

studio sound

March 1980 75p

AND BROADCAST ENGINEERING



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A LINK HOUSE PUBLICATION

studio sound

AND BROADCAST ENGINEERING

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February 1980 provides two celebrations for *Studio Sound*—21 years ago the magazine was launched as *The Tape Recorder*, and exactly 10 years ago it changed its name to *Studio Sound*. The magazine has changed considerably since its early days—when it concentrated on what one could loosely call amateur recording. The first issue of *The Tape Recorder* was published in February 1959 by Miles Henslow Publications, Miles also being the magazine's editor. Typical advertisements from that period promoted the Brenell 3 Star, Simon SP4, Repts (Tape Recorders) Ltd, the *Stuzzi Mambo*, REW, Lustraphone, British Ferrograph Recorder Co, Emitape, Elizabethan, Francis of Streatham, Teletape, Metrosound Manufacturing Co, Grundig and Vortexion. Few of these companies are still around in their original form, although some now trade under new names (Magnetic Tapes Ltd is run by Tom Repts for instance). Five years later in June 1964, having dropped 'The' from the name, to be plain *Tape Recorder*, the magazine was sold to the present publisher, Link House Publications Ltd in Croydon, together with *Hi-fi News* which is still our sister publication covering the other end of the market.

By far the most popular series of articles that *Tape Recorder* ran was 'A studio quality audio mixer' designed by David Robinson and published in 1964, followed by the updated series in 1970 'A high quality mixer'. Looking back over the 1964 version is quite an experience, seeing microphone amplifiers with ancient AC107, OC44 and OC202 transistors, while the 1970 update utilised BC109s—of course today it would all be op-amps. 1970 was also the year that *Studio Sound* was born. There was a transition period while *Tape Recorder* slowly became *Studio Sound*; the new name first appeared, albeit in small face, on the cover of the February 1970 issue, and running alone from July. The magazine as it is known today developed over the following two years into a publication aimed directly at the professional audio business (rather than amateur recording in the early days), but then of course there was no professional recording business back in 1959 because record companies basically produced and recorded all their own discs, many pressing them as well. *Studio Sound* has also provided 'spin-offs' over the years. In the early Seventies, *Studio Sound* slowly became involved with the then rapidly expanding video business, and in 1975 a new magazine *Video & Audio Visual Review* started, taking with it the then editor of *Studio Sound*, while 1977 saw the publication of the first annual *Video Yearbook*. *Sound International* was launched in 1978 to cater for semi-professional audio, and 1980 sees the prospect of four new annual Yearbooks variously aimed at pro- and semi-pro audio markets.

Looking back over the last 10 years, I hope that we have achieved our original purpose of keeping professionals fully informed in all aspects of the pro-audio business, and that the next 10 years will be just as successful—certainly if demand for copies remains at its present level, we'll know that we're on the right track.

Cover of EECO MQS 100 synchroniser with a pair of Ampex MM1200 multi-tracks, by Adrian Mott and Ray Hyden

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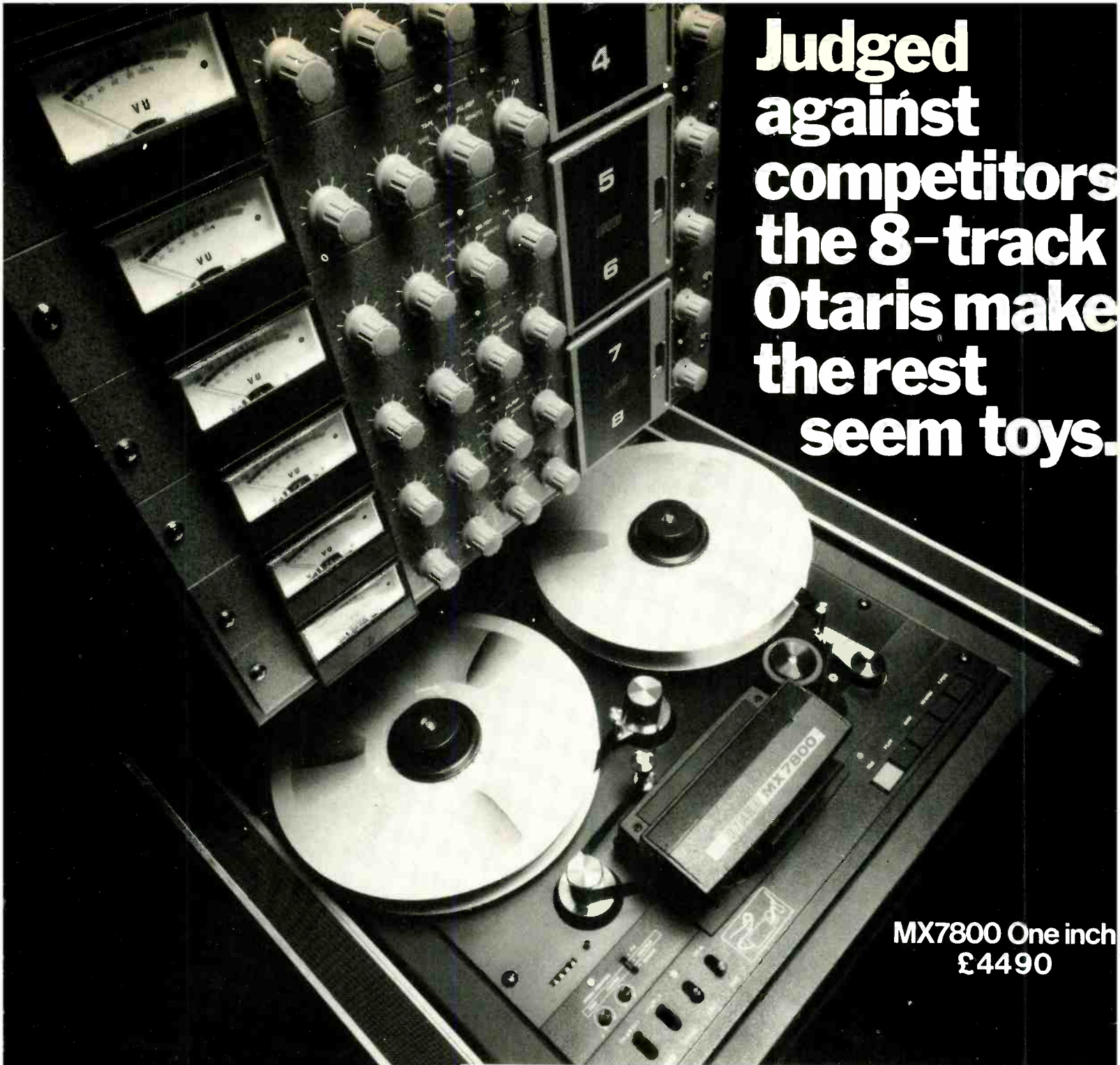
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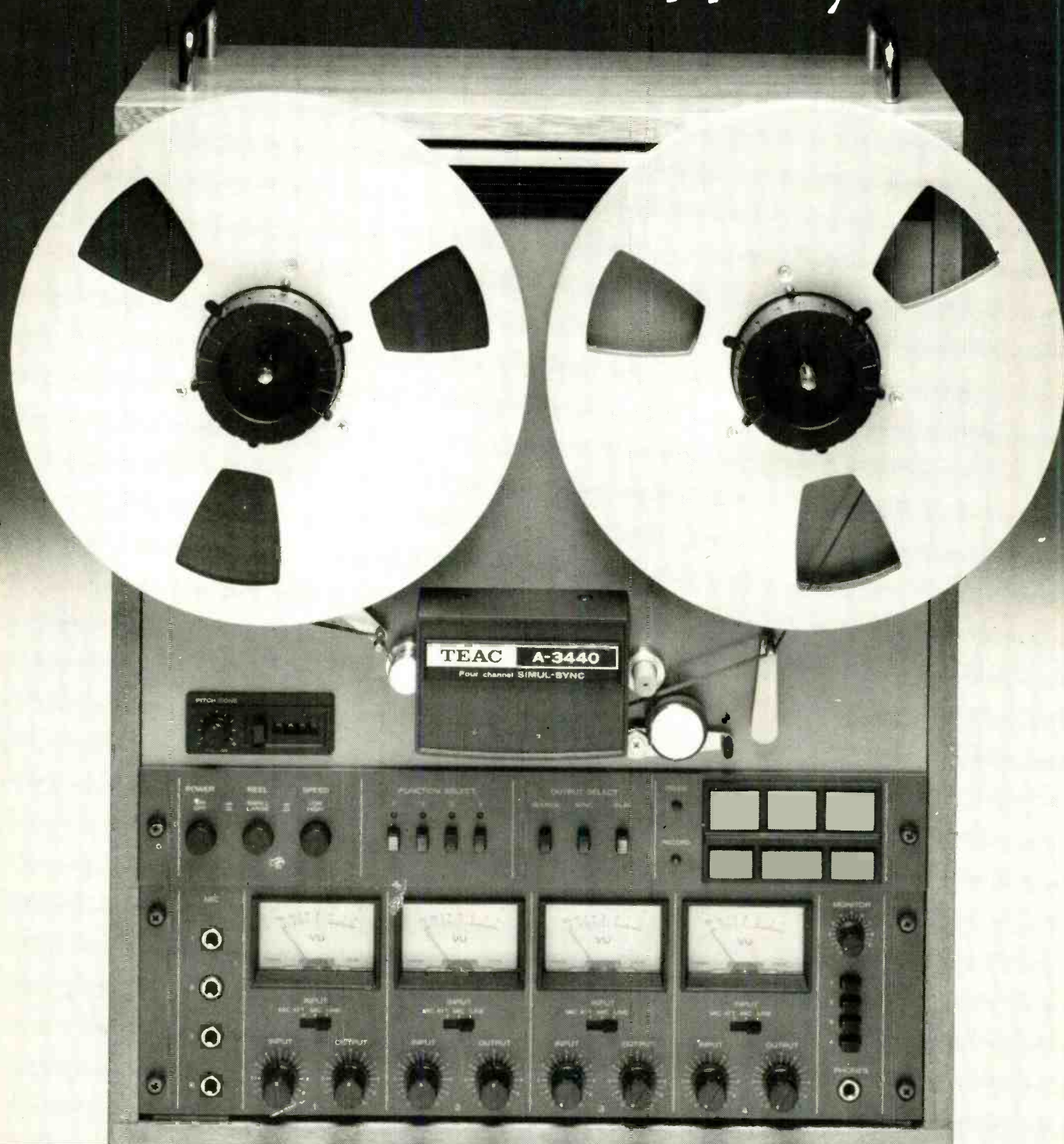
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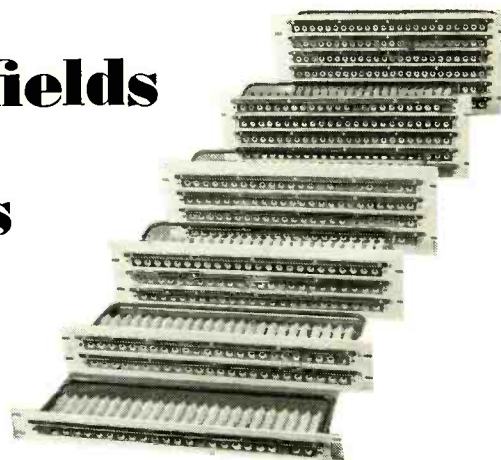
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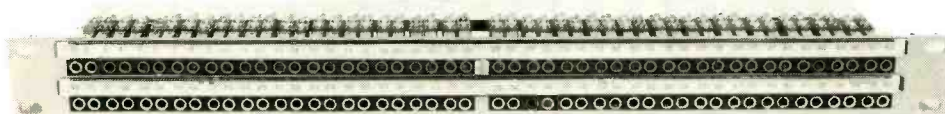
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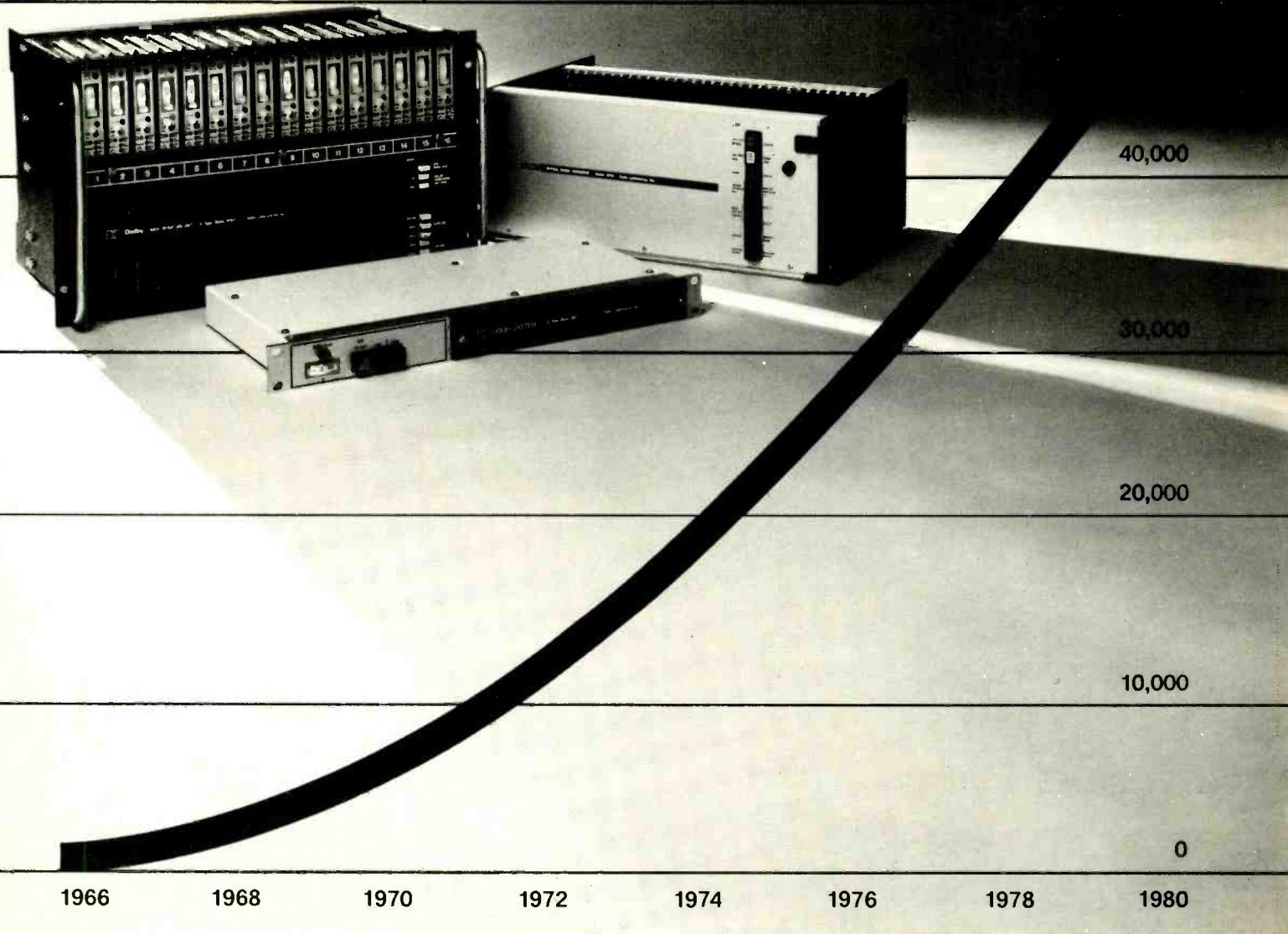
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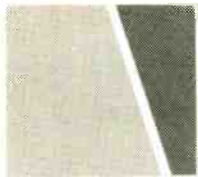


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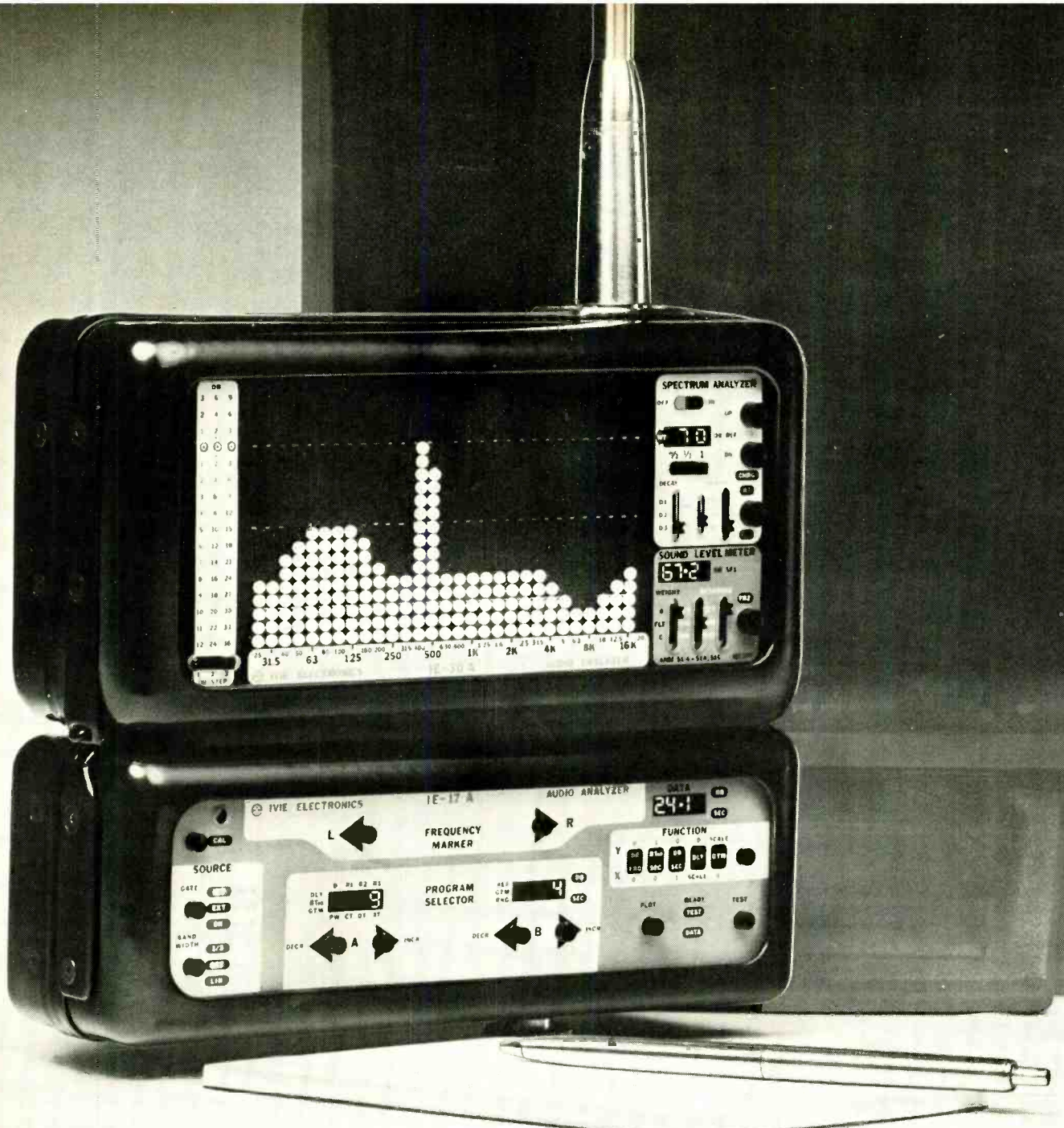
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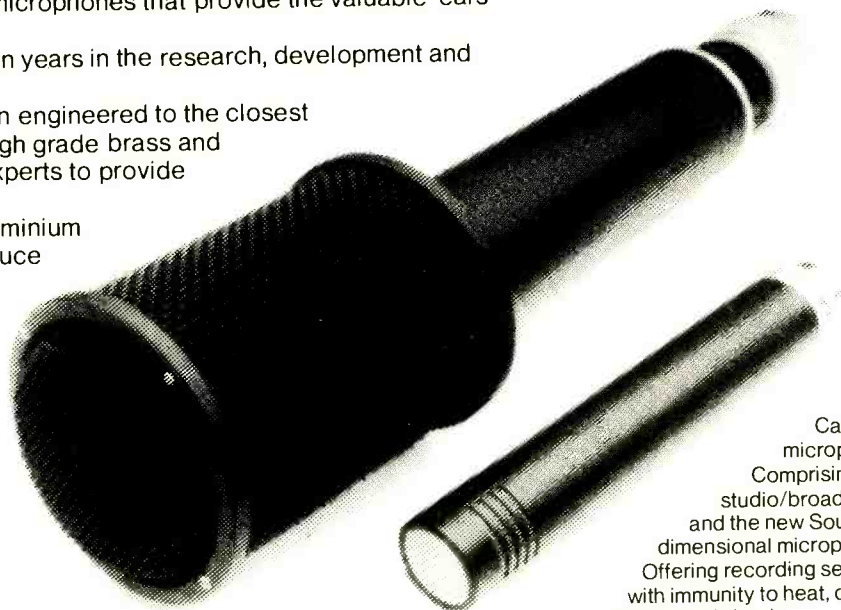
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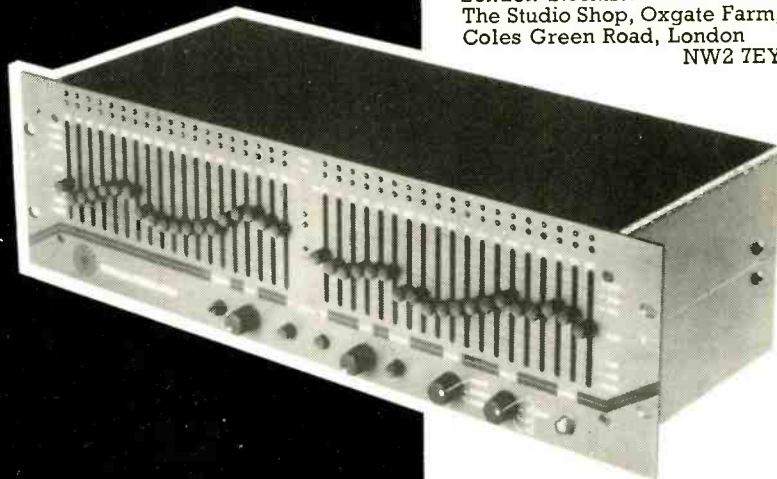
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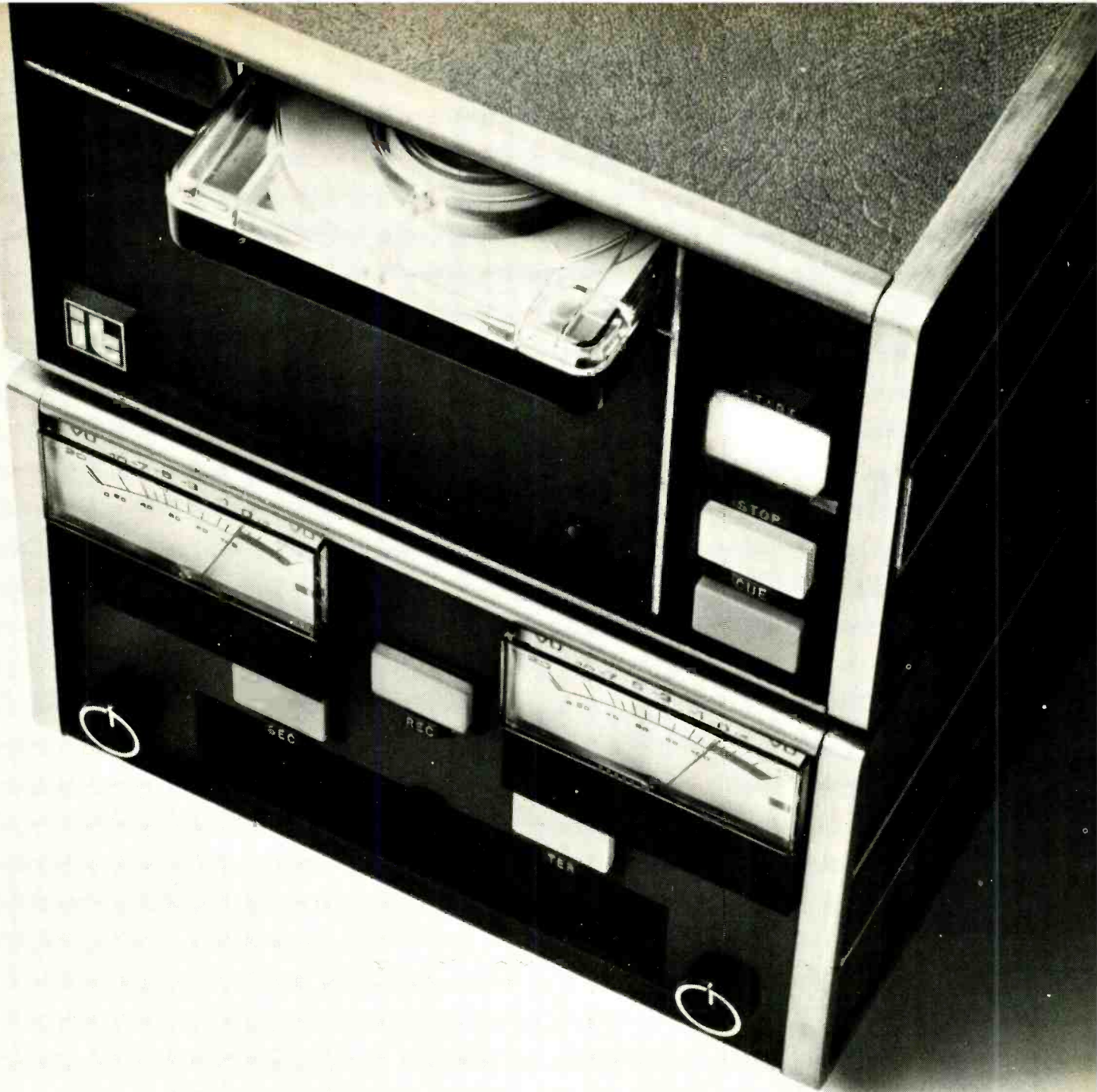
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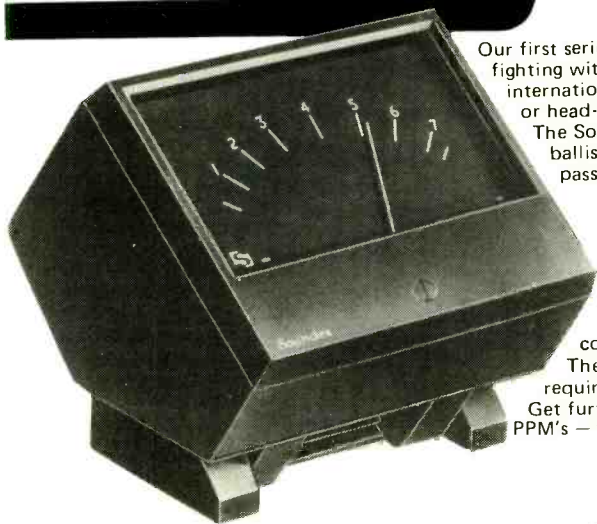
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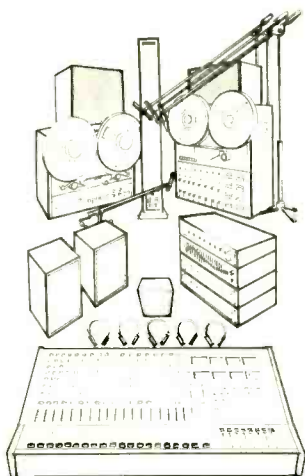
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Our business is helping you with yours

Considering or upgrading a multitrack system?
We offer a select range of studio equipment, backed with
advice, demonstration and service. Turnkey sell, install, lease or hire.



SYSTEMS

As our name implies, at TURNKEY we specialise in systems.

From the simplest four channel setup to large eight or sixteen track installations, we can tailor a package to fit your exact needs.

This can include acoustics advice, wiring, consoles, training and so on.

Ask for our 'Quotation Sheet' or call Andrew Stirling now, on 01-440 9221 and discuss your requirements first hand.



MONITORING

QUAD is a remarkable company that has stayed in the forefront of monitor amplifiers for over a decade. Their current series, the 303 and 405 are available for medium and high power use.

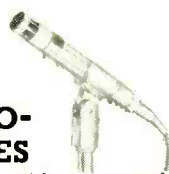
JBL and **TANNOY** share the market for studio monitors worldwide. We demonstrate and supply matched systems for budget and big-time monitoring. The renowned AURATONE mini-mighty speaker cubes, are also in stock.



SIGNAL PROCESSORS

The choice is immense. We cannot sell them all so we pick and choose the best.

Take MXR for example. This American based company has grown from making effects for guitars to studio equipment for professionals. Their digital



MICROPHONES

As with speaker systems, the choice of microphones is very much one of personal preference and we stock a range to satisfy most requirements. Our current favourites are the new CSE range by AKG. This is a system (in similar lines to the revolutionary C451 range some years ago) of interchangeable bodies and capsules. As electret technology is used, the prices are correspondingly low.



delay and graphics are second to none.

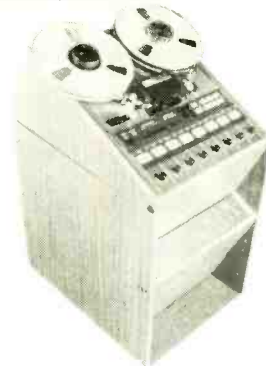
Roland of synthesiser fame, have introduced their 'Studio Series' of rack-mount units, including a phaser/flanger with extensive control facilities. We also have the budget ACCESSIT range.

ACCESSORIES

As well as supplying standard plugs, tapes etc., We have developed an exclusive range of 'hard to find' studio accessories.



Take for example our 'Great British Spring' - a high quality stereo reverb developed for the budget conscious studio.

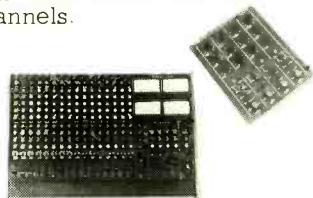


We also have . . . mike boxes . . . track sheets . . . preamplifiers . . . direct boxes . . . rolling consoles . . . and much more.

Full details in our 'TURNKEY by mail' catalogue.

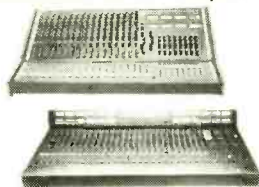
MIXERS

Our exclusive 1478 is a freebie with all four track recorders. Treble, bass, pan and level on four channels.



The RSD, 16 by 4, offers great value for money in budget multitrack mixers. Packed with features and our own mods for 8 track.

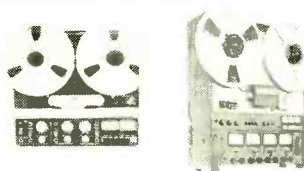
SOUNDCRAFT is well known for its' state of the art performance. We have extensive experience of the Series Two, 16 by 8.



SYNCON by A&H is a major breakthrough in the design of big consoles for 16 and 24 track. We offer fast delivery and installation.

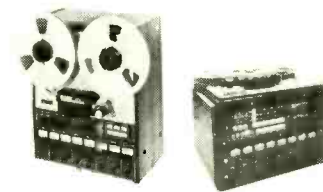
TAPE RECORDERS

REVOX lead in the field of 2 track mastering. The new B77 includes all the features that were hot-rodged to the A77.

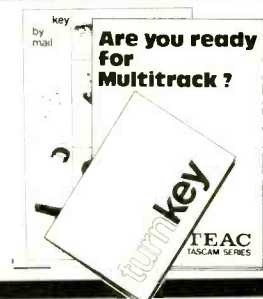


TEAC's new 3440 is the updated version of the 3440S. Now with varispeed, logic switching, monitoring and motion sensing.

The TASCAM 80-8 is the most reliable half inch, 8 track recorder available. We also supply dBx and a studio console optionally.



The 8 track, one inch from SOUNDCRAFT MAGNETICS is a sophisticated workhorse with unique remote control facilities.



Write or call for a free copy of the 'Turnkey Book', the 'Turnkey by mail' catalogue and TEAC's 'Are you ready for Multitrack' book.

You are welcome to come and visit our extensive demonstration showroom at any time during normal office hours.

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of Recording Equipment**

**Telephone 01-440 9221
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turnkey

turnkey mix

RacKit



Accessit signal processors can now be mounted into standard 19 inch racks using the new RacKit mounting. Three units can be mounted together giving a huge range of dedicated equipment such as line drivers, voice processors etc. Drop us a line for full details and a copy of the revised Accessit catalogue.

RADIO BOOM

With the expansion of commercial radio in this country, there has been a great demand for production studios in the last few months, calling for sophisticated installations combining multi-track equipment with classic production facilities. Our experience of broadcast has resulted in fast installations for YAMCO in LONDON and SSK Audio Visual in Glasgow.

PORTASTUDIO

At last - TEAC's long awaited PORTASTUDIO. No bigger than a normal cassette machine this remarkable unit is a four channel mixer and simul-sync recorder in one. Add a microphone and a pair of headphones and you can make four track demos immediately. Available now.



SOUND CRAFT UPDATE

The ultimate in eight track has become even better with the introduction of Soundcrafts Series 400 consoles. LED metering, twin mute busses, full parametric eq and single cable interface are just some of the remarkable facilities being offered.

As main dealers in this country we are offering exclusive packages and installation, call us for details.

SHORT TAKES

..... **TURNK** our newly installed computer is busy preparing quotations and controlling our mailing lists **AURATONES** now come in a portable road version, we have exclusive stocks now **PAUL** Nice, previously of A&H and Midas recently joined our sales staff **NOW** that TEAC has put four tracks on cassette we expect eight on quarter inch soon **THE** excellent Pearl microphones from Sweden are new in this country they compare in quality with the most expensive brands

NEW TIME MACHINE

Not just a metronome, TEMPO-CHECK is the complete recording aid for all musicians.

It incorporates a 12 note chromatic tuning device, a beat counter, and indicates down beats and sub-divisions within the bar. A battery charger and earphone are included.

All the products that we sell can be bought using Access or Barclaycard/Visa. Order by phone for fast delivery.

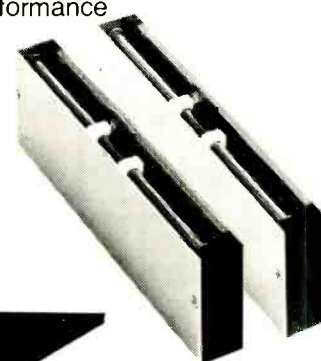


two more Penny & Giles audio products

the 1100 fader

our new 1100 series linear motion conductive plastics faders provide the opportunity to build in performance at a budget price because we've designed them to have all the smooth performance advantages of Penny & Giles audio products - but limited the options to keep manufacturing costs down.

our new 1100 series linear motion conductive plastics faders provide the opportunity to build in performance at a budget price because we've designed them to have all the smooth performance advantages of Penny & Giles audio products - but limited the options to keep manufacturing costs down.

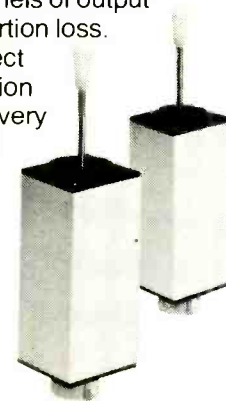


Examine the specification - the 1100 fader sounds good.

and the QCP-1

Penny & Giles QCP-1 quad pot takes a single input and produces four correctly attenuated channels of output with only 0.5dB insertion loss. The feel is positive. Direct coupling to the infinite resolution conductive plastics tracks means very fine settings can be made. Six special law tracks produce a truly balanced sound effect and enable sensitive control in the central position.

Penny & Giles QCP-1 quad pot takes a single input and produces four correctly attenuated channels of output with only 0.5dB insertion loss.



Our quad pot is impressive, but you need to use one to know how much better it is.



Why not have full details of Penny & Giles complete range of audio products. Send for our brochure.

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Germany:
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Telephone: Augsburg (0821) 518 251
Telex: 53790

USA:
1640 5th Street Santa Monica California 90401
Telephone: (213) 393-0014



ELEKTRONIK DBM VISUAL DISPLAY

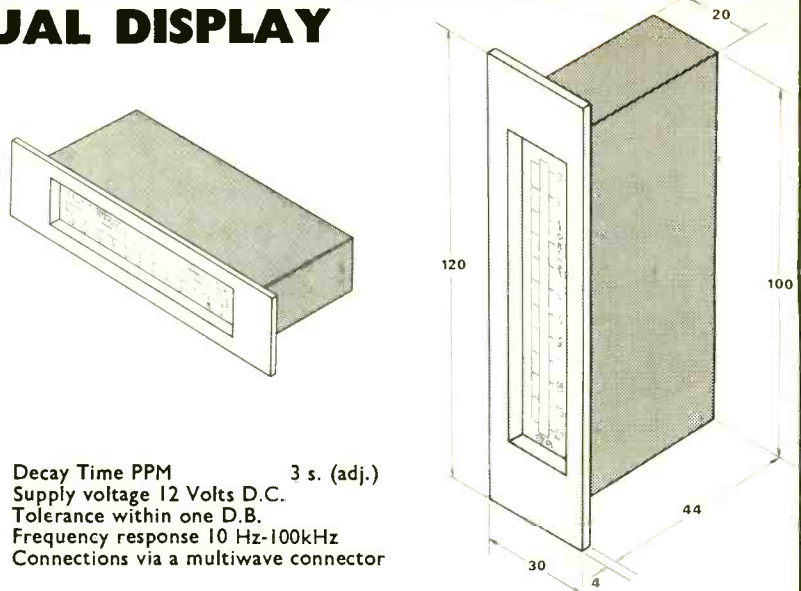
A comprehensive range of Bargraph visual displays which uses high intensity L.E.D.'s and the most up to date logic control making them very accurate and versatile with a good dynamic range. Available with vertical or horizontal scales which can be illuminated and comes in an attractive moulded case with an elegant matt black finish.

Models available: VU-VU switchable, PPM-VU switchable, PPM with peak memory. 12 or 20 segments. Bar or single segment movements.

Brief Specification

Input sensitivity 770 m.v. (adj.)
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 Rise Time VU 35 M.S.
 Decay Time VU 300 M.S. (adj.)
 Rise Time PPM 3 M.S.

Decay Time PPM 3 s. (adj.)
 Supply voltage 12 Volts D.C.
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Also available a range of inexpensive mono and stereo displays in a very attractive case with an acrylic facia. Ideal for level or VU monitoring. Prices on application. For further information please contact U.K. marketing agents.

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Telephone: Reading (0734) 53411.
Telex: 847605 a/b TILLEXG.

P.S. If you like glowing praise and flattering photos turn the page.

18000Hz, 0.9mv Pa \approx 60dbm, 153dbm, 200ohms, > 10000 ohms

These are the specifications that make the Beyer Dynamic M260 NS ribbon microphone the best in its field.

A specially shaped short ribbon, 0.002 mm thick, weighing only 0.000438 grammes guarantees that the M260 NS gives absolute fidelity of reproduction.

Complete absence of non-linear distortion lends startling clarity and transparency to the whole sound spectrum.

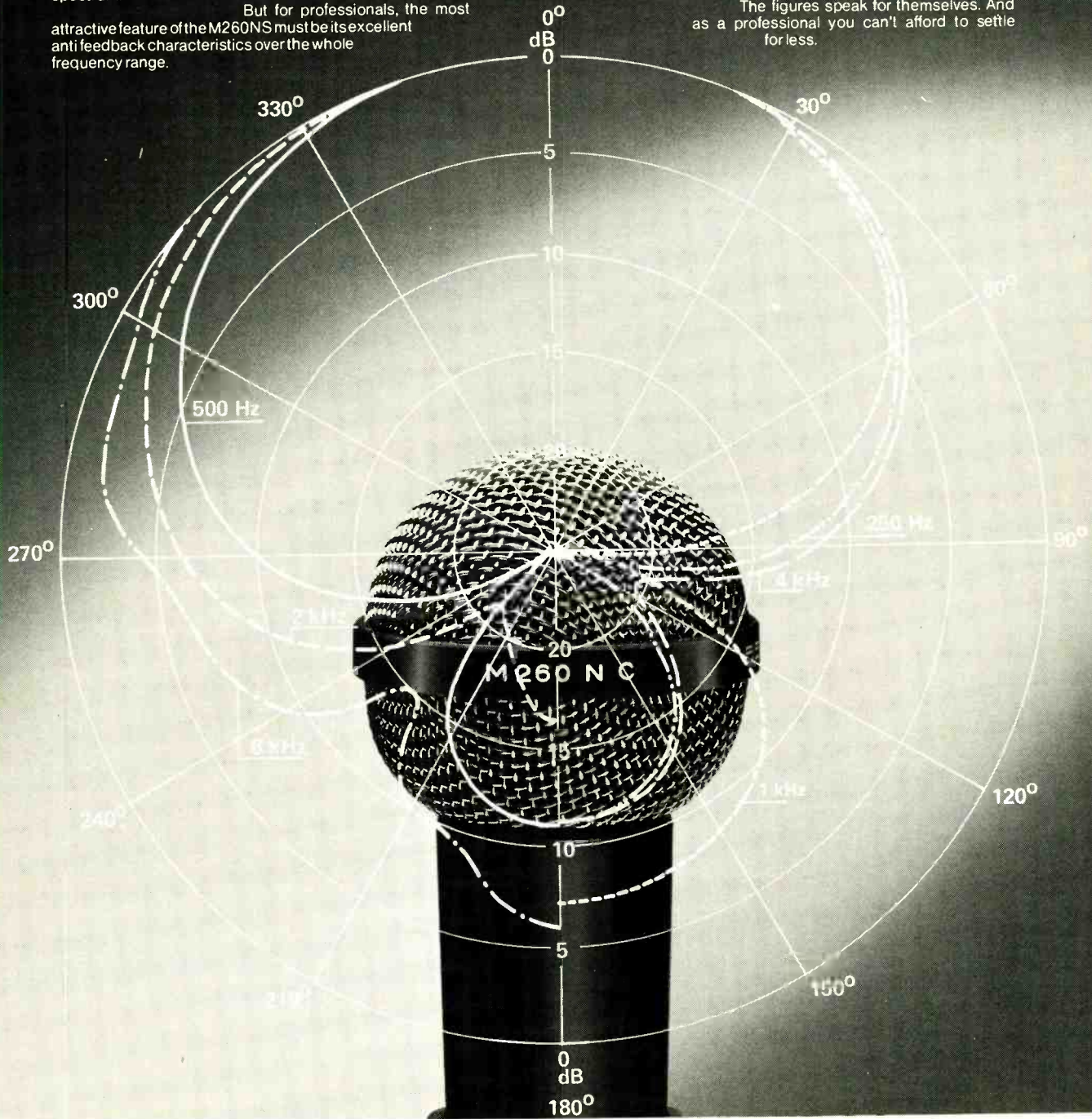
But for professionals, the most attractive feature of the M260 NS must be its excellent anti feedback characteristics over the whole frequency range.

Small wonder it is the world's most popular microphone for vocal and instrumental recordings and public address work.

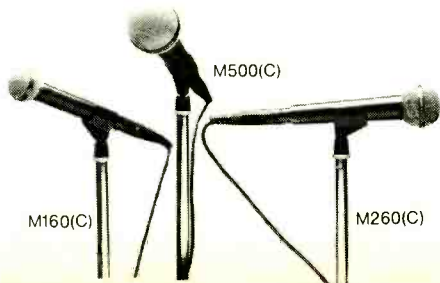
The M260 NS is only one of the range of ribbon microphones made by Beyer Dynamic.

And each one is manufactured to the same high standards, incorporating all that is best in microphone technology.

The figures speak for themselves. And as a professional you can't afford to settle for less.



For a complete catalogue of Beyer products send to the address below



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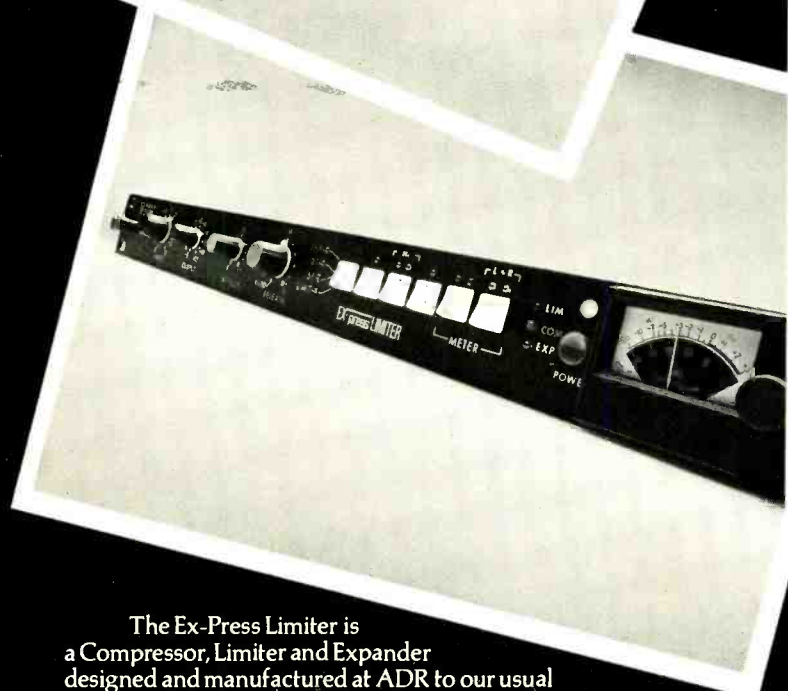
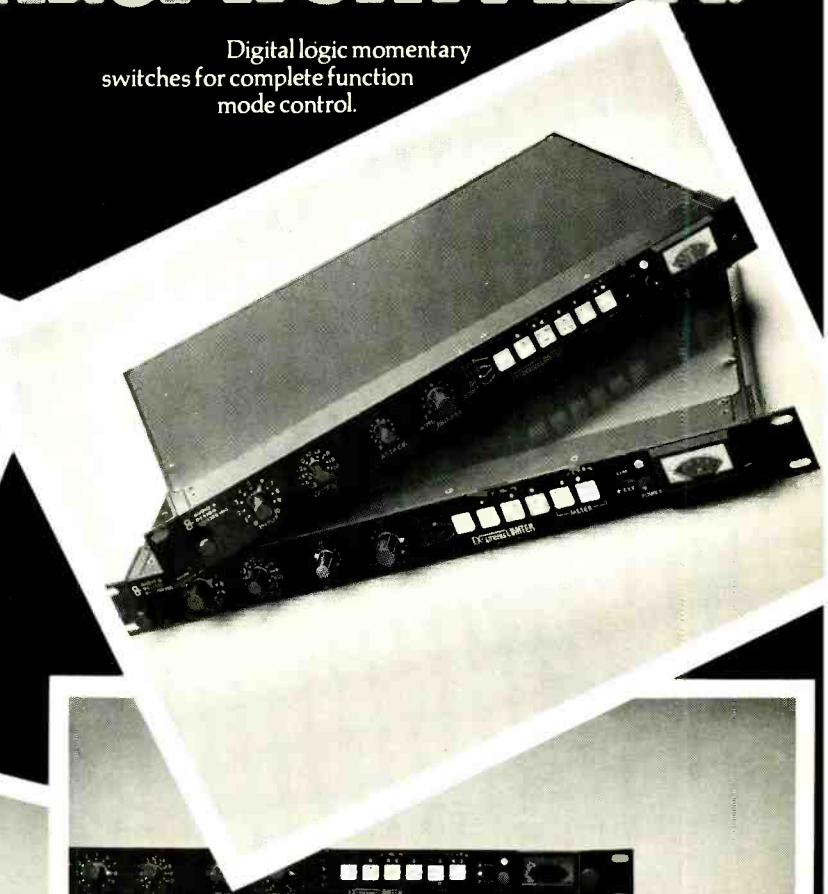
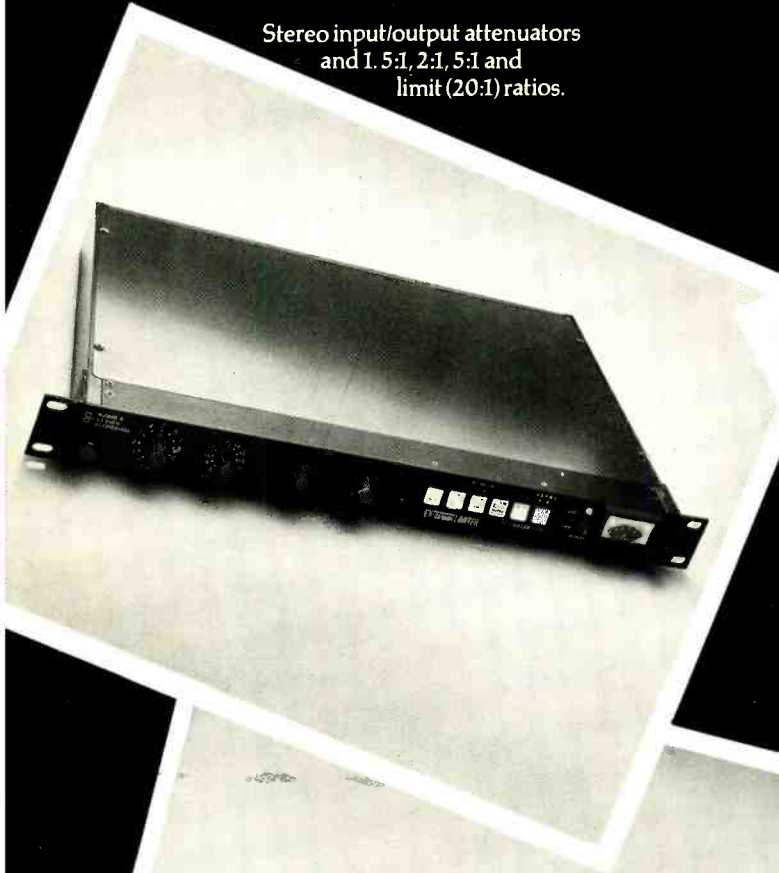
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Glowing praise and flattering photos about the Ex-Press Limiter from ADR.

Stereo input/output attenuators and 1.5:1, 2:1, 5:1 and limit (20:1) ratios.

Digital logic momentary switches for complete function mode control.



The Ex-Press Limiter is a Compressor, Limiter and Expander designed and manufactured at ADR to our usual excellent technical specification.

Function Control is by digital logic switches and Led indicators show options in use as well as remembering 'last use' settings when the power is cut.

The Ex-Press also has stereo input/output attenuators, variable attack and release times and an auto release network for maximum in-studio versatility.

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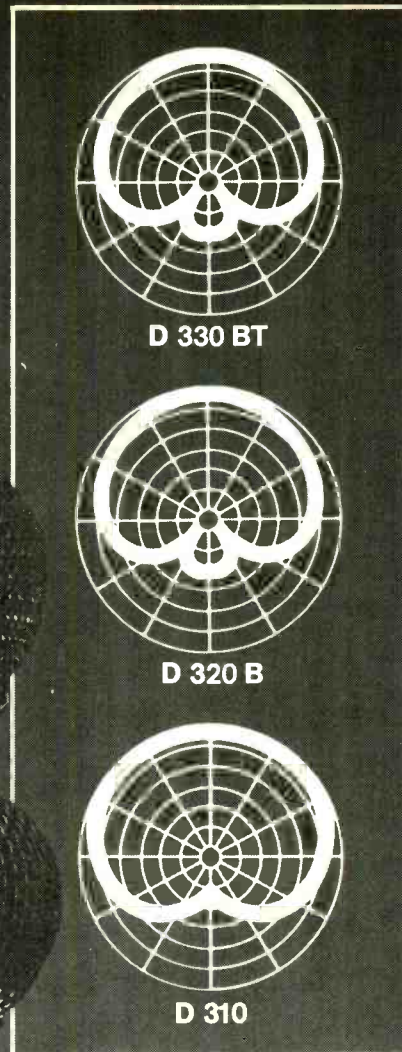
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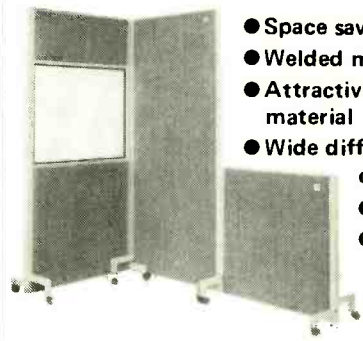
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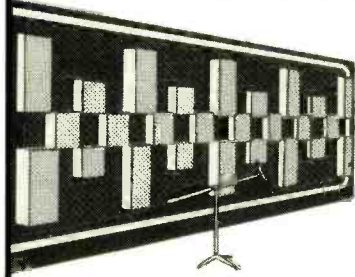
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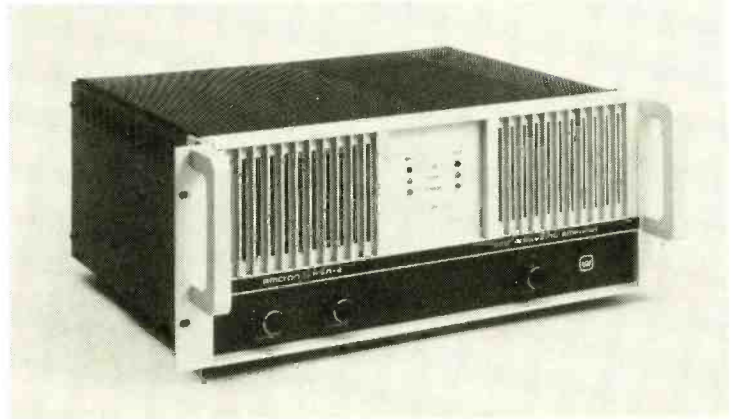




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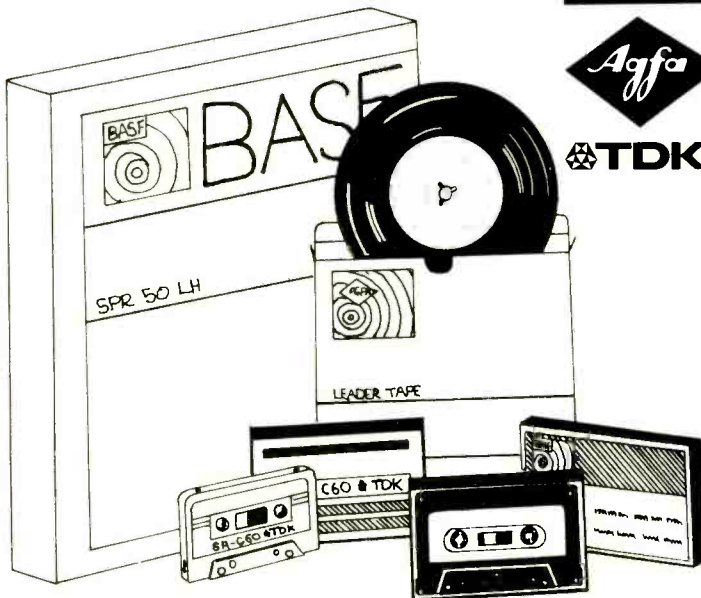
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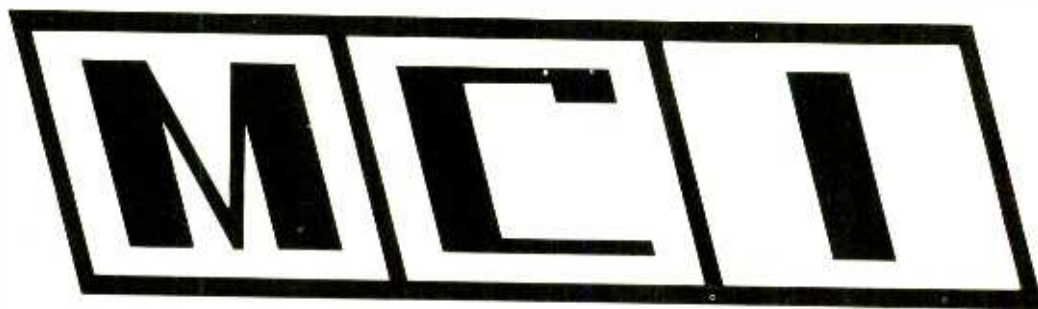
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**We did not invent the
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**Nor did we invent the
mixing console or the
transistor . . .**



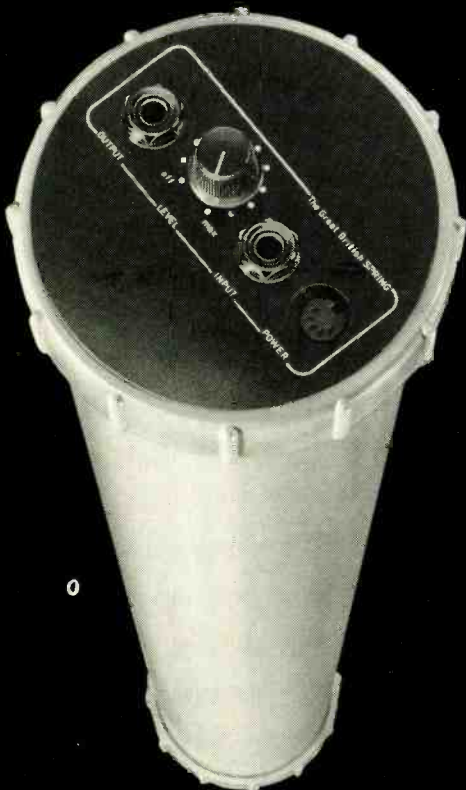
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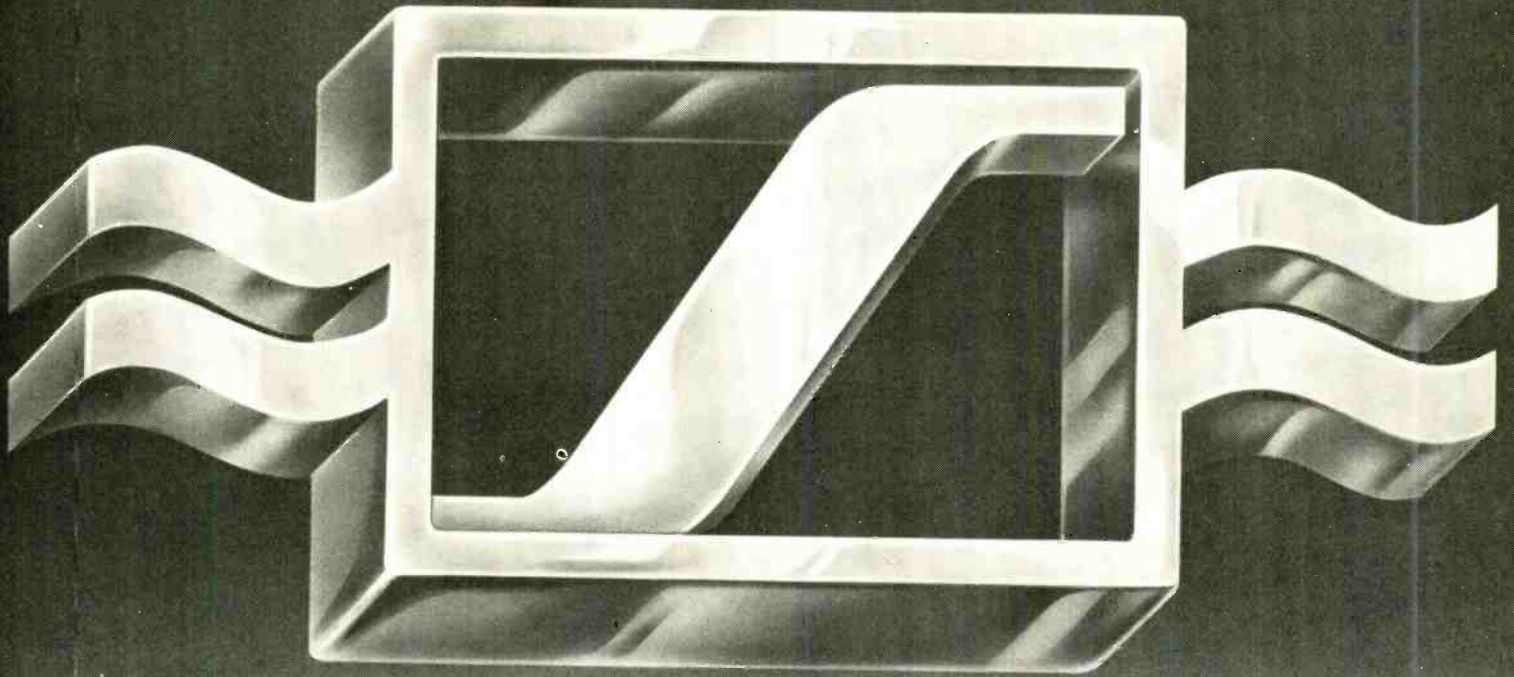


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U.K. Distributor: **TRAD ELECTRONIC SALES LTD.** 149B St. Albans Road, Watford Herts,
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To complement the Electret series Sennheiser have designed the RF Condenser range to cover 48 volt phantom and 12 volt AB powering, plus the MKH 110 to cope with instrumentation recording.

In the fields of film, television and radio presentation Sennheiser have developed a new, totally integrated, high quality Radio Microphone System (transmitter/receiver units are available on five separate frequencies), and an exciting sound effect vocoder (VSM 201) which can lend the human voice an amazing variety of sounds.

And when it comes to high-technology transmission, the Sennheiser 'Infraport' System, using infra-red light to transmit information, is now available in up to nine-channel units.

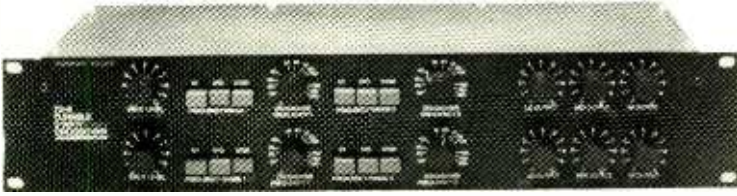
Add to all this a new version of the Universal Level Meter (the UPM 550), a range of headphones and accessories which is second to none and you'll see there's quite a lot behind the Sennheiser 'S'.

If you have a particular sound problem to solve, or need further information, please contact us, we'll do all we can to help.

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Hayden Laboratories Limited, Hayden House,
Churchfield Road, Chalfont St. Peter, Bucks.
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Furman Model TX-4

Furman Sound has introduced the *Model TX-4*, a new tunable crossover/ bandpass filter unit providing four crossover points, each of which may be independently tuned to any frequency in the audio spectrum 20Hz to 20kHz. The crossover points may be used separately in pairs as in a stereo tri-amped system, or together as in a mono quad- or quint-amped system. A rear panel switch allows selection of stereo 3-way or mono 5-way modes. Tuning for each crossover point is by selecting a frequency range pushbutton, and then zeroing in on the exact frequency with the crossover frequency control. Front panel labelling for the 3-way setting is printed in white, while labelling for the 5-way setting is in red. The high and low-pass outputs of each crossover point track each other as the frequency is changed. Each input has a separate level control and in addition level controls are provided for each output facilitating overall system balancing. The *TX-4* features a red LED pilot

light and a separate regulated power supply for each channel. Unbalanced inputs are standard; however, balanced inputs with Cannon - style connectors are optionally available. The *TX-4*'s design uses active filter circuitry providing two-pole Butterworth response with 12dB per octave rolloffs. In addition to the usual sound reinforcement application it is also suitable for studio application as a tunable filter set, since it offers either four independent high or low-pass filters or two bandpass filters whose exact cutoff frequencies and output levels may be adjusted to any requirements. A smaller version of the *TX-4*, the *TX-3* for stereo bi-amp or mono tri-amp operation, is also available. Prices are *Model TX-4* \$415 and *Model TX-3* \$245. Furman Sound, 616 Canal Street, San Rafael, Cal 94901, USA. Phone: (415) 456-6766. UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511.

Mobile Recording Survey

In our August 1979 issue of *Studio Sound* the heading of the Record Plant Mobile entry was incorrectly given as 'Black Pete'. This is a term of endearment assigned to the mobile by its crew; however, its official title is 'Record Plant, New York, Remote Recording Truck'. We know which title we prefer!

Music Laboratory agencies

Music Laboratory are marketing two new product ranges in the UK. The first from PSE (Production Studio Equipment) is a specialised range of studio equipment comprising the following: echo-reverb plate; spring reverb; DI boxes (six versions passive and active); cable tester; headphone amplifiers; equipment racks; and phantom power supplies. The second range being marketed by Music Labs is the QMI range of amplifiers from the USA. At present three amplifiers are being marketed, the most powerful being the *GC 500* capable

of delivering 500W per channel. Music Laboratory, 72/74 Eversholt Street, London NW1, UK. Phone: 01-388 5392.

Noise control—a solution

Fastback Studios in Chiswick, London, were the realisation of a rock band's dream enabling the group to offer not just a commercial recording service, but also to practise and perfect their own sound. However, the studio quickly hit a major snag when 110dB 'sounds' reached far beyond the confines of the studio to a neighbour's flat. Even though the studio is in a substantially built old brewery, the sound leakage obviously had to be dealt with. The group firstly called in manufacturers of proprietary wall treatments but found that not only were the estimated costs of remedial treatment into five figures, but there were no guarantees of a complete solution.

In desperation one of the group

turned to Yellow Pages and let his fingers do the walking! There he found the phone number of a company called Sound Attenuators Ltd, London—a company somewhat better known in the world of industrial noise control than among pop musicians. A visit by Sound Attenuators' engineers was quickly arranged and after an initial survey the engineers suggested an off-the-shelf acoustic enclosure which could be built as a room within the studio leaving just a few inches space between walls and ceiling. As these enclosures are typically employed to control plant and machinery noise, and even the odd jet engine, it wasn't surprising that SAL were confident of solving Fastback's problem. What is more they even gave a guarantee and an installed price of under £5,000.

The installation also boasted another novel feature—an inertia base, once again this is a well tried industrial product usually found insulating pumps and compressors from the ground. In the Fastback Studios it isolates the drummer and prevents percussion effects being transmitted via the floor to areas outside the studio. The interior of the enclosure has been partially treated with hessian wall covering and curtaining, striking just the right aesthetic and acoustic balance. An acoustic access door, double glazing to the control room and provision for future airconditioning completed the installation.

A recent survey since the installation of Sound Attenuators' equipment showed that the design specification had been met. So satisfactorily in fact that the studio has been able to revert to its original plan of being open 24 hours per day.

Sound Attenuators Ltd, Eastgates, Colchester CO1 2TW, UK. Phone: 0206 69111.

RED Professional loudspeaker

RED Acoustics Ltd has introduced the *RED Professional* loudspeaker, an integrated loudspeaker/amplifier unit. The unit is a 2-way self-powered reproducer incorporating four drive units and an electronic assembly, housed in a 19in cabinet. The unit is mains powered, with active electronic input signal processing and filtering circuits, and separate output amplifiers (two for the lf units and one for the hf units) directly driving two independently baffled 8in lf drivers and two specially positioned 1in hf radiators. Size of the unit is 345 x 480 x 335mm (hwd) and quoted specifications are: frequency response 40Hz to 18kHz ± 3 dB; signal-to-noise ratio 100dB; and maximum undistorted peak programme level 120dB SPL. In addition to its normal operating mode the unit may be placed in a standby mode. Price of the *RED Professional* is approximately £1,500 per pair.

RED Acoustics Limited, 88-90 Grays Inn Road, London WC1, UK.

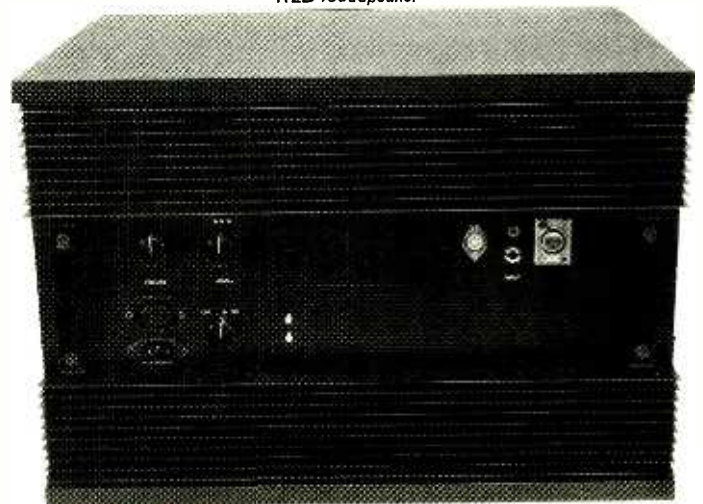
Phone: 01-404 0810.

New Midas theatre console

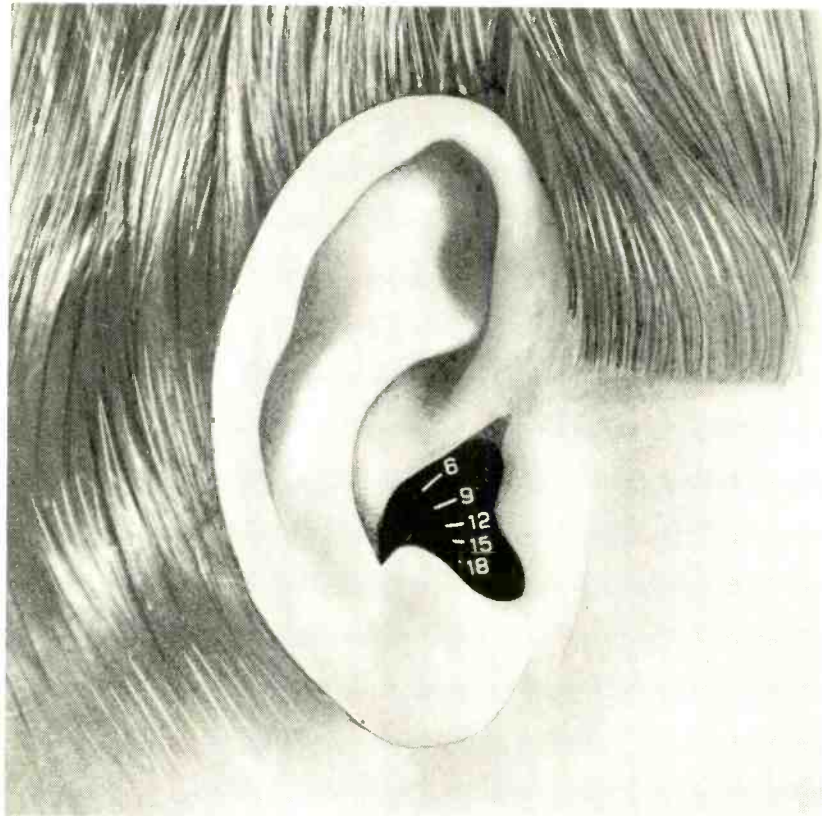
Midas Audio Systems has introduced a new range of consoles specially developed for theatre sound mixing applications. Available in 24, 30 and 36 into 8-8 formats, the Midas *TR System* is fully modular with a full range of options allowing custom formats to be easily catered for. The *TR System* is a development from the established Midas *PR System* of live sound reinforcement consoles. Full production of the new system

36 ▶

RED loudspeaker



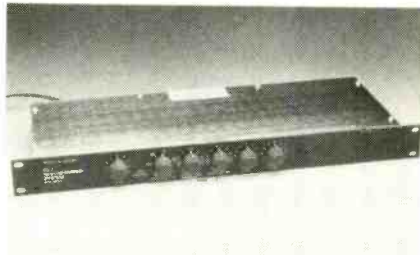
One of our best customers



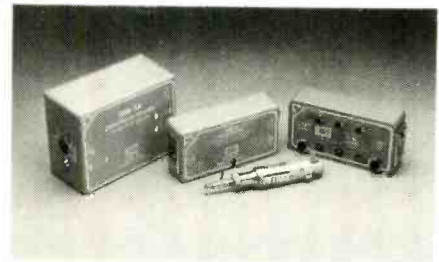
Atlantex products are designed to satisfy the calibrated earhole syndrome



Ashly audio processing units represent the technology of the future. The well-designed, easy-to-use layout allows precision control over the audible spectrum. Shown is the SC-50 peak limiter compressor. Other 19" Ashly units are parametric equalisers, electronic crossovers, pre-amp/processors.



The Furman range includes mono and stereo parametric equalisers with pre-amps, tunable crossover/bandpass filter, and (shown here) the neat reverb system with limiter and equaliser. The simple layout and wide range of control gives full scope for creative engineering at a price which gives great value for money.



Sescom, the world's finest audio interfacing units, are renowned for high quality products, combined with ruggedness and reliability. The wide range of models includes D.I. boxes, audio transformers, cable testers, and many more useful studio accessories.

ASHLY **SES**
FURMAN SOUND **COM**

Atlantex

Atlantex Music Limited,
34 Bancroft, Hitchin,
Hertfordshire SG5 1LA.
Telephone 0462 31511
Telex 826967

is scheduled for April 1980 and several *TR System* consoles have already been ordered. Orders include a 36 into 8-8 for the Adelaide Festival Centre, Adelaide, Australia; a 40 into 8-8 for Opryland Productions, Nashville, Tennessee; and a 24 into 8-8 and a 16 into 8-8 for the Kitchener Centre, Hamilton, Ontario.

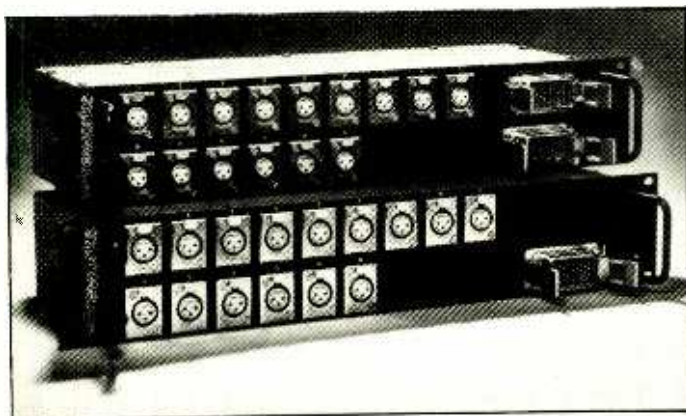
HF Engineering

Hugh Ford's company, HF Engineering, has recently moved from Sunbury-on-Thames to Richmond. New address is HF Engineering, 24a Trinity Road, Richmond, Surrey, TW9 2LD. Phone: 01-948 5669.

Wireworks Multitrack

Wireworks, manufacturer of mic cables and professional mic multicable systems, has introduced the *Multitrack*, a mic multicable termination unit designed to accept individual cables from mics and other equipment. The *Multitrack* is a modular component used to terminate Wireworks multipair mic cables and featuring Switchcraft *QG Series* and AMP multipin connectors. The unit is a standard 19in rack mount unit and it is available in all Wireworks multicable sizes: 3, 6, 9, 11, 15, 19, 27, 36 and 50 pairs. The unit is totally enclosed and is multipin compatible with other components of the same pair size. *Multitracks* are available with dual outputs, XLR or ¼in returns and ground lift switches. Wireworks Corporation, 380 Hillside Avenue, Hillside, New Jersey 07205, USA. Phone: (201) 686-7400.

Wireworks multitrack



Samuelson new products

Samuelson Sight and Sound has introduced two new products. First is the *SFS-IAB* power supply unit which provides an interface between 12V (nominal) AB powered capacitor mics and the mic inputs of tape recorders etc. The unit also provides bass cut filtering (6dB per octave) and switchable adjustment of insertion loss. The unit is powered by two PP3 batteries and has XLR connections, plus a battery test facility. The second new product, the *4ABN/P Mini Mixer* is designed to be used with Nagra portable tape recorders and two versions are available, one for the Nagra 1S and the other for the Nagra 4.2 and Nagra 4S. The mixer features four mic inputs switchable AB or 200Ω dynamic, channel 4 switchable mic/line, two position bass cut filter switch, rotary channel faders, and unit powering from the Nagra recorder. Samuelson Sight and Sound Limited, 303/315 Cricklewood Broadway, London NW2 6PQ, UK. Phone: 01-452 8090.

Financial

● Further to the news item in our January issue on Thorn's takeover bid for EMI, we can confirm that an increased bid by Thorn of some £175 million has succeeded. In early December shareholders of both companies passed resolutions confirming the merger of the two companies to form a new company, Thorn EMI. Under the merger EMI's music, entertainment and leisure interests are to be reorganised into one operation and Lord Delfont, chief executive of EMI Limited, is to head up the operation. Lord Delfont additionally joins the board of the 'new' company together with Sir John Read, chairman of EMI Limited, and Bhaskar Menon, chairman and chief executive of EMI Music.



Samciné Mini-Mixer

Harrison expands

Harrison Systems Inc has announced the completion of a recent plant expansion and facilities renovation. According to president Dave Harrison about 4,000sq ft of new space has been added to the module production areas, along with extensive improvements in existing space utilisation. The improvements include provision of a new area for software development, expanded administrative office space, and numerous improvements to the company's new-product development facilities. The company has also quadrupled the size of its engineering, documentation, and printed circuit board layout areas. Over the past year the number of employees has doubled and Dave Harrison states that this plus the plant expansion will allow the company "to experience continuing production increases on all our current product lines, as well as some carefully charted diversification". Harrison Systems Inc, PO Box 22964, Nashville, Tenn 37202, USA. Phone: (615) 834-1184.

Address change

● Lemo (UK) Limited has moved to new headquarters at 12 North Street, Worthing, West Sussex. Phone: 0903 34543.
● RTS Systems has moved to 1100 West Chestnut Street, Burbank, Cal 91506, USA. Phone: (213) 843-7022.

Improved IMF loudspeaker

IMF Electronics has introduced an improved version of the *ALS40* loudspeaker, the *ALS40 IIa*. Employing the active-line principle the new model supersedes the Mk II, production of which has been discontinued. Exploiting the same basic principle as the recently introduced *ALS30*, the *ALS40 IIa* incorporates two ribbed bextrene

bass drivers, plus a midrange unit and a domed tweeter fitted with a hf dispersion pad. Other features include a redesigned crossover filter network, while a perspective control provides a nominally flat response together with adjustment of mid-band and treble output. Supplied in matched mirror image pairs, the loudspeaker is 68 x 35 x 35cm, has a frequency response of 28Hz to 20kHz, a matching impedance of 8Ω, an efficiency of 98dB (pink noise, at 40W at 1m), and is designed to be driven by amplifiers delivering up to 60W.

IMF Electronics, Westbourne Street, High Wycombe, Bucks HP11 2PZ, UK. Phone: 0494 35576.

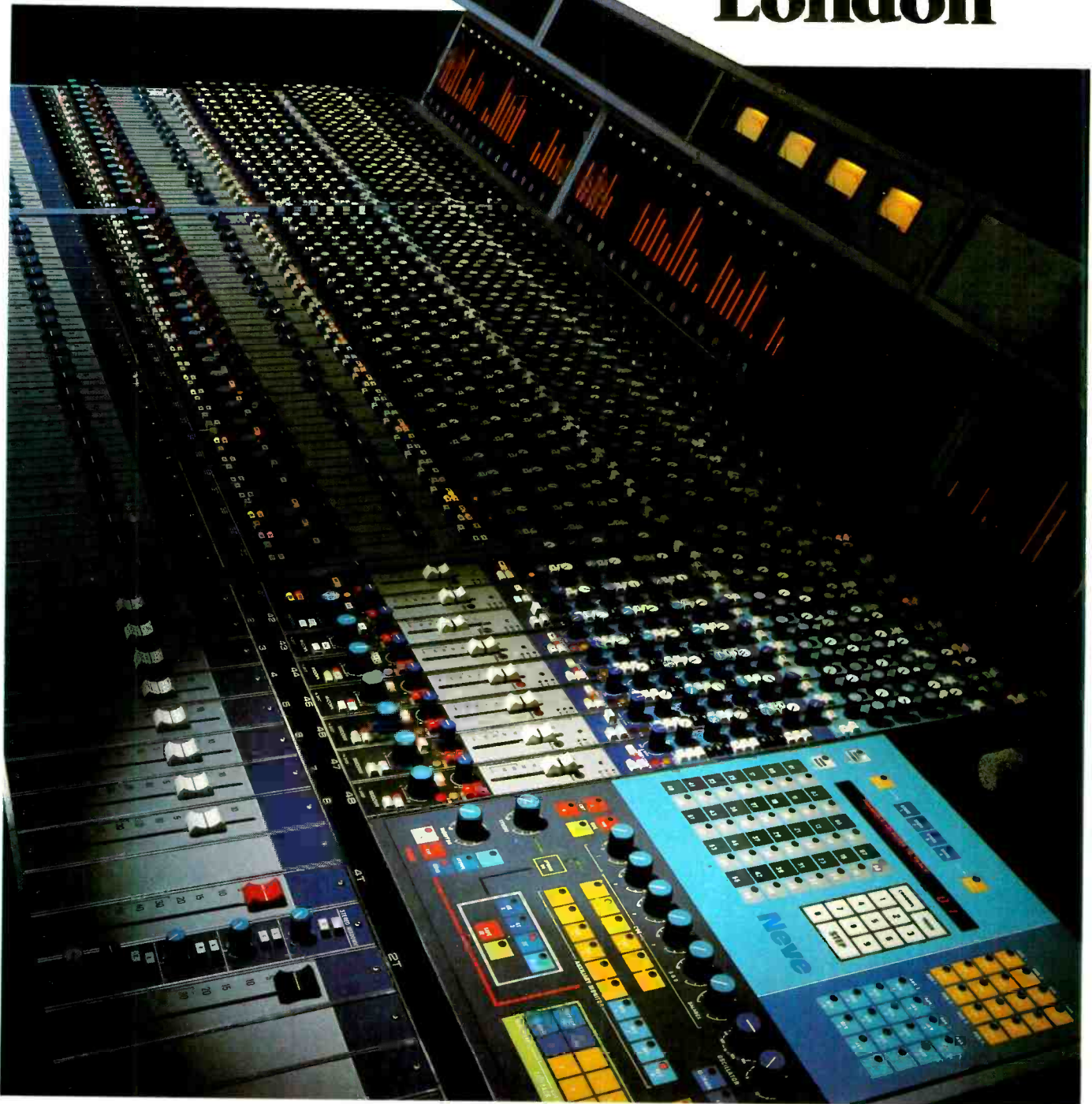
Audiomarketing electronic crossover

Audiomarketing has developed a new active electronic crossover unit called the *Time/Sync* frequency dividing network which is designed to be fully compatible with Audiomarketing's *Red Series* studio loudspeaker systems, as well as any *Model 604* loudspeaker. Designed to be used in particular with the *Big Red* co-axial point source loudspeaker, *Time/Sync* incorporates time delay in the low pass section which electronically synchronises the outputs of the bass driver and tweeter to produce a coherent sound source. The new unit is a standard 19in rack mount unit, offers a dynamic range of 95dB and has a crossover frequency of 3kHz. Input impedance is 25kΩ balanced, hf control is via high pass shelving at 2kHz and 8kHz, and the unit incorporates LED over-level indicators. Price of the dual channel *Time/Sync* studio monitor system which includes two *Big Red* loudspeakers and a *Time/Sync* electronic crossover is \$1,775, while the *Time/Sync* unit is priced at \$495.

Audiomarketing Limited, 652 Glenbrook Road, Stamford, Conn 06906, USA. Phone: (203) 359-2315.

The 8108

see us at A.E.S London



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- New Sweep frequency 4 stage equaliser + 2 filters.
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- 56 input 48 track or 48 input 32 track or 32 input 24 track—Sub fitted options.
- Optional output transformers, electrically balanced line inputs.
- VU, PPM, or Both at once.
- Audio track, VCA Sub Group or NECAM faders.

Neve Electronics International Ltd. Cambridge House, Melbourn, Royston, Herts. SG8 6AU, England. Tel: (0763) 60776 (24 hr. Ansaphone facility) Telex: 81381, Cables; Neve Cambridge. **Rupert Neve Incorporated**, Berkshire Industrial Park, Bethel, Connecticut 06801, USA. Tel: (203) 744 6230. Telex: 969638 **Rupert Neve Incorporated**, Suite

609, 6255 Sunset Boulevard, Hollywood, California 90028, USA. Tel: (213) 465-4822. **Rupert Neve GmbH** D-6100 Darmstadt, Bismarckstrasse 114, W. Germany. Tel: 6151-87038. Telex: 419581. **Rupert Neve of Canada Limited**, 2721 Rena Road, Malton, Ontario L4T 3K1, Canada. Tel: (416) 6677-611. Telex: 21 06 9835 02.

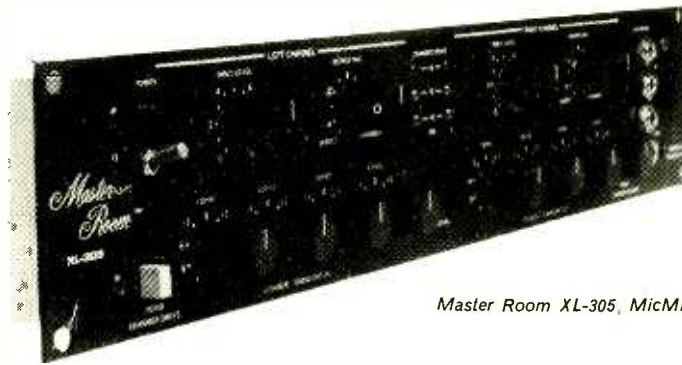
STC radio relay Lincompex System

A system to overcome fading and interference on hf radio links to broadcast standard has been developed by the electronics division of Standard Telephones and Cables (STC). Known as radio relay lincompex (linked compressor and expander) equipment, it provides high quality circuits between main radio station studios and local broadcast transmitters or distant studios and the main broadcasting station. The new system is claimed to eliminate problems associated with rapid changes in signal level, and reduce noise and interference accompanying the signal. STC's system is intended for point-to-point transmission over a 6kHz audio channel and comprises a transmit or receive terminal each having separate speech and control paths. Benefits of lincompex radio relay equipment are claimed to include the use of lower power studio/broadcast station link transmitters to achieve a given signal-to-noise ratio and an increase in transmitter range. Also because the transmitter does not handle signal levels with abnormal dynamic range, operation nearer the peak envelope power level is possible and this results in increased average transmitted power.

Standard Telephones and Cables Limited, Electronics Division, Newport, Gwent, UK.

Micmix XL-305 improved

MicMix has made a number of design changes to its *XL-305 Master-Room, Acoustic Chamber Synthesiser*. This unit was originally detailed in our news pages in November 1979. The redesigned *XL-305* features 2-channel stereo capability, plus stereo imaging of a mono signal or full mono operation. Each channel features an input level control, LED chamber drive indicators (+6, 0 and -6dB), and an output mix control to blend the direct and reverberated signals. Front panel output level controls are provided, while the aux input/output jacks automatically defeat the rear panel connections. An input/output transformer version is also available, the *XL-305T*. Each channel also has a 4-band peak/dip ± 12 dB equaliser with centre frequencies at 150Hz, 600Hz, 2kHz and 6kHz. Specifications are: decay time 3.5s at 1kHz; reverberant channel crosstalk better than -45dB; harmonic distortion typically less than 0.1%; and reverb frequency range 125Hz



Master Room XL-305, MicMix

to 8kHz (direct channel 20Hz to 20kHz).
 MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220, USA.
 Phone: (214) 352-3811.
 UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
 Phone: 01-734 2812.

Contracts

- Neve Electronics has won a contract worth in excess of £300,000 from the BBC for seven new *Mark IV* general purpose studio control consoles for use in the News and Current Affairs studios in Broadcasting House, London. Similar contracts for general purpose desks have been placed with two other British manufacturers, Calrec Audio Limited and Audix Limited.
- Clive Green & Co Limited, UK distributor of Enertec, has received an order from Scottish Television for a number of *DS16 Series* 16mm film record/reproducers.
- Digital Recording Systems Company, a newly-formed company specialising in digital recording and editing, has purchased a Sony *PCM-1600* digital audio processor. Based in Elkins Park, Pennsylvania, the company's digital system is available as an air-transportable package with full engineering support. The company is also assembling a stationary digital mixdown and editing facility near Philadelphia.
- London's Rockstar Recording Studios has acquired an Allen and Heath 28/28 *Syncon* console with full 24-track monitoring. The studio's previous 16-track *Modular 2* console, we are reliably informed, is now on its way to Jamaica.

Audio & Design price increases

Audio & Design (Recording) Ltd has announced increases in the prices of most of its signal processing equipment effective from January 1, 1980. The average increase is approximately 11%, although some products will remain

at their 1979 prices. Copies of the new price list are being circulated to all existing ADR customers or they may be obtained on request. Audio & Design (Recording) Ltd, 84 Oxford Road, Reading RG1 7LJ, UK.
 Phone: 0734 53411.

Neal-Ferroglyph new products

Neal-Ferroglyph has produced two new versions of its *SP7* modular 'custom built' tape recorder. These are a delay version and a 4-channel logging recorder. The delay version features a redesigned head block to provide a long tape loop between the record and replay heads, this loop allowing the following delay times: 2s (15in/s), 4s (7½in/s) and 8s (3¾in/s). This version is based on the basic *SP7* transport and the delay facility can be built into any model in the *SP7* range. The 4-channel logging recorder version complies with IBA specifications and provides four recording channels, each with its own balanced input and preset level control. A single balanced output is switchable to any one of the four channels, with tape/source switching, and the signal from the track selected is also fed to a signal level VU meter. Each channel has a preset replay level control which is normally set with the record preset for Line In/Line Out at a fixed level to suit any particular brand of tape. Each channel also has a preset bias control. The logging recorder operates at ½in/s and takes NAB reels of ¼in tape (cine centred reels can also be used) giving a recording time of more than 1½ hours using Long Play tape or 17 hours with Double Play. The logging recorder has provision for connection of a second *SP7* logging recorder with automatic change-over from one recorder to the other. Price of the *SP7* logging recorder is £1,350, while that of the *SP7* delay recorder is £900. Other new products from Neal-Ferroglyph are two new cassette recorders, the *Model 340* 4-channel cassette recorder with full metering facilities and Dolby

noise reduction, and the *Model 330* 3-channel audio visual cassette recorder with two audio channels and a separate sync track. Neal-Ferroglyph Limited, Simonside Works, South Shields, Tyne and Wear NE34 9NX, UK.
 Phone: 0632 566321.

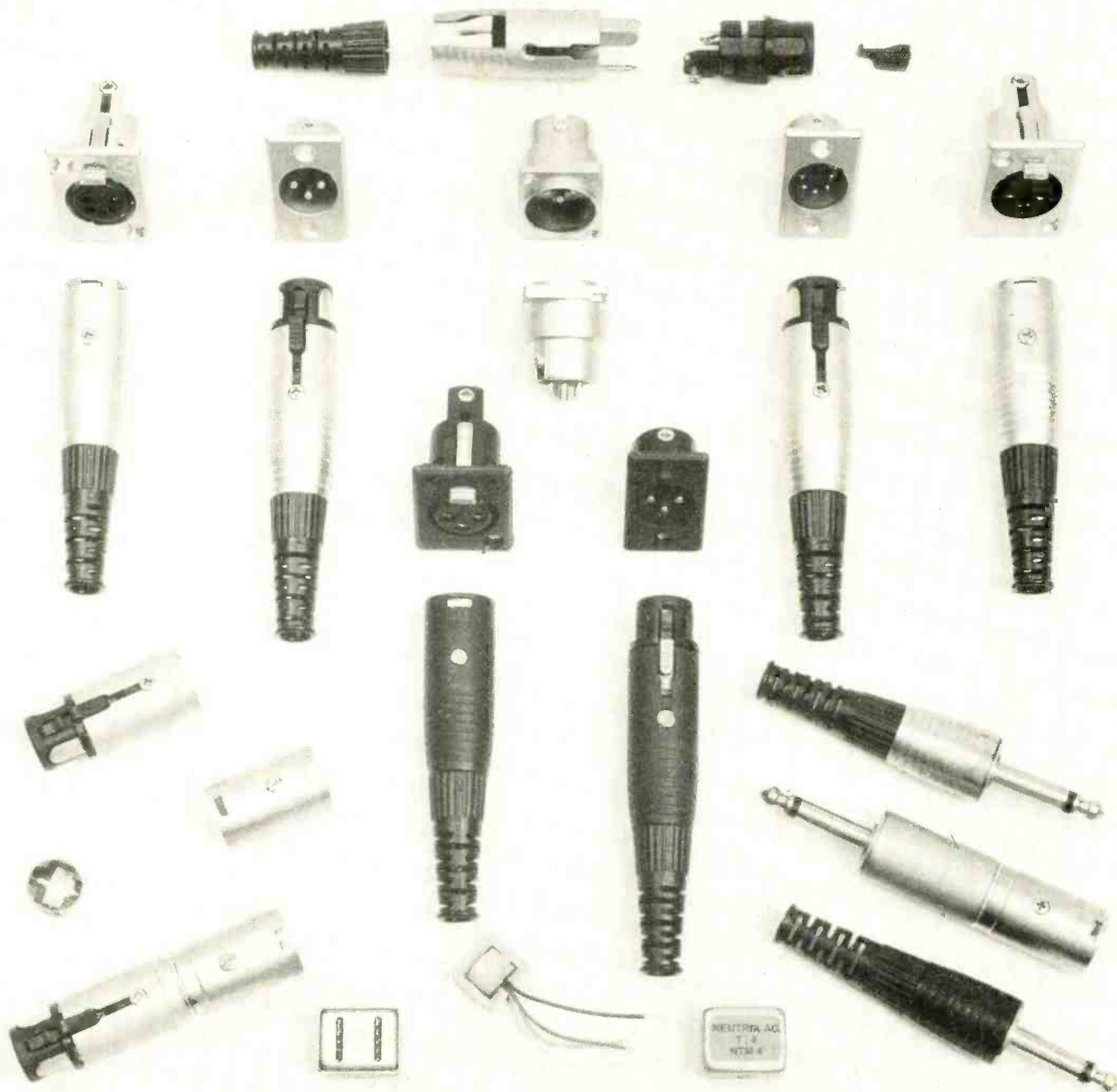
People

- Pye Business Communications Limited has appointed Alasdair Gardner as its national sales manager for PA equipment.
- Ferdinand Boyce has been named marketing manager of E-V/TAPCO. Other appointments include the promotion of Ric Chinn and Jeff Michka to product managers.
- Len Morphew and Graham Hobbs have been appointed executive directors of Peavey Electronics (UK) Limited.
- Bill Isenberg has joined RTS Systems as senior design engineer for a new range of equipment.
- Neve Electronic Holdings has announced the appointment of Ronald Skelton as group manufacturing director.
- Walt Weiskopf has joined Los Angeles' Scott/Sunstorm Recording Studios as disc mastering/recording engineer. Walt was previously with Motown Records, Artisan Sound Recorders, and ABC Recording Studios.
- Ed Engberg has been appointed product manager of the audio products group within the Ampex Corporation's Audio-Video Systems Division.
- Richard King and Ray Townsend have been appointed directors of World Wide Pictures Limited, the film sound recording and audio visual production company based in London.

All aspects of static

A new publication has been launched which is entirely devoted to the important question of static—its causes, the many problems it creates, and the means by which the problems may be solved. Sponsored by Vermason Limited, a leading UK manufacturer and distributor of anti-static materials, and consultant on all matters appertaining to static, the news sheet is called 'Aspect'. Apart from its direct meaning, 'Aspect' is a mnemonic for Anti-Static Proposals & Electro-Conductive Technologies. 'Aspect', which will initially appear three times a year, is distributed free of charge and copies are available from Vermason Limited, Staton House, Birds Lane, Letchworth, Herts SG6 1HX, UK.
 Phone: 04626 72005.

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studio diary

Olympia Studios, Munich

The former wine and beer cellars of the Diesel family's house (yes, the inventor of the engine) may seem like an unlikely place for a modern 24-track recording studio yet that is where Olympia Studios, Munich has its base. Unfortunately on this particular day my camera refused to work particularly well, so I'll have to put my descriptive powers to work the best I can!

The studios are owned by composer and producer Ralph Siegel and in some ways they operate in a similar manner to Barbarossa, in as much as the studio caters mainly for in-house productions. However, this by itself is no small operation as it covers Siegel Music and various other music publishing companies, a record company, a production company, plus the studio. There are also three resident house producers and between them and the various associated productions, account for 80-90% of studio time worked, the remaining time is taken up by outside bookings. As may be deduced, Olympia is very much geared to the German hit parade and easy listening market—plus the inevitable disco—and as such offers less than could be desired in the way of experimentation or development for the three resident engineers. The engineers are an international bunch: Conny Jahn (German), Cedric Beatty (British) and Bruno Gebhard (Swiss). The main complaint of the hit parade market in Germany is that competition tends to stifle any development as everybody jumps onto the same bandwagon for fear that any change will be meddling with success. The result is that out of 20 records released you will have a hard job trying to tell which one is which! This situation has been very frustrating for many engineers who feel that in terms of new techniques and music the outside world is passing them by. However, there have been signs recently that the climate may be changing with enquiries and bookings from groups and artists 'on the other side of the fence'. They are looking at studios such as Olympia because it is more forward technically and not just a 'hit parade factory'. In this way the 10-20% free studio time may start to become more important artistically than the production line work though the preferable state of affairs will be to strike a happy medium between the two types of work as in

the long run both can benefit each other.

The building is situated in a fairly quiet residential area—rather like St John's Wood in London—and therefore does not suffer from traffic or tram noise—or parking problems! The main house holds the offices of the various companies and the studio entrance is at the side where a wide flight of steps gives access to the basement—or cellar—studio premises. A hall serving as lobby and waiting room allows access to the two control rooms and main studio, meaning that excess people can be parked comfortably with a cup of coffee or whatever. I was met by Bruno, the Swiss engineer from Basle, and we steamed first of all into the control room. This is a 90° room with the



studio window to the right. Construction bears more than a passing resemblance to the Eastlake style though the two *TM-3* monitors are the only actual Eastlake installations at present. However, the control room is scheduled to be rebuilt by Eastlake which will entail sinking the floor further down to give more ceiling height and turning the room round to give straight-through vision into the studio. Mixing, centres around a 3-year old Harrison *4032* desk with Allison programmer. Olympia seem quite happy with the Harrison and are already showing interest in the new models. Monitoring is as mentioned on *TM-3*'s with *HH 500D* amplifiers and White equalisers. Recording is via Studer *480/24* and two *480/2*-track recorders as well as the usual 'where would we be without them' *Revox 477s*. All recorders are situated between the monitors. Outboard

equipment also includes Audio & Design *F760* and *Scamp* equipment, Urei limiters, Eventide *DDL*, Orban sibilance controller, Aphex, Dolby's and White $\frac{1}{3}$ -octave analyser. I also noticed two Cadac compressor modules which Bruno told me were used mainly on the stereo foldback sends, this is quite popular with the studio musicians. Reverberation is selected from either an EMT gold foil or *AKG BX20*. There are also naturally full cassette and record playing facilities. The control room also sports a fair selection of electronic keyboards for 'on-site' work and includes models from Oberheim, Moog and Roland, thus giving a comprehensive range of sounds to work with. The instruments are arranged either in front of the desk or along the left wall and

so are out of the way when not needed. The atmosphere in the room is very pleasant and relaxed and has none of that cramped feel about it that some well-stocked control rooms can have though to be fair about it not all studios have this amount of space available.

Next, the studio, though one could really say studios, as it is here that the former vocation of the cellar becomes apparent! Again the style and decor owes something to Eastlake as well as quite a bit of homegrown imagination to enhance the existing architecture of walls and arches. The decor definitely creates a relaxing atmosphere with much use of soft carpets, light colours and coupled with many movable spotlights. The entrance to the room, rather like a small lobby, could be described as a rhythm area with a large number of percussion instruments lying around as well as assorted bass and guitar

amplifiers. The arch going through into the studio used to be double and here a bit of ingenuity has been used. Owing to the thickness of the walls, one arch has been made into a trap for bass guitar amps and Bruno told me that it had worked out very well. (So now you know what you can do with your disused doorways!) Through the archway into the main area and on the right is the 'open' drum cage, with movable screens should you want to cage the drummer in properly. Again various amps were scattered around the walls but in the main the central floor is left clear for vocal mics thus giving room to move. The far wall houses two isolation rooms, one for guitar and one for piano. In the past these alcoves were no doubt used for housing the better vintage and most musicians probably feel that it is a pity that the tradition is not continued! The booth for the grand piano has been made very dead using close miking technique—even down to covering the lid with a blanket. If a more 'open' sound is required it's no hassle to just roll the piano out into the main studio. By contrast the guitar room is much livelier with basically, a panelled wall construction, enabling the amplifier to be miked up a couple of feet away, thus giving a more onstage sound. In a corner by the isolation rooms are some of the other in-house keyboards such as Clavinet and Rhodes plus an old Hammond *M3*. In fact I saw quite a few *M3*'s around in Munich so they must be popular—*B* or *C3* type sound in a spinet organ meaning less space and weight to take up and haul around.

The next part of the studio is right out of Edgar Allan Poe (author of many mysteries). Going through yet another archway you find yourself on a balcony looking down into a well or sunken floor with the ceiling in the shape of a quarter sphere with curving arched supports. Though it could be a useful small arena where troublesome clients could be thrown to the lions, it is in fact used for recording string and brass sections. There is enough room for 30 musicians comfortably, and a few more without too much squeezing. The acoustics are needless to say excellent and though fairly close miking is used more often than not, a stereo pair mounted on long boom stands from the entrance balcony, will more than suffice to get a real

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concert hall sound. Certainly for large productions this kind of facility is a considerable asset.

Microphones used around the studio are mainly AKG and Neumann including a reasonable collection of valve U47s. Apparently these latter can prove to be a mixed blessing as, like many things in life, they can have their days and vary from excellent to downright disappointing, even though nothing will have been touched or moved from one day to the next. They still don't want to sell them, however!

Olympia also have a well equipped copy room or Studio B. This houses Studer A80 2-track machines as well as a Studer 089 console. Monitoring is by large Cadac's with built-in amplifiers. The studio is fitted with 10 mic lines that are linked through to the main patch in studio A so that the room can be used as an extra studio when large productions require it.

Among the well known German names who record at Olympia are Peter Alexander and the group Ghenghis Khan. The latter were the German entry for the 1979 Eurovision song contest and are another example of a group manufactured from session singers and musicians. In fact they were getting ready to finish off some vocal overdubs while I was taking my leave of Bruno.

This then is Olympia, a large modern studio that is committed mainly to in-house productions for the home German market. Though no one would dispute that successful business is what keeps a studio solvent and this usually means the hit parade, it would be a shame if a studio with such possibilities were not given a bit more of a chance to flex its artistic and creative muscles—to everybody's mutual benefit. Perhaps even the hit parade's!

Olympia Studios, Hoechstrasse 2, D-8000 Munich 80, Germany. Phone 089 984926. Telex: 05 22946.

Terry Nelson

Crystal Sound Recording Studios, Hollywood

Crystal Sound Recording Studios is not just another Hollywood Studio—in their 10 years of operation they have been responsible for a number of firsts (apart from over 300 hit records) within the industry, some of which have been adopted by the industry—whether or not the industry realises it or manufacturers will admit it. Owned jointly

by Andrew Berliner (president and chief engineer) and John Fischback (vice-president and chief engineer), both have very strong and often revolutionary ideas about the recording industry—glimpses of which can be seen in this article.

Crystal began in 1969 in existing premises with studio A and a Crystal Custom 30/24 console in a massive 27ft by 30ft control room and large 50ft by 40ft studio. In 1970 disc mastering was added with Neumann lathe and Studer 2-track preview machine. Finally two years ago a mix room was added using heavily modified Studer multitrack tape machines and a brilliant custom Crystalab mixing console. Throughout these 10 years the Crystal studios have been constantly taking shape, as room for improvement or better ways of

For now, it is still state of the art for 1979 with 30 channels and 24-out; 4-stage equalisation on each channel with access points for peripheral equipment and a comprehensive jack bay. Outboard equipment in regular use includes two EMT 250 digital reverberation synthesisers, Marshall *Time Modulators*, two ADR *Scamp* systems, Urei, Teletronics, EMT and ADR *Vocal Stresser/Complex* limiters, plus two live echo chambers. Tape recorders are Studer A80, 16- and 24-track machines. Full Dolby-A noise reduction system is permanently installed in all studios. The mix room is full of surprises—it appears surprisingly small but to a sound wave it looks like a 30ft hall and there are no problems with standing waves—a series of unique louvres will catch bass waves as

only machine with two heads: one for 16 and one for 24-track so that 16 or 24-track tapes can be played back at will—the whole system, Dolby's and all, can be switched between 16- and 24-track with one flick of one switch and you're in business. Originally, after we purchased that machine Studer informed us that they wouldn't sell us any more transports but when they saw what we had done they were pleased to say we could have as many as we liked. I was pleased too because it set a standard which was important for us and for the industry.

And so to the console which is the biggest surprise of all—the Crystalab 40/24 mixing console. Designed by Andrew Berliner, it is simple to operate (some people have complained that it looks too simple, they being preoccupied with knobs, buttons and packing density), but as Andrew Berliner pointed out, one of the most expensive items on today's console is the complex switching systems which is also where you tend to get most failures and consequently costly down time. Peripherals can be patched in at any point as and when they are needed.

The equaliser on each channel of the console is a 5-band parametric with detents on all controls for repeatability. The equaliser circuitry employs differential summing techniques where a signal is drained off the main signal flow and processed, and then added back through the feedback circuit of the summing amplifier. Essentially equalisation of a small portion of the signal takes place and is then mixed back into the original signal either in-phase or out-of-phase depending on boost or cut . . . it's the side chain principle which has only recently come into prominence. The effect is when eq is added to the differential summing, the distortion goes *down* instead of up. This is particularly significant when boosting at 15kHz and above at 20dB, the distortion goes from a nominal level of 0.09% to 0.04%.

Andrew Berliner: "We thought we had made a mistake when we first measured it. We knew the equaliser design was sound but were surprised to see the distortion actually go down. A great added bonus—Supertramp made good use of that added bonus on *Breakfast in America* because they worked on the mix for the album for a couple of weeks and then scrapped all the mixes they had done having realised what could be done with the console." And then there is the astounding programmable para-

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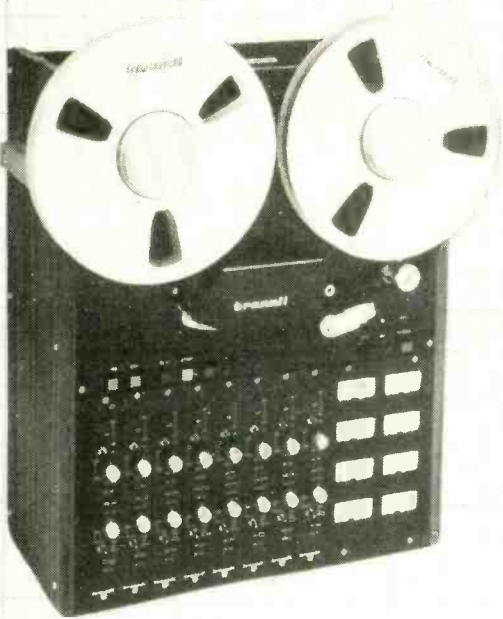
Crystal Sound

doing things were seen. Design is all in-house, the Crystal people are very wary of expensive 'guaranteed performance' rooms. John Fischback explains: "We know from experience that no matter who goes in and designs the studio, the greatest acoustic designer in the world cannot guarantee to get it right. There is a studio in New York that spent tens of thousands of dollars the first time for a 'guaranteed performance' studio design, and *again* the second time and they still haven't got it right. You can't make a mock-up, calculate everything and then build it (like an airplane) and have it come out right—it never works out that way. You must feel your way when you are building a studio."

The board in A was built 11 years ago and is due to be replaced towards the end of the year with another Crystalab custom console.

they follow the wall and channel them into deadening material; whatever gets through will be channelled off by the next louvre and so on. Waves hitting the back wall will be absorbed by a thick hand-made wool tapestry—there is a space behind the tapestry for a trap, in case it was needed . . . which it never was. The room is panelled throughout with birch, all dowering was turned from ebony blocks so it is all *real*—including the sound—and the whole room floats. Monitoring is via custom cabinets with JBL components and small Visonics which are used a lot. The tape machine is a surprise—a heavily modified Studer A80. Andrew Berliner describes it: "We call it the Crystal/Studer/Dolby system. Basically it's all Studer electronics with Dolby *Cat-22* card built right in and then we built the interface for it. This is a playback-

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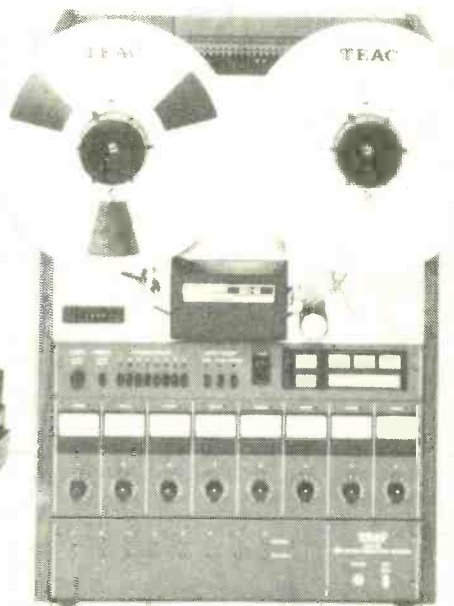
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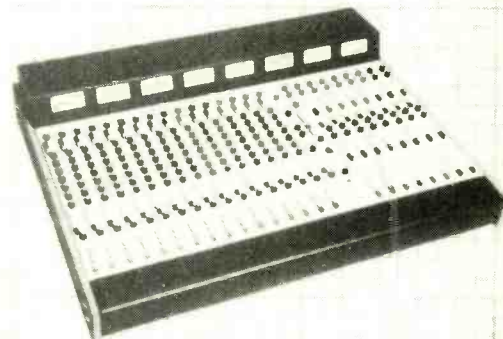
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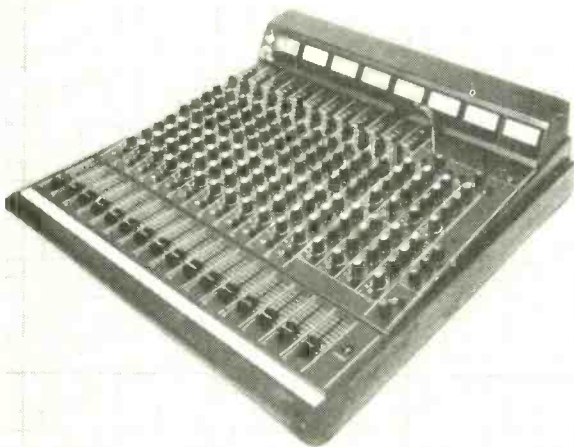
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metric attenuator coupled to the Crystalab proprietary automation system with Crystalab time code system. The Crystal console is presently equipped with 6in throw faders with a modified A curve (6dB for the first inch travel, 6dB for the second inch, 12dB for the third, 12dB for the fourth, and 24dB for each of the fifth and sixth inches, for a maximum 80dB range. By inserting one plug in the exponential memory card the audio taper of all 50 channels can be changed to whatever an engineer desires. Thus, there is no optimum point on the fader as with most conventional faders.

While other automated faders are scanned at a rate of 60 times a second the Crystalab fader is scanned 1000 times a second, giving typically greater resolution of an order and a half, and this is significant especially at the lower end of the fader's travel, where on conventional automated faders there is often great error. With the Crystal system all 50 faders (or more) will track exactly together within $\frac{1}{16}$ th of a dB over the entire 80dB range. All this and specs to baffle—slew rates of 125dB per second at 1kHz to 2,500dB per second at 20kHz are inherent in its design. Charge coupled noise of better than -90dB relative to input with no zipper noise, no modulation . . . an FET switch is the secret to it all.

Andrew Berliner: "A well-known British manufacturer came to us with an interesting offer for the fader and attenuator system but they wanted to put their name on it so we couldn't agree—other companies have approached us as well. Incidentally the first prototypes were developed in two weeks, while an aerospace company we know of with 36 engineers working on a similar device weren't able to do it." Storage is via a fixed disc and the Crystalab proprietary timecode system allows synchronisation of the master audio tape, console and disc memory systems—the timecode signal itself is a modulated 20kHz sine wave recorded at 35dB below reference, inconspicuously onto a bass drum or bass track—it can't be heard and even if it could it can always be filtered out of a bass track. With SMPTE timecode, at least one track on the multitrack is given up, more often two with a guard track—in conventional automation data is stored on other tracks and a lot of tracks can get lost. Andrew Berliner: "It's like the VCA—there's a better way of doing it, it may cost more to develop but it's

well worth the cost". The console doesn't end there. It has a unique submaster system described by Andrew as "a multiple grouping system where each one of the six submasters are additive in the total dB attenuation curve". What this means is that each channel has six selectable submasters not a thumb-wheel where only one submaster can be selected for each channel—all six submasters can be selected on one channel giving greater flexibility. Drums and bass can move together for example or a guitar with a piano. They can also be used as mutes and are great for effects; the effects return can be put on submasters and have a number of effects coming in and out at the same time or at different times or they can be used to add increments of delay.

In practice, the local fader can be dialled-in for 10dB of attenuation and selected on two or three submasters each with 10dB of attenuation. Thus the net is 30 to 40dB of attenuation. So the overall attenuation is controlled by either each one or a combination of grouping systems. The console is super quiet; the summing buss noise is -90dBV below reference (0.775V). This noise can then be brought down further in 3dB steps. As the mix gets progressively louder, instead of bringing the master fader down, the whole summing buss can be brought down bringing the whole noise of the console down. With a mix at -6dB the total noise can be brought down to -96dB by the time the job is done, which means fading out into absolute nothingness.

John Fischback: "On a digital machine it is unbelievable; when a song is over there is nothing, absolutely nothing, no matter how much gain is in the system". Crystal has been experimenting with the Sony digital 2-track recorder and is enthusiastic. John Fischback: "Contrary to the opinion of some, digital is happening right now, not in two years' time. The 2-track digital recorder is a reality and those that have heard a mix onto digital 2-track will agree that the step has been taken right there. The first thing we did was set up a 2-track Studer with Agfa tape running at 30in/s and sent the same mix to a Sony 2-track digital. We played back all three machines, the original master multitrack, the digital and the Studer, all synchronised. You can't tell the difference between the digital and the original multitrack and our Studer is good and Agfa tape is fantastic. The transient response gives it away in

an instant—a snare drum all of a sudden doesn't have the snap, the clarity isn't there.

"And our mix console can actually use the digital noise floor because it's lower—digital is going to mean big problems for some consoles because they won't be able to make full use of the digital technology; -70dB to -80dB is the noise floor for the average console though many manufacturers claim a lot more. With all 40 channels onto the busses you're talking about better than -90dB on the Crystal console. It's all how you measure it of course—some people make outrageous claims and there are some people who will think our claims are outrageous." The underneath of the console, it was pointed out, was as it were 'open to the elements' and for inspection, no shielding. The system does not suffer from RF, a remarkable feat when one considers digital and analogue circuitry are running side by side throughout the console and Crystal stands right in the path of 50kW of radio station in Inglewood. John Fischback: "Every guitar amp in the studio can be busy with KDAY but the console will remain silent".

There is no doubt that Crystal with the installation of the new Crystalab console in studio A is ready for the first multitrack digital machine (by which they don't mean 3M)—"it's not a professional machine yet and you can quote me on that," quoted Andrew Berliner. The new recording console for studio A, apart from having the ingredients of the existing mix console, will be a 48-input x 24-output design with 32-track monitor unit including an effects insertion switch on each channel. The same military spec parts will be used exclusively. John Fischback: "Building your own console is expensive and time consuming and to be honest we would have bought a Neve or a Helios or a Cadac or SSL if their audio performance was up to this one. As it is they concentrate too much on knobs, flexibility and cosmetics rather than the sound, not that they sound bad, they could sound better—the technology is there and cost does come into it." Apart from the signal processing already mentioned, not much is used in the mix room. Clients who use Crystal's services don't tend to use a lot of outboard equipment . . . "You just don't see the room stacked with DDLs and so on. For example, Peter Henderson used a few extra tape machines for Supertramp's last album but very little outboard equipment, he had it all

on tape—apart from which the nature of the music didn't lend itself to that, by that I mean heavy metal. We haven't done a lot of heavy metal—it seems the people we cater for are more interested in the music than effects. Not that we don't have this capability."

Of the outboard equipment that is in regular use, the ADR *Scamp* system is a firm favourite, due, apart from the effects obtainable, to its extremely low noise and distortion. John Fischback: "It's one of the few pieces of equipment that doesn't add noise to the console. The analogue *S24 Time Shape Module* is a particular favourite—when you use a regular digital effects unit, it's so noisy that should you have anything simple going on where it is quiet, anything you process with those things through the console just adds noise and it's impossible to gate it out because all of a sudden you get this swoosh as it rushes in and out every time the gate is triggered."

Crystal studios then is by no means your average 'state of the art' studio—but one that is staffed by people with very much their own idea, who are not afraid to experiment to achieve the best. They probably suffer in the process, but are unanimously agreed amongst themselves that it's worth every penny and minute, because apart from being professionals, they enjoy it. If some of the stories about the board sound too good to be true—hearing is believing . . . so next time you're in Los Angeles why not go and ask to hear a demonstration.

Crystal Sound Recording Studios, 1014 North Vine Street, Hollywood, Cal 90028.
Phone: (213) 466-6452. Enbee

The Sound Box—Mobile

A new mobile recording studio. The Sound Box, owned and operated by Tom Newman (ex-The Manor, and of Mike Oldfield's *Tubular Bells* engineering fame) has recently joined the ranks of mobiles based in the UK. On a wet and windy autumnal afternoon I visited Tom in north-west London to see the new mobile for myself.

Prior to being shown the mobile, I briefly discussed with Tom his involvement with the UK's recording industry. Tom was in at the ground floor development level of the present UK recording scene. He's probably best known as the creator with Richard Branson (owner of Virgin Records) of that archetype out-of-town recording

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studio, The Manor. When he and Richard set about converting The Manor into a studio, 4-track was the state-of-the-art and of course there have been many changes since then; however, it is worth remembering that Tom and Richard progressively improved the studio facilities and equipment as technology progressed, never content to rest on their laurels. Tom has always believed in being at the forefront of innovation, something which to a large extent The Manor epitomised, and although his ties with The Manor and Virgin Records are less strong now, he readily acknowledges that his experiences at The Manor have had a strong influence on his approach to the mobile. His belief in diversification and long experience certainly appear to have been carried over to the mobile which although it is only 16-track has, to say the least, some unusual features.

Before detailing the equipment and facilities of The Sound Box, I'll outline the vehicle's history—which has an unusual pedigree. Upon my arrival at Tom's London headquarters I surveyed the vehicle from afar and concluded, unless my eyesight had suddenly deteriorated, that it was a converted horse-box truck unit—the type which racehorse trainers use for transporting potential Derby and Grand National winners, etc. I asked Tom and the mobile's administrator Pete Sullivan if this was in fact the case and received the somewhat perplexing answer of "No and yes". Tom explained: "The vehicle is built on a Bedford horsebox chassis, but it

never was a horsebox. The chassis dates from 1952, but the vehicle was built for ATV as a mobile video/audio OB unit primarily designed to be used as an OB commentary and video/audio mixing unit, which was stationed at various racecourses to cover horse-racing meetings." The vehicle at this stage in its development was split into various partitioned areas and had its interior and under-floor area crammed full of bulky valve equipment and tie-lines, much of which was mounted in a plethora of 19in racking. After a while the mobile became rather outdated for its ATV function and in need of replacement, so the mobile was then sold to Laurie Marsh who stationed it at Pinewood Film Studios. Here it apparently remained until the solid-state revolution and advent of inexpensive colour video production facilities made it redundant. The result of all this was that when Tom acquired the vehicle in 1976 it had only travelled 5,000 miles and was still in very good condition.

At this period of time Tom had ceased work at The Manor and was involved in his own highly unusual mobile studio, The Barge. This was, and still is, a converted canal narrow boat. When Tom owned The Barge he had a 16-track studio in it and operated from a base on the Grand Union Canal in north-west London. Although The Barge was mainly permanently moored, Tom recalled one occasion when he travelled along the canal and moored outside a church on the canal and ran his tie-lines in to

record a session. While this was all very enjoyable, not to say slightly mind-boggling (let's face it, only an unusual person would put a recording studio in a canal boat!). Tom eventually decided to concentrate his attentions on the mobile and in early 1979 he sold The Barge to Richard Branson of Virgin. Currently, The Barge is permanently moored at the Regent's Park canal basin, and its facilities have been expanded so that it now has a 16-track studio and an 8-track studio, ideal for demo work.

But returning to the mobile, a great deal of time in the early days was devoted to stripping it out. The internal partitions were removed, and apart from the majority of the 19in racking, which Tom acknowledges as being a pleasant bonus facility, the interior was virtually gutted. Repainting and reconstruction as a mobile sound recording studio didn't commence until late 1978 due to Tom's other commitments, and it was only in mid-1979 that The Sound Box began to take shape.

As previously mentioned the vehicle is a Bedford (horsebox) unit. It is 7ft 7in wide and 23ft long, of which approximately 18ft is usable as the mobile's control room. The rear half of the mobile, containing the console and ancillary equipment racks, is at a higher level than the front, which contains the multitrack tape machine. This is a legacy from the vehicle's early days when various video equipment was positioned beneath this high level floor. Although retained at present, Tom has not ruled out the possibility of lowering this floor in the future. However, it presents no problems in its present form as the console, ancillary equipment and monitors are neatly placed for near ideal operational usage.

Equipment which The Sound Box boasts is most definitely out of the ordinary. The console, for example, is one of only three built by Rebis Audio, better known for its ancillary processing equipment. The Sound Box's Rebis console is a 28/16 desk with 16-group busses, two aux sends, and four Rebis comp/limiters built in. The console uses Penny & Giles faders, has an external patchbay mounted in the aforementioned 19in racking, and utilises the mic/line module format including two sections of parametric equalisation per channel. Although presently in a 16-track configuration, Tom informed me that the console can be expanded to 24-track without much alteration and he stated that in due course this expansion would take place.

The finish and feel of the console was to a very high standard and I was suitably impressed by it.

The Sound Box has two Ampeg AG440 stereo machines and a Revox A77; these are rack mounted at the rear of the mobile. The multitrack machine, however, is highly unusual. It comprises an Ampeg MM1000 transport with 16-track and 8-track headblocks, but Tom has added two sets of Soundcraft Magnetics' electronics, ie the electronics used on Soundcraft's SCM-381 8-track tape machine. This customisation allows the MM1000 to be optimised for equalisation and speed, the normal operating speed being 15in/s. The multitrack will also operate at 7½ and 30in/s; however, at these speeds the equalisation requires re-alignment. Incidentally, the multitrack is fitted with dbx and Dolby-A noise reduction. Tom is also currently customising a second MM1000 to the same configuration as that presently installed in the mobile.

The majority of ancillary equipment consists of Rebis Audio modules; ie six noise gates, six compressors, and six limiters, plus a further 16 noise gates mounted in a separate 19in rack. Other units available include a Sound Workshop Model 262 stereo spring reverb and an EMT Model 240 plate reverb. There is the almost statutory wide selection of microphone types from AKG, Beyer, Electro-Voice, Neumann and Shure. Tom's only comment regarding mics was that in a fit of pique he recently sold his valve U47s and has been regretting it ever since.

Monitoring in The Sound Box is via either *Auratones* mounted on top of the console's VU meter panel, driven by a Leak TL25 valve amplifier, or through JBL 431/s driven by an Amcron DC300. These latter monitors are mounted on side wall slide rails allowing the JBL's to be adjusted forward or backward for the preferred listening position of different engineers. A sensible arrangement for a mobile where space is limited. Incidentally, monitoring over Stax headphones may also be carried out, the headphones being driven by the Leak valve amplifier.

In addition to Tom Newman, The Sound Box can call on the services of engineers Andy Morris and Steve Cater, both ex-The Manor, while bookings are handled by Pete Sullivan and Ian Roche.

Noel Bell

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Tom Newman at the console of the Sound Box Mobile

Photo: courtesy of Chis Nation



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- * Two outputs, each with up to 400 ms of delay.
- * Two selectable algorithms to optimize pitch change performance.
- * Micro pitch change ensures extremely precise, stable settings.
- * Long delay permits simulated reverb.
- * High and low feedback equalization, coupled with the use of delay and pitch change makes possible a range of special effects hitherto unobtainable.
- * 15 kHz band width.
- * 96 dB dynamic range.
- * Dual colour LEDs give markedly improved front panel readability.
- * Switchable 115/240 volts.



* Harmonizer is a trade mark of Eventide Clockwork Inc.



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Expression through time delay.

Time delay has become increasingly important to musicians and engineers as a way to color musical sounds and create spatial illusions. MXR's Flanger/Doubler and Digital Delay have proven to be effective tools for the musically creative professional who requires a wide range of performance possibilities from a precise and cost effective time delay unit.

Both the MXR Flanger/Doubler and Digital Delay offer a flexible system of controls which provide ultimate freedom for creative expression. They feature frequency sweep and width controls, a mix control (between the dry and the delayed signals), a regeneration control for additional intensity and multiple repeats on doubling and echoes, and a delay bypass jack which enables the user to employ a footswitch to bypass the unit entirely for instantaneous cut-offs of time delay effects. Both units represent an expandable system, and can be easily ganged together or interfaced with other instruments and recording gear.

The MXR Flanger/Doubler provides a manual control over delay time, and rear panel connections offering full remote delay time adjustments and a VCA output suitable for stereo ganging of two units. The MXR Flanger/Doubler can switch easily between flanging and doubling modes, and two LED indicators are provided for easy visual monitoring of sweep speed and range.

The Flanger/Doubler is capable of producing infinite varieties of flanging, hard reverberation, vibrato, and numerous doubling effects including subtle chorus sounds. It offers a time delay range of .25 to 5 milliseconds in the flanging mode and 17.5 to 70 milliseconds in the doubling mode.

The MXR Digital Delay offers a continuous range of delay times from .08 to 320 milliseconds. This range of delay times is expandable with three optional memory cards, in 320 millisecond increments to 1280 milliseconds, with full bandwidth (20Hz to 20kHz) capability to 160 milliseconds. The Digital Delay features push button controls for varying delay ranges. A level control regulates the input signal to prevent overloading of the unit's circuitry, and LEDs monitor the input level and indicate whether the effect is in or out.

At fixed delay times the Digital Delay is perfectly suited for "traditional" delay applications such as "slap echo," discrete echoes, and synchronization of speakers in PA applications. By adjusting sweep frequency, mix, regeneration, and level controls, the Digital Delay offers additional effects which include doubling flanging, pitch alteration (vibrato, pitch bending), frequency modulating, and infinite (non-deteriorating) repeat hold.

The MXR Flanger/Doubler and Digital Delay are designed for use in the studio and on stage, with line or instrument levels. They're reliable, delivering a clean signal consistently, with a dynamic range exceeding 80 dB. And as with all MXR Pro Group products, optional road cases are available. For the serious artist, the MXR Flanger/Doubler and Digital Delay are the versatile tools which provide the key that will unlock his creative musical imagination.

MXR Professional Products Group



New realms of expression from MXR.

The Pitch Transposer is MXR's newest addition to our professional line. It is one of our most innovative products, and possibly the most revolutionary signal processor in the music industry today. It is a unique, high-quality unit which provides a cost effective and flexible package for today's creative artists.

The Pitch Transposer extends your musical boundaries by creating live instrumental and vocal harmonies. It has 4 presets which allow the artist to predetermine the intervals to be processed. Transposed intervals can be preset anywhere from an octave below to an octave above the original pitch. The chosen interval is activated by means of touch controls or a rugged footswitch. LED indicators display which of the four presets has been selected.

A mix control is provided, enabling the unit to be used in one input of a mixing console, or with musical instrument amplifiers. A regeneration control provides for the recirculation of processed signals, creating more and more notes, depending upon the selected interval. This results in multitudes of voices or instrumental chords. An entire new range of sound effects and musical textures, unattainable with any other type of signal processor, is suddenly at your fingertips.

With many other pitch transposition devices a splicing noise, or glitch, is present. The MXR Pitch Transposer

renders these often offensive noises into a subtle vibrato which blends with the music, and is, in some cases, virtually inaudible. The result is a processed signal which is musical and usable.

We have been able to maintain a high level of sonic integrity in this most versatile signal processor. The frequency response of the processed signal is beyond 10 kHz, with a dynamic range exceeding 80 dB.

A micro computer based display option allows the user to read the created harmonic interval in terms of a pitch ratio, or as a musical interval (in half steps). This unique feature allows the pitch to be expressed in a language meaningful to both musicians and engineers.

We designed our Pitch Transposer as a practical musical tool for those actively involved in creative audio. It reflects our commitment to provide the highest quality signal processors with the features and performance that will satisfy the creative demands of today's musical artist. See your MXR dealer.

Atlantex Music, Ltd., 34 Bancroft Hitchin, Herts. SG51LA, Eng., Phone 0462 31513, Tlx 826967



Audio sweetening

Stefan Sargent (Molinare)



Moli audio sweetening studio with custom built console, ITC triple stacks, Studer A80 16-track, and TLS2000 Tapelock, and Mitsubishi large screen television.

THE technique for sound mixing films is internationally standardised but unfortunately the technique for video tape post production is not. The term 'dubbing' applied to films means only one thing, mixing together pre-laid music, speech and sound effects, but applied to video tape could mean duplicating video tape, picture, sound and all! Even the expression 'sound mixing' in video means mixing the sound live. 'Video sound post production is an accurate description but no use at all in everyday speech.

The Americans coined a beautifully succinct and evocative term 'audio sweetening'—"It'll be great with a little audio sweetening". While this sort of jargon goes down well in Los Angeles, in London it doesn't. We at Molinare say: "Let's book the TLS", TLS being Tape Lock System. The BBC have 'Sypher' which stands for—I think—Synchronised Picture Helical with Eight Track Recorder. Personally, I'll stick with 'audio sweetening'.

Before any sound can be sweetened either on film or video, the picture and its original soundtrack need to be edited and it's worthwhile describing how the film people tackled the problems. During film editing the original $\frac{1}{2}$ in sound tape is transferred on to magnetic coated film, this film having exactly the same physical dimensions as the picture film. A

One of the principal applications for synchronisers is audio sweetening—the post production of sound for video. Stefan Sargent, MD of Molinare, a large radio and television production studio complex in London, and has spent considerable time developing television post production facilities.

crystal generated 50Hz pulse on the $\frac{1}{2}$ in tape controls the speed of the replay machine so that 24 frames of sound film matches exactly and synchronises with 24 frames of picture film. The first frame shows the clapper board in the closed position and is synchronised up with the bang of the clapper. The picture is put into a projector and the sound played by a magnetic replay machine, usually called a sound follower. Long ago, the two were locked up mechanically so that as the film projector turned so the sound replay mechanism also turned frame for frame, foot for foot. Nowadays, this is done with servo motors but the principle is the same. The secret of synchronisation is the sprocket holes and these little marvels keep everything tightly in sync, backwards and forwards.

At the end of the picture editing process the editor has cut film, synchronised with separate magnetic sound. It is one track of synchronous sound—dialogue or sound recorded while the camera was shooting. All the other sounds like music, background sound

effects, overlapping dialogue are missing. The cut sync sound has unwanted level changes, abrupt dropouts of background atmosphere—even unwanted background sound effects such as passing aircraft. Now the music is scored and recorded, dialogue post synchronised, special effects like punches in a bar room are recorded and synchronised. Each 1,000ft reel of picture may have 10 or 20 reels of magnetic sound film. Each reel is separate and contains just one kind of sound to make it easier on the sound mixer. The film and sound editors have now completed track laying.

Finally, there's the sound dubbing session. The sound mixer has a cue sheet with footages relating to projected film footages on the screen. To assist him in anticipating effects or sound changes the film is often marked by long chinagraph lines moving across the screen from left to right. Major dubbing theatres can run more than 10 replay sound followers at the same time plus, of course, a recording machine. If the dubbing mixer makes a mistake or

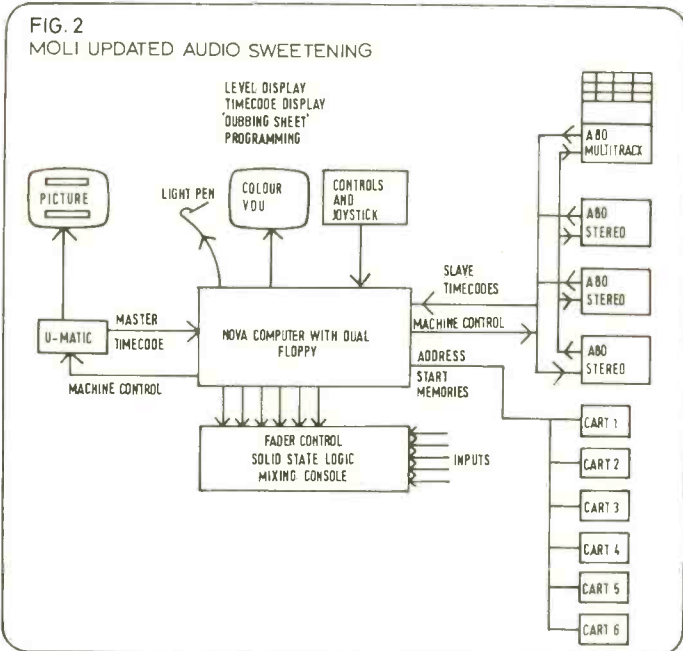
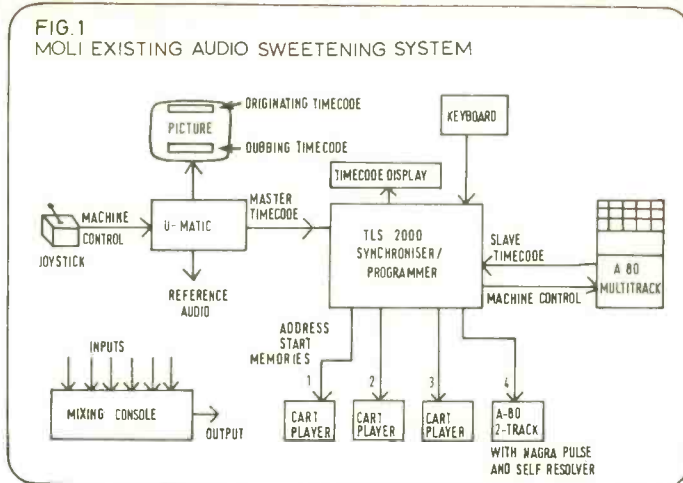
simply does not like the balance, all the machines stop, rewind at high speed and run forward again in perfect synchronism. This technique of constantly shuttling backwards and forwards is called 'rock 'n roll'.

These relatively simple film dubbing techniques are almost impossible to duplicate in video. Film has sprocket holes, real tangible pictures that can be scribbled on, chopped up, stuck together. Film has a perfect length by length relationship with sound. The magnetic film can also be chopped, written on, hung on hooks, etc. Video tape, whether it's 2in, 1in, $\frac{1}{2}$ in or $\frac{1}{4}$ in, has no sprocket holes, cannot be touched and is useless when static. When running synchronised with a sound tape there is always a speed difference. For example, 1in C-format tape in PAL runs at 9.44in/s while $\frac{1}{2}$ in sound is normally recorded at 15in/s—unlike film, there is no perfect length by length relationship.

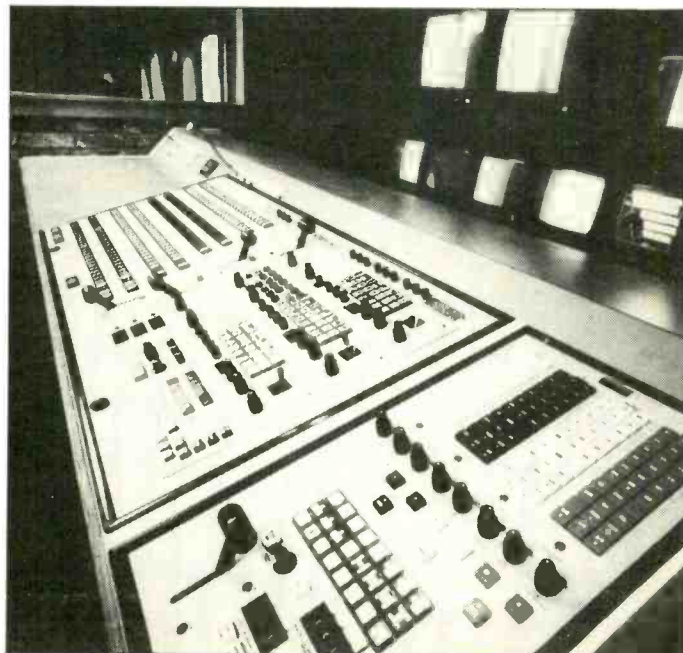
Fortunately, the need for audio sweetening co-incided with the computer age. By use of digital equipment it is now possible to track lay and sound mix with video which, when compared with film, is much more immediate and generally more flexible. Here is how we operate at Moli—by the end of 1980 we will have updated all the equipment, but more of that later.

When we are shooting we normally record the sound on the same video tape as the picture, as well as on to a ¼in stereo Nagra. Both the video tape recorder and the Nagra contain a quartz clock which produces a time of day signal (timecode) recorded on a special audio track on both machines. When replayed through a micro-processor controlling the mechanics of the video tape and audio machine, this timecode becomes the electronic version of sprocket holes. Not as simple as a clapper board but much more accurate since every frame is numbered individually. The video editor always knows true sync whereas the film editor loses sync reference once the clapper is removed. This gives us a double system for location sound just like the film people. Not only is our sound quality dramatically improved by recording on ¼in tape, but it allows us a better flexible shooting and editing operation.

Picture gathering is essentially a shot by shot operation whereas sound gathering is more continuous. Consider a band marching down the street—the sound man needs to record the music intact while the cameraman needs to be here, there and everywhere, getting various angles. A few years ago, video consisted of multiple cameras fed to a vision mixer and, in turn, to a video tape recorder in a truck. Nowadays, the trend is to work with one camera—film style—and record the sound separately. Back at base, the video editor cuts the picture and the sound. The ¼in tape at this point is either left untouched or is laid down as a continuous sound master for picture editing. The video tapes for editing are replayed from several video tape machines and their time code at this stage is used by a computer editor which finds shots, synchronises machines and does frame accurate edits. Pictures and sound are normally cut at the same time. VTR sound is often used as a guide track and replaced by ¼in sound in audio sweetening. The editor has a small sound mixer which serves as a source select and level control. The mixer also provides an easy means of switching between direct and replay sound from the record machine. The record machine has pre-recorded black video with continuous timecode that runs from zero to one hour. It also has four audio tracks—tracks one and two are used for stereo or twin-track audio. On track three we re-record the original 'time of day' timecode and track four is our master dubbing timecode. The advantage of using two timecodes is that we can always find the original shot again and it is extremely useful if we



below: Moll Video editing desk with Vital vision mixer and Squeezezoom digital video effects generator used for visual effects



decide to drop the sound recorded on the video tape recorder and replace it with high quality Nagra ¼in tape.

When editing a documentary we use the two audio tracks on the record video tape machine for putting down commentary and edited sync sound. If we were doing a documentary on the 'Art of the Potter', we would lay down commentary on track one say for example: 'The clay now enters the kiln'. We'd then look for a shot to suit and insert it on to the video tape with the location sync sound of the kiln room on track two. On track three is the time of day when the scene was taken, say, 10hrs, 38mins, 42s and 06 frames. On track four, dubbing timecode, say, 0hrs, 5mins, 22s and 14 frames. The video tape is now ready for the audio sweetening people. It's important you understand that it has to pass through four distinct operations.

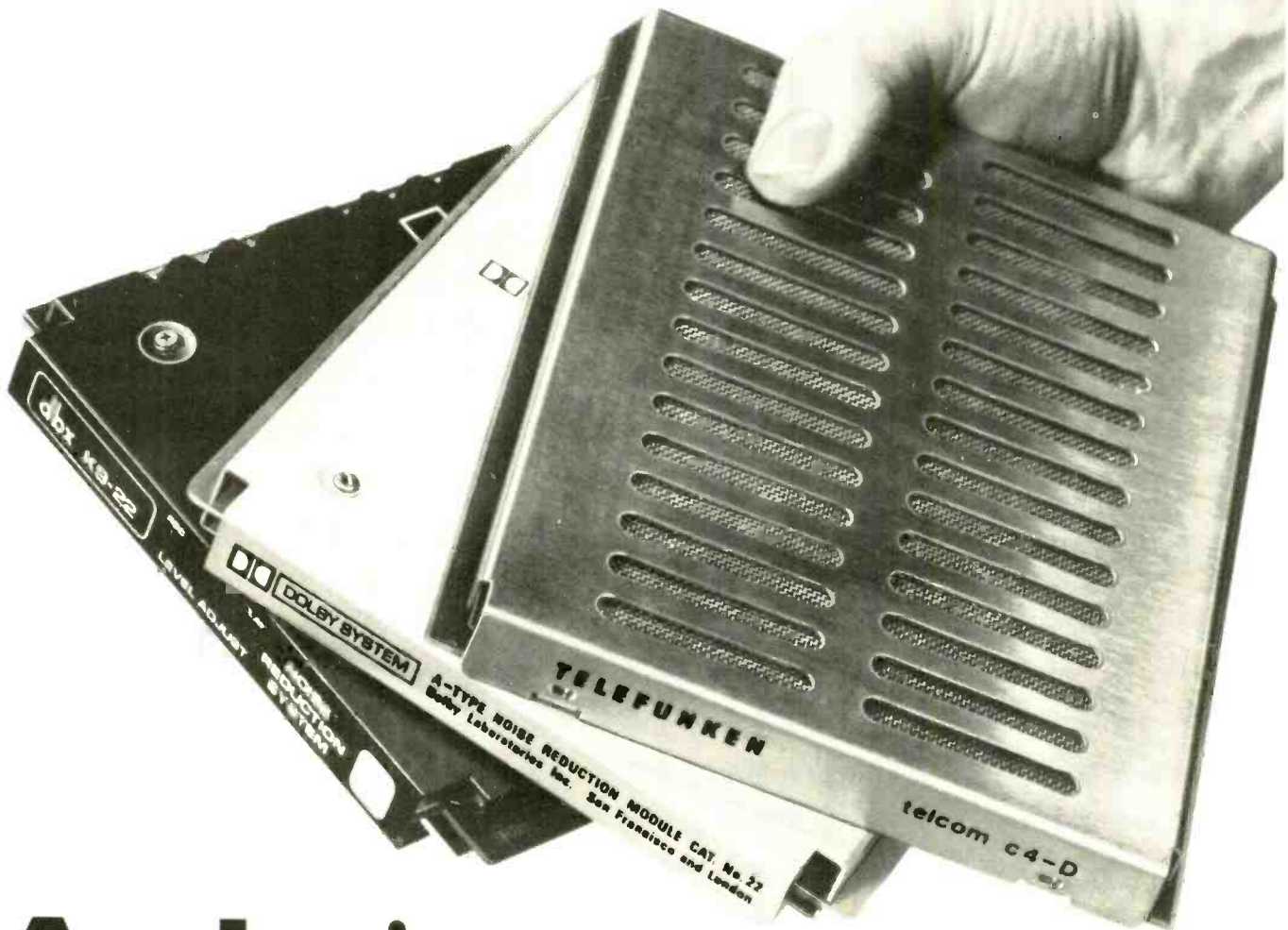
Stage one is the making of a U-Matic (video cassette) copy of the picture with 'burnt-in' timecodes. On top is the timecode of the original shot; in the pottery documentary this was 10:38:42:06 (hrs, mins, s and frames). At the bottom of the frame we insert the timecode of the master tape—00:05:22:14. All these numbers are permanently on the picture. A U-Matic only has two audio tracks. Track two is traditionally used for reference audio and track one has the dubbing timecode. It is this timecode from the U-Matic which is later used as the master timecode. To the multitrack tape, we transfer timecode to track 16, the narration to track five and the VTR sound to track 11.

Timecode, although a hearty sounding machinegun noise, is very easily distorted and needs to be reprocessed through a timecode generator each time it's copied. We often receive tapes from other studios where the timecode has gone through several copies without regeneration and it is almost impossible to use. This is a small plea for timecode to be re-created rather than duplicated!

With the preparation of the multitrack tape and the U-Matic cassette, step one is completed. Step two is track laying. Although we use our video dubbing suite for this process, we are not mixing the sound. All we are doing is building up separate music and sound effects tracks on the multitrack machine. At the moment, we are using a 16-track Studer A80, however, working in stereo we are running out of tracks and will soon have to move to 24.

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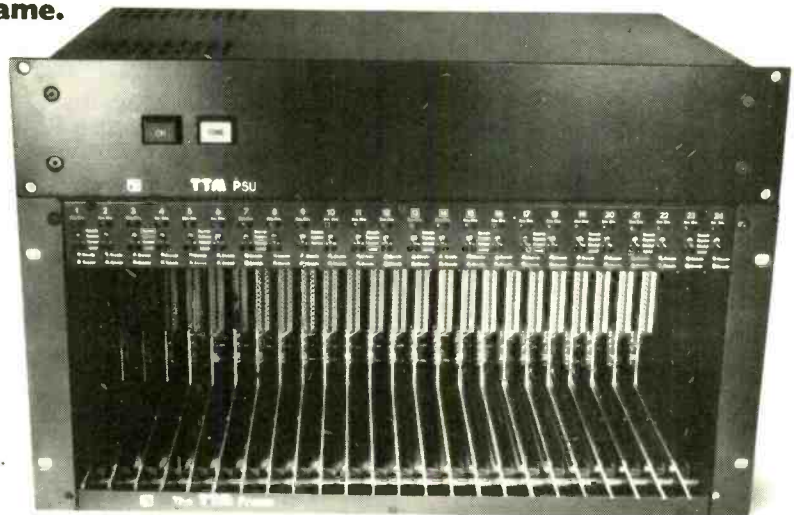
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Audio sweetening

A computer memory is programmed to start and stop the effects tape at pre-determined timecodes. The picture, the multitrack tape and the slave $\frac{1}{2}$ inch tape are run and the $\frac{1}{2}$ inch duped on one track of the multitrack. The effects tape is replaced by another one and it too is transferred to another multitrack track, stopped and started by timecode. We never have the time to make up a pre-edit tape. Our clients camera shoot in the morning, video edit in the afternoon and audio sweeten at night. This is why we have a flexible, fast system using multiple cart machines.

Step three is the mixing of the tracks down to premixes and then on to track 14. It's very similar to a music mixdown and requires a music type mixing desk. The first task is to go through the dialogue, equalise, rebalance and mix on to track nine. No matter how careful the video editor has been with his levels, he cannot get it completely right because he has been working one shot at a time, whereas the dubbing mixer is hearing it as a sequence. Sometimes we need to lift off a dialogue track on to $\frac{1}{2}$ inch

for re-synchronising or extending and overlapping. As the TLS system only locks together two machines, we need a third machine that will hold sync. For this purpose we have adapted an A80 with a Nagra 50Hz pulse. It has its own built-in self synchroniser and will record and replay at exactly the same speed. The only problem is to get it to start at the right point. This is done using an address start memory and a chinagraph start mark on the tape.

Step four is taking the mixed sound track from track 14 and laying it back to the master video tape recording. To do this the video tape recorder is loaded with the original master video tape. Its timecode is played back to the TLS system which now slaves the A80 to it rather than the U-Matic.

Our current system represents the state of the art. Although it is in constant use, there's always room for improvement. Solid State Logic are developing a system that will do the following:

1. Lock up one master video tape recorder with three slave stereo machines plus one 24-

track.

2. Address start up to 10 cart machines.

3. Control all mixing levels by timecode which can be preset during the track laying operation and updated during the mix.

4. Memorise equalisation, compression, expansion, limiting and refer this back to each frame of timecode for manual matching.

5. Joy stick control of all machines, together or individually.

6. Colour visual display unit with two functions:

(i) display all timecodes and address starts and with space for arithmetic calculations such as offsets and address start.

(ii) a film type dubbing sheet using computer graphics in lock with the master video tape. As the picture moves so the dubbing sheet moves up the screen in synchronism. It should be possible to enter any level changes and address starts directly on to the dubbing sheet using either a light pen or a digitising tablet.

The beauty of the system is that 8-digit SMPTE timecode figures should never need to be entered by keyboard: access is direct through the visual display unit.

At Moli we're trying out a novel form of timecode interlock that is infinitely expandable and does not rely on machine ballistics or interfaces. The secret is the use of a primary channel digital delay unit. In practice the audio slave machines are started a few seconds ahead of the master video. Each slave audio machine has a high quality delay line inserted in its audio path. The delay operates at a sample rate of 50kHz with a 16-bit word. The dynamic range of the unit is 100dB, noise and distortion is less than 0.001%, to all intents and purposes the delay unit doesn't exist. The length of the delay is controlled by a comparator that samples the master timecode and multiplexed slave timecodes. Each delay unit has a capture range of 10s and so the machines can be run with no special servo speed controls at all. It also means that we can synchronise any audio source—cartridges, cassettes, film, anything—as long as the slave machine is started a few seconds earlier than the vision with which it has to synchronise.

I foresee that all programme production for television will ultimately be shot and edited on tape. Not too far away there will be more 'audio sweetening' than 'film dubbing'. ■

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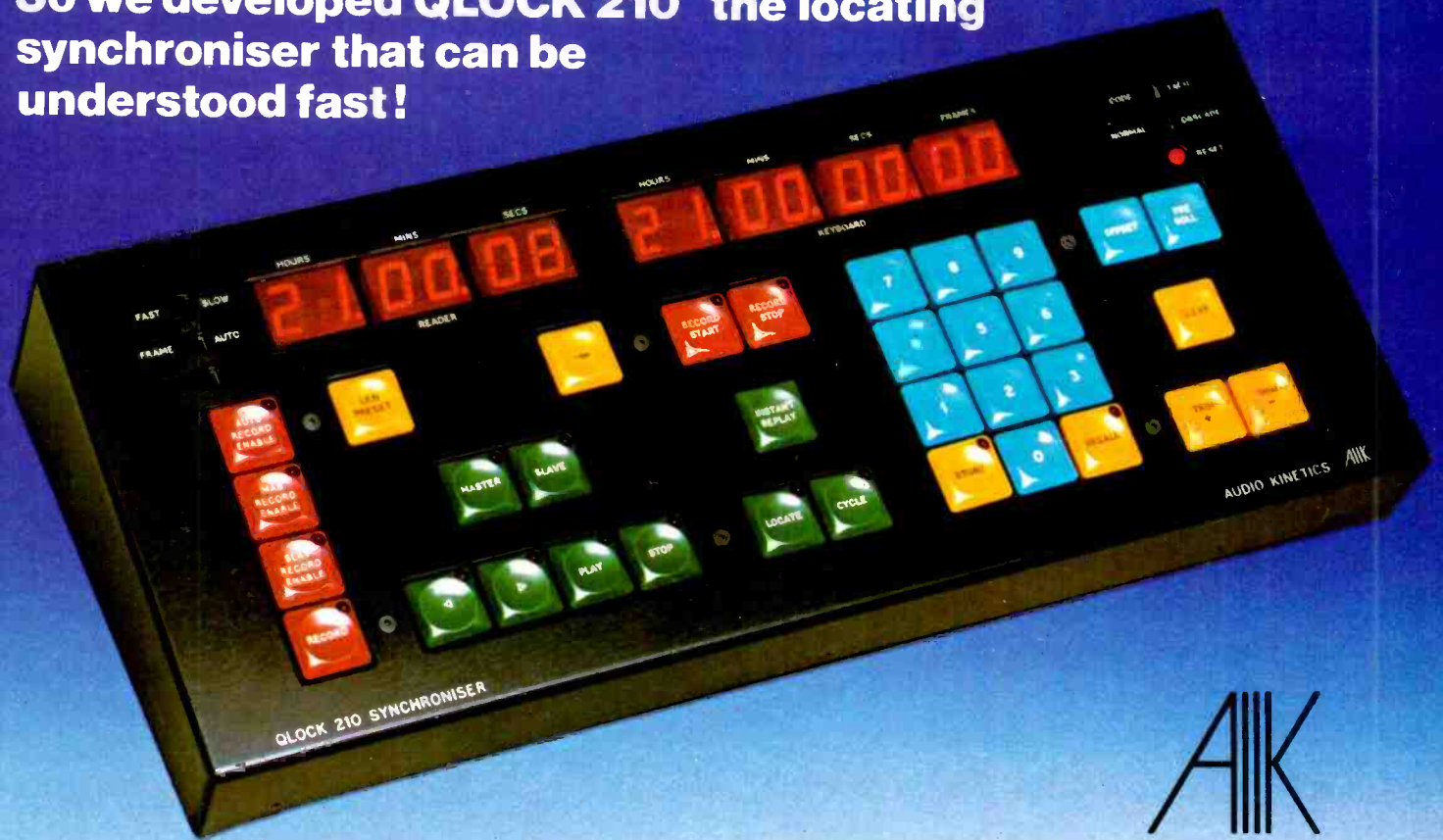
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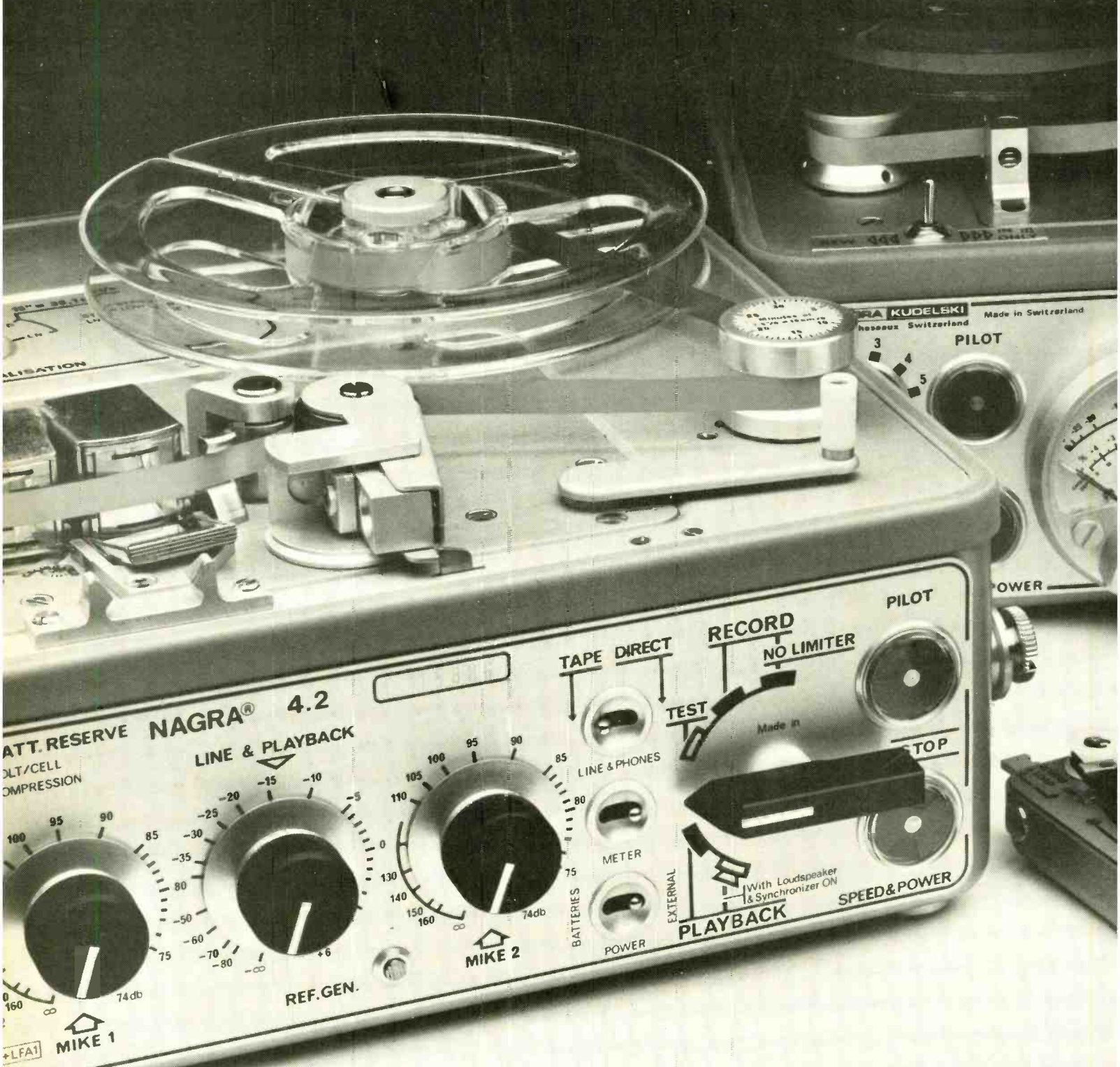
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Survey: synchronisers and autolocators

This survey includes electronic tape synchronisers using timecode to provide locking between two or more tape transports, and autolocators that are available as options for tape recorders but not autolocators built into tape machines. It also includes the more common timecode generators for those synchronising systems that do not already have a generator built-in. SMPTE timecode is American based for 30 frame/s television pictures, EBU being the European derivative for 25 frame/s. Maglink timecode is not compatible with SMPTE/EBU timecode, but may be read in fast wind without wide bandwidth heads and amps.

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Phone: 0344 26726. Telex: 849371.

Model 605

Synchroniser for master transport providing locking for two slaves (video or audio), using SMPTE/EBU timecode. Operates over 1,000:1 speed range with an accuracy to 1/100th of a TV frame (333µs USA, 400µs Europe). Operates with inconsistent and mixed timecodes, provides programmable stop and automatic roll-back, permits independent rapid cueing of transports. Slaves follow master wind and stop functions and 15 stores are available for timecode comparisons. Servo outputs are available as either bipolar dc signals with adjustable offset, or as 9.6kHz FM signals. The timecode reader does not use phase locked analogue loops and is thus able to recognise noise, drop-outs and splices before they reach the tape recorder capstan and cause flutter. Interfaces are available for Ampex MM1100/1200, ATR100 VPR1, VPR2, VR2000, Ferrograph Studio 8, Bosch BCN50, JVC CR8300, Sony



Adams-Smith Model 605 video tape editing synchroniser

VO2850 (modified), Studer A80, 3M M79 and Philips PVR2. Does not include timecode generator. Price: £8,000 including three interfaces.

an amplifier. Offset range is $\pm 0.33s$, accuracy 3.3ms. Price: on application.

API (USA)

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Minimag

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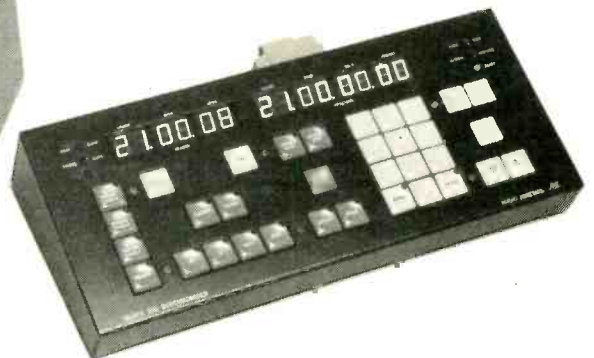
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60 ▶



Left: Audio Kinetics XT24 Intelocator remote control and autolocator. Below: Qlock 210 Synchroniser, Audio Kinetics



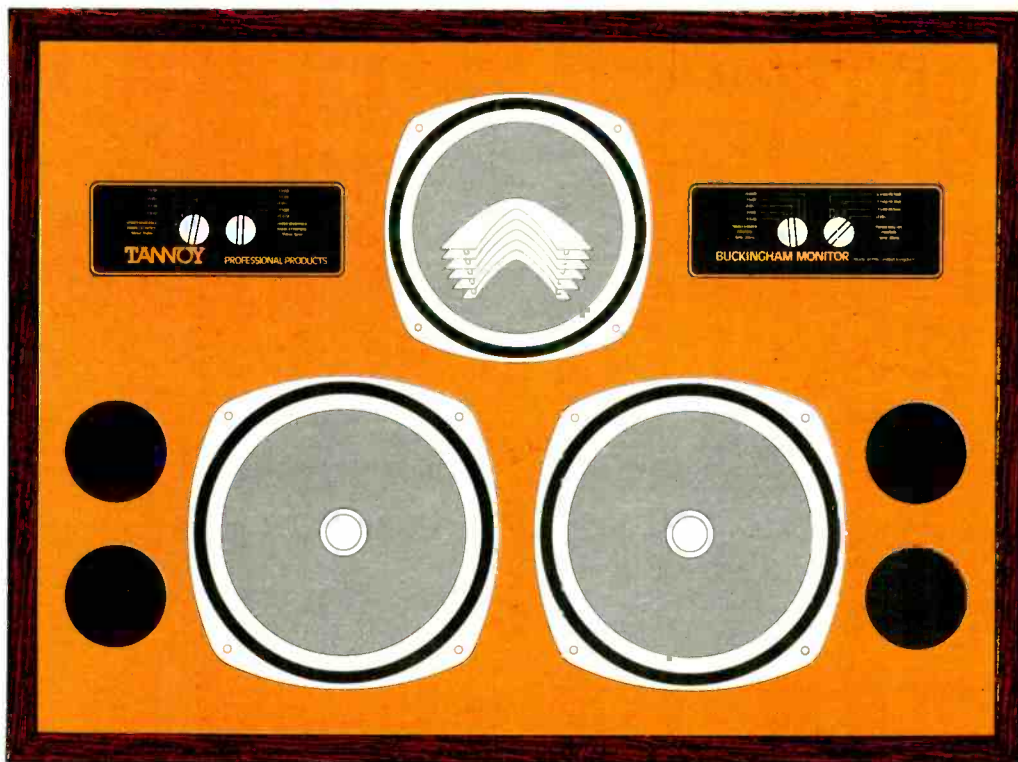
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Buckingham Monitor internal volume 230 litres (8.1 cu. ft.); 1030 mm width x 722 mm height x 430 mm deep
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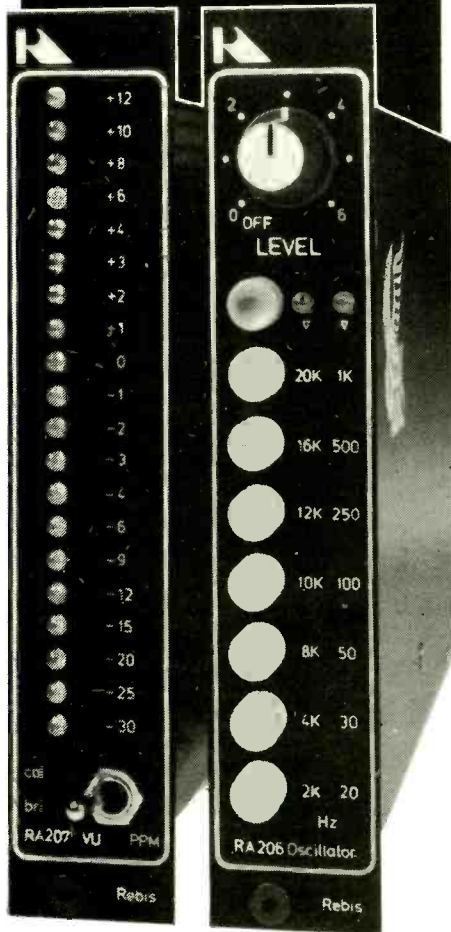


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RA206 OSCILLATOR. A very low distortion signal source with push button selection for 14 accurate spot frequencies. Variable output level of up to +22 dBm into 600 ohms, and constant level at all frequencies make the RA206 Oscillator an invaluable aid to efficient studio maintenance. Price £68.00

RA200 RACK. Accepts 16 RA200 Series modules. Size 5.25" (3U) x 19" x 10". Price £80.00. RA200 PSU £78.00

For full details of the
RA200 Series contact:
Rebis Audio
Kinver Street Stourbridge
West Midlands DY8 5AB England
Telephone Brierley Hill (0384) 71865

SURVEY: SYNCHRONISERS AND AUTOLOCATORS

QLOCK 210

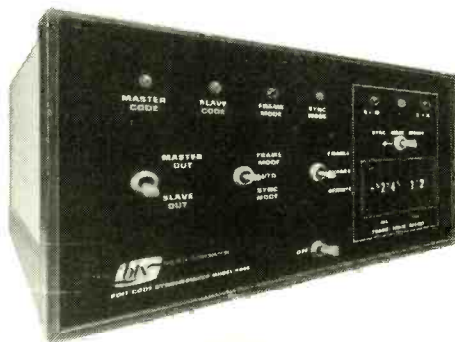
A multi-microprocessor SMPTE/EBU timecode generator and synchroniser able to locate and lock two audio/audio or audio/video transports. Cyclic sequence programming, SMPTE single frame accuracy, two additional event operations for auto record drop-in and out memories, or additional machines start and stop. Built-in SMPTE/EBU timecode generator with jam sync. Offset memory with calculation facility, 10 memory locate points, record/offset/locate memory frame trim facility, user definable pre-roll, use definable instant replay full transport remote controls, high speed tachometer processing eliminates need for tape to head contact in wind. Cascade feature allows linkage of two or more QLOCK systems for control of three or more machines, or control by external computer command source. Interfaces to Ampex MM1200, ATR-100 and VPR-2, IVC 9000, JVC 8300, Lyrec TR532, MCI JH-16, 3M M79, PAG Broadcast 16 (mag film transport), Otari MTR-90, Sony 2860 and Studer A80 and A800.

Price: £5,800 including two interfaces and cables.

XT-24 Intelocator

Intelligent autolocator that has the capacity to 'learn' a particular tape plus transport behaviour pattern, and subsequently optimise the locate sequence. Uses two separate counters for master and intelocate, four pre or immediate load memories, in/s readout for varispeed, full transport remotes, leverwheel numerics for fast entry of locations, $\pm 2s$ accuracy over 30 mins of tape at 15in/s, auto compensations for high and low speed, auto master count freeze display. Illegal commands are indicated on the display by 'Huh?', and interface are available for 3M M79, Studer A80, Ampex MM1200 and ATR-100 MCI JH-16.

Price: £1,300.



Btx 4500

BTX (USA)

The BTX Corporation, 438 Boston Post Road,
Weston, Mass 02193, USA.

Phone: (617) 891-1239.

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

4500

Synchroniser designed to slave a single magnetic transport to another audio or video transport using SMPTE/EBU timecode. Contains integral timecode readers and offers three modes. Frame Mode provides frame-by-frame comparison of actual timecode, Sync Mode maintains synchronisation by comparing frame rates of timecode but ignoring actual numbers, Auto Mode provides direct synchronisation by comparing timecode numbers then maintains its using rate. Master timecode input operates at only normal speed, slave between $\frac{1}{2}x$ and $4x$. Accuracy $\pm 50\mu s$. Provides both a dc control voltage for servo capstan machines, and a squarewave frequency which may be used with an external amplifier to drive non-capstan servo

transports. Thumbwheel switches set frame offset, but no timecode generator or code display. May be slaved to synchronise more than one slave. Interfacing to specific machines only requires cable sets to be made up, no specific electronics being required.

Price: £2,850.

4100

SMPTE/EBU timecode generator, includes presettable start code, display and remote function capability.

Price: £1,995.

4200

SMPTE/EBU timecode reader, reads standard code down to $-18dBm$ from $\frac{1}{10}x$ to $80x$ play speed, forward and reverse, includes large LED display and BCD serial and parallel outputs.

Price: £1,995.

4300

SMPTE/EBU timecode video display and reader, reads standard code down to $-12dBm$ at play speed only, and inserts frame location into looped through video for monitor or recording.

Price: £1,060.

4600

SMPTE/EBU tape remote controller designed to offer timecode automation to standard audio or video recorders. Provides full remote control of fast forward, rewind, play, stop, record in, record out, record enable. Pre-programmable with up to 30 sequential instructions, multiple instant previews or replays, 'learns' conventional manual production sequences, calculator adds or subtracts codes, two LED displays of code, basic unit interfaces to two recorders, but may be expanded to handle three or four. Built-in timecode generator.

Price: two machine controller £3,450.

EECO (USA)

EECO, 1441 East Chestnut Avenue, Santa Clara,
Cal 92701, USA.

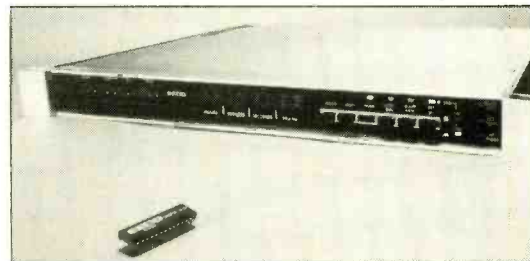
Phone: (714) 835-6000. Telex: 678420.

UK: Ampex GB Ltd, Acre Road, Reading RG2 0QR.
Phone: 0734 85200. Telex: 848346.

MQS-100

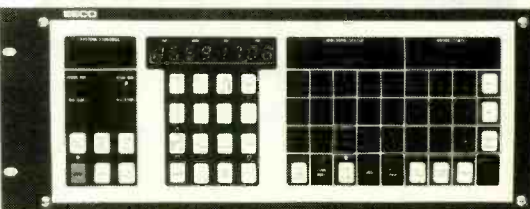
Provides synchronisation for three machines, video or audio, using SMPTE/EBU timecode. Latest model includes a MOS enhancement program providing additional and improved capabilities over earlier models. Features include roll back, cue, store direct, chase, offset adjustments, machine status, mixed transports, mixed timecodes (unrestricted offsets, drop or non-drop frame), remote

62 ▶

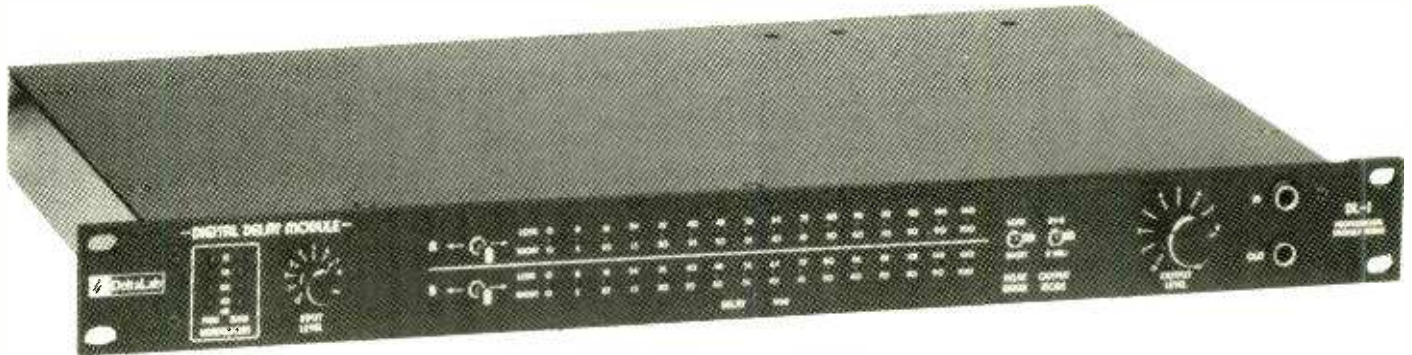


Above: EECO'S MTG 550 Series

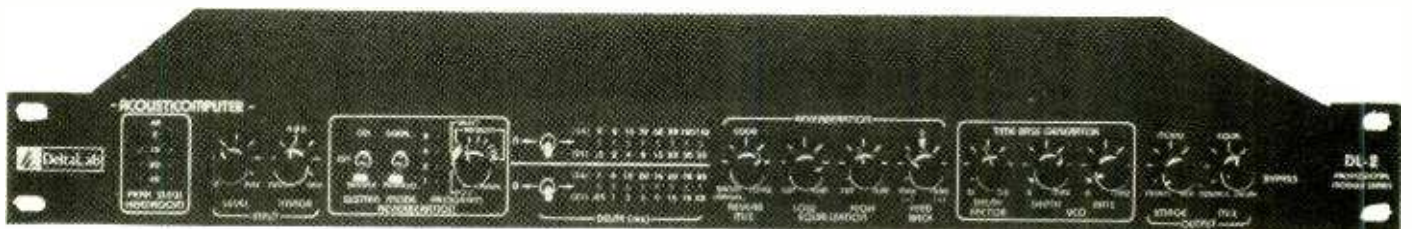
Below: EECO MQS-100



The DELTALAB DL1 offers 160 mS digital delay with a no compromise 20Hz-15KHz bandwidth and 85dB dynamic range even at maximum delay



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- ★ Equalisation controls

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The TRIAMP S30 speaker system has been designed to satisfy the requirements found in broadcasting, monitoring in small and medium-sized music and speech studios and control rooms where the maximum SPL needed is roughly 100 dB. The TRIAMP S30 is a three-way system with three integrated power amplifiers and an active crossover network.

Features

- \pm 3 dB from 40 Hz to 20 kHz
- symmetric input, + 6 dBm
- 105 dB SPL at 1 m
- separate power amplifiers for each driver
- level controls in each amplifier
- low level active crossover
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- solid construction with no frills or gimmicks
- compact size, 45 litres
- low cost

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SURVEY: SYNCHRONISERS AND AUTOLOCATORS

operation. Timecode may be transferred from any machine readout to any cue or register storage, machines enabled or disabled during system operation to reduce mode changing, three internal event commands for staggered starting, six scratch pad memories, freeze store of running code. Resync time is slow or fast, the former being sufficiently slow to eliminate pitch changes, accuracy is $\pm 100\mu$ s. Interfaces available for Ampex 1000, 1100, 1200, ATR, AG440, VPR1 and VPR2, AVR3, AVR2, RCA TR600, MCI JH-16, Studer A80 and A800, Sony 2850, 2860, JVC 8500, or timecode only option for other transports.

Price: about \$16,000 including three interfaces.

MTG-550

SMPTE/EBU timecode generator, presettable start time, drop frame or non-drop frame, binary word input for user bits, slave input, parallel data output, option for 24 frames/s.

Price: about \$3,000.

ELECTOR (Canada)

Electro & Optical Systems Ltd, 3015 Kennedy Road, Scarborough, Ontario M1V 1E7, Canada. Phone: (416) 291-4492. Telex: 06525431.

UK: Seltech Equipment Ltd, Rose Industrial Estate, Cores End Road, Bourne End, Bucks SL8 5AT. Phone: 06285 29131. Telex: 848960.

TCG MkIII

Portable, battery-operated SMPTE or EBU timecode generator. Keyboard allows user bits or timecode start to be entered, display for timecode, drop-frame.

Price: on application.

TCG/D2

Rack mounting SMPTE/EBU timecode generator. External input for user bits, jam sync mode, thumb-wheel entry of start code, timecode display.

Price: on application.

MAGLINK (UK)

Maglink Audio Products Ltd, 17 Erncroft Way, Twickenham TW1 1DA, UK. Phone: 01-891 2770/0895 39779. Telex: 8954029 for Maglink.

Maglink Multi-Machine System

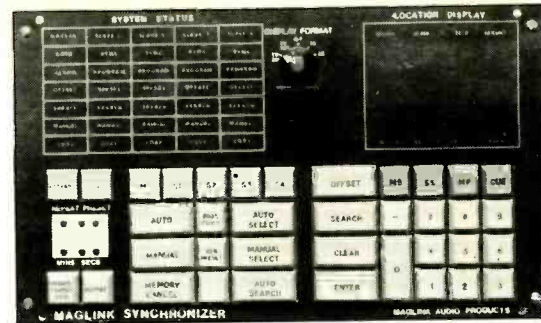
Expandable synchronising system using Maglink timecode (which is rather lower rate than SMPTE, and easier to use not requiring special heads and wideband electronics to read in winding). The basic system operates with one master and one slave, but additional slave cards may be added, up to a maximum of four. Interfaces to audio, video and film machines. Features include location display, switchable display format for various video or film formats, display hold, system status display, machine select and keyboard for entries, offset, searching, programme cue, advance or retard to speed up or slow down machines, repeat function, and cue recall. Interfaces available for Studer A80 and B62, 3M M79, MCI JH-100, Lyrec TR532, Tandberg 10X, Revox A700, Ferrograph Studio 8, Ampex ATR100, Brenell Mini 8, Soundcraft 381-8, Sondor Libra, JVC 8300, JVC 8500, Sony 2850 and IVC 711PC. Built-in timecode generator.

Price: basic one slave £9,650, extra slaves to five £1,400 each.

Mag-Lock Synchroniser

Basic synchroniser using Maglink timecode to lock two machines at play speed only. Both machines replay Maglink timecode which is displayed on built-in readers. Machines must be manually wound to within 50s of each other (using the display), before the unit is able to provide full synchronisation, after which the two machines remain in sync while in play. Includes built-in Maglink timecode generator.

Price: £2,500.



Maglink Synchroniser

Mag-Lock Basic Synchroniser

Similar to above, but without the Maglink timecode readers, so that initially the two tapes must be physically aligned to the same starting point (leader, splice or mark on tape) after which the unit keeps both in synchronisation using timecode.

Price: £1,250.

Maglink II Synchronising System

Basically similar to the Maglink Multi-Machine Synchroniser, but simplified to only operate with one master and one slave. Otherwise contains all the same features.

Price: £5,000.

Maglink Code Generator

Generates Maglink timecode, the start time being set of thumbwheel switches to any time within 24 hours, LEDs show code output, frame rate is switchable 25/30 frames/s.

Price: £950.

Maglink Code Reader

Reads and provides digital display of Maglink timecode. Operates in play mode with range of 0.02 to 2.5x play speed, and spooling mode (externally or manually selected) from 2.5 to 100x play speed.

Price: £950.

Minimag Reader

For use with Minimag (an API product), in conjunction with a Minimag Synchroniser, provides display of master and slave positions.

Price: £1,300.

Sprocket Code Generator

Enables a Maglink synchroniser to be easily interfaced with any machine having a shaft encoded output related to the transport. Generates Maglink timecode from a bi-phase input clock frequency normally available on most sprocketed film and sepomag machines, thus eliminating the need to record a timecode track. Thumbwheel switches allow timecode to be started at a specific time.

Price: £1,250.

SMPTE/EBU to Maglink Interface

Provides interface between tapes recorded with SMPTE/EBU timecode, and Maglink equipment. Reads EBU timecode at $\frac{1}{2}$ to 50x play speed, displays timecode on front panel, and then generates Maglink timecode which may be either re-recorded or used to lock Maglink equipment directly.

Price: £1,250.

Portable Code Generator

Generates both SMPTE/EBU and Maglink timecodes, start time set on thumbwheel switches, portable battery operated.

Price: £950.

MCI (USA)

MCI, 4007 NE 6th Avenue, Fort Lauderdale, Florida 33334, USA. Phone: (305) 566-2853. Telex: 514362. UK: MCI, MCI House, 54-56 Stanhope Street, London NW1 3EX. Phone: 01-388 7867. Telex: 261116.



Substantially more than just a recording console, the Solid State Logic Master Studio System is the world's only thoroughly integrated control room command center. The scope of the system's features affords a degree of creative precision that is without rival; yet the "total controller" approach actually simplifies studio operations. Producers have commented that the SSL brings previously impossible accomplishments within reach, while handling procedures which were once both tedious and difficult almost effortlessly.

A unique tandem-function logic network provides simultaneous command and status indication of both console and multi-track electronics. The most sophisticated studio software yet developed brings valuable computer assistance to recording and overdubbing as well as mixing. Comprehensive in-line signal processors, coupled with innovative signal routing, provide virtually un-

limited control of your audio without patching!

Control panel layouts are both logical and legible, allowing the most complex session requirements to be handled with nearly instinctive ease. Readily accessible modular electronics simplify maintenance, as does the extensive "Tests" program of the SSL Studio Computer. To ensure impeccable performance and reliability, production-line construction standards have been raised to the level of meticulous craftsmanship.

We were not satisfied to build just another recording console. Our challenge was to create, for the true artists in our industry, a powerful, elegant instrument which would not limit their creative expression in any way. The strength of this commitment has shaped one of the most exceptional products of recording technology ever offered: The Solid State Logic E Series Master Studio System.

Solid State Logic

Master Studio Systems

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Colin Sanders
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TLX 837400

THE AMERICAS
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3421 M Street N.W.
Washington, DC 20007
Doug Dickey
East Coast (202) 333-1500
West Coast (213) 464-8034
TLX 440519

SURVEY: SYNCHRONISERS AND AUTOLOCATORS

JH-45 Autolock

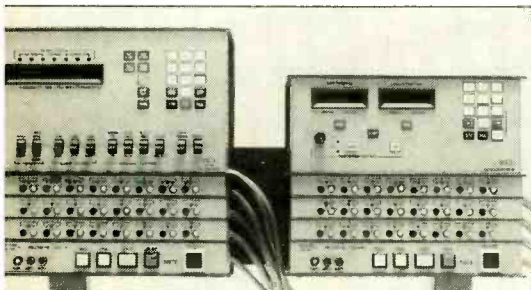
A self-contained synchroniser with built-in SMPTE/EBU timecode generator, readers, synchroniser and autolocator. Slaves any MCI transport to an audio/video/film transport replaying timecode, with a typical accuracy of $\pm 50\mu\text{s}$. Generates timecode synchronised to external power frequency, permits use of user bits in timecode, reads either tachometer pulses or high speed timecode in spooling mode, advance/retard at rate of 3 frames/s, code display shows absolute difference between master and slave, adjusted timecode display subtracts the offset to absolute timecode difference, park slave allows machine to stop within a frame of timecode display, punch in/out record at selected programmable sequence, 10 scratch pad memories, autolocator mode with realtime display, auto read/write of tape position counter onto tape itself with 10 memory positions, shuttle function between two points. Designed to interface to MCI transports for slaving, while timecode input is all that is required from master.

Price: \$7,896.

Autolocator III

Microprocessor based autolocator for MCI transports. Ten memory locations, up/down counter, displays realtime in minutes and seconds, flashing decimal point for a negative domain indicator, shuttle or repeat function, tape velocity indicator showing both in/s and pitch shift in $\frac{1}{4}$ semitone increments. 35ft connecting cable. Includes a fast windback time for 30in/s of about 15s per 100ft or tape by measuring inertia of tape spools. RTZIII is similar but built into JH-110 transports, provides only four memories, return to zero, up/down counter, tape speed indication in in/s, resettable counter. Price: Autolocator III \$1,725 factory installed RTZIII \$554.

MCI JH-45 (left) and Autolocator III (right)



SONDOR (Switzerland)

Sondor Export AG, Dachslerenstrasse 11, CH-8702 Zollikon, Zurich, Switzerland.

Phone: 01 65.80.90. Telex: 55670.

UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.

Phone: 02813 88447. Telex: 849469.

EPS8000

System allowing synchronising of any number of Sondor magnetic film transports from timecode supplied by an audio/video/film master transport. The system will operate by either using timecode on slave as a timing reference for synchronous operation with actual synchronism achieved by using start marks, or timecode, using timecode on slave to achieve precise synchronism comparing frame numbers, but with possible offset, and finally not using slave timecode, but taking timing information from transport itself with synchronism manually achieved on start mark. Allows electronic looping (rock 'n roll) within the Sondor system, provides reading at $\frac{1}{4}$ to 50x play speed and display of SMPTE/EBU timecode, but no built-in generator. Synchronising input from slave is either timecode or 2-phase

signal, output to slave is 2-phase signal. Price: on application.

STUDER (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf, Switzerland.

Phone: 01 840.29.60. Telex: 58489.

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

Phone: 01-953 0091. Telex: 27502.

USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tenn 37203, USA.

Phone: (615) 329-9576. Telex: 554453.

Tapelock System 2000 MkII

Synchronising system designed to operate with A80/VU or A800 as slave, and accepts most machines as masters. Synchronisation accuracy is 30 μs . Principal features are lock where the slave searches for the master address and synchronises immediately, offset up to 24 hours with display of actual offset, pilot which uses pilot tone as reference after synchronising achieved for transfers back to film, edit mode for programmable drop-in and drop-out to 1ms accuracy and with 8s pre-roll facility, and with rehearse facility (A800 only), address start and stop for up to four playback machines (cart machines), SMPTE/EBU timecode generator built-in with any address start, hold to capture a time in the memories, store offset which allows discontinuous timecode to be read back, offset being changed when necessary, wow and flutter compensation, operates at 24, 25, 29.97 or 30 frames/s, lock-up time 3s, auto muting of all playback amps during lock-up, $\pm 5\text{ms}$ ($\pm 1\text{ms}$ with repark command) accurate parking allows manual editing, built-in calculator for address manipulation, built-in variable speed control $\pm \frac{1}{8}$ tones, presettable address limits to stop tape winding out. Parallel/serial converter rack allows the programmer to locate several hundred metres away from the synchroniser. Main programmer is available for A800, A80 master control or A80 autolocator. Interfaces available for Sony VP2850 and BVU200, Ampex VPR1, Bosch BCN50, Sony BVH1000 and JVC 8500. Address start interfaces for Studer A80/VU, A80/RC, B67, B62 and ITC 3D. Price: A800 slave version in rack £11,312, in trolley £11,894 (A800 requires interface), A80 slave version £12,282. Master interface rack £372, master interface boards for VTRs £469. Master interface for A80 £2,748. Address start interface £96.96.

Autolocator

Available to operate with A800 and A80 models, no interfacing required. Microprocessor controlled, separate displays for actual tape position and locate position, 20 memories to store addresses, cue store for auto storage of cue points on the fly (10 memories), roll back to defined time, loop operation, two additional working memories, offsetting of tape position using keyboard, optimisation of search and park for fastest response.

Price: for A800 £1,342, for A80 £1,255.



Telefunken MTS15A-2 Audio Editing System

TELEFUNKEN (West Germany)

AEG-Telefunken, Postfach 2154, D-7750 Konstanz, West Germany.

Phone: 07531 862460. Telex: 733233.

UK: Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.

Phone: 02813 88447. Telex: 849469

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014.

Phone: (212) 741-7411. Telex: 236779.

MTS15A-1 Synchronising System

Multimachine synchronising system using one or two Telefunken M15A transports as slaves, and most video/audio transports as master. Operates using EBU timecode, three built-in readers but no generator. Timecode errors, fast synchronising time, timecode offset for record/replay head preparation, timecode display for each transport, operation with non-continuous timecode, external indication of parking and synchronisation. Accuracy to one frame (40ms), stability 0.5ms. Slave M15A transports require timecode amplifier and synchroniser adaptor. Interfaces for Bosch BCN, Sony 2850, JVC 8300.

Price: on application.

MTS15A-2 Audio Editing System

Basically similar to MTS-15A-1 system, but operates with up to four M15A slaves and provides prompting display with alphanumeric display. Also provides electronic editing with punch-in and punch-out in record mode, status display, master remote control, offset manually, by keyboard or during synchronising up.

Price: on application.

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- ★ Approved by broadcasting authorities in the U.K. and overseas for critical programme monitoring.
- ★ Reviewed *Studio Sound* September 1976. Meets IEC268-10A, draft BS5428-9.
- ★ Accurate law at and between all PPM marks with minimal preset adjustment. Marginal adjustment is retained to allow compensation for the tolerance in scale markings between meter manufacturers and different meters from the same maker.
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- ★ Gold-plated connector and floating input protected against mains or static voltages on the signal lines.
- ★ Supply input protected against reverse polarity.
- ★ Close tolerance components with excellent temperature and ageing characteristics used throughout.
- ★ Soak-tested boards, Ernest Turner meter movements 640, 642, 643 and TWIN, flush-mounting adaptors and illumination kits from stock. Scalings available 1/7, IEC268 10A; Type 11a; -12/TEST/+12 Type 11b used by EBU and conforming to CCITT recommendation N15 (1972), but not recommended by us except for EBU and measuring instruments.

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AES 65th Convention and Sound 80 Exhibitions, London—a preview

●Acoustic Design by Jeff Cooper: display of their professional recording studio, control room, and film studio designs including details of their recent design projects. ●Acoustical Manufacturing: Quad range of amplifiers including the Quad 405 and Quad 50E. ●Agfa-Gevaert: range of tapes including PEM-568 and PEM-368 mastering tapes; PEM-526 bin tape; PE-611, PE-811 and PE-1211 bulk cassette tapes; and PE-36 duplicating tape. Two new professional tapes types PER-528 and PEM-428 will also be shown. ●AKG: D-300 series of vocalists mics; new D-125 and D-130 dynamic mics; C-535EB condenser mic; full range of mics and accessories; and the TDU 7000 modular time delay unit. ●Allen and Heath Brenell: demonstration of the Syncon 16/24/28-track console. Also the AHB 8-track package system and the company's range of consoles and tape recorders. ●Allen and Heath Brenell: range of sound reinforcement consoles including the SR Series available in 20 or 28-input configurations; the SD12-2 mixer; and the Mini Mixer. Also the Pro Limiter which provides automatic level control of mic or time level signals. ●Altec: range of studio monitor loudspeakers. ●Amdio: Paso public address equipment including a new range of mains operated amplifiers and Paso rack equipment; Melodium mics; Davenport PA equipment; and Keith Monks professional sound equipment including a new range of mic stands and a new version of the phase tester. ●Amek: new M2000A 36/24 automated recording console featuring 4-band parametric equalisation on all input channels and utilising the Allison 65K programmer. Also on show modules from the M1000 sound reinforcement console, the M3000 VCA assisted 32-track recording console, and the new TAC (Total Audio Concepts) series. ●Ampex: UK debut of the ATR-124 multitrack recorder available in 24-track or 16-track configurations. Also the MM-1200, ATR-100 and ATR-700 tape recorders; the MQS-100 synchroniser; the ATR-102 and ADD-1 disc mastering system; and Ampex tapes and cassettes. ●AMS (Advanced Music Systems): DMX 15-80 digital delay line of modular design with various options and DM 2-20 phaser/flanger. ●Aphex Systems: new Model 712 Aural Exciter designed to replace the Model 602; Model 602B broadcast version of the Aural Exciter; Model 1537A voltage controlled attenuator; OAS-24 grouping and automation system; CX-1 compressor/

The 65th Convention of the Audio Engineering Society will be held from Monday, February 25 to Thursday, February 28 at two London hotels — the London Hilton Hotel and the Park Lane Hotel. Concurrent with the AES Convention, the Association of Sound & Communications Engineers are holding their annual exhibition, Sound 80, at the Cunard International Hotel, Hammersmith, London, from Tuesday, February 26 to Thursday, February 28. To facilitate travel between the two exhibitions the ASCE and AES are providing a free minibus shuttle service. Participants in both exhibitions are included in our joint preview, and exhibitors are differentiated by ● for the AES and ▲ for Sound 80. As is the normal practice of the organisers the AES Convention lecture programme and the ASCE seminar programme will take place alongside the respective exhibitions.

expander; and EQF-2 parametric equaliser. ●Ashly Audio: wide range of signal processing equipment. ●ATC: range of loudspeaker drivers, horns and passive crossover networks from American manufacturer Renkus-Heinz; plus ATC's range of studio monitor loudspeakers. ●Atlantex Music: wide range of products from the Ashly, Furman Sound, MXR and Sescor ranges of audio signal processing equipment. ●Audio & Design (Recording): Scamp signal processing equipment; the Express Limiter compact compressor/limiter/expander; F760-RS complex limiter; F769X-RS vocal stressor; E950-RS paragraphic equaliser; E500 band processor; E900 sweep equaliser; and F690 voice-over limiter. Also the new M600 Series of modular limiters and active bandwidth restricting filters. ●Audio Developments: ADO55 compressor/limiter; ADO07 portable mixer; ADO45 Pico mixer and ADO31 Micro mixer; plus a new small mixer for ENG use. ●Audio Kinetics: QLOCK 210 SMPTE timecode synchroniser; XT-24 Intelocator; and

a new range of modular acoustic screens.

●Audiomatic/Electro Sound: ES 8000 Series microprocessor based 64:1 tape duplicating system and accessories. Also a quality control reproducer with computerised print-out and an automatic cassette loader. ●Avis Asona: range of tape duplicating equipment and turnkey cassette production facilities. ●Ban Electromusic: Yamaha range of professional and PA equipment, plus PA equipment from other companies. ●BASF: range of professional tapes, cassettes and magnetic film including calibration and test tapes. ●FWO Bauch: details of the company's UK product agencies, plus a display of Klein & Hummel monitor loudspeakers and parametric equalisers, and Transco disc recording blanks. ●Beyer: range of dynamic and condenser mics plus headphones. ●BGW: range of amplifiers including the Model 50A 2-channel power amplifier. ●Bouyer: wide range of public address equipment including loudspeakers, small mixers and intercom equipment. Also the PEL Phone 16 or 32-way digital telephone system and the Topkit digital intercom system which can operate between two to 99 stations without a central exchange and uses standard TV co-axial cable. ●WH Brady: range of splicing and sensing tapes for audio and video tapes. ●Bruel & Kjaer: comprehensive range of audio measurement instruments. ●Bulgin Electronics Soundex: range of small audio mixers, free standing PPM's and various power supplies. ●B & W Loudspeakers: Model 801 professional monitor loudspeaker, a 3-way vertical in-line system with minimum linear phase interference. ●Calrec: prototype of a new microprocessor controlled OB switching unit which can also be adapted to many other forms of pre-programmed signal routing. Also the company's range of professional condenser mics including the Soundfield mic, plus sound control consoles. ●Canadian Instruments: range of PA and intercom loudspeakers from Atlas Sound, plus Turner mics. ●Canary: wide range of medium-sized PA and recording consoles, plus amplifiers and electronic crossovers. ●Canford Audio: Rondson range of loudspeakers; an automatic cable tester; a new low noise battery mic pre-amp; a telephone balance unit; studio ancillary equipment; EMO DI boxes; and Liebh cassette mechanisms. ●Cetec-Gauss: tape duplication system

68 ▶



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for a master and up to 20 slaves, plus the company's range of loudspeakers. ▲**Cheshire Communications**: range of loudspeakers; Coles mics and headphones; Raven entertainment equipment; and the *Mareco 600 Series* modular sound mixing system. ▲**Clarke & Smith**: *Vortexion* PA equipment. ●**Consilium**: new *SPA 11* narrow band spectrum analyser and *GNA 11M* network analyser; plus *RTA 11* and *RTA 12P* audio realtime analysers, and *PNG 11* pseudo noise generator unit. ●**Court Acoustics**: the company's range of loudspeakers and ancillary electro-acoustic equipment, plus **BGW** power amplifiers. ▲**Covmain**: comprehensive range of PA and communications equipment from **RCF** including a new modular amplification system. ●**Cross Music**: demonstration of the *CT-1800* automatic cassette labelling machine. ●**Crowmay**: automatic cassette loader; loop-bin cassette duplicating system; and an in-cassette duplicating system. ▲**CTH Electronics**: range of mains/battery PA equipment, plus sophisticated digital timing equipment. ▲**Davenport**: range of public address equipment. ▲**Delta**: range of PA cabinet loudspeakers plus a new range of auto-reverse cassette units. ●**Dolby**: range of professional Dolby-A noise reduction units. ▲**Eagle**: range of PA and general sound equipment including mics, small mixers and intercoms. New products include outdoor column loudspeakers, three mic/programme mixers, the *M* range of mics, and the *PRO T30* pocket sound level meter. ●**Eardley Electronics**: *Neutrik Audiotracer 3201* which measures and makes hard-copy recordings of the audio response of electronic and electro-acoustic systems. Also the *AD-4* analogue delay line, plus audio connectors and modular in-line components. ▲**EDC**: *Cygnus* and *Minkom* radio mic transmitter/receiver systems, plus the new *Sirius* system which utilises a *Shure R97* dynamic cardioid mic with integral aerial. ▲**Electrical & General**: range of cabinet loudspeakers. ●**Electro-Voice**: full range of professional mic and loudspeaker systems, plus mixers and amplifiers from sister company **Tapco**. New products on display will include the *C-12* mixer from Tapco and the *XEQ-1* electronic crossover/equaliser from Electro-Voice. ▲**Electro-Voice**: comprehensive range of PA horns, line radiators and dynamic mics. ●**Elektroimpex**: *FIT-IC* modular automation ready console; *STM 610* tape recorder; *SL-101* direct drive professional turntable; and *PCP-101* commentators desk. ●**EMT**: range of studio turntables including the *EMT 930* and *EMT 950*, and a new model, the *EMT 948* direct drive turntable featuring quick-start and back-cueing facilities, a low rumble drive and a motor-driven tone arm lift for low pick-up wear. Also the company's reverb units. ●**Enertec**: *UPS-4000* series 24-track automation ready console; *UPS-5000* and *UPS-5100* consoles; *F-462* series of tape recorders; *GCE-4000* series of solid state switching grids; and a cassette broadcasting system. ▲**Eurotronic**: range of PA equipment including loudspeakers and amplifiers. ●**Feldon Audio**: wide range of products including *Inovonics Model 500* acoustic analyser and improved *Eventide Model H949 Harmonizer*. ▲**Fitch Tape Mechanisms**: *T250* range of NAB 'A' tape cartridge record and playback machines; *T100* replay machine; *T101* record/replay machine; and *T70 Cartette* machines. Also Audiopak car-



New EMT 948

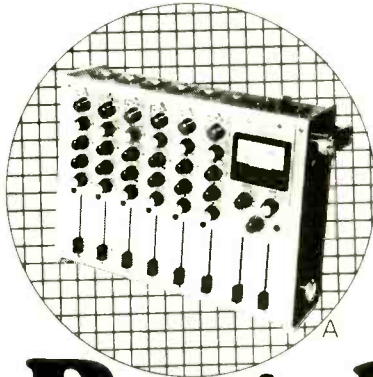
tridges and the company's range of *BGM NAB 'C'* cartridge machines for background music installations. ●**Future Film Developments**: comprehensive range of cables, cords, connectors, jackfields, wiring aids and associated components, plus a wide range of audio accessories. ●**Genelec**: range of monitor loudspeakers comprising the *1019A* bi-amplified mini monitor; the *S30* tri-amplified broadcast monitor; and the *1024A* tri-amplified music monitor. ●**Gotham**: wide range of products will be displayed including *Amber 3500* distortion measurement instrument; *Allison Kepex II* noise gate; *TTM 124* multitrack and *202* stereo noise reduction card frames; *Inovonics* digital plotter option for the *Model 500* sound analyser; *Urei 1178* stereo limiter and *546* dual parametric equaliser; *Urei* studio monitor loudspeakers; *Lexicon 224* digital reverb unit; *Switchcraft QG* audio connectors; and *MRL* test tapes. ●**Gramplan**: dynamic ribbon mics; amplifiers; reverb units; and portable mixers. ●**Harrison**: *Autoset* micro-computer based control system; *4832C* and *3624 Series* automated consoles; and new *DCI* (Distributed Control Intelligence) *MR-1* digital/analogue hybrid console. ▲**Hayden Laboratories**: full range of *Sennheiser* mics and headphones, plus a new radio mic transmitter/receiver, and further additions to the *Infraport* infra-red sound transmission system. ●**HH Electronics**: *TPA Series D* and *S500D* professional power amplifiers and the company's *MOSFET* power amps. Also electronic echo units and portable stereo sound control mixers. ●**ICM**: *C-Zero* cassettes; the *DO-2000* dropout checker; *ICM 7804* automatic wind tester; and the *C-Box* cassette packing and storage system. ●**Infonics**: *200 Series* tape duplicators including a high speed metal tape cassette duplicator. ●**Ivie**: *IE-17A* micro-processor controlled acoustics analyser and *IE-30A* spectrum analyser. ●**ITC**: *3D Series*, *RP Series*, and *SP/WP Series* cartridge machines, plus new *Series 99* cartridge machines featuring microprocessor control and modular electronics. ●**JBL**: complete range of studio monitor loudspeakers. ●**KEF Electronics**: range of monitor loudspeakers.

▲**Keith Monks**: *EDC* radio mics; new semi-professional record cleaning machine; and a comprehensive range of audio equipment. ●**Klark-Teknik**: new *DN60* $\frac{1}{3}$ -octave realtime spectrum analyser; plus the *DN27* and *DN22* graphic equalisers; *DN70* digital delay line and *DN71* controller; and the *DN34* and *DN36* analogue time processors. Also the *Statik Acoustic* range including the *SA30* electronic crossover; *SA20* dual reverberation system; *SA10* octave equaliser; and *SA100* dynamic delay/flanger. ●**Leevers-Rich**: *Proline 2000TC* and *Proline 1000* $\frac{1}{4}$ in professional tape recorders, plus the *LR70* and *LR71* bulk erasers, the *LR72* tape head demagnetiser, and the *LR73* studio digital clock. ●**Lyrec**: new-look, externally redesigned *TR532* 24-track tape recorder and the *ATC* remote controller. Also the company's high speed cassette duplicating system. ●**3M**: UK debut of the company's 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor. Also the *M79* 24-track recorder; *Wollensak* cassette duplicators; and *Scotch* audio tapes including the *Scotch 265* digital mastering tape. ▲**Martello Sound**: radio mic equipment; cordless radio PA system; and a portable PA system. ●**MCI**: *JH-600* console, *JH-45* synchroniser, *JH-24* tape recorder and the *JH-100 Series* recorders in various configurations. ●**Midas**: *PR System* mixing consoles in a variety of input/output configurations for sound reinforcement, on-stage monitoring, recording and production applications. Also, new *TR System* modular theatre consoles available in 24, 30 and 36 into 8-8 formats. ▲**Millbank**: range of sound system equipment including the *PAC-System*, *MIL Series Two* system, and the *IPA 410* radio mic system. ▲**Modular Communications**: range of PA equipment including rack-mount units, a programmable mixer and several integrated amplifiers. ●**Mosses & Mitchell**: range of jacks and jackfields including the *440* range of miniature jack sockets and jackfields. ▲**Mustang Communications**: range of sound equipment including the *MMA* and *DA50* mixer/amplifier units and the *SS* range of power amplifiers. Also the new *M20* range of entertainment programme sources. ●**Nagra**: range of portable tape recorders in a number of configurations. ●**National Research Development Corporation**: the **NRDC** will demonstrate the *Ambisonic* surround sound system using material originated from the *Calrec Soundfield* mic. ●**NEAL-Ferroglyph**: modular *SP7* $\frac{1}{4}$ in tape recorder, available in a number of customised configurations. Also the *Logic 7* and *Studio 8* recorders, the *RTS/2* and *ATU/1* test instruments, and the **NEAL** range of cassette recorders. ●**Neve**: *Model 8108* console with centralised microprocessor controlled assignment facility. ●**Neumann**: *VMS-80* automated disc mastering lathe, plus special preview tape deck, *SP79* control console, *SAL74* cutter drive logic, and *SX74* feedback stereo cutterhead. Additionally, complete range of mixing console components and studio condenser mics including the *KMS84* and *U89*, and the new *KMR84* condenser shot gun mic. ●**NTP Elektronik**: wide range of products including **PPM** meters; compressor/expander amplifiers; limiting amplifiers; equalisers; and other audio processing units. New models include the type *582-100* programmable remote controlled 14-band graphic equaliser, comprising a central control and programming

70 ►

Audio

Developments



Portable professional mixers

Designed to team up with professional equipment for studio sound on location

Of advanced design and proven performance these are purpose built battery powered portables, of solid $\frac{1}{8}$ " aluminium with carrying handles. Top quality components, modular construction and stringent quality control ensures the highest degree of reliability. For use on location with professional tape recorders — Nagras/Stellavox etc, outdoor broadcast, stage mixing or to supplement studio consoles when added capacity is required. Over 300 in trouble free use world wide.

MINIMIXER AD 007

8 in 4 out. Compressors. size 540 x 480 x 225mm Weight 22.7 kg

MICROMIXER AD 031

8 in 2 + 1 out + options size 420 x 335 x 127mm Weight 10 kg

PICOMIXER AD 045

6 in 2 out size 340 x 265 x 110mm Weight 6.2 kg

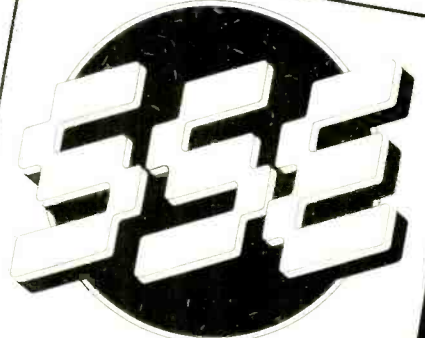
PICOMIXER AD 045

Mk II

AD 075 Super System

AD 055 Stereo Compressor Limiter

A-Picomixer AD 045
B-Micromixer AD 031
C-Minimixer AD 007



Scenic Sounds Equipment
now stock the
Pico Series Mixers

Audio

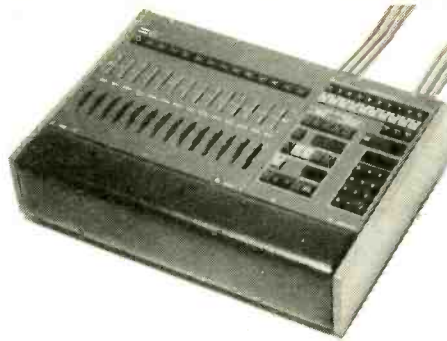
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Telephone: Brownhills 535T/2/3 (STD Code 05433)
Telex: 338212 Audio

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unit, which is fed by a motherboard with four eq channels (or multiples thereof), and which has a floppy disc computer facility. ●**Ortofon**: *DSS 731/732* stereo cutterheads; *GO 741/GE 741* cutting amplifier set; *CPS 741* correction amplifier; *STL 732* regulated filter; *TTG 791* test tone generator with two VU meters; and the company's range of pick-up cartridges. Also the **Cybersonics** *DM 2002* automated disc cutting lathe. ●**Otari**: *MTR-90* 2in, 16/24-track master recorder featuring symmetrical tape path and pinch-roller-free direct drive capstan controlled by a phase-locked closed-loop servo system. ●**Philips**: motionial feedback loudspeakers. ●**Prophon**: *MX8A* 8-channel stage multiway system for use in conjunction with an off-stage mixer. ●**Pye Business Communications**: new **Philips** *SQ6* modular programmable PA system. ●**Pyral**: wide range of open-reel and cassette tapes; plus magnetic soundtrack film; master lacquer discs; and a spectrum analyser. ●**Racal-Zonal**: range of audio tapes and cassettes including the low noise *888* mastering tapes, type *666* tapes; and super ferric oxide cassettes. ●**Raindirk**: *Series III 28/24* console and the *S2000* 16-track console for smaller studio, broadcast and sound reinforcement applications. ●**Recortec**: automated cassette duplicator system with automatic cassette feeder. ●**Rediffusion Reditronics**: full range of PA and audio-visual equipment including signal sources, processors and loudspeakers. ●**SAE**: *Model 180* 2-band per channel parametric eq; *Model 2800* 4-band parametric eq; and the *Model 1800* dual 2-band parametric eq. Also the company's range of power amplifiers. ●**SATT Elektronik**: *SAM82* small 8/2 portable mixer; plus the new *SS Series* and a new small 4/2 mixer, the *SAM42*. ●**Scenic Sounds Equipment**: wide range of products including **Amber** audio test sets; **Allison Fadex** automated VCA fader module and *65K* programmer; **APSI** modular equalisers; **BTX** SMPTE code generators and tape synchronisers; **dbx** comp/limiters; **Deltalab** *DL-1* digital delay module, *DL-2 Acousticcomputer*, *DL-3* digital delay line and *DL-4 Time Line*; **Editall** precision editing blocks; **Emilar** range of loudspeaker components; **Lexicon** *Model 224* digital reverberation system; **Marshall** *Mini Modulator* and *5002* time modulator; **MicMix** *XL-305* reverb unit; **Orban** effects and equaliser units; **Rebis** parametric equaliser, comp/limiter and noise gates; **Schoeps** capacitor mics; **Valley People** *Trans Amp LZ* pre-amplifier; **White Instruments** *200 Series* microprocessor controlled realtime analyser; and a new programmable parametric equaliser with 28 non-volatile memories from **360 Systems**. ●**Schoeps**: large range of studio condenser mics and accessories including several new active accessories for the *Colette Series*. ●**Sennheiser**: new radio mic transmitter/receiver equipment using the company's *HiDyn* compander system to increase dynamic range. Also the company's range of mics and headphones. ●**Sescom**: expanded range of audio modules and transformers; and a new range of electronic products including a 3-band parametric equaliser, 10-band graphic equaliser, and 4-channel mixer; plus several new 3-way splitter boxes. ●**Shure**: *SM81* cardioid condenser mic; *SC39 Series* phono cartridges; and *Pro Master* sound system; plus the company's range of dynamic mics. ●**Sifam**: wide range of VU and PPM



NTP 582-100 programmable equaliser system

meters, control knobs, switches and transformers. ●**Solid State Logic**: *SL-4000 E Series* automated console and *SSL* studio computer system, including several new hardware and software extensions, and a *Total Recall* option using a satellite computer to store and recall each control setting of the console's I/O modules. ●**Sony**: wide range of digital audio units. ●**Soundcraft**: range of consoles and multitrack tape recorders. Tape recorders comprise the *SCM-381-8* 8-track and *SCM-381-16* 16-track, while consoles include the *Series 400*, *Series 1S*, *Series 1624* and the *Series 3B* automated console in 16/24/32-track configurations. ●**Stanton**: new *Model 310* phono pre-amplifier/equaliser and *Dynaphase 55* headphones. Also the *500 Series*, *680 Series*, *681 Series* and *881S Series* phono cartridges. ●**Studer**: *A800* and *A80VU* multitrack recorders; *TLS 2000* SMPTE sync/edit system; new 20-memory autolocator; new remote control unit for the *A80VU*; new *A80* disc cutting preview machine for use with the **Neumann** *VMS-80*; and the **Revox** range. Also the *Model 369* 32/4 console; *Model 069* OB console; package stereo local radio console; telephone hybrid; and stereo balancing unit. ●**Swintek**: *Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand-held lavalier cordless mics with multiple diversity antennae; and *MK200* communicator. ●**Tannoy**: *Buckingham* 3-way monitor loudspeaker system; *Classic Dual Monitor* and *Super Red* loudspeakers; and the company's hybrid passive/active crossover with time compensated circuitry and parametric equalisation for the low frequency

section. ●**Telefunken**: *M15A* 32-track tape recorder, plus the company's other tape machines. ●**Toa**: comprehensive range of sound and communications equipment. New products include a range of horn loudspeakers and drivers; the *VMS 2000* modular PA system; and a new range of professional equipment comprising 6, 8 and 16-channel mixers, front loaded and bass reflex cabinets, powered column and monitor loudspeakers, plus a graphic equaliser and the *EMX 10* digital echo mixer. ●**Tore Seem**: new *SEESAM* broadcast/recording console with solid state input/output matrices, dc grouping, and microprocessor controlled fader operation and routing and signalling functions. Also on display a wrap-around broadcast console system and a small mixer. ●**TRAD**: details and products from this company which specialises in buying and selling new and second-hand studio equipment. ●**Trident**: *Series 80* modular console; *TSM Series* console available in 32/24 or 40/32 configurations; and *Fleximix* modular console system expandable to 24-track. Also the rack-mount parametric equaliser/filter and stereo limiter/compressor. ●**Trusound**: wide range of public address, intercom and entertainment distribution systems. ●**Tweed Audio**: semi-standard broadcast console system in various frame sizes with comprehensive metering and monitoring facilities. Also the *B164* standard production console and the *BC82* battery/mains portable mixer. ●**Ursa Major**: *SST-282 Space Station* digital reverberation system comprising a digital delay line and digital reverberation synthesiser. ●**Vitavox**: range of multicellular high frequency horns, compression drivers, bass drivers, and passive dividing networks. ●**Wayne Kerr**: *Wayne-Kerr-Radford* ranges of high quality test instruments including the *RA200* analyser and *ADSI* digital store unit. ●**Woelke**: range of professional record, playback and erase heads for 16/24-channel multitracks, plus the company's other multitrack heads. Additionally, wow and flutter meters, wave analysers, and bias/distortion meters. ●**Studio Sound**: editor **Angus Robertson** and assistant editor **Noel Bell** will be living up the proceedings together with **Phil Guy** who will be on hand to meet advertisers. Also in attendance will be staff from our sister magazine *Sound International* including editor **Richard Elen**. ■

The new Philips SQ6 modular programmable pa system





The whole truth.

Bipolar transistor power amplifiers are obsolete.

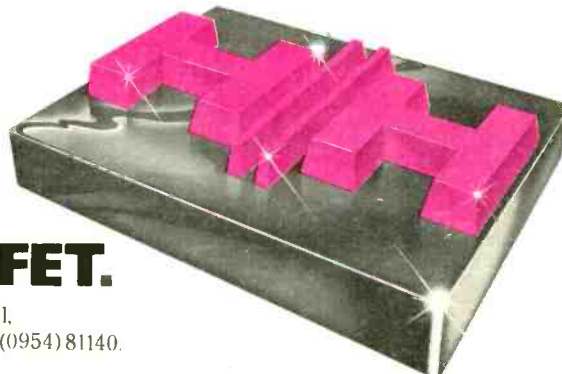
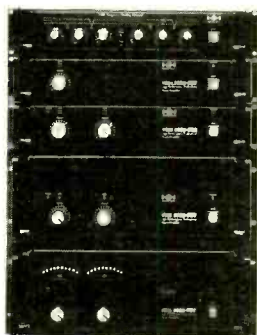
Now there's HH MOS-FET technology; with no thermal runaway, no secondary breakdown, simpler circuits, fewer components and superior high-end performance for better sound quality when reproducing fast transients.

Naturally, we anticipate that most professional sound engineers will be eagerly switching over to MOS-FET at the first opportunity. So to make it easier, there are 4 models (all 19" rack mounting) with outputs

from 150 to 800 Watts..and multiples thereof, using the X300 frequency dividing network.

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

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



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DAL 9036

Direct cut

No prizes, but guaranteed surprises, for anyone who can date the following note taken verbatim from an LP album sleeve. 'Since the introduction of magnetic tape, recordings have been made on tape, then transferred to discs. To eliminate the tape step is to reduce distortion, widen frequency response, eliminate hiss, improve transient response and increase signal-to-noise ratio. Heretofore, only a few recording engineers have heard the fantastic fidelity that is possible by recording directly on the master disc . . . the music was cut directly onto the disc master at the recording session; no magnetic tape was used and no editing possible. Equipment of the highest quality was used (Neumann lathe with Teldec cutting head) and the music was chosen for its extremely wide dynamic and frequency ranges.'

The music in fact was just under 17 minutes worth of the Mannes College Brass ensemble, conducted by Simon Karasick—one piece by Tomasi and one by Bach. No it wasn't one of the current spate of direct-to-disc recordings that followed the 1970 release of *Lincoln Mayorga and Distinguished Colleagues*. The record in question was actually published in 1963. In that year the enterprising American magazine *Hi Fi/Stereo Review* put out a stereo test record (under the uninspiring title *Model 211*). Side 1 was a string of the usual identification, phasing, balance, response and tracking tests. But Side 2 was the direct cut programme mentioned above. Though my copy has long since been degraded by sub-standard pickups it still sounds very impressive. One interesting point is that the two musical pieces are separated by a locked groove, ie the side doesn't play straight through: you need to lift off and replace the pickup in the lead-in groove on the second track. Those of us (self included) who have traditionally referred to the Lincoln Mayorga disc as the first direct cut LP ought really to rephrase our descriptions as the 'first double-sided direct-cut album with no locked grooves and continuous play throughout both sides'.

Chance find

Browsing through the 'remainder' racks of an American record store I chanced on a real oddity. RCA LSP 4543. It's a Nilsson album, titled *Aerial Pandemonium Ballet*. As the title suggests it's a compilation of tracks re-issued from Nilsson's superb early albums *Aerial Ballet* and *Pandemonium Shadow Show*. In fact the record has been sitting, apparently unnoticed and forgotten, in RCA's lists since 1973. The British company was for instance unable to find a single copy. There is an interesting reason why, unlike most compilation albums, it's never carried any commercial clout. The album isn't just a compilation. The selected tracks, some from each album and one mysteriously missing from the originals, is a remixed, revamp. There are even some freshly recorded vocals. The remix is surprisingly extensive and

explained on the sleeve. Backing tracks have been slowed down, voice dumped and backings re-equalised. On the track *Together* new vocals have been added, the bridge completed, edited out and the backings remixed to lose some instruments and gain others. Perhaps, predictably, different engineers are credited on the new and old issues. There's an old motto, 'Never tamper with perfection', which seems more than a little appropriate in this case.

Quick as a flash

At least twice now commissioners at the BBC TV Theatre in London have tried to eject actors 'planted' in the audience when they started to play a pre-rehearsed part in the show. On each occasion no one had thought to tell the commissioners in advance that an interruption from the audience was planned. It also happened during the Proms a couple of years ago. Some bright spark on the production side thought it would breathe fresh life into *Leonora* if a trumpet blast were to be sounded from high up in the gods, rather than the brass section on the Albert Hall stage. A few bars in advance of his entry, the distant trumpet player unpacked his horn and fingered the valves as trumpet players do. Quick as a flash a commissioner appeared out of thin air. "We'll have none of that there here," he pronounced, confiscating the musician's trumpet. "If you want to fool about like that, go downstairs with the other promenaders."

More on hearing

An engineer's ears are his most valuable possession, so it pays to look after them. Since few engineers are likely to read medical books at bedtime it seems a reasonable assumption that few people will have noted, let alone ploughed through, a recent medical field study by three Polish workers on hearing loss in a remote Silesian village. Their work isn't a Monty Python joke, and it's more than a little relevant to the studio world.

By now it's pretty well known that excessive exposure to exceedingly loud noise can induce permanent hearing loss. It's also pretty well known that impulse noise is more dangerous than steady noise. Old soldiers, who were subjected to long periods of rifle range practice without ear protection, often have seriously impaired hearing. But medics have found it very hard to produce hard facts and figures on INIHL (impulse noise induced hearing loss) because it requires a long-term study of a very stable work force. This is where Silesia comes into the picture. It was there that the three Poles found a remote village which, for over 200 years, has been famous for its drop-forging. People from the village have been working at the forge for several generations, mostly without any ear protection. So in that village it is possible to compare the hearing of people who had worked with loud impulse noise over periods ranging from a few months to a whole

lifetime. The researchers found sound levels of between 127 and 134dBA (dependent on the weight of the drop forge hammer) with an almost instantaneous risetime and an impulse duration of between 100 and 200µs. There was also a general background noise level of around 110dBA and workers were subjected to between 3,000 and 10,000 noise impulses every day. This compares quite closely to mixing rock at high level, with peak-unlimited drum tracks, for long periods of time.

The sobering discovery made from comparing old and new workers at the forge was that during the first three years their hearing in the range 4kHz to 6kHz deteriorated at a rate of around 20dB a year. With steady state noise it would take between 10 and 15 years to produce the same amount of damage as the villagers suffered in five years. Also at lower frequencies, between 1kHz and 2kHz, the damage was less and occurred much more slowly. The most easily damaged frequency range proved to be around 6kHz, which suffered serious and irrevocable damage within just two years.

What this means is that anyone in the business of mixing percussive or transient-rich music (either in a studio or at live concerts) shouldn't cross their fingers and assume that ear damage only starts to matter after a few years. Even after just two or three years it may be too late, at least in the 4kHz to 6kHz range.

agony

Is there any other company in the world, which is better known than its country? Rather curious was the statement to AKG-President Leopold Steinkellner, when talking with an engineer of a broadcasting company in New York. The young man was mistaking 'Austria' for 'Australia': even 'lovely Vienna' was quite strange to him. But: "Of course. I know AKG and your excellent microphones". The president: "For a patriot it's disappointing, but for my company the finest reference!"

Peter Fellgett, Professor of Cybernetics at Reading University, has been left speechless by the current output from *Studio Sound*, the highly-technical journal specialising in microphones, stereo, quadraphonics and all that jazz.

Paying tribute to the prof in an article on ambisonics, the magazine states: 'British NRDC patent 1369813 stems from the work of Peter Fellgett and dates back to 1871 . . .'. "Peter Fellgett is not as old as this suggests,"

I am told by Ted Bell, the university's senior assistant registrar.

So if you are receiving me, *Studio Sound*, I can assure you that our prof is still very much switched on.

Reading Evening Post

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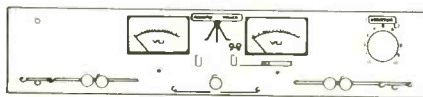
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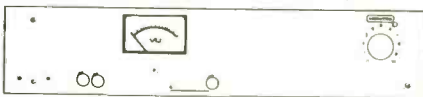
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Mono



Mono + Mic input

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NEAL FERROGRAPH



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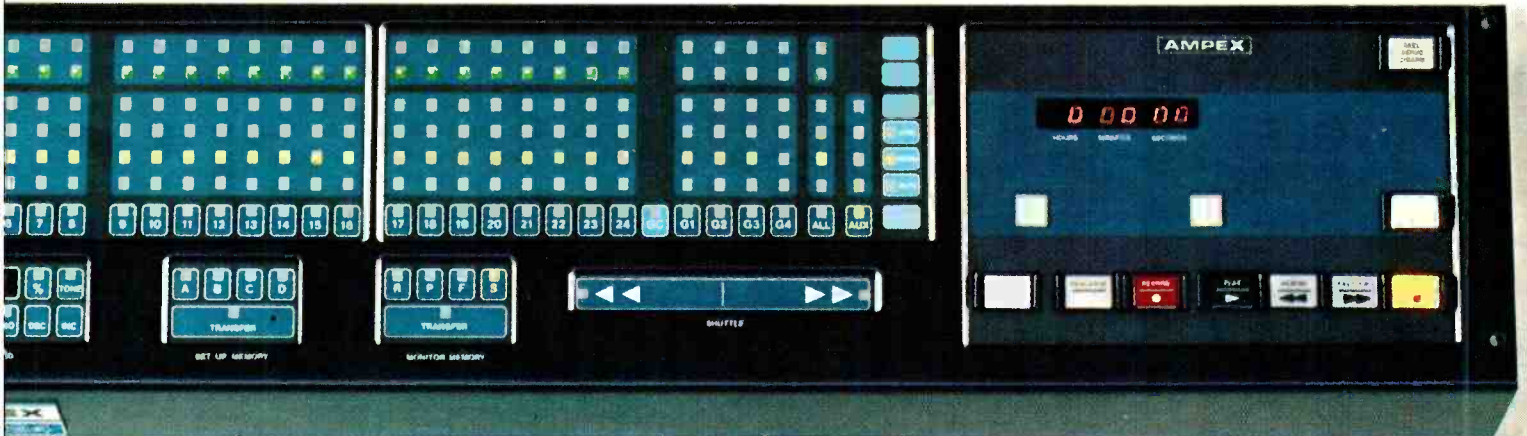
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from the future: ATR-124.

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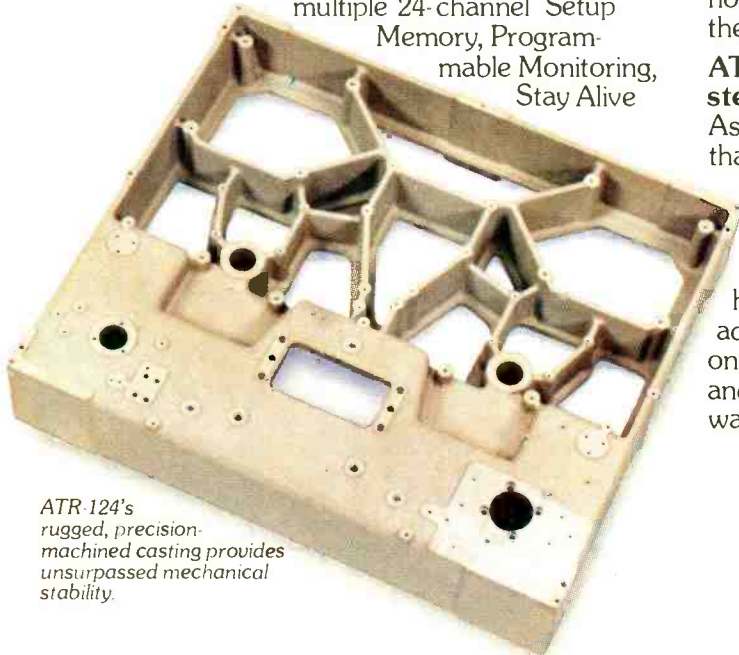
ATR-124's Control Panel. Speed and accuracy at your fingertips.

replace anything that you do. On the contrary, it's going to improve the skills you have, if not help you develop some new ones.

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Commercial radio, the engineering experience

John Lumsden

IT doesn't seem so very long since October 1972 when London Broadcasting Company (LBC), the first of Britain's Independent Local Radio Stations, took to the airwaves, but in fact six years have elapsed. In broadcasting and technology terms this is a considerable period of time, and a number of changes have occurred. Changes in programming, equipment, presentation and, perhaps most important, changes in financial viability, and here is the key to the development of ILR.

Early on, during the embryonic period of Independent Local Radio, very few stations were capable of 'making ends meet', and a number of stations are still recovering. For some stations during that awkward period of time massive additional capital investment had to be made by their shareholders, usually as loan stock, and this has to be repaid. Those days, however, are now behind Independent Local Radio and all companies are trading profitably. A few are even paying 'secondary rental' to the IBA. This is a charge levied by the IBA to companies whose profits exceed a certain level, at present five percent, of net advertising revenue. The forthcoming year will possibly see eight or nine out of the original 19 in this situation.

With financial success comes better programming, since programming budgets can be increased, wider coverage of sport and an increase in outside broadcasts. More and more companies are getting into drama and this area is highly consumptive of money and studio time.

The programming of ILR is now much 'tighter' than previously (all of six years ago). Gone are the

John Lumsden, chief engineer of Radio Clyde in Scotland, looks at how the technical operation of independent local radio stations has changed in Britain over the past six years.

days when commercial breaks were identified by jingles in and out—today the commercials are more a part of programming. In this particular area, ie commercials, things have certainly improved. Perhaps not technically but certainly from a production point of view, and in particular a much more intelligent use is made of stereo. There has even been a move in some stations to broadcast live commercials from department stores etc.

As an engineer my main interest, strangely as it may seem, is engineering and here there have been many changes—all for the better. Six years ago for instance, before the Technics *SP10* turntable, almost all stations used Gates or Russco turntables. These turntables were very well made and proved to be extremely reliable, but they suffered from rumble, wow and flutter and lack of speed accuracy, but they did start fast allowing very tight cueing of records. They also had a nasty habit of jumping the first groove, which was due to the very high and undamped torque of the motor. Brute force rather than technology got the record up to speed.

The Technics *SP10* completely solved all of these problems. Speed was locked absolutely solidly against a quartz reference. Rumble, and wow and flutter, could rival the best hi-fi units, and the start time was incredibly fast, partly because it was under logic control.

It is no wonder that these turntables have found their way into most, if not all, of the Independent Local Radio Stations. The turntable is probably the most important piece of electro-mechanical equipment in Independent Local Radio Stations since they carry around 50% of the station's output.

One of the hardest worked pieces of equipment at any station, second only to the turntable, is the professional tape recorder. Improvements here have been in technology rather than performance, although the performance has been marginally improved in most parameters. In general the audio performance is fairly comparable to that of the early machines, but real improvements have been seen in the tape transport and the ability of the machine to handle tape 'more gently'. Machines have appeared like the Leavers-Rich *Proline 2000* with dual capstans featuring extremely low wow and flutter due to the very efficient servos used, and of course with twin capstans, the tape tension across the headblock can be defined to very, very close limits.

The MCI *JH110* is also a 'state of the art' tape machine. It does not use dual capstans, but certainly does not suffer as a result. The machine uses a very comprehensive logic system of control which amazingly is extremely reliable. It even comes with its own fault-finding LED annunciator panel, and has built-in autolocate, and a

special feature of the transport is the ceramic capstan spindle which does not conduct heat, nor magnetic flux, and is extremely stable mechanically. Ceramic can also be ground to very great accuracy with extremely small amounts of run out and, therefore, the wow and flutter is held to very acceptable limits.

Magnetic tape used for recording during the past six years has been improved, giving better frequency response and a much higher output with the attendant improvements therefore in noise. Racal in particular introduced the very cost effective *Type 888* which falls into the category of Super Tapes, like those manufactured by Ampex and 3M.

Noise reduction equipment is now widely used in Independent Local Radio. Equipment like dbx and Dolby has applications ranging from logging recorders to radio links, and multitrack tape recorders are now being used for music recording and drama production. Four, eight, 16 and even 24-track machines are finding their place, and techniques in music recording, as a result of the availability of the multitrack recorders (like those used in a recording studio), are becoming widespread.

In the production studio of the ILR station you will find digital delay lines, harmonisers, flangers, compressors, limiters, automatic double track units, echo plates and echo springs. The need has been recognised by the ILR stations to provide the equipment capable of allowing the producer to approach as closely as possible, in the studio, the sounds that one hears on records.

The broadcast cartridge machine

is also a piece of equipment which has improved out of all recognition; in particular, the ITC 99 Series which is an extremely advanced micro-processor based unit (see *Studio Sound* Feb 1980). Top marks to ITC for a superb piece of work, and top marks also to ITC for not releasing the 99 Series machines until they were 100% convinced that all the bugs were out of the equipment. Compared to the older cart designs it's like comparing a T-type Ford to a Lotus Esprit. The 99 Series features automatic azimuth adjustment of the record head, which gives extremely stable phase performance, automatic bulk erasure of each cartridge prior to recording, with full ramp down of the erase flux giving a very, very clean cart, almost indistinguishable from virgin tape. It is a pity that the Audiopak triple A series cart has not been fully sorted out, since it would compliment the excellent performance of the 99, and in particular, improve the noise performance which, at the present moment, is a limitation imposed by the tape used at present in the cartridges. The tape wound in the new triple A is of the HOLN type (high output, low noise), has much more headroom and a better distortion performance. In the meantime, we will have to wait for the automatic dbx noise reduction unit under development for the cartridge machine, and this should help to alleviate the noise and distortion problems which are, to say the very least, marginal at the present moment.

Another area for improvement in stations has been the introduction of digital delay lines for phone-in programmes. The Eventide BD955 is a mono unit offering full 15kHz bandwidth, very low noise and 6.4s delay, and has a facility allowing the user to slide into delay. This avoids all the difficulties previously associated with tape delay units. Arrangements have been made by Eventide to slave a second unit from the master, so allowing stereo operation, and amazingly there is no degradation of the phase performance.

Whilst on the subject of phone-ins, it is only fair to mention the Post Office who have been quite busy redesigning the phone-in interface, previously referred to as the Hedgecoe Equipment and now called Telespot. This new equipment works very well but is expensive. A number of the smaller stations have modified key and lamp units with line divert relays. These also work very well and are ideally suited to the smaller stations operations. Hopefully these will continue to be made available.

Now the radio frequency side of broadcasting. Electronic news gathering equipment is now avail-

able from McMartin and Marti. These small compact units offer high quality audio performance with power outputs up to about 3W, allowing coverage of most towns and cities. They offer to newsmen the ability to 'get in' live to programming from the scene of almost any occurrence. These units are fitted with rechargeable batteries and up to three hours continuous broadcasting can be had from one charge.

The IBA themselves have also been busy and a number of improvements have been made to the programme injection equipment at the transmitters. These improvements have, on medium frequency transmitters in particular, improved the sound by using a 'harder' limiter setting, so allowing the average level of modulation to increase.

Some over-air tests have been made with the *Optimod-AM* unit produced by Orban. This is a multi-band limiter/compressor which allows very high average levels of modulation, and is guaranteed to win any loudness war with Radio One. Whether or not this unit is adopted remains to be seen, but it certainly does increase the loudness of the station. The clarity is also improved since the hf end is enhanced due to the band processing employed by the device. Even the coverage area is improved marginally because, obviously, with the higher level of average modulation the signal-to-noise ratio at the fringe of the coverage area is improved.

Looking to the next six years what do we see in the crystal ball? Traffic information broadcast via the BBC's excellent Carfax system or alternatively on VHF, using one of the SCA channels of the VHF transmitters. Radio Oracle is also a possibility with an alphanumeric display built into the radio receiver. This could also provide programme information or station identification which could allow the listener to select his or her type of entertainment without actually listening to the station! Something not quite right here—but being serious once again, the most important development could be the possible introduction of stereo on medium wave using one of the many systems currently being reviewed by the National Association of Broadcasters in the USA and the IBA in the UK, and it is almost certain that the BBC are likewise looking at stereo on medium wave with a view to providing this service sometime in the future.

Radio has been around since the Twenties but it is still going strong and with 40 or so new stations due within the next few years, I think it's safe to say a healthy future is ahead and radio is here to stay. ■

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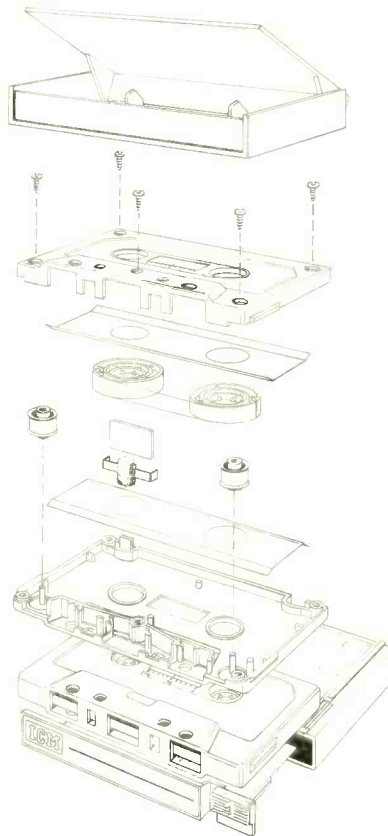
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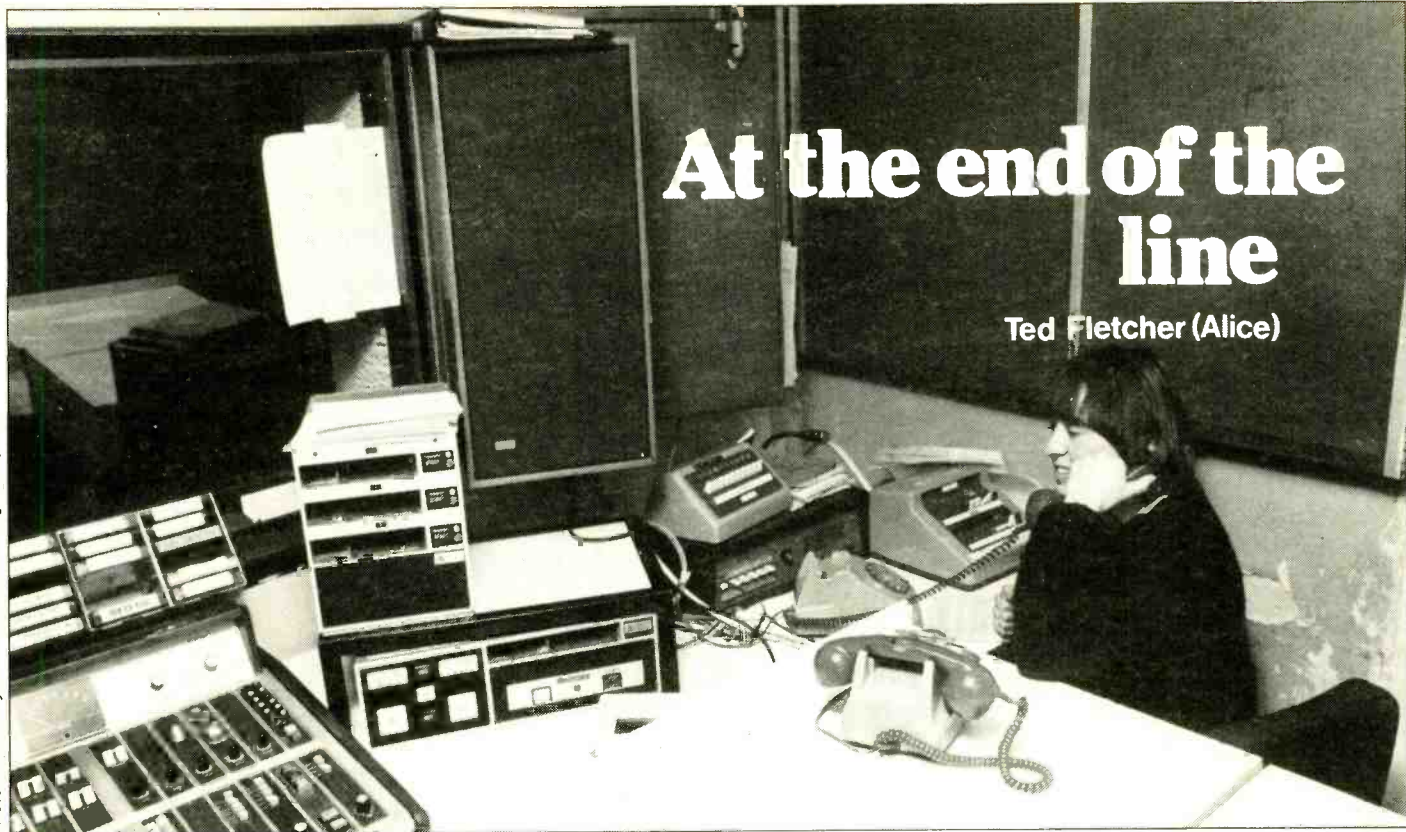
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At the end of the line

Ted Fletcher (Alice)

Photos: courtesy London Broadcasting Company



TECHNICALLY, the phone-in is a complex form of radio making use of clean feeds and equipment to separate the voices of presenter and subscriber. In its simplest form, a phone-in consists of a person telephoning the radio station where the call is routed to the on-air control room. The presenter then talks to the subscriber (person phoning in) and both ends of the conversation are transmitted—sometimes via a time delay mechanism in case the caller uses 'unbroadcastable' language.

But there are many difficulties associated with phone-ins, which may be divided into two main headings.

1) Line terminations and balancing
It is essential that the incoming telephone line shall be terminated not only most efficiently but in accordance with the requirements of the telephone authority. On the telephone line are two signals, incoming and outgoing. The purpose of the balancing unit is to separate these signals as efficiently as possible (a 2- to 4-wire converter).

2) Levels and phase
The outgoing level to line will be approx +4dBm when measured on a PPM (see appendix A) while the signal level from the subscriber will be between -26 and -10dBu. This signal difference has to be made up in the system somewhere and so, by definition, degrades the crosstalk performance of the 2- to 4-wire converter.

Because the telephone line is

The telephone 'phone-in' programme has been with us in Britain for six years as a serious programme format, the very first use of 'phone-in' techniques having taken place as recently as 1965 when listeners to the light programme were invited to phone in their requests to the Bob Miller band.

physically long parallel pieces of wire, the capacitances, resistances and inductances produce a complex impedance which further complicates the 2- to 4-wire conversion. The signals have to be separated as carefully as possible because any mixing of the presenter's voice from the telephone circuit back into the control room mixer will cause unpleasant 'coloration' effects. This can be seen in fig 1. $A + f(A)$ is the original signal modified by the effects of being coupled directly to the telephone line. Simple subtraction of the 'A' signal will leave the $f(A)$ component with the 'B' signal.

Basic 2- to 4-wire conversion is performed by a hybrid transformer, or the electronic equivalent, and a simple hybrid is shown in fig 2. The system makes use of two accurately matched transformers

arranged so that the 'A' signal is cancelled in one set of windings leaving the 'B' signal separated. The $f(A)$ component shown is reduced by introducing a phase shift into the 'model' winding. This arrangement gives adequate performance on short telephone lines but has disadvantages.

- a) Being a passive device, no gain correction is applied to the signals, this having to be accomplished in the presenter's mixer.
- b) The adjustment of the variable elements is critical and has to be made for each individual call for optimum results.
- c) No frequency response shaping or filtering takes place so that the system is susceptible to hum and out-of-band noise.

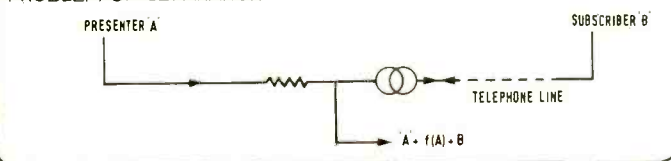
The Electronic Hybrid

The electronic version of the hybrid

as developed by Alice, approaches the problem from the same direction as the transformer but goes much further. The theory is simply that in order to balance out the $f(A)$ component exactly, it is necessary to create the function first. This can only be done with an exact copy of the telephone line in use—so the solution to the problem is either to rent a second line for every caller, or build a model of a telephone line of variable length. The first option is ideal but prohibitively expensive, the second option has been the subject of research for over five years.

The first two types of telephone balance units produced by Alice made the basic assumption that the line characteristic had only two variables; resistive and reactive variables, and that these could be present in different proportions. A second assumption was made in that once the unit was connected to a particular set of lines to a local exchange, the balance on each line would closely approximate to the others—the predominant characteristics being the type of cable and the distance to the local exchange. Within limits, these assumptions were valid. The widely used *TBU2* has proved to be an effective tool over a wide variety of areas, its success being attributable to a combination of a moderate ability to balance the line, in conjunction with a complex processing system which operates as an automatic gain control, a filter

FIG.1
PROBLEM OF SEPARATION



system and a selectable 'ducker' which gives the operator the ability to override the subscriber automatically.

More recent research has shown that the dominant problems in the cancellation of the f(A) function are less obvious and have their roots in transmission line theory. When a signal is sent down a long line unless the line is correctly loaded, a proportion of it will be reflected back from the far end and be received at the send end a finite time later depending on the send and return distance. Very few telephone lines are matched by the receiving apparatus and on lines above 16 miles in length (including both local ends and lines between exchanges), this reflection has a significant effect, making simple balancing extremely difficult. Luckily, however, the majority of telephone phone-in programmes make use of lines shorter than 16 miles and these can be approximated by the simplified diagram fig 3. From the sending apparatus, the line looks like the small

FIG. 2
SIMPLE HYBRID

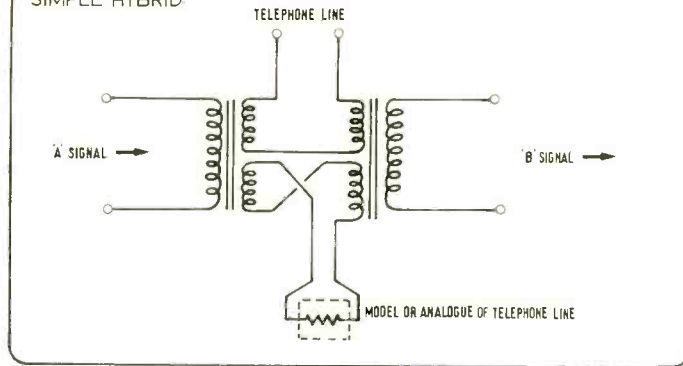


FIG. 3
APPROXIMATION OF SHORT TELEPHONE LINE

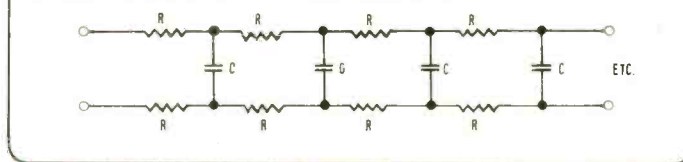
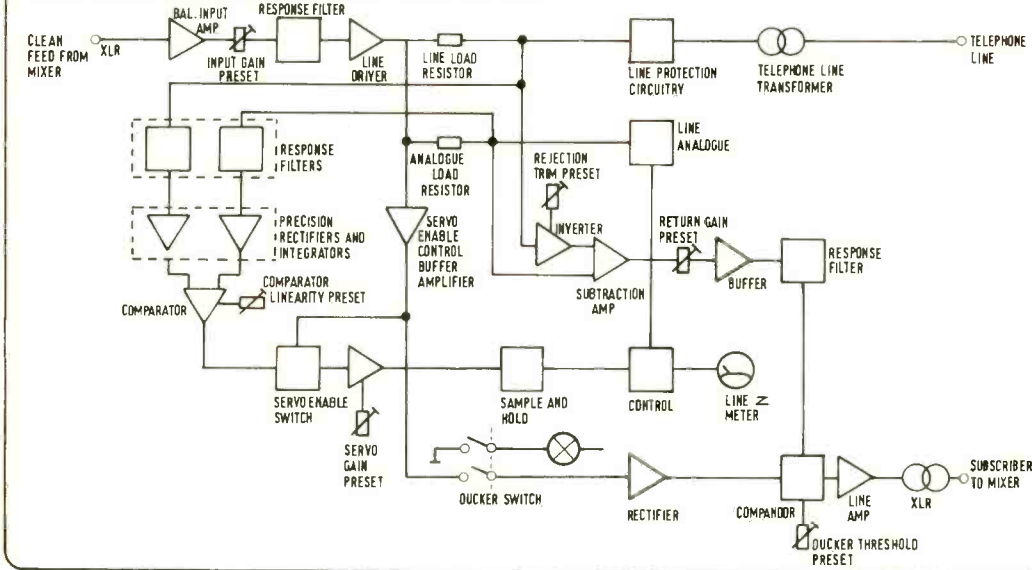


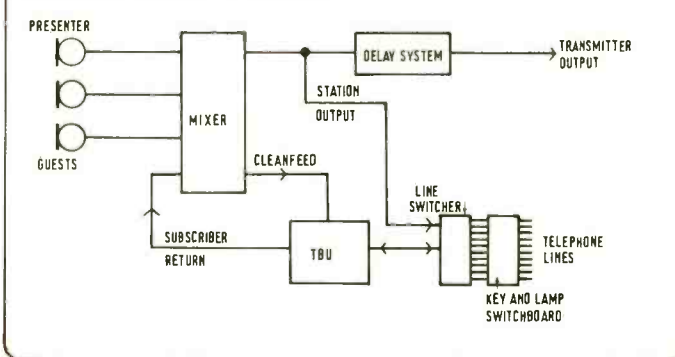
FIG. 4
ALICE AUTOMATIC TELEPHONE BALANCING UNIT TBU3



resistance $2R$ in series with a small capacitance C which is in turn paralleled by a further resistor and capacitor and so on. The research produced a circuit giving a close approximation to this idea of the line together with a single variable making the approximation valid for any line between approx half a mile and 16 miles.

Practical tests gave encouraging results with the variable component being adjusted for each line. For 80% of lines tested, rejections of over 20dB were achieved across the audio band (measured after lifting the return level to equal the send level). However, the better the rejection the more sensitive the

FIG. 5
PRACTICAL PHONE-IN SYSTEM



adjustment because of minor differences between lines, and the 'all lines to the same exchange are similar' thinking had to be modified. To get good consistent balancing, the system had to be automatic.

The Automatic System

The variable element in the line analogue was redesigned to be current controlled and electronic techniques normally found in precision engineering were borrowed to produce a high definition servo system. The result is the TBU3 which senses the characteristics of the presenter's own voice when sent to both the telephone line and the analogue, and adjusts the analogue to mimic the line. The lessons learnt with earlier systems were applied in the form of signal processing, further improving the 'A' signal rejection so that for most lines the broadcasted coloration is not noticeable, fig 4.

Long Lines

For lines above 16 miles in length, the time factor of reflected signals has an increasingly significant effect on the balance setting at the high frequency end, and the results become less and less predictable. An extreme example of this showed itself during tests on a 200-mile line where the dominant reflection was measured to be 4.5ms after the send signal, and the dominant impedance was heavily resistive. This gave the automatic system a problem that it was not equipped to solve, so it assumed that we were showing it a pure resistance and that the reflections were part of the 'B' signal. Results of current experiments indicate that the direction of further research will be in the computer field with fast calculation of the significant time delay modes and insertion of artificially created analogues. It is interesting that having developed a practical system and knowing that further development is well down the slope of diminishing returns, the cracking of the time domain problem could have the spin-off of eliminating echo from satellite telephone links without the need for that annoying squelch circuitry.

Practical Phone-in

The simplest practical system is shown in fig 5 and is widely used in smaller radio stations. The presenter monitors the desk output on headphones. A number of telephone lines appear on a standard key and lamp switchboard where the calls can be answered and held by a receptionist. The receptionist can communicate in some way, usually via a talkback system, with the presenter and can cue him on a waiting caller. As

At the end of the line

required, the presenter can route a selected line through to the TBU where it is converted to 4-wire operation and feeds a line level channel on the mixer. The TBU also receives a feed from the mixer of all channels *except* the line level channel that it is itself feeding. This is the concept of clean feed. At this stage, all being well, the presenter can converse normally with the subscriber and both sides of the conversation are transmitted.

A further refinement is that all incoming phone lines in the line switcher are fed with station output. This prevents the callers getting bored and keeps them informed of the state of the programme. When a profanity delay is used, the system is identical except that the mixer output is fed through the delay system. When anything 'unbroadcastable' occurs, the presenter can either trip the system into 'real time' or insert a jingle to cover the preceding seven seconds, then the programme returns automatically to the delay mode. Increasing use is being made of the digital delay line where the programme starts in 'real time' and builds up the delay

over two minutes by removing segments between words. The 'dump' procedure then loses the delayed interval and returns to realtime—starting the delaying procedure again. Operationally the system is superior to tape delay but has the disadvantages of not allowing rapid repetition of dumping nor having available a permanent record of the programme—a back-up logging tape! The use of delay introduces extra disciplines in that the presenter is forced to listen to the output of his own mixer—transmitter output being delayed. The subscriber must have no radios turned on (in case of feedback), and the station feed to waiting subscribers has to be predelay.

Conference Systems

Where engineering effort has been available, a number of larger stations have extended the scope of the system to multiple phone-in or 'conference' systems. This basically enables a number of subscribers to be on the air simultaneously with the ability to hear the presenter and each other. The system remains substantially

the same except that a separate balancing unit is required for each on-air caller, and a separate clean feed must send him all except himself. Thus the system is limited by budgetary considerations—and the design of the mixer, unless a conferencing telephone balancing system is used (Alice *TBU3A*) where the clean feeds are derived internally.

Commercial Telephone Balancing Systems

The first commercial balancing unit to be used successfully in Britain was the Hes Electronics module from Belgium (see *Studio Sound* January 1973). This unit reduced the effects of the complex line impedance with a resistive buffer before applying a simple phase correction, level adjustment and filter system. I understand that the original *TSV30* unit is now superseded by a more elegant design eliminating the requirement of setting a rough balance.

The Alice *TBU2* was marketed in 1974 after field trials and proved to be a usable and reliable system with the remaining disadvantage of variable rejection on difficult lines.

The most recent devices on the market are the Studer *Telephone Hybrid* and the Alice *TBU3* and *3A*.

The Studer unit is fully automatic and resembles the Alice *TBU3* in its approach to the problem. Differences between the 'A' and f(A) signals are sampled, processed and control signals are generated to correct an analogue line circuit into near matching of the telephone line.

The *TBU3* performs a similar function with the addition of automatic level control of the 'B' signal and a ducking facility. The *TBU3A* is a collection of up to six balancing units with the addition of locally derived individual clean feeds for conference operation.

With the availability of automatic systems, future developments will be in the operational field rather than the technical performance of the convertors. ■

Appendix A

The level allowed to be sent down a telephone line is defined by the British Post Office as a level of -13dBm, this figure being measured on a meter which averages the programme peaks over a period of one minute!

Due to the lack of suitable equipment for measuring this parameter, it is usual to assume that peaks of up to +8dBm and music to 0dBm will be within this requirement (measurements made on a standard PPM).

agony

A studio had decided to produce its own records and was putting a great deal of time and money into a 5-minute recording of a 35-piece steel band. The studio was located on a quiet hilltop, in a huge, abandoned US Navy tracking installation, with outside walls of corrugated steel 40ft high. Outside was a large asphalt parking lot, ideal for setting up the band.

The engineer would like to have done the whole thing using a single pair of Neumann *U87s*, in stereosonic formation (set for bi-directional, coincident at 90° to each other), but the chairman of the corporation, a film-maker whose previous recording experience had been with on-location portables, insisted on having remixing capability on the recording. Subsequently, the engineer set up eight pairs of mics, using *U87s*, *AKG C414s*, *D202s* and *D140Es* (the mic collection was a little strange having been ordered by an AKG dealership in the Caribbean). He drew up placement charts for all of the instrumental sections, showed his assistants where to place the group (as far away from the building as possible), wrote down a mic plot, and left for dinner at the local Kentucky Fried Chicken.

When he returned, the brand-new cable drum was being rolled out, the mics were all in position and the tape machine had been aligned. Trouble was the orchestra had been set up right next to one of the steel walls. The engineer started to give his assistants bloody hell, when the chairman intervened. 'It was my idea to set them there. You see the last time we recorded a steel band that's where we put them.' 'What was it for?' he was asked, 'and what were you recording with?' 'A film and the soundman used a Uher. Mono'.

Night was falling and the temperature in the dry season in Trinidad drops very fast.

The band completed a take, and it went well. There were some unexplained noises on a few channels, but the biggest problem was the slapback—it would have made an MXR digital delay proud of itself. The chairman smiled sheepishly and agreed to move the band to the engineer's location. The second take was marred by the strange noises again, but everyone agreed that the sound was excellent. As they geared up for a third and, it was hoped, final take, strange popping noises started to appear, first on one track, then spreading to all of the others. The engineer rushed outside in a panic. It had started to rain.

Left: Post Office Telespot rack at LBC. Key and lamp switchboard has 10 lines, the lower keys providing answering and sending recorded message to line, the upper keys switching lines to the TBU. All switching is dc to the rack, which has 10 line cards each with 11ne relays and termination, amplifiers for the recorded announcement, meters to count calls answered, and U-links for testing. Below: Bias profanity delay tape recorder, with Alice *TBU2* balance unit bottom of left rack, and Studer *Telephone Hybrid* bottom of right rack.



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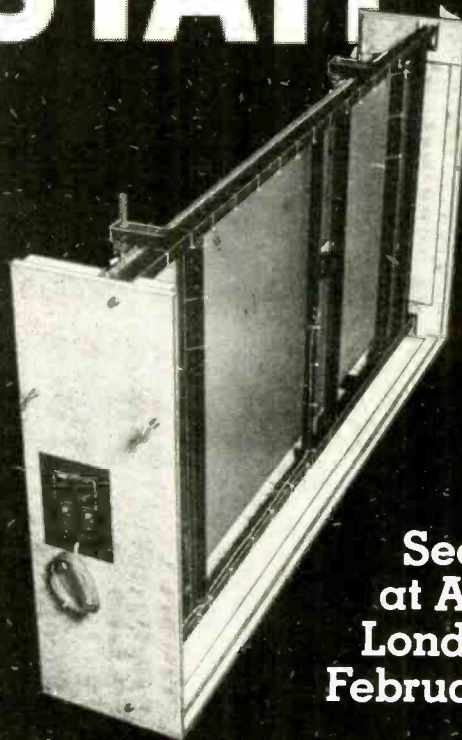
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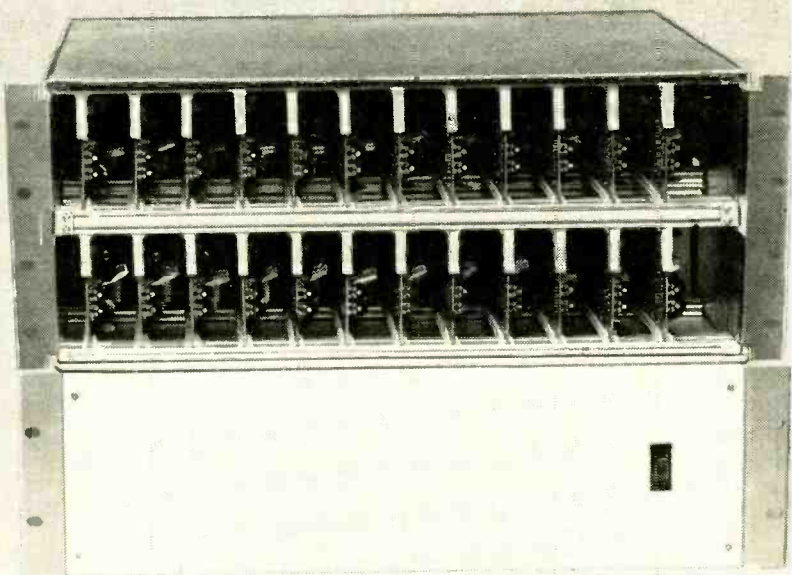
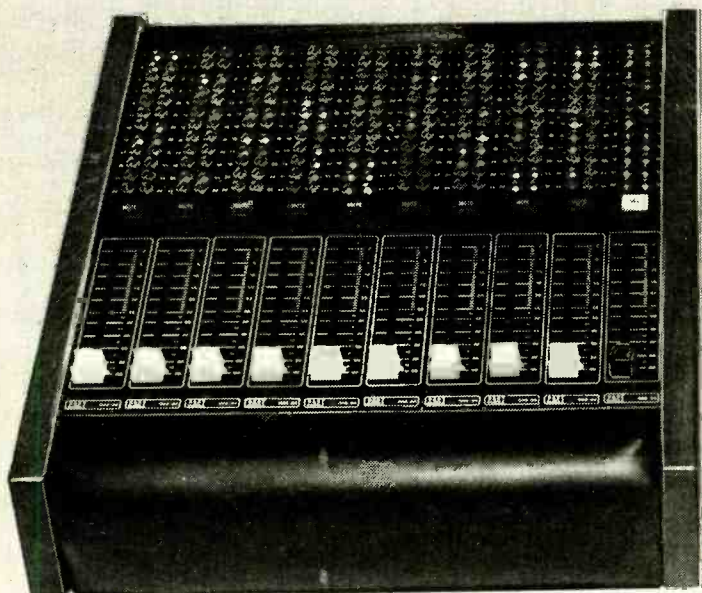
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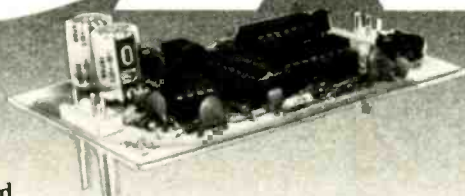
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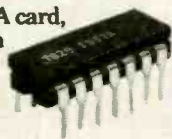
B&B VCA 500A Card

This is a retrofit VCA for the MCI 500 Series and requires no additional circuitry.

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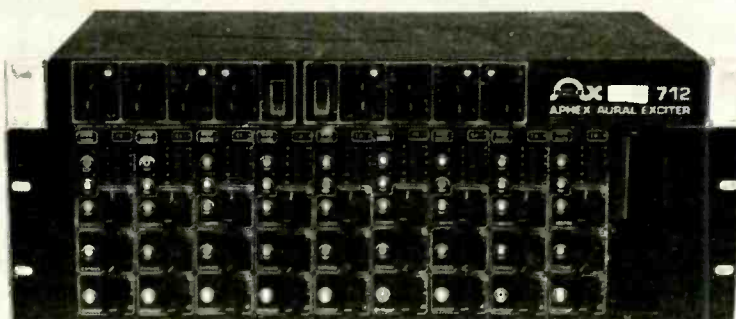
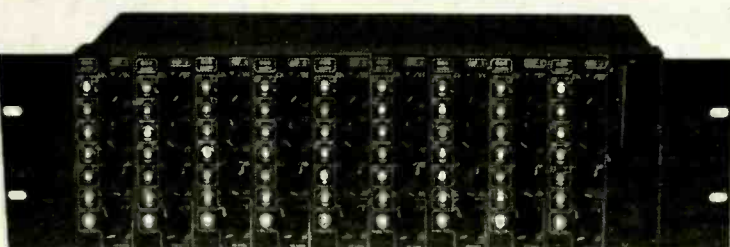
B&B CX1 Compressor-Expander

As a compressor, release time is variable from 50 msec to 2.5 sec, and threshold operates from -40dBv to +20dBv.

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Letters

High frequency ringing

Dear Sir, I wonder if the three tape machines reviewed by Hugh Ford in your December issue are typical of most machines as far as high frequency ringing on a 1kHz squarewave is concerned. Frankly, those oscillograms amazed me; one of which clearly indicated a 6dB reduction in high frequency headroom in a machine which had little enough anyway.

It may be interesting for Mr Ford to conduct a more detailed investigation into this defect in these and other machines he may review in the future; I believe we take the performance of reputable makes too much for granted. Transducers apart, such a response would hardly be regarded as acceptable in other parts of a linear audio system, particularly since in this case levels are not often monitored. Not that a meter would tell us much unless it were a scope, but I'll bet our ears would.

It seems that the designers of these machines have so concerned themselves with obtaining a flat response to the limit of a test tape, that they have possibly overlooked the effect of head (both record and replay) resonances outside the audio passband. It is perfectly possible to obtain a maximally flat response from a tape machine by correct head tuning and damping, which is where I suspect the problem lies.

Yours faithfully, M.A.Hall, 11 Henhayes Lane, Crewkerne, Somerset TA18 7JJ.

Hugh Ford replies: Mr Hall raises valid points about the performance of analogue tape recorders which leave much to be desired in comparison with other parts of the audio recording/replay system.

As far as the squarewave performance is concerned, this relates not only to frequency response but also to phase response, and it is the latter which appears to receive little attention from manufacturers. If the loudspeaker manufacturers are to be believed the phase response of an audio system has a significant effect on the reproduced sound, but, extremely few tape recorder manufacturers have taken any steps to phase compensate their electronics.

Genuine professional recorders have a flat high frequency response up to say 16kHz, above which there is no need to extend the high frequency response—too many semi-professional and domestic machines have high frequency responses extending to well above 20kHz and this serves no useful purpose for recording music or speech for human hearing. Indeed excessive high frequency response is undesirable because it increases noise and can introduce distortion.

Regarding high frequency headroom, it's my experience that with virtually all professional machines this is limited by the tape performance, there being substantial differences between tape types as there is with mid-frequency headroom. Unfortunately the two are not related to each other and there are some tapes of reputable manufacture with an excellent mid-frequency performance and a poor high frequency performance.

Mr Hall rightly points out that head resonances can be a problem, but, I would add

that resonances in other inductors such as microphone transformers aren't an uncommon evil and don't attract adequate attention.

While on the subject of the poor performance of analogue tape recorders it's my opinion that modulation noise and sideband generation, due to flutter, are the most important shortcomings. A/B comparison of a 10kHz tone shows these all too clearly in the very best machines and it is in this area, rather than dynamic range, that digital recording becomes a real benefit.

Revox whistles

Dear Sir, I may have the solution for Mr James Boyk (California Institute of Technology, Los Angeles), whose cry for help caught my eye in the May issue of Studio Sound.

I bought a new Revox A77 in April 1978 and this had an audible whistle identical to the one described for his A700, the whistle dropping by an octave as the lower speed was selected.

I returned my machine to REW who had agreed to exchange it for a new machine. I asked for a listening test before I took the machine, and although I was not too happy with their monitoring amplifier, I came away convinced there was no whistle on the new machine.

Back in my studio I connected the Revox up to my old faithful Quad 22 system and to my disappointment it whistled merrily away. Assuming that the monitoring amplifier at REW was not up to Quad standard, I wrote to Revox in Switzerland to see if it was a common complaint. I received a reply from Revox ELA AG, CH-8105 Regensdorf, Switzerland, Althardstrasse 146. They suggested that the noise could be the tachometer frequency leaking into the power supply, thereby becoming faintly audible through the audio output. The solution suggested was one of decoupling, which involved inserting a 22Ω resistor in series with the +21V supply to the tachometer electronics.

I tried it, it works, and it is now wonderful to listen to the silence.

I hope that the problem of Mr James Boyk and all other whistling Revox owners is from the same source, as the solution is so simple.

For anyone not confident enough to work on their Revox, FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ, were quoted in my letter as being conversant with the problem and how to proceed with this modification.

Yours faithfully, V. A. Lewis, Glass Recording, 21 Marlborough Grove, Oxtou, Birkenhead, Merseyside L43 5RJ.

Crown/Amcron mod

Dear Sir, We are a small company specialising in electronic design and repair in the PA and recording business.

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being the DC300A. Recently a common fault has come to light, and a very simple one too! It seems that high vibration environments cause two bolts under the main PCB to come loose and rise up, shorting a PCB track to earth. The result is usually several failed transistors and fried resistors, but worse than this, it almost always happens while in use and causes 60V dc to appear across the loudspeaker, with expensive consequences.

Preventive maintenance is worthwhile on this amplifier, and consists of removing the PCB, removing the bolts, and fitting shakeproof washers.

I hope readers of Studio Sound will find this information useful.

Yours faithfully, Simon Baker, Greenwich Audio Services, 16 St. Alfege Passage, London SE10.

Soundcraft review

Dear Sir, I write in connection with the review of the Soundcraft SMC 381-8 tape recorder in the December 79 issue. Many thanks for a complimentary and positive review about which we have received several enthusiastic telephone calls.

However, there were one or two points deserving a further comment.

The frequency response graph shown in fig 2 is by no means representative of the machine performance as supplied from the factory. It is difficult to ascertain at this late stage the reason for this result, but by way of support for this argument, I enclose a recording of a random sample audio channel which has not had any special attention. This test was performed on the same tape as used by Mr Ford.

I would also take the opportunity to explain the reasoning behind the 'peculiarity' in the record interlocking as noted by Mr Ford. The record system is arranged such that when making a recording on more than one track, the facility exists that all selected tracks may be 'dropped out' simultaneously, by a single pressing of the record button. It thus follows that the record button must be released before the play button on drop in, or the system will interpret the command as an immediate drop out. Another reason for choosing the arrangement over the more conventional 'hold record, dab play' system was to enable the user to have the option of not recording during the start up of the machine.

May I finally add that carrying handles are an easily fitted option, probably only worth mentioning since the comment appears in the very first paragraph of the review!

Yours faithfully, T. J. Eustace, Director, Soundcraft Magnetics Limited, 9-10 Great Sutton Street, London EC1V 0BX.

Hugh Ford replies: Similar frequency response results were obtained from several channels on the SMC381-8 supplied for review. The graph supplied by Soundcraft differed only slightly from the published curves showing similar characteristics, but tighter response. ■



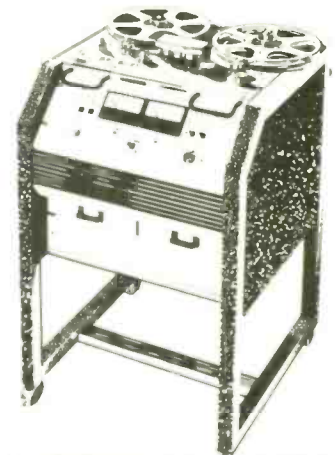
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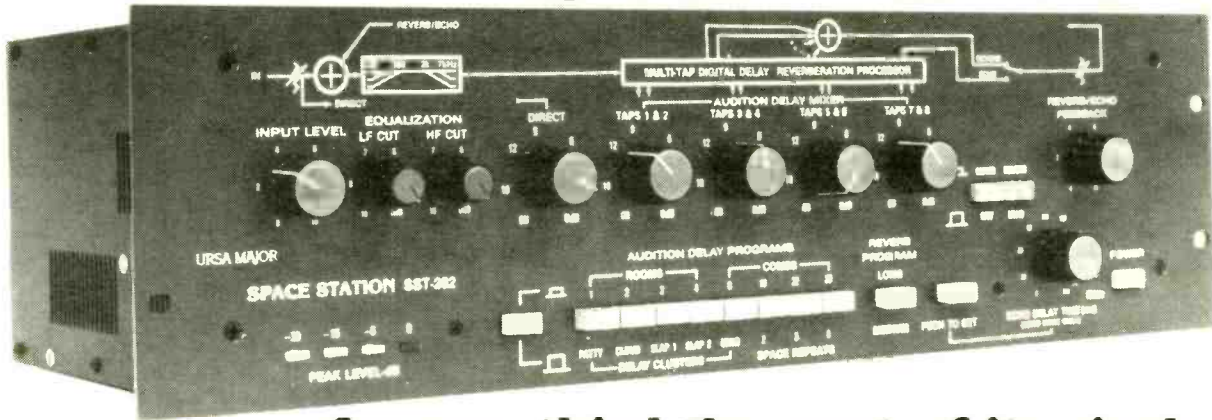


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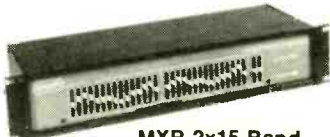
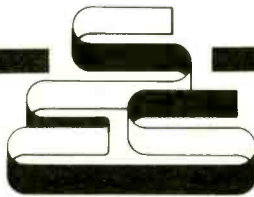
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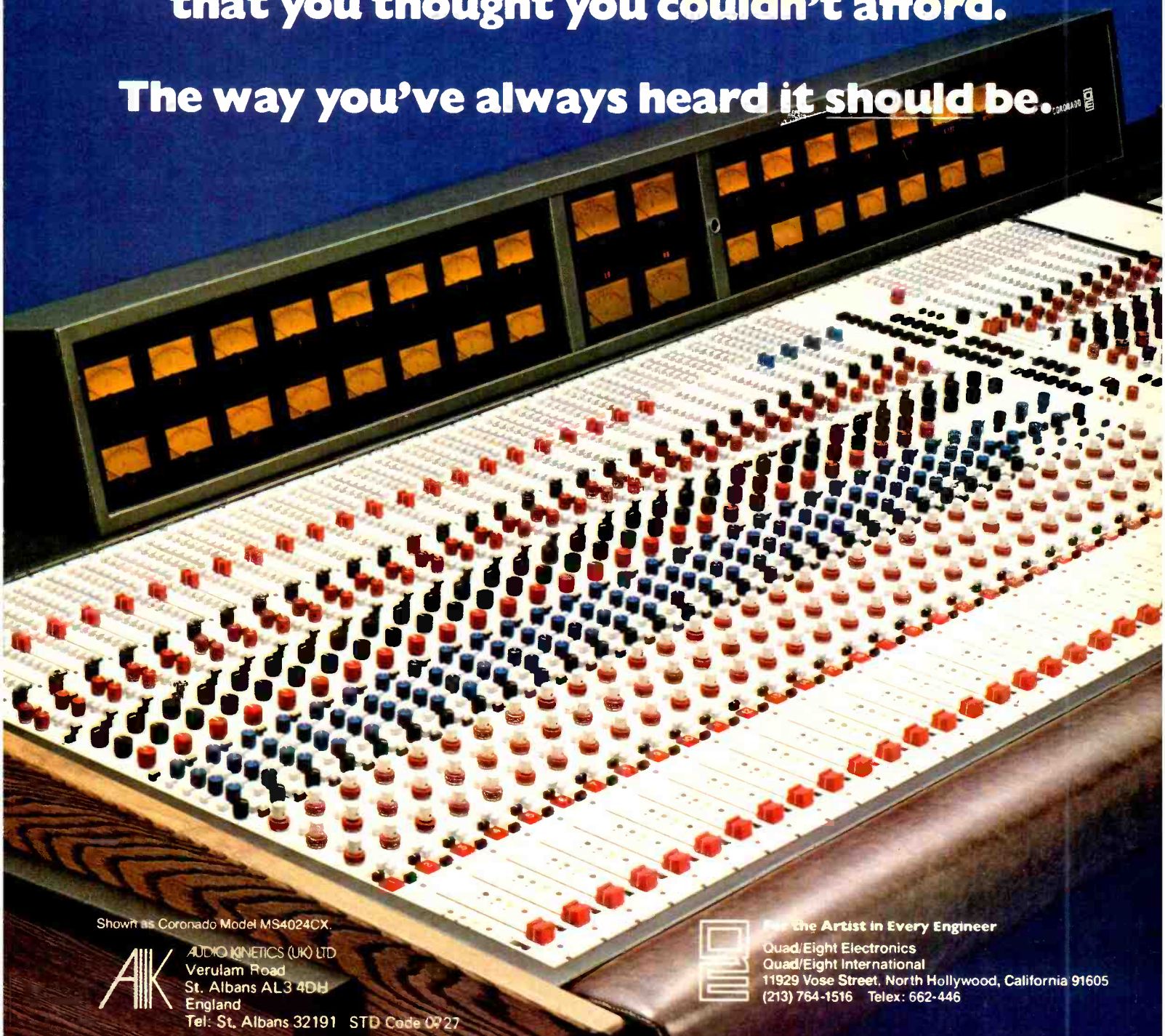


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ATEAP Exhibition Paris - a report

Noel Bell

THE 1979 ATEAP Exhibition held at the Sofitel Hotel, Paris was a much larger and comprehensive affair than the inaugural exhibition held last year. Forty companies displayed their wares and distributed product lines this year which was a much more substantial line-up than previously. This in itself was an undoubted plus point for the exhibition which, whilst it remains outside the predominant stranglehold the Anglo-American sound industry holds, was an encouraging sign that at long last there is greater recognition of the Continental dimension to the recording industry. While undoubtedly most manufacturers and distributors see the AES Conventions and the London APRS show as their major launching pads to the audio industry, it was interesting to discover how the French recording industry and its suppliers were faring in these less than expansionist times.

Although there was a subdued aspect to the exhibition and its associated lecture programme, which largely reflects the present recessionist influences on the recording industry, attendance was high with 1,500 visitors and a number of interesting products were displayed. The most important new arrival was the Ampex *ATR-124* 24-track tape recorder making its European debut in the wake of the New York AES Convention. Seeing this new comprehensively engineered recorder twice within the space of

The Association pour les Techniques Electro-Acoustics Professionnel was held at the Sofitel Hotel, Paris from November 13-15

two weeks reinforced my belief that this is probably the simplest 24-track in human engineering terms which has so far appeared on the market. Whilst I had been more than impressed by its facilities in New York a number of facilities were brought to my attention in Paris. One of these was the ability to load individual channel monitoring switching into the transport functions. Perhaps of further interest, with regard to maintenance, the input/output buss system allows access to all or individual channels, while optional auto-bias allows the machine to be optimised. Several separate parameter set-ups may be stored in the *ATR-124* which memorises eq's, bias and level, thereby allowing predetermined over-bias conditions to be set up easily. Incidentally the inputs/outputs of the *ATR-124* are totally transformerless giving an excellent slew rate and squarewave performance. Alongside the *ATR-124* Ampex also had on display its full range of tape recording equipment, plus its synchroniser and tape products.

French manufacturer Technicobel launched a number of new products, mainly aimed at the broadcast market. Foremost is the *CARL 50* broadcast console which the French television channel FR3 is installing in its regional broadcasting stations. To date five consoles have been delivered and a further 10 consoles are on order. In addition to the *CARL 50*, Technicobel also displayed their *RB60* broadcast mixing console introduced at Montreux. This is a modular console which in its standard broadcast format is a 12-input/4-group/2-output/6-aux send console.

Among Technicobel's new products is a 19in rack mount reverberation unit, the *CRA60*, developed under licence from Telediffusion de France. This unit uses helicoidal springs, has a stereo output, and features independent adjustable reverberation time from 1.55s to 5s of bass and treble, equalisation of bass and treble output levels, adjustable 0 to 33ms initial delay, and remote control of reverberation time and equalisation. Technicobel also



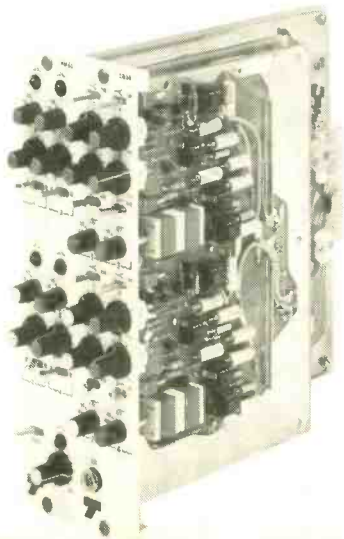
Sonetec CM1243

introduced a number of compact plug-in modules: the *PM60* pre-mixer with four mic inputs; the *CQ60* equaliser module; the *CF50* parametric equaliser; and the *NG50* dynamic noise gate. Yet more new products are the *CFD60* 2-channel, 4-band parametric equaliser which is a 19in rack mount unit; the *GAT60* 4-input/2-output commutation grid; the *ALA50* mono line amplifier equipped with its own power supply; and the *AGC60* VCA attenuator module, the first French VCA of broadcast quality. And finally, the *MGB60* 1/2in 2-track tape recorder, designed for heavy duty operation and featuring modular electronics. Other features of this recorder include servo controlled dc spooling motors using a digital open loop servo to provide constant tape tension, twin servo controlled dc capstans with built-in varispeed, velocity controlled spooling, and logic operation. The *MGB60* is available in various tape speed configurations, the standard configuration being 7 1/2 and 15in/s. Incidentally, Technicobel are also the distributors for Leavers Rich tape equipment in France.

Sonétec, who specialise in sound reinforcement systems, showed a wide range including the *DR1000S* professional direct drive 3-speed turntable with plug-in electronics. This unit features instantaneous starting with a run-up time of 0.25s, back cueing assist, and incorporates a 4W monitoring amplifier and 4Ω loudspeaker. Also on display was the company's *CM1243* 12-input/4-output/3-aux send

90 ▶

PM60 pre mixer and CQ60 equaliser, Technicobel



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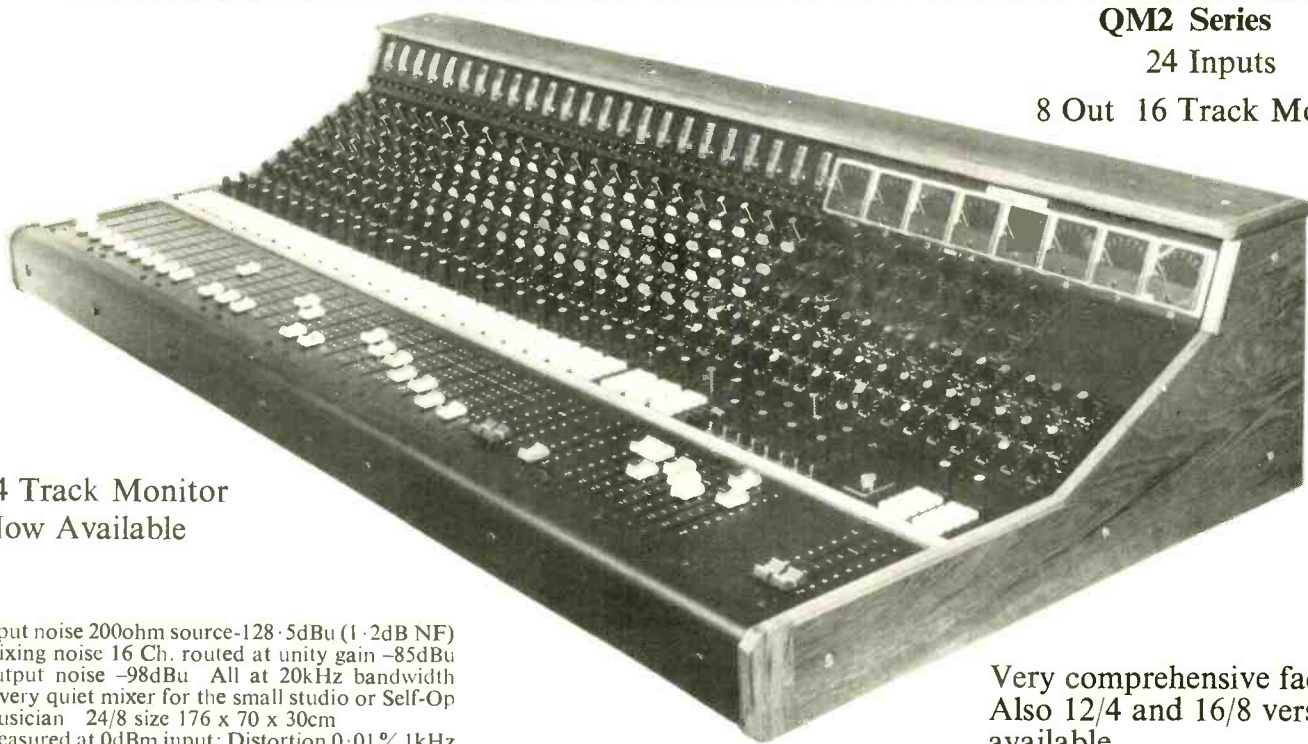
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ATEAP EXHIBITION

modular console, which under the designations *CM1843* and *CM3264* is available in 18 and 32-input versions.

French distributor **Comel** showed several product ranges aimed at the PA and sound reinforcement market. Most interesting were the range of loudspeakers, drive units, horns, crossover networks, loudspeaker kits, headphones and dynamic mics from Japanese manufacturer **Fostex**. Of particular interest were **Fostex's** laboratory series of loudspeaker systems, kits, and component units. Two loudspeakers from this range, the *BS1502* and *Fostex I*, are suitable for studio monitoring and are 3-way bass reflex systems with nominal 8Ω impedances. These systems are capable of handling 150W (music) and have an efficiency of 100dB at 1W at 1m.

Son Professionel showed an unusual direct drive turntable, the **Bernard TDR100**. This is a 2-speed turntable fitted with an Audio Technica pick-up arm which offers an unusual method of achieving instantaneous cueing. This method involves a 3-point record support system which holds the disc above and clear of the turntable platter which revolves beneath the disc at its set speed. If the cueing point is already known all that is then required is the pressing of a button. The disc then descends onto the platter and in synchronism the pick-up stylus makes contact with the disc. Obviously the addition of the mass of the disc to that of the platter causes speed drift; however, the time needed for the disc/platter combination to return to correct speed is only 300ms.

The French **Amcron** distributor **SCV Audio** showed a range of units under its own name. Apart from a DI box all were 19in rack mount units and comprised a compressor/de-esser; an active crossover filter network for tri/quad amplification; a spectrum analyser; a stereo reverberation unit; a 4 x 100W amplifier; and a stereo noise gate. The compressor has a compression ratio variable between 2:1 and 20:1, variable attack time from 0.2ms to 70ms, and variable release time from 300ms to 3s. The spectrum analyser covers the range 31.5Hz to 20kHz in 29 bands at ISO centres, has 12 LEDs per band, and may be calibrated at 1, 2 or 3dB per LED. The stereo reverberation unit has a reverb decay time of 2.5s, operates over the range 100Hz to 8kHz with bass and treble cut and boost of ±12dB at 200Hz and 8kHz, and has a signal-to-noise ratio of 70dB. Finally, the stereo noise gate which features highpass 12dB per octave filtering variable over the range 20Hz to 2kHz, lowpass 12dB per octave filtering variable over the range 200Hz to 20kHz, an attack time of 1ms, vari-

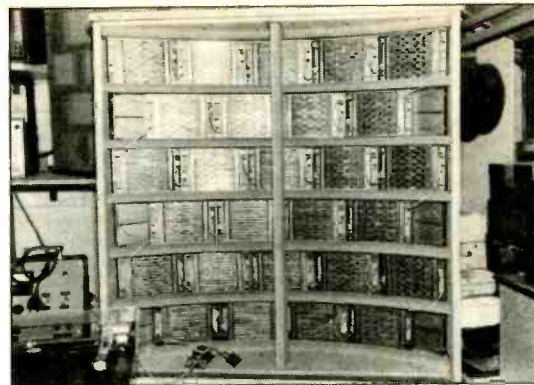
able release threshold from -50dBm to +10dBm, and automatic control of release time.

French manufacturer **LEM** had a wide range of electronic modules; however, the most interesting item on the company's stand was the *P1443* hand-held sound level meter. This covers a dynamic range of 34dB to 114dB in two linear scales of 34dB to 84dB and 64dB to 114dB with an accuracy of ±1.3dB. The meter has an A-weighted response curve and operates on two 4.5V batteries giving up to 20 hours continuous use. Indication of sound level is by red LEDs, the unit has a built-in electret condenser mic, and the display has a peak level hold facility. A demonstration of the meter indicated that it's a very versatile and simple to operate unit and the LED display was, unlike some, easy to read and should present no difficulties even in adverse lighting conditions.

Many exhibitors were displaying foreign manufactured consoles—these included **Soracitel** (Neve), **Studio Equipment** (MCI), **Regie Scene** (Midas), **RED Studio Centre** (Quad-Eight), and **Lazarc** (Trident)—there were also several manufactured in France. Other than **Technicobel** and **Sonétec**, consoles were shown by **Girardin**, **SAJE**, **Plus 30** and **Freevox**. **Girardin** specialise in broadcast consoles and showed the model *C124P* and *C184P* portable consoles which are respectively 12 and 18-input/4-output consoles. **Girardin** also manufacture modular studio broadcast consoles and the company additionally produce the *Model 564* tape recorder which is available in ½in, ¾in and 1in (2/4/8-track) versions.

SAJE showed their modular *CSM6* console suitable for sound reinforcement, multitrack recording, and broadcast use. This console is available in configurations from 4 to 40 inputs and 2 to 8 outputs, in sections of six modules, with desk capacity being in multiples of six modules. A total of eight different modules are available and they feature optional transformer balanced inputs and outputs. **Plus 30** had on display their *RS80* modular console which is available in 28, 36 or 52-input configurations. This console features comprehensive I/O modules, optional *RS64* programmer with the facility for separate mute and level encoding, and peak/VU lightmeters, phase meter and spectrum analyser fitted as standard. Finally, **Freevox's** range of consoles intended primarily for PA usage including the moderately priced and excellently engineered *2000 Series* available with 8 to 32-inputs.

As well as showing a **Midas** multitrack console, **Regie Scene** also displayed a range of power conditioners from American manufacturer **Topaz Electronics**. Two basic models are available, one portable and the other



Rear of polystyrene loudspeaker showing the modular construction

stationary, both models are available in a number of nominal power ratings. The units are specifically designed to eliminate problems in the power supply resulting from electrical line noise and voltage fluctuations. Capable of providing a constant supply of regulated ac power with negligible power line distortion, the units are especially useful for supplying power to sophisticated equipment such as console automation systems. The manufacturers claim that using their power conditioner in conjunction with such systems will cut down the number of program errors, and lessen the likelihood of memory loss, system damage and program wipeout. While the problem of power line disturbance is not particularly critical in the UK, due to the nature of the UK's national grid system, the same is not true of the continent. In France for example power fluctuations of over 10% often occur in the winter months, hence the availability of the **Topaz** units is a god-send for our European colleagues enabling them to ensure reliable equipment operation.

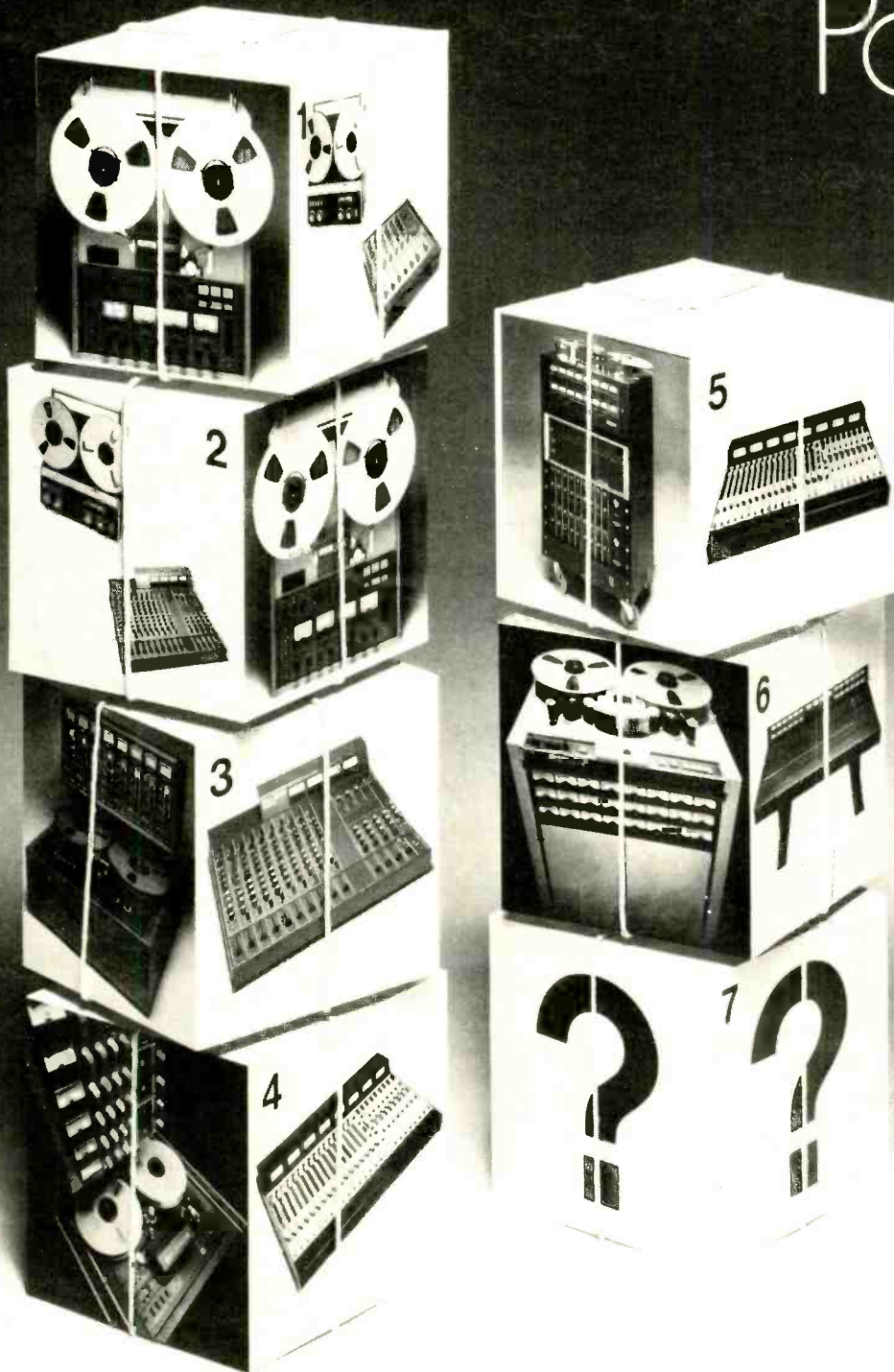
To conclude I'd like to mention one other product which was being demonstrated, although it isn't really within our field of interest. This was a novel polystyrene loudspeaker with metal tracks at the rear of the polystyrene diaphragm working on the electromagnetic principle in conjunction with further metal tracks on the diaphragm support unit. The loudspeaker is approximately the same size and shape as the **Quad** electrostatic and contains 27 polystyrene diaphragm units wired in series. It was rather uncanny seeing the square polystyrene diaphragms vibrating in operation, but unfortunately the quality of records being played through the loudspeaker left much to be desired, hence although the system obviously had a good frequency response and dynamic range it was difficult to come to any final conclusions as to its quality. Also the designer didn't speak English and my French proved less than adequate to elucidate further details, so unfortunately I was unable to discover more.

Apart from the above mentioned manufacturers and distributors most other exhibitors were showing the usual selection of products which form the basis of studio equipment throughout the world. Here there were no surprises or new additions to the fold, just an excellent opportunity for French engineers to see what was available and to renew their association with the equipment. Overall, **ATEAP** was considered a successful exhibition for all concerned and the high level of attendance should augur well for its future. ■

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4. 8 track 1 inch package. Otari MX7800, Allen & Heath 16x8 Mixer	£7185	£6395
5. 16 track 1 inch package. Itam 1610, Allen & Heath 16x8, Revox HS77	£9045	£8185
6. 24 track package. Otari MTR90, Allen & Heath Syncon 28x28	£29275	£24990
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Commercial radio, American style

Part two

Brendan Hurley

IT'S a typical sunny Florida afternoon. Pleasantly warm, with fluffy cumulus clouds scattered across the deep blue sky. But inside a small brick building in the middle of a grassy field Mike Kale cannot see the sun. The room he is in has only one window, and it is hidden from his view by racks of tape decks that stand 10ft high.

From a loudspeaker mounted just over the console Mike sits behind, the strains of Kermit the Frog singing *Rainbow Connection* can be heard. But Mike is not listening to the song. His ear is waiting to pick up a series of beeps fed to him from a computer 1,100 miles to the north, a series of five high pitched sounds that will come at 1s intervals beginning at precisely 10s before 4.24pm.

The tones come, exactly on time—beep, beep, beep, beep, beep. Then 5s of silence. *Rainbow connection* is faded out. Then a deep voice—originating from the same building in New York city as the computerised timing signal—says: 'This is Walter Cronkite reporting with news and analysis on the CBS Radio network'.

Mike is a disc jockey at WMEL Radio—the CBS affiliated station in Melbourne, Florida. He and his station are typical of radio in America. WMEL is a modest facility in a modestly populated area. The building in which the transmitter and studios are located is small and plain and originally was purchased in 1956. The equipment at the station is not ultra-modern, but it is functional.

Contrary to what some may think, most of the radio stations in America are not lucrative businesses. Of the 8,000 stations, only a handful are in the so-called

American radio is doing better than it ever has before, currently grossing \$3½ billion in commercial revenues. But in spite of that, the AM portion of the radio band in this country has been losing listeners and revenue to FM. I look at the reasons why and the way programmers gauge their audience here in Part Two.

major markets—the big cities with huge potential audiences. Most stations are like WMEL. No, forget that last remark. Many are not as fortunate as WMEL. For unlike most of the other 13 stations that share the Brevard County (in Central Florida) market, WMEL is making a profit.

Brevard County is like a number of other radio markets throughout the country. It does not have enough potential listeners to support all of its radio stations. Just this year, two of the stations in the northern part of the market had to be sold when on the verge of bankruptcy. After the changeover, the new owners of WRMF AM and FM made the usual promises that under their leadership prosperity and high ratings were all but a certainty, and that everyone's job was secure. Within a month, five of the eight full-time members of the air staff had either been fired or had resigned. All typical in the radio business.

Roughly one-third of all radio stations in the States lose money. That is why the staff and management of WMEL consider themselves lucky. They make a profit—albeit modest—and their jobs are secure, at least by radio standards. The pay for most of the staff is low, in some cases barely above minimum wage for air staff members. But that does not seem to matter

much. The DJs and newsmen love what they do, and some of them consider this a learning opportunity that could help propel them into the 'big time'—major market radio.

The War Between AM and FM

But even though WMEL does reasonably well in the ratings, it is still only number two in its market. It sits in the shadow of a 100kW giant just 20 miles to the north in Cocoa Beach, a pop-rock station—WCKS - FM—more commonly called CK-101. CK took the market by storm four years ago when it changed to its current mass appeal format. Now it has 25 per cent of the available audience. By comparison, M-E-L has six per cent.

The process by which FM stations take away more and more of the audience of the established AM stations is called FM penetration. It's a growing phenomenon in the States. Last year, for the first time in the history of radio here, FM stations grossed more money than AM's nationwide. This year, FM acquired a larger audience than AM from coast to coast.

What is happening in American radio according to Jerry Del Coliano, publisher of *Inside Radio*, a magazine for station managers, is a subtle revolution perhaps as

big as the one that occurred 25 years ago when television forced radio to re-adjust its programming.

"To understand what's going on today we have to go back to just after World War II when TV was just starting to grow in popularity," says Del Coliano. "It scared the hell out of radio. Broadcasters considered TV as radio with pictures and tried to compete with it head to head. They programmed in hour and half-hour blocks and got clobbered."

"Then came Todd Storz and Gordon McLendon, considered the fathers of top 40 radio. They said radio shouldn't compete with TV, that it should, instead, be a juke box. When the Storz and McLendon formula proved it could capture an audience—albeit a young one—it was picked up by radio stations all over. As a result, listening to the radio became a popular fad among teenagers of the Fifties. By the end of the decade, radio had a large and youthful audience and was financially viable.

"By the early Sixties rock had become popular and it was followed by all news. In the middle part of the decade, radio continued to diversify. Beautiful music stations, middle of the road stations and information stations came on the scene. Radio was now a vending machine, people punched up stations that provided programming to match their mood.

"Towards the end of the decade, some of the FM stations capitalised on the new mood radio with acid rock; it matched the mood of young people during the Vietnam war era. It also provided DJs who sort of broke the rules. Unlike AM jocks they were unfantastic,

"Simultaneously, AM radio was beginning to abuse its audience. The abuse developed from a sense of well-being, of unconquerability. They thought they were the living end in radio. No one was taking FM seriously.

"So AM felt secure and began to programme selfishly. They increased their spotload, irritating listeners with too many commercials. Because market research was unheard of at that time, AM radio began to lose touch with the hearts of the listeners it originally won in the early Fifties. The screaming DJs and frenzied programming pace was turning off listeners."

Les Garland, programme director of KFRC AM, San Francisco's number one music station, agrees: "People didn't run to FM, they ran away from AM. There wasn't anything so great about FM, it was just new and poorer and had fewer commercials and consequently more music.

"AM radio isn't dying, it's killing itself. It's forced people away with clutter, too many commercials and lack of knowing what its audience wanted. A whole generation of people grew up with top 40 radio and it was immensely popular. But as that generation matured, AM didn't mature with it. The stations failed to adapt.

"That's why the mix of listeners has changed so dramatically over the last ten years. Back then you had 80% of the audience listening to AM, 20% to FM. Now the mix is something like 50-50."

Market research: American Radio's newest tool

But isn't it possible that FM radio could make the mistake AM made years ago? Could FM lose touch with its audience. That prospect seems a bit unlikely.

Even small and medium market stations are in growing numbers practising market research. CK, for instance, invests 25 manhours each week surveying listeners both by phone and in person. In the phone surveys, randomly selected people are asked what station they have on at the moment and what station they listened to, say, yesterday in the morning. During personal interviews, respondents may be asked to evaluate a song.

In the past, market research with records didn't go much beyond taking a look at the charts that showed the 40 hottest selling records in the country. Baker says that's not enough any more. "The charts are four to six weeks behind popular taste," according to CK's programme director. "So we're constantly examining tastes on our own trying to identify the hits before others recognise them as

hits. But that's not where our job ends. If we get on a song before others in the market do, we may deliberately overplay it. The idea is to get listeners in this market burned out on it before the others see it on the sales charts and play it on their air."

But Baker cautions: "Research is more than a science. It's an art. It requires interpretation and judgement. You can't take it too literally.

"For example, market research shows that only 25% of all listeners are interested in contests. If you take that data at face value, you'd think contests would alienate 75% of your audience, so you'd drop them. But the fact is, 75% of the audience isn't alienated by contests, they're alienated by contest 'hyp'. They don't want to hear people screaming: 'Oh my God, I won, I won'.

"So it turns out that if you interpret the data correctly, you can have your contests and keep all of your audience happy."

KFRC's Les Garland agrees with Baker that you've got to be careful with research. "You can't underrate the importance of experience and creativity in radio. You need the research, but you also have to be able to understand it and put it into the proper context. Some people forget that you don't listen to records with paper or survey questionnaires. You listen to them with your ears.

"You can't let the researchers completely run your station. That's where programming knowledge comes in. What AM radio in general needs is a swing back to personality. That's what radio was originally about. Real people who come from the real world and can communicate. Radio should genuinely be fun. You can have all the surveys you want, and follow them to the letter and in the end, if you don't care about what you do and if you're not creative, you won't survive."

The Book

One of the most significant forms of market research involves what is known in the trade as 'the book'. Roughly one quarter of all the 8,000 radio stations in the country subscribe to ratings books. Most of them—approximately 1,300—subscribe to a ratings service known as Arbitron.

Arbitron, also called A-R-B, is the acknowledged leader of the ratings services in America. It charges radio stations a fee for measuring their audiences. The largest stations in the largest markets pay up to \$65,000 a year for the ratings service. (About 1% of their gross revenues.) In the big markets, Arbitron will conduct four

separate ratings each year. The information gathered in each survey, the number of listeners, their age, ethnic background, income distribution, etc, is used as the basis for establishing rate cards—the amount of money the station charges for advertisements. In the larger markets an advertiser may pay up to \$500 for a single commercial, and so the money spent on ratings books can easily be recouped.

In the smaller markets, where stations charge as little as \$2 per spot, the price of subscription to the A-R-B is proportionately lower. In those markets as few as one survey per year is conducted at a cost of perhaps \$5,000 to the subscriber.

Programme consultants

And if radio stations feel they haven't spent quite enough money on books and private surveys of their own, or if the results of those surveys are disappointing, they can pay for yet another programming service. They can hire a consultant to come in and analyse your audience, and have him programme your station to meet with the listener's approval.

The Atlanta-based firm of Burkart and Abrams is one of the more well known programming consultants in America. They programme 120 stations across the country. The firm's most notable programming success came in New York City recently where they brought a previously low rated FM station, AKTU, to the number one position in the market.

Kent Burkart, one of the firm's chiefs, says that currently in this country four categories of programming seem to be enjoying great success.

"They are," says Burkart, "Top 40, Album Rock, a combination of the first two, and dance music. Disco is what we used to boost KTU's ratings.

"We use those four formats largely on FM. On AM all talk and all news seem to do well, but so do some music formats such as country and middle of the road music.

"Whenever we programme a station we take a careful look at the demographics of its market. We identify who the potential listeners are and programme for them."

Network Affiliation

There are four major commercial networks in America, and two networks that run no commercials. Among them, they share some 3,000 affiliated stations.

Invariably, the networks provide their stations with one type of programming—news. The com-

mmercial networks also place commercials within their newscasts. Affiliated stations must run these commercials by legal agreement. Some of the networks require affiliates to carry very little of their news programming, just as long as the commercials are run. Others, such as CBS, demand that a large percentage of the programming and all of the commercials be run.

The success of the networks is measured by the size of their audience, and the size of the audience is often associated with the number of affiliates they can attract. Sometimes networks will go to great lengths to get a station to affiliate with them, even offering the stations money to carry them.

Of all the networks, ABC is the most listened to. That is largely because it pioneered a unique networking strategy. ABC is actually four networks within a single network. It offers four different newscasts with different formats at different parts of each hour.

For example, at the top hour, ABC feeds out its American information cast, designed to gel with stations that have adult contemporary formats: it runs at the top of each hour. But at quarter hour, the network runs its American FM newscast which is read and written in a casual conversational style. It consists largely of feature and human interest type news and is designed to go with album rock formats. The other two networks run at different times and are designed to match different programming states.

It is not uncommon for ABC to have several affiliates in a single market subscribing to one or other of the newscasts. It's a highly successful and highly profitable strategy, now being imitated by two of the three other networks: NBC and Mutual.

The two networks which do not run commercials are the Associated Press Radio Network and United Press International Radio. But these are more properly referred to as audio services rather than networks. They provide commercial-less newscasts at the top of each hour and audio cuts to their subscribers in between the newscasts (the four other networks also feed audio cuts to affiliates). Stations pay a fee to subscribe to AP or UPI.

Part Three: Paths for the future in American Radio

As the quality of programming on AM in general began to decline, and as AM stations began to lose touch with their audiences, low budget FM stations began to pick up AM's dissatisfied listeners.

Commercial radio, American style

During the Seventies, a new awareness of the importance of knowing your audience arose. Radio stations began spending appreciable sums of money engaging in audience research of their own. Radio is now at a crossroads, with its audience divided just about equally between AM and FM stations. So, what does the future have in store?

The Coming of AM Stereo

There is an experiment taking place in American radio. Five radio stations in five major markets across the country have been broadcasting AM signals in stereo for the very first time. The purpose of the experiment is to evaluate AM stereo for possible future use in broadcasting.

Harris Corporation is the largest manufacturer of radio transmitters in the USA, building more of them than RCA and Collins Corporation combined. Harris is also one of the firms who is proposing its AM stereo design as the most viable of the five systems now being tested.

Harris spokesman Fred Baker is convinced that AM stereo will be an important tool to either block or reverse the current trend away from AM listenership.

"FM radio has definitely grown substantially, both in terms of listenership and in terms of gross revenues. And if you look at the figures you'll see that over 90% of the FM stations have opted to become FM stereo.

"The message we want to get to AM broadcasters is that AM stereo can be a benefit to them. It has some definite advantages over FM stereo.

"For one thing, FM transmission is limited to line of site. Once the horizon gets between you and an FM transmission tower you lose the signal. FM stations can rarely broadcast in more than a 100-mile radius. But AM signals can follow the curve of the earth, and commonly AM stations can be heard for hundreds of miles.

"This has important implications. A person driving along a highway listening to his FM stereo would have to change channels more frequently than someone listening to an AM stereo. Also AM stations are less subject to multi-pass problems — periodic drop out.

"Another thing about AM stereo that broadcasters will like is that it's relatively inexpensive. It costs a minimum of \$3-5,000 to convert your transmitter and perhaps another \$20,000 for other studio changes."

But AM stereo does have some drawbacks. The most notable one is fidelity. The range of high sounds that FM can carry is fully 50% higher than AM's capability. Frequencies of up to 15kHz can be heard on an FM receiver, while the AM bandwidth extends to only 10kHz. That means there is a noticeable difference in sound quality.

But you'd be surprised how small the difference really is," says Gene Maxwell—an engineer for WABC Radio in New York City. "Only an audiophile would be able to tell.

"We experimented with AM stereo here for about a month. When you listen to the signal on a good AM receiver it sounds remarkably good. You see the difference between 10kHz and 15kHz is smaller than you might think. We test with 10 and 15kHz tones quite frequently and they sound pretty similar.

"The reason AM radio gets a bad name is because of the receivers most people use to pick up AM signals. The things are usually only capable of carrying up to 3.5kHz—that's about comparable to a phone. If people had receivers that could pick up the full range of sounds that we broadcast, then the technical quality of AM radio would be more fully appreciated."

Indeed, it does seem as though AM radio gets a bad wrap because people are accustomed to listening to it on cheaper receivers than they use to listen to FM broadcasts. But if that bad image persists, it could prevent AM stereo from getting off the ground.

"AM stereo won't put an end to the decline of AM Radio in the USA," says *Inside Radio* publisher Jerry Del Coliano. "AM is suffering from a lingering bad image here and that bad image isn't totally the result of the technical quality of the sound. AM stereo doesn't mean a rat's ass, and here's why.

"Even if the commission (the Federal Communications Commission) approves it in the near future, and I don't believe they will, who'll buy it? Our magazine conducted a survey recently and we asked people if they were willing to buy AM stereo receivers. Most of the respondents said they wouldn't. A large percentage were undecided, and a small number said 'Yes'. It will be 10, 15 or 20 years before a significant number of AM receivers are in the hands of the public. Let's face it. There are 500 million monaural receivers out there valued at tens of billions of dollars. It will take a long time

to replace them. But even if people had the receivers there's still the problem of perception.

"In another study we conducted, we asked people why they listened to FM. They cited three major reasons: fewer commercials, less irritating DJs, more music.

The Advantages of Radio Advertising

But perhaps all this creates too negative a picture of American radio. The fact is that in spite of the competitiveness of the medium—or perhaps because of it—the industry as a whole has probably never been healthier.

"You bet your boots radio is hot," says Ken Costa of the Radio Advertising Bureau in New York. It's the bureau's job to extoll the virtues of radio to potential advertisers, to convince them that radio is the medium over which to push its products. Costa backs up his claims about radio's benefits with incredible enthusiasm and reams of facts and figures.

"Radio is one of the most cost effective means of reaching any audience and, more and more, advertisers are beginning to realise that," says Costa.

"The basic production costs and overheads of radio are low compared to television and newspapers. We pass the benefits of those low costs on to our advertisers in the form of low rates. Between 1967 and 1978 the cost per thousand of television advertising increased 103%. The cpm of newspapers was up 111%. But radio was up only 52%.

"But even more importantly, radio gives the advertiser the opportunity to target a message to a particular audience. TV and newspapers hit mass audiences. If you've got a product that's mainly of interest to, say, blacks, and you advertise it on the tube, only a small percentage of your audience will consist of people who need your product. But I can put that same advert on a radio station and guarantee it will be heard by an audience that's 80% blacks. What's more, I can reach any audience cheaply.

"For example, if you wanted to buy a 1-minute national spot on TV it would cost you anywhere from \$50,000 to \$120,000. That's for a normal programme. A special, like the superbowl, could probably hit half a million bucks. But you can buy a national spot on radio for about one fiftieth of the price of TV, \$1,000 to \$1,800."

What's more, says Costa, radio is a much more pervasive medium than TV. He points out there are 135,000,000 television receivers in the States.

Costa claims: "There are almost

that many radios in cars alone—110,000,000. There's an average of 5.2 radios in each household, for a total of half a billion receivers—half a billion!

"The average person spends about three hours a day listening to the radio. It's an incredibly pervasive medium. We listen to it in the car, at work, at home. You pick up things on the radio you didn't even realise you heard. In a given week, radio reaches 95% of all the people in the USA, so if you want to reach people, radio is the way to go."

Conclusion

So, in summary, this is the state of American radio. Stations here are, by and large, modest facilities—except perhaps in the country's 40 or 50 largest markets. The average profits of all the nation's radio stations in the latest year for which data is available was 10.8%. One in every three stations in the country loses money.

American radio has been in a state of flux lately. The old established AM stations have been losing listeners to FM. It appears unlikely that AM will be able to win those listeners back using the programming formulae that gave them success in the past. FM's greater fidelity gives it an edge in musical programming and AM will probably have to keep expanding on the informational aspects of its programming to maximise its listenership.

Even though the advent of AM stereo is certainly no more than a few years away, it alone will not reverse the trend of increasing FM penetration of markets across the country. Though AM stereo stations are—watt for watt—capable of a greater range than FM's, the frequency response of AM is no match for FM. It will be many years before the impact of AM stereo can be felt simply because it will be a long time before AM stereo receivers are in the hands of the American public in large numbers.

But in spite of the conflict within the industry, radio has more listeners now than it ever had, and more commercial revenues. Three and a half billion dollars worth. Radio's diversity of programming and its low production costs become more attractive to advertisers each year, allowing them to reach the precise audience required, with cheap, tailor-made messages.

Yes, American radio is undergoing a metamorphosis, but the indications are that it's through the worst of its turmoil and actually healthier for having gone through it. Radio in America—both AM and FM—is redefining its role and has a bright future. ■

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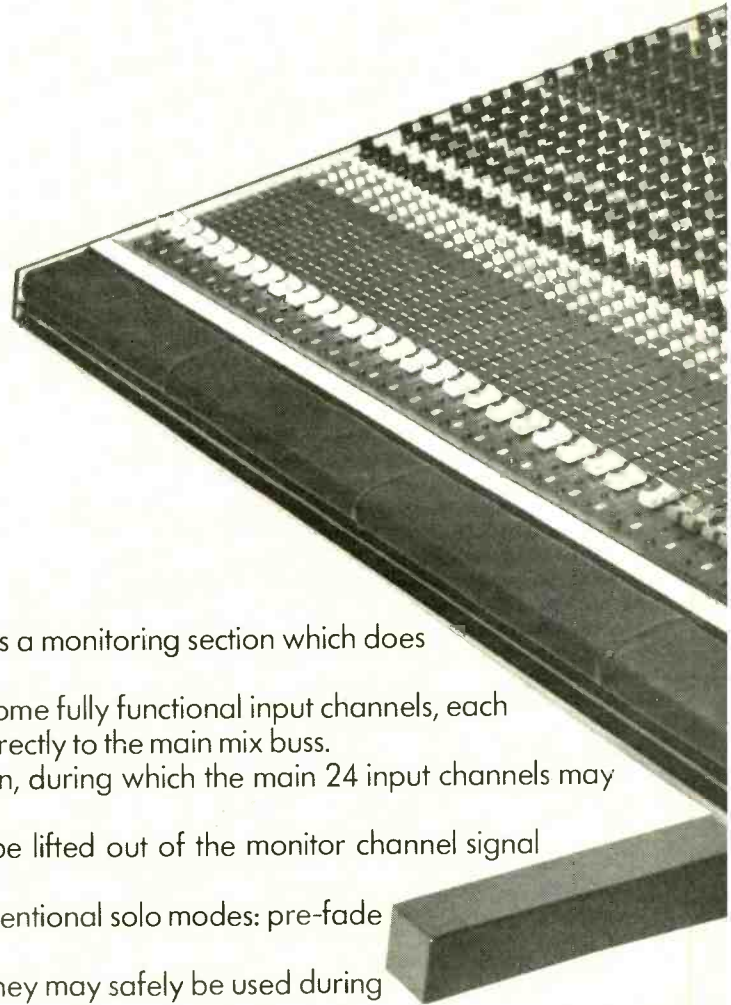
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Revolutionary, in that, unlike any other split console, it has a monitoring section which does not become redundant during mixdown.

Instead, with simple switching, the monitor channels become fully functional input channels, each with EQ, aux, pan, fader, solo and mute, and are assigned directly to the main mix buss.

Therefore, a 24/16 console has 40 channels in mixdown, during which the main 24 input channels may still be assigned to the 16 group faders as sub groups.

Furthermore, the auxiliary sends (cues) and pan may be lifted out of the monitor channel signal path and inserted into the subgroup signal path.

Revolutionary, in that the console provides all three conventional solo modes: pre-fade (mono), post-fade (stereo) and solo in-place.

The first two modes do not disturb any signal paths, so they may safely be used during recording or mixdown.

The in-place mode mutes all channels not soloed, except monitor channels being used as effects returns or input channels in "safe" mode.

Other sophisticated features include: two programmable mute busses; six auxiliary sends, two of which may be assigned to follow the pan pot; a proprietary transformerless mic pre-amplifier; 41-position detented potentiometers, which are so precise that volume tracking between two similar controls will be typically within 1dB, and frequency tracking within 2 semitones.

Console equalisation is particularly versatile. Input channel equalisers have 4 variable-frequency bands, and a separate variable high-pass filter, while the monitor channel equalisers have 3 bands; the mid band with variable frequency.

All sections of the console electronics have been carefully designed to minimise phase deviation through the signal path, so that, typically, channel to track phase error is within 20° at 20kHz.

Conventional VU meters with peak level LED indicators are standard (as illustrated), but Soundcraft bargraph displays are available as an option.

Series 1624 is available in two mainframe sizes—24/16 (which with an optional 8 channel module provides 24 track monitoring) and 16/16, either of which can be supplied part filled.



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1624.



**Soundcraft
Series
1624**

**A
revolutionary
24
track
console**

**Soundcraft
Electronics** 

reviews

Lexicon 224 digital reverberator



MANUFACTURER'S SPECIFICATION

Program capacity: up to eight different program types may be installed, two standard.

Reverberation time: adjustable in two bands from 0.6 to 70s.

Frequency contouring: crossover and treble decay, each adjustable from 100Hz to 10kHz.

Depth control: adjustable, controls apparent pick up location in simulated chamber.

Pre-delay: adjustable in 1ms increments from 0 to 250ms in mono programs or 0 to 125ms in stereo programs.

Register storage: four complete programme mixes in addition to panel settings.

Additional controls: pot display select (6). Register select (4). Program select (8). Mode select (3) and keyboard shift (1).

Display: 3-digit numeric, dual 5-position headroom, overload warning and engineering units indicator.

Mainframe controls: power and system reset.

Dynamic range*: in reverberant mode 84dB typical, 81dB minimum relative to reference level at 20Hz to 20kHz noise bandwidth for all reverberation times between zero and 10s. In non-reverberant mode 90dB typical, 86dB minimum in 20Hz to 20kHz noise bandwidth.

Total noise and harmonic distortion*: 0.05% typical, 0.07% maximum at reference level for all reverberation times between zero and 35s.

Frequency response: 20Hz to 8kHz +1, -2dB.

Inputs: two, balanced and transformer isolated. 20k Ω input impedance. Level adjustable from +8 to +18dBm.

Outputs: four, balanced and transformer isolated. 90 Ω output impedance. Level adjustable from +8 to +18dBm.

Remote console cable: 15ft standard. Optional 25 or 50ft cables are available to special order.

Power: 100/115/200/230V switchable, 50/60Hz, 100W.

Protection: mains fused, secondary windings fused with voltage crowbar and/or current limited with thermal protection.

Connectors: XLR-3 audio connectors, standard IEC 3-wire power cord, DB-25 remote and RS-232 connectors.

Power on muting: 3s.

Serviceability: field serviceable with all major assemblies pluggable.

Diagnostic programs: control and display via remote control panel.

Cooling: convection cooled power supply, forced air cooling of logic cards.

Environment: zero to 35°C operating, -30 to 75°C storage, relative humidity up to 93% without condensation.

Dimensions: mainframe is standard 19in rack mount 7in high by 15in deep (483 x 178 x 381mm). Console 5.4 x 8.8 x 3in (137 x 224 x 76mm).

Weight: mainframe 34lb (15.5kg)—shipping 48lb (22kg). Console 2.5lb (1.2kg)—shipping 6lb (2.7kg)

Automation interface: optional RS232C serial interface.

RFI shielding: power and audio connectors are RFI shielded as standard. Optional RFI shielded cable available.

*In concert hall reverberation program with input sensitivity set so that 1kHz +12dBm input corresponds to '0' LED just going out (this is reference level) output sensitivity set to produce +12dBm with 600 Ω load in self test mode (unity gain).

Price: £4,800 including four programs, extra programs £130 each.

Manufacturer: Lexicon Incorporated, 60 Turner Street, Waltham, Mass 02154, USA.

UK: Scenic Sounds Equipment, 97/99 Dean Street, London W1.

THE Lexicon 224 digital reverberation unit generates a variety of reverberation effects purely by digital means, the reverberation

patterns being stored in read only memories. The latter may be replaced at any time to update the unit or to provide new reverberation types which may become available.

Basically the unit has two inputs and four outputs which are suitable for stereophonic and 4-channel effects with some reverberation programs. Conveniently the system is 2-part with the main electronics in a rack-mounting chassis, which is fed from a small remote control unit. A 15ft long remote control cable is supplied as standard, but 25 or 50ft cables are available.

At the rear of the main unit are XLR connectors for the floating audio inputs and outputs together with an IEC standard power connector and the multi-pole remote control connector. There is also a space for a further optional connector for use with remote digital interfacing.

Only two controls are fitted at the front of the main unit, the power on/off pushbutton (with an adjacent LED power indicator) and a system reset button for resetting the electronics if necessary. However, recessed behind the front panel are five single turn potentiometers which may be screwdriver-operated through the front panel to control input and output levels.

Access to the electronics is gained by removing the front panel which is fixed with captive thumbscrews. Part of the power supplies are located to the left, behind the front panel, the remainder are at the rear centre with a large heatsink protruding on the rear panel. The Imperial mains fuse is unidentified in value, and the two power rail fuses although identified are most inaccessible.

The seven electronics boards are mounted into a card cage with a mother board to the rear; all components are mounted on plug-in boards to ease servicing, which can be a difficult problem with digital units of this complexity. Throughout, good quality components are used and the electronics cage is cooled by a relatively quiet fan with an air

100 ▶

FIG.1
LEXICON 224 WHITE NOISE FREQUENCY RESPONSE

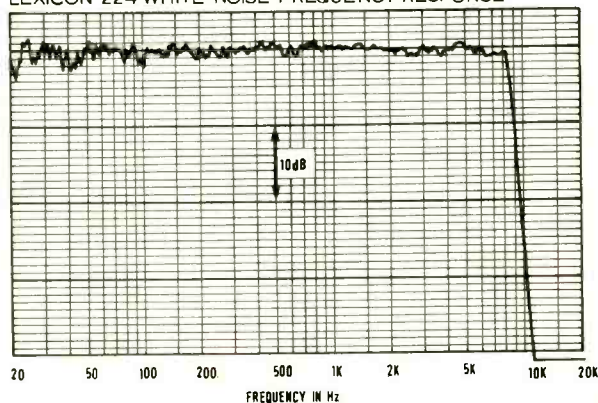
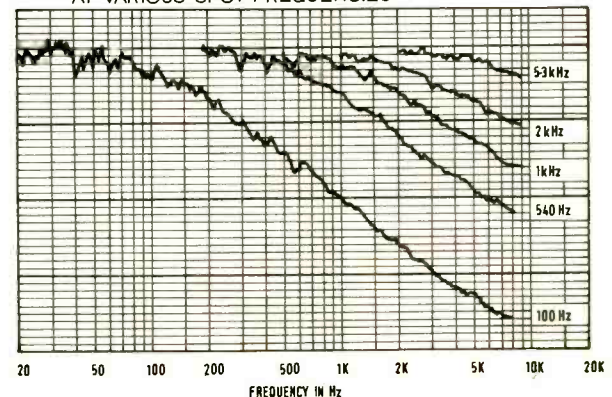


FIG.2 LEXICON 224 TREBLE DECAY
AT VARIOUS SPOT FREQUENCIES



SYNCON

Logic and Music in Harmony

It is a fact that many medium priced consoles use ungraded VCAs and ICs resulting in signal degradation and unpredictable performance. Syncon uses top quality discrete circuitry on interchangeable cards which allow not only instant replacement but future upgrading.

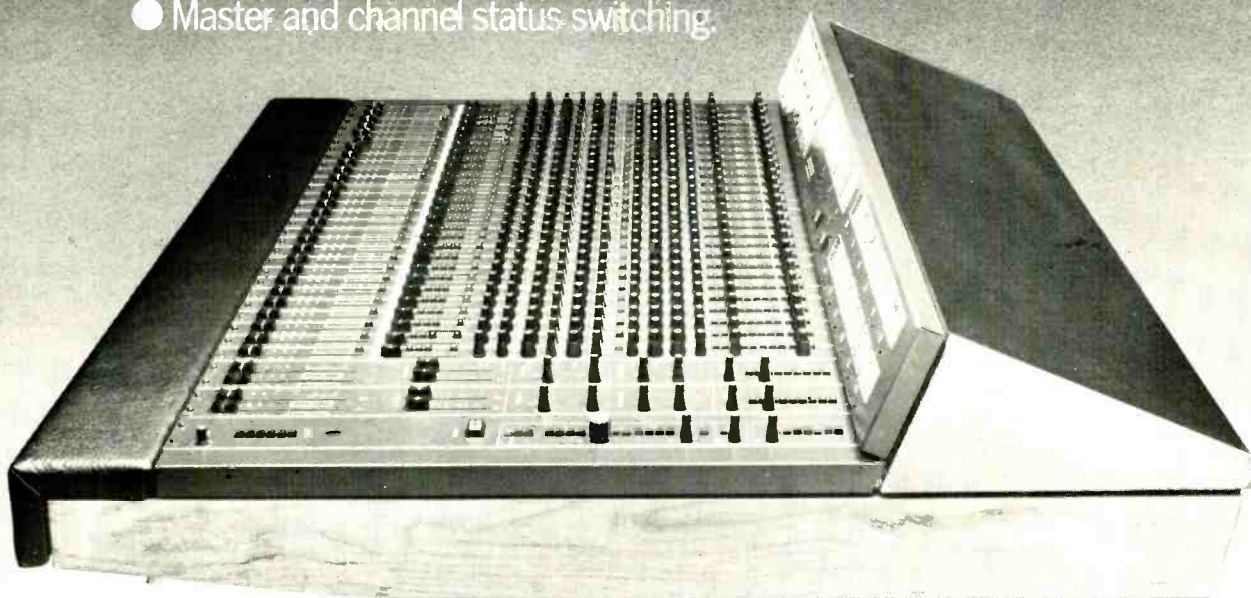
Sophisticated PCB design has virtually eliminated hardwiring making Syncon not

only cost effective but incredibly reliable and serviceable, an important factor for studios without resident 'boffins'.

Add to this a superb status, routing and grouping system enabling 28 tracks or effects to be mixed through 14 stereo subgroups and you have a very logical alternative to the headaches of cut price automation.

SYNCON FEATURES

- 28 Input output capacity.
- 24 Track monitor.
- Quad mixing.
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- 6 Auxiliaries.
- 2 Stereo and quad echo.
- Master and channel status switching.
- 26dB Output.
- Parametric eq.
- 3 Module inserts.
- Producer's desk and patchbay.
- Price range \$20,000-\$30,000.



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filter in the side of the chassis. Components on the boards are properly identified for servicing and the seven board functions are logical; there being an audio input board with anti-aliasing filters, an audio output board with filters, the arithmetic unit, floating point control, timing and control, data memory and finally the microprocessor board. There is also space for an option board which is separate from the optional RS232 interface.

The control unit is a neat desk top device fitted with rubber feet and connects to the main electronics by a ribbon cable. All push-buttons have an integral LED indicator with six slide potentiometers controlling various parameters. At the top of the panel is a 5-step LED programme level display, together with a 3-digit decimal display and adjacent LED indicators giving the nature of the display in seconds, ms, Hz or kHz.

Below this display eight pushbuttons select the type of reverberation program, stored in read-only memories, which may be readily interchanged as new programs become available. The six slide controls and six pushbuttons beneath them select the characteristics of each reverberation program.

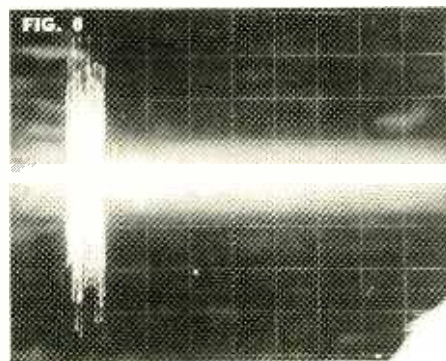
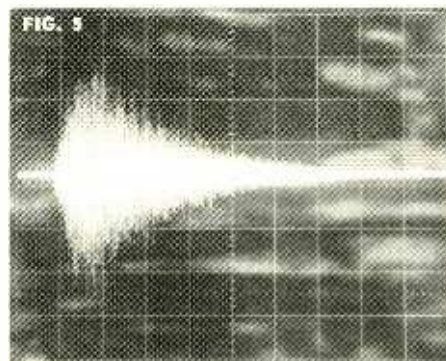
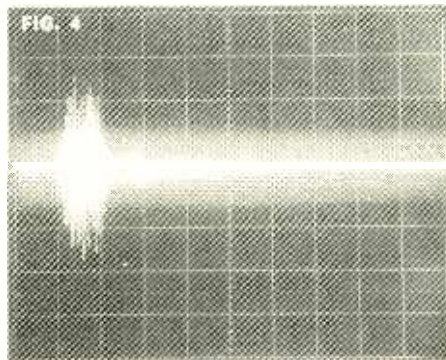
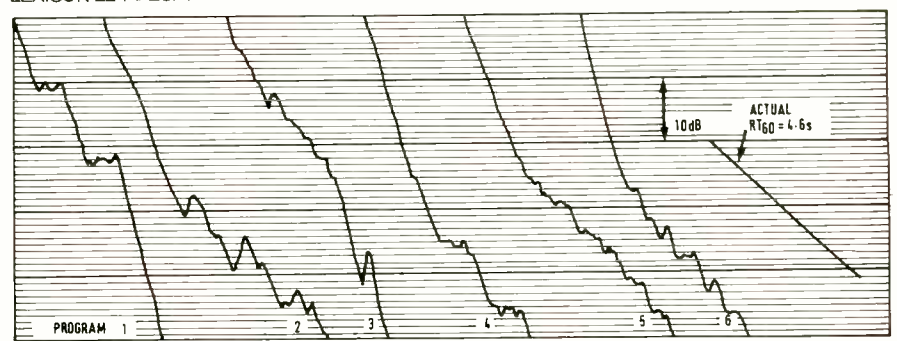
Two of the slide controls select the bass and mid frequency reverberation time from 0.6s up to 70s, the selected time is displayed at the top of the unit when the pushbutton below the appropriate slide control is depressed. When none of these buttons are pressed the display shows the average reverberation time. The next slide control sets the crossover frequency between the bass and mid frequency reverberation sections over the range 100Hz to 10.9kHz, the frequency is displayed with the appropriate pushbutton depressed. The 'treble decay' slide control follows, which adjusts the frequency where the reverberation falls off in the range 100Hz to 10.9kHz, again with the ability to display the set frequency.

And on from this, the 'depth' control, which varies the apparent distance of the sound source in the concert hall reverberation programs. As this parameter has no dimensions the display just uses the numbers zero to seven as a convenient way of recording the control setting. Finally the pre-delay may be increased over that preset in the selected program. The range of this slide control is from zero up to 250ms in mono programs, or 125ms in stereo programs, in 1ms increments; the set pre-delay is displayed when the pushbutton under the slide control is depressed.

These are the basic operating controls for this extremely complex and versatile reverberation system but there are more valuable features to come as it's possible to store four complete sets of control settings by means of a further row of seven pushbuttons, with an eighth pushbutton providing an automatic diagnostic routine which will enable an operator to identify a faulty board.

Four buttons, which are the control settings' stores, are identified register A, B, C and D. In normal use the 'immed' button is depressed and the unit takes its instructions from the panel controls. However, pressing the 'set' button followed by one of the register buttons stores all control settings in the selected register. Thus the four registers may be filled with four different sets of control settings. To recall the contents of a register just press the

FIG. 3 LEXICON 224 DECAY CURVE FOR THE SIX PROGRAMS AT 4.6s REVERBERATION TIME



'call' button followed by the desired register button and the unit takes its instructions from the contents of the register and ignores the control settings completely. Once the 'set' button has been pressed it is only necessary to press the register buttons to recall the contents

of each register, thus enabling a quick comparison of four different sets of control settings or the current control settings. However this cannot be done 'live' as changing the reverberation program can cause clicks to the audio outputs.

A final feature of the control panel is an 'overflow' LED indicator located next to the stereo level indicators in the display. The overflow light tells the operator that the unit has too many bits whizzing round its microprocessor and in effect says 'help!'. This condition is not only related to the level of the audio input but also to its frequency spectrum and the overall control settings.

The reverberation programs

At the time of writing a number of reverberation programs are under development and information was only available on a few of the current variety. The original type V1.1 read-only memory provided four programs—small concert hall, plate, large concert hall and acoustic chamber with the displayed pre-delay being the incremental delay not including the in-built delay. The later V1.2 read-only memory contains the same programs but with the displayed pre-delay being the actual pre-delay with the potential of sweeping the pre-delay time with a resulting pitch shift. The next V1.3 read-only memory is identical to the V1.2 but only containing the small concert hall and the plate programs.

The review sample contained a more complex read-only memory with six available programs plus a feature for varying the tail of the reverberation decay. The following is a brief description of the available programs in the review unit:

PROGRAM 1. Small Concert Hall. Mono or stereo inputs with mono, stereo or four-channel outputs. A hall-like uneven 200ms initial sound with the decay having a moderate tail and moderate initial diffusion. Reverberation with little coloration.

PROGRAM 2. Vocal Plate. Mono or stereo only. An explosive initial sound. The decay starts within 50ms with the tail depending upon the reverberation time setting. Moderate to high initial diffusion with low to moderate coloration. Gives the sound of a plate with less initial diffusion.

PROGRAM 3. Large Concert Hall. Mono or stereo inputs with mono, stereo or four-channel outputs. A hall-like uneven 200ms

SAVE MONEY SAVE TIME

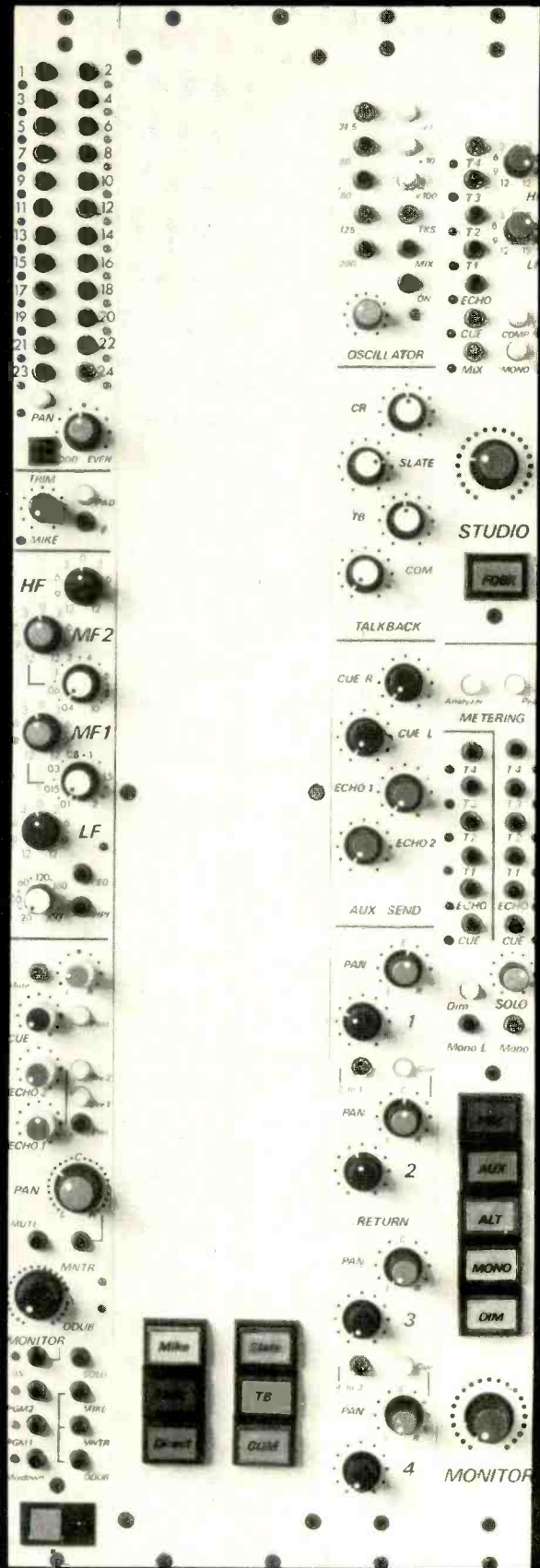
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- * Momentary short travel mute switches
- * All solo facilities including «Solo in place» either in monitor or in remix mode
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initial sound followed by a decay with a very long tail, low initial diffusion and very low coloration except at the very end of the tail. Not a good program for transients.

PROGRAM 4. Acoustic Chamber. Mono or stereo use only. Initial sound flat for 150ms followed by a decay with some tail, moderate initial diffusion with low to moderate coloration. Sounds like a chamber with less initial diffusion.

PROGRAM 5. Percussive Plate. An initial explosive sound with very high initial diffusion becoming rapidly very dense. Mono or stereo use only. A good program for transients.

PROGRAM 6. A new version of the Small Concert Hall.

The measurements

I found that the bass and mid frequency reverberation time controls had ranges from 0.6s to 70s in increments varying from 0.1s at low reverberation times up to 35s at maximum. Whilst the latter is a somewhat large increment in the normally used range of reverberation times, increments were adequately small.

Similarly the frequency range of the crossover between mid, bass and treble decay had varying increments over the full range from 100Hz up to 10.9kHz. But in this case the increments were satisfactorily small throughout the control's range. In the instances of the pre-reverberation delay the control has 1ms increments with the full range depending upon the reverberation program selected. In the case of programs 1, 3 and 6 the range was from 24ms to 152ms, 20ms to 127ms for program 2, 25ms to 255ms for program 4 and zero to 107ms for program 5. All the measured times were within 1ms of those indicated.

Frequency response of the reverberation unit with the treble control 'flat' is shown in fig 1 a spectrum analysis of white noise fed to the inputs; this shows that the frequency response is effectively flat up to 8kHz where a steep anti-aliasing filter comes into effect.

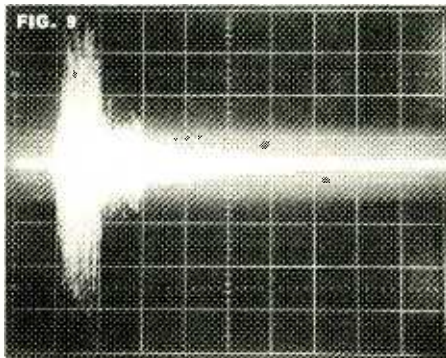
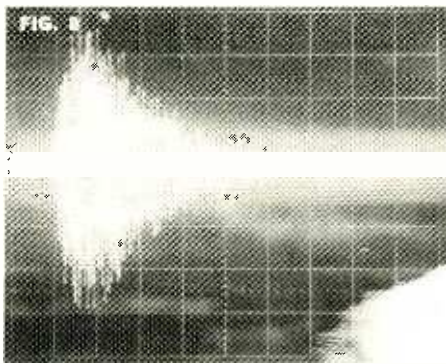
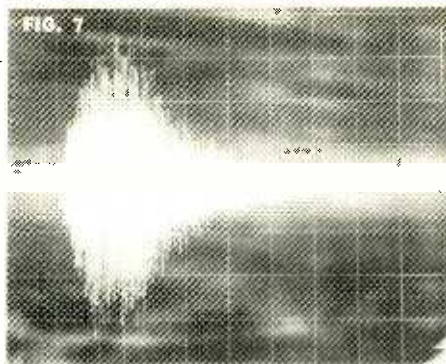
The remarkably wide range of the treble decay control fig 2 for the spot frequencies 100Hz, 540Hz, 1kHz, 2kHz and 5.3kHz shows that the control introduces a 6dB per octave attenuation about the set frequency.

The noise produced by the reverberation unit varied with control settings and with the chosen program and also varied with the presence of a signal. Table I relates noise to maximum signal output level and shows best and worst case conditions:

TABLE I

	Signal-to-noise ratio		
	No signal		With +5dBm
22Hz to 22kHz band limited rms	Best	Worst	1kHz Worst
A-weighted rms	89dB	80dB	79dB
CCIR-weighted rms	88dB	81dB	79dB
CCIR-weighted quasi-peak	83dB	76dB	72dB
	80dB	72dB	68dB

Bearing in mind that reverberation is normally returned at low level through an echo return, the above signal-to-noise capabilities are more than adequate. I noted, however, that at times the reverberation unit got into a cycle where there was discrete tone in the noise, and in spite of its very low level, this



might in unusual circumstances be significant.

Measurement of distortion in a reverberation system is always a difficult operation, but measurements of total harmonic distortion plus noise showed that this was typically less than 0.03% below 1kHz rising to a typical value of 0.05% at 8kHz—a very good performance.

I didn't feel the reverberation characteristics appropriate for undertaking a lengthy and complicated series of measurements and these would probably have little practical meaning to readers. More important are the subjective

effects and I can fairly say that this must be the most versatile reverberation unit ever manufactured. The six programs subjectively are completely different and fit the manufacturer's descriptions giving a very wide range of effects—and the versatility of the six slide controls providing unusual effects.

A simple plot of the wide band reverberation time in fig 3 demonstrates a substantial difference in the decay patterns. However from these plots it appears that the reverberation times measured conventionally are somewhat less than the reverberation time read from the unit's display.

Figs 4 to 8 inclusive show the varying dispersion characteristics of the six different reverberation programs with the reverberation time set to 2s, a crossover frequency of 1.5kHz and a treble decay of 1.5kHz. These oscillograms obtained by exciting the reverberation unit with an 80ms burst of white noise, show that all programs have substantial differences in build up and decay.

As with all digital devices it's vital that the system not be overloaded, as this results in violent distortion. Therefore it's important that the signal level metering should be fast and easily read. In this case, the response time of the LED level indicators was adequately fast at about 40µs but I felt that the display should be held longer for better readability. The zero on the display was just short of clipping with the -6, -12, -18 and -24dB indications within 1dB of the actual input level at all frequencies.

As supplied the zero dB indication corresponded to an input level of +14dBm but this range was adjustable from +6dBm to +22dBm with a satisfactorily high input impedance of 78kΩ at the floating and transformer coupled input. The common mode rejection was excellent at -90dB at 50Hz decreasing with frequency at about 6dB per octave.

The outputs had an impedance of 40Ω at 1kHz which is adequately low, the output voltage range at system clipping is adjustable from +6dBm to +20dBm by screwdriver-operated potentiometers on the front panel.

Summary

The Lexicon 224 is a remarkable device which is well engineered and should be easy to maintain. The reverberation characteristics offer an endless variety of reverberation effects which must make this the most versatile unit commercially available. **Hugh Ford**

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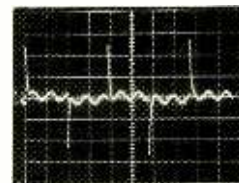
DYNAMIC INTERMODULATION DISTORTION

It is widely recognised that two pieces of equipment may have the same Total Harmonic and Static Intermodulation distortion performance yet sound quite different. Remaining distortion is attributed to transient distortion effects and these can be quantified with a combined square wave and sine wave test signal. The signal used consists of a 3.18kHz square wave through single pole -3dB at 100kHz plus 15kHz sine wave, 4:1 amplitude ratio. The signal after pre-emphasis is shown above. Distortion in the equipment under test will produce sum and difference products and the RMS sum of those below 15kHz quoted relative to the amplitude of the 15kHz sine wave is the Dynamic Intermodulation Distortion.

High (Line) output: Loaded with 10kΩ, 1kHz at -44dBV.7 (5mV) set for 0dBV.7 output.
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Reviewed in November issues of *Gramophone*, *Hi-Fi For Pleasure* and *Popular Hi-Fi*. Please ring or write for six page specification leaflet.

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reviews

dbx 165 comp/limiter



UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1.

THE dbx 165 compressor/limiter is single channel but may be linked to another 165 for stereo use; it also has the unusual facility of being able to separate the audio and the control inputs so the control can be derived for a second source of audio. The 165, designed for mounting into a 19in rack, is constructed of alloy front and back panel extrusions, to which the sides with rack-mounting ears are screwed. The thin alloy top and bottom covers slide into the front and rear extrusions.

A single large glass fibre pcb in the base supports almost all the electronic components, except for one of the front panel pots which is bolted to the front panel.

The pcb is far from densely populated, but no component identification is provided for servicing, and there are eight preset controls on the board. However, all integrated circuits are socketed for ease of servicing and access to all components is excellent. The standard of component insertion left something to be desired, though.

On the rear panel the signal inputs to the

compressor and its control, are linked on a barrier strip which also provides for the single-ended output with, it is believed, the option of a floating output; both inputs are electronically balanced. A Jones connector enables linking of two units for stereo use. Mains power is supplied by only a short lead—1.4m long—but there is a properly identified Imperial size fuse. The remaining rear panel feature is a screwdriver-operated potentiometer for calibrating the front panel meter. This meter, which is scaled linearly from -20dB to $+10\text{dB}$, may be switched to read either the input level, the output level or the gain change in use by means of three interlocking pushbutton switches. Adjacent is a system bypass switch and a system gain potentiometer roughly calibrated from -20dB to $+20\text{dB}$ which is the actual gain range available.

The power on/off switch is on the left of the front panel with an adjacent red LED power indicator. Following this a stereo coupler pushbutton with a yellow warning LED and the threshold level potentiometer with a range of -40dB to $+10\text{dB}$. Above this control green, yellow and red LED indicators show if the audio signal is below, at or above the threshold.

The compression ratio is set by a larger potentiometer knob with calibration points at 1:1, 1.5:1, 2:1, 3:1, 4:1, 6:1, 10:1, 20:1 and infinite compression.

Regarding compressor time constants, there

MANUFACTURER'S SPECIFICATION

Compression ratio: variable according to compression control setting, threshold setting and signal level. Compression control determines maximum compression ratio, continuously variable from 1:1 to infinity to one.

Threshold: variable from -40 to $+10\text{dBm}$ (7.8mV to 2.5V).

Attack: in manual mode the maximum attack rate is variable from 1 to 400dB/ms . In automatic mode the time for 63% reduction in dB signal level is 15ms for 10dB level change, 5ms for 20dB level change and 3ms for 30dB level change.

Release: in manual mode the maximum release rate is variable from 10 to 4000dB/s . In automatic mode 120dB/s . (Attack and release time constants measured in infinity compression region of 'over easy' curve.)

Output gain: variable from -20 to $+20\text{dB}$.

Metering: analogue meter range of -20 to $+10\text{dB}$. Switchable to read level at input, output or gain change. Meter zero adjust -10 to $+10\text{dBm}$.

Input impedance: signal input $22\text{k}\Omega$ balanced or $11\text{k}\Omega$ unbalanced. Detector input $620\text{k}\Omega$ unbalanced or $310\text{k}\Omega$ unbalanced.

Input level: $+24\text{dBm}$ maximum.

Equivalent input noise: less than -90dBm , 20Hz to 20kHz.

Output impedance: less than 47Ω (active low impedance output).

Output level: $+23\text{dBm}$ into 600Ω load.

Frequency response: $\pm 0, -1\text{dB}$, 20Hz to 20kHz.

Distortion: second harmonic 0.05%, third harmonic 0.2% (auto or manual with attack and release controls centred). Note: figures are typical at infinite compression, 1kHz, 0dBm input and output. Second harmonic is relatively unaffected by compression ratio, time constants and frequency while third harmonic decreases with slower time constants, higher frequencies and lower compression ratio.

Controls: compression, threshold, attack, release, output gain, power, stereo coupler, auto/manual, meter selector (input, output, gain change), system bypass, meter zero adjust.

Indicators: below/above LED's (green, yellow, red), automode LED, power LED, slave LED, signal level/gain change meter.

Connectors: input/output Cinch-Jones type barrier terminal. Stereo coupler 12-pin Jones connector.

Case: black painted steel sides, extruded aluminium front and rear panels, vinyl-clad steel top and bottom covers.

Dimensions (hwd): $3\frac{1}{2} \times 19 \times 10\frac{1}{2}\text{in}$ ($89 \times 483 \times 257\text{mm}$).

Weight: 8lb (3.6kg).

Power line requirements: 117V ac $\pm 10\%$ 60Hz. 240V 50Hz version available.

Power consumption: 25W.

Price: £280.

Manufacturer: dbx Incorporated, 71 Chapel Street, Newton, Mass 02195, USA.

FIG. 1
dbx 165 OVERALL FREQUENCY RESPONSE

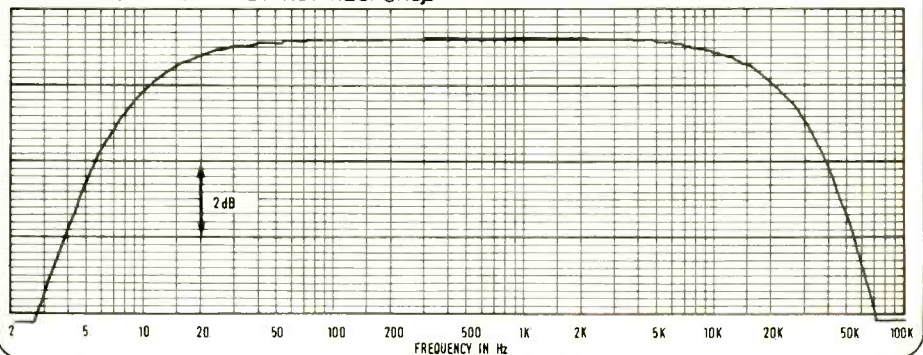
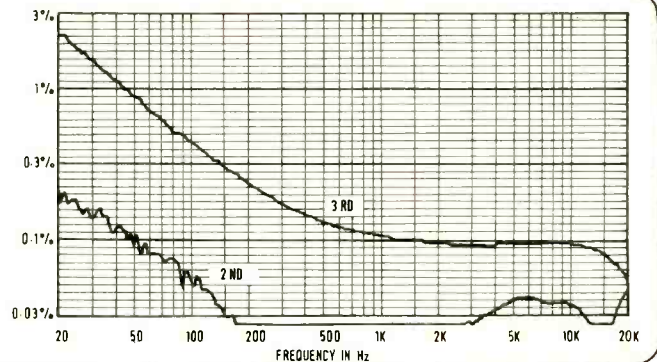


FIG. 2
dbx 165 HARMONIC DISTORTION, 10dB COMPRESSION, AUTO MODE



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are two modes of operation set by a push-button switch with a yellow warning LED. In the automatic mode the compression time constants are such that the attack time varies with the amount of level change with a fast release time, while in the manual mode two potentiometers control the attack and release time constants with an attack time range, from nominally 1dB/ms to 400dB/ms and release times from 10dB/s to 4000dB/s.

All these controls are clearly identified in silver on a black front panel but the cursor lines on the knobs aren't at all easy to see; however, the control layout is uncluttered and easy to operate.

Frequency response and noise

The overall frequency response was the same at all input levels (fig 1). This shows that there is a slight high frequency roll-off, to the extent of 1.2dB at 20kHz above which the response falls fairly rapidly.

The metering's performance was satisfactory with the -1dB points occurring at 32Hz and 63kHz with the low end falling to -2dB at 22Hz.

The effective noise referred to the input, varied considerably with the output gain setting as shown in Table 1.

TABLE 1

Measurement method	Noise referred to the input		
	-20dB gain	unity gain	+20dB gain
Band limited 22Hz to 22kHz rms	-59.5dBm	-89dBm	-96dBm
A-weighted rms	-82dBm	-96dBm	-103dBm
CCIR-weighted rms ref 1kHz	-73.5dBm	-87dBm	-94dBm
CCIR-weighted quasi peak ref 1kHz	-69.5dBm	-83dBm	-90dBm

Referring to Table 1 the maximum input level capability of +25dBm gives a more than adequate dynamic range, but, clearly it is advisable to provide a large input signal if the unit is to be run at less than unity gain.

Distortion

Testing the review sample showed that the distortion varied widely between the manual and automatic modes irrespective of the attack and release time settings. Furthermore it appeared that the range of the attack and release time controls was incorrect. As a result, a second review sample was called for and very promptly supplied by Scenic Sounds Equipment.

This second sample gave a substantially better performance and I concluded that the alignment of the first sample was incorrect. Fig 2 shows the second and third harmonic distortion in the automatic mode with +10dBm input, 10dB compression and infinite compression ratio settings, while fig 3 shows the distortion under similar conditions in the manual mode. In this instance the attack rate was set to 40dB/ms and the release rate set to 400dB/s. These figures show a fairly large increase in third harmonic distortion but in the manual mode the difference depends as

106 ►



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expected on the settings of the attack and release rates.

Measurement of total harmonic distortion under the conditions used for the manufacturer's specification—0dBm input at 1kHz at infinite compression ratio—gave 0.1% in the automatic mode and 0.15% in the manual mode; these satisfactory figures are within specification.

Twin-tone intermodulation distortion was substantially constant with frequency at 1% in the automatic mode. In the manual mode this varied widely with release rate settings and could be anywhere between 0.1% and 6%, using a 1kHz and 1.07kHz pair of tones.

The compression characteristics

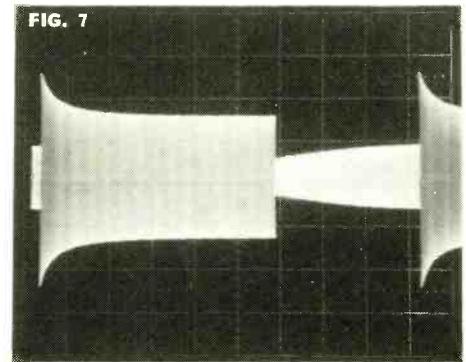
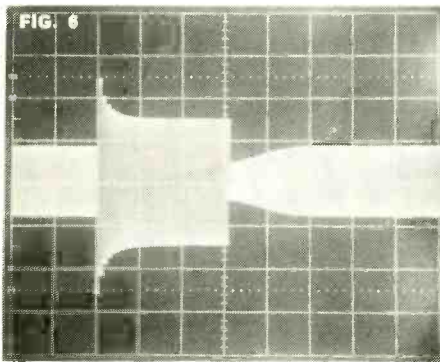
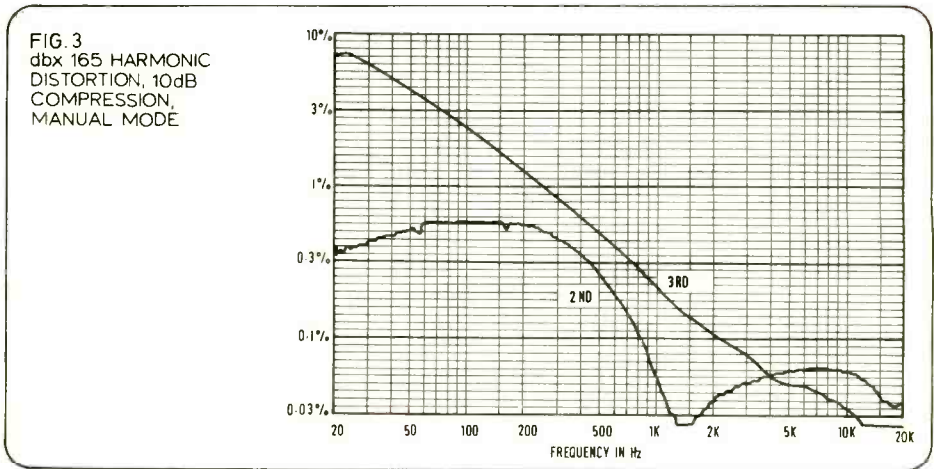
With a threshold setting of -10dB, fig 4 shows the effect of varying the compression ratio from 1:1 to infinity to one and demonstrates the gradual entry into the desired compression ratio without any defined 'knee'—what dbx describe as their 'over easy' curve. Similarly fig 5 shows the effect of varying the threshold between +10dB, -10dB and -30dB with the compression ratio set to 2:1 again showing the gradual entry into the desired compression ratio.

The application of tone bursts driving the unit into 10dB of compression, on top of a constant tone input, is shown in fig 6, for the fastest attack and release times in the manual mode, and in fig 7 for the automatic mode. In both cases the unit is not a hard limiter as is desired for some applications (for avoiding over modulation of radio transmitters) but a soft limiter.

Using similar tone bursts, the effect of the release rate control changed the recovery time from between 2ms and 700ms, and the attack rate control changes the reaction time from between 600µs and 12ms; all of which appears to correspond reasonably to the suggested performance in the case of the second review sample.

Input and output

Zero dB indication on the meter corresponded



to +4dBm in the standard settings which could be adjusted by the rear panel control; this is a true rms meter with a risetime of 80ms and a falltime of 250ms, thus giving a useful indication of programme level.

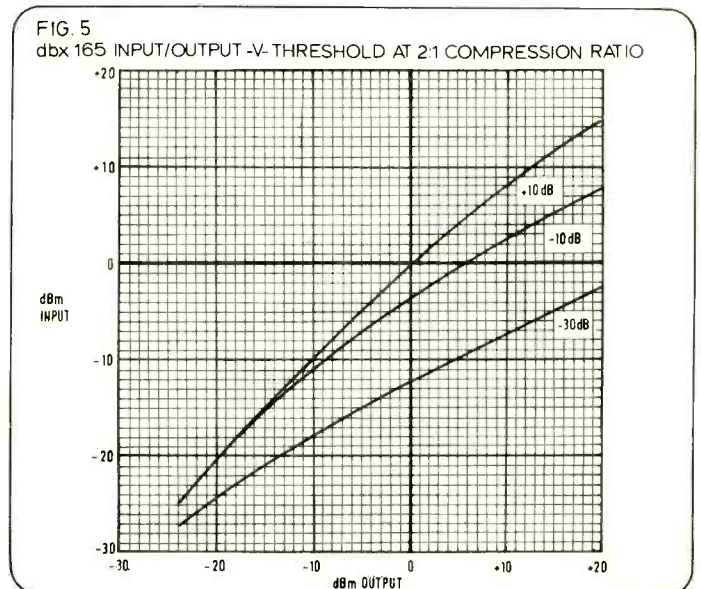
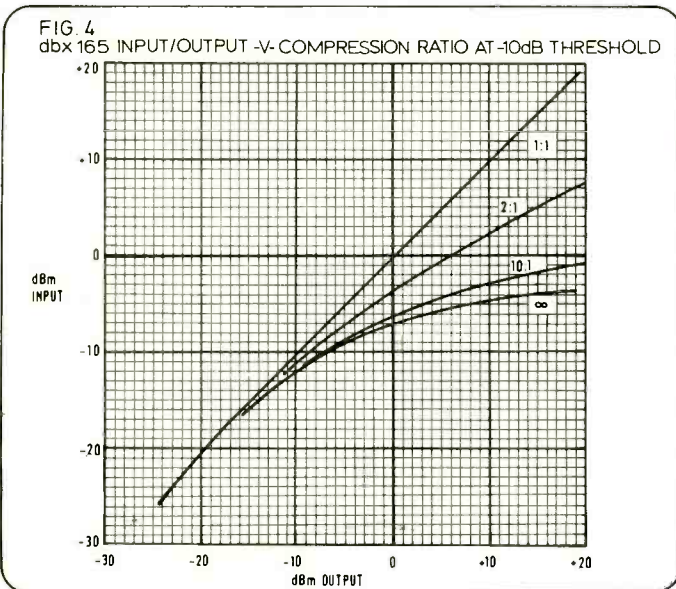
Summary

The second sample of the dbx 165 compressor/limiter gave a very good performance in the automatic mode with great flexibility in the manual mode. In the automatic mode there

was no sign of clicks or other nasty effects present in some units with any degree of compression. Although the first sample was defective in the manual mode, the second sample passed with flying colours and was a versatile and pleasant compressor.

The layout and range of the controls was excellent making the unit simple to use and the overall standard of construction was to a satisfactory standard, though not outstanding.

Hugh Ford



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Reviews



dbx 163 comp/limiter

MANUFACTURER'S SPECIFICATION

Compression ratio: automatically varies from 1:1 below threshold to infinity to one above threshold in accordance with 'over easy' transfer curve.

Threshold: -36dBm to +4dBm.

Input impedance: 25k Ω unbalanced.

Input level: +17dBm nominal maximum. +24dBm clipping point.

Equivalent input noise: -78dBm, 20Hz to 20kHz.

Output: +18dBm into 2k Ω . 47 Ω source resistance.

Frequency response: +0, -1dB 30Hz to 20kHz, 5k Ω load. +0, -3dB 30Hz to 20kHz, 2k Ω load.

Distortion: second harmonic 0.1% at 1kHz. Third harmonic 0.2% at 1kHz, 0.5% at 100Hz. (Measured at infinite compression in -10dBm nominal setting.)

Attack time: 5ms for 20dB level change.

Release rate: 120dB/s in infinite compression region.

Controls: 'compression' on front panel. 'Nominal operating level' on rear panel.

Connectors: phono jacks.

Display: 12 LED 'gain change' display from -2 to -30dB.

Case: standard—solid walnut sides, extruded panels, vinyl-clad steel. Optional—rack mounted pair of units, 1 $\frac{1}{2}$ in panel height.

Dimensions (whd): 9 x 1 $\frac{1}{8}$ x 6 $\frac{7}{8}$ in.

Weight: standard single unit 2.5lb (1.1kg). Optional rack pair 5.2lb (2.4kg).

Power line requirements: 117V ac \pm 10%. 50/60Hz (240V version available).

Power consumption: 6W.

Price: £100 per channel.

Manufacturer: dbx Incorporated, 71 Chapel Street, Newton, Mass 02195, USA.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1.

THE dbx 163 compressor/limiter is a very simple device with a single operational control and a 12-segment LED display on the front panel. The unit is mono only as it cannot be coupled for stereo use.

The single control affects the threshold of compression onset, with a range from -36dBm to +4dBm, and simultaneously alters the overall system gain to partially compensate for the different subjective effects of compression. The 12 LED's indicate the instantaneous degree of gain change in 2dB steps, from 2dB to 12dB and then in 3dB steps from 15dB to 30dB.

The input and output phono sockets are at the rear, the nominal output level is set by a 3-position slide switch, which provides levels of +4dBm and -10dBm in addition to a variable level, which may be set nominally from -20dBm to +10dBm by a screwdriver-operated potentiometer—this is accessed through a hole in the rear panel.

Mains power is supplied by a 2-core lead about 6ft long and it is surprising that no mains fuse or other protection is fitted. All external features are clearly identified as are all components within the unit. The overall construction is based on extruded front and rear panels which are secured with wooden ends, the top and bottom covers slide into

slots in the extrusions which creates a solid unit onto which the single printed circuit board is screwed.

Good quality components are cleanly arranged on the pcb which includes a socket for the LED indicators. Also on the pcb are six preset controls which aren't sealed and I couldn't find any instructions for their alignment.

As can be appreciated from the single knob operation, the compression characteristics and the time constants are fixed, the compression characteristic being a gentle entrance into infinite compression with the attack time varying according to the degree of compression (or level change) and, it is believed, a fixed release time.

Frequency response and noise

The overall frequency response into a 2k Ω load in fig 1 shows a total excursion of 1dB from 40Hz to 20kHz, the lower end depending upon the loading. This characteristic was independent of level within the operating capability and the high frequency roll-off is considered satisfactory.

As a result of the front panel compression threshold control, also affecting overall gain, the system noise depended upon the threshold setting as well as the output level setting. At the +4dBm output setting the overall gain was 6dB at minimum compression setting increasing to 43dB at maximum compression setting with the output noise varying as Table I.

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FIG. 1
dbx 163 FREQUENCY RESPONSE AT 0dBm, NO COMPRESSION

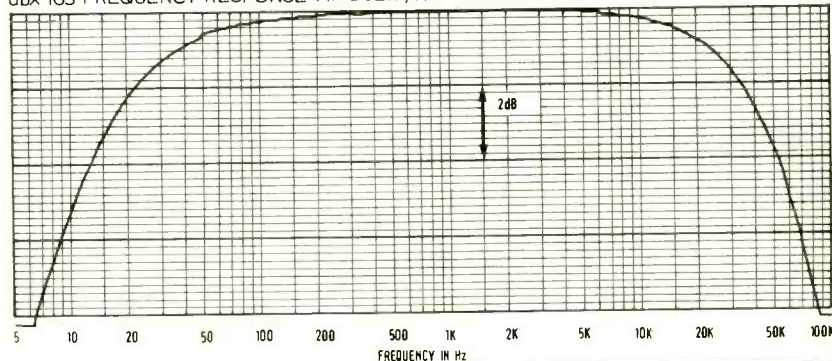


FIG. 2
dbx 163 HARMONIC DISTORTION, NO COMPRESSION

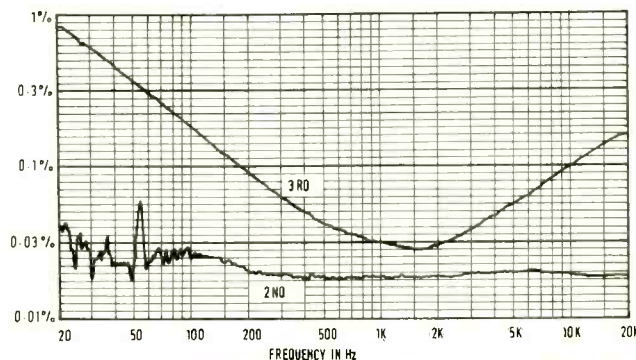
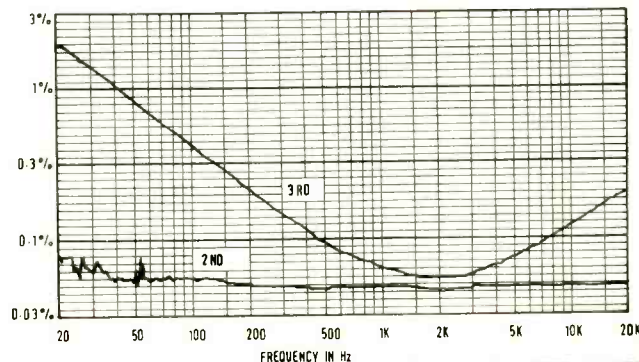
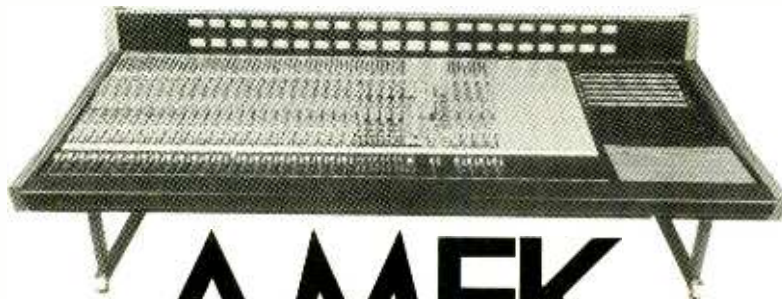


FIG. 3
dbx 163 HARMONIC DISTORTION, 10dB COMPRESSION



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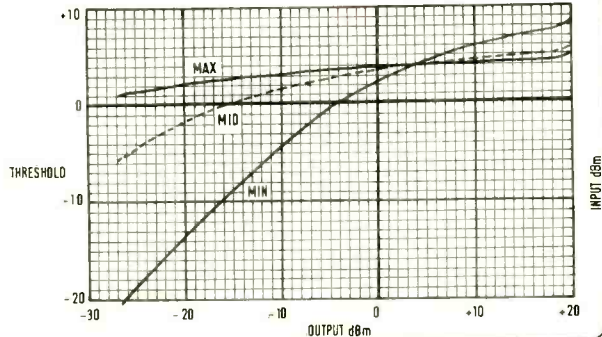
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FIG. 4
dbx 163 COMPRESSION
CHARACTERISTICS



At maximum compression, mains hum became significant with the 150Hz third harmonic at -62dBm, 100Hz at -69dBm and 50Hz at -66dBm. Whilst the noise performance is good at minimum compression setting, I felt that in some applications it could be troublesome if the maximum compression setting were used.

TABLE I	Minimum Compression	Maximum Compression
22Hz to 22kHz band limited rms	-89dBm	-58.5dBm
A-weighted rms	-94dBm	-63dBm
CCIR-weighted rms ref 1kHz	-85.5dBm	-55dBm
CCIR-weighted quasi peak ref 1kHz	-81dBm	-50.5dBm

Distortion

The second and third harmonic distortion was measured, without any compression and with 10dB compression, both at 0dBm output to produce figs 2 and 3. These show that the second harmonic is low at all frequencies but the third harmonic rises substantially at low frequencies, particularly with the 10dB compression in action.

In any compressor/limiter, distortion is a function of attack and release times. Taking into account the semi fixed parameters of this unit, the distortion is not unreasonable for many applications where low frequencies below say 50Hz are unlikely to be present to a significant extent.

The compression characteristic

The static compression characteristics for minimum, maximum and mid point setting of the threshold control is shown in fig 4 which is a plot of the input level versus the output level.

From this figure, at all settings the onset of infinite compression ratio is gradual and follows the manufacturers 'over easy' curve.

The application of 10dB bursts in level above a constant level of input produced an output as shown in the oscillogram fig 5 which confirms the manufacturer's specified attack time of 15ms for a 10dB level change and also shows a recovery time in order of 120dB/s. These results were independent of frequency and at no time did the compressor produce clicks of other similar defects.

Input and output

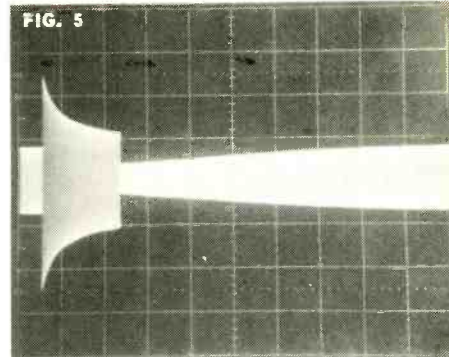
The maximum input level that could be handled was more than adequate at +22dBm into the unbalanced input which had an impedance of

24kΩ in parallel with 770pF. While the resistive component of the input impedance is satisfactory I felt that the shunt capacitance is high for semi-professional and domestic applications.

The single-ended output had a drive capability of +21.5dBm into 600Ω from a low source impedance in the order of 6Ω at mid frequencies, rising to about 300Ω at 50Hz, due to the series output capacitor.

At infinite compression the output level was +6dBm for the +4dB output setting, -8dBm for the -10dB setting and variable between +22dBm and -18dBm in the variable setting.

The gain change indication shown by the front panel LED indicators was very rapid in action, such that it gave a useful indication of the instantaneous state of the compressor/limiter. The accuracy of the indication was



within 1dB at low degrees of gain change with the accuracy never being worse than 1.5dB—quite adequate for the intended usage.

In practical use the single control gave useful effects, but naturally the amount of control over the compressed sound was limited. However this is clearly a cheap and useful compressor/limiter for mono use or for use on single instruments.

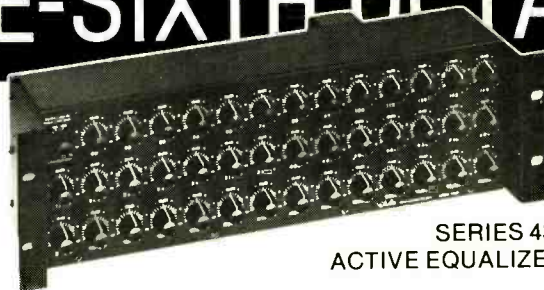
Summary

The dbx 163 compressor limiter is a useful and practical addition for the small studio where a smooth sounding compressor is required at a budget price.

As it's mono only, the applications are limited but it is well made and will be compatible with virtually all semi-professional equipment.

Hugh Ford

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- As the volume of rooms increase to Auditorium or Gymnasium sizes, the acoustic

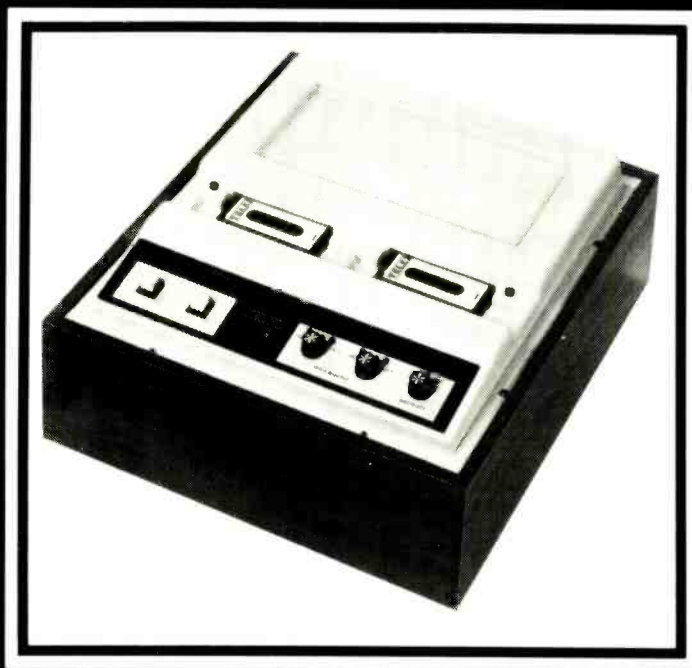
- problems tend to rise in frequency. Models 4310 and 4311 offer 29, 1/6 Octave Bands from 180 Hz through 4.5 kHz plus 12, 1/3 Octave bands from 31.5 Hz through 160 Hz and 5000 Hz through 10 kHz.
- We have a 1/6 Octave equalizer OPTIMIZED FOR SPEECH. The Model 4240 concentrates DOUBLE RESOLUTION in the SPEECH INTELLIGIBILITY band with broader bandwidth filters to trim either side.
- Quick and efficient installation of these new equalizers is made possible by the MODEL 200 SIGNAL ANALYZER which features inexpensive, field plug-in, INTERCHANGABLE FILTER SETS.
- Call or write us for all the details.

ONE SIXTH OCTAVE REALTIME ANALYZERS AVAILABLE

White instruments, incorporated
P O Box 698 AUSTIN TEXAS 78767
PHONE AREA 512/892-0752

Distribution in U.K. & Western Europe
SCENIC SOUNDS EQUIPMENT
97-99 Dean St., London W1 Tel: 734-2812

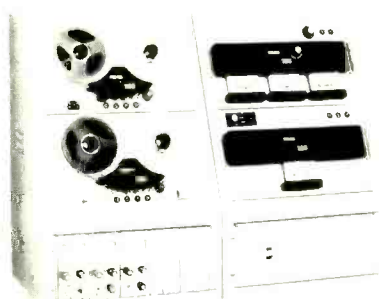
A high speed stereo cassette copier for £995



The TELEX cassette copier IV duplicates a stereo cassette at 12 times normal speed, accurately and reliably. With simple 2 button control, individual track selection, a bias switch for ferric or chrome tapes, and a frequency response of 40 to 10KHz, the copier IV is exceptional value.

(Specifications: 20 ips operation, 40-10,000Hz frequency response, 45dB crosstalk rejection at 1KHz, 45dB S/N ratio, automatic rewind and automatic erase, cassette fault sensing.)

TELEX 300 SERIES
DUPLICATOR.



from £2,191.00 plus V.A.T.



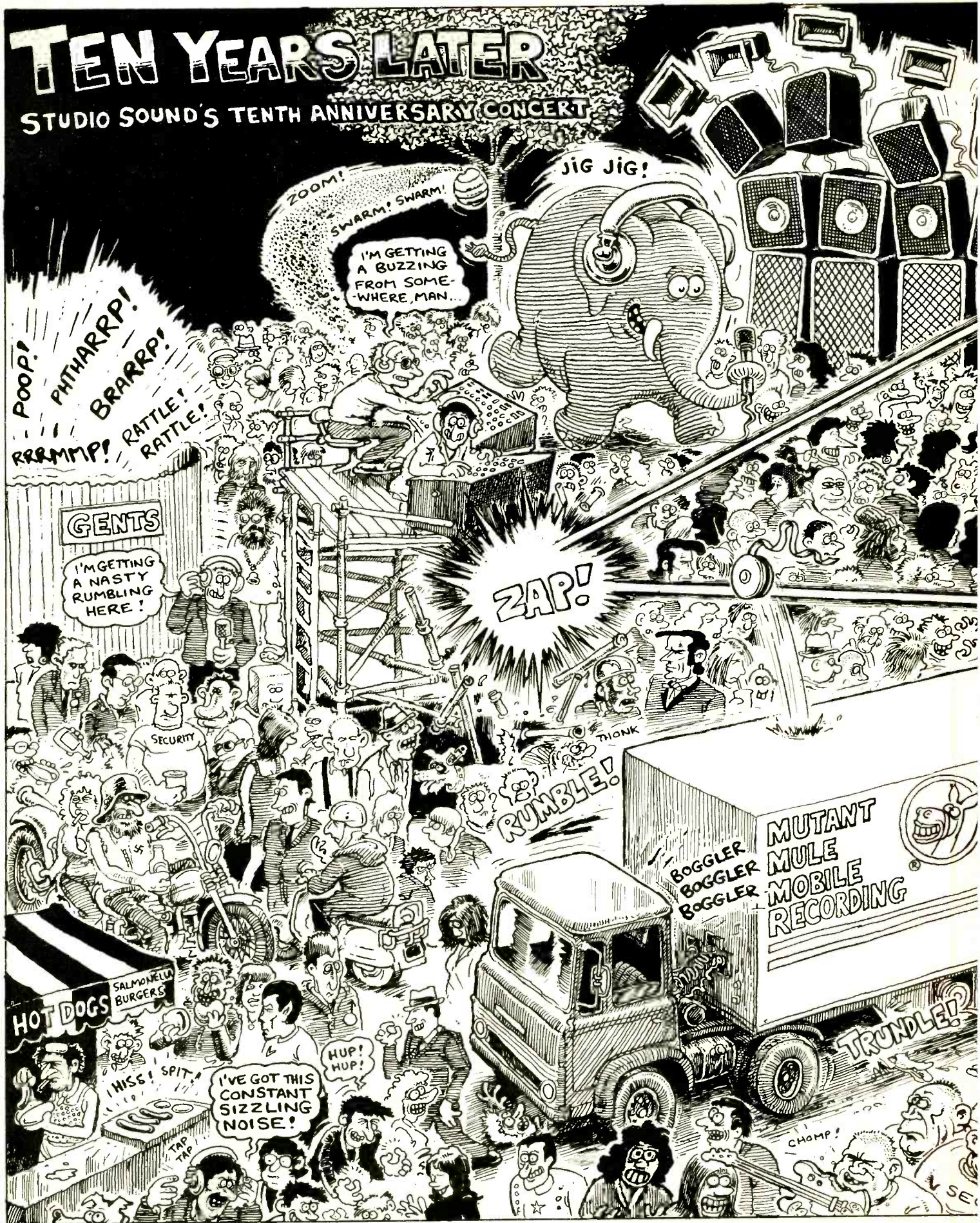
TELEX MC CART MACHINE.
from £619.00 plus V.A.T.

TELEX manufacture a range of cassette copiers, tape duplicators, NAB broadcast cart machines, industrial tape transports & communications headsets. For full product information contact ►

► Avcom Systems Limited,
P.O. Box 755,
London, W12 7HS
Tel: 01-749 2201
Telex: 986691 AVC.

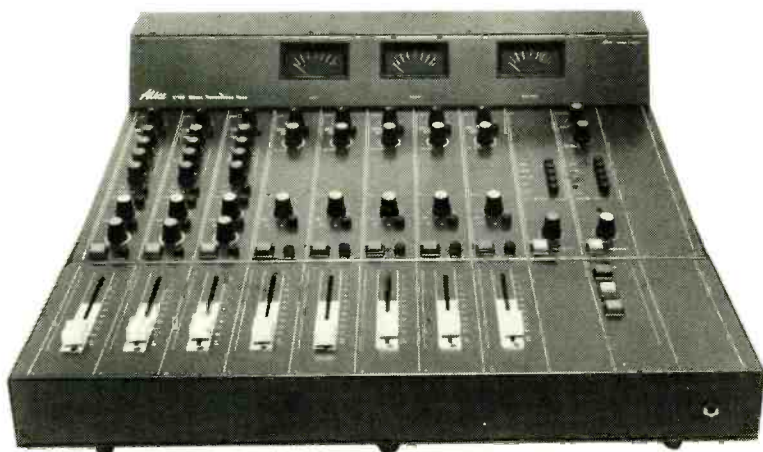
TEN YEARS LATER

STUDIO SOUND'S TENTH ANNIVERSARY CONCERT



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STM 8 STEREO TRANSMISSION MIXER



3 mic inputs with limiter, EQ, digital on/off.
 5 stereo line inputs with optional RIAA phono inputs.
 Stereo and mono programme, mono aux. & clean-feed, stereo P.A./Monitor outputs.
 Optional voice-over facility.
 Comprehensive monitoring on PPMs and headphones.
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Full Servo Loop Speed Control

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 SURREY, ENGLAND KT12 1AP

TEL: WALTON-ON-THAMES 43124/5/6 TELEX: 928475

plan AUDIO

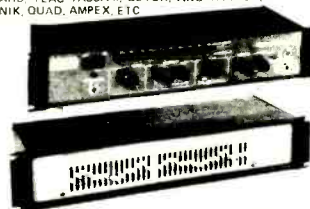
9 South Street, Epsom, Surrey
 Telephone Epsom 41822

**CAN FIT THE PIECES!
 TOGETHER FOR YOU!**

BUILDING ALTERATIONS, EXTENSIONS, ACOUSTIC TREATMENT, ALL DESIGNED AND CONSTRUCTED UNDER FULL SUPERVISION. WE SPECIALISE IN HOUSE BASEMENT/ROOM CONVERSIONS AND EXTENSIONS FOR MUSICIANS AND SMALL INDEPENDENT STUDIOS WHO REQUIRE A HIGH STANDARD OF USABILITY AND FINISH.

- WE ARE PROFESSIONAL DEALERS AND STOCKISTS FOR MANY MANUFACTURERS, INCLUDING: AHB, TEAC, TASCAM, BEYER, AKG, TANNY, REVOX, STATIK, KLARK, TECNIK, QUAD, AMPEX, ETC.

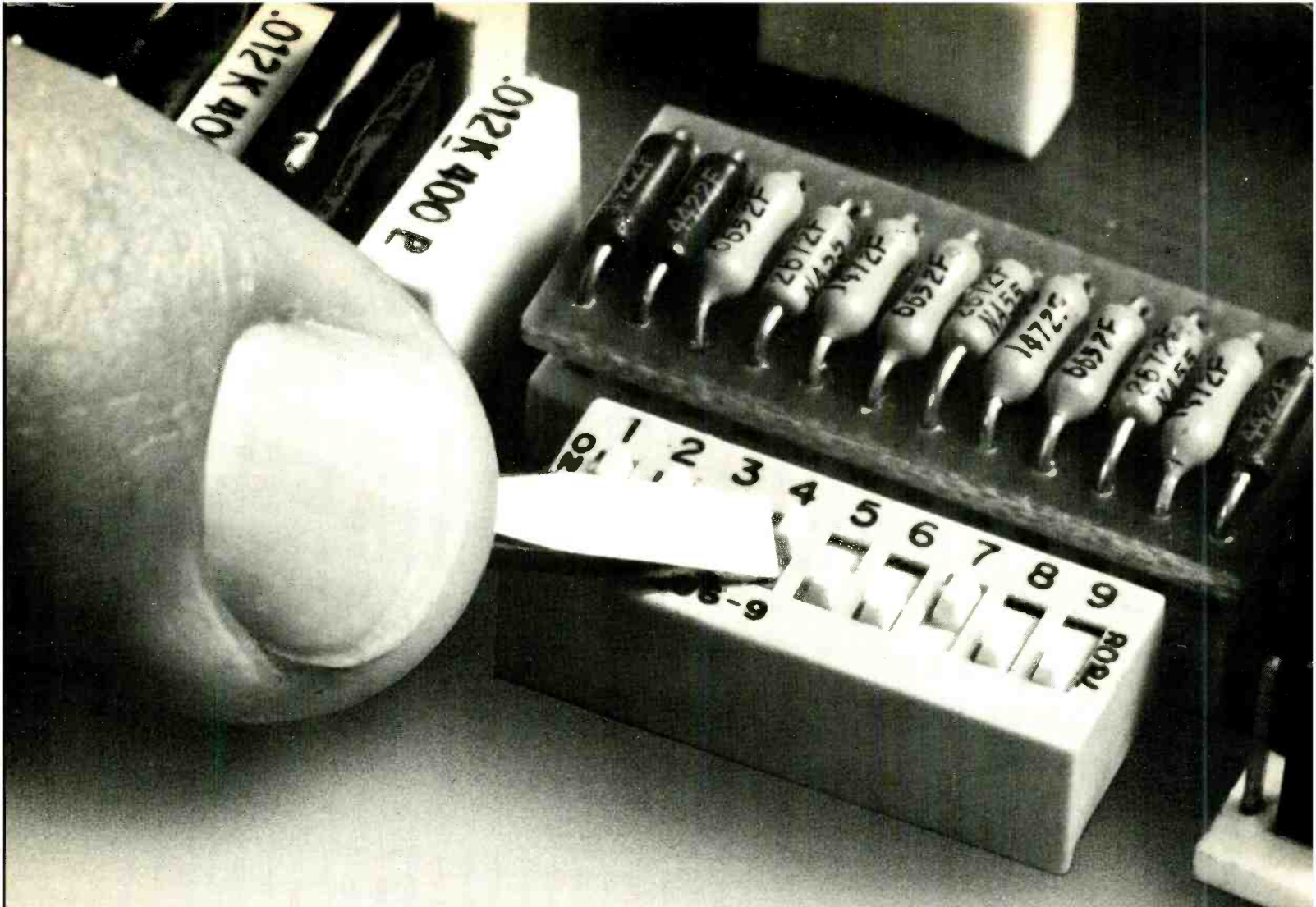
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- WE CARRY A LARGE STOCK OF TOOLS, CABLE, CONNECTORS AND ACCESSORIES, INCLUDING PRODUCTS BY: BOWTHORPE, HELLERMANN, BELDEN, RENDAR, NEUTRIK, CLIFF, ETC.

OUR SERVICES INCLUDE

- INSTALLATION, MODIFICATION AND SERVICING OF EQUIPMENT SUPPLIED.
- COMPLETE PACKAGE SYSTEMS COMBINING ALL OR ANY OF THE FOLLOWING: BUILDING DESIGN/CONSTRUCTION, ACOUSTIC DESIGN/CONSTRUCTION, WIRING DESIGN/INSTALLATION, DECORATION DESIGN/CONSTRUCTION, EQUIPMENT SELECTION/INSTALLATION.



Pots are the Pits

The Model 10 and the Model 20, the potless professional crossovers from BGW. They're the first crossovers to feature Switchset™. With Switchset™ you can now select eight different 18 dB/octave crossover points... plus eight sub-sonic filter frequencies! Switchset™ provides repeatable precision via internal DIP switches... repeatability you can't get with inferior potentiometers.

Both models feature: separate signal and chassis grounding; level controls on all outputs; professional XLR-type connectors; low impedance long-line capability; and rear panel provisions for balanced inputs and outputs through plug-in transformers on the

Introducing the BGW Crossovers with Exclusive Switchset™

Model 10. The Model 20 has electronically balanced differential inputs and bridged outputs as well as provisions for plug-in input transformers. Each crossover takes up only one rack-unit (1¾") of space in its steel, RFI immune case.



The Model 20 is a truly universal electronic crossover. By presetting the programming links it can be a stereo 2-way, stereo 2-way with mono subwoofer, mono 3-way, or mono 4-way crossover. Frequencies can overlap for special applications.

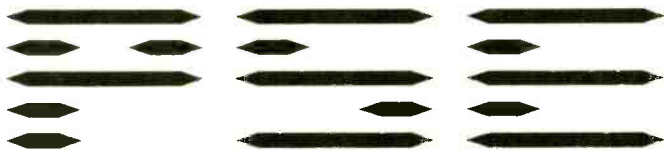
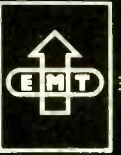
As a pro, you know that pots can be the pits. Check-out the superior design of the BGW crossovers. Write for full technical details or contact your local BGW pro dealer.

The new Model 10 and Model 20 crossovers with exclusive Switchset™ join the incomparable BGW amplifier line-up. We're The Power That Pros Depend On.



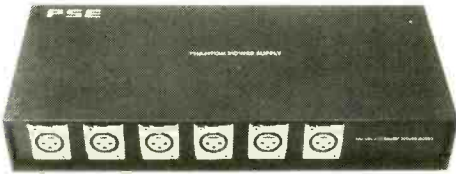
Depend On Us.

BGW Systems, Inc., 13130 S. Yukon Ave., Hawthorne, CA 90250 (213) 973-8090 In Canada: Omnimedia Corp., 9653 Cote de Liesse, Dorval, Quebec H9P 1A3

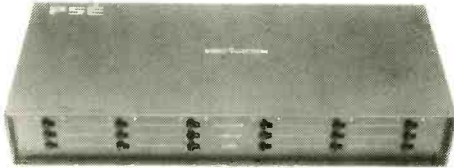


production studio equipment

PHANTOM POWER SUPPLY
10/48v Automatic Power Supply
6 or 2 way version.



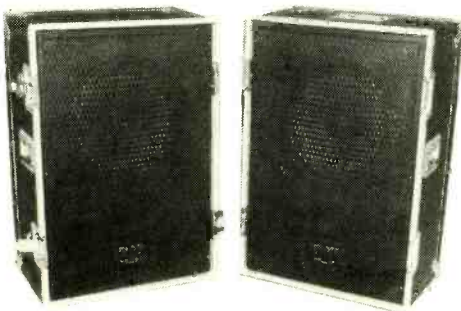
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1, 2 or 6 way version, passive. Featuring
ground lift, 30dB and noise filter



19" EQUIPMENT RACK
Ultra heavy duty



STUDIO MONITOR
Flight case construction. Choice of tannoy
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together for transport.



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Eindhoven
Tel: 080 520662

BELGIUM

A.S.C
Rue Barastraat 146
B1070 Brussels
Tel: 02520 0827

NORWAY

Pro. Technic
Lydersagengate 19
Oslo 3
Tel: 0246 0554

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STUDIO TECHNOLOGY of world wide fame



EMT 948 New Broadcast Turntable

Direct drive with fast start, stop and reverse
cue all remoteable. Motor-driven tone-arm
lift. In-built amplifiers with balanced studio
line outputs and output for cue monitor.
New effective shock absorbing system.
New pickup illumination. Dust cover stores
discs and sleeves.

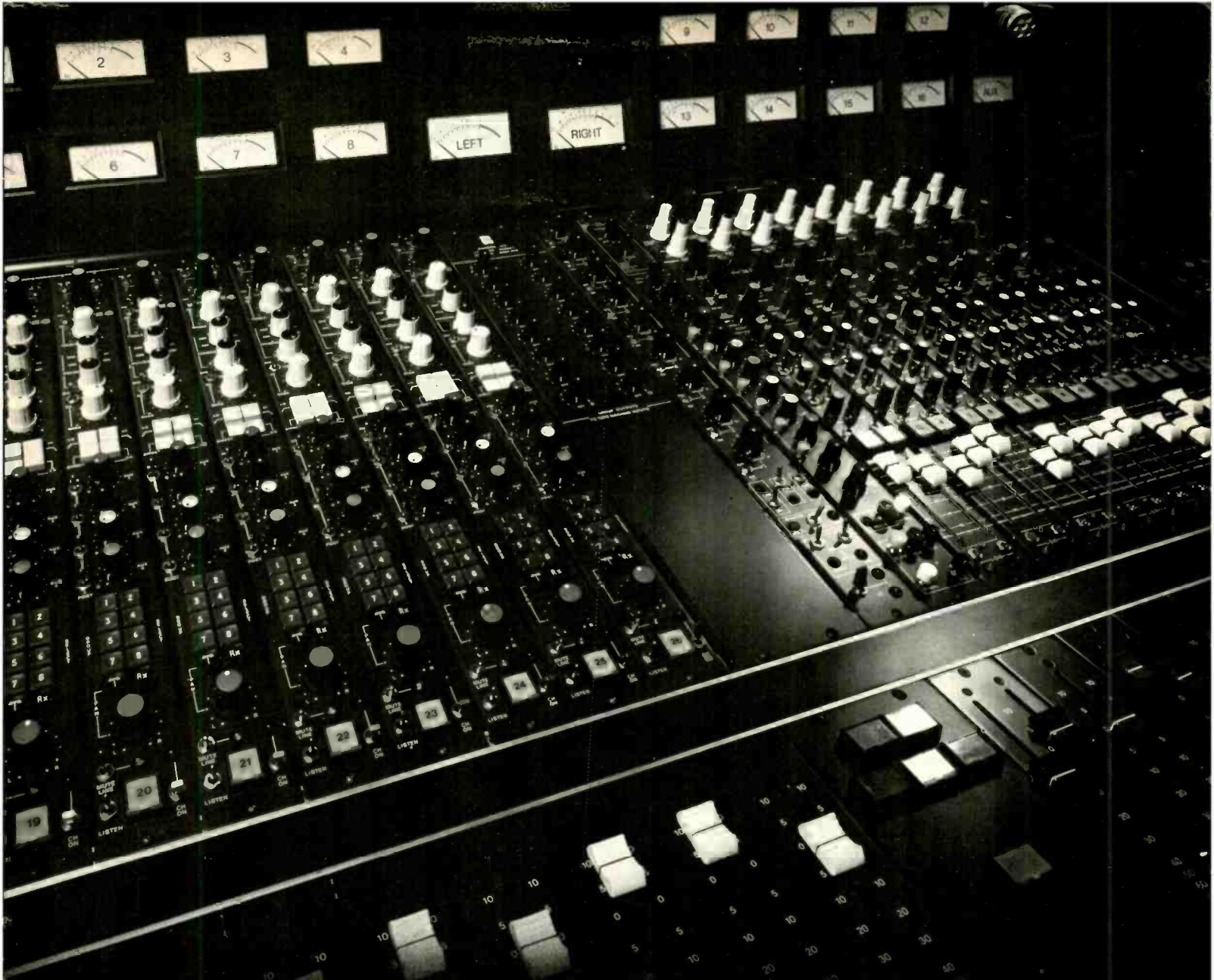
Product Line

Reverberation Devices · Studio Turntables and
Pick-up Cartridges · Tape Recorders with endless
loop cassettes, and for 24 hour recordings · Elec-
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and Polarity Testers · Flutter Analyzers

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WELL PROVEN SERIES III

low noise wide frequency response - lots of goodies

INPUT CHANNEL

Separate Microphone and Line input level potentiometers. Single Mic/line input master control with local 'reverse input' switch, channel input phase reverse, Mic attenuator, 3 treble and base frequencies, swept mid EQ., -12 db/Oct hi-lo filters, 4 independent Echo/FB sends with pre/post switch, 8 group and master stereo (remix) routing. In place channel solo, PFL (or AFL) listen, channel selection to master cut buss. Ch direct outputs, 48V phantom Mic power.

GROUP ROUTING AND RE-INSERT

Full panel mounted routing of any group o/p to tape input - no patching. Re-insert of main groups to the stereo group outputs via pan pots.

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Canada C.O.R.A. Inc.
131 - 18eme Rue. 1046 Quebec P.Q.
Canada Tel. 418-522-1397

Denmark Audiophil
Howitzei, 49-1, 2000 Copenhagen,
Denmark Tel. 134 1622

Netherlands & Belgium Pieter Bollen, Geluidstechniek bv,
Hastelweg 6, Eindhoven,
Holland. Tel. 40 51 2777/520662

South Africa Prosound,
Elkham, Upper Level Pretoria Street,
Hillbrow, Johannesburg 2001,
South Africa. Tel. 642-8721/1209

Spain Telco Sociedad Limitada, Gravina 27
Madrid, Spain. Tel. 1 2317840

France Reditec,
62-66 Rue Louis Ampere,
93330 Neuilly/Seine, France
Tel. 300 96 30

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U.S.A. (Brochure Service Only)
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Glenbrook CT 06906
Tel. (203) 348-4969

MONITORING

L1/LO of the multitrack, stereo (remix) or copy machines. Monitor 'dim. mono, graphic display of monitor levels 2 cues (FB) and one echo send. Monitor state indicated by red or green LED's.

AUX LINE INPUTS

8 (option 12) equalised line input channels with stereo routing and pan to all main groups and monitor circuits, plus sends to channel and monitor cue lines.

P & G faders throughout, comprehensive patch facilities - parallels and spares, switchcraft in/out connectors, PSU, patch cords, maintenance kit, many customer facilities available - PPM's, film pan pots, fader packages with 6 channel muting busses etc.

Raindirk Limited Downham Market Norfolk Tel. 03663-2165 Telex No. 817737



**1 PERSON
OPERATION**

~~32 OR
64 TIMES~~ **NOW
50 OR
100 TIMES**

AUTOMATED CASSETTE DUPLICATOR

COMBINING duplication and loading into one operation is Recortec's contribution to cutting your labor costs. And, the Bi-Directional Master eliminates the master bin loop! With the system pictured, one operator keeps the C-zero hoppers supplied, puts on new pancakes and spot checks the finished product.

QUALITY is built into this professional equipment to provide the best in open reel type duplication systems. The standard 32 times duplication ratio provides the highest fidelity attainable in high speed duplication. Even at 64 times, the bandwidth is sufficient for most recording applications.

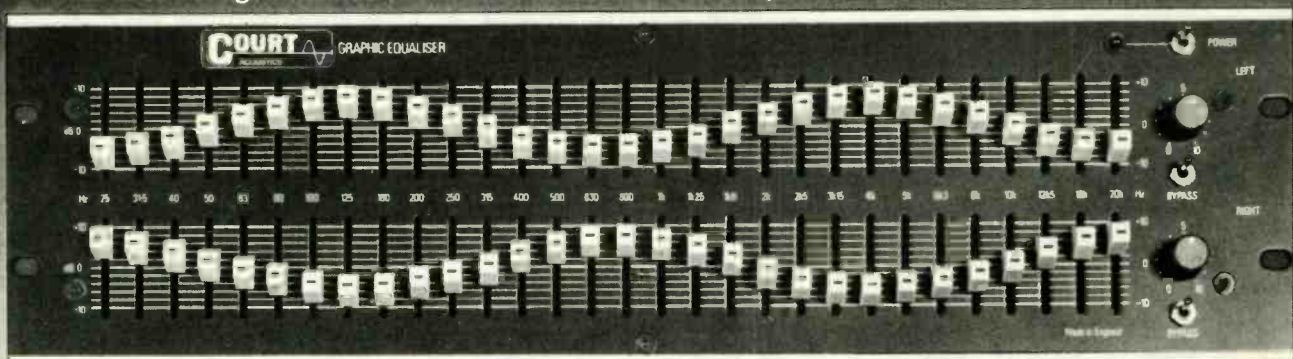
PRODUCTIVITY of your operation can be continually expanded from a start-up 1 x 1 system, to a 1 x 8 as pictured and even to larger configurations. Our systems provide highest productivity, and a quality product with fewer operators. Only Recortec offers automated duplication and loading in one operation!

RECORTEC, INC. 475 ELLIS STREET, MT. VIEW, 0994043 TEL. (415) 962-9220, TWX. 910-379 5022

AT LAST THE ULTIMATE IN TONE CONTROL IS HERE!

When we decided to design a graphic equaliser to end all graphic equalisers – we had no idea exactly how long it would take. Not just to give more facilities than all the others – that wasn't too difficult for us – but to outperform all the competition and at a reasonable price – took a little longer than we expected.

To our overseas agents and all our customers who have been so patient – we think it has been worth the wait.



- 2 stereo bands of 30 faders with centre click stops giving 20dB of control
- ISO centre frequencies giving a total range of 21hz-21khz in 1/2 octaves
- Level control giving up to 20dB of gain
- Hi & Lo pass filters at each end for rumble, subsonic and supersonic rejection
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- 60 precision inductors for maximum curve performance and minimum noise
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COURT ACOUSTICS LTD

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Here it is!

SAM 82

A small portable mixer for professional applications

The mixer SAM82 is designed for mobile and stationary applications in broadcasting, television and recording studios. The mixer has an all-metal case (aluminium) with a plastic cover with slide-in application.

INPUTS

8 Mic/line Channels
2 Echo Returns
2 Monitoring

FEATURES

RF-filters
AC or Battery Supply
Phantom Supply
Test Tone Generator
Inputs/Outputs
Transformers
Peak Programme
Meter (PPM)

OUTPUTS

2 Master Channels
2 Auxiliary
1 Talk-back

ACCESSORIES FOR EXAMPLE

Battery Unit BU 4020
Carrying Case



MADE IN SWEDEN BY

SATT Elektronik AB

Tellusborgsvägen 90-94
P.O. B. 32006
S-12611 Stockholm
Sweden

Phone: National (08) 810100
International +46 8 810100
Telex: 10884 SATTTEL S
Cable: SATT Stockholm

Adart

I am interested in the SAM 82.

Please get in touch with me right away for a demonstration.

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Name _____

Address _____

Postal code _____

Country _____

SS 3



The Soloist Microphone which Stands Alone

The Neumann KMS 84 is a condenser hand microphone insensitive to explosive sounds and handling noise and yet retaining the typical condenser brightness.

An electrical high-pass filter enables a balanced linear frequency response to be achieved, both for close speech and the pick-up of more distant sound sources.

The KMS 84 is lightweight, unobtrusive in camera and interchangeable coloured grilles are available for simple identification on stage.

Audio Export Georg Neumann & Co. GmbH
D - 7100 Heilbronn Fleinerstrasse 29 West Germany



F.W.O. Bauch Limited

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

News from Sweden!

Stockholm 80-02-20

Real time analyzers, sweeping generators and analyzers, noise generators.

This is the new line of measuring instruments developed by the Swedish company Consilium. The most modern technique is used, thus enabling good performance and interesting prices. Agents are looked for.

All instruments will be exhibited at the AES Convention stand 23 H. STOP

Consilium Industri AB

Parkvägen 12, S-171 83 Solna. Tel. 08-83 2236

ARS

AUDIO REINFORCEMENT SERVICES LTD 216 Archway Road, London N6

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Competitive prices:- Neutrik connectors, panel male 90p, panel female 145p, line male 120p, line female 130p, (black/gold Neutriks also stocked). Mic cable, choice of seven types, from 18p metre. Brook-Siren lead testers £23. Quad 405's £145. Gaffa tape £3.50/50 metres. (those prices below £25 include VAT)

Services include:- mic. leads etc. — fast while u wait service; stage boxes, multicores, distribution units, audio transformers etc — to order. Rack mounting conversions and accessories for Quad 405's. Rack units and accessories; re-cones for JBL/ATC and Coral. Competitive hire rates for Equalisers, Cross-overs, amps, effects and signal processing equipment.

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(from 3rd March).

Telephone 01-341 1506.

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cadac audio's revolutionary **digicat**® digitally controlled fader takes automation silently into the 80's.

digicat® is a totally new concept in audio gain control devices.

Only **digicat**® uses a microprocessor controlled multiplying D/A convertor with its inherently temperature stable, linear and virtually noise free 12 bit resistor ladder network to precisely determine attenuation.

Compared to the best conductive plastic fader and buffer amplifiers available, **digicat**® contributes no distortion, no gain drift, no modulation noise and no signal to noise degradation—all without setting up trims.

Available in automation or sub grouping systems with our proven 'In Line' Series consoles from 16 to 48 tracks—and our new P5248 console specifically engineered for dual 24 track working—**digicat**® is silent automation.

proven technical excellence meticulously handcrafted

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C. A. Audio Systems Ltd,
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AL5 5EQ, England.
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8 channel, 2 group MXT -
1000 - each channel fitted
with compressor

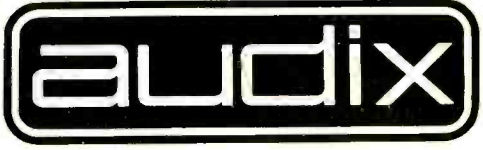
The MXT-1000
A unique system enabling
your own requirements to
be built from standard
equipment

MXT-1000 AUDIO MIXING SYSTEM

Manufacturers of
sound systems
and electronics

Audix Limited
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The Quality Microphone That Isn't Made In Deutschland.



DC-96

DC-63

VM40/41

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The VM40 (omni) or 41 (cardioid) are extremely rugged and compact mics that are particularly impressive for close range miking. The '63, '96 and 40/41 are only 3 of a full line that includes electret lavaliers, advanced design XY-axis stereo mics, and complete accessories. Please write us for full technical information and ask your pro-dealer for a demonstration. We'll bet you dollars to marks you'll be surprised how much more you'll get with the Swedish Steal. Dealer inquiries invited. **Sverige Ar Bäst.**

PML PROFESSIONAL
MICROPHONES

Worldwide Marketing: **Creative Trade, CTAB AB**, Knutsgatan 6, S-26500, Astorp, Sweden, Tel: 4642/515 21
U.S. Distributor: **Cara International, Ltd.**, P.O. Box 9339, Marina del Rey, Ca. 90291, (213) 821-7898
Australia: **Werner Electronics Ind. Pty. Ltd.**, P.O. Box 98, Kilkenny S.A. 5009, Tel: (08) 268-2766
U.K.: **Allotrope Ltd.**, P.O. Box 4BS, London W1R 4BS, Tel: (01) 437-1892/3

AND NOW YOUR VERY OWN STUDIO SOUND T-SHIRT or SWEATSHIRT



T-Shirts—Black—£2.50 or \$6 (inc p&p)

Sweatshirts (longsleeve)

Red or Black—£5.50 or \$13 (inc p&p)

- Tick **Black T-Shirt** **S**
 Red Sweatshirt **M**
 Black Sweatshirt **L**
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 30 x 24 ex CHIPPING NORTON
 STUDIOS. VERY GOOD
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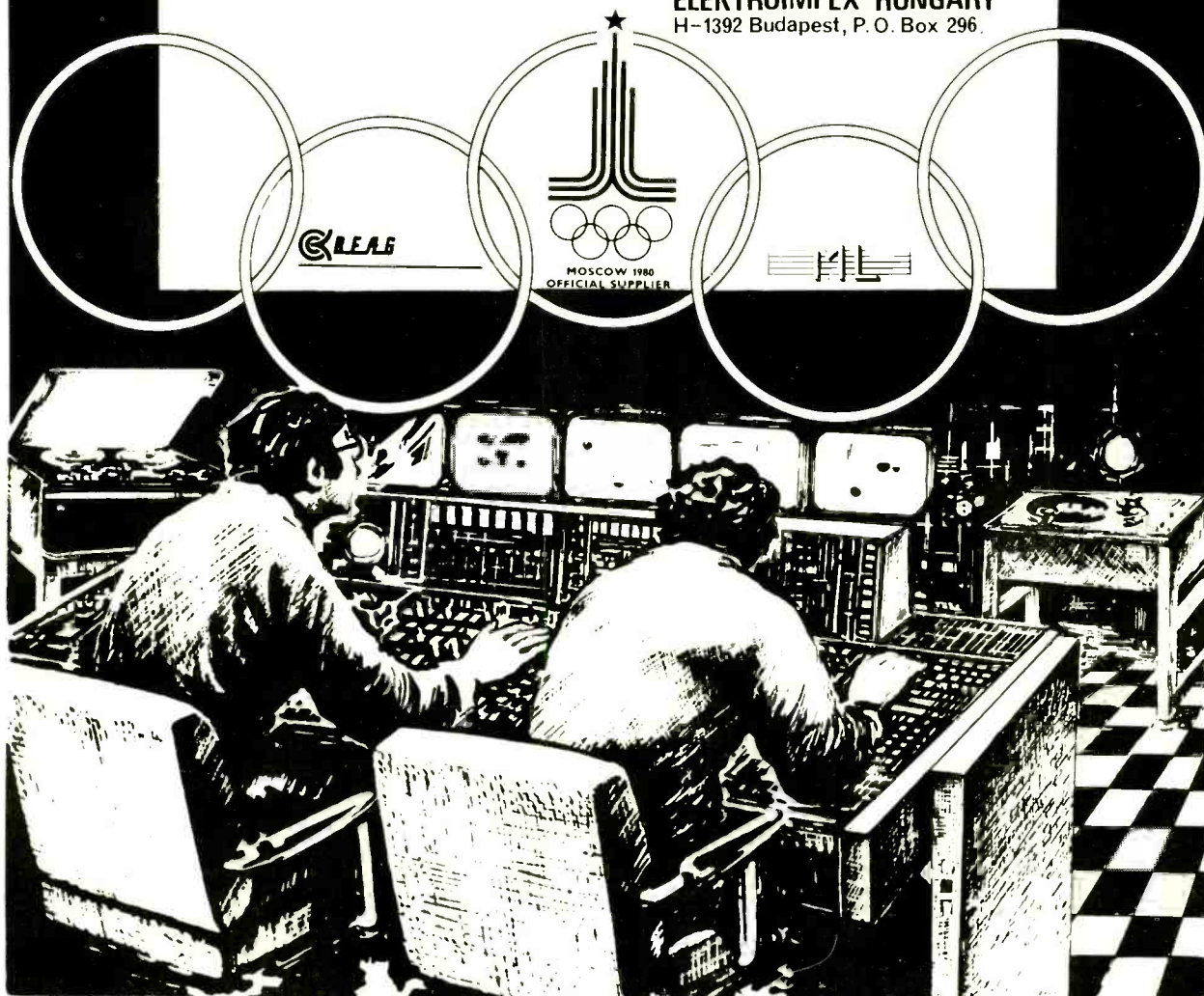
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- servo controlled tape recorders
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Note: Advertisement copy must be clearly printed in block capitals or typewritten.

Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality. **SEX DISCRIMINATION ACT 1975:** No job advertisement which indicates or can reasonably be understood as indicating an intention to discriminate on grounds of sex (e.g. by inviting applications only from males or only from females) may be accepted, unless (1) the job is for the purpose of a private householder or (2) it is in a business employing less than six persons or (3) it is otherwise excepted from the requirements of the Sex Discrimination Act. A statement must be made at the time the advertisement is placed saying which of the exceptions in the Act is considered to apply.

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SHORT-RUN CASSETTE DUPLICATING

Hi-Speed Mono One to One stereo 10-250 36hr service
From **32p** each inclusive

Write or phone for rate card to:

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STUDIO ACOUSTIC DESIGN



Acoustic Technology Limited

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Tel 0703 37811

320 Dresser Tower
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Cassette Duplication	Empty Tape Spools
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50-99	48p	50p	52p	55p	58p	61p	68p	76p	84p	94p	104p	114p
100-149	47p	49p	51p	52p	54p	56p	63p	72p	79p	89p	99p	109p
150-249	43p	45p	47p	48p	50p	52p	60p	69p	74p	84p	94p	104p
250-499	41p	43p	45p	46p	47p	48p	56p	64p	70p	80p	90p	100p
500-999	39p	40p	41p	42p	43p	44p	51p	59p	67p	77p	87p	97p
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Auto-Set is a complete self-contained automation programmer made by Harrison Systems. It is specifically designed to interface with all Harrison consoles ever built. Interface is quick and simple through the use of multipin connectors.

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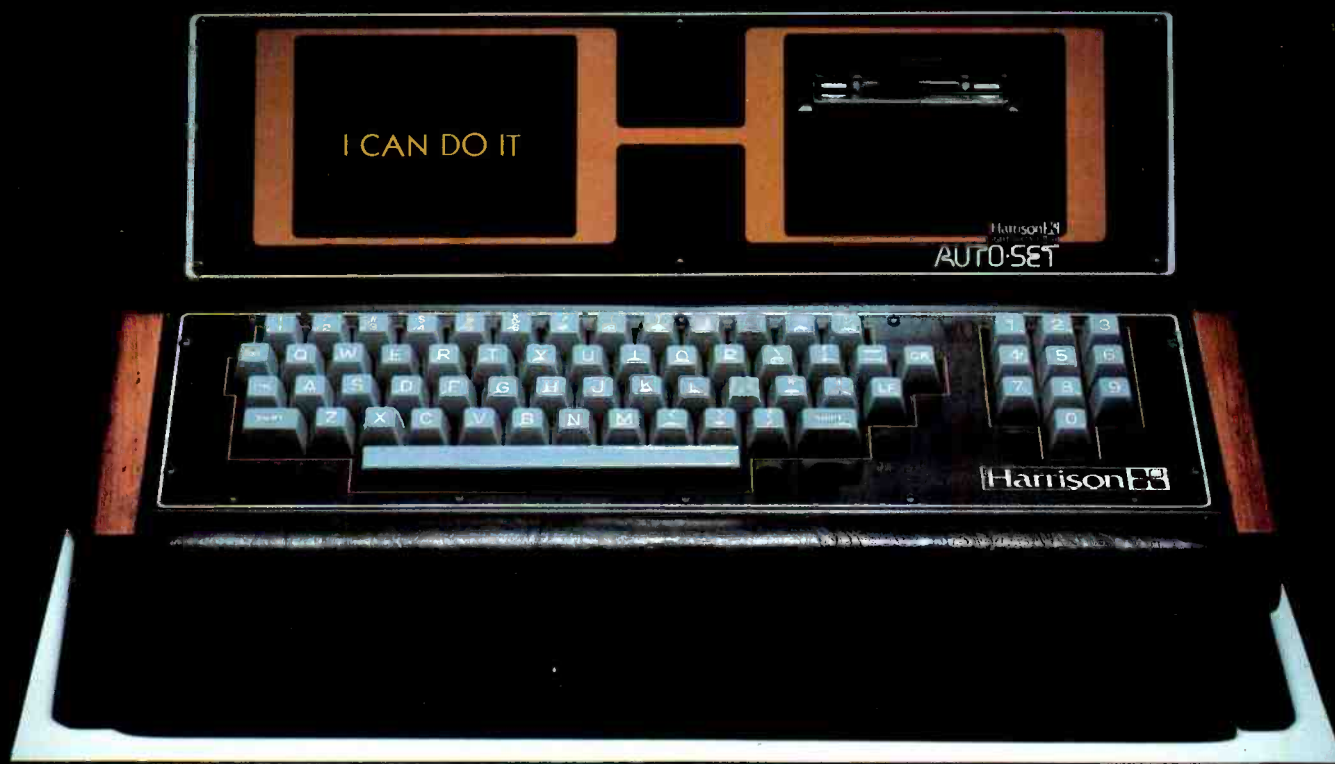
an expensive mass storage device and a time code system. Also, you never run out of data storage space as the data space increases with the length of material to be mixed.

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