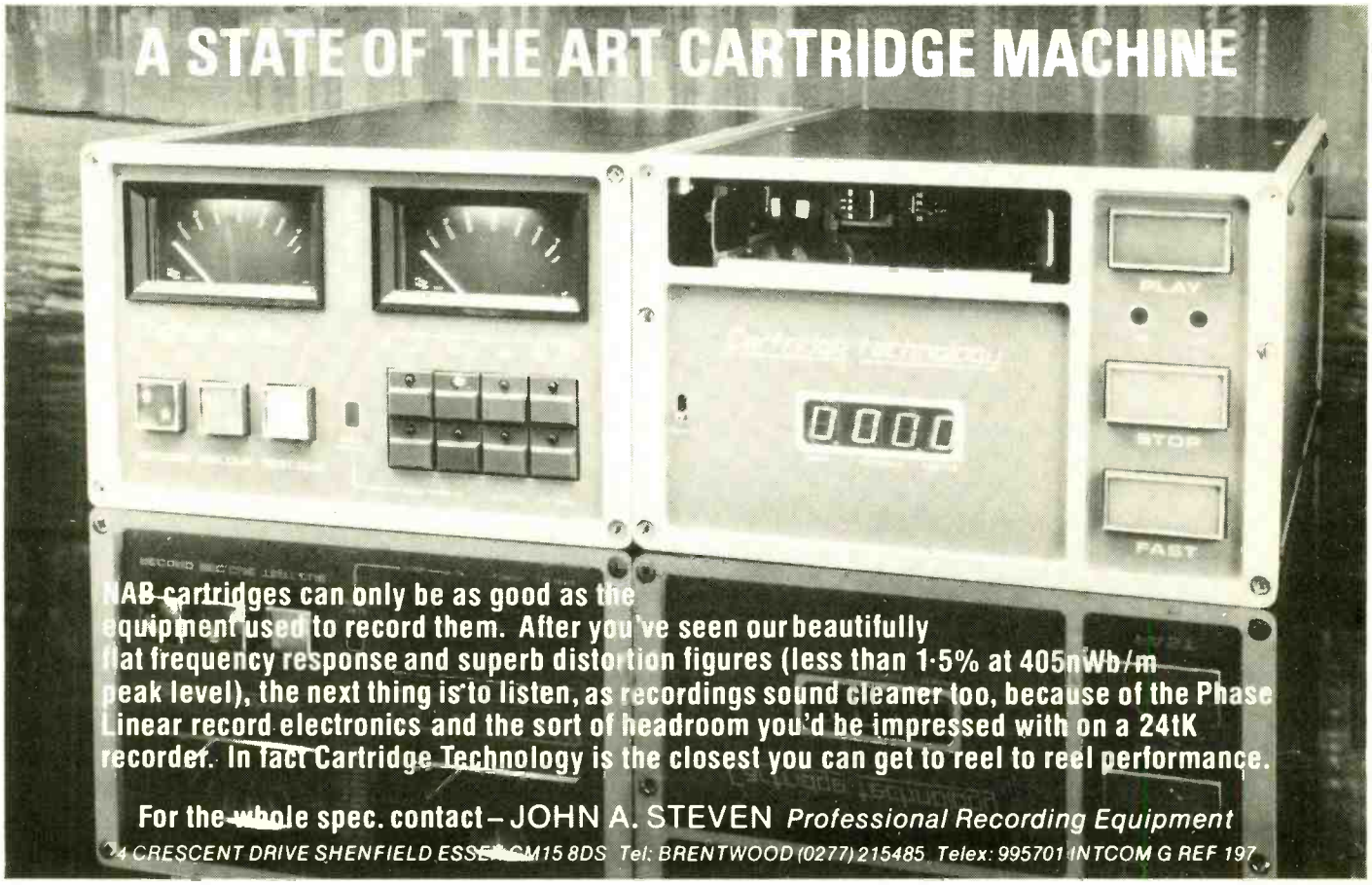
A STATE OF THE ART CARTRIDGE MACHINE



NAB cartridges can only be as good as the equipment used to record them. After you've seen our beautifully flat frequency response and superb distortion figures (less than 1·5% at 405nWb/m peak level), the next thing is to listen, as recordings sound cleaner too, because of the Phase Linear record electronics and the sort of headroom you'd be impressed with on a 24tK recorder. In fact Cartridge Technology is the closest you can get to reel to reel performance.

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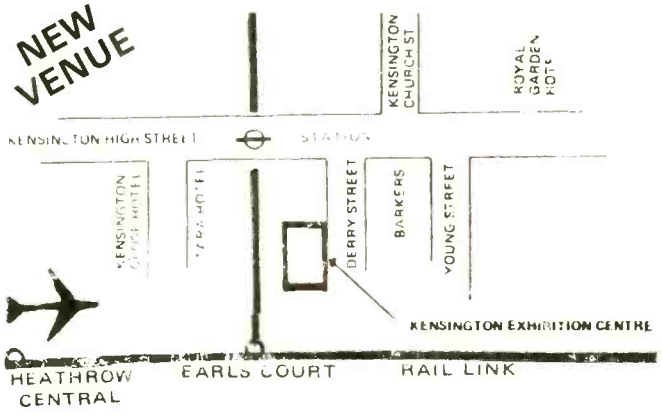

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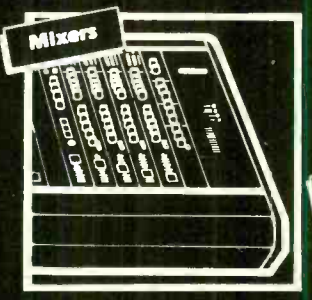

Our range includes, Alice, AHB, Amek, APSI, HH, RSD, Studiomaster, Soundcraft, Trident & MCI.

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Mics by AKG, Beyer, Calrec Neuman, Shure & Sennheiser. Ampex tape (bulk purchase discount), leader tape – all colours, editing blocks, blades, splicing tape, demagnetisers, cleaning kits etc.

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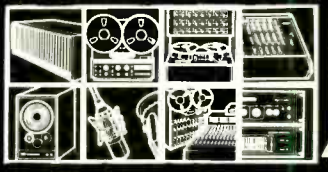

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The ideal mastering machine for the small studio giving really excellent results at a reasonable price. And for those who want to go even better we also stock the Revox A700.

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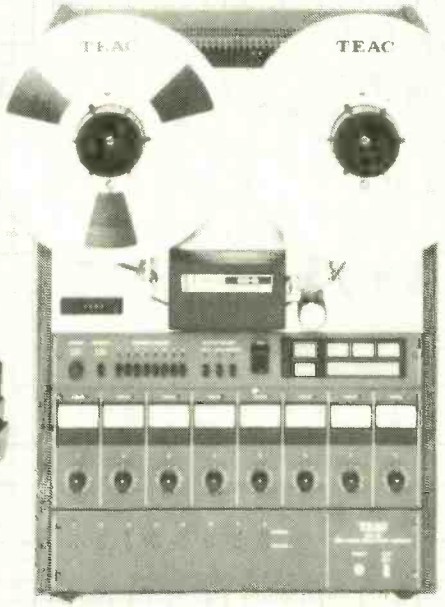

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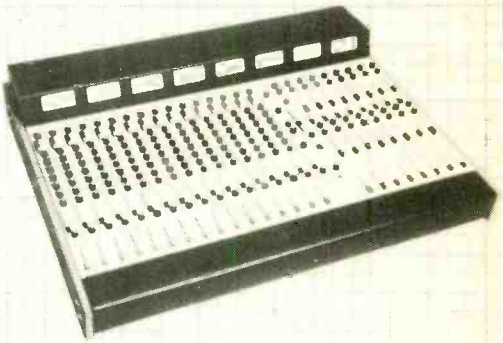

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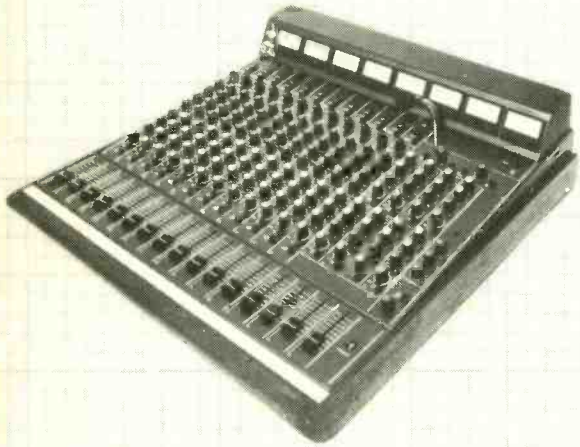

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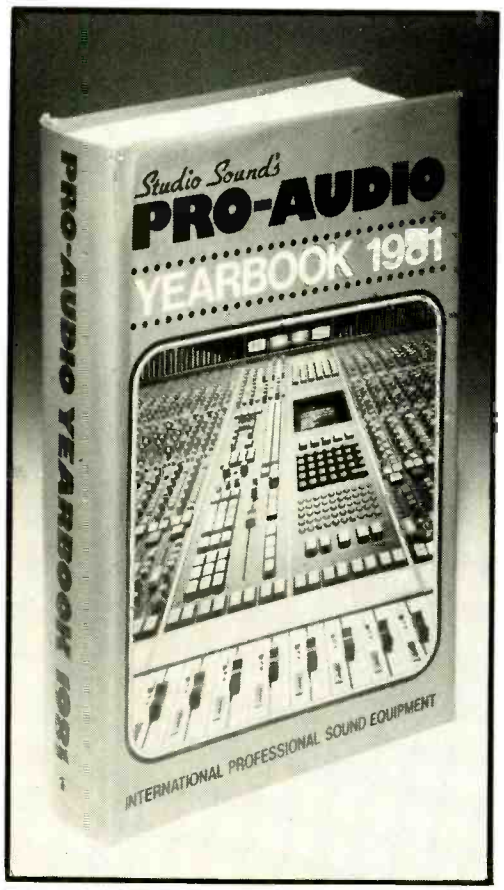

From the publishers of the monthly magazine *Studio Sound*, the *Pro-Audio Yearbook* is the latest addition to a series of comprehensive annual publications providing extensive coverage of the ever expanding audio and video markets. The *Pro-Audio Yearbook* is divided into two parts, the first covering Pro-Audio Equipment and Services, the second various indexes. Different sections cover every conceivable aspect of the pro-audio business, ranging from amplifiers through mixing consoles to tape recorders, with most sections being profusely illustrated and containing up to date prices for most of the products featured.

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Publication May 1981

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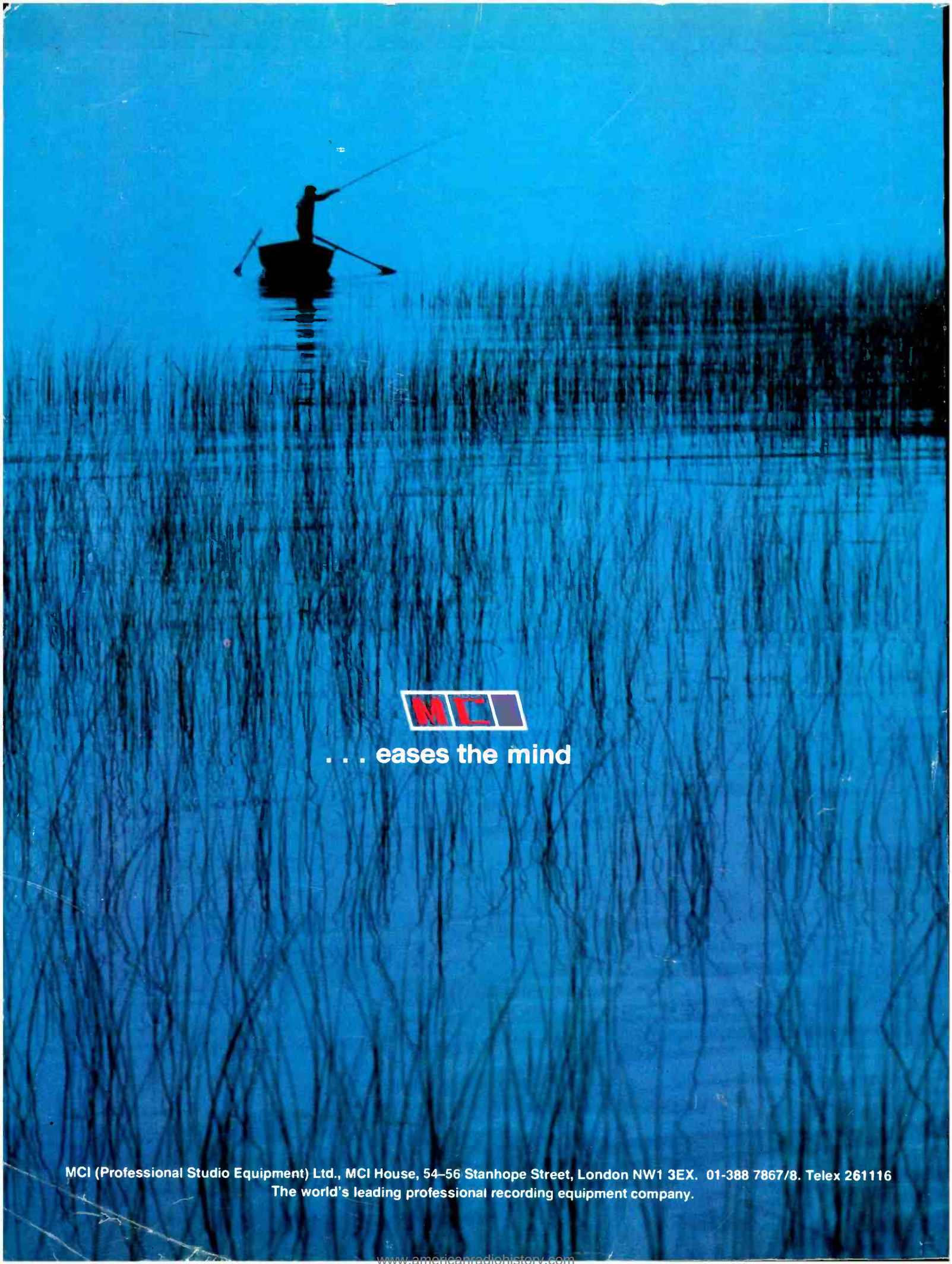

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