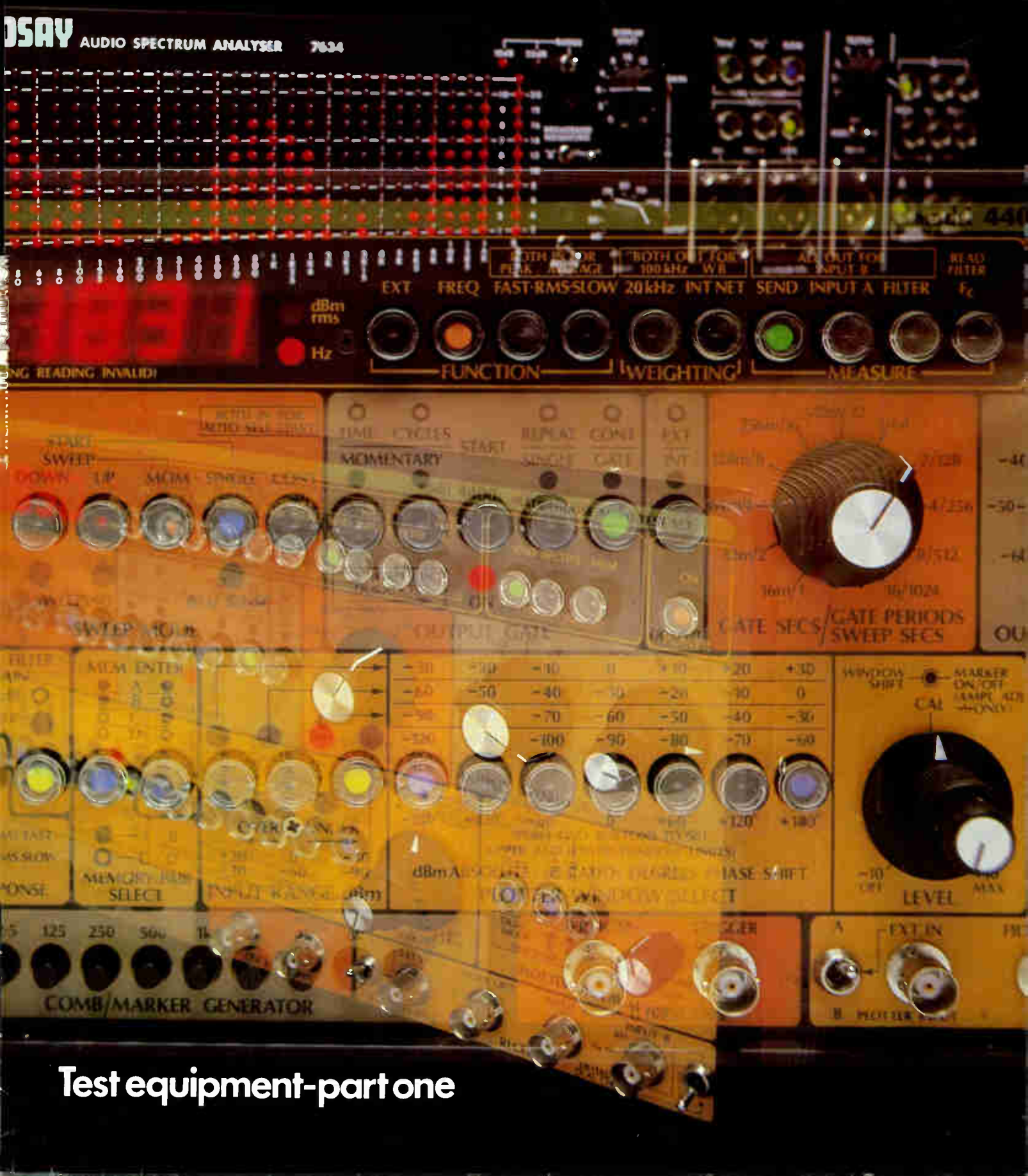
April 1980 75p

# studio sound

AND BROADCAST ENGINEERING

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# studio sound
## AND BROADCAST ENGINEERING



This month, for the first time, we're publishing a comprehensive test equipment survey (previously it was only a short directory) including signal generators and oscillators, distortion meters and analysers, wow and flutter meters and analysers, real time spectrum analysers and plotters. Next month's issue will include test tapes and discs, and handheld sound level meters. Simply, due to lack of space, we haven't even attempted to cover more general equipment such as oscilloscopes, power supplies, voltage calibrated millivoltmeters and multimeters, but information on these should be available from general industry sources. It is perhaps also interesting to note that while companies offering specific pro-audio equipment such as mixers, tape recorders, effects and so on, tend to become popular and then decline as new companies penetrate the market, test equipment manufacturers seem to be rather more stable, possibly due to their product's multiple applications in many industries, not just audio. I also suspect that profit margins on general test equipment are rather higher than many pro-audio companies. Unfortunately it is also a market where Britain takes second place, although a few companies are making significant contributions.

For the last couple of years, the recording and music business has been reported as going through a difficult period, with little money available for expansion, or re-equipping the new studios. With such a 'slump' one might expect manufacturers and distributors to be keeling over weekly, as money being spent on new equipment becomes less readily available. It may be what one might expect, but certainly doesn't appear to have happened. New products are being continually launched, orders are reaching such heights that delivery periods are becoming longer, and many delivery dates are simply not being kept. While *Studio Sound* doesn't actually spend any money, it does review equipment regularly (you may have noticed) and over the past few months has found considerable difficulty in borrowing some for review—this is equipment being continually promoted through exhibitions and advertisements. This has made it difficult to plan reviews in advance, where equipment has been promised but for various reasons doesn't arrive in this country in time for us to conduct a proper review. So one or two reviews recently haven't been as thorough as we would have liked and where minor problems have arisen, we haven't had time for deeper investigation. Most intended reviews eventually appear, although often not for several months since once they have missed their 'slot' in the schedule, it isn't always possible to run them a couple of months later. So while we always attempt to provide balanced coverage with leading products reviewed within 18 months of their launch, and many far earlier, this is unfortunately becoming more difficult to achieve.

Cover of an Amber 4400A test set and Lindsay spectrum analyser by Adrian Mott and Ray Hyden

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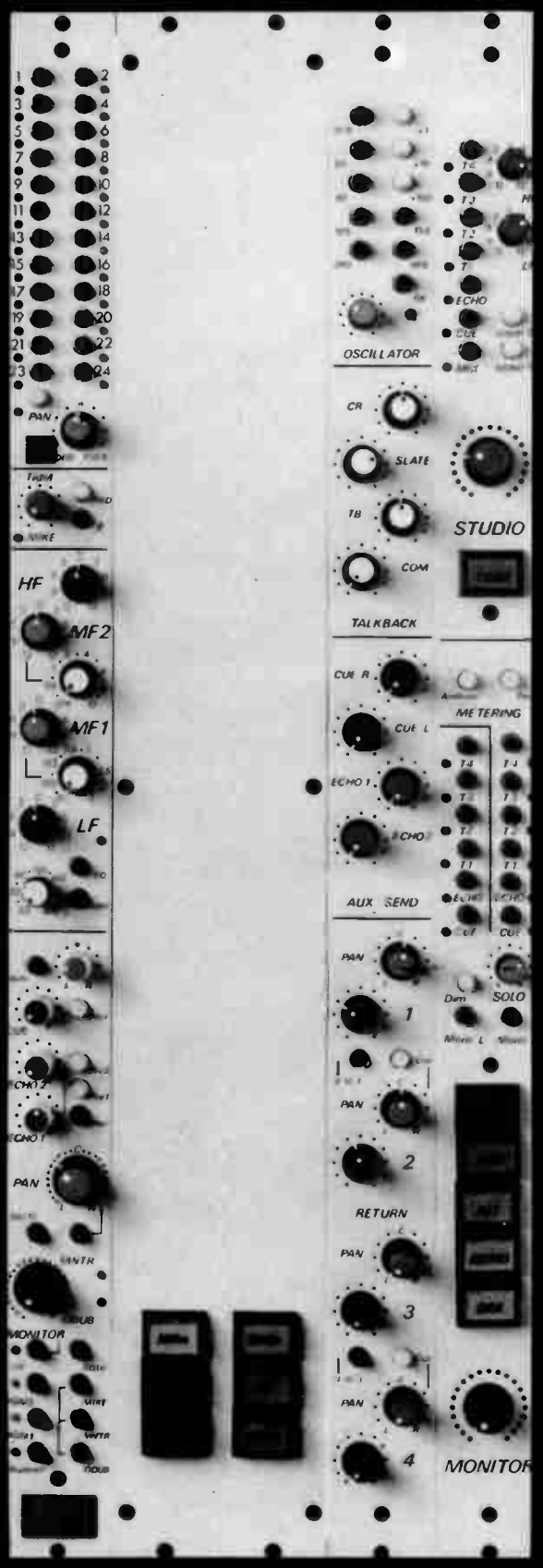


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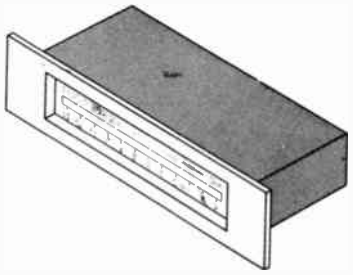

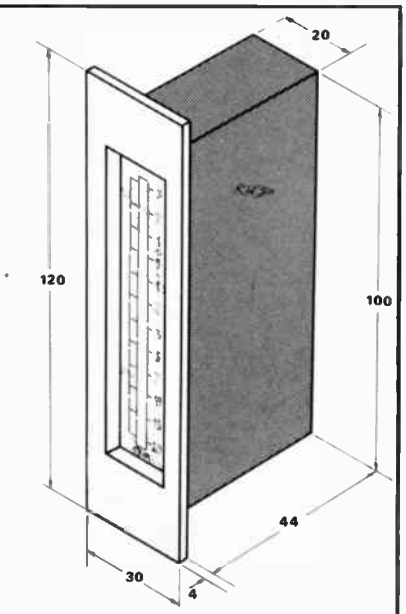


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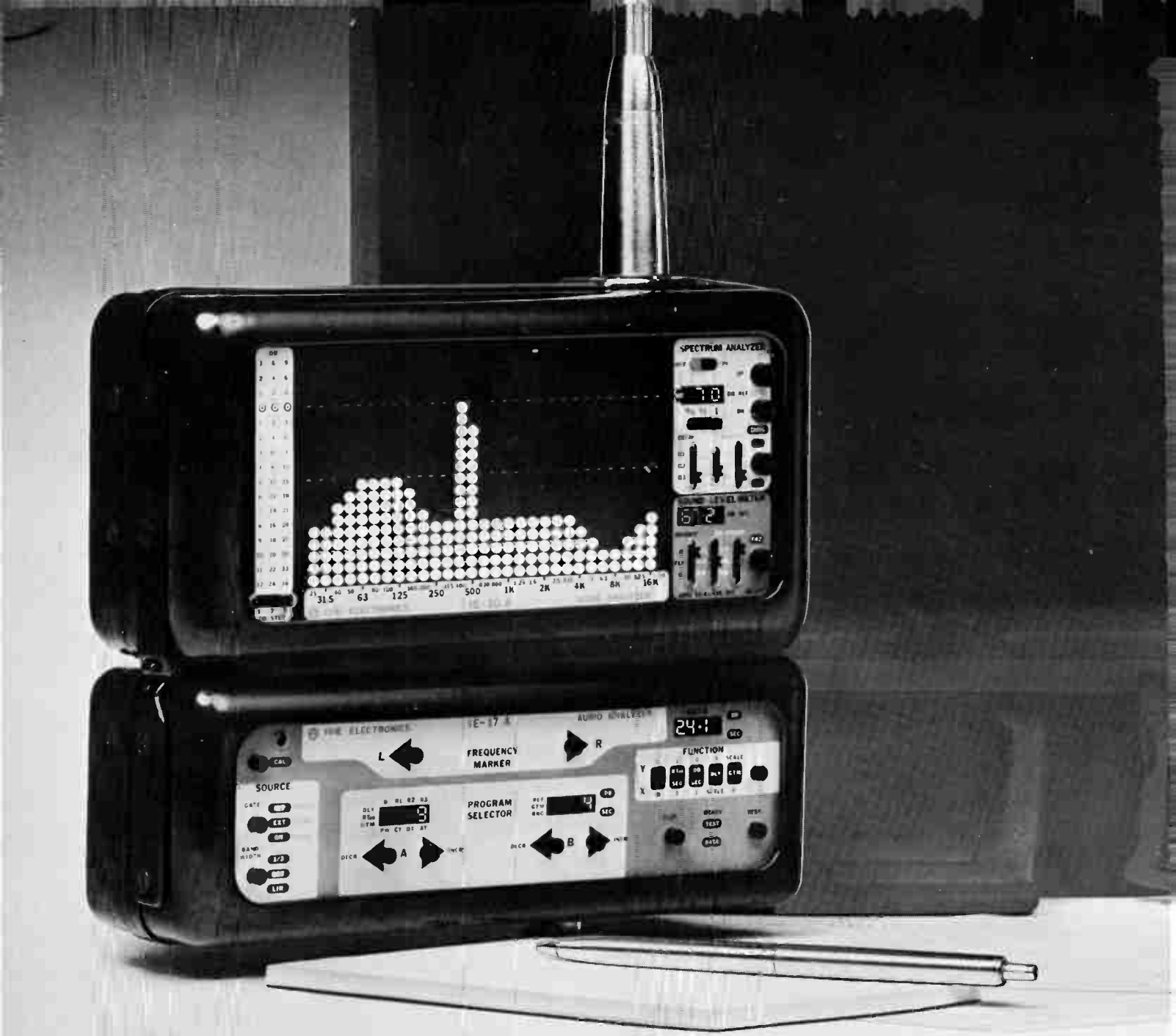


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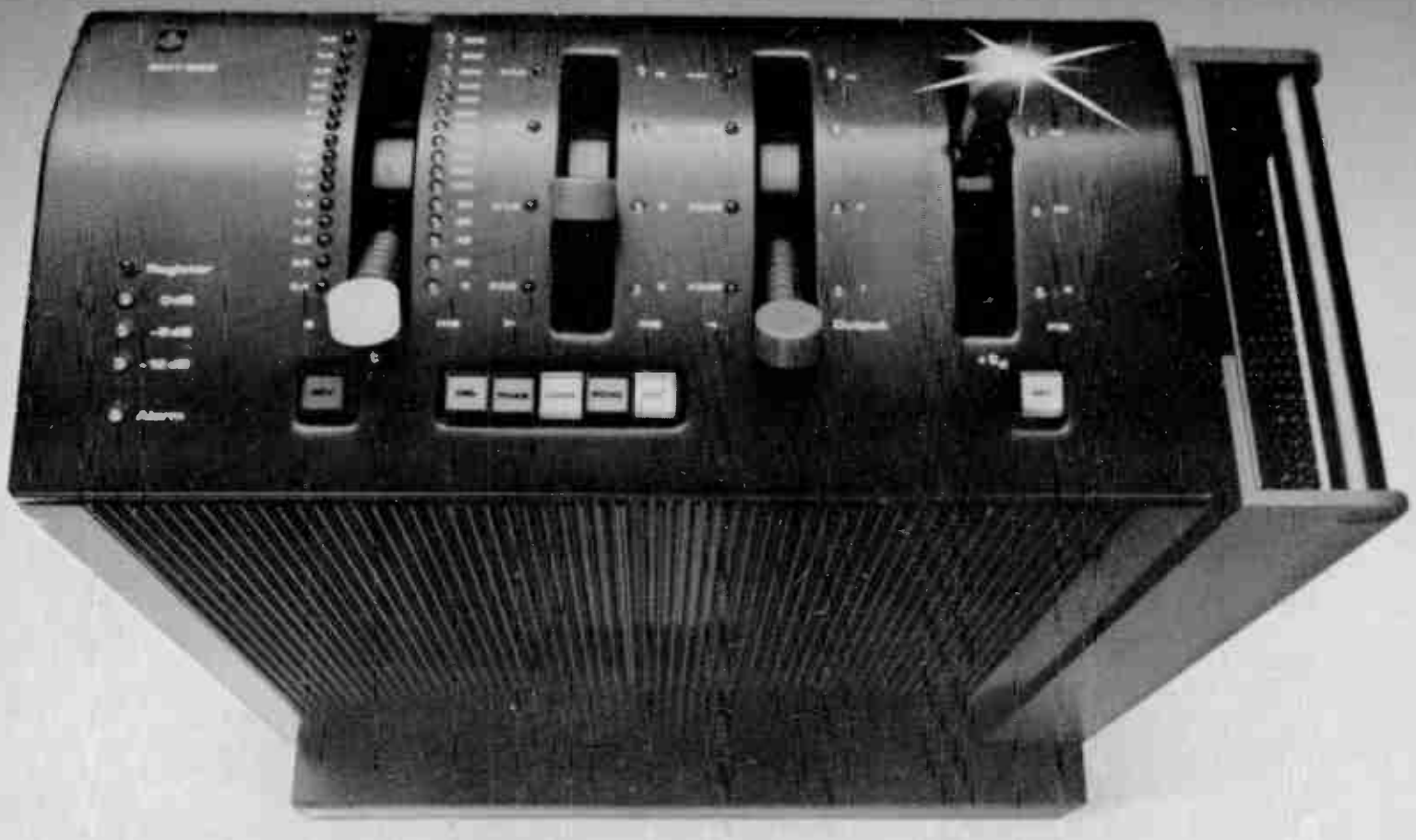

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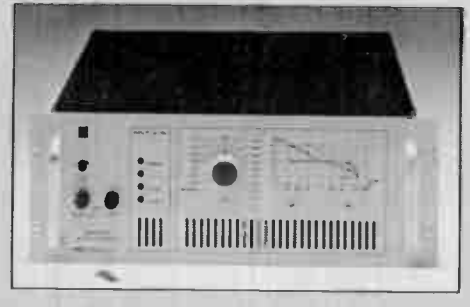

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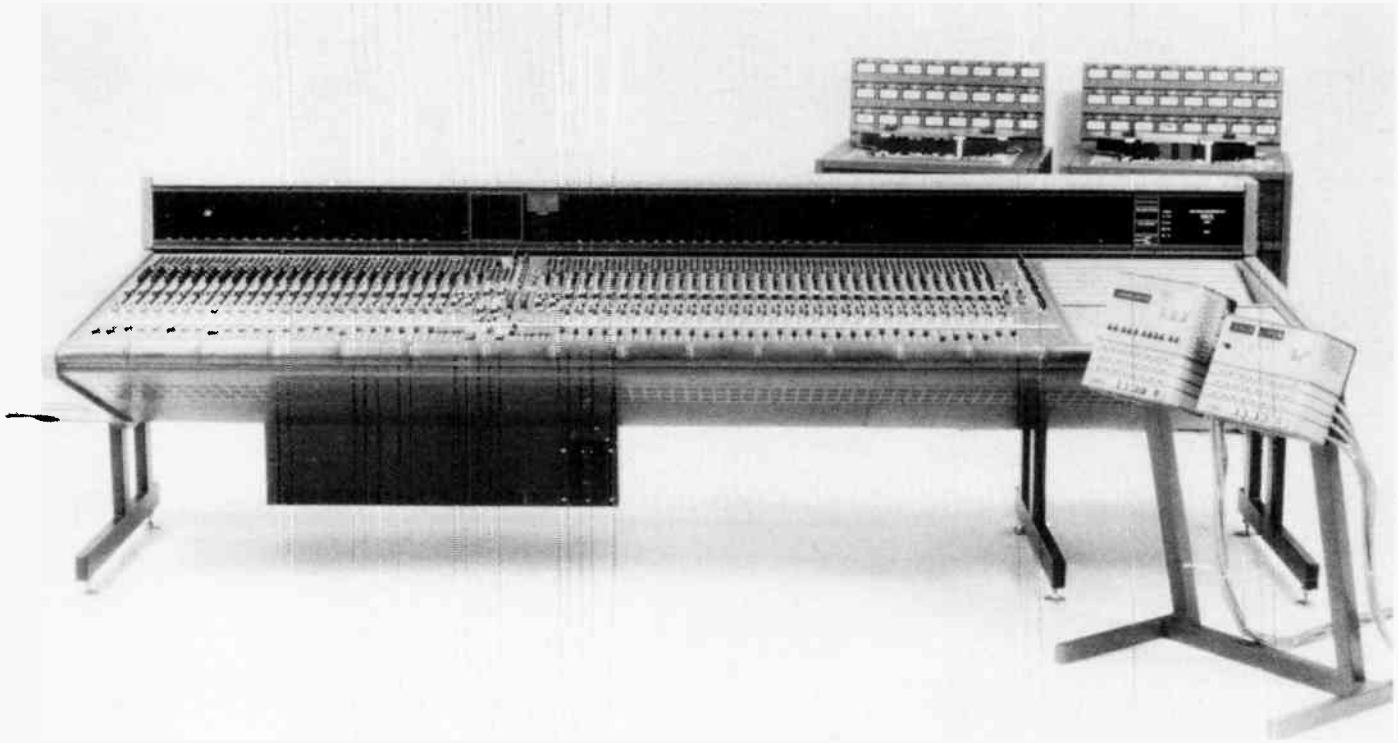

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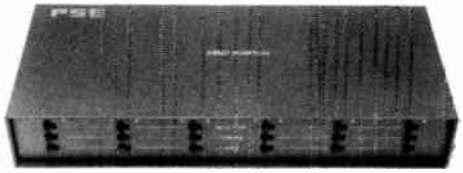

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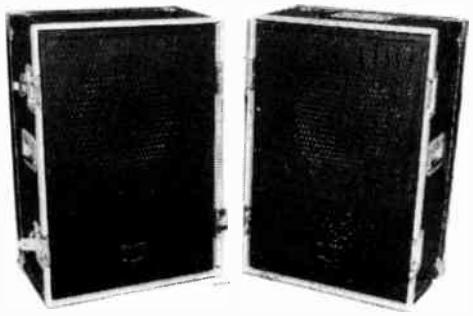

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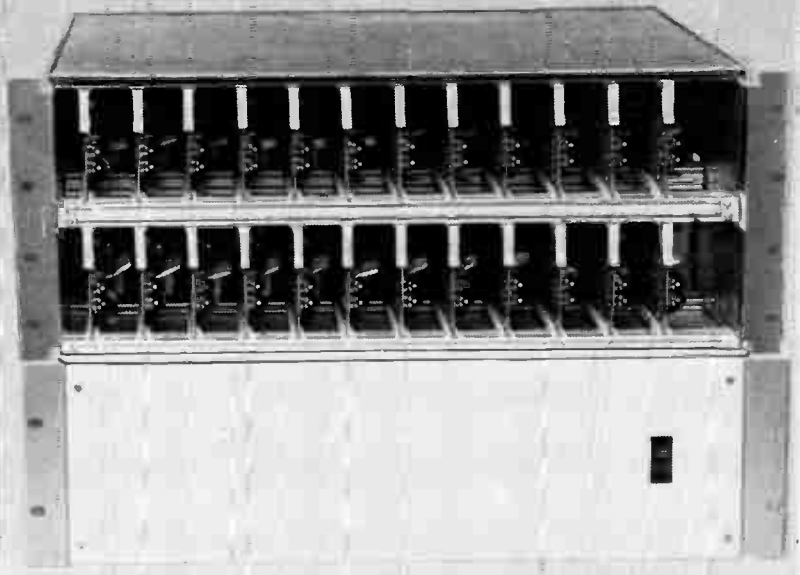

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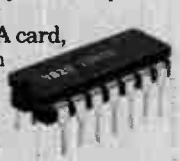
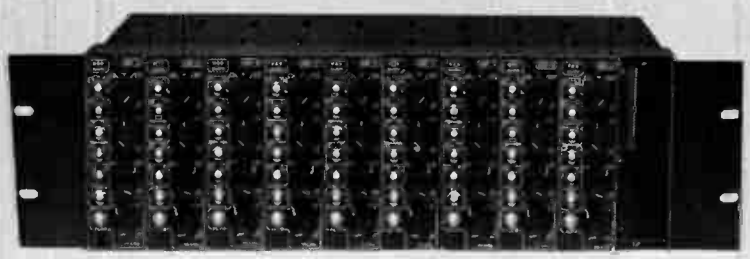
B&B VCA 500A Card
This is a retrofit VCA for the MCI 500 Series and requires no additional circuitry.
THD, IMD and modulation noise are down to their theoretical limits as a result of patented "Class A" circuitry. Thus the 500A is free of colouration and distortion.
In addition, there is a B&B VCA 505 Universal Card which has a 15-pin edge mount, and buffered inputs. All the op-amps are on sockets so when even more sophisticated devices become available, they can be updated easily.
The 1537A VCA chips, which are the heart of the 500A card, are available separately for those who want to design their own applications.

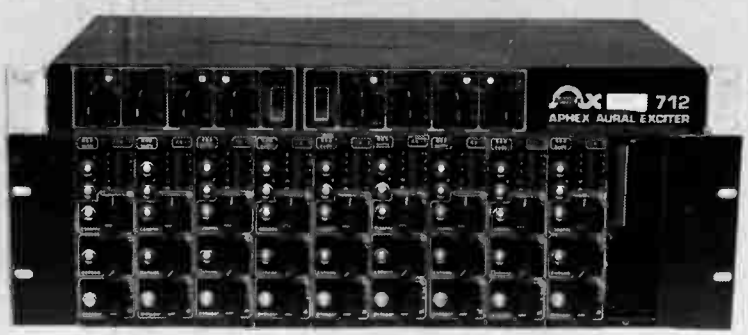


B&B EQF2 Parametric Equaliser/Filter
Equalisation is switchable peak or shelf, with reciprocal cut or boost.
Filtering is tunable high and low pass.
The B&B EQF2 covers the full audio band from 20Hz to 20kHz, and over each of its three frequency ranges it maintains a constant Q.
It is a high quality device well-known as a powerful and creative tool in the studio. Its response curves were chosen carefully to sound good and not just look good on paper.
It is illustrated in the new racking system which accommodates up to 10 devices, each of which plugs directly into the rear mother board.



Model 712 Aural Exciter
The original Exciter launched in 1978 was greeted universally with tremendous enthusiasm by studios, producers and artists.
This new model provides even more control. As well as the previous facilities you can now adjust the phase slope and harmonic content of the processed signals to produce even greater clarity and presence.
It also features bargraph displays for easier monitoring, and all controls are now mounted on the front panel for easier operation.

B&B CX1 Compressor – Expander
As a compressor, release time is variable from 50 msec to 2.5 sec, and threshold operates from –40dBv to +20dBv.
As an expander, release time is variable from 50 msec to 2.5 sec, and threshold operates from –75dBv to –10dBv.
Attack time for both the compressor and the expander is less than 1μsec.
The CX1 has 9 controllable functions and a built-in 10-segment bargraph display for metering any one of 4 different signal levels.
It is illustrated in the new racking system which accommodates up to 10 devices, each of which plugs directly into the rear mother board.

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(Frankfurt) Tel: (0 64 42) 53.03
TLX: (841) 414073 (ROCK D)

**APHEX ITALY**
(Bologna) Tel: 051-76 66 48
TLX: (843) 511361 (BAUER I)

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(Honolulu) Tel: (808) 521-6793
TLX: 7430148 (SOUND)

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TLX: (722) 23071 (JMGPH)

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(Nashville) Tel: (615) 327-3133

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**APHEX SYSTEMS (SUISSE) SA**
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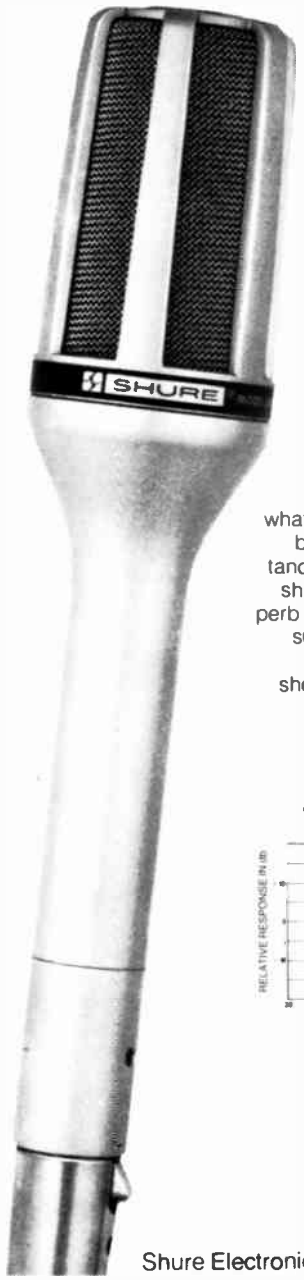
APHEX

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

Shure makes microphones for every imaginable use.
Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects.
Take, for example, the Shure SM58 and SM59 microphones:




## SM59

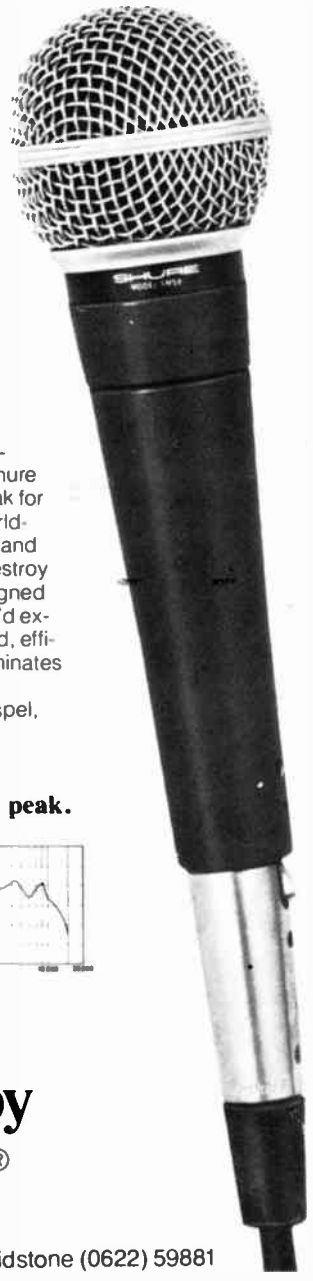
**Mellow, smooth, silent...**

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted for critical studio productions. In fact, you'll see it most often where accurate, natural sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged—it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

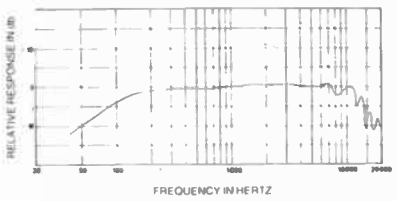
## SM58

**Crisp, bright "abuse proof"**

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications...especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreen eliminates pops. The first choice among rock, pop, R & B, country, gospel, and jazz vocalists.




**Some like it essentially flat...**




**...some like a "presence" peak.**


## professional microphones...by SHURE®

Shure Electronics Limited, Eccleston Road, Maidstone ME 15 6AU—Telephone: Maidstone (0622) 59881

# BUZZ MUSIC

## BRITAINS LEADING PROVINCIAL MULTITRACK CENTRE

### Six good reasons for visiting Hereford

**TEAC/TASCAM**

Our stocks are possibly the best in the country. We always have the Teac 3440 and Tascam 80-8 in stock and on demonstration but our involvement doesn't stop there. Our stocks include everything from the excellent mixers, to the superb cassette decks (including the professional C1, C2 and the amazing new "portastudio"—the 144) and the invaluable range of accessories, all on demonstration and available for immediate delivery.

**REVOX**

We hold large stocks of most Revox B77 configurations, including high speed and sync models. With prices starting at £510 plus VAT, our customers include most major Midlands studios and broadcast companies.

**ALLEN & HEATH/BRENELL**

In addition to the standard 8 track package, we also carry the Model II in 16-8, 20-8 and 24-8 configurations. Where else can the Model II be compared directly with the Soundcraft Series 400?

**STUDIOMASTER RSD**

We carry the full range of these excellent desks, including the 16-4, 20-4, 24-4, 16-8 and 20-8.

**ANCILLARIES**

With everything from the excellent MXR studio range, Reverbs by Furman, ACES, GBS, Roland, EMS Vocorders, and a full range of studio effects, to XLR connectors, patch bays, and Tannoy and JBL monitors, we can supply all your urgent needs from stock.

**PRICES AND SERVICE**

Together amount to the best deal available. Our free telephone advice service is always in demand. Regular deliveries to London and the North, backed by our genuine 2 year guarantee and professional advice are in addition to our excellent prices. Our free catalogue gives full details of everything from microphones to complete studio packages with no hidden extras. Full Finance and Leasing available. But don't take our word for it: ask our customers, or better still, come and see for yourself—the kettle's always on!

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# Not another boring product Ad.

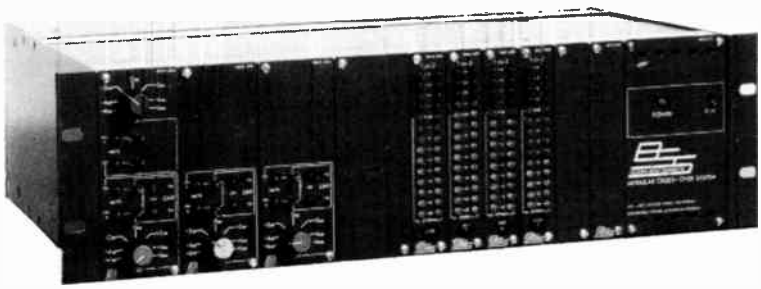
We could fill a whole page with glowing praise
and flattering photos of our Ex-Press Limiter but we think you'd
do better to get one yourself.
It's in stock, order your's now, we're as near as your telephone.

**Audio & Design (Recording) Ltd.,**
84 Oxford Road, Reading, Berks. RG1 7LJ.
Telephone: Reading (0734) 53411.
Telex: 847605 a/b TILLEX G.

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

DAL 9015

# news



## Brooke Siren Systems

Brooke Siren system's range of ancillary equipment comprises the *MCS Series 200* modular crossover and limiter system, a lead tester, and a DI box. The *MCS Series 200* is a 19in rack mount, modular, expandable crossover system with integral limiting and output level meters. The unit has a 5-way stereo capacity and features 10kΩ unbalanced or optional transformer balanced inputs, 600Ω balanced outputs (maximum output level +20dBm), plug-in frequency and slope setting cards, and individual section mute and limiter cancel switches with LED status indication. The standard frequency slope is 24dB/octave. The limiter section is inserted halfway through the filter chain, hence overcoming the frequency shifting problem associated with end of line limiting. Attack and release times depend on the frequency band covered; maximum attack is 1ms, with attack release ratio set to 1:50; and the threshold is adjustable from -6dBm to +20dBm. Each LED module houses two independent columns, with 14 LEDs per display covering the range -20dB to +4dB. The *AR105* will test any lead using 3-pin XLR connectors or ¼in jack connectors for open or short circuits and cross wiring. The unit operates off a PP3 battery and has LED indicators for increased battery life. The *AR116* DI box is a compact screened unit accepting direct signal feeds from any sound source. The unit houses an electronic input amplifier for high input impedance and low noise, and has a transformer balanced fully floating output. The *AR116* features two parallel ¼in jack input connectors for convenient line bridging, an XLR output, selectable 4kHz and 8kHz lowpass filter, input/output earth lift switch, phase reverse switch, input attenuator switch for bridging, main and standby battery powering system, and the facility to replace the main battery with a phantom powering unit.

Brooke Siren Systems, 92 Colney Hatch Lane, Muswell Hill, London N10, UK.
Phone: 01-444 7892.

## New Eventide computer peripherals

Following the success of the Eventide realtime audio spectrum analyser for the Commodore *PET* computer, the company has introduced similar units for the Radio Shack *TRS-80* and *Apple* computers. The *VTU02* (for the *TRS-80*) and the *AIB232* (for the *Apple*) divide the audio spectrum from 20Hz to 20kHz into 31 ⅓-octave bands, and displays the bands with their relative amplitudes and input levels on the computer CRT. Each analyser is designed to interface with its host computer with the minimum of fuss. The *VTU02* plugs into the *TRS-80* expansion port (and provides an equivalent port for further expansion), and the *AIB232* has an interface board which fits one of the *Apple* interface slots. The *AIB232* analyser can make dynamic use of colour, as the colour of each bar of the display is under software control, therefore one or several of the bars can change colour in realtime. Because of the capabilities of the computers great flexibility in the manipulation of the analysed data is permitted. Data can be stored, and compared with past, future, or other channel information. Programs to access the analyser are written in BASIC, and three programs are provided with each unit: interactive operation; minimal operation; and self test. Prices of the available computer peripherals are $595 for the *THS224* (Commodore *PET*) and *VTU02* (Radio Shack *TRS-80*), and $545 for the *AIB232* (*Apple*).

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA.
Phone: (212) 581-9290.
UK: Feldon Audio Limited, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4314.

## USA — PPM and VU meters

American readers may care to know that a wide range of PPM and VU meters designed by Ernest Turner Instruments are available from associate company Crompton Instruments who manufacture and market their equipment in the USA.

Crompton Instruments Inc, 1562A Parkway Loop, Tustin, Cal 92680, USA.
Phone: (714) 731-2333.

## Forthcoming Exhibitions

**March 21 to 25**
Home Video Show, London (01-686 2599).
**April 13 to 16**
NAB, Las Vegas (Washington (202) 293-3500).
**April 23 to 27**
High Fidelity 80, London (024026 2674).
**May 6 to 9**
AES 66th Convention, Los Angeles (New York (212) 661-2355).
**June 18 to 20**
APRS, London (09278 72907).
**September 12 to 18**
Photokina, Cologne (Cologne 0221 8211).
**September 20 to 23**
International Broadcasting Convention, Brighton (London 01-240 1871).
**October 31 to November 3**
AES 67th Convention, New York ((212) 661-2355).

## Revolutionary new recording technique

*Studio Sound* is proud to announce it has been chosen to introduce to the world a revolutionary new recording technique which has made present digital and analogue research totally outdated. The new technique which uses a cuneiform digital block waveform recording technique is the joint invention of Professor Bloch and Dr La Serdiode of the Department of Physics at Phoenix University.

While researching the electrical characteristics of granite crystals, the development team at Phoenix University led by Professor Bloch and Dr La Serdiode accidentally discovered that by using high power laser beams, music waveforms could be recorded and replayed from granite crystals. During the course of the team's experiments on granite crystals accidental RF modulation of the laser from local FM radio station HOAX caused the molecular structure of the granite crystals under investigation to change into a cuneiform waveform. Having noticed this phenomenon and traced the source of the modulation causing the cuneiform effect, the team wondered if the granite crystals could be replayed. The team took a thin wafer of granite and scanned the wafer with the modulated laser driven directly from mics recording the University's resident string quartet. Re-scanning the wafer with the laser in a negative polarity feedback reception mode, their million-to-one chance experiment worked and a distortion-free replica, with astonishing dynamic range, was reproduced.

Analysing the results of their experiments, the team realised that the granite crystals were acting as sophisticated memory cells and that the recorded waveform was automatically converted via the laser and the atomic structure of the granite molecules into cuneiform digital blocks with electron-biased interleaving, quark-coding, and charm block intervals. The results of the Phoenix experiments open up vast possibilities for the recording industry, especially in the light of the world's limited oil reserves. In the near future oil and plastic based recording technology will be redundant and fortunately the world's supply of granite is vast.

Readers will be pleased to hear that further investigation by the Phoenix team has also conquered the problem of granite block recording duplication. By using a still secret lava flow technique (for patent reasons we are unable to give details here) which involves molten magma liquid crystal cooling, extensive quarrying, crushing and pressing by hydraulic rams, 1 ton LPs have already been produced. The research team believe, however, that the weight problem can be overcome and hope that in conjunction with the Phoenix University Geology Department and the US Mining Commission they will be able to produce LP kilogram slabs. Commercial release of the revolutionary new system with its servo-actuated laser pick and slab production from the Etna pressing plant is expected to be announced on April 1, 1980.

28 ▶

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

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

Digital logic momentary switches for complete function mode control.

Unique dual–calibrated meter with both V.U. and Gain Reduction scales.

RMS or Peak sensing compressor side-chain.

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

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

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

All this in a 1¾" rack mounting makes the Ex-Press about the best signal processor on the market.

And it's in stock! Call us now, we're as near as your telephone.

**Audio & Design (Recording) Ltd.,**
84, Oxford Road, Reading, Berks. RG1 7LJ.
Telephone: Reading (0734) 53411.
Telex: 847605 a/b TILLEX G.

**Audio & Design Recording Inc.,**
PO Box 786, Bremerton WA98310 U.S.A. Telephone: (206) 275 5009.
Telex: 152426 a/b NOTA B.

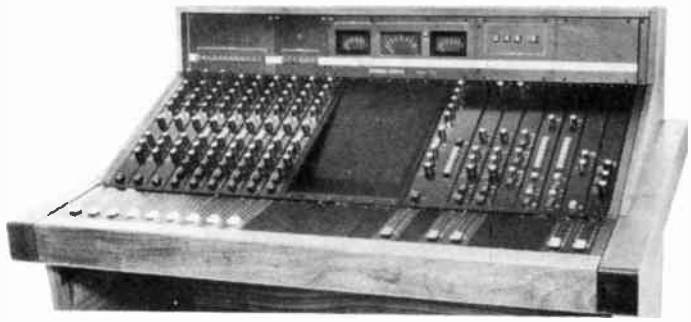
## Gotham celebrates 30 years

Stephen Temmer, owner and president of the Gotham Organisation, comprising the Gotham Audio Corporation, Gotham Export Corporation and Telden Leasing, celebrated 30 years in business on January 28, 1980. The organisation's operations began in 1950 when the Gotham Recording Corporation opened its doors at 2 West 46th Street in New York and became the first independent recording operation equipped with Ampex tape recorders. Prior to this only broadcast networks were so equipped. Four years later the Gotham Audio Development Corporation was started as a manufacturing subsidiary, and it built the 150W power amplifier which formed part of the Gotham /Grampian disc cutting system. In 1956 Temmer sold his 50% interest in the recording operation to his partner Herbert Moss, and concentrated his attention on the manufacturing company. A chance meeting with Georg Neumann in Berlin in 1957, however, led to the organisation's involvement in the import/export of audio equipment. Gotham became the importer of Neumann equipment and over a period of 23 years the company has represented a large number of respected companies including EMT, Telefunken, Studer, Beyer, Lyrec, NTP, and Pyral. Since 1972 the company has also been exporting equipment manufactured by American and Canadian companies such as Allison, Amber, Inovonics, MRL, Switchcraft, and Urei. Today Gotham has representatives in 34 countries.

## MBI broadcast console

Maldwyn Bowden International has launched its *Series 24A* expandable, modular broadcast mixer designed particularly with the UK's ILR stations in mind. The console is designed to be used in a wide range of applications ranging from a simple DJ on-air desk through to a major network master control room switching desk. It fulfils the technical specifications set by the UK's broadcasting authorities and has been ergonomically designed for easy use by trained engineering staff and semi-trained broadcasters. Features of the *Series 24A* include a wide selection of input modules; optional eq on mono and stereo channels; comprehensive metering with overload warning (PPM and VU options); multi-source monitoring; auto-ducking on all input modules; remote and local equipment start (fader or push button); versatile talkback and intercommunication facilities; independent clean feeds on outside source modules; transmitter status warnings; telephone-in and OB line modules with talkback; and XLR connections as standard. Options include script spaces, balanced insert points, and associated furniture available for a wrap-around console format. In addition to the console MBI is also offering a complete turnkey design, construction and installation service for radio stations.

MBI Broadcast Systems Ltd, 168 Edward Street, Brighton, Sussex BN2 2JB, UK.
Phone: 0273 607384.



## Stolen equipment

The contemporary vocal ensemble, Electric Phoenix, had its sound equipment stolen on January 13, 1980 in Amsterdam. Some of the stolen equipment is unique and a reward of 10% of the value of items recovered is being offered for information leading to their return. The items comprise an MM Electronics 16/8 PA mixer; Stellamaster *SM7* tape recorder (headblock serial number 732083Q, chassis serial number 741378); Neal *140* 4-channel cassette recorder (serial number D1220); four custom-built vocal synthesisers (with the name Electric Phoenix etched on the fascias); four Bose *802* loudspeakers; two Auratones; two Quad *405* power amplifiers; a Sony amplifier; plus a number of mics and mic stands, cables, etc. Most of the equipment was housed in zinc flight cases. Any reader with information as to the whereabouts of these items is asked to contact *Studio Sound.*

## Address Changes

● Spectra Sound products are now being marketed from the offices of parent company Spectra Sonics. All enquiries should now be addressed to Spectra Sound, 3750 Airport Road, Ogden, Utah 84403, USA. Phone: (801) 392-7531.

● Bandridge Ltd, the audio component and accessories distributor has moved to new premises at: 1 York Road, Wimbledon, London SW19 8TP. Phone: 01-543 3633.

● Leonard Wadsworth & Co (Electronics) Ltd, the UK distributor for the *Belden* range of cables has moved to new premises at: Block F, Imber Court Trading Estate, Orchard Lane, East Molesey, Surrey KT8 0DA. Phone: 01-398 4288. Telex: 264028.

## APRS courses

We have received details of two forthcoming APRS courses. Over the weekend of March 28-30, 1980, the APRS are holding a course aimed at non-technical studio staff, covering the basic electronics and physics behind the operation of studio equipment. The second course, for technical staff, is on digital electronics and will be held from April 25-27, 1980. This will cover digital technology, binary and hexadecimal mathematics, aspects of microprocessor design and operation, methods of storing digital information, A/D and D/A conversions, and techniques for digitising audio information. Full details of the courses are available from E L Masek, APRS Secretary, 23 Chestnut Avenue, Chorleywood, Herts WD3 4HA, UK. Phone 09327 72907.

## Loft Series 800 console

Loft has introduced the *Series 800* 24-track modular console available in two frame sizes *Model 2624* accepting up to 26 inputs and *Model 5624* accepting up to 56 inputs. The console features 4-band per channel parametric eq with individual Q and frequency controls and a range of ±18dB/octave cut or boost; quasi-parametric eq on each send/return section; transformerless mic pre-amps; 12 stereo groups; and a plug-in modular patch bay. Other features include 4-send, 4-cue, 8-return busses; 24-channel busses with odd/even panning; and mute, mute preview, solo and phase reversal switches. The console can be supplied with an automation ready package which uses the Allison *Fadex* system. Console metering is either mechanical with average reading and standard ASA ballistics, or single column 100 segment fluorescent bar metering displaying peak and true rms levels simultaneously. Prices of the consoles range from $30,000 for a 16/16 console to $115,000 for a 56/24 automation ready console.

Loft Modular Devices Inc, 91 Elm Street, Manchester, Conn 06040, USA.
Phone: (203) 646-7806.

## People

● The Millbank Electronics Group has appointed Bernard Brown as sales co-ordinator for the company's sales department and client technical services division.

● Mick Batchelor, formerly assistant head of projects at Prowest Electronics and EMI, has joined Pro-Bel Ltd as senior projects engineer with overall responsibility for the design of custom-built switching systems. In addition Peter Dhesi, joins as senior design engineer, responsible for microprocessor development work being undertaken by the company.

● Rose Morris has appointed David Pinel as sales representative for its eastern counties region.

## ADR units upgraded

Audio & Design (Recording) has upgraded its *F760X-RS* compex limiter and *F769X-R* vocal stresser to provide optional pre-emphasis in the peak limiter 'side-chain' of 50 or 75μS. Replacing the previous 'in/out' peak limiter switch is an 'in/out/pre-emph' switch for selection. Although factory set to 50 or 75μS as standard, a custom curve can easily be adopted since the internal component change required is minor. The upgrading of the two units makes them more suitable for broadcast use (to match transmitter characteristics) and also for production and mastering work (with 100μS custom curves) providing a useful deessing or sibilance control.

Audio & Design (Recording) Ltd, 84 Oxford Road, Reading RG1 7LJ, UK.
Phone: 0734 53411.

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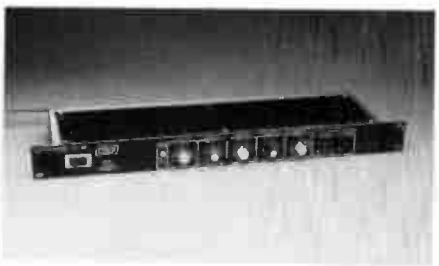
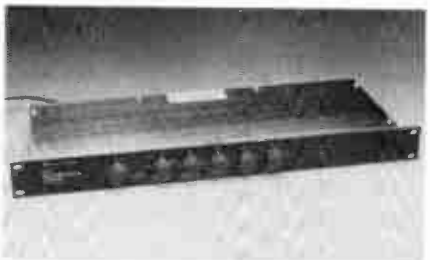
# One of our best customers


## Atlantex products are designed to satisfy the calibrated earhole syndrome



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



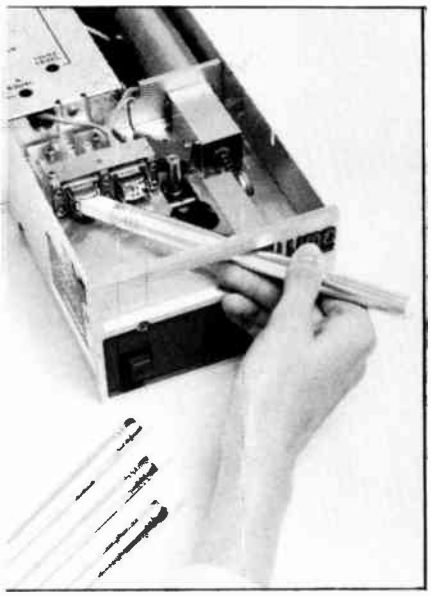
The Furman range includes mono and stereo parametric equalisers with pre-amps, tunable crossover/bandpass filter, and (shown here) the neat reverb system with limiter and equaliser. The simple layout and wide range of control gives full scope for creative engineering at a price which gives great value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

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

ASHLY SESCOM FURMAN SOUND

**Atlantex**

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



## Texwipe tape head cleaning kit

A new audio tape head cleaning kit has been produced by American manufacturer Texwipe. Designated the *TX250* kit, it contains everything a broadcast or audio engineer requires to keep tape heads in peak condition. The kit comprises two audio cleaning pens; a cleaning solvent; 10 replacement pen wicks; a wick cutter; a machine-tooled open-front cartridge shell pressure roller activator for insertion in the tape deck to elevate the rollers into an accessible position for easy cleaning; and a rack to keep all the materials handy, thus encouraging regular head maintenance. A major feature of the kit is its specially designed audio cleaning pens, one for pressure rollers and one for heads. Each pen holds an adjustable, lint - free, absorbent wick, which can be cut to the exact shape required. The kit will readily remove oxides, dust, lubricant residue and oil. In addition to head cleaning the kit may be used to clean capstan shafts, hubs and pressure rollers. Price of the kit is $27.50 and it contains sufficient material for more than 900 cleanings. Incidentally, components of the kit can be re-ordered in economical quantities, hence overcoming the need to purchase complete kits when re-ordering.
The Texwipe Company, PO Box 278, Hillsdale, New Jersey 07642, USA.
Phone: (201) 664-0555.

## Lexicon Model 224 software

Lexicon has introduced a second generation of software for its *Model 224* digital reverb. The new software, termed the "Version 2 Operating System", features two new reverberation programs, a new sub-program which improves the decay characteristics of all programs, and a comprehensive set of hardware diagnostics for maintenance analysis. Version 2 software is available in 2, 4 or 6-program versions. The new reverberation programs include a Percussion Plate program for percussion and other fast attack instruments and Small Concert Hall program. The new sub-program, called Decay Optimisation, can be applied to all reverb programs to improve the smoothness and naturalness of the final decay. To ensure rapid field service, Lexicon has developed a comprehensive hardware diagnostic program which automatically performs checks on the system's performance on each power up or on command. This program greatly aids field maintenance since the system provides error messages and data displays which allow the user to pinpoint modules or components requiring service or adjustment. Present owners of the *Model 224* can update to the 4-program software Version 2 for $150, while updating to the 6-program Version 2 Operating System software costs $650.
Lexicon Inc, 60 Turner Street, Waltham, Mass 02154, USA.
Phone: (617) 891-6790.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812.

## New ADC graphic equaliser

ADC has introduced a new graphic equaliser, the *SS-110*. Although primarily aimed at the hi-fi market the new model could prove to be of interest to smaller studios. The *SS-110* has 10 frequency centres per channel, each controlled by a line potentiometer giving up to 12dB lift or cut in 2dB steps. A centre detent position allows easy location of the 0dB position and tape monitoring and bypass facilities are included. Price of the *SS-110* is approximately £160.
Audio Dynamics Corporation, Powke Lane, Cradley Heath, Warley, West Midlands B64 5QU, UK.
Phone: 0384 65191.

## Agencies

● The multitrack sound mixing consoles designed and built by Clive Green & Co Limited are to be distributed on an international basis by French company Enertec. We also understand that at a later stage Enertec will also be manufacturing these consoles.

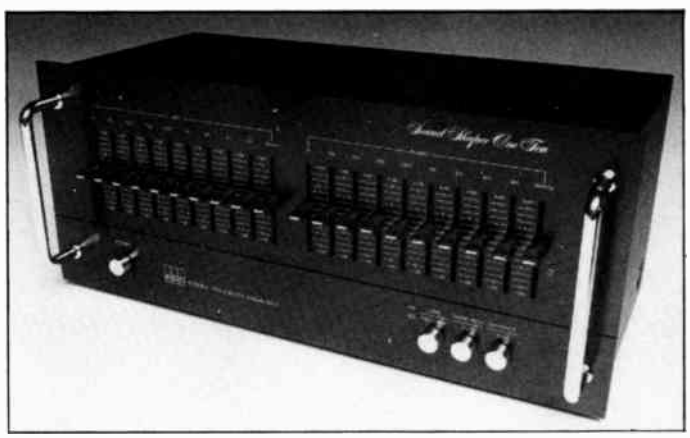
● UK tape manufacturer Racal-Zonal Limited has appointed a new distributor to the retail trade, M and E Products of Wimborne, Dorset.

● AKG has formed a new subsidiary company in Japan, AKG Japan Service KK, based in Tokyo. Management of the new AKG subsidiary is in the hands of Hisao Takagi, previously general manager of the AKG Liaison Office in Japan.

## New Electro-Voice mics

Electro-Voice has introduced two new mics. First is the *DO56*, a shock - isolated omnidirectional dynamic mic designed primarily for vocalists and news and sports broadcasters. Shock isolation is provided by nonmetallic support rings and butyl rubber shock isolation rings. The *DO56* has a high density windscreen and has a frequency response of 80Hz to 18kHz with a nominal impedance of 150Ω. The second mic, the *RE18*, is a super-cardioid dynamic mic fitted with a similar shock isolation mounting to the *DO56*, plus an integral low-profile blast filter and a hum-bucking coil. The *RE18* features Electro - Voice's Variable-D design which essentially eliminates proximity effect. Frequency response of the *RE18* is 80Hz to 15kHz with a nominal impedance of 150Ω.
Electro-Voice Inc, 600 Cecil Street, Buchanan, Michigan 49107, USA.
Phone: (616) 695-6831.
UK: Electro-Voice Division, Gulton Europe Ltd, Maple Works, Old Shoreham Road, Hove BN3 7EY.
Phone: 0273 778401.

*ADC SS-110*



## Q-COMM ring intercom system

Spectrum Audio has provided us with details of its *Q-COMM* range of ring intercom equipment comprising operator and master desk stations. *Q-COMM* is a 'hands-free' ring intercom system which operates on three wires only, and which is designed to provide maximum rejection of interference. The ring circuit layout can be of various configurations; twin screened cable is normally used; with the standard power pack cable runs of up to 1000m may be used; an unlimited number of Cannon sockets may be sited on the ring; and existing wiring can readily be used. Basis of the system is the *HST* operator station and headset with boom mic. The *HST* station incorporates controls for headset volume, mic switching, and LED indication of operator station powering. Powering is provided by either the *PSU 10* or *PSU 20* phantom power supply units providing power for 10 or 20 operator stations respectively. Complementary to the operator stations are a series of master desk stations incorporating power packs, loudspeakers, mic override, external programme input and other facilities. These comprise the basic *MCT* station, the *MCU 1* which offers more sophisticated facilities, and the *MCU 2* which is identical to the *MCU 1* except that it will feed and control two intercom rings which can be talked to separately or together.
Spectrum Audio Limited, Lopen Works, Lopen Road, London N18 1PU, UK.
Phone: 01-807 0019.

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# SYNCON

## Logic and Music in Harmony

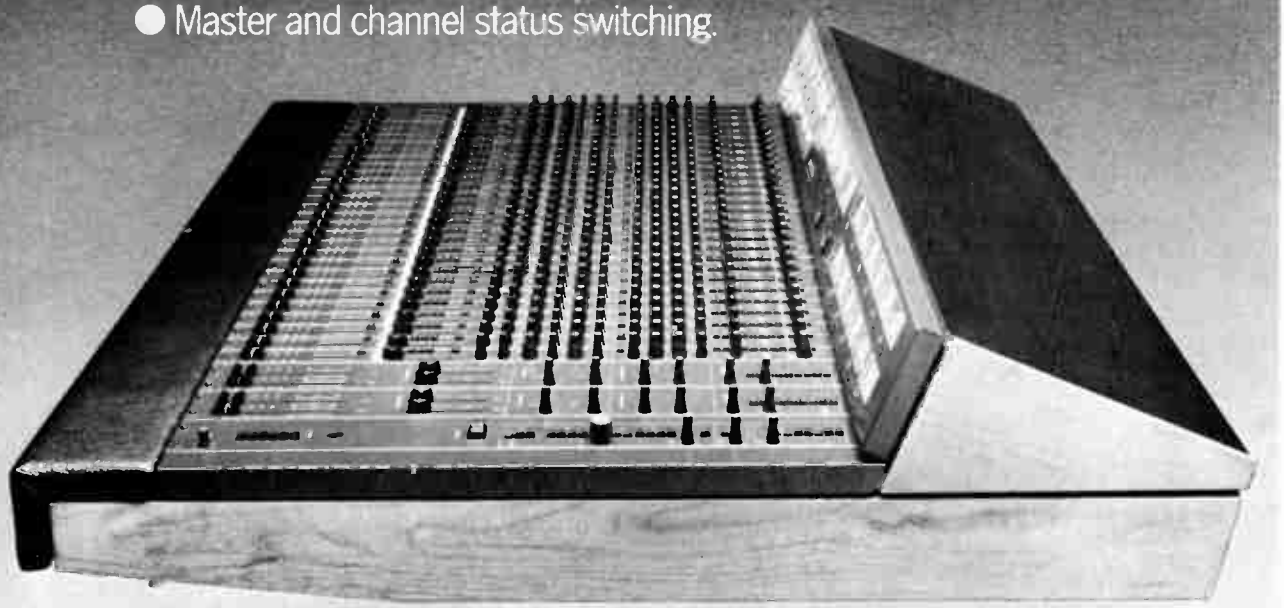
It is a fact that many medium priced consoles use ungraded VCAs and ICs resulting in signal degradation and unpredictable performance. Syncon uses top quality discrete circuitry on interchangeable cards which allow not only instant replacement but future upgrading.

Sophisticated PCB design has virtually eliminated hardwiring making Syncon not only cost effective but incredibly reliable and serviceable, an important factor for studios without resident 'boffins'.

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

### SYNCON FEATURES

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



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U.S.A.
Tel: (203) 359 2312

## Contracts

● Calrec Audio has won a contract, worth in excess of £250,000, to supply and install a complete programme sound system at the BBC's new Manchester Studio B complex. The contract includes the supply and installation of three consoles with associated bays for programme and communications distribution, bay monitoring equipment and signal and PA distribution equipment.

● Solid State Logic has installed consoles at Larrabee Sound, Hollywood; Le Studio, Montreal; Nidaros Studio, Trondheim, Norway; Kendun Recorders, Burbank, California; and CGD Studios (formerly CBS), Rome. Scheduled for delivery are consoles for Ridge Farm Studios, UK; the BBC's new Manchester multitrack music facility; Splash Studios, Capri, Italy; Union Studios, Munich; Record Plant, Los Angeles (four consoles); and RCA Studios, Mexico City (three consoles).

● The IBA has awarded contracts totalling more than £16 million to Marconi Communication Systems Ltd and Pye TVT Ltd for the supply and installation of UHF transmitters for the UK's fourth TV channel. Installation and commissioning of the new transmitters will commence in early 1981.

● Neve has received its first three orders for its latest *Necam D* TV post production computer aided mixdown system. The orders are from ATV for its Birmingham studio; from the BBC for its Sypher Suite at the White City; and from the Australian Broadcasting Commission.

● Klark-Teknik has sold 80 *DN27* ⅓-octave graphic equalisers to Singapore for use in the new Changi International Airport. They will be used to equalise the acoustics of every room and corridor.

● Dutch distributor Special Audio Products BV has received an order for the installation of a sound system including radio and TV lines for the new Theatre 't Spant in Bussum, Holland.

## KEF Model 101 loudspeaker

KEF Electronics has introduced a small loudspeaker in its reference series, the *Model 101*. The new loudspeaker is a 6.7 litre enclosure with a 110mm bass driver and 25mm dome tweeter. The two drivers are computer tested and matched to each other such that their specifications are within 0.5dB. The *Model 101* may be driven by amplifiers of up to 100W and maximum output is 98dB spl. Two features of the *Model 101* are an overload protection device (an electronic circuit which continuously monitors the terminal voltage to each drive unit, and attenuates the voltage when necessary) and an anti-vibration gasket which acoustically isolates the bass drive unit from the loudspeaker enclosure.

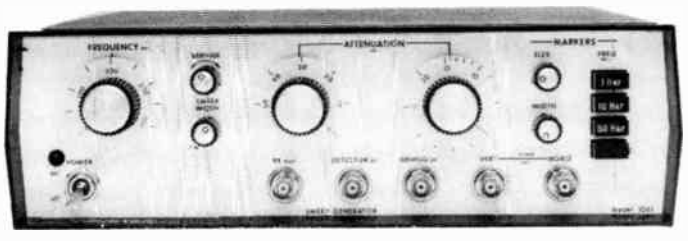
*KEF Model 101*

KEF Electronics Ltd, Tovil, Maidstone, Kent ME15 6QP, UK.
Phone: 0622 672261.

## Wavetek Model 1061

Wavetek has introduced the *Model 1061* carrier wave generator and sweep generator with a bandwidth of 1 to 400MHz. The instrument features crystal controlled markers in the sweep mode at switch selected intervals of 1, 10 or 50MHz. Maximum output of the instrument is +10dBm from 50Ω with a response within ±0.25dBm over the range of the instrument. The *Model 1061* also features a built-in RF detector and demodulator together with a horizontal drive for an oscilloscope, making the instrument suitable for testing the frequency response of systems.
Wavetek Inc, 9045 Balboa Avenue, San Diego, Cal 92112, USA.
Phone: (714) 279-2200.
UK: Wavetek Electronics Ltd, 109 Crockhamwell Road, Woodley, Reading, Berks RG5 3JP.
Phone: 0734 694944.

*Wavetek Model 1061*



## Acoustic Technology

Acoustic Technology is a British consultancy company providing a specialist service in all aspects of acoustics, noise and vibration control. The company was formed in 1970 and operates on a worldwide basis. Services available from the company include acoustic design, preparation of drawings, supervision of construction and installation, and acoustic testing to ensure that the client's specification is met. The company can undertake the design of TV, radio and recording studios; auditoria; and sound reinforcement systems. The company also offers a control room equalisation service, using sophisticated instrumentation which provides a hard copy of the frequency response for the client's records. Projects with which Acoustic Technology has been involved include Highland Recording Studios, Inverness; Radio Victory, Portsmouth; National Broadcasting Studios, Gaberone, Botswana; the TV Studios, Aden; and Visnews TV Studios, London.
Acoustic Technology Ltd, 58 The Avenue, Southampton, SO1 2TA, UK.
Phone: 0703 37811.

## Amber Model 3500

Amber has introduced its *Model 3500* distortion and noise measurement instrument following its display at various exhibitions last year. The *Model 3500* is a compact portable unit incorporating a low distortion sine wave oscillator, a total harmonic distortion (plus noise) analyser, a wide band and weighted true rms level meter and a tunable band pass filter. It will measure signal level, frequency response, wide band noise, weighted noise, narrow band noise, crosstalk and total harmonic distortion. With an option, it can also measure intermodulation distortion. Controls include automatic features such as auto-set-level and automatic nulling, while the frequency tuning control is continuously variable over each of four decades selectable by four push buttons. Frequency range of the *Model 3500* is 10Hz to 100kHz, while level range is +40dBV to -60dBV wide band (-120dBV narrow band). The unit can measure THD down to below 0.002% and price of the *Model 3500* is $1600. The *Model 3500* is also available with an optional internal rechargeable battery, while normal powering is via an external 12V transformer.
Amber Electro Design Inc, 4810 Jean Talon West, Montreal H4P 2N5, Canada.
Phone: (514) 735-4105.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812.

## Elliott Bros (Audio Systems)

Bruce Elliott, previously of SHE Audio, has formed a new company, Elliott Bros (Audio Systems) exclusively to service the interface requirements of the audio industry. The company has been in operation since mid-1979 and to date has installed equipment for Capital Radio, The London Palladium, Roundhouse Recording Studios, The JCB Audio Visual Complex, and Silk Sound Studio. Elliott Bros is operating throughout Europe.
Elliott Bros (Audio Systems) Ltd, 114-115 Tottenham Court Road, London W1, UK.
Phone: 01-388 1833. ■

# studio diary

## Indigo Ranch, Malibu

North of Los Angeles past the highway exit for Malibu Canyon and before the Zuma Beach turnoff is the private entrance to Indigo Ranch. The studio is situated in one of the most idyllic surroundings I've ever come across, nearly one mile from the top of the canyon, among fruit orchards, flowers, rocks, roses and natural inhabitants. Several hundred feet below the foot of the hills is the blue Pacific ocean and all around are Malibu hills, 60 acres of which go with the studio. Pure creative isolation but only a half-hour drive to Los Angeles. Sounds like blurb in a holiday brochure but this is no exaggeration.

It all began in 1974 when Michael Pinder of the Moody Blues and Richard Kaplan returned from a year in the UK (where they had intended to start a studio until a negative turn in the economic climate); both had a picture in their minds of the property they were looking for in vain and spent five days a week for six or seven months trying to find it. Finally they settled on a building in Santa Monica and even put a deposit down, which was later forfeited, because Michael happened to spot a new listing at a local estate—the old John Barrymore estate in the Malibu Hills! "We drove up and looked at it and I was sorting out the legalities the next day so that we could get started as soon as possible. This was the place we had pictured—and we had thought it didn't exist and if it did, it wouldn't be for sale. Places like this never come up for sale. The price was within reach, the terms were right and the place even has a history of music . . . it was destined in a way" said Richard.

Throughout the ages the piece of land on which Indigo stands has been an Indian ceremonial ground —nothing heavy or weird like burials or sacrifices—but a place where the Indians would come to celebrate their most important days with music. One amusing session reiterated to me was the recording of the first Summer Solstice dancing festival since the white man's arrival, recorded straight on to 2-track; the problem was (as a feather clad Indian chief pointed out after it was too late) the music could only be played once a year; so the engineers having got levels, couldn't ask for 'once again from the top, please'.

Michael Pinder and Richard Kaplan, in designing and constructing the studio, took a unique acoustical approach. They designed every aspect from the choice of equipment to the acoustics of the control room and studio, and even did much of the physical construction themselves with the help of some very competent friends. Using stone and timber, they were aiming for a natural super chic living room approach. "None of this compression room business"—a super home hi-fi sound with a top console in the recording chain.

"In terms of monitoring we wanted the results to sound the same in a car, home, or in another studio. As the control room developed during construction the results were extremely pleasing but it was not entirely the case with the studio. It was B+ and we were shooting for straight A's right across. Indigo Ranch was never intended to be a commercial operation; it was originally meant to be our personal production house. It was only through demand that we ever went commercial. So we weren't building to push the studio off on a customer at some monstrous rental. If the studio wasn't right the only people to suffer would be ourselves, although we were at a point where most commercial studios would never have bothered going beyond," Richard proferred.

The problem in the studio was resonance. Three well respected acousticians were each hired and paid independently to give their opinions on how to correct the room—a combination of ideas being deemed the wisest choice for the best ultimate result. The main feature of the final A-grade studio is a large slat resonator on the right wall. This looks more like a piece of art with its sculpted wood than a slat resonator. "George Augspurger designed the device; he came up with a mathematical formula which we put through a computer and came up with a work of art to suit the atmosphere of the room rather than a flat, standard resonator together with several other ideas."

Incidentally, each acoustician individually tried the control room and in each case the initial comments were 'hmmm, the room is almost a square it must be terrible'. Each used the room with various techniques (time delay, 1-mic method, 3-mic method, and averaging method) and the reaction in every case was disbelief. One comment was 'It could be the best control room I've ever tried in my life but it *shouldn't be*'. The room looks square but in fact is deceiving —there are no parallel walls, the room is larger than it looks and is well trapped.

So the studio was bought in 1974, work started immediately and the first recording took place in early 1975. Construction continued until December 1976. During that time two albums were recorded—on one, a private release of singer Jean Ray, the vocals were recorded when the back wall didn't exist with excellent results. The control room is 18 by 15ft and the studio 40 by 20ft. The construction is mainly timber though the back of the studio is built of stone.

Following Indigo's first major release (Michael Pinder's solo album) more time was spent by the two owners in the UK. It was then that outside engineers and musicians asked if they could rent the studio.

"People who had worked on an album project at Indigo wanted to rent the studio while we were away; when asked how much they were prepared to pay the offers were sufficiently large that they could not be refused. Since then we've been booked solid. We've never advertised, there's been no promotion—all word of mouth which is the best form. The atmosphere of the place allow musicians to perform in a way that a lot of people believe can't be achieved in a concrete building in Hollywood's studio row—not that I have anything against those places; as an independent engineer I am in and out of these studios all the time."

Since the renting began the list of artists who have recorded and/or mixed include: Billy Preston, Canned Heat, Neil Young, Neil Diamond, Frankie Valli, The Moody Blues last album, Ronnie Laws, Hubert Laws, Olivia Newton John, Lenny White, and a new band called Wha Koo.

Richard (whose father was an electronics engineer) has been very equipment oriented since childhood and he has carried this over to Indigo. A vast collection of microphones and outboard equipment both ancient and modern have been amassed.

"It doesn't matter whether it's 50 years old or a prototype of a future gadget, if it sounds good then it's the right piece for the job—like the original *LA2* limiter—not the *LA2A*. The *LA2* has a remarkable sound, which has yet to be repeated; it's something in the amplifier circuitry which gives it its

*Indigo Ranch, Malibu*

sound—a mushy old vacuum tube or a transformer—some part that isn't available today." Indigo also have a lot of Pultec tube limiters and equalisers as well as at least two channels of the latest devices including API, Orban, UREI and B&B equalisers, Eventide *Harmonizers*, Quad Eight DDLs, a Marshall time modulator, dbx limiters, *1176s* and Altec limiters.

Richard uses the MXR *Digital Delay* a lot for direct echo delay and guitars (but never on vocals); on everything else he uses an ADR *Compex* limiter (specially modified for side chain access by any equaliser) and this has become a real workhorse and favourite. Indigo is well known for its selection of microphones which apart from the standard modern units includes large numbers of early tube microphones. A sampling includes: Neumann *47s*, *M49s*, *50* Series, *53*, *54*, *56*, *64*, *SM23s*, *67s*, plus all modern Neumanns. 30 tube Neumanns in all. Sony tube microphones, a pair of Sony *220A* stereo vacuum tube condenser mics of which there were only 50 ever made.

An additional feature of Indigo which clients like is the versatile echo system including a live chamber, an old Telefunken reverb (the only one in existence), three EMT plates, the live chamber and various digital units. Monitoring is via JBL components with an in-house designed crossover powered by Mac Intosh and Crown Amplifiers.

Tape machines have been 3M from day one but have been heavily modified by Dean Jensen. Other equipment includes 32 channels of dbx which is rarely used these days. Everything is included in the price of the studio—Richard sees no point in having equipment around that is only available at extra cost.

The 32/24 console is one of a kind—custom built to Indigo's specification by Aengus Engineering of Massachusetts; Dean Jensen designed all the electronics. The layout of the board, originally intended for the UK studio which never got off the ground, leans towards the British design philosophy and features a very comprehensive system of echo and effects sends. Six main, plus three auxiliary, such that several different mixes can be set up simultaneously on the console, using the echo sends, the main board, plus the monitor mix resulting in a very extensive patch bay.

Each channel has its own mute/on/solo pre/solo post fader allowing the tracing of a problem in the recording chain at the push of a button (a scope always being to hand). A programme 2 'switch' is normalled to the 2-track and 4-track machines so they can automatically appear at the board with their own channels; a 'mic/line switch'; and pre and post switch for the overload LED circuit. "There's so much headroom in the board you rarely, if ever, see the lights go on no matter how hard you pound it—I like to use tape limiting on things—a sound no limiter will give you—most boards in most studios I've worked will not allow this because the electronics clip before tape saturation is reached." A new VCA section switchable in or out has been added to the board recently for those who like VCAs (it's a proprietary VCA which Richard didn't want to talk about). Dean Jensen line amps are standard throughout the console. Then there is a pad, phase reverse, bass cut, stereo and mono echo sends for each channel, then normal bussing and routing. And finally a graphic equaliser using thumbwheels on each channel. "Basically the assumption with any board is that the electronics won't colour the sound too much enabling you to tell one board from another (this is not always the case)—if the line amps colour the sound the board is out of the game. It comes down to what the board feels like and how the equalisation sounds—equalisation is the heart of the board and of all equalisers the heavily Dean Jensenized Aengus graphic equaliser is the smoothest, most pleasing sounding equaliser I've ever put my hands on" says Richard.

The board is modified constantly obviating the need for a new one. Many of the mods are in-house or from the designs of Dean Jensen and Bart Johnson so it's always up to the latest specifications. VU metering is to be had on all 24 channels.

All this plus a 3-bedroom cottage for those who want to live-in while recording, a fully appointed kitchen run by a gourmet chef provides for the customers' appetites.

My thanks to Richard Kaplan for a very interesting visit, and to Beverley, who manages Indigo, for a luverly cuppa tea. **Enbee**

Indigo Ranch Recording Studio, PO 24A-14, Los Angeles, Cal 94024, USA. Phone (213) 456-9277.

## Electric Lady Studios
## New York

Throughout the extensive renovations undertaken at Electric Lady Studios in the past two years, one wall remains untouched. The brightly coloured mural that dominates the lobby and extends the whole length of the first floor ("art deco from the acid Sixties," explains owner Alan Selby) was painted in 1969. It remains as a remembrance of the studio's founder, the legendary Jimi Hendrix.

Electric Lady's historical significance in American pop music has grown over the years; hundreds of young musicians come here to record, mix, or simply to stand in awe in Studio A.

"The A room was Hendrix's own room, to do whatever he wanted in," Selby recalled. The famed guitarist, with architect John Stark and producer Eddie Kramer, converted the space into two studios, from what was originally a nightclub. The B studio was to accommodate other clients. The unusual name derives from the title cut of Hendrix's third album.

Hendrix died seven months after acquiring the studio. Estate lawyers ran the establishment in absentia until its purchase in 1977 by Alan Selby, who describes himself as "a businessman, not an engineer".

Selby brought in new management and began overhauling and re-equipping the studios. A third room, Studio C, was added last year. All three facilities boast Neve mixing consoles; Model *8078* in Studio A is a 72-input, 40-output mixer, the second such unit installed on the East Coast. There are two 3M 24-track tape recorders and one MCI. The sound system is by Westlake. A full complement of mics and outboard equipment is available.

Electric Lady is also one of the first American studios to install a Necam computer mixing system. The Necam is unique in that all mixing information is stored on a floppy disc, and not on a master tape. Upon recall, the system's motorised fader switches free the engineer to concentrate on other elements of the mix.

The medium sized studios (42 x 37ft, 22 x 32ft, and 25 x 20ft) have roomy control areas adjacent. High ceilings in Studios A and B add to the facility's acoustical charm.

Legends and memories are not all that draw artists to the Greenwich Village shop. Electric Lady has also been known for exceptional reproduction of percussion and guitar.

"We have a creek," Selby explained, with a half-smile. A tributary of the Hudson River, Minetta Creek runs underground right beneath the studios. Hollowed rock supporting the subterranean waterway rests just under the studio rooms, which are themselves below street level. According to Selby, this geological idiosyncrasy is responsible for a characteristic sound.

Dave Wittman is the chief engineer and has a staff of three. Artists are always welcome to bring their own crews. Bookings through studio manager Steve Bramberg are available 24 hours a day at a rate of $185 an hour for 24-track recording.

As befits a studio dedicated to popular music, the albums that have been recorded at Electric Lady run the gamut from Peter Frampton to Chic, from Kiss to Chick Corea. At the time of my visit, Studio C had been in use by the Stones for a month, who were overdubbing and mixing their latest album, the second to be completed in the New York shop.

Studios A and C were occupied at that time by jazz artists Lenny White and Earl Klugh. Recent albums recorded there include Joni Mitchell's *Mingus*, the Kiss album *Dynasty*, and the debut album for The Hots.

With a substantial investment in new hardware now completed, studio management plans to enter the new decade with a new direction as a record company. Electric Lady Productions is run by Selby also. In December the company announced the sale of its first master, an album by a new band named Glass Moon. Selby said the parent studio expects to be 'heavily involved' in similar projects.

Besides a re-tooling of Studio C scheduled for early summer, final alterations at Electric Lady are cosmetic in nature—every room and office is being recarpeted and repainted. All except for one wall, of course.

**Mia Amato**

Electric Lady Studios, 52 W Eighth St, 10011, New York, USA. Phone: (212) 677-4700.

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## Barbarossa Tonstudio, Munich

A well timed dash from the taxi through the torrential downpour to the basement entrance of a large house in the residential suburb area of Munich brought me to Barbarossa Tonstudio. Down the stairs, into the large corridor, turn left and there you are in the fairly spacious room that serves as a control room. Though the word 'serves' may give the idea that all is rough and ready this is not at all the case, a fair amount of acoustic treatment in the way of absorption and rear trapping has been carried out, but in such a way as to retain the basic 'room' feel. In the control room Peter Kramper the resident engineer was setting up for a mixdown of the German version of *Lola Montez* by Mireille Mathieu, and at the same time was glad to show me around the studio and give some background information. Until very recently the studio was 24-track but at the time of my visit the second Studer *A80* was in place, together with the TLS system for linking the two machines in sync, and was awaiting only the final wiring and connecting up. Studer are also well represented by the two *A80* master recorders. Mixing centres around a Helios console with 32 - input / output modules and very flexible facilities. Outboard gear includes UREI graphic equalisers, Eventide Instant Flanger and *Harmonizer* with keyboard and Amber realtime analyser. The desk also features inbuilt compressors. Monitoring is by way of Altec *9846-8A*'s and two bookshelf hi-fi speakers for domestic comparison checks.

Going through to the studio, this is divided into two parts, there being the main studio and what may be termed as a large isolation booth. This booth is really a small room off the studio fitted out as drum-booth-cum general isolation room as witnessed by the miked-up drum kit in the middle of the floor and Hammond organ, Clavinet and Rhodes, etc arranged against the walls. Communication with the studio is via windows in the door and dividing wall, so lone drummers and other musicians need not feel cut off from the outside world. As can be seen from the photo, the studio itself tends to resemble a cellar room in a small restaurant which is what comes out of having a studio built into the basement, or cellars, of a large house. The white box on the right with the rhythm unit sitting on top of it is not the bar (though it no doubt serves as one from time to time) but the boxed-in upright piano. As may be deduced, the studio is used mainly for acoustic instruments—or if you prefer, non-electric ones—and though small, has a very pleasant sound. Okay, how do you define a pleasant sound? Let's say there was no boom or ringiness that you often associate with small rooms but the impression of a room larger than it actually is. Whether the round far wall contributes to this effect would be interesting to find out. Microphones are the usual Neumann, AKG, Electro-Voice that one would expect to see, as well as a sprinkling of DI boxes.

Into the field of recording techniques, Peter prefers—in the main—a multimic technique for the drums, even down to close mics, on each cymbal as well as drums, in order to have maximum control over each component of the drum-kit. Each microphone is also fed through a noise gate in order to get breakthrough or phase problems down to a minimum, though obviously careful attention to phasing is made as well. The technique of using noise gates on individual drum channels seems quite widespread in German studios and may possibly contribute quite a lot to the 'German sound'. The drum image is then carefully built up via the panpots with very often excellent results and without the 'string of percussionists between the speakers' syndrome as our colleague Richard Elen (*Sound International*) would put it! String sections, brass and woodwinds, acoustic guitars, etc are often recorded with just a stereo pair depending upon the set-up for the session, while electric instruments are more often than not DI'd. However, there are times when the amplified sound is also wanted, in which case the musician is shut up in his box and allowed to let it blast--the ratio between DI and mic being decided at mixdown. At this stage of the discussions we were joined by in-house producer Sylvester Levay, quite an ebullient personage, who also emphasised with Peter the need not to be hidebound by just one or two techniques but to use any means to get the desired sound, even if it means quite a bit of experimenting.

At this point we adjourned to the control room and back to Mireille Mathieu. I asked if this had been just a vocal overdub onto a master tape that had been recorded in France, but no, it had all been recorded at Barbarossa. Listening to the full rhythm section, brass, strings, choir, etc, etc it was hard to believe from the sound that this had all been done in a small studio. Multitracking obviously meant that the full orchestra had not all been crammed in at one sitting but this was the impression the tape gave. For this kind of number, multitrack versions nearly always have that overdub fuzziness and 'not quite together' feel, but here it was as if the whole recording had been done simultaneously in a large hall with excellent acoustics, it was that good. Separation and clarity were outstanding but it was the depth and 'togetherness' that really stood out.

During these run-throughs we were also joined by manager/owner Christian Bruhn, the studio appropriately enough is in the basement of his house! In fact, the studio is run on a semi-private basis for Bruhn's own realisations. Being a very well known composer in the popular field, as well as for TV, radio, films, etc over some years, Herr Bruhn has found it much more convenient and economical to have his own studio close at hand than buy studio time elsewhere. Artistes such as Mireille Mathieu are more friends than clients who like to come and record in a relaxed atmosphere without any publicity or big-time aggro. For this reason the studio is not promoted as a commercial enterprise though sessions can be done there if free time allows and you know the address and, preferably, Christian Bruhn. Though this in itself is not surprising, the fact that the first studio in Munich to have 46-track facilities is not one of the large commercial facilities, is rather out of the ordinary. Future plans also include a new desk to handle the increased track numbers. Several names were mentioned but nothing has been decided as yet—automation will also be included. Everybody concerned with the studio was very pleased with the present Helios console and I got the impression that if they can keep it to do other work then they will, though economics will have the final word. The monitoring system is also due to be upgraded to a more powerful one, though there again, nothing is finalised. Not being faced with the pressures of a full-time top commercial studio, Barbarossa can afford to take its time in evaluating and planning any updates so that when the change is made the chances of error are kept to a minimum. And it isn't as if the studio is underequipped now!

It just remained for me to thank everyone for their courteous and open welcome and brave the rain for the next studio on the list.

**Terry Nelson**

Barbarossa Tonstudio, Irmgardstrasse 11, D8000 Munich 71, Germany. Tel. 089 79.57.18 or 79.49.99.

**Above:** *Control room of Barbarossa Tonstudio.*
**Left:** *Barbarossa's studio.*

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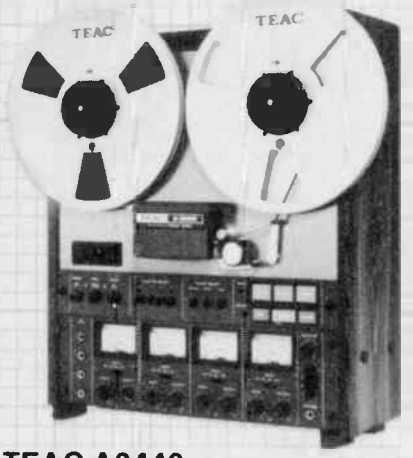

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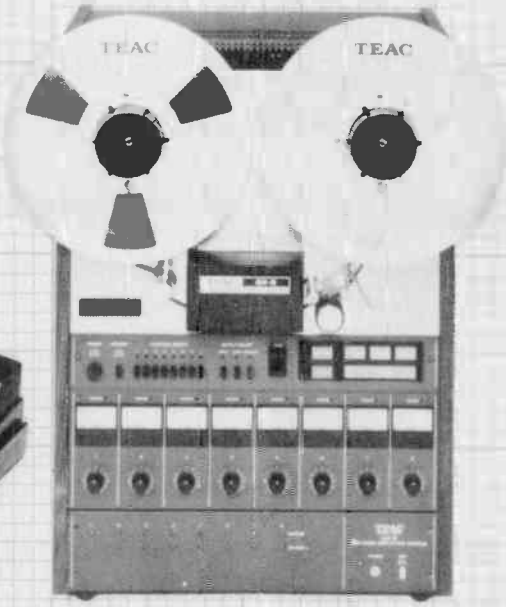

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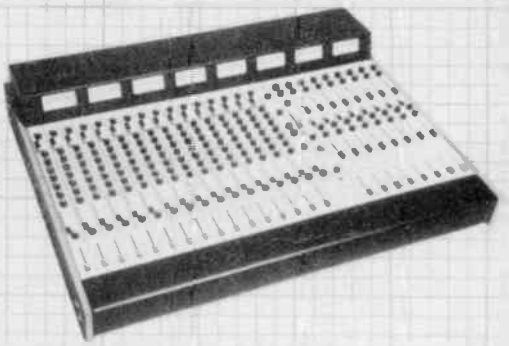

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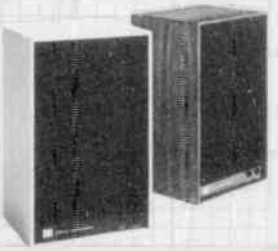

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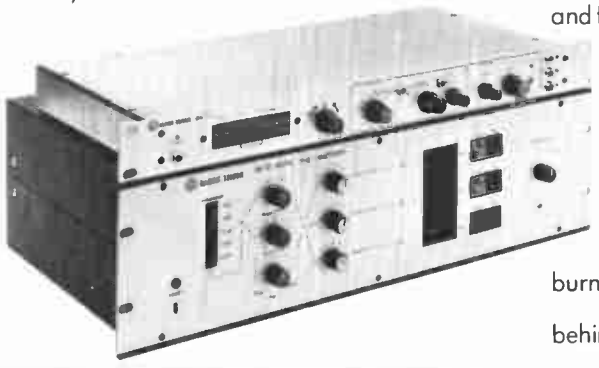

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# Thoughts on maintenance

Pete Smith

**While recording studios almost invariably have happy atmospheres, when equipment goes down, tempers begin to flare. Pete Smith, a freelance maintenance engineer, looks at some of the more common problems, and the ways management can assist the engineer.**

THE RECORDING industry today supports many recording units both large and small. Of the former, a maintenance department staffed day-to-day by qualified and trainee staff is the norm and as a consequence the equipment, in theory at least, receives constant service attention therefore reducing breakdowns to a minimum. Modifications that wouldn't normally have been incorporated in the original units can be developed and installed to the liking of the engineering staff that use the equipment every day. This is luxury for those who can afford it; repair work and advice just an internal phone call away. But in the latter's case you often find that the recording engineer is doubling as the maintenance engineer, he probably even designed and built the place; consequently he is well versed in the control room's system and can both repair and record his sessions, or at least have a good idea of the faults he is likely to encounter. This advantage can be short lived though, for electronic advancement is running at such a pace that to keep up with the developments is a full-time job. So he has to make a decision; whether to remain a recording engineer or leave the stresses and strains of the comfy chair and the long days and nights demanded by the artists, and take up the soldering iron as a full-time concern. To many there is little choice; recording seems a more profitable occupation than that of keeping the midnight oil burning whilst delving into the latest list of integrated circuits which have just appeared on the market, thus making the latest toy you have just designed both bulky and less versatile.

So the studio searches around for a freelance maintenance engineer to take over the service of their costly investment. Problems can be generated here, also, for the outsider has to learn the system incorporated in this studio; although in concept the same as many others, it may well label a function you're familiar with by another name. This labelling of functions or access points becomes apparent when a selection of jackfields is studied and you find that translating the titles in search of a particular function can be a time-consuming, if not impossible, task unless you are armed with that studio's terminology dictionary. The layout of the desk may also be different, in which case to trace a lost signal can be a frustrating waste of time when no amount of button-pushing or knob-twiddling seems to reveal its whereabouts and it's only when the person familiar with the equipment is present to guide the uninitiated through the jungle of titles and routes that the signal's presence is revealed. This can be doubly frustrating when the individual armed with the knowledge presses the one button you had ignored or just not seen, instantly bringing the beast to life. System understanding is therefore at the heart of all good servicing. This not only saves down-time and its associated loss of money on the studio's behalf, but can be very impressive when you walk in and confidently tap the offending section of equipment thereby establishing the fault's location and speedy repair, keeping everybody happy. Modern recording consoles are becoming more complex day by day and as the price falls on techniques that were only in the price range of the big fish, many of the smaller studios are already possessing large quantities of digital equipment requiring a specialised knowledge when things start to go wrong, as they inevitably do sooner or later. The outside maintenance engineer also holds a disadvantage for the smaller units both in the distance he will have to travel to the studio, and the time he might have available to attend all his clients and their various problems.

There have been vast steps forward in the reliability of electronic equipment in the past few years and this trend is for ever on the increase. Today's designer can select from extensive lists of components all the necessary parts he will require to accomplish a specific task and quite often can expect them to accommodate extensive protection circuitry, increasing reliability, and safety, yet taking up no additional amount of space. In the past, to keep equipment from being too massive, the designer may well have asked many of the components to work close to their maximum; however, today's units can rely on less components to accomplish the same task at under half their maximum working tolerances, thereby eliminating possible failure at a later date. Most of the likely areas of failure are going to be due to old age, or misuse, or weak components that show up at a later stage. Rectification in the control room normally requires no more than the replacement of a plug-in module to keep the session running; at a later date the manufacturer will replace, for a small charge, this module from stock with the return of the offending dead unit. Designers have incorporated protection circuitry preventing misuse having any harmful effects upon the system. In high power applications complex circuitry protects not only the associated components within its own unit, but the rest of the equipment as well. Power supplies these days can tolerate many different attacks upon their function, such as current limiting, where the designed maximum current likely to be drawn from the unit, plus say 10% on top (after which the supply simply shuts down until any fault on the power lines is removed) allows normal working and the supply to return safely to the original designed demand. Short circuits could at one time destroy a power supply in seconds whereas today's units simply light an indicator to this fault and shut down until all is back to normal.

Price obviously has a lot to do with the quality and quantity of equipment you are likely to buy. Sound quality may not on listening appear to be any different but when it comes to hard work or overload

margins you start to realise the reason for price differences. Many of the cheaper units will be built in such a way that service is not that easy and far more time-consuming when compared with the more expensive units that will have servicing problems taken as part of the original concept. It must be remembered that repair time is money lost no matter how it is arranged.

Many studio owners I have come across are a little stubborn when a day is put aside for servicing and try filling it with a session of some kind to bring in another few pounds. This can be false economy for if a service day is put aside every so often costly session breaks for breakdowns can be reduced; this is beneficial to the financial wellbeing and reputation of the studio. A good reputation takes a long time to create, a bad one no time at all. Whether the service engineer you use is inhouse or not, he must be allowed a margin of time in which to repair and prevent faults occurring. Preventive maintenance is the key to this, not only leaving just enough time to repair any faults, but the regular cleaning and replacement of heavily-used components before they fail totally, especially the electro-mechanical components which are required to render the most demanding specifications in the most adverse conditions.

All too often lack of communication between the owner or recording engineer and the maintenance engineer can exist, simply because what one calls the thingemy-jig the other calls a mix buss etc. A clear description of the fault can assist any engineer in determining the likely cause and save a lot of time and trouble. Also the test gear may not be to hand, in which case a clear description may well indicate the need for sophisticated test-rigs to be brought along, in order to trace the fault, that may not normally be carried in a run-of-the-mill service call.

I'd like to illustrate a fairly typical example of a session in progress and how a fault can develop in an artistic as well as technical sense.

Imagine a control room with the day's debris scattered around every available flat surface. The occupants, whose former selves left the studio several hours ago, sit tantellised by that elusive sound that all are expecting to hear at any moment usher forth from the ever-fresh speakers. However, so fierce is the explosion that the bass cone's coils failed miserably in their attempt to return to rest in the inner sanctum of the magnetic field, but stick irreparably on the magnet's surface. Sign language becomes the order of the early hours, excepting the engineer who is now trying to regain his self control in an attempt to rectify the situation, all that is left of the reference monitors is the middle and high frequency units. The tape is played again with the monitor level turned down, just in case of further incidents. They discover that the voltage controlled amplifiers associated with the faders are all jammed at full level, generating an appalling din.

"Well?" the producer demands, "what are you going to do about it?". The engineer admits defeat in the face of overwhelming odds. The producer continues: "I've got an album to finish and little time to do it in". "I'm off to ring the maintenance engineer and get him over here to sort this mess out," retorts the engineer.

Half an hour later the maintenance engineer arrives fresh from his warm bed into the harsh reality of the control room to find his worst fears confirmed; sarcasm runs riot as all the band and studio staff try to alleviate all their frustrations upon his shoulders. As the problems had been hastily reported over the phone when his mind was least capable of absorbing them, his first enquiry is directed at the engineer. "Can you tell me what happened again, and what you think's wrong with it?" His question is answered abruptly, and with feeling, by the recording engineer. "Sure, it's fucked!"

The maintenance engineer notices the buckled pair of headphones and overturned chair in the studio. With the additional scraps of subconscious conversation slowly being recalled, he starts to fill in the gaps. The engineer plays the tape, and once again the shrill cry of the monitors announces that they are the first repair to be effected. Off come the covers to reveal the bass speaker cones in their contorted and solid position, application of pressure to their centres reveals no movement.

Next to be examined is the desk itself. It is apparent, since all the fader amplifiers were delivering their full output, that the control voltage had ceased to exist. This required the inspection and testing of the power supply associated with this voltage to ascertain its output. The lack of reading when he put a volt meter across the output of this power supply made it clear that it had given up the ghost or at least shut down because a fault was still existing across its lines. By removing one of the feed cables and measuring the output of the supply once again a normal, healthy 5V was registered so he assumed that there was some kind of a short across the supply line and in fact no structural repair was needed. Next, with a test meter, he measured the faulty supply line with the power supply detached and removed each of the fader modules containing a VCA. He kept a constant watch upon the meter as it read the zero resistance across the lines until the offending card was removed and the meter once again indicated a safe load for the power supply to work with. Lastly he returned the other fader modules to their respective positions one at a time to discover if they had been damaged during the incident; luckily no further faults were found so the feed lines were reconnected to the power supply. In the end, the final problem of the duff VCA was a piece of debris which was never found when the case was removed; it could only be assumed that a loose piece of solder was the root cause which melted when the VCA was examined. This careful study of the situation and a methodical check-back of associated equipment and wires is really the only way to go about simple maintenance as well as the more mysterious faults; with a reasonable systems knowledge and a bit of luck, nearly all faults can be caught-up with and cured.

For those who don't read the dictionary in bed, the maintenance of electro-mechanical components, switches and the units that hide under the knobs of a desk, are often a major problem in servicing any equipment. The effects of dust and dirt can mean an acceleration of the time when failure will occur. Liquid refreshments have to be the worst enemy of all, especially those with a high sugar content. The owners of these drinks, either by missing their mouths, or when demonstrating a new golf swing hit a hole in one! spilling the liquid onto the surface of the equipment, which creeps into every orifice of the desk. This acts as a temporary lubricant to the mechanical parts and a more direct path for the signal or dc to travel. Unfortunately with the heat of the equipment, these liquids dry out and leave a sticky residue attracting all kinds of foreign bodies, eventually hindering the efficiency of the workings within the device and causing untold cost when repair time comes along. With mechanical parts the effect is that of crackling or a stiffening of their movements, requiring far greater effort on the part of the operator and greater strain on the part of the component which unfortunately gives-in within a short period of time causing more annoyance and trouble.

These electro-mechanical components are only guaranteed to accomplish a certain number of movements before they lose their ability to justify an accurate account of their job. Yearly checks and cleaning are essential to remove offending particles and gunge from their surface. Potentiometers which make up the bulk of movable components, whether disguised as faders, parametric equalisers or just plain gain controls, rely on a semi-circular base on which a carbon deposit has been laid—a sprung metal wiper is dragged over its surface by the rotation of the externally mounted knob. As we can see, with the continual wiping back and forth of this sprung-metal arm, we are left with very little surface after several thousand sweeps. This can be accomplished within a very short space of time on a hard working desk.

Faders on any recording desk suffer from the harshest treatment since they are the main working tool within the studio control room. They are in direct line of attack from ash, drinks and fodder, plus, of course, being the main adjustment in all recording, and with even the best protection from outside elements they have to cope with this falling debris, and do an accurate job as quietly and efficiently as possible. There is nothing more annoying than a noisy or sticky fader, especially when it jams ('scuse the pun) at the vital point in a mix, constant care and attention must therefore be poured onto these devices. Since the advent of the Voltage Controlled Amplifier (VCA) some of the problems have been eliminated. With these amplifiers the audio signal is not required to pass along the fader's conductive plastic track to be picked off the surface by a metal brush, but has its gain controlled by the VCA's electronics which are not susceptible to the effects of contact resistance, dirt, or grease deposits, or the variability of the fader resistive track. Apart from a slight increase in distortion that is only just measurable, these units clean up an otherwise near perfect system, and coupled with the addition of an automation unit, they have the advantage of assisting the engineer's hands to cope with 24 or more faders at one time. There are still many desks that use the audio fader and here cleanliness is essential in preventing signal levels jumping alarmingly should they be left in a dirty condition for too long. The best method, I've found, is to dismantle the fader carefully, guarding against the possibility of damaging the delicate fader contact brushes which normally consist of a number of fine wire strands that can be easily bent out of shape, leaving you with a bigger problem than you had before you started (fig 1). With a fine-haired brush, dust out the unit to remove all loose deposits, then with a mild soap solution wash out the

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# Thoughts on maintenance

inevitable liquid deposits and very gently clean the conductive track and slide mechanism employed in your fader. Allow this to dry, then with a fluff-free soft cloth wipe the fader track once or twice to remove any final grease deposits that might quickly attract more dust. With alcohol also wipe the brushes in the direction they are required to work, removing any deposits from their surface. A quick clean of the slider mechanism may help its action as well. The unit is then ready for careful reassembly. Do not be tempted to oil the slider mechanism as oil travels very easily and normally ends up on the conductive plastic, not only damaging it but causing contact failure between the brushes and track. A little silicone grease can be applied but very sparingly, only leaving the finest film; no lubricant is usually the best of all. The final result is a fader that is a dream to use and one that will give good service for yet another year's hard labour.

Switches, whether of the rotary or key variety, also suffer from these problems, with the key switch it is normally the lever that snaps off or falls apart at its fulcrum. Many of these units are sealed in an attempt to reduce the possibility of failure due to dust and unwanted liquids, but even this doesn't prevent their demise when under heavy use.

Tape head cleaning and demagnetisation is also important. Cleaning the heads before or after every session is essential for the removal of tape deposits. Most studios carry this out and it requires little further discussion on my part. However, demagnetisation is another little job that ought to be considered at regular intervals to prevent the build-up of magnetic noise in all the heads. Often it is ignored for long periods of time until someone notices that their tapes are getting a little noisier, or a static-like sound seems to be apparent, in which case the defluxer comes out of hiding to demagnetise the heads. There is a sequence in demagnetisation which few people seem to realise. Most run the demagnetiser up or down the head stack once or twice and then shoot on to the next head, often with the machine still switched on, destroying four dozen meters at one sitting. This is not demagnetisation but remagnetisation assisting the head to generate its own polarity which it should have none of. Apart from a new battery demagnetiser that TDK have just announced, I know of only one method of demagnetisation (fig 2). The operator must stroke the tape head without actually touching it, if at all possible; damage can be caused if contact is made either from strong vibration or the defluxing head scratching the polished surface of the tape head. Once the defluxing head has passed from the base of the head stack to the top, the demagnetiser is then withdrawn from the tape head at a constant speed and brought back into the base of the head stack once again performing an elliptical motion bringing your hand well away from the tape head. Two or three actions of this nature for each head is sufficient, but it must be emphasised that all demagnetisation of heads should be accomplished with this constant withdrawal procedure and not snatched away.

Little attention seems to be paid to the pinch roller and considering this has a difficult task to perform, it should receive the same attention as the other items in the tape's path. Alcohol as a cleaning agent is not recommended as the neoprene rubber often used on the pinch roller loses its surface oils due to the degreasing action of the evaporating alcohol leaving a hard rubber crust that rapidly becomes glossy with use. The consequence of this is loss of gripping power and fluctuation of tape speed. The best cleaner I've found is a mild detergent abrasive such as 'Jif' which removes the fine surface coat of tape dust and leaves the rubber surface both soft and smooth with a fine bloom which seems to remain in good condition for some time. Again regular cleaning is most important.

All manufacturers of professional audio equipment supply an extensive list of specifications: noise, crosstalk, overload margins and distortion which are relevant at the time of delivery but very few recording studios seem to check these figures after a reasonable period of time, assuming that once it has been measured by the manufacturer this specification will not change with use. Many of the figures reached today are well out of the human ear's detection and do require good test equipment to measure their presence in the system. Noisy components or an increase in crosstalk may not be noticed by the operator until it has become quite severe, consequently a high quality recording desk may end up with figures that are no better than a reasonable high-fidelity unit, and considering the cost of pro-audio equipment this particular angle of neglect seems ludicrous: preventative maintenance with occasional measurement of parameters of different parts of the equipment can save hours of work when the problems really start to show up at a later date.

A major nuisance associated with any fairly complex unit is the possibility of dry joints which can hide away for long periods of time after unit manufacture and then show themselves when least wanted or expected. These faults are about the most frustrating failure any engineer is likely to come across as they are usually of an intermittent nature and, as such, indicate their presence only when they feel like it and never when a maintenance engineer is present! The number of times I've been called out to one of these situations and on entering the control room not heard any fault nor been able to restart the crackling that is normally associated with these joints, much to the frustration of all concerned. By the time you have driven half a mile down the road you can be sure the crackling or intermittent signal will have started again, negating the session, and decreasing the occupants' threshold

44 ▶

FIG.1 PENNY & GILES FADER DISMANTLED

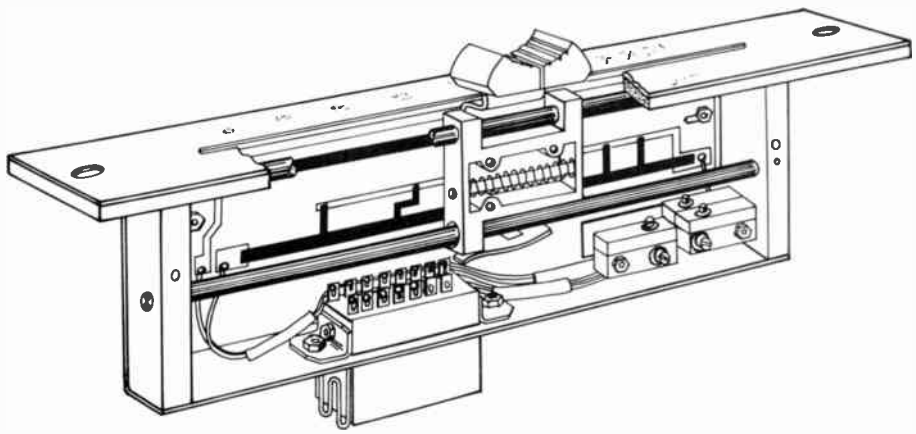
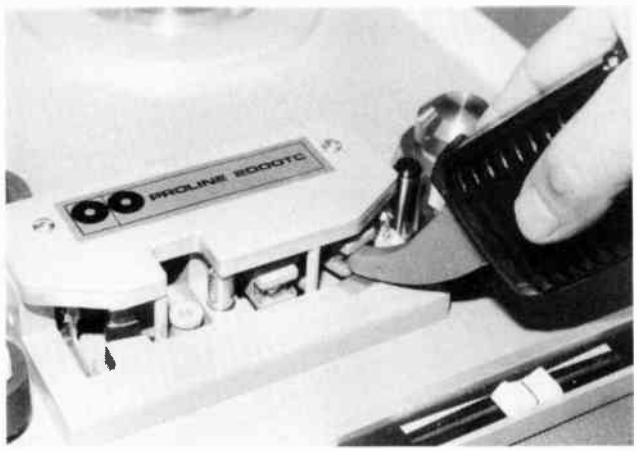


FIG. 2 DEMAGNETISING A TAPE HEAD. NOTE THAT THE DEFLUXER SHOULD BE DRAWN STEADILY AWAY FROM THE HEAD BEFORE BEING SWITCHED OFF



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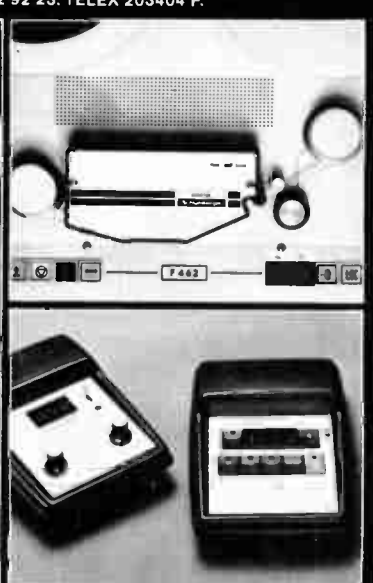


# Thoughts on maintenance

of patience to flying fits of temper. Once this dry joint can be made to show itself up with more regularity, by tapping the offending equipment or circuit board, the chances of detection swing in your direction. Quite often they are invisible to the eye and require careful application of the soldering iron with the unit power off; at other times they show up instantly simply because the offending joint was never soldered in the first place. How can this happen? You only have to think of the many millions of solder joints likely in any piece of equipment to realise the percentage error and the likelihood of Monday morning or Friday afternoon soldering joints that are not as carefully checked as the client might have liked.

Tracking down an anomaly in any unit requires the right tools. A knife and fork job is nearly always unsatisfactory since a temporary repair often turns into a permanent lashup that is for ever going wrong and followed by considerable swearing on the part of all involved; unfortunately some circumstances require this type of repair but a large notice placed somewhere obvious can help remind one and all that it will need proper attention as soon as time allows. The maintenance log book should also record this fact allowing all to see what has to be done and make allowances for this. Many faults that occur are of a simple nature and require only a good knowledge of system techniques; in other words the routes or route that a signal has to take within the desk or ancillary equipment. Armed with this knowledge vast quantities of electronics and wire can often be eliminated from the inquiry, reducing the burden by assimilating whole areas of equipment at one time, thus only those essential areas that are now left need our undivided attention. Using the same signal and starting from its source we simply follow it through until it either disappears for no apparent reason, or develops an audible fault. An in-depth study should now be carried out around this area. These checks are like investigating a crime novel where the author has laid false or unnecessary information and the detective or reader is required to analyse and remove these from his mind so as to get a clear idea of the true essential information leading to the final solution. Effective cure is in the hands of the investigator who has this ability. For many engineers and owners this knowledge is not their forte and they are more concerned with other problems associated with running a studio, but, as was said before, a good diagnosis of the likely area of a fault and its clear interpretation, either into the maintenance log or verbally to the maintenance engineer, will help in overcoming any major jobs at a later date.

I come across many strange faults that often have a clear and simple solution at a later date. For instance, at one studio when the desk was switched on, it would bang and crash into the monitors, in a resounding way, for a short period of time and yet repeated investigation showed that the desk's power supply, which fed the studio amplifiers, was feeding the correct voltage perfectly. When measured at the desk this voltage was varying alarmingly and yet when the linking connections were checked all seemed well, until one day a little while later, when still trying to trace this phenomena, the live cable at the power supply end was given a good tug and it came adrift in my hands. It was then realised that the cable had fractured inside the insulation and was making and breaking in the minute gap that had been produced, although this was being held in its position because the insulation sleeve around the cable was well caught by the tag clip that was being used to attach it to the power supply. The moral of this tale is check all connections no matter how firm and well connected they may seem. Often wires that have too much tension applied to them in an attempt to save the cost of using too much cable cause their own headaches as they often get caught in a bundle of looser cables and become impossible to see. Slowly they give way at their weakest point and in consequence cease to function. At this stage the lack of suitable length renders repair impossible requiring a full replacement of the cable, the laying of which may very easily be totally impossible. Unfortunately in this sort of case the wires have often not been coded, causing yet another headache in trying to find the offending cable that fails when the desk or other piece of equipment was used in a particular format. Remember here that the engineer will not know that a wire fracture has occurred and so for quite a time he is working totally in the dark until he finds a disconnection within one of the wires in the bundle. Here of course the use of carefully coded cables that have been indicated on the necessary drawings can aid tracing. Be warned, savings in initial cable costs don't allow for the suitable slack that can save a lot of trouble in future years.

Perplexing failures can sometimes cause humorous situations not normally associated with the stresses of breakdowns. The incident I have in mind is one that occurred in a mobile studio. The unit was on location when recording a series of live concerts and, as such, required the equipment to behave itself throughout all the recordings. Luckily in this case the fault occurred during a rehearsal whilst checking the sound level and quality from stage. The monitors appeared to distort no matter what level was presented to them, from a whisper to a scream; with the signals removed any movement, no matter how light, would generate a buzz of short duration in both speakers. The first assumption was that the desk was the cause of this effect. Being a mobile unit with efficient chassis support to prevent excessive movement within the room it still moved slightly, and had the effect that whatever was touched or whoever moved within the room, they would set off this buzz. This eventually reduced three people to tiptoeing around, tapping and shifting each and every piece of equipment in the mobile, with still the same disturbing result. I removed the front grilles of the speakers and watched one of the cones as my colleagues continued their ceaseless tiptoeing and tapping. To the outsider this behaviour must have seemed remarkable; one inquirer was silenced by three loonies in a caravan filled with electronic gadgetry tapping anything from a coffee cup to the underside of a table covered with flashing lights and knobs. The final solution to this dilemma was discovered when the base cone of either of the speakers was touched or moved, the attached power amplifier would reply by trying to re-centre the speaker's position. A fault in the power supply of this amplifier was causing it to pass dc current into the coil of the speaker and no matter what movement was created in the speaker cone it was immediately and violently answered by this opposing force, thus the cone would gently oscillate until it was at rest in its newly-found position.

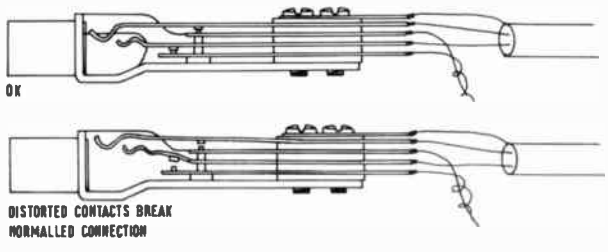
The jack field requires some mention for the reason that damage is often caused to the normalling switches located in the rear of the field. The occasional use of phono jacks in these fields is unfortunate because although the diameter is the same as the Post Office jacks for which the field was designed, the tip is oversized. This is where the root of many problems lie; only too often phono jacks with their large tip diameter spread the contacts within the jackfield causing excessive bending of the spring tongues so that when the jack is removed it doesn't return to its original position but remains bent away from its normalling switch (fig 3).

Whilst on the subject of jackfields there are associated problems with the installation of ancillary equipment, since the jackfield is normally used for their termination. It is in the area of shielding and earthing that perfect and/or costly equipment can become susceptible to radio frequency interference, mains hum and other nasty gremlins which are caused either by electro-magnetic induction, or by the presence of ac mains currents within the audio shielding. In the former, strong magnetic fields that surround power cables will have an influence on unprotected, sensitive, low-level wires such as audio cables. In the latter, ac currents that find an escape route to ground only, via the audio shielding, will make their presence felt should they arrive at the front end of a sensitive amplifier, especially as this kind of amplifier will exaggerate the problem. The results of this interference will be heard in either the mains fundamental frequency of 50Hz or the second harmonic, 100Hz. This cannot be blamed entirely on the devices installed for in any system both mains and audio must go hand in hand.

Another problem with high gain

46 ▶

FIG.3 TYPICAL PROBLEM WITH JACK SOCKETS



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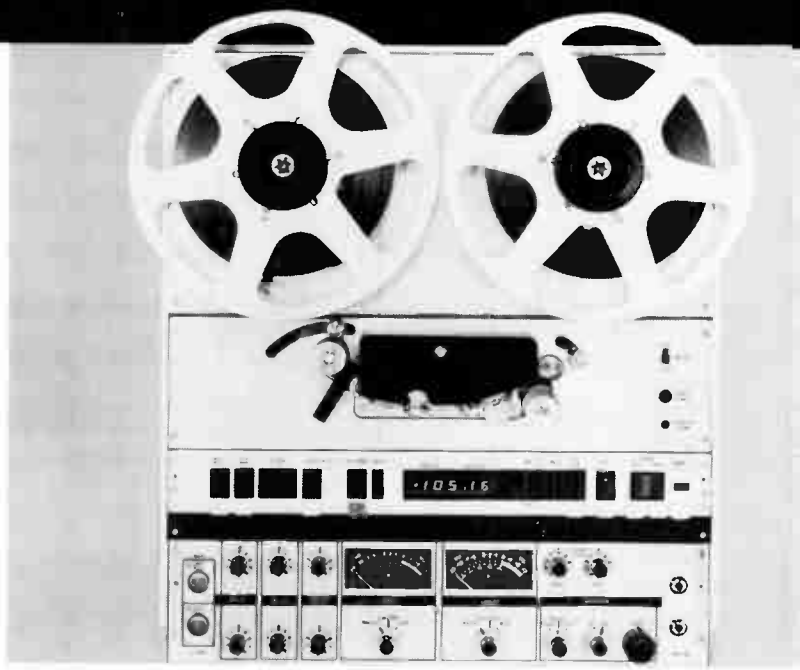
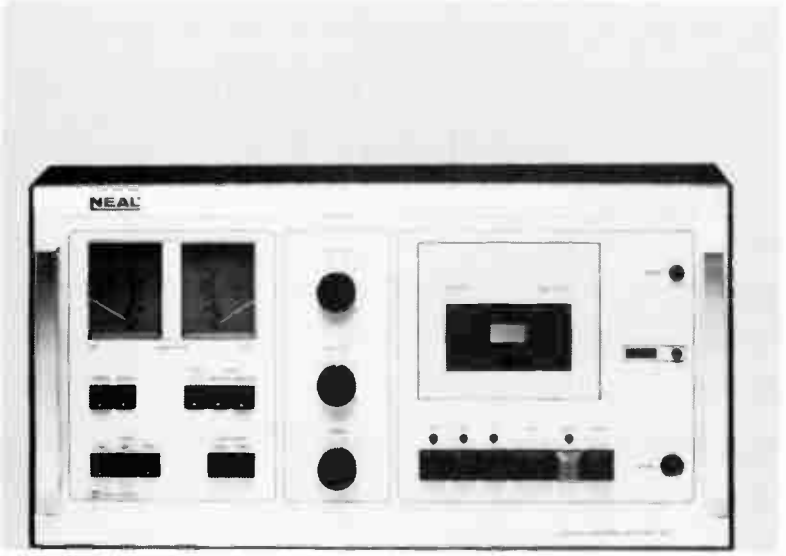
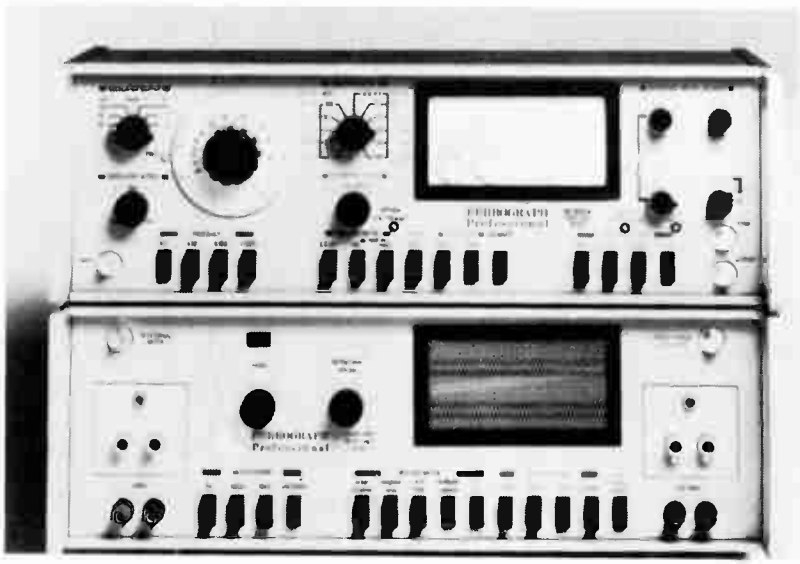


**The Ferrograph Studio 8**
A professional studio tape recorder, logic controlled and offering a choice of stereo, twin track and full or half track mono heads, PPM or VU meters, IEC (CCIR) or NAB equalisation. It is designed to meet the needs of modern radio and television broadcasting organisations and features include servo-controlled run and spooling, tape motion sensing and three editing modes. For up to 10½" spools it accepts standard, long-play and double play ¼" tape and has total type protection by electronic interlocks.




**The Neal 302**
A studio cassette recorder that incorporates three a.c. motors for reliability and smooth effortless power. It is controlled by a full solid state logic system actuated by ultra light touch buttons. A massive decoupled flywheel and oversize capstan result in exceptionally low wow and flutter. Tapes are protected by constant monitoring and in the event of snag or snarl the machine returns to stop. The 302 is used by top recording studios and broadcasting stations for quality cassette copies and in-cassette duplication masters.



**The Ferrograph RTS2 and ATU1**
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# Thoughts on maintenance

amplifiers is their susceptibility to radio frequency interference, should they happen to be part of a faulty earthing system. Unfortunately it is the foreign stations that are detected, which doesn't hold much interest when having to listen to them and repair the fault at the same time!

It is important when wiring in new or existing equipment that it be routed in only one direction, the most preferable being through the desk's power supplies (fig 4). The best way I have found of understanding this earthing principle is to imagine a tree whose roots are the power supply, the trunk the desk, and the tape machines and ancillary equipment as individual members of each bough or branch. In this way the flow of the earth-bound current passes directly into the main trunk of this earth tree and thus to ground without passing back along other branches. At no time must any one branch or bough touch any other.

When wiring screened leads, do not be tempted to earth all the ends as you may run the risk of forming opportunities for an earth loop. In the accompanying figs 5a and 5b I have included several diagrams relating to the connection of screen leads which, if followed, should help many of the possible problems you may face. On most pro audio equipment the mains earth is connected to the chassis of the equipment and not the audio ground which is left floating for its final attachment to the desk's audio ground buss. The mains earth must be connected within the control room's power earthing system, and only removed if it is found to cause an earth loop and for no other reason. If this should be the case, however, the loop is likely to have been caused because the manufacturer has connected the audio earth to the chassis. The screen wire should be allowed to finally ground the unit with the mains earth removed and a suitable sticker placed on the plug indicating this fact.

A studio with a maintenance department will have a reasonable workshop normally with a good selection of components, specialised parts and tools, and a suitable working surface. The small studio, on the other hand, may well have none of these facilities and only stock light bulbs and other such oddments in the control room. He probably won't have the space required to house a workshop and spares store and cannot afford the capital outlay. There are likely to be some spare parts relating to the equipment in the studio that were supplied when the equipment was purchased, but he may well avoid the outlay on any other items considering them an unnecessary expense until a breakdown forces him to renew them. This is fine as long as nothing more serious happens than a replaceable module going wrong or a light bulb blowing; however, quite often many faults can be fixed on the spot with a few components that cost very little. Returning faulty devices to the manufacturer is a very good policy when certain specialised components fail but can be very time consuming if all that fails is a resistor or standard transistor, whose replacement from your own stock could be a simple job. It is equally important that outside maintenance engineers are fully self-sufficient, for if they have to answer a call in the early hours of the morning and forget to take the relevant component to effect a repair, the whole expedition becomes redundant.

FIG. 4

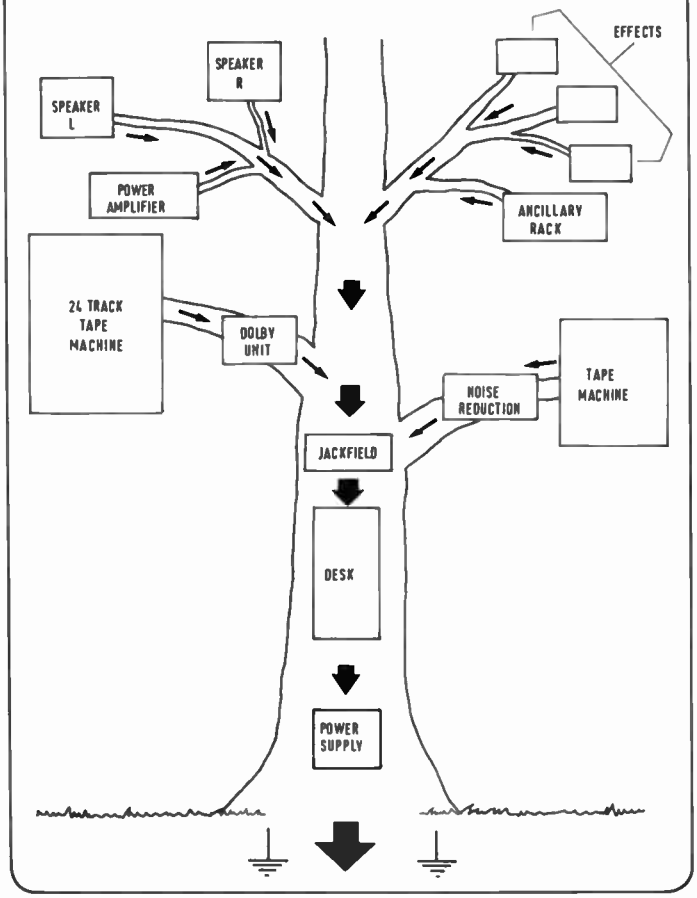
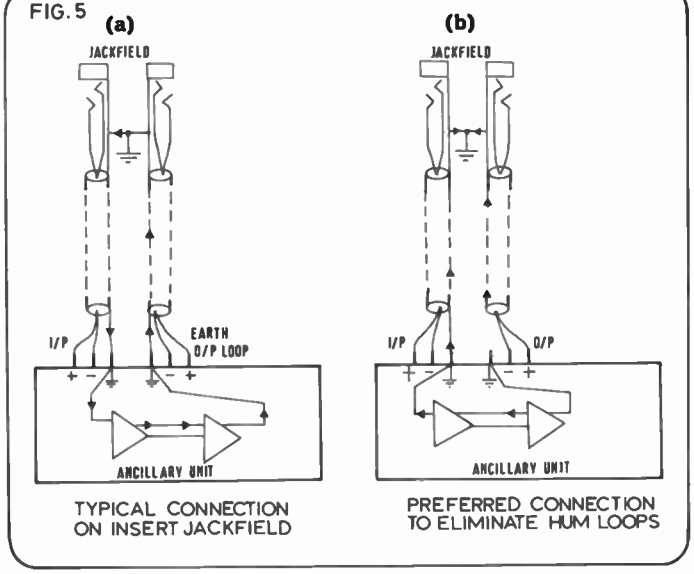



FIG. 5




A once a year inspection should be the norm in all studios where, come what may, the equipment receives a thorough clean, a mechanical overhaul, if necessary replacing any suspicious pots or switches, and a check-up on the essential characteristics and accuracy of the electronics. Vibration and itchy fingers with a screwdriver can reap havoc with the electronics causing all sorts of wrong or false readings that were not apparent until checked against a standard test instrument. As much as possible must be covered in the time allowed—at least a couple of full days—in which to cover desk and tape machine metering against their relative inputs or outputs. Each must read the same and all faders must be matched for level and travel, and be thoroughly cleaned. Dust out connector trays and modules for previously explained reasons. Clean under tape deck top plates to remove dust and tape pieces that slipped unawares into the bowels of the recorder and, if indicated by the manufacturer, oil any moving parts, but only if the manufacturer recommends this. The back of the tape machines usually end up coated in rubbish; old woollies and dead packets of fags. A good clean-up would not go amiss and maybe the old woolly will be of more use to a person than a machine. If the time is available, further investigation into the electronic parameters will definitely be worthwhile as these can tell many a true story about the equipment's condition.

With this course of action the future year and condition of the units will be such that servicing during sessions, when it costs a lot more than the engineer's time, will have been significantly reduced. It is essential that competent maintenance engineers carry out most of the electronic work. The cleaning and tidying up you can accomplish yourself of course, but do not be tempted to put off today what you feel you could do tomorrow, for preventative maintenance and constant attention will save a lot of money in breakdown time and raise the eventual second-hand sale price of any of your equipment. ■

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# business

ADRIAN HOPE

## Call me, Call me, Call me, Call me...

IS THERE, or is there not, anything wrong with the new Fleetwood Mac single *Sara?* Disc jockeys at Capital Radio London got so sick of the record repeatedly sticking in the groove at the 'call me' phrase that they vowed publicly over the air never even to try and play it again. Another London-based radio station, the British Forces Broadcasting Service, had exactly the same problem, with groove-sticking in exactly the same place. So did Piccadilly Radio in Manchester. But BBC Radio One seemed luckier and the copy which I bought cash-over-the-counter from the Virgin Megastore in Oxford Street, London, played perfectly.

Such is the appalling average quality of today's disc pressing that Virgin has a special counter in the store set aside for taking back faulty records from dissatisfied customers. The Virgin faulty counter hadn't had any *Sara* singles back but they knew all about Capital's problem. "In any case the public don't usually bother to bring back faulty singles," added the sales girl. (This prompts a passing thought—is the public really now so conditioned to wasting good money on bad pressings that they have given up complaining?)

According to a Capital record librarian the station had been through three separate batches of the single but were now happy with it. So I 'phoned WEA who had pressed the record in England. At first they 'didn't know of any problems'. But under a little more pressure WEA 'remembered' that Capital had indeed had some problems but had subsequently apologised to WEA for their on-air moans. I checked back with Capital and they helpfully looked out a copy of their letter to WEA. It was just a couple of lines, and sure enough it did more or less apologise. The trouble, wrote Capital, had been incompatibility between the Shure cartridge on turntable 3 and the *Sara* single.

The Shure cartridges in use at Capital are *M75*s at relatively low cost and low compliance. A change to a better cartridge, such as a Stanton, had been necessary to cope with *Sara*. At BFBS they use EMT arms and cartridges tracking at around 2½g, and BFBS coped with *Sara* by increasing the tracking rate to around 3½g. It would be interesting to hear whether other stations have had similar problems with *Sara* and if so how they coped with them.

The real irony of the situation is that the *Sara* single is extracted from the *Tusk* LP which is very probably the most expensive album ever produced. Just for starters its production soaked up nearly a year of studio time at Village Recorders, Los Angeles, and the base rate there is around $20,000 a week. In the USA the first pressings of the first single extracted from the LP (the title track *Tusk*) were recalled as faulty. And now we have a question mark over British pressings of the second single *Sara*. Can it really be coincidence that three radio stations have all experienced exactly the same problem?

There's another sad irony. After spending so much on *Tusk*, Warner in the UK has pulled the financial plug on Enigma, the independent classical label that they bought just a year or so ago. At the time of writing it's still unsure whether Enigma will fold as a production company and the back catalogue be re-issued on a budget label or whether some source of outside cash can be found to buy up the Enigma operation from WEA. One theory on the axing is that Enigma upset the WEA management by making no effort to disguise their decision to have Enigma discs pressed by Teldec in Germany instead of WEA's own plant at West Drayton. So when Warner's accountants came up with a profit and loss equation that looked bad for Enigma there was insufficient sympathy from WEA management to buy the company extra time.

---

## BBC Radio goes digital

BBC RADIO is now busily and happily playing publicly with a new digital toy—a recording system based on the Sony *PCM 1600*. Needless to say, it's been largely forgotten that the BBC Engineering Research Department out at Kingswood Warren has been beavering away at the development of digital tape recorders since 1972, and that by that year the BBC was already regularly distributing PCM encoded sound with television and stereo radio around Britain by microwave link. This followed PCM field trials in 1968 which in turn followed R&D work based on a pioneering patent on PCM filed by Alec Reeves of STC in 1939.

During the mid Seventies the BBC Research Department several times demonstrated digital audio recorders, for instance at AES meetings, and a favourite trick was to prove that a 13-bit code and 32kHz sampling rate (offering 15kHz bandwidth and s/n ratio of around 75dB) was adequate for most practical purposes. As the microwave distribution links use a 13-bit, 32kHz standard (in line with international agreements) the use of a similar standard for recording seemed logical, with the bonus of direct digital interface between recorder and distribution system. It also seemed logical, when the BBC and 3M pooled resources to develop a multitrack digital recorder for master studio use, that a higher standard (50kHz sampling and 16-bit words) should be adopted to give the studios extra bandwidth and dynamic range headroom. (It wasn't surprising, when the BBC and 3M amicably parted company after their 2-year co-operation, that the BBC resisted the temptation to buy a 3M machine (costing around £75,000) and the Research Department settled down to build a prototype 10-channel machine of 13-bit, 32kHz format. This was shown at the Radio '80 exhibition which was held inside the BBC last year to give engineers, producers and top brass an idea of what the research department has up its sleeve for the future.)

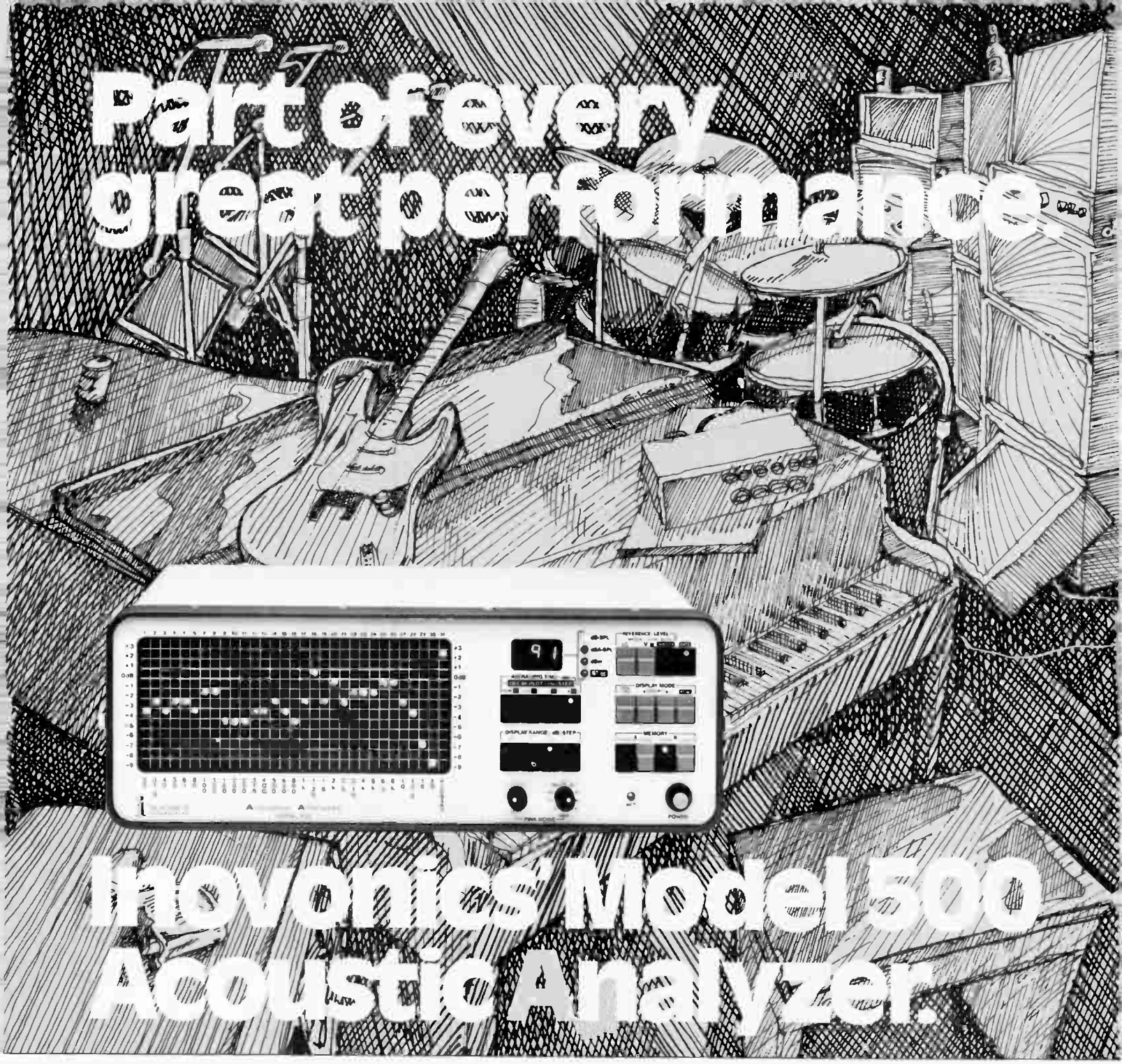
By Christmas 1979 the BBC had been allowed an increase in licence fees and thus Broadcasting House felt politically safe to be seen by the public to be spending a little money. With surround-sound test broadcasting still stymied by industrial action, Broadcasting House turned its thoughts to things digital. The research department prototype wasn't operational in the sense that it certainly couldn't be carted round the country to make location recordings. There was also growing concern that 13-bit, 32kHz just isn't enough for master recording even for radio. What Broadcasting House needed was an operational machine of higher audio standard. The obvious answer was a Sony *PCM 1600*. So the Beeb bought one, along with a pair of *U-Matic* video cassette recorders. Their engineers only needed to build a sync-lock system to keep the two *U-Matics* in step and so provide a changeover between tapes when a programme longer than an hour has to be recorded.

This is the system which is now being extensively used. It's emphasised that the BBC hasn't yet made a final decision on future plans and that adoption of the 44kHz, 16-bit Sony *1600* (NTSC-related) standard is still only part of an ongoing experiment. Some people inside BH believe that a 14-bit code is adequate and that a sampling frequency of 48kHz (which is a convenient multiple of 32kHz) would be ideal. But the Sony *1600* was the only off-the-shelf system available which offered more than enough quality at halfway to reasonable price.

Next project for the research engineers must surely be a digital transcoder so that the Sony 16-bit, 44kHz output can be directly interfaced with the BBC 13-bit 32kHz distribution system. At present the Sony output has to be returned to analogue form and re-encoded for input into the distribution system.

Many of the first BBC digital recordings have been broadcast as repeats of live broadcasts transmitted a couple of days earlier, eg the Christmas carol service from Cambridge was first transmitted live on Christmas Eve and then as a digital recording on Christmas Day. This produces a delightful paradox. The recordings can sound better than the live originals. How come? The live transmissions are relayed to Broadcasting House via analogue Post Office land lines; the repeat broadcasts originate in Broadcasting House direct from the digital masters. ■

# Part of every great performance.



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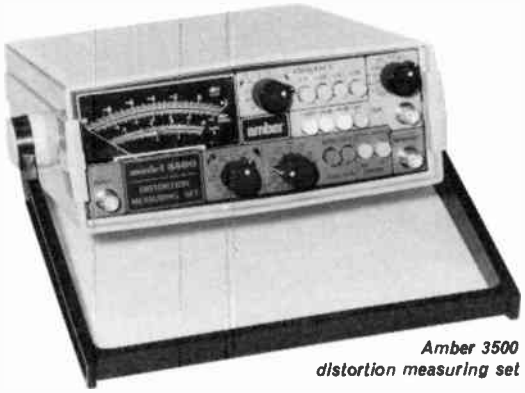
Telex 12-9269

# Survey: test equipment



*Amber 3500 distortion measuring set*

**This survey does not include hand sound level meters, oscilloscopes, power supplies, frequency or volt meters. Next month's surveys will cover sound level meters and test tapes/discs.**

### ABACUS (UK)

**Abacus Electrics, 10 Barley Mow Passage, London W4 4PH.**
**Phone: 01-994 6477. Telex: 8811418.**
**UK:** Kirkham Electronics, Mill Hall, Mill Lane, Diss, Norfolk.
Phone: 037976 594.

**ARTA 8000**
**Type:** ⅓-octave realtime analyser with CRT display. Rack mounting unit with circular CRT display for 27 ISO (centred to ±2.5%) ⅓-octave bands from 40Hz to 16kHz, display range switchable 20dB in 2dB steps, or 10dB in 1dB steps with 0.5dB accuracy, slow or fast response, pink noise generator output, and mic and line inputs on front and rear panels. 200V power on mic socket for instrumentation mics, displays range from —70dBm to +30dBm. Adaptor boxes for B&K 2619 mic (including 20dB amp), 48V phantom mics (including amp), dynamic mics (with 40dB amp).
**Price:** £1,950 including one mic adaptor box, others £30–£40, pink noise card £40.

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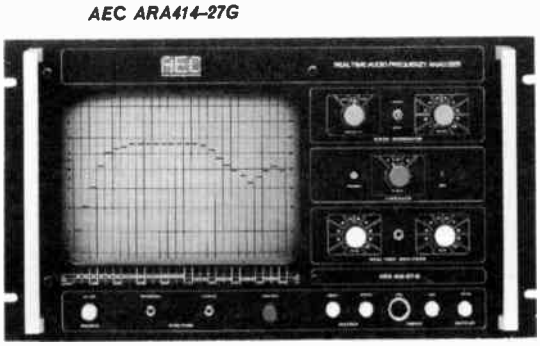
### ACOUSTILOG (USA)

**Acoustilog, 19 Mercer Street, New York, NY 10013, USA.**
**Phone: (212) 925-1365.**

**232A**
**Type:** reverberation timer providing digital LED display of time.
Allows room decay time to be displayed for each of 19 switchable frequency bands on ⅓-octave intervals from 63Hz to 12.5kHz, provides 10ms resolution of reverb time up to 9.99s with 20dB x 3, or 30dB x 2 to measure $RT_{60}$. Built-in pink noise generator, one octave filters, mic input with 15V phantom for C451, adaptable to line level, rack width, 1¾in high.
**Price:** $795. 48V phantom $65, 220/110V 50/60Hz $75, pulse/trigger jacks $35, log amp mod for scope display $90, remote display $180.

*AEC ARA414-27G*



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### AEC (West Germany)

**Audio Engineering Components GmbH, Geleitrasse 11, D-6053 Obertshausen, West Germany.**
**Phone: 06104 42324.**

**ARA414-27G**
**Type:** ⅓-octave realtime analyser using rectangular CRT for display.
Displays 27 ⅓-octave bands from 40Hz to 16kHz with displayed 27dB range and three selectable release times, built-in pink noise generator, mic and aux inputs on front panel, rack mounting.
**Price:** on application.

**AFA415SG/B**
**Type:** dual channel frequency response measurement unit using rectangular CRT for display.
Generates 13 separate frequencies from 40Hz to 16kHz with left and right level controls for tape recorder, displays left and right replay from tape recorder simultaneously either side of the CRT screen with a scale from +6dB to —7dB for response and related measurements. Low or high level inputs on DIN on or BNCs, rack mounting.
**Price:** on application.

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### AMBER (Canada)

**Amber Electro Design Ltd, 4810 Jean Talon West, Montreal H4P 2N5, Canada.**
**Phone: (514) 735-4105.**
**UK:** Scenic Sounds Equipment, 97–99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.

**4400A**
**Type:** multipurpose audio test set.
Generator provides sine, triangle, square, pulse, asymmetrically clipped sine, triangle, sweep, pink noise and comb in range 20Hz to 100kHz with max +33dBm output level in range +30dBm to —70dBm. Digital meter section reads narrow band level +30dBm to —120dBm or to —90dBm wide band, and frequencies from 10Hz to 100kHz. Provides 0.01dB level and 1Hz frequency resolution, accuracy ±0.2dB from +30dBm to —30dBm 50Hz to 20kHz, true rms fast or slow, average or peak reading, numerous weightings available. Receiver section provides differential or dual channel input and enables four digital plots (256 x 256) to be stored and displayed on a normal scope or a plotter. Provides plots of amplitude or phase versus time or frequency. Also contains a multimode filter for bandpass or reject, high or lowpass, and variable Q, and a spectrum analyser with log frequency sweep and constant percentage bandwidth. The analyser and filter may be used with the digital meter for noise and other measurements, and the digital plot for generation of noise floor plots, crosstalk, $RT_{60}$ etc.
**Price:** £2,695.

**4400AXY**
Similar to *4400A* but with X and Y dc signals, and pen drop contact closure for plotters.
**Price:** £2,931.

**4405**
Accessory for *4400A* which allows distortion to be measured and plotted, contains a tracking notch filter and additional circuitry to interface with main test set oscillator. Mounts on top of *4400A*.
**Price:** £1,640. *4407* is similar but with full digital metering, £2,195.

**Model 444**
Weighting network kit providing five dedicated weighting filters, 400Hz highpass, 10kHz lowpass, ANSI A, B and C, and five blanks for custom networks.
**Price:** £122.

**3500**
**Type:** portable distortion measuring set.
Includes an ultra low distortion sinewave oscillator (0.0015% 10Hz to 20kHz) with +22dBV to —60dBV output, total harmonic distortion analyser and noise meter covering 10Hz to 100kHz in four ranges (tracking oscillator) with distortion level input +10dBV to —30dBV, wide band level to —60dBV, narrow band to —120dBV, true rms meter, slow or fast, linear dB scale (fundamental rejection 100dB 10Hz to 20kHz). Narrow band filter internally adjustable 1 to $\frac{1}{10}$-octave tunable over full range. Automatic operation for null and set level, measures to lower than 0.002%. Option for intermodulation distortion measurement comprising second oscillator and analyser fitting internally to measure to SMPTE standard as well as variable HF component from 2kHz to 100kHz.
**Price:** £850.

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### AWA (Australia)

**Amalgamated Wireless (Australia) Ltd, PO Box 96, North Ryde 2113, New South Wales, Australia.**

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# Penny-pinching Packages from ITA


| | List | Package |
|---|---|---|
| 1. 4 track package. Teac A3440, Revox HS77, Model 2A Mixer | £1668 | **£1350** |
| 2. 4 track package. Teac A3440, Revox HS77, Itam 10-4 Mixer | £2535 | **£2090** |
| 3. 8 track ½ inch package. Itam 806, 10-4 Mixer, Revox HS77 | £3917 | **£3220** |
| 4. 8 track 1 inch package. Otari MX7800, Allen & Heath 16×8 Mixer | £7185 | **£6395** |
| 5. 16 track 1 inch package. Itam 1610, Allen & Heath 16×8, Revox HS77 | £9045 | **£8185** |
| 6. 24 track package. Otari MTR90, Allen & Heath Syncon 28×28 | £29275 | **£24990** |
| 7. Any other package tailored to your requirements | ? | ? |

Prices exclusive of VAT

Full range of ancillary equipment available. Finance facility. Full after sales service back up.

**ITA, 1-7 Harewood Ave., Marylebone Road, London NW1. Tel: 01-724 2497. Telex: 21879.**

**Phone: 888 8111. Telex: 20623.**
**UK:** Marconi Instruments Ltd, Longacres, St Albans, AL4 0JN.
**Phone:** 0727 59292. Telex: 23350.

**G232**
**Type:** low distortion oscillator.
Four ranges covering 10Hz to 110kHz, max output +22dBm, calibrated variable +22dBm to —100dBm, 0.001% distortion 30Hz to 20kHz, digital frequency readout, balanced output.
**Price:** £1,165.

**G233**
**Type:** ultra low distortion oscillator.
Four ranges covering 10Hz to 110kHz, max output +12dBm, variable attenuator, 0.001% distortion.
**Price:** £345.

**F242A**
**Type:** distortion and noise meter.
Provides automatic tuning on the fundamental rejection frequency over the range 20Hz to 20kHz with no manual selection or tuning, providing residual distortion less than —90dB, distortion measurement to below 0.005% with —30 to +30dBm range, also level measurement from —110 to +32dBm, true rms reading, balanced or unbalanced, Low and high cut filters.
**Price:** £1,520.

**E247**
**Type:** level meter psophometer.
Provides true rms or quasi-peak reading meter, balanced or unbalanced, for measurement of level, noise or psophometrically weighted noise in range 10Hz to 110kHz with a variety of filters. Meter ranges —80dBm to +30dBm, accuracy ±0.2dB.
**Price:** £820.

**A248**
**Type:** wow and flutter meter.
Measures drift, wow and flutter to DIN, IEC, IEEE and ANSI standards, weighted or unweighted, stable 3150Hz tone for recording on tape, balanced or unbalanced inputs and outputs, ranges from 0.1% to 3%.
**Price:** £387.

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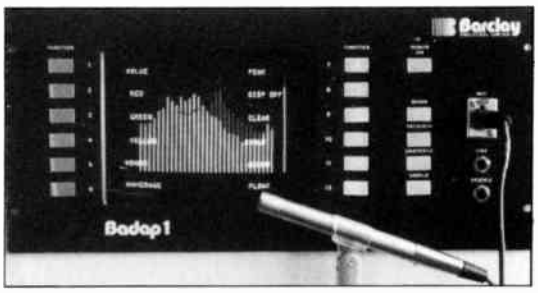
## BARCLAY (USA)

**Barclay Analytical Ltd, 233 E Lancaster Avenue, Ardmore, Penn 19003, USA.**
**Phone: (215) 649-4915.**

**Badap 1**
**Type:** 'audio micro computer', programmable audio measurement system.
Comprises a 9in diagonal colour television display which may be used to display a wide number of audio parameters depending upon the software used with the system. Provides line and mic inputs, displays offer 1, 3, or 6dB/division, while the 6dB/div shows +20 to —60dB range, plus providing 0.25dB resolution on 1dB/div. Five software packages are presently available: realtime ⅓-octave analysis from 20Hz to 20kHz, with rapid plot or memory analysis option, $RT_{60}$ displays decay of reverberant sound field as a graph on the screen. Acoustic Distance Measurement indicates distance between loudspeaker and mic for determination of critical distance and delay line setting. Chromatic spectral decay shows reverberant decay in 31 bands to provide a 'sonic' blueprint of particular rooms. Optional hardware input multiplexer which provides 32 channels of level display, peak or average, and two simultaneous ⅓-octave analysis displays. Future software packages will include 64-channel multiplexer, disc tracker, ⅛-octave analyser, harmonic distortion, intermodulation distortion, weighting curves, digital filtering, wow and flutter spectral analysis, loudspeaker phase alignment.
**Price:** *Badap 1* including RTA $5,495, 32-channel input multiplexer $1,795, stereo analyser $2,995, software programs $300 to $460.

*Barclay Badap 1 programmable audio measurement system*

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## B & O (Denmark)

**Bang & Olufsen, DK-7600 Struer, Denmark.**
**Phone: 07 85.11.22.**
**UK:** Bang & Olufsen, UK Ltd, Eastbrook Road, Gloucester GL4 7DE.
Phone: 0452 21591.

**WM1**
**Type:** wow and flutter meter with drift and frequency analyser.
Measures to DIN, IEC, CCIR, IEEE and ANSI standards, with analyser for wow and flutter spectrum, quasipeak and sigma meter circuit for 30s to 5s measuring periods, analogue outputs for scope, measures down to 0.03% with input voltage 3mV to 10V.
**Price:** £678.

**WM2**
Similar to *WM1* but without analyser.
**Price:** £379.

**AM1**
**Type:** audio monitor with wattmeter and voltmeter. Stereo wattmeter has range 10nW to 140W, LF voltmeter has range 300μV to 37V over range 4Hz to 500kHz. Includes calibrated amp with gain —30dB to +50dB, monitor amplifier with built-in speaker.
**Price:** £261.

**RWM4**
**Type:** wattmeter.
Stereo wattmeter covering range 10nW to 100W over range 8Hz to 700kHz.
**Price:** on application.

**TG7**
**Type:** low distortion oscillator.
Generates sine and square waveforms in range 10 Hz to 1MHz with output voltage 0-3.6V, distortion is 0.05% .
**Price:** £259.

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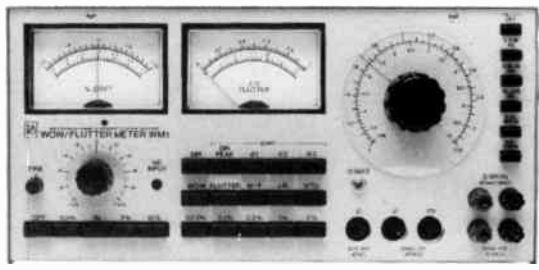
## B & K (Denmark)

**Bruel & Kjaer A/S, DK-2850 Naerum, Denmark.**
**Phone: 02 80.05.00. Telex: 37316.**
**UK:** B & K Laboratories Ltd, Cross Lances Road, Hounslow, Middx TW3 2AB.
Phone: 01-570 7774. Telex: 934150.
**USA:** B & K Instruments Inc. 5111 West 164th Street, Cleveland, Ohio 44142.
Phone: (216) 267-4800. Telex: 810421.

**Measuring microphones**
Wide range of capacitor measuring microphones with diameters of ⅛in (6.5Hz to 140kHz), ¼in (3.9Hz to 70 or 100kHz), ½in (to 16/18/20/40kHz) 1in (to 8.5/20kHz). Free field or linear pressure responses, screw on pre-amplifiers, numerous adaptors and extension cables, nose cones and windshields. Boxed kits also available. Various power supplies.
**Prices:** £197 to £275.

**4220/4221/4230**
**Types:** microphone calibrators.



*B & O WM1 wow and flutter meter*

*4220* Pistonphone is battery driven with +124dB level and barometer for pressure corrections. *4221* is a high pressure calibrator at up to 164dB spl and 3Hz to 1kHz. *4230* is a pocket sized battery powered calibrator giving 94dB at 1kHz.
**Prices:** *4220* £312, *4221* £1,298, *4230* £150.

**4204/4205**
**Type:** sound sources for room measurement.
*4204* is a reference sound source of 70dB with frequency range of 100Hz to 10kHz with less than 6dB directivity. *4205* can be used for A-weighted or octave band etc, comprising sound generator and separate radiator.
**Prices:** *4204* £1,078, *4205* £1,262.

**7507**
**Type:** sound power processor.
Allows sound measurement in octave or ⅓-octave bands with digital display of level and frequency.
**Price:** £4,456.

**1023/1027**
**Type:** sine and sine/random generators.
*1023* covers 10Hz to 20kHz in one range, linear or log, variable frequency modulation of output signal, external mechanical or electrical sweep control. *1027* generates sine waves, narrow bands of random noise, white noise and pink noise. Range is 2Hz to 200kHz in three linear and log ranges, external sweeping.
**Prices:** *1023* £2,304, *1027* £4,036.

**2610/2607**
**Type:** measuring amplifiers with meter displays.
*2610* has sensitivity 10μV to 300V, true rms level, fast or slow, peak hold, range 2Hz to 200kHz with limiter for 22.4Hz to 22.4kHz, A, B, C, and D-weighting networks. *2607* is similar but also provides peak measurement with variable decay.
**Prices:** *2607* £2,344, *2610* £1,610.

**2429**
**Type:** psophometer for noise measurement.
Sensitivity 100μV to 30V, four weighting networks, telephone, linear, programme one or two.
**Price:** £1,323.

**2971/6202**
**Type:** phase meter and phase delay unit.
*2971* provides digital display of phase differences, frequency range 2Hz to 200kHz. When used with *6202* phase delay unit enables characteristics of loudspeakers, acoustic delay lines, tape recorders etc to be measured, delay to 8.73ms.
**Prices:** *2971* £1,275, *6202* £622.

**6203**
**Type:** wow and flutter meter.
Provides auto selection of five ranges from 0.03 to 3%, built-in xtal 3150Hz oscillator, linear or weighted.
**Price:** £1,022.

**1617/8**
**Type:** bandpass filters.
*1618* has 41 ⅓-octave filters from 2Hz to 20kHz with 41 overlapping octave bands, A-weighting or linear mode, digital display of selected band. *1617* is similar but with extra ⅓-octave filters from 25kHz to 160kHz, B, C and D-weighting.
**Prices:** *1617* £2,886, *1618* £1,924.

**2010**
**Type:** heterodyne analyser.

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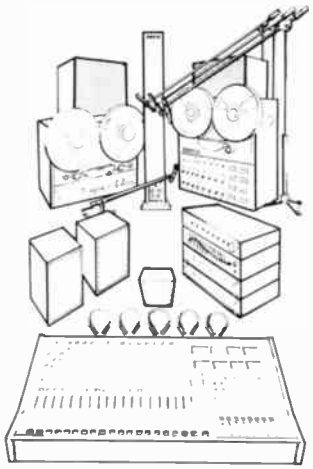
# Our business is helping you with yours

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



## SYSTEMS

As our name implies, at TURNKEY we specialise in systems.
From the simplest four channel setup to large eight or sixteen track installations, we can tailor a package to fit your exact needs.
This can include acoustics advice, wiring, consoles, training and so on.
Ask for our 'Quotation Sheet' or call Andrew Stirling now, on 01-440 9221 and discuss your requirements first hand.

## MONITORING

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

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

## SIGNAL PROCESSORS

The choice is immense. We cannot sell them all so we pick and choose the best.
Take MXR for example. This American based company has grown from making effects for guitars to studio equipment for professionals. Their digital delay and graphics are second to none.
Roland of synthesiser fame, have introduced their 'Studio Series' of rack-mount units, including a phaser/flanger with extensive control facilities.
We also have the budget ACCESSIT range.

## MICRO-PHONES

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

## ACCESSORIES

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

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

We also have . . . mike boxes . . . track sheets . . . preamplifiers . . . direct boxes . . . rolling consoles . . . and much more.
Full details in our 'TURNKEY by mail' catalogue.

## MIXERS

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

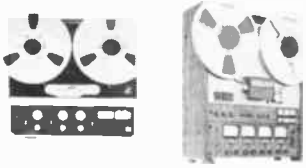
The RSD, 16 by 4, offers great value for money in budget multitrack mixers. Packed with features and our own mods for 8 track.

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

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

## TAPE RECORDERS

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



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

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

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


Write or call for a free copy of the' Turnkey Book', the 'Turnkey by mail' catalogue and TEAC's 'Are you ready for Multitrack' book.
You are welcome to come and visit our extensive demonstration showroom at any time during normal office hours.

**8 East Barnet Road,**
**New Barnet,**
**Herts EN4 8RW**
**Supply & Installation of Recording Equipment**
**Telephone 01-440 9221**
**Telex : 25769**

turnkey

Comprises frequency selective measuring amp and BFO, tunable from *1902* for harmonic, difference frequency and intermodulation distortion analysis. Three ranges for 2Hz to 200kHz, A, B, C and D-weighting, bandwidth and time of rectifier variable.
**Price:** £5,973.

**2020**
**Type:** heterodyne slave filter.
Highly selective constant bandwidth filter tuned automatically by generators *1023/1027* and analyser *2010*. Extremely useful for suppressing background noise.
**Price:** £3,127.

**2120**
**Type:** frequency analyser.
Frequency selective, high gain measuring amp tunable 2Hz to 20kHz, switchable bandwidths and weighting networks.
**Price:** £4,014.

**1902/1901**
**Type:** distortion measurement control unit and tracking frequency multiplier.
Operates with the *2010*, *2020*, *2031* for measurement of non-linear distortion and periodic signal tracking.
**Prices:** *1902* £2,387, *1901* £1,988.

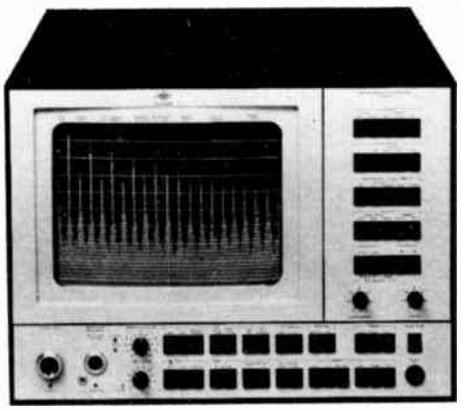
**2031**
**Type:** narrow band spectrum analyser using 11in display screen.
Digital instrument which generates and displays 400 channels (bands), with different frequency ranges, dynamic range greater than 70dB with 9dB crest factor, various display modes.
**Price:** £7,050.

**2131**
**Type:** digital frequency analyser using 11in display screen. Uses digital filtering, detection and averaging, displays 42 ⅓-bands from 1.6Hz to 20kHz or 14 octave bands from 2Hz to 16kHz.
**Price:** £11,996.

**2306**
**Type:** level recorder using paper roll.
Portable, battery powered chart recorder using either fibre pen or stylus on wax coated paper, log recording in range 1.6Hz to 20kHz, linear and log recording of dc signals, rms detector. Eight paper speeds, and four writing speeds, chart width 2in.
**Price:** £1,485.

**2307**
**Type:** level recorder using paper roll.
Versatile chart recorder for range 2Hz to 200kHz, recording as a function of time or frequency in conjunction with generators and analysers, recording using ink or stylus, chart widths 2in or 4in, 15 writing speeds, 12 chart speeds, polar plotter, two shafts for mechanical connections.
**Price:** £3,104.

*B & K narrow band spectrum analyser*



**2308**
**Type:** X-Y chart recorder.
Plots chart for fast linear dc signals, fast slewing speed of 1,000mm/s$^{-1}$ and max acceleration of 100mm/$^{-1}$s. Takes A4 sized paper, uses fibre tipped pens, built-in sweep generator, remote control.
**Price:** £2,360.

**2309**
**Type:** 2-channel level recorder using paper roll.
Portable, battery powered chart recorder similar to *2306*, but two separate writing systems, pen lift.
**Price:** £2,945.

**3922**
**Type:** motorised turntable designed to rotate test objects for polar diagram responses in synchronism with *2307* level recorder, max test load 100kg, speed 0.7rpm.
**Price:** £1,222.

**4416**
**Type:** response test unit.
Designed for measurements of tape recorders, cartridges and turntables, contains necessary amplifiers, filters, de-emphasis (RIAA) chopper for balance measurements, A and B rumble filters and synchrostarter which operates with 1kHz bands recorded on B&K test discs, and provided by *1023/27* generators for test tapes.
**Price:** £821.

**4712**
**Type:** audio frequency response tracer using 14in display. Provides frequency response curves on long persistence CRT when used with sweep generator.
**Price:** £3,116.

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## CONSILIUM (Sweden)

**Consilium Industri AB, Birger Jarlsgatan 15, S-11145 Stockholm, Sweden.**
**Phone: 08 22.23.40/32.21.33. Telex: 11083.**

**RTA11**
**Type:** realtime ⅓-octave analyser using external scope for display.
Includes 31 ⅓-octave filters from 20Hz to 20kHz, each band being displayed on a separate scope (not supplied) which is triggered from the analyser, three integrating time constants.
**Price:** on application.

**RTA12P**
Similar to *RTA11* but with 32nd wide band for sound pressure reading, and three selectable memories.
**Price:** on application.

**RTA12PD**
Similar to *RTA12P* but with LED matrix display with 16 levels, and 1, 2 or 3dB/octave selection.
**Price:** on application.

**PNG11**
**Type:** pseudo noise generator.
Uses 39-bit long shift register to generate noise, pink or white being selectable, gate output.
**Price:** on application.

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## CROWN/AMCRON (USA)

**Crown International, 1718 W Mishawaka Road, Elkhard, Indiana 46514, USA.**
**Phone: (219) 294-5571. Telex: 810-294 2160.**
**UK:** HHB PA Hire Ltd, Unit F, New Crescent Works, Nicoll Road, London NW10.
Phone: 01-961 3295.

**RTA-2**
**Type:** realtime 32-band ⅓-octave analyser using 5in CRT display.
Includes 32 ⅓-octave bands from 16Hz to 20kHz, switchable to full octaves, 60dB dynamic range with 5 or 10dB/division, rack mountable.
**Price:** £1,795.

## DANELCO (Denmark)

**Export:** Hammer Trading Co ApS, Dalen 8, DK-3060 Espergaerde, Denmark.
**UK:** Telonic Berkeley UK, 2 Castle Hill Terrace, Maidenhead, Berks SL6 4JR.
Phone: 0628 28057. Telex: 849131.

**SAW3150**
**Type:** wow and flutter meter.
Uses 3,150Hz oscillator, and measuring section with 30mV input, four ranges for flutter from 0.1 to 3%, four ranges for drift from ±0.1 to 3%. Measures to DIN and CCIR, optional JIS/NAB.
**Price:** £355.

**SPM100**
**Type:** 2-channel lf wattmeter.
Provides separate indication for two channels, 10 ranges from 10μW to 100W, true rms, A weighting, response 20Hz to 20kHz, load resistance 4, 8 or 16Ω.
**Price:** £295.

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## EMT (West Germany)

**EMT-Franz GmbH, Postfach 1520, D-7630, Lahr, West Germany.**
**Phone: 07825 512. Telex: 754319.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.
**USA:** Gotham Audio Corp, 741 Washington Street, New York, NY 10014.
Phone: (212) 741-7411. Telex: 129269.

**EMT424/425**
**Type:** wow and flutter analyser.
Equipped with manual or automatic tunable band-pass filter with special circuitry to provide stable readings, and also displays drift and run-up time to provide stability. Also allows frequency intermodulation factor to be determined. *EMT425* is similar, but rather than using standard 3,150Hz tone, uses switchable 25.2kHz, 50.4kHz and 100.8kHz for high speed duplicator measurement.
**Price:** *EMT*424 £2,252.

**EMT-HE16**
**Type:** Helcoscriptor chart recorder for 424/425
Uses thermosensitive paper to provide chart records of wow and flutter, six recording speeds.
**Price:** £1,438.

**EMT422**
**Type:** wow and flutter meter.
Allows two presettable threshold limits, various weighting functions, and shows flutter and drift on separate meter, built-in 3,150Hz generator.
**Price:** £596.

**EMT160/161**
**Type:** acoustic polarity tester.
A single pulse of defined length and phase is fed to the unit under test, or radiated from a built-in speaker, the output from the unit or from a special polarity microphone then indicates whether polarity is correct using red and green lights.
**Price:** £460, *161* microphone pre-amp £141.32.

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## EVENTIDE (USA)

**Eventide Clockworks Inc, 265 West 54th Street, New York 10019, USA.**
**Phone: (212) 581-9290.**
**UK:** Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4313. Telex: 28668.

**Realtime Spectrum Analyser**
**Type:** realtime 31-band ⅓-octave analysers available as accessory or add-on boards for *PET*, *Apple* and *TRS80* home computers.
The analysers comprise a board of electronics with filters, detectors, ADC and program ROM, which fits internally to the *PET* (versions for all three models), and externally to the *Apple* and *TRS80*, all

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# Our back room boys are out in front.

Our R & D Division have been leading from behind, so to speak, for the last 50 years or so, but since we created our Professional Products Division a few months back it's really gone to their heads.

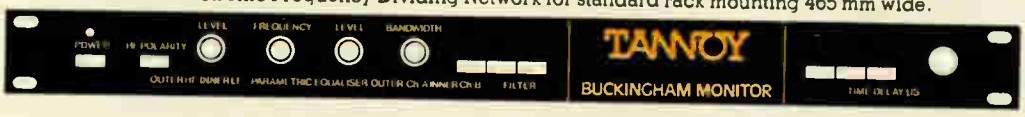
Now they have come up with a range of three new monitors. The Buckingham is a three way system, using a 10" Dual Concentric unit and two 12" L.F. drivers, with 94dB sensitivity and 150 watts continuous power handling. Two 15" Dual Concentric monitors, the Super Red and Classic, complete the range.

For an encore they have introduced an electronic Frequency Dividing Network with L.F. parametric equaliser and time delay facility that is as elegant a piece of electronic engineering as you'll ever see.

If you would like further technical information regarding these and other Tannoy products contact: David Bissett-Powell, Professional Products Division, Tannoy Products Ltd., St. John's Road, Tylers Green, High Wycombe, Bucks. HP10 8HR.
Tele: Penn (049 481) 5221. Telex: 837116.


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

X05000 Electronic Frequency Dividing Network for standard rack mounting 465 mm wide.




TANNOY®

PROFESSIONAL PRODUCTS DIVISION

control being through the computers keyboards, and display on the computer CRT display. 31 ⅓-octave filters from 20Hz to 20kHz on ISO centres (but not to ISO standards), with extra wide band level channel.
**Prices:** all £340, computers extra.

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## FARNELL (UK)

**Farnell Instruments Ltd, Sandbeck Way, Wetherby, West Yorks LS22 4DH.**
**Phone: 0937 63541. Telex: 557294.**

**LFM3**
**Type:** sine/square oscillator.
Covers 10Hz to 10MHz in six ranges for sinewaves, and to 1MHz for square, distortion 100Hz to 20kHz 0.1%, to 100Hz 0.5%. Output 20V p-p.
**Price:** £285.

**PR1A and PR2A**
**Type:** chart recorder with one or two pens.
Various input modules, 10in wide paper, 21 chart speeds, pen response 800mm/s, expendable fibre tipped pens or capillary, chart take-up and cutter.
**Price:** *PR1A* £499, *PR2A* £810.

**X-Y recorders**
**Type:** X-Y chart recorders with single pen.
Available in A3 or A4 paper sizes, A3 size having optional timebase module, electrostatic paper hold, fibre or ink pens, pen lift.
**Prices:** *A3* £1,047, *A3T* £1,132, *A4* £852.

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## FEEDBACK (UK)

**Feedback Instruments Ltd, Park Road, Crowborough, Sussex TN6 2QR.**
**Phone: 08926 3322. Telex: 95255.**
**USA:** Feedback Inc, 438 Springfield Avenue, Berkeley Heights, New Jersey 07922.
Phone: (201) 464-5181.

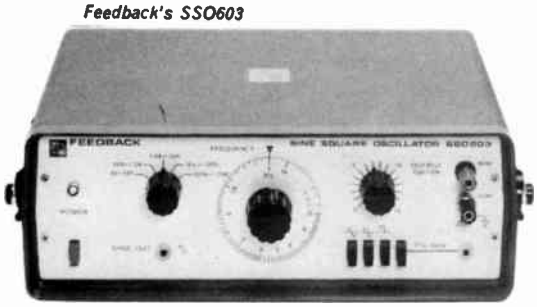
**FG600/601**
**Type:** function generators.
Generate sine, square and triangle waveforms, *FG600* 0.01Hz to 100kHz in seven ranges, *FG601* 0.001Hz to 1MHz in nine ranges.
**Prices:** *FG600* £148, *FG601* £262.

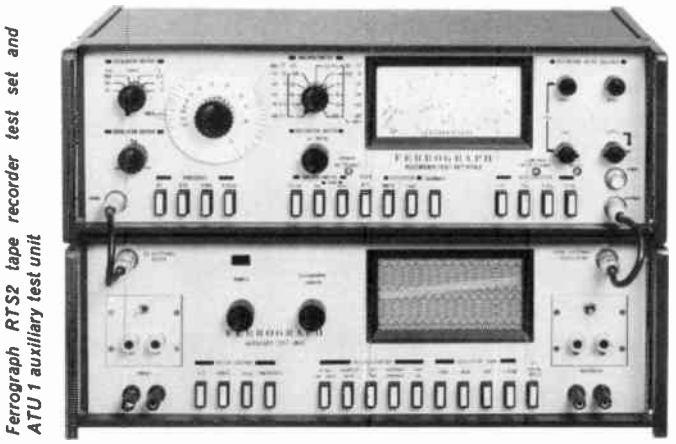
**VPO602**
**Type:** variable phase oscillator.
Covers range 10Hz to 100kHz with phase adjustable over full 360°.
**Price:** £285.

**SSO603**
**Type:** sine/square oscillator.
Generates sine and squarewaves over the range 10Hz to 1MHz in five ranges.
**Price:** £122.

**EW604**
**Type:** electronic wattmeter.
Covers power range 250mW to 10kW, voltage 5V to 1,000V, current 50mA to 10A, frequency range dc to 20kHz.
**Price:** £166.

*Feedback's SSO603*



*Ferrograph RTS2 tape recorder test set and ATU 1 auxiliary test unit*

## FERROGRAPH (UK)

**North East Audio Ltd, Simonside Works, South Shields, Tyne & Wear NE34 9NX.**
**Phone: 0632 566321. Telex: 537227.**
**USA:** Neal-Ferrograph (USA) Inc, 652 Glenbrook Road, Stamford, Conn. 06906.
Phone: (203) 348-1045.

**RTS2**
**Type:** tape recorder test set.
Includes 4-range oscillator covering 15Hz to 15kHz with variable output, millivoltmeter covering —60dBm to +40dBm fsd, lf cut filter, distortion meter reading down to 0.1% fsd with manual tuning, wow and flutter measurement down to 0.1%, and drift.
**Price:** £541.18.

**ATU1**
Accessory for use with *RTS2* which provides balanced inputs and outputs, monitor loudspeaker, meter loading, weighting network, oscillator amplifier and attenuator.
**Price:** £270.59.

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## FIDELIPAC (USA)

**Fidelipac Inc, 109 Gaither Drive, Mount Laurel, New Jersey 08057, USA.**
**Phone: (609) 235-3511.**

**65-390**
**Type:** wow and flutter meter.
Portable wow and flutter meter, edge movement meter, internal ref 3,150Hz oscillator, range 0.1% and 0.5% fsd, drift ±5%.
**Price:** on application.

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## FORMULA SOUND (UK)

**Formula Sound Ltd, 3 Waterloo Road, Stockport SK1 3BD.**
**Phone: 061-480 3781.**

**SG19GA**
**Type:** 2-channel graphic equaliser and analyser using 2 LEDs per band.
Provides two channels of 20 bands of ⅓-octave graphic equalisation from 31Hz to 16kHz with ±12dB range, and a similar analyser set each with two LEDs to indicate level switchable ±1 to 4dB, and switchable to read off graphic, output or analyse mic input, measurements being taken by using graphic controls to create 'null'. May be internally calibrated to specific curves.
**Price:** £795.

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## GENRAD (USA)

**GenRad Inc, 300 Baker Avenue, Concord, Mass 01742, USA.**
**Phone: (617) 369-8770. Telex: 923354.**
**UK:** GenRad Ltd, Norreys Drive, Maidenhead, Berks SL6 4BP.
Phone: 0628 39181. Telex: 848321.

**Measuring microphones**
Range of microphones, preamplifiers and accessories. *1961* and *1962* are electret types of 1in and ½in diameters respectively covering 20Hz to 10kHz and 20Hz to 20kHz, while the *1971* is a 1in ceramic mic covering 20Hz to 12.5kHz.
**Prices:** *1961/2* £225, *1971* £147.

**1987**
**Type:** minical sound level calibrator.
Produces 1kHz at levels of 94 or 114dB, adaptors for 1½, 1, ½, and ½in mics.
**Price:** £157.

**1562-A**
**Type:** sound level calibrator.
Produces five frequencies between 125Hz and 2kHz with ±0.3dB accuracy at 500Hz, at 114dB, fits 1½, 1 and ½in mics.
**Price:** £803.

**1995**
**Type:** integrating real time ⅓-octave analyser using 5in display screen.
Provides full and ⅓-octave real time analysis between 25Hz (or 2.5Hz) and 20kHz with 50dB display range on a CRT which normally shows bar graph display, but may be switched to numerical values. A weighting or flat, sound exposure level, integration times.
**Price:** £7,251.

**1985**
**Type:** dc chart recorder using paper roll.
Chart recorder accepting dc inputs and designed for use with GenRad precision sound level meters or community noise analysers, but may also be used with many other devices. Provides 50dB dynamic range, chart speeds from 2cm/hr to 60cm/min, battery operated for eight hours on one charge, disposable pens.
**Price:** £939.

**2512**
**Type:** narrow band spectrum analyser using 5in display.
Covers the range dc to 100kHz with 400 lines of frequency resolution, but real time analysis only up to 20kHz, alphanumeric display of operating functions and calibration data on screen, optional full and ⅓-octave filters.
**Price:** £8,330.

**1840-A**
**Type:** output power meter.
Measures from 0.1mW to 20W over range 20Hz to 20kHz with input impedance selectable from 0.6Ω to 32kΩ.
**Price:** £952.

**1381/1382**
**Type:** random noise generators.
The *1381* generates noise flat from 2Hz to 2, 5 or 50kHz with adjustable clipping, while the *1382* provides white, pink or ANSI spectras.
**Prices:** *1381* £684, *1382* £701.

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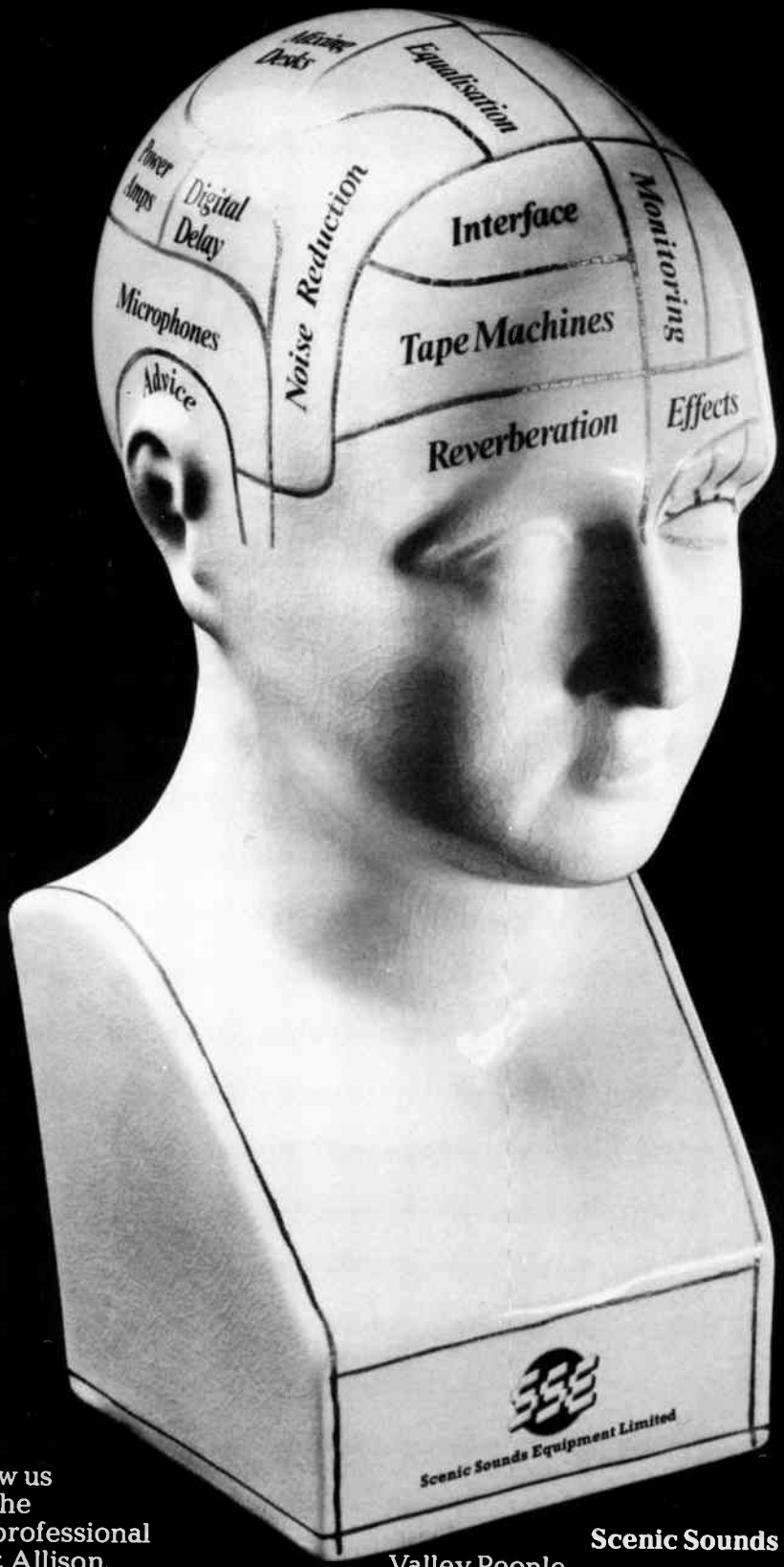
# head and shoulders above the rest for expertise in studio equipment




You probably know us as distributors of the following quality professional products:- Amber, Allison, dbx, Deltalab, Editall, Jensen, Marshall Electronic, Roger Mayer, MicMix Audio, Orban Associates, Rebis, Schoeps, 360 Systems, Valley People, White Instruments, - but what you may not know is that we are able to supply complete studio packages employing the equipment of your choice.

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27 939 SCENIC G

# SURVEY: TEST EQUIPMENT

## GOULD ADVANCE (UK)

**Gould Advance Ltd, Roebuck Road, Hainault, Essex IG6 3UE.**
**Phone: 01-500 1000. Telex: 263785.**

**J3B**
**Type:** test oscillator.
Covers 10Hz to 100kHz in four ranges, various outputs including unattenuated low distortion output with 0.2% distortion above 200Hz, other outputs 0.1%, 30V rms output.
**Price:** £355.

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## HEATH (USA)

**Heath Co, Hilltop Road, Benton Harbour, Michigan 49022, USA.**
**Phone: (616) 982-3411.**
**UK:** Heath Electronics UK, Bristol Road, Gloucester GL2 6EE.
Phone: 0452 29451. Telex: 42179.

**SG-5218**
**Type:** sine/square wave audio generator.
Generates sine and square waves from 1Hz to 100kHz (square only down to 5Hz) in four ranges with linear frequency selection. Sine distortion 0.1— from 10Hz to 20kHz, 10V p-p output, switched attenuator, —62dB to +22dB.
**Price:** £164.34, *IG5218* kit £91.30.

**SG-1272**
**Type:** low distortion audio frequency oscillator.
Generates sine waves from 5Hz to 100kHz with push button frequency selection, distortion 0.04% over range 40Hz to 20kHz, 10V output, 10–70dB attenuator.
**Price:** £167.64, */G-1272* kit £122.95.

**SM-5258**
**Type:** harmonic distortion analyser.
Measures total harmonic distortion with auto nulling, covers range 5Hz to 100kHz, ranges from 0.3% to 100%, min reading 0.03%, 3.6mV input for distortion, also acts as AC millivoltmeter with sensitivity 1mV to 300V in 12 ranges.
**Price:** £312.87, */M-5258* kit £184.05.

**SM-5248**
**Type:** intermodulation distortion analyser.
Measures intermodulation distortion using 60Hz and 7kHz frequencies, external oscillator input for different frequencies, distortion ranges from 0.1 to 100%, ac millivoltmeter can be used separately with 12 ranges from 10mV to 300V.
**Price:** £258.28, */M-5248* kit £127.52.

**ID-5252**
**Type:** audio load.
Provides loads of 2Ω, 4Ω, 8Ω, 16Ω and 32Ω depending upon how load resistors are connected across binding posts, includes test leads etc. Available loads are four 8Ω 60W, two 16Ω 120W, one 32Ω 240W, one 2Ω 240W. one 8Ω 240W.
**Price:** kit only £53.31.

*Heath SG/IG-1272*


**IR-18M**
**Type:** strip chart recorder using wide paper roll.
Allows plotting on 10in wide paper linearly scaled, 1mV or 10mV sensitivity, 12 chart speeds from 5s/in to 200min/in, pen holder accepts standard pens.
**Price:** kit only £198.50.

**SR-207**
**Type:** XY chart plotter.
Uses standard 8½ x 11in graph paper, calibrated ranges of 1mV to 1V per inch, or to 10V in variable mode, electric pen lift, balancing time less than 1s for any position, TTL remote control, uses red or blue pens.
**Price:** £569.85, */R-5207* kit £463.39.

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## HEWLETT-PACKARD (USA)

**Hewlett-Packard Corp, 1501 Page Mill Road, Palo Alto, Cal 94304, USA.**
**Phone: (415) 493-1501. Telex: 348461.**
**UK:** Hewlett-Packard Ltd, King Street Lane, Winnersh, Wokingham, Berks RG11 5AR.
Phone: 0734 784774. Telex: 847178.

**3311A**
**Type:** function generator.
Provides sine, square, triangle and pulse functions from 0.1Hz to 1MHz in 10 ranges, 3% distortion, dc offset, pulse output, 600Ω output max 10V p-p.
**Price:** £169.

**3312A**
**Type:** function generator.
Provides sine, square and triangle waveforms from the main generator from 0.1Hz to 13MHz in eight ranges, the output of which may be modulated by a second function generator covering 0.01Hz to 10kHz, the modulation being AM, FM, swept, triggered or gated. Internal sweep for main generator over two decades, dc offset, external frequency control, 10V p-p output.
**Price:** £558.

**239A**
**Type:** low distortion oscillator.
Generates 10Hz to 110kHz in four ranges with less than -95dB total harmonic distortion (0.0018%) at 20kHz, 600Ω output, 30V p-p.
**Price:** £358.

**339A**
**Type:** distortion measurement set.
Combines true rms distortion analyser, ultra low distortion oscillator and AC millivoltmeter in one package allowing distortion measurement down to 0.0018% with inputs down to 30mV over the range 10Hz to 110kHz. It features auto frequency tuning and set level, tracking oscillator, directional range and frequency indicators, hi pass and two lo pass filters, normal or VU meter characteristic.
**Price:** £1,260.

**7563A/7562A**
**Type:** log voltmeter/amplifier and voltmeter/converter.
The *7563A* provides 110dB dynamic range, positive or negative dc inputs, output scaling. Allows inputs from 0.3mV to 100V (—110 to 0dB) to be displayed logarithmically on a single range meter, or fed to a chart recorder. The *7562A* only has 80dB dynamic range (1mV to 10V) but also accepts ac signals over the range 0.5Hz to 100kHz, provides 0.25dB accuracy, switchable to cover 10mV to 100V, switchable lower frequency limit.
**Prices:** *7563A* £890, *7562A* £1,142.

**3581A**
**Type:** wave analyser.
Separates and measures the amplitude and frequency of spectral components over range 15Hz to 50kHz with 1Hz digital readout resolution, dB, dBm or volts, bandwidths down to 3Hz, 30nV sensitivity, log —150dBm or dBV to +30dBm, manual or swept frequency tuning, stimulus response testing, optional internal batteries, AFC, ext oscillator input.
**Price:** £2,283.

**3585A**
**Type:** spectrum analyser using CRT display.
Covers 20Hz to 40MHz with 3Hz minimum resolution bandwidth, synthesised tuning, up to 0.4dB accuracy, —137 to +30dBm dynamic range, 80dB spurious free dynamic range, digitally stored and refreshed trace, alphanumeric display of display parameters with tunable marker with frequency and amplitude readout.
**Price:** £11,564.

**Strip chart recorders**
**Type:** four strip chart recorders using paper roll. *680* is compact and versatile with 5in wide charts, 10 ranges from 6mV to 120V and 8 speeds from 20cm/min to 2.5cm/hr, stainless steel or disposable pens, *7155B* is similar but portable and rugged with nine hours operation on one charge, 16 ranges from 0.1mV to 10V/cm, 7 speeds, disposable pens on coated paper. *7132A* has two pens (option one) writing on 10in wide paper, 8 chart speeds, thermal or ink pens, various inputs. *7100B* series is plug-in adaptable, 10in wide paper and many options.
**Price:** *680* £1,008, *7155B* £1,497, *7132A* £1,571, *7100B* £1,483.

**7101B**
**Type:** X-Y recorder plotter.
Designed primarily for OEM with A4 or 8½ x 11in charts, autogrip feature, single input range 0.1V/in, fibre pens, manual pen lift, slewing speed 50cm/s.
**Price:** £756.

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## INOVONICS (USA)

**Inovonics Inc, 503-B Vandell Way, Campbell, Cal 95008, USA.**
**Phone: (408) 374-8300.**
**UK:** Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.
Phone: 01-580 4313. Telex: 28668.

**Model 500**
**Type:** real time ⅓-octave analyser and reverb analysis using LED matrix display.
Uses 30 ⅓-octave filters from 25Hz to 20kHz, and one wideband channel, 13-step LED matrix switchable for 0.5, 1, 2 or 3dB per step, various decays, dB-spl, dBA-spl, dBm and $RT_{60}$ measurement using 15 or 30dB decay, two separate memories, auto level function, internal pink noise generator, digital readout of reference level. Also provides decay plot for reverb.
**Price:** £1,630.

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## IVIE (USA)

**Ivie Electronics Inc, 500 West 1200 South, Orem, Utah 84057, USA.**
**Phone: (801) 224-1800. Telex: 910-971 5884.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01-953 0091. Telex: 27502.

**IE-10A**
**Type:** handheld full octave real time analyser using LED matrix display.
Battery powered, handheld 10 band full octave from 32Hz to 16kHz real time analyser with 16 step display, switchable 45, 30 or 15dB dynamic range, built-in capacitor measurement mic, display dims and graticle lights up in dim conditions, 2 hour operating time on one charge, external charger supplied, 80dB preamp, switchable to operate as sound level meter with A or C weighting. Phono connectors, optional adaptor leads. Weight 430g.
**Price:** £356.

**IE-20B**
**Type:** handheld pink and white noise generator.
Battery powered, handheld pink and white noise generator, covers 20Hz to 20kHz ±0.5dB, digitally generated with word length greater than 2bn bits, x 12 hour operating on one charge, external charger

60 ▶

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

A unique tandem-function logic network provides simultaneous command and status indication of both console and multi-track electronics. The most sophisticated studio software yet developed brings valuable computer assistance to recording and overdubbing as well as mixing. Comprehensive in-line signal processors, coupled with innovative signal routing, provide virtually unlimited control of your audio without patching!

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

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

# Solid State Logic

## Master Studio Systems


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Colin Sanders
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TLX 837400

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

supplied, weight 200g. Attenuation to —58dBm.
**Price:** £144.

**IE-15A**
**Type:** handheld distortion analyser and oscillator for use with external meter.
Battery powered, handheld, contains a switchable 1 or 4kHz oscillator with output 1mV to 1V, and analyser with 90dB rejection at 1kHz, and measuring distortion from 0.01 to 100% with 80dB dynamic range for inputs from 160mV to 100V (for amplifiers). *IE-10A* may be used to display distortion value with special scale, or a separate meter used. 12 hours operating on one charge, external charger.
**Price:** £197.

**IE-30A**
**Type:** handheld ⅓-octave real time spectrum analyser using LED matrix display, and precision sound level meter.
Battery powered, handheld 30-band ⅓-octave from 25Hz to 20kHz analyser using LED matrix with 16 steps, and switchable 15, 30 or 45dB dynamic range, also displays octaves, or weighted ⅓-octaves. Reference level selectable and displayed on LEDs, switchable decay including peak holding, two memories (non-volatile for storage), precision sound level meter operates simultaneously with direct LED readout in 0.1dB resolution of dB spl and dBμV, digital hold, fast, slow, impulse and peak readings, A, C or flat weightings. Supplied with electret measuring microphone, 3 hours operation from one charge, external charger, automatic display intensity with control panel illumination in dim conditions. Output connector for scope, voice prints or chart recorder. Optional interface leads and probes.
**Price:** £2,263.

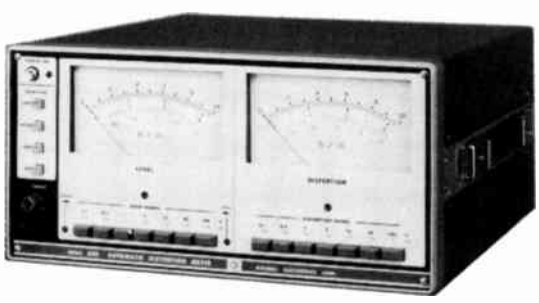
**IE-17A**
**Type:** handheld microprocessor audio analyser, accessory for *IE-30A*.
Accessory which clips onto *IE-30A*, and which allows reverberation time to be measured for full and ⅓-octaves, also displays reverb plots (on the *IE-30A*), and provides tracking filters. Measures room relays, frequency marker to provide 0.1dB measurements from any band on the *IE-30A*, tone burst and auto gating, automatic plotting on chart or X-Y recorders. Takes power from *IE-30A*.
**Price:** £997.

## KENWOOD (Japan)

**US:** Kenwood Electronics Inc, 75 Seaview Drive, Secacus, New Jersey 07094.
Phone (201) 863-5600.
**UK:** BH Morris & Co (Radio) Ltd, Precision Centre, Heatherpark Drive, Wembley, Middx HA0 1SU.
Phone: 01-902 9422. Telex: 922131.

**SE-9000**
**Type:** suitcase mounted acoustic measuring system with chart recorder.
Contains four basic sections, chart recorder, level meter, signal generator and reverberation meter. Signal generator provides man or sweep 20Hz to 20kHz, or spot frequencies with less than 2% distortion, 3V output. Level meter has line input for —60dB to +20dB, and mic input, A weighted 60dB to 120dB spl, built-in eq for B&K test records, Reverb meter allows measurements at different frequencies, auto average value after five tests, ranges to 1 or 2s. Chart recorder uses thermal paper 80mm wide, switchable ranges and speeds. Includes electret mic. Mains powered.
**Price:** on application.

*Kikusui 630*



## KIKUSUI (Japan)

**Kikusui Electronics Corp, 3-1175 Shinmaruko Higashi, Nakahara-Ku, Kawasaki City, Japan.**
**Phone: 044 411-0111. Telex: 3842678.**
**UK:** Telonic Berkeley UK, 2 Castle Hill Terrace, Maidenhead, Berks SL6 4JR.
Phone: 0628 28057. Telex: 849131.

**4045**
**Type:** low distortion oscillator.
Covers 5Hz to 500kHz in five ranges, with sine or square wave outputs, 0.01% distortion from 150Hz to 15kHz, 5V rms output.
**Price:** £303.

**458A**
**Type:** function generator.
Generates sine, square and triangle waveforms, covering 0.01Hz to 100kHz in seven ranges, output 30V p-p, 0.6% distortion 20Hz to 30kHz.
**Price:** £385.

**462**
**Type:** sweep generator.
Covers 2Hz to 200kHz in a single sweepable range, sine wave output, 0.6% distortion.
**Price:** £730.

**1631A**
**Type:** ac millivoltmeter.
Cover 0.1mV to 300V in 14 ranges, —80dB to +50dB with a response from 20Hz to 200kHz.
**Price:** £156.

**6702**
**Type:** wow and flutter meter.
Measures with either 3,000 or 3,150Hz, input level 0.1mV to 10V, digital indication of wow and flutter, tape speed, frequency counter and frequency ratio, memory function built-in, selection of integration time. Measuring range 0.002% to 3% in six ranges.
**Price:** £590.

**677C**
**Type:** wow and flutter meter.
Measures with either 3,000 or 3,150Hz, input level 5mV to 10V, digital tape speed indication, measures 0.005% to 3% in four ranges.
**Price:** £535.

**630**
**Type:** automatic distortion meter.
Measures distortion at 400Hz and 1kHz (or with external filter), measures 0.1% to 30% in six ranges, auto level setting, level meter 10mV to 100V with response from 20Hz to 100kHz, separate meters for level and distortion.
**Price:** £372.

**860**
**Type:** withstanding voltage and insulation resistance tester.
Applies test voltage of 0 to 2.5kV or 5kV at max of 100mA, leak current detection, manual/timer test from 0.5s to 10s. Resistance ranges 200kΩ to 250MΩ at 500V dc, or 500kΩ to 500MΩ at 1,000V dc.
**Price:** £888.

## KLARK-TEKNIK (UK)

**Klark-Teknik Research Ltd, Walter Nash Road West, Coppice Trading Estate, Kidderminster, Worcs DY11 7HS.**
**Phone: 0562 741515. Telex: 339821.**
**USA:** Hammond Inc, 155 Michael Drive, Syosset, NY 00791.
Phone: (516) 346-1900. Telex: 961396.

**DN60**
**Type:** realtime ⅓-octave spectrum analyser LED matrix display.
Uses 30 bands from 25Hz to 20kHz on ⅓-octave intervals, 16-steps providing 15dB or 31dB steps, internal pink noise generator, three memories, microprocessor controlled, peak and average reading, three time constants, sound pressure level readout on 31st band, peak hold facility, mic or line inputs with phantom powering, variable intensity display, optional $RT_{60}$ facility, optional outputs for plotter and scope.
**Price:** £895, $RT_{60}$ option about £150.

## LEADER (Japan)

**Leader Electronics Corp, 2-6-33 Tsunashima Higashi, Kohoku-Ku, Yokohama 223, Japan.**
**Telex: 47780.**
**UK:** Cybervox Ltd, 105/109 Oyster Lane, Byfleet, Surrey KT14 7JH.
Phone: 09323 51051. Telex: 262525.
**UK:** Martron Ltd, 20 Park Street, Princes Risborough, Bucks.
Phone: 08444 4414. Telex: 837979.

**LAS-5500**
**Type:** audio system analyser containing signal generator, attenuator, ac millivoltmeter, dummy load, wow and flutter meter and oscilloscope.
The oscillator covers 10Hz to 1MHz in five ranges with 0.05% distortion from 500Hz to 20kHz, the attenuator covers 0 to 101dB in 0.1dB steps, the ac meter 30μV to 100V in 12 ranges, the dummy load is 8Ω at 50W, the wow and flutter and drift meter operates at 3,000Hz and 3,150Hz with down to 15mV level and measurements down to 0.03% with five ranges. The scope has a 5MHz bandwidth, with a sweep frequency from 10Hz to 100kHz.
**Price:** £930.

**LAV-191**
**Type:** audio tester with signal generator and ac millivoltmeter.
The sine and square wave generator covers 10Hz to 1MHz in five ranges, with 0.05% distortion from 500Hz to 20kHz, while the ac meter covers —80 to +56dB with 10Hz to 1MHz bandwidth.
**Price:** £287.

**LFR-5600**
**Type:** frequency response chart recorder with sweep oscillator.
Chart recorder has bandwidth of 20Hz to 30kHz with four response speeds, three chart speeds, writing pen on 73mm wide paper, sweep oscillator 20Hz to 30kHz.
**Price:** £1,380.

**LEA-5610**
**Type:** equalising amplifier for *LFR-5600*.
Provides 40dB amp, and either linear or B&K eq for cartridges.
**Price:** £271.

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*Leader LFM-39*

# Now, for the first time, you can play any cards.


# And win.

**Introducing the TTM 24-track Frame.**

The world's only multi-track frame that can accept all the noise reduction cards on the market today.

And using only 12¼ inches (310 mm) of rack space—including the silent-fan equipped power supply.

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## SURVEY: TEST EQUIPMENT

**LDM-170**
**Type:** distortion meter.
Includes signal generator covering 20Hz to 20kHz in three ranges with 0.03% distortion, provides measurement of distortion from 0.3% to 100%, and measures noise to 70dB below reference level, hi pass filter.
**Price:** £232.

**LFM-39A**
**Type:** wow and flutter meter.
Two versions for either 3,000Hz (JIS, CCIR) or 3,150Hz (DIN) to measure wow and flutter down to 0.03% with input voltage down to 15mV.
**Price:** CCIR £325, DIN £340.

**LFM-30**
**Type:** tape speed checker.
Uses operating frequencies from 1 to 9kHz to measure speed or drift with ±3% indication.
**Price:** £87.

**LAG-26**
**Type:** audio generator.
Signal generator covering 20Hz to 200kHz in four ranges, distortion 0.5% 200Hz to 20kHz, sine and square waves.
**Price:** £64.

**LAG-125**
**Type:** low distortion audio generator.
Signal generator covering 10Hz to 1MHz in five ranges with 0.03% distortion from 500Hz to 20kHz, sine and square wave outputs.
**Price:** £255.

**LMV-182A**
**Type:** ac millivoltmeter.
Covers frequency range 5Hz to 1MHz, measures —90 to +42dB, or 30μV to 100V in 12 ranges.
**Price:** £125.

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### LEVELL (UK)
**Levell Electronics Ltd, Moxon Street, Barnet, Herts EN5 5SQ.**
**Phone: 01-440 8686/449 5028.**

**TG152**
**Type:** RC oscillator.
Generates sine and square waves from 3Hz to 300kHz in five ranges with 0.2% distortion from 50Hz to 50kHz, 7V p-p output.
**Prices:** with meter £92, without £74.

**TM3A/B**
**Type:** ac microvoltmeters.
Cover bandwidth 1Hz to 3MHz and measure —100 to +50dB or 15μV to 100V in 16 ranges.
**Price:** *TM3A* 83mm scale £175, *TM3B* 127mm scale £189.

**TM14**
**Type:** Insulation tester.
Measures resistances in the range 10kΩ to 10TΩ using test voltages from 1V to 1,000V in 11 ranges, and current from 100pA to 100μA. Battery powered.
**Price:** £155.

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### LINDSAY (UK)
**Lindsay Electronics Ltd, Ifton Hill House, Portskewett, Newport, Gwent NP6 4TT.**
**Phone: 0291 420517.**
**UK:** Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA.
Phone: 01-734 2812. Telex: 27939.

**Model 7634**
**Type:** realtime ⅓-octave spectrum analyser using LED matrix display.
Provides 27 ⅓-octave bands from 40Hz to 16kHz, with a 10 step LED matrix with 10 or 20dB display ranges, flat or A weighted, over range indication on each band, fast or slow decay, mic and line inputs, mic input displayed directly in dB spl for level measurement, two memories, internal noise generator, overload indicators.
**Price:** £1,600.

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### LYONS (UK)
**Lyons Instruments Ltd, Ware Road, Hoddesdon, Herts EN11 9DX.**
**Phone: 09924 67161. Telex: 22724.**

**SQ10**
**Type:** sine/square oscillator.
Generates sine and square waveforms from 10Hz to 1MHz in five decade ranges, 10V p-p output, distortion 0.1% 50Hz to 100kHz, typically 0.05%.
**Price:** £163.

**D10**
**Type:** distortion meter.
Covers 0.3% to 10% in four ranges, tunable over band 10Hz to 100kHz in four ranges, manual nulling, input level 200mV to 5V.
**Price:** £198.

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### MARCONI (UK)
**Marconi Instruments Ltd, Longacres, St Albans AL4 0JN.**
**Phone: 0727 59292. Telex: 23350.**
**USA:** Marconi Electronics Inc, 100 Stonehurst Court, Northvale, New Jersey 07647.
Phone: (201) 767-7250. Telex: 710-991 9752.

**TF2000**
**Type:** af signal source.
Covers 20Hz to 20kHz in six bands with 0.1% distortion (0.05% from 63Hz to 6.3kHz), three decade 111dB in 0.1dB step monitored attenuator, bal or unbal output.
**Price:** £850.

**TF2005R**
**Type:** two tone signal source.
Basically similar to *TF2000*, but two identical oscillators with a single monitored attenuator. May be used separately or together for intermodulation measurements.
**Price:** £1,200.

**TF2102M**
**Type:** af oscillator.
Basically similar to *TF2000*, but no stepped attenuator, and range from 3Hz to 30kHz in four bands.
**Price:** £375.

**TF2330A**
**Type:** wave analyser.
Covers range 20Hz to 76kHz, measures amplitude of individual frequency components, suitable for FM stereo encoded signals, and also harmonics, 7Hz bandwidth for closely spaced components, 15 ranges of sensitivity from 30μV to 300V, auto frequency control to lock analyser to selected frequency.
**Price:** £1,700.

**TF2331A**
**Type:** distortion factor meter.
Covers range 20Hz to 20kHz, input frequencies to 100kHz, measures distortion and noise from less than 0.05%, weighting filter, noise measurements to —72dBm. Manual nulling.
**Price:** £750.

**TF2337A**
**Type:** automatic distortion meter.
Separate meters for level and distortion, fixed fundamental frequencies of 400Hz and 1kHz, distortion measurement from 0.01% to 30% in six ranges, input levels 100mV to 100V.
**Price:** about £550.

**TF893A**
**Type:** af power meter.
Measures 1mW to 10W in five ranges over frequency range 20Hz to 20kHz, impedance 2.5Ω to 20kΩ in 48 steps, bal or unbal, direct calibration in watts and dBm.
**Price:** £360.

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### MJS ELECTRONICS (UK)
**MJS Electronics, 27 Walnut Close, Yately, Camberley, Surrey GU17 7DA.**
**Phone: 0252 871401.**

**Model 401**
**Type:** noise and level test set.
Measures noise to the IBA 'code of practice' using either standard PPM 1-7 scale, or special dBm and V calibrated scale, measures audio level from —90 to +30dBm, or 30μV to 30V, switchable in 10 and 1dB steps, input level accuracy ±0.05dB on 10dB steps, and ±0.02dB on 1dB steps, equivalent input noise 30kHz bandwidth —115dB rms, —112dB peak, input filter, hi and lo pass filters, CCIR filter, external filter sockets, phones output, normal PPM scale (with 4dB between divisions) or expanded scale (with 0.5dB between divisions).
**Price:** £585.

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### 3M/MINCOM (USA)
**3M Mincom Division, 3M Centre, St Paul, Minnesota 55101, USA.**
**Phone: (612) 733-1110.**
**UK:** 3M UK Ltd, PO Box 1, Bracknell, Berks RG12 1JU.
Phone: 0344 26726. Telex: 849371.

**Model 6155A**
**Type:** wow and flutter meter.

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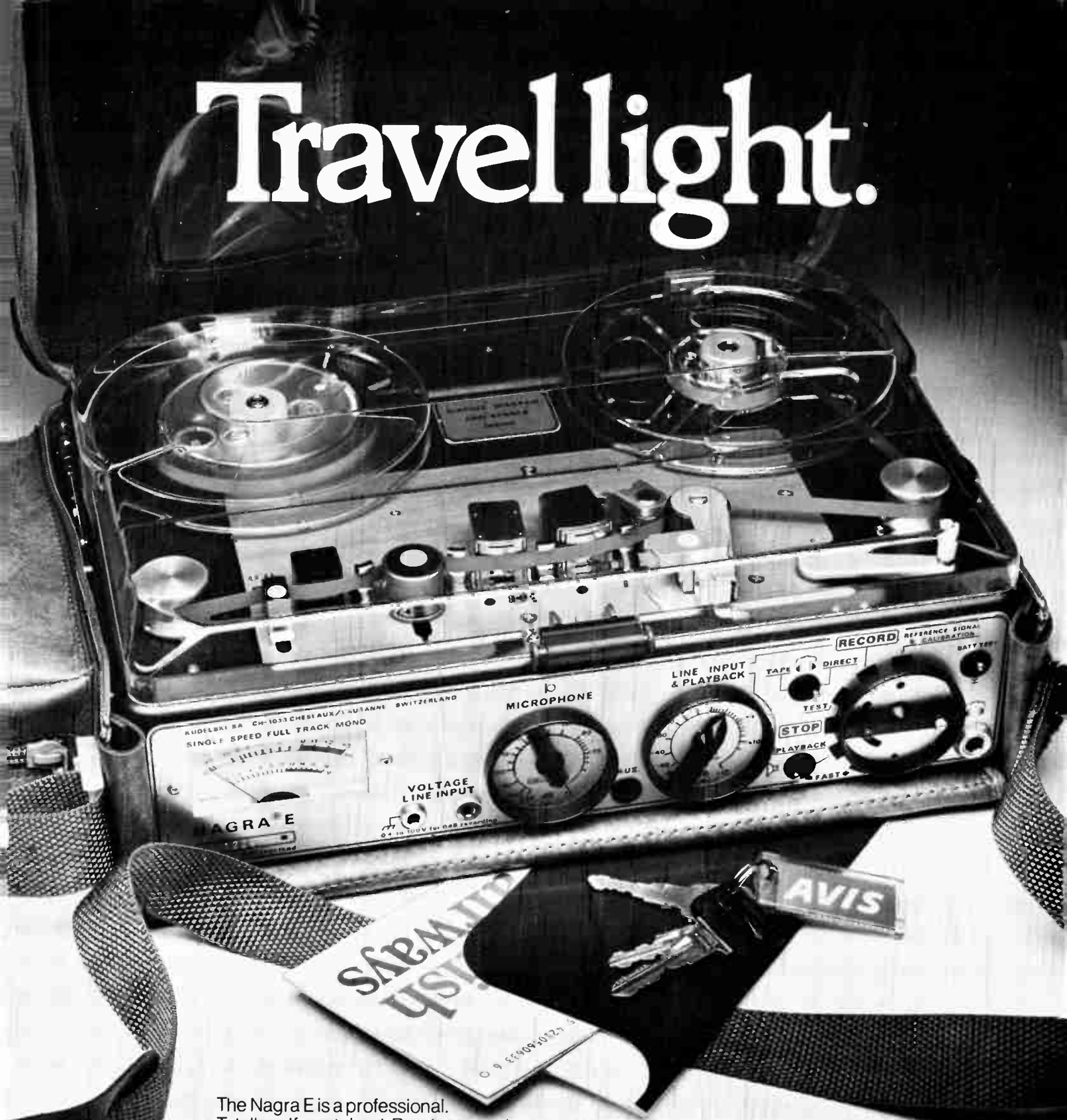
# Travel light.




The Nagra E is a professional.

Totally self-contained. Ready to travel anywhere, anytime.

The 'E' has all the proven characteristics of Nagra high performance, quality and accuracy.

Add to these, simplicity of operation, a useful range of accessories, a smart leather carrying case (complete with microphone pocket) and you will see that your lightweight travelling companion is no lightweight recorder.

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Exclusive UK Agent

Hayden Laboratories Limited,
Hayden House, Churchfield Road,
Chalfont St Peter, Bucks.
Telephone: Gerrards Cross 88447.
Telex: 849469.

## SURVEY: TEST EQUIPMENT

Measures with 3,000, 3,150 and 1,000Hz tones, input level 100mV min, six ranges from 0.03% to 10%, rms (NAB) or peak (IEEE/DIN).
**Price:** £730.

**Model 8100A-W**
**Type:** audio wow and flutter meter.
Measures with 3,000Hz tone, input level 5mV min, six ranges from 0.03 to 10% flutter, drift measurement and wave analyser from 0.5 to 600Hz tunable in three decade bands.
**Price:** £2,535.

**Model 610A**
**Type:** wideband sweep generator.
Provides single continuous frequency sweep from 400Hz to 2.2MHz and is ideal for alignment of high speed duplication equipment.
**Price:** £1,218, various options.

**Model 6100**
**Type:** audio test set including sine wave generator, ac millivoltmeter and wave analyser for distortion measurement.
Signal generator covers 10Hz to 10MHz in six decade ranges with 0.2% distortion from 100Hz to 500kHz, while the meter reads 1mV to 30V in 10 10dB steps, The wave analyser measures 2nd and 3rd harmonic distortion.
**Price:** £4,830.

### NEPTUNE (USA)
**Neptune Electronics Inc, 934 NE 25th Avenue, Portland, Oregon 97232, USA.**
**Phone: (503) 232-4445.**
**UK:** Court Acoustics Ltd, 35/39 Britannia Row, London N1 8QH.
Phone: 01-359 0956/5275. Telex: 268279.

**Model 2709**
**Type:** realtime ⅓-octave spectrum analyser using LED matrix display.
Uses 27 ⅓-octave bands from 40Hz to 16kHz, with nine steps per band switchable 1 or 3dB per step, internal pink noise generator, lo and hi imp inputs.
**Price:** £659.40.

### NEUTRIK (Liechtenstein)
**Neutrick AG, FL-9494 Schaan, Liechtenstein.**
**Phone: 075 263.83. Telex: 77771.**
**UK:** Eardley Electronics Ltd, Eardley House, 182–184 Campden Hill Road, London W8 7AS.
Phone: 01-221 0606. Telex: 299574.
**USA:** Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, New Jersey 07430.
Phone: (201) 529-3800.

**3201 Audiotracer**
**Type:** portable automatic level recorder.
Comprises a voltage controlled oscillator covering either 20Hz to 20kHz, or 200Hz to 200kHz, with 0.5% distortion from 200Hz to 5kHz, warble tone modulator with 5Hz swing. Input amplifier has 5mV sensitivity, switchable ranges for linear, 25 or 50dB, three writing speeds, variable paper speed, thermosensitive recording paper, pen lift, mains powered.
**Price:** £825, mic £36.80.

### PHILIPS (Netherlands)
**Philips, Eindhoven, Netherlands.**
**Phone: 040 791111. Telex: 511121.**
**UK:** Pye Unicam Ltd, York Street, Cambridge CB1 2PX.
Phone: 0223 358866. Telex: 817331.
**USA:** Philips Test and Measuring Instruments Inc, 85 McKee Drive, Mahwah, New Jersey 07430.
Phone: (201) 529-3800.

**PM8202/22**
**Type:** single and two pen chart recorders.
Uses stepper motor, input sensitivity 1mV to 50V, 11 chart speeds, 0.25s response over 250mm width of chart, nylon pen cartridge.
**Prices:** *PM8202* £735, *PM8222* £1,180.

**PM8110**
**Type:** portable single line chart recorder.
120mm chart width, two speeds, battery operated, 10mV to 100V input, nylon pen cartridge.
**Price:** £395.

**PM8131/32**
**Type:** single and dual pen XY chart recorders.
0.25% accuracy, vector speed 1m/s, 50μV sensitivity, disposable nylon cartridges, pen lift, zero suppression.
**Prices:** *PM8131* £1,580, *PM8132* £2,250.

**PM5107**
**Type:** low frequency generator.
Generates sine and square waves from 10Hz to 100kHz in four ranges, 20dB attenuator, portable.
**Price:** £250.

**PM5165**
**Type:** low frequency sweep generator.
Generates sine, square and triangle waveforms, covers four decades in each sweep, selectable from 0.1Hz to 1MHz, variable sweep width and speed, also internal sawtooth generator covering four decades. Digital frequency display, pen lift output.
**Price:** £695.

**PM6307**
**Type:** wow and flutter meter.
Operates with 3,000 or 3,150Hz tones, crystal controlled, separate drift and flutter indications.
**Price:** £345.

### PYRAL (France)
**Pyral SA, 47 rue de l'Echat, F-94001 Creteil Cedex, France.**
**Phone: (1) 207.48.90. Telex: 230742.**
**UK:** Pyral Magnetics Ltd, Airport House, Purley Way, Croydon CR0 0XZ.
Phone: 01-681 2833. Telex: 946670.
**USA:** Gotham Audio Corp, 741 Washington Street, New York, NY 10014, USA.
Phone: (212) 741-7411. Telex: 129269.

**ASA3**
**Type:** real time ⅓-octave analyser using bargraph displays.
Displays 28 ⅓-octave bands from 40Hz to 20kHz, gives 0.25dB resolution on 25dB scale with bargraph displays, two memories, option for pink noise generator or sine sweep generator. 25dB or 50dB ranges.
**Price:** on application.

### RE (Denmark)
**Radiometer Electronics A/S, Frederikssundsvej 254, DK-2700 Bronshoj, Denmark.**
**Phone: 01 80.12.11. Telex: 22211.**

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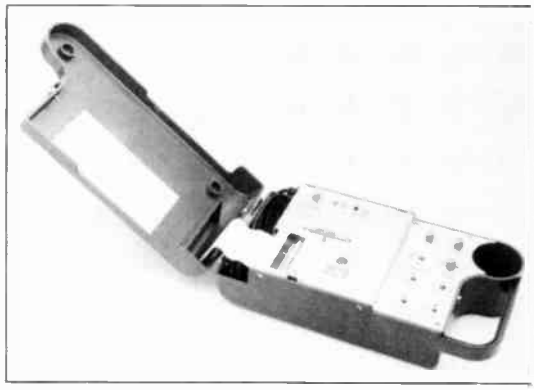
*Neutrik 3201*



# Why Amcron is demanding protection money.

Over the years, Amcron has earned a peerless reputation as a pioneer in professional sound.

Amcron built the first solid-state four-channel tape recorder back in 1962. Then they developed the first stereo amplifier with direct coupled input and output.

In 1977, they introduced digital logic to the pre-amplifier and achieved another first.

But Amcron's latest first is probably the most significant of all.

The PSA-2 power amplifier is self-protecting.

A Self-Analysing circuit employs an analogue computer which constantly monitors the performance of the amplifier's critical stages.

Should the power transformer begin to overheat, an output transistor fail, or a short circuit occur, then the amplifier will automatically shut down to its 'stand-by' mode without damage to itself or to external equipment.

The protection circuitry also safeguards the PSA-2 against 'chain destruction' and damage caused by mis-matched loads.

As Dr. Mark Sawicki observed in his review of the PSA-2:

"When reading reports of systems used by The Who, McCartney and Genesis...the Amcron name appears frequently...Why?

Well, reliability and outstanding performance are the answers.

Overall, the performance of the PSA-2 amplifier...is excellent."

Now. Given that you're spending a lot of money on a power amplifier (arguably the most crucial piece of equipment in your system), doesn't it make sense to spend a little more on a unit which is virtually disaster-proof? We think so.


Which is why we went all out to win the sole British agency for the PSA-2. And, indeed, the whole range of Amcron audio equipment.

Drop in and see us anytime. We'll be delighted to give you an earfull.

HHB HIRE AND SALES

HHB HIRE AND SALES, UNIT F, NEW CRESCENT WORKS, NICOLL ROAD, LONDON, NW10 9AX. TEL. 01-961 3295, TELEX 923393.

## SURVEY: TEST EQUIPMENT

**USA:** Radiometer Electronics US Inc, 811 Sharon Drive, Cleveland, Ohio 44145, USA.
Phone: (216) 871–7617.

**RE402**
**Type:** wow and flutter meter.
Uses crystal controlled oscillator with 3,000 or 3,150Hz, digital display of drift in % with 0.01% accuracy, sensitivity 3mV, six ranges for flutter covering 0.03 to 10%, DIN, NAB and JIS standards.
**Price:** on application.

**RE403**
**Type:** wow and flutter analyser using LED matrix display.
Provides real time frequency analysis of wow and flutter using digital filter equivalent to 30 ⅓-octaves over range 0.2 to 200Hz with 10 steps in each band providing 20dB dynamic range.
**Price:** on application.

### RCF (Italy)
**Radio Cine Forniture, Via Notari 1a, I-42029 S. Maurizio, Italy.**
**Phone: 0522 40141/33346.**
**UK:** Covemain Ltd, Dunchurch Trading Estate, London Road, Dunchurch, Rugby CV23 9LL.
Phone: 0788 815020.

**AFSA1**
**Type:** real time ⅓-octave spectrum analyser using LED matrix display.
Uses 27 ⅓-octave bands from 40Hz to 16kHz, providing 12 steps (three colour to provide level indication) with total 24dB dynamic range, +3 to –4dB in 1dB steps, then four steps to –20dB. Internal pink noise generator, stereo line inputs.
**Price:** £800.

### SENNHEISER (West Germany)
**Sennheiser Electronic, D-3002 Wedemark 2, West Germany.**
**Phone: 05130 8011. Telex: 0924623.**
**UK:** Hayden Laboratories Ltd, Hayden House, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW.
Phone: 02813 88447. Telex: 849469.
**USA:** Sennheiser Electric Corp, 10 West 37th Street, New York, NY 10018.
Phone: (212) 239–0190. Telex: 421608.

**UPM550**
**Type:** universal level meter.
Covers bandwidth 10Hz to 1MHz with 15 ranges to measure –98 to +52.5dBm. Includes peak or rms rectification, and a variety of weighting filters: 1,000Hz, CCIR weighted noise, DIN audio range, CCITT weighted noise, DIN weighted noise (A filter) and space for two extra filters including 1967 DIN noise, rumble weighting, rumble noise weighting, telephone weighting, FM radio weighting filter, and several others.
**Price:** £510.

**ZP-2**
**Type:** impedance tester.
Portable, battery operated impedance tester for speakers, tape heads, microphones etc, uses frequencies of 250Hz, 1 and 4kHz, measures 1Ω to 1MΩ in 12 ranges.
**Price:** on application.

### SOLIDYNE (Argentina)
**Solidyne SRL, Tres de Febrero 3254, 1429 Buenos Aires, Argentina.**
**Phone: 701-8622.**

**900A**
**Type:** audio frequency generator.
Covers 15Hz to 150kHz in four ranges, distortion 0.005% between 15Hz and 20kHz, attenuator provides –100 to +12dBm.
**Price:** on application.

### SOUND TECHNOLOGY (USA)
**Sound Technology, 1400 Dell Avenue, Campbell, Cal 95008, USA.**
**Phone: (408) 378-6540. Telex: 357445.**
**UK:** Cybervox Ltd, 105–107 Oyster Lane, Byfleet, Surrey KT14 7JH.
Phone: 09323 51051. Telex: 262525.

*Sennheiser UPM550*

**1500A**
**Type:** tape recorder test system with CRT display.
Microprocessor controlled system that provides displays on CRT including explanatory alphanumerics, optional hard copy. Measures frequency response, 2nd and 3rd harmonic distortion relative to record level, wow and flutter, wow and flutter spectral components, noise and noise spectrum, speed accuracy and drift, channel separation v frequency, head azimuth accuracy. Noise measurement is to NAB, ANSI or CCIR/ARM, flutter to NAB, JIS or DIN/ANSI. Automatic measuring, with left and right channels.
**Price:** £2,995.

**1410A/1400A**
**Type:** ultra low distortion signal generator.
Push button tuned over range 10Hz to 110kHz with 0.001% distortion, output variable from –90 to +26dBm in 0.1dB steps. Provides both sine and SMPTE IM signal.
**Price:** £1,150. *1400A* similar but no IM output or dB attenuators, only variable voltage 1mV to 3V, £540.

**1700B**
**Type:** distortion measurement system.
Push button tuned oscillator over range 10Hz to 110kHz, fully automatic nulling, measures 30μV to 300V, provides distortion measurement down to 0.002% in 5s, measures power across 8Ω. Options for automatic set level when measuring distortion, IM distortion analyser and switch selectable meter response.
**Price:** £1,305.

**1701A**
Similar to *1700B* but lower residual distortion and noise, average or true rms, or peak meter reading, 6V output, 10dB/step attenuator.
**Price:** £1,650.

**1710A**
Basically similar to *1700B*, but oscillator output adjustable from –89.9 to +26dBm in 0.1dB steps, sensitivity 100μV to 100V, measures power —80dBm to +40dBm, balanced inputs.
**Price:** £1,865.

### JE SUGDEN (UK)
**JE Sugden & Co Ltd, Carr Street, Cleckheaton, West Yorkshire BD19 5LA.**
**Phone: 0274 872501.**

**453**
**Type:** signal generator.
Covers 13Hz to 30kHz in six ranges, 0.05% distortion at 1kHz, sine and square waves, fine and course attenuator, RIAA equalised output, battery operated.
**Price:** £78.

**451**
**Type:** ac millivoltmeter.
Provides five ranges from 1mV to 200V selected by both range and scale switches, response 20Hz to 100kHz, battery operated.
**Price:** £78.

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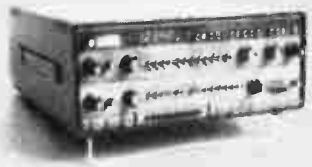
# Amber 4400A: top studio performer.

AMBER 4400A MULTIPURPOSE AUDIO TEST SET. Designed for an industry where time is money, and maintaining top performance is essential. It saves you time by integrating virtually every test and measurement function you could need. It cuts setup time, and assures quality equal to or exceeding competitive equipment, but at a fraction of the cost.
With your oscilloscope, the Amber 4400A can plot the frequency response of a tape recorder or monitor system; measure the weighted noise of a console; plot the phase response of an equalizer or check the transient behaviour of a speaker; tune your room or measure the $RT_{60}$ of your studio. Optional interface lets you make hard copy plots with any XY recorder.
The Amber 4400A combines versatility with quality. It integrates sine, function, sweep, tone burst and noise generator; autoranging digital dBm meter and frequency counter; multimode filter; spectrum analyser; frequency response and phase response plotter.



**The Amber 4400A lets you make sure your product is always at its best.**

UK Distributors
**Scenic Sounds Equipment**
97-99 Dean Street, London W1V 5RA
Telephone : 01-734 2812

Amber Electro Design Ltd.
4810 Jean Talon West
Montreal Canada H4P 2N5
Telephone (514) 735 4105

**amber**

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# THE LINDSAY AUDIO SPECTRUM ANALYSER 7634

- 27 1/3 octave I.S.O. bands (40Hz-16KHz).
- 1/3 octave filters meet specifications of ANSI S1.11-1971 Class II and I.E.C. 225-1966.
- Flat or "A" weighted broad band channel.
- Slow, "VU" or "PPM" time constants.
- 28 x 11 L.E.D. display.
- 10dB or 20dB display ranges.
- Display shift facility increases dynamic range to 40dB.
- Over-range indication on each channel.
- Microphone and line inputs transformer coupled (balanced and floating).
- Microphone input displayed in dB SPL directly.
- Internal calibration facility.
- Gain range of 70dB.
- Overload limit indicators for input and gain.
- Internal noise generator, low impedance balanced output.
- 2 independent memories, each with hold, accumulate and erase functions.
- 19" rack mounting.
- Sync and video outputs.

**LINDSAY** LINDSAY ELECTRONICS LTD.,
Ifton Hill House, Portskewett, Gwent.

Sales and export enquiries to:
**Scenic Sounds Equipment,**
**97-99 Dean Street, London W.1.**
**Tel: 734 2812**

**452**
**Type:** distortion measuring unit.
Input sensitivity 300mV to 3V, notch tunable over 15Hz to 20kHz, manual tuning of notch filter for null, lf cut filter. Requires external oscillator and millivoltmeter.
**Price:** £63.

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## TEKTRONIX (USA)
**Tektronix Inc, PO Box 500, Beaverton, Oregon 97077, USA.**
**Phone: (503) 644-0161. Telex: 910-467-8708.**
**UK:** Tektronix UK Ltd, Beaverton House, PO Box 69, Harpenden, Herts.
Phone: 05827 63141. Telex: 25559.

**AF501**
**Type:** bandpass filter/amplifier in *TM500* plug-in system.
Tunable bandpass filtering 3Hz to 35kHz, sine wave generation to 35kHz, up to 500x gain amplifier.
**Price:** on application.

**SG505**
**Type:** oscillator in *TM500* plug-in system.
Covers 10Hz to 100kHz sine wave, ultra low distortion of 0.0008% from 20Hz to 20kHz, calibrated output +10dBm to –60dBm.
**Price:** on application.

**SG502**
**Type:** oscillator in *TM500* plug-in system.
Covers 5Hz to 500kHz in sine and square waves, distortion 0.035% 20Hz to 50kHz, 0–40dB variable attenuator, stepped 0–70dB.
**Price:** on application.

**5L4N**
**Type:** spectrum analyser using CRT display.
Covers range 20Hz to 100kHz, dynamic range on screen 80dB, auto resolution, built-in tracking generator, 20Hz to 20kHz log sweep, may be plugged into any *5000* series/oscilloscope mainframe.
**Price:** on application.

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## UREI (USA)
**United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352, USA**
**Phone: (213) 767-1000. Telex: 651389.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.
Phone: 01–953 0091. Telex: 27502.

**Model 200**
**Type:** XY plotter.
*Model 200* is mainframe co-operately designed by UREI and Hewlett-Packard, and accepts *2000* series electronic modules for various applications. Uses electrostatic paper holddown for A4 or 8½ x 11in graphs, disposable or felt tip pens, vertical range 1V/in, horizontal 0.1V/in, 20in/s slewing speed.
**Price:** £1,077.

**Model 2000**
**Type:** frequency response module for *Model 200* plotter.
Provides 20Hz to 20kHz sweep, 64dB dynamic range, 0.05dB resolution, auto or manual frequency control, pen lift, four sweep times, four vertical ranges from 1 to 10dB/in. 50mV sensitivity.
**Price:** £868.

**Model 2010**
**Type:** level and frequency detector module for *Model 200* plotter.
Provides level plotting with 50mV rms sensitivity, and frequency plots over range 20Hz to 20kHz.
**Price:** £927.

**Model 2020**
**Type:** dc input module for *Model 200* plotter.
Provides sensitivity of 0.1, 1 and 10V/in, pen lift.
**Price:** £202.

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## WAYNE KERR RADFORD (UK)
**Wilmot Breeden Electronics Ltd, Durban Road, Bognor Regis, West Sussex PO22 9RL.**
**Phone: 0243 825811. Telex: 86120.**

**ANM3/ANM4**
**Type:** noise meters.
*ANM3* reads switchable quasi-peak or true rms, while the *ANM4* is average responding with modified CCIR filter. Sensitivity of both is selectable in 16 ranges from –100dBm to +50dBm. Weightings on the *ANM3* includes DIN audio band, IEC A curve and CCIR.
**Prices:** *ANM3* £350, *ANM4* £275.

**RA200/ADS1**
**Type:** frequency response analyser using large CRT display to show curves directly.
Includes variable sweep generator with settable limits and rate, various sweep modes, x1, x2.5 and x5 vertical scale on the large CRT display, variable output and input levels, graticle giving scales. *ADS1* is an optional display store that allows four different curves to be stored and simultaneously displayed.
**Prices:** *RA200* £1,950, *ADS1* £900.

**LDO4/5**
**Type:** low distortion oscillators.
Cover range 10Hz to 100kHz in four ranges, attenuator control for outputs from –80dB to +20dB, sine or square waves, distortion 0.0003% for *LDO4* and 0.001% for *LDO5*. Former is mains powered with 10V output, latter battery with 3V output.
**Prices:** *LDO4* £450, *LDO5* £325.

**DMS4/5**
**Type:** distortion measuring sets.
Used in conjunction with *LDO4/5*, the *DMS4/5* allow harmonic distortion to be measured, the former down to 0.0003%, the latter 0.001%, both are battery operated. Cover range 5Hz to 50kHz with manual nulling.
**Prices:** *DMS4* £450, *DMS5* £375.

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## WHITE (USA)
**White Instruments Inc, PO Box 698, Austin, Texas 78767, USA.**
**Phone: (512) 892-0752.**
**UK:** Scenic Sounds Equipment, 97–99 Dean Street, London W1V 5RA.
Phone: 01–734 2812. Telex: 27939.

**Model 140**
**Type:** real time ⅓–octave spectrum analyser using LED matrix display.
Provides 27 ⅓–octave bands from 40Hz to 16kHz with separate display of true dB spl, 11 step LED for 10 or 20dB dynamic range with over range on each band, also 20dB variable attenuator. Built-in pink noise generator, XLR connectors on front panel for noise out and mic input with calibration.
**Price:** £1,700.

**System 200**
**Type:** real time ⅓– or ½–octave spectrum analyser using LED matrix display.
Provides 30 ⅓–octave bands from 25Hz to 20kHz and optionally 30 ½–octave bands from 40Hz to 1.12kHz. LED display is 15 steps for 15, 30 and 45dB dynamic range with over range. The *System 200* is microprocessor controlled and has eight working memories storing filter levels to 0.5dB resolution (indicated on a numeric LED display), which also store the important operational parameters such as time constant, weighting etc. Standard response curves (RIAA, tape curves etc), may be stored in an optional curve memory for comparison. Options are

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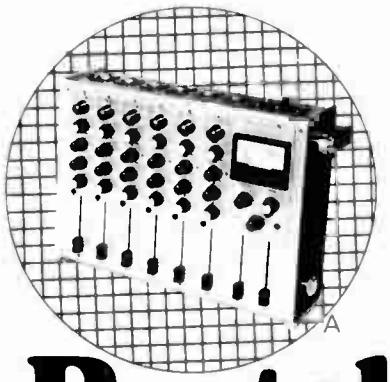
Audio
Developments





# Portable professional mixers

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

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B - Micromixer AD 031
C - Minimixer AD 007

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**MINIMIXER AD 007**
8 in 4 out. Compressors. size 540 × 480 × 225mm Weight 22.7 kg
**MICROMIXER AD 031**
8 in 2 + 1 out + options size 420 × 335 × 127mm Weight 10 kg
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**PICOMIXER AD 045**
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**AD 075 SuperSystem**
**AD 055 Stereo Compressor Limiter**

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**Scenic Sounds Equipment**
97-99 Dean Street London W1V 5RA

also available for $RT_{60}$ and reverberation time analysis.
**Price:** £3,495 including $RT_{60}$.

## WOELKE (West Germany)

**Woelke Magnetbandtechnik GmbH, Woelkestrasse 2-3, D-8069 Schweitenkirchen, West Germany.**
**Phone: 08444 394. Telex: 55547.**
**UK:** Lennard Developments Ltd, 206 Chase Side, Enfield EN2 0QX.
Phone: 01-363 8238.
**USA:** Tonmeister Instruments Inc, 4007 NE 6th Avenue, Fort Lauderdale, Florida 33334.
Phone: (305) 566-2853. Telex: 514362.

**ME105**
**Type:** wow and flutter meter.
Uses 3,000 or 3,150Hz with internal xtal controlled oscillator, input sensitivity 3mV to 20V, drift measurement ±0.1% to ±10%, flutter from 0.03% to 3%. To DIN, IEC and ANSI standards.
**Price:** £915.

**ME106 series**
**Type:** wow and flutter meters.
Uses 3,150Hz with xtal oscillator, input sensitivity 30mV to 30V, drift 0.5% to 5%, flutter 0.1% to 3%. To DIN, CCIR, ANSI and IEC standards.
**Price:** £455.

**ME108 series**
Similar to *ME106*, but only single drift range of 5%.
**Price:** £350.

**ME110 series**
Similar to *ME108*, but simplified even further with single meter switchable to read single ranges for either drift or flutter.
**Price:** £275.

**ME301C**
**Type:** wave analyser.
Provides tunable filter covering 1Hz to 1kHz in six ranges, with 40dB/octave pass band. Used with external meter or plotter, Requires 2.2V input.
**Price:** £665.

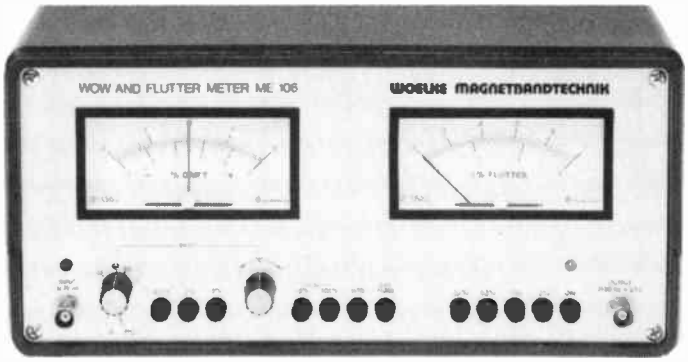
**ME401**
**Type:** automatic distortion meter.
Provides direct distortion reading and built-in 333Hz oscillator. Single scale covering 0.2% to 10%, level from —20dB to +10dB.
**Price:** £285.

## XEDIT (USA)

**Xedit Corp, 182-25 Tudor Road, Jamaica, NY 11432, USA.**
**Phone: (212) 380-1592.**

**Model 20P/16P/15P**
**Type:** drift and flutter meter.
Portable flutter meter with three ranges for 0.05% to 5%, and drift ±5%, oscillator either 3,000 or 3.150Hz. *Model 15-P* is DIN, *16P* JIS (rms only), *20P* DIN and JIS (rms).
**Prices:** on application. ■

*Woelke ME106*




*White System 200*

Designed for the 1980's, the MTR-90 is a synthesis of the most up-to-date technology and innovation currently available. The new generation tape transport incorporates a pinch-roller-free direct drive capstan with the PLL DC-servo circuitry. Other features include gapless, noise-free punches, digitally controlled logic, ±20% varispeed, and SMPTE interface access. Comes with a full function remote and available in 16 and 24 track configurations. For further details, please contact us.

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Otari Electric Co., Ltd.
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Tokyo 167 Phone: (03) 333-9631,
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# The most advanced 24-track available. OTARI MTR-90.

# letters

## MU facts

*Dear Sir, Your article,* What's in a Union *by Adrian Hope in your January issue, surprised me for two reasons. Firstly because it made me out to be some sort of ill-mannered ogre and secondly, because of its gross inaccuracies and, in one respect, major distortion of fact.*

*I have already spoken to Mr Hope and told him I am sorry he picked up such a poor impression of me in our telephone conversation. I also pointed out to him that his article contained a number of major errors.*

*In reference to these errors, he spoke of the Union's 'Anti-library rules that have sent musicians scurrying off to Belgium to record'. The facts are we have no 'anti-library music rules' but we do have library music agreements with 12 different companies.*

*He then spoke of 'the convoluted situations that can arise because the rules are different if it's a film session and sometimes a film session doubles as a record session'. He then says these rules are 'terribly complicated'. He is entitled to his view but it is one we cannot share. In the case of his example we would require the appropriate rate to be paid for each of the two services, film and gramophone record. Convoluted?*

*Next, his 'on one studio session the issue of an extra half-fee hinged on the burning question of whether or not the players were reading verse and chorus from a single sheet of paper or separate sheets' example has to be a piece of absurd fantasy or perhaps he has been the victim of the well-known musicians' sense of humour.*

*Although I am an ex-musician, my sense of humour was sorely stressed by the attack he launched on me at the end of his article. Earlier he stated that when he 'tried* recently *to get some official MU views on the increasingly burning issue of videogram agreements', he experienced the MU 'brush-off technique'. He has a funny idea of the meaning of the word 'recently'. I have established that the 'phone call to which he refers took place sometime before May 24, 1979, when the ITCA Videogram Agreement to which his article refers was in the final stages of negotiation. Having that in mind, how does he expect a responsible trade union official to behave when pressed by a most persistent journalist? More responsibly—one hopes—than he behaves in implying that the telephone conversation took place 'recently' and not months ago, before the Agreement was even signed.*

**Yours faithfully, S Hibbert, Assistant Secretary, Musicians' Union, 60/62 Clapham Road, London SW9 0JJ.**

## Adrian Hope replies

I leave the studio world to decide for itself whether MU rules are or are not complicated and whether they do or do not produce convoluted situations in practice. But in the light of Mr Hibbert's letter I feel obliged to make a point which I had deliberately excluded from the published item. After my abortive initial discussion with Mr Hibbert I noted a letter from John Morton, General Secretary of the MU, which was published in *Music Week*. In this letter he stated that 'those who wish to deal reasonably with us will find that we are always ready to reciprocate'. I then wrote to Mr Morton offering a few background credentials, eg winning money for MU members after a piece I wrote in *Studio Sound* showed how Capital Radio had a few years ago broadcast a record company concert tape under the guise of a Capital recording. I then went on to say: 'Recently when I was researching a piece on videogram rights I 'phoned the MU and Equity for clarification of the unions' position . . . when I 'phoned the MU I was referred to Stan Hibbert (with whom incidentally I had previously dealt on the Capital affair) and received one of the most curt brush-offs I have ever received from any spokesman. 'The whole matter is under discussion by our executive committee and has not yet been resolved' was the only 'help' that Mr Hibbert would offer. Would you blame me if in future I didn't bother to 'phone the MU for their point of view on a contentious story?'

In reply I received the following comment from John Morton: 'I am sorry that you felt that your communication with this office was unsatisfactory; I can only suppose that Mr Hibbert was under some pressure at the time —not an unusual situation. Thank you for writing.' For quite some time I expected to hear further from Stan Hibbert—but heard nothing until after my piece was finally published. As a journalist I am continually amazed at the way in which spokesmen for official bodies, after evading the press, huff and puff when their evasion is reported in print.

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## Rapid service

*Dear Sir, Further to your editorial (January 1980), may I offer ourselves as possible contenders for the title 'Super Service Team 1980'.*

*We know only too well the causes of the frustration veiled in your editorial in connection with pro-audio equipment maintenance (and not-so-pro as well), and therefore our simple policy on service and maintenance is this: if the customer bought it, whether it be pro or not-so-pro, and it needs mending, then who are we to turn up our noses at the potential mutual benefit to be derived from our prompt and expert attention?*

*Our existing customers will testify that we have probably quite a unique facility: a telephone answering machine which actually* does *bring relatively instant response to your call, rather than the more usual 'The office is closed—ring back tomorrow'. In short, our 'instant response' availability means that equipment down time (and the related hidden costs of same) is minimised. (Read that bit twice, for full impact!)*

*Don't be fooled either by our 'back of beyond' address. The motorway age (and a fleet of fast cars) puts us on a geographical centre between Liverpool and Hull, Tyneside and the West Midlands. We have been known to attend London service calls with a faster response than 'The London Firm'!*

*To conclude, a challenge: give us a call. It doesn't matter whether it's your Heath Robinson Digital Spirojaponica, or your 3M Autolocate/Necam desk, we have the technology, we can fix it.*

**Yours faithfully, Richard A Lockyer, Audio Visual Systems (Halifax), Unit 2, West Parade Industrial Estate, Halifax, West Yorkshire HX1 2TF.**

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## Prices

*Dear Sir, As a buyer of all types of professional audio equipment I find your monthly surveys of great interest and help in my search for the 'right buy'.*

*However 'buy' is the operative word and it is irritating and frustrating to find the coy 'price on application' tagged onto the end of some specifications.*

*Current inflation obviously results in rapid price changes, but surely manufacturers must understand that price is often* the *most important factor in the buyer's choice. Perhaps the cautious ones could imitate the method used to inform us of noise, wow and flutter etc, ie: Price: X £s plus or minus a few quid/bucks.*

*May I also congratulate Audio & Design (Recording) Ltd on the way in which they keep their potential customers so well informed of their new products and recommend to their rivals the same energetic approach to marketing. Some companies, sadly, many British, seem positively alarmed that they might sell something if they allow anyone to find out what they sell and for how much.*

*I hope the Eighties permit us the pleasure of a healthy industry and the continued growth and excellence of your publication.*

**Yours faithfully, Nicholas Sykes, 3 Fielding Road, West Kensington, London W14 0LL.**

Naturally we're glad that you find our surveys beneficial, and this is the reason that even wider coverage surveys will soon be published annually as a series of *Studio Sound* Yearbooks, the first will be published this summer. Prices cause us many difficulties when compiling surveys, principally because we circulate in both America and Britain (and many other countries of course), and the cost of shipping a product across the Atlantic, import duties, taxes, and the higher cost of back-up spares, mean that prices are invariably higher in one country or the other—and many manufacturers and distributors do not wish this information made obvious to their customers because they then ask 'how come it costs $1,000 in America, but £1,000 in Britain, and why shouldn't I buy it direct to get it cheaper?'. Also, some American products come to Britain via an export agent, and this also increases the price since two agents are taking a slice of the selling price, while in America many products are sold directly from the factory at much lower cost. In the end, even if distributors will not quote accurate prices, we still try to pin them down to 'about'. Even then, some companies still refuse to supply prices to us—perhaps one day we will publish a black list of 'persistent offenders' . . . **Ed.** ■

## Hot off the drawing board

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# The art of interconnection

Franklin J. Miller (Sescom)

**While everybody looks closely at the performance of particular pieces of equipment, few consider how they will behave when connected together. Franklin Miller takes us back to consider the advantages of balancing and the purposes of transformers.**

HAVING been in the audio business since 1960, I have seen many changes, but the basic principles today are the same as when I first started. It is an industry that must obey the laws of physics, working with basic principles that must be observed. It seems that in haste to do a job we forget the basics taught to us in the beginning.

The great audio industry explosion with new people being added at a great rate, without being made aware of the simple basics, hasn't escaped my notice. They are shown to operate equipment when it's set up and working in a particular mode, but not *why* it should be done that way.

Here I attempt to go back to basics and explain why certain things are done and where changes can be made. I hope to cover special areas of interest to all in the audio business, whether a studio owner, broadcaster, a public address user, or just an audio enthusiast.

The most important idea a system owner or user can have is to think in terms of the complete overall system and its performance. In **fig 1** a simple recording/playback system indicates some of the points I consider important—I will explain these later, but first some general points. The system is quite simple; imagine when it is multiplied by many microphones, effects, mixers, power amps and speakers . . . it can be a nightmare.

Cables are a common problem in the typical system. The right cable will enhance a system greatly, or conversely the wrong cable will cause undue problems that might be impossible to correct. Single conductor shielded cable, 2-conductor shielded cable, multipair cable, or twisted cable can all be used in the system if the following thoughts are taken into consideration: single conductor shielded cables should be used in short runs, not to exceed 20ft because in distances greater than this the capacity per foot (metre) will roll off the high frequencies by an intolerable amount. These cables are generally used between the mixer and effects, and the mixer and the tape machine, and note that they work at a high impedance above 10kΩ. Some inexpensive microphones use single conductor shielded cables; these should be avoided whenever possible. Two-conductor shielded cables are the most commonly used and there are currently three kinds of construction in use—in order of high to low cost, braided shielded, spiral wrap shielded and aluminium/mylar shielded. The latter is the one most used today because of cost and is a good cable for permanent systems—but not the best choice for portable, because the foil combination has a tendency to open in a flexing mode; the best cable in portable applications is a braided shielded. Two-conductor shielded cables are to be used in balanced lines where the length may be considerable. For example, a 50 to 200Ω mic can be run to a distance of 200ft without affecting the frequency response. It's a fairly safe rule to follow that the lower the impedance of the line, the greater the distance it can be run. Another important feature in a 2-conductor shielded cable is that the individual conductors are twisted because in an ac circuit the radiation of the usual ac field around a conductor carrying an alternating current is reduced since the field from one wire is 180° out of phase with the other. This causes a reduction in the strength of the magnetic field, reducing its effect on surrounding circuitry.

Multipair cables are quite common for systems involving many microphones operated remotely. These cables are sometimes known as 'snakes' and are usually constructed of three or more pairs of aluminium/mylar twisted pairs and put into a common jacket. These cables are commonly available but are constructed for permanent installations and not field use, therefore great care must be used when coiling and uncoiling them. The problem is the foil shield has a tendency to open after prolonged usage giving a bad ground condition, or foils might touch each other and cause a noise condition. Also, their jackets are constructed of PVC which have a tendency to crack under extreme temperature conditions, but most people use them because there is generally nothing else available. A better cable would have a braided shield and a rubber jacket, but these things all cost money.

Twisted pair cables for connecting loudspeakers are greatly affected by several factors: the load impedance and wire gauge (see

FIG.1 CONSIDERATIONS WHEN PLANNING A SYSTEM

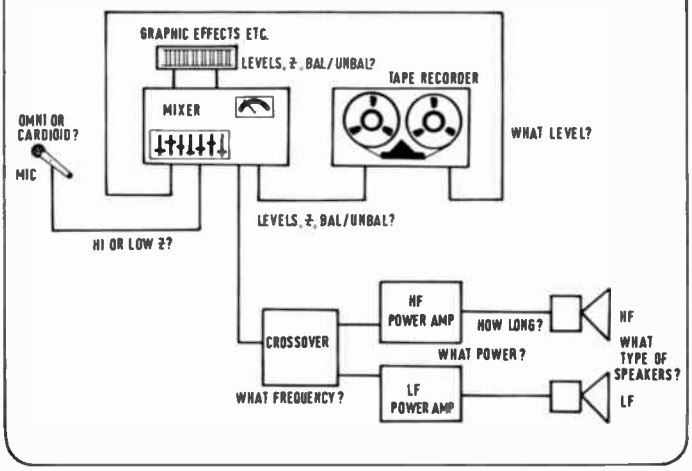

fig 2). You will notice that the lower the impedance the shorter the distance you would be able to run with the same gauge wire. When running wires for speakers, the correct gauge is very important as you are transferring power between two devices. The larger gauge wire has the lower dc resistance which translates into lower losses. If too small a gauge is used, then part of the amplifier's power will go to heat up the wire, reducing power at the speaker terminals.

The next most common items in the system are the connectors. There are literally thousands you can use, but I will discuss the most common ones. Impedance circuits use two (see fig 3); the RCA type phono connector and the ¼in phone jack. The ¼in phone jack is the best suited connector for high impedance circuits. It has the best strain relief system and makes the best connection. The tip is wired as the hot side and the sleeve is used as the ground connection. This type of jack has been used by the military for over 50 years and a military version is available with gold contacts. The RCA phono jacks are used on consumer gear because they are less expensive, but they are unreliable in high usage applications as they aren't as mechanically sound and can cause intermittent connections. They should be avoided in professional systems because of these problems.

**Fig 2 Suggested lengths for loudspeaker cabling**

| Wire size | Load impedance | | |
|---|---|---|---|
| | 4Ω | 8Ω | 16Ω |
| 14 awg | 125ft | 250ft | 450ft |
| 16 awg | 57ft | 150ft | 300ft |
| 18 awg | 50ft | 100ft | 200ft |
| 20 awg | 25ft | 50ft | 100ft |

Two types of connector are used in balanced systems (fig 4). The commonest and best connector for use with 2-conductor shielded cable is the XLR 3-pin connector. Almost everyone uses pin 1 as the ground connection but that is where the exact standard ends. Most people use pin 2 as hot and pin 3 as the cold side. You must watch the equipment you use so that you're not reversing the phase on some of your gear. It is advisable to keep your system in phase, this is a very minor but important point in the overall system's performance. The other connector used in 2-conductor shielded cables is the stereo ¼in phone jack—this is generally used to reduce costs or for jackfields. The tip or right channel is generally hot, the ring or left channel is cold, and the sleeve is the ground connection. Note that the tip diameter is smaller than the mono jack which can bend the contacts of stereo sockets.

In multipair systems the choice is wide, and since there is no standard whatsoever, no recommendation can be made; just choose one that suits your needs. I much prefer one that can be soldered to, because I believe that someday that connector will have to be repaired in the field just before a show, in great haste. Make sure you use a good cable strain relief—this is essential.

The next common component in the system includes audio transformers. One of the first questions you might ask is 'can I get away with not using any transformers in my system?' You have been told that your equipment has electronic balanced inputs and low impedance outputs and the system works fine at the factory. That is probably true, but in the world where your system must work, there are many problems not encountered in the lab, such as RFI, need for more common mode rejection, noise on the lines, ground loops and many more too numerous to mention. I am sure you have come across these at one time or another. Most of them can be solved with a properly chosen, high quality audio transformer. 'Chosen properly' is the key phrase; you must have a component that will handle the signal levels you will be placing on it. It must have low distortion and good frequency response, enough magnetic shielding and electrostatic shielding or it will also fail. Missing any one of these ingredients will make it fail miserably.

To illustrate more clearly I will divide audio transformers into three categories: input transformers, line input and line output. The input types are designed for mics, the line inputs are for balancing line feeds; and the line outputs are for matching outputs to feed other sources. These aren't the only transformers used, but by far the most common encountered in today's modern audio systems.

Input transformers fall into two categories: first, (see fig 5a) a true balanced circuit, one using an input transformer with a centre tap to ground. This transformer must be wound with windings on the primary side that have equal dc resistance, equal inductance, and distributed capacitance to ground. This type of transformer was used quite extensively in broadcast systems in the past but with the use of phantom powered mics it isn't used as often now; the most common today is the symmetrical type (fig 5b)—not a true balanced input. The symmetrical input type can be made to power capacitor microphones easily (fig 6). The input transformer has two main objectives in an audio system. The output level of a microphone is generally a low level signal that ranges between −60dB and −40dB at nominal operating levels. The input transformer can provide a step-up of voltage gain, some common gains of audio input transformers in fig 7 illustrate that, as the secondary impedance increases, the voltage gain increases but there are limitations to this voltage gain. High frequency losses are due to the increasing amount of turns on the secondary of the transformer which increases the distributed capacitance but this can be corrected to some extent in the kind of winding methods used but at greater cost in manufacture. This gain is obtained with the lowest noise figure, better than any op-amp yet developed; also the audio input transformer

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FIG.3 UNBALANCED CONNECTORS

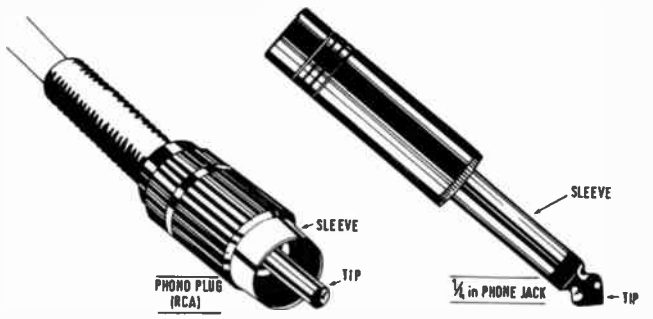



FIG. 4 BALANCED CONNECTORS

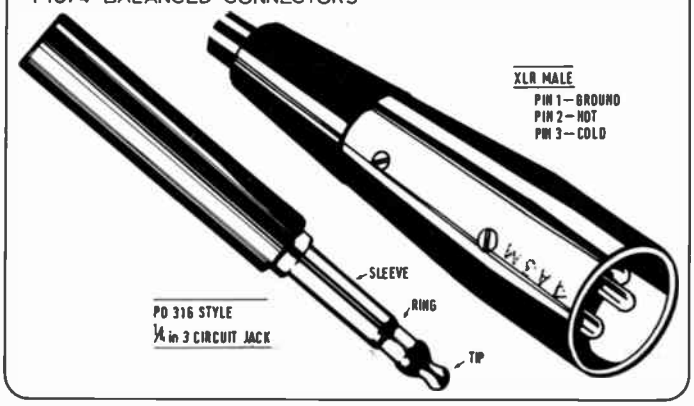



FIG.5 TYPES OF BALANCED INPUTS

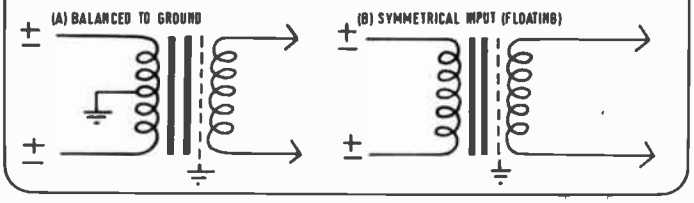
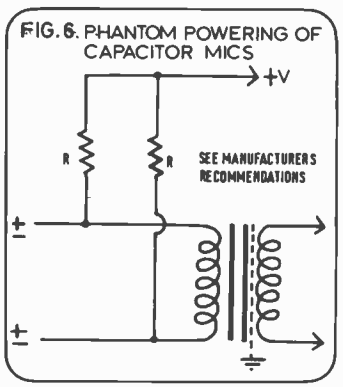



FIG. 6. PHANTOM POWERING OF CAPACITOR MICS



# The art of interconnection

has the highest common mode rejection. These are all very important factors in designing audio systems. Also included in good audio input transformers is an electro-static shield between the primary and secondary windings which has the effect of preventing the passage of line noise and radio frequency signals from the transformer into the power supply, and hence to other parts of the equipment.

Magnetic shielding is another important consideration when choosing an audio input transformer. The shields are constructed out of a special metal alloy which has a high content of nickel alloy steel, and placing an audio transformer inside an aluminium box has little effect on its hum rejection qualities. Very good audio input transformers generally have two nested shields of high nickel alloy steel (Mu-metal). A single shield will generally give about −30dB rejection of hum while two nested shields will yield −60dB of rejection. Choice of single or dual shields depends greatly on the original design. If the mains power transformer is large and in close proximity to the input transformers, a double shield unit should be used. When building a prototype of a new unit try a single shield; by proper orientation and good design techniques you can be quite successful.

Many questions about choosing audio input transformers are frequently asked, such as, "what is the low frequency distortion?" or "what is the bandwidth?". These questions can be answered if all the facts are known. It is important to know the input power level range. A typical input transformer for a modern day mixer will need a range of −60dB to − 10dB unpadded. At these operating levels the low frequency distortion should not exceed 0.1% 30Hz to 20kHz. In actual practice the distortion will decrease as the frequency increases with the input power level held constant in most good audio transformers. The maximum input power level is the most critical at low frequency and is limited by the amount of primary inductance and power handling capacity of the lamination. There are certain physical limits that must be followed. The high frequency response is related to the distributed capacitance of the secondary winding which is a function of the number of turns on the secondary and its construction. The construction of a fine audio input transformer is a precision art but when designed properly they perform very well.

The second type of audio transformers are the line inputs which are commonly used in balancing line inputs to mixers, equalisers and power amplifiers. For common impedances see fig 8. Again, the gain of the transformer is calculated as in fig 7. A very important factor in using a line input transformer is not to use too much gain because it tends to overload the circuit. For example, if you have a line level signal of 0dB and the transformer is matching 600Ω to 15kΩ with a gain of 14dB, and if the total system is capable of +18dB, then you only have 4dB of head room, which is not good practice. You can see that the choice of tranformers is very critical and can cause great harm in the system. In some line input applications it is best to use a bridging type input such as a transformer with a 1:1 ratio. Examples of this type are 600Ω to 600Ω, 15kΩ to 15kΩ, and 60kΩ to 60kΩ.

The problems of shielding are not as great as they are with low level transformers. Generally, single shielded units work very well and an electrostatic shield is still essential. The design factors apply as they do with input types. Low distortion and good frequency response are also important factors.

The last kind of audio transformer is the output type, designed to transfer power. They are generally designed to balance outputs of mixers or signal processing equipment and are driven by a very low impedance source, typically lower than 100Ω, from an op-amp driver. Transformers are usually selected on a one-to-one basis, the commonest used, being a 600Ω to 600Ω type. Shielding is not generally a great problem at +18dBm to +30dBm operating levels. The distortion and frequency response characteristics have the same consideration as the other types.

Termination of all these audio transformers is probably the most important and misunderstood subject. There are four ways to terminate transformers (see fig 9). Unterminated transformers are generally used in microphone and photocell pre-amplifiers—these are called open-circuit connections. Terminated transformers are generally used in line, equaliser, filter or similar devices. Termination may be used to obtain certain roll-off characteristics to avoid ringing or peaking of secondaries. Double termination is used when the primary and secondary windings are terminated so that both source and send are properly terminated, but the frequency response will look completely different from an unterminated transformer.

These may seem minor points to consider but very often it is the little things that count.■

FIG. 9 TRANSFORMER TERMINATIONS

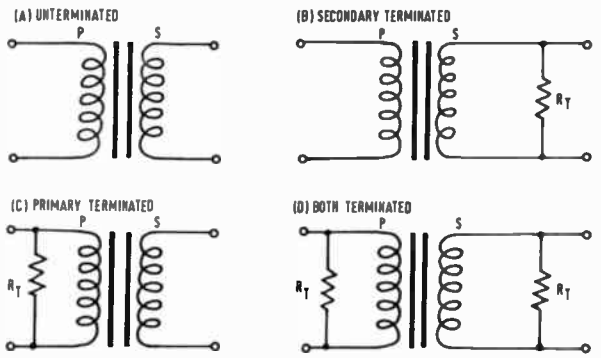


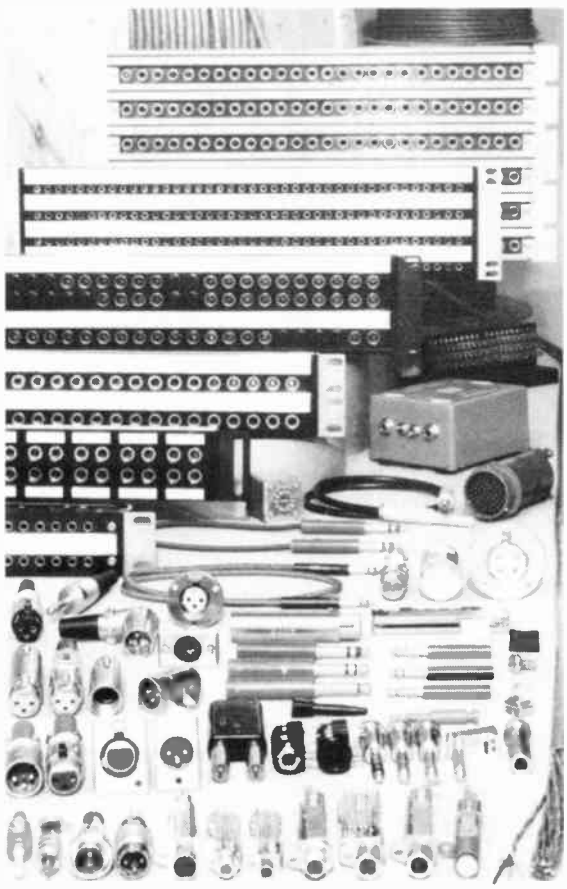

**Fig 7 Ideal gain obtainable on input transformers**

| Primary impedance $Z_1$ | Secondary impedance $Z_2$ | Gain (ideal) |
|---|---|---|
| 150Ω | 5kΩ | 15.2dB |
| 150Ω | 10kΩ | 18.2dB |
| 150Ω | 15kΩ | 20.0dB |
| 150Ω | 20kΩ | 21.2dB |
| 150Ω | 25kΩ | 22.2dB |
| 150Ω | 30kΩ | 23.0dB |
| 150Ω | 45kΩ | 24.7dB |
| 150Ω | 60kΩ | 26.0dB |

**Fig 8 Common impedances for line input transformers**

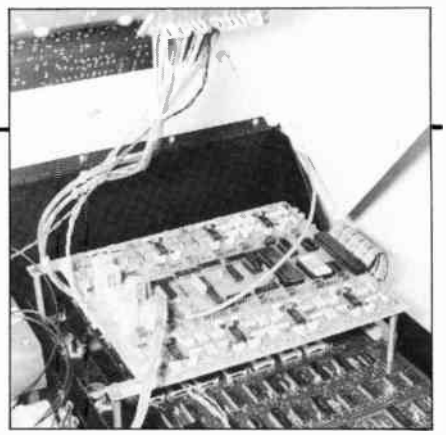
| Primary impedance $Z_1$ | Secondary impedance $Z_2$ |
|---|---|
| 600Ω | 600Ω |
| 5kΩ | 15kΩ |
| 10kΩ | 30kΩ |
| 15kΩ | 60kΩ |
| 30kΩ | |
| 60kΩ | |

*Part of the range of connectors from Future Film Equipment*



# reviews

# Eventide THS-224 realtime audio spectrum analyser



**MANUFACTURER'S SPECIFICATION**

**Input:** input level +14 to −20dBV for full screen display. Impedance 10kΩ unbalanced.

**Filters:** 31 2-pole filters from 20Hz to 20kHz, on ISO centre frequencies. Centre frequency tolerance is 3.5%. These filters do not meet ISO standards.

**Absolute level:** one bar of the display (LEVEL) indicates the actual level of the signal before it is bandpass filtered.

**Resolution:** the PET display allows 144 vertical elements. The various filter outputs are mapped on this display under software control. Assuming a 1V input signal, resolution is about 7mV in the linear display mode.

**Accuracy:** amplitude readout at centre frequency of each filter uniform within 1dB total from 20Hz to 20kHz, typically ± 0·25dB (0·5dB total), slightly decreased with higher gain.

**Power and interface:** obtained from host PET computer. All cables and hardware supplied.

**Memory usage:** analyser responds to various addresses in the $BOOO through $BFFF range. Also the second cassette buffer is used for data storage, end various zero page locations are used within routines for scratchpad storage. With the exception of the second cassette buffer, no memory is stolen from the PET, and the operation of the PET is not affected in any way.

**Accessories supplied:** instruction manual containing schematics and detailed software usage instructions (no source listing supplied), including memory map with buffer and flag locations. Cassette with three BASIC programs; interactive operation, minimal operation and self test. All programs may be user modified. Installation kit including jumper cable, memory port cable and hardware. Keyboard overlay to define keys used in interactive program.

**Price:** Analyser board and kit £340 retail. PET computers from £550 to £795 for the 32K PET as used for the review.

**Manufacturer: Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019, USA.**

**UK:** Feldon Audio Ltd, 126 Great Portland Street, London W1N 5EH.

REALTIME spectrum analysers tend to be extremely expensive tools which frequently cannot be justified for studio use. However, they are very useful for checking the spectrum of audio signals and thus preparing master tapes with a suitable characteristic for disc cutting, cassette duplication etc.

The Eventide *THS-224* realtime analyser has been designed to fit into the popular Commodore PET computer systems which in their simplest form consist of a keyboard and a visual display unit (VDU). The analyser takes its power from the PET's power supplies and interfaces with the PET's digital electronics via the second cassette tape buffer in the PET's electronics.

Installation of the analyser within the PET takes only a few minutes and with the exception of occupying the second cassette buffer, the presence of the analyser doesn't interfere with the normal operation of the PET computer.

The input signal to the analyser is fed to an unbalanced ¼in jack socket which is secured at the rear of the computer. The input then passes to a variable gain amplifier, the gain of which is controlled by the computer altering the feedback around the input amplifier. From here the amplifier's output is fed to 31 filters which divide the signal into the standard ISO ⅓-octave centre frequencies from 20Hz to 20kHz. The outputs from the filters then feed halfwave peak rectifiers with an additional rectifier fed by the unfiltered output from the variable gain input amplifier.

The outputs from the rectifiers then represent a ⅓-octave analysis of the input plus an unfiltered output which represents the unfiltered and unweighted audio level.

The constant percentage bandwidth filters are based on the standard centre frequencies although the filter shape doesn't comply with the usual standards, but this doesn't matter for many applications. The rectifier outputs place a charge on a capacitor and this charge is a representation of the peak voltage output from the associated filter. No discharge resistor is fitted so the voltage is held until after each analysis, the computer then discharging the capacitor thus giving a new analysis for each scan of the filter outputs. This arrangement allows the program in the computer to alter the effective time constant of each filter. The filter and rectifier outputs are scanned by the computer via an analogue multiplexer and then fed to an A/D converter which feeds the computer with digital data related to the amplitude of the selected rectifier output.

It follows that under program control the computer can select the overall gain, any ⅓-octave for analysis, and control the rectifier time constant.

Eventide give the purchaser three programs on a cassette for operating the spectrum analysis system. 1 'Interact', a comprehensive program allowing the analysis conditions to be altered from the computer's keyboard which is equipped with an overlay redefining the functions of various keys. 2 'Minimal' which only allows the selection of a linear or logarithmic display, averaging or nonaveraging, and slow or fast rectifier characteristic. 3 'Selftest', a routine for checking the correct operation of the analyser.

For normal operation the more complex program 'Interact' would be used and this allows the setting of the analysis with a choice of linear or logarithmic level display, peak hold—fast—medium—slow or very slow decay rate, normal or averaging mode. And additionally the gain may be changed in 3 or 6dB increments up or down, plus the facility for increasing or decreasing the update rate.

In the standard programmed modes, the display consists of a bar graph with the level bar to the left and the ⅓-octave bars proceeding to the right, their centre frequencies shown on the display below the bars. Lines at each side of the display act as an aid to reading the levels, but reading wasn't particularly easy to achieve accurately.

Legends at the top of the display show whether the linear or logarithmic modes have been selected, fast or slow and average or single operation.

For users who wish to develop their own programs rather than use those provided by Eventide, the spectrum analyser conversion provides 10 functions, available in the form A=USR(x). USR(1) draws the frequency and amplitude scales on the screen. USR(2) draws the bargraph of the stored data. USR(3) performs a spectrum analysis and stores the data. USR(4) sets the slow decay mode, USR(5) the fast decay mode and USR(6) the average mode. USR(7) clears the average mode and returns the number of averages. USR(8) sets a linear display, USR(9) a logarithmic display and finally USR(0) disables the analyser functions.

Normal computer instructions control the gain and the decay rate with the level data available in normal stores. It follows that it isn't difficult to program the computer to do a great variety of analysis forms in realtime without any hardware alterations. However, simple hardware changes can turn the analyser section into a 32-channel analogue input to the computer. A simple application for this would be a multichannel level display, but a

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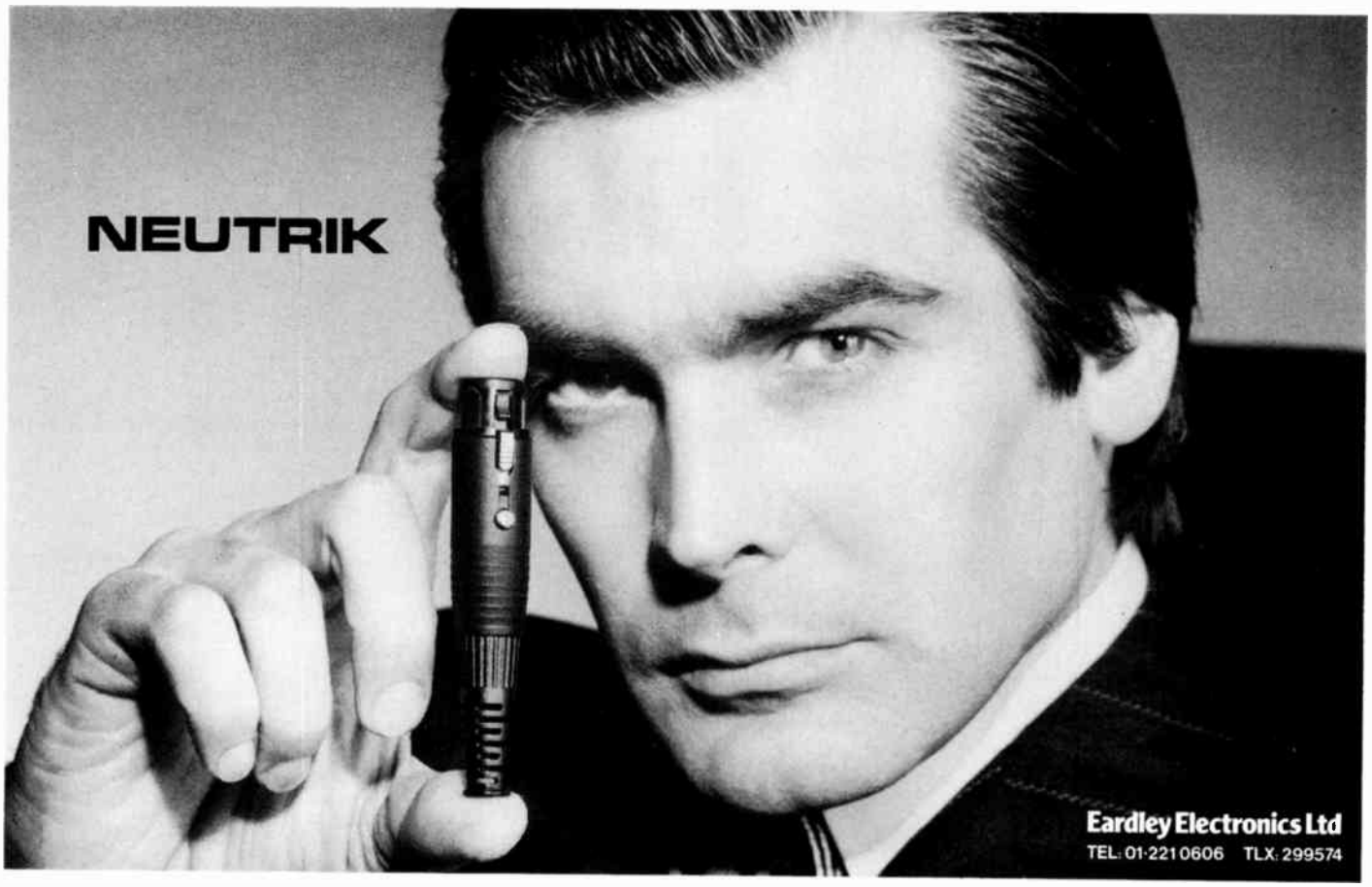


little thought suggests many applications, not only in the sphere of audio measurements.

All three of the Eventide programs of course use the subroutines in different combinations and the 'Selftest' program has other features. This program initially checks the read-only memory for errors and then instructs the user to connect a signal generator and a frequency meter to the analyser. The user is then instructed to tune the generator to the various centre frequencies and at the end of the run the computer prints on the screen the correct frequency of each filter, the actual frequency and the percentage error. Also printed are the level amplitude, actual amplitude and percentage error with out-of-tolerance frequency or amplitude creating a message such as 'Amplitude match error this filter'.

**The performance**

Initial checks on the centre frequencies of all the filters showed that all were within the specification; all but five of the filters were within ±2% and the worst case was −3% thus giving a practical performance for most ⅓-octave tasks. It should, however, be noted that the filter shapes are non-standard and will not give results which correlate with ISO or ASA standard ⅓-octave filters when measuring noise.

The frequency response of the system varied substantially with the gain setting and whilst the manufacturer mentions this matter in the instruction manual I feel that the high frequency deviations are excessive. At minimum gain the unfiltered bar had −3dB points at 3Hz and 150kHz with the overall display within ±0.25dB which is quite satisfactory. However at maximum gain the −3dB points for the unfiltered bar became 3Hz and 5.9kHz which can only be described as a poor performance with the display showing the following errors, **Table 1.**

To give an idea of the relation between frequency response and gain the error at 20kHz was checked at 6dB and 12dB less than maximum gain, with the respective errors −6dB and −2dB which suggests that the manufacturer would have been wise to limit the gain to 12dB less than the existing gain.

Another factor that would also improve is the input overload margin which was satisfactory at minimum gain with 20dB in hand reducing to 8dB at maximum gain.

The use of random noise in frequency response analysis needs some caution, as low frequency response errors occur to the extent of 4/6dB in the slow modes with only the average and peak mode giving correct results within ±1.5dB for pink noise.

Using the logarithmic display mode the input sensitivity was 4V rms at minimum gain, rising to 13.4mV at maximum gain with a satisfactory input impedance of 9.4kΩ in parallel with 100pF.

Checking the accuracy of the nominal gain increments of 6dB and 3dB gave the following results (**Table 2**) which suggest some non-linearity in the analogue multiplier which controls the input gain.

The 3dB gain increments showed a similar pattern with increasing step errors at higher gains.

The ⅓-octave bands had no problem with noise, but the wide band bar gave a noise reading of −22dB below full scale at maximum gain.

Investigations into the attack and fall times of the ⅓-octave bars showed that they were all similar, the effective attack time remaining constant with the various decay time settings at about 5ms to reach the full steady state level when fed from a tone burst.

In the 'fast' mode the fall time to the bottom of the logarithmic scale was 600ms increasing to 4s in the medium mode, 8s in the slow mode and 24s in the very slow mode, thus giving a very useful range of computer-controlled decay times with the added valuable facility of the peak hold function.

The display, which in the logarithmic mode has a dynamic range of 36dB, is divided into 2dB sections at either side of the bar graph with a maximum resolution of 0.25dB resulting from the 144 vertical display elements. Checking the display for incremental accuracy at 1kHz and in the wide band bar, and also for cumulative errors produced **fig 1.** This shows, allowing for reading difficulties, that the incremental accuracy within any 2dB step was better than 0.72dB at 1kHz, with cumulative errors of less than 1dB down to a −14dB indication. The accuracy of the wide band bar wasn't all that different and the overall display accuracy was quite adequate for most purposes.

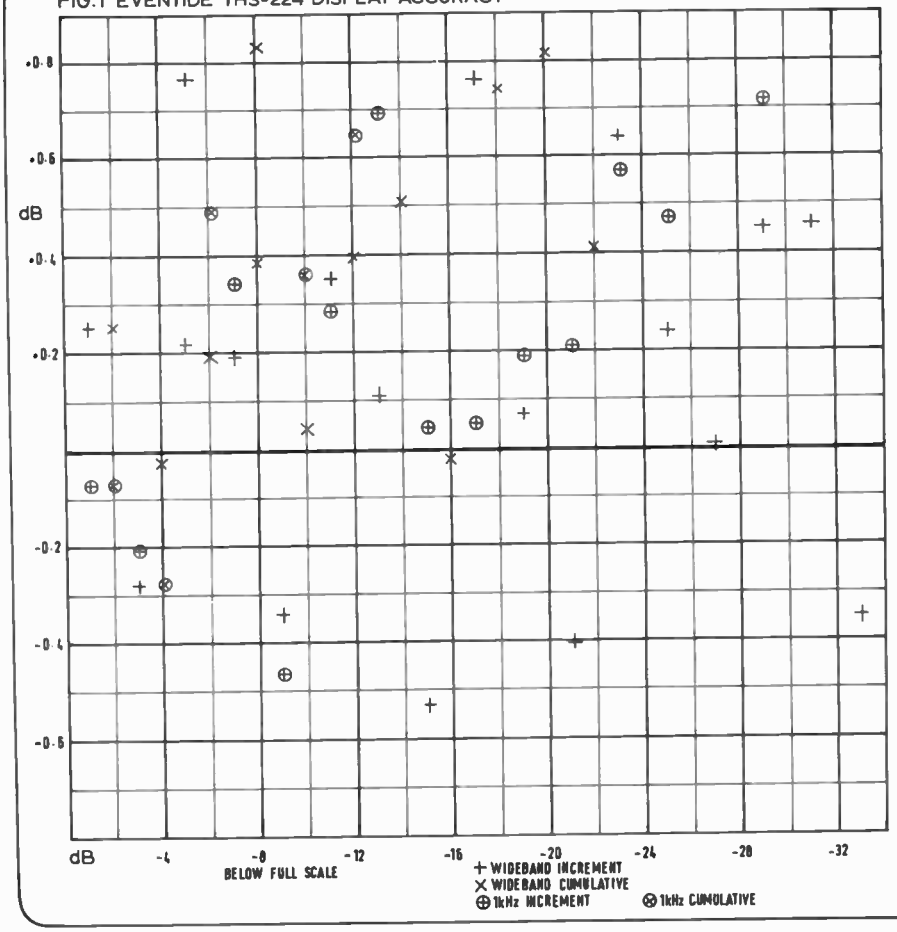
**Table 1**

| Frequency | 2·5kHz | 3kHz | 4kHz | 5kHz | 6kHz | 8kHz | 10kHz | 12kHz | 16kHz | 20kHz |
|---|---|---|---|---|---|---|---|---|---|---|
| Error (dB) | −0·25 | −1·5 | −2·5 | −4 | −5 | −6 | −7·5 | −9 | −11 | −13 |

**Table 2**

| Gain Min | +6dB | +12dB | +18dB | +24dB | +30dB | +36dB |
|---|---|---|---|---|---|---|
| Increment | 6·1dB | 5·9dB | 6·2dB | 6·4dB | 7·7dB | 10·3dB |

FIG.1 EVENTIDE THS-224 DISPLAY ACCURACY




**Summary**

This is a review of the Eventide *Spectrum Analyser* rather than the PET computer, but I must mention that the PET uses the 'Basic' programming language which is very easy to learn. Therefore, even if you don't have any experience of computers don't be put off by the PET. It's great fun to play with and apart from playing games it can be interfaced to many peripheral devices so you can do the mundane tasks of writing invoices and stock keeping plus other audio measurements with interfaceable instruments.

The realtime analyser is an extremely useful device for many audio applications, and mostly great accuracy is completely unnecessary and other than the high gain frequency response errors the Eventide module is quite adequate.

I feel that Eventide could quite easily overcome this problem and that they should warn users about the potential snags when using random noise with the analyser.

Overall, this is an inexpensive and versatile piece of equipment which can be simply programmed to undertake complex analysis in realtime—I'm sorely tempted to keep it.

**Hugh Ford**

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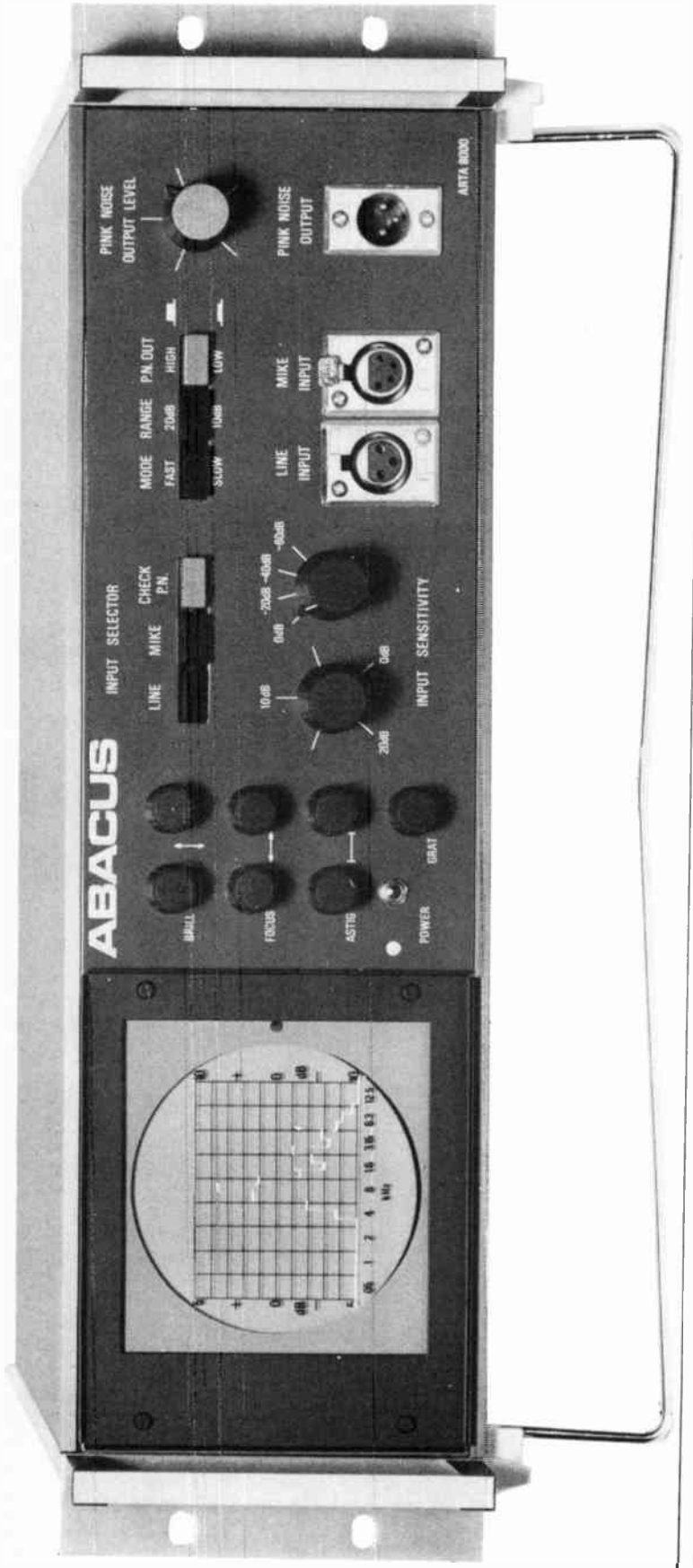


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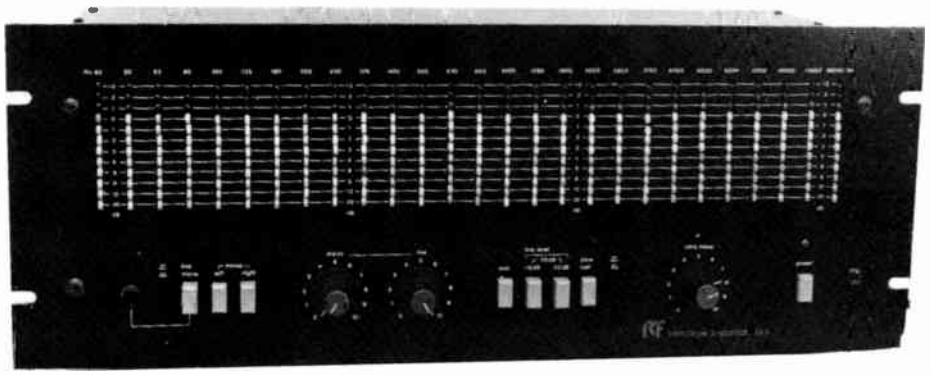
# RCF spectrum analyser SA1



**MANUFACTURER'S SPECIFICATION**
**Frequency range:** from 40Hz to 16kHz.
**Frequency bands:** 27 bands of ⅓-octave.
**Centre frequency of bands:** 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800Hz, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 8, 10, 12.5, 16kHz.
**Indicators per channel:** 12 LEDs.
**Dynamic range:** 23dB (from +3 to —20dB).
**Weighting:** 12dB per octave.
**Separation between adjacent channels:** four LEDs in central zone.
**Microphone input:** balanced with 12V phantom supply. Sensitivity 50mV. Impedance 1500Ω. Maximum signal level 120mV.
**Stereo line input:** sensitivity range 24.5, 77.5, 245 or 775mV. Input impedance 68kΩ, maximum signal level 50V.
**Pink noise output:** maximum level 200mV. Source impedance 10kΩ.
**Display speeds:** normal or slow.
**Power requirements:** 220V 50Hz at 50VA.
**Protective fuse:** 0.5A slow.
**Dimensions:** 188 x 482 x 217mm.
**Weight:** 8.15kg.
**Price:** £800.
**Manufacturer: Radio Cine Forniture SPA, I-20149 Milano, Via Alberto Mario 28, Italy.**
**UK:** Covemain Limited, Dunchurch Trading Estate, London Road, Dunchurch, Rugby.

THE RCF spectrum analyser is a ⅓-octave instrument with LED level displays centred on the standard ISO centre frequencies from 40Hz up to 16kHz involving 27 vertical displays each incorporating 12 LED indicators. The top three LEDs are red and indicate levels of +3, +2 and +1dB with the lower four yellow LEDs indicating 0dB, −1, −2 and −3dB, below which are the green LEDs indicating levels of −4, −6, −8, −12 and −20dB thus providing a sensible display range for aligning equipment and rooms.

The dark brown front panel is mainly occupied by the above display which is mounted on a grid of white lines and clear legends indicate the level and centre frequency of each display. Bottom left of the front panel is a ¼in microphone jack allowing the connection of a balanced microphone input and includes 12V phantom powering for capacitor mics; this connection is duplicated at the rear of the instrument. Right of this input are three locking pushbuttons which select the input source. One switch selects the microphone or the line inputs, the remaining two select the left or right line input connections or the sum of the two.

Right of these are potentiometer level controls for the microphone input and the line input (the latter being a single control affecting both inputs) with the controls uncalibrated but having legends from zero to 10. Next, four further locking pushbutton switches, one of which provides a test function connecting the internal pink noise source to the spectrum analyser section and the remaining three controlling the display. One button selects either a fast or slow display speed, the other two control the line input sensitivity such that it can be increased by 10dB, 20dB or 30dB.

The remaining features are a potentiometer for setting the level of the pink noise output, a power on/off pushbutton and the red LED power indicator.

At the rear of the instrument is a rather short fixed mains lead and the properly identified metric power fuse, with an adjacent earth terminal. Four ¼in jack sockets remain, one for the balanced microphone input, two for the unbalanced line inputs and one for the unbalanced pink noise output.

The thick alloy front panel with mounting slots for a 19in rack is bolted to a sheet metal chassis. The upper part of the chassis is largely covered by a mother board into which plug the 27 display boards, each having three preset potentiometers. Further electronics are mounted onto the glassfibre mother board which has pin connectors for the mains transformer and the power stabiliser at the rear on the chassis.

Underneath the instrument is a small fixed pcb for the microphone pre-amp and boards for the two switch banks. None of the boards included any component identifications and the instruction manual which was in Italian didn't give any maintenance information but did include basic operating instructions. Generally, though solid, construction and layout was old fashioned, making it a bulky instrument by modern standards.

### The noise source

The narrow band spectrum analysis of the pink noise output in fig 1 confirms that the noise spectrum is close to the ideal 3dB per octave line and within 1dB over the analyser's range from 40Hz to 16kHz—this was true at all output level settings with the output free from mains hum.

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FIG.1
RCF PINK NOISE OUTPUT

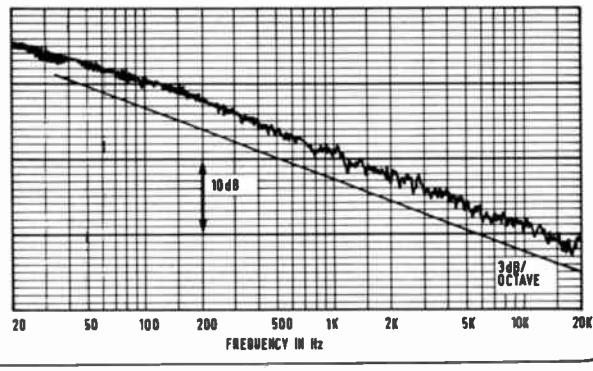



FIG. 2
RCF FREQUENCY
RESPONSE MIC INPUT

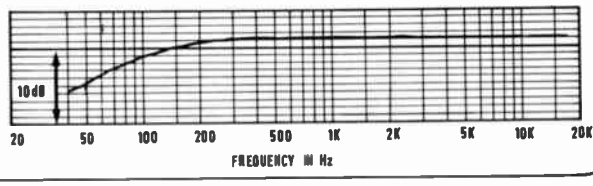
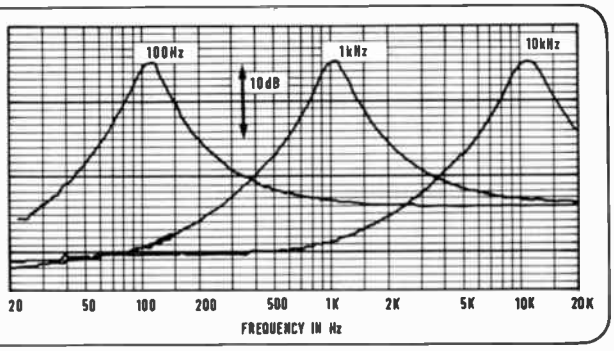


FIG.3
RCF FILTER CURVES




Measured over a band 22Hz to 22kHz the maximum rms noise output was 180mV from a source impedance which varied with output level setting, up to 5kΩ. I felt that for many applications the output level is too low and the source impedance undesirably high.

**The inputs**

The unbalanced line inputs had an input impedance of 70kΩ, constant with the input sensitivity setting—sensitivity at 1kHz was switchable between −1dBm, −11dBm, −21dBm or −31dBm by pushbuttons on the front panel. These levels corresponded to the 0dB LED display just being illuminated, and gave a 1dB too high sensitivity at all settings of the accurate steps.

The microphone input impedance was again constant with the sensitivity control setting at 850Ω which is a little on the low side for some microphones, preferring 1kΩ. The input sensitivity as for the line input had a range from −83dBm to −20.5dBm, input overload occurring at −12dBm which may be on the low side for some applications. The line input overload point was at +24dBm; quite adequate, as was the input impedance.

**The display**

Checking the accuracy of the displays at 1kHz and 5kHz gave rather disappointing results: the instrument's calibration left something to be desired and the −20dB indication was considerably in error (see **Table I**).

**TABLE I**

| Indication | Actual Input Level 1kHz | 5kHz |
|---|---|---|
| +3dB | +1.5dBm | +1.0dBm |
| +2dB | +0.7dBm | +0.24dBm |
| +1dB | −0.1dBm | −0.6dBm |
| 0dB | −0.95dBm | −1.5dBm |
| −1dB | −1.7dBm | −2.4dBm |
| −2dB | −2.4dBm | −3.4dBm |
| −3dB | −3.4dBm | −4.7dBm |
| −4dB | −5.0dBm | −6.0dBm |
| −6dB | −6.1dBm | −7.5dBm |
| −8dB | −7.7dBm | −9.5dBm |
| −12dB | −9.8dBm | −10.5dBm |
| −20dB | −14.7dBm | −15dBm |

Using the line inputs the frequency response of the display was within 1dB, but the microphone input's bass fell off by a substantial amount at 40Hz as fig 2. The filter shapes at 100Hz, 1kHz and 10kHz are as fig 3 which shows that the filters are fairly wide, but this is of little significance for general frequency response alignment.

Checking the centre frequencies of the filters showed that most were aligned within ±2.5% of the nominal frequency but five filters were outside this limit with worst cases of −5.4% and +6%. Again it would appear that the factory alignment could well be improved.

The rectifier characteristics indicated that a peak rectifier was used, which is fine for measuring the level of recordings, but a disadvantage for equipment suffering from phase shift, where an rms rectifier is often essential.

The fast and slow display speeds showed that for some reason the 800Hz filter didn't behave in the slow mode. In the fast mode the response time reached the final steady state reading on the application of a tone burst, at 20ms, with the fallback time to no reading being 400ms with no hold. In the slow mode response time was 350ms with a fall time of 15s. While no claim is made about meeting standards, this performance is very far from the standard for sound level meters.

**Summary**

Although the RCF spectrum analyser provides a useful display of an audio frequency spectrum it cannot be used for measuring sound pressure levels, as many other analysers can. Also it is perhaps surprising that it doesn't incorporate a wideband level display.

The performance accuracy of the factory alignment leaves something to be desired but if this is improved the instrument will be useful for room alignment and many other tasks. However, the review sample was not adequately accurate for such tasks as aligning professional studio equipment.

**Hugh Ford**

## agony

Owing to an ageing Calder 12/4 mixer and lack of finance, we have in collaboration with our Physics and Biology Dept come up with ARM (Automated Reflex Mixer).

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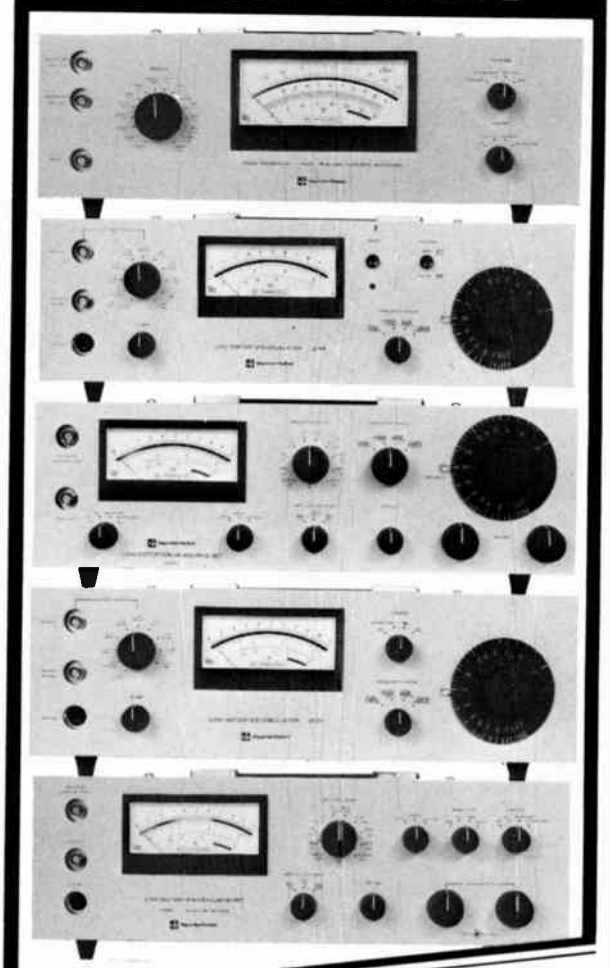

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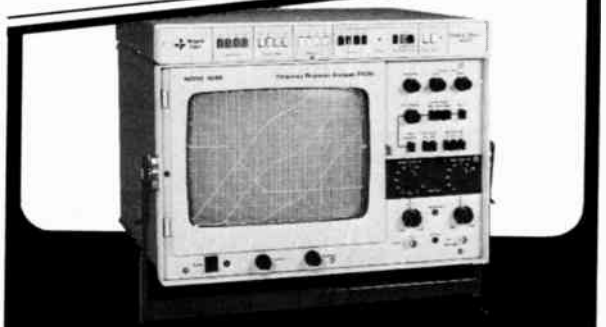

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# EMT 422 flutter meter


**MANUFACTURER'S SPECIFICATION**

**OSCILLATOR**
**Frequency:** 3150Hz.
**Frequency change:** +0.3% by pushbutton.
**Outputs:** 1V from a source resistance of 100Ω and 100mV from a source resistance of 100Ω.

**INPUT CIRCUIT**
**Test frequency:** 3150Hz ±6%.
**Input impedance:** 100kΩ.
**Input voltage range:** 40mV to 3V automatically compensated internally.
**Measuring ranges:** 0.1%, 0.3%, 1%, 3% and 10%.

**MEASUREMENTS**
**Measurement of flutter to:** a) weighting curve according to IEC/DIN/ANSI; b) linear from 0.2Hz to 300Hz (—3dB); c) bandpass filter, 20Hz to 300Hz (—3dB); d) lowpass filter, 0 to 2Hz (roll-off 6dB/octave); e) external filter. The ballistic behaviour is according to IEC/DIN/ANSI.

**CONNECTIONS**
**External filter connections:** output to filter 2V peak-to-peak from a source resistance of less than 200Ω. Input from filter 0.5V peak-to-peak with an input load greater than 100kΩ.
**Level recorder and oscilloscope outputs:** REC 1 and REC 2:2V peak-to-peak output from a source resistance of less than 200Ω. SPEC output 1V dc for a source resistance of less than 200Ω.

**GENERAL**
**Power requirements:** ac input 100–120V or 200–240V 50/60Hz, 15VA.
**Dimensions (whd):** 294 x 146 x 240mm (11½ x 5¾ x 9½in).
**Weight:** 2kg (4.4lb).
**Price:** £596.
**Manufacturer: EMT-Franz GmbH, Postfach 1520, D-7630 Lahr, West Germany.**
**UK:** FWO Bauch Ltd, 49 Theobald Street, Boreham-wood, Hertfordshire.

THE EMT *422* flutter meter is very much a simplified version compared with other EMT wow and flutter meters. Such facilities as sigma memories aren't included but, apart from the IEC weighting, the *422* does include a lowpass and a bandpass filter for wow and flutter analysis. Furthermore the instrument can be fitted with an optional threshold monitor, which is a valuable addition for production line testing where the operator only has to observe three lights instead of reading meters.

The front panel is dominated by two meters, one for indicating drift and the other for wow and flutter but identified as 'FM-Peak-value' for some reason. The sensitivity of both meters is controlled by a row of five interlocking pushbuttons. These provide wow and flutter sensitivities of 0.1, 0.3, 1, 3 or 10% on the meter, which is clearly scaled from zero to 10 and zero to three. The drift or 'deviation' meter is as usual a centre zero instrument with scales of plus/minus 3% and 10% providing a maximum full-scale drift indication of ±0.1%.

Beneath the drift meter is the drift set zero potentiometer control which I found rather fiddly to adjust on the most sensitive ranges and could well be replaced with a multiturn potentiometer, or fine and coarse controls. With no incoming signal to the instrument's input, the wow and flutter section may be connected to the internal oscillator, thus allowing the drift meter to be set to zero for a 3150Hz input. A spring-loaded toggle switch allows the internal oscillator frequency to be changed by 0.3% for checking the calibration of the drift meter.

Bottom left of the instrument are the oscillator outputs at nominal 100mV and 1V levels, and the input which covers a wide range of levels without adjustment. All front panel connections are via 3mm banana sockets, black for ground, red for outputs and green for inputs. Unfortunately these connections aren't on the standard ¾in (19mm) spacing.

Similar sockets arranged in the bottom right-hand corner provide for an external weighting filter and external recorders or analysers. Five interlocked pushbuttons beneath the wow and flutter indicator select the filtering between linear 0.2Hz to 300Hz (–3dB), bandpass 20Hz to 300Hz, IEC weighted, lowpass dc to 2Hz with 6dB per octave roll-off or the use of an external filter.

The wow and flutter metering ballistics are controlled by a toggle switch next to the meter, which selects either IEC standard ballistics or a non-standard 'slow' condition which can often be a useful addition.

Reverting to the auxiliary outputs for recording or analysis, the 'Rec 1' output provides the ac flutter meter signal without rectification, this being useful for spectral analysis of the wow and flutter components. The 'Rec 2' output gives an output corresponding to the drift meter's input and is therefore effectively a dc output corresponding to the drift or speed deviation. Finally the 'Spec' output which is an ac signal corresponding to the flutter meter's indication, including the time constant, and is useful for recording variations in the IEC weighted wow and flutter in relation to time.

The final front panel feature is the optional threshold monitor facility, appearing as three lights: red, yellow and green, plus a recessed 3-pin DIN socket. Normally, the standard programming plug is inserted into the socket and when the indicated wow and flutter reaches 50% full-scale deflection the green light is illuminated, the yellow at 30% and the red at 70%. However the threshold at which the yellow and red lamps are illuminated may be set to any value by altering two resistors in the programming plug so that the illumination of the green and yellow lamps can be set to a 'pass' wow and flutter level, and the red lamp to a 'fail' wow and flutter test level—very simple for production line use with relatively unskilled labour.

The IEC standard power connection with adjacent voltage selection and properly identified mains fuse is at the instrument's rear. A 5-pin 180° DIN socket provides a stereo connection to DIN equipped devices for input and output, and another 5-pin, but 270°, DIN connector is associated with the threshold monitor system. The threshold monitor includes relays which operate at the green, yellow and red thresholds, and an isolated relay common, plus a contact from each relay, is brought to this connection. According to the position of jumpers on the threshold monitor board these connections may be normally open or closed contacts.

The base of the U-shaped chassis is covered with the master printed circuit board which

supports all components except the oscillator and threshold monitor boards; these plug into the master board. While component identifications are rather sparse, the handbook includes good layout diagrams and circuits, and the well spaced components ease servicing. However the *422* includes 19 preset potentiometers (which seems an excessive number) and no alignment instructions are provided in the instruction manual.

Overall the standard of components, and mechanical and electrical construction is to a high standard and the clear front panel layout and uncluttered controls make the instrument simple and quick to use.

**The modus operandi**

As is not uncommon, the input signal to the measuring section is fed to an automatic gain control amplifier to deal with a wide range of signal input levels. However, after this stage the design is interesting, it doesn't use the conventional type of discriminator, but uses a phase locked loop form of demodulation instead.

The signal from the input amplifier is fed to a comparator which compares the input frequency with that of a 3150Hz signal, derived by dividing down a 200kHz VCO; which works at 200kHz in order to obtain the necessary frequency stability to measure low values of wow and flutter.

The output from the phase comparator passes to a lowpass filter to remove noise and on to a dc amplifier which provides a dc signal to control the VCO; this dc signal is a representation of the frequency error of the input signal, and hence the demodulated frequency modulation components. Thus, the output of the dc amplifier is fed to the metering and weighting section of the wow and flutter meter, directly feeding the deviation meter via a switched gain amplifier controlling the sensitivity.

In other respects the instrument is conventional, and perhaps surprisingly the oscillator from which the output frequency is derived is of an R/C design rather than a crystal.

**The performance**

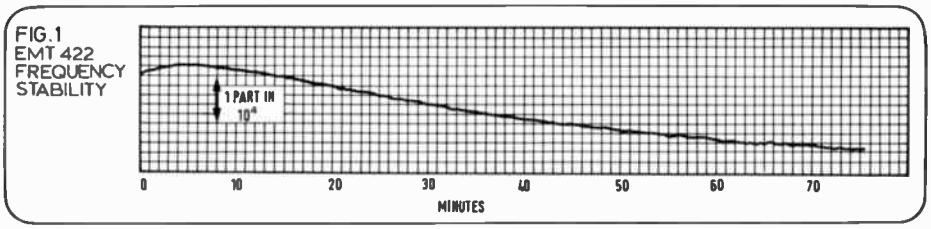
Initial attention was directed at the 3150Hz internal oscillator which delivered 0.85V rms at the 1V front panel output from a source impedance of 99Ω, or 87mV at the 100mV outputs at the front and rear panels from a source impedance of 92Ω—all satisfactory for domestic or professional use.

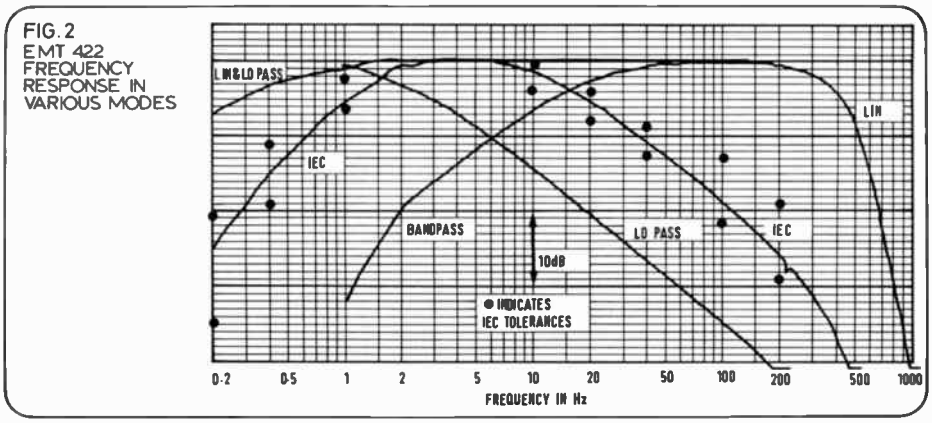
Bearing in mind that this is an R/C oscillator, the frequency stability is good but the drift of about 1½ parts in $10^4$ (0.015%) over the first hour from switch-on could lead to significant errors when measuring the drift of professional recorders (**fig 1**). After this initial change in oscillator frequency the frequency stability was excellent.

The accuracy of the drift meter was checked at four points on each range and is generally very good, but for some reason showed an increased error at the −5 point (**Table 1**). 88 ▶

**TABLE 1**

| Indication | Actual Drift Range | | | | |
|---|---|---|---|---|---|
| | 0.1% | 0.3% | 1% | 3% | 10% |
| +10 | 0.098% | | 0.98% | | 9.74% |
| +5 | 0.051% | | 0.506% | | 4.94% |
| +3 | | 0.298% | | 2.98% | |
| +2 | | 0.20% | | 2.03% | |
| —2 | | 0.209% | | 2.07% | |
| —3 | | 0.305% | | 3.01% | |
| —5 | 0.054% | | 0.524% | | 5.24% |
| —10 | 0.102% | | 1.02% | | 10.21% |




The accuracy of the 0.3% offset in oscillator frequency for calibration purposes was good at 3.008%, with the set zero control of the drift meter allowing the use of input frequencies within +4.79% to −4.94% of the nominal 3150Hz, thus just allowing the use of 3000Hz recordings if it is required to use records for this old standard frequency.

The front and rear panel inputs to the flutter meter were identical, with a minimum input requirement of 35mV into 255kΩ in parallel with 570pF for the illumination of the signal present indicator on the front panel. Similarly the input from the external filter had a sensible input impedance of 96kΩ in parallel with 170pF.

The filter output is always 'live', which can be a useful feature with the output voltage at 0.962V corresponding to full-scale deflection of the flutter meter with a source impedance of 200Ω. The 'Rec 1' output, which is ac weighted wow and flutter, had an output voltage of 1.03V peak-to-peak from 169Ω; the 'Rec 2' output which is the dc drift component +0.998V to −1.01V for full-scale drift indication from 201Ω; and the 'Spec' output being the rectified input to the flutter indicator, an output voltage of 1.01V dc for full-scale deflection—all these are accurate levels satisfactory for feeding most recorders.

The characteristics of the weighting filters and the frequency response of the instrument in **fig 2** shows that the IEC weighting curve is very close to the centre line of the IEC tolerances. Also the other filters are close to the manufacturer's specification and provide useful measuring facilities for determining the source of wow and flutter.

The actual accuracy of the wow and flutter indication was good and within 5% of full-scale deflection on all ranges; there was no sign of beating effects with the internal oscillator at very low levels of wow and flutter—a fairly common complaint.

Also amplitude modulation of the input signal has no significant effect upon the flutter indication, with the presence of 20% mains hum in the input signal not having any effect on the indication. However, a peculiarity was noticed during measurements, the effect of which was to give different flutter indications on rising and falling input frequency. This effect became very apparent when testing the instrument for correct peak indication by rectangular bursts of frequency variation in one direction repeated at 1Hz, as called for in the standard.

Subsequently it was found that this peculiarity only occurred if the drift meter had not been set to zero. All was well with the drift meter at zero but the performance became asymmetrical if the drift meter was near full scale deflection.

The effect of positive and negative bursts was very different, as shown in **Table 2**, for various burst lengths.

**TABLE 2**

| Burst Length | Percentage Full Scale Deflection | | |
|---|---|---|---|
| | Positive Burst | Negative Burst | Standard Requirement |
| 100ms | 102% | 110% (appr) | 100 ±4% |
| 60ms | 87% | 93% | 90 ±6% |
| 30ms | 60% | 67% | 62 ±6% |
| 10ms | 23% | 29% | 21 ±3% |

At the time of writing it wasn't known if this was a peculiarity of the review sample, and the UK agent will be investigating further samples of the instrument to see if the same fault appears.

**Summary**

Subject to exercising caution about the above this is a very well made instrument. The performance is generally good and with the exception of the drift set zero control being rather coarse in action the instrument is easy to use.

If to be used for factory production line work the optional threshold monitor facility is particularly valuable with the ability to set any desired thresholds. **Hugh Ford**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- installation, testing and maintenance of professional recording equipment;
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Application forms can be obtained from the Staff Officer, University of Surrey, Guildford, Surrey GU2 5XH or by telephone on Guildford 71281 ext. 776.

# ANNOUNCEMENT

On behalf of Nagra Kudelski, Switzerland, and Hayden Laboratories Limited, England, Terence McAvoy Associates wishes to extend its apology to the Academy of Motion Picture Arts and Sciences for the unauthorized depiction of the Oscar statuette which appeared in the October 1979 issue of this magazine. The Oscar statuette is the copyrighted property of the Academy of Motion Picture Arts and Sciences and is the trademark and service mark of that organization.

# INDEX TO DISPLAY ADS




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# STEP OUT IN FRONT

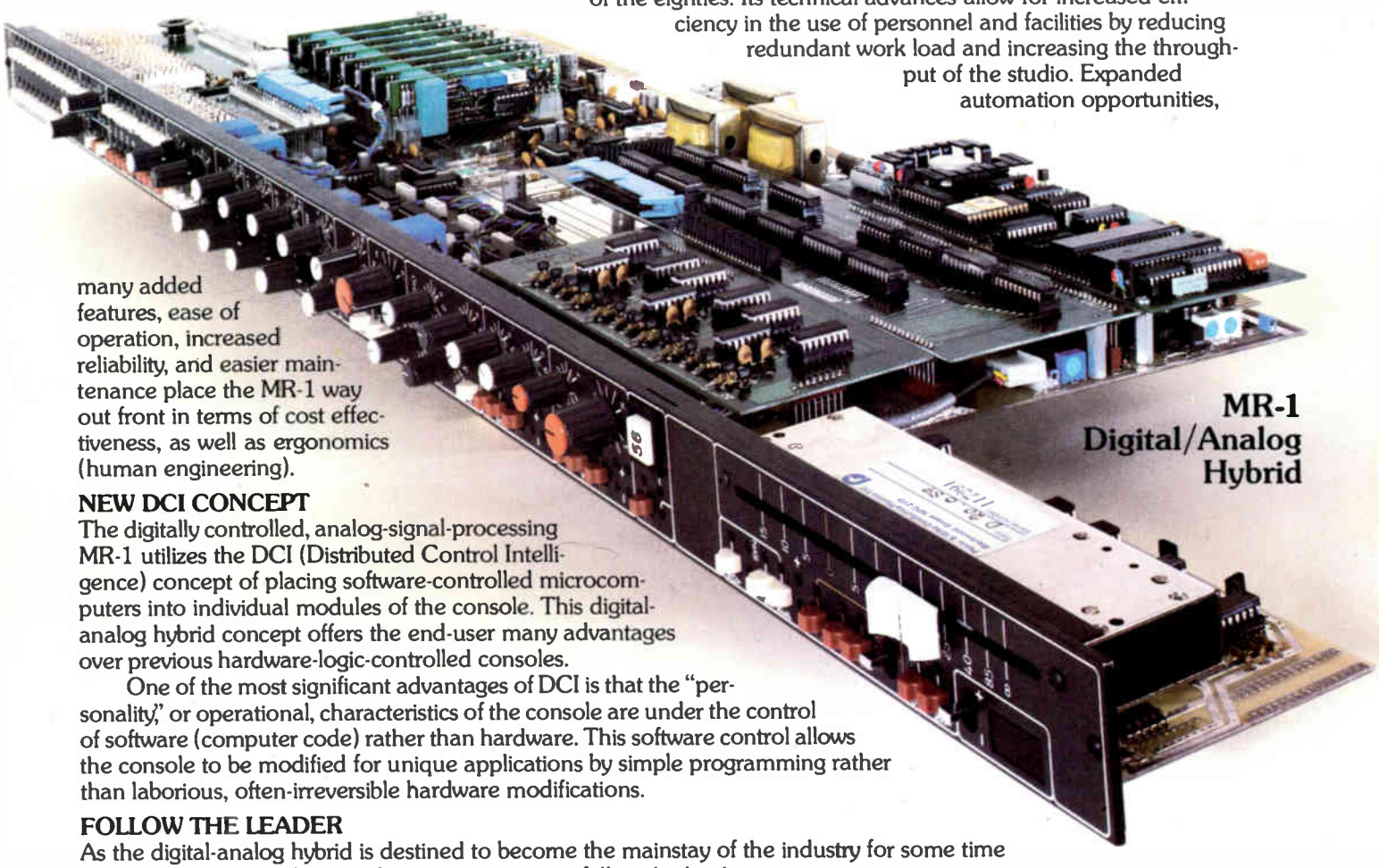
With a giant step forward, the MR-1 has become the first of its kind—the first in a whole new generation of recording consoles.

Making its entry at the beginning of the eighties, the MR-1 is unquestionably a radically new and different breed of console from that of the seventies. Through its inception, a giant step toward digital has truly been taken.

For the first time—with the advent of the MR-1—many of the advantages obtained through digital have become both practical and available. By incorporating all existing cost-effective digital-control technology into advanced analog formats, Harrison Systems has designed and produced the industry's first digital-analog "hybrid" music recording console . . . the MR-1.

## MORE VALUE – NOW

The MR-1 is clearly a console designed for the eighties, with the new technology of the eighties. Its technical advances allow for increased efficiency in the use of personnel and facilities by reducing redundant work load and increasing the throughput of the studio. Expanded automation opportunities, many added features, ease of operation, increased reliability, and easier maintenance place the MR-1 way out front in terms of cost effectiveness, as well as ergonomics (human engineering).



MR-1
Digital/Analog
Hybrid

## NEW DCI CONCEPT

The digitally controlled, analog-signal-processing MR-1 utilizes the DCI (Distributed Control Intelligence) concept of placing software-controlled microcomputers into individual modules of the console. This digital-analog hybrid concept offers the end-user many advantages over previous hardware-logic-controlled consoles.

One of the most significant advantages of DCI is that the "personality," or operational, characteristics of the console are under the control of software (computer code) rather than hardware. This software control allows the console to be modified for unique applications by simple programming rather than laborious, often-irreversible hardware modifications.

## FOLLOW THE LEADER

As the digital-analog hybrid is destined to become the mainstay of the industry for some time to come, other console manufacturers are sure to follow the lead in the use of these new methods and technologies. But as of now, the concepts are unique to Harrison, and the MR-1 has moved out in front of its field.

The eighties hold many challenges for the audio industry, and Harrison offers a console to help you meet those challenges.

**. . . or stay back with the pack**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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.

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