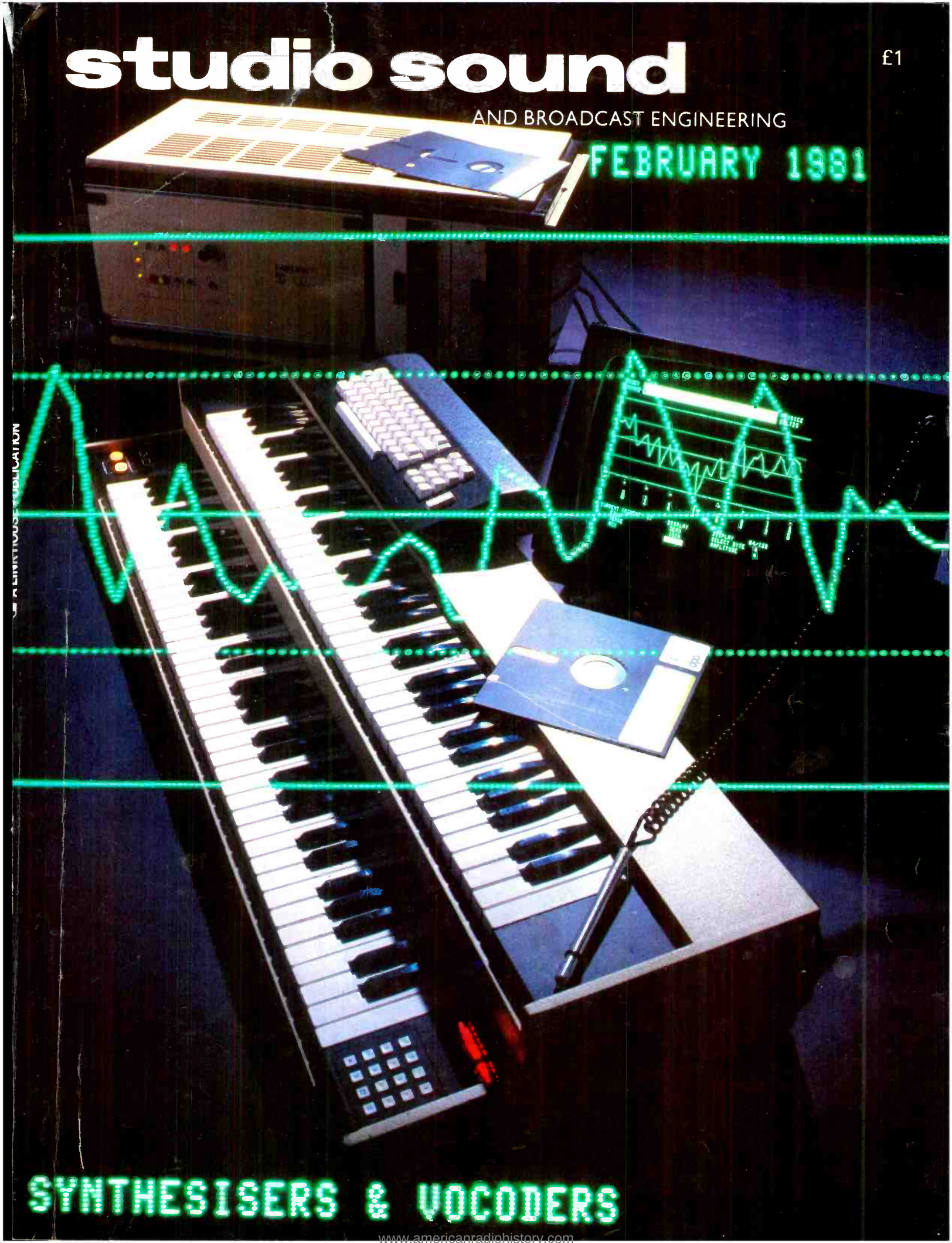
# studio sound

AND BROADCAST ENGINEERING

£1

FEBRUARY 1981



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MIDAS CANADA Bob Snelgrove, Gerr-Electro-Acoustics, 363 Adelaide Street, Toronto, Ontario M5A IN3 Canada. Tel. 416-868 0528

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# studio sound
## AND BROADCAST ENGINEERING



DESIGNING A MIXING CONSOLE: Due to postal problems we regret we were unable to bring you Part Six of our series in this issue. The next part—When is a Ground not a Ground?—will be featured in our March issue.

**Synthesisers for the Studio**

Last year's New York AES saw, more than ever before, a strong presence from manufacturers of electronic musical instruments, particularly some of the more complex, computer-based variety. These, and other modern synthesisers and musical effects units, appear in this issue, in our first-ever full-scale survey of *Synthesisers and Vocoders*. Why, you may well ask, are we, a studio and broadcasting magazine, going into such detail about an area that really concerns our clients the musicians who use our studios? The answer is twofold. Firstly, many professional musicians are getting their own studios together, and nowhere is the musician/studio marriage more necessary and upcoming as in the electronic music field. It may well be that the electronic music studios of the future will include a complete, integrated, computer-based system which handles not only console and recording automation, but also sound synthesis. Some instruments, like the *Synclavier* and the *CMI*, already offer sophisticated digital multitracking facilities, and thus already represent a move in that direction.

Secondly, these devices are used extensively by the musicians in our studios, but the majority of modern digital synthesisers are of such complexity and sophistication, and therefore price, that only a few musicians can afford them (often those same people who have their own studios). There is therefore a definite case for the studio owner to examine the feasibility of having such a music system available, and perhaps even the people to use it. Additionally, it may benefit us engineers to be aware of the sort of things that people are likely to turn up with for a session: we might as well know how to interface them to the console, and how to point the session in the right direction. A similar case exists for producers to be aware of the possibilities when it comes to organising a session. One presumes that it is exactly these kinds of reasons which are prompting synthesiser manufacturers to show their wares with increasing prevalence at our professional audio shows, and that is why *we're* doing it. I hope it's useful.

**The beginning of the end?**

Little has been heard of a case which is presently making its way through the Courts of England. We don't yet know what the final outcome will be, but the story so far is rather disturbing.

The case involves a studio, who, in the usual way, held on to a client's tapes because he didn't pay the bills for the studio time. Said client sued the studio for interrupting work in progress and—at least initially—won! As the case is currently at county court level, it doesn't establish a serious legal precedent, but a lot of people are keeping their eyes on what's happening, for obvious reasons.

Apart from the horrifying thoughts about all those unpaid-for reels in the tape store, the establishment of a legal precedent in this area is certain to change the whole way studios work. Even if you have respected clients, who come back time after time, will you risk giving them credit? Obviously not. It'll be money up-front or no session. In other words, we should be ready for a complete shake-up in the way we do business, at least in Britain, and maybe people in other countries will get the same bright ideas. We'd better watch out, and find better ways of hanging a Sword of Damocles over the heads of some of our less-reputable clients.

**Mixer reviews**

Due to the remarkable size of the Mixing Consoles Survey carried in our last two issues we were unable to include some of the mixer module technical reviews promised for those issues. These reviews including consoles by Soundcraft and Eela Audio appear in this issue. We apologise to both the manufacturers concerned and to readers for the inconvenience.

**Richard Elen**

**Cover of Fairlight CMI by Adrian Mott**

**ISSN 0144-5944**
**FEBRUARY 1981 VOLUME 23 NUMBER 2**

# fact: the SC39 Series meets all the unique demands of professional cartridge users

- **Broadcasting**
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**The SC39 Solution:** The internal support wire and special elastomer bearing ensure stable and accurate backcuing without groove jumping. This, plus the following exclusive features, protect the SC39 from accidental stylus damage.

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A unique lateral deflection assembly prevents the most common stylus damage by withdrawing the entire stylus shank and tip safely into the stylus housing before it can be bent

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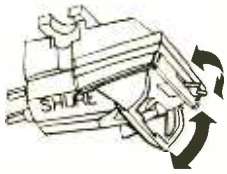
The exclusive lever-operated, locking stylus guard gives the stylus tip positive protection when not in use. With the flip of a lever, it snaps out of the way, and positions a highly visible cuing aid




**The Professional Challenge:** Prolonged record (and lacquer master) playability without objectionable noise buildup.

**The SC39 Solution:** A unique Shure MĀSAR™ stylus tip is designed to minimize noise and cue-burn on records. Tests on lacquer masters show that the noise level on a record played repeatedly with an unworn Shure MĀSAR tip is significantly below that of a similar disc played with an unworn conventional stylus. The SC39 also reduces noise buildup on 45 rpm records made from reprocessed or substandard vinyl.


**The Professional Challenge:** A multiplicity of different applications, which no one cartridge can satisfy.

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| **SC39EJ** | Biradial (Elliptical) | 1-1/2—3 grams | Where heavier tracking forces are required. AM broadcast, disco. |
| **SC39B** | Spherical | | |

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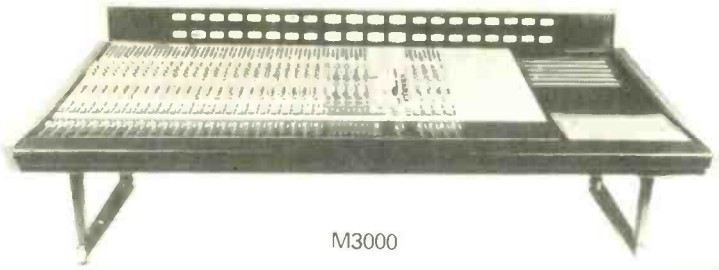
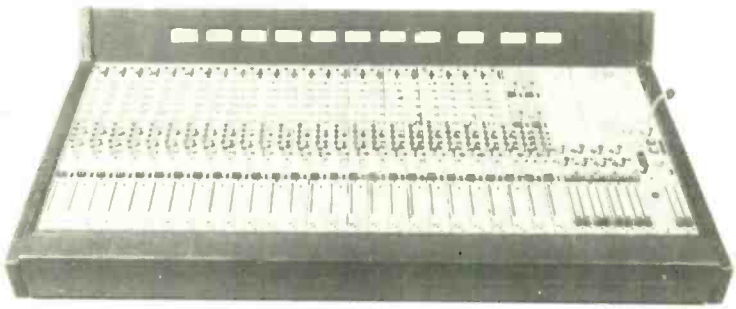


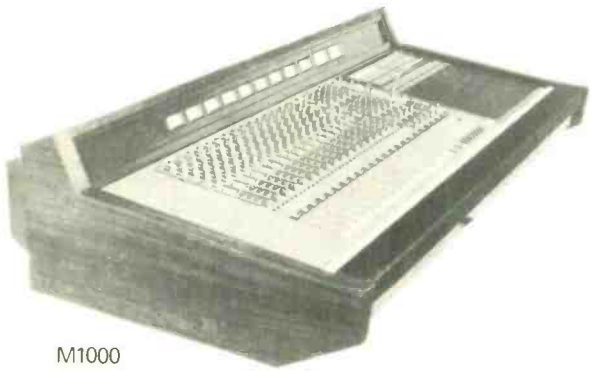
M3000

The AMEK/TAC current product range: TAC 1682, TAC 500, AMEK 1000 systems offering consoles of varying sophistication for recording, sound reinforcement, A/V production, onstage monitor mixing; AMEK M2000 non-automated, M2000A/2500 and M3000 automation-capable master recording consoles for 16/24/48 track recording. Coming: AMEK's Tapepak and Autopak computer mixdown systems....

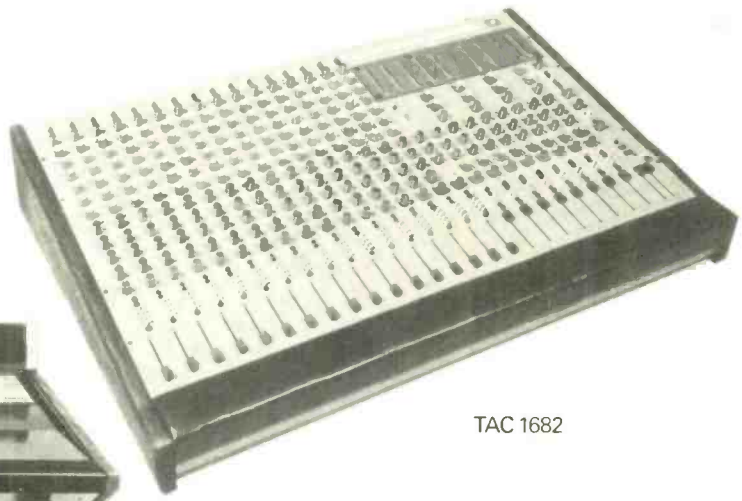
M2000



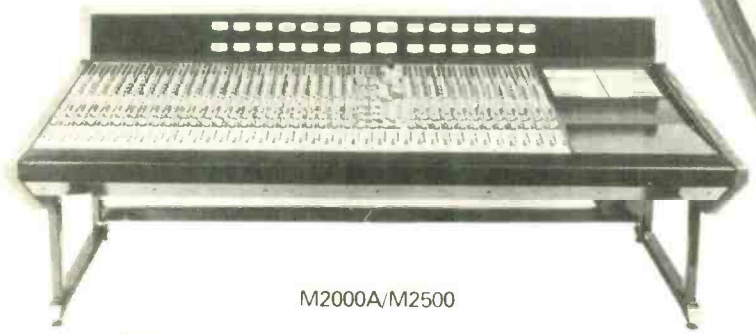
TAC 500



M1000



TAC 1682



M2000A/M2500

UK SALES: SCENIC SOUNDS, 97-99 DEAN ST, LONDON W1V 5RA (01) 734 2812

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AMEK SYSTEMS AND CONTROLS LIMITED/TOTAL AUDIO CONCEPTS LTD, ISLINGTON MILL, JAMES ST, SALFORD M3 5HW, ENGLAND (061) 834 6747 TELEX 668127 NICK FRANKS/GRAHAM LANGLEY

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| | List | Package |
|---|---|---|
| 4 track package. Teac A3440, Revox HS77, Model 2A Mixer | £1668 | **£1350** |
| 4 track package. Teac A3440, Revox HS77, Itam 10-4 Mixer | £2535 | **£2090** |
| 8 track ½ inch package. Itam 806, 10-4 Mixer, Revox HS77 | £3917 | **£3220** |
| 8 track 1 inch package. Otari MX7800, Allen & Heath 16×8 Mixer | £7185 | **£6395** |
| 16 track 1 inch package. Itam 1610, Allen & Heath 16×8, Revox HS77 | £9045 | **£8185** |
| **16 track 2 inch packages** | **from** | **£13800** |
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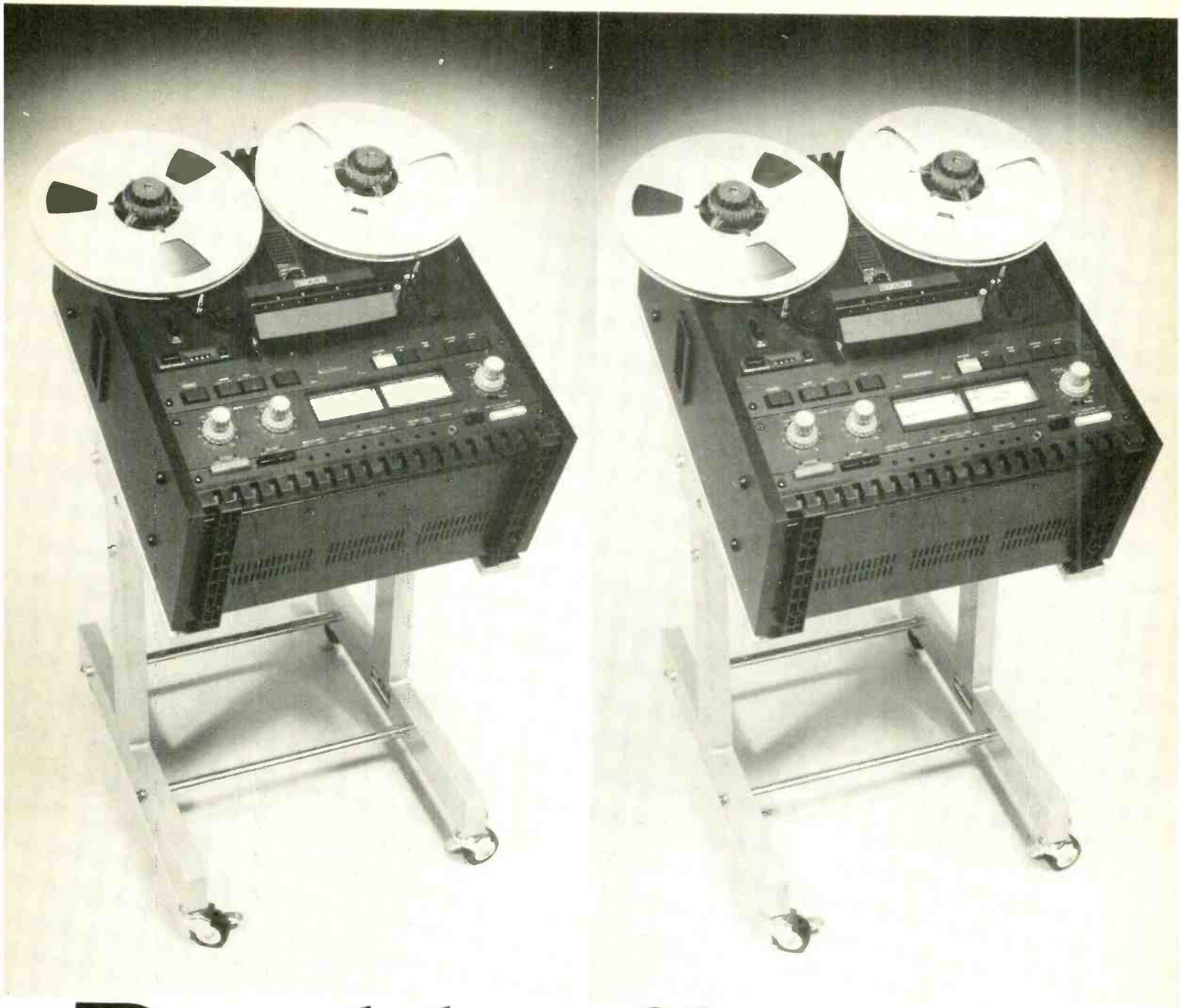

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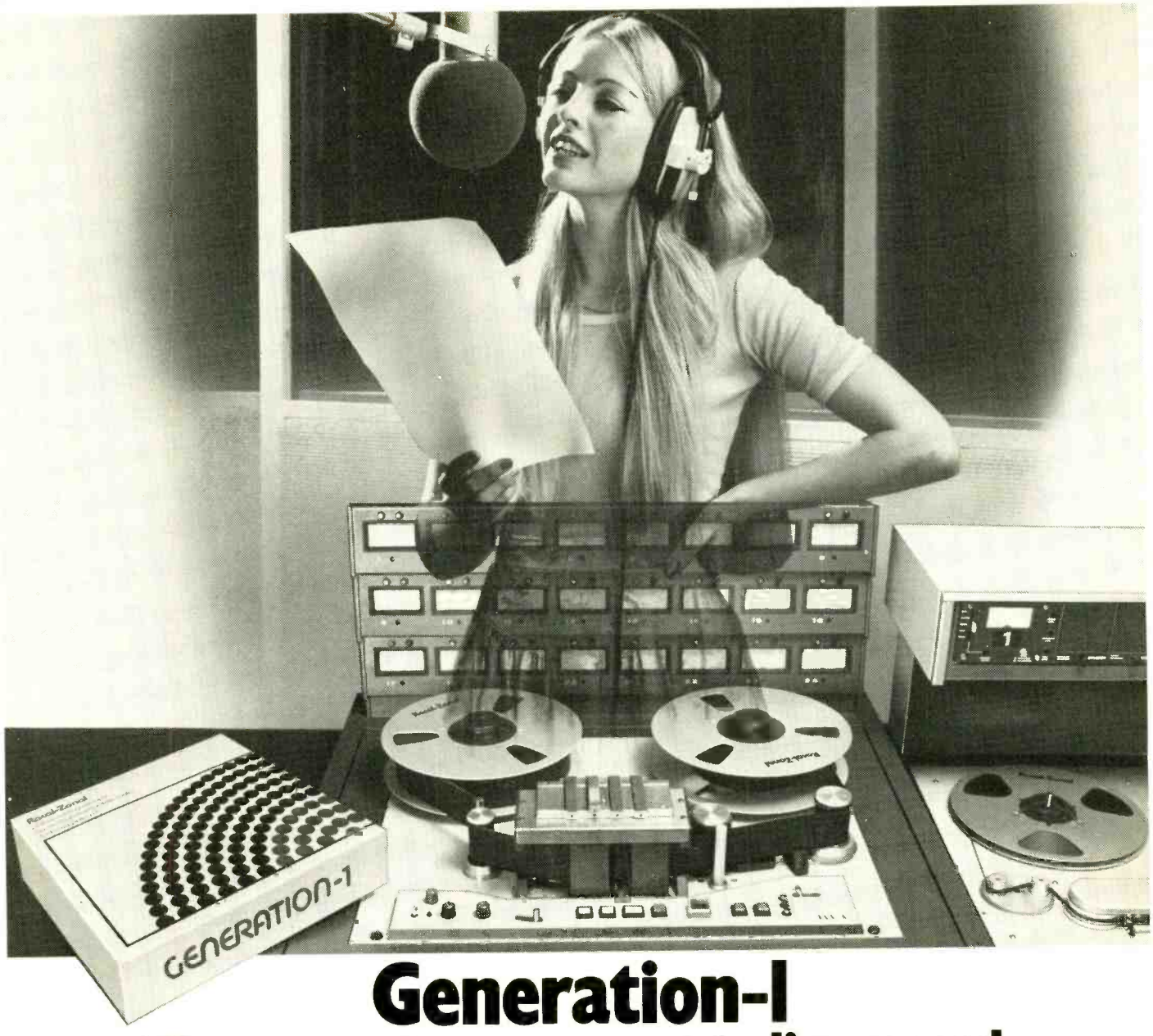


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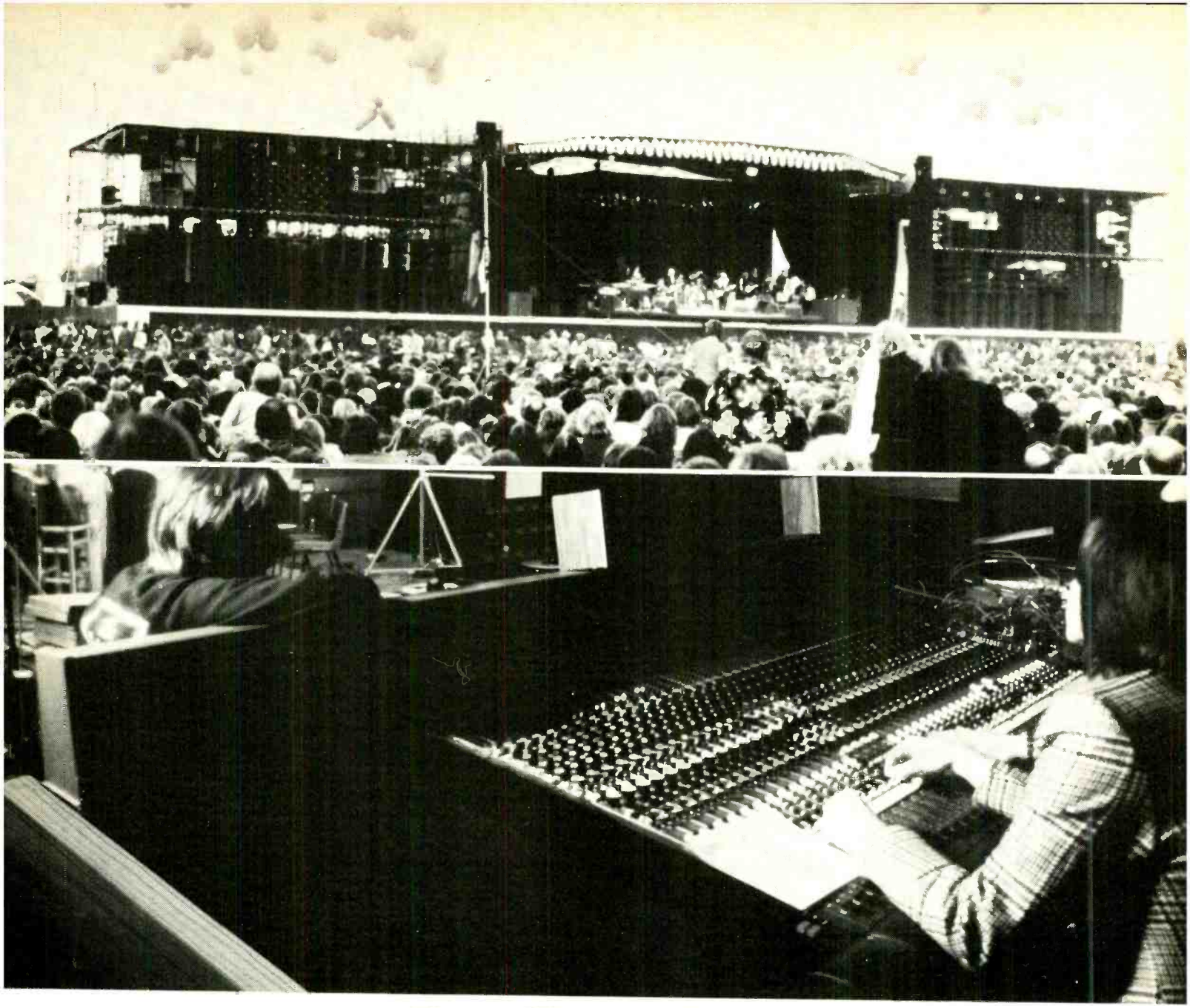

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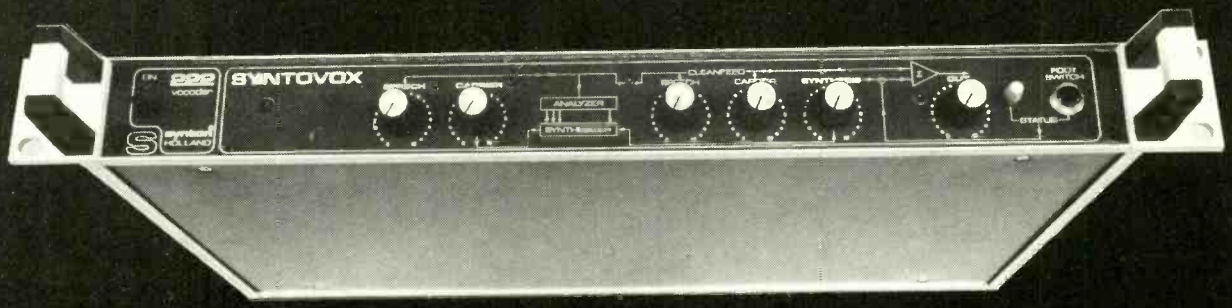


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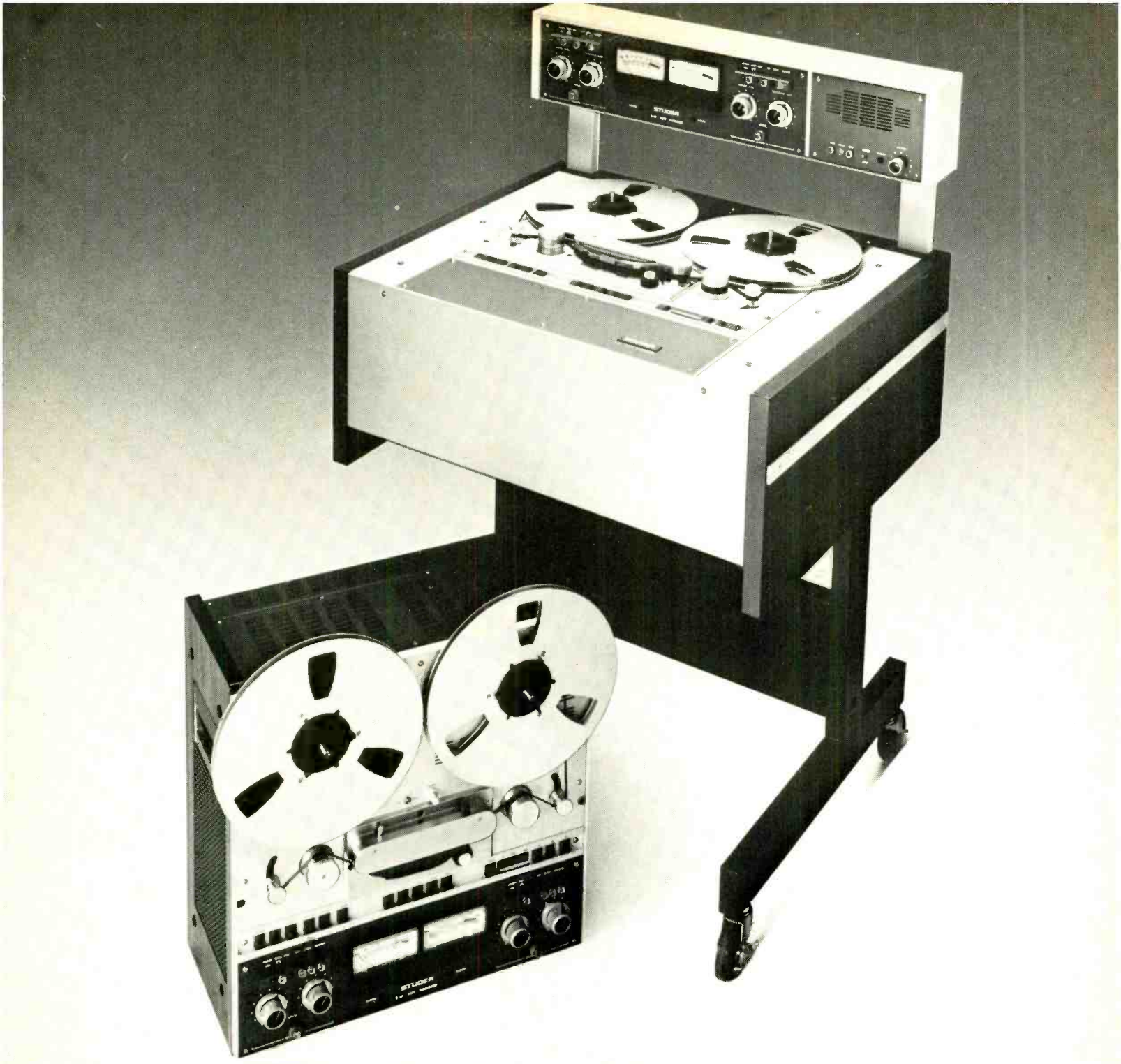

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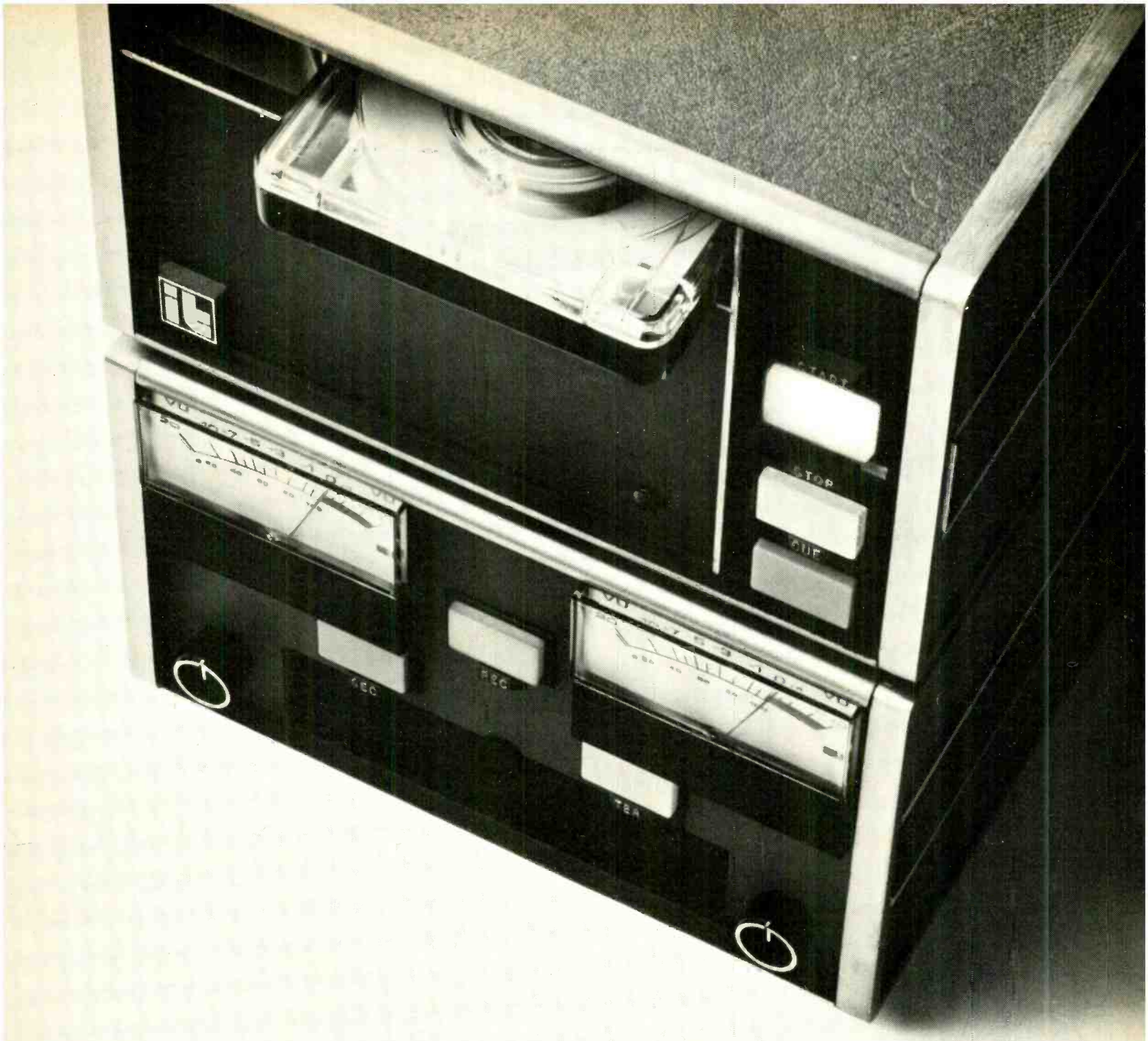


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Angus McKenzie (March 1978)

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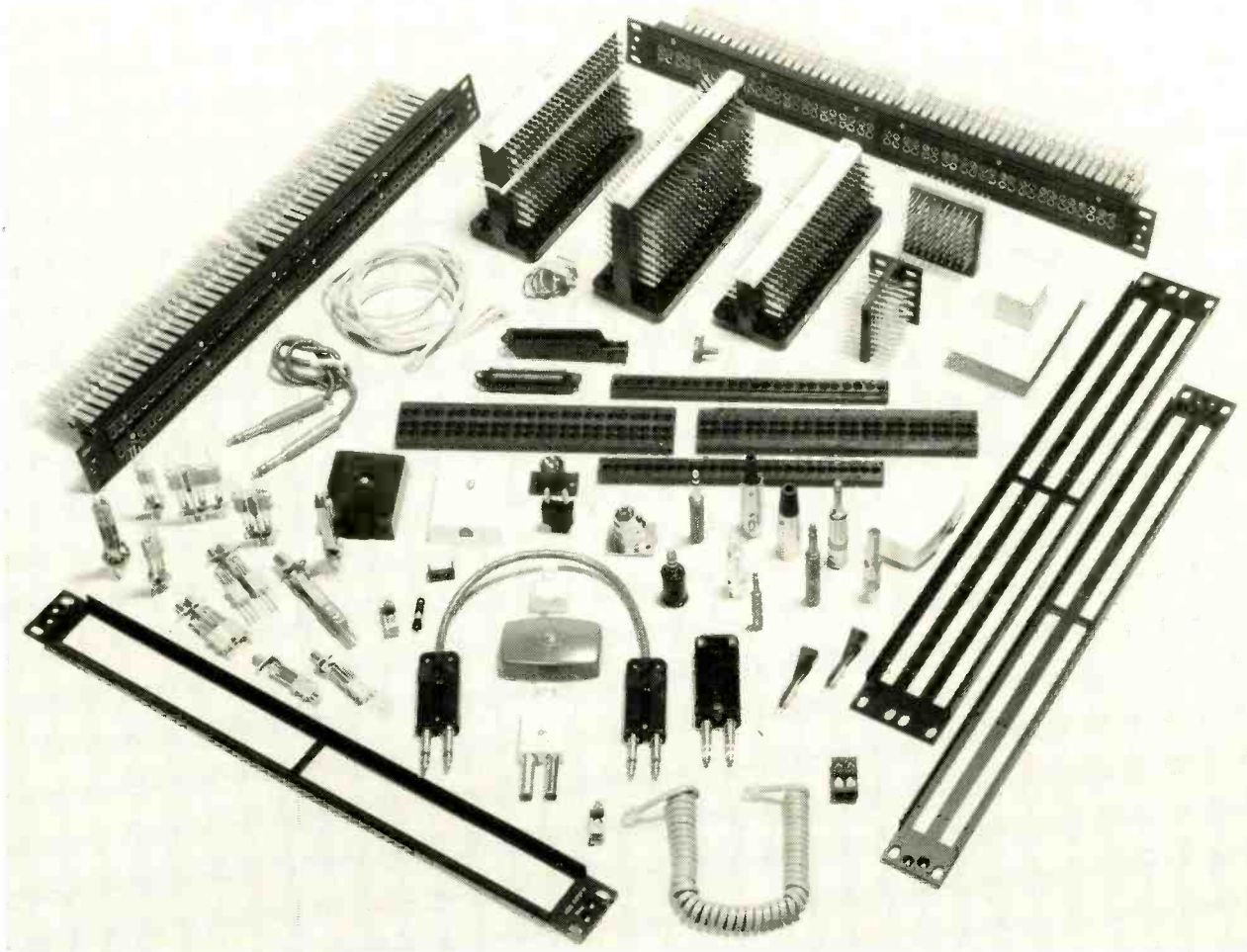

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# news

## Varitone acoustic panels

A new product from Industrial Acoustics Co Ltd is its *Varitone* sound absorption system comprising a range of rectangular panels suitable for wall or ceiling mounting. The *Varitone* panels are available in lengths up to 12ft and in thicknesses of 2 or 4in and are formed of a sandwich of acoustic infill material sandwiched between front and rear faces of 0.76mm steel, these panels being covered in vinyl coated finishes. The panels have noise reduction coefficients of 0.95 and higher and feature a high degree of sound absorption in the troublesome 1f range (63Hz to 125Hz). An additional advantage of the panels is their thermal insulation qualities such that a 4in panel offers a heat transfer coefficient of 0.07 BTU/hr/sq ft/°F.

Industrial Acoustics Co Ltd, Walton House, Central Trading Estate, Staines, Middlesex, UK. Phone: 0784 56251.

## Wireworks cable guide

Wireworks has produced a 24×36in wall poster audio cable configuration guide detailing sound reinforcement and studio applications for the company's range of cables. Anyone wishing to obtain a copy of the wall chart should contact Angela DiCicco on (210) 686-7400 or write to Wireworks Corp, 380 Hillside Aveneue, Hillside, New Jersey 07205, USA.

## Trompeter Electronics

A company which we inadvertently omitted from our survey and reviews of audio cables and connectors (November issue) was Trompeter Electronics Inc. Trompeter, handled in the UK by Lee Engineering, produce a wide range of patch panels, patch cords, cable assemblies, jacks, looping plugs, power dividers, RF connectors, etc. While the company's range is too extensive to detail here it is worth noting that patch panels are 19in rack mount panels and are available in standard and miniature types with a wide range of patchcords and plugs to suit, whilst cables are available in twinax, triax, and quadrax types. A comprehensive catalogue giving full details of the Trompeter range is available.

Trompeter Electronics Inc, 8936 Comanche Avenue, Chatsworth, Cal 91311, USA. Phone: (213) 882-1020.
UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Phone: 09322 43124.

## Shure M97HE-AH

Shure has introduced the *M97HE-AH* integrated cartridge headshell with an *M97* cartridge. Fitted with a universal 4-pin bayonet connector for simple pick-up arm installation the integrated unit features lower headshell/cartridge mass, plus the established cartridge features of hyperelliptical stylus, viscous damped dynamic stabiliser, telescoped stylus shank and stylus guard. Price of the integrated unit is £51.80.

Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU, UK. Phone: 0622 59881.

## Sound Ideas effects library

Canford Audio has informed us that its Sound Ideas effects library is now available on single tape reels. As with the full library all royalties are included in the purchase price of £15.60 per single reel. The full library is still available at a cost of £840 and the tapes run at 7½in/s. Copies of the full catalogue of effects are available from Canford at a cost of £1.00, while a short form catalogue is free.

Canford Audio, Stargate Works, Ryton, Tyne and Wear NE40 3EX, UK. Phone: 089422 4515.

## Portable broadcast console

Tangent Systems has introduced a portable broadcast audio mixing console, the *BC-1*.

The console is available with eight to 32 inputs on a modular input channel configuration. Features are 3-band eq, three sends, Penny & Giles faders, fully balanced inputs and outputs, PFL/mute and flexible monitoring on each input.

The stereo output module includes a switchable LED PPM and analogue VU or PPM meters and built-in headphone amp. Optional facilities are RTS intercom talkback, IFB systems, down-cue switching, and various carrying cases.

Tangent Systems Inc, 2810 South 24th Street, Phoenix, Arizona 85034, USA. Phone: (602) 267-0653.

## New phone number

Penny & Giles Conductive Plastics Ltd has a new phone number in the UK. This is now 0495 228000.

## SQN mini mixer

A new portable mini mixer which has come to our attention is the *SQN-3* from SQN Sales. Available in two versions, type C and type M, the mini mixer has three mic inputs plus line with a variety of mic powering facilities including 12V and 48V phantom. Features include channel and master volume controls; peak reading meter; switchable 20:1 limiter; 1.1kHz line up tone; switchable 0/−10/−20dB input attenuation; switchable flat/−4/−10dB bass cut at 100Hz; and headphone monitor outlet with adjustable level. The mixer is powered from internal AA type batteries, but can also be powered by any external supply in the range 5.5V dc to 18.5V dc. A battery test facility is fitted. The type C version which is designed to interface with the Nagra SN tape recorder, (this being mounted on the mixer's top surface and interconnected via the *SQNP-04* plugbox), offers the following additional features: front panel control of the recorder's playback, stop and record functions; monitor (mixer output/tape output) switch; remote record and bleep/tone gate control; and crystal pilot sync. Size of the mini mixer is 210×120×44mm (wdh) for both versions, with the type M weighing 1.2kg and the type C including batteries, plugbox and *SN* recorder weighing less than 2kg.

SQN Sales Ltd, 2 High Street, Port St Mary, Isle of Man, UK. Phone: 0624 834294.

## Radio Hallam new studio

Radio Hallam has opened its new £70,000 studio. Known as Studio E, it has been specially designed for news, talk production and programme interviews and is Hallam's first new purpose-built studio since the station went on air in 1974.

The studio has been designed jointly by Radio Hallam's chief engineer Derrick Connolly, Krystal Promotions and Beaumont and Cowling. Radio Hallam engineer Mick Adams supervised the project and designed and installed the new studio's electronics. The mixer's circuitry is racked separately and includes Aphex DCAs. This arrangement makes maintenance easy and has the advantage that the desk, housing just faders and push-buttons, is less affected by coffee, cigarette ash, etc.

Other equipment includes Studer *B62* tape machines for editing, Revox *B77*s, ITC cart machines record/replay and triple stack, and ADR limiters. Closed circuit TV and video equipment is also available.

## Klark-Teknik USA

Klark-Teknik has formed a US company to handle US distribution of its own and sister company Statik Acoustics' products. Under the control of Jack Kelly, the new company Klark-Teknik Electronics Inc is based at 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3660. 24 ▶

# Sons of Super Red

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## Sonifex cart machines

Sonifex has produced a new broadcast cartridge machine featuring a new principle of pinch lift giving silent and rapid starts and stops. The new machines called the *Micro HS (μHS) Series* are compact units featuring a rugged alloy machined deckplate carrying the tape drive dc servo motor and neoprene pinch roller lift mechanism. A heavy flywheel capstan assembly is carried in microfine sealed ball races and the machine has spring cartridge guides for positive location, with accurate tape guidance being ensured by four edge tape guides. To aid access and maintenance all electronic sub-assemblies are carried on the main deckplate with pcb connections. Priced from £825, the units are available as play only, play/record and interlocked triple stack with three cue tone response and triple forward speed cueing.

Sonifex Sound Equipment, 15 College Street, Irthlingborough, Northants, NN9 5TU, UK. Phone: 0933 650700.

## Modular construction collet knobs

Zaerix Electronics has announced a range of modular construction collet knobs with components permitting assembly of custom made units.

Standard shaft fitting is ¼in but 3, 4 and 6mm are also available. Bodies can be black, grey or red, lined or unlined in a choice of widths. They can be standard or winged and gloss or matt finished. Caps come in a choice of colours.

Other accessories in the range include nut covers, pointers to match caps and various indicator dials.

Zaerix Electronics Ltd, 46 Westbourne Grove, London W2 5SF. Phone: 01-727 5641/7774. Telex: 261306.

## APRS digital harmonisation

The APRS is holding its next working party on digital harmonisation in late January. While the APRS has already received considerable support from manufacturers and studios, they would like to hear the views of as many studios as possible and accordingly urge all member and non-member studios to attend the next meeting. Further details are available from the APRS Secretary (09237 72907).

## BKSTS course

The British Kinematograph, Sound and Television Society (BKSTS) is repeating its course on sound recording technology. This evening course which runs from February 16 to April 6 covers the basics of audio engineering and acoustics, and includes a very helpful handbook giving basic information on the topics covered. Full details and enrolment forms are available from Bill Pay, Secretary BKSTS, 110-112 Victoria House, Vernon Place, London WC1B 4DJ, UK. Phone: 01-242 8400.

## SPARS expansion

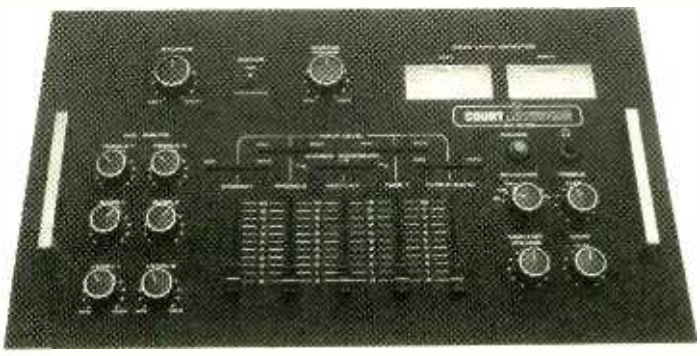
Murray Allen, the newly elected president of the Society of Professional Audio Recording Studios (SPARS), has announced details of the new organisational structure SPARS is adopting to expand its membership. In addition to regular membership for 24-track studios and disc mastering houses at a cost of $1,000, SPARS is introducing three new categories of membership. These are: affiliate membership for those studios not meeting the regular membership criteria; advisory associate membership for any company engaged in providing services or supplies to the recording industry; and associate membership for any company or individual engaged in or utilising the services of the recording industry. Membership fees are respectively $500, $2,500, and $250 for each of the categories.

SPARS, 215 South Broad Street, 7th Floor, Philadelphia, PA 19107, USA. Phone: (215) 735-9666.

## Court PM10 mixer

Court Acoustics has introduced the *PM10* fully professional mixer to broadcasting standard specifically designed for club or disco usage. Designed to mix professional turntables, low impedance mics and tape machines, the mixer features low and high level outputs, an automatic muting facility, cross fading facility, and PPM metering of master output or cued signals. Other features include mic input equalisation and variable input level (stage gain) to facilitate maximum S/N ratio and constant output irrespective of disc or tape levels.

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



## FRAP new products

FRAP has released three new products, the *W-350* preamp for use with the type *W* transducer; the *F-350* preamp for use with the type *F* transducer; and the *IT-2* integrated transducer. The *W-350* is suitable for all wind instruments and features an LED indicating battery checker, a phase reversal switch, and a 12 position eq switch including a flat position. Priced at $550 the unit is designed for use with the type *W* pressure-only transducer which is available in three versions—flute, piccolo, and screwmount. The *F-350* priced at $350, is suitable for all types of acoustic string instruments and various percussion instruments, and features an LED battery checker with locking on/off switch, a phase reversal switch, and 12 position bass roll-off switch. Finally, FRAP has introduced the *IT-2* single dimensional transducer-preamp system for acoustic string instruments, which features a separately cased IC preamp with a ¼in phono plug output and an integrated transducer connected to the preamp by a 3m lead. Price of the *IT-2* is $88.

FRAP, PO Box 40097, San Francisco, Cal 94140, USA. Phone: (415) 431-9350.

## PZM mics

HHB the UK distributor of the Crown/Amcron range of amplifiers, has announced the availability of Crown PZM mics in the UK. Two models the *PZM-6LP* and *PZM-30GP* together with their associated power supply units are currently available. HHB informs us that a number of PZM mics are available for demonstration purposes.

HHB Hire & Sales, Unit F, New Crescent Works, Nicoll Road, London NW10 9AX, UK. Phone: 01-961 3295.

## BGW 100C power amp

BGW has introduced a new 50W per channel power amp, the *Model 100C*. Designed as a replacement for the *100B*, the *100C* delivers a minimum 50W per channel into 8Ω (20Hz to 20kHz) with a maximum THD of 0.05%. The new power amp is a 19in rack mount unit and features toroidal power transformer; new LED display of channel clipping; separate stepped channel input attenuators; front panel mounted magnetic circuit breaker/power switch; improved front-end circuitry; modular construction; and separate channel heatsink extrusions which are field replaceable. Price of the *100C* is $499.

BGW Systems, 13130 South Yukon Avenue, Hawthorne, Cal 90250, USA. Phone: (213) 973-8090.

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

## IC sockets

Winslow Component Systems has announced a new range of IC sockets which they claim to be virtually indestructible. Suitable for use with automatic insertion equipment the new range feature an inverted leaf contact system allowing careless handling when inserting an IC. Available in two versions—*W3200* with tin plated contacts and *W3300* with tin and gold plated contacts—the sockets are moulded in glass reinforced polyester; are only 0.15in high; and come in a range of contact configurations from 8 to 40 pins. The *W3300* which is suitable for professional applications is 100% anti-wicking and has its contacts totally insulated from surface tracks on double sided pcb's.

Winslow Component Systems Ltd, Southon House, Station Road. Edenbridge, Kent TN8 5LP, UK. Phone: 0732 864488.

## U-matic spindle height gauge

Suitable for use on *U-matic* recorders is the new *U-matic* spindle height gauge from Tentel. Designed to indicate the accuracy of the two spindle heights, the gauge will also check for any flatness error in the four cassette locating pins and will additionally indicate the amount of vertical spindle wobble. The gauge is supplied with an instruction manual and a quantity of shim spacers to adjust spindle height.

Tentel, 50 Curtner Avenue, Campbell, Cal 95008, USA. Phone: (408) 377-6588.

UK: Crow of Reading Ltd, PO Box 36, Reading RG 1 2NB. Phone: 0734 595025.

26 ▶

# Sony microphones. Made by professionals- for use by professionals.

The Sony professional range of microphones have been used extensively in studios throughout the world for many years, and have been recognised for their quality of manufacture and state of the art reproduction of sound.

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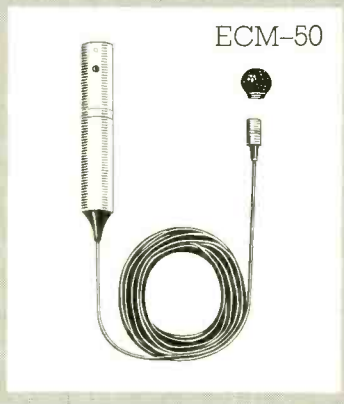
Four types are produced, the FET Condenser, Dynamic, Electret and Back Electret, one for almost every conceivable recording use.

Contact FELDON AUDIO LIMITED for further details.




C48

C-37P

F-560


U.K. Distributors

Feldon Audio Ltd.,

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

MTR-10-2

## Otari new products

Following on from its successful multitrack tape machine, the *MTR-90* (of which over 100 have been delivered worldwide), Otari has introduced a new series of production/mastering professional tape machines designated the *MTR-10 Series*. Available in two versions, the *MTR-10-2* two channel ¼in machine, and the *MTR-10-4* four channel ½in machine, the latter also being convertible to a ½in 2-channel recorder, the series feature modular electronics with both models having two different tape speed combinations of 30/15/7½in/s and 15/7½/3¾in/s. The tape transport features a PLL dc-servo capstan drive with microprocessor controlled spooling, tape speed and tape tension; ±20% stepless varispeed with digital readout down to 0.1%; and a return-to-zero facility. The transport deckplate is hinged for ease of access and the modular electronics are front panel mounted to aid servicing. The modular electronics include direct coupled outputs; transformerless active-balance I/O circuitry; dual independent electronic timers with display in hours/minutues/seconds; built-in test oscillators for 100Hz/1kHz/10kHz sinewaves and 1kHz/10kHz squarewaves; adjustable phase compensation, bias, record and playback levels; and a rear panel interface to transport and time-base functions for SMPTE interlock. Other features include NAB/IEC switchable Rec/Rep equalisation; selectable 3-position reference record-flux levels (320/250/185nWb/m); SRL switches for line input/output, a simple tape path with no swing arms; tape splicing block; selectable edit modes; tape shuttle control; NAB adaptors; and desk-height console fitted with casters. Options include autolocator with 10-position memory and shuttle; transformer balanced I/O circuitry; remote transport control; and remote varispeed controller.

Otari has also introduced a new ¼in 4-channel recorder, the *5050BQ-Series II*. Successor to the *5050QXD* the new machine has tape speeds of 15/7½in/s; motion sensing control logic; selective reproduce; variable speed dc capstan servo motor; built-in test and cue oscillator; and a plug-in head assembly. New features include microprocessor controlled transport; electronic realtime counter with LED display; automatic monitor switching; selectable 20dB mic input attenuator; selectable track headphone monitoring; PPMs on each channel; and separate mic/line mixing on each channel. Other features include 10½in reel capacity; front panel editing and adjustable cue; bridging input; and low impedance output. Options include balanced 600Ω line I/O transformers and remote control unit.

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

USA: Otari Corp, 1559 Industrial Road, San Carlos, Cal 94070. Phone: (415) 592-8311.

UK: ITA, 1-7 Harewood Avenue, Marylebone Road, London NW1 6LE. Phone: 01-724 2497.

## Soundcraft Series 800

First shown at AES New York was the new *Series 800* console from Soundcraft, an 8-group console available in either 18 input or 32 input frame sizes, and with a choice of input and output modules to cater for either studio or PA applications. The standard input modules feature transformerless balanced mic inputs with switchable 48V phantom powering; phase reverse switching; 12dB/octave 100Hz highpass filter; 4-band eq; peak overload LEDs; Penny & Giles plastic conductive faders; 8-group routing in addition to stereo mix; four aux sends; and a pre-fader solo system. The PA input modules have similar facilities but without the 48V phantom mic powering, and with eight individual post-fader group sends and only two aux sends. The recording output modules feature two group outputs and four monitor channels to allow for 16-track monitoring with eight group outputs; individual monitor switching between group output and tape return; meter switching following monitor selection; 30 segment LED meters switchable peak/VU; four aux sends from each monitor section; and pre-monitor fader solo system. The PA output modules feature two group outputs and two effects return channels; electronically balanced group outputs; 30 segment LED meter on each output; two aux send controls; group routing to the main stereo mix via a panpot and 'Sub' switch; 3-band eq in each effects return; panpot signal routing to the main stereo mix; and two aux sends switchable pre/post fader. The master module contains four aux master level controls; talkback selection; and stereo mix and monitoring facilities. A further module option is an effects return module with four effects return channels, identical to the effects return section of the PA output module.

Soundcraft Electronics Ltd, 5-8 Great Sutton Street, London EC1V 0BX, UK. Phone: 01-251 3631.

## People

- George Pappas has been named acting general manager of Axis Sound Studios in Atlanta, Georgia.
- Sony Broadcast has appointed Michael Bennet as manager of its professional audio department.
- Salty Dog Studios, California has appointed Molly Hansen as its studio manager and Brian Vessa to the position of chief engineer.
- Charles Chaney has been appointed publicity officer for the Radio Industries Club.
- Blind Radio Hallam presenter Elaine Harris has joined the ILR station full time with the objective of developing the station's involvement in the International Year of the Disabled.
- Peter Harris of the Music Centre, Wembley, has become the new chairman of the APRS.

## Contract

- HHB has supplied Amcron power amplifiers to the London Palladium, The Venue, and Jethro Tull.

## Agencies

- Otari has appointed Everything Audio, 16055 Ventura Blvd, Suite 1001, Encino, Cal 91436, (Phone: (213) 995-4175) as a distributor for its *MTR-90* multitrack recorder.
- Special Audio Products BV, Amsterdam has been appointed Dutch agents for the dbx range of professional products and the Emilar range of audio components.

## Stereo RF clipper

Surrey Electronics has introduced a broadcast quality stereo RF clipper in a compact 19in rack mount unit. Using the unit the audio input is filtered and a single sideband suppressed carrier RF signal generated. This sideband signal then passing through a symmetrical precision clipper with the wanted sideband only being demodulated. A true peak reading meter displaying clipping allows the signal to be readily set either beneath the clipping threshold or with a known amount of RF clipping. Using this technique it is claimed that harmonic clipping products are completely lost, as are all intermodulation products falling in the opposite sideband region. The unit features *XLR* balanced inputs; input gain adjustable from −10dB to +20dB; switchable pre- and de-emphasis of 0, 25, 50, 75μs; 23kHz, 18dB/octave lowpass filters on the inputs and outputs; RF gain adjustable from unity to +15dB; and switchable metering (input/output, quasi-peak PPM; RF, true peak ±12dB display of clipping point). Quoted specifications include: frequency response 20Hz to 20kHz ±0.5dB; THD for any degree of RF clipping −55dB, 0.2%; carrier suppression −45dB; unwanted lower sideband −40dB; clipper peak level variations ±0.2dB; increase in output level for change in input from theshold to 15dB of RF clipping, 3dB ±0.5dB true-peak (programme); noise −60dBV. A mono version of the RF clipper is also available.

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

## Electronic timers, etc

A new range of electronic timers has been introduced by Highland Electronics. The range includes over 20 variations of universal, delay on energisation, delay on de-energisation, pulse relay, flashing and recycling timers, which enable the most complex of timing requirements to be fulfilled. The timers will operate from 240V and 110V ac or 24V ac, with other voltages available to order. A useful feature is the ability to change the timing range even when the timer is installed by altering the plug-in control modules. The new timers are available in three case versions: for symmetric DIN 32 rail mounting; for panel mounting; and as plug-in units to 8 and 11 pin busses.

Also new from Highland are a series of connectors, designated the *JR4 Series*, available in feed-through, rail-mounted and pcb versions.

Highland Electronics Ltd, Highland House, 8 Old Steine, Brighton, Sussex BN1 1EJ, UK. Phone: 0273 693688.

## Harbeth ML loudspeaker

Harbeth Acoustics has introduced a small companion to its *HL* professional monitor, the *ML* loudspeaker. A compact bookshelf sized monitor, the *ML* utilises a 5in vacuum formed polypropylene coned lf unit and a 1in soft impregnated fabric dome hf unit with a crossover frequency of 3kHz. Frequency response is 70Hz to 20kHz, and the loudspeaker's recommended power handling rating is 40W into 8Ω. Prices are from approximately £190 per pair and adjustable stands are available. Harbeth Acoustics, 2a Nova Road, Croydon CR0 2TL, Surrey, UK. Phone: 01-681 7676. ■

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Sweden **Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel : Gothenburg 130 216
Spain **Mike Llewelyn-Jones** Francisco de Rojas 9, 2 DER, 9 Madrid 10 Tel: Madrid 445 1301

# studio diary

## Good Earth, London

Good Earth Productions is owned by Tony Visconti and can be found in the basement of 59 Dean Street, in London's Soho. Walking into the studio, after the rush and bustle of the West End, is a very pleasant experience. There is an immediate and enveloping feeling of warmth and welcome, and a very peaceful and gentle ambience achieved by the soft lighting and muted colours—beige and brown with pine and bamboo fittings.

The studio itself is very modern and used to belong to Zodiac. In 1977 Tony took over—at the time he had a 16-track studio in a terraced house in Shepherd's Bush, but had found he could only record a maximum of six people at a time and needed something larger. On moving he changed to 24-track and Tony planned the new design and layout of the studio himself. He has incorporated many ideas gleaned from his vast experience of producing in other studios and feels that Good Earth is very efficient for this reason—nothing is superfluous. He particularly strove to create an atmosphere of relaxation and ease—the success of this must be reflected in the creativity he manages to draw out of people.

The reception area is spacious, and leads to two offices, a passageway to the studio, and the control room. The control room is large: before Tony moved in it was used as a junk room. He wanted to have a large control room because he felt that this is where everybody gathers and most of the work is done. It measures 19 × 18ft and is built on three levels. The highest level at the back of the room is fitted out with comfortable and relaxing seating, so positioned that spectators can overlook the console with an unrestricted view of the studio. The console, on the second level, is well-lit and very well stocked with equipment. On the lowest level is the studio which is L-shaped and measures 582sq ft. It is large enough to hold 35 musicians at a time and contains two isolation booths, which measure 14 × 10½ft and 12½ × 12ft. In the corner is a Steinway Grand.

Good Earth has a staff of six people—Tony, three engineers and two girls—who co-operate and take responsibility to ensure that things run efficiently, overlapping roles as necessary. Tony feels that as long as they are all healthy they can cope with anything that might arise—a minimum staff of two must be present when someone is recording.

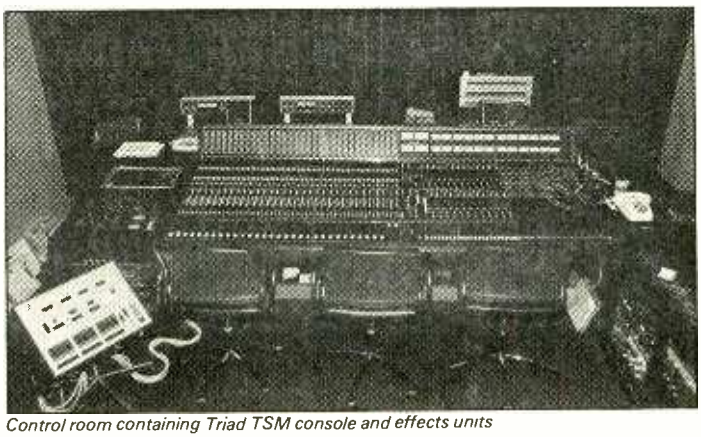
Kit Woolven acts as studio manager and chief engineer and has been with Tony for three years. Previously he was a guitarist with Quintessence, and at one time worked as a porter for Selfridges. He met Tony through a former studio manager, and under Tony's supervision has attained producer status in his own right now co-producing Thin Lizzy, who record all their albums at Good Earth (very satisfied clients!) Gordon Fordyce used to work for John Kongos' studio, and has been with Tony for two years. He has worked with a Virgin band, Cowboys International, and used to work with the Big John Band. Chris Porter came via the redecoration of the studio about a year ago, in which he was involved with other out-of-work musicians. He has sung with many groups over the years, and this month is engineering the new Linx album following on their chart success with *You are Lying*. Tony's personal assistant is Diane Wagg, who looks after everything for him, copes with the financial running of the studio and also runs Tony's two other companies based in Holland and Guernsey. Katie Mitchell has been with the studio for a year and handles studio bookings, invoicing, etc.

Tony himself spends five days a week administrating or recording. He produces abroad a lot with people such as the Boomtown Rats and David Bowie, who don't record much in this country now, but he doesn't like to be away for more than six weeks at a time. He feels that after this length of time morale starts to slip a bit without someone at the helm. He is very pleased with the way his studio works, and because it is so small he knows immediately if anything is wrong and is always willing to share problems.

Leisure facilities are provided for the benefit of people who work here—there is a television room with lots of prerecorded video tapes, including Monty Python, Fawlty Towers, etc; electronic games, pool table, bar billiards, a darts board and playback facilities for listening to recordings in a domestic situation. There are also facilities for making tea and coffee, and of course there is plenty of choice of food in the area—some restaurants staying open until 5am. Next door to the studio there are ample car parking facilities.

All three engineers are involved in producing due to Tony's encouragement and advice; he likes to take in people with little experience, give them the benefit of his own, and allow them to develop their own creativity as fully as possible within the scope of his studio. He has a training programme for teaching new engineers and is at present building a producer's workshop. The buying of new equipment is always discussed and a close eye kept on equipment, updating whenever necessary and Tony is always willing to assess any new idea.

The equipment available includes a well-liked Triad *TSM* customised desk, 32 in/24 out with stereo foldback, full parametric eq on each channel, basic eq on monitoring, and six echo sends. There are three types of monitor speakers— JBL *4333*, powered by two Studer *A-68*s, Klein and Hummel *Telewatts* and *Auratones*. Machines include a Lyrec 24-track tape recorder with full remote control facilities including 100% varispeed, and two Studer *A-80* 2-track recorders, a Studer *B62* 2-track, Studer *B67* 2-track and 2 Revox *A77*s modified with very wide varispeed. There are 14 specialised compressor limiters and expanders supplied by UREI, Allison and Audio & Design Recording. 'Toys' include six different types of digital/analogue delay and *Harmonizer* supplied by Audio & Design, Deltalab and Eventide. EMT *140* and *240* echo plates, and a Quad Eight *RV10* spring echo (for laughs!) provide reverb, and 28 pairs of Beyer *DT100* headphones (with improved frequency response) are used for foldback. Approximately 40 to 50 mics were supplied by Neumann, AKG, Beyer, Shure and Calrec. Full *Dolby-A* noise reduction is available for all tape recorders; two Pioneer *CT-700* cassette decks with adjustable bias control give maximum frequency response on any brand of tape for personal cassette copies. Instruments include a Steinway Grand piano, Minimoog synthesiser, Crumar Jazzman electric piano, Rogers drum kit, Wem 200W valve amp and 4 × 12 cabinet, HH *100* combo amp, plus a large selection of percussion instruments and special effects pedals.



*Control room containing Triad TSM console and effects units*

The huge success of Tony's work is apparent on walking into his office—two walls are covered with platinum, gold and silver discs—he says he has lots more but not enough room to hang them all! His first gold disc was with T.Rex who with Thin Lizzy (among others) helped to establish the studio in the early days—Thin Lizzy providing him with his first platinum disc for *Live and Dangerous*. Now they are a constant stream—David Bowie's *Ashes to Ashes* has just gone gold, and also Hazel O'Connor's *Breaking Glass*. Another great success is of course, Tony's wife, Mary Hopkin.

Tony is justly proud of his achievement with *Breaking Glass*—his first film production. Hazel O'Connor wrote the songs and Tony did all the arranging and incidental music. This is a field in which he would like to get more involved.

The Boomtown Rats are also produced by Tony—their latest album was recorded in an isolated studio in the north of Ibiza—Ibiza Sound. The Boomtown Rats were the first major British group to work at this studio, which is owned by a German and has 46-track capability. Ibiza Sound has no mains electricity but relies on two generators, which means candlelight after daylight hours when nobody is recording! Neither is there a telephone—which caused a bit of a problem for Tony trying to keep in contact with his studio at home as he had to travel to use a telephone, and then wait to be able to use it! However, he enjoyed his stay and would like to record there again.

Other recent work includes David Bowie's *Scary Monsters* produced by Tony at the Power Station in New York—someone he appreciates working with because he rarely interferes with the production but trusts Tony's judgement, commenting only if he feels very strongly about something.

Tony used to produce six to seven albums a year but has now cut this down to about three. The studio used to be an all-purpose studio but he found that the amount of business brought in from jingles wasn't worth getting up at 7.00 to do, and they now primarily produce rock. He receives about 30 to 50 cassettes a week from hopefuls—but can't listen to them

30 ▶

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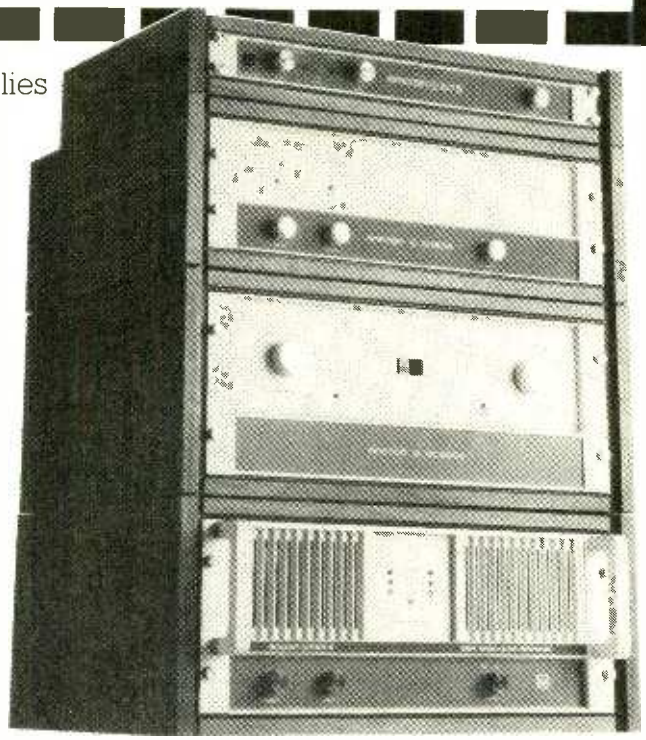
Nevertheless, you'll find that in most cases an Amcron amplifier will cost you only marginally more than an indifferent alternative.

And that, in the long run, the matchless reliability of Amcron engineering will actually save you money on servicing and repairs.



Amcron

Control room

## Kapco Sound, New Delhi

The recording industry in India is still using obsolete equipment, even though it has become a major industry. India is the world's largest producer of feature films—the only source of entertainment for a population exceeding 650 million people. Whilst the cinematographic industry has progressed rapidly with the availability and use of the latest cameras and printing equipment, the situation is quite the reverse in the audio field. Recording is still being done on 35mm sprocketed magnetic film and is confined to a maximum of four tracks. Very few studios in India are properly equipped but with the present stress on industrialisation by the Government, India is fast emerging as a major market for professional audio equipment. In fact, Kudelski of Switzerland has already entered into a collaboration agreement with a Government enterprise, Meltron, to produce the famous Nagra recorders in India. Studer has also reportedly agreed to allow their models to be manufactured in India.

The recording studios of India can be broadly classified into two groups. Either the studios are designed for and engage in film recording work or they are predominantly designed for production of radio commercials. The latter form the group of smaller studios using ¼in format. There is not even one 16- or 24-track recording studio in India, but next year will witness the emergence of a major studio which will be 24-track and 'automation ready'.

The studio, Kapco Sound Studio, is presently a 2-track stereo operation owned by K K Kapoor. Kapco has several firsts to its credit. It was the first studio in New Delhi and was constructed in 1970. It is the only centrally air conditioned studio in North India, which is a big asset in the summer season with temperatures touching 45° Celsius. Trident Audio Developments have sold their first piece of equipment to the studio—a stereo compressor limiter. Ken Bray, sales manager of Trident, was in New Delhi recently and witnessed the installation of the unit. Thus Kapco has become the first studio in New Delhi to use compressor limiters! Trident has also appointed Kapco as their sole agents in India for their products. This appointment has great significance because with Studer being locally available and with strong agency representations by Ampex and MCI, Trident were one of the few major companies who were not represented at all. In fact, a visit to a few studios in New Delhi by Ken Bray and Sunil Kapoor, recording engineer at Kapco, has evoked considerable interest and there is a possibility of equipping quite a few studios with Trident mixing desks. The *Fleximix* series is ideal for the average Indian studio which is generally equipped with Japanese machines.

Equipment at Kapco comprises an Ampex *AG-440,* four Ferrograph *Series 7* recorders, and an Ampex 6-channel mixer. Ancillary equipment includes a Yamaha analogue delay unit, Enbee graphic equaliser, and a Grampian spring reverb unit. The microphones are AKG, Sennheiser and RCA *77DX* and *BK-11* for rhythm. The studio also produces a series of pre-recorded cassettes under their own label and have quite a few artists under contract. The duplicating machines are Electro Sound-Viewlex in-cassette duplicators. The cassette mastering is done on a pair of Nakamichi *582* cassette decks. No noise reduction is being used presently.

The expansion programme is twofold. The first phase envisages a complete gramophone record manufacturing facility using a Neumann *VMS70* cutting lathe, silver plating plant from AB Europa Film, Sweden, and presses from Toolex Alpha, Sweden. The mastering machine will be an Ampex *ATR-102* with *ADD-1* digital delay for preview. The equipment has been ordered and is expected to arrive at Kapco's factory by March '81. The arrival and commissioning of this operation will mark the studio's entry into the Indian music industry as the fourth major company. The record manufacturing facility is to be housed in a factory situated 150 miles north of Delhi, amidst extremely pleasant surroundings. The place is called Parwanoo and it is a little hill town amidst the Himalayan mountains. The covered area of this factory will be in the region of 9000 sq ft when constructed.

The second phase will see the construction of the first multitrack studio in India. The 24-track operation is expected to be ready by mid 1981. The equipment expected to be installed is a Trident *Series 80* (automation ready) console, and a Trident *TSR* 24-track tape machine. Ancillary equipment will include an Ursa Major *Space Station* effects unit, UREI graphic equalisers and compressors, limiters, Eventide *Harmonizers*, Aphex *Aural Exciter*, *Scamp* system, dbx noise reduction Lexicon *224* reverb, ADR *Compex-Limiter, Kepex* & Roger Meyer noise gates, and a Klark-Teknik *Analogue Time Processor*. The microphones will be a choice of Neumann, AKG, Sennheiser, and Beyer. The mixdown machines will be Ampex *ATR-100* and *AG-440*. Amongst the portable machines will be a pair of Revox *B77*s.

For overseas customers, a series of package deals will be available and accommodation will be provided. The business is managed by a board of directors and K K Kapoor is the managing director and also the founder-owner of Kapco. The technical aspect is handled by Sunil Kapoor whilst Anil Kapoor handles the marketing.

**Sunil Kapoor**

Kapco Sound Studios, Flat 5-B, Shamkar Market, Connaught Circus, New Delhi-110001, India. Phone: 43718.

## Good Earth cont'd

all. He listens to recommended ones, the latest of which are The Photos. They sound as if they can't miss—Wendy Wu, the lead singer, according to Tony sounds like Debbie Harry, and the guitarist gets his inspiration from old David Bowie and T.Rex numbers. They are a young band, all under 20, and write their own songs. Tony was very impressed when he listened to them but felt that their production was weak and they would benefit from his help and experience (more gold discs?).

The greatest discretion is maintained at the studio when well-known people are recording—their anonymity is respected if they don't wish it to be known that they are there. Normally the chauffeur will stop outside the studio, ring the bell to say who's arrived, and then whoever it may be slips out of the car and into the studio without attracting any attention. On one occasion though, when David Bowie was re-recording *Space Oddity*, a teenager happened to discover this, and within an hour there were about 40 of them hanging around the studio doors. Fortunately David managed to make his exit via a back entrance.

Tony has another possible contender for great success in the future—his son Delaney, who could engineer at the great age of 2½, knows all about mixing and is, according to his Dad who in this respect must know best, a genius. Delaney has been in on the production of many a hit record and has actually formed a group with David Bowie's son. The two of them should make quite a formidable combination in the pop world—they're waiting to be signed up if anyone's interested! The two boys did make a tape which they engineered and produced themselves—Tony was relegated to providing the backing and accompaniment. His daughter Jessica is no less talented; she has inherited her mother's lovely voice, and plays many instruments.

Tony has also entertained pupils from his children's school at the studio. He recorded the school orchestra and gave the tape to the school—and also demonstrated the effects of the *Harmonizer* to them, using the headmaster's voice which must have caused lots of merriment. The children were able to play around with the equipment—much more fun than a normal singing lesson.

All in all a unique studio and a unique man. Tony has no plans for expansion of this studio—he is very happy with things as they are and has no plans to computerise: he prefers traditional methods and a lot of personal involvement. With the way things are, and only carrying a small staff, his overheads stay fairly low and therefore he manages to keep his rates down—below £50 an hour for recording—and his clients are getting a first-rate service. He believes in supplying an inexpensive service and wants to help young engineers advance, and for this reason would like to build another studio further out of town—he would dearly like to find an old church or cathedral for the ambience, so if anybody knows of one out of use . . .

**Harry Mangle**

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# Affordable Technology

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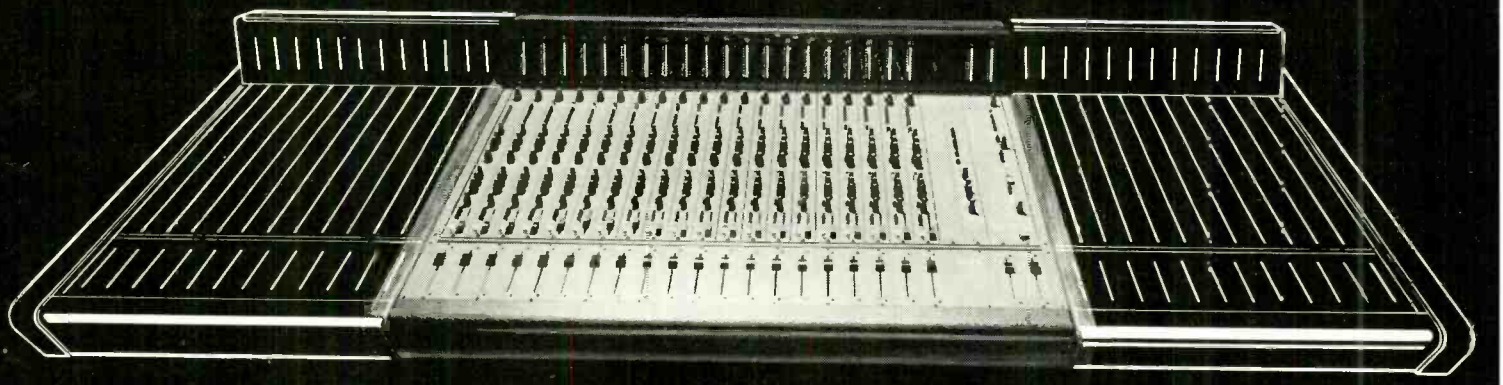

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## Phonotype Record, Naples

Not many studios in existence today can boast of having been founded in 1901 and still remaining in the family, as can Phonotype Record in Naples. Launched by Raffaele Esposito, the Società Fonografica Napoletana was among the first (if not the first) record producers in Italy and was very soon to become Phonotype Record in accordance with its disc labels. Right from the beginning, Phonotype was a complete service doing recording, pressing and distribution on its own label and even at one point sold gramophones of its own manufacture for the then princely sum of 360 lire. Over the years the operation of the company has remained much the same and today Phonotype is in the process of installing a large new pressing plant just outside Naples in a purpose-built building with room for a brand new studio which will, to use a popular phrase, be 'state of the art'. The complex when completed will thus be able to offer recording, mastering, cutting and pressing all under one roof, as well as being out of the traffic and in the countryside.

Entering the control room, the first impression is one of functionality and the whole atmosphere recalls British studios in the Sixties or early BBC studios. Acoustic treatment consists of tiles and panel absorbers and whereas the room is quite pleasant, there are no frills. Space is not too much of a problem, either, as the room did not seem unduly crowded with about 10 people in it at one time between takes. The console is a Cadac *24/16* (fully quad capable) and also has some Cadac compressor modules as part of the desk. The right wall of the control room is lined with recorders and these include a Studer *A80* 16-track (which is 24-track prewired should they feel so inclined), *A80* 2-track for mastering and some Telefunken *M10*s for workhorse duties such as copying, etc. There is even an old Telefunken 8-track left over from earlier days but which is still in perfect operating condition. Monitoring is on JBL *4333* speakers set fairly high up either side of the control room window and angled down more heavily than is now usual to converge at the mixer's seat. Power is courtesy of McIntosh and equalisation by UREI room graphics. Outboard equipment in the mobile racks includes UREI ⅓-octave graphics, *1176* compressors, *545* parametric equalisers, Astronic graphic, Eventide *Instant Flanger* (which I suspect will soon have the *Instant Phaser* card as well), MXR DDL, Dynacord digital reverberation, with additional echo from the omnipresent AKG *BX20*. Record playing is no problem either, as there is an EMT disc player. For those who like a light show with their music there is also an Inovonics analyser on hand to monitor programme content. For older equipment enthusiasts there is even a rather old Klein & Hummel selective equaliser which is rarely used now due to the fact that it is fairly noisy. The studio has also just acquired an ADR *Vocal Stressor* but as yet have not had much opportunity to play around with it. It is also worth mentioning that the control room has fully stabilised power supplies for 220V and 115V.

*Raffaele Esposito, studio manager, and Renato Tramontano, chief engineer, happy in their work!*

Come out of the control room, turn right down a few steps and there you are in the studio. Once again, the feeling is of a large BBC or broadcast type of studio—what I tend to describe as the 'Sixties' feel. Not that this is really too surprising considering that these premises were built around 1964/5. The studio is quite spacious, roughly 50 x 15ft with a ceiling height of 16ft. Though the impression is of a square room, no two sides are parallel. In addition to panel absorbers, the ceiling has an 'uphill-and-down-dale' configuration while two of the side walls have either cylindrical or triangular vertical surfaces, all of which provides good dispersion. The studio was built with large orchestra recording very much in mind and the only concessions to modern close mic techniques have been the additions of high, mobile acoustic screens and a drum booth that has been built into one corner. The studio has a good selection of instruments including Steinway concert grand and standard grand pianos, large Hammond with Leslie, celeste, spinet, marimbas and vibes, tympani and drum kit, plus Yamaha preset synthesiser in the control room along with an ARP string ensemble (or Solina, if you will). Foldback to the studio is by headphones and/or Altec *Voice of the Theatre* speakers that were the previous control room monitors. As far as microphones are concerned, Neumann are by far the front runner with a large collection of *U87*s and *U47*s, the latter being of both the valve and FET variety. One amusing little anecdote is that when I told Phonotype that some studios would give their eyeteeth for such a collection of *U47*s, their reaction was one of surprise and that they hardly ever use the four valve *U47*s now, only the FETs for brass instruments now and again! I noticed a pair of *KM86* being used for the small grand piano. For the drums, in addition to Neumann, Schoeps *Collette* series for overheads and a Telefunken for bass drum. In fact as I was later to hear, the drum sound was very good indeed, with quite an exceptional bass drum sound. Though how much of this is due to the mic, drum, drummer, etc, is difficult to say, at least it shows that the mic can handle it. Acoustically, the studio had a nice feel of 'spaciousness' about it with no disturbing echoes, the reverb time being fairly low at around 0.8 to 0.9s.

Last visit on the list was downstairs to a former small studio that has been converted into a cutting room. Here the equipment is pretty much what one would expect with Studer *A80* preview recorder, Neumann lathe and Telefunken desk, ADR *Compex* stereo limiter/compressor and another Inovonics analyser. Monitoring is by Telefunken loudspeakers. The acoustic design is along the same lines as the rest of the studio—panel absorbers and geometric deflectors, etc—with a low reverb time. The room also contains a grand piano for use in certain recording situations, the mic lines going through to the control room upstairs.

At the time of my visit, the studio was doing sessions for Italian TV, RAI, in the form of backing tracks for a forthcoming series of shows. In the morning I was able to listen to the rhythm tracks going down and in the afternoon the brass tracks. The brass session consisted of three trumpets, two trombones and three saxes with *U87*s for the trumpets, *U47* for the trombones and a mixture of *U87* and Schoeps for the various saxes. An interesting feature was several *U87*s placed behind the players as ambience mics. The sound in the control room was extremely lifelike with a very good stereo image and what can only be described as big, wide sound. Though a multimic technique was being used, the result was such that the instruments were not uncomfortably close and at this stage no echo was being added for monitoring.

I had a chance for a chat with chief engineer, Renato Tramontano, who told me that he prefers to get a good rhythm sound down on tape to start with so that he doesn't have to worry about it any more at mixdown, ie, no 'fix-it-in-the-mix' attitude. The effects rack also has a couple of Siemens compresssor/expander modules and one of these is used almost exclusively for bass guitar with good results. When asked about his preference for Neumann microphones he replied that he liked their flat response and prefers to do sound tailoring at the console rather than with different mics. His main complaint about the type of work that is done at present in Phonotype is that there is little or no chance of experimentation with equipment or techniques. It is common for albums to be done in two to three days and singles—both sides—in a day! One might gather from this that the working atmosphere is one of pressure but in fact it is just the opposite with everything being very calm and relaxed and no 'busy-busy'. At the same time this can be deceptive as the work is done, almost without being noticed, which seems to me to be a nice way to go about things.

Most of the work done by Phonotype at present is Neapolitan 'folk', which is the traditional melodic song style of Naples, and disco orientated middle-of-the-road, with just a smattering of rock. In addition the RAI tends to use the studio quite a lot when its own are getting a bit saturated. Well known Italian artists include Claudio Villa, Gianni Nazzaro and Mario Merola. In addition well known concert piano teacher, Vincenzo Vitale, has had his pupils from his school in Naples make recordings from the classical piano repertoire. With the present clientele the attitude is to spend as little time as possible in the studio and if it sounds all right why bother with fiddling around for different sounds. With the new studio project, Phonotype look forward to enlarging their custom with the rest of Italy and from abroad. My thanks again to all mentioned above for their warm welcome and a jolly good lunch! **Terry Nelson**

Phonotype Record, Via Enrico de Marinis, 4, I-80134 Naples, Italy. Phone: (081) 314.140 or 322.694.

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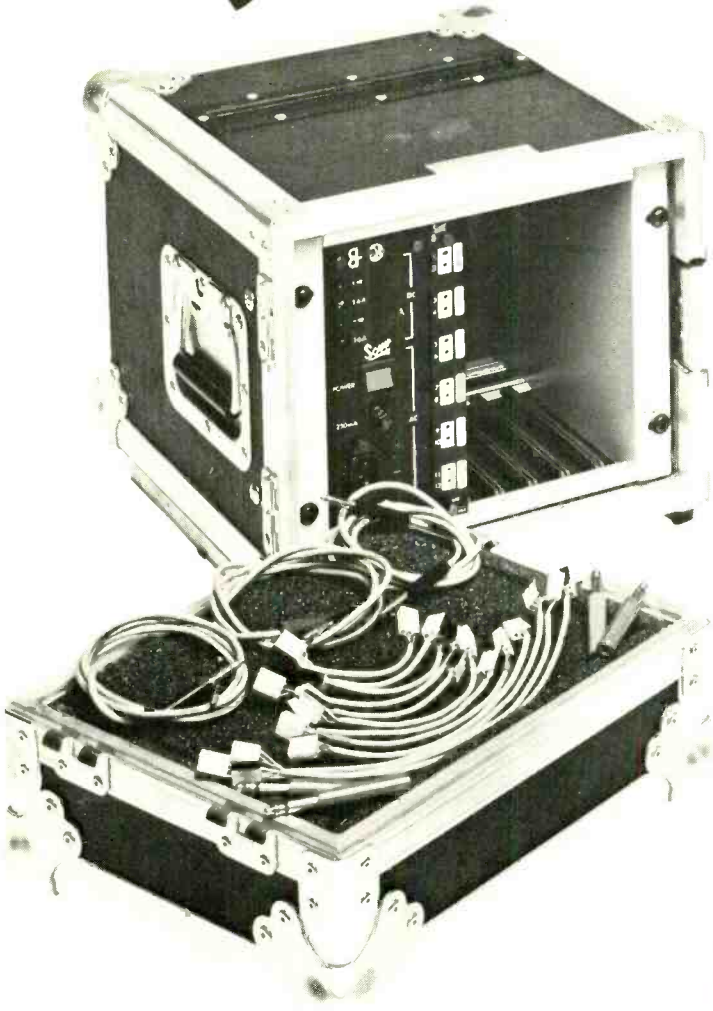
# Now there's a Scamp System for everybody.



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## West Coast Wander—the LA Recording Scene

How successful are demo and 'budget' recording studios in Los Angeles, compared to those in Britain? Kitchen Sync on Sunset Boulevard and Music Lab in East Hollywood are two low-priced studios that specialise in 8- and 16-track high-quality demo and session work. Both studios give every appearance of making a respectable living, and have one or two ideas about the future of the recording industry.

"Something happens to bands in Los Angeles when they get a deal", offered Ian Michael Hamilton, co-owner with two musician friends of Kitchen Sync, a small 16-track studio located on Sunset Boulevard in West Hollywood. "I've worked with several bands who've come in here, liked the place, and produced a good demo. Then all of a sudden they're stars; and it's a matter of their careers being on the line: the Big Chance. They've got to have a 'name' producer and use a 'name' studio that's got gold records upon the wall. I've listened to their mixes, some have been a bit better, some a *lot* worse but still they go back to those places for their second album. So all the time you're fighting this star mentality that goes on around Hollywood."

Kitchen Sync started life as a 4-track garage studio run strictly as a hobby. Ian and his partner Larry Menshek began to hire the place out for $5 an hour in 1976, to cover their out of pocket expenses and the studio mushroomed from there. In early '77 Ian and Larry took on a partner, Jeff Snyder, and moved to their present location. Since then Kitchen Sync has upgraded from 8-track on ½-in to the possibly headier world of 16-track on 2in: MCI *JH-110* multitrack, Soundworkshop *Series 1600* console and Ampex *ATR-100* mastering machine. (But they also hung on to their original Teac *80-8* ½in machine for bargain-basement demo sessions.)

"We never really sat down and said let's start a studio and become moguls in the recording industry," Ian explained. "It was just a hobby. We've always tried to keep that attitude: do a good job and have fun. Kitchen Sync built its reputation on being a cosy, intimate studio, without any pressure on the clients. It also helps that all three of us are personally involved with the studio as owners."

The recent upgrading from 8- to 16-track, while perhaps inevitable, has enabled Kitchen Sync to get into some bigger projects with bands. "You've got enough room on the tape to spread the drums out, and then work with a basic set of tracks before adding background vocals and overdubbed solos. Sixteen has a lot of advantages over 24-track—basically because of the wider track format. You can burn it hot and don't have to worry about the noise reduction. All the 24-track tapes I've heard, sound squeezed, and you don't have to worry about headroom; you really do need dbx or Dolby.

"We've got plans to expand to 24-track, eventually, but I'm not in any great hurry. There must be 30 to 50 such studios in Hollywood already. I went to retain a unique identity and keep a personal involvement with the tapes. I think there's room for that, even in this jaded town."

Session time is split roughly 60:40 between singer/songwriters recording demos for publishers and record company (A&R) types, and bands wanting to lay down high-quality, pre-production demos, plus the occasional low budget single or album session. The studio's recording gear is being leased rather than purchased outright; so as long as the studio can pull in at least the $3700 a month required to keep the doors open, Kitchen Sync intends to stay in business. Ian and his partners in the studio may never make it fabulously rich but at least they retain their independence.

Across town in East Hollywood, Chaba Mehes, owner of Music Lab studios has a similar attitude to giving the customers what they want at the right price. "Moderate prices for the professional," is his motto, he has two studios both equipped for 16- or 24-track recording. Studio A is MCI-equipped throughout, while Studio B across the street, in what was formerly an American Legion hall, has a Tangent *3216* console linked to an MCI *JH-110* with interchangeable head block. Each studio has an excellent selection of sound benders, microphones and musical instruments available free of charge.

Chaba isn't hoping to attract the bigger bands although obviously he wouldn't turn away such work. He'd rather try and help the newer groups. "Instead of waiting for a record company to come up with the money," he feels, "why not let the individual invest in himself if he feels he has something to offer? Even with only $500 to $1000, a band could walk away with a couple of well-mixed songs that they can give to a producer. They might end up with a deal as a result, and can then come back to Music Lab under the record company's umbrella."

Music Lab will bend over backwards to give a band its first step on the recording ladder, at a price that shouldn't break the bank. Bands can use credit cards to pay their bills; Chaba will even take musical instruments and PA gear in part payment, or as a deposit against recording charges. He also has a flat fee of $25 to transfer a ½in multitrack to 2in tape, and by using freelance recording engineers, he only needs to charge 6% Californian sales tax on studio time and not the engineer's fee. To provide cover on sessions, Chaba has a pool of qualified engineers on which he can call. He will only recommend engineers who have at least four years experience in both PA *and* studio work. "The PA side is important," he says, "because a band can gain from that knowledge. Some bands like a nice live sound, so an engineer has got to be familiar with the sort of mics a band might use in their act, and the kind of sound they want." Engineers who work at Music Lab must also be musicians themselves. Chaba doesn't demand that they be virtuoso performers, but they must be able to communicate with groups on the same level.

*Kitchen Sync control room*

These days, Chaba feels, it's not enough for a studio to simply offer recording time. Apart from running his own production company, which is always on the look-out for promising bands, Chaba also plans to develop his own in-house video facility. With well over two million video cassette and disc players currently in use in the USA, he foresees a blossoming market for video recordings of bands.

The quality of any production—be it video or audio—is always important, he stressed. "If I was a producer listening or looking at a demo tape, I'd be wondering how much thought went into this piece. A good production gives the producer a better chance of looking into the artist's mind, and seeing what they are capable of. The music may win through in the end, but the packaging is still important."

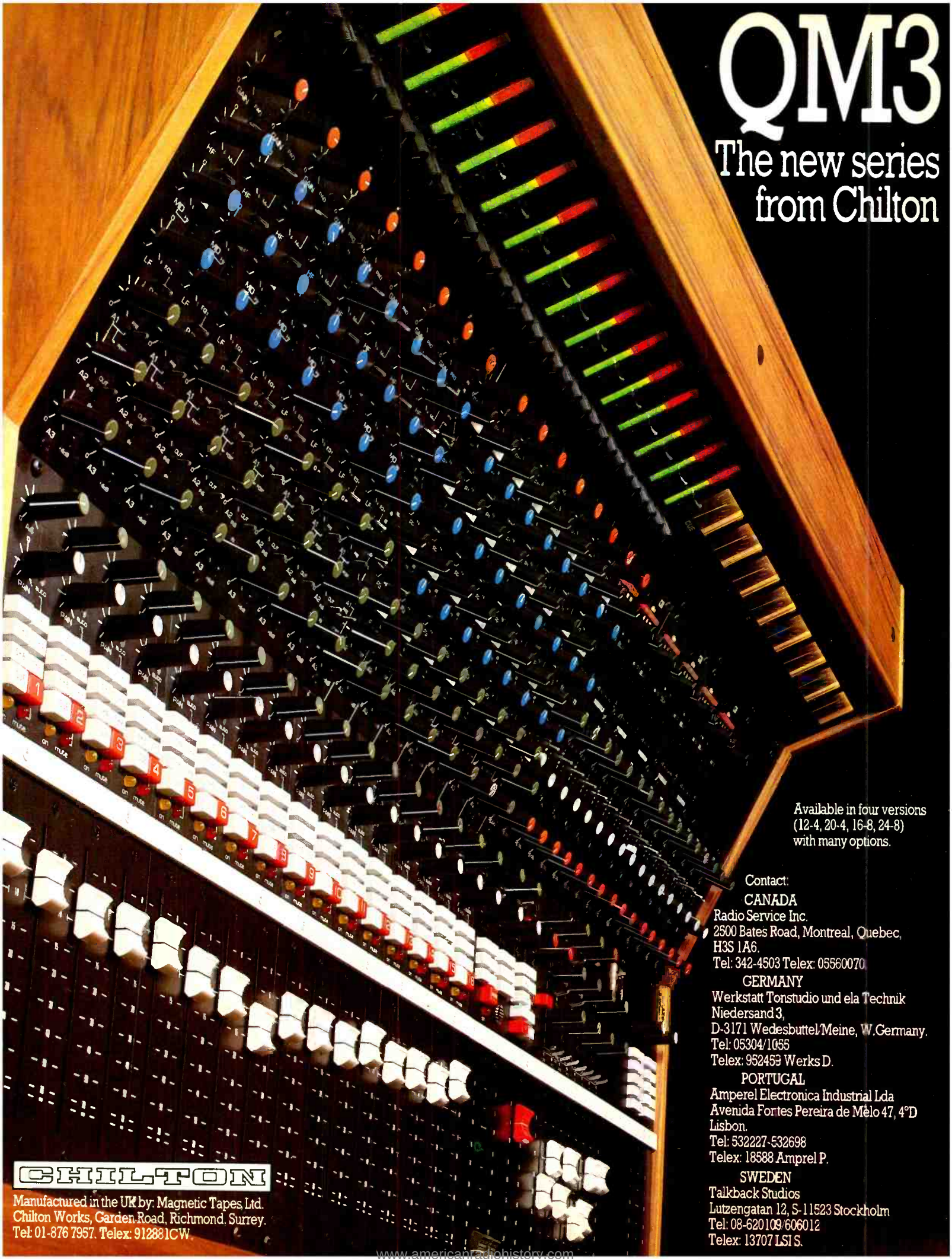
Another area in which Chaba's studio in tends to develop in parallel fields to audio recording is through the Music Lab Institute of Audio/Video Engineering. Starting in early July of this year, Chaba began classes for between 40 and 50 part-time students, taking courses in all aspects of audio and video production. He wants to keep the classes small—no more than 10 people together in the studio or classrooms at any one time—and he hopes to run up to five classes concurrently. This will allow students working during the day to attend evening sessions, or put in their time in the studio at the weekend. Chaba has also set aside some space for a small 8-track demo studio where students can gain hand-on experience of recording techniques.

One of the Music Lab Institute's main aims is to bring fresh talent into the recording industry. As Chaba explained: "It's almost impossible these days to get a job as an engineer. A lot of young people may not stay in the industry, but would still like to find out more about it. At least a school will give them an opportunity to decide whether they want to follow through.

Both Ian Michael Hamilton and Chaba Mehes give every indication of having their fingers firmly on the pulse of what's happening on the West Coast. With less money around these days for lavish and expensive production, Kitchen Sync and Music Lab place particular emphasis on offering good value for money, providing a relaxed and friendly recording environment, and at the same time are making sure that they keep a weather eye on future developments. That's the name of the game is a studio wants to survive the precarious conditions facing most of the recording industry.

Kitchen Sync Recorders, 5325 Sunset Boulevard, Hollywood Cal90027, USA. Phone: (213) 463-2375.

Music Lab, 1831 Hyperion Avenue, Hollywood Cal90027, USA. Phone: (213) 666-9000. **Mel Lambert** ■



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# Understanding noise in mixers

Ted Fletcher (Alice)

**Of all areas of study in sound recording and broadcasting, noise is one of the most important and least understood by the practical engineering fraternity. This is almost certainly due to the attitude of the more esoteric of us who write learned articles swathed in symbols, attacking the subject head-on from a pure maths direction. A practical engineer hardly needs this depth of knowledge—he is interested in knowing the basic physics, the physical limitations and how to get the best practical results. As an attempt to satisfy these requirements the subject is now to be stripped of its mathematics and discussed in terms that are (should be) familiar.**

IN a control room, if one sits very quietly and lifts the monitor level with no signal present, noise will become apparent. This will be a combination of the following three types of noise.

1. **Thermal noise**
   Called 'thermal' because it is temperature dependent—if the temperature is lowered to absolute zero, it disappears. This is noise generated by molecular motion within a resistor (or anything with resistance). It is a constant value of noise proportional to the value of the resistor and the temperature—although at 'normal' temperatures there is very little variation.

2. **Self-generated amplifier noise**
   This includes shot noise, Johnson noise, i/f noise and all nasties that happen within audio amplifiers.

3. **System noise**
   Hums and buzzes that occur within or between pieces of equipment.

The reduction of noise is intimately tied in with the study of levels which can most easily be seen by looking at **Fig 1** which is a typical audio path from microphone to monitor loudspeaker.

Start by substituting a 200Ω resistor for the microphone. This resistor has an inherent noise of −129.6dBu (voltage value) at normal room temperature and when measured rms between 20Hz and 20kHz. (The computer program to calculate the noise in a resistor is listed at the end of this article for the benefit of name-dropping engineers with time on their hands.)

With the assumption that 70dB gain is necessary for the microphone, then the minimum noise physically possible at the line output attributable to the resistor will be (−129.6+70) or −59.6dBu. This seems bad—but there is worse to come. The mic amp itself has a noise factor. This is quoted as the number of dB above the lower theoretical noise limit and, until very recently, has been in the order of 3dB for very good amplifiers. With careful design and new devices, this can now be improved to approx 1dB (see **Fig 2**).

This mic amp makes use of the high input impedance characteristic of the *NE5534* to avoid loss of signal and the bi-polar transistor input arrangement of the device to optimise the noise characteristic of the amplifier. The theoretical noise factor of the system is 0.9dB at high gain settings and this is approached very closely (figure based on *NE5534* published specification).

With this amplifier in circuit, the output noise is degraded by about 1dB so that we are left with −58.6dB. The signal then goes through an equaliser where the noise contribution should be insignificant. This is because the output of the mic amp is low impedance and applies a short circuit to the equaliser input. The equaliser noise should be around the −100dBu mark, so that allowing for a level of −5 signal, the additional noise component is below −90dBu. Similarly the buffer amp contributes little. A well-designed line amp should approach its theoretical noise limit (approx −110dBu for 5kΩ input impedance) which again adds little to the basic noise of the system. The next significant noise generator is the mixing amp which, in the majority of mixers, uses the current-mixing or 'virtual earth' principle. This system is delightful in its simplicity but has the distinction of increasing its own gain automatically to compensate for the

number of inputs hung on to it. Thus a 10-input mixer stage has 20dB more gain than a single input into the same amplifier. Strangely, the value of input resistor used is not very critical and luckily modern high performance integrated circuits are very happy when used in the 'virtual earth' mode and return noise figures of about 8dB (8dB worse than the theoretical figure of approx −108dBu) so that a 10-input mixer has a noise capability of approx −80dBu when operating at an input/output level of 0dBu. When related to the noise generated by the microphone system, this is still insignificant as, since noise is not coherent (each separate noise generator being completely random), the noise is not simply added. To be a little mathematical, for random noise, a useful sum is:

$$\frac{\text{rmsNV'A'} + \text{rmsNV}}{2} = \text{total rms noise}$$

(NV: noise voltage)

After the mix amp, the signal is processed through a series of amplifiers right through to the loudspeaker where a large voltage gain is introduced and the impedance is modified to drive the loudspeaker itself. Noise generated in this system should be well below that of the mix amp.

Having been through the system, it is now obvious that the largest single noise contributor is the mic amp system and the worst part of this is the microphone (or dummy load) itself. If a microphone has a resistance element of about 200Ω, then the figures given apply in practice. However, there are some microphones—mostly ribbon types—whose impedance is heavily inductive and so they have very small resistive components. This is why it is possible to 'beat the system' and produce extremely quiet speech recordings using ribbon microphones which, although their output is low, have extremely low inherent noise.

## Measuring noise

Noise is by far the most difficult parameter to measure in a sound system without resorting to a well-equipped laboratory: however, a few words of warning will help to avoid the more serious pitfalls.

Firstly, what are the units of measurement? There are three ways of quantifying the noise: rms, peak and average. Rms is technically the most exact, as an rms meter will accurately convert the random form into a predictable value. The peak method is used in broadcasting and is written around the use of a standard PPM. 'Peak' is a misnomer as the PPM in reality indicates a very fast average. The average method is the easiest and produces meaningful results which equate well with the rms system provided that the noise is close to pure white noise.

Secondly, noise is present over all frequencies so that the range of frequencies it is measured over has a significant bearing on the reading obtained.

Thirdly, and probably obviously, the frequency response performance of the circuit under the test has to be significantly flat over the range being measured otherwise the readings will be worthless. To take a mixer noise measurement, the system gain must be accurately set. This is done by applying a tone to the mic input and setting the level at say −70dBu by measuring across the input with the tone connected. The mixer output is then adjusted to exactly 0dBu: this sets the gain of the test path to exactly 70dB. The tone is then removed and replaced by a resistor of known value (say 200Ω). The output of the mixer is then measured on an accurate meter and, provided that the meter is reading between the limits 20Hz to 20kHz, the readings will be (for a healthy mixer) approx:

−48dBu peak;
−57dBu rms;
−58dBu average.

It is then interesting and instructive to apply a short-circuit to the input and measure again. This gives a good indication of the noise factor of the mic amp, which varies little between input loads of 200Ω and short circuit.

If the second measurement is significantly (6dB) better than the first, then the amplifier has a good noise factor. The closer the two values, the poorer the amp—showing that the noise contribution of the amp is greater than the resistor. In general practice a noise factor of 5dB is adequate for music recording but speech recording is more demanding.

## Microphone types

It must be remembered that the above hardly applies at all when capacitor mics are used. A very instructive experiment was carried out recently to compare the practical noise performance of a good moving coil mic (Beyer *M201*) and a good capacitor mic (Neumann *U87*). After careful setting up in anechoic conditions, for equal system gain the moving coil unit was 3dB quieter than the capacitor unit. This is no reflection whatsoever on the Neumann microphone which is the world's best for many applications—it merely goes to prove that things are not always what they seem! The capacitor mic has its own head amp with its own noise problems—these invalidate the careful measurements mentioned earlier.

FIG.1 UNDERSTANDING NOISE
TYPICAL AUDIO PATH FROM MIC TO MON LOUDSPEAKER (ALICE ACM SERIES)

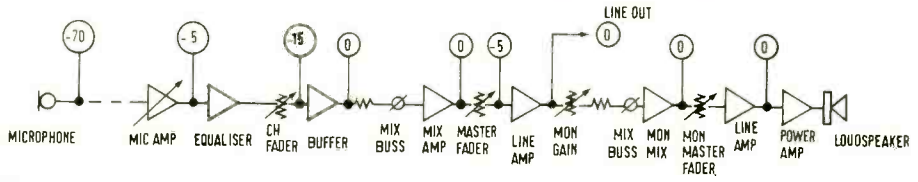
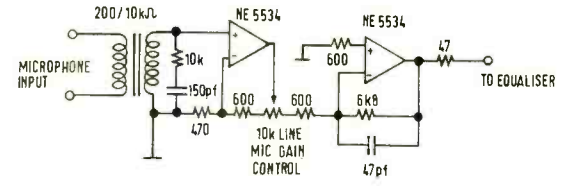



FIG.2 UNDERSTANDING NOISE
MIC AMP NOISE FACTOR REDUCED TO 1dB




## Line level operation

When a mixer is operated in 'line in' condition, the noise swamping effect of the mic amp is removed and the other noise generators become important. Luckily for mixer manufacturers, other noise generators in the form of tape noise or gram preamps do the swamping. Ignoring these, the predominant generator is the mix amp which happily sits at around the −70 mark even in large mixers. This represents a S/N ratio of 78dB in tape recorder terms—insignificant beside tape noise but starting to intrude where dbx is used. Unfortunately, until digital systems are perfected, this represents the limit of physics and if this level is found to be annoying, then the listener was born 20 years too early!

To get the best performance from a mixer, one must be aware of its limitations in respect of noise, overload and distortion. Modern mixers make use of integrated circuits which have extremely good distortion characteristics up to the point of overload, this overload point being governed by the voltage of the power supply. Commonest voltages are 24 or 30, which allow audio signals up to +19dBu and +21·5dBu respectively. Unless transformers are used, these levels are absolute limits.

In the system block diagram **(Fig 1)** the output from the mic amp is shown as −5dBu. This gives an overload margin (assuming 0dBu as the standard level) of 5+21.5dB=26.5dB. This is considered as a minimum for mic amps to allow for transient overloads. Once through the channel fader level control, the level is increased to 0dBu in order to hit the mixing buss with the highest possible level. This minimises mix amp noise and allows a 21.5dB overload margin. Line-out level adjustment is made in the output line amp where gain is made up to +4dBu (for VU operation) or held at 0dBu in broadcast applications.

Overload margin in the line amp is least important as its output is fixed to the outside world in the form of tape machines (overload margin about 14dB) or power amps (as low as 12dB). Lowest mixer noise performance is obtained by operating all circuits and systems at as high a level as possible while being aware of how close to overload they are.

It is quite legitimate to encroach into the overload regions when signals are well controlled—much music can be pushed through the mixer with the meter needles hammering the red. This noise saving technique can only be adopted with care—remember that the VU meter can under-read peaks in the human voice by up to 12dB and French horn by up to 20dB. (Most electronic instruments also have nasty characteristics like that.)

## Recognising noise problems

Thermal noise—the noise that no-one but cyrogenic experts can do

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# Understanding noise in mixers

anything about—is instantly recognisable because of its wideband purity—a continuous and steady rushing sound with no predominant frequency.

Self-generated amplifier noise can take the form of random low frequency 'bumping', usually an effect of an inferior or faulty integrated circuit or leaky electrolytic capacitor, or various noises with 'character'. These are often ramifications of instability outside the audio band.

Hums and buzzes can be generated within the mixer by poor power supply regulation and current architecture, but are much more likely to be caused by incorrect earth paths associated with equipment connected to the mixer. The golden rules are that for unbalanced equipment, the earth path must follow the signal—screened leads grounded at both ends. For balanced equipment, let the mains earth take care of everything and connect with screened twin cable with the screen only connected at one end (except for microphones of course). For low noise work, microphones must always be balanced and should be connected with good high density screened cable.

Now for the computer program. This was originally written for the Ohio Scientific *C4* by my colleague and late-night digital friend Steve Dove. However it will run quite successfully with no modification on the PET or other small micros with a Microsoft BASIC. The assumption is made that the bandwidths are rectangular: ie 20Hz to 20kHz means exactly that. It has some amusing traps for the unwary—try it! ■

**NOTES**

1. This clears the screen on standard OSI gear (CEGMON users replace with PRINT CHR$(26)). For other machines, use standard screen-clear.
2. Adjust length of 'Wait loop' to suit machine speed and personal taste.
3. This program should perform without major alterations on most micros running a Microsoft BASIC *(eg* Applesoft, TRS-80, PET BASICs etc). Note format of INPUT statements *(ie* INPUT "xxxx"; X). Some BASICs prefer a comma instead of the semicolon. Also, some BASICs require all string variables to be dimensioned *(eg* DIM G$(3)). OSIs doesn't: DIMs default to 10.

```
LIST

   50  FOR A=1 TO 32: PRINT: NEXT A: REM-See Note 1
  100 PRINT"     The Vexed Question of"
  110 PRINT
  120 PRINT"    Equivalent Input Noise"
  130 PRINT
  140 PRINT"    ======================"
  145 FOR A=1 TO 1000: NEXT A: REM-See Note 2
  150 PRINT:PRINT:PRINT:PRINT:PRINT
  152 PRINT"   Noise figure calculation program"
  153 PRINT"          by Steve Dove"
  157 PRINT
  160 PRINT"Variables assumed for this program:"
  225 T=20
  240 B=19.98
  250 R=200
  253 PRINT:PRINT
  255 PRINT"   Bandwidth (Rectangular)=";T;"kHz"
  256 PRINT
  257 PRINT"   Temperature            =";T;"deg. C"
  260 PRINT
  265 PRINT"   Source Resistance      =";R;"Ohms"
  266 PRINT
  267 IF R<1 THEN 5000
  268 T2=T+273:REM- get temp into deg Absolute
  269 REM- This is the hairy bit!
  270 RV=SQR(4*1.38E-23*T2*B*1000*R):REM-get noise source volts
  280 RU=20*LOG(RV/.77456669)/LOG(10):REM-get volt level,dBu
  282 VR=20*LOG(RV/1)/LOG(10):REM-get dBV
  285 RV=RV*1E+6
  290 PRINT:PRINT
  300 PRINT"   Noise Source Voltage=";RV;"uV"
  310 PRINT
  320 PRINT"   Voltage Level       =";RU;"dBu"
  330 PRINT
  340 PRINT"         "             =";VR;"dBV"
  345 PRINT
  350 PRINT"Do you wish to change any pa ameters?"
  360 PRINT
  370 PRINT"       B,T,R,SV, or NO";
  380 INPUT G$:REM-See Note 3
  385 PRINT
  390 IF G$="B" THEN 450
  400 IF G$="T" THEN 500
  410 IF G$="R" THEN 550
  420 IF G$="SV" THEN 600
  440 IF LEFT$(G$,1)="N" THEN 700
  450 INPUT"Bandwidth (kHz)";B
  460 GOTO 253
  500 INPUT"Temperature (deg. C)";T
  510 GOTO 253
  550 INPUT"Source Resistance (Ohms)";R
  560 GOTO 253
  600 GOTO 1000
  700 PRINT:PRINT
  710 PRINT"To obtain System Noise Factor, enter:"
  720 PRINT
  730 INPUT"(a) Indicated RMS Noise Reading";RM
  740 PRINT
  750 INPUT"(b) Measured System Gain";SG
  760 PRINT:PRINT:PRINT
  770 SN=RM-SG
  780 NF=SN-RU
  790 PRINT"System Equivalent Input Noise=";SN;"dB"
  800 PRINT
  810 PRINT"System Noise Factor          =";NF;"dB"
  820 PRINT:PRINT:
  830 INPUT"Further calculations (Y/N)";G$
  840 IF G$<>"N" THEN 345
  850 END
 1000 FOR A=1 TO 32
 1005 PRINT"Have you got a ferret up your nose?"
 1010 NEXT A
 1020 FOR A=1 TO 1000:NEXT A: GOTO 345
65535 REM- Original program by Steve Dove; small mods by Richard Elen

OK
```

# Expression through equalization.

The MXR Dual-Fifteen Band and Thirty-One Band equalizers are cost effective electronic signal processors designed to meet the most exacting equalization requirements in a wide range of professional applications.

The MXR Dual-Fifteen Band equalizer can be used to tailor the frequency response of two sides of a stereo system, or it can act as two separate mono equalizers. In performance one channel can equalize the house system, while the other is used independently in the stage monitor line adjusting frequency response and minimizing the possibility of feedback. In the studio the Dual-Fifteen Band equalizer can be used to compensate for control room acoustics.

The MXR Thirty-One Band equalizer provides maximum detail in the most demanding equalization applications. It can be used in pairs for ultimate stereo control, or in live performance interfaced with PA systems and other instruments. The Thirty-One Band equalizer is also the perfect tool for conditioning film or video sound tracks, and in mastering applications.

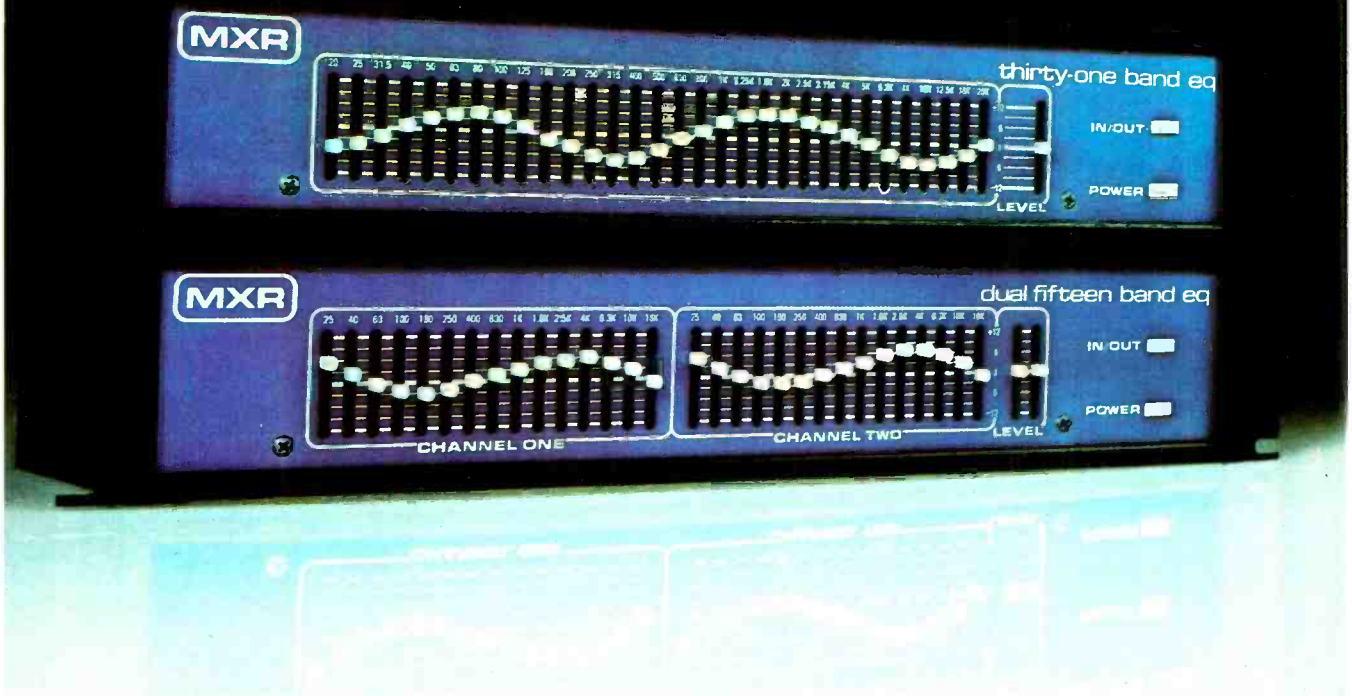
The spacing of frequency bands on ISO centers (2/3 octave in the Dual-Fifteen Band; 1/3 octave in the Thirty-One Band) and a flexible system of controls offer superior accuracy in frequency equalization. Each band can be boosted or cut over a range of ±12 dB. Clear, readable markings alongside each level control allow for quick and accurate checks of equalization settings, and aid in resetting the sliders to predetermined positions. The tight mechanical action of the sliders prevents slips during indelicate handling.

The MXR Pro Group equalizers afford maximum control of frequencies while maintaining the highest level of sonic integrity. The Dual-Fifteen and Thirty-One Band equalizers both have a dynamic range exceeding 110 dB and, as all MXR Pro Group products, will drive low impedance lines. Audio signal, including transients, is reproduced faithfully due to a high slew rate and a wide bandwidth.

The MXR Dual-Fifteen and Thirty-One Band equalizers are designed to withstand the demands of a professional road and studio schedule. Their superior design and superb craftmanship reflect MXR's continuing commitment to the manufacture of the highest quality electronic signal processors for today's creative artists.

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

MXR Professional Products Group



# letters

## Connectors and leads

*Dear Sir, With regard to Hugh Ford's review of connectors in the November issue of* Studio Sound *we would like to make the following comments concerning the review of Neutrik XLR-type connectors.*

*It would appear that the samples Hugh Ford tested originate from a very early production batch dating from 1978, the tested connectors not being examples of our current production which include a number of modifications made shortly after their introduction. Accordingly, a number of the criticisms Mr Ford made have in fact been solved. For example all our connectors have been equipped with ground tags (grounding lugs) since early 1979. Also the female plug inserts are manufactured from hard plastic (glass filled polyester) which withstands a soldering time of 15 to 20s/350°C, more than stipulated by IEC 68-2-20. Additionally, the plastic grommet for cable entry is manufactured from an elastomeric nylon based compound with a much higher shear strength than rubber. We also believe that our collet cable clamping mechanism is superior to conventional solutions, both regarding pullout force and cable protection, especially over long periods of use.*

*We would also like to draw your attention to the special features of our female connectors, in particular the fact that there is no mechanical noise due to the provision of damping ribs and a plastic ring, especially important for mic connection. Further there is no wearing of the latching mechanism as this is manufactured from spring steel. Additionally, Neutrik are also the only manufacturer producing connectors in a true black chrome finish, both with gold and silver contacts.*

*Finally, we would have appreciated Mr Ford's investigation of the contact principles used in the different types of connectors, these having an important bearing on the performance of the connectors.*

**Yours faithfully, Bernhard Weingartner, Neutrik AG, Schaan, Liechtenstein.**

---

*Dear Sir, In the November 1980 issue of* Studio Sound, *you associated our parent company, ADC Products, with Atlantex Music Ltd, leading your readers to believe that Atlantex are our agents in the UK. This is erroneous.*

*Our agents in the UK for the ADC long frame and bantam jacks, jack panels and patch cords are CAE (Communication Accessories & Equipment) Ltd, 70-80 Akeman Street, Tring, Herts HP23 6AH, UK.*

*I would like to add that ADC Products also manufacture low impedance plugs and receptacles (XLR-type) and high impedance ¼ in plugs. These products being distributed in the UK by two companies, CAE and Music World Merchandise Co, 159 Park Road, Kingston, Surrey KT2 6BX, UK.*

*I should be grateful if you could bring this information to the attention of your readers.*

**Yours faithfully, Christian Breynaert, ADC SA Geneve, 42 rue de Lausanne, CH-1201 Geneva, Switzerland.**

*Dear Sir, As the sole UK agents for Neutrik XLR-type connectors, we strongly object to the fact that* Studio Sound *did not obtain samples for its review of audio connectors directly from ourselves or our principals. Especially as unfortunately, the samples which were reviewed were in fact manufactured in 1978 and are now long obsolete.*

*It was only after modifications to the original XLR-types were made that Eardley Electronics won a substantial market share of the UK connector market, both with OEM manufacturers and component distributors, therefore it is particularly unfortunate that the samples reviewed were not from current production.*

**Yours faithfully, Peter Eardley, Eardley Electronics Ltd, Eardley House, 182/4 Campden Hill Road, London W8 7AS, UK.**

---

**Richard Elen and Hugh Ford reply:** While we certainly agree that it is unfortunate that the Neutrik connectors reviewed transpire not to have been of current manufacture, we are rather surprised that such a common-usage *XLR*-type connector readily obtainable from numerous sources should have been an obsolete type. We regret the confusion caused by this matter, but certainly did not expect when obtaining the samples from a reputable distributor that they would be outdated.

To make a more general point, as this is the first time that *Studio Sound* has covered this field the potential for error is much greater. While we obviously endeavour to be as thorough and correct as possible, occasionally errors and omissions occur. These are unfortunate side effects of breaking new ground. To help us obviate these potential problems we would urge all manufacturers and suppliers to keep us fully informed as to their product lines.

Finally, we would like to comment on the question of investigation of the contact principles used in the different types of *XLR* connectors. While, as with other reviews, we would have liked to go into greater depth and included such matters as contact resistance, contact life, corrosion, etc, as with most reviews it is a question of getting a quart into a pint pot and neither time nor space permits such in-depth investigations.

---

*Dear Sir, Regarding Hugh Ford's review of cables in the November issue of* Studio Sound, *I think that you have again demonstrated your keen sense of what this industry needs in the way of information to be better able to select its products.*

*We were, however, disappointed by two items concerning Gotham cables. A minor point is that all the 3-conductor and 10-pair cables we sell (you did not list that one), are made in Austria and only there. None are made in West Germany except those for old tube microphones (multi-conductor) which we still buy from Neumann.*

*More serious is the fact that the table on page 90 shows that you must have obtained a cable made by someone else. That is clear from your listing of 78 strands (ours is 96 strands) and even worse, polyethylene insulation for the conductors. The company which makes our cables doesn't have the capability of working with polyethylene! Could you perhaps also explain the difference between 'twin lap' and 'twin wrap'?*

*Thanks for your co-operation in this matter.*

**Yours faithfully, Stephen F Temmer, Gotham Export Corp, 741 Washington Street, New York, NY 10014, USA.**

**Hugh Ford replies:** I have used the term 'twin lap' to describe two layers which are in contact and overlapping. 'Twin wrap' refers to two separated layers. Assembling a large amount of detailed information such as that necessary for this review, we would have been very lucky if no errors had crept through and we apologise for quoting the incorrect details.

---

## Noise measurement

*Dear Sir, I compliment Hugh Ford on his lucid article 'Noise Measurement' (November* Studio Sound*) but must ask if he has a personal dislike of my professional friends at Broadcasting House or Crawley Court. The BBC developed the peak programme meter donkey's years ago and it has been the standard measuring instrument for noise in broadcasting equipment (including tape machines) for many years. BBC performance specifications and the IBA code of practice (the day-to-day requirement for ILR systems—not a performance specification) require measurements both linear and weighted, the figure being read on a peak programme meter to BS 4297. Although there are moves afoot to modify the specification towards something a little more 'quasi' the standard PPM will be in use for many years to come. The Dolby proposition to make unity gain at 2kHz when using the CCIR Rec 468 curve, seems as extraordinary to me as a manufacturer as it does to Hugh as a reviewer. Specification writing is quite difficult enough in avoiding ambiguity without introducing yet another standard.*

*Regarding availability of testgear, I have no axe to grind but must mention that Mike Sells (MJS Electronics) produces a most elegant noise measuring set of extreme accuracy (PPM of course!)*

**Yours sincerely, Ted Fletcher, Alice Stancoil Ltd, 38 Alexandra Road, Windsor, Berks, UK.**

---

*Dear Sir, I would like to make a few comments on Hugh Ford's timely article on noise measurement. 'Timely', because several countries, including the UK are at present trying to persuade the IEC to drop the use of A-weighting (with a true rms meter) for the objective measurement of the disturbing effect of electrical noise on programme signals. There is no question of changing from A-weighting for the measurement of acoustic noise by itself, although some experts in this field are beginning to call for a reconsideration of the A-weighting curve standard.*

*With regard to the CCIR quasi-peak meter, the present situation is that the cost and availability are much improved. This is a 'chicken and egg'*

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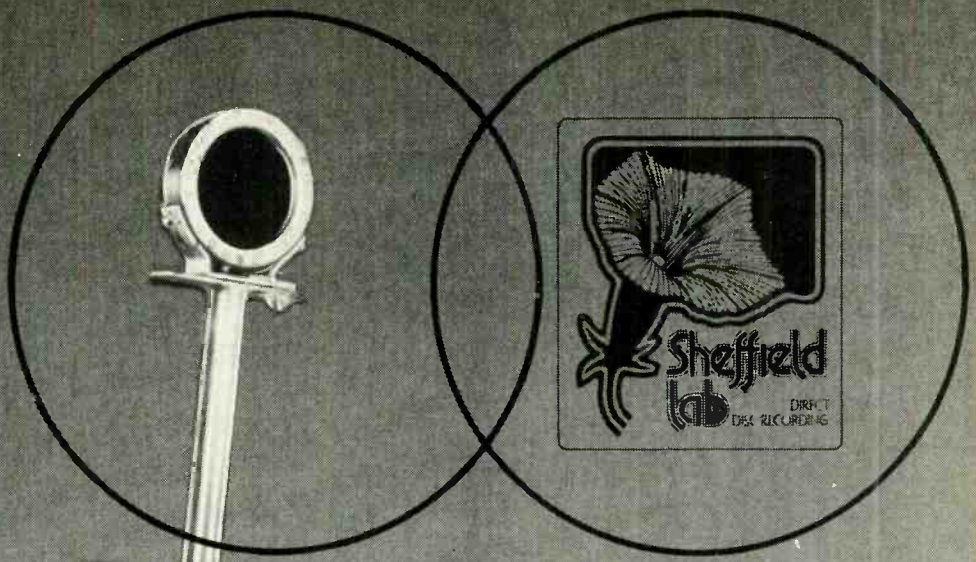
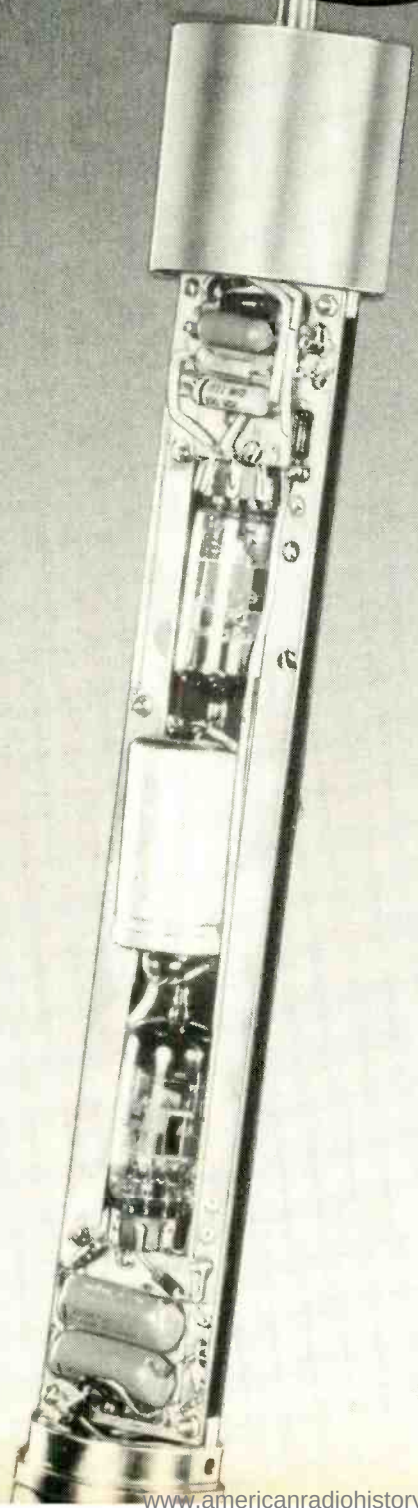
AKG
acoustics



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AKG is an Austrian company engaged in basic research, development, manufacture and marketing of sophisticated and mostly professional audio products.
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"For the demanding standards of our custom microphone electronics, Sheffield Lab uses microphone capsules manufactured by AKG. On many of our recordings, the professional microphone of choice is also AKG".

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*situation of course. While demand is low, prices will be high and vice versa. The advantages of the much greater discrimination of the CCIR method, and the confidence in results gained from using an internationally standardised method of measurement more than outweigh the present cost difference.*

*In case there should be some misunderstanding, the Dolby Laboratories' proposal (CCIR/ARM) calls for use of an ordinary laboratory voltmeter, which responds to the average value of the full-wave rectified signal but is scaled to read rms values of sinusoidal signals. There is no mention of the use of a VU meter in the Dolby documentation.*

*The adoption of a zero-level at 2kHz in the Dolby method raises an important, if unwelcome, consideration which is fundamental to standardisation. A standard only has value when it is accepted and used; however scientifically accurate it is, it will be totally sterile, and the time and money devoted to its preparation completely wasted, if it is not used. Now while the broadcasters, represented by the CCIR, have highly qualified technical people to interpret equipment specifications, this is not true at all of say the hi-fi business, where increasingly, purchasers have no technical knowledge whatsoever. Furthermore, judging by the type of advertising used by some suppliers, and the number of errors in published specifications, a proportion of purchases of PA and even studio equipment appear to be made without full understanding of all the technical aspects. Consequently manufacturers are very reluctant to reduce their S/N ratio specifications by 14dB (the approximate difference between CCIR/quasi-peak and A-weighting/rms measurements on pink noise) or so, because if some manufacturers don't do it, their products will appear to be better. This is, in fact, what happened with tape recorders in Germany about eight years ago, where German machines were specified according to DIN 45405, while Japanese machines were specified with A-weighting. Even the powerful German standards organisation (DIN) found it impossible to prevent this and the Germans were forced to abandon their own, more scientific measurement method and adopt A-weighting, which cannot distinguish good designs from bad designs.*

*It thus seems inevitable that, if we are to gain the advantages of greater discrimination between good and bad noise performance offered by the CCIR weighting curve, we shall have to accept an attenuation adjustment factor so that well-designed equipment can be specified according to the new method with the minimum possible change (preferably none) to the actual figures. Possibilities include CCIR/ARM, with 5.5dB adjustment factor, or CCIR/rms with a 6.6dB adjustment factor. Incidentally, true rms meters are now, well, not ten-a-penny but certainly far cheaper than only a few years ago.*

**Yours sincerely, J. M. Woodgate, ITT Consumer Products (UK) Ltd, Chester Hall Lane, Basildon, Essex, SS14 3BW, UK.**

## Meter makers

*Dear Sir, I am writing following the appeal for makers of CCIR meters to make themselves known in Hugh Ford's article (November).*

*People building their own noisemeters using the weighting circuit in Hugh's article, or the Dolby CAT98 box, may like to know that we can provide PPM2 (balanced) and PPM2 (unbalanced) drive circuits modified to the CCIR468-2 recommendations for noise metering. For aligned and soak tested boards there is a £5 charge but for kits there is no extra charge.*

*Ernest Turner meter movements are also stocked with a decibel scaling which may be preferred on a test instrument to the usual 1/7 scale.*

*Switching can be arranged for the board to revert to normal PPM characteristic, so the noise-meter can also form a useful programme multimeter.*

**Yours sincerely, Trevor Brook, Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey, GU6 7BG, UK.**

## Tape levy

*Dear Sir, The proposal to add an 'across the board' levy to the price of blank cassette tapes would unfairly penalise many legitimate users. Record producers and studio managers like David Harries (September Letters) tend to forget that cassettes have other uses besides recording music, eg education, talking newspapers for the blind, churches, doctors, businesses and journalism.*

*Supporters of the levy should give consideration to the following. Although all records carry a small print notice prohibiting copying, the record companies and Mechanical Copyright Protection Society have been very lax in their marketing of the amateur recording licence. No attempt has been made to sell the licence in record or tape shops and records rarely carry an advertisement for the licence.*

*If the proposed levy is really necessary, I trust that the supporters of the levy will at least concede that legitimate users should be exempted from paying.*

**Yours faithfully, Kevin Timewell-Read, Sound Marketing & Services, 1 Chase Close, Old Catton, Norwich NR6 7AR.**

## Monitors & studios

*Dear Sir, With regard to Noel Bell's and Hector Calabia's 'game' I really think the score is about '15 love' to Noel. I know what he means by the 'dated' sound from monitors and as non-technical as it may be I would call it 'feel'. Perhaps a rather over-used word in 'the biz', but speaking as a valve lover it's much like the difference between the round and warm sound of valves in comparison to transistors.*

*With regard to David Harries' letter (September 1980), I quite agree that something has to be done to keep the industry running and if studios hold tape manufacturers over a barrel on the cassette issue, this should certainly rock the boat a bit. Biased (excuse the pun) as I may be, being involved with smaller studios, I do think that putting some of the blame (if that's what's happening) on to them is not right. After all, if people are enterprising enough, in an already depressed industry to get it together, why not?*

*Realising that David and I have our reasons for and against both large and small studios, I feel that while protecting the business, we should also allow newcomers to enter, with their own ideas and schemes, some of which will help a great deal and may become a vital part of the industry. I know that besides not having the best gear in the world, a slight feeling of non-professionalism exists regarding small studios and some of this may occur from engineering personnel having so many other duties to perform such as managing, cleaning, etc. But the reason so many survive is because they are very tight, hardworking organisations and do, against considerable odds, produce good quality product. Another reason for feelings against 'front room' studios is, of course, the use of semi-pro (even completely non-pro) gear but for demo use at a budget a 4-track will at least produce something which is affordable and would otherwise be hard to get. Two sides to every coin! But more important, let's stop the world ripping off both large and small organisations and for those people running 4-track, test tapes are available from us, to help S/N ratio and general quality control of recorded matter.*

**Yours faithfully, Karl Brown, Cindy Electronix Ltd, 56 Westmoreland Drive, Sutton, Surrey.**

■

# agony

## Tough testing

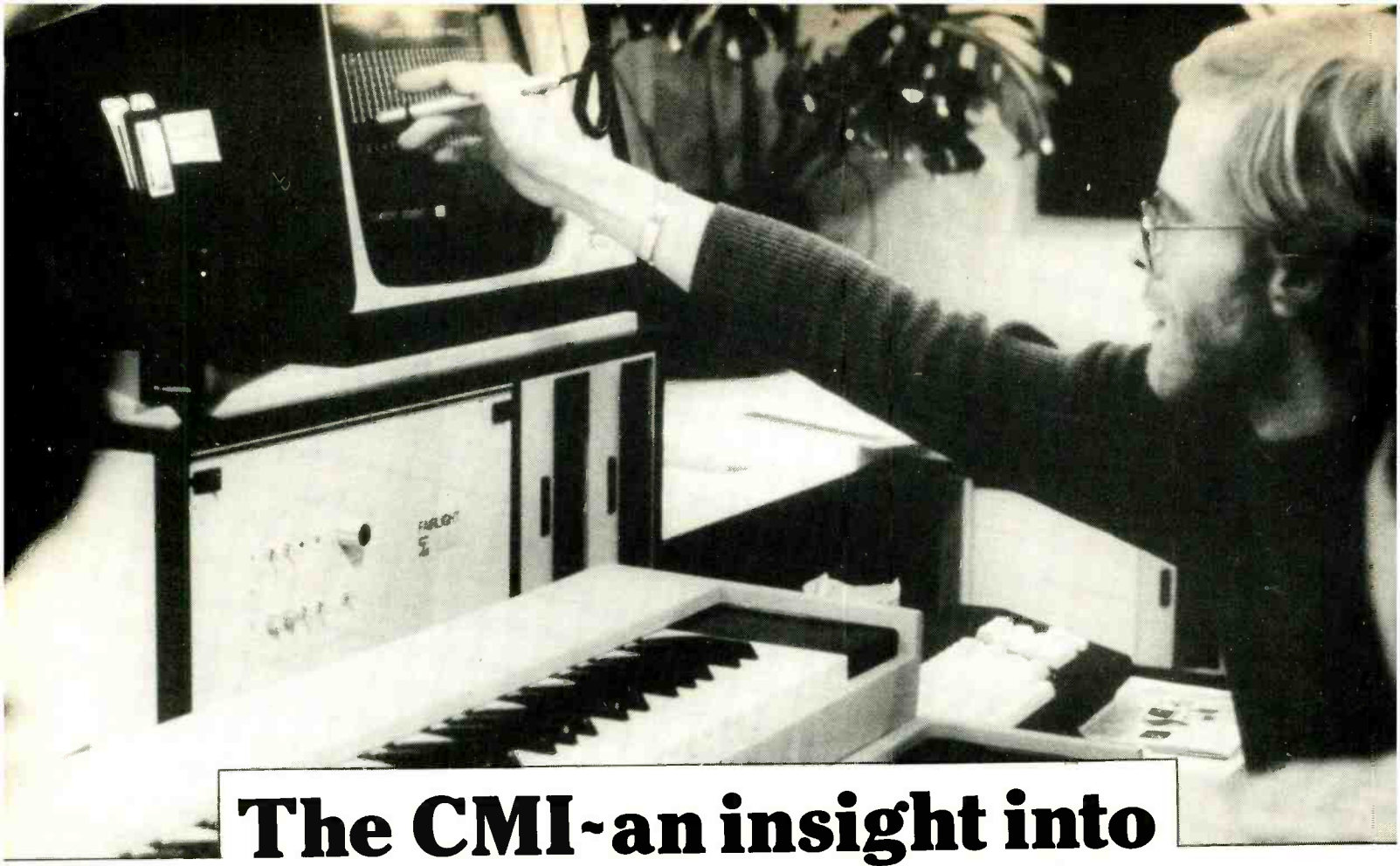
The AKG *D330* mic, designed primarily for use by vocalists on stage and in the studio, is built to withstand plenty of hard knocks, but its endurance was tested to the full when it was fixed to the outside of ace Austrian rally driver Rudolf Stohl's saloon, mounted down low by the wheels, for the 1980 Himalayan Rally. The unsuspecting *D330* was driven for over 3,000 miles across the Himalayas from Bombay to Delhi and subjected to extremes of heat and cold, icy water, dust and constant vibration.

As AKG engineers expected, the mic functioned perfectly when tested afterwards. After all, some Swiss journalists had recently dragged an AKG *D300* mic over 35 miles tied to the back of a car, and Switzerland is far from flat. The *D300* had also worked perfectly afterwards.

## Old habits die hard

An ex-junkie jazz sax player now lives a life of opulent leisure in a castle down by the Mediterranean. A fat record contract keeps him rich and famous with only the occasional need to make a record or guest appearance. Recently, a Scandinavian TV station approached him for a half-hour programme. An outrageous fee was negotiated and return tickets despatched to the sunny castle. Almost immediately, the TV station 'phone rang. It was the rich and famous jazzer on a reverse charge call, angry that he had been sent second rather than first class air tickets. First class replacements were duly despatched and the jazzer arrived for the show. He'd flown second class and converted the first class reservations into cash.

■



# The CMI-an insight into digital sound synthesis

Richard Elen

**Synthesisers have come a long way from the analogue voltage-controlled instruments of the mid-sixties. In this article, Richard Elen looks at recent developments in music synthesis and takes a more detailed look at one particular modern synthesiser, the Fairlight CMI.**

IT STILL doesn't seem so long ago that CBS records issued an album which must have made a great impact on the public's attitude to synthesisers and synthesised music: *Switched On Bach*. Produced on 8-track in 1968, the album utilised one of the earlier Moog modular synthesisers, which was normally in the form of three suitcase-sized cases housing a number of modules, plus a keyboard, ribbon controller and other accessories. Such a system, analogue though it was (we might say in these digitised times), could produce an extraordinarily wide range of sounds and, by virtue of the fact that a sound was created and shaped by patching together a fair number of devices — oscillators, filters, voltage-controlled amps, and the like — extraordinary lengths of time were necessary to create them! This latter was no fault of Doctor Moog; on the contrary, it was the pure flexibility of the system that led to the complexity of its use. It was very much a studio instrument, and, not surprisingly, a number started to appear in recording studios, ready to be tackled by anyone who could spend some time getting a good selection of more-or-less musical sounds together for a session. Unlike a preset or programmable-preset instrument, large, modular analogue synths were, and are, characterised by great flexibility *and* the need to spend more time and effort in the sound-creation stage. The basic rule established by such instruments as the original Moog modular systems still holds true today: the most sophisticated of modern computer-based synthesisers will almost certainly take longer on a session, simply because of the greater number of possibilities (even if it's no more than a matter of sorting through disk files to see what someone else has been up to, and whether *they've* got anything interesting!). This may seem an obvious comment, but time is a factor easily forgotten in the face of thousands of pounds or dollars-worth of gleaming hardware.

A modern, computer-based synthesiser is expensive to purchase: well outside the range of even moderately successful players. Most of the currently-available computer synths cost around the £15,000 mark, which means straight away that if you want to use one on your session, you'll either have to hire one or find someone who you can call in to play the beast. Even this can be comparatively expensive: around £100 per day was one figure I was quoted (but for that you get the instrument, plus someone who knows how to drive it). If you own a studio and are considering the possibility of buying one of these new machines, it should be remembered that the synth on its own may well not be enough: you will have to find or train someone who can use it successfully. Without something in the region of three months experience on a particular system, the sounds produced (or lack of them) may make the machine look like an expensive mistake — yet this is not necessarily the case.

## Language problem

Perhaps the major problem with systems of this nature is learning to speak their language — not as silly as it sounds. Because the original Moog modular systems, with their ranks of knobs, switches, plugs and patch-cords, looked so formidable and complex, some people — only half-laughingly — suggested that you would have to be a combination of airline pilot, computer programmer and even telephone switchboard operator to get any sounds out of the thing. It wasn't true, of course: what you had to do was speak the language. In that case, it was the logic of the signal path and how to create it. The logic of the module layouts also came into it, together with questions like whether Doctor Moog had decided to put his level controls on the input or the output of a module. So it is also with one of these gala new lumps of digital technology. In this case, the language is primarily the operating system which receives your commands, interprets them into a form the machine can understand,

and then, hopefully, if the gods of the microprocessor are with us, gets the machine to go off and do them. And computers being very particular things, we need to remember (or at least be able to look up easily) the various commands which cause important things to happen, and the exact syntax required by the machine.

Although you also have to learn to use these commands to the best effect, at least half the battle with any computer system would seem to be getting to grips with the 'man-machine interface' — talking to the bloody thing without it informing you of a **COMMAND SYNTAX ERROR**! Invariably (well, almost) you didn't write the operating system, and *they* didn't write it *quite* the way you would have done. They probably got the colour of the knobs wrong too. Never mind, this is what they write manuals for.

Even after you have come to terms with this kind of system, however, it may still take some time if you have to create a new sound from scratch (or you are wating for someone else to do so). There are at least two completely different methods of sound construction utilised on presently-available systems, and both of them will take time to get real subtlety into a sound.

## The Fairlight CMI

The Fairlight *CMI* (Computer Musical Instrument) is probably the best-known of the computer-based synthesisers currently on the market, others including the New England Digital *Synclavier*, the Con Brio *ADS-200*, and the Crumar *General Development System*. You couldn't say it was 'typical' as the different systems vary so widely in their approach and implementation. Technically, one imagines that they are all capable of similar degrees of precision: the way this is achieved, however, is largely different.

The *CMI* consists of three main units (see the cover of this issue): a computer unit/card frame, which includes the majority of the electronics for the system, and contains two 8in floppy disk drives; one or two music keyboards covering six octaves each; and an alpha-numeric keyboard and graphics TV monitor. Unusually, the QWERTY keyboard is separate from the TV monitor: a useful feature which enables the two to be placed in convenient positions (although generally the use of a light-pen plus the alphanumeric keyboard means that they end up quite close together). Apart from the half-dozen or so sockets on the central unit which are concerned with interconnecting the various parts of the system, there are no less than 15 *XLR* sockets providing various audio ins and outs, plus a headphone socket. Outputs include one socket for each of the instrument's eight channels; a mixed output at line level; a 20W, 8Ω speaker output; sync and sampling filter connections, and three sockets relating to the sampling aspect of the machine, taking mic and line in and giving an ADC direct output. Other accessories can be attached to the system, including foot-pedals and controllers.

## Display pages

On powering up, the system waits for a Systems Disk to be placed in the left-hand drive and the lid closed. When this is done, the initial message 'CMI READY' is replaced by 'CMI LOADING', until the operating system has been down-loaded from disk into RAM. An index then appears on the screen.

The 'Display Page' concept used by Fairlight is a very versatile one. There are a number of pages, some numbered, some lettered, each page containing the data displays required for specific functions, and having specific commands associated with it. The page functions are shown in **Table 1.** Thus, Page 1 is a menu of the available pages, and is used only to select other pages (or remind yourself what they do); Page 2 contains a list of all the sound files on the particular library disk inserted into the right-hand drive, and may be used to load, save, rename, create or delete disk files; Page 3 allows voice registers to be output via the appropriate output channel, and enables each register to be assigned the desired octave(s) of each keyboard; Pages 4 and 5 allow a sound to be synthesised by adding desired levels of harmonics (up to 32); Page 6, (shown on our front cover) enables a waveform to be drawn with the light-pen; Page 7 allows the setting of such functions as portamento and glissando, attack, level, vibrato, etc; Page 8 is used to sample an external sound as the basis for sound manipulation; and Page 9 relates to the keyboard-programmed 8-voice polyphonic sequencer. Each page contains its own display area plus two lines at the top of the screen the Status Line (which displays error messages and other indications), and the Command Line, which displays commands as they are entered from the keyboard.

**TABLE 1**

| Page number | Function |
|---|---|
| 1 | Index |
| 2 | File Maintenance |
| 3 | Keyboard Control |
| 4 | Time Profiles |
| 5 | Waveform Generation |
| 6 | Waveform Drawing |
| 7 | Control Parameters |
| 8 | Sound Analysis |
| 9 | Sequencer |

In addition, Page K gives access to disk files direct from the numeric keypad on the main music keyboard, enabling voices to be loaded into the machine with the minimum of effort (eg for live work), Page D allows a simulated 3-dimensional waveform display, and Page C allows access to the *MCL* composition language.

## Creating sounds

With the *CMI*, there are three major methods of creating a sound. A real sound can be sampled — effectively digitally recording it — via Page 8, the waveform can be drawn with the light-pen on Page 6, or a sound can be created from various levels of harmonics on Page 5. The latter uses a display analogous to a set of organ-style 'drawbars'. The light-pen is used to move a pointer to an appropriate level for each harmonic, from the fundamental up to the 32nd. The harmonic structure can be determined for any or all of the time-segments from which the sound is built up: in Mode 1 there are 32 segments, while in Mode 4 (usually used for sampling real sounds) there are 128. The harmonic levels determined for a segment may be 'filled' into a block of segments with a keyboard command. When a set of harmonics has been determined for each segment, either by constructing them with the light-pen, or by filling a block, they may be computed and entered into the machine's waveform memory. A display of the waveform in the current segment is also shown, and the first thing you learn from this is what bizarre collections of waveforms can be constructed from *very* few harmonics. It is also interesting to discover that certain wildly-different shaped waveforms *sound* very similar!

Even more interesting than the construction of a waveform from harmonics is the waveform drawing facility on Page 6. Fairlight rightly describe this as one of the instrument's most powerful features. Commands are available to display a segment of the current waveform memory, fill a segment of memory with a displayed waveform, mix and merge the contents of successive segments, and, most important of all perhaps, are the commands relating to the drawing of a waveform. Commands are provided to Plot or Join points on a graph, the former requiring the pen to be moved in the exact shape of the waveform, while the Join command allows 'geometric' waveforms, like square, sawtooth or triangle for example, to be created rapidly by plotting a minimum number of points, the machine joining successive points with a straight line. This is where you learn that drawing nice, symmetrical square waves isn't as easy as you thought, despite the very useful Join function!

The last method of sound creation is to sample a real sound. This signal can be input either via a mic or at line level, and may be used if desired as the basis for bizarre modifications. The sound is converted to digital, being in effect digitally recorded, although with rather lower bit-rates than studio digital audio systems. It is, however, more than adequate for capturing even complex musical sounds. A sitar, for example, which you might expect to cause particular difficulties, can be captured most authentically.

The procedure for sampling a sound is to display Page 8, which handles the commands for this function. Here a sample can be taken and loaded into an already-created disk file. There are two stages in the sampling process: the triggering stage and the actual sampling itself. When the command 'Sample' is given, the machine waits for a trigger — the appearance of an audio signal of appropriate level at the input. This initiates the sampling. The trigger characteristics and the characteristics required of the audio signal are determined by the settings of a sophisticated digital filtering system. If the system doesn't hear a suitable audio signal within 10-15s, it aborts the sample. Once a trigger has occurred, an A/D converter samples the signal at a rate determined by a pre-determined sampling frequency, in the range 1 to 32kHz. The sampling rate determines not only the frequency range of the digitised signal (the maximum frequency being half the sampling rate) but also its pitch, in absolute terms, on replay. Thus to ensure that a musical sound appears at the right place on the keyboard (although it is easily altered), it's worth choosing a sampling rate carefully. In fact, the sample rate should be chosen ideally so that one period of the sampled sound's fundamental fits exactly into one segment of waveform memory. A graph of the sample's amplitude is displayed: this is useful for determining whether or not the sample was satisfactory.

When the basic sound has been produced by whatever means, there are a wide variety of controls and adjustments which may be performed. Page 4 enables the harmonic amplitudes in time to be altered (in fact a waveform may be synthesised in this way, as well as with the 'harmonic faders' of Page 5), and the energy of the sound in time (effectively an infinitely variable envelope generator) may be varied, including an ability to scale the harmonics' amplitude to an overall energy contour, or create an energy contour from the levels of the harmonics. In addition, Page 4 allows the duration of each waveform segment to be altered, and

46 ▶

segments may be looped back on themselves at any point, to create an infinite sustain at any level. This can be very useful, as one disadvantage of this kind of waveform reproduction is that different pitches are (presumably) created by clocking the memory at different rates: thus a high-pitched sound will not last as long as a low-pitched one. Looping segments to give a note for the entire time a key is pressed ensures that you don't 'lose' the higher notes of a long chord before the lower ones, or run out of waveform before the desired note length.

## Control functions

Control values such as level and attack may be assigned, via Page 7 — either fixed numeric values, or variables such as the key velocity. Assigning 'Keyvel' therefore, to 'Level' on Page 7 will result in a sound being louder, the harder you hit the keys. Such factors as vibrato depth and speed, filtering, sustain, attack and damping (decay after note release) may also be assigned values.

An interesting new feature available on the latest Fairlight system software (like all good manufacturers, the system is under constant improvement, and new features are being added almost weekly) is portamento (glide) and glissando. The portamento has the usual effect of gliding between successive notes: glissando, on the other hand, offers the possibility of playing automatic arpeggios between chords, where the rate of pitch-change can be set as a fixed time between successive notes played, or as a fixed time *per musical interval*. This has interesting possibilities: either arpeggios which all arrive at the next chord at the same time, or ones which arrive at different times, but travel in step with each other! Other functions of this page include the ability to control certain parameters with footswitches or the faders and buttons provided on the main music keyboard.

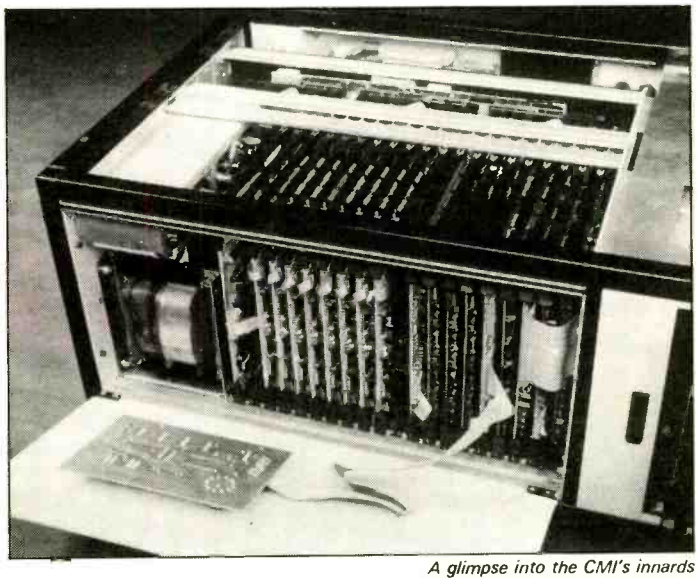
The data created on this page can be associated with a voice by creating a control file for it. On page 2, files are denoted by a name and a code relating to the type of file. Thus 'PIANO .VC' would be a file containing waveform — Voice — information, while 'PIANO .CO' could be its associated control file. Other types of files are those with an '.SQ' suffix — these contain sequencer patterns — and those followed by '.IN'. These latter are instrument files, and can contain the complete configuration of the instrument, including several voices and control files each allocated to different registers, channels and parts of the keyboards.

When a voice is loaded from disk, it is loaded into one of eight registers. These registers are then assigned to different keyboard areas, with a resolution of one octave per register (ie a register can be assigned to as little as one octave on one keyboard). The *CMI* is 'octophonic' or 8-voice, and a parameter, 'NPHONY', relates to each voice file loaded (this information being displayed on Page 3), assigning a number, 1-8, for the number of notes of that sound which can be played at once. Other Page 3 functions include octave setting, ±6 octaves in octave steps; semitone tuning offset, ±11 semitones, and a fine tuning parameter which allows tuning adjustments up to ±99 hundredths of a semitone, in 1/100th semitone steps (cents). Additionally, the scale factor can be adjusted from its default value, 12th root of 2, which generates the familiar even-tempered 12-semitone scale, to produce more or less any tuning system you feel like, in which case the tuning offsets follow the scaling factor (so, for example, the octave setting always relates to 12 keys on the keyboard, no matter what the actual *musical* interval between those keys).

The Fairlight offers three methods of playing the sounds which have been created or loaded into the instrument. Firstly, and most obviously, they can be played on the keyboards. Secondly, the keyboards may be used along with Page 9 to enter polyphonic sequence data, which effectively records a performance in memory as keystrokes for different voices and registers which may be replayed, and the equivalent of overdubbing performed. Given the maximum total number of voices, very impressive results can be obtained (the *Synclavier*, too, offers a 'recording' system analogous to a tape machine). The third method of realisation involves the use of a separate software system: a Music Composition Language, *MCL* (Page C). This is able to use the regular data files containing instrument data, and utilise them in the execution of a piece which is entered from the alphanumeric keyboard. It is exactly what it says: a Composition Language. Commands and variables are entered corresponding to such factors as pitch, note length, and so on, and the whole may be entered and realised without the use of a music keyboard at all: it can all be done from the terminal. The music 'program' can be listed, edited, added to and stored like any regular computer program, adding a remarkable new facility to an already remarkable instrument.

Hopefully, this short guided tour of one of the most sophisticated of modern sound synthesis systems will be helpful in making better use of these machines when they turn up, as they are likely to do, in the studio more frequently. Systems like the Fairlight *CMI* are capable of creating almost any sound you can imagine (and, as with most flexible synthesisers, the trouble is that it's sometimes difficult to imagine!), if you're prepared to work at understanding the system first. Because of the sophistication of the system, it is possibly ideally suited to the studio environment, and there particularly to the personal electronic music studio or specialist facility, where it can be permanently installed and under the supervision of someone who knows how to use it. Whilst the *CMI* can be used in live work, calling up pre-prepared sounds from disk files, instruments like the *Synclavier* are probably more suited to 'instant' sound generation, where a sound of sorts can be obtained in seconds. In its full synthesis modes, the *CMI*, and other instruments with this kind of 'constructional' capability, need time to be spent on the generation of new sounds.

When using the *CMI* on sessions recently, it was brought home to me how easy it is to waste a machine like this: with limited time it is all too easy to do no more than thumb through library disks looking for pre-created sounds, turning the instrument into a massive and expensive preset synth — this certainly doesn't do justice to the system. Used correctly, however, computer-based synthesisers of this type have a vast potential. ■



*A glimpse into the CMI's innards*

*CMI in use, live, for the Berlin Opera's performance of Wagner's Parsifal. The display shows a Page 6 display of Segment 60 of a bell sound used in the work.*

Many thanks to Steve Paine and Mike Kelly of Syco Systems, the UK importers of the *CMI*, for arranging for me to borrow the instrument, and especial thanks to the amazing Philip of Beta Entec, who did more than was humanly possible to make the thing materialise in the right place at the right time.

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## Digital standards

Digital studio standardisation? Not yet, but don't be too surprised if you read elsewhere that it's all over bar the shouting because Sony and Studer are tying in with the 3M stationary head, multitrack format.

In a recent release 3M tells how the company's digital equipment is in "great demand" and finding its way into more and more recording studios. Unfortunately, the company just couldn't resist the temptation to preface the list of 3M-equipped studios with a little extra PR which is ripe for misinterpretation by anyone who isn't *au fait* with the digital scene. "The announcement recently by Sony/Studer of their intention to enter the digital audio equipment market has led to this comment by Dr Marshall Hatfield, vice-president of the 3M Mincom division," reads the 3M release. " 'We welcome Studer into this field. As a company with an established reputation for quality, its intention to manufacture digital audio recorders in the future is seen as yet another indication of the trend towards the growing use of digital technology.' "

I asked Sony whether Hatfield's "welcome" to Sony and Studer meant that they were now adopting the same stationary head format as 3M. "Only if 3M have adopted the Sony/Studer format," said Sony. Of course, they haven't.

As 3M see it, Sony hasn't yet settled on a fixed standard and thus might still follow 3M either through choice or pressure from trade consensus of opinion. Frankly this sounds highly unlikely but only time will tell. For the time being at least Sony are firm over a hierarchical approach. At the top end there's a 24-track/24-channel machine which samples at 50.4kHz and records on ½in tape running at 30in/s. But the hierarchy also allows for 15in/s with two tracks per channel or 7.5in/s with four tracks per channel, ie the same tape area at each speed. Meanwhile, 3M uses one track per channel at 45in/s tape speed and sampling at 50kHz, with other differences from Sony, for instance in error correction.

Although 3M has been curiously secretive over the exact nature of the error correction they use, full details have been published in British patent application No. 2 007 888. This should be read in conjunction with AES pre-print No. 1298 (M-2) from the November 1977 AES Convention in New York.

## Film sound

It used to be news when a new film sported a Dolby stereo soundtrack; now it's news when it doesn't. The cinema industry is in the process of rediscovering sound. Sometimes the results are superb, as in the Academy award-winning *Apocalypse Now*. Other times the results are much less happy, as in *Rocky II*. Dolby Labs were obviously worked off their feet making and installing equipment and finally reaping some reward for almost a decade of effort and investment in overcoming all the apathy and bigotry which lurks in so many film studio dubbing suites.

There's little doubt that Dolby stereo really took off with *Star Wars*. The system contributed to the success of the film and benefited from it. Then came *Close Encounters* and some heavy flak. Cinema managers often played the soundtracks far too loud for their sound system which had been installed decades ago for more homely musical fayre. So audiences were subjected to the most appalling overload distortion. There were even letters to the London *Times*, one correspondent seriously arguing that the sound of *Close Encounters* had been louder than the wartime blitz on London.

Fortunately, and under some pressure from Dolby Labs, the worst offenders have now started to behave more sensibly. Several London cinemas, including the Empire in Leicester Square, have now installed more powerful amplifiers (often *Quad 405*s) to keep the sound clean. The Dominion, Tottenham Court Road, one of the worst offenders in the I-can-play-loud game, has installed better surround sound speakers to avoid overload and reduced the overall playback level. *The Empire Strikes Back* ('Son of *Star Wars*' featuring Darth Vader in his well known Lord Reith impersonation) has been peaking there at around 90dB. Even the National Film Theatre in London which runs on a very underpowered sound system, has at least "obtained an estimate for the installation of a Dolby sound system". All they need now is the money to install it.

The real culprits now are the film makers. Alexander Walker, film critic for the late London *Evening Standard*, reported on how bad soundtracks were "enraging many people, to judge from my mail bag, who can't hear what the characters are saying". The root problem here is excessively wide dynamic range. The first culprit was *A Star is Born* where the yoyo changing levels between super loud rock music and throw-away dialogue from Barbra Streisand and Kris Kristofferson left cinema audiences guessing at what was actually being said.

The same thing happened with *The Rose*. Whole acres of Alan Bates' dialogue was unintelligible, apparently due to the current industry craze for using original dialogue direct-recorded on location and preserved in the final mix in the interests of immediacy. It may be immediate, but what use is it if the audience needs sub-titles?

The *Rocky II* track was curious on two counts. Firstly, although supposedly a stereo track the sound image was so narrow it might just as well have been mono. Worse still some of the music and dialogue suffered from arguably the worst ever hf splash and sibilance on a modern track. The effect, which was apparently not due to a faulty print, is best compared with running a conventional Academy track on flat equalisation so that all the Academy pre-emphasis spits like a viper.

Film studios are now facing the same learning curve that faced the record industry when hi-fi became a domestic boom. Sibilance on a dull Academy track may pass unnoticed but on a Dolby track it will be reproduced in all its nasty glory.

To end on an up note, *Apocalypse Now* seems generally acknowledged as the best Dolby stereo soundtrack yet. Mind you, it should be. The audio mix took nine full months to complete. If you want to hear cinema sound at its best in the current state of the art, see *Apocalypse Now*; or at least the first three quarters, before Marlon Brando's famously expensive self indulgence turns a remarkable film into an equally remarkable bore.

## Book review

I chanced recently on *All You Need is Ears* by George Martin with Jeremy Hornsby. Like all hardback books it's expensive (£7.95 from Macmillan) but who knows, perhaps there will eventually be a paperback edition. If so, it's a must for anyone in the studio business. The only mystery is why the publishers haven't publicised the book more to the kind of people who would want to read it. For instance, *Studio Sound* didn't see a review copy until we asked for one a year after publication. And has anyone ever seen the book reviewed in the music papers?

As you would expect there's some wonderful gen on the Beatles' recordings but there's much more besides. A lot of it is pretty hard hitting stuff too. The financial arrangements between Martin and EMI are laid bare and not to put too fine a point on it, EMI doesn't come out too well. At the end of 1963, after 14 years with EMI, George Martin had had the company "right up to here". He didn't qualify for the Christmas bonus because he was earning just over £3,000 a year, so in mid 1964 he gave a year's notice and was called in to talk it over with EMI managing director Len Wood.

A chance remark during the conversation revealed that the company had made £2.2m profit on the sales of his records in the previous year. "It is difficult, looking back, to describe the depths of my bitterness," writes Martin and that of course, was how AIR was born.

He also has some interesting observations on the film business. When Martin was employed by the Boulting Brothers to make *The Family Way* he wanted to record the soundtrack at CTS in Bayswater rather than Shepperton. John Boulting, with close ties to Shepperton, persuaded him to try a test session out there before booking into CTS. What happened with a string quartet makes for good reading. According to Martin, Shepperton had "the wrong equipment. It's out of date . . . what's more we don't use the people you are using any more. It's all about the basic attitude to the job."

George Martin's words here will doubtless warm the cockles of quite a few hearts in Dolby Labs. To be euphemistic, Dolby in the '60s found it less than easy to sell the idea of hi-fi stereo sound to film technicians happy as crickets with mono technology and compromise standards dating back to the early '30s.

To go further would really mean quoting the whole of George Martin's book because hardly a page turns without some little factual snippet or scurrilous gem. It seems a pity that such meaty material has received so little publicity. Presumably the book trade has its own equivalent of record hyping and *All You Need is Ears* was one that just didn't get hyped. ■

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# Studio Equipment Services Limited

100 Hamilton Road, London NW11
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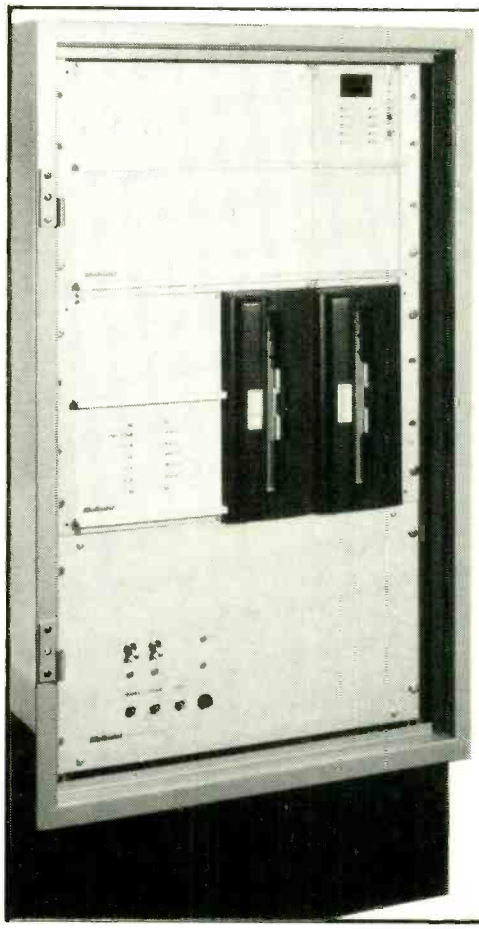

# GT800 Automated Automation

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

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SIFAM

# Survey: synthesisers and vocoders

ARP 2600

**Our first ever survey of synthesisers and vocoders covers all units suitable for studio usage. While we have endeavoured to be fully comprehensive, should any manufacturer be omitted would they please send us full details of their products for future inclusion in *Studio Sound*.**

## ARAGORN (UK)

**UK:** Turner Electronics, 58 Upper Tooting Road, London SW17 7PB.
Phone: 01-672 8585. Telex: 946108.

**Graph transducer system**
In its *AD2000* format comprising an *S101* VCO sequencer, three *S102* extender modules, and an *S103* module, this system will sequence a standard synthesiser setting a tune, its duration, plus the level and filter frequency of each note.

## AHAK (UK)

**Arak Sound Ltd, Preston House, High Street, Crowthorne, Berks.**
**Phone: 03446 2550.**

**Polycontroller**
Polyphonic keyboard controller which can be connected to any standard synthesiser or synthesisers. CV and gate outputs for up to 10 voices and separate ADSR for each with one set of master controls. 'Bend Bar' for bending pitch of notes. Computer interface which will allow the control of any synthesiser attached to the polycontroller by the computer. Vibrato, portamento and volts/octave adjustments.

## ARP (USA)

**ARP Instruments Inc, 45 Hartwell Avenue, Lexington, Massachusetts 02173.**
**Phone: (617) 861-6000. Telex: 940483.**
**UK:** London Synthesiser Centre, 22 Charlton Street, London NW1.
Phone: 01-387 7449.

**ARP Odyssey**
Self-contained portable synthesiser with integral duophonic keyboard.
**Oscillators:** two; sawtooth, square, pulse and dynamic pulse on each; VCO1 0.2 to 20Hz in low-frequency mode; VCO1 and VCO2 20Hz to 20kHz in audio range. Pulse width 5 to 50%: ADSR + 45%, and LFO + 15% modulation.
**Noise generator:** pink and white.
**Transpose:** normal and ±2 octaves.
**Pitch Bend:** Proportional pitch control; 3 'live' rubber pads that respond to finger pressure (pitch bend up, vibrato, pitch bend down). Vibrato rate controlled by LFO speed.
**Portamento:** 0.01ms to 1.5s/octave.
**Filters:** one VCF lowpass, 16Hz to 16kHz, maximum 'Q' 30.
**Ring modulator:** digital working with VCO1 and VCO2 squarewave inputs.
**Sample and hold:** from keyboard or LFO trigger commands, sampling VCO1 square and sawtooth, VCO2 square and pink noise.
**Envelope generators:** 2; ADSR attack 5ms to 5s, decay 10ms to 8s; sustain 0 – 100% of peak, and release 15ms to 10s; AR attack 5ms to 5s; and release 10ms to 8s.
**Keyboard:** 37-note 3-octave.
**Outputs:** 2; 2.5V peak-to-peak 100kΩ, and 0.25V peak-to-peak 10kΩ.
**Interface jacks:** keyboard CV in/out; gate in/out; trigger in/out; and external audio input.
**Dimensions:** 24¾ × 18½ × 10in.
**Weight:** 28lb.

**ARP AXXE**
Self-contained synthesiser with integral keyboard.
**Oscillator:** 1; sawtooth, square, pulse and dynamic pulse, range 16Hz to 16kHz, 'tune' control range ±1.5 semitones, vibrato depth ±1 octave maximum; trill depth ±1.2 octaves maximum; ADSR shift +9 octaves maximum; pulse width 5-50% and ADSR + 45%; LFO ±25%.
**Noise generator:** pink, 20Hz to 20kHz ±3dB.
**Transpose:** down 2 octaves, normal, up 2 octaves.
**Pitch Bend:** proportional pitch control: 3 'live' rubber pads that respond to finger pressure (pitch bend up, vibrato, pitch bend down). Vibrato rate controlled by LFO.
**Portamento:** 0.01ms to 1.5s/octave.
**Filter:** 1 VCF, 16Hz to 16kHz, max. 'Q' approx 30; LFO modulation 1.5 octaves max and ADSR sweep 10 octaves maximum.
**Sample and hold:** from LFO squarewave commands, pitch deviation in VCO and frequency deviation in VCF 2.5 octaves maximum.
**Outputs:** 2; 2.5V and 0.25V peak-to-peak.
**Interface jacks:** keyboard CV in/out; gate in/out; trigger in/out and external audio input.
**Dimensions:** 26.5 × 15.5 × 4.5in.
**Weight:** 22lb.

**ARP OMNI-2**
Self-contained synthesiser, portable with integral keyboard. Features electronic switching, single/multiple triggering and a separate bass synthesiser.
**String section controls:** instruments — violins, violas, cellos and bass; envelope controls — attack and release times.
**Synthesiser section controls:** waveform (sawtooth and dynamic pulse), bass, VCF, LFO speed, ADSR level and times.
**Keyboard:** 4 octaves, split for bass voices at 1½ octaves from low end.
**Outputs:** 4; main high and low level, and synthesiser line level (can be used simultaneously for discrete stereo effects), gate and trigger out, and foot switch and optional pedal.
**Weight:** 41lb.

**ARP PRO/DGX**
Compact portable synthesiser with 30 preset 'instrument' sounds utilising internal analogue and digital circuitry. Preset selected by click switches with LED indication.
**Touch sensor effects:** keyboard responds to any increase in finger pressure and gives variety of selectable effects including pitch bend, wow, growl, brilliance, volume and vibrato.
**Variable keyboard adjustments:** volume, brilliance, portamento speed and touch sensor sensitivity.
**Other controls:** transpose, vibrato speed, repeat switch.

**ARP QUADRA**
User-presettable polyphonic synthesiser with integral keyboard. *Quadra* is really 4 separate synthesisers in one microprocessor-controlled system; bass synthesiser, string synthesiser, polyphonic synthesiser and 2-voice synthesiser.
**Bass synthesiser:** can be set to control the 2 lower octaves of the keyboard with a variety of settings.
**String synthesiser:** produces string sounds and can be used with the stereo phase shifter over 4-octave range.
**Polyphonic synthesiser:** can be processed through VCA VCF, sample and hold, etc.
**Lead synthesiser:** 2-note synthesiser with pressure sensitive keyboard control over 5 octaves or 3 octaves if the bass section is in use. This section has the capability of 2-channel portamento, intervals and octaves to be programmed from the keyboard using the microprocessor, built-in sequencer which can memorise and play sequences while other sections are being used. Sixteen sounds can be programmed into the memory and recalled at will. Each section of the Quadra is programmable and mixable through the internal output mixer.
**Oscillators:** frequency range of 20Hz to 20kHz; sawtooth, square, pulse and dynamic pulse waveforms; pulse width 5% to 50%; pulse width modulation, LFO ±25%, ADSR +25%.
**Low frequency oscillator:** frequency range of 0.2Hz to 20Hz with square or sine waveforms.
**Filters:** voltage controlled lowpass filter with 24dB/octave slope over 16Hz to 16kHz. Maximum LFO modulation 1.5 octaves and maximum ADSR sweep 10 octaves.
**Envelope generator:** Attack 5ms to 5s; decay 10ms to 8s; sustain level 0 to 100% of peak; release 15ms to 10s.

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# Survey

**VCA:** dynamic range of 80dB.
**Interface jacks:** control voltage in/out; gate out/in; trigger out/in.

**ARP 2600**
Portable synthesiser with optional keyboard. Any prewired connection(s) can be overridden by simply inserting 'a patch cord insertion'.
**Oscillators:** 3 VCO 0.03Hz to 20kHz in two ranges. Variable width pulse, triangular, sine, square and sawtooth waveforms.
**Filter:** 1 VCF lowpass, variable resonance. Doubles as a low-distortion sinewave oscillator.
**Ring modulator:** 1, ac or dc coupled.
**Envelope generators:** 2.
**Envelope follower:** 1.
**Noise generator:** 1, variable white to pink.
**Sequencing:** 1 electronic switch, bi-directional.
**Reverberation:** 2 uncorrelated stereo outputs.
**Keyboard:** 4-octave with variable tuning, portamento, tone-interval and memory circuit.
**Additional features:** general purpose mixer and panpot; 1 voltage processor with variable lag; 2 voltage processors with inverters; 2 built-in monitor amps and speakers with headphone jack; 1 mic preamp with adjustable gain.

**ARP Solus**
Portable synthesiser with integral keyboard.
**Oscillators:** 2, mixable sawtooth and pulse wave outputs with continuously variable pulse width. Both VCO can be phase-synchronised.
**Filter:** 4-pole filter that can be modulated with inverted ADSR.
**Keyboard:** 3-octave.
**Additional features:** ring modulator, master vibrato and pitch bend sharp and flat, full system interface jacks.

**ARP Sequencer**
16-note sequencer which can also be operated as 2 separate 8-note channels. Tuning of each note is by tuning sliders. Steps can be skipped, and with the foot pedal control starts, skips, stops and steps can be remotely controlled.
**Output:** 5 gate outputs, pulse width modulation control, mini 'D' patching jacks to interface with ARP synthesisers such as the 2600.

## BARTH (West Germany)
**R. Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76.**
**Phone: 040 229 8883. Telex: 0212095.**

**Musicoder**
Compact rack mounting vocoder with 16 filter channels and mono/stereo output. Input level controls for programme and control signals; hi-boost switch to add mid and high frequency boost to the control signal to increase harmonic content prior to vocoding; bypass matching controls; Auto-bypass to route programme to output if no control signal is present and this may be done in a fast or slow mode; threshold and level controls for noise generator; output level control.

## BLACET (USA)
**Blacet Music Research, 18405 Old Monte Rio Road, Guerneville, California 95446.**

*Casiotone 201*

**Syn-Bow**
Compact handheld synthesiser using a rotating lever as the principal control. The lever, known as the frequency bow, moves through 300° to achieve a 3-octave range with 3 sound types — blown, bowed and plucked. Other controls include 'attack sensor', pulse width, frequency modulation, sub-octave mix and 'natural filter patch' which is responsible for the 'organic' quality of the sound. Powered by 9V batteries or ±15V and available only in self-assembly kit form.
**Price:** $124.

## BUCHLA (USA)
**Buchla and Associates; Box 5051, Berkley, California 94705.**
**Phone: (415) 452-4136.**

Two series of modular electronic music components. The *200 series* includes 12 modules with various cabinet and power supply options. The *300 series* enables digital control of the *200 series*.

**Model 207 mixer/preamplifier**
6-channel stereo mixer and single universal pre-amplifier. Mixer section includes VC location capability and the preamp handles a variety of impedances and levels.

**Model 208 programmable sound source**
Primary signal source is 'complex oscillator' with second oscillator used to modulate the amplitude and frequency. Signal enveloping by 2 lowpass gates with ability to gate in frequency or amplitude domains or both simultaneously. Control voltage section includes 5-position sequencer, random voltage generator with 4 uncorrelated outputs, an envelope generator with voltage controllable attack, sustain and decay times and a voltage controlled pulser that provides trigger pulses and additional envelopes. Provides capability for permanent storage and retrieval of instrument patches by plug-in cards. Includes preamplifier with envelope follower in addition to reverb, mixing and monitoring.

**Model 221 kinesthetic input port**
Touch-sensitive keyboard with capacitance-activated rapid response keys. Positional feedback achieved via frets and raised keys. 32-note section provides CV for pitch and pressure and pulses for transient information. Lateral key pressure gives control over portamento and pitch bending. Additional sections control presets, octave shifting and 2 variable joystick controls. Buffered outputs for digital processor interface and specialised keys for 'Patch IV' the music language employed in the *300 series* systems.

**Model 227 system interface**
For equalisation, location, mixing monitoring and routing of signals in 4-channel studio or performance environments. 12 signal inputs include 4 primary inputs with bass, treble, echo send and pan controls while remaining 2 groups of 4 are for line use. 4-channel output busses. VU metering and internal reverb.

**Model 230 triple envelope detector**
3 envelope followers with control voltage outputs. Decay times adjustable from 0.1 to 5s. Pulse outputs can be coupled to output voltage or respond to transients which enables detection of attack transients over wide amplitude and background noise variations.

**Model 257 dual control voltage processor**
2 identical sections, each of which applies several control voltages to one signal. Algebraic manipulations possible include addition, subtraction, scaling, inversion and multiplication. Control voltage may transfer control between 2 additional applied voltages.

**Model 259 programmable complex waveform generator**
2 independent oscillators primary oscillator 27Hz to 7kHz, phase locking and separate VC of harmonic intensity, order and symmetry. Second oscillator 0.25Hz to 7kHz in 2 ranges, selectable waveshapes and provision for use as LFO control for pitch, amplitude and/or timbre. Provision for VC. All functions can be remoted for computer control and automatic crystal referenced tuning.

**Model 266 'source of uncertainty'**
Produces 2 continuously varying random voltages with VC probable rates of change and 4 pulse activated random voltages with VC over quantisation levels and probability distributions. Also includes noise source with 3 energy distribution patterns, a VC integrator and sample and hold.

**Model 281 quad envelope generator**
4 independent envelope generators with VC attack and decay with provision for complex shapes in addition to transient functions.

**Model 285 frequency shifter/balanced modulator**
VC frequency shifter, control voltage internal or external. Frequencies above and below reference simultaneously available. Separate VC balanced modulation included providing all stages between unmodified to amplitude modulated and ring modulated signals.

**Model 292 quad voltage controlled low pass gate**
4 independent gates with selectable amplitude-dependent spectral characteristics. Knob settings and applied control voltages determine levels and cut-off frequencies. A summed output facilitates voltage controlled mixing.

**Model 296 programmable spectral processor**
16-channel filter with 6-pole filter sections. Can be operated as graphic equaliser with envelope followers and VCA for analysis and synthesis. Computer interface. Also operable as 2 8-channel filters or in other modes as vocoder.

**Model 300A processor**
Compact *S-100* based computer with *8080* CPU, 32KB memory and interfaces for cassette recorder, video display, EIA terminal and the *300 Series* databus. It requires an auxiliary cassette recorder for program and data storage and a video monitor for display. It includes a high level interactive music language called *Patch IV* enabling effective communication between the musician and the *300 Series* system. *Patch* IV is fully documented, software listings being provided in both source and object form and is periodically updated.

**Model 329 Patchbay**
Interface for connecting between *200 series* modules and the *300 series* hardware.

**Model 360 octal programmable sound source**
Multiplexed oscillator that combines 24 digital oscillators into 8 discrete outputs. Pitch fm frequency, fm index, timbre, timbre modulation frequency, tm index and amplitude may be digitally specified, voltage controlled or manually operated from the panel. Operated with *300A* processor with *Patch IV* and *364* multiple arbitrary function generator.

**Model 364 multiple arbitrary function generator**
Generates under software control up to 64 simultaneous static or dynamically varying voltages for the various voltage controlled parameters in the *200/300 series* modules. Up to 16 input voltages may be simultaneously processed.

**Touche**
Digital/analogue keyboard controlled synthesiser. Integral 16-bit computer for user communication and data processing using FOIL language. Sound generation by multiplexed digital signal generator with crystal derived pitch. 24 digital oscillators combined into 8 voices assignable to variety of polyphonic split keyboard and multi-instrument

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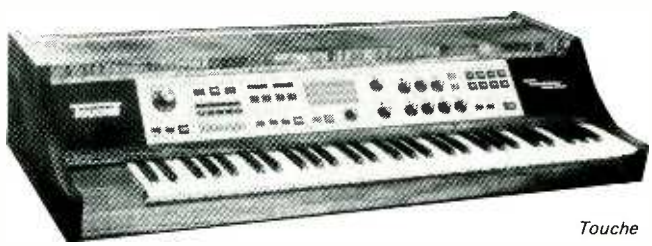


*Touche*

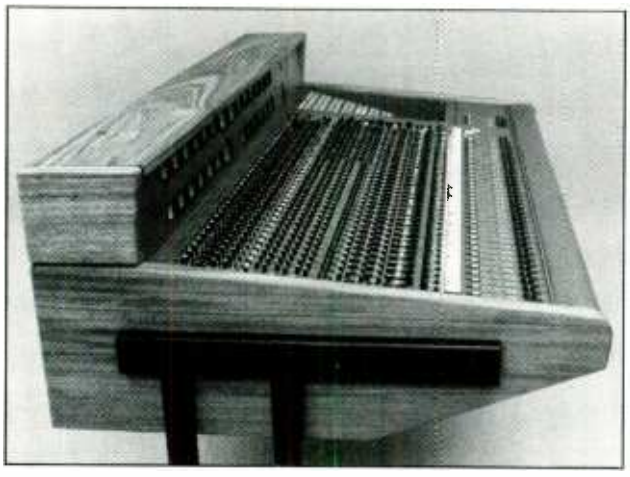
# ANOTHER MCI FIRST

## MCI—the first company to offer the totally transformerless system

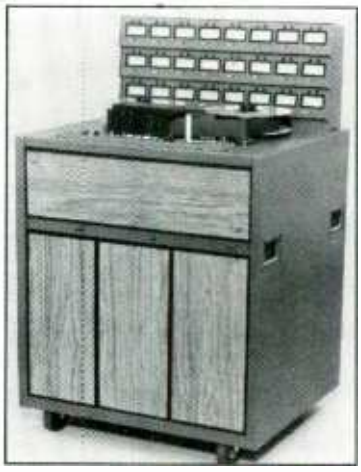
New integrated circuitry now make it possible for MCI to remove transformers throughout their product range

No head transformers in tape machines
No mike transformers in consoles
Electronically balanced inputs and outputs throughout*

JH-600



JH-24



JH-110B Series

*Line transformers optionally available

MCI (PROFESSIONAL STUDIO EQUIPMENT) LTD.

MCI House, 54-56 Stanhope Street, London NW1 3EX. Tel: 01-388 7867/8. Telex: 261116

modes. Internal processor for processing external inputs. Fully programmable with up to 64 labelled instrument definitions storable with additional programs storable on tape for later retrieval.
**Price:** $8,500 approx.

## CASIO (Japan)
**UK:** Casio Electronics Co Ltd, 28 Scrutton Street, London EC2A 4TY.
Phone: 01-377 9087.

**Casiotone CT-201**
Compact polyphonic synthesiser (8-voice) with 49-note keyboard. 29 preset sounds selectable by keyboard in set mode. 4-position switch holds selected presets for quick access. Other features include 2 position tone selection, vibrato and sustain. Internal speaker.
**Dimensions:** (hwd) 3 x 33½ x 9⅜ in.
**Weight:** 15lb.
**Price:** £248.

**Casiotone M-10**
Small 2½-octave (32-note) polyphonic synthesiser with 4 preset sounds, internal speaker, vibrato and powered by internal battery or ac adapter.
**Dimensions:** (hwd) 2 x 16½ x 5⅜ in.
**Weight:** 3.5lb.
**Price:** £69.

## CON BRIO (USA)
**975 San Pasqual Street, Suite 313, Pasadena, California 91106.**
**Phone: (213) 795-2192.**

*ADS 200*

**ADS 200**
Digital synthesiser with 2 manual keyboard, video display and disk drive. Contains 5 microprocessors, 64 multiwaveform digital oscillators and dual 16-bit stereo output channels. Instant recall from floppy disk and assignment to left or right side of keyboard — split position variable. Tuning storable on disk with fine tuning on panel. Ensemble position allows grouping of voice assignments, transpositions, volume balancing, channel assigns and cued playback material for recall as complete groups which can be selected by footswitch. 'Unlimited' storage space for polyphonic tracks on disk and replay of up to 4 tracks at once. Video screen can be used to display in conventional musical notation what has just been performed which can then be printed by interfacing with a line printer and the necessary software package. 6 waveforms are available: sine, triangle, sawtooth, square, pulse and noise together with conventional ADSR or 16 segment envelopes. Synthesis modes include additive synthesis, phase modulation, frequency modulation, etc. All parameters can be floppy disk stored. Comprehensive interface capability and software available includes an operating system, text editor and macro-assembler. Can be interfaced with *PDP 11, PDP 10, LSI 11,* Nova or IBM computers.
**Dimensions:** 21 x 48 x 31in (hld).
**Weight:** 175lb.

## CRUMAR (USA)
**Digital Keyboards Inc, 105 Fifth Avenue, Garden City Park, New York 11040.**
**Phone: (516) 747 7890. Telex: 5102227618.**

**Crumar GDS**
Digital computer controlled synthesiser with 61-note velocity sensitive keyboard. System consists of keyboard, video display, alpha-numeric keyboard, *Z-80* microprocessor, and 2 disk drives. The system can use up to 8 independent voices and each voice may use up to 16 of the 32 available oscillators. Video display for program parameters; 16-bit D/A converter; 65 input devices. 8-track digital event recorder with editor, speed, transposition and rhythm controls and allows the superimposition of improvised material. Complete system under software control allowing continual update.

## EMS (UK)
**EMS Synthesisers, 277 Putney Bridge Road, London SW15.**
**Phone: 01-788 3491.**
**USA:** EMSA, 269 Locust Street, Northampton, Massachusetts 01060.
Phone: (413) 586 3777.

**Synthi VCS 3 Mk II**
Voltage-controlled unit with facility for connection to external keyboard.
**Inputs:** 2 of 1.8V ac max into 50kΩ; two of 2.5V dc max into 50kΩ; 2 of 5mV ac into 600Ω (mic).
**Outputs:** 2 of 2V peak-to-peak into 600Ω with filters and panning; two of 10V peak-to-peak into 50Ω (headphones, etc); two of ±5V dc into 10kΩ.
**Oscillators:** 3; 1 to 10kHz, sine and ramp; 1 to 10kHz, rectangular and ramp; 0.025 to 500Hz, rectangular and ramp.
**Noise generator:** variable white/pink noise.
**Filter:** adjustable Q and frequency; up to 20 max and 5Hz to 10kHz respectively. Cut-off rate 18dB/octave maximum.
**Ring modulator:** transformerless IC design with −60dB input rejection.
**Envelope shaper:** attack 2ms to 1s; decay 3ms to 15s; variable gain with trapezoidal output.
**Reverberation:** dual spring, 25 and 35ms with maximum reverb time of 2s; voltage control of reverb/mix ratio from 0 to 100%.
**Joystick:** any 2 parameters in x-y motion.
**Meter:** level or sequencer readout. (If KS keyboard is added, indicates the contents of memory).
**Auxiliaries:** may connect directly to KS or DK2 keyboards or other EMS modules.
**Dimensions:** 17¼ x 17½ x 16½ in (hwd).
**Price:** £1,268.

**Synthi-AKS**
Compact portable voltage-controlled unit comprising *Synthi VCS3 Mk II* facilities and KS touch keyboard/sequencer. Older models of *VCS3* or *A* can be updated by a works modification to operate with the KS keyboard.
**Price:** £1,452.

**Synth E**
General purpose synthesiser especially designed for educational purposes. A teaching course has in fact been based on this unit.
**Oscillators:** 3; 1Hz to 10kHz sine, triangular and VC pulse; 0.01 to 15Hz LFO; 10Hz to 10kHz filter/oscillator with VC low, high and bandpass or pure sinewave.
**Other facilities:** trapezoid generator, noise generator, inverter, mixer, modulator, manual slide tape controls — 1 stepped for use as a keyboard and the other for variable control. Internal monitor amplifier and speaker.
**Price:** £558.
*Synthi DKE* 3-octave mechanical keyboard for *Synthi E.*
**Price:** £200.

**EMS Polysynthi**
Keyboard controlled polyphonic synthesiser.
**Oscillators:** fully polyphonic oscillator bank covering 9 octaves in 6 overlapping ranges. Triangle, square and pulse waveforms may be mixed in any combination.
**Noise generator:** white noise. This can be mixed with external inputs and mixed with the oscillator before filtering.
**Filters:** lowpass filter switchable 12 and 24dB/octave voltage controlled. Variable Q and frequency can be controlled by ADSR, LFO and keyboard voltages. This can also be swept by *ADSR 1* or an external control.
**Delay line:** integral analogue delay line for effects. The delay time can be voltage controlled from the ADSR, LFO or keyboard voltages for special effects.
**Keyboard:** 49-note C to C providing control voltages for the oscillator bank and 2 additional control voltages — 1 corresponds to the highest note played and the other is proportional to the total keyboard pressure.

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# Survey

**Rear panel:** jack sockets for external input, 3 foot pedal sockets, and output.
**Sequencer option:** microprocessor controlled sequencer allows up to 10min of polyphonic music to be stored. Also capable of octave additions, transpositions and harmonic voicings, and editing.
**Price:** £2,090.

**8-octave filter bank**
**Input:** 6V peak-to-peak maximum.
**Gain:** 10 dB ±1.5 dB maximum.
**Filter gain:** 9dB ±3dB maximum.
**Filter frequencies:** 63, 125, 250, 500, 1k, 2k, 4k, 8kHz.
**Filter tuning:** centre frequencies to ±10%.
**Filter slope:** 12dB/octave maximum.
**Crosstalk:** −60dB between channels.
**Hum and noise:** −80dB ref maximum gain.
**Power:** 240/115V, 50/60 Hz.
**Size:** available in case or rack-mounting (standard 19in × 1¾in).

**2-voltage random generator**
**Outputs:** two staircase type; steps occur randomly; range and time variance controllable; outputs change simultaneously.
**Time control:** Internal clock may be: free running, subject only to manual control; pulse controlled (manual or external); free running such that mean rate controlled by external voltage. Time variance control may range from zero (mean rate constant) to maximum (random variation more than 100:1, rectangular distribution).
**Control output:** ±2.5V maximum.
**Trigger output:** +4V.
**Time range:** mean 0.2 to 20 events/s.
**Power:** 240/115V, 50/60 Hz.
**Size:** available in case or rack-mounting (standard 19in × 1¾in).

**Pitch-to-voltage converter**
'Adaptive filter' provides tracking of fundamental down to strengths of 10% of total signal energy. Chooses lowest note of chord.

Output may reproduce envelope of incoming signal, or related envelope shape. Signal channel gives manually preset mixture of original input signal with tuneable internal oscillator which tracks input in pitch and loudness. Control voltage output can be pitch or loudness (envelope) following. Reference oscillator enables accurate tuning.

Envelope triggering pulse can give steady level wherever input is above trigger threshold, or 20ms (approx) pulse whenever input rises to threshold.
**Input:** minimum level for gate operation 10mV peak-to-peak (low range) or 1V peak-to-peak (high range); maximum 100mV and 100V peak-to-peak (low and high range respectively).
**Output:** 18V peak-to-peak maximum.
**Pitch voltage:** 1V (±0.15V)/octave (invertible).
**Internal oscillator:** 256Hz ±24%. Octave function precise.
**Trigger output:** average +4V, maximum unloaded 12V.
**Envelope voltage:** 1V (±0.15V) per 6dB gain. Log/lin, both invertible.
**Noise and hum:** −60dB ref max output.
**Connectors:** Jack sockets on front, multiway connector at rear.
**Power:** 240/115V, 50/60 Hz.
**Size:** available in case or rack-mounting (standard 19in × 1¾in).

**Vocoder 2000**
'Compact, low-cost, simple to use' vocoder system.
**Input:** speech and excitation both 'line' into 500kΩ, or 'mic' into 5.6kΩ.
**Output:** mix of synthesiser, excitation and voice; line level, low impedance; S/N better than 60dB.
**Oscillator:** 0-1kHz pulse, optionally gated by 'voiced' decision.
**Noise generator:** white, optionally gated by 'voiced' decision.
**Filters:** 16; 14 6th-order active bandpass, plus low and highpass; plus 16 envelope followers and modulators, dynamic range 55dB.
**Others:** slew/freeze controls over wide range, oscillator range 1 to 30Hz.
**Dimensions:** 20 × 4 × 13½in.
**Weight:** 11lb.
**Price:** £813.

**Vocoder 5000**
Self-contained portable instrument that can synthesise speech at constant and varying pitch; and modify it in numerous ways. Speech signal is

*Vocoder 5000*


analysed in frequency bands, the amplitude of which is converted into voltage that controls gain of filter bank. Can be computer monitored and controlled, and linked to *Synthi 100* and others.
**Input:** 10kΩ unbalanced, −20dBm minimum level.
**Output:** 'low' impedance, 0dBm unbalanced.
**Oscillators:** 2VCO; range 1 to 10kHz; square or ramp; gating, frequency, level, pitch extraction, external voltage and keyboard input controls.
**Noise generator:** variable colour and gating.
**Filters:** bank of 22 channels each containing analysing filter, envelope follower, slew limiter, VCA and synthesising filter; 20 and 7,888Hz (±3%); high and lowpass filters complete bank; S/N ratio 72dB; all inputs and outputs available on rear multiway.
**Pitch extractor:** produces voltage proportional to log of speech glottal pulse frequency; range 50-1kHz; response time for 6% accuracy 5 cycles or 20ms; output voltage +0.5V/octave and ±1.1V/octave.
**Patching:** one 22 × 22 patchboard.
**Spectrum display:** real time; outputs via two *BNC*, connectors to external 'scope (not included).
**Monitoring:** three PPMs for speech, excitation and output levels.
**Others:** voiced/unvoiced detector; slew/freeze; frequency shifter, range ±0.05-1kHz; keyboard controller/interfacer.
**Dimensions:** 35 × 9½ × 21½in.
**Weight:** 45lb.
**Price:** £7,165.

**Synthi DK2 dynamic keyboard**
Conventional keyboard with dynamic control for *Synthi VCS3* or *A* models.
**Outputs:** two voltages proportional to the pitch interval of the notes played (keyboard voltage); one voltage proportional to velocity of key depression (dynamic voltage); sawtooth wave from keyboard oscillator, pitch and loudness controlled by the keyboard; trigger signal every time key is depressed, to be connected to synthesiser envelope shaper.
**Range:** 3 octaves (nominal), C to C.
**Keyboard voltages:** ±1.5V at 1V/octave.
**Dynamic voltage:** ±1.5V, range adjustable.
**Sawtooth voltage:** 30Hz to 2kHz fundamental. Maximum output 10V peak-to-peak. Tuning position and spread controls.
**Power:** +12V and −9V connected by multicore cable from synthesiser power unit.
**Price:** £472.

**Synthi KS digital sequencer keyboard**
Touch keyboard incorporating simple sequencer to fit in *Synthi A* case.
**Outputs:** one direct from keyboard section, one from output of sequencer memory.
**Range:** 30-note conventional keyboard format. Capacitive touch keyboard, plastic coated for humidity and mechanical protection.
**Sequence length:** 1536 (= 256 × 6).
**Memory:** shift register.
**Keyboard pitch voltage:** 1V per octave adjustable, mean.
**Sequencer pitch voltage:** 0.32V per octave adjustable, mean.
**Sequencer ripple:** worst case 30mV peak-to-peak.
**Controls:** clock rate, pitch spread, trigger select.
**Touch pads:** record, play, random voltage, transpose (semitone, major third, perfect fifth).
**Power:** +12V and −9V connected by multicore cable from synthesiser power unit.
**Price:** £267.

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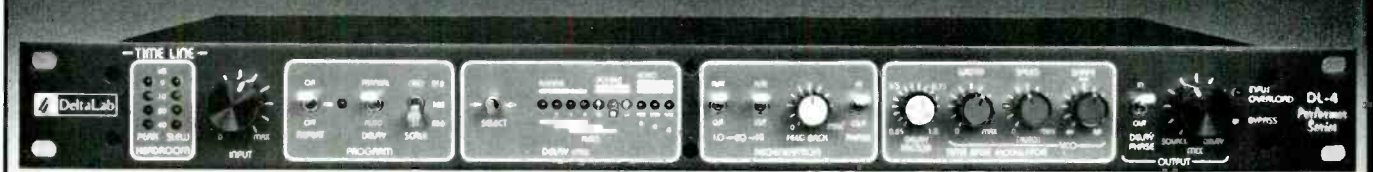


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# Survey

**Synthi sequencer 256**
Fast access digital storage unit incorporating analogue-to-digital and complementary converters. Designed to provide convenience of sequence editing of up to 3 simultaneous parameter pairs (such as pitch/loudness). Sequence refers each event to one standard time, as opposed to a previous event, so that individual segments may be updated without affecting adjacent data.
**Outputs:** 10 signal and control voltages, at individual jack sockets or multiway connector.
**Storage:** maximum 256 events, each of 42 bits; total 10,752 bits.
**Tracks:** 3, with 4th available for pulse data only.
**Byte arrangement:** 13 bits start time, 13 bits end time, 12 bits controlled parameters divisible between two parameters depending on resolution required.
**Sequence:** time resolution enables reference to common time.
**Access time:** maximum 0.01s.
**Clock rate:** 0.1 to 200Hz; clock functions may be operated remotely.
**Range:** 5 octave (nominal) dynamic keyboard of conventional layout.
**Compatibility:** automatic offset control for use with equipment other than EMS.
**Price:** on application.

**S128**
Small version of the *Sequencer 256* offering editing facilities with built-in metronome and event by event options.

**Universal sequencer**
Interfaces with any other synthesiser. Self-contained with integral keyboard. Up to 256 notes and triggers can be recorded in a sequence from 30-note keyboard. Digital display of sequencer position, plus indication of mode. Transposition of sequence voltage by preset touch tabs. Random noise generator. External trigger from audio signal or pulse. Wide range of internal clockspeed.

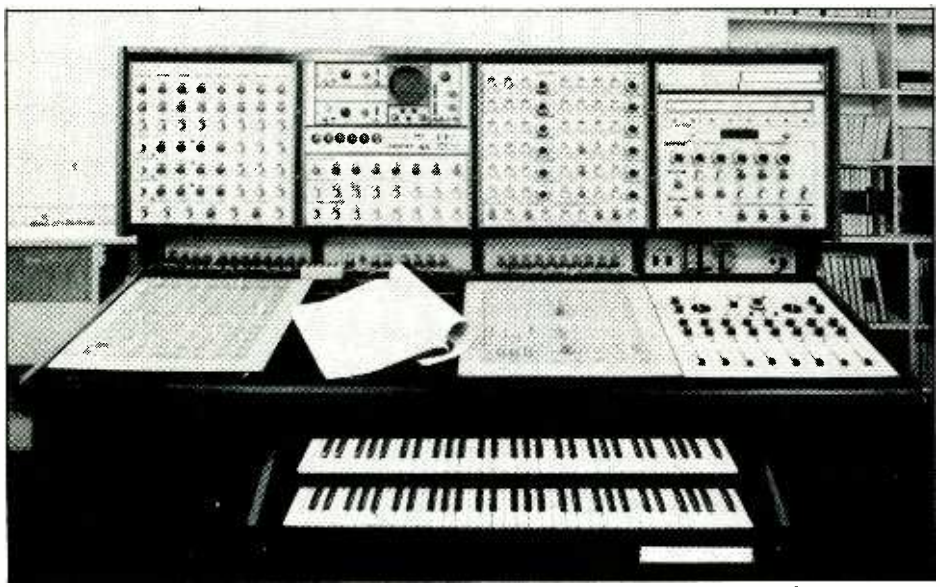
**Computer synthi**
A 'full sized' computer with full supporting software systems. Sequencer can be used to control any VC system.

**Synthi 100**
Extensive system incorporating various modules and additional facilities.
**Oscillators:** 12: six of sine/ramp, 1 to 10kHz, with sync input; 3 of square and triangular, 1 to 10kHz, with sync input; 3 of square and triangular, 0.025 to 500Hz, with sync input.
**Noise generators:** 2, with variable frequency envelope.
**Random generator:** 2 outputs, rectangular distribution, time variance 1:1 to 100:1; mean time 10ms to 10s.
**Envelope shapers:** 3; 5 triggering modes; each section of dual trapezoidal output variable 2ms to 20s.
**Filters:** 4 of lowpass to resonance; 4 of high pass to resonance: range 5 to 20kHz; Q up to 20; cut-off 12dB/octave for 1st octave then 18dB/octave; 8 of fixed narrow bandpass filters, octaves between 62.5 and 8kHz.
**Reverberation:** 2 spring units, VC of reverb/direct ratio.
**Slew limiters:** 3, 1ms to 10s.
**Ring moduators:** 3, IC transformerless; input rejection 60dB.
**Sequencer:** as for *Sequencer 256* digital storage unit (see above).
**Output:** 8VCAs each with fader, pan, meter and variable filter.
**Joysticks:** 2, x-y type, any parameter pair.
**Keyboards:** 2, nominal 5-octave dynamic.
**Patching:** 2 of 60 x 60 pin matrix patch, boards; 1 for signals, 1 for controls, plus interconnections.
**Input:** 8 ac/dc input amplifiers; maximum 1.8V ac rms or ±2.5V dc.
**Frequency-voltage converter:** 1V/octave.
**Envelope followers:** 2, 1V ac rms per 6dB.
**External ties:** 4 send and return, plus multiway plug for external connection eg to a computer.
**Oscilloscope:** double beam.
**Others:** digital frequency meter/timer/counter; plus optional digital voltmeter and sequencer free store display.
**Size:** 80 x 38 x 33in (without stand).
**Price:** on application.

## FAIRLIGHT (Australia)

**Fairlight Instruments Pty Ltd, Boundary Street, Rushcutters Bay, Sydney.**
**Phone: (02) 33-5222. Telex: AA27998.**
**USA:** Fairlight Instruments USA, 1610 Butler Avenue, West Los Angeles, California 90025.
Phone: (212) 478 2414.
**UK:** Syco Systems, Ashcombe House, Swainswick, Bath, Avon.
Phone: 0225 859687.

**Fairlight CMI**
Digital computer based synthesiser consisting of keyboard, video display, alpha-numeric keyboard, CPU and 2 disk drives. The keyboard is 6-octave, velocity sensitive with 8-note polyphonic capability with its own central processor. A second keyboard manual is available. The tuning of the keyboard is referenced to a master crystal 'clock' and the scale is normally equally tempered although it is easily changed. Controls and foot pedals, etc, assigned to a function after programming. Synthesis includes Fourier synthesis, arbitrary waveform synthesis and video display and light pen. A waveform displayed on the screen can be modified using the light pen or originated on the screen. The alpha-numeric keyboard may also be used to modify the waveform. Capability to sample signal from audio input — mic or tape, digitise, manipulate and pitch it to the keyboard to enable playing of natural sounds which then may be modified using the CMI facilities. Realtime progammable sequencer which also stores key velocity information onto floppy disk with a maximum of 30 mins of music. Merge capability between sequences, click-track generation and the ability to replay up to 7 sequences while recording another. Full music composition language software (MCL). Disk drives use 2 diskettes — 1 for system and the other for library. Central processor unit consists of 2 *6800* microprocessors and with 80KB of RAM, with room for expansion and interface. The computer section can also be used for word processing separately from the CMI with standard industry interface. The system also includes an integral 20W amp.



*Synthi 100 studio*

## KORG (Japan)

**KEIO Electronic Laboratories Corp, Maison Yutaka Building, No 190, Nishiohkubo, 2-chome, Shinjuku-ku, Tokyo.**
**USA:** Unicord Inc, 75 Frost Street, Westbury, Long Island, New York 11590.
Phone: (516) 333-9100.
**UK:** Rose-Morris & Co Ltd, 32-34 Gordon House Road, London NW5 1NE.
Phone: 01-267 5151. Telex: 23170.

**PS-3300**
Polyphonic synthesiser requiring external control eg *PS 3010* keyboard. Consists of 3 source modules each with separate VCO, VCF, VCA and envelope generator for each note on the keyboard. Each note has individually adjustable pitch to alter the scaling of the keyboard. Signal generators adjustable over 6 waveforms and 4 footages. Comprehensive frequency modulation, filters, ADSR, LFO, modulation generators, signal mixing, sample and hold, general envelope generator and voltage processors etc.

**PS-3200**
Programmable polyphonic synthesiser with optional 48-note keyboard. 16 programmable presets under microprocessor control for instant access and update. Memory can memorise settings of 32 front panel functions with battery back-up. As well as programmable controls additional features include 7-band equaliser, extra signal generation and modulation balance module.

**PS-3100**
Polyphonic synthesiser with integral keyboard. VCO, VCF, VCA and envelope generator for each of the 48 keyboard notes. Built-in patch panel. Sample and hold, control wheel and momentary switch.

**MS-10/MS-20/MS-50**
Range of monophonic synthesisers with integral keyboards except the *MS-50* which has no keyboard. All feature patching facilities as standard with no internal connections. *MS-10/20* have control wheels and 2½ octave, 1 VCO and 3 Octave, 2 VCO features respectively. *MS-50* has patchable voltmeter.

**VC-10**
Vocoder with integral 32 note keyboard and internal oscillators. Switchable metering with chorus, vibrato, pitch bend and external signal facilities.

Other synthesisers for which information was not supplied include the *Trident* and *Delta* polyphonic synthesisers, *X91* guitar synthesiser and *SQ-10* sequencer.

## LINN (USA)

**Linn Electronics Inc, 3249 Tareco Drive, Hollywood, California 90068.**
**Phone: (213) 850-0741.**
**Marketing:** 360 Systems, 18730 Oxnard Street, Suite 215, Tarzana, California 91356.
Phone: (213) 342-3127.

**LM-1 drum computer**
Combination of synthesiser and drum machine. The memory has 12 digitally recorded drum sounds from the normal full kit to conga, cowbell, claves, claps, cabasa and tambourine as well as a metronome click track. Each drum sound is tunable in pitch. 13 input mixer for balancing level of the individual drums although each has a separate output as well. Keying buttons for each drum. Programming a rhythm involves tapping on the desired drum button against a selected metronome tempo. This can be with several drums or one at a time. The *LM-1* can then be instructed to correct any errors in timing to varying degrees or 'human feel' if required. Complete songs may be programmed with fills, rolls, dynamics, build-ups etc. Any time signature is possible and it may be synchronised to tape for overdubbing. Digital readout in beats per minute. Programmes retained in memory after power is removed and data may be stored on cassette tape for later reprogramming.

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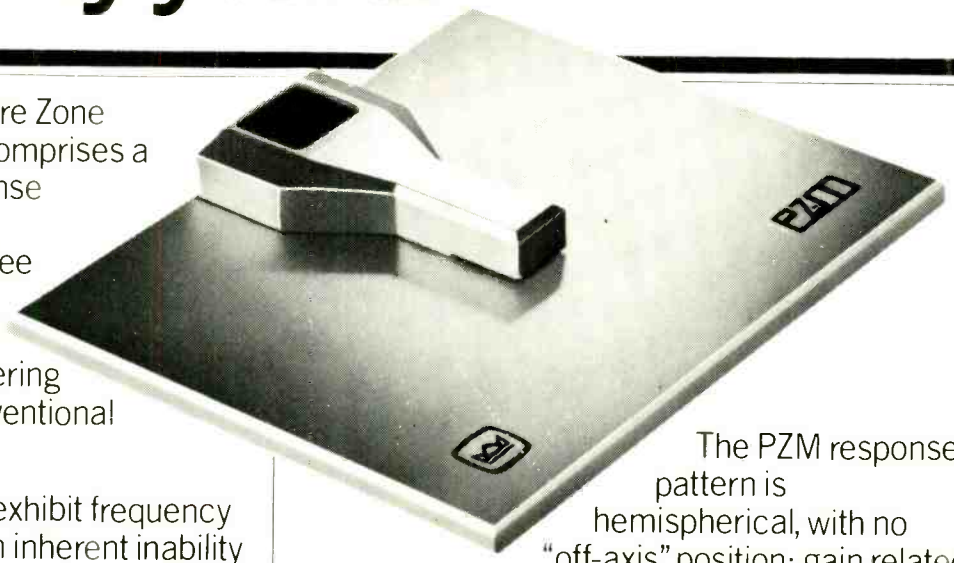
# Can you afford to ignore the most significant development in microphone technology of the last fifty years?




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

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

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

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

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

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

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

HHB

Amcron

PZM and PZMicrophone are registered trade marks of Crown International.

# Survey

## MOOG (USA)

**Moog Music Inc, 2500 Walden Avenue, Buffalo, NY 14225.**
**USA:** Norlin, 7373 North Cicero Avenue, Lincolnwood, Illinois 60646.
**UK:** Norlin, 114 Charing Cross Road, London WC1. Phone: 01-379 6400.

**Micromoog**
Small stage synthesiser with 32 note F to C keyboard with low note priority. Oscillator can be swept up or down from centre position on ribbon control or transposed to five different ranges from 32′ to 2′ with additional wide range setting. Modulation wheel for pitch bending, vibrato etc. Single waveform oscillator with doubling facility for mixing octave and two octaves (below primary) with main signal. Waveform continuously variable from sawtooth to narrow rectangular. Sample and hold, pink noise source, separate contour controls for VCF and VCA. LFO with modulation speeds of 0.3Hz to 30Hz.

**Minimoog**
Small portable performance instrument with integral keyboard.
**Oscillators:** 3 in six overlapping ranges 0.1Hz to 20kHz. Waveform switchable triangular, sawtooth, triangular-sawtooth mix, reverse sawtooth (osc. 3 only) and three widths of rectangular. Oscillators tunable individually except oscillator 1, which tunes with the master pitch control.
**Noise source:** white and pink noise generators switchable.
**Input:** preamp input 10mV to 2V at 100kΩ.
**Amplifiers:** two VCA with 80dB dynamic range.
**Envelope shapers:** two — one controlling filter through an attenuator and the other controlling the first VCA. Adjustable attack and release times of 10ms to 10s with range of sustain level 0 to 100% of contour peak.
**Outputs:** high level 0.5V, 3kΩ into low level 15mV into 1kΩ, headphone output 0.3V into 8Ω.
**Keyboard:** 44 note, 3½-octave keyboard F to C. Low note priority.
**Additional facilities:** pitch bending and modulation injection wheels; five input mixer; *A-440* tuning control; glide control; external control facilities for oscillator, trigger input, VCF and VCA. Customising facilities are now being offered by Moog including touch sensitive keyboard, multiple triggering, additional LFO facilities, wheels changed for ribbon control etc.

**Taurus pedal synthesiser**
Foot pedal instrument with three factory-preset synthesiser voices plus a fourth programmable voice. Operationally, the musician selects the sound from a series of pushbuttons. Two oscillators create phasing, parallel intervals and percussive sounds. The unit also includes variable attack, glissando and decay. There is a 5-octave range with foot sliders for swell and tone colour.

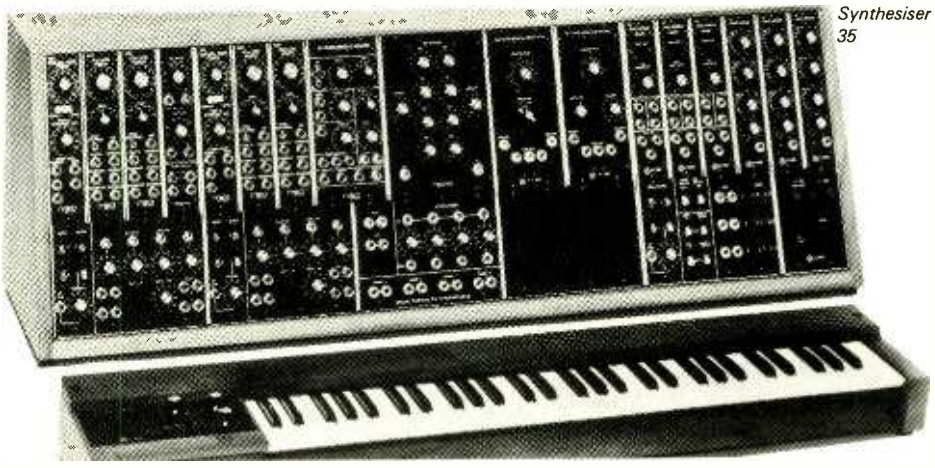
**Multimoog**
Compact keyboard controlled synthesiser.
**Oscillators:** Two with ranges of 0.1Hz to 20kHz. Master octave switch transposes oscillators to 32′, 16′, 8′, 4′, or 2′ ranges with additional position for wide range. Waveform is variable from sawtooth to narrow pulse.
**Noise generator:** pink noise source.
**Filter:** lowpass filter with variable height resonant peak at the cut-off frequency and a 24dB/octave slope. Range adjustable from 1Hz to 40kHz, voltage controlled. When set to the 'tone' mode filter becomes a sine wave generator with a 50Hz to 5kHz range.
**Amplifier:** one VCA with 80dB dynamic range.
**Envelope shaper:** two, one for VCF and one for VCA with attack and release variable over 1ms to 10s. Bypass switch to hold VCA open. Filter and loudness independently selectable for full or zero sustain.
**Keyboard:** 44 note F to C keyboard with low note priority. Single or multiple keyboard triggering selectable. Touch sensitive keyboard can be used to control pitch bend or the amount of modulation selected by the source selector.
**Modulation:** LFO producing square and triangle waveforms adjustable over 0.3Hz to 30Hz. Also supplies trigger to sample and hold.
**Additional features:** Sample and hold; portamento; ribbon for pitch bend; modulation wheel; provision for external control of most facilities.
**Dimensions:** 5½ × 31¾ × 15in (hwd).
**Weight:** 26lb.

**Moog Liberation**
Polyphonic with separate lead synthesiser in a portable format designed to be worn around musicians shoulder as if it was a guitar. A 'neck' is fitted to the bass end and contains the pitch control ribbon, filter emphasis, modulation, glide and volume.
**Oscillators:** polyphonic oscillator bank producing square waveform with a tunable range of ±3 semitones. Two separate voltage controlled oscillators. Oscillator 1 is sawtooth, triangle and rectangular waveforms with octave switching for 32′, 16′ and 8′. Oscillator 2 has sawtooth, triangular and square waveforms with octave switching for 16′, 8′, 4′.
**Noise source:** pink noise.
**Envelope shapers:** Two, one for VCA and the other for VCF. Attack, sustain and release times adjustable from 1ms to 10s with the sustain level variable from 0 to 100% of the contour peak.
**Filters:** range of 8 octaves for low pass filter cut-off frequency with slope of 24dB/octave.
**Controllers:** 44 note touch sensitive keyboards F to C with high note priority. Monophonic glide variable from 2ms to 3s. Pitch ribbon range ± a fifth.
**Additional facilities:** Sample and hold; external synthesiser interface; digital ring modulator; power supply/interface box with 40′ interconnecting cable.
**Dimensions:** 5⅜in × 46¾in × 12⅞in (hwd).
**Weight:** 14lb.

**Prodigy**
Small low-cost synthesiser with integral keyboard.
**Oscillators:** two; both give sawtooth and triangular waveform with oscillator 1 also producing rectangular and oscillator 2, square waveforms. Octave switching 32′, 16′ and 8′ on oscillator 1 and 16′, 8′ and 4′ on oscillator 2. Oscillators may be synchronised.
**Envelope generators:** two; one for VCF and the other VCA. Attack and release times 1ms to 10s with range of sustain level from 0 to 100% of envelope peak.
**Filter:** 24dB/octave cut-off slope sweepable over 8-octaves.
**Keyboard:** 32-note F to C.
**Additional features:** pitch and modulation wheels; separate LFO: adjustable portamento.
**Dimensions:** 5⅝in × 14⅞ × 23¼in (hwd).
**Weight:** 16lb.

**Moog studio systems**
This comprises 3 models *15*, *35* and *55*. Modular systems designed for more permanent installation except for the *15* which is packaged to be portable. All three models are available to special order only.

**Synthesiser 15**
Portable, modular constructed synthesiser. May be operated in conjunction with *952* (included) or *951* keyboards, *1120* foot pedal controller, *1150* ribbon controller, portable sequencer or touch sensitive percussion controller. A carrying case is available. Modules available as follows:
**Inputs:** 4-input mixer with + ve and − ve outputs, jack multiples.
**Oscillators:** *921* VCO, range 0.01-40kHz; fine and coarse tuning control; sine, sawtooth, triangular and rectangular forms; six switch-selectable auxiliary waveforms; three frequency-controlled input jacks; waveforms; sync at any point in the cycle. *921A* VCO driver, providing controls for associated *921Bs*; fine and coarse tuning control; three frequency control input jacks; rectangular waveform control 5% to 95%: two rectangular width control input jacks; *921* VCO, range 1 to 40kHz; sine, sawtooth, triangular and rectangular waveforms; ac and dc coupled frequency control input jacks; phaselock sync input.
**Amplifier:** *902* VCA, 80dB dynamic range, linear or exponential switchable response; three control inputs.
**Noise generator:** *923* white and pink; low and high pass filters, cut off frequency variable from 10 to 20kHz.
**Filters:** *907A* fixed filter bank; separate gain control of 10 ranges; half-octave bands between 250 and 2.8kHz; *904A* VC and manual lowpass filter; frequency variable 60 to 20kHz; three control inputs.
**Alternators:** *995* panel.
**Envelope generator:** *911*; separate control of rise/decay, sustain level and final decay time.
**Module complement:** 2 of *902*; 1 of *904A*; 1 of *907A*; 2 of *911*; 1 of *921*; 1 of *921A*; 2 of *921B*; 1 of *923*.
**Keyboard:** duophonic, nominally four octaves C to C.
**Power:** 110-125V ac, 50-60 Hz, 130W. Conversion for 220/240V available.
**Size:** 18 x 25 x 9½in (whd) (portable case).
**Weight:** 80lb.
**Price:** on application.



*Synthesiser 35*

**Synthesiser 35**
Modular constructed synthesiser for studio use. May be operated with auxiliary modules as *Synthesiser 15*. Includes *951* keyboard. For details of modules see above.
**Filters:** additional *904B* VC highpass filter, VC or manual control, 60 to 20kHz. Module complement: 3 of *902*; 1 of *904A*; 1 of *904B*; 1 of *907A*; 3 of *911*; 1 of *921*; 2 of *921A; 4 of 921B*; 1 of *923*.
**Keyboard:** *951*, nominally five octaves C to C.
**Power:** 110/125V or 220/240V ac, 50/60Hz, 180W.
**Size:** module housing 48½in wide × 15in high × 14in deep, keyboard 43in long × 4in high × 9½in deep.
**Weight:** 130lb.
**Price:** on application.

**Synthesiser 55**
Largest VC studio synthesiser of range, housed in three walnut cabinets. Includes *951* keyboard. For module details see above.
**Trigger delay:** *911A1* delay periods from 2ms to 10s; alternative delay periods running sequentially or concurrently (switch selected).
**Sequencer:** *960* sequential controller, three independent programmable voltage sequences; VC internal clock, manual and voltage control of start/stop; voltage trigger in and out for each sequence step; indicator light for operational status and sequencer state; *961* interface; *962* sequential switch selects up to three input signals; sequence stepping by external voltage trigger.
**Module complement:** 5 of *902*; 1 of *903A; 1 of 904A*; 1 of *904B*; 5 of *911*; 1 of *911A*; 1 of *914*; 1 of *921*; 2 of *921A*; 6 of *921B*; 1 of *960*; 1 of *961*; 1 of *962*; plus additional interface and control modules.
**Keyboard:** *951*, nominally five octaves C to C.
**Power:** 85-130V or 171-260V ac, 50-60Hz, 350W.
**Size:** main cabinet 48½in wide, 15½in high and 14in deep, upper cabinet 48½in wide, 10in high and 8½in deep, keyboard 43in long, 4in high and 9½in deep.

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# Neutrik XLR type line connectors
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## U.K. Sales:
## 1977 ~ Hundreds 1978 ~ Thousands
## 1979 ~ Tens of thousands 1980 ~ Still rising


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* 8 voice poly phony with two independant banks of sound
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**kobol**

SYCO SYSTEMS

Polykobol £2100-£2800
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20/21 Conduit Place
London W 2
Tel: (01) 723 3844

# Survey

**Weight:** 190lb.
**Price:** on application.

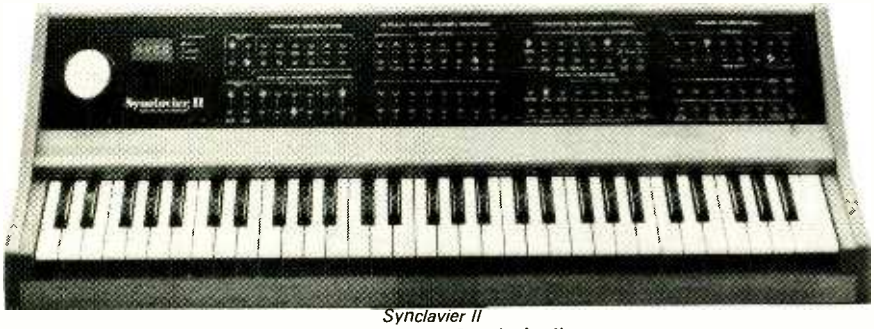
**Polymoog synthesiser**
Polyphonic keyboard controlled synthesiser. 8 pre-programmed voices and one user progammable voice. Pre-programmed settings may be modified using the variable controls.
**Inputs:** Filter 0.64V/octave; pitch 0.9V/octave; swell 5V for 30dB change; modulation amount 0.5V range; external synth; trigger mode; sustain; glide; on/off.
**Outputs:** 5 outputs 0dBm nominal 600Ω. XLR mix outputs. Keyboard voltage adjustable 0.9 to 1.2V/octave and triggering single or multiple negative with retriggering time of 20ms.
**Keyboard:** 71-note.
**Dimensions:** 6in x 45½ in x 22¼ in.
**Weight:** 82lb.

**Moog accessories**
**Sample and hold:** self contained unit to interface with *Micromoog, Multimoog, Minimoog* and studio systems.
**Ribbon controller:** adjustable in the pitch mode to span up, to 10 octaves. For use with *Micromoog, Multimoog, Minimoog* and studio systems.
**Percussion controller:** Touch sensitive drum that can control pitch of the synthesiser and the filter. The sensitivity and the scale of response are both adjustable. Usable with *Micromoog, Minimoog, Multimoog* and the studio systems.

**Moog vocoder**
**Channels:** 16 with external patching between analyser and synthesiser sections.
**Inputs:** line 0dBm and mic 40dBm; 20k and 30kΩ respectively. Carrier input 0dBm at 100kΩ.
**Output:** + 10dBm and 100kΩ.
**S/N:** 60dB.
**Additional features:** Sample/hold facility to provide expanded control of momentary program input; foot switch jacks for remote switching of sample hold, patch select and bypass.

## MULTIVOX (USA)

**Sorkin Music Co Inc, 370 Motor Parkway, Hauppauge, New York 11787.**
**Phone: (516) 895-6300. Telex: 510-227 9866.**
**UK:** London Synthesiser Centre, 22 Charlton Street, London NW1.
**Phone:** 01-387 7449.



*Synclavier II*

**MX-75**
Dual oscillator pre-set sythesiser. Thirty preset tabs allow selection of variety of instrument sounds with second oscillator completely adjustable. Touch sensitive keyboard controls volume, resonance, distortion, vibrato and pitch bend. Keyboard 37-note three octave C to C. Other features include touch sensitive portamento, envelope controls, sample and hold and ring modulator. VCO, VCF and key/gate interface.
**Dimensions:** 24 x 13½ x 5½ in (wdh).
**Weight:** 22lb.
**Price:** $1,295.

**MX-8100 Digital sequencer**
**Storage capacity:** 480 pitched events in four channels.
Each channel can be programmed for automatic consecutive play, single or continuous repetition. Integral 37-note keyboard for programming memory and can be used to transpose on playback. Fully adjustable clock. Portamento adjustments.
**Rear panel connections:** CV input and output linear and exponential; positive and negative gate inputs; and outputs; 2 data ports; external remote controls. Multivox claim the *MX-8100* will interface with most major synthesiser makes due to offering linear and exponential connections.
**Dimensions:** 23½ x 13½ x 5½ in (wdh).
**Weight:** 18¼ lb.
**Price:** $1,495.

**MX-65**
Simple polyphonic synthesiser with six preset sounds, four octave keyboard and adjustable controls including wide range pitch control, filters, envelope generator, LFO, 3-mode ensemble switch with gate outputs and VCF inputs.
**Dimensions:** 29 x 10 x 4in (wdh).
**Weight:** 16lb.
**Price:** $799.50.

## MUSICO (USA)

**Musico, 1225 N. Meridian Street, Indianapolis, Indiana 46204.**
**Phone: (317) 924-1300.**
**UK:** Syco Systems Ltd, Ashcombe House, Swainswick, Bath, Avon.
**Phone:** 0225 859687.

**Resynator**
Synthesiser, controlled from the output of a musical instrument. Suitable inputs include guitar, voice, piano, horns and wind instruments, and bass. The Resynator is in two sections with left side controlling the sound synthesis and the right, the envelope shaper and filters. The input is digitally analysed and used to control a VCO producing sawtooth, square, variable pulse waveforms with LFO pulse width modulation. This can be blended with the effects oscillator to produce harmonic intervals, and phase-synchronisation for harmonic feedback effects. The 'Timbral Image Modulator' consists of 8 complex waveshapes which control the envelope shape. Other controls include *A440* tuning reference; external control input with variable routing and inverting; computer controlled effects oscillator, foot controlled; VCA sustain and VCF peak foot activated; output mixer, variable and foot operated with full VCO, VCF, gating, triggering etc. 1V/octave interfacing facilities.
**Dimensions:** 3½ x 19in rack mounting.
**Price:** $1,980.

## NEW ENGLAND DIGITAL (USA)

**New England Digital, Main Street, Norwich, Vermont 05055.**
**Phone: (802) 649-5183.**
**UK:** Syco Systems, Ashcombe House, Swainswick, Bath, Avon.
Phone: 0225 859687.

**Synclavier II**
Compact computer controlled digital synthesiser. Available with 8, 16, 24, 32 voices or to special order 128. Keyboard is 5-octave, 61-note with keyboard split, delay function on low notes, auto arpeggio, repeat, frequency modulation, chorus and adjustment of the scale from equal tempered to whole tone scales etc. or individual pitch adjustment of single notes. Automatic A-440 tuning. Internal metronome. All functions controllable from front panel and no computer access necessary. Synthesis uses 'Partial Timbre' system with each partial timbre consisting of 24 adjustable harmonics, volume envelope generator, harmonic envelope generator, adjustable vibrato, adjustable portamento rate and special effects. Separate envelope generator for each voice. All programming is by multiple selection buttons and master control knob with digital readout. The diskette drive is located under the keyboard with front access and each diskette can be used to store up to 64 programs or 15,000 notes. All recalled programs are modifiable. Controllers include 2 foot pedals, 6 foot switches, ribbon controller and an optional velocity sensitive keyboard. Sixteen track digital memory designed to operate in a manner analagous to a tape recorder. Central processor is 16 bit, with 128KB memory and can be stored in a flight case of less than 20sq in. Full interface facilities.
**Dimensions:** 35¾ x 12 x 6¾ in (ldh).
**Weight:** 25lb.
**Prices:** from $13,750.

## OBERHEIM (USA)

**Oberheim Electronics Inc, 1455 19th Street, Santa Monica, California 90404.**
**Phone: (213) 829-6831.**
**UK:** London Synthesiser Centre, 22 Charlton Street, London NW1.
Phone: 01-387 7449.

**OB-X**
Programmable, four, six and eight-voice polyphonic synthesisers. Five octave keyboard. Pre-programmed with 32 presets that can be modified altered or relocated or stored onto cassette. Pitch bend and modulation levers; polyphonic portamento and sample and hold; noise generator; two envelope shapers; two oscillators per voice with sawtooth and pulse waveforms; LFO with sine or square waveforms; remote foot controls.

*OB-SX*

**OB-SX**
Pre-programmed polyphonic with integral keyboard. 24 presets on plug-in memory chip. Each preset can be modified by front panel controls but available as an option is a further 24 programme chip giving a range of 48 presets. Custom chips to order. The OB-SX is available with four or six voices; a four octave keyboard; portamento; LFO; detunable oscillators; filter; ADR; the 'Hold' position maintains the output of the keyboard for as long as desired with the note or chord being played when the button is selected. The 'Chord' position will transpose any note or chord held in the Hold setting by playing a single note on the keyboard. Pitch bend and modulation levers. Oberheim computer interface and provision for external voltage control connections.
**Dimensions:** 34½ x 20 x 4½ in.
**Weight:** 35lb.
**Price:** 4 voice $2,995, 6 voice $3,495.

Oberheim produce a series of synthesisers, from two to eight voice, using a system of synthesiser expander modules as the basic building block.

**Synthesiser expander module**
Two VCOs are arranged to operate with a 4-mode VC filter, two envelope generators, a low-frequency oscillator and a VCA. The manufacturer recommends the following applications: use with a keyboard to form a small electronic music synthesiser; to expand existing synthesisers; with a sequencer (also manufactured by Oberheim) allowing the main synthesiser and the sequencer to be played simultaneously; with polyphonic keyboards to form a multivoice synthesiser, etc. The VCOs produce sawtooth and pulse outputs with a variable mark/space ratio; either can be synchronised with the other or from an external source. The filter network can be programmed for either lowpass, bandpass, highpass or notch.

**Two voice polyphonic synthesiser**
Comprises a 37-note keyboard, two modules as above, a minisequencer, sample-hold and output mixer.

**Four voice polyphonic synthesiser**
Four expander modules, portamento 49-note polyphonic keyboard and output mixer, etc.

**Six voice polyphonic synthesiser**
Six expander modules, 49-note polyphonic keyboard, and six voice programmer.

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SFR. 66900. —. The cost of one of our final testing places. A large investment just for checking power amplifiers. But then our power amplifiers are not «just checked». Each one sees this place 3 times: first after the assembly of the power stage, second after the complete power amplifier is assembled and third after it has been in the burn-in room for 100 hours and on the shake-table for two hours. The average final test time including calibration amounts to 5 hours. Very time consuming, very expensive, very safe. One of the reasons why an FM ACOUSTICS is more expensive and more reliable than any other power amplifier. But for a true professional nothing is more important than reliability.
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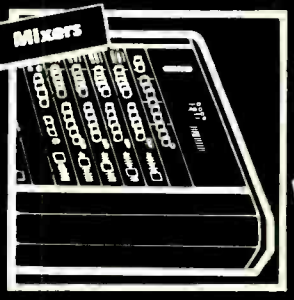
## The Total Package

If you are considering a complete multitrack installation, Lake Audio can offer you 8, 16 and 24 track at very competitive prices, for further details, call our sales office
8 track from around £3,500
24 track from around £28,000

## Tape Machines

Mastering: Revox, TEAC & ASC, Multitracking: TEAC/TASCAM, Brenell, Soundcraft, Studer, Lyrec, and MCI.N.R: Dolby and dbx.

## Mixers



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

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

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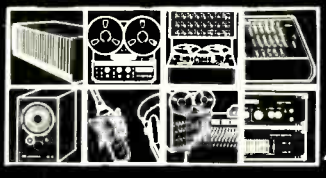

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# Survey

**Eight voice polyphonic synthesiser**
Eight expander modules, eight voice keyboard and electronics, polyphonic eight voice programmer, two output mixers and portamento controls.

**Digital sequencer DS-2A**
This enables up to 144 programme steps to be stored. These may be split into 96 + 48, or 48 + 48 + 48 steps (notes). Each note in sequence can have a duration from 8 to 0.05s. There are three basic transposition alternatives as well as a single-steploading playing feature. Transposition may be made over a four octave range. The manufacturer states that the sequencer may be used with either Moog or Arp synthesisers as well as its own products.

## PAIA (USA)

**PAIA Electronics Inc, 1020 West Wilshire Boulevard, Oklahoma City, Oklahoma 73116.**
**Phone: (405) 843-9626.**

**P4700**
Computer synthesiser including 37-note encoded keyboard, D/A converters, control oscillators/noise source, balanced ring modulator/VCA, reverb springline, VCO, VCF, envelope generator. Includes *8700* computer, (*6503* microprocessor with random access memory and cassette interface) with software to control monophonic/polyphonic playing and sequencing.
**Price:** $799 built and $519 in kit form.

**Proteus I**
Programmable preset lead synthesiser with two VCO with five waveform and sync. capability, noise source, VCF, LFO, ADSR, envelope generator, 3 octave keyboard 16 programmable presets with battery back-up, computer port. Patching acces between the sections on the rear but units normalled with no patch insertions. LED display for memory number. Extra facilities, eg joysticks are available.
**Price:** $499 assembled and £399 kit.

**Modular systems**
*4700 Series* of modules includes VCAs, mixers, reverb, VCOs, VCFs, ADSR, control oscillators, power modules, joystick controllers, D/A converters, digital sample and hold, cabinets and keyboards.
*2720/R Series* is for educational purposes and is in kit form only.
**Price:** $299.

## RIVERA (USA)

**Rivera Music Services, 48 Brighton Avenue, Suite 11, Boston, Massachusetts 02134.**
**Phone: (617) 782-6554.**

Rivera produce a comprehensive modification package for the Moog *Minimoog* synthesiser. The modifications include the provision of keyboard control voltage and gate outputs, plus oscillator and filter signal outputs, to allow external processing of the *Minimoog's* signals.

## ROLAND (Japan)

**Roland Corporation, 7/13 Shinkitajima, 3-chome, Suminoe-ku, Osaka 559.**
**USA:** Roland Corp US, 2401 Saybrook Avenue, Los Angeles, California 90040.
Phone: (213) 685-5141.
**UK:** Brødr-Jørgensen UK Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middlesex TW8 9DN.
Phone: 01-568 4578. Telex: 934470.

**Jupiter JP-4**
Programmable polyphonic 48 note keyboard controlled synthesiser. Memory holds 18 presets of which 8 are programmable and 10 factory preset. Battery to preserve programs with power off. Oscillators generate square, sawtooth or pulse waveforms. Noise generator and high and low pass filters which can be controlled from keyboard, LFO or ADSR including invert position. Multi-purpose bender control. Hold position; stereo output with integral chorus effect; arpeggio generator to produce sequencer-like effects, 'orchestral' arpeggios and random notes in four separate patterns with internal and external control over the rate.
**Price:** £1,574.

**Vocoder Plus VP-330**
Vocoder/preset synthesiser with 48-note keyboard C to B inclusive. It can operate on the preset controls of Strings and Human Choir with variable parameters or with the vocoder section which requires the addition of a microphone while the output pitch is determined by the keyboard. Other features include vibrato with depth, rate and vibrato delay; mixer for balancing outputs of the 3 sections; provision to replace the keyboard with an external control; preset pitch transposition; portamento and vocoder hold position.
**Price:** £1,143.

**Paraphonic RS-505**
Three section polyphonic synthesiser with 48-note keyboard. Sections include Strings, Polyphonic synthesiser and Bass. The polyphonic section has a selection of preset positions and octave range is selected by 7 preset tabs for the upper and lower halves of the keyboard. Oscillators produce a pulse wave/sawtooth mix with VCF, LFO and envelope generator. Single or multiple triggering from keyboard. Pitch glide and preset pitch transposition. Bass section preset controlled with ensemble mode giving phasing, flanging or chorus effect.
**Price:** £1,069.


*SH-09*

**SH-09 Synthesiser**
Monophonic compact keyboard controlled synthesiser. VCO offers sawtooth, square and pulse waveforms with ranges of 32', 16', 8', 4' and 2'. Pulse waveform width may be modulated by LFO, envelope generator or manual slider. Sub-oscillator for addition of square wave one or two octaves below primary pitch or pulse waveform two octaves below. VCF contains low-pass filter at 24dB/octave which may be controlled from the LFO or envelope generator. Envelope generator four part ADSR. Bender control for either pitch or VCF. Portamento and audiomixer. 32-note keyboard.
**Price:** £434.

**SH-2 Synthesiser**
Compact dual oscillator synthesiser similar to *SH-09*. Second oscillator has four waveforms — sine, square, sawtooth and pulse. One oscillator is independently tunable and both can be assigned to the bend control independently. 37-note keyboard and comprehensive external interface connections.
**Price:** £486.

**Promars MRS-2**
Programmable dual oscillator synthesiser. VCO section offers sawtooth, square and pulse waveforms in three octave ranges. Sub-octave for square wave one octave below primary. Pulse waveform width controlled from either LFO or slider. VCO 2 has preset tuning positions allowing instant changing of intervals. VCF section includes high and low pass filters allowing control from the keyboard, LFO, slider or ADSR which may also be inverted. VCA controlled by ADSR. LFO can be controlled by four separate waveforms. Bender control has up to six assignable functions. All control functions from LFO to output volume may be programmed excepting those usually controlled manually. Up to eight settings may be written into the memory as well as the ten factory presets. CV and gate sockets.
**Price:** £919.

**Digital sequencer CSQ-100**
**Storage capacity:** 168 notes, 84 per channel.
**Weight:** 5.9lbs.
**Dimensions:** 13½ × 3¾ × 12in (whd).
**Features:** Calibration for matching any voltages differences between synthesiser and sequencer allowing use with any 1V/octave equipment; internal metronome; CV and gate information may be loaded independently; sequence may be programmed for stop and start positions; can be run one or two channel; continuous or one-off play; portamento control; full interface facilities and remoting connections.
**Price:** £416.

**Digital sequencer CSQ-600**
**Storage capacity:** 600 notes, 150 per channel
**Weight:** 8.6lbs.
**Dimensions:** 17¾ × 3¾ × 12in (whd).
**Features:** Four channel memory with rechargable battery back-up; memories may be replayed in any combination, singularly or together or in any order, updating of parts of stored material as well as forward and backstepping through the memory; programmable portamento including all the features of the *CSQ-100*.
**Price:** £695.

Roland has recently introduced the *TR-808* programmable drum machine. This unit enables up to 16 patterns to be programmed, 12 main patterns plus four intro/fill patterns which may be inserted into the rhythm manually or automatically. Each pattern preset can contain two variations, A and B, which may be played AAAA..., BBBB..., or ABAB.... In addition, each pattern may contain up to 16 beats in each of two parts. Individual drum sounds may be programmed with the preset buttons or by tapping in the rhythm manually in realtime, each sound being selected by a rotary switch, with twelve positions, some 'instruments' being switch-selected after the rotary selector. Additionally, pre-programmed patterns may be arranged and 'recorded' on to 12 tracks, each containing up to 64 patterns. If the 'recording'exceeds 64 measures, it runs automatically to the next track. Thus the rhythm for an entire piece may be programmed. Individual and mixed outputs are featured.

## RSF (France)

**RSF, 19 rue Claire Cazelles, F-31200, Toulouse.**
**UK:** Syco Systems Ltd, Ashcombe House, Swainswick, Bath, Avon.
Phone: 0225 859687.

**Polykobol**
Polyphonic 8-voice synthesiser individually assignable to two banks of presets. Sixty-four position memory; cassette interface; autotune capability; programmable arpeggio; digital delay line; *6502* microprocessor; 5-octave keyboard; integral sequencer; modulation and pitch bend wheels.

## SENNHEISER (West Germany)

**Sennheiser Electronic, 3002 Wedemark 2.**
**Phone: (05130) 8011. Telex: 0924623.**
**UK:** Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St. Peter, Bucks SL9 9EW.
Phone: 02813 88447. Telex: 849469.

**Vocoder VSM 201**
Comprehensive 20-channel vocoder with an analysis range of 100 to 8kHz. Each channel adjustable for emphasis and 'speech addition/multifilter' with between channel adjustments for silence bridging. Individual access to envelope for each channel. LED metering.
**Dimensions:** (in carrying case) 24 × 15¼ × 14½in.
**Weight:** (in carrying case) 44lb.

## SEQUENTIAL CIRCUITS (USA)

**Sequential Circuits Inc, 3051 North First Street, San Jose, California 95134.**
**Phone: (408) 946-5240.**
**UK:** Rod Argent's Keyboards, 20 Denmark Street, London WC2H.
Phone: 01-240 0084.

*Prophet-5*

**Prophet 5**
Completely programmable polyphonic 5-voice synthesiser. Five octave keyboard. It comes with 40 preprogrammed patches all of which are modifiable or replaceable. Two oscillators with square and sawtooth on osc.A and sawtooth, triangular and square waveforms on osc.B Separate pulse width controls on each oscillator. Osc.B can be low range of 0.4 to 10Hz (in addition to separate 3 waveform LFO) as well as four octave tuning range on both. Outputs from B section can be used to modify frequency, pulse width and filter

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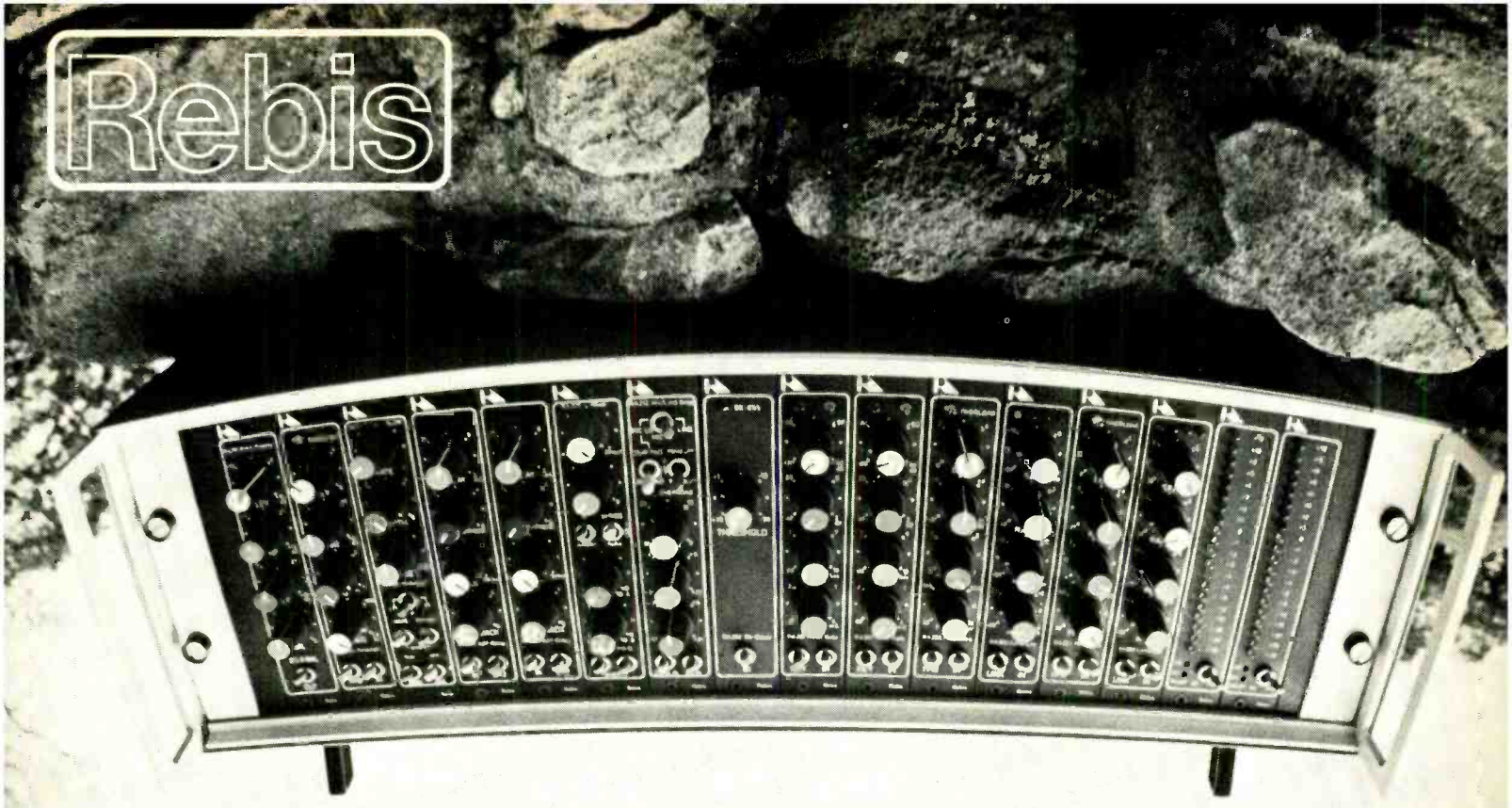


# New Perspectives

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

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RA205 ADT/Delay
RA206 Oscillator
RA207 LED Meter
RA208 Modulator
RA209 Mixer
RA210 RIAA Preamp.
RA211 Timer
RA212 Mic/Line Amp.
RA213 Mono MDA.
RA214 Stereo MDA.
RA200J Connector

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For further information contact: Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 5AB. Tel: 0384 71865.

SSE

Export Enquiries to: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939 Scenic G.

**France;** Lazare Electronic, Paris 8786210. **Netherlands;** SAP, Amsterdam 797055. **Sweden;** Tal & Ton, Gothenberg 130216. **Belgium;** S.E.D., Brussels 522 7064. **Spain;** Mike Llewellyn Jones, Madrid 637 0752. **Japan;** Continental Far East, Tokyo, Tlx. 72 22498. **U.S.A.;** Great West Indies Music Co., Gulf Div., Miami 2712120.

of A section or both sections can be 'hard' synchronised. Mixing section combines the outputs of A and B osc. with a noise source. Filter section is low pass 24dB/octave with resonance control. Two ADSR per voice. Programmed settings stored in 5 memory banks all recallable or recordable from the programmer section with the operative store being displayed by digital readout. Portamento control. Internal crystal referenced *A440* tuning oscillator. The keyboard has a variable tuning scale allowing use of pitch and intervals between notes other than those of an equally tempered scale. This setting can also be stored in the memory. Pitch bend and modulation wheels. Back up battery in memory section. Interface to record memory programs onto cassette for storage. CV, trigger, gating and sequencer interface jacks.

**Prophet 10**
Two manual 10-voice polyphonic synthesiser, 5 voices for each manual. Sixty-four programme memory, 32 for each manual. The VCO, VCF and VCA control section is similar to the Prophet 5 with the addition of keyboard mode control, equalisation, voice to manual assignment and pedal control section. There is an optional polyphonic sequencer which can be installed on order or at a later date. Includes micro-cassette recorder for program and sequencer storage.

**Sequencer model 800**
**Storage capacity:** 256 note with pitch and timing from synthesiser. Memory divided into 16 banks of 16 notes selectable or switchable in any combination in playback. Speed can be varied from ±15 times recorded tempo. Sequences can be stopped started and stepped as needed. Single notes can be reprogrammed with rest of sequence being effected. Remote control facilities with full interface with *Prophets 5* and *10*.
**Dimensions:** 5 × 9 × 9in.

**Programmer model 700**
Digital programmer intended for use with synthesisers that don't have this facility internally. It consists of two 5-control envelope generators, 3 voltage sources and auxiliary functions. The memory is arranged as 8 banks with access to the eight programmes in each bank by push button giving a total of 64 programmes. All connections are both jack and mini-phono sockets as well as a special 12 pin connector which matches with interfaces provided by other manufacturers or can often be fitted as required.
**Dimensions:** 16 × 11 × 4in.

## SERGE (USA)

**Serge Modular Music Systems, 572 Haight Street, San Francisco, California 94117.**
**Phone: (415) 621-6898.**

Exceptionally large range of modular synthesiser components for assembly into a variety of comprehensive formats. Choice of over 40 modules including VCO (2), VCA (3), filters (4), VC output mixers (5) with the rest of the range being audio processors and CV generators or processors. The system is available only direct from the manufacturers and there are no standard models but to order only. Kit self assembly is available. The range is designed for continuous expansion and development with new products matching and usable with older items, extensive interface capability with external equipment including microprocessors, computers, keyboards and other controllers.

## SYNARE (USA)

**STAR Instruments Inc, PO Box 145, Stafford Springs, Connecticut 06076.**
**Phone: (203) 684-4258.**

Range of electronic drums usually played as part of a drum kit but some models can be used as controllers for external synthesiser equipment as well as generating their own adjustable sounds.

**Synare bass drum**
Can be stand mounted or in a special bass drum stand for playing with a beater. Adjustable electronic tuning, multiple beat from single hit, repeat, decay sensitivity and duration of sound.

**Synare tympani**
Similar to Synare bass drum but additional electronic sweep control with foot pedal.

**Synare 3X**
Electronic drum with 6 preset sound positions.

**Synare 4**
Adjustable electronic drum with controls for tuning, modulation rate, modulation depth downsweep, upsweep, sweep time, sensitivity and volume.

**Hi & lo toms**
Similar to the Synare 4 but facility for changing pitch between two determined points each time the drum is hit or in steps.

**Synare 3 sequencer**
Sequencer for use with the *Synare 3* or *3X*. It can memorise up to four 32 note sequences of up to 32 seconds each. Memorises intervals between notes, rhythm dynamics and which of the four drums was hit. On playback these sequences may be combined and the tempo varied. Drums can be used while sequencer is replaying.

**Synare sensor**
Sensor for mounting on the side of a drum but not touching the skin. The vibrations picked up are translated into electronic signals. The sensor has a variety of controls to modify the synthesised sounds.

## SYNTON (Holland)

**Synton Electronics BV, PO Box 83-3620 AB, Breukelen.**
**Phone: 03462-3499. Telex: 40541.**
**UK:** Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314. Telex: 28668.
**USA:** Parasound Inc, Wharfside, 680 Beach Street, San Francisco, California 94109.
Phone: (415) 673-4544.

**Syntovox 221**
Twenty channel vocoder with filters at ¼ octave spacing and 54dB/octave slopes. The twenty control voltage outputs from the analyser section are passed to a 20 × 20 matrix enabling a variety of control permutations. The twenty channel synthesis section has one output and one input with identical filters to the analyser section. Each channel has a modulator with a control voltage input whose sensitivity can be adjusted. Multiway connector for external and computer interface. Fill-in facility and realtime LED analysis read-out. Rack mounting.
**Price:** £2,780.

**Syntovox 232**
Sixteen channel vocoder for speech analysis and synthesis; built-in voiced/unvoiced detector system; multiway connector for external patching of analyser outputs to synthesiser control inputs; rapid format patch cards. Rack mounting.

**Syntovox 222**
Simplified vocoder based on the *221* using separate analysis and synthesis but simplified for stage or studio use without the individual channel controls and matrixing. Rack mounting.
**Price:** £468.

**Syntovox 202**
Even more simplified version of the *222* vocoder intended for musical instrument use. Integral hf synthesis. Rack mounting.
**Price:** £275.

**Syntrack 216**
Voice follower, pitch-to-voltage converter; built-in VCO, filter and VCA. Will track any complex audio signal from 40Hz to 8kHz. Rack mounting.

**VC Filter Bank 233**
Bank of 16 voltage controlled filters. Can be used with or without *232* vocoder to shift dynamic formats over a 6-octave range. Features 16 envelope followers and 16 VCA.

**Series 3000**
Fully modular synthesiser system consisting of 12 modules which can be assembled into a choice of two mainframe sizes. A 3½ octave keyboard is also available. The modules may be used for applications outside of this system and will mount into a 19 in rack system.
**Prices:** VCO *3021* £70; VCF *3017* £60; 2VCA £40; Ring Mod/Noise Gen £55; 2LFO *3223* £55; S&H/LFO £45; EGR *3005* £45 (envelope gen); ENV/CPR *3235* £40; 2INV/SLR *3218* £35 (inverter/s limiter); MXA *3015* £35 (mixer) MPL *3006* £32 (splitter); power supply £85.

**Studio system 500**
Series of digital and voltage controlled oscillators, filters, amplifiers and controllers (envelope generators, LF modulators, envelope follower, sample and hold and random generator).

## 360 SYSTEMS (USA)

**360 Systems, 18730 Oxnard Street, Suite 215, Tarzana, California 91356.**
**Phone: (213) 342-3127.**

**Spectre**
Guitar synthesiser that will accept the output of a Hex-pickup fitted to a standard solid bodied guitar and use it to key the functions of the synthesiser which are similar to those found on standard keyboard controlled synthesisers. In addition the sound of the guitar may be processed itself or combined with the synthesised sound using the *Spectre* as an elaborate effects unit. A three channel mixer on the unit combines the output from the various sections.
**Features:** two oscillators; two pre-settable interval transposers; five octave switching; two envelope generators; four mode filter with adjustable resonance; polyphonic processor and two audio outputs.
Outputs for interfacing into other synthesisers are included as is a socket for connection to a programmer capable of storing 64 settings (Sequential Circuits *Model 700*).

## YAMAHA (Japan)

**Nippon Gakki Co Ltd, Hamamatsu.**
**UK:** Kemble (Organ Sales) Ltd, Mount Avenue, Bletchley, Milton Keynes MK1 1JE.
Phone: 0908 71771.
**USA:** Yamaha, PO Box 6600, Buena Park, California 90622.
Phone: (714) 522-9105.

**CS-80**
Polyphonic keyboard controlled synthesiser. 22 presets in 2 banks with 2 selectable at any one time in addition to 4 memory presets and 2 manual adjustments. Keyboard touch sensitive with 61-note range; 16 VCO; 16 VCF; 16 VCA; 32 envelope generators; sub-oscillator. Effects include ring modulator, sustain, portamento/glissando, ribbon controller and tremelo/chorus.

**CS-60**
Polyphonic synthesiser similar to *CS-80* but with only 8 VCO, VCA, VCF and 16 envelope generators. Twelve presets and one programmable and one memory position.

**CS-50**
Polyphonic keyboard synthesiser with 4 VCO, 4 VCF, 4 VCA and 8 envelope generators. Similar to the *CS-60* with only a 4 simultaneous note capability, 13 presets and 1 programmable. 4 transposition settings and 49-note keyboard.

**CS-40M**
Duophonic synthesiser with 44-note keyboard. 4 VCO, 2 VCF, 2 VCA, LFO and 4 envelope generators. Footage selectors in 2 ranges. Effects controls include unison switching, portamento/glissando, brilliance, sustain, pitch bend and modulation.

**CS-20M**
Keyboard synthesiser similar to the *CS-40M* but with only half the number of VCO, VCA, VCF and envelope generators. Keyboard 37-note.

**CS-30L**
Monophonic synthesiser similar to *CS-40M* but with different layout and only 3 envelope generators and with the addition of a ring modulator.

**CS-30**
Similar to *CS-30L* but with the addition of a sequencer.

**CS-15D**
Monophonic synthesiser with 37-note keyboard, 2 VCO, 2 VCF, 2 VCA, LFO and 4 envelope generators. 5 footage ranges with 29 presets; one programmable preset; portamento brilliance, sustain, pitch bend and modulation.

**CS-10**
Monophonic synthesiser with 37-note keyboard and VCO, VCF, VCA, LFO and 2 envelope generators. 6 footage selectors with portamento and pitch bend. ■

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# Concord S~2000

**MANUFACTURER'S SPECIFICATION**
**Microphone inputs:** transformer balanced, impedance 1,200Ω, 20dB pre-transformer pad, 48V phantom power. Maximum gain 73dB. Gain control 44dB (plus the 20dB pad). Maximum input at 30Hz + 15dBm. Frequency response 16Hz to 22kHz (+0, −1dB), 10Hz to 35kHz (+0, −3dB). Equivalent input noise (unweighted 20Hz to 20kHz) − 126dBm.
**Line inputs:** unbalanced, impedance 25kΩ. Optional transformer balanced input, impedance 10kΩ. Nominal sensitivity +4dBm. Maximum input +23dBm. Frequency response 15Hz to 30kHz (+0, −1dB).
**Equalisers:** operating level 0dBm. Headroom 23dB. Switchable highpass filter with turnover frequency of 70Hz and 12dB/octave attenuation. High frequency shelving ±14dB at 10kHz. Mid frequency 1 peak/dip ± 14dB over the frequency range 500Hz to 12kHz with constant Q of 1.4. Mid 2 — as Mid 1 but with a frequency range of 220Hz to 5.8kHz. Low frequency shelving ±14dB at 50Hz.
**Insertion points:** pre-fader, post-equalisation. Operating level 0dBm. Maximum load 2kΩ. Return input impedance 3kΩ.
**Outputs:** operating level +4dBm, maximum level +23dBm. Impedance 10kΩ. Minimum load 600Ω.
**Distortion:** from the mic or line inputs to all outputs at operating level. Total harmonic distortion at 30Hz 0.07%, at 1kHz 0.03%, at 10kHz 0.03%, at 20kHz 0.06%.
**Signal-to-noise:** unweighted 20Hz to 20kHz, stereo outputs, mix mode — with all channels mute 83dB — with all channels unity gain 80dB — cue and auxiliary outputs 86dB. Group outputs, no channels routed 92dB — 1 channel routed 86dB — all channels routed 80dB.
**Crosstalk:** at 10kHz with stereo mute or fader down 80dB. Group, no channels assigned 80dB.
**Connectors:** mic inputs *XLR*, line input/outputs 30-way Amphenol/Tuchel connectors.
**Power requirements:** 100 – 120V or 200 – 240V, 70VA.
**Dimensions:** width 1.15m (20 I/O) 1.51m (28 I/O). Extra for producer desk/patch panel 0.5m. Maximum depth 730mm.
**Weight:** 60kg (20 I/O), 75kg (28 I/O).
**Price:** 16/20-channel frame £5,440. 28/28-channel frame £7,900. Producers desk £880.
**Manufacturer: Pieter Bollen Geluidstechniek BV, Hondsruglaan 83a, 5628 DB, Eindhoven, Netherlands.**
**UK:** EELA Audio Industries, 13 Molesworth, Hoddesdon, Hertfordshire.

THE Concord *S2000* series mixer is based on a combination of three types of module plus a patchbay when required. The complete mixer normally comprises a number of I/O modules, a master/monitor module including an oscillator and talkback, and a patchbay/status module having limited patching facilities. In order to make the mixer lightweight and readily portable a separate power supply unit is used, this being connected to the mixer by a multiway cable.

Normally the mic inputs are balanced *XLR-3* connections with the tape machine connections being by means of multiway connectors with miniature jack sockets being used for the patch fields.

The basis of the complete mixer is a printed circuit mother board into which the individual modules are plugged by means of pin connectors which mate with the sockets on the modules. Except for the wiring from the mother board to the input and output connectors this form of construction virtually eliminates any hand wiring and thus increases reliability.

An unusual feature of the mixer is the use of digitally controlled analogue switching in the I/O modules. This allows either local or remote control of the module's status by means of dc control busses. Five master busses from the master/monitor module and the patchbay/status module are fed to all I/O modules giving the following status signals—master record, master tape, master mix, solo and solo enable.

These signals are combined at an interface within each I/O module with the local status switches, mix, tape, record, fader, solo and mute. The combination of the local and remote status signals is the feed to a programmed read-only memory which decodes its inputs and produces dc control signals to feed 10 analogue switches within each I/O module. The 11 control lines have a possibility of 2048 combinations, not all of which can give legal switch combinations, so should an erroneous combination be selected a local error light is illuminated on the responsible I/O module.

As with other modules the I/O modules consist of 2 very high quality pcbs with the audio signal circuits and analogue switches being mounted on the main board and the read only memory and the digital circuits being mounted on the smaller board which fits into pin connectors on the main board.

With the exception of the Audiofad channel fader all controls are soldered onto the main pcb with the rotary control spindles securing the board to the module's front panel. All components were

70 ▶

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clearly identified with not only their circuit reference but also their type and value—a useful and unusual feature. In addition all integrated circuits were socketed for easy maintenance with the overall standard of quality being excellent.

Turning now to the individual modules, the input/output module is divided into five sections with the top section having the eight buss assignment buttons in the common 1/2, 3/4, etc, arrangement with an adjacent panpot. An additional 'direct' button feeds the channel direct to the appropriate line output disconnecting the busses and the panpot.

Proceeding down the panel the next section is the input section including the mic gain potentiometer together with a switch for a 20dB pad and a switched bass cut filter which is also inserted into the tape input, the selection of the tape or mic signals being accomplished by the previously mentioned analogue switches.

There follows the equaliser section which can be switched in or out of circuit. Four equalisers are fitted to provide high and low frequency shelving plus two overlapping swept equalisers which provide cut or boost over the frequency ranges 220Hz to 5.8kHz and 500Hz to 12kHz.

Next there is the auxiliary send section which provides signals for the two monophonic auxiliary busses via separate pot level controls. The auxiliary 2 buss is always fed from the pre- or post-fade signal with the auxiliary 1 buss also being capable of being fed from the channel signal in the record or tape modes of the module. Depending upon the mode the auxiliary buss signals are switched by analogue switches, themselves controlled by the local and remote status buttons.

The remainder of the module deals with the stereo monitor and cue busses and the overall status. Individual panpots feed the monitor and cue busses with the cue buss having a dedicated level control and the monitor level being controlled either by the monitor level pot or by the channel fader in the remix mode in which case the monitor level control feeds the mixing busses.

Locking pushbuttons control the local status of the module. A solo button mutes all other modules and provides an in place solo with the mute button performing its obvious function. There remain the 4 local status buttons together with 3 LED indicator lights. A red light indicates an erroneous status setting with a green light indicating the tape mode and a yellow light indicating local control. Record, tape and mix buttons set the local status. In the 'record' mode the input signal comes from the mic input and is fed to the channel output and routing switches with the channel line output being monitored and also fed to the cue and auxiliary circuits. In the 'tape' mode the monitoring signal is derived from the tape return with other feeds remaining as before. In the 'remix' mode the module's input is derived from the tape input with the signal being fed via the equalisers and the channel fader to the panpot and the selected busses.

The master/monitor module comprises 3 sections, the test oscillator, talkback and master controls. The oscillator is controlled by four pushbuttons, an on/off button with an adjacent red warning LED indicator and 3 interlocked buttons for selecting the frequency which may be 100Hz, 1kHz or 10kHz with the output level being controlled by a potentiometer.

Talkback is derived from an electret mic below the front panel which has the talkback level pot and 3 spring loaded pushbuttons for sending talkback to either tape (slate), to a separate talkback feed to the studio, or to the cue output.

In the master section there are 6 pushbuttons for the selection of the monitoring source which may be from either of the auxiliary busses, the cue buss, the normal stereo mixer output or from 1 of 2 stereo tape machine returns. In addition there is a mono button for the monitor, this being useful for checking correct phase — however, the I/O modules have no facility for correcting phase.

Nearby is the master monitor level pot and the monitor mute button. A red LED indicator gives warning if any module is in solo. The remaining controls consist of master level controls for the 2 auxiliary busses, the cue buss and an echo return to the cue buss. A further echo return is connected to the stereo busses with their master level control being the fader at the bottom of the module.

Turning to the final module this is the patchbay/status module. The upper part of the module is occupied by a '2 in line' patch panel which provides the insert points and returns for all the I/O modules. In addition insert and return points for the stereo outputs are provided together with twin oscillator outputs.

Three illuminated pushbutton switches control the master status of the mixer selecting the record, tape or mix modes of all I/O modules which are not switched to local control.

Finally, before dealing with the performance some comment should be made upon the power supply. This is a unit suitable for mounting into a standard 19in rack with the multiway feed to the mixer and the IEC standard mains power connector at the rear. To the front is a power on/off switch and a mains power fuse neither of which have any identifications, however, a power indicator lamp is provided.

It was further noted that no rating plate is fitted, however, within the unit components were properly identified, but it was felt that servicing the pcb would not be particularly easy. All outputs were stabilised with ±18V driving the audio electronics, +5V feeding the digital logic and +48V feeding the phantom powering of the mic inputs, all dc supplies except the latter being protected by internal fuses.

**Inputs and outputs**

All outputs were unbalanced connections derived from the outputs of operational amps via a dc blocking capacitor, thus offering a very low impedance suitable for driving into any sensible load.

Whilst most high level inputs are of constant

72 ▶

FIG. 1
CONCORD S2000
CMR AT MIC INPUT

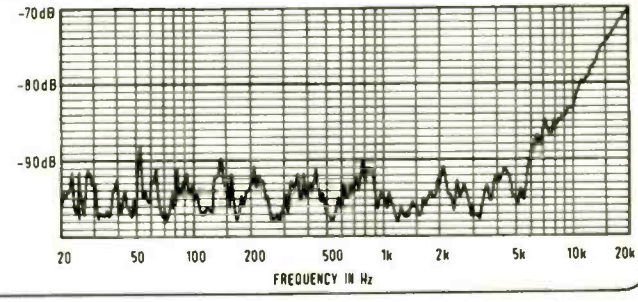



FIG. 2

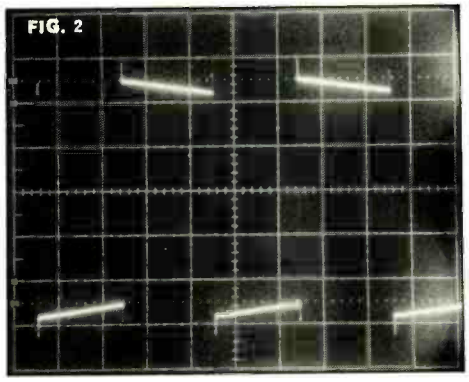


FIG. 3

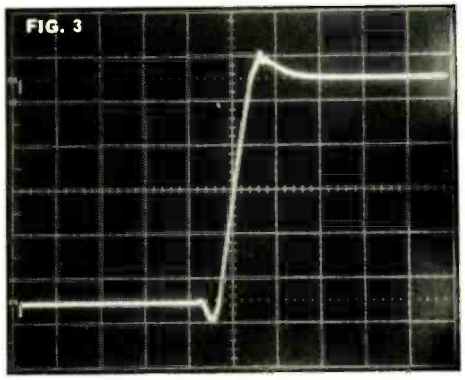
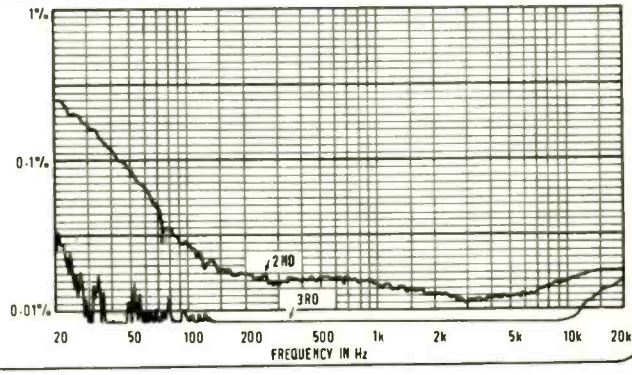


FIG. 4
CONCORD S2000
2ND AND 3RD HARMONIC
DISTORTION



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and high impedance, feeding operational amps via a dc blocking capacitor, it was found that the insertion point return input impedance was variable according to the setting of the channel fader and monitor level pot. The worst case impedance fell to 4.23kΩ with the maximum being 5.16kΩ. It is felt that both these input impedances are undesirably low with my personal preferance being for input impedances to exceed 10kΩ.

The latter was the case with the unbalanced tape returns which had an input impedance of 24.7kΩ constant with control settings. If required the tape returns can as an option be balanced, provision for balancing transformers being already made on the I/O module circuit boards.

The high level inputs were found to be capable of handling in excess of +22dBm with the outputs being capable of driving +20dB reference 0.775V or +17dBm loaded into 600Ω.

Turning to the mic input this is a balanced connection provided with +48V phantom powering which cannot be switched off — no doubt it can be unwired on the I/O modules, but a switch would be a distinct advantage. The mic input impedance was found to be satisfactory at a constant 1.1kΩ without the 20dB pad in circuit or 1.37kΩ with the pad in circuit.

The signal handling capability of the mic input was found to be remarkable at +6dBm without the 20dB pad, with an excellent common mode rejection as shown in **Fig 1** which shows in excess of 90dB up to 6kHz.

The maximum gain from the mic input to the insertion point output was found to be 60dB without the 20dB pad or 39dB with the pad in circuit with the gain control having a wide range (44dB) but being excessively coarse in operation near the maximum gain setting.

**Noise**

Measuring the noise attributed to the mic inputs at maximum gain and shunted with 200Ω gave an equivalent input noise of −124.5dBm over a 20kHz effective noise bandwidth (using a lowpass filter with a −3dB point at 15.7kHz and 6dB/octave slope). Clearly this noise factor of 5dB could be bettered with the A-weighted effective noise at the input being −127dBm(A).

Noise when using the tape inputs was found to be 92.5dBm A-weighted or −83dBm using the CCIR-weighting with a quasi-peak meter to the CCIR recommendations — a perfectly satisfactory performance.

Whilst not strictly a noise problem the isolation between the tape input and the mic input was thought to be a potential source of trouble. At maximum mic gain the breakthrough from the tape input was found to be −69dB at 1kHz increasing to −49dB at 10kHz.

**Distortion**

The application of a fast 1kHz squarewave to the mic inputs gave the waveform depicted in **Fig 2** at the insertion point output, it being seen that there is virtually no ringing due to the input transformer, but that the waveform exhibits spikes at both transitions. This effect, which was found to be irrespective of gain, is shown in an expanded form in **Fig 3** which demonstrates that the effect is rather unusual.

Measuring the 2nd and 3rd harmonic distortions from the mic input to the insertion point output at maximum gain produced **Fig 4** for

74 ▶

FIG. 5
CONCORD S2000
IM DISTORTION

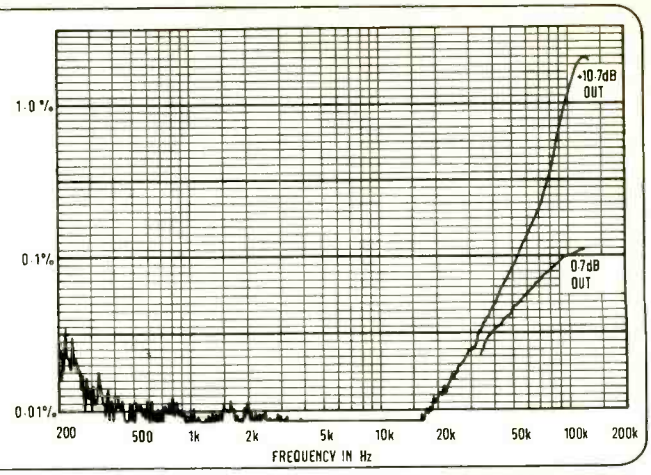



FIG. 6
CONCORD S2000 FREQUENCY RESPONSE

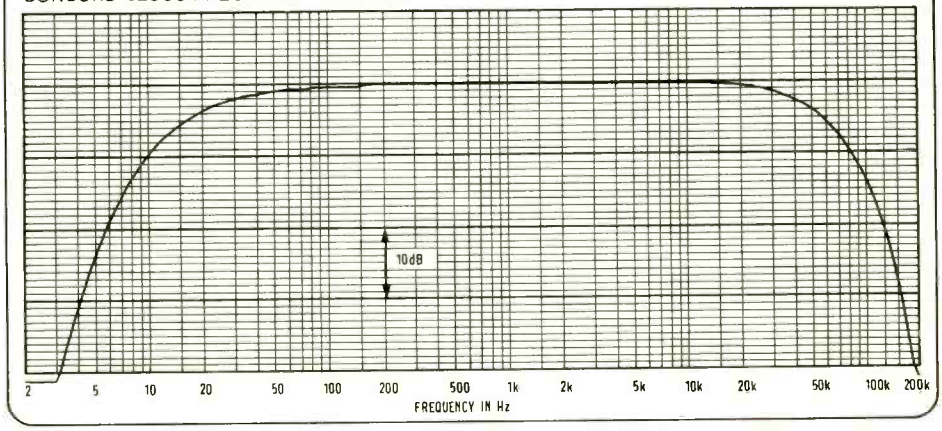



FIG. 7
CONCORD S2000
BASS CUT FILTER

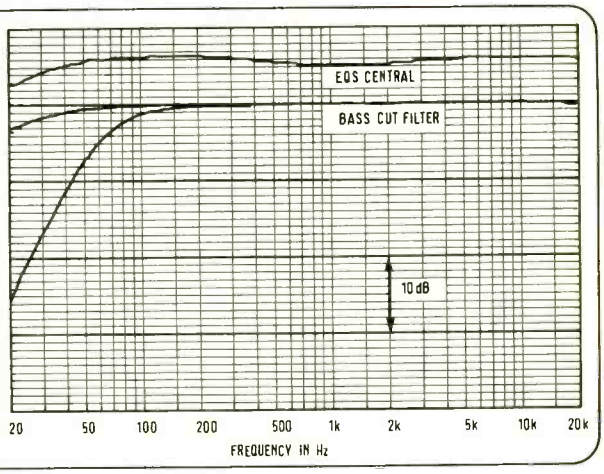
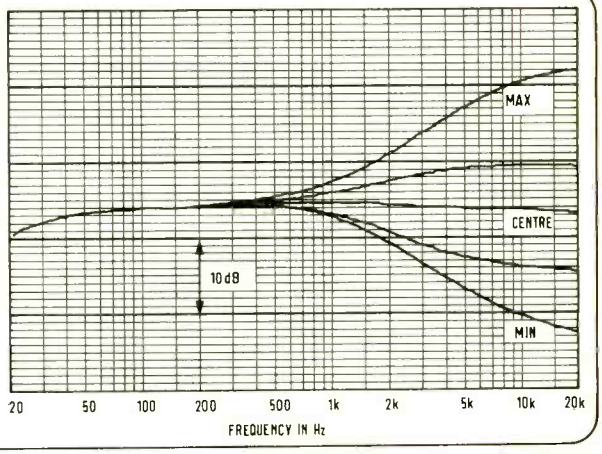



FIG. 8
CONCORD S2000
HF EQ



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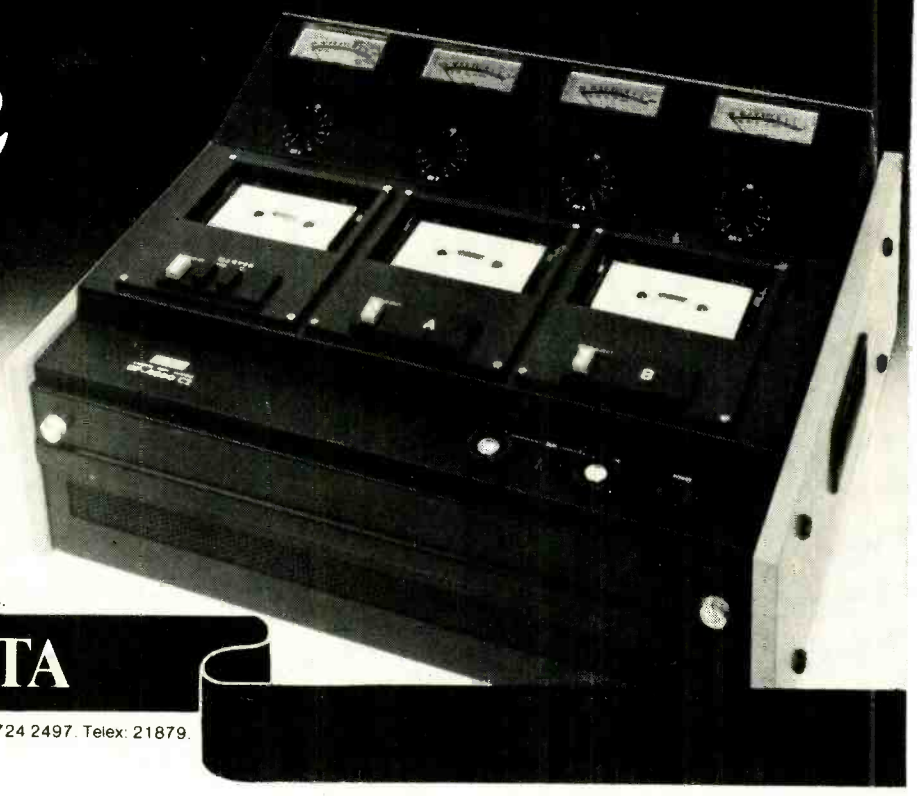

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+10dBm output, the distortions decreasing rapidly at lower output levels giving a satisfactory performance.

Intermodulation distortion measurements under the same conditions using the CCIF twin tone method with the tones separated by 70Hz gave **Fig 5** from which it will be noted that intermodulation distortion within the audio frequency band is at a very low level. At higher frequencies and at high levels the intermodulation distortion rises rapidly, but, as shown in **Fig 5** the distortion falls very rapidly at reduced levels.

**Frequency response, equalisers and filters**

The overall frequency response of the I/O modules from the mic input at maximum gain is shown in **Fig 6** with the equalisers out of circuit, it being seen that there is a sensible high frequency roll off, but, perhaps a slightly excessive bass roll off.

Reference to **Fig 7** shows that the bass cut filter offers a sharp cut below its −3dB point at 70Hz. Insertion of the equalisers with the controls at their flat position gave a response which was not flat, typical deviations being shown at the top of **Fig 7**. As no detents are fitted to the controls it was difficult to achieve a flat response with the equalisers in circuit and it was found that the true flat position did not correspond exactly to the mechanical centre positions of the controls.

The effects of the high frequency and low frequency equalisers at five symmetrical control positions are shown in **Figs 8** and **9** which show a range of about ±15dB at 10kHz and 50Hz with a good control law. The characteristics of the MID 1 and MID 2 equalisers at maximum cut/boost are shown in **Figs 10** and **11** it being seen that the frequency calibration is satisfactory with the control law being again good. A typical effect of the cut/boost controls is shown in **Fig 12** demonstrating that the equalisers can be set with a satisfactory resolution.

FIG.9
CONCORD S2000
LF EQ

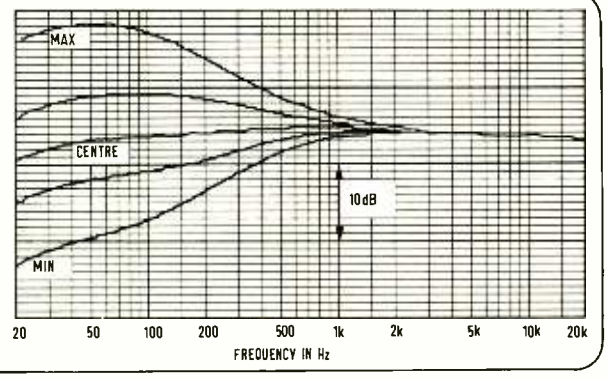



FIG.10
CONCORD S2000
MID 1 EQ AT MAX
CUT/BOOST

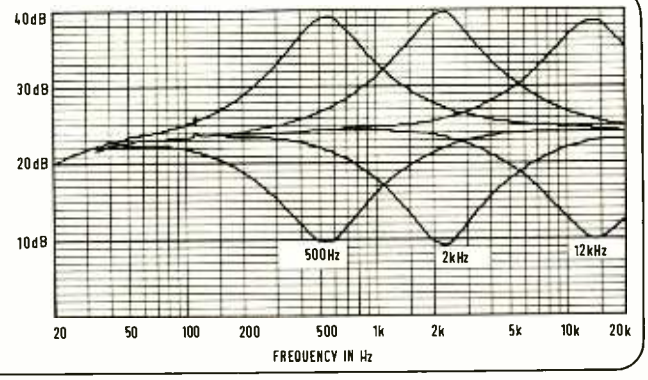



FIG.11
CONCORD S2000
MID2 EQ AT MAX
CUT/BOOST

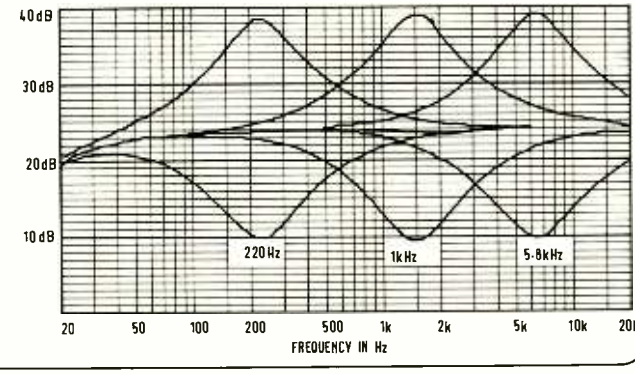
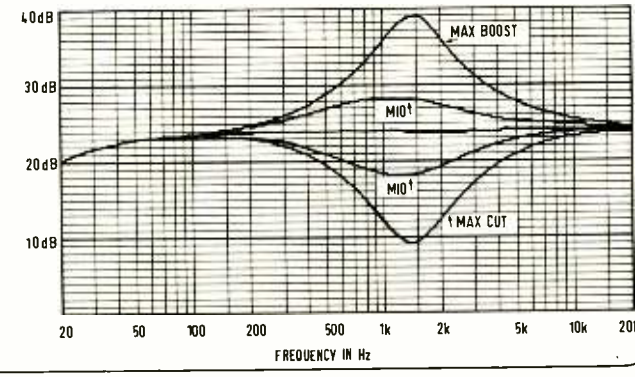



FIG.12
CONCORD S2000
EFFECT OF CUT/BOOST
CONTROLS




**Other matters**

The internal oscillator was found to be capable of delivering 5.39V from a source impedance of 100Ω and to be flat within 0.1dB. Distortion was the same at the 3 frequencies, being 1.5% 2nd harmonic and 0.15% 3rd harmonic. The actual frequencies were found to be 9.59kHz, 1.03kHz and 117Hz with not too excessive a bounce when changing frequency.

The solo and the mute functions were found to provide an isolation in excess of 80dB up to 10kHz.

Checking the VU meters showed that the rectifier characteristic was correct and that the accuracy of level indication on steady tone was reasonable, however, the meters were slow in response taking about 700ms to rise to the steady state condition upon the applications of a steady tone. Similarly the fall time was excessive.

The general performance of all controls, including the pan controls, gave smooth results without any complaints. Generally the control layout and the use of coloured knobs made operation of the mixer simple with the front panels being uncluttered and all controls spaced for easy operation. In particular the short length of the front panels made a compact unit with all controls well within reach of the operator.

**Summary**

This versatile mixer offers many attractions for portable use, being lightweight and compact. Operation initially needs a fair amount of thought until one masters the signal routing associated with the digital system but once one is familiar with the system it proves to be of considerable assistance.

So far as the performance is concerned the measurements show that many features are excellent, but, the mic input is not the quietest available and the squarewave performance has a peculiarity — it is, however, far better than many transformer coupled inputs.

Finally it must be said that the standard of construction and of the components used is first class with all components being very well identified for servicing. **Hugh Ford**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# reviews

# Soundcraft Series 1624

**MANUFACTURER'S SPECIFICATION**
**Distortion:** mic preamp at −30dBV in and +4dBV out, 40Hz 0.008%, 1kHz 0.005%, 18kHz 0.007%, IMD 0.015%. Channel line input to mix output at +4dBV in and out, 40Hz 0.005%, 1kHz 0.005%, 18kHz 0.05%, IMD 0.009%.
**Crosstalk:** line input through pan control to stereo mix buss 40Hz −64dB, 1kHz −63dB, 18kHz −55dB. Adjacent channel 40Hz −100dB, 1kHz −95dB, 18kHz −85dB.
**Noise:** equivalent input noise reference 200Ω −128.5dBV. Mix noise with 24 inputs and 16 monitors routed to mix at unity gain −76dBV (DIN audio).
**Input impedance:** mic input 2kΩ (5kΩ with pad). Line input 10kΩ.
**Output impedance:** any output <40Ω.
**Output capability:** any group or mix into 600Ω +21dBV.
**Gain:** mic 75dB maximum. Line 40dB maximum.
**Frequency response:** mic input at 50dB gain to mix, −1.6dB at 20Hz, 0dB at 1kHz, −0.2dB at 20kHz. Line input at unity gain to mix, −0.8dB at 20Hz, 0dB at 1kHz, −0.2dB at 20kHz.
**Phase response:** line input to mix output +20° at 20Hz, 0 at 1kHz, −20° at 20kHz.
**NB:** 0dBV = 0.775Vrms [sic].
**Price:** £10,450.
**Manufacturer: Soundcraft Electronics Limited, 5–8 Great Sutton Street, London EC1V 0BX, UK.**

The Soundcraft *1624* series consoles are split consoles of more traditional design than the 'in line' console which is frequently far less versatile and certainly far more complicated to use for complex set-ups.

The normal configuration of the Soundcraft *1624* is 24 input/output modules, 8 group/monitor modules each handling 2 channels, and a master module. Optionally a 24-track monitor module may be installed, this single module catering for 8 tracks.

For this review a small desk consisting of 4 input/output modules, 2 group/monitor modules and a master module was used with a small patchfield. A separate mains power unit is connected to the console using a multiway cable.

The form of construction of the console is particularly interesting as no main frame or mother boards are used. Instead all modules are interconnected by a 'daisy chain' ribbon cable assembly which connects into each module with a 40-way ribbon connector. The I/O modules have the remaining connections by means of a 10-way ribbon cable and a 3-way pin connector for the mic inputs.

Clearly this interconnection technique saves a lot of mechanical engineering as there is no need to locate the individual modules with any accuracy for inserting the boards into printed circuit connectors. This form of construction allows the console to be made basically from 2 tapped alloy strips screwed on to alloy end frames, each module simply being installed by 2 screws, one at the top and the other at the bottom. Access to the 'daisy chain' and other connectors is via a hinged door in the base of the console; the door being secured by fasteners operable with a coin.

Each module uses good quality pcbs with clear component identifications and incorporates good quality components in an uncluttered layout. All front panel controls are soldered on to the pcb with the potentiometer bushes being used to secure boards to the front panels, the only hand wiring being the feed to the P & G faders.

The power unit, which is designed for rack mounting into a 19in rack, is connected to the mains and the console by heavy duty Cannon connectors. Within the power supply the standard of wiring was first class with a toroidal transformer providing the ±18V and a +15V line, the presence of which is shown by front panel indicator lamps. Also the front panel has a power fuse failure lamp, a properly identified power fuse and twin recessed line voltage selectors.

All supplies are stabilised with a heatsink at the rear cooling the control transistors which did not have insulated covers — the manufacturer should correct this omission as it would be easy to short the live transistor cases. Also, another complaint, a loose piece of wire and the remains of two cable ties were rattling about loose within the power supply.

Overall the standard of construction and finish of the desk was excellent with the complete desk having a pleasant look with its chocolate brown finish and clear cream coloured legends. All push-button controls have cream coloured knobs with engraved legends, the potentiometers having brown knobs with colour coded caps.

### Input/output modules

The input/output modules can be conveniently divided into a number of sections with the input section being at the top of the module. This section consists of separate trims for the line and mic inputs in the form of calibrated potentiometers each with 41 detents. Line/mic input is selected with a locking pushbutton switch with further similar switches providing a 20dB pad in the mic input, mic phase reversal and 48V phantom powering.

Proceeding down the panel there is the comprehensive filtering and equalisation section. At the top a switchable highpass filter offers 12dB/octave attenuation with a detented pot offering frequencies between 50Hz and 800Hz — a more than adequate range.

A separate switch switches the 4 equalisers in and out of circuit. These consist of high and low frequency shelving equalisers each with a centre detented potentiometer providing ±15dB range and a switch allowing a choice of two frequencies: 60Hz or 120Hz for the lower frequency equaliser and 8kHz or 16kHz for the high frequency.

The remaining two equalisers also have a ±15dB range by means of a centre detented potentiometer with multidetent pot giving a choice of frequency from 150Hz to 2.4kHz for the 'LOMID' equaliser and 800Hz to 10kHz for the 'HIMID' equaliser.

There follows the signal routing section which has 16 separate pushbuttons for sending to any combination of 16 busses plus a direct send to the mixing buss. In addition there are six auxiliary sends controlled by multidetented pots. Auxiliary sends 1 and 2 are permanently pre-fade mono sends with auxiliaries 3 and 4 also being mono sends, but switchable to pre- or post-fade. Sends 5 and 6 are permanently post-fade but a pushbutton allows them to be switched as a post-panpot stereo feed with all six sends being switched in or out of circuit by a 'CUE ON' button.

Above the Penny and Giles fader is an important section of the module containing the centre-detented panpot which can be switched in or out of circuit, with the remainder of the section being occupied by five pushbuttons. One button with a nearby green LED indicator switches the channel on/off with the remaining 4 buttons being associated with the solo system. In addition there is a red LED indicator which indicates the danger of channel overload.

A solo button normally mutes all other channels, however, a 'solo safe' button may be pressed to stop any individual channel being muted. Two further buttons 'MUTES A and B' allow master mute buttons A and B on the master module to mute a choice of 2 groups (A and B) of input/output modules.

### Group monitor modules

Each master/monitor module consists of a twin channel module each channel having completely separate controls side by side. Four different modes of operation are possible, the record mode, the subgroup mode, subgroup with cues and pan to group and finally just cues and pan to group.

In the normal recording mode the group buss is fed via insert points and the group fader to tape with the monitoring being switchable to pre- or post-tape. In the subgroup mode the buss input is fed via an insert point to the group fader and thence to the left or right stereo mixing buss, even channels feeding left and odd channels feeding right. In addition the tape return may be used to feed the stereo mixing buss via the monitor faders, equalisers and the panpot.

In the third mode of operation, subgroup with cues and pan to group, the auxiliary sends and the

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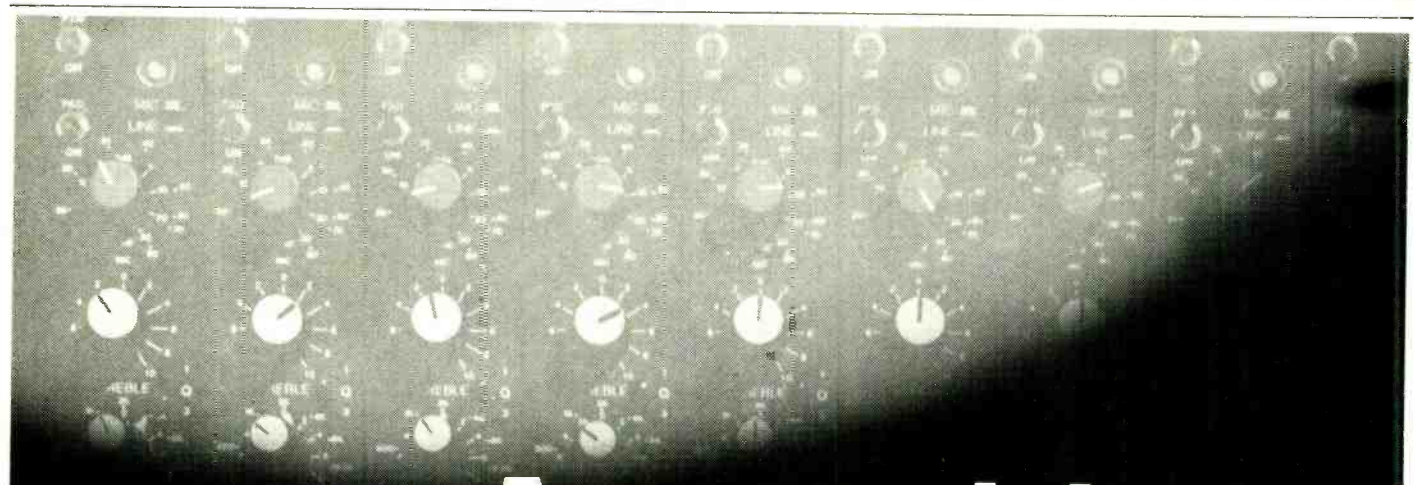

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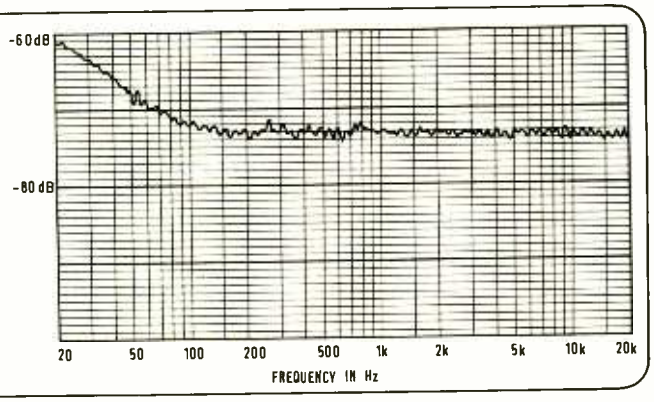
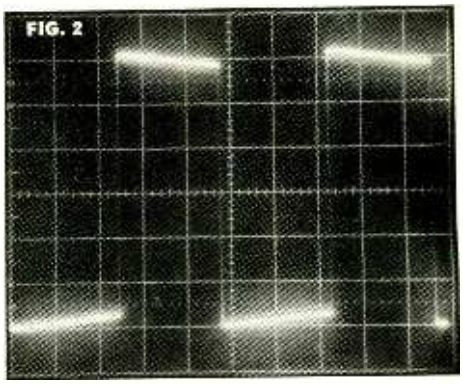
FIG.1
SOUNDCRAFT
SERIES 1624 CMR




panpot are transferred to the subgroup enabling them to be panned across the stereo mixing buss. In addition the monitor return is available to feed the left or right stereo mixing buss via the monitor fader and equalisers with the left buss being fed by even numbered channels and the right buss by odd numbered channels.

In the fourth mode, cues and pan to group, a subgroup is formed feeding the left or right stereo mixing busses but without auxiliary sends, with the facility to insert outboard devices into the group via the group output and monitor.

Located at the top of the module are equalisers comprising hf and lf shelving controls plus a mid-band equaliser with variable frequency from 300Hz to 5kHz, all 3 equalisers having a ±15dB range by means of centre detented pots. Push-button switches are provided to switch the equalisers in or out of circuit and further buttons to switch the six cue feeds in or out.

As with the input/output modules, the cues 1 and 2 are permanently pre-fade, cues 3 and 4 can be switched to pre- or post-fade and cues 5 and 6 can be switched to stereo.

Below the cues section are the panpots for each channel followed by the monitor on/off button with an adjacent green warning LED, the cues to group switches and tape return switches, below which short slider faders provide the monitor level controls.

The remaining features consist of pushbutton switches for monitor solo, group solo (both with red warning LEDs), group to mix and fader reverse for interchanging the group and monitor faders, the group fader being a full size Penny and Giles fader at the bottom of the module.

**Master module**

Proceeding from the top of the master module there are 6 master auxiliary send level controls in the form of 41-detent pots with adjacent solo buttons and red warning LEDs. The studio level and control room level controls take a similar form with pushbuttons giving a choice of three 2-track inputs or the mix for control room monitoring. In addition the control room monitors can be switched to mono for phase checking and also dimmed 20dB if required.

As metering follows the control room monitoring it is possible to monitor the level on any buss by using the solo feature, a small section of the master module with a red ('solo on somewhere') warning lamp providing stereo or mono solo including solo 'in place'. This section also contains the master mute buttons A and B which, as previously mentioned, allow groups of inputs to be muted. Overall mix level control is by means of a stereo fader in the master module.

Within the talkback section there is an inbuilt mic with a pot level control. Three locking pushbuttons allow talkback to be routed to any combination of pairs of auxiliary busses 1/2, 3/4 and 5/6 with talkback being activated by either a red 'talkback' button which also routes talkback to the studio speakers as well as the chosen busses, or a green 'comm' button which sends talkback to the chosen busses only. A further button provides 'slate' which sends talkback plus a 30Hz tone to all group busses, the 30Hz tone making it easy to locate slated points on tape at high speeds.

The final section of the master module is the oscillator section which has a variable frequency oscillator covering 45Hz to 15kHz in 2 switched ranges. A pot level control and 2 locking push-button switches allow the oscillator to be routed to all group busses, all auxiliary busses or both.

**The 24-track monitor module**

Not included in the review hardware, this module deals with the extra 8 tape tracks in a single module allowing the meters for tracks 9 to 16 to be switched to tracks 17 to 24 in 2 groups of 4 tracks, with individual track switches allowing A/B monitoring.

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FIG.3
SOUNDCRAFT
SERIES 1624 2ND & 3RD
HARMONIC DISTORTION

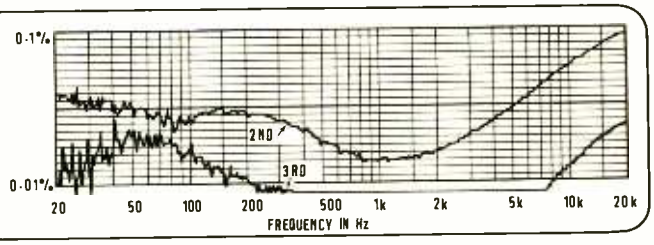



FIG.4
SOUNDCRAFT
SERIES 1624 IM
DISTORTION AT +10dBm

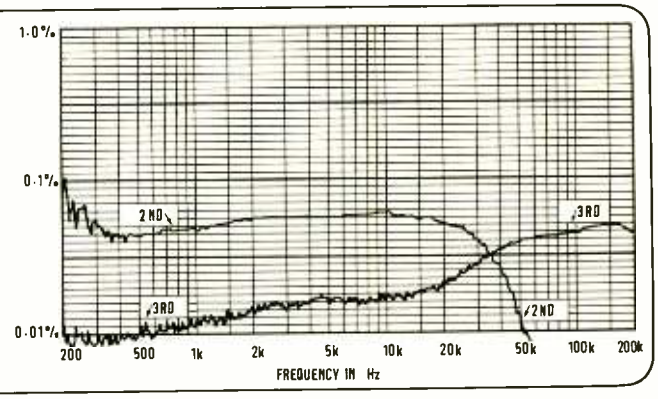
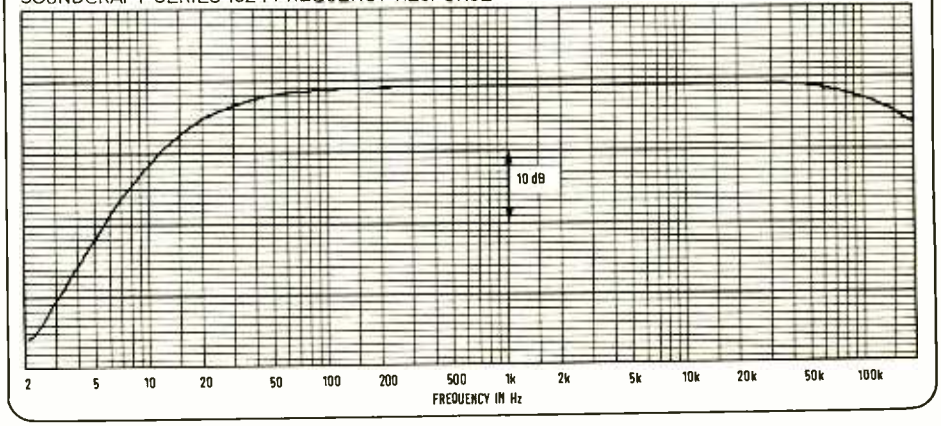
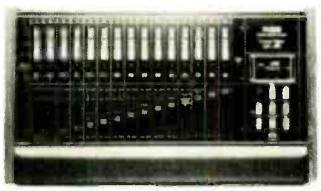



FIG.5
SOUNDCRAFT SERIES 1624 FREQUENCY RESPONSE



# turnkey mix



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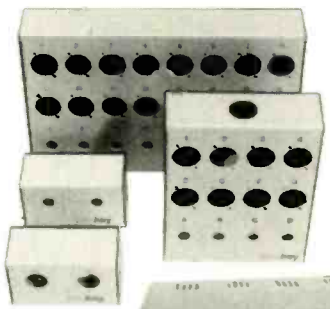

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## GREEN BOOK

Much more than a catalogue, the new "Turnkey by Mail", 28 page book includes hints on setting up a studio, choosing equipment, and other practical advice. Call or write for a copy or use the reply coupon in the September issue of Studio Sound.


## 5 STUDER 24 TRACK'S DELIVERED

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Four auxiliary send level pots normally feed auxiliaries 1 and 2 pre-monitor level and 3 and 4 post-monitor level. However, the sends to auxiliaries 3 and 4 may alternatively be routed to auxiliaries 5 and 6 in groups of 4 tracks.

Further controls allow panning into the mix and adjustment of monitor level with each track having a monitor on/off and a solo button.

**Patchfield**

The patchfield includes a multitude of insert points including the input/output modules, the group module inputs, master mixing busses etc. In addition line in and line out to the input/output modules, group outputs and tape sends and returns are available for patching. Virtually every useful point is available for attack at the patchfield, plus the internal test oscillator.

**Inputs and outputs**

With the exception of the electronically-balanced mic input, all inputs and outputs are unbalanced single-ended connections with all connectors normally being of the *XLR* type.

Outputs are derived from operational amps with a dc blocking capacitor and thus have a very low impedance with the drive capability being +22dBm (loaded into 600Ω) or +23dB reference 0.775V into a high impedance.

The high level inputs all feed operational amps and have a relatively high impedance, the line input having an impedance of 15.3kΩ which remained constant with the gain control setting, the input being capable of accepting in excess of +22dBm without clipping.

Measuring the available gain from the line input to the output of the I/O module with the channel fader set to 0 gave a range from 16dB gain to −13dB loss with 10dB of further gain being available at the maximum fader setting.

Turning to the mic input, this offered a maximum gain of 67dB to the channel module's output with a signal handling capacity of −35dBm at maximum gain, +2.5dBm at minimum gain, without the use of the nominal 20dB pad the attenuation of which varied with the source impedance. The input impedance was found to be effectively constant with gain setting, being 1,805Ω without the pad in circuit or 4,630Ω with the pad in circuit.

As shown in **Fig 1** the common mode rejection is just short of 70dB at 50Hz rising to 73dB at higher frequencies.

The red peak LED overload indicators in the channel modules were found to become illuminated with steady state signals 3dB below clipping and to be relatively fast on tonebursts when they operated on anything more than 10ms of overload in any part of the I/O module.

The peak overload lights associated with the VU meters had a similar characteristic with the meters having a genuine VU meter ballistics and rectifier characteristic.

**Noise**

Measurement of the noise in the mic amp with the input shunted with 200Ω gave a noise referred to the input of −127.8dBm over a 20kHz effective noise bandwidth (using a 15.7kHz lowpass filter with 6dB/octave attenuation). A good performance.

Noise when using the line input showed mild variations from one channel to another and also showed a variable increase when the equalisers were put into circuit in the 'flat' setting. With channels set to unity gain the output noise average was −93dBm A-weighted rms or −80.5dBm CCIR-weighted using a quasi-peak meter without the equalisers. When the latter were inserted the A-weighted noise rose to −88dBm and the CCIR-weighted noise to −76dBm both of which represent an entirely satisfactory performance.

With 4 input channels set to line input and for unity gain to the stereo mix output the noise in the output was found to be satisfactory at −84dBm A-weighted rms or −72dBm CCIR-weighted quasi-peak.

**Distortion**

The application of a fast 1kHz squarewave to the mic input gave the waveform shown in **Fig 2** at the channel output with the equalisers out of circuit, the reproduced waveform being completely free from any signs of ringing or other aberrations.

Measuring the 2nd and the 3rd harmonic distortion from the mic input at maximum gain to the channel output gave **Fig 3** at +10dBm output with the distortion products falling even lower at lower I/O levels such that even at 0dBm output the distortion products were below 0.01%.

Intermodulation distortion to the CCIF twin tone method using tones separated by 70Hz again using the mic input at maximum gain produced **Fig 4** at +10dBm output showing a very clean performance, particularly at high frequencies where high intermodulation distortion would be an indication of transient intermodulation problems. With the input reduced by 10dB for 0dBm output the 3rd order intermodulation products

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FIG. 6
SOUNDCRAFT
SERIES 1624 HIGHPASS
FILTER AFFECTING
LOW FREQUENCIES

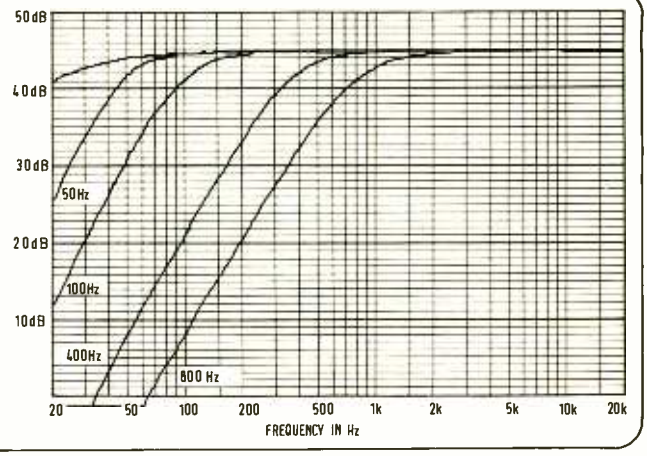
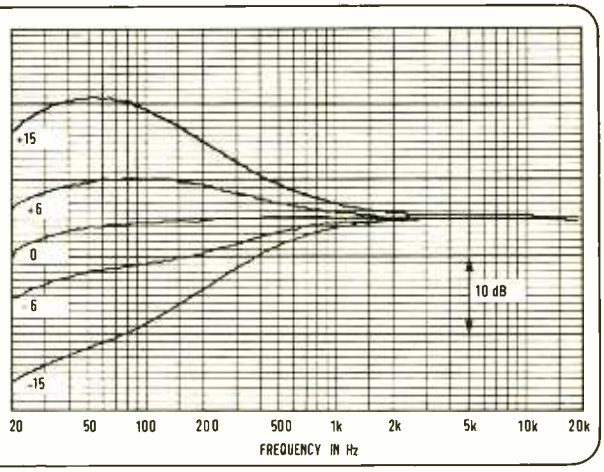
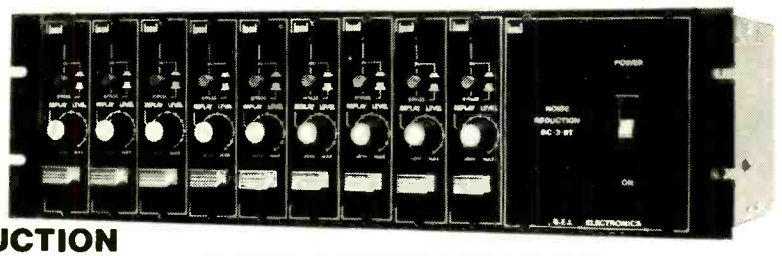



FIG. 7
SOUNDCRAFT
SERIES 1624 LF EQS
AT 60Hz



# HISS-OFF



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A sophisticated multitrack console hidden in a small package. A true in-line mixer—input output modules equipped with separate microphone and monitor circuits. Fader and monitor potentiometer can be transposed to enable monitor mixing while recording, free grouping and multitrack buss selection, electronic (PROM) function switching providing 18 useful switch combinations.
CONCORD S2000 can be used for either 8, 16 or 24 track operation.
CONCORD S2000—one of the new family of EELA AUDIO compact mixers that leave all the others behind.
EELA AUDIO compact mixers for small studios who have to tackle big sound problems: SYS TEM S200, a stereo mixer built on a versatile module system.
SYSTEM S300, a stereo/4 track/ 8 track mixer. A module system creating a variety of mixing consoles for applications ranging from 4 into 2 film dubbing to 16 into 8 multitrack recording. In addition, the EELA AUDIO E.N.G. MIXER, a compact portable mixer designed for TV and film newsgathering.

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**PIETER BOLLEN geluidstechniek bv. HONDSRUGLAAN 83 A, 5628 DB EINDHOVEN. Tel. 040-424455. TLX: 59281 BOLLE NL.**

had fallen to below 0.01% where they remained at lower I/O levels. The insertion of the equalisers did not appear to have any significant effect upon distortion levels.

**Frequency response, equalisers and filters**

The overall frequency response from the mic input at maximum gain to the channel output is shown in **Fig 5** giving a flat response at audio frequencies with −3dB points at about 25Hz and 120kHz.

Insertion of the equalisers in their flat position did not have any significant effect upon the frequency response with the highpass filter only affecting the low frequencies as shown in **Fig 6** which shows its 12dB/octave slope together with accurate frequency calibrations.

The characteristics of the low frequency equaliser set to 60Hz are shown in **Fig 7** showing that the control has a good law for fine adjustment. When set to 120Hz the characteristics are of similar shape with the complete plot shifted up in frequency by an octave.

This is also true of the high frequency equaliser the response of which is shown in **Fig 8** for the 8kHz setting with the complete pattern being shifted in the 16kHz setting.

The remaining two equalisers, LOMID and HIMID, have a well-controlled cut/boost characteristic of up to ±15dB with an overlapping frequency range. A typical cut/boost frequency response is shown in **Fig 9** with the frequency range limits at maximum cut/boost being shown in **Figs 10 and 11** for the two equalisers. It will be noted from these 3 figures that the frequency and cut/boost calibrations are accurate and that all controls have a good law.

FIG. 8
SOUNDCRAFT
SERIES 1624 HF EQS
AT 8kHz

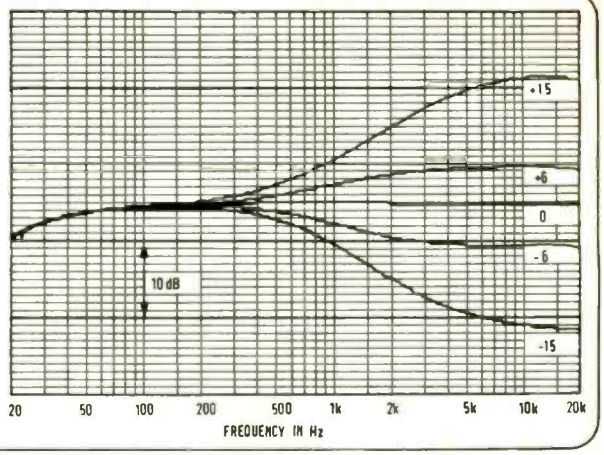
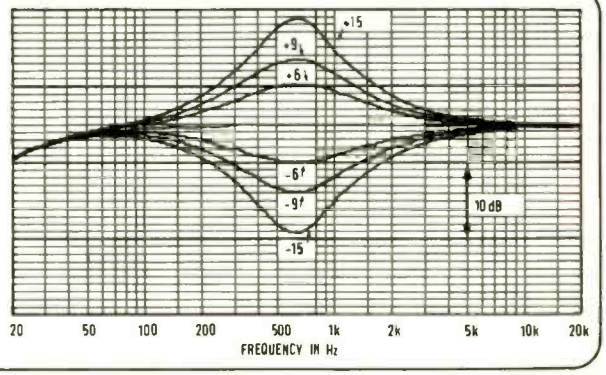



FIG. 9
SOUNDCRAFT
SERIES 1624 'LOMID'
EQ AT 600Hz




**Other matters**

Checking the isolation of the mic inputs from any unwanted crosstalk from the line inputs showed that the isolation was at least 58dB up to 12 kHz. Muting of an I/O channel was found to give over 100dB crosstalk elimination.

Forming 2 adjacent inputs into 2 adjacent groups both at unity gain and then measuring the crosstalk between the groups showed a good performance with crosstalk being 82dB at 1kHz decreasing to 63dB at 15kHz.

Checking the test oscillator showed it to have a maximum output of +19.8dB reference 0.775V from a source impedance of 34Ω. The maximum output into 600Ω or when routed to group was +17dBm above which level the oscillator clipped — not a satisfactory state of affairs.

Whilst the flatness of the output was within 0.1dB the frequency calibration was poor at points with a nominal 700Hz actually being 848Hz. Distortion was adequately low with the 2nd/3rd harmonics being as follows, 100Hz 0.018/0.032%, 1kHz 0.022/0.008%, 10kHz 0.08/0.04%.

FIG. 10
SOUNDCRAFT
SERIES 1624 MID-HIGH
EQ FREQUENCY
RANGE LIMITS

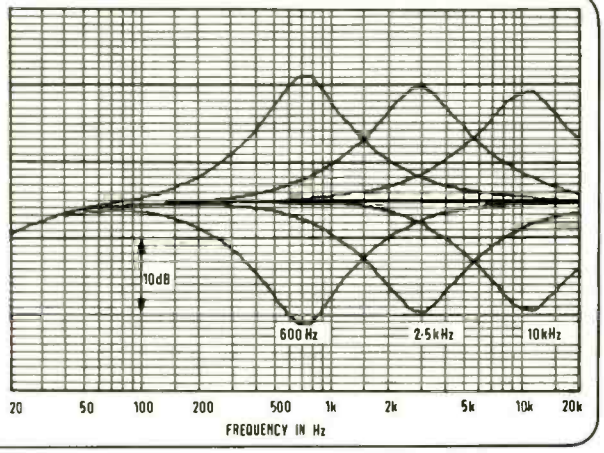
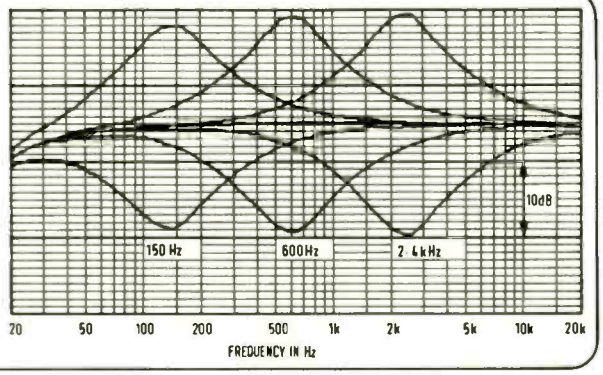



FIG. 11
SOUNDCRAFT
SERIES 1624 LO-MID EQ
FREQUENCY RANGE LIMITS




**Summary**

The Soundcraft *1624* is a particularly well-made mixer using a novel form of construction and with a high standard of component quality.

The general layout was found to be good with groups of controls being colour coded for quick identification. However it was felt that the modules were rather long, making access to the far controls difficult but this is a criticism of many desks where there has to be a compromise between the size and the knob packing density.

So far as the measured performance is concerned all figures were good with low noise and low distortion and a particularly good square-wave reproduction via the mic input.

Overall this is a versatile mixing system which is simple to use and is provided with a great number of facilities including easy interfacing with outboard equipment via the patchfield which can break into the mixer at many points.

**Hugh Ford**

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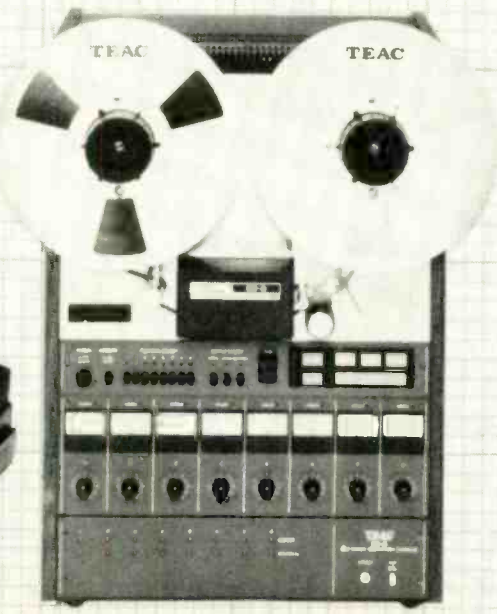


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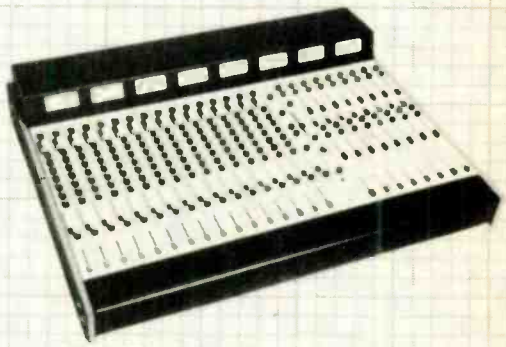

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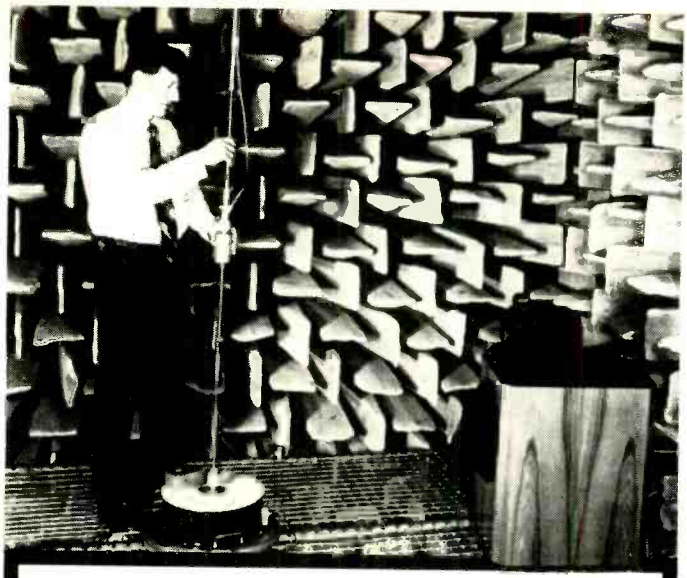

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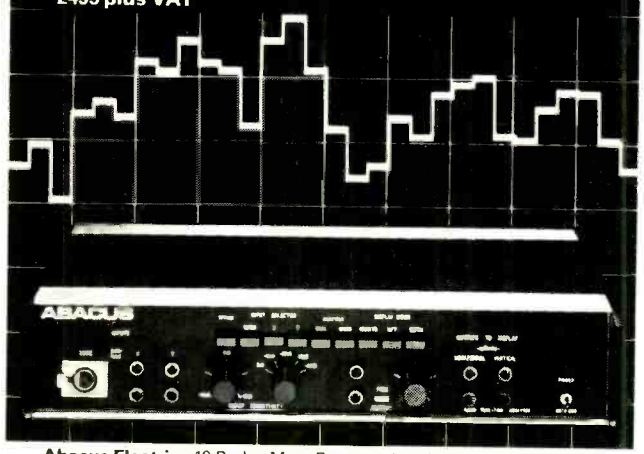

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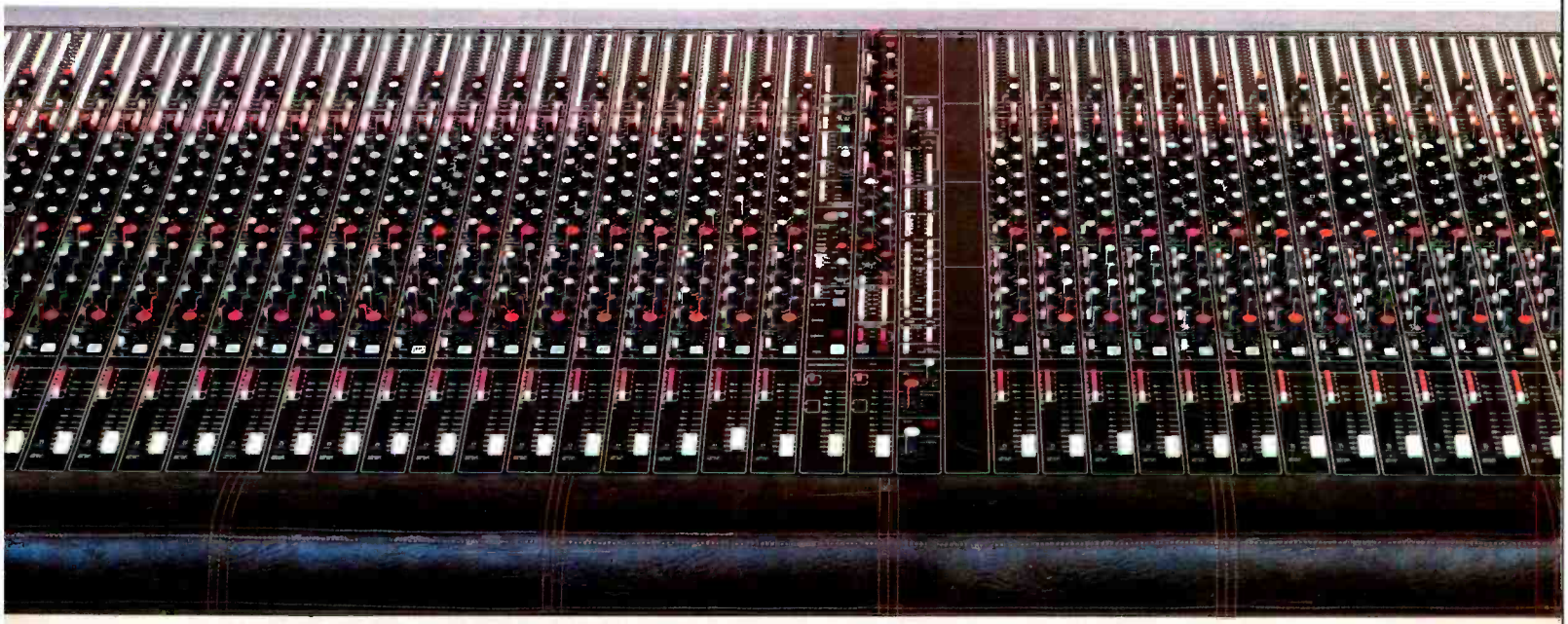

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